SCO® UNIX®
Operating System
User's Reference

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UNIX Reference manual sections xiii
Alphabetized list xv

Commands (C)

Intro(C) 1
300(C) 4
4014(C) 6
450(C) 7
assign(C) 9
at(C) 11
auths(C) 15
awk(C) 17
banner(C) 34
basename(C) 35
bc(C) 36
bdiff(C) 51
bfs(C) 52
cal(C) 56
calendar(C) 57
cancel(C) 58
cat(C) 59
cd(C) 61
checkmail(C) 62
chgrp(C) 63
chmod(C) 64
chown(C) 68
clear(C) 69
cmchk(C) 70
cmp(C) 71
col(C) 72
comm(C) 74
compress(C) 75
copy(C) 77
cp(C) 79
cpio(C) 80
cron(C) 85
crontab(C) 86

crypt(C) 90
csh(C) 92
csplit(C) 115
ct(C) 117
ctags(C) 119
cu(C) 121
cut(C) 127
date(C) 129
dc(C) 132
dd(C) 135
devnm(C) 138
df(C) 139
dfspace(C) 141
diff(C) 142
diff3(C) 144
dircmp(C) 146
dirname(C) 147
disable(C) 148
diskcp(C) 150
dos(C) 152
dtox(C) 159
dtype(C) 160
du(C) 162
echo(C) 163
ed(C) 165
enable(C) 177
env(C) 178
ex(C) 179
expr(C) 181
factor(C) 185
false(C) 186
file(C) 187
find(C) 188
finger(C) 191
fixhdr(C) 193
format(C) 195
getopt(C) 197
getopts(C) 199
gets(C) 202
greek(C) 203
grep(C) 204

hd(C) 207
head(C) 209
hello(C) 210
hp(C) 211
hwconfig(C) 213
i286emul(C) 216
id(C) 218
ismpx(C) 219
join(C) 220
jterm(C) 222
jwin(C) 223
kill(C) 224
ksh(C) 225
last(C) 265
layers(C) 266
line(C) 269
ln(C) 270
lock(C) 272
logname(C) 274
lp(C) 275
lprint(C) 281
lpstat(C) 283
ls(C) 286
machid(C) 291
mail(C) 292
man(C) 307
mesg(C) 312
mkdir(C) 313
mkfifo(C) 314
mknod(C) 315
mnt(C) 316
more(C) 320
mpstat(C) 324
mv(C) 327
newform(C) 328
newgrp(C) 333
news(C) 335
nice(C) 337
nl(C) 338
nohup(C) 340
od(C) 341

pack(C) 342
passwd(C) 345
paste(C) 353
pax(C) 355
pcpio(C) 361
pg(C) 365
pr(C) 369
prwarn(C) 372
ps(C) 373
pstat(C) 378
ptar(C) 383
purge(C) 386
pwd(C) 389
quot(C) 390
random(C) 391
rcp(C) 392
rcvalert(C) 394
rcvfile(C) 395
rcvprint(C) 397
rcvtrip(C) 398
remote(C) 401
resend(C) 403
rm(C) 404
rmdir(C) 406
rsh(C) 407
sddate(C) 408
sdiff(C) 409
sed(C) 411
setcolor(C) 415
setkey(C) 417
sg(C) 420
sh(C) 423
shl(C) 438
sleep(C) 441
slot(C) 442
sort(C) 444
spell(C) 448
spline(C) 451
split(C) 452
strings(C) 453
stty(C) 454

su(C) 459
sum(C) 462
swconfig(C) 463
tabs(C) 465
tail(C) 469
tape(C) 470
tapecntl(C) 477
tapedump(C) 479
tar(C) 481
tee(C) 486
test(C) 487
tic(C) 489
time(C) 494
touch(C) 495
tput(C) 496
tr(C) 500
translate(C) 502
true(C) 504
tset(C) 505
tty(C) 508
umask(C) 509
uname(C) 510
uniq(C) 511
units(C) 512
uptime(C) 513
usemouse(C) 514
uucp(C) 518
uuencode(C) 522
uustat(C) 523
uuto(C) 525
uux(C) 527
vi(C) 530
vidi(C) 566
vmstat(C) 568
w(C) 571
wait(C) 573
wc(C) 574
what(C) 575
who(C) 576
whodo(C) 579
write(C) 580

x286emul(C) 582
xargs(C) 583
xtod(C) 586
xtract(C) 587
yes(C) 588

Miscellaneous (M)

Intro(M) 589
aio(M) 590
ascii(M) 594
chrtbl(M) 596
clone(M) 599
coltbl(M) 600
console(M) 602
daemon.mn(M) 603
environ(M) 605
error(M) 609
fcntl(M) 610
getclk(M) 612
getty(M) 613
init(M) 617
isverify(M) 622
jagent(M) 624
layers(M) 625
ld(M) 628
locale(M) 634
log(M) 636
login(M) 639
mapchan(M) 645
mapkey(M) 650
math(M) 652
mestbl(M) 654
montbl(M) 656
mscreen(M) 658
multiscreen(M) 662
numtbl(M) 664
prof(M) 666
profile(M) 668
ptmx(M) 669

rmb(M) 670
scanon(M) 671
streamio(M) 672
string(M) 682
subsystem(M) 683
sxt(M) 699
systty(M) 701
term(M) 702
terminals(M) 706
terminfo(M) 716
termio(M) 771
termios(M) 783
timod(M) 785
timtbl(M) 787
tirdwr(M) 790
trchan(M) 792
tty(M) 794
tz(M) 795
undocumented(M) 797
values(M) 799
xtproto(M) 801

Preface

The *User's Reference* is one of a two-volume set that includes manual pages for the entire SCO UNIX System V/386 Operating System, including sections (C), (M), (ADM), (F) and (HW).

This volume contains a complete set of the section (C) and (M) manual pages, in that order.

The manual pages for section (C) contain comprehensive descriptions of user commands.

The manual pages for section (M) contain miscellaneous information used for access to devices, system maintenance and communication.

All of these manual pages are accessible online by using the **man** command.

UNIX Reference manual sections

The complete UNIX Reference is actually divided into parts and distributed as individual reference sections in the various volumes of the Operating and Development Systems. The following table lists the name, content, and location of each reference section.

Section	Description	Volume
ADM	Administrative Commands - used for system administration	System Administrator's Reference
C	Commands - used with the Operating System	User's Reference
CP	Programming Commands - used with the Development System	Programmer's Reference Manual
DOS	MS-DOS and OS/2 library routines - used with the Development System	Programmer's Reference Manual
F	File Formats - description of various system files used with the Operating System	System Administrator's Reference
FP	Programming File Formats - used with the Development System.	Programmer's Reference Manual
HW	Hardware device manual pages - used with the Operating System	System Administrator's Reference
K	Kernel routines - used for writing device drivers	Device Driver Writer's Guide
M	Miscellaneous - information used for accessing devices, performing system maintenance, and handling communications	User's Reference
S	System Calls and Library Routines - used for C and assembly language programming in the Development System	Programmer's Reference Manual
XNX	XENIX cross development manual pages - used with the Development System	Programmer's Reference Manual

The *Permuted Index for Reference Manuals*, which is distributed with the Operating System documentation set, is useful in matching a desired task with the manual page that describes it.

Certain pages in the Operating System distribution make reference to include files that are part of the Development System.

The alphabetized list given on the following pages is a complete listing of all UNIX commands, system calls, library routines, and file formats.

Alphabetized list

Commands, system calls, library routines, and file formats

a.out ..... a.out (FP)
abort ..... abort (S)
abs ..... abs (S)
acceptable_password ..... accept_pw (S)
accept ..... accept (ADM)
access ..... access (S)
acctcms ..... acctcms (ADM)
acctcom ..... acctcom (ADM)
acctcon1 ..... acctcon (ADM)
acctcon2 ..... acctcon (ADM)
acctcon ..... acctcon (ADM)
acctdisk ..... acct (ADM)
acctdusg ..... acct (ADM)
acctmerg ..... acctmerg (ADM)
accton ..... accton (ADM)
accton ..... acct (ADM)
acctprc1 ..... acctprc (ADM)
acctprc2 ..... acctprc (ADM)
acctprc ..... acctprc (ADM)
acctsh ..... acctsh (ADM)
acctwtmp ..... acct (ADM)
acct ..... acct (ADM)
acct ..... acct (FP)
acct ..... acct (S)
acos ..... trig (S)
adb ..... adb (CP)
addch ..... curses (S)
addch ..... tam (S)
addch ..... terminfo (S)
addkey ..... curses (S)
addkey ..... terminfo (S)
addstr ..... curses (S)
addstr ..... tam (S)
addstr ..... terminfo (S)
addxusers ..... addxusers (ADM)
admin ..... admin (CP)
advance ..... regexp (S)
agetcommand ..... authcap (S)
agetdefault ..... authcap (S)
agetfile ..... authcap (S)
agetflag ..... authcap (S)
agettty ..... authcap (S)
agetuser ..... authcap (S)
aioinfo ..... aioinfo (ADM)
aiolkinit ..... aiolkinit (ADM)
aiomemlock ..... aiomemlock (F)
aio ..... aio (F)
aio ..... aio (M)
alarm ..... alarm (S)
ale ..... ale (ADM)
allocldptr ..... ldptr (S)
ap ..... ap (ADM)
archive ..... archive (F)
ar ..... ar (CP)
ar ..... ar (FP)
ar ..... ar (XNX)
arc ..... plot (S)
as ..... as (CP)
at ..... at (C)
ascii ..... ascii (M)
asctime ..... ctime (S)
asin ..... trig (S)
asktimer ..... asktime (ADM)
asktime ..... asktime (ADM)
asroot ..... asroot (ADM)
assert ..... assert (S)
assign ..... assign (C)
atan ..... trig (S)
atan2 ..... trig (S)
atcronsh ..... atcronsh (ADM)
atexit ..... atexit (S)
atof ..... atof (S)
atoi ..... atof (S)
atol ..... atof (S)
attroff ..... curses (S)
attroff ..... tam (S)
attroff ..... terminfo (S)
attron ..... curses (S)
attron ..... tam (S)
attron ..... terminfo (S)
attrset ..... curses (S)
attrset ..... terminfo (S)
audit ..... audit (HW)
auditcmd ..... auditcmd (ADM)
auditd ..... auditd (ADM)
auditsh ..... auditsh (ADM)
audit_adjust_mask ..... authaudit (S)
audit_auth_entry ..... authaudit (S)
audit_close ..... audit (S)
audit_lax_file ..... authaudit (S)

audit_lock ..... authaudit (S)
audit_login ..... authaudit (S)
audit_no_resource ..... authaudit (S)
audit_open ..... audit (S)
audit_passwd ..... authaudit (S)
audit_read ..... audit (S)
audit_subsystem ..... authaudit (S)
authaudit ..... authaudit (S)
authcap ..... authcap (F)
authcap ..... authcap (S)
authck ..... authck (ADM)
authckrc ..... tcbck (ADM)
authorized_user ..... subsystems (S)
auths ..... auths (C)
authsh ..... authsh (ADM)
autoboot ..... autoboot (ADM)
awk ..... awk (C)
a64l ..... a64l (S)
backup ..... backup (ADM)
backupsh ..... backupsh (ADM)
badtrk ..... badtrk (ADM)
banner ..... banner (C)
basename ..... basename (C)
batch ..... at (C)
baudrate ..... curses (S)
baudrate ..... tam (S)
baudrate ..... terminfo (S)
bc ..... bc (C)
bcheckrc ..... brc (ADM)
bdiff ..... bdiff (C)
beep ..... curses (S)
beep ..... tam (S)
beep ..... terminfo (S)
bessel ..... bessel (S)
bfs ..... bfs (C)
bigcrypt ..... getpasswd (S)
bigcryptmax ..... getpasswd (S)
boot ..... boot (HW)
Bottom ..... libwindows (S)
bottom_panel ..... panel (S)
box ..... curses (S)
box ..... plot (S)
box ..... terminfo (S)
brc ..... brc (ADM)
brk ..... brk (S)
brkctl ..... brkctl (S)
bsearch ..... bsearch (S)
btld ..... btld (F)
btldinstall ..... btldinstall (ADM)
cal ..... cal (C)
calendar ..... calendar (C)
calloc ..... malloc (S)
cancel ..... cancel (C)
can_change_color ..... curses (S)
can_change_color ..... terminfo (S)
captoinfo ..... captoinfo (ADM)
cat ..... cat (C)
catclose ..... catopen (S)
catgets ..... catgets (S)
catopen ..... catopen (S)
cb ..... cb (CP)
cbreak, crmode ..... tam (S)
cbreak, crmode ..... terminfo (S)
cbreak ..... curses (S)
cc ..... cc (CP)
cd ..... cd (C)
cdc ..... cdc (CP)
cdrom ..... cdrom (HW)
ceil ..... floor (S)
cfgetispeed ..... cfspeed (S)
cfgetospeed ..... cfspeed (S)
cflow ..... cflow (CP)
cfree ..... malloc (S)
cfsetispeed ..... cfspeed (S)
cfsetospeed ..... cfspeed (S)
cfspeed ..... cfspeed (S)
chargefee ..... acctsh (ADM)
chdir ..... chdir (S)
checkaddr ..... checkaddr (ADM)
checklist ..... checklist (F)
checkmail ..... checkmail (C)
checkque ..... checkque (ADM)
checkup ..... checkup (ADM)
chgrp ..... chgrp (C)
chg_audit ..... chg_audit (ADM)
chkshlib ..... chkshlib (CP)
chmod ..... chmod (C)
chmod ..... chmod (S)
chown ..... chown (C)
chown ..... chown (S)
chroot ..... chroot (ADM)
chroot ..... chroot (S)
chrtbl ..... chrtbl (M)
chsize ..... chsize (S)
chtype ..... unretire (ADM)
circle ..... plot (S)
ckpacct ..... acctsh (ADM)
cleanque ..... cleanque (ADM)
cleantmp ..... cleantmp (ADM)
clear ..... clear (C)
clear ..... curses (S)
clear ..... tam (S)

clear ..... terminfo (S)
clearerr ..... ferror (S)
clearok ..... tam (S)
clearok ..... curses (S)
clearok ..... terminfo (S)
clock ..... clock (F)
clock ..... clock (S)
clone ..... clone (HW)
clone ..... clone (M)
close ..... close (S)
closedir ..... directory (S)
closepl ..... plot (S)
clri ..... clri (ADM)
clrtobot ..... curses (S)
clrtobot ..... tam (S)
clrtobot ..... terminfo (S)
clrtoeol ..... curses (S)
clrtoeol ..... tam (S)
clrtoeol ..... terminfo (S)
cmchk ..... cmchk (C)
cmos ..... cmos (HW)
cmp ..... cmp (C)
cnvtmbox ..... cnvtmbox (ADM)
codeview ..... codeview (CP)
col ..... col (C)
color_content ..... curses (S)
color_content ..... terminfo (S)
coltbl ..... coltbl (M)
comb ..... comb (CP)
comm ..... comm (C)
compress ..... compress (C)
compver ..... compver (F)
configure ..... configure (ADM)
console ..... console (M)
consoleprint ..... consoleprint (ADM)
cont ..... plot (S)
conv ..... conv (CP)
convert ..... convert (CP)
convkey ..... mapkey (M)
copy ..... copy (C)
copydvagent ..... getdvagent (S)
copyright ..... copyright (F)
copywin ..... curses (S)
copywin ..... terminfo (S)
core ..... core (FP)
cos ..... trig (S)
cosh ..... sinh (S)
cp ..... cp (C)
cpio ..... cpio (C)
cpio ..... cpio (F)
cpp ..... cpp (CP)
cprs ..... cprs (CP)
cps ..... fixmog (ADM)
crash ..... crash (ADM)
creat ..... creat (S)
creatsem ..... creatsem (S)
cron ..... cron (C)
crontab ..... crontab (C)
crypt ..... crypt (C)
crypt ..... crypt (S)
cryptopen ..... crypt (S)
crypt_close ..... crypt (S)
cscope ..... cscope (CP)
csh ..... csh (C)
csplit ..... csplit (C)
ct ..... ct (C)
ctags ..... ctags (C)
ctermid ..... ctermid (S)
ctime ..... ctime (S)
ctrace ..... ctrace (CP)
ctype ..... ctype (S)
cu ..... cu (C)
curoff ..... curses (S)
curoff ..... terminfo (S)
curon ..... curses (S)
curon ..... terminfo (S)
Current ..... libwindows (S)
curses ..... curses (S)
curs_set ..... curses (S)
curs_set ..... terminfo (S)
curtbl ..... montbl (M)
cuserid ..... cuserid (S)
custom ..... custom (ADM)
cut ..... cut (C)
cxref ..... cxref (CP)
daemon.mn ..... daemon.mn (M)
dat ..... dat (HW)
date ..... date (C)
dbm ..... dbm (S)
dbmbuild ..... dbmbuild (ADM)
dbmedit ..... dbmedit (ADM)
dbminit ..... dbm (S)
dbxtra ..... dbxtra (CP)
dc ..... dc (C)
dcopy ..... dcopy (ADM)
dd ..... dd (C)
deassign ..... assign (C)
default ..... default (F)
defopen ..... defopen (S)
defread ..... defopen (S)
def_prog_mode ..... curses (S)
def_prog_mode ..... terminfo (S)

def_shell_mode ..... curses (S)
def_shell_mode ..... terminfo (S)
delay_output ..... curses (S)
delay_output ..... terminfo (S)
delch ..... curses (S)
delch ..... tam (S)
delch ..... terminfo (S)
Delete ..... libwindows (S)
delete ..... dbm (S)
deleteln ..... curses (S)
deleteln ..... tam (S)
deleteln ..... terminfo (S)
deliver ..... deliver (ADM)
delta ..... delta (CP)
delwin ..... curses (S)
delwin ..... terminfo (S)
del_curterm ..... curses (S)
del_curterm ..... terminfo (S)
del_panel ..... panel (S)
depend ..... depend (F)
des_crypt ..... crypt (S)
des_encrypt ..... crypt (S)
des_setkey ..... crypt (S)
devices ..... devices (F)
devnm ..... devnm (C)
df ..... df (C)
dfsck ..... fsck (ADM)
dfspace ..... dfspace (C)
dial ..... dial (ADM)
dial ..... dial (ADM)
dialcodes ..... dialcodes (F)
dialers ..... dialers (F)
diff ..... diff(C)
difftime ..... difftime (S)
diff3 ..... diff3 (C)
dir ..... dir (FP)
dircmp ..... dircmp (C)
directory ..... directory (S)
dirent ..... dirent (FP)
dirname ..... dirname (C)
disable ..... disable (C)
diskcmp ..... diskcp (C)
diskcp ..... diskcp (C)
diskusg ..... diskusg (ADM)
displaypkg ..... displaypkg (ADM)
dis ..... dis (CP)
div ..... div (S)
divvy ..... divvy (ADM)
dkinit ..... dparam (ADM)
dlvr_audit ..... dlvr_audit (ADM)
dmesg ..... dmesg (ADM)
dodisk ..... acctsh (ADM)
dos ..... dos (C)
doscat ..... dos (C)
doscp ..... dos (C)
dosdir ..... dos (C)
dosformat ..... dos (C)
dosld ..... dosld (CP)
dosls ..... dos (C)
dosmkdir ..... dos (C)
dosrm ..... dos (C)
dosrmdir ..... dos (C)
doupdate ..... curses (S)
doupdate ..... terminfo (S)
dparam ..... dparam (ADM)
draino ..... curses (S)
draino ..... terminfo (S)
drand48 ..... drand48 (S)
dtox ..... dtox (C)
dtype ..... dtype (C)
du ..... du (C)
dump ..... dump (CP)
dumpmsg ..... dumpmsg (CP)
dumpwin ..... terminfo (S)
dupwin ..... curses (S)
dupwin ..... terminfo (S)
dup ..... dup (S)
dup2 ..... dup2 (S)
dup_field ..... field (S)
eaccess ..... access (S)
ecc ..... ecc (ADM)
echo ..... curses (S)
echo ..... echo (C)
echo ..... tam (S)
echo ..... terminfo (S)
eccd ..... ecc (ADM)
echochar ..... curses (S)
echochar ..... terminfo (S)
ecvt ..... ecvt (S)
ed ..... ed (C)
edata ..... end (S)
edit ..... ex (C)
egrep ..... grep (C)
eisa ..... eisa (ADM)
enable ..... enable (C)
encrypt ..... crypt (S)
end ..... end (S)
enddvagent ..... getdvagent (S)
endgrent ..... getgrent (S)
endprdfent ..... getprdfent (S)
endprfient ..... getprfient (S)
endprpwent ..... getprpwent (S)

endprtcent ..... getprtcent (S)
endpwent ..... getpwent (S)
endutent ..... getut (S)
endwin ..... curses (S)
endwin ..... tam (S)
endwin ..... terminfo (S)
env ..... env (C)
environ ..... environ (M)
eof ..... regexp (S)
erand48 ..... drand48 (S)
erase ..... curses (S)
erase ..... plot (S)
erase ..... tam (S)
erase ..... terminfo (S)
erasechar ..... curses (S)
erasechar ..... terminfo (S)
erf ..... erf (S)
erfc ..... erf (S)
errno ..... perror (S)
error ..... error (M)
ERROR ..... regexp (S)
etext ..... end (S)
ev_block ..... ev_block (S)
ev_close ..... ev_close (S)
ev_count ..... ev_count (S)
ev_flush ..... ev_flush (S)
ev_getdev ..... ev_getdev (S)
ev_getemask ..... ev_getemask (S)
ev_gindev ..... ev_gindev (S)
ev_init ..... ev_init (S)
ev_open ..... ev_open (S)
ev_pop ..... ev_pop (S)
ev_read ..... ev_read (S)
ev_resume ..... ev_resume (S)
ev_setemask ..... ev_setemask (S)
ev_suspend ..... ev_suspend (S)
execl ..... exec (S)
execle ..... exec (S)
execlp ..... exec (S)
execseg ..... execseg (S)
exec ..... exec (S)
execve ..... exec (S)
execvp ..... exec (S)
execv ..... exec (S)
exit ..... exit (S)
Exit ..... libwindows (S)
ex ..... ex (C)
exp ..... exp (S)
expr ..... expr (C)
fabs ..... floor (S)
factor ..... factor (C)
false ..... false (C)
fclose ..... fclose (S)
fcntl ..... fcntl (M)
fcntl ..... fcntl (S)
fcvt ..... ecvt (S)
fd ..... fd (HW)
fdisk ..... fdisk (ADM)
fdopen ..... fopen (S)
fdswap ..... fdswap (ADM)
feof ..... ferror (S)
ferror ..... ferror (S)
fetch ..... dbm (S)
ff ..... ff (ADM)
fflush ..... fclose (S)
fgetc ..... getc (S)
fgetgrent ..... getgrent (S)
fgetpasswd ..... getpasswd (S)
fgetpos ..... fgetpos (S)
fgetpwent ..... getpwent (S)
fgets ..... gets (S)
fgrep ..... grep (C)
fields ..... fields (S)
fieldtype ..... fieldtype (S)
field ..... field (S)
field_arg ..... field (S)
field_back ..... field (S)
field_buffer ..... field (S)
field_count ..... form (S)
field_fore ..... field (S)
field_index ..... form (S)
field_info ..... field (S)
field_init ..... form (S)
field_just ..... field (S)
field_opts ..... field (S)
field_opts_off ..... field (S)
field_opts_on ..... field (S)
field_pad ..... field (S)
field_status ..... field (S)
field_term ..... form (S)
field_type ..... field (S)
field_userptr ..... field (S)
file ..... file (C)
filehdr ..... filehdr (FP)
fileno ..... ferror (S)
filesys ..... filesys (F)
filesystem ..... filesystem (FP)
filter ..... curses (S)
filter ..... terminfo (S)
find ..... find (C)
findstr ..... findstr (CP)
finger ..... finger (C)

firstkey ..... dbm (S)
fixhdr ..... fixhdr (C)
fixmog ..... fixmog (ADM)
fixperm ..... fixperm (ADM)
flash ..... curses (S)
flash ..... tam (S)
flash ..... terminfo (S)
floor ..... floor (S)
flushinp ..... curses (S)
flushinp ..... tam (S)
flushinp ..... terminfo (S)
fmod ..... floor (S)
fopen ..... fopen (S)
fork ..... fork (S)
form ..... form (S)
format ..... format (C)
form_driver ..... form (S)
form_init ..... form (S)
form_opts ..... form (S)
form_opts_off ..... form (S)
form_opts_on ..... form (S)
form_page ..... form (S)
form_term ..... form (S)
fpathconf ..... pathconf (S)
fpgetmask ..... fpgetround (S)
fpgetround ..... fpgetround (S)
fpgetsticky ..... fpgetround (S)
fprintf ..... printf (S)
fpsetmask ..... fpgetround (S)
fpsetround ..... fpgetround (S)
fpsetsticky ..... fpgetround (S)
fputc ..... putc (S)
fputs ..... puts (S)
fread ..... fread (S)
free ..... malloc (S)
freeldptr ..... ldptr (S)
free_fieldtype ..... fieldtype (S)
free_field ..... field (S)
free_form ..... form (S)
free_item ..... item (S)
free_menu ..... menu (S)
freopen ..... fopen (S)
frexp ..... frexp (S)
fsave ..... fsave (ADM)
fscanf ..... scanf (S)
fsck ..... fsck (ADM)
fsdb ..... fsdb (ADM)
fseek ..... fseek (S)
fsetpos ..... fsetpos (S)
fsname ..... fsname (ADM)
fspec ..... fspec (F)
fsphoto ..... fsphoto (ADM)
fsstat ..... fsstat (ADM)
fstat ..... stat (S)
fstatfs ..... statfs (S)
fstyp ..... fstyp (ADM)
ftell ..... fseek (S)
ftime ..... time (S)
ftok ..... ftok (S)
ftw ..... ftw (S)
fuser ..... fuser (ADM)
fwrite ..... fread (S)
fwtmp ..... fwtmp (ADM)
fxlist ..... xlist (S)
gamma ..... gamma (S)
garbagedlines ..... curses (S)
garbagedlines ..... terminfo (S)
gcvt ..... ecvt (S)
gencat ..... gencat (CP)
gencc ..... gencc (CP)
get ..... get (CP)
getbegyx ..... curses (S)
getbegyx ..... terminfo (S)
getc ..... getc (S)
getch ..... curses (S)
getch ..... tam (S)
getch ..... terminfo (S)
getchar ..... getc (S)
getclk ..... getclk (M)
getcwd ..... getcwd (S)
getc ..... regexp (S)
getdents ..... getdents (S)
getdim ..... curses (S)
getdim ..... terminfo (S)
getdvagent ..... getdvagent (S)
getdvagnam ..... getdvagent (S)
getegid ..... getuid (S)
getenv ..... getenv (S)
geteuid ..... getuid (S)
getgid ..... getuid (S)
getgrent ..... getgrent (S)
getgrgid ..... getgrent (S)
getgrnam ..... getgrent (S)
getgroups ..... getgroups (S)
gethz ..... gethx (S)
getlogin ..... getlogin (S)
getluid ..... getluid (S)
getmaxyx ..... curses (S)
getmaxyx ..... terminfo (S)
getmsg ..... getmsg (S)
getopt ..... getopt (C)
getopt ..... getopt (S)

getoptcvt ..... getopts (C)
getopts ..... getopts (C)
getorg ..... curses (S)
getorg ..... terminfo (S)
getpass ..... getpass (S)
getpasswd ..... getpasswd (S)
getpgrp ..... getpid (S)
getpid ..... getpid (S)
getppid ..... getpid (S)
getprdfent ..... getprdfent (S)
getprdfnam ..... getprdfent (S)
getprfient ..... getprfient (S)
getprfinam ..... getprfient (S)
getpriv ..... getpriv (S)
getprpwent ..... getprpwent (S)
getprpwnam ..... getprpwent (S)
getprpwuid ..... getprpwent (S)
getprtcent ..... getprtcent (S)
getprtcnam ..... getprtcent (S)
getpw ..... getpw (S)
getpwent ..... getpwent (S)
getpwnam ..... getpwent (S)
getpwuid ..... getpwent (S)
gets ..... gets (C)
gets ..... gets (S)
getstr ..... curses (S)
getstr ..... terminfo (S)
getsyx ..... curses (S)
getsyx ..... terminfo (S)
getty ..... getty (M)
gettydefs ..... gettydefs (F)
getuid ..... getuid (S)
getut ..... getut (S)
getutent ..... getut (S)
getutid ..... getut (S)
getutline ..... getut (S)
getw ..... getc (S)
getyx ..... curses (S)
getyx ..... tam (S)
getyx ..... terminfo (S)
get_seed ..... seed (S)
gmtime ..... ctime (S)
goodpw ..... goodpw (ADM)
gps ..... gps (F)
graph ..... graph (ADM)
greek ..... greek (C)
grep ..... grep (C)
group ..... group (F)
grpck ..... grpck (ADM)
gr_idtoname ..... pw_nametoid (S)
gr_nametoid ..... pw_nametoid (S)
gsignal ..... ssignal (S)
halfdelay ..... curses (S)
halfdelay ..... terminfo (S)
haltsys ..... haltsys (ADM)
hashcheck ..... spell (C)
hashmake ..... spell (C)
has_colors ..... curses (S)
has_colors ..... terminfo (S)
has_ic ..... curses (S)
has_ic ..... terminfo (S)
has_il ..... curses (S)
has_il ..... terminfo (S)
hcreate ..... hsearch (S)
hd ..... hd (C)
hd ..... hd (HW)
hdestroy ..... hsearch (S)
hdr ..... hdr (XNX)
head ..... head (C)
hello ..... hello (C)
help ..... help (CP)
hide_panel ..... panel (S)
hp ..... hp (C)
hs ..... hs (F)
hsearch ..... hsearch (S)
hwconfig ..... hwconfig (C)
hypot ..... hypot (S)
iAPX286 ..... machid (C)
iconv ..... iconv (CP)
id ..... id (C)
idaddld ..... idaddld (ADM)
idbuild ..... idbuild (ADM)
idcheck ..... idcheck (ADM)
idconfig ..... idbuild (ADM)
identity ..... identity (S)
idinstall ..... idinstall (ADM)
idld ..... ld (M)
idleout ..... idleout (ADM)
idlok ..... curses (S)
idlok ..... terminfo (S)
idmkenv ..... idbuild (ADM)
idmkinit ..... idmkinit (ADM)
idmknod ..... idmknod (ADM)
idmkunix ..... idbuild (ADM)
idscsi ..... idbuild (ADM)
idspace ..... idspace (ADM)
idtune ..... idtune (ADM)
idvidi ..... idbuild (ADM)
inch ..... curses (S)
inch ..... terminfo (S)
infocmp ..... infocmp (ADM)
init ..... init (M)

init.base ..... inittab (F)
initcond ..... initcond (ADM)
initscript ..... initscript (ADM)
initscr ..... curses (S)
initscr ..... tam (S)
initscr ..... terminfo (S)
inittab ..... inittab (F)
init_color ..... curses (S)
init_color ..... terminfo (S)
init_pair ..... curses (S)
init_pair ..... terminfo (S)
inode ..... inode (FP)
insch ..... curses (S)
insch ..... tam (S)
insch ..... terminfo (S)
insertln ..... curses (S)
insertln ..... tam (S)
insertln ..... terminfo (S)
insertmsg ..... insertmsg (CP)
install ..... install (ADM)
installf ..... installf (ADM)
installpkg ..... installpkg (ADM)
integrity ..... integrity (ADM)
intrflush ..... curses (S)
intrflush ..... terminfo (S)
Intro ..... intro (ADM)
Intro ..... Intro (CP)
Intro ..... Intro (C)
Intro ..... intro (F)
Intro ..... intro (HW)
Intro ..... Intro (M)
Intro ..... Intro (S)
ioctl ..... ioctl (S)
ipcrm ..... ipcrm (ADM)
ipcs ..... ipcs (ADM)
isaddindex ..... isaddindex (S)
isalnum ..... ctype (S)
isalpha ..... ctype (S)
isascii ..... ctype (S)
isatty ..... ttyname (S)
isbuild ..... isbuild (S)
isclose ..... isclose (S)
iscntrl ..... ctype (S)
isconv ..... isconv (S)
isdelcurr ..... isdelcurr (S)
isdelete ..... isdelete (S)
isdelindex ..... isdelindex (S)
isdelrec ..... isdelrec (S)
isdigit ..... ctype (S)
isendwin ..... curses (S)
isendwin ..... terminfo (S)
iserase ..... iserase (S)
isgraph ..... ctype (S)
isindexinfo ..... isindexinfo (S)
islock ..... islock (S)
islower ..... ctype (S)
ismpx ..... ismpx (C)
isnan ..... isnan (S)
isnand ..... isnan (S)
isnanf ..... isnan (S)
isopen ..... isopen (S)
isprint ..... ctype (S)
ispunct ..... ctype (S)
isread ..... isread (S)
isrelease ..... isrelease (S)
isrename ..... isrename (S)
isrewcurr ..... isrewcurr (S)
isrewrec ..... isrewrec (S)
isrewrite ..... isrewrite (S)
issetunique ..... issetunique (S)
isspace ..... ctype (S)
isstart ..... isstart (S)
issue ..... issue (F)
isuniqueid ..... isuniqueid (S)
isunlock ..... isunlock (S)
isupper ..... ctype (S)
isverify ..... isverify (M)
iswrcurr ..... iswrcurr (S)
iswrite ..... iswrite (S)
isxdigit ..... ctype (S)
is_starting_egid ..... identity (S)
is_starting_euid ..... identity (S)
is_starting_luid ..... identity (S)
is_starting_rgid ..... identity (S)
is_starting_ruid ..... identity (S)
item ..... item (S)
item_count ..... item (S)
item_description ..... item (S)
item_index ..... menu (S)
item_init ..... menu (S)
item_name ..... item (S)
item_opts ..... item (S)
item_opts_off ..... item (S)
item_opts_on ..... item (S)
item_term ..... menu (S)
item_userptr ..... item (S)
item_value ..... item (S)
item_visible ..... item (S)
i286 ..... machid (C)
i286emul ..... i286emul (CP)
i286emul ..... i286emul (C)
i386 ..... machid (C)

i486 ..... machid (C)
jagent ..... jagent (M)
jn ..... bessel (S)
join ..... join (C)
jrand48 ..... drand48 (S)
jterm ..... jterm (C)
jwin ..... jwin (C)
j0 ..... bessel (S)
j1 ..... bessel (S)
kbmode ..... kbmode (ADM)
keyboard ..... keyboard (HW)
keyname ..... curses (S)
keyname ..... terminfo (S)
keypad ..... curses (S)
keypad ..... tam (S)
keypad ..... terminfo (S)
kill ..... kill (C)
kill ..... kill (S)
killall ..... killall (ADM)
killchar ..... curses (S)
killchar ..... terminfo (S)
kmem ..... mem (FP)
ksh ..... ksh (C)
l ..... ls (C)
label ..... plot (S)
labelit ..... labelit (ADM)
labs ..... labs (S)
langinfo ..... langinfo (FP)
last ..... last (C)
lastlogin ..... acctsh (ADM)
layers ..... layers (C)
layers ..... layers (M)
lc ..... ls (C)
ld ..... ld (CP)
ld ..... ld (M)
ld ..... ld (XNX)
lcong48 ..... drand48 (S)
lconv ..... lconv (FP)
ldaclose ..... ldclose (S)
ldahread ..... ldahread (S)
ldaopen ..... ldopen (S)
ldclose ..... ldclose (S)
lddbl ..... isconv (S)
ldexp ..... frexp (S)
ldfcn ..... ldfcn (FP)
ldfhread ..... ldfhread (S)
ldfloat ..... isconv (S)
ldgetname ..... ldgetname (S)
ldint ..... isconv (S)
ldiv ..... ldiv (S)
ldlinit ..... ldlread (S)
ldlitem ..... ldlread (S)
ldlong ..... isconv (S)
ldlread ..... ldlread (S)
ldlseek ..... ldlseek (S)
ldnlseek ..... ldlseek (S)
ldnrseek ..... ldrseek (S)
ldnshread ..... ldshread (S)
ldnsseek ..... ldsseek (S)
ldohseek ..... ldohseek (S)
ldopen ..... ldopen (S)
ldrseek ..... ldrseek (S)
ldshread ..... ldshread (S)
ldsseek ..... ldsseek (S)
ldtbindex ..... ldtbindex (S)
ldtbread ..... ldtbread (S)
ldtbseek ..... ldtbseek (S)
leaveok ..... curses (S)
leaveok ..... terminfo (S)
lex ..... lex (CP)
lf ..... ls (C)
lfind ..... lsearch (S)
libwindows ..... libwindows (S)
limits ..... limits (FP)
line ..... line (C)
line ..... plot (S)
linemod ..... plot (S)
linenum ..... linenum (FP)
link ..... link (ADM)
link ..... link (S)
link_fieldtype ..... fieldtype (S)
link_field ..... field (S)
link_unix ..... link_unix (ADM)
lint ..... lint (CP)
list ..... list (ADM)
list ..... list (CP)
llog ..... llog (S)
ll_close ..... llog (S)
ll_err ..... llog (S)
ll_hdinit ..... llog (S)
ll_init ..... llog (S)
ll_log ..... llog (S)
ll_open ..... llog (S)
ln ..... ln (C)
locale ..... locale (M)
localeconv ..... localeconv (S)
localtime ..... ctime (S)
lock ..... lock (C)
lock ..... lock (S)
lockf ..... lockf (S)
locking ..... locking (S)
log ..... exp (S)

log ..... log (HW)
log ..... log (M)
login ..... login (M)
logname ..... logname (C)
logname ..... logname (S)
logs ..... logs (F)
log10 ..... exp (S)
longjmp ..... setjmp (S)
longname ..... curses (S)
longname ..... terminfo (S)
lorder ..... lorder (CP)
lp ..... lp (C)
lp ..... lp (HW)
lpadmin ..... lpadmin (ADM)
lpfilter ..... lpfilter (ADM)
lpforms ..... lpforms (ADM)
lpmove ..... lpsched (ADM)
lpr ..... lp (C)
lprint ..... lprint (C)
lprof ..... lprof (CP)
lpsh ..... lpsh (ADM)
lpsched ..... lpsched (ADM)
lpshut ..... lpsched (ADM)
lpusers ..... lpusers (ADM)
lp0 ..... lp (HW)
lp1 ..... lp (HW)
lp2 ..... lp (HW)
lr ..... ls (C)
lrand48 ..... drand48 (S)
ls ..... ls (C)
lsearch ..... lsearch (S)
lseek ..... lseek (S)
lstat ..... stat (S)
ltol3 ..... l3tol (S)
lx ..... ls (C)
l3tol ..... l3tol (S)
l64a ..... a64l (S)
machid ..... machid (C)
mail ..... mail (C)
maildelivery ..... maildelivery (F)
mailx ..... mail (C)
majorsinuse ..... majorsinuse (ADM)
make ..... make (CP)
makekey ..... makekey (ADM)
mallinfo ..... mallinfo (FP)
mallinfo ..... malloc (S)
malloc ..... malloc (S)
mallopt ..... malloc (S)
man ..... man (C)
mapchan ..... mapchan (F)
mapchan ..... mapchan (M)
mapkey ..... mapkey (M)
mapscrn ..... mapkey (M)
mapstr ..... mapkey (M)
mar ..... mar (CP)
masm ..... masm (CP)
math ..... math (M)
matherr ..... matherr (S)
maxuuscheds ..... maxuuscheds (F)
maxuuxqts ..... maxuuxqts (F)
mblen ..... mblen (S)
mbstowcs ..... mblen (S)
mbtowc ..... mblen (S)
mcart ..... tape (C)
mcconfig ..... mcconfig (F)
mcdaemon ..... mcconfig (F)
mcs ..... mcs (CP)
mc68k ..... machid (C)
mdevice ..... mdevice (F)
mem ..... mem (FP)
memccpy ..... memory (S)
memchr ..... memory (S)
memcmp ..... memory (S)
memcpy ..... memory (S)
memmove ..... memmove (S)
memory ..... memory (S)
memset ..... memory (S)
menu ..... menu (S)
menumerge ..... menumerge (ADM)
menu_back ..... menu (S)
menu_driver ..... menu (S)
menu_fore ..... menu (S)
menu_format ..... menu (S)
menu_grey ..... menu (S)
menu_opts ..... menu (S)
menu_opts_off ..... menu (S)
menu_opts_on ..... menu (S)
menu_pad ..... menu (S)
menu_term ..... menu (S)
mesg ..... mesg (C)
mestbl ..... mestbl (M)
meta ..... curses (S)
meta ..... terminfo (S)
mfsys ..... mfsys (FP)
mkdev ..... mkdev (ADM)
mkdir ..... mkdir (C)
mkdir ..... mkdir (S)
mkfifo ..... mkfifo (C)
mkfifo ..... mkfifo (S)
mkfs ..... mkfs (ADM)
mknod ..... mknod (C)
mknod ..... mknod (S)

mkshlib ..... mkshlib (CP)
mkstr ..... mkstr (CP)
mktemp ..... mktemp (S)
mktime ..... mktime (S)
ml_adr ..... ml_send (S)
ml_aend ..... ml_send (S)
ml_cc ..... ml_send (S)
ml_end ..... ml_send (S)
ml_file ..... ml_send (S)
ml_init ..... ml_send (S)
ml_send ..... ml_send (S)
ml_tinit ..... ml_send (S)
ml_to ..... ml_send (S)
ml_txt ..... ml_send (S)
ml_1adr ..... ml_send (S)
mmdf ..... mmdf (ADM)
mmdf ..... mmdf (S)
mmdfalias ..... mmdfalias (ADM)
mmdftailor ..... mmdftailor (F)
mm_end ..... mmdf (S)
mm_init ..... mmdf (S)
mm_pkend ..... mmdf (S)
mm_pkinit ..... mmdf (S)
mm_radr ..... mmdf (S)
mm_rinit ..... mmdf (S)
mm_rrec ..... mmdf (S)
mm_rrply ..... mmdf (S)
mm_rstm ..... mmdf (S)
mm_rtxt ..... mmdf (S)
mm_sbend ..... mmdf (S)
mm_sbinit ..... mmdf (S)
mm_wadr ..... mmdf (S)
mm_waend ..... mmdf (S)
mm_winit ..... mmdf (S)
mm_wrec ..... mmdf (S)
mm_wrply ..... mmdf (S)
mm_wstm ..... mmdf (S)
mm_wtend ..... mmdf (S)
mm_wtxt ..... mmdf (S)
mnlist ..... mnlist (ADM)
mnt ..... mnt (C)
mnttab ..... mnttab (F)
modf ..... frexp (S)
monacct ..... acctsh (ADM)
monitor ..... monitor (S)
montbl ..... montbl (M)
more ..... more (C)
mount ..... mount (ADM)
mount ..... mount (S)
mountall ..... mountall (ADM)
mouse ..... mouse (HW)
move ..... curses (S)
move ..... plot (S)
move ..... tam (S)
move ..... terminfo (S)
Move ..... libwindows (S)
move_field ..... field (S)
move_panel ..... panel (S)
mpstat ..... mpstat (C)
mrand48 ..... drand48 (S)
mscreen ..... mscreen (M)
msg ..... msg (FP)
msgctl ..... msgctl (S)
msgget ..... msgget (S)
msgop ..... msgop (S)
msgrcv ..... msgop (S)
msgsnd ..... msgop (S)
mtune ..... mtune (F)
multiscreen ..... multiscreen (M)
mv ..... mv (C)
mvaddch ..... curses (S)
mvaddch ..... tam (S)
mvaddch ..... terminfo (S)
mvaddstr ..... curses (S)
mvaddstr ..... tam (S)
mvaddstr ..... terminfo (S)
mvcur ..... curses (S)
mvcur ..... terminfo (S)
mvdelch ..... curses (S)
mvdelch ..... terminfo (S)
mvdevice ..... mvdevice (F)
mvdir ..... mvdir (ADM)
mvgetch ..... curses (S)
mvgetch ..... terminfo (S)
mvgetstr ..... curses (S)
mvgetstr ..... terminfo (S)
mvinch ..... curses (S)
mvinch ..... tam (S)
mvinch ..... terminfo (S)
mvinsch ..... curses (S)
mvinsch ..... terminfo (S)
mvprintw ..... curses (S)
mvprintw ..... terminfo (S)
mvscanw ..... curses (S)
mvscanw ..... terminfo (S)
mvwaddch ..... curses (S)
mvwaddch ..... terminfo (S)
mvwaddstr ..... curses (S)
mvwaddstr ..... terminfo (S)
mvwdelch ..... curses (S)
mvwdelch ..... terminfo (S)
mvwgetch ..... curses (S)

mvwgetch ..... terminfo (S)
mvwgetstr ..... curses (S)
mvwgetstr ..... terminfo (S)
mvwin ..... curses (S)
mvwin ..... terminfo (S)
mvwinch ..... curses (S)
mvwinch ..... terminfo (S)
mvwinsch ..... curses (S)
mvwinsch ..... terminfo (S)
mvwprintw ..... curses (S)
mvwprintw ..... terminfo (S)
mvwscanw ..... curses (S)
mvwscanw ..... terminfo (S)
m4 ..... m4 (CP)
nap ..... nap (S)
napms ..... curses (S)
napms ..... terminfo (S)
nawk ..... awk (C)
nbwaitsem ..... waitsem (S)
ncheck ..... ncheck (ADM)
netbuf ..... netbuf (FP)
netconfig ..... netconfig (ADM)
netutil ..... netutil (ADM)
New ..... libwindows (S)
newform ..... newform (C)
newgrp ..... newgrp (C)
Newlayer ..... libwindows (S)
newpad ..... curses (S)
newpad ..... terminfo (S)
news ..... news (C)
newterm ..... curses (S)
newterm ..... terminfo (S)
newwin ..... curses (S)
newwin ..... terminfo (S)
new_fieldtype ..... fieldtype (S)
new_field ..... field (S)
new_item ..... item (S)
new_page ..... form (S)
new_panel ..... panel (S)
nextkey ..... dbm (S)
nice ..... nice (C)
nice ..... nice (S)
nictable ..... nictable (ADM)
nl ..... curses (S)
nl ..... nl (C)
nl ..... tam (S)
nl ..... terminfo (S)
nlist ..... nlist (S)
nlsadmin ..... nlsadmin (ADM)
nl_ascxtime ..... nl_cxtime (S)
nl_cxtime ..... nl_cxtime (S)
nl_fprintf ..... nl_printf (S)
nl_fscanf ..... nl_scanf (S)
nl_init ..... nl_init (S)
nl_langinfo ..... nl_langinfo (S)
nl_printf ..... nl_printf (S)
nl_scanf ..... nl_scanf (S)
nl_sprintf ..... nl_printf (S)
nl_sscanf ..... nl_scanf (S)
nl_strcmp ..... nl_strcmp (S)
nl_strncmp ..... nl_strcmp (S)
nl_types ..... nl_types (FP)
nm ..... nm (CP)
nm ..... nm (XNX)
nocbreak ..... curses (S)
nocbreak, nocrmode ..... tam (S)
nocbreak, nocrmode ..... terminfo (S)
nodelay ..... curses (S)
nodelay ..... tam (S)
nodelay ..... terminfo (S)
noecho ..... curses (S)
noecho ..... tam (S)
noecho ..... terminfo (S)
nohup ..... nohup (C)
nonl ..... curses (S)
nonl ..... tam (S)
nonl ..... terminfo (S)
noraw ..... curses (S)
noraw ..... terminfo (S)
notimeout ..... curses (S)
notimeout ..... terminfo (S)
nrand48 ..... drand48 (S)
nssend ..... nssend (FP)
null ..... null (FP)
nulladm ..... acctsh (ADM)
numtbl ..... numtbl (M)
oawk ..... awk (C)
od ..... od (C)
open ..... open (S)
openagent ..... libwindows (S)
openchan ..... libwindows (S)
opendir ..... directory (S)
openpl ..... plot (S)
opensem ..... opensem (S)
os2ld ..... os2ld (CP)
overlay ..... curses (S)
overlay ..... terminfo (S)
overwrite ..... curses (S)
overwrite ..... terminfo (S)
paccess ..... paccess (S)
pack ..... pack (C)
page ..... more (C)

pair_content ..... curses (S)
pair_content ..... terminfo (S)
panel ..... panel (S)
panel_above ..... panel (S)
panel_below ..... panel (S)
panel_hidden ..... panel (S)
panel_userptr ..... panel (S)
panel_window ..... panel (S)
parallel ..... parallel (HW)
passlen ..... passlen (S)
passwd ..... passwd (C)
passwd ..... passwd (FP)
paste ..... paste (C)
pathconf ..... pathconf (S)
pause ..... pause (S)
pax ..... pax (C)
pcat ..... pack (C)
pclose ..... popen (S)
pcpio ..... pcpio (C)
pdp11 ..... machid (C)
pechochar ..... curses (S)
pechochar ..... terminfo (S)
PEEKC ..... regexp (S)
permissions ..... permissions (F)
perror ..... perror (S)
pg ..... pg (C)
phs ..... phs (S)
phs_get ..... phs (S)
phs_msg ..... phs (S)
phs_note ..... phs (S)
pipe ..... pipe (ADM)
pipe ..... pipe (S)
pkgadd ..... pkgadd (ADM)
pkgask ..... pkgask (ADM)
pkgchk ..... pkgchk (ADM)
pkginfo ..... pkginfo (ADM)
pkginfo ..... pkginfo (F)
pkgmap ..... pkgmap (F)
pkgmk ..... pkgmk (ADM)
pkgparam ..... pkgparam (ADM)
pkgproto ..... pkgproto (ADM)
pkgrm ..... pkgrm (ADM)
pkgtrans ..... pkgtrans (ADM)
plock ..... plock (S)
plot ..... plot (FP)
plot ..... plot (S)
pnch ..... pnch (FP)
pnoutrefresh ..... curses (S)
pnoutrefresh ..... terminfo (S)
point ..... plot (S)
Poll ..... poll (F)
poll ..... poll (S)
Poll.day ..... poll (F)
Poll.hour ..... poll (F)
popen ..... popen (S)
post_form ..... form (S)
post_menu ..... menu (S)
pos_form_cursor ..... form (S)
pos_menu_cursor ..... menu (S)
pow ..... exp (S)
prctmp ..... acctsh (ADM)
prdaily ..... acctsh (ADM)
prefresh ..... curses (S)
prefresh ..... terminfo (S)
prf ..... prf (HW)
prfdc ..... profiler (ADM)
prfld ..... profiler (ADM)
prfpr ..... profiler (ADM)
prfsnap ..... profiler (ADM)
prfstat ..... profiler (ADM)
primary_auth ..... subsystems (S)
primary_of_secondary_auth ..... subsystems (S)
printenv ..... env (C)
printf ..... printf (S)
printw ..... curses (S)
printw ..... tam (S)
printw ..... terminfo (S)
proc ..... proc (FP)
proctl ..... proctl (S)
prof ..... prof (CP)
prof ..... prof (M)
prof ..... prof (XNX)
profil ..... profil (S)
profile ..... profile (M)
profiler ..... profiler (ADM)
proto ..... proto (ADM)
prototype ..... prototype (F)
pr ..... pr (C)
prs ..... prs (CP)
prtacct ..... acctsh (ADM)
prwarn ..... prwarn (C)
ps ..... ps (C)
pstat ..... pstat (C)
ptar ..... ptar (C)
ptmx ..... ptmx (M)
ptrace ..... ptrace (S)
pts??? ..... ptmx (M)
purge ..... purge (C)
purge ..... purge (F)
putc ..... putc (S)
putchar ..... putc (S)

putdvagnam ..... getdvagent (S)
putenv ..... putenv (S)
putmsg ..... putmsg (S)
putp ..... curses (S)
putp ..... terminfo (S)
putprdfnam ..... getprdfent (S)
putprfinam ..... getprfient (S)
putprpwnam ..... getprpwent (S)
putprtcnam ..... getprtcent (S)
putpwent ..... putpwent (S)
puts ..... puts (S)
pututline ..... getut (S)
putw ..... putc (S)
pwck ..... pwck (ADM)
pwconv ..... pwconv (ADM)
pwd ..... pwd (C)
pwunconv ..... pwconv (ADM)
pw_idtoname ..... pw_nametoid (S)
pw_nametoid ..... pw_nametoid (S)
qsort ..... qsort (S)
queue ..... queue (F)
queuedefs ..... queuedefs (F)
quot ..... quot (C)
raise ..... raise (S)
ramdisk ..... ramdisk (HW)
rand ..... rand (S)
random ..... random (C)
randomword ..... randomword (S)
ranlib ..... ranlib (XNX)
raw ..... curses (S)
raw ..... terminfo (S)
rcc ..... rcc (CP)
rcflow ..... rcflow (CP)
rcp ..... rcp (C)
rcvalert ..... rcvalert (C)
rcvfile ..... rcvfile (C)
rcvprint ..... rcvprint (C)
rcvtrip ..... rcvtrip (C)
rcxref ..... rcxref (CP)
rc0 ..... rc0 (ADM)
rc2 ..... rc2 (ADM)
rdchk ..... rdchk (S)
read ..... read (S)
readdir ..... directory (S)
readlink ..... readlink (S)
realloc ..... malloc (S)
reboot ..... haltsys (ADM)
red ..... ed (C)
reduce ..... reduce (ADM)
refresh ..... curses (S)
refresh ..... tam (S)
refresh ..... terminfo (S)
regcmp ..... regcmp (CP)
regcmp ..... regcmp (S)
regcmp ..... regex (S)
regex ..... regcmp (S)
regex ..... regex (S)
regexp ..... regexp (S)
reject ..... accept (ADM)
relax ..... relax (ADM)
reloc ..... reloc (FP)
relogin ..... relogin (ADM)
remote ..... remote (C)
remove ..... remove (S)
removef ..... removef (ADM)
removepkg ..... removepkg (ADM)
rename ..... rename (S)
replace_panel ..... panel (S)
resend ..... resend (C)
resetty ..... curses (S)
resetty ..... tam (S)
resetty ..... terminfo (S)
reset_prog_mode ..... curses (S)
reset_prog_mode ..... terminfo (S)
reset_shell_mode ..... curses (S)
reset_shell_mode ..... terminfo (S)
reset_tty ..... curses (S)
reset_tty ..... tam (S)
reset_tty ..... terminfo (S)
Reshape ..... libwindows (S)
restartterm ..... curses (S)
restartterm ..... terminfo (S)
restore ..... restore (ADM)
RETURN ..... regexp (S)
rewind ..... fseek (S)
rewinddir ..... directory (S)
ripoffline ..... curses (S)
ripoffline ..... terminfo (S)
rksh ..... ksh (C)
rlint ..... rlint (CP)
rm ..... rm (C)
rmail ..... rmail (ADM)
rmb ..... rmb (M)
rmdel ..... rmdel (CP)
rmdir ..... rmdir (C)
rmdir ..... rmdir (S)
rmgroup ..... rmuser (ADM)
rmpasswd ..... rmuser (ADM)
rmuser ..... rmuser (ADM)
Routines ..... Routines (S)
Routines ..... Routines (DOS)
rsh ..... rsh (C)

rtc ..... rtc (HW)
runacct ..... acctsh (ADM)
runacct ..... runacct (ADM)
Runlayer ..... libwindows (S)
run_crypt ..... crypt (S)
run_setkey ..... crypt (S)
sact ..... sact (CP)
sadc ..... sar (ADM)
sag ..... sag (ADM)
sar ..... sar (ADM)
savetty ..... curses (S)
savetty ..... tam (S)
savetty ..... terminfo (S)
sa1 ..... sar (ADM)
sa2 ..... sar (ADM)
sbrk ..... brk (S)
scale_form ..... form (S)
scale_menu ..... menu (S)
scancode ..... scancode (HW)
scanf ..... scanf (S)
scanoff ..... scanon (M)
scanon ..... scanon (M)
scanw ..... curses (S)
scanw ..... terminfo (S)
sccsdiff ..... sccsdiff (CP)
sccsfile ..... sccsfile (FP)
schedule ..... schedule (ADM)
scnhdr ..... scnhdr (FP)
screen ..... screen (HW)
scroll ..... curses (S)
scroll ..... terminfo (S)
scrollok ..... curses (S)
scrollok ..... terminfo (S)
scr_dump ..... curses (S)
scr_dump ..... scr_dump (FP)
scr_dump ..... terminfo (S)
scr_init ..... curses (S)
scr_init ..... terminfo (S)
scr_restore ..... curses (S)
scr_restore ..... terminfo (S)
scsi ..... scsi (HW)
sc_copyscstate ..... sc_raw (S)
sc_exit ..... sc_init (S)
sc_getfkeystr ..... sc_init (S)
sc_getinfo ..... sc_raw (S)
sc_getkbmap ..... sc_init (S)
sc_getkeymap ..... sc_init (S)
sc_getled ..... sc_init (S)
sc_getscreenswitch ..... sc_raw (S)
sc_init ..... sc_init (S)
sc_kb2mapcode ..... sc_readkb (S)
sc_mapcode2kb ..... sc_readkb (S)
sc_mapcode2str ..... sc_readkb (S)
sc_mapinit ..... sc_init (S)
sc_mapin ..... sc_readkb (S)
sc_mapout ..... sc_readkb (S)
sc_raw ..... sc_raw (S)
sc_readkb ..... sc_readkb (S)
sc_readmapcode ..... sc_readkb (S)
sc_readstr ..... sc_readkb (S)
sc_receive_kb ..... sc_init (S)
sc_setfkeystr ..... sc_init (S)
sc_setinfo ..... sc_raw (S)
sc_setkeymap ..... sc_init (S)
sc_setled ..... sc_init (S)
sc_setscreenswitch ..... sc_raw (S)
sc_str2kb ..... sc_readkb (S)
sc_unraw ..... sc_raw (S)
sd ..... sd (ADM)
sdb ..... sdb (CP)
sdd ..... sd (ADM)
sddate ..... sddate (C)
sdenter ..... sdenter (S)
sdevice ..... sdevice (F)
sdfree ..... sdget (S)
sdget ..... sdget (S)
sdgetv ..... sdgetv (S)
sdiff ..... sdiff (C)
sdleave ..... sdenter (S)
sdwaitv ..... sdgetv (S)
secondary_auth ..... subsystems (S)
sed ..... sed (C)
seed ..... seed (S)
seed48 ..... drand48 (S)
seekdir ..... directory (S)
select ..... select (S)
sem ..... sem (FP)
semctl ..... semctl (S)
semget ..... semget (S)
semop ..... semop (S)
serial ..... serial (HW)
setbuf ..... setbuf (S)
setclock ..... setclock (ADM)
setcolor ..... setcolor (C)
setcolour ..... setcolor (C)
setdvagent ..... getdvagent (S)
setgid ..... setuid (S)
setgrent ..... getgrent (S)
setgroups ..... setgroups (S)
setjmp ..... setjmp (S)
setkey ..... crypt (S)
setkey ..... setkey (C)

setlocale ..... setlocale (S)
setluid ..... setluid (S)
setmnt ..... setmnt (ADM)
setpgid ..... setpgid (S)
setpgrp ..... setpgrp (S)
setprdfent ..... getprdfent (S)
setprfient ..... getprfient (S)
setpriv ..... setpriv (S)
setprpwent ..... getprpwent (S)
setprtcent ..... getprtcent (S)
setpwent ..... getpwent (S)
setscrreg ..... curses (S)
setscrreg ..... terminfo (S)
setsid ..... setsid (S)
setsyx ..... curses (S)
setsyx ..... terminfo (S)
settime ..... settime (ADM)
setuid ..... setuid (S)
setupterm ..... curses (S)
setupterm ..... terminfo (S)
setutent ..... getut (S)
setvbuf ..... setbuf (S)
set_current_field ..... form (S)
set_current_item ..... menu (S)
set_curterm ..... curses (S)
set_curterm ..... terminfo (S)
set_fieldtype_arg ..... fieldtype (S)
set_fieldtype_choice ..... fieldtype (S)
set_field_back ..... field (S)
set_field_buffer ..... field (S)
set_field_fore ..... field (S)
set_field_init ..... form (S)
set_field_just ..... field (S)
set_field_opts ..... field (S)
set_field_pad ..... field (S)
set_field_status ..... field (S)
set_field_term ..... form (S)
set_field_type ..... field (S)
set_field_userptr ..... field (S)
set_form_fields ..... form (S)
set_form_init ..... form (S)
set_form_opts ..... form (S)
set_form_page ..... form (S)
set_form_sub ..... form (S)
set_form_term ..... form (S)
set_form_userptr ..... form (S)
set_form_win ..... form (S)
set_item_init ..... menu (S)
set_item_opts ..... item (S)
set_item_term ..... menu (S)
set_item_userptr ..... item (S)
set_item_value ..... item (S)
set_menu_back ..... menu (S)
set_menu_fore ..... menu (S)
set_menu_format ..... menu (S)
set_menu_grey ..... menu (S)
set_menu_init ..... menu (S)
set_menu_items ..... menu (S)
set_menu_mark ..... menu (S)
set_menu_opts ..... menu (S)
set_menu_pad ..... menu (S)
set_menu_pattern ..... menu (S)
set_menu_sub ..... menu (S)
set_menu_term ..... menu (S)
set_menu_userptr ..... menu (S)
set_menu_win ..... menu (S)
set_new_page ..... form (S)
set_panel_userptr ..... panel (S)
set_seed ..... seed (S)
set_term ..... curses (S)
set_term ..... terminfo (S)
set_top_row ..... menu (S)
set_tty ..... curses (S)
set_tty ..... terminfo (S)
sfmt ..... sfmt (ADM)
sfsys ..... sfsys (FP)
sg ..... sg (C)
sgetl ..... sputl (S)
sh ..... sh (C)
shl ..... shl (C)
shm ..... shm (FP)
shmat ..... shmop (S)
shmctl ..... shmctl (S)
shmdt ..... shmop (S)
shmget ..... shmget (S)
shmop ..... shmop (S)
show_panel ..... panel (S)
shutacct ..... acctsh (ADM)
shutdn ..... shutdn (S)
shutdown ..... shutdown (ADM)
sigaction ..... sigaction (S)
sigaddset ..... sigset (S)
sigdelset ..... sigset (S)
sigemptyset ..... sigset (S)
sigfillset ..... sigset (S)
sighold ..... sigsetv (S)
sigignore ..... sigsetv (S)
sigismember ..... sigset (S)
siglongjmp ..... sigsetjmp (S)
signal ..... signal (S)
sigpause ..... sigsetv (S)
sigpending ..... sigpending (S)

sigprocmask ..... sigprocmask (S)
sigrelse ..... sigsetv (S)
sigsem ..... sigsem (S)
sigset ..... sigset (S)
sigset ..... sigsetv (S)
sigsetjmp ..... sigsetjmp (S)
sigsuspend ..... sigsuspend (S)
sin ..... trig (S)
sinh ..... sinh (S)
size ..... size (CP)
size ..... size (XNX)
sleep ..... sleep (C)
sleep ..... sleep (S)
slk_clear ..... curses (S)
slk_clear ..... terminfo (S)
slk_init ..... curses (S)
slk_init ..... terminfo (S)
slk_label ..... curses (S)
slk_label ..... terminfo (S)
slk_noutrefresh ..... curses (S)
slk_noutrefresh ..... terminfo (S)
slk_refresh ..... curses (S)
slk_refresh ..... terminfo (S)
slk_restore ..... curses (S)
slk_restore ..... terminfo (S)
slk_set ..... curses (S)
slk_set ..... terminfo (S)
slk_touch ..... curses (S)
slk_touch ..... terminfo (S)
slot ..... slot (C)
smmck ..... tcbck (ADM)
sort ..... sort (C)
space ..... plot (S)
space ..... space (F)
spell ..... spell (C)
spellin ..... spell (C)
spline ..... spline (C)
split ..... split (C)
sprintf ..... printf (S)
sputl ..... sputl (S)
sqrt ..... exp (S)
srand ..... rand (S)
srand48 ..... drand48 (S)
sscanf ..... scanf (S)
ssignal ..... ssignal (S)
standend ..... curses (S)
standend ..... terminfo (S)
standout ..... curses (S)
standout ..... terminfo (S)
startup ..... acctsh (ADM)
start_color ..... curses (S)
start_color ..... terminfo (S)
stat ..... stat (FP)
stat ..... stat (S)
statfs ..... statfs (S)
stdarg ..... varargs (S)
stdbl ..... isconv (S)
stderr ..... stdio (S)
stdin ..... stdio (S)
stdio ..... stdio (S)
stdout ..... stdio (S)
step ..... regexp (S)
stfloat ..... isconv (S)
stime ..... stime (S)
stint ..... isconv (S)
stlong ..... isconv (S)
stopio ..... stopio (S)
store ..... dbm (S)
strace ..... strace (ADM)
strcat ..... string (S)
strchr ..... string (S)
strclean ..... strclean (ADM)
strcmp ..... string (S)
strcoll ..... strcoll (S)
strcpy ..... string (S)
strcspn ..... string (S)
strdup ..... string (S)
streamio ..... streamio (HW)
streamio ..... streamio (M)
strerr ..... strerr (ADM)
strerror ..... strerror (S)
strftime ..... ctime (S)
strftime ..... strftime (S)
string ..... string (M)
string ..... string (S)
strings ..... strings (C)
strip ..... strip (XNX)
strlen ..... string (S)
strncat ..... string (S)
strncmp ..... string (S)
strncoll ..... strcoll (S)
strncpy ..... string (S)
strnxfrm ..... strcoll (S)
strpbrk ..... string (S)
strrchr ..... string (S)
strspn ..... string (S)
strtod ..... strtod (S)
strtok ..... string (S)
strtol ..... strtol (S)
strtoul ..... strtoul (S)
strxfrm ..... strcoll (S)
stty ..... stty (C)

stune ..... stune (F)
su ..... su (C)
submit ..... submit (ADM)
subpad ..... curses (S)
subpad ..... terminfo (S)
subsystems ..... subsystems (S)
subsystem ..... subsystem (M)
subwin ..... curses (S)
subwin ..... terminfo (S)
sulogin ..... sulogin (ADM)
sum ..... sum (C)
swab ..... swab (S)
swap ..... swap (ADM)
swconfig ..... swconfig (C)
sxt ..... sxt (M)
symlink ..... symlink (S)
syms ..... syms (FP)
sync ..... sync (ADM)
sync ..... sync (S)
sysadmcolor ..... sysadmcolor (F)
sysadmmenu ..... sysadmmenu (F)
sysadmsh ..... sysadmsh (ADM)
sysconf ..... sysconf (S)
sysdef ..... sysdef (ADM)
sysfiles ..... sysfiles (F)
sysfs ..... sysfs (S)
sysi86 ..... sysi86 (S)
systemid ..... systemid (F)
systems ..... systems (F)
system ..... system (S)
systty ..... systty (M)
sys_errlist ..... perror (S)
sys_nerr ..... perror (S)
S_ISBLK ..... stat (S)
S_ISCHR ..... stat (S)
S_ISDIR ..... stat (S)
S_ISFIFO ..... stat (S)
S_ISNAM ..... stat (S)
S_ISREG ..... stat (S)
tables ..... tables (F)
tabs ..... tabs (C)
tail ..... tail (C)
tai_end ..... tai (S)
tai_get ..... tai (S)
tai_init ..... tai (S)
tam ..... tam (S)
tan ..... trig (S)
tanh ..... sinh (S)
tape ..... tape (C)
tape ..... tape (HW)
tapecntl ..... tapecntl (C)
tapedump ..... tapedump (C)
tar ..... tar (C)
tar ..... tar (F)
tcbck ..... tcbck (ADM)
tcdrain ..... tcflow (S)
tcflow ..... tcflow (S)
tcflush ..... tcflow (S)
tcgetattr ..... tcattr (S)
tcgetpgrp ..... tcpgrp (S)
tcsendbreak ..... tcflow (S)
tcsetattr ..... tcattr (S)
tcsetpgrp ..... tcpgrp (S)
tdelete ..... tsearch (S)
tee ..... tee (C)
telinit ..... init (M)
telldir ..... directory (S)
tempnam ..... tmpnam (S)
term ..... term (M)
term ..... term (F)
termcap ..... termcap (F)
termcap ..... termcap (S)
terminal ..... terminal (HW)
terminals ..... terminals (M)
terminfo ..... terminfo (F)
terminfo ..... terminfo (M)
terminfo ..... terminfo (S)
termio ..... termio (M)
termios ..... termios (M)
termupd ..... ttyupd (ADM)
test ..... test (C)
tfind ..... tsearch (S)
tgetent ..... curses (S)
tgetent ..... termcap (S)
tgetent ..... terminfo (S)
tgetflag ..... curses (S)
tgetflag ..... termcap (S)
tgetflag ..... terminfo (S)
tgetnum ..... curses (S)
tgetnum ..... termcap (S)
tgetnum ..... terminfo (S)
tgetstr ..... curses (S)
tgetstr ..... termcap (S)
tgetstr ..... terminfo (S)
tgoto ..... curses (S)
tgoto ..... termcap (S)
tgoto ..... terminfo (S)
tic ..... tic (C)
tigetflag ..... curses (S)
tigetflag ..... terminfo (S)
tigetnum ..... curses (S)
tigetnum ..... terminfo (S)

tigetstr ..... curses (S)
tigetstr ..... terminfo (S)
time ..... time (C)
time ..... time (S)
times ..... times (S)
timex ..... timex (ADM)
timezone ..... timezone (F)
timod ..... timod (HW)
timod ..... timod (M)
timtbl ..... timtbl (M)
tirdwr ..... tirdwr (HW)
tirdwr ..... tirdwr (M)
tmpfile ..... tmpfile (S)
tmpnam ..... tmpnam (S)
toascii ..... ctype (S)
toascii ..... toascii (S)
todigit ..... toascii (S)
toint ..... toascii (S)
top ..... top (F)
Top ..... libwindows (S)
top.next ..... top (F)
top_panel ..... panel (S)
top_row ..... menu (S)
total_auths ..... subsystems (S)
touch ..... touch (C)
touchline ..... curses (S)
touchline ..... terminfo (S)
touchwin ..... curses (S)
touchwin ..... terminfo (S)
toupper ..... ctype (S)
toupper ..... toascii (S)
tparm ..... curses (S)
tparm ..... terminfo (S)
tplot ..... tplot (ADM)
tput ..... tput (C)
tputs ..... curses (S)
tputs ..... termcap (S)
tputs ..... terminfo (S)
tr ..... tr (C)
traceoff ..... curses (S)
traceoff ..... terminfo (S)
traceon ..... curses (S)
traceon ..... terminfo (S)
translate ..... translate (C)
trchan ..... trchan (M)
trig ..... trig (S)
true ..... true (C)
tsearch ..... tsearch (S)
tset ..... tset (C)
tsort ..... tsort (CP)
tty ..... tty (C)
tty ..... tty (M)
ttyname ..... ttyname (S)
ttyslot ..... ttyslot (S)
ttytype ..... ttytype (F)
ttyupd ..... ttyupd (ADM)
tty1[a-h] ..... serial (HW)
tty2[a-h] ..... serial (HW)
turnacct ..... acctsh (ADM)
twalk ..... tsearch (S)
typeahead ..... curses (S)
typeahead ..... terminfo (S)
types ..... types (FP)
tz ..... tz (M)
tzset ..... ctime (S)
t_accept ..... t_accept (S)
t_alloc ..... t_alloc (S)
t_bind ..... t_bind (S)
t_close ..... t_close (S)
t_connect ..... t_connect (S)
t_error ..... t_error (S)
t_free ..... t_free (S)
t_getinfo ..... t_getinfo (S)
t_getstate ..... t_getstate (S)
t_info ..... t_info (FP)
t_listen ..... t_listen (S)
t_look ..... t_look (S)
t_open ..... t_open (S)
t_optmgmt ..... t_optmgmt (S)
t_rcvconnect ..... t_rcvconnect (S)
t_rcvdis ..... t_rcvdis (S)
t_rcvrel ..... t_rcvrel (S)
t_rcvudata ..... t_rcvudata (S)
t_rcvuderr ..... t_rcvuder (S)
t_rcv ..... t_rcv (S)
t_snddis ..... t_snddis (S)
t_sndrel ..... t_sndrel (S)
t_sndudata ..... t_sndudata (S)
t_snd ..... t_snd (S)
t_sync ..... t_sync (S)
t_unbind ..... t_unbind (S)
uadmin ..... uadmin (ADM)
uadmin ..... uadmin (S)
ulimit ..... ulimit (S)
umask ..... umask (C)
umask ..... umask (S)
umnt ..... mnt (C)
umount ..... mount (ADM)
umount ..... umount (ADM)
umount ..... umount (S)
umountall ..... mountall (ADM)
uname ..... uname (C)

uname ..... uname (S)
uncompress ..... compress (C)
unctrl ..... curses (S)
unctrl ..... terminfo (S)
undocumented ..... undocumented (M)
unexecseg ..... execseg (S)
unget ..... unget (CP)
ungetc ..... ungetc (S)
ungetch ..... curses (S)
ungetch ..... terminfo (S)
UNGETC ..... regexp (S)
uniq ..... uniq (C)
unistd ..... unistd (FP)
units ..... units (C)
unlink ..... link (ADM)
unlink ..... unlink (S)
unpack ..... pack (C)
unpost_form ..... form (S)
unpost_menu ..... menu (S)
unretire ..... unretire (ADM)
update_panels ..... panel (S)
uptime ..... uptime (C)
usemouse ..... usemouse (C)
ustat ..... ustat (S)
utime ..... utime (S)
utmp ..... utmp (F)
utmpname ..... getut (S)
uuchat ..... dial (ADM)
uucheck ..... uucheck (ADM)
uucico ..... uucico (ADM)
uuclean ..... uuclean (ADM)
uucp ..... uucp (C)
uudecode ..... uuencode (C)
uudemon ..... uudemon (ADM)
uudemon.admin ..... uudemon (ADM)
uudemon.clean ..... uudemon (ADM)
uudemon.hour ..... uudemon (ADM)
uudemon.poll2 ..... uudemon (ADM)
uudemon.poll ..... uudemon (ADM)
uuencode ..... uuencode (C)
uugetty ..... getty (M)
uuinstall ..... uuinstall (ADM)
uulist ..... uulist (ADM)
uulog ..... uucp (C)
uuname ..... uucp (C)
uupick ..... uuto (C)
uusched ..... uusched (ADM)
uustat ..... uustat (C)
uuto ..... uuto (C)
uutry ..... uutry (ADM)
uux ..... uux (C)
uuxqt ..... uuxqt (ADM)
u3b15 ..... machid (C)
u3b2 ..... machid (C)
u3b5 ..... machid (C)
u3b ..... machid (C)
u370 ..... machid (C)
val ..... val (CP)
values ..... values (M)
varargs ..... varargs (S)
vax ..... machid (C)
va_alist ..... varargs (S)
va_arg ..... varargs (S)
va_dcl ..... varargs (S)
va_end ..... varargs (S)
va_list ..... varargs (S)
va_start ..... varargs (S)
vc ..... vc (CP)
vectorsinuse ..... vectorsinuse (ADM)
vedit ..... vi (C)
vfprintf ..... vprintf (S)
vi ..... vi (C)
vidattr ..... curses (S)
vidattr ..... terminfo (S)
vidi ..... vidi (C)
vidputs ..... curses (S)
vidputs ..... terminfo (S)
view ..... vi (C)
vldldptr ..... ldptr (S)
vmstat ..... vmstat (C)
volcopy ..... volcopy (ADM)
vprintf ..... vprintf (S)
vsprintf ..... vprintf (S)
vwprintw ..... curses (S)
vwprintw ..... terminfo (S)
vwscanw ..... curses (S)
vwscanw ..... terminfo (S)
w ..... w (C)
waddch ..... curses (S)
waddch ..... terminfo (S)
waddstr ..... curses (S)
waddstr ..... terminfo (S)
wait ..... wait (C)
wait ..... wait (S)
waitpid ..... wait (S)
waitsem ..... waitsem (S)
wall ..... wall (ADM)
wattroff ..... curses (S)
wattroff ..... terminfo (S)
wattron ..... curses (S)
wattron ..... terminfo (S)
wattrset ..... curses (S)

wattrset ..... terminfo (S)
wc ..... wc (C)
wclear ..... curses (S)
wclear ..... terminfo (S)
wclrtobot ..... curses (S)
wclrtobot ..... terminfo (S)
wclrtoeol ..... curses (S)
wclrtoeol ..... terminfo (S)
wcstombs ..... mblen (S)
wctomb ..... mblen (S)
wdelch ..... curses (S)
wdelch ..... terminfo (S)
wdeleteln ..... curses (S)
wdeleteln ..... terminfo (S)
wechochar ..... curses (S)
wechochar ..... terminfo (S)
werase ..... curses (S)
werase ..... terminfo (S)
wgetch ..... curses (S)
wgetch ..... terminfo (S)
wgetstr ..... curses (S)
wgetstr ..... terminfo (S)
what ..... what (CP)
what ..... what (C)
who ..... who (C)
whodo ..... whodo (C)
widest_auth ..... subsystems (S)
winch ..... curses (S)
winch ..... terminfo (S)
winsch ..... curses (S)
winsch ..... terminfo (S)
winsertln ..... curses (S)
winsertln ..... terminfo (S)
wmove ..... curses (S)
wmove ..... terminfo (S)
wnoutrefresh ..... curses (S)
wnoutrefresh ..... terminfo (S)
wprintw ..... curses (S)
wprintw ..... terminfo (S)
wrefresh ..... curses (S)
wrefresh ..... tam (S)
wrefresh ..... terminfo (S)
write ..... write (C)
write ..... write (S)
write_authorizations ..... subsystems (S)
wscanw ..... curses (S)
wscanw ..... terminfo (S)
wsetscrreg ..... curses (S)
wsetscrreg ..... terminfo (S)
wstandend ..... curses (S)
wstandend ..... terminfo (S)
wstandout ..... curses (S)
wstandout ..... terminfo (S)
wtinit ..... wtinit (ADM)
wtmpfix ..... fwtmp (ADM)
wtmp ..... utmp (F)
x.out ..... x.out (FP)
xargs ..... xargs (C)
xbackup ..... xbackup (ADM)
xbackup ..... xbackup (F)
xdump ..... xbackup (ADM)
xdumpdir ..... xdumpdir (ADM)
xinstall ..... xinstall (ADM)
xlist ..... xlist (S)
xrestor ..... xrestore (ADM)
xrestore ..... xrestore (ADM)
xstr ..... xstr (CP)
xt ..... xt (HW)
xtd ..... xtd (ADM)
xtod ..... xtod (C)
xtproto ..... xtproto (M)
xtract ..... xtract (C)
xts ..... xts (ADM)
xtt ..... xtt (ADM)
x286emul ..... x286emul (CP)
x286emul ..... x286emul (C)
yacc ..... yacc (CP)
yes ..... yes (C)
yn ..... bessel (S)
y0 ..... bessel (S)
y1 ..... bessel (S)
zcat ..... compress (C)
86rel ..... 86rel (FP)
300s ..... 300 (C)
80387 ..... 80387 (HW)
4014 ..... 4014 (C)
300 ..... 300 (C)
450 ..... 450 (C)
_nextchoice ..... fieldtype (S)
_prevchoice ..... fieldtype (S)
_tolower ..... ctype (S)
_tolower ..... toascii (S)
[..... test (C)
__scoinfo ..... __scoinfo (S)

Commands (C)

Intro

introduces UNIX commands

Description

This section describes the use of the individual commands available in the UNIX Operating System. Each individual command is labeled with either a C, or a CP for easy reference from other volumes. The letter "C" stands for "command". The letter "P" stands for commands that come with the optional Development System (Programming). For example, the reference **date**(C) indicates a reference to a discussion of the **date**(C) command in the C section; the reference **cc**(CP) indicates a reference to a discussion of the **cc** command in the Development System. The Development System is an optional supplemental package to the standard Operating System.

The "ADM" Administration section contains miscellaneous information including a great deal of system maintenance information. Other reference sections include the "M" Miscellaneous section, the "S" System Services section, the "HW" Hardware section, and the "F" File Format section.

Syntax

Unless otherwise noted, commands described in the "Syntax" section of a manual page accept options and other arguments according to the following syntax and should be interpreted as explained below.

name [***-option***...] [***cmdarg***...]

where:

[ ]	Surround an ***option*** or ***cmdarg*** that is not required.
...	Indicates multiple occurrences of the ***option*** or ***cmdarg***.
name	The name of an executable file.
option	(Always preceded by a "-".) ***noargletter***... or, ***argletter optarg***[,...]
noargletter	A single letter representing an option without an option-argument. Note that more than one ***noargletter*** option can be grouped after one "-" (Rule 5 in the following text).
argletter	A single letter representing an option requiring an option-argument.

optarg An option-argument (character string) satisfying a preceding ***argletter***. Note that groups of ***optargs*** following an ***argletter*** must be separated by commas or separated by white space and quoted (Rule 8 below).

cmdarg Path name (or other command argument) *not* beginning with "-", or "-" by itself indicating the standard input.

Command syntax standard: rules

These command syntax rules are not followed by all current commands, but all new commands use them. **getopts**(C) should be used by all shell procedures to parse positional parameters and to check for legal options. It supports Rules 3-10 below. The enforcement of the other rules must be done by the command itself.

1. Command names (***name*** above) must be between two and nine characters long.
2. Command names must include only lowercase letters and digits.
3. Option names (***option*** above) must be one character long.
4. All options must be preceded by "-".
5. Options with no arguments may be grouped after a single "-".
6. The first option-argument (***optarg*** above) following an option must be preceded by white space.
7. Option-arguments cannot be optional.
8. Groups of option-arguments following an option must either be separated by commas or separated by white space and quoted (for example, 8-o xxx,z,yy or 8 -o "xxx z yy").
9. All options must precede operands (***cmdarg*** above) on the command line.
10. "-" may be used to indicate the end of the options.
11. The order of the options relative to one another should not matter.
12. The relative order of the operands (***cmdarg*** above) may affect their significance in ways determined by the command with which they appear.
13. "-" preceded and followed by white space should only be used to mean standard input.

See also

getopts(C), **exit**(S), **getopt**(S), **wait**(S)

Diagnostics

Upon termination, each command returns 2 bytes of status, one supplied by the system and giving the cause for termination, and (in the case of "normal" termination) one supplied by the program (see **wait**(S) and **exit**(S)). The former byte is 0 for normal termination; the latter is customarily 0 for successful execution and non-zero to indicate troubles such as erroneous parameters, bad or inaccessible data. It is called variously "exit code", "exit status", or "return code", and is described only where special conventions are involved.

Note

Not all commands adhere to the syntax described here.

300, 300s

handle special functions of DASI 300 and 300s terminals

Syntax

300 [**+12**] [***-n***] [**-d*t,l,c***]

300s [**+12**] [***-n***] [**-d*t,l,c***]

Description

300 - Handles special functions for the DASI 300 terminal

300s - Handles special functions for the DASI 300s terminal

The **300** command supports special functions and optimizes the use of the DASI 300 (GSI 300 or DTC 300) terminal; **300s** performs the same functions for the DASI 300s (GSI 300s or DTC 300s) terminal. It converts half-line forward, half-line reverse, and full-line reverse motions to the correct vertical motions. In the following discussion of the **300** command, it should be noted that unless your system contains the text processing software, references to certain commands (for example, **nroff**, **neqn**, **eqn,** etc.) will not work. It also attempts to draw Greek letters and other special symbols. It permits convenient use of 12-pitch text. It also reduces printing time by between 5% and 70%. The **300** command can be used to print equations neatly, in the sequence:

neqn *file* ... | **nroff** | 300

WARNING: if your terminal has a PLOT switch, make sure it is turned *on* before **300** is used.

The behavior of **300** can be modified by the optional flag arguments to handle 12-pitch text, fractional line spacings, messages, and delays.

+12 permits use of 12-pitch, 6 lines/inch text. DASI 300 terminals normally allow only two combinations: 10-pitch, 6 lines/inch, or 12-pitch, 8 lines/inch. To obtain the 12-pitch, 6 lines per inch combination, the user should turn the PITCH switch to 12, and use the **+12** option.

-n controls the size of half-line spacing. A half-line is, by default, equal to 4 vertical plot increments. Because each increment equals 1/48 of an inch, a 10-pitch line-feed requires 8 increments, while a 12-pitch line-feed needs only 6. The first digit of ***n*** overrides the default value, thus allowing for individual taste in the appearance of subscripts and superscripts. For example, **nroff** half-lines could be made to act as quarter-lines by using **-2**. The user could also obtain appropriate half-lines for 12-pitch, 8 lines/inch mode by using the option **-3** alone, having set the PITCH switch to 12-pitch.

-d*t,l,c* controls delay factors. The default setting is **-d3,90,30**. DASI 300 terminals sometimes produce peculiar output when faced with very long lines, too many tab characters, or long strings of blankless, non-identical characters. One null (delay) character is inserted in a line for every set of *t* tabs, and for every contiguous string of *c* non-blank, non-tab characters. If a line is longer than *l* bytes, 1+(total length)/20 nulls are inserted at the end of that line. Items can be omitted from the end of the list, implying use of the default values. Also, a value of zero for *t* (*c*) results in two null bytes per tab (character). The former may be needed for C programs, the latter for files like */etc/passwd*. Because terminal behavior varies according to the specific characters printed and the load on a system, the user may have to experiment with these values to get correct output. The **-d** option exists only as a last resort for those few cases that do not otherwise print properly. For example, the file */etc/passwd* may be printed using **-d3,30,5**. The value **-d0,1** is a good one to use for C programs that have many levels of indentation.

Note that the delay control interacts heavily with the prevailing carriage return and line-feed delays. The **stty**(C) modes **nl0 cr2** or **nl0 cr3** are recommended for most uses.

The **300** command can be used with the **nroff -s** flag or **.rd** requests, when it is necessary to insert paper manually or change fonts in the middle of a document. Instead of hitting the Return key in these cases, you must use the line-feed key to get any response.

In many (but not all) cases, the following sequences are equivalent:

nroff -T300 *files* ... and **nroff** *files* ... | **300**
nroff -T300-12 *files* ... and **nroff** *files* ... | **300 +12**

The use of **300** can thus often be avoided unless special delays or options are required; in a few cases, however, the additional movement optimization of **300** may produce better aligned output.

See also

450(C), **mesg**(C), **graph**(ADM), **stty**(C), **tabs**(C), **tplot**(ADM)

Notes

Some special characters cannot be correctly printed in column 1 because the print head cannot be moved to the left from there.

If your output contains Greek and/or reverse line-feeds, use a friction-feed platen instead of a forms tractor; although good enough for drafts, the latter has a tendency to slip when reversing direction, distorting Greek characters and misaligning the first line of text after one or more reverse line-feeds.

4014

paginator for the TEKTRONIX 4014 terminal

Syntax

4014 [**-t**] [**-n**] [**-c***N*] [**-p***L*] [*file*]

Description

The output of **4014** is intended for a TEKTRONIX 4014 terminal; **4014** arranges for 66 lines to fit on the screen, divides the screen into *N* columns, and contributes an eight-space page offset in the (default) single-column case. Tabs, spaces, and backspaces are collected and plotted when necessary. TELETYPE Model 37 half- and reverse-line sequences are interpreted and plotted. At the end of each page, **4014** waits for a new-line (empty line) from the keyboard before continuing on to the next page. In this wait state, the command **!***cmd* will send the *cmd* to the shell.

The command line options are:

-t Do not wait between pages (useful for directing output into a file).

-n Start printing at the current cursor position and never erase the screen.

-c*N* Divide the screen into *N* columns and wait after the last column.

-p*L* Set page length to *L*; *L* accepts the scale factors **i** (inches) and **l** (lines); default is lines.

See also

pr(C)

450

handle special functions of the DASI 450 terminal

Syntax

450 [-f]

Description

The **450** command supports special functions of, and optimizes the use of, the DASI 450 terminal, or any terminal that is functionally identical, such as the Diablo 1620 or Xerox 1700. It converts half-line forward, half-line reverse, and full-line reverse motions to the correct vertical motions. It also attempts to draw Greek letters and other special symbols in the same manner as **300**(C).

The **-f** option sets up fast (1200 baud) output using the ETX/ACK protocol. The following errors are possible when using **-f**:

1. Standard output is not a terminal.
2. Error when opening output terminal for read.
3. Output terminal did not respond to ETX.
4. Output terminal did not respond with ACK.

It should be noted that, unless your system contains text processing software, certain commands (for example, **eqn, nroff, tbl,** etc.) will not work. Use **450** to print equations neatly, in the sequence:

neqn *file ...* **| nroff | 450**

WARNING: Make sure that the PLOT switch on your terminal is ON before **450** is used. The SPACING switch should be put in the desired position (either 10- or 12-pitch). In either case, vertical spacing is 6 lines/inch, unless dynamically changed to 8 lines per inch by an appropriate escape sequence.

Use **450** with the **nroff -s** flag or **.rd** requests when it is necessary to insert paper manually or change fonts in the middle of a document. Instead of hitting the RETURN key in these cases, you must use the LINE-FEED key to get any response.

In many (but not all) cases, the use of **450** can be eliminated in favor of one of the following:

nroff -T450 *files* ...

or

nroff -T450-12 *files* ...

The use of **450** can thus often be avoided unless special delays or options are required; in a few cases, however, the additional movement optimization of **450** may produce better aligned output.

See also

graph(ADM), **tplot**(ADM), **300**(C), **mesg**(C), **stty**(C), **tabs**(C),

Notes

Some special characters cannot be correctly printed in column 1 because the print head cannot be moved to the left from there.

If your output contains Greek and/or reverse line-feeds, use a friction-feed platen instead of a forms tractor; although good enough for drafts, the latter has a tendency to slip when reversing direction, distorting Greek characters and misaligning the first line of text after one or more reverse line-feeds.

assign, deassign

assign and deassign devices

Syntax

assign [**-u**] [**-v**] [**-d**] [***device***] ...

deassign [**-u**] [**-v**] [***device***] ...

Description

assign - assigns devices

deassign - deassigns devices

The **assign** command attempts to assign ***device*** to the current user. The ***device*** argument must be an assignable device that is not currently assigned. An ***assign*** command without an argument prints a list of assignable devices along with the name of the user to whom they are assigned.

The **deassign** command is used to "deassign" devices. Without any arguments, **deassign** will deassign all devices assigned to the user. With arguments, an attempt is made to deassign each ***device*** given as an argument.

With these commands you can exclusively use a device, such as a tape drive or floppy drive. This keeps other users from using the device. They have a similar effect to **chown**(C) and **chmod**(C), although they only act on devices in */dev*. Other aspects are discussed further on.

Available options include:

-d Performs the action of **deassign**. The **-d** option can be embedded in device names to assign some devices and deassign others.

-v Gives verbose output.

-u Suppresses assignment or deassignment, but performs error checking.

The **assign** command will not assign any assignable devices if it cannot assign all of them. **deassign** gives no diagnostic if the device cannot be deassigned. Devices can be automatically deassigned at logout, but this is not guaranteed. Device names can be just the beginning of the device required. For example,

assign fd

should be used to assign all floppy disk devices. Raw versions of ***device*** will also be assigned, for example, the raw floppy disk devices */dev/rfd?* would be assigned in the above example.

Note that in many installations the assignable devices such as floppy disks have general read and write access, so the **assign** command may not be necessary. This is particularly true on single-user systems. Devices supposed to be assignable with this command should be owned by the user *asg*. The directory */dev* should be owned by *bin* and have mode 755. The **assign** command (after checking for use by someone else) will then make the device owned by whoever invokes the command, without changing the access permissions. This allows the system administrator to set up individual devices that are freely available, assignable (owned by *asg*), or nonassignable and restricted (not owned by *asg* and with some restricted mode).

Note that the first time **assign** is invoked, it builds the assignable devices table */etc/atab*. This table is used in subsequent invocations to save repeated searches of the */dev* directory. If one of the devices in */dev* is changed to be assignable or unassignable (that is, owned by *asg*), then */etc/atab* should be removed (by the superuser) so that a correct list will be built the next time the command is invoked.

Files

/etc/atab	Table of assignable devices
/dev/asglock	File to prevent concurrent access

Diagnostics

Exit code *0* returned if successful, *1* if problems, 2 if ***device*** cannot be assigned.

Note

Although it should never happen, if **assign** is aborted before completion (via **kill -9**, a power failure, etc.), the lock file */dev/asglock* may need to be removed by root.

at, batch

execute commands at a later time

Syntax

at *time* [*date*] [*increment*]

at -r *job-id ...*

at -l [*job-id ...*]

at -q*letter time* [*date*] [*increment*]

batch

Description

at - Schedules jobs for execution at a particular time

batch - Schedules jobs for execution when the system load permits

The **at** and **batch** commands both accept one or more commands from the standard input to be executed at a later time. **at** and **batch** differ in the way the set of commands, or job, is scheduled: **at** allows you to specify a time when the job should be executed, while **batch** executes the job when the system load level permits. After a job is queued with either command, the program writes a job identifier (a number and a letter), along with the time the job will execute, to standard error.

at takes the following arguments:

time — The *time* can be specified as 1, 2, or 4 digits. One- and two-digit numbers are taken to be hours, four digits to be hours and minutes. The time can alternately be specified as two numbers separated by a colon, meaning *hour:minute*. A suffix **am** or **pm** can be appended; otherwise a 24-hour clock time is understood. The suffix **zulu** can be used to indicate Greenwich Mean Time (GMT). The special names **noon**, **midnight**, and **now** are also recognized.

date — An optional *date* can be specified as either a month name followed by a day number (and possibly year number preceded by an optional comma) or a day of the week (spelt in full or abbreviated to three characters). Two special "days," **today** and **tomorrow**, are recognized. If no *date* is given, **today** is assumed if the given hour is greater than the current hour and **tomorrow** is assumed if it is less. If the given month is less than the current month (and no year is given), next year is assumed.

increment The ***time*** and optional ***date*** arguments can be modified with an increment argument of the form ***+n units***, where ***n*** is an integer and ***units*** is one of the following: **minutes, hours, days, weeks, months,** or **years**. The singular form is also accepted, and **+1** ***unit*** can also be written **next** ***unit***. Thus, legitimate commands include:

at 0815am Jan 24
at 8:15am Jan 24
at now + 1 day
at 5 pm Friday next week

-r ***job-id*** ... Removes the specified job or jobs previously scheduled by the **at** or **batch** command. ***job-id*** is a job identifier returned by **at** or **batch**. Unless you are the superuser, you can only remove your own jobs.

-l [***job-id*** ...] Lists schedule times of specified jobs. If no ***job-ids*** are specified, lists all jobs currently scheduled for the invoking user. Unless you are the super user, you can only list your own jobs.

-q*letter* Places the specified job in a queue denoted by ***letter***, where ***letter*** is any lowercase letter from "a" to "z". The queue letter is appended to the job identifier. The following letters have special significance:

a **at** queue
b **batch** queue
c **cron** queue

For more information on the use of different queues, see the **queuedefs**(F) manual page.

batch takes no arguments; it submits a job for immediate execution at lower priority than an ordinary **at** job.

at and **batch** jobs are executed using **sh**(C). Standard output and standard error output are mailed to the user unless they are redirected elsewhere. The shell environment variables, current directory, **umask**, and **ulimit** are retained when the commands are executed. Open file descriptors, traps, and priorities are lost.

Users are permitted to use **at** and **batch** if their usernames (logins) appear in the file */usr/lib/cron/at.allow*. If that file does not exist, the file */usr/lib/cron/at.deny* is checked to determine if a given user should be denied access to **at** and **batch**. If neither file exists, only root is allowed to submit a job. If only the *at.deny* file exists, and it is empty, global usage is permitted. The allow/deny files consist of one user name per line.

If the system is installed with C2 security (this is the default, unless the system administrator has relaxed the security), the user will also need the **chmodsuid** kernel authorization. For more information about system security and kernel authorizations, see the *User's Guide* and the *System Administrator's Guide*.

Examples

The simplest way to use **at** is to place a series of commands in a file, one per line, and execute these commands at a specified time with the following command:

at *time* < *file*

The following sequence can be used at a terminal to format the file *infile* using the text formatter **nroff**(CT), and place the output in the file *outfile*.

batch
nroff infile > outfile
⟨Ctrl⟩**d**

The next example demonstrates redirecting standard error to a pipe (|), which is useful in a shell procedure. The file *infile* is formatted and the output placed in *outfile*, with any errors generated being mailed to *user* (output redirection is covered on the **sh**(C) manual page).

batch <<!
nroff infile2 > &1 > outfile | mail user
!

To have a job reschedule itself, invoke **at** from within the job. For example, if you want ***shellfile*** to run every Thursday, executing a series of commands and then rescheduling itself for the next Thursday, you can include code similar to the following within ***shellfile***:

echo "sh shellfile" | at 1900 thursday next week

Files

/usr/lib/cron	main cron directory
/usr/lib/cron/at.allow	list of allowed users
/usr/lib/cron/at.deny	list of denied users
/usr/lib/cron/queuedefs	scheduling information
/usr/spool/cron/atjobs	spool area

See also

cron(C), **kill**(C), **mail**(C), **nice**(C), **ps**(C), **queuedefs**(F), **sh**(C)

Diagnostics

Complains about syntax errors and times out of range.

Standards conformance

at and **batch** are conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

auths

list and/or restrict kernel authorizations

Syntax

auths [-v] [-a *authlist*] [-r *authlist*] [-c *command*]

Description

The **auths** command performs actions associated with system privilege manipulation. With no arguments, **auths** returns the kernel authorizations associated with the current process. All other uses of **auths** are discussed below.

Either of the **-a** or **-r** options allow the user to alter the kernel authorizations in order to run a shell or a single command. The **-a** option requires a list of comma-separated authorizations, which become the absolute set of kernel authorizations for the new process. This new set must be a subset of the kernel authorizations of the invoking process. To start a process with a null set of kernel authorizations, use the empty string ""). The **-r** option also takes, as an argument, a comma-separated list of authorizations. These are removed from the authorization set of the invoking process when forming the kernel authorizations for the new process.

The argument to the **-c** option is passed to the user's shell as specified in the user's */etc/passwd* entry which is run as a single command. The user's shell must support the

-c *command*

syntax similar to **sh**(C). When the argument is absent (and **-a** or **-r** is specified), the user's shell is invoked as a process with adjusted authorizations. Exiting that shell will resume execution in the previous shell and the original kernel authorizations will be in effect. This option may be used to run a command with restricted authorizations, that is, fewer than those allowed the user in the Protected Password Database entry.

The **-v** option lists the new kernel authorizations before the new command or shell is run. It also warns with the **-a** option when more authorizations are attempted to be set than already exist or with the **-r** option when more authorizations are attempted to be removed than already exist.

The kernel authorizations are:

execsuid	allows the running of SUID programs
writeaudit	process can write directly to the audit trail
configaudit	process can change audit subsystem parameters
suspendaudit	process is not audited by the kernel
chmodsugid	process can set SUID and GID bits on files
chown	process can change ownership of files it owns

Examples

To execute a shell without the **execsuid** kernel authorization:

auths -r execsuid

To list the current kernel authorizations:

auths

To execute ***yourprog*** with no kernel authorizations:

auths -a "" -c yourprog

To execute ***myprog*** with **chmodsugid** and **execsuid**:

auths -a chmodsugid,execsuid -c myprog

See also

sh(C), **getpriv**(S), **getprwent**(S), **setpriv**(S)

"Using a secure system" in the *User's Guide*

Value added

auths is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

awk: awk, oawk, nawk

pattern scanning and processing language

Syntax

awk [**-F***sep*] [[**-e**] *'prog'*] ... [**-f** *progfile*] ... [[**-v**] *var=value* ...] [*file* ...]

Description

oawk - pattern scanning and processing language

nawk - pattern scanning and processing language

awk is an interpreted pattern-matching language with a wide range of applications. See the chapter on **awk** in the *User's Guide* for a complete discussion of its use.

You can enter an **awk** program (*prog*) directly from the command-line, enclosing it in single quotes to prevent interpretation by the shell. The **-e** flag preceding *prog* is optional. For longer **awk** programs, it may be more convenient to fetch them from a file (*progfile*); this is done with the **-f** option. You can specify multiple **-e** programs and **-f** files; they are concatenated together (with intervening newlines) to form the program that is executed. (This is like the **-e** and **-f** options in **sed**(C).)

Input *file*s are read in order. If no *file*s are given on the command line, the standard input is used.

You can change the **awk** field separator on the command line with the **-f***sep* option, where the regular expression *sep* is the new delimiter. You can also specify the field separator as a single character; this sets the field separator to be that character. **awk -Ft** is a special case that sets the field separator to a tab. (The field separator can also be changed within an **awk** program using the variable **FS**.)

You can set the value of variables you are going to use in the **awk** program from the command line using *var=value*, where *var* is the variable and *value* is the initial value you want it to have. This can be preceded with an optional **-v**.

What awk does with your program

After **awk** checks the syntax of your program, it reads each record (generally, each line) of the input and attempts to match it against the patterns specified in the program. For each pattern in the program, there may be an associated action performed when an input record matches the pattern. Actions can be made up of a single action statement, like **print**, or of a combination of statements.

A pattern-action statement has the form:

pattern { ***action*** }

Either ***pattern*** or ***action*** may be omitted. If there is no action with a pattern, the matching line is printed. If there is no pattern with an action, the action is performed on every input line.

Programming conventions

Pattern-action statements, and individual statements within actions, generally begin on a new line.

The opening brace ({) must be on the same line as the pattern for which the actions should be performed. Multiple action statements may appear on a single line if they are separated by semicolons (;).

A newline can be hidden with a backslash (\), so you can use backslash-newline to continue a long line.

Comments in **awk** are introduced by a number sign (#) and end with the end of the line. Comments can appear anywhere in a line.

Blank lines and whitespace (blanks and tabs) in an **awk** program are ignored.

Fields, records, and built-in variables

awk presumes that each field in a record is separated by whitespace, and that each record consists of one line of input. Both of these defaults can be modified.

You can change the field separator on the command line, as discussed earlier, using the **-F*sep*** option. You can also reset the value of the input field separator variable **FS** from within your **awk** program. **FS** can be set to any regular expression. The following action is a special case that resets **FS** to its default behavior:

```
BEGIN { FS = " " }
```

The **BEGIN** in this example is a special pattern that matches before the first record is read; this is the mechanism **awk** provides for doing introductory processing.

Setting **FS** to a single blank is equivalent to:

```
BEGIN { FS = "[ \t]+" }
```

That is, setting **FS** to a single blank tells **awk** to regard any combination of blanks and tabs (any whitespace) as a field separator. Note that once you set the input field separator to something other than a single blank (that is, to all whitespace), leading whitespace (before the first field) is no longer ignored.

awk is designed to consider each line of input as a complete record, but you can get **awk** to recognize multiline records by resetting the variable **RS**.

To get **awk** to recognize multiline records, set **RS** to the null string:

```
BEGIN { RS = "" }
```

Now, **awk** will presume that records are separated by one or more blank lines. When you reset **RS** like this to use multiline records, newline is always considered a field separator, no matter what the value of **FS** is. To restore the default record separator, reset **RS** to a newline:

```
{ RS = "\n" }
```

You can address any field in the input record using the syntax **$1**, **$2**, etc., where **$1** is the first field in a record, **$2** is the second field, and so on. The entire record is referred to as **$0**.

Fields can also be referred to in relation to the built-in field variables, for example, for a five-field record:

```
$(NF - 2)
```

would refer to the third field. The **NF** in this example is a built-in variable **awk** provides that counts the number of fields in a current record. (Thus, **$NF** refers to the last field in the current record.)

The following list shows all the built-in variables in **awk**:

Variable	Meaning
ARGC	number of command-line arguments plus 1
ARGV	array of command-line arguments (**ARGV**[0 ... **ARGC**-1])
ENVIRON	array of environment variables, indexed by the name of the variable
FILENAME	name of current input file
FNR	input record number in current file
FS	input field separator (default: any whitespace)
NF	number of fields in current input record
NR	number of records read so far
OFMT	output format for numbers (default: "%.6g"; see **printf**(S))
OFS	output field separator (default: blank)
ORS	output record separator (default: newline)
RS	input record separator (default: newline)
RSTART	index of first character matched by **match()**
RLENGTH	length of string matched by **match()**
SUBSEP	separates multiple subscripts in array elements (default: "\034")

Patterns

Patterns can be any of the following:

BEGIN
END
/expr/
relational expression
pattern && *pattern*
pattern | | *pattern*
(*pattern*)
!*pattern*
pattern1,*pattern2*

BEGIN and **END** match before the first line is read, and after the last line has been read, respectively.

All other patterns can contain *extended regular expressions*, like in **egrep**. See **grep**(C) and **ed**(C) for the pattern-matching syntax of extended regular expressions. (In the following discussion, extended regular expressions will be referred to simply as *regular expressions*.)

You can create a string matching pattern using a regular expression in one of three ways:

/regexpr/	This will match the current record if ***regexpr*** is contained anywhere in the current record.
expression ~ */regexpr/*	This will match if ***regexpr*** is contained anywhere in the string value of ***expression***.
expression !~ */regexpr/*	This will match if ***regexpr*** is *not* contained anywhere in the string value of ***expression***.

A *relational expression* is made up of two numeric or string expressions compared with one of the following operators:

Operator	Meaning
<	less than
<=	less than or equal to
>	greater than
>=	greater than or equal to
==	equal to
!=	not equal to

When strings are compared using relational operators (<, <=, >, >=), they are compared character by character using the sort order provided by the machine, which is usually the ASCII sort order. One string is less than another string if it would appear earlier (before) the other in the sort order.

When one operand in a relational expression is a string, the other operand is converted to a string as well and they are compared using the method described above.

Patterns can be joined using the logical operators && (AND) and || (OR). When patterns are joined like this, the pattern matches the current record if the entire pattern evaluates to true (nonzero or nonnull). A pattern can be negated using the ! logical NOT operator. Parentheses may be used for grouping patterns.

pattern **&&** ***pattern*** matches a record when both the first ***pattern*** and the second ***pattern*** match the record.

pattern **||** ***pattern*** matches a record when either the first ***pattern*** or the second ***pattern*** matches the record.

!*pattern* means "does not match ***pattern***." That is, **!*pattern*** matches every record that is not matched by ***pattern***.

pattern1, pattern2 defines a matching range. The accompanying action is performed for all records that match from the first occurence of ***pattern1*** to the following occurence of ***pattern2***, inclusive. (The action is performed for the lines containing ***pattern1*** and ***pattern2***, as well as all the lines in between.)

Actions

The actual work your **awk** program does occurs in the action part of the program.

Action statements can be made up of:

- expressions (numeric and string constants, variables, array references, and so on)
- flow control statements (branches or loops)
- built-in arithmetic or string functions or functions you define yourself

Variables in **awk** are not explicitly declared; they simply spring into existence when they are first used. **awk** determines from the context whether a variable is numeric or string. Numeric variables are automatically initialized to 0; string variables are automatically initialized to the empty string (""). (See "Number or string" below, and the chapter on **awk** in the *User's Guide* for more information about variable types and type coercion in **awk**.)

Values are assigned to variables in the usual way in **awk**:

```
a = 100
```

creates a numeric variable **a** with the value "100". You can assign several variables in a single statement:

```
water = oil = "wet"
```

This creates two string variables, **water** and **oil**, and sets them both to contain the string "wet".

Assignment operators are evaluated from right to left.

The following assignment operators are available; the shorthand assignment notation is borrowed from the C programming language:

Operator	Meaning
a=b	set a equal to b
a+=b	set a equal to a + b
a-=b	set a equal to a - b
a*=b	set a equal to a * b
a/=b	set a equal to a / b
a%=b	set a equal to a % b; a becomes the remainder of a divided by b
a^=b	set a equal to a ^ b; a becomes a^b

awk offers the usual arithmetic operators: "+" (add), "-" (subtract), "*" (multiply), "/" (divide), "%" (modulo; divide and give remainder), "^" (exponentiation; "**" is a synonym). The unary "+" (plus) and "-" (minus) are also available.

All arithmetic in **awk** is done in floating point.

Relational expressions in action statements use the same operators as relational expressions in patterns; consult the relational operators table in "Patterns" above.

The logical AND and logical OR (&& and | |) are also available, as well as the logical NOT (!, as in !***expr***).

There is also a conditional operator: "?":

expression1 ? ***expression2*** : ***expression3***

expression is evaluated, and if it is non-empty and non-zero, then the expression has the value of ***expression2***. Otherwise, it has the value of ***expression3***.

Variables can be incremented using prefix or postfix notation, as in C. *x*++ and ++*x* are both equivalent to $x = x + 1$, and *x*-- and --*x* both are equivalent to $x = x-1$. The difference between prefix (++*x*) and postfix (*x*++) is when *x* assumes its new value. In prefix notation, *x* is immediately incremented; in postfix notation, the current value of *x* is used and then *x* is incremented.

Parentheses can be used to alter the order of evaluation in arithmetic and relational expressions.

The following table of precedence shows all the available action statement operators and the order in which they are evaluated. The table is in decreasing order of precedence; operators higher in the table are evaluated before operators lower in the table.

Operator	Meaning
$	field
++ --	increment, decrement (prefix and postfix)
^	exponentiation (** is a synonym)
!	logical negation
+ -	unary plus, unary minus
* / %	multiply, divide, mod
+ -	add, subtract
(no explicit operator)	string concatenation
< <= > >= != ==	relationals
~ !~	regular expression match, negated match
in	array membership
&&	logical AND
||	logical OR
?:	conditional expression
= += -= *= /= %= ^=	assignment

All of these operators are evaluated from left to right (they are left associative), except for the assignment operators, the conditional expression operator, and exponentiation, which are evaluated from right to left (they are right associative).

Arrays

One-dimensional arrays are available in **awk**. Like other variables in **awk**, arrays and array elements do not need to be declared; they come into existence upon their first use.

awk allows you to use strings as array subscripts; arrays that do this are called *associative arrays*. This lets you group together data quite simply.

Say we have a data file listing employee names, department names, and the number of sick days the employee has taken:

```
Steve          Engineering     2
Chris          Engineering     1
Susannah       Documentation   0
Vipin          Sales           2
Connie         Marketing       3
Matt           Documentation   1
Nancy          Sales           1
Nigel          Documentation   0
```

The first field, **$1**, contains the employee name; the second field, **$2**, contains the department, and the third field, **$3**, contains the number of sick days for that employee.

To accumulate the number of sick days in each department:

```
{ sickness[$2] += $3 }
```

This creates the array **sickness**, which uses the values in the second field ("Engineering", "Documentation", "Sales", and "Marketing") as its subscripts. The sick day totals in field three are then collected under the appropriate subscript.

The construct:

for (*i* in *arr*) *statement*

does ***statement*** for every subscript ***i*** in the array ***arr***. Subscripts are looped over in a random order. If the value of ***i*** is changed within ***statement***, unpredictable results may occur.

The **split** function splits input into subscripts in an array. It takes the form:

split(*string*,*arr*,*fs*)

where ***string*** is the string you want to split, ***arr*** is the array into which you want to split it, and ***fs*** is the field separator on which you want to split. The first component of ***string*** is stored in ***arr***[1], the second in ***arr***[2] and so on. The return value is the number of fields.

Elements can be deleted from an array with the **delete** statement:

delete *arr* [*subscript*]

After this is done, ***arr*** [***subscript***] no longer exists.

awk does not support multi-dimensional arrays, but this can be simulated by using a list of subscripts; see the *User's Guide* for details.

Flow of control

awk uses branching and looping statements borrowed from the C programming language. In all the following constructs, a single statement can be replaced by a statement list enclosed in { braces }.

Each statement in a statement list should begin on a new line or after a semicolon.

The following constructs are available:

if (*expression*) *statement1* else *statement2*

If ***expression*** is non-zero and non-empty, do ***statement1***; otherwise, do ***statement2***. The "**else *statement2***" is optional. If there are several **if**s together with an **else**, the **else** belongs with the nearest preceding **if**.

while (*expression*) *statement*

While ***expression*** is non-zero and non-empty, ***statement*** is executed.

for (*expression1*; *expression*; *expression2*) *statement*

This is a generalized form of the **while** statement.

The **for** statement is the same as:

expression1
while (***expression2***) {
    statement
    expression3
}

All three ***expression***s are optional.

This is often used to go through a loop based on the value of a counter, where ***expression1*** is used to initialize a counter; ***expression*** is the test; and ***expression2*** increments the counter. While ***expression*** is non-empty and non-zero, ***statement*** is executed.

do ***statement*** **while** (***expression***)

statement is repeatedly executed until ***expression*** becomes null or zero.

The **break**, **continue**, and **next** statements can be used to break out of loops that would otherwise keep going. **break** drops out of the innermost **while**, **for**, or **do** loop. **continue** causes the next iteration of the loop to begin. Execution will go to the test expression in a **while** or **do** loop, and to ***expression3*** in a **for** loop. **next** reads the next record and starts the main input loop again.

exit will go straight to the **END** statements, if there are any. If **exit** occurs in an **END** statement, the program itself exits. If a numeric expression is given after **exit**, this expression is taken as the exit status for the **awk** program.

Output

The **print** and **printf** statements are used to write output in **awk**.

print ***expr1,expr2, ... ,exprn***

will print the string value of each expression separated by the output field separator, followed by the output record separator. Without the commas, the expressions are concatenated.

print by itself is an abbreviation for **print $0**.

To print an empty line use:

```
print ""
```

The **printf** function in **awk** is like **printf**(S) in C:

printf ***format, expr1, expr2, ... , expn***

format can be made up of regular characters, which are printed as-is, escaped special characters, such as Tab (\t) or Newline (\n), and format keyletters that specify how to print the expressions following the format. Format keyletters begin with a "%" and can be preceded with a width specification, a precision statement, and/or an instruction to left-justify an expression in its field. The first expression replaces the first formatting keyletter, and so on.

If a **print** or **printf** statement includes an expression with the greater-than operator (>), this expression should be enclosed in parentheses to avoid confusion between the greater-than operator and redirection into a file. For example:

```
{ print $0 $2 > $3 }
```

This statement says "print the record and then field 2 into a file named by field 3," while:

```
{ print $0 ($2 > $3) }
```

says "print the record, followed by a 1 if field 2 is greater than field 3, or a 0 it is not."

printf keyletters are:

Keyletter	Prints *expr* as
%c	the ASCII character referred to by the least significant 8 bits of the numeric value of *expr*; truncates *expr* to the nearest integer
%d	a decimal integer; truncates *expr* to the nearest integer
%e	scientific notation using the form [-]*d.dddddd*E[+-]*dd*
%f	scientific notation using the form [-]*ddd.dddddd*
%g	the shorter of e or f conversion, with nonsignificant zeros suppressed
%o	an unsigned octal number
%s	a string
%x	unsigned hexadecimal number
%%	prints a "%", no argument is converted

The following escape sequences are recognized within regular expressions and strings:

Escape sequence	Meaning
\b	Backspace
\f	Formfeed
\n	Newline
\r	Carriage return
\t	Tab
ddd	octal value *ddd*

Output can be redirected into files using:

> *filename*

and

>> *filename*

Files are opened only once using the redirection operator. The first form will overwrite whatever is in *filename*, if *filename* already exists, and will create *filename* if it does not exist. The second form will append output to *filename*.

To send output to a pipe, use:

| *command-line*

where ***command-line*** is the command line to which you want to send the output. Filenames and command lines can be expressions, variables, or literal filenames or command lines. If you want to use a literal filename or command line, you must enclose it in double quotes, otherwise, **awk** will treat it as a variable.

There is a limit to how many files and pipes you can open in an **awk** program (see "Limits" below). Use the **close** statement to close files or pipes:

close(*filename***)**
close(*command-line***)**

where ***filename*** or ***command-line*** is the open file or pipe.

Input

awk provides the **getline** function to read in successive lines of input from a file or a pipe.

getline	**getline** by itself takes the next record of input as **$0** and sets **NF**, **NR**, and **FNR**.
getline <*file*	The next record from ***file*** becomes **$0**; **NF** is set.
getline ***var***	The next record of input is placed in ***var***; **NR** and **FNR** are set.
getline ***var*** **<***file*	The next record in ***file*** is placed in ***var***.
command **| getline**	The output of ***command*** is piped to **getline**. **$0** and **NF** are set.
command **| getline** ***var***	The output of ***command*** is piped to **getline** and stored in ***var***.

All forms of **getline** return 1 for successful input, 0 for end of file, and -1 for an error.

To read input from a file until the file runs out, use:

```
while ( ( getline x < file ) > 0) { ... }
```

The "> 0" is needed so that the test catches a -1 error returned from **getline**. Otherwise, the **while** loop would read -1 as true, since it is non-zero.

Functions

The following arithmetic functions are built into **awk**:

Function	Returns
atan2(*y*,*x*)	arctangent of y/x in the range $-\pi$ to π
cos(*x*)	cosine of *x*, with *x* in radians
exp(*x*)	exponential function of *x*, e^x
int(*x*)	integer part of *x*; truncated toward 0 when $x > 0$
log(*x*)	natural (base *e*) logarithm of *x*
rand()	random number *r*, where $0 <= r < 1$
sin(*x*)	sine of *x*, with *x* in radians
sqrt(*x*)	square root of *x*
srand()	set the seed for **rand**() from the time of day
srand(*x*)	*x* is new seed for **rand**()

The string functions are:

gsub(*r*,*s*,*t*) globally substitutes the string *s* for the regular expression *r* in the string *t*. If *t* is omitted, substitutions are made in the current record (**$0**). The number of substitutions is returned.

index(*s*,*t*) returns the position in string *s* where string *t* first occurs, or 0 if it does not occur at all.

length(*s*) returns the length of its argument taken as a string, or of the whole record if there is no argument.

match(*s*,*re*) returns the position in string *s* where the regular expression *re* occurs, or 0 if it does not occur at all. **RSTART** is set to the starting position (which is the same as the returned value), and **RLENGTH** is set to the length of the matched string.

split(*s*,*a*,*fs*) splits the string *s* into array elements *a*[1], *a*[2], *a*[*n*], and returns *n*. The separation is done with the regular expression *fs* or with the field separator **FS** if *fs* is not given.

sprintf(*format*, *expr*,*expr*, ...)
formats the expressions according to the **printf** *format* and returns the resulting string.

sub(*r*,*s*,*t*) substitutes the string *s* in place of the first instance of the regular expression *r* in string *t* and returns the number of substitutions. If *t* is omitted, **awk** substitutes in the current record (**$0**).

substr(*s,p*) returns the suffix of *s* starting at position *p*.

substr(*s,p,n*) returns the *n*-character substring of *s* that begins at position *p*.

toupper(*s*) returns a copy of the string *s* with lowercase letters converted to uppercase.

tolower(*s*) returns a copy of the string *s* with uppercase letters converted to lowercase.

awk provides the **system** function for running commands:

system(*command-line*)

executes ***command-line*** and returns its exit status.

You can define your own functions in **awk**. The syntax for this is:

function *name*(*parameter-list*) {
    statements
}

name is the name of the function, ***parameter-list*** is a comma-separated list of variable names, which, within the function refer to the arguments with which the function was called, and ***statements*** are action statements that make up the body of the function.

Function definitions can appear anywhere a pattern-action statement can appear. Recursion is permitted within user-defined functions; that is, a function may call itself directly or indirectly.

Variables passed to functions (as arguments) are copied and a copy of the variable is manipulated by the function; that is, these variables are passed by value. The exception to this in **awk** is arrays, which are passed by reference, that is, the actual array elements are manipulated by the function, so array elements can be permanently altered, created, or deleted within a function.

Missing function arguments are set to null; extra arguments are ignored.

To define a return value for your function, you must include a statement

return *expression*

where ***expression*** is the value you want your function to return. ***expression*** here is optional; if you leave it out, control will be returned to the caller of the function, but the return value will be undefined. The **return** statement itself is optional as well.

The formal parameters of a function (the argument list) are local to that function, but any other variables are global. You can use the argument list as a way of creating variables local only to the function; like other variables in **awk** these will be automatically initialized with null values.

Number or string?

In **awk**, variables come into being when they are used; there is no declaration of a variable, and, therefore, you do not declare the *type* of a variable as a string or a number. Instead, **awk** assumes the type of a variable from its context.

In an assignment statement, such as *v=e*, the type of *v* becomes the type of *e*. When the context is ambiguous, **awk** determines the types when the program runs.

In comparisons, if both operands are numeric, they are compared as numbers; otherwise, they are compared as strings. (A string is greater than another string if it comes later in the sort sequence, and less than another string if it comes earlier in the sort sequence.)

All field variables are of type string; in addition, each field can be considered to have a numeric value (that is, the numeric value of a string). The numeric value of a string is the value of the longest prefix of a string that looks numeric. For example, if a field contains the string "123abc", the numeric value of this would be 123.

The value of a variable in **awk** is initially 0 or the string "".

You can force a variable of one type to become another type; this is known as *type coercion.* To force a number to a string:

number ""

(Concatenate the null string to number.)

To force a string to a number:

string + 0

For more information about variable types, see the chapter on **awk** in the *User's Guide.*

Limits

The following limits exist in this implementation of **awk**: (Limits marked with an asterisk (*) are safe approximations; your mileage may vary.)

100 fields
3000* characters per input record
3000* characters per output record
3000* characters per field
3000* characters per **printf** string
400 characters per literal string or regular expression
250* characters per character class
55* open files or pipes
double precision floating point

Numbers are limited to what can be represented on your machine; numbers outside this range will have string values only.

Examples

The following examples are all individual **awk** programs; to try them out, you will need to put them in a file and call the file with **awk -f**, or enclose them in single quotes on the **awk** command line.

Print lines longer than 72 characters:

```
length > 72
```

Print only the first two fields in opposite order:

```
{ print $2, $1 }
```

Same, with input fields separated by comma and/or blanks and tabs:

```
BEGIN   { FS = ",[ \t]* | [ \t]+" }
        { print $2, $1 }
```

Add up the first column, print sum and average:

```
        { s += $1 }
END     {if ( NR > 0 )  print "sum is",  s, " average is", s/NR }
```

Print fields in reverse order (on separate lines):

```
{ for (i = NF; i > 0; --i) print $i }
```

Print all lines between start/stop pairs:

```
/start/, /stop/
```

Print all lines whose first field is different from previous one:

```
$1 != prev { print; prev = $1 }
```

Simulate **echo**(C):

```
BEGIN   {
        for (i = 1; i < ARGC; i++)
                printf "%s ", ARGV[i]
        printf "\n"
        exit
        }
```

Simple **env**(C):

```
BEGIN   {
        for (e in ENVIRON)
                print e "=" ENVIRON[e]
        }
```

See also

ed(C), **grep**(C), **lex**(CP), **printf**(S), **sed**(C)

"Simple programming with awk" in the *User's Guide*

Alfred V. Aho, Brian W. Kernighan, and Peter J. Weinberger,
The AWK Programming Language, Addison-Wesley, 1988.

Notes

Input whitespace is not preserved on output if fields are involved.

func is an obsolete synonym for **function**.

This version of **awk** is the so-called "new **awk**" described in *The AWK Programming Language* (referenced above). It is mostly compatible with an older version of **awk** still in common use. On some systems, the "new **awk**" is called **nawk**, the older one is **oawk**, and **awk** may be linked to either version. The **nawk** and **oawk** names do not exist on all systems, and even when they do exist, are not reliable. Only the name **awk** should be used.

Known incompatibilities between this version of **awk** and older **awk**s include:

- The definition of "what constitutes a number" is slightly different. In the old **awk**, a string had a numeric value only if the entire string looked numeric. In the new **awk**, a string has a numeric value if a prefix of the string looks numeric, and the numeric value is the value of the longest such prefix.

  For example, the string:

  ```
  123foo
  ```

  does not have a numeric value in the old **awk** (and is treated as 0), but has the value 123 in the new **awk**.

- Assigning to a nonexistent field in the new **awk** changes **$0** to include that field, whereas, in the old **awk**, **$0** did not change. Thus, the program:

  ```
  { $2 = $1; print }
  ```

  produces different output if the input has only one field.

- The new **awk** allows user-defined functions; these are not recognized in the old **awk**.

- There are several new reserved words in the new **awk** which could be used as variable names in the old **awk**.

- In addition, the parsing has changed, which may result in some ambiguous-looking expressions that were legal in the old **awk** failing with the new **awk**.

  For example, in regular expressions, the character class:

  ```
  [/]
  ```

  is not legal in the new **awk**, but was in the old. The equivalent character class for the new **awk** is:

  ```
  [\/]
  ```

  However, this character class, when used with the old **awk**, is not equivalent to the original expression.

Standards conformance

awk is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

banner

print large letters

Syntax

banner ***strings***

Description

The **banner** command prints its arguments (each up to 10 characters long) in large letters on the standard output. This is useful for printing names at the front of printouts.

See also

echo(C)

Standards conformance

banner is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

basename

remove directory names from pathnames

Syntax

basename ***string*** [***suffix***]

Description

The **basename** command deletes any prefix ending in " / " and the ***suffix*** (if present in ***string***) from ***string***, and prints the result on the standard output. The result is the "base" name of the file, that is, the filename without any preceding directory path and without an extension. It is used inside substitution marks (` `) in shell procedures to construct new filenames.

The related command **dirname** deletes the last level from ***string*** and prints the resulting path on the standard output.

Examples

The following command displays the filename *memos* on the standard output:

```
basename /usr/johnh/memos.old .old
```

The following shell procedure, when invoked with the argument */usr/src/cmd/cat.c*, compiles the named file and moves the output to a file named *cat* in the current directory:

```
cc $1
mv a.out `basename $1 .c`
```

See also

dirname(C), **sh**(C)

Standards conformance

basename is conformant with:

X/Open Portability Guide, Issue 3, 1989.

bc

invoke a calculator

Syntax

bc [**-c**] [**-l**] [*file* ...]

Description

bc is an interactive processor for a language that resembles C but provides unlimited precision arithmetic. It takes input from any files given, then reads the standard input. The **-l** argument stands for the name of an arbitrary precision math library.

bc acts as a preprocessor for **dc**, a calculator which operates on Reverse Polish Notation input. (**bc** is easier to use than **dc**.) Although substantial programs can be written with **bc**, it is often used as an interactive tool for performing calculator-like computations. The language supports a complete set of control structures and functions that can be defined and saved for later execution. The syntax of **bc** has been deliberately selected to agree with the C language. A small collection of library functions is also available, including sin, cos, arctan, log, exponential, and Bessel functions of integer order.

Common uses for **bc** are:

- Computation with large integers.
- Computations accurate to many decimal places.
- Conversions of numbers from one base to another base.

There is a scaling provision that permits the use of decimal point notation. Provision is made for input and output in bases other than decimal. Numbers can be converted from decimal to octal simply by setting the output base equal to 8.

The actual limit on the number of digits that can be handled depends on the amount of storage available on the machine, so manipulation of numbers with many hundreds of digits is possible.

Tasks

This section describes how to perform common **bc** tasks.

Computing with integers

The simplest kind of statement is an arithmetic expression on a line by itself. For instance, the expression:

142857 + 285714

when evaluated, responds immediately with the line:

```
428571
```

Other operators can also be used. The complete list includes:

```
+ - * / % ^
```

They indicate addition, subtraction, multiplication, division, modulo (remaindering), and exponentiation, respectively. Division of integers produces an integer result truncated toward zero. Division by zero produces an error message.

Any term in an expression can be prefixed with a minus sign to indicate that it is to be negated (this is the "unary" minus sign). For example, the expression:

7 + -3

is interpreted to mean that -3 is to be added to 7.

More complex expressions with several operators and with parentheses are interpreted just as in FORTRAN, with exponentiation (^) performed first, then multiplication (*), division (/), modulo (%), and finally, addition (+), and subtraction (-). The contents of parentheses are evaluated before expressions outside the parentheses. All of the above operations are performed from left to right, except exponentiation, which is performed from right to left.

Thus the following two expressions:

a^b^c and **a^(b^c)**

are equivalent, as are the two expressions:

a*b*c and **(a*b)*c**

bc shares with FORTRAN and C the convention that a/b*c is equivalent to (a/b)*c.

Internal storage registers to hold numbers have single lowercase letter names. The value of an expression can be assigned to a register in the usual way, thus the statement:

x = x + 3

has the effect of increasing by 3 the value of the contents of the register named **x**. When, as in this case, the outermost operator is the assignment operator (=), then the assignment is performed but the result is not printed. There are 26 available named storage registers, one for each letter of the alphabet.

There is also a built-in square root function whose result is truncated to an integer (see also *Scaling*, below). For example, the lines:

```
x = sqrt(191)
x
```

produce the printed result:

```
13
```

Specifying input and output bases

There are special internal quantities in **bc**, called **ibase** (or **base**) and **obase**. **base** and **ibase** can be used interchangeably. **ibase** is initially set to 10, and determines the base used for interpreting numbers that are read in to **bc**. For example, the lines:

```
ibase = 8
11
```

produce the output line:

```
9
```

and sets up **bc** to do octal to decimal conversions. Beware of trying to change the input base back to decimal by entering:

```
ibase = 10
```

Because the number 10 is interpreted as octal, this statement has no effect. For those who deal in hexadecimal notation, the uppercase characters A-F are permitted in numbers (no matter what base is in effect) and are interpreted as digits having values 10-15, respectively. These characters *must* be uppercase and not lowercase.

The statement:

```
ibase = A
```

changes back to decimal input base no matter what the current input base is. Negative and large positive input bases are permitted; however no mechanism has been provided for the input of arbitrary numbers in bases less than 1 and greater than 16.

obase is used as the base for output numbers. The value of **obase** is initially set to a decimal 10. The lines:

```
obase = 16
1000
```

produce the output line:

```
3E8
```

This is interpreted as a three-digit hexadecimal number. Very large output bases are permitted. For example, large numbers can be output in groups of five digits by setting **obase** to 100000. Even strange output bases, such as negative bases, and 1 and 0, are handled correctly.

Very large numbers are split across lines with seventy characters per line. A split line that continues on the next line ends with a backslash (\). Decimal output conversion is fast, but output of very large numbers (that is, more than 100 digits) with other bases is rather slow.

The values of **ibase** and **obase** do not affect the course of internal computation or the evaluation of expressions; they only affect input and output conversion.

Scaling quantities

A special internal quantity called **scale** is used to determine the scale of calculated quantities. Numbers can have up to 99 decimal digits after the decimal point. This fractional part is retained in further computations. We refer to the number of digits after the decimal point of a number as its *scale.*

When two scaled numbers are combined by means of one of the arithmetic operations, the result has a scale determined by the following rules:

Addition, subtraction	The scale of the result is the larger of the scales of the two operands. There is never any truncation of the result.
Multiplication	The scale of the result is never less than the maximum of the two scales of the operands, never more than the sum of the scales of the operands, and subject to those two restrictions, the scale of the result is set equal to the contents of the internal quantity, **scale**.
Division	The scale of a quotient is the contents of the internal quantity, **scale**.
Modulo	The scale of a remainder is the sum of the scales of the quotient and the divisor.
Exponentiation	The result of an exponentiation is scaled as if the implied multiplications were performed. An exponent must be an integer.
Square Root	The scale of a square root is set to the maximum of the scale of the argument and the contents of **scale**.

All of the internal operations are actually carried out in terms of integers, with digits being discarded when necessary. In every case where digits are discarded truncation is performed without rounding.

The contents of **scale** must be no greater than 99 and no less than 0. It is initially set to 0.

The internal quantities **scale**, **ibase**, and **base** can be used in expressions just like other variables. The line:

scale = scale + 1

increases the value of **scale** by one, and the line:

scale

causes the current value of **scale** to be printed.

The value of **scale** retains its meaning as a number of decimal digits to be retained in internal computation even when **ibase** or **obase** are not equal to 10. The internal computations (which are still conducted in decimal, regardless of the bases) are performed to the specified number of decimal digits, never hexadecimal or octal or any other kind of digits.

Using functions

The name of a function is a single lowercase letter. Function names are permitted to use the same letters as simple variable names. Twenty-six different defined functions are permitted in addition to the twenty-six variable names.

The line:

define a(x){

begins the definition of a function with one argument. This line must be followed by one or more statements, which make up the body of the function, ending with a right brace (}). Return of control from a function occurs when a **return** statement is executed or when the end of the function is reached.

The **return** statement can take either of the two forms:

return
return(*x*)

In the first case, the returned value of the function is 0; in the second, it is the value of the expression in parentheses.

Variables used in functions can be declared as automatic by a statement of the form:

auto x,y,z

There can be only one **auto** statement in a function and it must be the first statement in the definition. These automatic variables are allocated space and initialized to zero on entry to the function and thrown away on return. The values of any variables with the same names outside the function are not disturbed. Functions can be called recursively and the automatic variables at each call level are protected. The parameters named in a function definition are treated in the same way as the automatic variables of that function, with the single exception that they are given a value on entry to the function. An example of a function definition follows:

```
define a(x,y){
        auto z
        z = x*y
        return(z)
}
```

The value of this function, when called, will be the product of its two arguments.

A function is called by the appearance of its name, followed by a string of arguments enclosed in parentheses and separated by commas. The result is unpredictable if the wrong number of arguments is used.

If the function **do_something** is defined as shown above, then the line:

do_something(7,3.14)

would print the result:

```
21.98
```

Similarly, the line:

x = do_something(so_something(3,4),5)

would cause the value of **x** to become 60.

Functions can require no arguments, but still perform some useful operation or return a useful result. Such functions are defined and called using parentheses with nothing between them. For example:

b ()

calls the function named **b**.

Using subscripted variables

A single lowercase letter variable name followed by an expression in brackets is called a subscripted variable and indicates an array element. The variable name is the name of the array and the expression in brackets is called the subscript. Only one-dimensional arrays are permitted in **bc**. The names of arrays are permitted to collide with the names of simple variables and function names. Any fractional part of a subscript is discarded before use. Subscripts must be greater than or equal to zero and less than or equal to 2047.

Subscripted variables can be freely used in expressions, in function calls and in return statements.

An array name can be used as an argument to a function, as in:

f(a[ ])

Array names can also be declared as automatic in a function definition with the use of empty brackets:

```
define f(a[ ])
auto a[ ]
```

When an array name is so used, the entire contents of the array are copied for the use of the function, then thrown away on exit from the function. Array names that refer to whole arrays cannot be used in any other context.

Using control statements: if, while and for

The **if, while,** and **for** statements are used to alter the flow within programs or to cause iteration. The range of each of these statements is a following statement or compound statement consisting of a collection of statements enclosed in braces. They are written as follows:

if (***relation***) ***statement***
while (***relation***) ***statement***
for (***expression1*** ; ***relation*** ; ***expression2***) ***statement***

A relation in one of the control statements is an expression of the form:

expression1 rel-op expression2

where the two expressions are related by one of the six relational operators:

< > <= >= == !=

Note that a double equal sign (==) stands for "equal to" and an exclamation-equal sign (!=) stands for "not equal to" . The meaning of the remaining relational operators is their normal arithmetic and logical meaning.

Beware of using a single equal sign (=) instead of the double equal sign (==) in a relational. Both of these symbols are legal, so no diagnostic message is produced. However, the operation will not perform the intended comparison.

The **if** statement causes execution of its range if and only if the relation is true. Then control passes to the next statement in the sequence.

The **while** statement causes repeated execution of its range as long as the relation is true. The relation is tested before each execution of its range and if the relation is false, control passes to the next statement beyond the range of the **while** statement.

The **for** statement begins by executing ***expression1***. Then the relation is tested and, if true, the statements in the range of the **for** statement are executed. Then ***expression2*** is executed. The relation is tested, and so on. The typical use of the **for** statement is for a controlled iteration, as in the statement:

for (i=1; i<=10; i=i+1)

which will print the integers from 1 to 10.

The following are some examples of the use of the control statements:

```
define f(n){
        auto i, x
        x=1
        for(i=1; i<=n; i=i+1) x=x*i
        return(x)
}
```

The line:

```
f(a)
```

prints **a** factorial if **a** is a positive integer.

The following is the definition of a function that computes values of the binomial coefficient (**m** and **n** are assumed to be positive integers):

```
define b(n,m){
        auto x, j
        x=1
        for(j=1; j<=m; j=j+1) x=x*(n-j+1)/j
        return(x)
}
```

The following function computes values of the exponential function by summing the appropriate series without regard to possible truncation errors:

```
scale = 20
define e(x){
        auto a, b, c, d, n
        a = 1
        b = 1
        c = 1
        d = 0
        n = 1
        while(1==1) {
                a = a*x
                b = b*n
                c = c + a/b
                n = n + 1
                if(c==d) return(c)
                d = c
        }
}
```

Using other language features

Language features which are less frequently used but still essential to know about are listed below.

- Normally, statements are entered one to a line. It is also permissible to enter several statements on a line if they are separated by semicolons.
- If an assignment statement is placed in parentheses, it then has a value and can be used anywhere that an expression can. For example, the line:

  (x=y+17)

  not only makes the indicated assignment, but also prints the resulting value.

  The following is an example of a use of the value of an assignment statement even when it is not placed in parentheses:

  x = a[i=i+1]

  This causes a value to be assigned to "x" and also increments "i" before it is used as a subscript.
- The following constructions work in **bc** in exactly the same manner as they do in the C language:

Construction	Equivalent
x=y=z	x =(y=z)
x =+ y	x = x+y
x =- y	x = x-y
x =* y	x = x*y
x =/ y	x = x/y
x =% y	x = x%y
x =^ y	x = x^y
x++	(x=x+1)-1
x--	(x=x-1)+1
++x	x = x+1
--x	x = x-1

  If one of these constructions is used inadvertently, it is possible for something legal but unexpected to happen. Some of these constructs are case-sensitive. There is a real difference between **x=-y** and **x= -y**. The first replaces **x** by **x-y** and the second by **-y**.
- The comment convention is identical to the C comment convention. Comments begin with /* and end with */.
- There is a library of math functions that can be obtained by entering:

  bc -l

  when **bc** is invoked. This command loads the library functions sine, cosine, arctangent, natural logarithm, exponential, and Bessel functions of integer order. These are named **s**, **u**, **a**, **l**, **e**, and **j(n,x)** respectively. This library sets **scale** to 20 by default.

- If **bc** is loaded with:

  bc *file ...*

  bc will read and execute the named file or files before accepting commands from the keyboard. In this way, user programs and function definitions can be loaded.

Language reference

This section is a comprehensive reference to the **bc** language. It contains a more concise description of the features mentioned in earlier sections.

Tokens

Tokens are keywords, identifiers, constants, operators, and separators. Token separators can be blanks, tabs or comments. Newline characters or semicolons separate statements.

Comments — Comments are introduced by the characters /* and are terminated by */.

Identifiers — There are three kinds of identifiers: ordinary identifiers, array identifiers and function identifiers. All three types consist of single lowercase letters. Array identifiers are followed by square brackets, enclosing an optional expression describing a subscript. Arrays are singly dimensioned and can contain up to 2048 elements. Indexing begins at 0 so an array can be indexed from 0 to 2047. Subscripts are truncated to integers. Function identifiers are followed by parentheses, enclosing optional arguments. The three types of identifiers do not conflict; a program can have a variable named x, an array named x, and a function named x, all of which are separate and distinct.

Keywords — The following are reserved keywords:

base	if	sqrt	auto
obase	break	length	return
scale	define	while	quit
for			

Constants — Constants are arbitrarily long numbers with an optional decimal point. The hexadecimal digits A-F are also recognized as digits with decimal values 10-15, respectively.

Expressions

All expressions can be evaluated to a value. The value of an expression is always printed unless the main operator is an assignment. The precedence of expressions (that is, the order in which they are evaluated) is as follows:

Function calls
Unary operators
Multiplicative operators
Additive operators
Assignment operators
Relational operators

There are several types of expressions:

Named expressions
: Named expressions are places where values are stored. Simply stated, named expressions are legal on the left side of an assignment. The value of a named expression is the value stored in the place named.

identifiers
: Simple identifiers are named expressions. They have an initial value of zero.

array-name [*expression*]
: Array elements are named expressions. They have an initial value of zero.

scale, **ibase** and **obase**
: The internal registers **scale**, **ibase**, and **obase** are all named expressions. **scale** is the number of digits after the decimal point to be retained in arithmetic operations and has an initial value of zero. **ibase** and **obase** are the input and output number radixes respectively. Both **ibase** and **obase** have initial values of 10.

Constants
: Constants are primitive expressions that evaluate to themselves.

Parenthetic Expressions
: An expression surrounded by parentheses is a primitive expression. The parentheses are used to alter normal operator precedence.

Function Calls
: Function calls are expressions that return values. They are discussed in the next section.

Function calls

A function call consists of a function name followed by parentheses containing a comma-separated list of expressions, which are the function arguments. The syntax is as follows:

function-name ([*expression* [, *expression* ...]])

A whole array passed as an argument is specified by the array name followed by empty square brackets. All function arguments are passed by value. As a result, changes made to the formal parameters have no effect on the actual arguments. If the function terminates by executing a return statement, the value of the function is the value of the expression in the parentheses of the return statement, or 0 if no expression is provided or if there is no return statement. Three built-in functions are listed below:

sqrt (*expr*) The result is the square root of the expression and is truncated in the least significant decimal place. The scale of the result is the scale of the expression or the value of **scale**, whichever is larger.

length (*expr*) The result is the total number of significant decimal digits in the expression. The scale of the result is zero.

scale (*expr*) The result is the scale of the expression. The scale of the result is zero.

Unary operators

The unary operators bind right to left.

-expr The result is the negative of the expression.

++named_expr The named expression is incremented by one. The result is the value of the named expression after incrementing.

--named_expr The named expression is decremented by one. The result is the value of the named expression after decrementing.

named_expr++ The named expression is incremented by one. The result is the value of the named expression before incrementing.

named_expr-- The named expression is decremented by one. The result is the value of the named expression before decrementing.

Multiplicative operators

The multiplicative operators (*, /, and %) bind from left to right.

*expr*expr* The result is the product of the two expressions. If "a" and "b" are the scales of the two expressions, then the scale of the result is:

min (a+b, max (scale, a, b))

expr/expr The result is the quotient of the two expressions. The scale of the result is the value of **scale**.

expr%expr The modulo operator (%) produces the remainder of the division of the two expressions. More precisely, **a%b** is **a-a/b*b**. The scale of the result is the sum of the scale of the divisor and the value of **scale**.

expr^expr The exponentiation operator binds right to left. The result is the first expression raised to the power of the second expression. The second expression must be an integer. If "a" is the scale of the left expression and "b" is the absolute value of the right expression, then the scale of the result is:

min(a*b,max(scale,a))

Additive operators

The additive operators bind left to right.

expr+expr The result is the sum of the two expressions. The scale of the result is the maximum of the scales of the expressions.

expr-expr The result is the difference of the two expressions. The scale of the result is the maximum of the scales of the expressions.

Assignment operators

The assignment operators listed below assign values to the named expression on the left side.

named_expr = expr
This expression results in assigning the value of the expression on the right to the named expression on the left.

named_expr =+ expr
The result of this expression is equivalent to:
named_expr = named_expr + expr.

named_expr =- expr
The result of this expression is equivalent to:
named_expr = named_expr - expr.

named_expr = expr*
The result of this expression is equivalent to
*named_expr = named_expr * expr.*

named_expr = / expr
The result of this expression is equivalent to:
named_expr = named_expr / expr.

named_expr =% expr
The result of this expression is equivalent to:
named_expr = named_expr % expr.

named_expr =^expr
The result of this expression is equivalent to:
named_expr = named_expr ^ expr.

Relational operators

Unlike other operators, the relational operators are only valid as the object of an **if** or **while** statement, or inside a **for** statement.

These operators are listed below:

expr < *expr*
expr > *expr*
expr <= *expr*
expr >= *expr*
expr == *expr*
expr != *expr*

Storage classes

There are only two storage classes in **bc**: global and automatic (local). Only identifiers that are to be local to a function need to be declared with the **auto** command. The arguments to a function are local to the function. All other identifiers are assumed to be global and available to all functions.

All identifiers, global and local, have initial values of zero. Identifiers declared as **auto** are allocated on entry to the function and released on returning from the function. They, therefore, do not retain values between function calls. Note that **auto** arrays are specified by the array namer, followed by empty square brackets.

Automatic variables in **bc** do not work the same way as in C. On entry to a function, the old values of the names that appear as parameters and as automatic variables are pushed onto a stack. Until return is made from the function, reference to these names refers only to the new values.

Statements

Statements must be separated by a semicolon or a newline. Except where altered by control statements, execution is sequential. There are four types of statements: expression statements, compound statements, quoted string statements, and built-in statements. Each kind of statement is discussed below:

Expression statements
: When a statement is an expression, unless the main operator is an assignment, the value of the expression is printed, followed by a newline character.

Compound statements
: Statements can be grouped together and used when one statement is expected by surrounding them with curly braces ({ and }).

Quoted string statements
: For example:

  "*string*"

  prints the string inside the quotation marks.

Built-in statements

Built-in statements include **auto, break, define, for, if, quit, return,** and **while.**

The syntax for each built-in statement is given below:

Auto statement

The **auto** statement causes the values of the identifiers to be pushed down. The identifiers can be ordinary identifiers or array identifiers. Array identifiers are specified by following the array name by empty square brackets. The **auto** statement must be the first statement in a function definition. Syntax of the **auto** statement is:

auto *identifier* [, *identifier*]

Break statement

The **break** statement causes termination of a **for** or **while** statement. Syntax for the **break** statement is:

break

Define statement

The **define** statement defines a function; parameters to the function can be ordinary identifiers or array names. Array names must be followed by empty square brackets. The syntax of the **define** statement is:

define ([*parameter* [, *parameter* ...]]) {*statements*}

For statement

The **for** statement is the same as:

first-expression
while (*relation*) {
    statement
    last-expression
}

All three expressions must be present. Syntax of the **for** statement is:

for (*expression; relation; expression*) *statement*

If statement

The statement is executed if the relation is true. The syntax is as follows:

if (*relation*) *statement*

Quit statement
The **quit** statement stops execution of a **bc** program and returns control to the Operating System when it is first encountered. Because it is not treated as an executable statement, it cannot be used in a function definition or in an **if**, **for**, or **while** statement. Note that entering a ⟨Ctrl⟩**d** at the keyboard is the same as entering "quit". The syntax of the **quit** statement is as follows:

quit

Return statement
The **return** statement terminates a function, pops its auto variables off the stack, and specifies the result of the function. The result of the function is the result of the expression in parentheses. The first form is equivalent to "return(0)". The syntax of the return statement is as follows:

return(*expr*)

While statement
The statement is executed while the relation is true. The test occurs before each execution of the statement. The syntax of the **while** statement is as follows:

while (*relation*) *statement*

Files

/usr/lib/lib.bc	Mathematical library
/usr/bin/dc	Desk calculator proper

See also

dc(C)

Notes

A **for** statement must have all three E's.

quit is interpreted when read, not when executed.

Trigonometric values should be given in radians.

bdiff

compare files too large for diff(C)

Syntax

bdiff *file1 file2* [*n*] [**-s**]

Description

The **bdiff** command compares two files, finds lines that are different, and prints them on the standard output. It allows processing of files that are too large for **diff**. **bdiff** splits each file into *n*-line segments, beginning with the first non-matching lines, and invokes **diff** upon the corresponding segments. The arguments are:

n The number of lines **bdiff** splits each file into for processing. The default value is 3500. This is useful when 3500-line segments are too large for **diff**.

-s Suppresses printing of **bdiff** diagnostics. Note that this does not suppress printing of diagnostics from **diff**.

If *file1* (or *file2*) is a dash (-), the standard input is read.

The output of **bdiff** is exactly that of **diff**. Line numbers are adjusted to account for the segmenting of the files, and the output looks as if the files had been processed whole.

File

/tmp/bd?????

See also

diff(C)

Notes

Because of the segmenting of the files, **bdiff** does not necessarily find a smallest sufficient set of file differences.

Specify the maximum number of lines if the first difference is too far down in the file for **diff** and an error is received.

bfs

scan big files

Syntax

bfs [**-**] ***name***

Description

bfs is like **ed**(C) except that it is read-only and processes much larger files. Files can be up to 1024K bytes and 32K lines, with up to 255 characters per line. **bfs** is usually more efficient than **ed** for scanning a file, since the file is not copied to a buffer. It is most useful for identifying sections of a large file where **csplit**(C) can be used to divide it into more manageable pieces for editing.

Normally, the size of the file being scanned is printed, in the same way as the size of any file written with the **w** command. The optional dash (**-**) suppresses printing of sizes. Input is prompted for with an asterisk (*) when "P" and Return are typed. The "P" acts as a toggle, so prompting can be turned off again by entering another "P" and a Return. Note that messages are given in response to errors only if prompting is turned on.

All address expressions described under **ed** are supported. In addition, regular expressions may be surrounded with two symbols other than the standard slash (/) and "?": A greater-than sign (>) indicates downward search without wraparound, and a less-than sign (<) indicates upward search without wraparound. Note that parentheses and curly braces are special and need to be escaped with a backslash (\). Since **bfs** uses a different regular expression-matching routine from **ed**, the regular expressions accepted are slightly wider in scope (see **regex**(S)). Differences between **ed** and **bfs** are listed below:

\+ A regular expression followed by "+" means "one or more times". For example, **[0-9]+** is equivalent to **[0-9][0-9]***.

\\{*m*\\} \\{*m*,\\} \\{*m*,*u*\\}
Integer values enclosed in \{ \} indicate the number of times the preceding regular expression is to be applied. ***m*** is the minimum number and ***u*** is a number, less than 256, which is the maximum. If only ***m*** is present (for example, \\{***m***\\}), it indicates the exact number of times the regular expression is to be applied. \\{***m***,\\} is analogous to \\{***m***,***infinity***\\}. The plus (+) and star (*) operations are equivalent to **\\{1,\\}** and **\\{0,\\}** respectively.

(...)$n The value of the enclosed regular expression is to be returned. The value will be stored in the (n+1)th argument following the subject argument. At most ten enclosed regular expressions are allowed. **regex** makes its assignments unconditionally.

(...) Parentheses are used for grouping. An operator, for example *, +, \{ and \}, can work on a single character or a regular expression enclosed in parentheses. For example,

\ (a*\ (cb+\ )*\ )$0.

There is also a slight difference in mark names: only the letters "a" through "z" may be used, and all 26 marks are remembered.

The **e, g, v, k, p, q, w, =, !** and null commands operate as described under **ed** except that **e** does not remember filenames and **g** and **v**, when given no arguments, return the line after the line you were on. Commands such as **---, +++-, +++=, -12,** and **+4p** are accepted. Note that **1,10p** and **1,10** will both print the first ten lines. The **f** command only prints the name of the file being scanned; there is no remembered filename. The **w** command is independent of output diversion, truncation, or crunching (see the **xo, xt** and **xc** commands, below). The following additional commands are available:

xf *file* Further commands are taken from the named *file*. When an end-of-file is reached or an interrupt signal is received, or an error occurs, reading resumes with the file containing the **xf**. **xf** commands may be nested to a depth of 10.

xo [*file*] Further output from the **p** and null commands is diverted to the named *file*. If *file* is missing, output is diverted to the standard output. Note that each diversion causes truncation or creation of the file.

: *label* This positions a *label* in a command file. The *label* is terminated by a newline, and blanks between the ":" and the start of the *label* are ignored. This command may also be used to insert comments into a command file, since labels need not be referenced.

(. , .)**xb**/*regular expression*/*label*
A jump (either upward or downward) is made to *label* if the command succeeds. It fails under any of the following conditions:

1. Either address is not between 1 and "$".
2. The second address is less than the first.
3. The regular expression does not match at least one line in the specified range, including the first and last lines.

On success, dot (.) is set to the line matched and a jump is made to *label*. This command is the only one that does not issue an error message on bad addresses, so it may be used to test whether addresses are bad before other commands are executed. Note that the command

xb/^/ label

is an unconditional jump.

The **xb** command is allowed only if it is read from somewhere other than a terminal. If it is read from a pipe only a downward jump is possible.

xt ***number*** Output from the **p** and null commands is truncated to a maximum of ***number*** characters. The initial number is 255.

xv[***digit***] [***spaces***] [***value***]
The variable name is the specified ***digit*** following the **xv**. **xv**5100 or **xv**5 100 both assign the value 100 to the variable **5**. **xv**61,100p assigns the value 1,100p to the variable **6**. To reference a variable, put a "%" in front of the variable name. For example, using the above assignments for variables **5** and **6**:

```
1,%5p
1,%5
%6
```

prints the first 100 lines.

```
g/%5/p
```

globally searches for the characters "100" and prints each line containing a match. To escape the special meaning of "%", a "&" must precede it. For example,

```
g/".*[cds]/p
```

could be used to match and list lines containing **printf** characters, decimal integers, or strings.

Another feature of the **xv** command is that the first line of output from a UNIX command can be stored into a variable. The only requirement is that the first character of ***value*** be a "!". For example,

```
xv5!cat junk
!rm junk
!echo "%5"
xv6!expr %6 + 1
```

puts the current line in variable **5**, prints it, and increments the variable **6** by 1. To escape the special meaning of "!" as the first character of ***value***, precede it with a "\". For example,

```
xv7date
```

stores the value ***!date*** into variable **7**.

xbz ***label***
xbn ***label*** These two commands test the last saved return code from the execution of a UNIX command !**command**) or nonzero value, respectively, and jump to the specified label. The two examples below search for the next five lines containing the string size:

```
xv55
:1
/size/
xv5!expr %5 - 1
!if 0%5 != 0 exit 2
xbn 1
xv45
:1
/size/
xv4!expr %4 - 1
!if 0%4 = 0 exit 2
xbz 1
```

xc [***switch***] If ***switch*** is 1, output from the **p** and null commands is crunched; if ***switch*** is 0, it is not. Without an argument, **xc** reverses ***switch***. Initially ***switch*** is set for no crunching. Crunched output has strings of tabs and blanks reduced to one blank and blank lines suppressed.

See also

csplit(C), **ed**(C), **umask**(C).

Diagnostics

"?" for errors in commands if prompting is turned off. Self-explanatory error messages when prompting is on.

cal

print a calendar

Syntax

cal [[*month*] *year*]

Description

The **cal** command prints a calendar for the specified year. If a month is also specified, a calendar for that month only is printed. If no arguments are specified, the current, previous, and following months are printed, along with the current date and time. The *year* must be a number between 1 and 9999; *month* must be a number between 1 and 12 or enough characters to specify a particular month. For example, May must be given to distinguish it from March, but S is sufficient to specify September. If only a month string is given, only that month of the current year is printed.

Notes

Beware that "**cal** 84" refers to the year 84, not 1984.

The calendar produced is that for England and her colonies. Note that England switched from the Julian to the Gregorian calendar in September of 1752, at which time eleven days were excised from the year. To see the result of this switch, try "**cal** 9 1752".

Standards conformance

cal is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

calendar

invoke a reminder service

Syntax

calendar [-]

Description

calendar consults the file *calendar* in the user's current directory and mails the user lines that contain today's or tomorrow's date. Most reasonable month-day dates, such as "Sep. 14", "september 14", and "9/14", are recognized, but not "14 September", or "14/9".

On weekends, "tomorrow" extends through Monday. Lines that contain the date of a Monday will be sent to the user on the previous Friday. This is not true for holidays.

When an argument is present, **calendar** does its job for every user who has a file *calendar* in his login directory. Normally this is done daily, in the early morning, under the control of **cron**(C).

Files

calendar	
/usr/lib/calprog	To calculate today's and tomorrow's dates
/etc/passwd	
*/tmp/cal**	

See Also

cron(C), **mail**(C)

Note

To get reminder service, a user's *calendar* file must have read permission for all.

Standards Conformance

calendar is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

cancel

cancel requests to lineprinter

Syntax

cancel [***request-ids***] [***printers***]

Description

The **cancel** command cancels printer requests that were made by the **lp**(C) shell command. The shell command line arguments may be either ***request-ids*** (as returned by **lp**(C)) or ***printer*** names (for a complete list, use **lpstat**(C)). Specifying a ***request-id*** cancels the associated request even if it is currently printing. Specifying a ***printer*** cancels the request that is currently printing on that printer. In either case, the cancellation of a request that is currently printing frees the printer to print its next available request.

See also

lp(C), **lpstat**(C)

Standards conformance

cancel is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

cat

concatenates and displays files

Syntax

cat [-u] [-s] [-v] [-t] [-e] ***file*** ...

Description

cat reads each ***file*** in sequence and writes it on the standard output. If no input file is given, or if a single dash (-) is given, **cat** reads from the standard input. The options are:

-s Suppresses warnings about nonexistent files.

-u Causes the output to be unbuffered.

-v Causes non-printing characters (with the exception of tabs, newlines, and form feeds) to be displayed. Control characters are displayed as ^X (⟨Ctrl⟩**x**), where X is the key pressed with the ⟨Ctrl⟩ key (for example, ⟨Ctrl⟩**m** is displayed as ^M). The ⟨Del⟩ character (octal 0177) is printed as ^?. Non-ASCII characters (with the high bit set) are printed as M -*x*, where *x* is the character specified by the seven low order bits.

-t Causes tabs to be printed as ^I and form feeds as ^L. This option is ignored if the **-v** option is not specified.

-e Causes a "$" character to be printed at the end of each line (prior to the new-line). This option is ignored if the **-v** option is not set.

No input file may have the same name as the output file unless it is a special file.

Examples

The following example displays *file* on the standard output:

cat file

The following example concatenates *file1* and *file2* and places the result in *file3*:

cat file1 file2 >file3

The following example concatenates *file1* and appends it to *file2*:

cat file1 >> file2

See also

cp(C), **pr**(C)

Warning

Command lines such as:

cat file1 file2 > file1

will cause the original data in *file1* to be lost; therefore, you must be careful when using special shell characters.

Standards conformance

cat is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

cd

change working directory

Syntax

cd [*directory*]

Description

If specified, ***directory*** becomes the new working directory; otherwise the value of the shell parameter **$HOME** is used. The process must have search (execute) permission in all directories (components) specified in the full pathname of ***directory***.

Because a new process is created to execute each command, **cd** would be ineffective if it were written as a normal command; therefore, it is recognized and executed by the shell.

If the shell is reading its commands from a terminal, and the specified directory does not exist (or some component cannot be searched), spelling correction is applied to each component of ***directory***, in a search for the "correct" name. The shell then asks whether or not to try and change directory to the corrected directory name; an answer of **n** means "no", and anything else is taken as "yes".

The KornShell command, **ksh**, has extensions to the syntax for **cd**. Please refer to **ksh**(C) for more information.

Note

Wildcard designators will work with the **cd** command.

See also

pwd(C), **sh**(C), **chdir**(S)

checkmail

check for mail which has been submitted but not delivered

Syntax

checkmail [-a] [-f] [-m]

Description

checkmail checks the mail queue on the local machine for messages which have been sent by the invoker. If invoked without any arguments, the "Subject:" of each message found is given along with a list of addressees who have not yet received the message. Usually, messages are still in the queue because the addressee's host machine is down.

The **-a** (all addresses) option causes all addresses to be shown (both delivered and undelivered). Some delivered addresses may not appear since some sites remove already delivered addresses from the address list files for efficiency. The **-f** (fast) option suppresses the printing of the "Subject" line. The **-m** (all messages) option causes **checkmail** to check all messages in the mail queue, not just those of the invoker. This is only useful for mail system maintainers who wish to find obstinate hosts.

See also

deliver(ADM), **mmdf**(ADM)

Credit

MMDF was developed at the University of Delaware and is used with permission.

chgrp

change group ID

Syntax

chgrp ***group file*** ...

Description

chgrp changes the group ID of each ***file*** to ***group***. The group may be either a decimal group ID or a group name found in the file */etc/group*.

Files

/etc/passwd
/etc/group

See also

chown(C), **group**(F), **passwd**(FP), **chown**(S)

Note

Only the owner or the superuser can change the group ID of a file.

Standards conformance

chgrp is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

chmod

change the access permissions of a file or directory

Syntax

chmod *mode file*
chmod [*who*] [+|-|=] [*permission* ...] *file* ...

Description

The **chmod** command changes the access permissions (or "mode") of a specified file or directory. It is used to control file and directory access by users other than the owner and super user. The mode may be an expression composed of letters and operators (called "symbolic mode"), or a number (called "absolute mode").

A **chmod** command using symbolic mode has the form:

chmod [*who*] [+|-|=] [*permission* ...] *file* ...

In place of ***who*** you can use any one, or a combination, of the following letters:

a Stands for "all users". If ***who*** is not indicated on the command line, **a** is the default.

g Stands for "group", all users who have the same group ID as the owner of the file or directory.

o Stands for "others", all users on the system.

u Stands for "user", the owner of the file or directory.

The operators are:

+ Adds permission

- Removes permission

= Assigns the indicated permission and removes all other permissions (if any) for that variable. If no permission is assigned, existing permissions are removed.

Permissions can be any combination of the following letters:

x Execute (search permission for directories)

r Read

w Write

s Sets owner or group ID on execution of the file to that of the owner of the file. The mode "u+s" sets the user ID bit for the file. The mode "g+s" sets the group ID bit. Other combinations have no effect. When the group ID bit is set on a directory, all files created under it subsequently receive the group ID of that directory. When the group ID bit is not set, files are created with the group ID of the creating process/user.

t This is known as the "sticky bit" (see **chmod**(S)). Only the mode "u+t" sets the sticky bit. All other combinations have no effect. When this bit is set on a directory, files within the directory cannot be removed by anyone but the owner or the super user. Only the super user can set the sticky bit.

l Mandatory locking will occur during access

Multiple symbolic modes may be given, separated by commas, on a single command line. See the following "Examples" section for sample permission settings.

Mandatory file and record locking refers to a file having locked reading or writing permissions while a program is accessing that file. A file cannot have group execution permission and be able to be locked on execution. In addition, it is not possible to turn on the set-group-ID and enable a file to be locked on execution at the same time. The following examples show illegal uses of **chmod** and will generate error messages:

chmod g+x,+l *filename*

chmod g+s,+l *filename*

A **chmod** command using **absolute mode** has the form:

chmod *mode filename*

where ***mode*** is an octal number constructed by performing logical OR on the following:

4000 Set user ID on execution

20#0 Set group ID on execution if " #" is 7, 5, 3, or 1 and enable mandatory locking if " #" is 6, 4, 2, or 0.

1000 Sets the sticky bit (see **chmod**(S))

0400	Read by owner
0200	Write by owner
0100	Execute (search in directory) by owner
0040	Read by group
0020	Write by group
0010	Execute (search in directory) by group
0004	Read by others
0002	Write by others
0001	Execute (search in directory) by others
0000	No permissions

Examples

Symbolic mode

The following command gives all users execute permission for *file*:

chmod +x file

The following command removes read and write permission for group and others from *file*:

chmod go-rw file

The following command gives other users read and write permission for *file*:

chmod o+rw file

The following command gives read permission to group and others:

chmod g+r,o+r file

Absolute mode

The following command gives all users read, write and execute permission for *file*:

chmod 0777 file

The following command gives read and write permission to all users for *file*:

chmod 0666 file

The following command gives read and write permission to the owner of *file* only:

chmod 0600 file

The following example causes the *file* to be locked on access:

chmod +l file

See also

chmod(S), **ls**(C)

Notes

The setuid, setgid and sticky bit settings have no effect on shell scripts.

Standards conformance

chmod is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

chown

change owner ID

Syntax

chown *owner file ...*

Description

The **chown** command changes the owner ID of the *files* to *owner*. The owner may be either a decimal user ID or a login name found in the file */etc/passwd*.

Files

/etc/passwd
/etc/group

See also

chgrp(C), **chown**(S), **group**(F), **passwd**(FP).

Notes

Use of this utility is governed by the **chown** kernel authorization. If this authorization is not granted, ownership of files can only be changed by *root*. Restricted **chown** is required for NIST FIPS 151-1 conformance. The **chown** authorization should not be assigned to users if you wish to conform to these requirements.

Standards conformance

chown is conformant with:

AT&T SVID Issue 2;
NIST FIPS 151-1;
and X/Open Portability Guide, Issue 3, 1989.

clear

clear a terminal screen

Syntax

clear [*term*]

Description

The **clear** command clears the screen. If *term* is not specified, the terminal type is obtained from the **TERM** environment variable.

If a video terminal does not have a clear screen capability, newlines are output to scroll the screen clear. If the standard output is a hardcopy, the paper is advanced to the top of the next page.

File

/etc/termcap

See also

environ(M), **termcap**(F), **tput**(C)

Note

If the standard output is not a terminal, **clear** issues an error message.

cmchk

report hard disk block size

Syntax

cmchk

Description

Reports the hard disk block size in 512-byte blocks.

Value added

cmchk is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

cmp

compare two files

Syntax

cmp [**-l**] [**-s**] *file1 file2*

Description

cmp compares two files and, if they are different, displays the byte and line number of the differences. If *file1* is " - ", the standard input is used.

The options are:

-l Prints the byte number (decimal) and the differing bytes (octal) for each difference.

-s Returns an exit code only, 0 for identical files, 1 for different files, and 2 for inaccessible or missing files.

This command should be used to compare binary files; use **diff**(C) or **diff3**(C) to compare text files.

See also

comm(C), **diff**(C), **diff3**(C)

Standards conformance

cmp is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

col

filter reverse linefeeds

Syntax

col [-bfxp]

Description

col prepares output from processes, such as the text formatter **nroff**(CT), for output on devices that limit or do not allow reverse or half-line motions. **col** is typically used to process nroff output text that contains tables generated by the **tbl** program. A typical command line might be:

tbl *file* | **nroff** | **col** | **lpr**

col takes the following options:

-b Assumes the output device in use is not capable of backspacing. If two or more characters appear in the same place, **col** outputs the last character read.

-f Allows forward half linefeeds. If not given, **col** accepts half line motions in its input, but text that would appear between lines is moved down to the next full line. Reverse full and half linefeeds are never allowed with this option.

-x Prevents conversion of whitespace to tabs on output. **col** normally converts whitespace to tabs wherever possible to shorten printing time.

-p Causes **col** to ignore unknown escape sequences found in its input and pass them to the output as regular characters. Because these characters are subject to overprinting from reverse line motions, the use of this option is discouraged unless the user is fully aware of the position of the escape sequences.

col assumes that the ASCII control characters SO (octal 016) and SI (octal 017) start and end text in an alternate character set. If you have a reverse linefeed (ESC 7), reverse half linefeed (ESC 8), or forward half linefeed (ESC 9), within an SI-SO sequence, the ESC 7, 8 and 9 are still recognized as line motions.

On input, the only control characters **col** accepts are Space, Backspace, Tab, Return, Newline, reverse linefeed (ESC 7), reverse half linefeed (ESC 8), forward half linefeed (ESC 9), alternate character start(SI), alternate character end (SO), and vertical tag (VT). (The VT character is an alternate form of full reverse linefeed, included for compatibility with some earlier programs of this type.) All other non-printing characters are ignored.

See also

nroff(CT), **tbl**(CT)

Notes

col cannot back up more than 128 lines.

col allows at most 800 characters, including backspaces, on a line.

Vertical motions that would back up over the first line of the document are ignored. Therefore, the first line must not contain any superscripts.

Standards conformance

col is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

comm

select or reject lines common to two sorted files

Syntax

comm [**-123**] *file1 file2*

Description

comm reads *file1* and *file2*, which should be ordered according to the collating sequence defined by the current locale (see **sort**(C)), and produces a three-column output: lines only in *file1*; lines only in *file2*; and lines in both files. The filename "-" means the standard input.

Flags 1, 2, or 3 suppress printing of the corresponding column. Thus **comm -12** prints only the lines common to the two files; **comm -23** prints only lines in the first file but not in the second; **comm -123** is a no-op (does nothing).

See also

cmp(C), **diff**(C), **sort**(C), **uniq**(C)

Standards conformance

comm is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

compress, uncompress, zcat

compress data for storage, uncompress and display compressed files

Syntax

compress [**-cdfFqv**] [**-b** *bits*] *file*
compress -P *fd*
uncompress [**-fqc**] *file*
uncompress [**-P** *fd*]
zcat *file*

Description

compress - Compresses data

uncompress - Uncompresses data

zcat - Displays compressed files

The **compress** command takes a file and compresses it to a smaller size (without loss of information), creates a compressed output file, and removes the original file unless the **-c** option is present. Compression is achieved by encoding common strings within the file. **uncompress** restores a previously compressed file to its uncompressed state and removes the compressed version. **zcat** uncompresses and displays a file on the standard output.

If the **-P** *fd* option is specified, **compress** reads a list of file names from the pipe associated with the file descriptor *fd*. One filename is read from each successive 1 K block of data in the pipe. Each filename is null terminated. File names are read until a null character is encountered at the beginning of a block or the pipe is closed. Each file is then compressed. The output files have the same name as, and overwrite, the original files. This option can also be used with **uncompress**.

If no file is specified on the command line, input is taken from the standard input and the output is directed to the standard output. Output defaults to a file with the same filename as the input file with the suffix ".Z" or it can be directed through the standard output. The output files have the same permissions and ownership as the corresponding input files or the user's standard permissions if output is directed through the standard output.

If no space is saved by compression, the output file is not written unless the **-F** flag is present on the command line.

If you attempt to **compress** a symbolic link, the link will be broken and a compressed copy of the file to which the symbolic link pointed will be created locally. **compress** will fail on a file with hard (non-symbolic) links.

Options

The following options are available from the command line:

-b *bits* Specifies the maximum number of bits to use in encoding.

-c Writes output on the standard output and does not remove original file.

-d Decompresses a compressed file.

-f Overwrites previous output file.

-F Writes output file even if compression saves no space.

-q Generates no output except error messages, if any.

-v Prints the name of the file being compressed, the percentage of compression achieved. With **uncompress**, the name of of the uncompressed file is printed.

Notes

The **-P** option is provided for internal use by **tar**(C).

the **-v** option is not compatible with the **-c** option.

See also

ar(C), **cat**(C) **pack**(C), **tar**(C)

Value added

compress, **uncompress** and **zcat** are extensions of AT&T System V provided by The Santa Cruz Operation, Inc.

copy

copy groups of files

Syntax

copy [*option*] ... *source* ... *dest*

Description

The **copy** command copies the contents of directories to another directory. It is possible to copy whole file systems since directories are made when needed.

If files, directories, or special files do not exist at the destination, then they are created with the same modes and flags as the source. In addition, the superuser may set the user and group ID. The owner and mode are not changed if the destination file exists.

Note that there may be more than one source directory. If so, the effect is the same as if the **copy** command had been issued for each source directory with the same destination directory for each copy.

Options do not have to be given as separate arguments, and may appear in any order, even after the other arguments. The options are:

-a Asks the user before attempting a copy. If the response does not begin with a "y", then a copy is not done. When used together with the **-v** option, it overrides the verbose option so that messages regarding the copy action are not displayed.

-l Uses links instead whenever they can be used. Otherwise a copy is made. Note that links are never made for special files or directories.

-n Requires the destination file to be new. If not, then the **copy** command does not change the destination file. The **-n** flag is meaningless for directories. For special files a **-n** flag is assumed (that is, the destination of a special file must not exist).

-o If set, then every file copied has its owner and group set to those of the source. If not set, then the file's owner is the user who invoked the program.

-m If set, then every file copied has its modification time and access time set to that of the source. If not set, then the modification time is set to the time of the copy.

-r If set, then every directory is recursively examined as it is encountered. If not set then any directories that are found are ignored.

-ad Asks the user whether a **-r** flag applies when a directory is discovered. If the answer does not begin with a "y", then the directory is ignored.

-v Messages are printed that reveal what the program is doing. If used with the **-a** option, the **-a** option is given priority so that it overrides the verbose option, and the copy action message is not displayed.

Arguments to **copy** are:

source This may be a file, directory or special file. It must exist. If it is not a directory, then the results of the command are the same as for the **cp** command.

dest The destination must be either a file or directory name that is different from the source.

If the source and destination are anything but directories, then **copy** acts just like a **cp** command. If both are directories, then **copy** copies each file into the destination directory according to the flags that have been set.

Examples

This command line verbosely copies all files in the current directory to */tmp/food*:

copy -v . /tmp/food

The next command line copies all files, except for those that begin with a dot (.), and copies the immediate contents of any child directories:

copy * /tmp/logic

This command is the same as the previous one, except that it recursively examines all subdirectories, and it sets group and ownership permissions on the destination files to be the same as the source files:

copy -ro * /tmp/logic

Note

Special device files can be copied. When they are copied, any data associated with the specified device is *not* copied.

cp

copy files

Syntax

cp *file1 file2*

cp *files directory*

Description

There are two ways to use the **cp** command. With the first way, ***file1*** is copied to ***file2***. Under no circumstance can ***file1*** and ***file2*** be identical. With the second way, ***directory*** is the location of a directory into which one or more ***files*** are copied. This directory must exist prior to the execution of the **cp** command.

cp follows symbolic links given as arguments.

See also

copy(C), **chmod**(S), **cpio**(C), **ln**(C), **mv**(C), **rm**(C)

Notes

Special device files can be copied. If the file is a named pipe, then the data in the pipe is copied to a standard file. Similarly, if the file is a device, then the file is read until the end-of-file is reached, and that data is copied to a standard file. It is not possible to copy a directory to a file.

Standards conformance

cp is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

cpio

copy file archives in and out

Syntax

cpio -o [**aBcLvV**] [**-C***bufsize*] [[**-O***file*] [**-K***volumesize*] [**-M***message*]]

cpio -i [**AbBcdkmrtTuvVfsS6**] [**-C***bufsize*] [[**-I***file*] [**-M***message*]]
[*pattern* ...]

cpio -p [**adlLmuvV**] *directory*

Description

cpio -o (copy out) reads the standard input to obtain a list of pathnames and copies those files onto the standard output together with pathname and status information. Output is padded to a 512-byte boundary by default.

cpio -i (copy in) extracts files from the standard input, which is assumed to be the product of a previous **cpio -o**. Only files with names that match *patterns* are selected. *patterns* are regular expressions given in the filename-generating notation of **sh**(C). In *patterns*, metacharacters **?**, *****, and **[** ... **]** match the slash (/) character, and backslash (\) is an escape character. A "!" metacharacter means *not*. (For example, the **!abc*** pattern would exclude all files that begin with **abc**.) Multiple *patterns* may be specified and if no *patterns* are specified, the default for *patterns* is "*" (that is, select all files). Each *pattern* must be enclosed in double quotes; otherwise, the name of a file in the current directory is used. Extracted files are conditionally created and copied into the current directory tree based upon the options described below. If **cpio** is used to copy files by a process without appropriate privileges, the access permissions are set in the same fashion that **creat**( ) would have set them when given the `mode` argument, matching the file permissions supplied by the `c_mode` field of the **cpio** format. The owner and group of the files will be that of the current user unless the user is super user, which causes **cpio** to retain the owner and group of the files of the previous **cpio -o**.

NOTE: If **cpio -i** tries to create a file that already exists and the existing file is the same age or newer, **cpio** will output a warning message and not replace the file. (The **-u** option can be used to unconditionally overwrite the existing file.)

cpio -p (pass) reads the standard input to obtain a list of path names of files that are conditionally created and copied into the destination *directory* tree based upon the options described below. Archives of text files created by **cpio** are portable between implementations of UNIX System V.

The meanings of the available options are:

-a Reset access times of input files after they have been copied. Access times are not reset for linked files when **cpio -pla** is specified.

-A Suppresses absolute filenames. A leading " / " character is removed from the filename during copy-in. If a pattern is provided, it should match the relative (rather than the absolute) pathname.

-b Reverse the order of the bytes within each word. Use only with the **-i** option.

-B Input/output is to be blocked 5,120 bytes to the record. The default buffer size is 512 bytes when this and the **-C** options are not used. (**-B** does not apply to the **pass** option; **-B** is meaningful only with data directed to or from a character-special device, for example, */dev/rdsk/f0q15dt*.)

-c Write header information in ASCII character form for portability. Always use this option when origin and destination machines are different types.

-C*bufsize*
Input/output is to be blocked ***bufsize*** bytes to the record, where ***bufsize*** is replaced by a positive integer. The default buffer size is 512 bytes when this and **-B** options are not used. (**-C** does not apply to the **pass** option; **-C** is meaningful only with data directed to or from a character-special device, for example, */dev/rmt/c0s0*.) When used with the **-K** option, ***bufsize*** is forced to be a 1K multiple.

-d Directories are to be created as needed.

-f Copy in all files except those in ***patterns***. (See the paragraph on **cpio -i** for a description of ***patterns***.)

-I*file* Read the contents of ***file*** as input. If ***file*** is a character-special device, when the first medium is full, replace the medium and type a carriage return to continue to the next medium. Use only with the **-i** option.

-k Attempt to skip corrupted file headers and I/O errors that may be encountered. If you want to copy files from a medium that is corrupted or out of sequence, this option lets you read only those files with good headers. (For **cpio** archives that contain other **cpio** archives, if an error is encountered, **cpio** may terminate prematurely. **cpio** will find the next good header, which may be one for a smaller archive, and terminate when the smaller archive's trailer is encountered.) Used only with the **-i** option.

-K*volumesize*
Specifies the size of the media volume. Must be in 1K blocks. For example, a 1.2 MB floppy disk has a ***volumesize*** of 1200. Must include the **-C** option with a ***bufsize*** multiple of 1K. If you specify an incorrect size with **-K**, the command executes without error, but **cpio** generates the message "out of sync: bad magic" when the volume is read. (**-K** is not available with **cpio -i**.)

-l Whenever possible, link files rather than copying them. Usable only with the **-p** option.

-L Follow symbolic links.

-m Retain previous file modification time. This option is ineffective on directories that are being copied.

-M*message*
Define a message to use when switching media. When you use the **-O** or **-I** options and specify a character-special device, you can use this option to define the message that is printed when you reach the end of the medium. One **%d** can be placed in the message to print the sequence number of the next medium needed to continue.

-O*file* Direct the output of cpio to ***file***. If ***file*** is a character-special device, when the first medium is full, replace the medium and type a carriage return to continue to the next medium. Use only with the **-o** option.

-r Interactively rename files. If the user types a null line, the file is skipped. If the user types a ".", the original pathname will be copied. (Not available with **cpio -p**.)

-s Swap bytes within each half word. Use only with the **-i** option.

-S Swap halfwords within each word. Use only with the **-i** option.

-T Truncate long filenames to 14 characters. Use only with the **-i** option.

-t Print a table of contents of the input. No files are created.

-u Copy unconditionally (normally, an older file will not replace a newer file with the same name).

-v Verbose: causes a list of file names to be printed. When used with the **-t** option, the table of contents looks like the output of an **ls -l** command (see **ls**(C)).

-V Special Verbose: print a dot for each file seen. Useful to assure the user that **cpio** is working without printing out all file names.

-6 Process an old (that is, UNIX System Sixth Edition format) file. Use only with the **-i** option.

NOTE: cpio assumes 4-byte words.

If **cpio** reaches end of medium (end of a diskette for example) when writing to (**-o**) or reading from (**-i**) a character-special device, and **-O** and **-I** are not used, **cpio** will print the message:

```
If you want to go on, type device/file name
when ready.
```

To continue, you must replace the medium and type the character-special device name (*/dev/rdsk/f0q15dt* for example) and a carriage return. You may want to continue by directing **cpio** to use a different device. For example, if you have two floppy drives, you may want to switch between them so **cpio** can proceed while you are changing the floppies. (A carriage return alone causes the **cpio** process to exit.)

Examples

The following examples show three uses of **cpio**.

When standard input is directed through a pipe to **cpio -o**, it groups the files so they can be directed (>) to a single file (*../newfile*). The **-c** option insures that the file will be portable to other machines. Instead of **ls**(C), you could use **find**(C), **echo**(C), **cat**(C), etc., to pipe a list of names to **cpio**. You could direct the output to a device instead of a file.

ls | cpio -oc > ../newfile

cpio -i uses the output file of **cpio-o** (directed through a pipe with **cat** in the example), extracts those files that match the patterns (**memo/a1**, **memo/b***), creates directories below the current directory as needed (**-d** option), and places the files in the appropriate directories. The **-c** option is used when the file is created with a portable header. If no patterns were given, all files from *newfile* would be placed in the directory.

cat newfile | cpio -icd "memo/a1" "memo/b*"

cpio-p takes the file names piped to it and copies or links (**-l** option) those files to another directory on your machine (*newdir* in the example). The **-d** option says to create directories as needed. The **-m** option says retain the modification time. (It is important to use the **-depth** option of **find**(C) to generate path names for **cpio**. This eliminates problems **cpio** could have trying to create files under read-only directories.)

find . -depth -print | cpio -pdlmv newdir

See also

cat(C), **echo**(C), **find**(C), **ls**(C), **tar**(C), **cpio**(F)

Notes

1. Path names are restricted to 256 characters.
2. Only the super user can copy special files.
3. Blocks are reported in 512-byte quantities.
4. If a file has 000 permissions, contains more than 0 characters of data, and the user is not root, the file will not be saved or restored.

When **find** is used in conjunction with **cpio**, if the **-L** flag is used with **cpio** (follow symbolic links), then the **-follow** expression must be used with **find**.

Standards conformance

cpio is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

cron

execute commands scheduled by at, batch, and crontab

Syntax

/etc/cron

Description

The **cron** command is the clock daemon that executes commands at specified dates and times. **cron** processes jobs submitted with **at**(C), **batch**(C), and **crontab**(C). **cron** never exits; the **cron** command usually appears in the */etc/rc2* scripts to be invoked by **init**(M) when the system is brought up in multi-user mode.

Files

/etc/default/cron	**cron** logging default information
/usr/lib/cron	main **cron** directory
/usr/lib/cron/at jobs	**at** directory
/usr/spool/cron/crontabs	**crontab** directory
/usr/lib/cron/log	accounting information
/usr/lib/cron/queuedefs	**cron** data file
/usr/lib/cron/.proto	**cron** environment information

See also

at(C), **crontab**(C), **queuedefs**(F), **sg**(C), **sh**(C)

Diagnostics

A history of all actions by **cron** can be recorded in */usr/lib/cron/log*. This logging occurs only if the variable **CRONLOG** is set to YES in */etc/default/cron*. By default this value is set to NO and no logging occurs. If logging is turned on, be sure to check the size of the log file regularly.

Notes

cron will set the supplemental group list to that of the user requesting the job.

Standards conformance

cron is conformant with AT&T SVID Issue 2.

crontab

schedule commands to be executed at regular intervals

Syntax

crontab [*file*]

crontab -r

crontab -l

crontab -u *user* -r

crontab -u *user* -l

Description

The **crontab** command can be used to schedule commands to be executed at regular intervals. These commands are stored in the user's crontab file, */usr/spool/cron/crontabs/**username***. Any output or errors generated by the commands are mailed to the user.

If called with no options, **crontab** copies the specified file, or standard input if no file is specified, into the *crontabs* directory (if the user has a previous crontab file, it is replaced).

crontab with the **-r** option removes the user's crontab file from the *crontabs* directory.

crontab with the **-l** option lists the contents of the user's crontab file.

The **-u** option allows **crontab** to maniplulate a different crontab file from invoking users. If **crontab** is used from an su session then **crontab** by default will manipulate the su'ed users crontab file. The **-u** option may be used to direct **crontab** to manipulate the original login user's crontab file instead. The super user (root) can also use the **-u** option to manipulate any users crontab file.

If the file */usr/lib/cron/cron.allow* exists, only the users listed in that file are allowed to use **crontab**. If *cron.allow* does not exist, and the file */usr/lib/cron/cron.deny* does, then all users not listed in *cron.deny* are allowed access to **crontab**, with an empty *cron.deny* allowing global usage. If neither file exists, only the super user is allowed to submit a job. The allow/deny files consist of one user name per line.

The *crontabs* files consist of lines of six fields each. The fields are separated by spaces or tabs. The first five are integer patterns that specify the minute (0-59), hour (0-23), day of the month (1-31), month of the year (1-12), and day of the week (0-6, with 0=Sunday). Each of these patterns may contain:

- A number in the (respective) range indicated above
- Two numbers separated by a minus (indicating an inclusive range)
- A list of numbers separated by commas (meaning all of these numbers)
- An asterisk (meaning all legal values)

Note that the specification of days may be made by two fields (day of the month and day of the week). If both are specified as a list of elements, both are adhered to. For example, 0 0 1,15 * 1 would run a command on the first and fifteenth of each month, as well as on every Monday. To specify days by only one field, the other field should be set to "*" (for example, 0 0 * * 1 would run a command only on Mondays).

The sixth field is a string that is executed by the shell at the specified **time**(S). A "%" in this field is translated into a newline character. Only the first line (up to a "%" or end-of-line) of the command field is executed by the shell. The other lines are made available to the command as standard input.

The shell is invoked from your **$HOME** directory with an **arg0** of **sh**. Users who desire to have their *.profile* executed must explicitly do so in the crontab file. **cron** supplies a default environment for every shell, defining **HOME, LOGNAME, SHELL** (=*/bin/sh*), and **PATH**(=*/bin:/usr/bin:*).

Examples

An example *crontabs* file follows:

```
0         4  *  *  *  calendar -
15        4  *  *  *  find /usr/preserve -mtime +7 -exec rm -f {} ;
30        4  1  *  1  /usr/lib/uucp/uuclean
40        4  *  *  *  find / -name '#*' -atime +3 -exec rm -f {} ;
1,21,41   *  *  *  *  (echo -n ' '; date; echo ) >/dev/console
```

The lines in this example do the following: run the calendar program every night at 4:00 am, clear old files from the */etc/preserve* directory every night at 4:15 am, clean up the uucp spool directory every Monday and the first of every month at 4:30 am, find and remove any old files with names beginning with "#" every night at 4:40 am, and echo the current date and time to the console three times an hour at one minute, 21 minutes, and 41 minutes past the hour.

Files

/usr/lib/cron	main cron directory
/usr/spool/cron/crontabs	crontab directory
/usr/lib/cron/cron.allow	list of allowed users
/usr/lib/cron/cron.deny	list of denied users
/usr/lib/cron/.proto	cron environment information
/usr/lib/cron/queuedefs	cron data file

See also

at(C), **cron**(C), **sh**(C)

Diagnostics

crontab exits and returns a value of 55 if it cannot allocate enough memory. If it exits for any other reason, it returns a value of 1.

If the user (of **-u** ***user***) does not exist, **crontab** returns a value of 1 and an error message.

Notes

crontab commands are executed by **cron**(C). **cron** reads the files in the *crontabs* directory only on startup or when a new crontab is submitted with the **crontab** command, so changes made to these files by hand will not take effect until the system is rebooted. Changes submitted with the **crontab** command will take effect as soon as **cron** is free to read them (that is, when **cron** is not in the process of running a scheduled job or reading another newly submitted **at**(C) or **crontab** job).

Users who do not wish to have output from their commands mailed to them may want to redirect it to a file:

```
0 * * * * who >> /tmp/whofile 2> /dev/null
```

The example above would append the output of the **who**(C) command to a file, and throw away any errors generated. For more details on output redirection, see the **sh**(C) manual page.

Users should remember to redirect the standard output and standard error of their commands, otherwise any generated output or errors will be mailed to the user.

crontab will overwrite any previous crontab submitted by the same user.

Standards conformance

crontab is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

crypt

encode/decode

Syntax

crypt [***password*** **]**

crypt [-k]

Description

The **crypt** command reads from the standard input and writes to the standard output. The ***password*** is a key that selects a particular transformation. If no argument is given, **crypt** demands a key from the terminal and turns off printing to the screen while the key is being typed in. If the **-k** option is used, **crypt** will use the key assigned to the environment variable **CRYPTKEY**. The **crypt** command encrypts and decrypts with the same key:

crypt key <clear >cypher

crypt key <cypher | pr

Files encrypted by **crypt** are compatible with those treated by the editors **ed**(C), ***edit***, **ex**(C), and **vi**(C) in encryption mode.

The security of encrypted files depends on three factors: the fundamental method must be hard to solve; direct search of the key space must be infeasible; "sneak paths" by which keys or clear text can become visible must be minimized.

The **crypt** command implements a one-rotor machine designed along the lines of the German Enigma, but with a 256-element rotor. Methods of attack on such machines are known, but not widely; moreover the amount of work required is likely to be large.

The transformation of a key into the internal settings of the machine is deliberately designed to be expensive, that is, to take a substantial fraction of a second to compute. However, if keys are restricted to (say) three lower-case letters, then encrypted files can be read by expending only a substantial fraction of five minutes of machine time.

If the key is an argument to the **crypt** command, it is potentially visible to users executing **ps**(C) or a derivative. To minimize this possibility, **crypt** takes care to destroy any record of the key immediately upon entry. The choice of keys and key security are the most vulnerable aspect of **crypt**.

File

/dev/tty for typed key

See also

ed(C), **ex**(C), **makekey**(ADM), **ps**(C), **stty**(C), **vi**(C)

Notes

If two or more files encrypted with the same key are concatenated and an attempt is made to decrypt the result, only the contents of the first of the original files will be decrypted correctly.

Distribution of the **crypt** libraries and utilities is regulated by the U.S. Government and they are not available to sites outside of the United States and its territories. Because we cannot control the destination of the software, these utilities are not included in the standard product. If your site is within the U.S. or its territories, you can obtain the **crypt** software through your product distributor or reseller.

csh

invoke a shell command interpreter with C-like syntax

Syntax

csh [-cefinstvVxX] [*arg* **...]**

Description

csh is a command language interpreter. When it is first invoked, **csh** executes commands from the file *.cshrc*, located in the home directory of the user. If it is a login shell, it then executes commands from the file *.login* (in the same directory). Subsequently, if it is running in interactive mode, **csh** reads commands from the terminal, prompting the user for each new line by printing a "%". Arguments to the shell, and the use of the shell to process files containing command scripts, will be described later.

The shell repeatedly performs the following actions: a line of command input is read and broken into *words*. This sequence of words is placed on the command history list and then parsed. Finally, each command in the current line is executed.

When a login shell terminates, it executes commands from the file *.logout* in the user's home directory.

Lexical structure

The shell splits input lines into words at blanks and tabs with the following exceptions. The characters & | ; < > (and) are treated as separate words. Some of these characters can be paired up; the following pairs (&&, ||, <<, >>) are treated as single words. In order to use these metacharacters within other words, their special meaning must be suppressed by preceding them with a backslash (\). A newline preceded by a "\" is equivalent to a blank.

In addition, strings enclosed in matched pairs of quotations, (´), (`) or ("), form parts of a word; metacharacters in these strings, including blanks and tabs, are not treated as separate words. The semantics of quoted strings are described below. Within quoted strings delimited by pairs of (´) or (") characters, a newline preceded by a "\" gives a true newline character.

If the shell reads the character "#" in its input, it treats the rest of the current line (that is, all the text to the right of the "#") as a comment, and ignores it. The "#" character loses this special meaning if it is preceded by a backslash character (\) or placed inside quotation marks (`, ´, or ").

Commands

A simple command is a sequence of words, the first of which specifies the command to be executed. A simple command or a sequence of simple commands separated by " | " characters (pipes) forms a pipeline. The output from each command in a pipeline is used as the input to the next command. Sequences of pipelines may be separated by semi-colons (;); the elements of such a sequence are executed sequentially. A sequence of pipelines may be executed without waiting for it to terminate by ending the command line with an ampersand character (&). Such a sequence is protected from termination by hangup signals sent by the shell; the **nohup** command need not be used.

Any of the above commands may be placed in parentheses to form a new simple command (which in turn may be used as a component of a pipeline or some other more complex command.) It is also possible to separate pipelines with the "&&" or " | | " expressions: these stand for logical-OR and logical-AND respectively. (Due to an historical bug, **csh** assigns these symbols the opposite meaning to that assumed by the "C" programming language and other UNIX utilities.) Use of these expressions makes the execution of the second pipeline conditional upon the success (logical-AND) or failure (logical-OR) of the first. (See "Expressions" for more information.)

Substitutions

The following sections describe the various transformations the shell performs on the input in the order in which they are carried out.

History substitutions

History substitutions can be used to reintroduce sequences of words from previous commands, possibly altering them in the process. Thus, history substitutions provide a general **redo** facility.

History substitutions begin with the character "!" and may begin anywhere in the input stream unless a history substitution is already in progress. A "!" preceded by a backslash (\), or followed by a space, tab, newline, "=" or "(", is treated as a literal "!" and its special meaning is suppressed. History substitutions may also occur when an input line begins with "^". This special abbreviation will be described later.

The text of any input line containing a history substitution is echoed on the terminal after the substitution has been carried out, so that the user can see the literal command that is being executed.

Commands entered at the terminal and consisting of one or more words are saved on the history list, the size of which is controlled by the **history** variable. The previous command is always retained. Commands are assigned numbers incrementally, starting with"1" (the first command executed under the current **csh**).

For example, enter the command:

```
history
```

This internal command causes **csh** to print a list of the commands stored on the history list, along with their event numbers. Now, consider the following (sample) output from the history command:

```
 9  write michael
10  ex write.c
11  cat oldwrite.c
12  diff *write.c
```

It is not usually necessary to use event numbers, but the current event number can be made part of the prompt by placing a "!" in the prompt string.

If the current event (the current command line) is 13, we can refer to previous command lines in several ways:

By event number:

```
!11
```

to re-run `cat oldwrite.c`

By relative event number:

```
!-2
```

to go back two events; this will also re-run `cat oldwrite.c`

By part of a command:

```
!d
```

will re-run the most recent command starting with a "d", in this case `diff *write.c`, while:

```
!?mic?
```

will re-run the most recent command containing the string "mic"; `write michael`

These forms simply reproduce the words of the specified event, each separated by a single blank. The special case "!!" refers to the previous command; thus the history substitution "!!" means "repeat the last command." The form "!#" references the current command (the one being entered on the current line). It allows a word to be selected from further left in the line, for example to avoid retyping a long name, as in "!#:1".

To select words from an event, we can follow the event specification by a colon (:) and a designator for the desired words. The words of an input line are numbered from 0, the first (usually command) word being 0, the second word (first argument) being 1, and so on. The basic word designators are:

0	First (command) word
n	*n*th argument
^	First argument, that is, 1
$	Last argument
%	Word matched by (immediately preceding) ?*s*? search
x-*y*	Range of words
-*y*	Abbreviates 0-*y*
*	Abbreviates ^-$, or nothing if only 1 word in event
*x**	Abbreviates *x*-$
x-	Like *x** but omitting word $

The ":" separating the event specification from the word designator can be omitted if the argument selector begins with a ^, $, *, - or %. After the optional word designator, a sequence of modifiers can be placed, each preceded by a colon. The following modifiers are defined:

h	Removes a trailing pathname component
r	Removes a trailing *.xxx* component
e	Returns the trailing *.xxx* pathname component
s/*l*/*r*/	Substitutes *r* for *l*
t	Removes all leading pathname components
&	Repeats the previous substitution
g	Applies the change globally, prefixing the above
p	Prints the new command but does not execute it
q	Quotes the substituted words, preventing substitutions
x	Like q, but breaks into words at blanks, tabs, and newlines

Unless preceded by a "g", the modification is applied only to the first modifiable word. In any case it is an error for no word to be applicable.

The left sides of substitutions are not regular expressions like those recognized by the editors, but rather strings. Any character may be used as the delimiter instead of " / "; if it is necessary to include an instance of the delimiter character within one of the substitution strings, its special meaning may be removed by preceding it with a " \ ". An ampersand character (&) in the right side of a substitution is replaced by the text from the left side of the substitution. An ampersand preceded by a backslash (\&) is treated as a literal ampersand (&) with no special meaning. A null *l* uses the previous string either from an *l* or from a contextual scan string *s* in "**!?***s***?**". The trailing delimiter in the substitution may be omitted if a newline follows immediately, as may the trailing " ? " in a contextual scan.

A history reference may be given without an event specification (for example, **!$**). It is assumed that the reference is to the previous command unless a history substitution precedes it on the same line, in which case it is assumed to refer to the last event substitution. Thus **!?foo?^!$** gives the first and last arguments from the command matching **?foo?**.

A special abbreviation of a history reference occurs when the first nonblank character of an input line is a "^". This is equivalent to **!:s^**, providing a convenient shorthand for substitutions on the text of the previous line. Thus **^lb^lib** fixes the spelling of **lib** in the previous command. Finally, a history substitution may be surrounded with "{" and "}" if necessary to insulate it from the characters that follow. Thus, after **ls -ld ~paul** we might do **!{l}a** to do **ls -ld ~paula**, while **!la** would look for a command starting **la**.

Quotations with ' and "

Quoted (') or double quoted (") strings are exempt from some or all of the substitutions. Strings enclosed in single quotes are not subject to interpretation. Strings enclosed in double quotes are subject to variable and command expansion. Since history (!) substitution occurs within all quotes, you must escape "!" with a backslash (\) even within quotes if you want to prevent history substitution.

In both cases, the resulting text becomes (all or part of) a single word; only in one special case (see "Command substitution" below) does a double quoted string yield parts of more than one word; single quoted strings never do.

Alias substitution

The shell maintains a list of aliases which can be established, displayed and modified by the **alias** and **unalias** commands. After a command line is scanned, it is parsed into distinct commands and the first word of each command, left-to-right, is checked to see if it has an alias. If it does, then the text of the alias for that command is reread, and the history mechanism is applied to it as though that command were the previous input line. The resulting words replace the command and argument list. If no reference is made to the history list, then the argument list is left unchanged.

Thus, if the alias for "ls" is "ls -l", the command "ls /usr" would map to "ls -l /usr". Similarly if the alias for "lookup" was "grep \!^ /etc/passwd", then "lookup bill" would map to "grep bill /etc/passwd".

If an alias is found, the word transformation of the input text is performed and the aliasing process begins again on the newly generated input line. Looping is prevented by flagging the first word of the old text; if the first word of the new text is the same, further aliasing is prevented. Other loops are detected and cause an error.

Note that the mechanism allows aliases to introduce parser metasyntax. Thus we can say:

```
alias print 'pr :* | lpr'
```

to make a command that paginates its arguments to the lineprinter.

There are four **csh** aliases distributed. These are **pushd, popd, swapd,** and **flipd**. These aliases maintain a directory stack.

pushd ***dir*** Pushes the current directory onto the top of the directory stack, then changes to the directory ***dir***.

popd Changes to the directory at the top of the stack, then removes (pops) the top directory from the stack, and announces the current directory.

swapd Swaps the top two directories on the stack. The directory on the top becomes the second to the top, and the second to the top directory becomes the top directory.

flipd Flips between two directories, the current directory and the top directory on the stack. If you are currently in *dir1*, and *dir2* is on the top of the stack, when **flipd** is invoked you change to *dir2* and *dir1* is replaced as the top directory on the stack. When **flipd** is again invoked, you change to *dir1* and *dir2* is again the top directory on the stack.

Variable substitution

The shell maintains a set of variables, each of which has a list of zero or more words as its value. Some of these variables are set by the shell or referred to by it. For instance, the **argv** variable is an image of the shell's argument list, and words of this variable's value are referred to in special ways.

The values of variables may be displayed and changed by using the **set** and **unset** commands. Of the variables referred to by the shell a number are toggles; the shell does not care what their value is, only whether they are set or not. For instance, the **verbose** variable is a toggle which causes command input to be echoed. The setting of this variable results from the **-v** command line option.

Other operations treat variables numerically. The at-sign (@) command permits numeric calculations to be performed and the result assigned to a variable. However, variable values are always represented as (zero or more) strings. For the purposes of numeric operations, the null string is considered to be zero, and the second and subsequent words of multiword values are ignored.

After the input line is aliased and parsed, and before each command is executed, variable substitution is performed, keyed by dollar sign ($) characters. This expansion can be prevented by preceding the dollar sign with a backslash (\) except within double quotation marks (") where it *always* occurs, and within single quotation marks (') where it *never* occurs. Strings quoted by back quotation marks (`) are interpreted later (see "Command substitution" below) so dollar sign substitution does not occur there until later, if at all. A dollar sign is passed unchanged if followed by a blank, tab, or end-of-line.

Input and output redirections are recognized before variable expansion, and are expanded separately. Otherwise, the command name and entire argument list are expanded together. It is thus possible for the first (command) word to generate more than one word, the first of which becomes the command name, and the rest of which become arguments.

Unless enclosed in double quotation marks or given the **:q** modifier, the results of variable substitution may eventually be subject to command and filename substitution. Within double quotation marks ("), a variable whose value consists of multiple words expands to a portion of a single word, with the words of the variable's value separated by blanks. When the **:q** modifier is applied to a substitution, the variable expands to multiple words with each word separated by a blank and quoted to prevent later command or filename substitution.

The following sequences are provided for introducing variable values into the shell input. Except as noted, it is an error to reference a variable which is not set.

$*name*
${*name*}
: Are replaced by the words of the value of variable ***name***, each separated by a blank. Braces insulate ***name*** from following characters which would otherwise be part of it. Shell variables have names consisting of up to 20 letters, digits, and underscores.

  If ***name*** is not a shell variable, but is set in the environment, then that value is returned (but **:** modifiers and the other forms given below are not available in this case).

$name[selector]
${name[selector]}
: May be used to select only some of the words from the value of *name*. The *selector* is subjected to $ substitution and may consist of a single number or two numbers separated by a "-". The first word of a variable's value is numbered 1. If the first number of a range is omitted it defaults to 1. If the last member of a range is omitted it defaults to **$#*name***. The selector "*" selects all words. It is not an error for a range to be empty if the second argument is omitted or in range.

$#name
${#name}
: Gives the number of words in the variable. This is useful for later use in a *[selector]*.

$0
: Substitutes the name of the file from which command input is being read. An error occurs if the name is not known.

$number
${number}
: Equivalent to $argv[*number*].

$*
: Equivalent to $argv[*].

The modifiers **:h**, **:t**, **:r**, **:q** and **:x** may be applied to the substitutions above as may **:gh**, **:gt** and **:gr**. If braces ({ and }) appear in the command form then the modifiers must appear within the braces. Only one ":" modifier is allowed on each "$" expansion.

The following substitutions may not be modified with ":" modifiers.

$?name
${?name}
: Substitutes the string 1 if name is set, 0 if it is not.

$?0
: Substitutes 1 if the current input filename is known, 0 if it is not.

$$
: Substitutes the (decimal) process number of the (parent) shell.

Command and filename substitution

Command and filename substitution are applied selectively to the arguments of built-in commands. This means that portions of expressions which are not evaluated are not subjected to these expansions. For commands which are not internal to the shell, the command name is substituted separately from the argument list. This occurs very late, after input-output redirection is performed, and in a child of the main shell.

Command substitution

Command substitution is indicated by a command enclosed in back quotation marks (`). The output from such a command is normally broken into separate words at blanks, tabs and newlines, with null words being discarded. This text then replaces the original string. Within double quotation marks, only newlines force new words; blanks and tabs are preserved.

In any case, the single final newline does not force a new word. Note that it is possible for a command substitution to yield only part of a word, even if the command outputs a complete line.

Filename substitution

If a word contains any of the characters * ? [{ or begins with the character "~", then that word is a candidate for filename substitution, also known as globbing. This word is then regarded as a pattern, and is replaced with an alphabetically sorted list of filenames which match the pattern. In a list of words specifying filename substitution it is an error for no pattern to match an existing filename, but it is not required for each pattern to match. Only the metacharacters "*", "?", and "[" imply pattern matching. The characters "~" and "{" are more akin to abbreviations.

In matching filenames, the character "." at the beginning of a filename or immediately following a "/", as well as the character "/" must be matched explicitly. The character "*" matches any string of characters, including the null string. The character "?" matches any single character. The sequence within square brackets ([and]) matches any one of the characters enclosed. Within square brackets, a pair of characters separated by "-" matches any character lexically between the two.

The character "~" at the beginning of a filename is used to refer to home directories. Standing alone, it expands to the invoker's home directory contained in the variable **HOME**. When "~" is followed by a name consisting of letters, digits, and underscore characters (like_this), the shell searches for a user with that name and substitutes their home directory; thus **~ken** might expand to */usr/ken* and **~ken/chmach** to */usr/ken/chmach*. If the character "~" is followed by a character other than a letter or "/", or if it does not appear at the beginning of a word, it is left unchanged.

The metanotation **a{b,c,d}e** is a shorthand for **abe ace ade**. Left to right order is preserved, with results of matches being sorted separately at a low level to preserve this order. Thus **~source/s1/{oldls,ls}.c** expands to */usr/source/s1/oldls.c /usr/source/s1/ls.c*, whether or not these files exist, assuming that the home directory for source is */usr/source*. Similarly **../{memo,*box}** might expand to *../memo ../box ../mbox*. (Note that memo was not sorted with the results of matching *box.) As a special case "{", "}" and "{}" are passed unchanged. This construct can be nested.

Spelling checker

If the local variable **cdspell** has been set, the shell checks spelling whenever you use **cd** to change directories. For example, if you change to a different directory using **cd** and misspell the directory name, the shell responds with an alternative spelling of an existing directory. Enter "y" and press ⟨Return⟩ (or just press ⟨Return⟩) to change to the offered directory. If the offered spelling is incorrect, enter "n", then retype the command line. In this example the **csh** response is boldfaced:

```
% cd /usr/spol/uucp
/usr/spool/uucp? y
ok
```

Input/Output

The standard input and standard output of a command may be redirected with the following syntax:

< *name* Opens file ***name*** (after variable, command and filename expansion) as the standard input.

<< *word* Reads the shell input up to a line which is identical to ***word***. ***word*** is not subjected to variable, filename or command substitution, and each input line is compared to ***word*** before any substitutions are done on this input line. Unless a quoting backslash, double, or single quotation mark, or a back quotation mark appears in ***word***, variable and command substitution is performed on the intervening lines, allowing "\" to quote "$", "\" and "`". Commands which are substituted have all blanks, tabs, and newlines preserved, except for the final newline which is dropped. The resulting text is placed in an anonymous temporary file which is given to the command as standard input.

> *name*
>! *name*
>& *name*
>&! *name* The file ***name*** is used as standard output. If the file does not exist, then it is created; if the file exists, it is overwritten.

If the variable **noclobber** is set, then an error results if the file already exists or if it is not a character special file (for example, a terminal or */dev/null*). This helps prevent accidental destruction of files. In this case, the "!" forms can be used to suppress this check.

The forms involving "&" route the standard error into the specified file as well as the standard output. ***name*** is expanded in the same way as "<" input filenames are.

>> *name*
>>& *name*
>>! *name*
>>&! *name* Uses file *name* as standard output like ">" but places output at the end of the file. If the variable **noclobber** is set, then it is an error for the file not to exist unless one of the "!" forms is given. Otherwise similar to ">".

If a command is run in the background (followed by "&") then the default standard input for the command is the empty file */dev/null*. Otherwise, the command receives the input and output parameters from its parent shell. Thus, unlike some previous shells, commands run from a file of shell commands have no access to the text of the commands by default; rather they receive the original standard input of the shell. The << mechanism should be used to present inline data. This permits shell command scripts to function as components of pipelines and allows the shell to block read its input.

The standard error may be directed through a pipe with the standard output. Simply use the form "|&" rather than just "|".

Expressions

A number of the built-in commands (to be described later) take expressions, in which the operators are similar to those of C, with the same precedence. These expressions appear in the **@**, **exit**, **if**, and **while** commands. The following operators are available:

```
|| && | ^ & == != <= >= < > << >>
+ - * / % ! ~ ( )
```

Here the precedence increases to the right, == and !=, <=, >=, <, and >, << and >>, + and -, * / and % being, in groups, at the same level. The == and != operators compare their arguments as strings, all others operate on numbers. Strings which begin with "0" are considered octal numbers. Null or missing arguments are considered 0. The result of all expressions are strings, which represent decimal numbers. Note that no two components of an expression can appear in the same word unless the word is adjacent to components of expressions that are syntactically significant to the parser (& | < > ( )). These components should be surrounded by spaces.

Also available in expressions as primitive operands are command executions enclosed in "{" and "}" and file enquiries of the form *-l* name where *l* is one of:

r	Read access
w	Write access
x	Execute access
e	Existence
o	Ownership
z	Zero size
f	Plain file
d	Directory

Command and filename expansion is applied to the specified name, then the result is tested to see if it has the specified relationship to the real user. If the file does not exist or is inaccessible then all enquiries return false, that is 0. Command executions succeed, returning true, that is 1, if the command exits with status 0, otherwise they fail, returning false, that is 0.

If more detailed status information is required then the command should be executed outside of an expression and the variable **status** examined.

Control flow

The shell contains a number of commands which can be used to regulate the flow of control in command files (shell scripts) and (in limited but useful ways) from terminal input. Due to the implementation, some restrictions are placed on the word placement for the **foreach, switch,** and **while** statements, as well as the **if-then-else** form of the **if** statement. Please pay careful attention to these restrictions in the descriptions in the next section.

If the shell's input is not seekable, the shell buffers up input whenever a loop is being read and performs seeks in this internal buffer to accomplish the rereading implied by the loop. (To the extent that this allows, backward goto commands will succeed on nonseekable inputs.)

Built-in commands

Built-in commands are executed within the shell. If a built-in command occurs as any component of a pipeline except the last, then it is executed in a subshell.

alias
alias ***name***
alias ***name wordlist***
: The first form prints all aliases. The second form prints the alias for ***name***. The final form assigns the specified ***wordlist*** as the alias of ***name***. ***wordlist*** is the command; filename substitution may be applied to ***wordlist***. ***name*** is not allowed to be **alias** or **unalias**.

break
: Causes execution to resume after the **end** of the nearest enclosing **foreach** or **while** statement. The remaining commands on the current line are executed. Multilevel breaks are thus possible by writing them all on one line.

breaksw
: Causes a break from a **switch,** resuming after the **endsw**.

case ***label*:**
: This is part of the **switch** statement discussed below.

cd
cd ***name***
chdir
chdir ***name*** Changes the shell's working directory to directory ***name***. If no argument is given, it then changes to the home directory of the user. If ***name*** is not found as a subdirectory of the current directory (and does not begin with "/", "./", or "../"), then each component of the variable **cdpath** is checked to see if it has a subdirectory ***name***. Finally, if all else fails but ***name*** is a shell variable whose value begins with "/", then this is tried to see if it is a directory.

If **cdspell** has been set, the shell runs a spelling check as follows. If the shell is reading its commands from a terminal, and the specified directory does not exist (or some component cannot be searched), spelling correction is applied to each component of ***directory*** in a search for the "correct" name. The shell then asks whether or not to try and change the directory to the corrected directory name; an answer of **n** means "no", and anything else is taken as "yes".

continue Continues execution of the nearest enclosing **while** or **foreach**. The rest of the commands on the current line are executed.

default: Labels the default case in a **switch** statement. The default should come after all **case** labels.

echo ***wordlist***
The specified words are written to the shell's standard output. A "\c" causes the echo to complete without printing a newline. A "\n" in ***wordlist*** causes a newline to be printed. Otherwise the words are echoed, separated by spaces.

else
end
endif
endsw See the description of the **foreach, if, switch,** and **while** statements below.

exec ***command***
The specified ***command*** is executed in place of the current shell.

exit
exit (***expr***) The shell exits either with the value of the **status** variable (first form) or with the value of the specified ***expr*** (second form).

foreach *name* (*wordlist*)
...
end

The variable ***name*** is successively set to each member of ***wordlist*** and the sequence of commands between this command and the matching **end** are executed. (Both **foreach** ***name*** ***(wordlist)*** and **end** must appear alone on separate lines.)

The built-in command **continue** may be used to continue the loop prematurely and the built-in command **break** to terminate it prematurely. When this command is read from the terminal, the contents of the loop are read by prompting with "?" until **end** is typed before any statements in the loop are executed.

glob *wordlist*

Like **echo** but no "\" escapes are recognized and words are delimited by null characters in the output. Useful for programs which wish to use the shell to apply filename expansion to a list of words.

goto *word*

Filename and command expansion is applied to the specified *word* to yield a string of the form ***label:***. The shell rewinds its input as much as possible and searches for a line of the form *label:* possibly preceded by blanks or tabs. Execution continues after the specified line.

history

Displays the history event list.

if (*expr*) *command*

If the specified expression evaluates true, then the single ***command*** with arguments is executed. Variable substitution on *command* happens early, at the same time it does for the rest of the **if** command. ***command*** must be a simple command, not a pipeline, a command list, or a parenthesized command list. Input/output redirection occurs even if ***expr*** is false, and ***command*** is *not* executed.

if (*expr*) **then**
...
else if (*expr2*) **then**
...
else
...
endif

If the specified ***expr*** is true then the commands before the first **else** are executed; else if ***expr2*** is true then the commands after the second **then** and before the second **else** are executed, etc. Any number of **else-if** pairs are possible; only one **endif** is needed. The **else** part is likewise optional. (The words **else** and **endif** must appear at the beginning of input lines; the **if** (***expr***) **then** must appear alone on its input line or after an **else**.)

logout Terminates a login shell. Use this if **ignoreeof** is set.

nice
nice *+number*
nice *command*
nice *+number command*
The first form sets the **nice** for this shell to 4. By default, commands run under C-Shell have a "nice value" of 0. The second form sets the **nice** to the given number. The final two forms run *command* at priority 4 and *number* respectively. The super user may specify negative niceness by using "**nice** *-number* ...." The command is always executed in a subshell, and the restrictions placed on commands in simple **if** statements apply.

nohup
nohup *command*
The first form can be used in shell scripts to cause hangups to be ignored for the remainder of the script. The second form causes the specified command to be run with hangups ignored. Unless the shell is running in the background, **nohup** has no effect. All processes running in the background with " & " are automatically **nohup**ed.

onintr
onintr -
onintr *label* Controls the action of the shell on interrupts. The first form restores the default action of the shell on interrupts which is to terminate shell scripts or to return to the terminal command input level. The second form, **onintr -**, causes all interrupts to be ignored. The final form causes the shell to execute a **goto** *label* when an interrupt is received or a child process terminates because it was interrupted.

In any case, if the shell is running in the background, interrupts are ignored whether any form of **onintr** is present or not.

rehash Causes the internal hash table of the contents of the directories in the **path** variable to be recomputed. This is needed if new commands are added to directories in the **path** while you are logged in.

repeat *count command*
The specified *command*, which is subject to the same restrictions as the *command* in the simple **if** statement above, is executed *count* times. I/O redirection occurs exactly once, even if *count* is 0.

set
set ***name***
set ***name=word***
set ***name[index]=word***
set ***name=(wordlist)***

The first form of the command shows the value of all shell variables. Variables which have other than a single word as value print as a parenthesized word list. The second form sets ***name*** to the null string. The third form sets ***name*** to the single ***word***. The fourth form sets the ***index***th component of ***name*** to ***word***; this component must already exist. The final form sets ***name*** to the list of words in ***wordlist***. Command and filename expansion is applied in all cases.

These arguments may be repeated to set multiple values in a single set command. Note however, that variable expansion happens for all arguments before any setting occurs.

setenv ***name value***

Sets the value of the environment variable ***name*** to be ***value***, which must be a single string. Two useful environment variables are **TERM**, the type of your terminal and **SHELL**, the shell you are using.

shift
shift ***variable***

In the first form, the members of **argv** are shifted to the left, discarding **argv[1]**. It is an error for **argv** not to be set or to have less than one word as a value. The second form performs the same function on the specified variable.

source ***name*** The shell reads commands from ***name***. **Source** commands may be nested, but if they are nested too deeply, the shell may run out of file descriptors. An error in a **source** at any level terminates all nested **source** commands, including the **csh** process from which **source** was called. If **source** is called from the login shell, it is logged out. Input during **source** commands is never placed on the history list.

switch (*string*)
case *str1*:
...
breaksw
...
default:
...
breaksw
endsw

Command and filename substitution is applied to *string*; each case label is then successively matched against the result. Variable expansion is also applied to the case labels, so the file metacharacters "*", "?", and "[...]" can be used. If none of the labels match before a default label is found, then the execution begins after the default label. Each case label and the default label must appear at the beginning of a line. The command **breaksw** causes execution to continue after the **endsw**. Otherwise control may fall through case labels and default labels, as in C. If no label matches and there is no default, execution continues after the **endsw**.

time
time *command*

With no argument, a summary of CPU time used by this shell and its children is printed. If arguments are given, the specified simple command is timed and a time summary as described under the **time** variable is printed. If necessary, an extra shell is created to print the time statistic when the command completes. *command* has the same restrictions as the simple **if** statement described above.

umask
umask *value*

The file creation mask is displayed (no arguments) or set to the specified value (one argument). The mask is given in octal. Common values for the mask are 002 giving all access to the group and read and execute access to others, or 022 giving read and execute access to users in the group and all other users.

unalias *pattern*

All aliases whose names match the specified pattern are discarded. Thus, all aliases are removed by **unalias** *. It is not an error for nothing to be **unaliased**.

unhash

Use of the internal hash table to speed location of executed programs is disabled.

unset *pattern*

All variables whose names match the specified pattern are removed. Thus, all variables are removed by **unset** *; use this with care. It is not an error for nothing to be **unset**.

wait All child processes are waited for. If the shell is interactive, then an interrupt can disrupt the wait, at which time the shell prints names and process numbers of all children known to be outstanding.

while (*expr*)
...
end While the specified expression evaluates nonzero, the commands between the **while** and the matching **end** are evaluated. **break** and **continue** may be used to terminate or continue the loop prematurely. (The **while** (*expr*) and **end** must appear alone on their input lines.) Prompting occurs here the first time through the loop as for the **foreach** statement if the input is a terminal.

@
@ *name* = *expr*
@ *name*[*index*] = *expr*
The first form prints the values of all the shell variables. The second form sets the specified *name* to the value of *expr*. If the expression contains <, >, & or | then at least this part of the expression must be placed within ( ). The third form assigns the value of *expr* to the *index*th argument of *name*. Both *name* and its *index*th component must already exist.

The operators *=, +=, etc. are available as in C. The space separating the name from the assignment operator is optional. Spaces are mandatory in separating components of *expr* which would otherwise be single words. The space between "@" and *name* is also mandatory.

Special postfix ++ and -- operators increment and decrement *name* respectively, that is <@ i++.

Predefined variables

The following variables have special meaning to the shell. Of these, **argv**, **child**, **home**, **path**, **prompt**, **shell** and **status** are always set by the shell. Except for **child** and **status** this setting occurs only at initialization; these variables will not be modified unless done explicitly by the user.

The shell copies the environment variable **PATH** into the variable **path**, and copies the value back into the environment whenever **path** is set. Thus it is not necessary to worry about its setting other than in the file *.login* since inferior **csh** processes will import the definition of **path** from the environment.

argv Set to the arguments to the shell, it is from this variable that positional parameters are substituted, that is, **$1** is replaced by **argv**[1], etc. **argv**[0] is not defined, but **$0** is.

cdpath Gives a list of alternate directories searched to find subdirectories in **cd** commands.

child The process number of the last command forked with "&". This variable is **unset** when this process terminates.

echo Set when the **-x** command line option is given. Causes each command and its arguments to be echoed just before it is executed. For nonbuilt-in commands all expansions occur before echoing. Built-in commands are echoed before command and filename substitution, since these substitutions are then done selectively.

histchars Can be assigned a two-character string. The first character is used as a history character in place of "!", the second character is used in place of the "^" substitution mechanism. For example, **set histchars=",;"** will cause the history characters to be comma and semicolon.

history Can be given a numeric value to control the size of the history list. Any command which has been referenced in this many events will not be discarded. A **history** that is too large may run the shell out of memory. The last executed command is always saved on the history list.

home The home directory of the invoker, initialized from the environment. The filename expansion of "~" refers to this variable.

ignoreeof If set, the shell ignores end-of-file from input devices that are terminals. This prevents a shell from accidentally being terminated by pressing ⟨Ctrl⟩**d**.

mail The files where the shell checks for mail. This check is executed after each command completion. The shell responds with, "You have new mail" if the file exists with an access time not greater than its modify time.

If the first word of the value of **mail** is numeric, it specifies a different mail checking interval: in seconds, rather than the default, which is 10 minutes.

If multiple mail files are specified, then the shell responds with "New mail in ***name***", when there is mail in the file ***name***.

noclobber As described in the section "Input/Output", restrictions are placed on output redirection to insure that files are not accidentally destroyed, and that >> redirections refer to existing files.

noglob If set, filename expansion is inhibited. This is most useful in shell scripts which are not dealing with filenames, or after a list of filenames has been obtained and further expansions are not desirable.

nonomatch If set, it is not an error for a filename expansion to not match any existing files; rather, the primitive pattern is returned. It is still an error for the primitive pattern to be malformed, that is, **echo [** still gives an error.

path Each word of the path variable specifies a directory in which commands are to be sought for execution. A null word specifies the current directory. If there is no **path** variable, then only full pathnames will execute. The usual search path is */bin*, */usr/bin*, and ., but this may vary from system to system. For the super-user, the default search path is */etc*, */bin* and */usr/bin*. A shell which is given neither the **-c** nor the **-t** option will normally hash the contents of the directories in the **path** variable after reading *.cshrc*, and each time the **path** variable is reset. If new commands are added to these directories while the shell is active, it may be necessary to give the **rehash** command, or the commands may not be found.

prompt The string which is printed before reading each command from an interactive terminal input. If a "!" appears in the string, it will be replaced by the current event number unless a preceding "\" is given. Default is "%", or "#" for the super user.

shell The file in which the shell resides. This is used in forking shells to interpret files which have execute bits set, but which are not executable by the system. (See the description of "Nonbuilt-in command execution" below.) Initialized to the home of the shell.

status The status returned by the last command. If it terminated abnormally, then 0200 is added to the status. Built-in commands which fail return exit status 1, otherwise these commands set status to 0.

time Controls automatic timing of commands. If set, then any command which takes more than this many cpu seconds will cause a line to be sent to the screen displaying user time, system time, real time, and a utilization percentage which is the ratio of user plus system times to real time.

verbose Set by the **-v** command line option, causes the words of each command to be printed after history substitution.

Nonbuilt-in command execution

When a command to be executed is found to not be a built-in **csh** command, the shell attempts to execute the command via **exec**(S). Each word in the variable **path** names a directory from which the shell will attempt to execute the command. If it is given neither a **-c** nor a **-t** option, the shell will hash the names in these directories into an internal table so that it will only try an **exec** in a directory if there is a possibility that the command resides there. This greatly speeds command location when a large number of directories are present in the search path. If this mechanism has been turned off (via **unhash**), or if the shell was given a **-c** or **-t** argument, and for each directory component of **path** which does not begin with a " / ", the shell concatenates each directory component of **path** with the given command name to form a pathname of a file which it then attempts to execute.

Parenthesized commands are always executed in a subshell. Thus

```
(cd; pwd); pwd
```

prints the home directory but leaves you in the original directory, while

```
cd; pwd
```

moves you to the home directory.

If the file has execute permissions but is not an executable binary to the system, then it is assumed to be a file containing shell commands and a new shell is spawned to read it.

If there is an **alias** for **shell** then the words of the alias are prepended to the argument list to form the shell command. The first word of the **alias** should be the full pathname of the shell (for example, **$shell**). Note that this is a special, late occurring, case of **alias** substitution, and only allows words to be prepended to the argument list without modification.

Argument list processing

If argument 0 to the shell is "-" then this is a login shell. The flag arguments are interpreted as follows:

-c Commands are read from the (single) following argument which must be present. Any remaining arguments are placed in **argv**.

-e The shell exits if any invoked command terminates abnormally or yields a nonzero exit status.

-f The shell will start faster, because it will neither search for nor execute commands from the file *.cshrc* in the invoker's home directory.

-i The shell is interactive and prompts for its top-level input, even if it appears to not be a terminal. Shells are interactive without this option if their input and output are terminals.

-n Commands are parsed, but not executed. This may aid in syntactic checking of shell scripts.

-s Command input is taken from the standard input.

-t A single line of input is read and executed. A "\" may be used to escape the newline at the end of this line and continue onto another line.

-v Causes the **verbose** variable to be set, with the effect that command input is echoed after history substitution.

-x Causes the **echo** variable to be set, so that commands are echoed immediately before execution.

-V Causes the **verbose** variable to be set even before *.cshrc* is executed.

-X Causes the **echo** variable to be set even before *.cshrc* is executed.

After processing the flag arguments, if arguments remain but none of the **-c**, **-i**, **-s**, or **-t** options were given, the first argument is taken as the name of a file of commands to be executed. The shell opens this file, and saves its name for possible resubstitution by **$0**. On a typical system, most shell scripts are written for the standard shell (see **sh**(C)). The C shell will execute such a standard shell if the first character of the script is not a "#" (that is, if the script does not start with a comment). Remaining arguments initialize the variable **argv**.

Signal handling

The shell normally ignores **quit** signals. The **interrupt** and **quit** signals are ignored for an invoked command if the command is followed by "&"; otherwise the signals have the values which the shell inherited from its parent. The shell's handling of interrupts can be controlled by **onintr**. By default, login shells catch the **terminate** signal; otherwise this signal is passed on to children from the state in the shell's parent. In no case are interrupts allowed when a login shell is reading the file *.logout*.

Files

~/.cshrc	Read by each shell at the beginning of execution
/etc/cshrc	Systemwide default *cshrc* file for login C-shells
~/.login	Read by login shell, after *.cshrc* at login
~/.logout	Read by login shell, at logout
/bin/sh	Shell for scripts not starting with a "#"
*/tmp/sh**	Temporary file for <<
/dev/null	Source of empty file
/etc/passwd	Source of home directories for ~*username*

Limitations

Words can be no longer than 512 characters. The number of arguments to a command which involves filename expansion is limited to the number of characters allowed in an argument list, which is 5120, less the characters in the environment. The length of any argument of a command after filename expansion cannot exceed 159 characters. Also, command substitutions may substitute no more characters than are allowed in an argument list.

To detect looping, the shell restricts the number of **alias** substitutions on a single line to 20.

See also

access(S), **a.out**(FP), **environ**(M), **exec**(S), **fork**(S), **pipe**(S), **signal**(S), **umask**(S), **wait**(S)

User's Guide

Credit

This utility was developed at the University of California at Berkeley and is used with permission.

Notes

Built-in control structure commands like **foreach** and **while** cannot be used with |, & or ;.

Commands within loops, prompted for by "?", are not placed in the **history** list.

It is not possible to use the colon (:) modifiers on the output of command substitutions.

The C-shell has many built-in commands with the same name and functionality as Bourne shell commands. However, the syntax of these C-shell and Bourne shell commands often differs. Two examples are the **nice** and **echo** commands. Be sure to use the correct syntax when working with these built-in C-shell commands.

When a C-shell user logs in, the system reads and executes commands in */etc/cshrc* before executing commands in the user's **$HOME**/*.cshrc* and **$HOME**/*.login*. You can, therefore, modify the default C-shell environment for all users on the system by editing */etc/cshrc*.

During intervals of heavy system load, pressing the delete key while at a C-shell prompt (%) may cause the shell to exit. If **csh** is the login shell, the user is logged out.

csh attempts to import and export the **PATH** variable for use with regular shell scripts. This only works for simple cases, where the **PATH** contains no command characters.

The || and && operators are reversed in this implementation.

csplit

split files according to context

Syntax

csplit [-s] [-k] [-f*prefix*] *file arg1* [... *argn*]

Description

The **csplit** command reads ***file*** and separates it into n+1 sections, defined by the arguments ***arg1*** ... ***argn***. By default the sections are placed in files *xx00* ... *xxn* (***n*** may not be greater than 99). These sections get the following pieces of ***file***:

00: From the start of ***file*** up to (but not including) the line referenced by ***arg1***.

01: From the line referenced by ***arg1*** up to the line referenced by ***arg2***.

.
.
.

n+1: From the line referenced by ***argn*** to the end of ***file***.

The options to **csplit** are:

-s **csplit** normally prints the character counts for each file created. If the **-s** option is present, **csplit** suppresses the printing of all character counts.

-k **csplit** normally removes created files if an error occurs. If the **-k** option is present, **csplit** leaves previously created files intact.

-f*prefix* If the **-f** option is used, the created files are named ***prefix00*** ... ***prefixn***. The default is *xx00* ... *xxn*.

The arguments (***arg1*** ... ***argn***) to **csplit** can be a combination of the following:

/rexp/ A file is to be created for the section from the current line down to (but not including) the line containing the regular expression ***rexp***. The current line becomes the line containing ***rexp***. This argument may be followed by an optional "+" or "-" some number of lines (for example, **/Page/-5**).

%rexp% This argument is the same as ***/rexp/***, except that no file is created for the section.

lnno A file is to be created from the current line down to (but not including) ***lnno***. The current line becomes ***lnno***.

{*num*} Repeat argument. This argument may follow any of the above arguments. If it follows an *rexp*-type argument, that argument is applied *num* more times. If it follows *lnno*, the file will be split every *lnno* lines (*num* times) from that point.

Enclose all *rexp*-type arguments that contain blanks or other characters meaningful to the shell in the appropriate quotation marks. Regular expressions may not contain embedded newlines. **csplit** does not affect the original file; it is the user's responsibility to remove it.

Examples

csplit -f cobol file ´/procedure division/´ ´/par5./´ ´/par16./´

This example creates four files, *cobol00* ... *cobol03*. After editing the "split" files, they can be recombined as follows:

cat cobol0[0-3] > file

Note that this example overwrites the original file.

csplit -k file 100 {99}

This example would split the file at every 100 lines, up to 10,000 lines. The **-k** option causes the created files to be retained if there are less than 10,000 lines; however, an error message would still be printed.

csplit -k prog.c ´%main(%´ ´/^}/+1´ {20}

Assuming that *prog.c* follows the normal C coding convention of ending routines with a } at the beginning of the line, and that **main**( ) is the first function in *prog.c*, this example will create a file for each separate C routine, up to 21 routines.

See also

ed(C), **regex**(S), **sh**(C)

Diagnostics

Self-explanatory except for:

```
arg - out of range
```

which means that the given argument did not reference a line between the current position and the end of the file.

Standards conformance

csplit is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

ct

spawn getty to a remote terminal

Syntax

ct [**-w***n*] [**-x***n*] [**-h**] [**-v**] [**-s***speed*] ***telno*** ...

Description

The **ct** command dials the telephone number of a modem that is attached to a terminal, and spawns a **getty** process to that terminal. ***telno*** is a telephone number, with equal signs for secondary dial tones and minus signs for delays at appropriate places. The set of legal characters for ***telno*** is 0 through 9, -, =, *, and #. The maximum length ***telno*** is 58 characters. If more than one telephone number is specified, **ct** will try each in succession until one answers; this is useful for specifying alternate dialing paths.

ct will try each ACU line listed in the file */usr/lib/uucp/Devices* until it finds an available line with appropriate attributes or runs out of entries. If there are no free lines, **ct** will ask if it should wait for one, and if so, for how many minutes it should wait before it gives up. **ct** will continue to try to open the dialers at one-minute intervals until the specified limit is exceeded. This value can also be set on the command line by specifying the **-w***n* option, where ***n*** is the maximum number of minutes that **ct** is to wait for a line.

The **-x***n* option is used for debugging. It produces a detailed output of the program execution on stderr. The debugging level, ***n***, is a single digit; **-x**9 produces the most detailed output. If the **-v** option is used, **ct** will send a running narrative to the standard error output stream.

Normally, **ct** will hang up the current line, so the line can answer the incoming call. The **-h** option will prevent this action. The **-h** option will also wait for the termination of the specified **ct** process before returning control to the user's terminal.

The data rate may be set with the -s option, where ***speed*** is expressed in baud. The default rate is 1200.

After the user on the destination terminal logs out, **ct** prompts, `Reconnect?` If the response does not begin with the letter *y*, the line will be dropped; otherwise, **getty** will be started again and the `login:` prompt will be printed.

To log out properly, the user must type ⟨Ctrl⟩**d**.

(Of course, the destination terminal must be attached to a modem that can answer the telephone.)

Whenever **ct** makes a successful connection, it writes a log file, */usr/adm/ctlog*. This log file contains the login name of the user who invoked **ct**, the speed of the connection, the date and time of the connection, the length of the connection, and the telephone number that was dialed. The time of the connection is shown as ***minutes:seconds*** or as ***hours:minutes:seconds***, depending on how long the call lasted.

For example:

```
root    ( 1200) Mon Sept 16 14:55       1:25    264
```

In this example, the *ctlog* shows that *root* invoked **ct** at 1200 baud on Monday, September 16 at 2:55. The connection lasted 1 minute and 25 seconds and the telephone number dialed was 264.

Files

/usr/lib/uucp/Devices
/usr/lib/uucp/LCK.. (***tty-device***)
/usr/adm/ctlog

See also

cu(C), **getty**(M), **login**(M), **uucp**(C)

Notes

In hangup mode (**-h** not specified), when a suitable dialer has been allocated, **ct** prompts `Proceed to hang-up?` If the response does not begin with the letter *y*, the program simply exits. If you are logged in on a computer through a local terminal and you want to connect a remote terminal to the computer, you should use **nohup** with **ct** to accomplish this:

nohup ct -h -s*speed phone*

After the command is executed, a login prompt is displayed on the remote terminal. The user can then log in and work on the computer just as on a local terminal.

ctags

create a tags file

Syntax

ctags [-a] [-u] [-v] [-w] [-x] [*file* ...]

Description

The **ctags** command makes a tags file for **vi**(C) from the specified C or FORTRAN sources. A tags file gives the locations of specified objects (in this case, functions) in a group of files. Each line of the tags file contains the function name, the file in which it is defined, and a scanning pattern used to find the function definition. These are given in separate fields on the line, separated by blanks or tabs. Using the tags file, **vi** can quickly find function definitions.

-a Append new values for the specified *file*s to *tags*.

-u Update the specified *file*s in *tags*; that is, all references to them are deleted, and the new values are appended to the file. (This can be slow; it is usually faster to simply rebuild the tags file.)

-v Produce a list of function names, the filename in which each function is declared, and the function's line number. This list prints on the standard output, and no tags file is created.

-w Suppress warning diagnostics.

-x Produce a function index, printing the line in which each function is defined, along with the filename, function name, and line number. No tags file is created.

Files whose names end in *.c* or *.h* are assumed to be C source files and are searched for C routine and macro definitions. Otherwise, the files are scanned for the FORTRAN keywords **function, procedure, program**, and **subroutine**. If any of these keywords is found, **ctags** assumes *file* is a FORTRAN file; otherwise, it assumes it is a C file.

The tag **main** is treated specially in C programs. The tag formed is created by prefixing M to the name of the file, with a trailing .c. Leading pathname components are also removed. This makes use of **ctags** practical in directories with more than one program.

File

tags	Output tags file

See also

ex(C), **vi**(C)

Credit

This utility was developed at the University of California at Berkeley and is used with permission.

cu

call another UNIX/XENIX system

Syntax

cu [-s *speed*] [-l *line*] [-h] [-t] [-x*n*] [-o | -e | -oe] [-n] *telno*

cu [-s *speed*] [-h] [-x*n*] [-o | -e | -oe] -l *line* [dir]

cu [-h] [-x*n*] [-o | -e | -oe] *systemname*

Description

The **cu** command calls up another UNIX system, a terminal, or possibly a non-UNIX system. It manages an interactive conversation with possible transfers of ASCII files.

The **cu** command accepts the following options and arguments:

-s*speed* Specifies the transmission speed (150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400). The default value is "Any" speed which will depend on the order of the lines in the */usr/lib/uucp/Devices* file. A speed range can also be specified (for example, -s1200-4800).

-l*line* Specifies a device name to use as the communication line. This can be used to override the search that would otherwise take place for the first available line having the right speed. When the **-l** option is used without the **-s** option, the speed of a line is taken from the *Devices* file. When the **-l** and **-s** options are both used together, **cu** will search the *Devices* file to check if the requested speed for the requested line is available. If so, the connection will be made at the requested speed; otherwise, an error message will be printed and the call will not be made. The specified device is generally a directly connected asynchronous line (for example, */dev/ttyab*) in which case a telephone number (***telno***) is not required. The specified device need not be in the */dev* directory. If the specified device is associated with an auto dialer, a telephone number must be provided. Use of this option with ***systemname*** rather than ***telno*** will not give the desired result (see ***systemname*** below).

-h Emulates local echo, supporting calls to other computer systems which expect terminals to be set to half-duplex mode.

-t Used to dial an ASCII terminal which has been set to auto answer. Appropriate mapping of carriage-return to carriage-return-line-feed pairs is set.

-x*n* Causes diagnostic traces to be printed; it produces a detailed output of the program execution on stderr. The debugging level, ***n***, is a single digit in the range 0 to 9; **-x**9 is the most useful value.

-n For added security, **-n** will prompt the user to provide the telephone number to be dialed rather than taking it from the command line.

telno When using an automatic dialer, the argument is the telephone number with equal signs for secondary dial tone or minus signs placed appropriately for delays of 4 seconds.

systemname A UUCP system name may be used rather than a telephone number. In this case, **cu** will obtain an appropriate direct line or telephone number from */usr/lib/uucp/Systems*. Note: the ***systemname*** option should not be used in conjunction with the **-l** and **-s** options as **cu** will connect to the first available line for the system name specified, ignoring the requested line and speed.

dir The keyword **dir** can be used with **cu -l*line***, in order to talk directly to a modem on that line, instead of talking to another system via that modem. This can be useful when debugging or checking modem operation. Note: only users with write access to the *Devices* file are permitted to use **cu -l*line* dir**.

In addition, **cu** uses the following options to determine communications settings:

-o If the remote system expects or sends 7-bits with odd parity.

-e If the remote system expects or sends 7-bits with even parity.

-oe If the remote system expects or sends 7-bits, ignoring parity and sends 7-bits with either parity.

By default, **cu** expects and sends 8-bit characters without parity. If the login prompt received appears to contain incorrect 8-bit characters, or a correct login is rejected, use the 7-bit options described above.

After making the connection, **cu** runs as two processes: the *transmit* process and the *receive* process. The *transmit* process reads data from standard input and, except for lines beginning with "~", passes the data to the remote system. The *receive* process accepts data from the remote system and, except for lines beginning with "~", passes the data to standard output.

Normally, an automatic XON/XOFF protocol is used to control input from the remote system so the buffer is not overrun.

Lines beginning with "~" have special meanings.

The *transmit* process interprets the following user-initiated commands:

~.	terminate the conversation.
~!	escape to an interactive shell on the local system.
~!*cmd ...*	run *cmd* on the local system (via **sh -c**).
~$*cmd ...*	run *cmd* locally and send its output to the remote system.
~+*cmd ...*	run *cmd* on the local system but take standard input from the remote system.
~%**cd**	change the directory on the local system. Note: ~!**cd** will cause the command to be run by a sub-shell, probably not what was intended.
~%**take** *from* [*to*]	copy file *from* (on the remote system) to file *to* on the local system. If *to* is omitted, the *from* argument is used in both places.
~%**put** *from* [*to*]	copy file *from* (on the local system) to file *to* on the remote system. If *to* is omitted, the *from* argument is used in both places. For both ~%**take** and ~%**put** commands, as each block of the file is transferred, consecutive single digits are printed to the terminal.
~~*line*	send the line ~*line* to the remote system.
~%**break**	transmit a **BREAK** to the remote system (which can also be specified as ~%**b**).
~%**debug**	toggles the **-x** debugging level between 0 and 9 (which can also be specified as ~%**d**).
~t	prints the values of the termio structure variables for the user's terminal (useful for debugging).
~l	prints the values of the termio structure variables for the remote communication line (useful for debugging).
~%**nostop**	toggles between XON/XOFF input control protocol and no input control. This is useful in case the remote system is one which does not respond properly to the XON and XOFF characters.

The use of ~%**put** requires **stty**(C) and **cat**(C) on the remote side. It also requires that the current erase and kill characters on the remote system be identical to these current control characters on the local system. Backslashes are inserted at appropriate places.

The use of **~%take** requires the existence of **echo**(S) and **cat**(C) on the remote system. Also, **tabs** mode (see **stty**(C)) should be set on the remote system if tabs are to be copied without expansion to spaces.

The *receive* process normally copies data from the remote system to its standard output. It may also direct output to local files.

You can construct **take** and **put** commands that work between UNIX and non-UNIX systems by sending the appropriate characters to **cu**. To do this, you will need to know the equivalent of **echo**(C) and **cat**(C) on the non-UNIX system.

For example, to transfer a file named *fred* from a remote non-UNIX system to the file */tmp/fred* on the local UNIX system, construct a command similar to the following:

```
~%
echo '~>':/tmp/fred
cat fred
echo '~>'
```

This creates a file */tmp/fred* on the local UNIX system, putting the characters "~>" into it, which tells **cu** to start receiving data into this file. The file **fred** is then sent to standard output on the remote machine, and **cu** therefore receives it. Finally, a "~>" is echoed into the file; this is a signal to **cu** to stop receiving input. (Remember to replace **echo** and **cat** with the equivalent commands for the non-UNIX system.)

You can also append the file from the remote machine to an existing file on the local system:

```
~%
echo '~>>':/tmp/fred
cat fred
echo '~>'
```

This appends the remote file onto the end of the existing file */tmp/fred.*

When **cu** is used on ***system1*** to connect to ***system2*** and subsequently used on ***system2*** to connect to ***system3***, commands on ***system2*** can be executed by using "~~". Executing a tilde command reminds the user of the local system **uname**. For example, **uname** can be executed on systems 1, 2, and 3 as follows:

```
uname
system3
~!uname
system1
~~!uname
system2
```

In general, "~" causes the command to be executed on the original machine, and "~~" causes the command to be executed on the next machine in the chain.

Examples

To dial a system whose telephone number is 9 201 555 1212 using 1200 baud (where dialtone is expected after the 9):

cu -s1200 9=12015551212

If the speed is not specified, "Any" is the default value.

To login to a system connected by a direct line:

cu -l /dev/ttyXX or **cu -l ttyXX**

To dial a system with the specific line and a specific speed:

cu -s1200 -l ttyXX

To dial a system using a specific line associated with an auto dialer:

cu -l ttyXX 9=12015551212

To call up a system named *huey*:

cu huey

To talk directly to an ACU (connect directly with the modem and enter modem commands manually):

cu -lttyXX dir

Files

/usr/lib/uucp/Systems
/usr/lib/uucp/Devices
/usr/lib/uucp/LCK..(tty-device)

See also

cat(C), **ct**(C), **echo**(S), **stty**(C), **uucp**(C), **uname**(C)

Diagnostics

Exit code is zero for normal exit, otherwise, one.

Warnings

The **cu** command does not do any integrity checking on data it transfers. Data fields with special **cu** characters may not be transmitted properly. Depending on the interconnection hardware, it may be necessary to use a "~." to terminate the conversion even if **stty0** has been used. Non-printing characters are not dependably transmitted using either the **~%put** or **~%take** commands. **cu** between an IMBR1 and a penril modem will not return a login prompt immediately upon connection. A carriage return will return the prompt.

Note

There is an artificial slowing of transmission by **cu** during the **~%put** operation so that loss of data is unlikely.

Standards conformance

cu is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

cut

cut out selected fields of each line of a file

Syntax

cut -c ***list*** [***file1 file2*** ...]

cut -f ***list*** [**-d** ***char***] [**-s**] [***file1 file2*** ...]

Description

Use **cut** to cut out columns from a table or fields from each line of a file. The fields as specified by ***list*** can be fixed length, that is, character positions as on a punched card (**-c** option), or the length can vary from line to line and be marked with a field delimiter character like Tab (**-f** option). **cut** can be used as a filter. If no files are given, the standard input is used.

The meanings of the options are:

list A comma-separated list of integers (in increasing order), with an optional dash (-), indicates ranges, as in the **-o** option of **nroff/troff** for page ranges; for example, **1,4,7**; **1-3,8**; **-5,10** (short for **1-5,10**); or **3-** (short for third through last field).

-c ***list*** The ***list*** following **-c** (no space) specifies character positions (for example, **-c1-72** would keep the first 72 characters of each line).

-f ***list*** The ***list*** following **-f** is a list of fields assumed to be separated in the file by a delimiter character (see **-d**); for example, **-f1,7** copies the first and seventh field only. Lines with no field delimiters will be passed through intact (useful for table subheadings), unless **-s** is specified.

-d ***char*** The character following **-d** is the field delimiter (**-f** option only). Default is Tab. Space or other characters with special meaning to the shell must be quoted.

-s If the **-f** option is used, **-s** suppresses lines with no delimiter characters. Unless specified, lines with no delimiters will be passed through untouched.

Either the **-c** or **-f** option must be specified.

Notes

Use **grep**(C) to make horizontal "cuts" (by context) through a file, or **paste**(C) to put files together horizontally. To reorder columns in a table, use **cut** and **paste**.

Examples

cut -d: -f 1,5 /etc/passwd	Maps user ID's to names.
name=`who am i | cut -f1 -d" "`	Sets **name** to current login name.

See also

grep(C), **paste**(C)

Diagnostics

`line too long`	A line can have no more than 511 characters or fields.
`bad list for c / f option`	Missing **-c** or **-f** option or incorrectly specified ***list***. No error occurs if a line has fewer fields than the ***list*** calls for.
`no fields`	The ***list*** is empty.

Standards conformance

cut is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

date

print and set the date

Syntax

date [***mmddhhmm*[*yy*]** **] [** ***+format*** **]**

Description

If no argument is given, or if the argument begins with +, the current date and time are printed as defined by the locale. Otherwise, the current date is set. The first ***mm*** is the month number; ***dd*** is the day number in the month; ***hh*** is the hour number (24-hour system); the second ***mm*** is the minute number; ***yy*** is the last 2 digits of the year number and is optional. For example:

date 10080045

sets the date to Oct 8, 12:45 AM, if the local language is set to English. The current year is the default if no year is mentioned. The system operates in GMT. **date** takes care of the conversion to and from local standard and daylight time.

If the argument begins with +, the output of **date** is under the control of the user. The format for the output is similar to that of the first argument to **printf**(S). All output fields are of fixed size (zero padded if necessary). Each field descriptor is preceded by a percent sign "%" and will be replaced in the output by its corresponding value. A single percent sign is encoded by doubling the percent sign, that is, by specifying "%%". All other characters are copied to the output without change. The string is always terminated with a new line character.

Field Descriptors:

A Full weekday name

B Full month name

D Date as mm/dd/yy

H Hour - 00 to 23

I Hour (12 hour clock) in the range 01 - 12

M Minute - 00 to 59

S Second - 00 to 59

T Time as HH:MM:SS

U Week number of the year (Sunday as the first day of the week) as a decimal number in the range 00 - 53

W Week number of the year (Monday as the first day of the week) as a decimal number in the range 00 - 53

X Current time, as defined by the locale

Y Year (including century), as decimal numbers

Z Timezone name, or no characters if no timezone exists

a Abbreviated weekday - Sun to Sat

b Abbreviated month name

c current date and time, as defined by the locale

d Day of month - 01 to 31

h Abbreviated month - Jan to Dec

j Day of the year - 001 to 366

m Month of year - 01 to 12

n Inserts a newline character

p Equivalent of a.m. or p.m. for current locale

r Time in AM/PM notation

t Inserts a tab character

w Day of the week - Sunday = 0

x Current date, as defined by the locale

y Last 2 digits of year - 00 to 99

Example

The line

date ´+DATE: %m/%d/%y%nTIME: %H:%M:%S´

generates as output:

```
DATE: 08/01/90
TIME: 14:45:05
```

Diagnostics

`no permission`	You are not the super user and you are trying to change the date.
`bad conversion`	The date set is syntactically incorrect.

Standards conformance

date is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

dc

invoke an arbitrary precision calculator

Syntax

dc [*file*]

Description

dc is an arbitrary precision arithmetic package. Ordinarily it operates on decimal integers, but you may specify an input base, output base, and a number of fractional digits to be maintained. The overall structure of **dc** is a stacking (reverse Polish) calculator. If an argument is given, input is taken from that file until its end, then from the standard input. The following constructions are recognized:

number The value of the number is pushed on the stack. A number is an unbroken string of the digits 0-9. It may be preceded by an underscore (_) to input a negative number. Numbers may contain decimal points.

+ - / * % ^ The top two values on the stack are added (+), subtracted (-), multiplied (*), divided (/), remaindered (%), or exponentiated (^). The two entries are popped off the stack and the result pushed on the stack in their place. Any fractional part of an exponent is ignored.

s*x* The top of the stack is popped and stored into a register named *x*, where *x* may be any character. If the s is capitalized, *x* is treated as a stack and the value is pushed on it.

l*x* The value in register *x* is pushed on the stack. The register *x* is not altered. All registers start with zero value. If the **l** is capitalized, register *x* is treated as a stack and its top value is popped onto the main stack.

d The top value on the stack is duplicated.

p The top value on the stack is printed. The top value remains unchanged.

f All values on the stack are printed.

q Exits the program. If executing a string, the recursion level is popped by two. If **q** is capitalized, the top value on the stack is popped and the string execution level is popped by that value.

x Treats the top element of the stack as a character string and executes it as a string of **dc** commands.

X Replaces the number on the top of the stack with its scale factor.

[...] Puts the bracketed ASCII string onto the top of the stack.

<*x* >*x* =*x* The top two elements of the stack are popped and compared. Register ***x*** is evaluated if they obey the stated relation.

v Replaces the top element on the stack by its square root. Any existing fractional part of the argument is taken into account, but otherwise the scale factor is ignored.

! Interprets the rest of the line as a UNIX command.

c All values on the stack are popped.

i The top value on the stack is popped and used as the number radix for further input.

I Pushes the input base on the top of the stack.

o The top value on the stack is popped and used as the number radix for further output.

O Pushes the output base on the top of the stack.

k The top of the stack is popped, and that value is used as a non-negative scale factor; the appropriate number of places are printed on output, and maintained during multiplication, division, and exponentiation. The interaction of scale factor, input base, and output base will be reasonable if all are changed together.

z The stack level is pushed onto the stack.

Z Replaces the number on the top of the stack with its length.

? A line of input is taken from the input source (usually the terminal) and executed.

; : Used by **bc** for array operations.

Example

This example prints the first ten values of ***n***!:

```
[la1+dsa*pla10>y]sy
0sa1
lyx
```

See also

bc(C)

Diagnostics

x `is unimplemented`	The octal number *x* corresponds to a character that is not implemented as a command
`stack empty`	Not enough elements on the stack to do what was asked
`Out of space`	The free list is exhausted (too many digits)
`Out of headers`	Too many numbers being kept around
`Out of pushdown`	Too many items on the stack
`Nesting Depth`	Too many levels of nested execution

Notes

bc is a preprocessor for **dc**, providing infix notation and a C-like syntax which implements functions and reasonable control structures for programs. For interactive use, **bc** is preferred to **dc**.

dd

convert and copy a file

Syntax

dd [*option=value*] ...

Description

dd copies the specified input file to the specified output with possible conversions. The standard input and output are used by default. The input and output block size may be specified to take advantage of raw physical I/O.

if=*file*	Input filename; standard input is default
of=*file*	Output filename; standard output is default
ibs=*n*	Input block size is *n* bytes (default is **BSIZE** block size)
obs=*n*	Output block size (default is **BSIZE** block size)
bs=*n*	Sets both input and output block size, superseding **ibs** and **obs**. If no conversion is specified, it is particularly efficient since no in-core copy needs to be done
cbs=*n*	Conversion buffer size
skip=*n*	Skips *n* input records before starting copy. (The records are read but not output.)
seek=*n*	Seeks *n* records from beginning of output file before copying
iseek=*n*	Same as **skip**, but seeks over the records (that is, uses **iseek**(S))
oseek=*n*	As for **seek**.
files=*n*	Specify the number of input files to concatenate. This option effectively causes a sequence of *n* EOFs to be ignored. (It is generally only useful for tape.)
conv=block	Convert ASCII to unblocked ASCII.
conv=unblock	Convert unblocked ASCII to ASCII.
count=*n*	Copies only *n* input records
conv=ascii	Converts EBCDIC to ASCII

conv=ebcdic	Converts ASCII to EBCDIC
conv=ibm	Slightly different map of ASCII to EBCDIC
conv=lcase	Maps alphabetic characters to lowercase
conv=ucase	Maps alphabetic characters to uppercase
conv=swab	Swaps every pair of bytes
conv=noerror	Does not stop processing on an error
conv=sync	Pads every input record to **ibs**
conv=...,...	Several comma-separated conversions

Where sizes are specified, a number of bytes is expected. A number may end with **k**, **b**, or **w** to specify multiplication by 1024, 512, or 2 respectively; a pair of numbers may be separated by **x** to indicate a product.

cbs is used only if **ascii**, **ebcdic**, or **ibm** conversion is specified. In the former case, **cbs** characters are placed into the conversion buffer, converted to ASCII, and trailing blanks trimmed and newline added before sending the line to the output. In the latter two cases, ASCII characters are read into the conversion buffer, converted to EBCDIC, and blanks added to make up an output record of size **cbs**.

After completion, **dd** reports the number of whole and partial input and output blocks.

Examples

This command reads an EBCDIC tape, blocked ten 80-byte EBCDIC card images per record, into the ASCII file *outfile*:

dd if=/dev/rct0 of=outfile ibs=800 cbs=80 conv=ascii,lcase

Note the use of raw magtape. **dd** is especially suited to I/O on raw physical devices because it allows reading and writing in arbitrary record sizes.

See also

copy(C), **cp**(C), **tar**(C)

Diagnostics

f+*p* `records in(out)`	Numbers of full and partial records read (written)

Notes

The ASCII/EBCDIC conversion tables are taken from the 256-character standard in the *CACM Nov, 1968*. The **ibm** conversion corresponds better to certain IBM print train conventions. There is no universal solution.

Newlines are inserted only on conversion to ASCII; padding is done only on conversion to EBCDIC.

When using **dd** with a raw device, specify the block size as a multiple of 1K. For example, to use a 9K block size, enter:

dd if=file of=/dev/rct0 bs=18b

You could also enter:

dd if=file of=/dev/rct0 bs=9K

Standards conformance

dd is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

devnm

identify device name

Syntax

/etc/devnm [***names***]

Description

The **devnm** command identifies the special file associated with the mounted filesystem where the argument ***name*** resides.

This command is most commonly used by the **/etc/rc2** scripts to construct a mount table entry for the *root* device.

Examples

Be sure to type full pathnames in this example:

/etc/devnm /u

If */dev/hd1* is mounted on */u*, this produces:

```
hd1 /u
```

Files

*/dev/**	Device names
/etc/rc2	Startup commands

See also

setmnt(ADM)

Standards conformance

devnm is conformant with:

AT&T SVID Issue 2.

df

report number of free disk blocks

Syntax

df [-t] [-f] [-v -i] [*filesystems*]

Description

df prints out the number of free blocks and free inodes available for on-line filesystems by examining the counts kept in the super-blocks; ***filesystems*** may be specified by device name (for example, */dev/root*). If the ***filesystems*** argument is unspecified, the free space on all of the mounted filesystems is sent to the standard output. The list of mounted filesystems is given in */etc/mnttab*.

Options include:

-t Causes total allocated block figures to be reported as well as number of free blocks.

-f Reports only an actual count of the blocks in the free list (free inodes are not reported). With this option, **df** reports on raw devices.

-v Reports the percent of blocks used as well as the number of blocks used and free.

-i Reports the percent of inodes used as well as the number of inodes used and free. Use the **-i** option with the **-v** option to display counts of blocks and inodes free as well as the percentage of inodes and blocks used.

The **-v** and **-i** options cannot be used with other **df** options.

Files

*/dev/**
/etc/mnttab

See also

fsck(ADM), **mnttab**(F), **mount**(ADM)

Notes

See "Notes" under **mount**(ADM).

This utility reports sizes in 512 byte blocks. **df** will report 2 blocks less free space, rather than 1 block, since the file uses one system block of 1024 bytes.

The directory */etc/fscmd.d/TYPE* contains programs for each filesystem type **df** invokes the appropriate binary.

Authorization

The behavior of this utility is affected by assignment of the queryspace authorization. Refer to the "Using a secure system" chapter of the *User's Guide* for more details.

Standards conformance

df is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

dfspace

report disk space

Syntax

/etc/dfspace [***filesystem*** **...]**

Description

dfspace is a shell script interface to the **df**(C) command.

/etc/dfspace with no arguments will report the disk space used for each mounted file system, along with the total disk space available for that filesystem, and the percentage of space currently used. Total disk space, total disk space available, and percentage used are also reported. Disk space is reported in megabytes.

You can see disk space for a particular filesystem by supplying that filesystem as an argument to **dfspace**. You can specify filesystems by device name (for example, */dev/root*) if you wish.

dfspace is frequently used in the system startup files */etc/profile* or */etc/cshrc*.

Example

/etc/dfspace

```
/          :     Disk space:  31.12 MB of 146.47 MB available (21.25%).
/u         :     Disk space:  35.41 MB of 201.16 MB available (17.60%).
/z         :     Disk space:  50.37 MB of 272.74 MB available (18.47%).
/w         :     Disk space: 506.81 MB of 605.93 MB available (83.64%).

Total Disk Space: 623.72 MB of 1226.32 MB available (50.86%).
```

See also

df(C)

diff

compare two text files

Syntax

diff [-befh] ***file1 file2***

Description

The **diff** command tells the user what lines must be changed in two files to bring them into agreement. If ***file1*** or ***file2*** is a dash (**-**), the standard input is used. If ***file1*** or ***file2*** is a directory, **diff** uses the file in that directory that has the same name as the file (***file2*** or ***file1*** respectively) it is compared to. For example:

diff /tmp dog

compares the file named *dog* that is in the */tmp* directory, with the file *dog* in the current directory.

The normal output contains lines of these forms:

n1* a *n3,n4
n1,n2* d *n3
n1,n2* c *n3,n4

These lines resemble **ed** commands to convert ***file1*** into ***file2***. The numbers after the letters pertain to ***file2***. In fact, by exchanging **a** for **d** and reading backward, one can find out in just the same way how to convert ***file2*** into ***file1***. As in **ed**, identical pairs where ***n1*** = ***n2*** or ***n3*** = ***n4*** are abbreviated as a single number.

Following each of these lines come all the lines that are affected in the first file flagged by "<", then all the lines that are affected in the second file flagged by ">".

The **-b** option causes trailing blanks (spaces and tabs) to be ignored and other strings of blanks to compare equal.

The **-e** option produces a script of **a**, **c** and **d** commands for the editor **ed**, which will recreate ***file2*** from ***file1***. The **-f** option produces a similar script, not useful with **ed**, in the opposite order. In connection with **-e**, the following shell procedure helps maintain multiple versions of a file:

(shift; cat $*; echo ´1,$p´) | ed - $1

This works by performing a set of editing operations on an original ancestral file. This is done by combining the sequence of **ed** scripts given as all command line arguments except the first. These scripts are presumed to have been created with **diff** in the order given on the command line. The set of editing operations is then piped as an editing script to **ed** where all editing operations are performed on the ancestral file given as the first argument on the command line. The final version of the file is then printed on the standard output. Only an ancestral file ($1) and a chain of version-to-version **ed** scripts ($2,$3,...) made by **diff** need be on hand.

Except in rare circumstances, **diff** finds the smallest sufficient set of file differences.

The **-h** option does a fast, less-rigorous job. It works only when changed stretches are short and well separated, but the files can be of unlimited length. The **-e** and **-f** options cannot be used with the **-h** option.

Files

/tmp/d?????
/usr/lib/diffh (executable used when **-h** option is specified)

See also

cmp(C), **comm**(C), **ed**(C)

Diagnostics

Exit status is 0 for no differences, 1 for some differences, 2 for errors.

Notes

Editing scripts produced under the **-e** or **-f** option do not always work correctly on lines consisting of a single dot (.).

Standards conformance

diff is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

diff3

compare three files

Syntax

diff3 [-ex3] ***file1 file2 file3***

Description

diff3 compares three versions of a file, and publishes disagreeing ranges of text flagged with these codes:

====	All three files differ
====1	***file1*** is different
====2	***file2*** is different
====3	***file3*** is different

The type of change suffered in converting a given range of a given file to some other range is indicated in one of these ways:

f **:** ***n1*** **a**	Text is to be appended after line number ***n1*** in file ***f***, where ***f*** = 1, 2, or 3.
f **:** ***n1*** **,** ***n2*** **c**	Text is to be changed in the range line ***n1*** to line ***n2***. If ***n1*** = ***n2***, the range may be abbreviated to ***n1***.

The original contents of the range follow immediately after a **c** indication. When the contents of two files are identical, the contents of the lower-numbered file are suppressed.

Options are:

-e Publishes a script for the editor **ed**(C) that will incorporate into ***file1*** all changes between ***file2*** and ***file3***, that is, the changes that normally would be flagged ==== and ====3.

-x Produces a script to incorporate changes flagged with ====.

-3 Produces a script to incorporate changes flagged with ====3.

The following command applies a resulting editing script to ***file1***:

(cat script; echo '1,$p') | ed - file1

Files

*/tmp/d3**
/usr/lib/diff3prog

See also

diff(C), **ed**(C)

Notes

None of the options work properly for lines consisting of a single period. The input file size limit is 64K bytes.

dircmp

compare directories

Syntax

dircmp [**-d**] [**-s**] [**-w***n*] ***dir1 dir2***

Description

The **dircmp** command examines ***dir1*** and ***dir2*** and generates tabulated information about the contents of the directories. Listings of files that are unique to each directory are generated in addition to a list that indicates whether the files common to both directories have the same contents.

There are three options available:

-d Performs a full **diff** on each pair of like-named files if the contents of the files are not identical.

-s Suppresses output of identical filenames.

-w*n* Changes the width of the output line to ***n*** characters. The default width is 72.

See also

cmp(C), **diff**(C)

Standards conformance

dircmp is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

dirname

deliver directory part of pathname

Syntax

dirname *string*

Description

The **dirname** command delivers all but the last component of the pathname in ***string*** and prints the result on the standard output. If there is only one component in the pathname, only a "dot" is printed. It is normally used inside substitution marks (` `) within shell procedures.

The companion command **basename** deletes any prefix ending in a slash (/) and the suffix (if present in ***string***) from ***string***, and prints the result on the standard output.

Examples

The following example sets the shell variable **NAME** to */usr/src/cmd*:

NAME=`dirname /usr/src/cmd/cat.c`

This example prints `/a/b/c` on the standard output:

dirname /a/b/c/d

This example prints a "dot" on the standard output:

dirname file.ext

This example moves to the location of a file being searched for (*lostfile*):

cd `find . -name** *lostfile* **-exec dirname {} ;`

See also

basename(C), **sh**(C)

Standards conformance

dirname is conformant with:

X/Open Portability Guide, Issue 3, 1989.

disable

turn off terminals and printers

Syntax

disable ***tty...***
disable [-c] [-r [*reason*]] ***printers***

Description

For terminals, this program manipulates the */etc/conf/cf.d/init.base* file and signals **init** to disallow logins on a particular terminal. For printers, **disable** stops print requests from being sent to the named printer. The following options can be used:

-c Cancels any requests that are currently printing. This option cannot be used with the **-W** option.

-W Disables the specified printers when the print requests currently printing have finished. This option cannot be used with the **-c** option.

-r [***reason*** **]** Associates a ***reason*** with disabling the printer. The ***reason*** applies to all printers listed up to the next **-r** option. If the **-r** option is not present or the **-r** option is given without a ***reason***, then a default ***reason*** is used. ***reason*** is reported by **lpstat**(C).

Examples

In this example, a printer named *linepr* is disabled because of a paper jam:

```
disable -r"paper jam" linepr
```

Files

*/dev/tty**
/etc/conf/cf.d/init.base
*/usr/spool/lp/**

See also

login(M), **enable**(C), **inittab**(F), **getty**(M), **init**(M), **lp**(C), **lpstat**(C), **uugetty**(ADM)

Authorization

The behavior of this utility is affected by assignment of the **printerstat** authorization, which is usually reserved for system administrators. Refer to the "Using a secure system" chapter of the *User's Guide* for more details.

diskcp, diskcmp

copy or compare floppy disks

Syntax

diskcp [**-f**] [**-d**] [**-r**] [**-s**] [**-u**] [**-48ds9**] [**-96ds9**] [**-96ds15**] [**-135ds9**] [**-135ds18**]

diskcmp [**-d**] [**-s**] [**-48ds9**] [**-96ds9**] [**-96ds15**] [**-135ds9**] [**-135ds18**]

Description

diskcp - Copies floppy disks

diskcmp - Compares floppy disks

diskcp is used to make an image (exact copy) of a source floppy disk on a target floppy disk. On machines with one floppy drive, **diskcp** temporarily transfers the image to the hard disk until a target floppy is inserted into the floppy drive. On machines with two floppy drives, **diskcp** immediately places the image of the source floppy directly on the target floppy.

diskcmp functions similarly to **diskcp**. It compares the contents of one floppy disk with the contents of a second floppy disk using the **cmp** utility.

The options are:

-f Format the target floppy disk before the image is copied (**diskcp** only).

-d The computer has dual floppy drives. **diskcp** copies the image directly onto the target floppy.

-s Uses **sum**(C) to compare the contents of the source and target floppies; gives an error message if the two do not match.

-r Uses second floppy drive as source drive.

-u Prints usage message.

-48ds9 This setting is for low density 48tpi (360K) floppies. It is the default setting.

-96ds9 This setting is for medium density 96tpi (720K) floppies.

-96ds15 This setting is for high density 96tpi (1.2M) floppies.

-135ds9 This setting is for low density 135tpi (720K) 3.5 inch floppies.

-135ds18 This setting is for high density 135tpi (1.44M) 3.5 inch floppies.

When using the **-96ds9** and **-96ds15** options of **diskcp** without the **-f** option, if the first target disk is unformatted, the program will note it, format it and make the copy. If another copy is requested and another unformatted target disk is inserted, **diskcp** exits with a "System error". Quit, format the floppy, and reinvoke **diskcp** to make another copy.

Examples

To make a copy of a floppy, place the source floppy in the drive and type:

diskcp

When **diskcp** has finished copying to the hard disk, it prompts you to insert the target floppy in the drive. If you specify the **-f** flag when you invoke **diskcp**, the program formats the target floppy. When the copy is finished, **diskcp** asks if you would like to make another copy of the same source disk. If you enter " n ", it asks if you would like to copy another source disk.

Specify the **-d** flag on the command line if you have two floppy drives:

diskcp -d

Notes

If **diskcp** encounters a write error while copying the source image to the target disk, it formats the disk and tries to write the source image again. This happens most often when an unformatted floppy is used and the **-f** flag is not specified.

Files

/usr/bin/diskcp
/usr/bin/diskcmp
/tmp/disk????

See also

cmp(C), **dd**(C), **format**(C), **sum**(C)

Value added

diskcmp and **diskcp** are extensions of AT&T System V provided by The Santa Cruz Operation, Inc.

dos: doscat, doscp, dosdir, dosformat, dosmkdir, dosls, dosrm, dosrmdir

access to and manipulation of DOS files and DOS filesystems

Syntax

doscat [**-r** | **-c** | **-m**] *file* ...

doscp [**-r** | **-c** | **-m**] *file1 file2*

doscp [**-r** | **-c** | **-m**] *file* ... *directory*

dosdir [**-c**] *directory* ...

dosformat [**-fqv**] *drive*

dosls [**-c**] *directory* ...

dosrm [**-c**] *file* ...

dosmkdir [**-c**] *directory* ...

dosrmdir [**-c**] *directory* ...

Description

doscat - Displays a DOS file

doscp - Copies a DOS file to UNIX System

dosdir - Lists DOS directories in the DOS DIR style

dosformat - Formats a DOS floppy

dosls - Lists DOS directories in the UNIX System **ls** style

dosrm - Removes files from a DOS disk

dosmkdir - Makes a directory on a DOS disk

dosrmdir - Removes directories from a DOS disk

The **dos** commands provide access to the files and directories on MS-DOS floppy disks and on DOS partitions of a hard disk. Note that in order to use these commands on a DOS 4.0 partition the DOS volume label must be non null and the DOS serial number must be set. In order to use these commands on a DOS 3 partition the DOS volume label must be non null. It is also possible to mount and access a DOS filesystem while operating from the UNIX System partition.

The **dos** commands perform the following actions:

doscat Copies one or more DOS files to the standard output. If **-r** is given, the files are copied without newline conversions. If **-m** is given, the files are copied with newline conversions (see "Conversions" below). If **-c** is given, execution halts immediately if a file on a mounted filesystem is encountered (see "Accessing UNIX System File Systems with DOS Utilities" below).

doscp Copies files between a DOS disk and a UNIX System filesystem. If ***file1*** and ***file2*** are given, ***file1*** is copied to ***file2***. If a ***directory*** is given, one or more files are copied to that directory. If **-r** is given, the files are copied without newline conversions. If **-m** is given, the files are copied with newline conversions (see "Conversions" below). If **-c** is given, execution halts immediately if a file on a mounted filesystem is encountered.

dosdir Lists DOS files in the standard DOS style directory format. If **-c** is given, execution halts immediately if a file on a mounted filesystem is encountered.

dosformat Creates a DOS 2.0 formatted diskette. The drive may be specified in either DOS drive convention, using the default file */etc/default/msdos*, or using the UNIX System special file name. **dosformat** cannot be used to format a hard disk. The **-f** option suppresses the interactive feature. The **-q** (quiet) option is used to suppress information normally displayed during **dosformat**. The **-q** option does not suppress the interactive feature. The **-v** option prompts the user for a volume label after the diskette has been formatted. The **-c** option causes execution to halt immediately if a file on a mounted filesystem is encountered. The maximum size of the volume label is 11 characters.

dosls Lists DOS directories and files in a UNIX System format (see **ls**(C)) The **-c** option causes execution to halt at once if a file on a mounted filesystem is encountered.

dosrm Removes files from a DOS disk. If **-c** is given, execution halts immediately if a file on a mounted filesystem is encountered.

dosmkdir Creates a directory on a DOS disk. If **-c** is given, execution halts immediately if a file on a mounted filesystem is encountered.

dosrmdir Deletes a directory from a DOS disk. The **-c** option causes execution to stop if a file on a mounted filesystem is encountered.

The ***file*** and ***directory*** arguments for DOS files and directories have the form:

device:name

where ***device*** is a UNIX System pathname for the special device file containing the DOS disk, and ***name*** is a pathname to a file or directory on the DOS disk. The two components are separated by a colon (:). For example, the argument:

/dev/fd0:/src/file.asm

specifies the DOS file, *file.asm*, in the directory, */src*, on the disk in the device file */dev/fd0*. Note that slashes (and not backslashes) are used as filename separators for DOS pathnames. Arguments without a ***device:*** are assumed to be UNIX System files.

For convenience, the user configurable default file, */etc/default/msdos*, can define DOS drive names to be used in place of the special device file pathnames. It can contain lines with the following format:

A=*/dev/fd0*
C=*/dev/dsk/0sC*
D=*/dev/dsk/0sD*
K=*/dev/dsk/1sC*

The drive letter "A" may be used in place of special device file pathname */dev/fd0* when referencing DOS files (see "Examples" below). The drive letters "C" or "K" refer to the DOS partition on the first or second hard disk, and "D" refers to a logical drive in the extended partition on the first hard drive.

The commands operate on the following kinds of disks:

DOS partitions on a hard disk
5 ¼ inch DOS
3 ½ inch DOS
8, 9, 15, or 18 sectors per track
40 or 80 tracks per side
1 or 2 sides
DOS versions 1.0, 2.0, 3.0, 3.3 or 4.0

Conversions

In the case of **doscp**, certain conversions are performed when copying a UNIX System file. Filenames with a basename longer than eight characters are truncated. Filename extensions (the part of the name following separating period) longer than three characters are truncated. For example, the file *123456789.12345* becomes *12345678.123*. A message informs the user that the name has been changed and the altered name is displayed. Filenames containing illegal DOS characters are stripped when writing to the MS-DOS format. A message informs the user that characters have been removed and displays the name as written.

All DOS text files use a carriage-return/linefeed combination, **CR-LF**, to indicate a newline. UNIX System files use a single newline **LF** character. When the **doscat** and **doscp** commands transfer DOS text files to the UNIX System filesystem, they automatically strip the **CR**. When text files are transferred to DOS, the commands insert a **CR** before each **LF** character.

Under some circumstances the automatic newline conversions do not occur. The **-m** option may be used to ensure the newline conversion. The **-r** option can be used to override the automatic conversion and force the command to perform a true byte copy regardless of file type.

Examples

Note that the forward slash character (/) **must** be used as the directory separator character when dealing with DOS filesystems under UNIX. This is at variance with the usual DOS practice of using the backslash (\) character as the directory separator character. For example,

doscat /dev/fd0:/docs/memo.txt

is used instead of the DOS path syntax, which would be

doscat a:\docs\memo.txt

Other examples of the **dos**(C) commands are:

doscat /tmp/f1 /tmp/f2 /dev/fd0:/src/file.asm

doscp /tmp/myfile.txt /dev/fd0:/docs/memo.txt
doscp /tmp/f1 /tmp/f2 /dev/fd0:/mydir

dosdir /dev/fd0:/src
dosdir A:/src A:/dev

dosformat /dev/fd0

dosls /dev/fd0:/src
dosls B:

dosrm /dev/fd0:/docs/memo.txt
dosrm A:/docs/memo1.txt

dosmkdir /dev/fd0:/usr/docs

dosrmdir /dev/fd0:/usr/docs

Accessing DOS filesystems from the UNIX System partition

The ability to mount DOS filesystems is an extension of the DOS utilities documented here. There are several limitations within the DOS directory structure which make this a difficult task.

In short, the DOS filesystem does not associate as much information with each file as the UNIX System filesystem does. Therefore, allowances and assumptions have to be made for information that would be present under the UNIX System but that does not exist under DOS.

The DOS directory structure contains the following information:

- **Filename:** up to 8 characters with 3 character extension (*foo.bat*)
- **File Attribute:** read-only/read-write, hidden/visible file, system/normal file, Volume name/normal file name, subdirectory/normal file, archive/modified bit
- **Time of last modification**
- **Date of last modification**
- **Starting point** (reference through FAT)
- **File size in bytes**

Using this information, it is converted to a UNIX System inode. There are some UNIX System provisions which cannot be carried over, because the filesystem must remain sane under DOS.

- Any date in the UNIX System inode table for the DOS filesystem is the same as the modification date (ctime = atime = mtime).
- The only types of nodes allowed in the DOS filesystem are directories and normal files. Pipes, semaphores, and special device files do not exist because they do not have a counterpart under DOS.
- The permissions are 0777 for readable/writable files and 0555 for read only files. If a user can access the filesystem, the user will be limited by the permissions available under the DOS directory structure. This permission is read-only or read write. When creating a file, the creator's umask/mode is examined. The creation mode is based on the owner write bit.
- The GID/UID for all files on the DOS filesystem is the same as the mount point. The mount point will maintain the necessary security. If a user can get into the mount point, then the user has the same access as the owner.
- There is only one link for each file under the DOS filesystem. "." and ".." are a special case and are not links.
- On every change of the modification time (which on a UNIX system would change atime, ctime, mtime) the DOS archive bit is set.
- Following DOS filesystem requirements, all blocks previous to a written block are allocated before the original block is written. This differs from UNIX systems where the program may seek out beyond the end of a file and write a block. UNIX systems do not necessarily write blocks which have been skipped over.
- If a program does not use the **directory**(S) system calls, but opens the directory in the DOS filesystem as a file, the program should see the DOS directory structure as it really exists. By using the **directory** system calls, the filesystem switch code will put together a UNIX System style directory entry.
- File contents are not mapped from the DOS filesystem. The file appears exactly as it is under DOS. For example, \r\n combinations are left as \r\n and not mapped to just \n. The file and directory names are mapped to uppercase.

Accessing UNIX System File Systems with DOS Utilities

If an attempt is made to access a mounted UNIX System filesystem using the DOS utilities the message

command: ***devicename*** `is mounted`

is printed on *stderr* and the attempt fails. If possible, the ***command*** continues to operate on the remaining parameters and returns a value of 1. Upon normal completion, these commands return a value of 0.

If the **-c** option is used, execution of the ***command*** halts immediately upon encountering a file in a mounted filesystem.

DOS file conversion

The utilities **xtod**(C) and **dtox**(C) can be used to convert the **EOL** sequences used to and from DOS, respectively.

Files

/etc/default/msdos	Default information
*/dev/fd**	Floppy disk devices
/dev/dsk/	Hard disk devices

See also

assign(C), **dtox**(C), **dtype**(C), **mkfs**(C), **xtod**(C)

"MS-DOS and other DOS operating systems" in the *System Administrator's Guide*

Notes

Using the DOS utilities, it is not possible to refer to DOS files with wild card specifications. The programs mentioned above cooperate among themselves so no two programs will access the same DOS disk. Only one process will access a given DOS disk at any time, while other processes wait. If a process has to wait too long, it displays the error message, "can't seize a device", and exits with an exit code of 1.

You cannot use the **dosformat** command to format device A: because it is aliased to */dev/install*, which cannot be formatted. Use */dev/rfd0/* instead.

The Development System supports the creation of DOS executable files, using **cc**(CP). Refer to the *C User's Guide* and *C Library Guide* for more information on using your UNIX system to create programs suitable for DOS systems.

All of the DOS utilities leave temporary files in */tmp*. These files are automatically removed when the system is rebooted. They can also be manually removed.

Value added

doscat, doscp, dosdir, dosformat, dosls, dosmkdir, dosrm and **dosrmdir** are extensions of AT&T System V provided by The Santa Cruz Operation, Inc.

dtox

change file format from MS-DOS to UNIX

Syntax

dtox *filename* > *output.file*

Description

The **dtox** command converts a file from MS-DOS format to UNIX format. MS-DOS files terminate a line of text with a carriage return and a linefeed, while UNIX files terminate a line with a linefeed only. Also MS-DOS places a ⟨Ctrl⟩**z** at the end of a file, while UNIX systems do not. Some programs and utilities are sensitive to this difference and some are not. If a text or data file is not being interpreted correctly, then use the **dtox** and **xtod** conversion utilities. The **dtox** command strips the extra carriage return from the end of each line and strips the ⟨Ctrl⟩**z** from the end of the file. This utility is not required for binary object files.

If no filename is specified on the command line, **dtox** takes input from standard input. Output of the utility goes to standard output.

See also

xtod(C)

Value added

dtox is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

dtype

determine disk type

Syntax

dtype [-s] ***device ...***

Description

The **dtype** command determines the type of a disk and prints pertinent information on the standard output (unless the silent (**-s**) option is selected), then exits with a corresponding code (see below). When more than one argument is given for ***device***, the exit code corresponds to the last argument.

Miscellaneous Disk Types

Exit Code	Message (optional)
60	error (specified)
61	empty or unrecognized data

Storage Disk Types

Exit Code	Message (optional)
70	backup format, volume n
71	tar format [, extent e of n]
72	cpio format
73	cpio character (-c) format

XENIX or UNIX Disk Types

Version or type	Exit Code	Message (optional)
System III	120	XENIX 2.x filesystem [needs cleaning]
System V	130	XENIX 3.x or later filesystem [needs cleaning]
	140	UNIX 1K filesystem [needs cleaning]

MS-DOS Disk Types

Version or type	Exit Code	Message (optional)
1.x	80	DOS 1.x, 8 sec/track, single sided
	81	DOS 1.x, 8 sec/track, dual sided
2.x	90	MS-DOS 8 sec/track, 40 tracks/side, single sided, 5.25 inch
	91	MS-DOS 8 sec/track, 40 tracks/side, dual sided, 5.25 inch
	92	MS-DOS 9 sec/track, 40 tracks/side, single sided, 5.25 inch
	93	MS-DOS 9 sec/track, 40 tracks/side, dual sided, 5.25 inch
	94	MS-DOS fixed disk
data	100	MS-DOS data disk, n sec/track, single sided
	101	MS-DOS data disk, n sec/track, dual sided
	102	MS-DOS data disk, 9 sec/track, single sided
	103	MS-DOS data disk, 9 sec/track, dual sided
3.x	110	MS-DOS 9 (3.5 inch) or 15 (5.25 inch) sec/track, 80 tracks/side, dual sided
	111	MS-DOS 18 sec/track, 80 tracks/side, dual sided, 3.5 inch
	112	MS-DOS 8 sec/track, 80 tracks/side, single sided, 3.5 or 5.25 inch
	113	MS-DOS 8 sec/track, 80 tracks/side, dual sided, 3.5 or 5.25 inch

Notes

"word-swapped" refers to byte ordering of long words in relation to the host system.

XENIX filesystems and **backup** and **cpio** binary formats may not be recognized if created on a foreign system. This is due to such system differences as byte and word swapping and structure alignment.

This utility only works reliably for floppy diskettes.

Value added

dtype is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

du

summarize disk usage

Syntax

du [**-afrsu**] [***names***]

Description

The **du** command gives the number of blocks contained in all files and directories recursively within each directory and file specified by the ***names*** argument. The block count includes the indirect blocks of the file. If ***names*** is missing, the current directory is used.

The **-s** option causes only the grand total (for each of the specified ***names***) to be given. The **-a** option causes an entry to be generated for each file. Absence of either causes an entry to be generated for each directory only.

The **-f** option causes **du** to display the usage of files in the current file system only. Directories containing mounted file systems will be ignored. The **-u** option causes **du** to ignore files that have more than one link.

du is normally silent about directories that cannot be read, files that cannot be opened, and so on. The **-r** option will cause **du** to generate messages in such instances.

A file with two or more links is only counted once. Symbolic links are not followed, but the disk space used to hold the actual symbolic link is counted.

Notes

If the **-a** option is not used, non-directories given as arguments are not listed.

Files with holes in them will get an incorrect block count.

This utility reports sizes in 512 byte blocks. **du** interprets 1 block from a 1024 byte block system as 2 of its own 512 byte blocks.

Standards conformance

du is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

echo

echo

Syntax

echo [**-n**] [*arg*] ...

Description

The **echo** command writes its arguments separated by blanks and terminated by a new-line on the standard output. The **-n** option prints a line without the new-line; this is the same as using the **\c** escape sequence.

echo also understands C-like escape conventions; beware of conflicts with the shell's use of " \ ":

\b backspace

\c print line without new-line

\f form-feed

\n new-line

\r carriage return

\t tab

\v vertical tab

**** backslash

*****n* The 8-bit character whose ASCII code is a 1, 2 or 3-digit octal number. In all cases, ***n*** must start with a zero. For example:

echo "\07" Echoes ⟨Ctrl⟩**g**.

echo "\007" Also echoes ⟨Ctrl⟩**g**.

echo "\065" Echoes the number " 5 ".

echo "\0101" Echoes the letter " A ".

The **echo** command is useful for producing diagnostics in command files and for sending known data into a pipe.

See also

sh(C), **csh**(C), **ksh**(C)

Notes

When representing an 8-bit character by using the escape convention **\0*n***, the ***n*** must *always* be preceded by the digit zero (0).

For example, typing: **echo "WARNING:\07"** will print the phrase "`WARNING:`" and sound the "bell" on your terminal. The use of single (or double) quotes (or two backslashes) is required to protect the "\" that precedes the "07".

For the octal equivalents of each character, see **ascii**(M).

An internal version of this command is provided by **ksh**(C) and may behave slightly differently; please refer to the **ksh**(C) entry for details.

ed, red

invoke the text editor

Syntax

ed [**-**] [**-p** *string*] [*file*]

red [**-**] [**-p** *string*] [*file*]

Description

ed - Invokes the text editor

red - Invokes a restricted text editor

ed is the standard text editor. If the *file* argument is given, **ed** simulates an **e** command (see below) on the named file; that is to say, the file is read into **ed**'s buffer so that it can be edited. **ed** operates on a copy of the file it is editing; changes made to the copy have no effect on the file until a **w** (write) command is given. The copy of the text being edited resides in a temporary file called the *buffer*. There is only one buffer.

red is a restricted version of **ed**(C). It will only allow editing of files in the current directory. It prohibits executing **sh**(C) commands via the **!** command. **red** displays an error message on any attempt to bypass these restrictions.

In general, **red** does not allow commands like **!date** or **!sh**.

Furthermore, **red** will not allow pathnames in its command line. For example, the command:

red /etc/passwd

when the current directory is not */etc* causes an error.

Options

The options to **ed** are:

- Suppresses the printing of character counts by the **e**, **r**, and **w** commands, of diagnostics from **e** and **q** commands, and the "!" prompt after a **!** shell command.

-p Allows the user to specify a prompt string.

ed supports formatting capability. After including a format specification as the first line of *file* and invoking **ed** with your terminal in **stty-tabs** or **sttytab3** mode (see **stty**(C)), the specified tab stops will automatically be used when scanning *file*. For example, if the first line of a file contained:

<:t5,10,15 s72:>

tab stops would be set at columns 5, 10, and 15, and a maximum line length of 72 would be imposed.

Note: While inputting text, tab characters are expanded to every eighth column as the default.

Commands to **ed** have a simple and regular structure: zero, one, or two addresses followed by a single-character command, possibly followed by parameters to that command. These addresses specify one or more lines in the buffer. Every command that requires addresses has default addresses, so that the addresses can very often be omitted.

In general, only one command may appear on a line. Certain commands allow the input of text. This text is placed in the appropriate place in the buffer. While **ed** is accepting text, it is said to be in *input mode.* In this mode, *no* commands are recognized; all input is merely collected. Input mode is left by entering a period (.) alone at the beginning of a line.

ed supports a limited form of *regular expression* notation; regular expressions are used in addresses to specify lines and in some commands (for example, **s**) to specify portions of a line that are to be substituted. A regular expression specifies a set of character strings. A member of this set of strings is said to be *matched* by the regular expression. The regular expressions allowed by **ed** are constructed as follows:

The following one-character regular expressions match a *single* character:

1.1 An ordinary character (*not* one of those discussed in 1.2 below) is a one-character regular expression that matches itself.

1.2 A backslash (\) followed by any special character is a one-character regular expression that matches the special character itself. The special characters are:

a. . * [and \ (dot, star, left square bracket, and backslash, respectively), which are otherwise special, *except* when they appear within square brackets ([ ]); see 1.4 below).

b. ^ (caret), which is special at the *beginning* of an entire regular expression (see 3.1 and 3.2 below), or when it immediately follows the left of a pair of square brackets (see 1.4 below).

c. $ (dollar sign), which is special at the *end* of an entire regular expression (see 3.2 below).

d. The character used to bound (that is, delimit) an entire regular expression, which is special for that regular expression (for example, see how slash (/) is used in the **g** command below).

1.3 A period (.) is a one-character regular expression that matches any character except newline.

1.4 A nonempty string of characters enclosed in square brackets is a one-character regular expression that matches *any one* character in that string. If, however, the first character of the string is a caret (^), the one-character regular expression matches any character *except* newline and the remaining characters in the string. The star (*) also has this special meaning *only* if it occurs first in the string. The dash (-) may be used to indicate a range of consecutive ASCII characters; for example, [0-9] is equivalent to [0123456789]. The dash loses this special meaning if it occurs first (after an initial caret, if any) or last in the string. The right square bracket (]) does not terminate such a string when it is the first character within it (after an initial caret, if any); for example, **[ ]a-f]** matches either a right square bracket or one of the letters "a" through "f" inclusive. Dot, star, left bracket, and the backslash lose their special meaning within such a string of characters.

Ranges of characters (characters separated by "-" are treated according to the current locale's collation sequence (see **locale**(M)). Therefore, if the collation sequence in use is A, a, B, b, C, c, then the expression **[a-d]** is equivalent to the expression ***[aBbCcDd]***.

To specify a collation item within a class, the item must be enclosed between "[." and ".]". Two character to one collation item mappings *must* be specified this way. For example, if the current collation rules specify that the characters "Ch" map to one character for collation purposes (as in Spanish), then this collation item would be specified as **[.Ch.]**.

To specify a group of collation items, which are classified as equal unless all other collation items in the string also match, in which case a secondary "weight" becomes significant, a single member of that group must be enclosed between "[=" and "=]". For example, if the characters A and a are in the same group then the class expressions **[[=a=]b]**, **[[=A=]b]** and **[Aab]** are all equivalent.

The **ctype** classes can also be specified within regular expressions. These are enclosed between **[:** and **:]**. The possible **ctype** classes are:

[:alpha:]	Matches alphabetic characters
[:upper:]	Matches upper case characters
[:lower:]	Matches lower case characters
[:digit:]	Matches digits
[:alnum:]	Matches alphanumeric characters
[:space:]	Matches white space
[:print:]	Matches printable characters
[:punct:]	Matches punctuation marks
[:graph:]	Matches graphical characters
[:cntrl:]	Matches control characters

The following rules may be used to construct regular expressions from one-character regular expressions:

2.1 A one-character regular expression followed by a star (*) is a regular expression that matches *zero* or more occurrences of the one-character regular expression. If there is any choice, the longest leftmost string that permits a match is chosen.

2.2 A one-character regular expression followed by \{*m*\}, \{*m*,\}, or \{*m*,*n*\} is a regular expression that matches a *range* of occurrences of the one-character regular expression. The values of *m* and *n* must be nonnegative integers less than 255; \{*m*\} matches *exactly m* occurrences; \{*m*,\} matches *at least m* occurrences; \{*m*,*n*\} matches any number of occurrences between *m* and *n*, inclusive. Whenever a choice exists, the regular expression matches as many occurrences as possible.

2.3 The concatenation of regular expressions is a regular expression that matches the concatenation of the strings matched by each component of the regular expression.

2.4 A regular expression enclosed between the character sequences "\(" and "\)" is a regular expression that matches whatever the unadorned regular expression matches. See 2.5 below for a discussion of why this is useful.

2.5 The expression *n* matches the same string of characters as was matched by an expression enclosed between \(and \) *earlier* in the same regular expression. Here *n* is a digit; the subexpression specified is that beginning with the *n*-th occurrence of \(counting from the left. For example, the expression **\(.*\)\1$** matches a line consisting of two repeated appearances of the same string.

Finally, an *entire* regular expression may be constrained to match only an initial segment or final segment of a line (or both):

3.1 A caret at the beginning of an entire regular expression constrains that regular expression to match an *initial* segment of a line.

3.2 A dollar sign ($) at the end of an entire regular expression constrains that regular expression to match a *final* segment of a line. The construction ***^entire regular expression$*** constrains the entire regular expression to match the entire line.

The null regular expression (for example, //) is equivalent to the last regular expression encountered.

To understand addressing in **ed**, it is necessary to know that there is a *current line* at all times. Generally speaking, the current line is the last line affected by a command; the exact effect on the current line is discussed under the description of each command. Addresses are constructed as follows:

1. The character "." addresses the current line.

2. The character "$" addresses the last line of the buffer.

3. A decimal number *n* addresses the *n*-th line of the buffer.

4. *'x* addresses the line marked with the mark name character *x*, which must be a lowercase letter. Lines are marked with the *k* command described below.

5. A regular expression enclosed by slashes (/) addresses the first line found by searching *forward* from the line following the current line toward the end of the buffer and stopping at the first line containing a string matching the regular expression. If necessary, the search wraps around to the beginning of the buffer and continues up to and including the current line, so that the entire buffer is searched.

6. A regular expression enclosed in question marks (?) addresses the first line found by searching *backward* from the line preceding the current line toward the beginning of the buffer and stopping at the first line containing a string matching the regular expression. If necessary, the search wraps around to the end of the buffer and continues up to and including the current line. See also the last paragraph before "Files" below.

7. An address followed by a plus sign (+) or a minus sign (-) followed by a decimal number specifies that address plus or minus the indicated number of lines. The plus sign may be omitted.

8. If an address begins with "+" or "-", the addition or subtraction is taken with respect to the current line; for example, -5 is understood to mean .-5.

9. If an address ends with "+" or "-", then 1 is added to or subtracted from the address, respectively. As a consequence of this rule and of rule 8 immediately above, the address "-" refers to the line preceding the current line. (To maintain compatibility with earlier versions of the editor, the character "^" in addresses is entirely equivalent to "-".) Moreover, trailing "+" and "-" characters have a cumulative effect, so "--" refers to the current line less 2.

10. For convenience, a comma (,) stands for the address pair **1, $**, while a semicolon (;) stands for the pair **., $**.

Commands may require zero, one, or two addresses. Commands that require no addresses regard the presence of an address as an error. Commands that accept one or two addresses assume default addresses when an insufficient number of addresses is given; if more addresses are given than such a command requires, the last address(es) are used.

Typically, addresses are separated from each other by a comma. They may also be separated by a semicolon. In the latter case, the current line (.) is set to the first address, and only then is the second address calculated. This feature can be used to determine the starting line for forward and backward searches (see rules 5 and 6 above). The second address of any two-address sequence must correspond to a line that follows, in the buffer, the line corresponding to the first address.

In the following list of **ed** commands, the default addresses are shown in parentheses. The parentheses are *not* part of the address.

It is generally illegal for more than one command to appear on a line. However, any command (except **e**, **f**, **r**, or **w**) may be suffixed by **p** or by **l**, in which case the current line is either printed or listed, respectively, as discussed below under the **p** and **l** commands.

(.)a
<text>
.

The append command reads the given text and appends it after the addressed line; dot is left at the address of the last inserted line, or, if there were no inserted lines, at the addressed line. Address *0* is legal for this command: it causes the *appended* text to be placed at the beginning of the buffer.

(.)c
<text>
.

The change command deletes the addressed lines, then accepts input text that replaces these lines; dot is left at the address of the last line input, or, if there were none, at the first line that was not deleted.

(.,.)d The Delete command deletes the addressed lines from the buffer. The line after the last line deleted becomes the current line; if the lines deleted were originally at the end of the buffer, the new last line becomes the current line.

e *file* The edit command causes the entire contents of the buffer to be deleted, and then the named file to be read in; dot is set to the last line of the buffer. If no filename is given, the currently remembered filename, if any, is used (see the **f** command). The number of characters read is typed. *file* is remembered for possible use as a default filename in subsequent **e**, **r**, and **w** commands. If *file* begins with an exclamation (!), the rest of the line is taken to be a shell command. The output of this command is read for the **e** and **r** commands. For the **w** command, the file is used as the standard input for the specified command. Such a shell command is *not* remembered as the current filename.

E *file* The Edit command is like **e**, except the editor does not check to see if any changes have been made to the buffer since the last **w** command.

f *file* If *file* is given, the filename command changes the currently remembered filename to *file*; otherwise, it prints the currently remembered filename.

(1 , $)g/*regular-expression*/*command list*

In the **g**lobal command, the first step is to mark every line that matches the given regular expression. Then, for every such line, the given ***command list*** is executed with "." initially set to that line. A single command or the first of a list of commands appears on the same line as the global command. All lines of a multiline list except the last line must be ended with a "\"; **a**, **i**, and **c** commands and associated input are permitted; the "." terminating input mode may be omitted if it would be the last line of the ***command list***. An empty command list is equivalent to the **p** command. The **g**, **G**, **v**, and **V** commands are *not* permitted in the ***command list***. See also "Notes" and the last paragraph before "Files" below.

(1 , $)G/*regular-expression*/

In the interactive **G**lobal command, the first step is to mark every line that matches the given regular expression. Then, for every such line, that line is printed, dot (.) is changed to that line, and any *one* command (other than one of the **a**, **c**, **i**, **g**, **G**, **v**, and **V** commands) may be input and is executed. After the execution of that command, the next marked line is printed, and so on. A newline acts as a null command. An ampersand (&) causes the re-execution of the most recent command executed within the current invocation of **G**. Note that the commands input as part of the execution of the **G** command may address and affect *any* lines in the buffer. The **G** command can be terminated by entering an **INTERRUPT** (pressing the ⟨Del⟩ key).

h The **h**elp command gives a short error message that explains the reason for the most recent **?** diagnostic.

H The **H**elp command causes **ed** to enter a mode in which error messages are printed for all subsequent **?** diagnostics. It will also explain the previous diagnostic if there was one. The **H** command alternately turns this mode on and off. It is initially off.

(.)i
<text>
.

The **i**nsert command inserts the given text before the addressed line; dot is left at the address of the last inserted line, or if there were no inserted lines, at the addressed line. This command differs from the **a** command only in the placement of the input text. Address **0** is not legal for this command.

(. , .+1)j The **j**oin command joins contiguous lines by removing the appropriate newline characters. If only one address is given, this command does nothing.

(.)k*x* The mar**k** command marks the addressed line with name ***x***, which must be a lowercase letter. The address ***'x*** then addresses this line. Dot is unchanged.

(.,.)l The **l**ist command prints the addressed lines in an unambiguous way: a few nonprinting characters (for example, tab, backspace) are represented by mnemonic overstrikes, all other nonprinting characters are printed in octal, and long lines are folded. An **l** command may be appended to any command other than **e**, **f**, **r**, or **w**.

(.,.)m*a* The **m**ove command repositions the addressed line(s) after the line addressed by **a**. Address **0** is legal for **a** and causes the addressed line(s) to be moved to the beginning of the file. It is an error if address **a** falls within the range of moved lines. Dot is left at the last line moved.

(.,.)n The **n**umber command prints the addressed lines, preceding each line by its line number and a tab character. Dot is left at the last line printed. The **n** command may be appended to any command other than **e**, **f**, **r**, or **w**.

(.,.)p The **p**rint command prints the addressed lines. Dot is left at the last line printed. The **p** command may be appended to any command other than **e**, **f**, **r**, or **w**; for example, **dp** deletes the current line and prints the new current line.

P The editor will prompt with a "*" for all subsequent commands. The **P** command alternately turns this mode on and off. It is initially off.

q The **q**uit command causes **ed** to exit. No automatic write of a file is done.

Q The editor exits without checking if changes have been made in the buffer since the last **w** command.

($)r *file* The **r**ead command reads in the given file after the addressed line. If no filename is given, the currently remembered filename, if any, is used (see **e** and **f** commands). The currently remembered filename is *not* changed unless ***file*** is the very first filename mentioned since **ed** was invoked. Address **0** is legal for **r** and causes the file to be read at the beginning of the buffer. If the read is successful, the number of characters read is typed. Dot is set to the address of the last line read in. If ***file*** begins with "!", the rest of the line is taken to be a shell command whose output is to be read. Such a shell command is *not* remembered as the current filename.

(.,.)s/*regular-expression*/*replacement* or
(.,.)s/*regular-expression*/*replacement*/g or
(.,.)s/*regular-expression*/*replacement*/*n* *n*=1-512

The substitute command searches each addressed line for an occurrence of the specified regular expression. In each line in which a match is found, all nonoverlapped matched strings are replaced by ***replacement*** if the global replacement indicator **g** appears after the command. If the global indicator does not appear, only the first occurrence of the matched string is replaced. It is an error for the substitution to fail on *all* addressed lines. Any character other than space or newline may be used instead of "/" to delimit ***regular-expression*** and ***replacement***. Dot is left at the address of the last line on which a substitution occurred.

The ***n*** character represents any number between one and 512. This number indicates the instance of the pattern to be replaced on each addressed line.

An ampersand (&) appearing in ***replacement*** is replaced by the string matching the ***regular-expression*** on the current line. The special meaning of the ampersand in this context may be suppressed by preceding it with a backslash. The characters ***n***, where ***n*** is a digit, are replaced by the text matched by the ***n***-th regular subexpression of the specified regular expression enclosed between "\(" and "\)". When nested parenthesized subexpressions are present, ***n*** is determined by counting occurrences of "\(" starting from the left. When the character "%" is the only character in ***replacement***, the ***replacement*** used in the most recent substitute command is used as the ***replacement*** in the current substitute command. The "%" loses its special meaning when it is in a replacement string of more than one character or when it is preceded by a "\".

A line may be split by substituting a newline character into it. The newline in the ***replacement*** must be escaped by preceding it with a "\". Such a substitution cannot be done as part of a **g** or **v** command list.

(.,.)t*a* This command acts just like the **m** command, except that a *copy* of the addressed lines is placed after address **a** (which may be **0**). Dot is left at the address of the last line of the copy.

u The **u**ndo command nullifies the effect of the most recent command that modified anything in the buffer, namely the most recent **a, c, d, g, i, j, m, r, s, t, v, G,** or **V** command.

(1,$)v/*regular-expression*/*command list*

This command is the same as the global command **g** except that the ***command list*** is executed with dot initially set to every line that does *not* match the regular expression.

(1 , $)V/*regular-expression*/
This command is the same as the interactive global command **G** except that the lines that are marked during the first step are those that do *not* match the regular expression.

(1 , $)w *file*
The **w**rite command writes the addressed lines into the named file. If the file does not exist, it is created with mode 666 (readable and writeable by everyone), unless the **umask** setting (see **sh**(C)) dictates otherwise. The currently remembered filename is *not* changed unless ***file*** is the very first filename mentioned since **ed** was invoked. If no filename is given, the currently remembered filename, if any, is used (see **e** and **f** commands), and dot remains. If the command is successful, the number of characters written is displayed. If ***file*** begins with an exclamation (!), the rest of the line is taken to be a shell command to which the addressed lines are supplied as the standard input. Such a shell command is *not* remembered as the current filename.

($)= The line number of the addressed line is typed. Dot is unchanged by this command.

!*shell command*
The remainder of the line after the "!" is sent to the UNIX shell (**sh**(C)) to be interpreted as a command. Within the text of that command, the unescaped character "%" is replaced with the remembered filename. If a "!" appears as the first character of the shell command, it is replaced with the text of the previous shell command. Thus, "!!" will repeat the last shell command. If any expansion is performed, the expanded line is echoed. Dot is unchanged.

(.+1) An address alone on a line causes the addressed line to be printed. A RETURN alone on a line is equivalent to **.+1p**. This is useful for stepping forward through the editing buffer a line at a time.

If an interrupt signal (ASCII DEL or BREAK) is sent, **ed** prints a question mark (?) and returns to its command level.

ed has size limitations: 512 characters per line, 256 characters per global command list, 64 characters per filename, and 128K characters in the buffer. The limit on the number of lines depends on the amount of user memory.

When reading a file, **ed** discards ASCII NUL characters and all characters after the last newline. Files (for example, *a.out*) that contain characters not in the ASCII set (bit 8 on) cannot be edited by **ed**.

If the closing delimiter of a regular expression or of a replacement string (for example, " / ") would be the last character before a newline, that delimiter may be omitted, in which case the addressed line is printed. Thus, the following pairs of commands are equivalent:

s/s1/s2 s/s1/s2/p
g/s1 g/s1/p
?s1 ?s1?

Files

/tmp/e#	Temporary; # is the process number
ed.hup	Work is saved here if the terminal is hung up

See also

coltbl(M), **grep**(C), **locale**(M), **regexp**(S), **sed**(C), **sh**(C), **stty**(C)

Diagnostics

?	Command errors
? *file*	An inaccessible file

Use the **help** and **Help** commands for detailed explanations.

If changes have been made in the buffer since the last **w** command that wrote the entire buffer, **ed** warns the user if an attempt is made to destroy **ed**'s buffer via the **e** or **q** commands by printing "?" and allowing you to continue editing. A second **e** or **q** command at this point will take effect. The dash (-) command-line option inhibits this feature.

Notes

An exclamation (!) command cannot be subject to a **g** or a **v** command.

The **!** command and the **!** escape from the **e**, **r**, and **w** commands cannot be used if the the editor is invoked from a restricted shell (see **sh**(C)).

The sequence **\n** in a regular expression does not match any character.

The **l** command mishandles DEL.

Because **0** is an illegal address for the **w** command, it is not possible to create an empty file with **ed**.

If the editor input is coming from a command file; that is,

ed *file* < *ed-cmd-file*

the editor will exit at the first failure of a command in the command file.

Standards conformance

ed is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

enable

turn on terminals and line printers

Syntax

enable *tty* ...

enable *printers*

Description

For terminals this program manipulates the */etc/conf/cf.d/init.base* file and signals **init** to allow logins on a particular terminal.

For line printers, **enable** activates the named printers and enables them to print requests taken by **lp**(C). Use **lpstat**(C) to find the status of the printers.

Examples

A simple command to enable *tty01* follows:

enable tty01

Files

*/dev/tty**
/etc/conf/cf.d/init.base
/etc/conf/init.d/sio
*/usr/spool/lp/**

See also

disable(C), **getty**(M), **init**(M), **inittab**(F), **login**(M), **lp**(C), **lpstat**(C), **uugetty**(M)

Authorization

The behavior of this utility is affected by assignment of the **printerstat** authorization. Refer to the "Using a secure system" chapter of the *User's Guide* for more details.

env

set environment for command execution

Syntax

env [**-**] [***name=value***] ... [***command*** [***args***]]

Description

printenv - print environment for command execution

The **env** command obtains the current "environment", modifies it according to its arguments, then executes the command with the modified environment. Arguments of the form ***name*** are merged into the inherited environment before the command is executed. The "-" flag causes the inherited environment to be ignored completely, so that the command is executed with exactly the environment specified by the arguments.

If no command is specified, the environment is printed, one name-value pair per line.

See also

environ(M), **exec**(S), **profile**(F), **sh**(C)

Notes

The old **printenv** command was replaced in System V by the **env** command. The current **printenv** is a link to **env**.

Standards conformance

env is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

ex, edit

invoke a text editor

Syntax

ex [**-s**] [**-v**] [**-t** *tag*] [**-r** *file*] [**-L**] [**-R**] [**-c** *command*] *name* ...

edit [**-r**] [**-x**] [**-C**] *name* ...

Description

ex - Invokes the **ex** text editor

edit - Invokes a novice version of the **ex** text editor

The **ex** command is the root of the editors **ex**, **vi**(C), **view**, and **vedit**. **ex** is a superset of **ed**, with the most notable extension being a display editing facility. Display-based editing is the focus of the **vi** family of editors.

edit is a variant of **ex** recommended for new or casual users who wish to use a command-oriented editor. It operates precisely as **ex** with the following options automatically set:

novice	ON
report	ON
showmode	ON
magic	OFF

These options can be turned on or off via the **set** command in **ex**.

Refer to the **vi**(C) page for a complete description of the **ex** commands.

Files

/usr/lib/ex3.7strings	Error messages
/usr/lib/ex3.7recover	Recover command
/usr/lib/ex3.7preserve	Preserve command
/usr/lib/terminfo	Describes capabilities of terminals
$HOME/*.exrc*	Editor startup file
/tmp/Exnnnnn	Editor temporary
/tmp/Rxnnnnn	Named buffer temporary
/usr/preserve	Preservation directory

See also

awk(C), **ctags**(CP), **ed**(C), **grep**(C), **infocmp**(ADM), **sed**(C), **tic**(C), **terminfo**(F), **terminfo**(M), **vi**(C)

Credit

This utility was developed at the University of California at Berkeley and is used with permission.

Standards conformance

ex is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

expr

evaluate arguments as an expression

Syntax

expr ***arguments***

Description

The ***arguments*** are taken as an expression. After evaluation, the result is written on the standard output. Terms of the expression must be separated by blanks. Characters special to the shell must be escaped. Note that 0 is returned to indicate a zero value, rather than the null string. Strings containing blanks or other special characters should be quoted. Integer-valued arguments may be preceded by a unary minus sign. Internally, integers are treated as 32-bit, 2's complement numbers.

The operators and keywords are listed below. Individual parameters within expressions may need to be quoted or escaped, since many of the characters that have special meaning in the shell also have special meaning in **expr**. The list is in order of increasing precedence, with equal precedence operators grouped within braces ({ and }). Parentheses ( ) can be used for grouping; see the Examples section below for the syntax.

expr is useful for performing variable arithmetic and other variable manipulation within shell scripts. See the Examples section below for some ideas.

arg | ***arg*** — Returns the first ***arg*** if it is neither null nor 0, otherwise returns the second ***arg***.

arg & ***arg*** — Returns the first ***arg*** if neither ***arg*** is null nor 0, otherwise returns 0.

arg { =, ==, >, >=, <, <=, != } ***arg*** — Returns the result of an integer comparison if both arguments are integers, otherwise returns the result of a lexical comparison, as defined by the locale. The result will be 1 if the expression is true and 0 if the expression is false. The double equals sign (==) does the same thing as the single equals sign (=); it is simply an alternative syntax.

arg { *, /, % } ***arg*** — Multiplication, division, or remainder of the integer-valued arguments.

arg { +, - } ***arg*** — Addition or subtraction of integer-valued arguments.

arg **:** ***arg*** The matching operator (:) compares the first argument with the second argument, which must be a regular expression; regular expression syntax is the same as that of **ed**(C), except that all patterns are "anchored" (that is, begin with a caret (^)) and therefore the caret is not a special character in that context. (Note that in the shell, the caret has the same meaning as the pipe symbol (|).) Normally the matching operator returns the number of characters matched (0 on failure). Alternatively, the \(... \) pattern symbols can be used to return a portion of the first argument.

match ***string rexp*** The **match** operator is identical in function to the colon operator (:) described above, but with a different syntax.

substr ***string x y*** The **substring** operator takes three arguments: a ***string***, an integer index into the string, ***x***; and the number of characters to return from the string, ***y***. **substr** goes to the ***x***th character in ***string*** and returns the next ***y*** characters. If ***y*** is greater than the number of remaining characters in the string, **expr** will return the remainder of the string. ***x*** must be an integer greater than 0; ***y*** must be a positive integer (0 is acceptable, if you want 0 as the result). See the following section for an example.

length ***string*** The **length** operator returns the length (the number of characters) of ***string***.

index ***string r*** [***stuv***] The **index** operator returns an integer indicating the place of ***r*** in ***string***. If ***r*** is not in ***string***, 0 is returned. You can specify as many characters as you like in the second argument; **expr** will then take the first character which appears in ***string*** and return its place in the string as an integer. See the following section for an example.

Examples

This is an example of how **expr** can be used in a shell script to do variable arithmetic:

```
a=2
a=`expr $a + 1`
echo $a
3
```

Parentheses can be placed around the part of an expression you want evaluated first. Be careful with the syntax; the backslashes and whitespace are essential:

```
expr \( 1 + 2 \) \* 10
30
```

The matching operator in **expr** (**:** or **match**) can be used to return a portion of a pathname:

```
a=/usr/lulu/valentines/woowoo
expr $a : '.*/\(.*\)'
woowoo
```

basename(C) does the same thing, however, and uses a simpler syntax:

```
a=/usr/lulu/valentines/woowoo
basename $a
woowoo
```

You can use the **length** operator to check the length of a string variable, and assign this value to another variable, if you like:

```
a=/usr/lulu/valentines/woowoo
b=`expr length $a`
echo $b
27
```

The substring (**substr**) operator pulls out a specific part of a string:

```
expr substr mongoose 4 7
goose
```

Here, the **expr** substring operator returns a substring of "mongoose" specified by 4 (start from the fourth character) and 7 (give me the next seven characters). Note that there are not seven more characters in "mongoose" from the "g", so **expr** only returns what is left.

The **index** operator tells you the place of a character in a string:

```
expr index wombat zoqb
2
```

In this example, the index operator takes the "o", the first character that is actually in the string "wombat", and returns its place in the string. **expr index wombat o** would have the same result.

See also

awk(C), **basename**(C), **bc**(C), **d**(C), **locale**(M), **oltbl**(M), **sh**(C)

Diagnostics

As a side effect of expression evaluation, **expr** returns the following exit values:

0	If the expression is neither null nor zero
1	If the expression is null or zero
2	For invalid expressions

Other diagnostics include:

`syntax error` For operator/operand errors, including unset variables

`nonnumeric argument`
If arithmetic is attempted on a nonnumeric string

Notes

After argument processing by the shell, **expr** cannot tell the difference between an operator and an operand except by the value. If **$a** is an equals sign (=), the command:

```
expr $a = "="
```

looks like:

```
expr = = =
```

The arguments are passed to **expr** and will all be taken as the = operator. The following permits comparing equals signs:

```
expr X$a = X=
```

Standards conformance

expr is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

factor

factor a number

Syntax

factor [*number*]

Description

When **factor** is invoked without an argument, it waits for a number to be typed in. If you type in a positive number less than 2^{46} (about 7.2×10^{13}) it will factor the number and print its prime factors; each one is printed the proper number of times. Then it waits for another number. It exits if it encounters a zero or any non-numeric character.

If **factor** is invoked with an argument, it factors the number as above and then exits.

The time it takes to factor a number, n, is proportional to $\sqrt{n}$. It usually takes longer to factor a prime or the square of a prime, than to factor other numbers.

Diagnostics

factor returns an error message if the supplied input value is greater than 2^{46} or is not an integer number.

false

return with a non-zero exit value

Description

false does nothing except return with a non-zero exit value. **true**(C), **false**'s counterpart, does nothing except return with a zero exit value. **false** is typically used in shell procedures such as:

```
until false
do
        command
done
```

See also

sh(C), **true**(C)

Diagnostics

false is any non-zero value.

Standards conformance

false is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

file

determine file type

Syntax

file [**-cL**] [**-f** *ffile*] [**-m** *mfile*] *arg* ...

Description

The **file** command performs a series of tests on each argument in an attempt to classify it. If an argument appears to be ASCII, **file** examines the first 512 bytes and tries to guess its language. If an argument is an executable *a.out*, **file** will print the version stamp, provided it is greater than 0.

-c The **-c** option causes **file** to check the magic file for format errors. This validation is not normally carried out for reasons of efficiency. No file typing is done under **-c**.

-L The **-L** option causes **file** to follow symbolic links. By default, symbolic links are not followed.

-f If the **-f** option is given, the next argument is taken to be a file containing the names of the files to be examined.

-m The **-m** option instructs **file** to use an alternate magic file.

The **file** command uses the file */etc/magic* to identify files that have some sort of "magic number"; that is, any file containing a numeric or string constant that indicates its type. Commentary at the beginning of */etc/magic* explains its format.

Files

/etc/magic

See also

filehdr(FP)

Standards conformance

file is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

find

find files

Syntax

find ***pathname-list expression***

Description

The **find** command is used to find files matching a certain set of selection criteria. **find** recursively descends the directory hierarchy for each pathname in the ***pathname-list*** (that is, one or more pathnames) seeking files that match a boolean ***expression*** written in the primaries given below.

Expressions

For each file encountered, **find** evaluates the specified ***expression***, formed of one or more of the following primary expressions, which may evaluate as true or false. In the descriptions, the argument ***n*** is used as a decimal integer where ***+n*** means more than ***n***, ***-n*** means less than ***n*** and ***n*** means exactly ***n***.

-name ***pattern*** True if ***pattern*** matches the current file name. ***pattern*** is similar to **sh**(C)'s filename matching syntax and therefore care must be taken to escape or quote patterns containing the following characters: the left bracket ([), the question mark (?) and the star (*).

-perm ***onum*** True if the file permission flags exactly match ***onum*** (see **chmod**(C)). If ***onum*** is prefixed by a minus sign, all other modes become significant (see **mknod**(S)), including the file type, setuid, setgid, and sticky bits rather than just read/write/execute modes for owner/group/other.

-type ***x*** True if the type of the file is ***x***, where ***x*** is **bb** for block special file, **c** for character special file, **d** for directory, **p** for named pipe (first-in-first-out (FIFO)), **f** for regular file, or **l** for symbolic link.

-links ***n*** True if the file has ***n*** links.

-size ***n*** [**c**] True if the file is ***n*** blocks long (512 bytes per block). If ***n*** is followed by a "c", the size is in characters.

-follow Always true; causes symbolic links to be followed. When following symbolic links, **find** keeps track of the directories visited so that it can detect infinite loops. For example, an infinite loop in a **find** would occur if a symbolic link pointed to an ancestor. This expression should not be used with the **-type l** expression.

-mount Always true; restricts the search to the file system containing the directory specified, or if no directory was specified, the current directory.

-local True if the file physically resides on the local system.

-inum *num* True if the file's inode is ***num***. This is useful for locating files with matching inodes.

-user *uname* True if the file belongs to the user ***uname***. If ***uname*** is numeric and does not appear as a login name in the */etc/passwd* file, it is taken as a user ID.

-group *gname* True if the file belongs to the group ***gname***. If ***gname*** is numeric and does not appear in the */etc/group* file as a group name, it is taken as a group ID.

-atime *n* True if the file was last accessed ***n*** days ago.

-mtime *n* True if the data in the file was last modified ***n*** days ago.

-ctime *n* True if the file's status was last changed (that is, created or modified) ***n*** days ago.

-exec *cmd* Executes shell command ***cmd***. The end of ***cmd*** must be punctuated by an escaped semicolon. A command argument {} is replaced by the current path name. True if the executed ***cmd*** returns a zero value as exit status (most commands return a zero value on successful completion and a non-zero value if an error is encountered).

-ok *cmd* Like **-exec** except that the generated command line is printed with a question mark first, and is executed only if the user responds by typing " y ".

-cpio *device* Writes the current file on ***device*** in *cpio*(F) format (5120-byte records). Always true.

-depth Causes all entries in a directory to be acted upon before the directory itself. This can be useful when used with **cpio**(C) or the **-cpio** expression to transfer files located in directories without write permission. Always true.

-print Causes the current path name to be printed. This option is used to create a list of all files matched by the previous primaries. Always true.

-newer *file* True if the current file has been modified more recently than the argument ***file***.

(*expression*) True if the parenthesized expression is true. Usually used with the **-o** operator (see below), parentheses are used for grouping. Parentheses are special to the shell and must be escaped.

The primaries may be combined using the following operators (in order of decreasing precedence):

! The "!" operator specifies the negation of the next primary (that is, **! -newer** *file* is true if the current file is *not* newer than *file*). This is the equivalent of the logical "not" operator.

-o Placing the **-o** operator between two primaries creates an expression that is true if either of the two primaries is true. It should be used with parentheses (that is, **\(-perm 644 -o -perm 664 \)** is true if the current file has permissions 644 or 664). This is equivalent to the logical "inclusive or" operator.

Note that placing two primaries next to each other is the equivalent of the logical "and" operation. The precedence of this operation is less than that of the "!" operator but greater than that of the **-o** operator.

Examples

The following command searches for files named *chapter1* in the current directory and all directories below it and sends the pathname of any such files it finds to the standard output:

find . -name chapter1 -print

The following removes all files named *core* or filenames ending in *.out* that have not been accessed in the last seven days.

find / \(-name core -o -name "*.out" \) -atime +7 -exec rm {} \;

Files

/etc/passwd	User names and uids
/etc/group	Group names and gids

See also

cpio(C), **cpio**(F), **sh**(C), **stat**(S), **test**(C)

Standards conformance

find is conformant with:

AT&T SVID Issue 2 ;
and X/Open Portability Guide, Issue 3, 1989.

finger

find information about users

Syntax

finger [-bfilpqsw] [*login1* [*login2* . . .]]

Description

By default **finger** lists the login name, full name, terminal name and write status (as a "*" before the terminal name if write permission is denied), idle time, login time, office location, and phone number (if they are known) for each current user. (Idle time is minutes if it is a single integer, hours and minutes if a colon (:) is present, or days and hours if a "d" is present.)

A longer format also exists and is used by **finger** whenever a list of names is given. (Account names as well as first and last names of users are accepted.) This is a multi-line format; it includes all the information described above as well as the user's home directory and login shell, any plan which the person has placed in the file *.plan* in their home directory, and the project on which they are working from the file *.project* which is also in the home directory.

finger options are:

-b Briefer long output format of users.

-f Suppresses the printing of the header line (short format).

-i Quick list of users with idle times.

-l Forces long output format.

-p Suppresses printing of the *.plan* files.

-q Quick list of users.

-s Forces short output format.

-w Forces narrow format list of specified users.

Files

/etc/utmp	**who** file
/etc/passwd	user names, offices, phones, login directories, and shells
$HOME/*.plan*	plans
$HOME/*.project*	projects

See also

w(C), **who**(C)

Credit

This utility was developed at the University of California at Berkeley and is used with permission.

Notes

Only the first line of the *.project* file is printed.

Entries in the */etc/passwd* file have the following format:

login name*:*user password(coded):***user ID*:*group ID*:*comments*:*home directory*:*login shell***

The comment field corresponds to what appears in the **finger** output. For example, in the following */etc/passwd* entry:

```
blf:*:47:5:Brian Foster, Mission, x70, 767-1234
:/u/blf:/bin/sh
```

the comment field, "Brian Foster, Mission, x70, 767-1234", contains data for the "In Real Life", "Office", and "Home Phone" columns of the **finger** listings.

Idle time is computed as the elapsed time since any activity on the given terminal. This includes previous invocations of **finger** which may have modified the terminal's corresponding device file */dev/tty??*.

fixhdr

change executable binary file headers

Syntax

fixhdr ***option files***

Description

fixhdr changes the header of output files created by link editors or assemblers. The kinds of modifications include changing the format of the header, the fixed stack size, the standalone load address, and symbol names.

Using **fixhdr** allows the use of binary executable files, created under other versions or machines, by simply changing the header information so that it is usable by the target CPU.

These are the options to **fixhdr**:

-xa Change the *x.out* format of the header to the *a.out* format.

-xb Change the *x.out* format of the header to the *b.out* format.

-x4 Change the *x.out* format of the header to the 4.2BSD *a.out* format.

-x5 [-n] Change the *x.out* format of the header to 5.2 (UNIX™ System V Release 2) *a.out* format. The **-n** flag causes leading underscores on symbol names to be passed with no modifications.

-ax -c [11,86] Change the *a.out* format of the header to the *x.out* format. The **-c** flag specifies the target CPU. 11 specifies a PDP-11 CPU. 86 specifies one of the 8086 family of CPUs (8086, 8088, 80186, 80286 or 80386).

-bx Change the *b.out* format of the header to the *x.out* format.

-5x [-n] Change the 5.2 (UNIX System V Release 2) *a.out* format of the header to the *x.out* format. The **-n** flag causes leading underscores on symbol names to be passed with no modifications.

-86x Add the *x.out* header format to the **86rel** object module format. See **86rel**(FP).

-F *num* Add (or change) the fixed stack size specified in the *x.out* format of the header. ***num*** must be a hexadecimal number.

-A ***num***	Add (or change) the standalone load address specified in the *x.out* format of the header. ***num*** must be a hexadecimal number.
-M[smlh]	Change the model of the *x.out* or **86rel** format. Model refers to the compiler model specified when creating the binary. **s** refers to small model, **m** refers to medium model, **l** refers to large model, and **h** refers to huge model.
-v [2,3,5,7]	Change the version of XENIX specified in the header. XENIX Version 2 was based on UNIX Version 7.
-s ***s1=s2*** **[-s** ***s3=s4*****]**	Change symbol names, where symbol name ***s1*** is changed to ***s2***.
-r	Ensure that the resolution table is of non-zero size.
-C ***cpu***	Set the CPU type. ***cpu*** can be 186, 286, 386, 8086, or others.

File

/usr/bin/fixhdr

See also

a.out(FP), **86rel**(FP)

Notes

Give **fixhdr** one option at a time. If you need to make more than one kind of modification to a file, use **fixhdr** on the original file. Then use it again on the **fixhdr** output, specifying the next option. Copy the original file if you need an unmodified version as **fixhdr** makes the modifications directly to the file.

Value added

fixhdr is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

format

format floppy disks

Syntax

format [-n] [-v] [-f] [-q] [*device*] [-i *interleave*]

Description

The **format** command formats diskettes for use on a UNIX system. It may be used either interactively or from the command line. The default drive is specified in */etc/default/format*.

Options

The following command line options are available:

-f Suppresses the interactive feature. The **format** program does not wait for user-confirmation before starting to format the diskette. Regardless of whether you run **format** interactively, track and head information is displayed.

device
This specifies the device to be formatted. The default device is specified in */etc/default/format*.

-i *interleave*
Specifies the interleave factor.

-q Quiet option. Suppresses the track and head output information normally displayed. Although this option does not suppress the interactive prompt, it would typically be used with **-f** to produce no output at all.

-v Specifies format verification.

-n Specifies that the diskette is not to be verified (overrides verify entry in */etc/default/format*).

The file */etc/default/format* is used to specify the default device to be formatted and whether or not each diskette is to be verified. The entries must be in the format **DEVICE=***/dev/rfdnnn* and **VERIFY=[yYnN]**, as in the following example:

```
DEVICE=/dev/rfd096ds15
VERIFY=y
```

The device must be a character (raw) device.

Usage

To run **format** interactively, enter:

format

followed by any of the legal options except **-f**, and press ⟨Return⟩. When you run **format** interactively, you see the prompt:

```
insert diskette in drive and press return when ready
```

When you press ⟨Return⟩ at this prompt, **format** begins to format the diskette.

If you specify the **-f** option, you do not see this prompt. Instead, the program begins formatting immediately upon invocation.

Unless you specify the **-q** option, **format** displays which track and head it is currently on:

```
track #   head #
```

The number signs above are replaced by the actual track and head information.

Files

/etc/default/format
/dev/rfd[0 - n]

See also

fd(HW)

Notes

The **format** utility does not format floppies for use under DOS; use the **dosformat** command documented in **dos**(C).

UNIX systems require error free floppies.

It is not advisable to format a low density (48tpi) diskette on a high density (96tpi) floppy drive. Diskettes written on a high density drive should be read on high density drives. A low density diskette written on a high density drive may not be readable on a low density drive.

The device */dev/install* is used only for installing and reading floppies. Attempts made to format this device may result in an error.

getopt

parse command options

Syntax

set -- `getopt** ***optstring*** **$*`

Description

This command has been superseded, but is included for backwards compatability; **getopts**(C) should be used instead.

getopt is used to check and break up options in command lines for parsing by shell procedures. ***optstring*** is a string of recognized option letters (see **getopt**(S)). If a letter is followed by a colon, the option is expected to have an argument which may or may not be separated from it by whitespace. The special option "--" is used to delimit the end of the options. **getopt** will place "--" in the arguments at the end of the options, or recognize it if used explicitly. The shell arguments ($1 $2 ...) are reset so that each option is preceded by a dash (-) and in its own shell argument. Each option argument is also in its own shell argument.

Example

The following code fragment shows how one can process the arguments for a command that can take the options **a** and **b**, and the option **o**, which requires an argument:

```
set -- `getopt abo: $*`
if [ $? != 0 ]
then
        echo "usage: $0 [-a | -b] [-o <arg>]"
        exit 2
fi
for i in $*
do
        case $i in
        -a | -b)        shift; FLAG=$i;;
        -o)             OARG=$3; shift; shift;;
        --)             shift;  break;;
        esac
done
```

This code will accept any of the following as equivalent:

```
cmd -aoarg
cmd -a -o arg
cmd -oarg -a
cmd -a -oarg --
```

See also

getopt(S), **getopts**(C), **sh**(C)

Diagnostics

getopt prints an error message on the standard error when it encounters an option letter not included in ***optstring***.

Notes

The "Syntax" given for this utility assumes the user has an **sh**(C) shell.

Standards conformance

getopt is conformant with:

AT&T SVID Issue 2.

getopts, getoptcvt

parse command options

Syntax

getopts ***optstring name*** [***arg*** ...]

/usr/lib/getoptcvt [**-b**] ***file***

Description

getopts - Parses positional parameters in shell procedures

getoptcvt - Converts shell scripts to use **getopts** instead of **getopt**

The **getopts** command is used by shell procedures to parse positional parameters and to check for legal options. It supports all applicable rules of the command syntax standard (see Rules 3-10, **Intro**(C)). It should be used in place of the **getopt**(C) command. (See the "Notes" below.)

This feature is only available in the Bourne (**sh**) and Korn (**ksh**) shells.

optstring must contain the option letters the command using **getopts** will recognize; if a letter is followed by a colon, the option is expected to have an argument, or group of arguments, which must be separated from it by white space.

Each time it is invoked, **getopts** will place the next option in the shell variable ***name*** and the index of the next argument to be processed in the shell variable **OPTIND**. Whenever the shell or a shell procedure is invoked, **OPTIND** is initialized to 1.

When an option requires an option-argument, **getopts** places it in the shell variable **OPTARG**.

If an illegal option is encountered, " ? " will be placed in ***name***.

When the end of options is encountered, ***getopts*** exits with a non-zero exit status. The special option " -- " may be used to delimit the end of the options.

By default, **getopts** parses the positional parameters. If extra arguments (***arg*** ...) are given on the **getopts** command line, **getopts** will parse them instead.

The **/usr/lib/getoptcvt** command reads the shell script in ***file***, converts it to use **getopts**(C) instead of **getopt**(C), and writes the results to the standard output.

-b the results of running **/usr/lib/getoptcvt** will be portable to earlier UNIX releases. **/usr/lib/getoptcvt** modifies the shell script in ***file*** so that when the resulting shell script is executed, it determines at run time whether to invoke **getopts**(C) or **getopt**(C).

So all new commands will adhere to the command syntax standard described in **Intro**(C), they should use **getopts**(C) or **getopt**(S) to parse positional parameters and check for options that are legal for that command (see "Notes" below).

Example

The following fragment of a shell program shows how one might process the arguments for a command that can take the options **a** or **b**, as well as the option **o**, which requires an option-argument:

```
while getopts abo: c
do
        case $c in
        a | b)  FLAG=$c;;
        o)      OARG=$OPTARG;;
        ?)      echo $USAGE
                exit 2;;
        esac
done
shift `expr $OPTIND - 1`
```

This code will accept any of the following as equivalent:

```
cmd -a -b -o "xxx z yy"
cmd -a -b -o "xxx z yy" --
cmd -ab -o xxx,z,yy
cmd -ab -o "xxx z yy"
cmd -o xxx,z,yy -b -a
```

See also

Intro(C), **getopt**(S), **sh**(C)

Notes

Although the following command syntax rule (see **Intro**(C)) relaxations are permitted under the current implementation, they should not be used because they may not be supported in future releases of the system. As in the "Example" section above, **a** and **b** are options, and the option **o** requires an option-argument:

cmd* -abo *filexxx (Rule 5 violation: options with option-arguments must not be grouped with other options.)

cmd* -ab -o*xxx file (Rule 6 violation: there must be white space after an option that takes an option-argument.)

Changing the value of the shell variable **OPTIND** or parsing different sets of arguments may lead to unexpected results.

Diagnostics

getopts prints an error message to the standard error when it encounters an option letter not included in ***optstring***.

gets

get a string from the standard input

Syntax

gets [***string***]

Description

The **gets** command can be used with **csh**(C) to read a string from the standard input. If ***string*** is given it is used as a default value if an error occurs. The resulting string (either ***string*** or as read from the standard input) is written to the standard output. If no ***string*** is given and an error occurs, **gets** exits with exit status 1.

See also

line(C), **csh**(C)

Value added

gets is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

greek

select terminal filter

Syntax

greek [-T*terminal*]

Description

greek is a filter that reinterprets the extended character set, as well as the reverse and half-line motions, of a 128-character TELETYPE Model 37 terminal for certain other terminals. Special characters are simulated by overstriking, if necessary and possible. If the argument is omitted, **greek** attempts to use the environment variable **$TERM** (see **environ**(M)). Currently, the following terminals are recognized:

300	DASI 300.
300-12	DASI 300 in 12-pitch.
300s	DASI 300s.
300s-12	DASI 300s in 12-pitch.
450	DASI 450.
450-12	DASI 450 in 12-pitch.
1620	Diablo 1620 (alias DASI 450).
1620-12	Diablo 1620 (alias DASI 450) in 12-pitch.
2621	Hewlett-Packard 2621, 2640, and 2645.
2640	Hewlett-Packard 2621, 2640, and 2645.
2645	Hewlett-Packard 2621, 2640, and 2645.
4014	Tektronix 4014.
hp	Hewlett-Packard 2621, 2640, and 2645.
tek	Tektronix 4014.

Files

/usr/bin/300
/usr/bin/300s
/usr/bin/4014
/usr/bin/450
/usr/bin/hp

See also

300(C), **4014**(C), **450**(C), **environ**(M), **hp**(C), **term**(M), **tplot**(ADM)

grep, egrep, fgrep

search files for a pattern

Syntax

grep [**-bchilnsvy**] [**-f** *expfile*] [[**-e**] *expression*] [*files*]

egrep [**-bchilnv**] [**-f** *expfile*] [[**-e**] *expression*] [*files*]

fgrep [**-bclnvxy**] [**-f** *expfile*] [[**-e**] *expression*] [*files*]

Description

grep - Searches a file for a pattern

egrep - Searches a file for one or more patterns

fgrep - Searches a file for a fixed string

Commands of the **grep** family search the input *files* (or standard input if no *files* are specified) for lines matching a pattern. Normally, each matching line is copied to the standard output. If more than one file is being searched, the name of the file in which each match occurs is also written to the standard output along with the matching line (unless the **-h** option is used, see below).

grep patterns are limited regular *expressions* in the style of **ed**(C). **grep** uses a compact nondeterministic algorithm. **egrep** patterns are full regular *expressions*; it uses a fast deterministic algorithm that sometimes needs exponential space. **fgrep** patterns are fixed *strings*. **fgrep** is fast and compact.

The following options are recognized:

-v All lines but those matching are displayed.

-x Displays only exact matches of an entire line. (**fgrep** only.)

-c Only a count of matching lines is displayed.

-l Only the names of files with matching lines are displayed, separated by newlines.

-h Prevents the name of the file containing the matching line from being prepended to that line. Used when searching multiple files. (This option works with **grep** and **egrep** only.)

-n Each line is preceded by its relative line number in the file.

-b Each line is preceded by the block number on which it was found. This is sometimes useful in locating disk block numbers by context.

-s Suppresses error messages produced for nonexistent or unreadable files. (**grep** only.) Note that the **-s** option will not suppress error messages generated by the **-f** option.

-i Turns on matching of letters of either case in the input so that case is insignificant. Conversion between uppercase and lowercase letters is dependent on the locale setting.

-y Turns on matching of letters of either case in the input so that case is insignificant. Conversion between uppercase and lowercase letters is dependent on the locale setting. **-y** does not work with **egrep**.
Note: **-y** is not a standard UNIX system option. It is maintained for backwards compatibility with XENIX.

-e ***expression*** or ***strings***
Same as a simple ***expression*** argument, but useful when the ***expression*** begins with a dash (-).

-f ***expfile***
The regular ***expression*** for **grep** or **egrep**, or ***strings*** list for **fgrep** is taken from the ***expfile***.

In all cases (except with **-h**) the filename is output if there is more than one input file. Care should be taken when using the characters **$ * [^ | ( )** and **** in ***expression***, because they are also meaningful to the shell. It is safest to enclose the entire ***expression*** or ***strings*** argument in single quotation marks. For example:

grep '[Ss]omeone' text.file

This command would find all lines containing the word "someone" in the file *text.file*, whether the initial "s" is uppercase or lowercase.

Multiple strings can be specified in **fgrep** without using a separate strings file by using the quoting conventions of the shell to imbed newlines in the ***string*** argument. For example, if you were using the Bourne shell (**sh**(C)) you might enter the following on the command line:

fgrep 'Someone
someone' text.file

This would have the same effect as the **grep** example above. See the **csh**(C) manual page for ways to imbed newlines in a string when using **csh**(C).

egrep accepts regular expressions as in **ed**(C), with the addition of the following:

- A regular expression followed by a plus sign (+) matches one or more occurrences of the regular expression.
- A regular expression followed by a question mark (?) matches 0 or 1 occurrences of the regular expression.
- Two regular expressions separated by a vertical bar (|) or by a newline match strings that are matched by either regular expression.

- A regular expression may be enclosed in parentheses "( )" for grouping. For example:

  egrep ´([Ss]ome | [Aa]ny)one´ text.file

  This example displays all lines in *text.file* containing the words "someone" or "anyone", whether or not they are spelled with initial capital letters. Without the parentheses, this example would display all lines containing the words "some" or "anyone" (because the vertical bar (|) operator is of lower precedence than concatenation, see below).

Because of the algorithm used, **egrep** does not support extended ranges as in **ed**(C): Ranges like [a-z] are interpreted on the basis of the machine's collating sequence, not the collating sequence defined by the locale. **grep** supports **col**(C) extended ranges.

The \(and \) operators, supported by **ed**(C), are not supported by **egrep**.

The order of precedence of operators is [ ], then * ? +, then concatenation, then backslash (\) with newline or vertical bar (|).

See also

col(C), **coltbl**(M), **ed**(C), **locale**(M), **sed**(C), **sh**(C)

Diagnostics

Exit status is 0 if any matches are found, 1 if no matches are found, and 2 for syntax errors or inaccessible files.

Notes

Ideally there should be only one **grep**, but there isn't a single algorithm that spans a wide enough range of space-time tradeoffs.

Lines are limited to 256 characters. Longer lines are truncated.

When using **grep** with the **-y** option, the search is not made totally case insensitive in character ranges specified within brackets.

Standards conformance

egrep, **fgrep** and **grep** are conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

hd

display files in hexadecimal format

Syntax

hd [-*format*] [-s *offset*] [-n *count*] [*file*] ...

Description

The **hd** command displays the contents of files in hexadecimal, octal, decimal, and character formats. Control over the specification of ranges of characters is also available. The default behavior is with the following flags set: **-abx -A**. This says that addresses (file offsets) and bytes are printed in hexadecimal and that characters are also printed. If no ***file*** argument is given, the standard input is read.

Options include:

-s *offset* Specify the beginning offset in the file where printing is to begin. If no ***file*** argument is given, or if a seek fails because the input is a pipe, ***offset*** bytes are read from the input and discarded. Otherwise, a seek error will terminate processing of the current file.

The ***offset*** may be given in decimal, hexadecimal (preceded by 0x), or octal (preceded by a 0). It is optionally followed by one of the following multipliers: **w**, **l**, **b**, or **k**; for words (2 bytes), long words (4 bytes), half kilobytes (512 bytes), or kilobytes (1024 bytes), respectively. Note that this is the one case where "b" does *not* stand for bytes. Since specifying a hexadecimal offset in blocks would result in an ambiguous trailing "b", any offset and multiplier may be separated by an asterisk (*). (The asterisk may need to be escaped to protect it from the shell.)

-n *count* Specify the number of bytes to process. The ***count*** is in the same format as ***offset***, above.

Format flags

Format flags may specify addresses, characters, bytes, words (2 bytes) or longs (4 bytes) to be printed in hex, decimal, or octal. Two special formats may also be indicated: text or ASCII. Format and base specifiers may be freely combined and repeated as desired in order to specify different bases (hexadecimal, decimal or octal) for different output formats (addresses, characters, etc.). All format flags appearing in a single argument are applied as appropriate to all other flags in that argument.

acbwlA Output format specifiers for addresses, characters, bytes, words, longs and ASCII respectively. Only one base specifier will be used for addresses. The address will appear on the first line of output that begins each new offset in the input.

The character format prints all printable characters without change, special C escapes as defined in the language, and the remaining values in the specified base.

The ASCII format prints all printable characters without change, and all others as a dot (.). This format appears to the right of the first of other specified output formats. A base specifier has no meaning with the ASCII format. If no other output format (other than addresses) is given, **bx** is assumed. If no base specifier is given, *all* of **xdo** are used.

xdo Output base specifiers for hexadecimal, decimal and octal.

t Print a text file, each line preceded by the address in the file. Normally, lines should be terminated by a **\n** character; but long lines will be broken up. Control characters in the range 0x00 to 0x1f are printed as **^@** to **^_**. Bytes with the high bit set are preceded by a tilde (~) and printed as if the high bit were not set. The special characters ^, ~ and \ are preceded by a backslash (\) to escape their special meaning. As special cases, these two values are represented numerically as '\177' and '\377'. This flag will override all output format specifiers except addresses.

If no output format is given, but a base specifier is present, the output format is set to **-acbwl**. If no base specifier is given, but an output format is present, the base specifier is set to **-xdo**. If neither is present, the format flag is set to **-abx-A**.

head

print the first few lines of a file

Syntax

head [*-count*] [*file ...*]

Description

The **head** filter prints the first ***count*** lines of each of the specified files. If no files are specified, **head** reads from the standard input. If no ***count*** is specified, then 10 lines are printed.

See also

tail(C)

Credit

This utility was developed at the University of California at Berkeley and is used with permission.

hello

send a message to another user

Syntax

hello *user* [*tty*]

Description

hello sends messages from one user to another. When first called, **hello** displays the following message:

`Message from` ***sender's-system! sender's-name sender's-tty***

The recipient of the message should write back at this point. Communication continues until interrupted. (On most terminals, pressing the ⟨Del⟩ key sends an interrupt.) At that point **hello** prints `(end of message)` on the other terminal, and exits.

To write to a user who is logged in more than once, the user can employ the *tty* argument to specify the appropriate terminal name. The **who**(C) command can be used to determine the correct terminal name.

Permission to write may be allowed or denied by the recipient, using the **mesg** command. Writing is disallowed by default. Certain commands, such as **nroff** and **pr**, prohibit messages in order to prevent disruption of output.

If the character "!" is found at the beginning of a line, **hello** calls the shell to execute the rest of the line as a command.

The following protocol is suggested for using **hello**. When first writing to another user, the sender should wait for that user to write back before sending a message. Each party should end each message with a signal indicating that the other may reply: 'o' for "over" is conventional. The signal 'oo' for "over and out" is suggested when conversation is about to be terminated.

Files

/etc/utmp
/bin/sh

See also

mail(C), **mesg**(C), **who**(C), **write**(C)

Value added

hello is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

hp

handle special functions of Hewlett-Packard terminals

Syntax

hp [**-e**] [**-m**]

Description

hp supports the special functions of the Hewlett-Packard 2640 series of terminals, with the primary purpose of producing accurate representations of most **nroff** output. A typical usage is in conjunction with text processing software:

nroff -h *files* ... | **hp**

Regardless of the hardware options on your terminal, **hp** tries to do sensible things with underlining and reverse line-feeds. If the terminal has the "display enhancements" feature, subscripts and superscripts can be indicated in distinct ways. If it has the "mathematical-symbol" feature, Greek and other special characters can be displayed.

The flags are as follows:

-e It is assumed that your terminal has the "display enhancements" feature, and so maximal use is made of the added display modes. Overstruck characters are presented in the Underlined mode. Superscripts are shown in Half-bright mode, and subscripts in Half-bright, Underlined mode. If this flag is omitted, **hp** assumes that your terminal lacks the "display enhancements" feature. In this case, all overstruck characters, subscripts, and superscripts are displayed in Inverse Video mode, that is, dark-on-light, rather than the usual light-on-dark.

-m Requests minimization of output by changing new-lines to ^M's. Any contiguous sequence of 3 or more new-lines is converted into a sequence of only 2 new-lines; that is, any number of successive blank lines produces only a single blank output line. This allows you to retain more actual text on the screen.

With regard to Greek and other special characters, **hp** provides the same set as **300**(C) , except that "not" is approximated by a right arrow, and only the top half of the integral sign is shown.

Diagnostics

`line too long` if the representation of a line exceeds 1,024 characters.
The exit codes are **0** for normal termination, **2** for all errors.

See also

300(C) , **greek**(C)

Notes

An "overstriking sequence" is defined as a printing character followed by a backspace followed by another printing character. In such sequences, if either printing character is an underscore, the other printing character is shown underlined or in Inverse Video; otherwise, only the first printing character is shown (again, underlined or in Inverse Video). Nothing special is done if a backspace is adjacent to an ASCII control character. Sequences of control characters (for example, reverse line-feeds, backspaces) can make text "disappear." In particular, tables generated by **tbl**(CT) that contain vertical lines will often be missing the lines of text that contain the "foot" of a vertical line, unless the input to **hp** is piped through **col**(C) .

Although some terminals do provide numerical superscript characters, no attempt is made to display them.

hwconfig

read the configuration information

Syntax

/etc/hwconfig [-nlhcq] [-f *filename*] [*param*] [*param=val*] ...

Description

The **hwconfig** command returns the configuration information contained in the file */usr/adm/hwconfig* or in the file specified on the command line with the **-f *filename*** option. Using combinations of the remaining options, the user can view as much information as needed from the configuration file. The display format is as follows:

```
magic_char device_name base+finish vec dma rest
```

where:

magic_char	is the character " % "
device_name	is the name of the device driver
base+finish	are the starting and the finishing addresses of the driver working space
vec	is the interrupt vector number in decimal
dma	is the DMA channel number
rest	is a possibly empty list of ***parameter=value*** pairs

The default **hwconfig** display looks similar to this:

```
fpu      -           13   -   type=80387
floppy   0x3F2-0x3F7  6   2   unit=0 type=96ds15
serial   0x2F8-0x2FF  3   -   unit=1 type=Standard nports=1
parallel 0x378-0x37A  7   -   unit=0
console  -           -    -   unit=ega type=0
disk     0x1F0-0x1F7 14   -   type=W0 unit=0 cyls=791 hds=16 secs=48
```

Options

-n	The device name is always printed out.
-l	The long format of the device configuration content is used.
-h	Use the long format, with headers.
-c	Check for device conflicts, including I/O addresses, DMA channels, and interrupt vectors which are being used by more than one driver.

-q Check quietly for device conflicts; display nothing. When both **-c** and **-q** are given, display conflicts only.

-ffile Use ***file*** as the input file instead of the default */usr/adm/hwconfig*.

param Show all values of ***param*** throughout the configuration file. ***param*** can be any valid system parameter. The current valid system parameters are: **name, base, offset, vec, dma, unit, type, nports, hds, cyls, secs,** and **drvr**.

param=val Show only information from the line where ***param*** equals the value ***val***.

The **-n, -l** and **-h** options are in increasing overriding power. That is, if **-n** and **-l** are both specified, **-l** will be used. ***param*** on its own indicates a query for its corresponding value(s), whereas ***param=value*** indicates a matching *<token,val>* pair in the input file. **-l** is used by default if there are no queries and no explicit option.

Command-line queries, that is, those with parameters only, are always displayed in short format.

Examples

hwconfig The entire contents of the file */usr/adm/hwconfig* are printed.

hwconfig base
All the values of the **base** parameter found in */usr/adm/hwconfig* are printed.

hwconfig -f conf base=300 vec=19
All entries in *conf* that match the **base** and **vec** values given are printed.

hwconfig name=floppy base
The name and value of **base** in */usr/adm/hwconfig* for the drivers with the name *floppy* are printed for all entries.

hwconfig -n base dma
The device name associated with the **base** and **dma** is displayed. For example,

```
name=scsi base=0x234 dma=4
```

hwconfig base dma vec=4
The **base** and **dma** values of all */usr/adm/hwconfig* entries with matching **vec=4** are printed.

hwconfig -l base dma vec=4
is like

hwconfig -l vec=4
except that **base** and **dma** values will be printed first.

hwconfig -h

Everything is printed in the long format, with a header similar to the one shown at boot time. It will ignore all queries, but perform matching on the token values. For example,

```
hwconfig -h vec=4 dma=1
```

will print in long format, with headers, all those entries with **vec=4** and **dma=1**

hwconfig -ch

displays */usr/adm/hwconfig* in an easy-to-read tabular format and checks for device conflicts.

Files

/etc/hwconfig	program file
/usr/lib/hwconfig.awk	**awk** program which **hwconfig** uses
/usr/adm/hwconfig	default source file

Diagnostics

hwconfig returns 0 for success, 1 for conflicts detected, 2 for invalid arguments.

Notes

Information about conflicts is purely advisory because **hwconfig** can only report about hardware devices which have been correctly recognized by a kernel driver.

/etc/hwconfig is only runnable by *root*.

/usr/adm/hwconfig is not normally readable by users, but can be made so by the system administrator.

/usr/adm/hwconfig is written by the error logger daemon. The logger daemon does not run while in system maintenance mode. This means that the **hwconfig** report is not up to date until the system is brought into multi-user mode.

Value added

hwconfig is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

i286emul

emulate UNIX 80286

Syntax

i286emul [*arg* ...] *prog286*

Description

i286emul is an emulator that allows programs from UNIX System V Release 2 or Release 3 on the Intel 80286 to run on UNIX System V Release 3 on the Intel 80386.

The UNIX system recognizes an attempt to **exec**(S) a 286 program, and automatically **exec**'s the 286 emulator with the 286 program name as an additional argument. It is not necessary to specify the **i286emul** emulator on the command line. The 286 programs can be invoked using the same command format as on the 286 UNIX System V.

i286emul reads the 286 program's text and data into memory and maps them through the LDT (Local Descriptor Table) (via **sysi86**(S)) as 286 text and data segments. It also sets callgate 89 in the GDT (Global Descriptor Table) (which is used by 286 programs for system calls) to point to a routine in **i286emul**. **i286emul** starts the 286 program by jumping to its entry point.

When the 286 program attempts to do a system call, **i286emul** takes control. It does any conversions needed between the 286 system call and the equivalent 386 system call, and performs the 386 system call. The results are converted to the form the 286 program expects, and the 286 program is resumed.

The following are some of the differences between a program running on a 286 and a 286 program using **i286emul** on a 386:

- A 286 program under **i286emul** always has 64K in the stack segment if it is a large-model process, or 64K in the data segment if it is a small-model process.
- System calls and signal handling use more space on the stack under **i286emul** than on a 286.
- Attempts to unlink or write on the 286 program will fail on the 286 with **ETXTBSY**. Under **i286emul**, they will not fail.
- **ptrace**(S) is not supported under **i286emul**.
- The 286 program must be readable for the emulator to read it.

File

/bin/i286emul The emulator must have this name and be in */bin* if it is to be automatically invoked when **exec**(S) is used on a 286 program.

Notes

The signal mechanism under the emulator is the System V release 2 signal mechanism rather than the System V release 3 mechanism.

id

print user and group IDs and names

Syntax

id [-l] [-s]

Description

The **id** command writes a message on the standard output, giving the user and group IDs and the corresponding names of the invoking process. If the effective and real IDs do not match, both are printed.

With the **-s** option, **id** also shows the supplemental group list. On systems that support a large number of supplemental groups, the **-s** option may produce a very long line.

With the **-l** option, **id** outputs the Login User ID (LUID) of the caller.

id -l produces output with the following format:

```
uid=12460(fred) gid=7003(trusted) luid=12460(fred)
```

and **id -l -s** produces:

```
uid=12460(fred) gid=7003(trusted) luid=12460(fred)
groups=7003(trusted),50(group)
```

If the LUID is not set the output is:

```
uid=0(root) gid=0(root) luid=-1(not set)
```

See also

logname(C) , **getuid**(S) , **sg**(C)

Standards conformance

id is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

ismpx

return windowing terminal state

Syntax

ismpx [-s]

Description

The **ismpx** command reports whether its standard input is connected to a multiplexed **xt**(HW) channel; that is, whether it is running under **layers**(C) or not. It is useful for shell scripts that download programs to a windowing terminal or depend on screen size.

The **ismpx** command prints `yes` and returns `0` if invoked under **layers**(C), and prints `no` and returns `1` otherwise.

-s Do not print anything; just return the proper exit status.

Diagnostics

Returns `0` if invoked under **layers**(C), `1` if not.

See also

jwin(C), **layers**(C), **xt**(HW)

Example

```
if ismpx -s
then
        jwin
fi
```

join

join two relations

Syntax

join [*options*] *file1 file2*

Description

The **join** command prints to the standard output a join of the two relations specified by the lines of *file1* and *file2*. If *file1* is a dash (-), the standard input is used.

file1 and *file2* must be sorted in increasing collating sequence (defined by the current locale; see **locale**(M)) on the fields on which they are to be joined, normally the first in each line.

There is one line in the output for each pair of lines in *file1* and *file2* that have identical join fields. The output line normally consists of the common field, then the rest of the line from *file1*, then the rest of the line from *file2*.

Fields are normally separated by blank, tab or newline. In this case, multiple separators count as one, and leading separators are discarded.

These options are recognized:

-a *n* In addition to the normal output, produces a line for each unpairable line in file *n*, where *n* is 1 or 2.

-e *s* Replaces empty output fields by string *s*.

-j *nm* Joins on the *m*th field of file *n*. If *n* is missing, uses the *m*th field in each file.

-o *list* Each output line comprises the fields specified in *list*, each element of which has the form *n.m* where *n* is a file number and *m* is a field number.

-t *c* Uses character *c* as a field separator. Every appearance of *c* in a line is significant.

See also

awk(C), **comm**(C), **sort**(C)

Notes

With default field separation, the collating sequence is that of **sort -b**. With **-t**, the sequence is that of a plain sort.

Standards conformance

join is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

jterm

reset layer of windowing terminal

Syntax

jterm

Description

The **jterm** command is used to reset a layer of a windowing terminal after downloading a terminal program that changes the terminal attributes of the layer. It is useful only under **layers**(C). In practice, it is most commonly used to restart the default terminal emulator after using an alternate one provided with a terminal-specific application package. For example, on the AT&T TELETYPE 5620 DMD terminal, after executing the **hp2621** command in a layer, issuing the **jterm** command will restart the default terminal emulator in that layer.

Diagnostics

Returns `0` upon successful completion, `1` otherwise.

Notes

The layer that is reset is the one attached to standard error; that is, the window you are in when you type the **jterm** command.

See also

layers(C)

jwin

print size of layer

Syntax

jwin

Description

The **jwin** command runs only under **layers**(C) and is used to determine the size of the layer associated with the current process. It prints the width and the height of the layer in bytes (number of characters across and number of lines, respectively). For bit-mapped terminals only, it also prints the width and height of the layer in bits.

Diagnostics

Returns `0` on successful completion, `1` otherwise.

If **layers**(C) has not been invoked, an error message is printed:

```
jwin: not mpx
```

Note

The layer whose size is printed is the one attached to standard input; that is, the window you are in when you type the **jwin** command.

See also

layers(C)

Example

In the following example, the user input is in bold:

```
$jwin
bytes:  86 25
bits:   780 406
```

kill

terminate a process

Syntax

kill [*-signo*] *processid* ...

Description

The **kill** command sends signal 15 (terminate) to the specified process(es). This will normally kill processes that do not catch or ignore the signal. The process number of each asynchronous process (background process) started with "&" is reported by the shell (unless more than one process is started in a pipeline, in which case the number of the last process in the pipeline is reported). Process numbers can also be found by using **ps**(C).

For example, if process number 0 is specified, all processes in the process group are signaled.

The killed process must belong to the current user unless he is the super user.

If a signal number preceded by "-" is given as the first argument, that signal is sent instead of the terminate signal (see **signal**(S)). In particular **kill -9** ... is a sure kill.

Note

A version of **kill** is built into the Korn shell (**ksh**(C)). It differs slightly from the command described here. For further details, refer to the **ksh**(C) entry.

See also

kill(S), **ps**(C), **sh**(C), **csh**(C), **ksh**(C), **signal**(S)

Standards conformance

kill is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

ksh, rksh

KornShell, a standard/restricted command and programming language

Syntax

ksh [±**aefhikmnoprstuvx**] [±**o** *option*] ... [**-c** *string*] [*arg* ...]

rksh [±**aefhikmnoprstuvx**] [±**o** *option*] ... [**-c** *string*] [*arg* ...]

Description

ksh - Invokes the Korn shell

rksh - Invokes a restricted Korn shell

ksh is a command and programming language that executes commands read from a terminal or a file. **rksh** is a restricted version of the command interpreter **ksh**; it is used to set up login names and execution environments whose capabilities are more controlled than those of the standard shell. See "Invocation" below for the meaning of arguments to the shell.

Definitions

A *metacharacter* is one of the following characters:

; & ( ) | < > new-line space tab

A *blank* is a space or a tab.

An *identifier* is a sequence of letters, digits, or underscores starting with a letter or underscore. Identifiers are used as names for functions and named parameters.

A *word* is a sequence of characters separated by one or more non-quoted metacharacters.

Commands

A *command* is a sequence of characters in the syntax of the shell language. The shell reads each command and carries out the desired action either directly or by invoking separate utilities.

A *special command* is a command that is carried out by the shell without creating a separate process. Except for documented side effects, most special commands can be implemented as separate utilities.

A *simple-command* is a sequence of blank-separated words which may be preceded by a parameter assignment list. (See "Environment" below). The first word specifies the name of the command to be executed. Except as specified below, the remaining words are passed as arguments to the invoked command. The command name is passed as argument 0 (see **exec**(S)). The value of a simple-command is its exit status if it terminates normally, or (octal) 200+***status*** if it terminates abnormally (see **signal**(S) for a list of status values).

A *pipeline* is a sequence of one or more commands separated by "|". The standard output of each command but the last is connected by a **pipe**(S) to the standard input of the next command. Each command is run as a separate process; the shell waits for the last command to terminate. The exit status of a pipeline is the exit status of the last command.

A *list* is a sequence of one or more pipelines separated by **;** **&** **&&** or **||** and optionally terminated by **;** **&** or **|&**. Of these five symbols, **&&** and **||** have highest precedence. The following three symbols, **;** **&** and **|&** are of equal precedence, as are **&&** and **||**. A semicolon (;) causes sequential execution of the preceding pipeline; an ampersand (&) causes asynchronous execution of the preceding pipeline (that is, the shell does *not* wait for that pipeline to finish). The symbol **|&** causes asynchronous execution of the preceding command or pipeline with a two-way pipe established to the parent shell. The parent shell can write to and read from the standard input and standard output of the spawned command using the **-p** option of the special commands **read** and **print** (described later). The symbol **&&** (**||**) causes the list following it to be executed only if the preceding pipeline returns a zero (non-zero) value. An arbitrary number of new-lines may appear in a list, instead of a semicolon, to delimit a command.

A command is either a simple-command or one of the following compound-commands. A *compound-command* is a command that results in the execution of one or more simple-commands, depending upon the state of its input. Unless otherwise stated, the value returned by a command is that of the last simple-command executed in the command.

for ***identifier*** [**in** ***word*** ...] **;do** ***list*** **;done**

Each time a **for** command is executed, ***identifier*** is set to the next word taken from the **in** ***word*** list. If **in** ***word*** ... is omitted, then the **for** command executes the **do** ***list*** once for each positional parameter that is set (see "Parameter substitution" below). Execution ends when there are no more words in the list.

select *identifier* [**in** *word* ...] **;do** *list* **;done**
A **select** command prints on standard error (file descriptor 2), the set of words, each preceded by a number. If **in** *word* ... is omitted, then the positional parameters are used instead (see "Parameter substitution" below). The PS3 prompt is printed and a line is read from the standard input. If this line consists of the number of one of the listed words, then the value of the parameter *identifier* is set to the word corresponding to this number. If this line is empty the selection list is printed again. Otherwise the value of the parameter *identifier* is set to null. The contents of the line read from standard input is saved in the parameter **REPLY**. The list is executed for each selection until a break or end-of-file is encountered.

case *word* **in** [[**(**] *pattern* [| *pattern*] ... **)** *list* **;;**] ... **esac**
A **case** command executes the list associated with the first pattern that matches *word*. The form of the patterns is the same as that used for file-name generation (see "File name generation" below).

if *list* **;then** *list* [**elif** *list* **;then** *list*] ... [**;else** *list*] **;fi**
The list following **if** is executed and, if it returns a zero exit status, the list following the first **then** is executed. Otherwise, the list following **elif** is executed and, if its value is zero, the list following the next **then** is executed. Failing that, the **else** list is executed. If no **else** list or **then** list is executed, the **if** command returns a zero exit status.

while *list* **;do** *list* **;done**
until *list* **;do** *list* **;done**
A **while** command repeatedly executes the **while** list and, if the exit status of the last command in the list is zero, executes the **do** list; otherwise the loop terminates. If no commands in the **do** list are executed, then the **while** command returns a zero exit status; **until** may be used in place of **while** to negate the loop termination test.

(*list* **)**
Execute *list* in a separate environment. Note, that if two adjacent open parentheses are needed for nesting, a space must be inserted to avoid arithmetic evaluation as described below.

{ *list* **;}**
list is simply executed. Note that unlike the metacharacters "(" and ")", "{" and "}" are reserved words and must be at the beginning of a line or after a ";" in order to be recognized.

[[*expression* **]]**
Evaluates *expression* and returns a zero exit status when *expression* is true. See "Conditional expressions" below, for a description of *expression*.

function *identifier* **{** *list* **;}**
identifier **()** **{** *list* **;}**
Define a function which is referenced by *identifier*. The body of the function is the list of commands between "{" and "}". (See "Functions" below.)

time *pipeline*
The *pipeline* is executed and the elapsed time as well as the user and system time are printed on standard error.

The following reserved words are only recognized as the first word of a command and when not quoted:

if	**then**	**else**
elif	**fi**	**case**
esac	**for**	**while**
until	**do**	**done**
{ }	**function**	**select**
time	**[[ ]]**	

Comments

A word beginning with "#" causes that word and all the following characters up to a new-line to be ignored.

Aliasing

The first word of each command is replaced by the text of an alias if an alias for this word has been defined. An alias name consists of any number of characters excluding metacharacters, quoting characters, file expansion characters, command substitution characters, and the equals sign (=). The replacement string can contain any valid shell script including the metacharacters listed above. The first word of each command in the replaced text, other than any that are in the process of being replaced, will be tested for aliases. If the last character of the alias value is a *blank* then the word following the alias will also be checked for alias substitution. Aliases can be used to redefine special built in commands but cannot be used to redefine the reserved words listed above. Aliases can be created, listed, and exported with the **alias** command and can be removed with the **unalias** command. Exported aliases remain in effect for scripts invoked by name, but must be reinitialized for separate invocations of the shell (see "Invocation" below).

Aliasing is performed when scripts are read, not while they are executed. Therefore, for an alias to take effect the **alias** definition command has to be executed before the command which references the alias is read.

Aliases are frequently used as an abbreviation for full path names. An option to the aliasing facility allows the value of the alias to be automatically set to the full pathname of the corresponding command. These aliases are called *tracked* aliases. The value of a tracked alias is defined the first time the corresponding command is looked up and becomes undefined each time the **PATH** variable is reset. These aliases remain tracked so that the next subsequent reference will redefine the value. Several tracked aliases are compiled into the shell. The **-h** option of the **set** command makes each referenced command name into a tracked alias.

The following *exported* aliases are compiled into the shell but can be unset or redefined:

```
autoload='typeset -fu'
false='let 0'
functions='typeset -f'
hash='alias -t'
history='fc -l'
integer='typeset -i'
nohup='nohup<'
r='fc -e -'
true=':'
type='whence -v'
```

(The alias of **nohup** with a trailing space allows **nohup** to be used with aliases.)

Tilde substitution

After alias substitution is performed, each word is checked to see if it begins with an unquoted "~". If it does, then the word up to a "/" is checked to see if it matches a user name in the */etc/passwd* file. If a match is found, the "~" and the matched login name are replaced by the login directory of the matched user. This is called a *tilde substitution.* If no match is found, the original text is left unchanged. A "~" by itself, or in front of a "/", is replaced by the value of the **HOME** parameter. A "~" followed by a "+" or "-" is replaced by **$PWD** and **$OLDPWD** respectively.

In addition, tilde substitution is attempted when the value of a *variable assignment parameter* begins with a "~".

Command substitution

The standard output from a command enclosed in parentheses preceded by a dollar sign ($) or a pair of grave accents (``) may be used as part or all of a word; trailing new-lines are removed. In the second (archaic) form, the string between the quotes is processed for special quoting characters before the command is executed. (See "Quoting".) The command substitution **$(cat *file*)** can be replaced by the equivalent but faster **$(<*file*)**. Command substitution of most special commands that do not perform input/output redirection are carried out without creating a separate process.

An arithmetic expression enclosed in double parentheses preceded by a dollar sign (**$(( ))**) is replaced by the value of the arithmetic expression within the double parentheses.

Parameter substitution

A parameter is an ***identifier***, one or more digits, or any of the characters *, @, #, ?, -, $, and !. A *named* parameter (a parameter denoted by an identifier) has a value and zero or more attributes. Named parameters can be assigned values and attributes by using the **typeset** special command. The attributes supported by the shell are described later with the **typeset** special command. Exported parameters pass values and attributes to the environment.

The shell supports a one-dimensional array facility. An element of an array parameter is referenced by a *subscript*. A subscript is denoted by a "[", followed by an arithmetic expression (see "Arithmetic evaluation" below) followed by a "]". To assign values to an array, use **set -A** ***name value*** .... The value of all subscripts must be in the range of 0 through 1023. Arrays need not be declared. Any reference to a named parameter with a valid subscript is legal and an array will be created if necessary. Referencing an array without a subscript is equivalent to referencing the element zero.

The value of a named parameter may also be assigned by writing:

name = ***value*** [**name** = ***value***] ...

If the integer attribute, **-i**, is set for ***name*** the ***value*** is subject to arithmetic evaluation as described below.

Positional parameters, parameters denoted by a number, may be assigned values with the **set** special command. Parameter **$0** is set from argument zero when the shell is invoked.

The character "$" is used to introduce substitutable parameters.

${*parameter*}
The shell reads all the characters from "${" to the matching "}" as part of the same word even if it contains braces or metacharacters. The value, if any, of the parameter is substituted. The braces are required when ***parameter*** is followed by a letter, digit, or underscore that is not to be interpreted as part of its name or when a named parameter is subscripted. If ***parameter*** is one or more digits then it is a positional parameter. A positional parameter of more than one digit must be enclosed in braces. If ***parameter*** is "*" or "@", then all the positional parameters, starting with **$1**, are substituted (separated by a field separator character). If an array identifier with subscript "*" or "@" is used, then the value for each of the elements is substituted (separated by a field separator character).

${#*parameter*}
If ***parameter*** is "*" or "@", the number of positional parameters is substituted. Otherwise, the length of the value of the parameter is substituted.

${#*identifier*[*]}
The number of elements in the array identifier is substituted.

${*parameter*:-*word*}
If ***parameter*** is set and is non-null then substitute its value; otherwise substitute ***word***.

${*parameter*:=*word*}
If ***parameter*** is not set or is null then set it to ***word***; the value of the parameter is then substituted. Positional parameters may not be assigned to in this way.

${*parameter*:?*word*}
If ***parameter*** is set and is non-null then substitute its value; otherwise, print ***word*** and exit from the shell. If ***word*** is omitted then a standard message is printed.

${*parameter*:+*word*}
If ***parameter*** is set and is non-null then substitute ***word***; otherwise substitute nothing.

${*parameter*#*pattern*}
${*parameter*##*pattern*}
If the shell pattern matches the beginning of the value of ***parameter***, then the value of this substitution is the value of the parameter with the matched portion deleted; otherwise the value of this parameter is substituted. In the first form the smallest matching pattern is deleted and in the second form the largest matching pattern is deleted.

${*parameter*%*pattern*}
${*parameter*%%*pattern*}
If the shell pattern matches the end of the value of ***parameter***, then the value of this substitution is the value of the ***parameter*** with the matched part deleted; otherwise substitute the value of parameter. In the first form the smallest matching pattern is deleted and in the second form the largest matching pattern is deleted.

In the above, ***word*** is not evaluated unless it is to be used as the substituted string, so that, in the following example, **pwd** is executed only if **d** is not set or is null:

echo ${d:-$(pwd)}

If the colon (:) is omitted from the above expressions, then the shell only checks whether ***parameter*** is set or not.

The following parameters are automatically set by the shell:

#	The number of positional parameters in decimal.
-	Flags supplied to the shell on invocation or by the **set** command.
?	The decimal value returned by the last executed command.
$	The process number of this shell.
_	Initially, the value "_" is the absolute pathname of the shell or script being executed as passed in the environment. Subsequently it is assigned the last argument of the previous command. This parameter is not set for commands which are asynchronous. This parameter is also used to hold the name of the matching **MAIL** file when checking for mail.

!	The process number of the last background command invoked.
ERRNO	The value of **errno** as set by the most recent failed system call. This value is system dependent and is intended for debugging purposes.
LINENO	The line number of the current line within the script or function being executed.
OLDPWD	The previous working directory set by the **cd** command.
OPTARG	The value of the last option argument processed by the **getopts** special command.
OPTIND	The index of the last option argument processed by the **getopts** special command.
PPID	The process number of the parent of the shell.
PWD	The present working directory set by the **cd** command.
RANDOM	Each time this parameter is referenced, a random integer, uniformly distributed between 0 and 32767, is generated. The sequence of random numbers can be initialized by assigning a numeric value to **RANDOM**.
REPLY	This parameter is set by the **select** statement and by the **read** special command when no arguments are supplied.
SECONDS	Each time this parameter is referenced, the number of seconds since shell invocation is returned. If this parameter is assigned a value, then the value returned upon reference will be the value that was assigned plus the number of seconds since the assignment.

The following parameters are used by the shell:

CDPATH	The search path for the **cd** command.
COLUMNS	If this variable is set, the value is used to define the width of the edit window for the shell edit modes and for printing select lists.
EDITOR	If the value of this variable ends in **emacs**, **gmacs**, or **vi** and the **VISUAL** variable is not set, then the corresponding option (see "Special commands" -- **set** below) will be turned on.

ENV If this parameter is set, then parameter substitution is performed on the value to generate the pathname of the script that will be executed when the shell is invoked. (See "Invocation" below.) This file is typically used for alias and function definitions.

FCEDIT The default editor name for the **fc** command.

FPATH The search path for function definitions. This path is searched when a function with the **-u** attribute is referenced and when a command is not found. If an executable file is found, then it is read and executed in the current environment.

IFS Internal field separators, normally **space**, **tab**, and **new-line**, that are used to separate command words which result from command or parameter substitution, and for separating words with the special command **read**. The first character of the **IFS** parameter is used to separate arguments for the **$*** substitution. (See "Quoting" below.)

HISTFILE If this parameter is set when the shell is invoked, then the value is the pathname of the file that will be used to store the command history. (See "Command re-entry" below.)

HISTSIZE If this parameter is set when the shell is invoked, then the number of previously entered commands that are accessible by this shell will be greater than or equal to this number. The default is 128.

HOME The default argument (home directory) for the **cd** command.

LINES If this variable is set, the value is used to determine the column length for printing **select** lists. **select** lists will print vertically until about two-thirds of **LINES** lines are filled.

MAIL If this parameter is set to the name of a mail file and the **MAILPATH** parameter is not set, then the shell informs the user of arrival of mail in the specified file.

MAILCHECK
This variable specifies how often (in seconds) the shell will check for changes in the modification time of any of the files specified by the **MAILPATH** or **MAIL** parameters. The default value is 600 seconds. When the time has elapsed the shell will check before issuing the next prompt.

MAILPATH A colon (:) separated list of file names. If this parameter is set then the shell informs the user of any modifications to the specified files that have occurred within the last **MAILCHECK** seconds. Each file name can be followed by a "?" and a message that will be printed. The message will undergo parameter substitution with the parameter **$_** defined as the name of the file that has changed. The default message is

```
you have mail in $_.
```

PATH The search path for commands (see "Execution" below). The user may not change **PATH** if executing under **rksh** (except in *.profile*).

PS1 The value of this parameter is expanded for parameter substitution to define the primary prompt string which by default is "$ " (dollar-space). The character "!" in the primary prompt string is replaced by the command number (see "Command re-entry" below).

PS2 Secondary prompt string, by default "> ".

PS3 Selection prompt string used within a **select** loop, by default "**#?** ".

PS4 The value of this parameter is expanded for parameter substitution and precedes each line of an execution trace. If omitted, the execution trace prompt is "+ ".

SHELL The pathname of the shell is kept in the environment. At invocation, if the basename of this variable matches the pattern ***r*sh**, then the shell becomes restricted.

TMOUT If **TMOUT** is set to a value greater than zero, the shell will terminate if a command is not entered within the prescribed number of seconds after issuing the **PS1** prompt. (Note that the shell can be compiled with a maximum bound for this value which cannot be exceeded.)

VISUAL If the value of this variable ends in **emacs**, **gmacs**, or **vi**, then the corresponding option (see "Special commands" below) will be turned on.

The shell gives default values to **PATH**, **PS1**, **PS2**, **MAILCHECK**, **TMOUT** and **IFS**, while **HOME**, **SHELL**, **ENV**, and **MAIL** are not set at all by the shell (although **HOME**, **MAIL**, and **SHELL** are set by **login**(M)).

Blank interpretation

After parameter and command substitution, the results of substitutions are scanned for field separator characters (those found in **IFS**) and split into distinct arguments where such characters are found.

Explicit null arguments ("" or ´´) are retained. Implicit null arguments (those resulting from parameters that have no values) are removed.

File name generation

Following substitution, each command word is scanned for the characters *, ?, and [unless the **-f** option has been set. If one of these characters appears then the word is regarded as a pattern. The word is replaced with lexicographically sorted file names that match the pattern. If no file name is found that matches the pattern, then the word is left unchanged. When a pattern is used for file name generation, the character "." at the start of a file name or immediately following a "/", as well as the character "/" itself, must be matched explicitly. In other instances of pattern matching the "/" and "." are not treated specially.

*	Matches any string, including the null string.
?	Matches any single character.
[...]	Matches any one of the enclosed characters. A pair of characters separated by "-" matches any character lexically between the pair, inclusive. If the first character following the opening "[" is a "! " then any character not enclosed is matched. A "-" can be included in the character set by putting it as the first or last character.

A ***pattern-list*** is a list of one or more patterns separated from each other with a "|". Composite patterns can be formed with one or more of the following:

?(*pattern-list*)	Optionally matches any one of the given patterns.
***(*pattern-list*)**	Matches zero or more occurrences of the given patterns.
+(*pattern-list*)	Matches one or more occurrences of the given patterns.
@(*pattern-list*)	Matches exactly one of the given patterns.
!(*pattern-list*)	Matches anything, except one of the given patterns.

Quoting

Each of the specified metacharacters (See "Definitions" above) has a special meaning to the shell and causes termination of a word unless quoted. A character may be quoted (that is, made to stand for itself) by preceding it with a backslash (\). The pair "\⟨Enter⟩" is ignored. All characters enclosed between a pair of single quote marks (´ ´) are quoted. A single quote cannot appear within single quotes. Inside double quote marks (""), parameter and command substitution occur and "\" quotes the characters \, ´, " and $. The meaning of $* and $@ is identical when not quoted or when used as a parameter assignment value or as a file name. However, when used as a command argument, $* is equivalent to "**$1*d*$2*d*...**", where ***d*** is the first character of the **IFS** parameter, whereas $@ is equivalent to "$1" "$2".... Inside grave quote marks (` `) \ quotes the characters \, `, and $. If the grave quotes occur within double quotes then \ also quotes the character ".

The special meaning of reserved words or aliases can be removed by quoting any character of the reserved word. The recognition of function names or special command names listed below cannot be altered by quoting them.

Arithmetic evaluation

An ability to perform integer arithmetic is provided with the special command **let**. Evaluations are performed using long arithmetic. Constants are of the form [***base*#**]***n*** where ***base*** is a decimal number between two and thirty-six representing the arithmetic base and ***n*** is a number in that base. If ***base*** is omitted then base 10 is used.

An arithmetic expression uses the syntax, precedence, and associativity of expression of the C language. All the integral operators, other than **++**, **--**, **?:**, and comma (,) are supported. Named parameters can be referenced by name within an arithmetic expression without using the parameter substitution syntax. When a named parameter is referenced, its value is evaluated as an arithmetic expression.

An internal integer representation of a named parameter can be specified with the **-i** option of the **typeset** special command. Arithmetic evaluation is performed on the value of each assignment to a named parameter with the **-i** attribute. If you do not specify an arithmetic base, the first assignment to the parameter determines the arithmetic base. This base is used when parameter substitution occurs.

Since many of the arithmetic operators require quoting, an alternative form of the **let** command is provided. For any command which begins with a **((**, all the characters until a matching **))** are treated as a quoted expression. More precisely, **((...))** is equivalent to **let "..."**.

Prompting

When used interactively, the shell prompts with the value of **PS1** before reading a command. If at any time a new-line is typed and further input is needed to complete a command, then the secondary prompt (that is, the value of **PS2**) is issued.

Conditional expressions

A conditional expression is used with the **[[** compound command to test attributes of files and to compare strings. Word splitting and file name generation are not performed on the words between **[[** and **]]**. Each expression can be constructed from one or more of the following unary or binary expressions:

-a *file*	True, if *file* exists.
-b *file*	True, if *file* exists and is a block special file.
-c *file*	True, if *file* exists and is a character special file.
-d *file*	True, if *file* exists and is a directory.
-f *file*	True, if *file* exists and is an ordinary file.
-g *file*	True, if *file* exists and is has its **setgid** bit set.
-k *file*	True, if *file* exists and is has its **sticky** bit set.
-n *string*	True, if length of *string* is non-zero.
-o *option*	True, if option named *option* is on.
-p *file*	True, if *file* exists and is a fifo special file or a pipe.
-r *file*	True, if *file* exists and is readable by current process.
-s *file*	True, if *file* exists and has size greater than zero.
-t *fildes*	True, if file descriptor number *fildes* is open and associated with a terminal device.
-u *file*	True, if *file* exists and is has its **setuid** bit set.
-w *file*	True, if *file* exists and is writable by current process.
-x *file*	True, if *file* exists and is executable by current process. If *file* exists and is a directory, then the current process has permission to search in the directory.
-z *string*	True, if length of *string* is zero.

-L *file*	True, if *file* exists and is a symbolic link.
-O *file*	True, if *file* exists and is owned by the effective user id of this process.
-G *file*	True, if *file* exists and its group matches the effective group id of this process.
file1 **-nt** *file2*	True, if *file1* exists and is newer than *file2*.
file1 **-ot** *file2*	True, if *file1* exists and is older than *file2*.
file1 **-ef** *file2*	True, if *file1* and *file2* exist and refer to the same file.
string **=** *pattern*	True, if *string* matches *pattern*.
string **!=** *pattern*	True, if *string* does not match *pattern*.
string1 **<** *string2*	True, if *string1* comes before *string2* based on ASCII value of their characters.
string1 **>** *string2*	True, if *string1* comes after *string2* based on ASCII value of their characters.
exp1 **-eq** *exp2*	True, if *exp1* is equal to *exp2*.
exp1 **-ne** *exp2*	True, if *exp1* is not equal to *exp2*.
exp1 **-lt** *exp2*	True, if *exp1* is less than *exp2*.
exp1 **-gt** *exp2*	True, if *exp1* is greater than *exp2*.
exp1 **-le** *exp2*	True, if *exp1* is less than or equal to *exp2*.
exp1 **-ge** *exp2*	True, if *exp1* is greater than or equal to *exp2*.

In each of the above expressions, if *file* is of the form */dev/fd/n*, where *n* is an integer, then the test is applied to the open file whose descriptor number is *n*.

A compound expression can be constructed from these primitives by using any of the following, listed in decreasing order of precedence.

(*expression***)**	True, if *expression* is true. Used to group expressions.
! *expression*	True if *expression* is false.
expression1 **&&** *expression2*	True, if *expression1* and *expression2* are both true.
expression1 **||** *expression2*	True, if either *expression1* or *expression2* is true.

Spelling checker

By default, the shell checks spelling whenever you use **cd** to change directories. For example, if you change to a different directory using **cd** and misspell the directory name, the shell responds with an alternative spelling of an existing directory. Enter "y" and press ⟨Return⟩ (or just press ⟨Return⟩) to change to the offered directory. If the offered spelling is incorrect, enter "n", then retype the command line. In this example the user input is boldfaced:

```
# cd /usr/spol/uucp
/usr/spool/uucp? y
ok
```

The spell check feature is controlled by the **CDSPELL** environment variable. The default value of **CDSPELL** is set to the string "cdspell" whenever a **ksh** session is run. A user can change it to any value, including the null string, but the value is immaterial: if **CDSPELL** is set to any value, the spell check feature is engaged.

To disable the spelling checker, enter the following at the **ksh** prompt :

unset CDSPELL

When the user does a **set** at the **ksh** prompt, **CDSPELL** is not listed if the **unset** was successful.

Input/Output

Before a command is executed, its input and output may be redirected using a special notation interpreted by the shell. The following may appear anywhere in a simple-command or may precede or follow a command, and are not passed on to the invoked command. Command and parameter substitution occurs before ***word*** or ***digit*** is used, except as noted below. File name generation occurs only if the pattern matches a single file and blank interpretation is not performed.

<word	Use file ***word*** as standard input (file descriptor 0).
>word	Use file ***word*** as standard output (file descriptor 1). If the file does not exist then it is created. If the file exists, and the **noclobber** option is on, this causes an error; otherwise, it is truncated to zero length.
>|word	Same as **>**, except that it overrides the **noclobber** option.
>>word	Use file ***word*** as standard output. If the file exists then output is appended to it (by first seeking to the end-of-file); otherwise, the file is created.
<>word	Open file ***word*** for reading and writing as standard input.

<<[-]*word* The shell input is read up to a line that is the same as ***word***, or to an end-of-file. No parameter substitution, command substitution or file name generation is performed on ***word***. The resulting document, called a *here-document*, becomes the standard input. If any character of ***word*** is quoted, then no interpretation is placed upon the characters of the document; otherwise, parameter and command substitution occurs, **\new-line** is ignored, and "\" must be used to quote the characters \, $, `, and the first character of ***word***. If "-" is appended to **<<**, then all leading tabs are stripped from ***word*** and from the document.

<&*digit* The standard input is duplicated from file descriptor ***digit*** (see **dup**(S)). Similarly for the standard output using **>&*digit***.

<&- The standard input is closed. Similarly for the standard output using **>&-**.

<&p The input from the co-process is moved to standard input.

>&p The output to the co-process is moved to standard output.

If one of the above is preceded by a digit, then the file descriptor number referred to is that specified by the digit (instead of the default 0 or 1). For example:

... 2>&1

means file descriptor 2 is to be opened for writing as a duplicate of file descriptor 1.

File descriptor 0 is standard input; 1 is standard output; 2 is standard error.

The order in which redirections are specified is significant. The shell evaluates each redirection in terms of the file descriptor, file association at the time of evaluation. For example:

... 1>*fname* 2>&1

first associates file descriptor 1 with file *fname*. It then associates file descriptor 2 with the file associated with file descriptor 1 (that is, *fname*). If the order of redirections were reversed, file descriptor 2 would be associated with the terminal (assuming this was the initial state of file descriptor 1) and then file descriptor 1 would be associated with file *fname*.

If a command is followed by "&" and job control is not active, then the default standard input for the command is the empty file */dev/null*. Otherwise, the environment for the execution of a command contains the file descriptors of the invoking shell as modified by input/output specifications.

Environment

The environment (see **environ**(M)) is a list of name-value pairs that is passed to an executing process in the same way as a normal argument list. The names must be identifiers and the values are character strings. The shell interacts with the environment in several ways. On invocation, the shell scans the environment and creates a parameter for each name found, giving it the corresponding value and marking it *export*. Executed commands inherit the environment. If the user modifies the values of these parameters or creates new ones, using the **export** or **typeset-x** commands they become part of the environment. The environment seen by any executed command is thus composed of any name-value pairs originally inherited by the shell, whose values may be modified by the current shell, plus any additions which must be noted in **export** or **typeset-x** commands.

The environment for any simple-command or function may be augmented by prefixing it with one or more parameter assignments. A parameter assignment argument is a word of the form ***identifier=value***. Thus:

TERM=wy60 ***cmd args***

and

(export TERM; TERM=wy60; ***cmd args*****)**

are equivalent (as far as the above execution of ***cmd*** is concerned, except for commands listed with one or two daggers (†) in the "Special commands" section).

If the **-k** flag is set, all parameter assignment arguments are placed in the environment, even if they occur after the command name. The following first prints `a=b c` and then `c`:

```
echo a=b c
set -k
echo a=b c
```

This feature is intended for use with scripts written for early versions of the shell and its use in new scripts is strongly discouraged. It is likely to disappear in the future.

Functions

The **function** reserved word, described in the "Commands" section above, is used to define shell functions. Shell functions are read in and stored internally. Alias names are resolved when the function is read. Functions are executed like commands with the arguments passed as positional parameters. (See "Execution" below.)

Functions execute in the same process as the caller and share all files and the present working directory with the caller. Traps caught by the caller are reset to their default action inside the function. A trap condition that is not caught or ignored by the function causes the function to terminate and the condition to be passed on to the caller. A trap on **EXIT** set inside a function is executed after the function completes in the environment of the caller. Ordinarily, variables are shared between the calling program and the function. However, the **typeset** special command used within a function defines local variables whose scope includes the current function and all functions it calls.

The special command **return** is used to return from function calls. Errors within functions return control to the caller.

Function identifiers can be listed with the **-f** or **+f** option of the **typeset** special command. The text of functions will also be listed with **-f**. Function can be undefined with the **-f** option of the **unset** special command.

Ordinarily, functions are unset when the shell executes a shell script. The **-xf** option of the **typeset** command allows a function to be exported to scripts that are executed without a separate invocation of the shell. Functions that need to be defined across separate invocations of the shell should be specified in the **ENV** file with the **-xf** option of **typeset**.

Jobs

If the **monitor** option of the **set** command is turned on, an interactive shell associates a "job" with each pipeline. It keeps a table of current jobs, printed by the **jobs** command, and assigns them small integer numbers. When a job is started asynchronously with "&", the shell prints a line which looks like:

```
[1] 1234
```

indicating that the job which was started asynchronously was job number 1 and had one (top-level) process, whose process id was 1234.

If you are running a job and wish to do something else you may hit the key **^Z** (control-Z) which sends a **STOP** signal to the current job. (This is known as the suspend character, and is ^Z by default; this can be changed in the **stty susp** line in a user's *.profile* file.) The shell will then normally indicate that the job has been 'Stopped', and print another prompt. You can then manipulate the state of this job, putting it in the background with the **bg** command, or run some other commands and then eventually bring the job back into the foreground with the foreground command **fg**. A **^Z** takes effect immediately and is like an interrupt in that pending output and unread input are discarded when it is typed.

A job being run in the background will stop if it tries to read from the terminal. Background jobs are normally allowed to produce output, but this can be disabled by giving the command "stty tostop". If you set this tty option, then background jobs will stop when they try to produce output like they do when they try to read input.

There are several ways to refer to jobs in the shell. A job can be referred to by the process id of any process of the job or by one of the following:

%number	The job with the given number.
%string	Any job whose command line begins with *string*.
%?string	Any job whose command line contains *string*.
%%	Current job.
%+	Equivalent to %%.
%-	Previous job.

The shell learns immediately whenever a process changes state. It normally informs you whenever a job becomes blocked so that no further progress is possible, but only just before it prints a prompt. This is done so that it does not otherwise disturb your work.

When the monitor mode is on, each background job that completes triggers any trap set for **CHLD**.

When you try to leave the shell while jobs are running or stopped, you will be warned that 'You have stopped(running) jobs'. You may use the **jobs** command to see what they are. If you do this or immediately try to exit again, the shell will not warn you a second time, and the stopped jobs will be terminated.

Signals

The **INT** and **QUIT** signals for an invoked command are ignored if the command is followed by "&" and the job **monitor** option is not active. Otherwise, signals have the values inherited by the shell from its parent (but see also the **trap** command below).

Execution

Each time a command is executed, the above substitutions are carried out. If the command name matches one of the "Special Commands" listed below, it is executed within the current shell process. Next, the command name is checked to see if it matches one of the user defined functions. If it does, the positional parameters are saved and then reset to the arguments of the function call. When the function completes or issues a return, the positional parameter list is restored and any trap set on **EXIT** within the function is executed. The value of a function is the value of the last command executed. A function is also executed in the current shell process. If a command name is not a special command or a user defined function, a process is created and an attempt is made to execute the command via **exec**(S).

The shell parameter **PATH** defines the search path for the directory containing the command. Alternative directory names are separated by a colon (:). The default path is */bin:/usr/bin:* (specifying */bin*, */usr/bin*, and the current directory in that order). The current directory can be specified by two or more adjacent colons, or by a colon at the beginning or end of the path list. If the command name contains a " / " then the search path is not used. Otherwise, each directory in the path is searched for an executable file. If the file has execute permission but is not a directory or an *a.out* file, it is assumed to be a file containing shell commands. A sub-shell is spawned to read it. All non-exported aliases, functions, and named parameters are removed in this case. If the shell command file doesn't have read permission, or if the **setuid** and/or **setgid** bits are set on the file, then the shell executes an agent whose job it is to set up the permissions and execute the shell with the shell command file passed down as an open file. A parenthesized command is executed in a sub-shell without removing non-exported quantities.

Command re-entry

The text of the last **HISTSIZE** (default 128) commands entered from a terminal device is saved in a history file. The file **$HOME**/*.sh_history* is used if the **HISTFILE** variable is not set or is not writable. A shell can access the commands of all interactive shells which use the same named **HISTFILE**. The special command **fc** is used to list or edit a portion of this file. The portion of the file to be edited or listed can be selected by number or by giving the first character or characters of the command. A single command or range of commands can be specified. If you do not specify an editor program as an argument to **fc** then the value of the parameter **FCEDIT** is used. If **FCEDIT** is not defined then */bin/ed* is used. The edited command(s) is printed and re-executed upon leaving the editor. The editor name "-" is used to skip the editing phase and to re-execute the command. In this case a substitution parameter of the form ***old=new*** can be used to modify the command before execution. For example, if **r** is aliased to '**fc -e -**' then typing **r bad=good c** will re-execute the most recent command which starts with the letter "c", replacing the first occurrence of the string **bad** with the string **good**.

In-line editing options

Normally, each command line entered from a terminal device is simply typed followed by a new-line (**RETURN** or **LINE FEED**). If the **emacs**, **gmacs**, or **vi** option is active, the user can edit the command line. To be in one of these edit modes **set** the corresponding option. An editing option is automatically selected each time the **VISUAL** or **EDITOR** variable is assigned a value ending in either of these option names.

The editing features require that the user's terminal accept **RETURN** as carriage return without line feed and that a space (' ') must overwrite the current character on the screen. ADM terminal users should set the "space - advance" switch to 'space'. Hewlett-Packard series 2621 terminal users should set the straps to 'bc̈GHxZ etX'.

The editing modes implement a concept where the user is looking through a window at the current line. The window width is the value of **COLUMNS** if it is defined, otherwise 80. If the line is longer than the window width minus two, a mark is displayed at the end of the window to notify the user. As the cursor moves and reaches the window boundaries the window will be centered about the cursor. The mark is a "**>**" (**<**, ***) if the line extends on the right (left, both) side(s) of the window.

The search commands in each edit mode provide access to the history file. Only strings are matched, not patterns, although a leading "**^**" in the string restricts the match to begin at the first character in the line.

Emacs editing mode

This mode is entered by enabling either the **emacs** or **gmacs** option. The only difference between these two modes is the way they handle **^T**. To edit, the user moves the cursor to the point needing correction and then inserts or deletes characters or words as needed. All the editing commands are control characters or escape sequences. The notation for control characters is caret (**^**) followed by the character. For example, **^F** is the notation for control **F**. This is entered by depressing 'f' while holding down the ⟨Ctrl⟩ (control) key. The ⟨Shift⟩ key is *not* depressed. (The notation **^?** indicates the ⟨Del⟩ (delete) key.)

The notation for escape sequences is **M-** followed by a character. For example, **M-f** (pronounced Meta f) is entered by depressing ⟨Esc⟩ (ASCII **033**) followed by 'f'. (**M-F** would be the notation for ⟨Esc⟩ followed by ⟨Shift⟩ (capital) 'F'.)

All edit commands operate from any place on the line (not just at the beginning). Neither the ⟨Return⟩ nor the **LINE FEED** key is entered after edit commands except when noted.

^F Move cursor forward (right) one character.

M-f Move cursor forward one word. (The emacs editor's idea of a word is a string of characters consisting of only letters, digits and underscores.)

^B Move cursor backward (left) one character.

M-b Move cursor backward one word.

^A Move cursor to start of line.

^E Move cursor to end of line.

^]*char* Move cursor forward to character ***char*** on current line.

M-^]*char* Move cursor back to character ***char*** on current line.

^X^X Interchange the cursor and mark.

erase (User defined erase character as defined by the **stty**(C) command, usually **^H** or **#**.) Delete previous character.

^D Delete current character.

M-d Delete current word.

M-^H (Meta-backspace) Delete previous word.

M-h Delete previous word.

M-^? (Meta-DEL) Delete previous word (if your interrupt character is **^?** (DEL, the default) then this command will not work).

^T Transpose current character with next character in **emacs** mode. Transpose two previous characters in **gmacs** mode.

^C Capitalize current character.

M-c Capitalize current word.

M-l Change the current word to lower case.

^K Delete from the cursor to the end of the line. If preceded by a numerical parameter whose value is less than the current cursor position, then delete from given position up to the cursor. If preceded by a numerical parameter whose value is greater than the current cursor position, then delete from cursor up to given cursor position.

^W Kill from the cursor to the mark.

M-p Push the region from the cursor to the mark on the stack.

kill (User defined kill character as defined by the **stty** command, usually **^U** or **@**.) Kill the entire current line. If two **kill** characters are entered in succession, all kill characters from then on cause a line feed (useful when using paper terminals).

^Y Restore last item removed from line. (Yank item back to the line.)

^L Line feed and print current line.

^@ (Null character) Set mark.

M-*space* (Meta space) Set mark.

^J (New line) Execute the current line.

^M (Return) Execute the current line.

eof End-of-file character, normally **^D**, is processed as an End-of-file only if the current line is null.

^P Fetch previous command. Each time **^P** is entered the previous command back in time is accessed. Moves back one line when not on the first line of a multi-line command.

M-< Fetch the least recent (oldest) history line.

M-> Fetch the most recent (youngest) history line.

^N Fetch next command line. Each time **^N** is entered the next command line forward in time is accessed.

^R*string* Reverse search history for a previous command line containing ***string***. If a parameter of zero is given, the search is forward. ***string*** is terminated by a **RETURN** or **NEW LINE**. If ***string*** is preceded by a "**^**", the matched line must begin with ***string***. If ***string*** is omitted, then the next command line containing the most recent ***string*** is accessed. In this case a parameter of zero reverses the direction of the search.

^O Operate - Execute the current line and fetch the next line relative to current line from the history file.

M-*digits* (Escape) Define numeric parameter, the digits are taken as a parameter to the next command. The commands that accept a parameter are **^F, ^B, erase, ^C, ^D, ^K, ^R, ^P, ^N, ^], M-., M-^], M-_, M-b, M-c, M-d, M-f, M-h, M-l** and **M-^H**.

M-*letter* Soft-key - Your alias list is searched for an alias by the name ***_letter*** and if an alias of this name is defined, its value will be inserted on the input queue. The ***letter*** must not be one of the above meta-functions.

M-]*letter* Soft-key - Your alias list is searched for an alias by the name ***__letter*** (two underscores precede ***letter***) and if an alias of this name is defined, its value will be inserted on the input queue. This can be used to program function keys on many terminals.

M-. The last word of the previous command is inserted on the line. If preceded by a numeric parameter, the value of this parameter determines which word to insert rather than the last word.

M-_ Same as **M-.**.

M-* Attempt file name generation on the current word. An asterisk is appended if the word doesn't match any file or contain any special pattern characters.

M-ESC File name completion. The current word is treated as a root to which an asterisk is appended. A search is conducted for files matching the current word. The first match found then replaces the current word. Subsequent matches are obtained by repeating the **M-ESC** keystroke. If the match is both unique and a directory, a " / " is appended to it. If it is unique but not a directory, a space is appended to it.

M-= List files matching current word pattern if an asterisk were appended.

^U Multiply parameter of next command by 4.

**** Escape next character. Editing characters, the user's **erase**, **kill** and **interrupt** (normally **^?**) characters may be entered in a command line or in a search string if preceded by a " \ ". The " \ " removes the next character's editing features (if any).

^V Display version of the shell.

M-# Insert a " #" at the beginning of the line and execute it. This causes a comment to be inserted in the history file.

Vi editing mode

There are two typing modes. Initially, when you enter a command you are in the **input** mode. To edit, the user enters **control** mode by typing ⟨Esc⟩ (**033**) and moves the cursor to the point needing correction and then inserts or deletes characters or words as needed. Most control commands accept an optional repeat count prior to the command.

When in **vi** mode on most systems, canonical processing is initially enabled and the command will be echoed again if the speed is 1200 baud or greater and it contains any control characters or less than one second has elapsed since the prompt was printed. The ⟨Esc⟩ character terminates canonical processing for the remainder of the command and the user can then modify the command line. This scheme has the advantages of canonical processing with the type-ahead echoing of raw mode.

If the option **viraw** is also set, the terminal will always have canonical processing disabled. This may be helpful for certain terminals.

input edit commands

By default the editor is in input mode.

erase (User defined erase character as defined by the **stty** command, usually **^H** or **#**.) Delete previous character.

^W Delete the previous blank separated word.

^D Terminate the shell.

^V Escape next character. Editing characters, the user's erase or kill characters may be entered in a command line or in a search string if preceded by a **^V**. The **^V** removes the next character's editing features (if any).

**** Escape the next **erase** or **kill** character.

motion edit commands

These commands will move the cursor.

[*count*]l Cursor forward (right) one character.

[*count*]w Cursor forward one alpha-numeric word.

[*count*]W Cursor to the beginning of the next word that follows a blank.

[*count*]e Cursor to end of word.

[*count*]E Cursor to end of the current blank delimited word.

[*count*]h Cursor backward (left) one character.

[*count*]b Cursor backward one word.

[*count*]B Cursor to preceding blank separated word.

[*count*]| Cursor to column ***count***.

[*count*]f*c* Find the next character ***c*** in the current line.

[*count*]F*c* Find the previous character ***c*** in the current line.

[*count*]t*c* Equivalent to **f** followed by **h**.

[*count*]T*c* Equivalent to **F** followed by **l**.

[*count*]; Repeats ***count*** times, the last single character find command, **f**, **F**, **t**, or **T**.

[*count*], Reverses the last single character find command ***count*** times.

0 Cursor to start of line.

^ Cursor to first non-blank character in line.

$ Cursor to end of line.

search edit commands

These commands access your command history.

[*count*]**k** Fetch previous command. Each time **k** is entered the previous command back in time is accessed.

[*count*]**-** Equivalent to **k**.

[*count*]**j** Fetch next command. Each time **j** is entered the next command forward in time is accessed.

[*count*]**+** Equivalent to **j**.

[*count*]**G** The command number *count* is fetched. The default is the least recent history command.

/string Search backward through history for a previous command containing *string*. *string* is terminated by a **RETURN** or **NEW LINE**. If *string* is preceded by a "^", the matched line must begin with *string*. If *string* is null the previous string will be used.

?string Same as " / " except that search will be in the forward direction.

n Search for next match of the last pattern to " / " or " ? " commands.

N Search for next match of the last pattern to " / " or " ? ", but in reverse direction. Search history for the *string* entered by the previous " / " command.

text modification edit commands

These commands will modify the line.

a Enter input mode and enter text after the current character.

A Append text to the end of the line. Equivalent to **$a**.

[*count*]**c***motion*
c[*count*]*motion*
Delete current character through the character that *motion* would move the cursor to and enter input mode. If *motion* is " c ", the entire line will be deleted and input mode entered.

C Delete the current character through the end of line and enter input mode. Equivalent to **c$**.

S Equivalent to **cc**.

D Delete the current character through the end of line. Equivalent to **d$**.

[*count*]d*motion*
d[*count*]*motion*
: Delete current character through the character that ***motion*** would move to. If ***motion*** is "d", the entire line will be deleted.

i : Enter input mode and insert text before the current character.

I : Insert text before the beginning of the line. Equivalent to **0i**.

[*count*]**P** : Place the previous text modification before the cursor.

[*count*]**p** : Place the previous text modification after the cursor.

R : Enter input mode and replace characters on the screen with characters you type overlay fashion.

[*count*]**r***c* : Replace the ***count*** character(s) starting at the current cursor position with *c*, and advance the cursor.

[*count*]**x** : Delete current character.

[*count*]**X** : Delete preceding character.

[*count*]**.** : Repeat the previous text modification command.

[*count*]**~** : Invert the case of the ***count*** character(s) starting at the current cursor position and advance the cursor.

[*count*]**_** : Causes the ***count*** word of the previous command to be appended and input mode entered. The last word is used if ***count*** is omitted.

***** : Causes a "*" to be appended to the current word and file name generation attempted. If no match is found, it rings the bell. Otherwise, the word is replaced by the matching pattern and input mode is entered.

**** : Filename completion. Replaces the current word with the longest common prefix of all filenames matching the current word with an asterisk appended. If the match is unique, a "/" is appended if the file is a directory and a space is appended if the file is not a directory.

other edit commands

Miscellaneous commands.

[*count*]y*motion*
y[*count*]*motion*
: Yank current character through character that ***motion*** would move the cursor to and puts them into the delete buffer. The text and cursor are unchanged.

Y	Yanks from current position to end of line. Equivalent to **y$**.
u	Undo the last text modifying command.
U	Undo all the text modifying commands performed on the line.
[*count*]**v**	Returns the command **fc -e ${VISUAL:-${EDITOR:-vi}}** ***count*** in the input buffer. If ***count*** is omitted, then the current line is used.
^L	Line feed and print current line. Has effect only in control mode.
^J	(New line) Execute the current line, regardless of mode.
^M	(Return) Execute the current line, regardless of mode.
#	Sends the line after inserting a "**#**" in front of the line. Useful for causing the current line to be inserted in the history without being executed.
=	List the file names that match the current word if an asterisk were appended to it.
@letter	Your alias list is searched for an alias by the name ***_letter*** and if an alias of this name is defined, its value will be inserted on the input queue for processing.

Special commands

The following simple-commands are executed in the shell process. Input/Output redirection is permitted. Unless otherwise indicated, the output is written on file descriptor 1 and the exit status, when there is no syntax error, is zero. Commands that are preceded by one or two †'s are treated specially in the following ways:

1. Parameter assignment lists preceding the command remain in effect when the command completes.
2. I/O redirections are processed after parameter assignments.
3. Errors cause a script that contains them to abort.
4. Words, following a command preceded by †† that are in the format of a parameter assignment, are expanded with the same rules as a parameter assignment. This means that tilde substitution is performed after the "**=**" sign and word splitting and file name generation are not performed.

†**:** [***arg*** **...**]
The command only expands parameters.

† . *file* [*arg*...]
Read the complete file then execute the commands. The syntax for this is dot-space-file followed by optional arguments. The commands are executed in the current shell environment. The search path specified by **PATH** is used to find the directory containing *file*. If any arguments *arg* are given, they become the positional parameters. Otherwise the positional parameters are unchanged. The exit status is the exit status of the last command executed.

†† **alias** [**-tx**] [*name* [=*value*]]...
alias with no arguments prints the list of aliases in the form *name=value* on standard output. An alias is defined for each name whose value is given. A trailing space in value causes the next word to be checked for alias substitution. The **-t** flag is used to set and list tracked aliases. The value of a tracked alias is the full pathname corresponding to the given name. The value becomes undefined when the value of **PATH** is reset but the aliases remained tracked. Without the **-t** flag, for each name in the argument list for which no value is given, the name and value of the alias is printed. The **-x** flag is used to set or print exported aliases. An exported alias is defined for scripts invoked by name. The exit status is non-zero if a name is given, but no value, for which no alias has been defined.

bg [*job*...]
This command is only on systems that support job control. Puts each specified job into the background. The current job is put in the background if job is not specified. See "Jobs" for a description of the format of job.

† **break** [*n*]
Exit from the enclosing **for**, **while**, **until**, or **select** loop, if any. If *n* is specified then break *n* levels.

† **continue** [*n*]
Resume the next iteration of the enclosing **for**, **while**, **until**, or **select** loop. If *n* is specified then resume at the *n*-th enclosing loop.

cd [**-LP**] [*arg*]
cd [**-LP**] *old new*
This command can be in either of two forms. In the first form it changes the current directory to *arg*. If *arg* is "-" the directory is changed to the previous directory. If no *arg* is specified, the shell parameter **HOME** is used as a default *arg*. The parameter **PWD** is set to the current directory. The shell parameter **CDPATH** defines the search path for the directory containing *arg*. Alternative directory names are separated by a colon (:). The default path is **<null>** (specifying the current directory). Note that the current directory is specified by a null path name, which can appear immediately after the equal sign or between the colon delimiters anywhere else in the path list. If *arg* begins with a "/" then the search path is not used. Otherwise, each directory in the path is searched for *arg*.

The second form of **cd** substitutes the string *new* for the string *old* in the current directory name, **PWD**, and tries to change to this new directory.

The **-L** and **-P** flags are relevant to systems with symbolic links. The default, **-L**, preserves logical naming, so that **cd -L ..** will move up one component towards the root. The physical option, **-P**, uses a physical model for paths. Thus, if */usr/include/sys* is a symbolic link to the directory */sys/h*, then after **cd /usr/include/sys**, a **cd ..** would make the current directory */usr/include*, while a **cd -P ..** would make it *sys*.

The **cd** command may not be executed by **rksh**.

echo [*arg* ...]
See **echo**(C) for usage and description.

† **eval** [*arg* ...]
The arguments are read as input to the shell and the resulting command(s) executed.

† **exec** [*arg* ...]
If *arg* is given, the command specified by the arguments is executed in place of this shell without creating a new process. Input/output arguments may appear and affect the current process. If no arguments are given the effect of this command is to modify file descriptors as prescribed by the input/output redirection list. In this case, any file descriptor numbers greater than 2 that are opened with this mechanism are closed when invoking another program.

† **exit** [*n*]
Causes the shell to exit with the exit status specified by *n*. If *n* is omitted then the exit status is that of the last command executed. An end-of-file will also cause the shell to exit except for a shell which has the **ignoreeof** option (see "set" below) turned on.

†† **export** [*name* [= *value*]] ...
The given names are marked for automatic export to the environment of subsequently-executed commands.

fc [**-e** *ename*] [**-nlr**] [*first* [*last*]]
fc -e - [*old=new*] [*command*]
In the first form, a range of commands from *first* to *last* is selected from the last **HISTSIZE** commands that were typed at the terminal. The arguments first and last may be specified as a number or as a string. A string is used to locate the most recent command that starts with that string. A negative number is used as an offset to the current command number. If the flag **-l**, is selected, the commands are listed on standard output. Otherwise, the editor program *ename* is invoked on a file containing these keyboard commands. If *ename* is not supplied, then the value of the parameter **FCEDIT** (default /bin/ed) is used as the editor. When editing is complete, the edited command(s) is executed. If *last* is not specified then it will be set to *first*. If *first* is not specified the default is the previous command for editing and **-16** for listing. The flag **-r** reverses the order of the commands and the flag **-n** suppresses command numbers when listing. In the second form the command is re-executed after the substitution *old=new* is performed.

fg [*job*...]
This command is only on systems that support job control. Each job specified is brought to the foreground. Otherwise, the current job is brought into the foreground. See "Jobs" for a description of the format of *job*.

getopts *optstring name* [*arg*...]
Checks *arg* for legal options. If *arg* is omitted, the positional parameters are used. An option argument begins with a "+" or a "-". An option not beginning with "+" or "-" or the special argument "--" ends the options. *optstring* contains the letters that **getopts** recognizes. If a letter is followed by a ":", that option is expected to have an argument. The options can be separated from the argument by blanks.

getopts places the next option letter it finds inside variable *name* each time it is invoked with a "+" prepended when *arg* begins with a "+". The index of the next *arg* is stored in **OPTIND**. The option argument, if any, gets stored in **OPTARG**.

A leading ":" in *optstring* causes **getopts** to store the letter of an invalid option in **OPTARG**, and to set *name* to "?" for an unknown option and to ":" when a required option is missing. Otherwise, **getopts** prints an error message. The exit status is non-zero when there are no more options.

jobs [**-lnp**] [*job*...]
Lists information about each given job, or all active jobs if *job* is omitted. The **-l** flag lists process ids in addition to the normal information. The **-n** flag only displays jobs that have stopped or exited since last notified. The **-p** flag causes only the process group to be listed. See "Jobs" for a description of the format of *job*.

kill [*-sig*] *job*...
kill -l
Sends either the **TERM** (terminate) signal or the specified signal to the specified jobs or processes. Signals are either given by number or by names (as given in */usr/include/signal.h*, stripped of the prefix "SIG"). If the signal being sent is **TERM** (terminate) or **HUP** (hangup), then the job or process will be sent a **CONT** (continue) signal if it is stopped. The argument *job* can specify the process id of a process that is not a member of one of the active jobs. See "Jobs" for a description of the format of *job*. In the second form, **kill -l**, the signal numbers and names are listed.

let *arg*...
Each *arg* is a separate arithmetic expression to be evaluated. See "Arithmetic evaluation" above, for a description of arithmetic expression evaluation.

The exit status is 0 if the value of the last expression is non-zero, and 1 otherwise.

† **newgrp** [*arg*...]
Equivalent to **exec /bin/newgrp** *arg*....

print [**-Rnprsu**[*n*]] [*arg*...]
The shell output mechanism. With no flags or with flag "-" or "--" the arguments are printed on standard output as described by **echo**(C). In raw mode, **-R** or **-r**, the escape conventions of **echo** are ignored. The **-R** option will print all subsequent arguments and options other than **-n**. The **-p** option causes the arguments to be written onto the pipe of the process spawned with **|&** instead of standard output. The **-s** option causes the arguments to be written onto the history file instead of standard output. The **-u** flag can be used to specify a one-digit file descriptor unit number *n* on which the output will be placed. The default is 1. If the flag **-n** is used, no new-line is added to the output.

pwd [**-LP**]
Equivalent to **print -r - $PWD**

The **-L** and **-P** flags are relevant only on systems with symbolic links. The default, **-L**, uses a logical model, while **-P** uses a physical model, for paths. Thus, if */usr/include/sys* is a symbolic link to the directory */sys/h*, then **cd /usr/include/sys; pwd; pwd -P** will print */usr/include/sys*, followed by */sys/h*.

read [**-prsu**[*n*]] [*name?prompt*] [*name* ...]
The shell input mechanism. One line is read and is broken up into fields using the characters in **IFS** as separators. In raw mode, **-r**, a "\" at the end of a line does not signify line continuation. The first field is assigned to the first *name*, the second field to the second *name*, etc., with leftover fields assigned to the last *name*. The **-p** option causes the input line to be taken from the input pipe of a process spawned by the shell using **|&**. If the **-s** flag is present, the input will be saved as a command in the history file. The flag **-u** can be used to specify a one digit file descriptor unit to read from. The file descriptor can be opened with the **exec** special command. The default value of *n* is 0. If *name* is omitted then **REPLY** is used as the default name. The exit status is 0 unless an end-of-file is encountered. An end-of-file with the **-p** option causes cleanup for this process so that another can be spawned. If the first argument contains a "?", the remainder of this word is used as a prompt on standard error when the shell is interactive. The exit status is 0 unless an end-of-file is encountered.

†† **readonly** [*name* [= *value*]]...
The given names are marked readonly and these names cannot be changed by subsequent assignment.

† **return** [*n*]
Causes a shell function to return to the invoking script with the return status specified by *n*. If *n* is omitted then the return status is that of the last command executed. If **return** is invoked while not in a function or a "." script, then it is the same as an **exit**.

set [±**aefhkmnopstuvx**] [±**o** *option*]... [±**A** *name*] [*arg*...]
The flags for this command have meaning as follows:

-A Array assignment. Unset the variable ***name*** and assign values sequentially from the list ***arg***. If **+A** is used, the variable ***name*** is not unset first.

-a All subsequent parameters that are defined are automatically exported.

-e If a command has a non-zero exit status, execute the **ERR** trap, if set, and exit. This mode is disabled while reading profiles.

-f Disables file name generation.

-h Each command becomes a tracked alias when first encountered.

-k All parameter assignment arguments are placed in the environment for a command, not just those that precede the command name.

-m Background jobs will run in a separate process group and a line will print upon completion. The exit status of background jobs is reported in a completion message. On systems with job control, this flag is turned on automatically for interactive shells.

-n Read commands and check them for syntax errors, but do not execute them. Ignored for interactive shells.

-o List all option settings.

The argument following **-o** can be one of the following ***option*** names:

allexport Same as **-a**.

errexit Same as **-e**.

bgnice All background jobs are run at a lower priority. This is the default mode.

emacs Puts you in an **emacs** style in-line editor for command entry.

gmacs Puts you in a **gmacs** style in-line editor for command entry.

ignoreeof The shell will not exit on end-of-file. The command **exit** must be used.

keyword Same as **-k**.

markdirs All directory names resulting from file name generation have a trailing " / " appended.

monitor Same as **-m**.

noclobber Prevents output redirection (>) from truncating existing files. Require >| to truncate a file when turned on.

noexec Same as **-n**.

noglob Same as **-f**.

nolog Do not save function definitions in history file.

nounset Same as **-u**.

privileged Same as **-p**.

trackall Same as **-h**.

verbose Same as **-v**.

vi Puts you in insert mode of a **vi** style in-line editor until you hit escape character **033**. This puts you in move mode. A return sends the line.

viraw Each character is processed as it is typed in **vi** mode.

xtrace Same as **-x**.

If no ***option*** name is supplied then the current option settings are printed.

-p Disables processing of the **$HOME**/*.profile* file and uses the file */etc/suid_profile* instead of the **ENV** file. This mode is on whenever the effective uid (gid) is not equal to the real uid (gid). Turning this off causes the effective uid and gid to be set to the real uid and gid.

-s Sort the positional parameters lexicographically.

-t Exit after reading and executing one command.

-u Treat unset parameters as an error when substituting.

-v Print shell input lines as they are read.

-x Print commands and their arguments as they are executed.

- Turns off **-x** and **-v** flags and stops examining arguments for flags.

-- Do not change any of the flags; useful in setting **$1** to a value beginning with "-". If no arguments follow this flag then the positional parameters are unset.

Using "+" rather than "-" causes these flags to be turned off. These flags can also be used upon invocation of the shell. The current set of flags may be found in **$-**. Unless **-A** is specified, the remaining arguments are positional parameters and are assigned, in order, to **$1 $2** .... If no arguments are given then the names and values of all named parameters are printed on the standard output. If the only argument is "+", the names of all named parameters are printed.

† **shift** [*n*]
The positional parameters from **$***n***+1** ... are renamed **1...**, default *n* is 1. The parameter *n* can be any arithmetic expression that evaluates to a non-negative number less than or equal to **$#**.

† **times**
Print the accumulated user and system times for the shell and for processes run from the shell.

† **trap** [*arg*] [*sig*]... *arg*
is a command to be read and executed when the shell receives signal(s) *sig*. (Note that *arg* is scanned once when the trap is set and once when the trap is taken.) Each *sig* can be given as a number or as the name of the signal. Trap commands are executed in order of signal number. Any attempt to set a trap on a signal that was ignored on entry to the current shell is ineffective. If *arg* is omitted or is "-", then all trap(s) *sig* are reset to their original values. If *arg* is the null string then this signal is ignored by the shell and by the commands it invokes. If *sig* is **ERR** then *arg* will be executed whenever a command has a non-zero exit status. If *sig* is **DEBUG** then *arg* will be executed after each command. If *sig* is **0** or **EXIT** and the **trap** statement is executed inside the body of a function, then the command *arg* is executed after the function completes. If *sig* is **0** or **EXIT** for a **trap** set outside any function then the command *arg* is executed on exit from the shell. The **trap** command with no arguments prints a list of commands associated with each signal number.

†† **typeset** [±**HLRZfilrtux**[*n*]] [*name*[=*value*]]...
Sets attributes and values for shell parameters. When invoked inside a function, a new instance of the parameter *name* is created. The parameter value and type are restored when the function completes. The following list of attributes may be specified:

-H This flag provides UNIX system to host-name file mapping on non-UNIX system machines.

-L Left justify and remove leading blanks from ***value***. If ***n*** is non-zero it defines the width of the field; otherwise it is determined by the width of the value of first assignment. When the parameter is assigned to, it is filled on the right with blanks or truncated, if necessary, to fit into the field. Leading zeros are removed if the **-Z** flag is also set. The **-R** flag is turned off.

-R Right justify and fill with leading blanks. If ***n*** is non-zero it defines the width of the field; otherwise it is determined by the width of the value of first assignment. The field is left filled with blanks or truncated from the end if the parameter is reassigned. The **-L** flag is turned off.

-Z Right justify and fill with leading zeros if the first non-blank character is a digit and the **-L** flag has not been set. If ***n*** is non-zero it defines the width of the field; otherwise it is determined by the width of the value of first assignment.

-f The names refer to function names rather than parameter names. No assignments can be made and the only other valid flags are **-t**, **-u** and **-x**. The flag **-t** turns on execution tracing for this function. The flag **-u** causes this function to be marked as undefined. The **FPATH** variable will be searched to find the function definition when the function is referenced. The flag **-x** allows the function definition to remain in effect across shell procedures invoked by name.

-i Parameter is an integer. This makes arithmetic faster. If ***n*** is non-zero it defines the output arithmetic base; otherwise the first assignment determines the output base.

-l All upper-case characters converted to lower-case. The upper-case flag, **-u** is turned off.

-r The given ***name***s are marked readonly and these names cannot be changed by subsequent assignment.

-t Tags the named parameters. Tags are user definable and have no special meaning to the shell.

-u All lower-case characters are converted to upper-case characters. The lower-case flag, **-l**, is turned off.

-x The given ***name***s are marked for automatic export to the environment of subsequently-executed commands.

Using "+" rather than "-" causes these flags to be turned off. If no ***name*** arguments are given but flags are specified, a list of names (and optionally the values) of the parameters which have these flags set is printed. (Using "+" rather than "-" keeps the values from being printed.) If no ***name***s and flags are given, the names and attributes of all parameters are printed.

ulimit [**-HS**] [***limit***]
Set or display a resource limit. The number of 512-byte blocks on files written by child processes (files of any size may be read). The limit is set when ***limit*** is specifed. The value of ***limit*** can be a number or the value **unlimited**. The **-H** and **-S** flags specify whether the hard limit or the soft limit is set. A hard limit cannot be increased once it is set. A soft limit can be increased up to the value of the hard limit. If neither the **-H** or **-S** option is specified, the limit applies to both. The current limit is printed when ***limit*** is omitted. In this case the soft limit is printed unless **-H** is specified.

umask [***mask***]
The user file-creation mask is set to ***mask*** (see **umask**). ***mask*** can either be an octal number or a symbolic value as described in **chmod**(C). If a symbolic value is given, the new umask value is the complement of the result of applying ***mask*** to the complement of the previous umask value. If ***mask*** is omitted, the current value of the mask is printed.

unalias ***name*** ...
The parameters given by the list of ***name***s are removed from the alias list.

unset [**-f**] ***name*** ...
The parameters given by the list of names are unassigned, that is, their values and attributes are erased. Readonly variables cannot be unset. If the flag, **-f**, is set, then the names refer to function names. Unsetting **ERRNO, LINENO, MAILCHECK, OPTARG, OPTIND, RANDOM, SECONDS, TMOUT**, and "**_**" removes their special meaning even if they are subsequently assigned to.

† **wait** [***job***]
Wait for the specified job and report its termination status. If ***job*** is not given then all currently active child processes are waited for. The exit status from this command is that of the process waited for. See "Jobs" for a description of the format of ***job***.

whence [**-pv**] ***name*** ...
For each ***name***, indicate how it would be interpreted if used as a command name.

The flag, **-v**, produces a more verbose report.

The flag, **-p**, does a path search for ***name*** even if name is an alias, a function, or a reserved word.

Invocation

If the shell is invoked by **exec**(S), and the first character of argument zero (**$0**) is "-", then the shell is assumed to be a login shell and commands are read from */etc/profile* and then from either *.profile* in the current directory or **$HOME**/*.profile*, if either file exists. Next, commands are read from the file named by performing parameter substitution on the value of the environment parameter **ENV** if the file exists. If the **-s** flag is not present and ***arg*** is, then a path search is performed on the first ***arg*** to determine the name of the script to execute. The script ***arg*** must have read permission and any **setuid** and **setgid** settings will be ignored. Commands are then read as described below; the following flags are interpreted by the shell when it is invoked:

-c *string* If the **-c** flag is present then commands are read from ***string***.

-s If the **-s** flag is present or if no arguments remain then commands are read from the standard input. Shell output, except for the output of the special commands listed above, is written to file descriptor 2.

-i If the **-i** flag is present or if the shell input and output are attached to a terminal (as told by **ioctl**(S)) then this shell is interactive. In this case **TERM** is ignored (so that **kill 0** does not kill an interactive shell) and **INTR** is caught and ignored (so that **wait** is interruptible). In all cases, **QUIT** is ignored by the shell.

-r If the **-r** flag is present the shell is a restricted shell.

The remaining flags and arguments are described under the **set** command above.

rksh only

rksh is used to set up login names and execution environments whose capabilities are more controlled than those of the standard shell. The actions of **rksh** are identical to those of **ksh**, except that the following are disallowed:

changing directory (see **cd**(C)),
setting the value of **SHELL**, **ENV**, or **PATH**,
specifying path or command names containing " / ",
redirecting output (>, >|, <>, and >>).

The restrictions above are enforced after *.profile* and the **ENV** files are interpreted.

When a command to be executed is found to be a shell procedure, **rksh** invokes **ksh** to execute it. Thus, it is possible to provide shell procedures to the end-user that have access to the full power of the standard shell, while imposing a limited menu of commands; this scheme assumes that the end-user does not have write and execute permissions in the same directory.

The net effect of these rules is that the writer of the *.profile* has complete control over user actions, by performing guaranteed setup actions and leaving the user in an appropriate directory (probably *not* the login directory).

The system administrator often sets up a directory of commands (for example, */usr/rbin*) that can be safely invoked by **rksh**. There is also a restricted editor, **red**.

Note that simply setting a user's login shell to **rksh** does *not* make their account "safe". Some thought and care must be put into creating a properly restricted environment.

Diagnostics

Errors detected by the shell, such as syntax errors, cause the shell to return a non-zero exit status. Otherwise, the shell returns the exit status of the last command executed (see also the **exit** command above). If the shell is being used non-interactively then execution of the shell file is abandoned. Run-time errors detected by the shell are reported by printing the command or function name and the error condition. If the line number that the error occurred on is greater than one, then the line number is also printed in square brackets (**[ ]**) after the command or function name.

Files

/etc/passwd
/etc/profile
/etc/suid_profile
$HOME/*.profile*
*/tmp/sh**
/dev/null

See also

cat(C), **cd**(C), **chmod**(C), **cut**(C), **echo**(C), **env**(C), **ln**(C), **newgrp**(C), **paste**(C), **stty**(C), **test**(C), **umask**(C), **vi**(C), **dup**(S), **exec**(S), **fork**(S), **ioctl**(S), **lseek**(S), **pipe**(S), **signal**(S), **umask**(S), **ulimit**(S), **wait**(S), **rand**(S), **a.out**(FP), **profile**(M), **environ**(M)

The chapter entitled "The Korn Shell" in the SCO UNIX *User's Guide*.

Notes

If a command which is a tracked alias is executed, and then a command with the same name is installed in a directory in the search path before the directory where the original command was found, the shell will continue to **exec** the original command. Use the **-t** option of the **alias** command to correct this situation.

Some very old shell scripts contain a "^" as a synonym for the pipe character (|).

Using the **fc** built-in command within a compound command will cause the whole command to disappear from the history file.

The built-in command . *file* reads the whole file before any commands are executed. Therefore, **alias** and **unalias** commands in the file will not apply to any functions defined in the file.

Traps are not processed while a job is waiting for a foreground process. Thus, a trap on **CHLD** won't be executed until the foreground job terminates.

last

indicate last logins of users and teletypes

Syntax

last [**-h**] [**-n** *limit*] [**-t** *tty*] [**-w** *wtmpfile*] [*name*]

Description

The **last** command checks the *wtmp* file, which records all logins and logouts for information about a user, a tty line or any group of users and lines. Arguments specify a user name and/or tty.

last -t 01 root

would list all *root* sessions as well as all sessions on */dev/tty01*. **last** prints the sessions of the specified users and ttys, including login name, the line used, the device name, the process ID, plus start time and elapsed time.

last with no arguments prints a record of all logins and logouts, in reverse chronological order.

The options behave as follows:

-h no header.

-n *limit* limits the report to n lines.

-t *line* specifies the tty.

-w *wtmpfile* uses *wtmpfile* instead of */etc/wtmp*. Note that this file must have the same format as */etc/wtmp*.

File

/etc/wtmp login database

See also

acct(FP), **acctcom**(ADM), **accton**(ADM), **finger**(C), **utmp**(F)

Value added

last is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

layers

layer multiplexer for windowing terminals

Syntax

layers [**-s**] [**-t**] [**-d**] [**-p**] [**-f** *file*] [*layersys-prgm*]

Description

The **layers** command manages asynchronous windows (see **layers**(M)) on a windowing terminal. On invocation, **layers** finds an unused **xt**(HW) channel group and associates it with the terminal line on its standard output. It then waits for commands from the terminal.

To use **layers**, you must have configured the *xt* driver. This is done using the **mkdev layers** script. For more information, see **mkdev**(ADM).

Command-line options:

-s Reports protocol statistics on standard error at the end of the session after you exit from **layers**. The statistics may be printed during a session by invoking the program **xts**(ADM).

-t Turns on **xt**(HW) driver packet tracing, and produces a trace dump on standard error at the end of the session after you exit from **layers**. The trace dump may be printed during a session by invoking the program **xtt**(ADM).

-d If a firmware patch has been downloaded, prints out the sizes of the text, data, and bss portions of the firmware patch on standard error.

-p If a firmware patch has been downloaded, prints the downloading protocol statistics and a trace on standard error.

-f *file* Starts **layers** with an initial configuration specified by *file*. Each line of the file represents a layer to be created, and has the following format:

origin_x origin_y corner_x corner_y command_list

The coordinates specify the size and position of the layer on the screen in the terminal's coordinate system. If all four are 0, the user must define the layer interactively. *command_list*, a list of one or more commands, must be provided. It is executed in the new layer using the user's shell (by executing: **$SHELL -i -c** "*command_list*"). This means that the last command should invoke a shell, such as **/bin/sh**. (If the last command is not a shell, then, when the last command has completed, the layer will not be functional.)

layersys-prgm A file containing a firmware patch that the **layers** command downloads to the terminal before layers are created and *command_list* is executed.

Each layer is in most ways functionally identical to a separate terminal. Characters typed on the keyboard are sent to the standard input of the UNIX system process attached to the current layer (called the host process), and characters written on the standard output by the host process appear in that layer. When a layer is created, a separate shell is established and bound to the layer. If the environment variable **SHELL** is set, the user will get that shell, otherwise, **/bin/sh** will be used. In order to enable communications with other users via **write**(C), **layers** invokes the command **relogin**(ADM) when the first layer is created. **relogin**(ADM) will reassign that layer as the user's logged-in terminal. An alternative layer can be designated by using **relogin**(ADM) directly. **layers** will restore the original assignment on termination.

Layers are created, deleted, reshaped, and otherwise manipulated in a terminal-dependent manner. For instance, the AT&T TELETYPE 5620 DMD terminal provides a mouse-activated pop-up menu of layer operations. The method of ending a **layers** session is also defined by the terminal.

Example

layers -f startup

where *startup* contains:

```
8 8 700 200 date ; pwd ; exec $SHELL
8 300 780 850 exec $SHELL
```

Notes

The **xt**(HW) driver supports an alternate data transmission scheme known as ENCODING MODE. This mode makes **layers** operation possible even over data links which intercept control characters or do not transmit 8-bit characters. ENCODING MODE is selected either by setting a configuration option on your windowing terminal or by setting the environment variable **DMDLOAD** to the value **hex** before running **layers**:

export DMDLOAD; DMDLOAD=hex

If, after executing **layers -f** *file*, the terminal does not respond in one or more of the layers, often the last command in the *command-list* for that layer did not invoke a shell.

When invoking **layers** with the **-s**, **-t**, **-d**, or **-p** options, it is best to redirect standard error to another file to save the statistics and tracing output (for example, **layers -s 2>stats**); otherwise all or some of the output may be lost.

Files

/dev/xt??[0-7]
/usr/lib/layersys/lsys.8;7;3
/usr/lib/layersys/lsys.8;?;?

See also

layers(M), **libwindows**(S), **mkdev**(ADM), **relogin**(ADM), **sh**(C), **write**(C), **wtinit**(ADM), **xts**(ADM), **xtt**(ADM), **xt**(HW)

line

read one line

Syntax

line

Description

The **line** command copies one line (up to a new line) from the standard input and writes it on the standard output. It returns an exit code of 1 on end-of-file and always prints at least a new line. It is often used within shell files to read from the user's terminal.

See also

gets(CP), **sh**(C)

Standards conformance

line is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

ln

make a link to a file

Syntax

ln [**-s**] [**-f**] *sourcename targetname*

ln [**-s**] [**-f**] *sourcename1 sourcename2* [*sourcename3* ...] *targetdirectory*

Description

A link is a directory entry referring to a file; a single file (together with its size, all its protection information, etc.) may have several links to it. There are two kinds of link: hard links and symbolic links.

By default **ln** makes hard links. A hard link to a file is indistinguishable from the original directory entry; any changes to a file are effective independent of the name used to reference the file. Hard links may not span file systems and may not refer to directories.

The **-s** option causes **ln** to create symbolic links. A symbolic link contains the name of the file to which it is linked; this file does not need to exist prior to the symbolic link. The referenced file is used when an **open**(S) operation is performed on the link. A **stat**(S) on a symbolic link will return the linked-to file; a **stat**(S) must be performed to obtain information about the link. The **readlink**(S) call may be used to read the contents of a symbolic link. Symbolic links may span file systems and may refer to directories.

Given two arguments, **ln** creates a link to a file *sourcename*. If *targetname* is a file, the link has that name; *targetname* may also be a directory in which to place the link; otherwise it is placed in the current directory. If only the directory is specified, the link will be made to the last component of *sourcename*.

Given more than two arguments, **ln** makes links in *targetdirectory* to all the named source files. The links made will have the same names as the files being linked to. If **ln** determines that the mode of *target* forbids writing, it will print the mode (see **chmod**(C)), ask for a response, and read the standard input for one line.

If the line begins with *y*, the **ln** occurs, if permissible; if not, the command exits.

When the **-f** option is used or if the standard input is not a terminal, no questions are asked and the **ln** is performed.

See also

cp(C), **mv**(C), **rm**(C)

Standards conformance

ln is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

lock

lock a user's terminal

Syntax

lock [**-v**] [***-number***]

Description

The **lock** command requests a password from the user, requests it again for verification, then locks the terminal until the password is reentered. If a ***-number*** is specified in the **lock** command, the terminal is automatically logged out and made available to another user after that number of minutes has passed.

This command uses the file */etc/default/lock*. This file has two entries:

DEFLOGOUT = ***number***
MAXLOGOUT = ***number***

DEFLOGOUT specifies the default time in minutes that a terminal will remain locked before the user is logged out. This default value is overridden if the ***-number*** option is used on the command line. If **DEFLOGOUT** and ***-number*** are not specified, the **MAXLOGOUT** value is used.

MAXLOGOUT is the maximum number of minutes a user is permitted to lock a terminal. If a user attempts to lock a terminal for longer than this time, **lock** will issue a warning to the user that it is using the system maximum time limit. If **DEFLOGOUT** and ***-number*** and **MAXLOGOUT** are not specified, users are not logged out.

DEFLOGOUT and **MAXLOGOUT** are configured by the system administrator to reflect the demand for terminals at the site.

The lock may be terminated by killing the lock process. Only the super user and the user who invoked **lock** may do so.

Options

-number Sets the time limit for **lock** to ***number*** of minutes, instead of the system default.

-v Specifies verbose operation.

File

/etc/default/lock

Notes

The file */etc/default/lock* is shipped with the following default values:

```
DEFLOGOUT = 30
MAXLOGOUT = 60
```

Value added

lock is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

logname

get login name

Syntax

logname

Description

logname returns the user's login name as found in */etc/utmp*. If no login name is found, **logname** returns the user's user ID number.

See also

env(C), **getlogin**(S), **getuid**(S), **id**(C), **login**(M), **logname**(S)

Standards conformance

logname is conformant with:

X/Open Portability Guide, Issue 3, 1989.

lp, lpr

send requests to lineprinter

Syntax

lp [*options*] *files*

lp -i *request-id* [*options*]

Description

lpr - send request to lineprinter

The first form of the **lp** shell command arranges for the named files and associated information (collectively called a *request*) to be printed. If no filenames are specified on the command line, the standard input is assumed. The standard input may be specified along with named *files* on the command line, by specifying the files as arguments to **lp** before the standard input. The *files* will be printed in the order they appear on the command line.

The second form of **lp** is used to change the options for a request. The print request identified by the *request-id* is changed according to the printing options specified with this shell command. The printing options available are the same as those with the first form of the **lp** shell command. If *request-id* has finished printing, the change is rejected. If *request-id* is already printing, it will be stopped and restarted from the beginning, unless the **-P** option has been given.

lp associates a unique *id* with each request and prints it on the standard output. This *id* can be used later to cancel, change, or find the status of the request. (See **lpstat**(C) for information about checking the status of a print request.)

Options to **lp** must always precede filenames but may be listed in any order. The following options are available for **lp**:

-c When **lp** runs, it immediately creates a copy of the files specified for printing. The copies are subsequently printed. Changes made to a file after the **lp** command is issued but before the file is printed will therefore not be reflected in the printed output. Versions of **lp** in earlier releases did not create a copy of the print files unless the **-c** flag was used (to indicate that copies of the print files should be made). Because this is now the default behaviour for **lp**, this flag is retained solely for backward compatability, and need not be used.

-d *dest* Prints this request using *dest* as the printer or class of printers. Under certain conditions (lack of printer availability, capabilities of printers, and so on), requests for specific destinations may not be accepted (see **accept**(ADM) and **lpstat**(C)). By default, *dest* is taken from the environment variable **LPDEST** (if it is set). Otherwise, a default destination (if one exists) for the computer system is used. Destination names vary between systems (see **lpstat**(C)).

-f *form-name* [**-d any**]
Prints the request on the form *form-name*. The **lp** print service ensures that the form is mounted on the printer. If *form-name* is requested with a printer destination that cannot support the form, the request is rejected. If *form-name* has not been defined for the system or if the user is not allowed to use the form, the request is rejected (see **lpforms**(ADM)). When the **-d any** option is given, the request is printed on any printer that has the requested form mounted and can handle all other needs of the print request.

-H *special-handling*
Prints the request according to the value of *special-handling*. Acceptable values for *special-handling* are **hold**, **resume**, and **immediate**, as defined below:

hold Will not print the request until notified. If already printing, stops it. Other print requests will go ahead of a held request until it is resumed.

resume Resumes a held request. If it had been printing when held, it will be the next request printed, unless subsequently overridden by an **immediate** request.

immediate (Available only to **lp** administrators)
Prints the request next. If more than one request is assigned **immediate**, the requests are printed in the reverse order queued. If a request is currently printing on the desired printer, you have to put it on hold to allow the immediate request to print.

-m Sends mail (see **mail**(C)) after the files have been printed. By default, no mail is sent upon normal completion of the print request.

-n *number* Prints *number* copies of the output (default is 1).

-o ***option*** Specifies printer-dependent or class-dependent ***options***. Several such ***options*** may be collected by specifying the **-o** keyletter more than once. The standard interface recognizes the following options:

nobanner Does not print a banner page with this request. (The administrator can disallow this option at any time.)

nofilebreak Does not insert a form feed between the files given if submitting a job to print more than one file.

stty=*stty-option-list*
Set the printer with a list of options valid for the **stty** command. Enclose the list with quotes if it contains blanks.

length=*scaled-decimal-number*
Prints the output of this request with pages ***scaled- decimal-number*** lines long. A ***scaled-decimal-number*** is an optionally scaled decimal number that gives a size in lines, columns, inches, or centimeters, as appropriate. The scale is indicated by appending the letter "i" (for inches) or the letter "c" (for centimeters). For length or width settings, an unscaled number indicates lines or columns; for line pitch or character pitch settings, an unscaled number indicates lines per inch or characters per inch (the same as a number scaled with "i"). For example, **length=66** indicates a page length of 66 lines, **length=11i** indicates a page length of 11 inches, and **length=27.94c** indicates a page length of 27.94 centimeters.

This option cannot be used with the **-f** option.

width=*scaled-decimal-number*
Prints the output of this request with page-width set to ***scaled-decimal- number*** columns wide. (See the explanation above for ***scaled-decimal-numbers***.) This option cannot be used with the **-f** option.

lpi=*scaled-decimal-number*
Prints this request for "lines per inch" with the line pitch set to ***scaled-decimal-number*** lines per inch. This option cannot be used with the **-f** option.

cpi=*scaled-decimal-number*

Prints this request for "characters per inch" with the character pitch set to ***scaled-decimal-number*** characters per inch. Character pitch can also be set to **pica** (representing 10 columns per inch) or **elite** (representing 12 columns per inch), or it can be **compressed**, to print as many columns as the printer can handle. There is no standard number of columns per inch for all printers; see the *terminfo*(F) database for the default character pitch for your printer. The **cpi** option cannot be used in conjunction with the **-f** option.

-P *page-list* Prints the page(s) specified in ***page-list***. This option can be used only if there is a filter available to handle it; otherwise, the print request will be rejected.

The ***page-list*** may consist of range(s) of numbers, single page numbers, or a combination of both. The pages will be printed in ascending order.

-q *priority-level*

Assigns this request ***priority-level*** in the printing queue. The values of ***priority-level*** range from 0, the highest priority, to 39, the lowest priority. If a priority is not specified, the default for the print service is used, as assigned by the system administrator.

-s Suppresses messages from **lp**(C) such as "request id is ...".

-S *character-set* [**-d any**]
-S *print-wheel* [**-d any**]

Prints this request using the specified ***character-set*** or ***print-wheel***. If a form has been specified that requires a ***character-set*** or ***print-wheel*** other than the one specified with the **-S** option, the request is rejected.

For printers that take print wheels: if the ***print-wheel*** specified is not one listed by the administrator as acceptable for the printer involved in this request, the request is rejected unless the print wheel is already mounted on the printer. For printers that use selectable or programmable character sets: if the ***character-set*** specified is not one defined in the terminfo database for the printer (see **terminfo**(F)) or is not an alias defined by the administrator, the request is rejected.

When the **-d any** option is used, the request is printed on any printer that has the print wheel mounted or any printer that can select the character set and can handle all other needs of the request.

- *title* Prints ***title*** on the banner page of the output. The default is no title.

-T *content-type* [**-r**]
While the printer type information tells the print service what type of printer is being added, the content type information tells the print service what types of files can be printed. Prints the request on a printer that can support the specified ***content-type***. If no printer accepts this type directly, a filter will be used to convert the content into an acceptable type. If the **-r** option is specified, a filter will not be used. If **-r** is specified but no printer accepts the ***content-type*** directly, the request is rejected. If the ***content-type*** is not acceptable to any printer, either directly or with a filter, the request is rejected.

-w Writes a message on the user's terminal after the ***files*** have been printed. If the user is not logged in or the terminal cannot be written to (**mesg** is **n**), then mail will be sent instead.

-y *mode-list* Prints this request according to the printing modes listed in ***mode-list***. The allowed values for ***mode-list*** are locally defined. This option can be used only if there is a filter available to handle it; if there is no filter, the print request will be rejected.

-R Removes file after sending it.

-L Local printing option. Sends print job to printer attached to the terminal.

The file */etc/default/lpd* contains the setting of the variable **BANNERS**, whose value is the number of pages printed as a banner identifying each printout. This is normally set to either 0 or 1.

The variables **LPR** and **PRINTER** can each be set to **spooler** or **local**. These variables let you send files to the spool printer or the terminal's local printer, respectively. The file */usr/bin/spool* contains the **spooler** setting for both variables. The file */usr/bin/local* contains the **local** setting. The following are a few examples of variable usage:

lp -*option* spooler
LPR=local
LPR=spooler
spool lp -*option device file*

Notes

Printers for which requests are not being accepted will not be considered when the destination is **any**. (Use the **lpstat -a** command to see which printers are accepting requests.) On the other hand, if a request is destined for a class of printers and the class itself is accepting requests, *all* printers in the class will be considered, regardless of their acceptance status, as long as the printer class is accepting requests.

lpr is a link to **lp**. These names may be used interchangeably.

Warning

For printers that take mountable print wheels or font cartridges, if you do not specify a particular print wheel or font with the **-S** option, whichever happens to be mounted at the time your request prints will be used. Use the **lpstat -p -l** command to see what print wheels are available. For printers that have selectable character sets, you will get the standard set if you don't give the **-S** option.

Files

*/usr/spool/lp/**
/etc/default/lpd

See also

accept(ADM), **cancel**(C), **enable**(C), **lpadmin**(ADM), **lpfilter**(ADM), **lpforms**(ADM), **lpsched**(ADM), **lpstat**(C), **lpusers**(ADM), **mail**(C), **terminfo**(F)

Standards conformance

lp is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

lprint

print to a printer attached to the user's terminal

Syntax

lprint [**-**] [*file*]

Description

The **lprint**(C) command accepts a filename to print or "-" to read from the keyboard. If the terminal has local printing abilities, it will then print the file to a printer attached to the printer port of the terminal.

This command uses the file */etc/termcap.*

Options

- Tells **lprint** to use the standard input for printing.

The variables **LPR** and **PRINTER** can each be set to 'spooler' or 'local'. These variables let you send files to the spool printer or the terminal's local printer, respectively. The file */usr/bin/spool* contains the 'spooler' setting for both variables. The file */usr/bin/local* contains the 'local' setting. The following are a few examples of variable usage:

lp -*option* spooler
LPR=local
LPR=spooler
spool lp -*option device file*

Files

/etc/termcap
/usr/bin/spool
/usr/bin/local

Notes

Only certain terminals have entries in */etc/termcap* with this capability already defined (for example, Tandy's DT-100 and DT-1, and Hewlett-Packard's HP-92).

To add attached printer capability to the *termcap* file for a different terminal, add entries for **PN** (start printing) and **PS** (end printing) with the appropriate control or escape characters for your terminal.

Terminal communications parameters (such as baud rate and parity) must be set up on the terminal by the user.

See also

termcap(F)

"Using printers" in the *System Administrator's Guide*

Value added

lprint is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

lpstat, rlpstat

print information about status of (remote) lp print service

Syntax

lpstat ***options***

rlpstat ***local_printer_name***

Description

rlpstat - print information about status of remote lp print service

lpstat prints information about the current status of the **lp** print service.

rlpstat prints information about the status of a print service on a remote host connected via TCP/IP.

If no options are given, **lpstat** prints the status of all requests made to **lp**(C) by the users. Any arguments that are not options are assumed to be request-ids (as returned by **lp**), printers, or printer classes. **lpstat** prints the status of such requests, printers, or printer classes. Options may appear in any order and may be repeated and intermixed with other arguments. Some of the keyletters below may be followed by an optional list that can be in one of two forms: a list of items separated from one another by a comma, or a list of items enclosed in double quotes and separated from one another by a comma and/or one or more spaces. For example:

-u ***user1, user2, user3***

Specifying **all** after any keyletters that take ***list*** as an argument causes all information relevant to the keyletter to be printed. For example, the command **lpstat -oall** prints the status of all output requests.

The arguments to **lpstat** are as follows:

-a [***list***] Print acceptance status (with respect to **lp**) of destinations for requests (see **accept**(ADM)). ***list*** is a list of intermixed printer names and class names; the default is **all**.

-c [***list***] Print class names and their members. ***list*** is a list of class names; the default is **all**.

-d Print the system default destination for **lp**.

-f [***list***] [**-l**] Print a verification that the forms in form-list are recognized by the **lp** print service. The **-l** option will list the form descriptions.

-o [*list*] [**-l**] Print the status of output requests. *list* is a list of intermixed printer names, class names, and request-ids; the default is **all**. The **-l** option gives a more detailed status of the request.

-p [*list*] [**-D**] [**-l**]
Print the status of printers named in *list*. If the **-D** option is given, a brief description is printed for each printer in *list*. If the **-l** option is given, a full description of each printer's configuration is given, including the form mounted, the acceptable content and printer types, a printer description, the interface used, and so on.

-r Print the status of the **lp** request scheduler.

-s Print a status summary, including the system default destination, a list of class names and their members, a list of printers and their associated devices, a list of all forms currently mounted, and a list of all recognized character sets and print wheels.

-S [*list*] [**-l**] Print a verification that the character sets or the print wheels specified in *list* are recognized by the **lp** print service. Items in *list* can be character sets or print wheels; the default for the list is **all**. If the **-l** option is given, each line is appended by a list of printers that can handle the print wheel or character set. The list also shows whether the print wheel or character set is mounted or specifies the built-in character set into which it maps.

-t Print all status information.

-u [*list*] Print status of output requests for users. *list* is a list of login names. The default is **all**.

-v [*list*] Print the names of printers and the path names of the devices associated with them. *list* is a list of printer names. The default is **all**.

rlpstat allows the user to look at the queue of a remote printer. The command is invoked with the name of the printer as it is known locally (that is, by its host computer). For example,

rlpstat *local_printer_name*

rlpstat will find the machine on which the printer is physically connected and do an **lpstat -o** *local_printer_name* to show the queue on that machine for that printer.

rlpstat makes the following assumptions:

- The user has **lp** accounts on both the networked machines.
- The documented format of */usr/spool/lp/remote* is adhered to.
- The first option of the **lp** command to be executed on the remote machine is the destination (**-d *local_printer_name***).

File

*/usr/spool/lp/**

See also

enable(C), **lp**(C)

Standards conformance

lpstat is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

l, lc, lf, lr, ls, lx

list contents of directories

Syntax

l [**-ACFLRabcdfginopqrstu**] [***directory*** | ***file*** ...]
lc [**-1AFLRabcdfgilmnopqrstux**] [***directory*** | ***file*** ...]
lf [**-1ALRabcdfgilmnopqrstux**] [***directory*** | ***file*** ...]
lr [**-1AFLabcdfgilmnopqrstux**] [***directory*** | ***file*** ...]
ls [**-ACFLRabcdfgilmnopqrstux**] [***directory*** | ***file*** ...]
lx [**-1ACFLRabcdfgilmnopqrstu**] [***directory*** | ***file*** ...]

Description

l - Lists files with full (long) information

lc - Lists files in columns

lf - Lists files indicating directories, executables, and symbolic links

lr - Lists files, recursively listing any subdirectories encountered

ls - Lists files

lx - Lists files in columns, sorted across the page, rather than down the page

l, **lc**, **lf**, **lr**, **ls**, and **lx** make up the **ls** family of commands.

For each ***directory***, the contents are listed. For each ***file***, the filename is repeated and any other requested information is displayed. By default, the output is sorted alphabetically. When no argument is given, the current directory is listed. When several arguments are given, they are sorted appropriately; file arguments are processed before directories and their contents.

lc lists files in columns by default.

lf lists files, indicating directories, executables, and symbolic links. **lf** is a variant of **lc**, so files are listed in columns by default.

l provides a long listing, one file per line, by default.

lr lists files, recursively listing any subdirectories encountered. **lr** is a variant of **lc**, so files are listed in columns by default.

ls lists files alphabetically, one entry per line, by default.

lx, another variant of **lc**, lists files in columns, but sorted across the page rather than down the page.

You can also list files in stream (across the page) output format, separated by commas, using **ls -m**.

ls determines the output format for the **-C** (**lc**), **-x** (**lx**), and **-m** options by using an environment variable, **COLUMNS**, to determine the number of character positions available on one output line. If this variable is not set, the *termcap* database is used to determine the number of columns, based on the environment variable **TERM**. If this information cannot be obtained, 80 columns are assumed.

Options are:

-1 Forces an output format with one entry per line, for **lc**, **lf**, **lr**, and **lx**.

-A Lists all entries. Entries whose name begin with a dot (.) are listed. Does not list current directory " . " and directory above " .. ".

-C Lists in columns with entries sorted down the columns. If the argument(s) are filename(s), output is across the page, rather than down the page in columns.

-F Causes directories to be marked with a trailing " / ", executable files to be marked with a trailing " * ", and symbolic links to be marked with a trailing " @ " symbol.

-L If an argument is a symbolic link, list the information for the file or directory the link references.

-R Recursively lists subdirectories.

-a Lists all entries; " . " and " .. " are not suppressed.

-b Forces printing of non-graphic characters in the **\ddd** notation, in octal.

-c Uses time of last modification of the inode (file created, mode changed, etc.) for sorting; use with **-t** option.

-d If an argument is a directory, lists only its name (not its contents); often used with **-l** to get the status of a directory.

-f Forces each argument to be interpreted as a directory and lists the name found in each slot. This option turns off **-l**, **-t**, **-s**, and **-r**, and turns on **-a**. The order is the order in which entries appear in the directory.

-g The same as **-l**, except that the owner is not printed.

-i For each file, prints the inode number in the first column of the report.

-l Lists in long format, giving mode, number of links, owner, group, size in bytes, and time of last modification for each file. If the file is a symbolic link, the filename is printed followed by "->" and the pathname of the referenced file. If the file is a special file, the size field will contain the major and minor device numbers, rather than a size. A total count of blocks in the directory, including indirect blocks, is printed at the top of long format listings. A description of the mode listing follows below.

-m Forces stream output format; files are listed across the page, separated by commas.

-n The same as **-l**, except that the user ID (UID) and group ID (GID) numbers are printed, rather than the owner name and the group name.

-o The same as **-l**, except that the group is not printed.

-p Puts a slash (/) after each directory.

-q Forces printing of non-graphic characters in filenames as the character "?".

-r Reverses the order of sort to get reverse alphabetic or oldest first, as appropriate.

-s Gives size in 512-byte blocks, including indirect blocks, for each entry.

-t Sorts by time modified (latest first) instead of by name.

-u Uses time of last access instead of time of last modification for sorting; use with the **-t** option.

-x Lists in columns with entries sorted across, rather than down, the page. If the argument(s) are filename(s), output is across the page, rather than down the page in columns.

The mode printed under the **-l** option (long listing, **l**) consists of 10 characters. The first character is:

- If the entry is an ordinary file.

d If the entry is a directory.

l If the entry is a symbolic link.

b If the entry is a block special file.

c If the entry is a character special file.

p If the entry is a named pipe.

s If the entry is a semaphore.

m If the entry is a shared data (memory) file.

The next 9 characters are the *permissions*, which control who can access the file. Permissions are in 3 sets of 3 bits each. The first set refers to the owner permissions; the second set to the group permissions; and the third set to permissions for all others.

Within each set, the three characters indicate permission to read, to write, or to execute the file, respectively.

The permissions are as follows:

r Read.

w Write.

x Execute; on a directory, this gives search permission.

s Setuid, setgid: set the UID or GID of the executing process to that of the file when the file is executed.

S Setuid/setgid is set, but the underlying execute permission is not set.

t On an executable file: the binary image of the file will remain in memory after the first time it is used. On a directory: files in the directory can only be removed by their owners, or by *root*.

T The sticky bit (t bit) is set, but the underlying execute permission is not set.

- No permission is set.

See **chmod**(C) for more information about permissions.

Files

/etc/passwd	where user IDs are found
/etc/group	where group IDs are found
/etc/termcap	where terminal information is found

See also

chmod(C), **coltbl**(M), **find**(C), **l**(C), **lc**(C), **locale**(M), **termcap**(F)

Credit

lc and its variants were developed at the University of California at Berkeley; they are used with permission.

Notes

ls sorts according to the collating sequence defined by the locale.

New line and tab are considered printing characters in filenames.

Unprintable characters in filenames may confuse the columnar output options.

ls -s interprets one 1024-byte block (a standard SCO UNIX block) as two of its own 512-byte blocks. Thus a 500-byte file is interpreted as two blocks rather than one.

Standards conformance

ls is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

machid: i286, iAPX286, i386, i486 (also: vax, mc68k, pdp11, u370, u3b, u3b15, u3b2, u3b5)

get truth value dependent on processor type

Syntax

i286
iAPX286
i386
i486
(also: **vax, mc68k, pdp11, u370, u3b, u3b15, u3b2, u3b5**)

Description

i286 - Return a true value if a machine is a 286

iAPX286 - Return a true value if a machine is a 286

i386 - Return a true value if a machine is a 386 or fully compatible

i486 - Return a true value if a machine is a 486 or fully compatible

If the machine is a 286, the **i286** and **iAPX286** commands will return a true value (exit code of 0); otherwise they will return a false (non-zero) value.

If the machine is a 386 or fully compatible with a 386 (such as a 486), the **i386** command will return a true value; otherwise it will return a false value.

If the machine is a 486 or fully compatible with a 486, the **i486** command will return a true value; otherwise it will return a false value.

This type of command is often used within makefiles (see **make**(CP)) and shell procedures (see **sh**(C)) to increase portability. Although SCO UNIX does not support these other machines, the commands **vax, mc68k, pdp11, u370, u3b, u3b15, u3b2,** and **u3b5** are all available and work in a similar manner (these will all return a false value).

See also

sh(C), **test**(C), **true**(C), **make**(CP)

mail, mailx

interactive message processing system

Syntax

mail [***options***] [***name*** ...]
mailx [***options***] [***name*** ...]

Description

mailx - interactive message processing system. **mailx** is a link to **mail**.

mail provides a flexible environment for sending and receiving messages electronically. For reading mail, **mail** provides commands to allow saving, deleting, and responding to messages. For sending mail, **mail** allows editing, reviewing, and other modification of the message as it is entered.

Many of the remote features of **mail** will only work if the UUCP package is installed on your system.

Incoming mail is stored in a standard file for each user, called the *mailbox* for that user. When **mail** is called to read messages, the *mailbox* is the default place to find them. As messages are read, they are marked to be moved to a secondary file for storage, unless specific action is taken, so that the messages need not be seen again. This secondary file is called the *mbox* and is normally located in the user's **HOME** directory (see **MBOX** under "Environment variables"). Messages can be saved in other secondary files named by the user. Messages remain in a secondary file until forcibly removed.

The user can access a secondary file by using the **-f** option of the **mail** command. Messages in the secondary file can then be read or otherwise processed using the same commands as in the primary *mailbox*. This gives rise to the notion of a current *mailbox*.

On the command line, ***options*** start with a dash (-) and any other arguments are taken to be destinations (recipients). If no recipients are specified, **mail** attempts to read messages from the *mailbox*. Command-line options are:

-e Test for presence of mail. **mail** prints nothing and exits with a successful return code if there is mail to read.

-f[***filename***] Read messages from ***filename*** instead of *mailbox*. If no ***filename*** is specified, the *mbox* is used.

-F Record the message in a file named after the first recipient. Overrides the **record** variable, if set (see "Environment variables").

-h*number*	The number of network "hops" made so far. This is provided for network software to avoid infinite delivery loops. (See **addsopt** under "Environment variables".)
-H	Print header summary only.
-i	Ignore interrupts. (See **ignore** under "Environment variables".)
-n	Do not initialize from the system default *.mailrc* file.
-N	Do not print initial header summary.
-r*address*	Pass ***address*** to network delivery software. All tilde commands are disabled. (See **addsopt** under "Environment variables".)
-s*subject*	Set the Subject header field to ***subject***.
-u*user*	Read ***user***'s *mailbox*. This is only effective if ***user***'s *mailbox* is not read protected.
-U	Convert UUCP style addresses to internet standards. Overrides the **conv** environment variable. (See **addsopt** under "Environment variables".)

When reading mail, **mail** is in *command mode*. A header summary of the first several messages is displayed, followed by a prompt indicating **mail** can accept standard commands (see Commands below). When sending mail, **mail** is in *input mode*. If no subject is specified on the command line, a prompt for the subject is printed. (A subject longer than 1024 characters will cause **mail** to dump core.) As the message is typed, **mail** will read the message and store it in a temporary file. Commands may be entered by beginning a line with the tilde (~) escape character followed by a single command letter and optional arguments. See "Tilde escapes" for a summary of these commands.

At any time, the behavior of **mail** is governed by a set of *environment variables*. These are flags and valued parameters which are set and cleared via the **set** and **unset** commands. See "Environment variables" below for a summary of these parameters.

Recipients listed on the command line may be of three types: login names, shell commands, or alias groups. Login names may be any network address, including mixed network addressing. If mail is found to be undeliverable, an attempt is made to return it to the sender's *mailbox*. If the recipient name begins with a pipe symbol (|), the rest of the name is taken to be a shell command to pipe the message through. This provides an automatic interface with any program that reads the standard input, such as **lp**(C), for recording outgoing mail on paper. Alias groups are set by the **alias** command (see Commands below) and are lists of recipients of any type.

Regular commands are in the format:

[***command***] [***msglist***] [***arguments***]

If no command is specified in *command mode*, **print** is assumed. In *input mode*, commands are recognized by the tilde escape character, and lines not treated as commands are taken as input for the message.

Each message is assigned a sequential number, and there is at any time the notion of a current message, marked by a right angle bracket (>) in the header summary. Many commands take an optional list of messages (***msglist***) to operate on. The default for ***msglist*** is the current message. A ***msglist*** is a list of message identifiers separated by spaces, which may include:

n	Message number ***n***.
.	The current message.
^	The first undeleted message.
$	The last message.
*	All messages.
n-m	An inclusive range of message numbers.
user	All messages from ***user***.
/string	All messages with ***string*** in the subject line (case ignored).
:c	All messages of type ***c***, where ***c*** is one of:

d	deleted messages
n	new messages
o	old messages
r	read messages
u	unread messages

Note that the context of the command determines whether this type of message specification makes sense.

Other arguments are usually arbitrary strings whose usage depends on the command involved. File names, where expected, are expanded via the normal shell conventions (see **sh**(C)). Special characters are recognized by certain commands and are documented with the commands below.

At start-up time, **mail** tries to execute commands from the optional system-wide file (*/usr/lib/mail/mailrc*) to initialize certain parameters, then from a private start-up file (**$HOME**/*.mailrc*) for personalized variables. With the exceptions noted below, standard commands are legal inside start-up files. The most common use of a start-up file is to set up initial display options and alias lists.

The following commands are not legal in the start-up file: **!**, **C** (copy), **e** (edit), **fo** (forward), **F** (Forward), **ho** (hold), **m** (mail), **pre** (preserve), **r** (reply), **R** (Reply), **sh** (shell), and **v** (visual). An error in the start-up file causes the remaining lines in the file to be ignored. The *.mailrc* file is optional and must be constructed locally.

Commands

The following is a complete list of **mail** commands:

! ***shell-command***
: Execute shell command and return. (See **SHELL** under "Environment variables".)

***comment***
: Null command (comment). This may be useful in *.mailrc* files.

=
: Print the current message number.

?
: Print a summary of commands.

a ***alias name ...***
g ***alias name ...***
: Declare an **alias** for the given names; declare a **group** for the given names. The names will be substituted when ***alias*** is used as a recipient. Useful in the *.mailrc* file.

alt ***name ...***
: **Alternates**. Declare a list of alternate names for your login. When responding to a message, these names are removed from the list of recipients for the response. With no arguments, **alternates** prints the current list of alternate names. (See **allnet** under "Environment variables".)

cd [***directory***]
ch [***directory***]
: Change directory. (**ch** is an abbreviation of **chdir**.) If ***directory*** is not specified, **$HOME** is used.

c [***filename***]
c [***msglist***] ***filename***
: **copy** messages to the file without marking the messages as saved. Otherwise equivalent to the s (save) command.

C [***msglist***]
: **Copy** the specified messages to a file whose name is derived from the author of the message to be saved, without marking the messages as saved. Otherwise equivalent to the **Save** command.

d [***msglist***]
: **Delete** messages from the *mailbox*. If **autoprint** is set, the next message after the last one deleted is printed (see "Environment variables").

di [*header-field* ...]
ig [*header-field* ...]
Discard or **Ignore** the header field. Suppress printing of the specified header fields when displaying messages on the screen. Examples of header fields to ignore are "status" and "cc". The fields are included when the message is saved. The **Print** and **Type** commands override these commands.

dp [*msglist*]
dt [*msglist*] **Delete** the specified messages from the *mailbox* and print the next message after the last one deleted. Roughly equivalent to a **delete** command followed by a **print** command.

ec *string* ... **Echo** the given strings (like **echo**(C)).

e [*msglist*] **Edit** the given messages. The messages are placed in a temporary file and the **EDITOR** variable is used to get the name of the editor (see "Environment variables"). Default editor is **ed**(C).

ex
x **Exit** from **mail** without changing the *mailbox*. No messages are saved in the *mbox* (see also **quit**).

fi [*filename*]
fold [*filename*] (Abbreviations for **file** or **folder**.) Quit from the current file of messages and read in the specified file. Several special characters are recognized when used as file names, with the following substitutions:

%	the current *mailbox*.
%user	the *mailbox* for *user*.
#	the previous file.
&	the current *mbox*.

Default file is the current *mailbox*.

folders Print the names of the files in the directory set by the **folder** variable (see "Environment variables").

for [*message*] *name* ...
Forward the specified message to the specified users, shifting the forwarded text to the right one tab stop.

F [*message*] *name* ...
Forward the specified message to the specified users, with no indentation.

f [*msglist*] (Abbreviation for **from**.) Prints the header summary for the specified messages.

g *alias name* ... **group**. See **alias**.

h [**+** | **-** | ***msglist***]
: **headers**. Lists the current range of headers. The **screen** variable sets the number of headers per page (see "Environment variables"). If a "+" argument is given, then the next page is printed, and if a "-" argument is given, the previous page is printed. Both "+" and "-" can take a number to view a particular window. If a message list is given, it prints the specified headers, disregarding all windowing. See also the **z** command.

hel
: (Abbreviation for **help**.) Prints a summary of commands.

ho [***msglist***]
: (abbreviation for **hold**.) Holds the specified messages in the *mailbox*.

i s|**r**
mail-commands
el
mail-commands
en
: (Abbreviations: **i** is short for **if**, **el** is short for **else**, and **en** is short for **end**.) Conditional execution, where **s** causes the first mail commands, up to an **el** (else) or **en** (endif) to be executed if the program is in *send* mode, and **r** causes the mail commands to be executed only in *receive* mode. The ***mail-commands*** after the else are executed if the program is in the opposite mode from the one indicated. Useful in the *mailrc* file.

ig ***header-field*** ...
: **ignore**. See **discard**.

li
: (Abbreviation: **li** is short for **list**.) Prints all commands available. No explanation is given.

l [***msglist***]
: (Abbreviation: **l** is short for **lpr**.) Print the specified messages on the lineprinter.

m ***name*** ...
: **Mail** a message to the specified users.

M ***name***
: **Mail** a message to the specified user and record a copy of it in a file named after that user.

mb [***msglist***]
: (Abbreviation: **mb** is short for **mbox**.) Arrange for the given messages to end up in the standard *mbox* save file when **mail** terminates normally. See the **ex** (exit) and **q** (quit) commands.

n [***message***]
: Go to **next** message matching ***message***. A ***msglist*** may be specified, but in this case the first valid message in the list is the only one used. This is useful for jumping to the next message from a specific user, since the name would be taken as a command in the absence of a real command. See the discussion of ***msglist***s above for a description of possible message specifications.

pi [*msglist*] [*shell-command*]
| [*msglist*] [*shell-command*]
Pipe the message through the given *shell-command*. The message is treated as if it were read. If no arguments are given, the current message is piped through the command specified by the value of the **cmd** variable. If the **page** variable is set, a form feed character is inserted after each message (see "Environment variables").

pre [*msglist*] Preserve (hold) the specified messages in the *mailbox*.

P [*msglist*]
T [*msglist*] **Print** (or **type**) the specified messages on the screen, including all header fields. Overrides suppression of fields by the **ig** (ignore) command.

p [*msglist*]
t [*msglist*] **Print** (or **type**) the specified messages. If **crt** is set, the messages longer than the number of lines specified by the **crt** variable are paged through the command specified by the **PAGER** variable. The default command is **more**(C) (see "Environment variables").

q (Abbreviation: **q** is short for **quit**.) Exit from **mail**, storing messages that were read in *mbox* and unread messages in the *mailbox*. Messages that have been explicitly saved in a file are deleted from the mailbox.

R [*msglist*] **Reply** (or **Respond**) to the specified message, including all other recipients of the message. If **record** is set to a file name, the response is saved at the end of that file (see "Environment variables").

r [*message*] (Abbreviation: **r** is short for **reply** or **respond**.) Send a response to the author of each message in the *msglist*. The subject line is taken from the first message. If **record** is set to a file name, the response is saved at the end of that file (see "Environment variables").

S [*msglist*] **Save** the specified messages in a file whose name is derived from the author of the first message. The name of the file is taken to be the author's name with all network addressing stripped off. See also the **C** (copy) commands and **outfolder** (see "Environment variables").

s [*filename*]
s [*msglist*] *filename*
Save the specified messages in the given file. The file is created if it does not exist. The message is deleted from the *mailbox* when **mail** terminates unless **keepsave** is set (see also "Environment variables" and the **ex** (exit) and **q** (quit) commands).

se
se ***name***
se ***name=string***
se ***name=number***

(Abbreviation: **se** is short for **set.**) Define a variable called ***name***. The variable may be given a null, string, or numeric value. **Se** by itself prints all defined variables and their values. See "Environment variables" for detailed descriptions of the **mail** variables.

sh Invoke an interactive **shell** (see **SHELL** under "Environment variables").

si [***msglist***] Print the **size** in characters of the specified messages.

so ***filename*** (Abbreviation: **so** is short for **source.**) Read commands from the given file and return to command mode.

to [***msglist***] Print the **top** few lines of the specified messages. If the **toplines** variable is set, it is taken as the number of lines to print (see "Environment variables"). The default is 5.

tou [***msglist***] **Touch** the specified messages. If any message in ***msglist*** is not specifically saved in a file, it will be placed in the *mbox*, or the file specified in the **MBOX** environment variable, upon normal termination. See **ex** (exit) and **q** (quit).

T [***msglist***] **Type**: see **Print**.

t [***msglist***] **type**: see **print**.

u [***msglist***] (Abbreviation: **u** is short for **undelete.**) Restore the specified deleted messages. Messages are undeleted in the order they were deleted; that is, the deleted messages are kept in a queue, not a stack. Will only restore messages deleted in the current mail session. If **autoprint** is set, the last message of those restored is printed (see "Environment variables").

uns ***name*** ... (Abbreviation: **uns** is short for **unset.**) Causes the specified variables to be erased. If the variable was imported from the execution environment (that is, a shell variable), then it cannot be erased.

ve Prints the current **version** and release date.

v [***msglist***] (Abbreviation: **v** is short for **visual.**) Edit the given messages with a screen editor. The messages are placed in a temporary file and the **VISUAL** variable is used to get the name of the editor (see "Environment variables").

w [*msglist*] *filename*
: **Write** the given messages on the specified file, minus the header and trailing blank line. Otherwise equivalent to the **save** command.

x
: See **e** (exit) or **q** (quit).

z [+|-]
: Scroll the header display forward or backward one full screen. The number of headers displayed is set by the **screen** variable (see "Environment variables").

Tilde escapes

The following commands may be entered only from *input mode*, by beginning a line with the tilde escape character (~). See **escape** under "Environment variables" for information on changing this special character.

~! *shell-command*
: Execute the shell command and return.

~.
: Simulate end of file (terminate message input).

~: *command*
~_ *command*
: Perform the command-level request. Valid only when sending a message while reading mail.

~?
: Print a summary of tilde escapes.

~A
: Expand the given alias.

~a
: Insert the autograph string **sign** into the message (see Environment variables).

~b *name* ...
: Add the *name*s to the blind carbon copy (Bcc) list.

~|^c *name* ...
: Add the *name*s to the carbon copy (Cc) list.

~d
: Read in the *dead.letter* file. (See **DEAD** under "Environment variables" for a description of this file.)

~e
: Invoke the editor on the partial message. (See **EDITOR** under "Environment variables".)

~f [*msglist*]
: Forward the specified messages. The messages are inserted into the message without alteration.

~h
: Prompt for "Subject line" and "To", "Cc", "Bcc", and "Return-Receipt-to" lists. If the field is displayed with an initial value, it may be edited as if you had just typed it.

~i *variable* Insert the value of the named variable into the text of the message. For example, **~A** is equivalent to **~iSign**. Environment variables set and exported in the shell are also accessible by **~i**.

~M [*msglist*] Insert the specified messages into the letter, with no indentation. Valid only when sending a message while reading mail.

~m [*msglist*] Insert the specified messages into the letter, shifting the new text to the right one tab stop. Valid only when sending a message while reading mail.

~p Print the message being entered.

~q Quit from input mode by simulating an interrupt. If the body of the message is not null, the partial message is saved in *dead.letter*. (See **DEAD** under "Environment variables".)

~r *filename*
~~< *filename*
~~< *!shell-command*
Read in the specified file. If the argument begins with an exclamation point (!), the rest of the string is taken as an arbitrary shell command and is executed, with the standard output inserted into the message.

~s *string* ... Set the subject line to *string*.

~t *name* ... Add the given *name*s to the "To" list.

~v Invoke a preferred screen editor on the partial message. (See also **VISUAL** under "Environment variables".)

~w *filename* Write the partial message onto the given file, without the header.

~x Exit as with **~q** except the message is not saved in *dead.letter*.

~| *shell-command*
Pipe the body of the message through the given *shell-command*. If the *shell-command* returns a successful exit status, the output of the command replaces the message.

Environment variables

The following are environment variables taken from the execution environment and are not alterable within **mail**.

HOME=*directory*
The user's base of operations.

MAILRC=*filename*
The name of the start-up file. Default is **$HOME/***.mailrc*.

The following variables are internal **mail** variables. They may be imported from the execution environment or set via the **se** (set) command at any time. The **uns** (unset) command may be used to erase variables.

addsopt Enabled by default. If **/bin/mail** is not being used as the deliverer, **noaddsopt** should be specified. (See "Notes" below.)

allnet All network names whose last component (login name) matches are treated as identical. This causes the ***msglist*** message specifications to behave similarly. Default is **noallnet**. See also the **alt** (alternates) command and the **metoo** variable.

append Upon termination, append messages to the end of the *mbox* file instead of prepending them. Default is **noappend.**

askcc Prompt for the "Cc" list after message is entered. Default is **noaskcc.**

asksub Prompt for subject if it is not specified on the command line with the **-s** option. Enabled by default.

autoprint Enable automatic printing of messages after **d** (delete) and **u** (undelete) commands. Default is **noautoprint.**

bang Enable the special-casing of exclamation points (!) in shell escape command lines as in **vi**(C). Default is **nobang.**

chron Cause messages to be displayed in chronological order. The default is reverse chronological order (most recent message first). See also **mchron** below.

cmd=*shell-command*
Set the default command for the **pi** (pipe) command. Not set by default.

conv=*conversion*
Convert UUCP addresses to the specified address style. The only valid conversion now is **internet**, which requires a mail delivery program conforming to the RFC822 standard for electronic mail addressing. Conversion is disabled by default. See also the **sendmail** variable and the **-U** command-line option.

crt=*number* Pipe messages having more than ***number*** lines through the command specified by the **PAGER** variable (**more**(C) by default). Disabled by default.

DEAD=*filename*
The name of the file in which to save partial letters in case of untimely interrupt. Default is **$HOME/***dead.letter*.

debug Enable verbose diagnostics for debugging. Messages are not delivered. Default is **nodebug**.

dot Take a dot on a line by itself during input from a terminal as end-of-file. Default is **nodot**.

EDITOR=*shell-command*
The command to run when the **e** (edit) or **~e** command is used. Default is **ed**(C).

escape=*c* Substitute *c* for the "~" escape character. Takes effect with next message sent.

folder=*directory*
The directory for saving standard mail files. User-specified file names beginning with a plus (+) are expanded by preceding the file name with this directory name to obtain the real file name. If ***directory*** does not start with a slash (/), **$HOME** is prepended to it. In order to use the plus (+) construct on a **mail** command line, **folder** must be an exported **sh** environment variable. There is no default for the **folder** variable. See also **outfolder** below.

header Enable printing of the header summary when entering **mail**. Enabled by default.

hold Preserve all messages that are read in the *mailbox* instead of putting them in the standard *mbox* save file. Default is **nohold**.

ignore Ignore interrupts while entering messages. Useful for noisy dial-up lines. Default is **noignore**.

ignoreeof Ignore end-of-file during message input. Input must be terminated by a dot (.) on a line by itself or by the **~.** command. Default is **noignoreeof**. See also the **dot** variable above.

keep When the *mailbox* is empty, truncate it to zero length instead of removing it. Disabled by default.

keepsave Keep messages that have been saved in other files in the *mailbox* instead of deleting them. Default is **nokeepsave**.

MBOX=*filename*
The name of the file to save messages which have been read. The **x** (exit) command overrides this function, as does saving the message explicitly in another file. Default is **$HOME**/*mbox*.

mchron Cause message headers to be listed in numerical order (most recently received first), but displayed in chronological order. See also **chron** above.

metoo If your login appears as a recipient, do not delete it from the list. Default is **nometoo**.

LISTER=*shell-command* The command (and options) to use when listing the contents of the **folder** directory. The default is **ls**(C).

onehop When responding to a message that was originally sent to several recipients, the other recipient addresses are normally forced to be relative to the originating author's machine for the response. This flag disables alteration of the recipients' addresses, improving efficiency in a network where all machines can send directly to all other machines (that is, one hop away).

outfolder Record outgoing messages in files located in the directory specified by the **folder** variable unless the pathname is absolute. Default is **nooutfolder**. See the **folder** variable above and the **S** (Save) and **C** (Copy) commands.

page Used with the **pi** (pipe) command to insert a form feed after each message sent through the pipe. Default is **nopage**.

PAGER=*shell-command* Use ***shell-command*** as a filter for paginating output. This can also be used to specify the options to be used. Default is **more**(C). For **PAGER** to function, the **crt** variable (see above) must be set to a non-zero value.

prompt=*string* Set the *command mode* prompt to ***string***. Default is "?".

quiet Refrain from printing the opening message and version when entering **mail**. Default is **noquiet**.

record=*filename* Record all outgoing mail in ***filename***. Disabled by default. See also **outfolder** above.

save Enable saving of messages in *dead.letter* on interrupt or delivery error. See **DEAD** for a description of this file. Enabled by default.

screen=*number* Set the number of lines in a full screen of headers for the **h** (headers) command.

sendmail=*shell-command*
Alternate command for delivering messages. Default is **rmail**(C).

sendwait Wait for background mailer to finish before returning. Default is **nosendwait**.

SHELL=*shell-command*
The name of a preferred command interpreter. Default is **sh**(C).

showto When displaying the header summary and the message from you, print the recipient's name instead of the author's name.

sign=*string* The variable inserted into the text of a message when the **~a** (autograph) command is given. Not set by default (see **~i** under "Tilde escapes").

Sign=*string* The variable inserted into the text of a message when the **~A** command is given. Not set by default (see also **~i** under "Tilde escapes").

toplines=*number*
The number of lines of header to print with the **to** (top) command. Default is 5.

VISUAL=*shell-command*
The name of a preferred screen editor. Default is **vi**(C).

Files

$HOME/*.mailrc*	personal start-up file
$HOME/*mbox*	secondary storage file
/usr/spool/mail	post office directory
*/usr/lib/mail/mail.help**	help message files
/usr/lib/mail/mailrci	optional global start-up file
*/tmp/R[emqsx]**	temporary files

See also

ls(C), **more**(C)

Notes

The **-h**, **-r** and **-U** options can be used only if **mail** is built with a delivery program other than **/bin/mail**.

Where ***shell-command*** is shown as valid, arguments are not always allowed. Experimentation is recommended.

Internal variables imported from the execution environment cannot be **uns** (unset).

The full internet addressing is not fully supported by **mail**. The new standards need some time to become established.

A line consisting only of a " . " is treated as the end of the message.

mailx is a link to the standard **mail** program; either name may be used.

Standards conformance

mail is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

man

print reference pages in this guide

Syntax

man [-afbcw] [-t*proc*] [-p*pager*] [-d*dir*] [-T*term*] [*section*] [*title*]

/usr/lib/manprog *file*

Description

The **man** program locates and prints the named ***title*** from the designated reference ***section***. For historical reasons, "page" is often used as a synonym for "entry" in this context.

Since UNIX commands are given in lowercase, the ***title*** is always entered in lowercase. If no ***section*** is specified, the whole guide is searched for ***title*** and the first occurrence of it is printed. You can search for a group of sections by separating the section names with colons (:) on the command line.

(The only exceptions to the lowercase rule are the "introduction" (Intro) pages. These pages describe the contents of their respective sections; they are not UNIX commands as such.)

The options and their meanings are:

-a "All" mode. Displays all matching titles. Incompatible with the **-f** option.

-f "First" mode. Displays only the first matching title. Incompatible with **-a** option. This is the default mode for **man**.

-b Leaves blank lines in output. **nroff**(CT) pads entries with blank lines for line printer purposes. **man** normally filters out these excess blank lines. Normally, **man** does not display more than 2 consecutive blank lines. The **-b** flag leaves blank lines in the CRT output.

-c Causes **man** to invoke **col**(C). Note that **col** is invoked automatically by **man** unless ***term*** is one of the following: **300, 300s, 450, 37, 4000a, 382, 4014, tek, 1620,** or **X**.

-w Prints on the standard output *only* the pathnames of the entries.

-t*proc* Indicates that if an unprocessed manual page is available, it is to be passed to *proc* for formatting. *proc* can be any command script in */usr/man/bin* or an absolute filename of a text processing program elsewhere on the system, for example **/bin/nroff**. The scripts in */usr/man/bin* invoke the actual processing programs with the correct flags and arguments. The default processor is **/usr/man/bin/nr**, which invokes **/bin/nroff** and produces output that safely prints on any terminal. The text is also preprocessed by **eqn**(CT) and **tbl**(CT) as a default.

-p*pager* Selects paging program *pager* to display the entry. Paging systems such as **more**(C), **pg**(C), **cat**(C), or any custom pagers that you may have are valid arguments for this flag. The default pager, **pg**, is set in */etc/default/man*.

-d*dir* Specifies directory *dir* to be added to the search path for entries. You can specify several directories to be searched by separating the directory names with colons (:) on the command line.

-T*term* Format the entry and pass the given *term* value to the processing program, then print it on the standard output (usually, the terminal), where *term* is the terminal type (see **term**(M) and the explanation below).

Section names

The names and general descriptions of the available manual sections are:

ADM	System Administration
C	Commands
M	Miscellaneous
F	File Formats
HW	Hardware Dependent
S	Subroutines and Libraries
CP	Programming Commands
DOS	DOS Subroutines and Libraries
LOCAL	Local utilities for your system

You can add other section names as you wish. Each new section, however, must follow the standard section directory structure. The LOCAL directory is shipped without contents, as no LOCAL manual pages are included.

/usr/man directory structure

The source files for the **man** program are kept in the directory */usr/man*. Each **man** section is comprised of two directories, and there is a directory called *bin* for programs and shell scripts related to **man**. There is also an index file called *index* in */usr/man*. This index is a list of all UNIX commands and their sections.

Each manual section has two directories in */usr/man*. These directories are called *man* and *cat*, plus the name of the section as a suffix. For example, the "C" manual section comprises of two directories, *man.C* and *cat.C*, both located in */usr/man*.

The unprocessed source text is in the *man* directory and the printable processed output is in the *cat* directory. When a title is requested, both directories are checked. The most recent copy of the manual page is used as the current copy. If the most recent title is in the source text directory and it is processed by the default processor with the default terminal type, a display copy of the output is placed in the *cat* directory for future use. Note that a file that must be processed takes longer to appear on the screen than a display copy.

Environment variables

There is a shell environment variable for use with the **man** utility. This variable is called **MANPATH** and it is used to change or augment the path **man** searches for entries. Multiple directories set with this variable must be delimited by colon characters (:). If the **MANPATH** environment variable is present, the directories are searched in the order that they appear. */usr/man* must appear in the **MANPATH** list to be included. If you set this environment variable, it supersedes the **MANPATH** entry in the */etc/default/man* file. Alternate subdirectories are expected to have the same form as the default directories in */usr/man*.

/etc/default/man

There is a file called *man* in the */etc/default* directory that contains the default settings for the **man** utility. The following options are set in */etc/default/man*:

```
PAGER=/usr/bin/pg
MANPATH=/usr/man
TERM=lp
ORDER=ADM:C:S:CP:M:F:HW:DOS:LOCAL
MODE=FIRST
PROC=nr
```

You can select a different paging system, search path, terminal type, search order, mode, and processor for the **man** system by changing the information in this file.

To change the search order for manual sections, edit the list following the **ORDER** variable. Be certain the section names are separated with colons (:). Section names not present in **ORDER** are searched in arbitrary order after those specified in */etc/default/man*.

Creating new manual entries

You can create new manual pages for utilities and scripts that you have developed. Use an existing manual page as an example of manual page structure. Use the **man** macros to format your manual page. For more information, refer to the **nroff**(CT) manual page.

You must be logged in as *root* (the "Super User") to place a new manual page in your */usr/man* directory structure. Place your new page in */usr/man/man.LOCAL* while logged in as *root* and view it using the **man** command, since only root has write permission for the cat-able directories. Once **man** has produced the cat-able output, any user can view the new page in the same manner as any other on line manual page.

Additionally, you can create your own custom sections by creating another manual directory and putting it in the **MANPATH**. For example, if subdirectories *man.X* and *cat.X* are present, then **man** recognizes that "X" is a valid manual section.

If you wish to use another text processing program (such as **troff**(CT)) to process your custom manual pages, use the **-t***proc* flag of **man**. ***proc*** can be any shell script in */usr/man/bin*. To place a cat-able copy of the manual page in the *cat* directory, use the **tee**(C) command to send the output to a file, as well as to the standard output.

Your command should have the form:

man -t*proc filename* | **tee** ***pathname***

In the above example, ***proc*** is the text processing script, ***filename*** is the manual page source file, and ***pathname*** is the path of the directory for the cat-able output.

Custom manual sections can have an index, if the format is the same as the index in */usr/man*. **man** uses the index to locate multiple commands that are listed on the same page as well as commands that have pages in several different sections.

The man macro package

The **man** macro package is located in */usr/lib/macros/an*. There are 15 basic macros in the package. Here is a table of the macros and brief descriptions of their functions:

Macro	Description
.TH ***title***	Title Heading
.SH ***title***	Section Heading
.SS ***title***	Subsection Heading
.SM ***text***	Reduce Point Size
.PP	New Paragraph
.IP	Indented Paragraph
.HP	Hanging Paragraph
.TP	Tagged Paragraph
.RS ***n***	Relative Indent
.RE	Release Relative Indent
.I ***text***	Italic Font
.B ***text***	Bold Font
.R ***text***	Roman Font
.PM	Proprietary Mark (copyright)

See also

eqnchar(CT), **nroff**(CT), **tbl**(CT), **troff**(CT), **environ**(M), **term**(F)

Notes

All entries are supposed to be reproducible either on a typesetter or on a terminal. However, on a terminal some information, such as **eqn**(CT) and **tbl**(CT) output, is either lost or approximated as it cannot be exactly reproduced.

In order to make use of **eqnchar**, **nroff**, **tbl**, and **troff**, it is first necessary to obtain and install the UNIX Text Processing System (available separately).

Value added

man is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

mesg

permit or deny messages sent to a terminal

Syntax

mesg [n] [y]

Description

The **mesg** command with argument **n** forbids messages via **write**(C) by revoking non-user write permission on the user's terminal. **mesg** with argument **y** reinstates permission. By itself, **mesg** reports the current state without changing it.

File

*/dev/tty**

See also

write(C)

Diagnostics

Exit status is 0 if messages are receivable, 1 if not, 2 on error.

Standards conformance

mesg is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

mkdir

make a directory

Syntax

mkdir [**-m** *mode*] [**-p**] [**-e**] *dirname* ...

Description

The **mkdir** command creates the named directories in mode 777 (possibly altered by **umask**(C)).

Standard entries in a directory (for example, the files ".", for the directory itself, and "..", for its parent) are made automatically. **mkdir** cannot create these entries by name. Creation of a directory requires write permission in the parent directory.

The owner ID and group ID of the new directories are set to the process's real user ID and group ID, respectively.

Three options apply to **mkdir**:

-m This option allows users to specify the mode to be used for new directories. Choices for modes can be found in **chmod**(C).

-p With this option, **mkdir** creates *dirname* by creating all the non-existing parent directories first.

-e For historical compatibility, **mkdir** changes the ownership of the new directory to the real user ID (RUID) and the real group ID (RGID). The **-e** option says to use the effective user ID (EUID) and effective group ID (EGID) instead.

See also

mkdir(S), **rm**(C), **rmdir**(C), **sh**(C), **umask**(C)

Diagnostics

The **mkdir** command returns exit code 0 if all directories given in the command line were made successfully. Otherwise, it prints a diagnostic and returns non-zero. An error code is stored in **errno**.

Standards conformance

mkdir is conformant with AT&T SVID Issue 2.

mkfifo

make a FIFO special file

Syntax

mkfifo *path ...*

Description

The **mkfifo** command makes a first-in first-out pipe named by the pathname *path*. The new FIFO has the permissions 666 (possibly altered by **umask**(C)).

See also

mkfifo(S), **umask**(C)

Diagnostics

mkfifo returns exit code 0 if all FIFO special files were created successfully. Otherwise, it prints a diagnostic and returns non-zero. An error code is stored in **errno**.

Value added

mkfifo is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

mknod

build special files

Syntax

/etc/mknod ***name*** **[c | b]** ***major minor***

/etc/mknod ***name*** **p**

/etc/mknod ***name*** **s**

/etc/mknod ***name*** **m**

Description

The **mknod** command makes a directory entry and corresponding inode for a special file. The first argument is the ***name*** of the entry. In the first case, the second argument is **b** if the special file is block-type (disks, tape) or **c** if it is character-type (other devices). The last two arguments are numbers specifying the ***major*** device type and the ***minor*** device (for example, unit, drive, or line number), which may be either decimal or octal. Minor numbers must be in the range 0 to 255.

The assignment of major device numbers is specific to each system. Major device numbers can be found in the system source file */etc/conf/cf.d/mdevice*.

mknod can also be used to create named pipes with the **p** option, semaphores with the **s** option, and shared data (memory) with the **m** option.

Only the super user can use the first form of the syntax.

See also

mknod(S)

Notes

mknod does not understand extended minor device numbers. It will impose an upper limit of 255 on the minor device number parameter.

Standards conformance

mknod is conformant with:

AT&T SVID Issue 2.

mnt, umnt

mount a filesystem

Syntax

/usr/bin/mnt [**-urant**] [*directory*]

/usr/bin/umnt *directory*

Description

mnt - Mount selected filesystems

umnt - Unmount selected filesystems

The **mnt** command allows users other than the super user to access the functionality of the **mount**(ADM) command to mount selected filesystems. The super user can define how and when a filesystem mount is permitted via the */etc/default/filesys* file.

The filesystem requirements are the same as defined for **mount**(ADM).

The **umnt** command unmounts the mountable filesystem previously mounted in *directory*.

mnt is invoked from the */etc/rc* scripts with the **-r**, the **-n** and possibly the **-a** flag to mount filesystems when the system comes up as multiuser. The **-a** flag is used when the system has autobooted. None of these flags should be specified during normal command line use.

The **-n** flag directs the system to mount all filesystems defined as **fstyp** "NFS" with **rcmount** set to "yes" in the */etc/default/filesys* file. Filesystems of this type should have **bdev** defined as follows:

bdev=*hostname*:*pathname*

The **cdev** entry is not necessary if the filesystem is of type "NFS". **rcfsck** should be set to "no".

The **-t** flag displays the contents of */etc/default/filesys*.

The **-u** flag forces **mnt** to behave like **umnt**.

Options

The following options can be defined in the */etc/default/filesys* entry for a filesystem:

bdev=*/dev/device*	Name of block device associated with the filesystem.
cdev=*/dev/device*	Name of character (raw) device associated with the filesystem.
mountdir=*/directory*	The directory the filesystem is to be mounted on.
desc=*name*	A string describing the filesystem.
passwd=*string*	An optional password prompted for at mount request time. Cannot be a simple string; must be in the format permitted by */etc/passwd*. (See "Notes.")
fsck=yes, no, dirty, prompt	If **yes/no**, tells explicitly whether or not to run **fsck**. If **dirty**, **fsck** is run only if the filesystem requires cleaning. If **prompt**, the user is prompted for a choice. If no entry is given, the default value is **dirty**.
fsckflags=*flags*	Any flags to be passed to **fsck**.
rcfsck=yes, no, dirty, prompt	Similar to **fsck** entry, but only applies when the **-r** flag is passed.
maxcleans=*n*	The number of times to repeat cleaning of a **dirty** filesystem before giving up. If undefined, default is 4.
mount=yes, no, prompt	If **yes** or **no**, users are allowed or disallowed to mount the filesystem, respectively. If **prompt**, the user specifies whether the filesystem should be mounted.
rcmount=yes, no, prompt	If **yes**, the filesystem is mounted by **/etc/rc2** when the system comes up as multiuser. If **no**, the filesystem is never mounted by **/etc/rc2**. With **prompt**, a query is displayed at boot time to mount the filesystem.
mountflags=*flags*	Any flags to be passed to **mount**.

prep=yes, no, prompt	Indicates whether any **prepcmd** entry should always be executed, never executed, or executed as specified by the user.
prepcmd=*command*	An arbitrary shell command to be invoked immediately following password check and prior to running **fsck**.
init=yes, no, prompt	Indicates whether an **initcmd** entry should always be executed, never be executed, or executed as specified by the user.
initcmd=*command*	An optional, arbitrary shell command to be invoked immediately following a successful mount.
fstyp=*type*	Defines the filesystem type. Available types include NFS, S51K, XENIX, and DOS.
nfsopts=*opts*	Defines NFS options for filesystems of type NFS. Available options are described in the **mount**(ADM) manual page.

Any entries containing spaces, tabs, or new lines must be contained in double quotes (").

The only mandatory entries in */etc/default/filesys* are **bdev** and **mountdir**. The **prepcmd** and **initcmd** options can be used to execute another command before or after mounting the filesystem. For example, **initcmd** could be defined to send mail to root whenever a given filesystem is mounted.

When invoked without arguments, **mnt** attempts to mount all filesystems that have the entries **mount=yes** or **mount=prompt**.

Examples

The following is a sample */etc/default/filesys* file:

```
bdev=/dev/root  cdev=/dev/rroot  mountdir=/  \
desc="The Root Filesystem"  rcmount=no  mount=no

bdev=/dev/u  cdev=/dev/ru  mountdir=/u  rcmount=yes  \
fsckflags=-y  desc="The User Filesystem"

bdev=/dev/x  cdev=/dev/rx  mountdir=/u  rcmount=no  \
mount=yes  fsckflags=-y  desc="The Extra Filesystem"
```

Of the examples above, only */x* is mountable by non super users.

File

/etc/default/filesys Filesystem data

See also

filesys(F), **mount**(ADM)

Diagnostics

mnt will fail if the filesystem to be mounted is currently mounted under another name.

Busy filesystems cannot be unmounted with **umnt**. A filesystem is busy if it contains an open file or if a user's present working directory resides within the filesystem.

Notes

The NFS options are only valid if NFS is installed; refer to your NFS documentation for **mount** options that are specific to NFS.

Some degree of validation is done on the filesystem; however it is generally unwise to mount corrupt filesystems.

In order to create a password for a filesystem, the system administrator must run the **passwd**(C) command using the **-F** option. Note that filesystem passwords are not supported on all systems.

Value added

mnt is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

more

view a file one screen full at a time

Syntax

more [**-cdflrsuvw**] [*-n*] [*+linenumber*] [*+/pattern*] [*name* ...]

Description

more - view a file one screen full at a time

page - is a link to **more**

This filter allows examination of continuous text one screen full at a time. It normally pauses after each full screen, displaying:

```
--More--
```

at the bottom of the screen. If the user then presses carriage return, one more line is displayed. If the user presses the Space bar, another full screen is displayed. Other possibilities are described below.

The command line options are:

-n An integer which is the size (in lines) of the window which **more** will use instead of the default.

-c **more** draws each page by beginning at the top of the screen and erasing each line just before it draws on it. This avoids scrolling the screen, making it easier to read while **more** is writing. This option is ignored if the terminal does not have the ability to clear to the end of a line.

-d **more** prompts with the message "Hit space to continue, Rubout to abort" at the end of each full screen. This is useful if **more** is being used as a filter in some setting, such as a class, where many users may be inexperienced.

-f This option causes **more** to count logical, rather than screen lines: that is, long lines are not folded. This option is recommended if **nroff** output is being piped through **ul**, since the latter may generate escape sequences. These escape sequences contain characters that would ordinarily occupy screen positions, but do not print when they are sent to the terminal as part of an escape sequence. Thus **more** may think that lines are longer than they actually are and fold lines erroneously.

-l Does not treat ⟨Ctrl⟩**l** (form feed) specially. If this option is not given, **more** pauses after any line that contains a ⟨Ctrl⟩**l**, as if the end of a full screen has been reached. Also, if a file begins with a form feed, the screen is cleared before the file is printed.

-r Causes carriage returns to be printed as "^M".

-s Squeezes multiple blank lines from the output, producing only one blank line. Especially helpful when viewing **nroff** output, this option maximizes the useful information present on the screen.

-u Normally, **more** handles underlining, such as that produced by **nroff**, in a manner appropriate to the particular terminal: if the terminal can perform underlining or has a stand-out mode, **more** outputs appropriate escape sequences to enable underlining or stand-out mode for underlined information in the source file. The **-u** option suppresses this processing.

-v Normally, **more** ignores control characters that it does not interpret in some way. The **-v** option causes these to be displayed as ^*C* where *C* is the corresponding printable ASCII character. Non-printing non-ASCII characters (with the high bit set) are displayed in the format M-*C*, where *C* is the corresponding character without the high bit set. If output is not going to a terminal, **more** does not interpret control characters.

-w Normally, **more** exits when it comes to the end of its input. With **-w** **more** prompts and waits for any key to be struck before exiting.

+linenumber
Starts up at ***linenumber***.

+/pattern
Starts up two lines before the line containing the regular expression ***pattern.***

more looks in */usr/lib/terminfo/** to determine terminal characteristics, and to determine the default window size. On a terminal capable of displaying 24 lines, the default window size is 22 lines.

more looks in the environment variable **MORE** to preset any flags desired. For example, if you prefer to view files using the **-c** mode of operation, the shell command "**MORE=-c**" in the *.profile* file causes all invocations of **more** to use this mode.

If **more** is reading from a file, rather than a pipe, a percentage is displayed with the "`--More--`" prompt. This gives the fraction of the file (in characters, not lines) that has been read so far.

Other sequences which may be entered when **more** pauses, and their effects, are as follows (***i*** is an optional integer argument, defaulting to 1 where not specified otherwise):

i ⟨Space⟩ Displays ***i*** more lines, (or another full screen if no argument is given).

⟨Ctrl⟩**d** Displays 11 more lines (a "scroll"). If ***i*** is given, then the scroll size is set to ***i***.

d	Same as ⟨Ctrl⟩**d**.
***i*z**	Same as entering a space except that ***i***, if present, becomes the new window size.
***i*s**	Skips ***i*** lines and displays a full screen of lines.
***i*f**	Skips ***i*** full screens and displays a full screen of lines.
b	Skips back and displays the previous screen of lines.
⟨Ctrl⟩**b**	Same as **b**.
q or **Q**	Exits from **more**.
=	Displays the current line number.
v	Starts up the screen editor **vi** at the current line.
h or **?**	Help command; gives a description of all the **more** commands.
***i*expr/**	Searches for the ***i***th occurrence of the regular expression ***expr***. If there are less than ***i*** occurrences of ***expr***, and the input is a file (rather than a pipe), then the position in the file remains unchanged. Otherwise, a full screen is displayed, starting two lines before the place where the expression was found. The user's erase and kill characters may be used to edit the regular expression. Erasing back past the first column cancels the search command.
***i*n**	Searches for the ***i***th occurrence of the last regular expression entered.
'	(Single quotation mark) Goes to the point from which the last search started. If no search has been performed in the current file, this command goes back to the beginning of the file.
!*command*	Invokes a shell with ***command***. The characters "%" and "!" in ***command*** are replaced with the current filename and the previous shell command respectively. If there is no current filename, "%" is not expanded. The sequences "\%" and "\!" are replaced by "%" and "!" respectively.
***i*:n**	Skips to the ***i***th next file given in the command line (skips to last file if ***i*** doesn't make sense).
***i*:p**	Skips to the ***i***th previous file given in the command line. If this command is given in the middle of printing out a file, **more** goes back to the beginning of the file. If ***i*** doesn't make sense, **more** skips back to the first file. If **more** is not reading from a file, the bell rings and nothing else happens.

:f Displays the current filename and line number.

:q or **:Q** Exits from **more** (same as **q** or **Q**).

. Repeats the previous command.

The commands take effect immediately. It is not necessary to enter a carriage return. Up to the time when the command character itself is given, the user may enter the line kill character to cancel the numerical argument being formed. In addition, the user may enter the erase character to redisplay the "`--More-- (`*xx*`%)`" message.

The terminal is set to **noecho** mode by this program so that the output can be continuous. What you enter will not show on your terminal, except for the slash (/) and exclamation (!) characters.

If the standard output is not a teletype, **more** acts just like **cat**, except that a header is printed before each file (if there is more than one).

Files

*/usr/lib/terminfo/**	Terminal database
/usr/lib/more.help	Help file

See also

cat(C), **csh**(C), **environ**(M), **sh**(C)

Credit

This utility was developed at the University of California at Berkeley and is used with permission.

Notes

The **vi** and **help** options may not be available.

Before displaying a file, **more** attempts to detect whether it is a non-printable binary file such as a directory or executable binary image. However, **more** cannot detect all possible kinds of non-printable files.

mpstat

multiprocessor CPU load status display

Syntax

mpstat [-x | c *CPU*] [-bho]
mpstat [-V]

Description

The multiprocessor load display utility, **mpstat**, displays system processor activity information on your screen for each of the processors installed on your system. CPU load display information updates every second.

When you invoke **mpstat**, the Multiprocessor Activity window displays on your screen. For each CPU installed on your system the following information displays:

CPU activity display windows

The CPU Activity Display Window displays CPU activity. The percentage of kernel code running, the percentage of user code running, and the percentage of CPU idle time are indicated as follows:

- dark shaded block or ':' - specifies one unit (5%) of kernel code
- light shaded block or '#' - specifies one unit (5%) of user code

The amount of space within the CPU Activity Display Window indicates the percentage of CPU idle time (one space equals 5%).

Status

Each CPU is in one of three states:

- **ACTIVE** - The CPU is available to run any process.
- **STATIC** - The CPU can only run processes specifically designated to run on that CPU.
- **INACTIVE** - The CPU runs no processes.

sys Specifies the number of system calls.

cs Specifies the number of context switches.

int Specifies the number of interrupts.

tr Specifies the number of traps.

The CPU load display utility displays status information for as many CPUs as possible on your screen. If you have a large number of processors installed, it may not be possible to display status information for all processors on one screen. **mpstat** allows you to examine status information for all CPUs using the screen movement keys. The screen movement keys are as follows:

⟨Ctrl⟩**f**	scrolls forward one screen
⟨Ctrl⟩**d**	scrolls forward one half screen
⟨Ctrl⟩**b**	scrolls backward one screen
⟨Ctrl⟩**u**	scrolls backward one half screen
⟨Home⟩ or ⟨Ctrl⟩**h**	moves to the first screen
⟨End⟩ or **G**	moves to the last screen
⟨Up Arrow⟩ or **j**	scrolls forward one CPU
⟨Down Arrow⟩ or **k**	scrolls backward one CPU
⟨Ctrl⟩**r** or ⟨Ctrl⟩**l**	refreshes the current screen

The Help window displays a full list of the screen movement keys. Press 'h' from the Multiprocessor Activity window to display the Help window. The Help window also displays Hotkey information. Hotkeys are used to move between **mpstat** windows. The Hotkeys are as follows:

⟨Esc⟩ or **q**	exit the current window
o	display the Options window

The **mpstat** utility allows you to lock this utility onto any one CPU (with the exception of the base CPU - CPU1). A lock on any CPU releases all other CPUs for normal operation. This will produce accurate system processor activity information.

If you lock **mpstat** onto a CPU, that CPU will only execute **mpstat** and processes currently designated to run on that CPU. The CPU displays on the status information screen as being in a **STATIC** state.

Invoke **mpstat** with the **-c** ***CPU*** option or select the lock option from the Options menu to lock **mpstat** to run on a specified CPU.

Invoke **mpstat** with the **-x** (default) option to allow **mpstat** to free run on any CPU. Note that allowing **mpstat** to free run on any CPU does not produce accurate processor load status information.

mpstat also allows you to hide the locked CPU. This option will move data on the locked CPU from the status display screen into the background.

Invoke **mpstat** with the **-h** option or select the hide option from the Options menu to hide the statistics of the locked CPU.

You can select the required options, on the Options screen, using the ⟨Up Arrow⟩ and ⟨Down Arrow⟩ keys. Invoke **mpstat** with the **-o** option or type 'o' at the Multiprocessor Activity window to display the Options window.

mpstat can be run with none or any of the following command line parameters:

-c *CPU*	lock **mpstat** utility on processor number *CPU*. Cannot be used with option **-x**
-b	use current screen colors
-h	hide statistics of locked CPU
-o	run Options window
-x	allow **mpstat** to free run on any CPU. Default option. Cannot be used with option **-c**
-V	display Corollary **mpstat** version number

mv

move or rename files and directories

Syntax

mv [**-f**] *file1 file2*

mv [**-f**] *directory1 directory2*

mv [**-f**] *file ... directory*

Description

In the first form, the **mv** command moves (changes the name of) *file1* to *file2* (or *directory1* to *directory2*).

If *file2* already exists, it is removed before *file1* is moved. If *file2* has a mode which forbids writing, **mv** prints the mode (see **chmod**(C)) and prompts you for confirmation. If you type "y", the move takes place; if not, **mv** exits.

No questions are asked (if *file2* is not writeable) when the **-f** option is given.

In the second form, **mv** can only move directories within a filesystem, the target *directory2* should not exist.

In the third form, one or more *files* are moved to the *directory*, keeping their original filenames.

mv refuses to move a file onto itself.

mv does not follow symbolic links given as arguments.

See also

chmod(S), **copy**(C), **cp**(C), **mvdir**(ADM)

Notes

If *file1* and *file2* lie on different filesystems, **mv** must copy the file and delete the original. In this case the owner name becomes that of the copying process and any linking relationship with other files is lost.

Standards conformance

mv is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

newform

change the format of a text file

Syntax

newform [**-s**] [**-i***tabspec*] [**-o***tabspec*] [**-b***n*] [**-e***n*] [**-p***n*] [**-a***n*] [**-f**] [**-c***char*] [**-l***n*] [*file* ...]

Description

The **newform** command reads lines from the named *files*, or the standard input if no input file is named, and reproduces the lines on the standard output. Lines are reformatted in accordance with command line options in effect.

Except for **-s**, command line options may appear in any order, may be repeated, and may be intermingled with *files*. Command line options are processed in the order typed. This means that option sequences like **"-e15 -l60"** will yield results different from **"-l60 -e15"**. Options are applied to all *files* on the command line.

-s Shears off leading characters on each line up to the first tab and places up to 8 of the sheared characters at the end of the line. If more than 8 characters (not counting the first tab) are sheared, the eighth character is replaced by a "*" and any characters to the right of it are discarded. The first tab is always discarded.

An error message and program exit will occur if this option is used on a file without a tab on each line. The characters sheared off are saved internally until all other options specified are applied to that line. The characters are then added at the end of the processed line.

-i*tabspec* Input tab specification: expands tabs to spaces, according to the tab specifications given. *tabspec* recognizes all tab specification forms described below. In addition, *tabspec* may be "--", in which **newform** assumes that the tab specification is to be found in the first line read from the standard input. If no *tabspec* is given, *tabspec* defaults to **-8**. A *tabspec* of **-0** expects no tabs; if any are found, they are treated as **-1**.

-o*tabspec* Output tab specification: replaces spaces by tabs, according to the tab specifications given. The tab specifications are the same as for **-i***tabspec*. If no *tabspec* is given, *tabspec* defaults to **-8**. A *tabspec* of **-0** means that no spaces will be converted to tabs on output.

-b*n* Truncates ***n*** characters from the beginning of the line when the line length is greater than the effective line length (see **-l*n***). The default is to truncate the number of characters necessary to obtain the effective line length. The default value is used when **-b** with no ***n*** is used. This option can be used to delete the sequence numbers from a COBOL program as follows:

newform -l1 -b7 *filename*

The option **-l1** must be used to set the effective line length shorter than any existing line in the file so that the **-b** option is activated.

-e*n* Truncates ***n*** characters from the end of the line.

-p*n* Prefixes ***n*** characters (see **-c*k***) to the beginning of a line when the line length is less than the effective line length. The default is to prefix the number of characters necessary to obtain the effective line length.

-a*n* Appends ***n*** characters to the end of a line. The default is to append the number of characters necessary to get the effective line length.

-f Writes the tab specification format line on the standard output before any other lines are output. The tab specification format line which is printed will correspond to the format specified in the *last* **-o** option. If no **-o** option is specified, the line which is printed will contain the default specification of **-8**.

-c*k* Changes the prefix/append character to ***k***. Default character for ***k*** is a space (see options **-p** and **-a**).

-l*n* Sets the effective line length to ***n*** characters. If ***n*** is not typed, **-l** defaults to 72. The default line length without the **-l** option is 80 characters. Note that tabs and backspaces are considered to be one character (use **-i** to expand tabs to spaces).

Tabs

Four types of tab specification are accepted for ***tabspec***: "canned", repetitive, arbitrary, and file. The lowest column number is 1. For tabs, column 1 always refers to the leftmost column on a terminal, even one whose column markers begin at 0, for example the DASI 300, DASI 300S, and DASI 450.

The "canned" tabs are given as ***-code*** where ***code*** (and its meaning) is from the following list:

-a 1,10,16,36,72
Assembler, IBM S/370, first format

-a2 1,10,16,40,72
Assembler, IBM S/370, second format

-c 1,8,12,16,20,55
COBOL, normal format

-c2 1,6,10,14,49
COBOL compact format (columns 1-6 omitted). Using this code, the first typed character corresponds to card column 7, one space gets you to column 8, and a tab reaches column 12. Files using this tab setup should include a format specification as follows:

<:t-c2 m6 s66 d:>

-c3 1,6,10,14,18,22,26,30,34,38,42,46,50,54,58,62,67
COBOL compact format (columns 1-6 omitted), with more tabs than COBOL **-c2**. This is the recommended format for COBOL. The appropriate format specification is:

<:t-c3 m6 s66 d:>

-f 1,7,11,15,19,23
FORTRAN

-p 1,5,9,13,17,21,25,29,33,37,41,45,53,57,61
PL/I

-s 1,10,55
SNOBOL

-u 1,12,20,44
UNIVAC 1100 Assembler

In addition to these "canned" formats, three other types exist:

-n A repetitive specification requests tabs at columns 1+***n***, 1+2****n***, etc. Note that such a setting leaves a left margin of ***n*** columns on TermiNet terminals *only*. Of particular importance is the value **-8**: this represents the UNIX system "standard" tab setting, and is the most likely tab setting found at a terminal. It is required for use with **nroff**(CT) **-h** option for high-speed output. Another special case is the value **-0**, implying no tabs at all.

n1,n2,... The arbitrary format permits the user to type any chosen set of number, separated by commas, in ascending order. Up to 40 numbers are allowed. If any number (except the first one) is preceded by a plus sign, it is taken as an increment to be added to the previous value. Thus, the tab lists 1,10,20,30 and 1,10,+10,+10 are considered identical.

--file If the name of a file is given, **newform** reads the first line of the file, searching for a format specification. If it finds one there, it sets the tab stops according to it; otherwise it sets them as **-8**. This type of specification may be used to make sure that a tabbed file is printed with correct tab settings.

Any of the following may be used also; if a given flag occurs more than once, the last value given takes effect:

-T*type* **newform** usually needs to know the type of terminal in order to set tabs and always needs to know the type to set margins. ***type*** is a name listed in **term**(CT). If no **-T** flag is supplied, **newform** searches for the **$TERM** value in the environment (see **environ**(M)). If no ***type*** can be found, **newform** tries a sequence that will work for many terminals.

+m*n* The margin argument may be used for some terminals. It causes all tabs to be moved over ***n*** columns by making column ***n*+1** the left margin. If **+m** is given without a value of ***n***, the value assumed is 10. For a TermiNet, the first value in the tab list should be 1, or the margin will move even further to the right. The normal (leftmost) margin on most terminals is obtained by **+m0**. The margin for most terminals is reset only when the **+m** flag is given explicitly.

Example

In the following example, **newform** converts a file named ***text*** with leading digits, one or more tabs, and text on each line to a file beginning with the text and the leading digits placed at the end of each line in column 73 (**-s** option). All tabs after the first one are expanded to spaces (**-i** option). To reach the line length of 72 characters (**-l** option), spaces are appended to each line up to column 72 (**-a** option) or lines are truncated at column 72 (**-e** option). To reformat the sample file ***text*** in this manner, enter:

newform -s -i -l -a -e text

Exit codes

0 - normal execution
1 - for any error

See also

csplit(C)

Diagnostics

All diagnostics are fatal.

`usage: . . .`	**newform** was called with a bad option.
`not -s format`	There was no tab on one line.
`can't open file`	Self-explanatory.

`internal line too long`	A line exceeds 512 characters after being expanded in the internal work buffer.
`tabspec in error`	A tab specification is incorrectly formatted, or specified tab stops are not ascending.
`tabspec indirection illegal`	A ***tabspec*** read from a file (or standard input) may not contain a ***tabspec*** referencing another file (or standard input).

Notes

newform normally only keeps track of physical characters; however, for the **-i** and **-o** options, **newform** will keep track of backspaces in order to line up tabs in the appropriate logical columns.

newform will not prompt the user if a ***tabspec*** is to be read from the standard input (by use of **-i**, **--** or **-o--**).

If the **-f** option is used, and the last **-o** option specified was "-o--", and was preceded by either "-o--" or a "-i--", the tab specification format line will be incorrect.

newgrp

log user into a new group

Syntax

newgrp [-] *group*

Description

The **newgrp** command changes the effective group identification of its caller. The same person remains logged in, and the current directory is unchanged, but calculations of access permissions to files are performed with respect to the new group ID.

newgrp without an argument changes the group identification to the group in the password file.

If the first argument to **newgrp** is a hyphen (-), the user will actually be logged in again as a member of the new group, ***group***.

If the first argument to **newgrp** is a hyphen, but ***group*** is not specified, the user will be logged in again as a member of the caller's original group identification according to the password file.

Files

/etc/group
/etc/passwd

See also

group(F), **ksh**(C), **sg**(C), **login**(M)

Notes

The **newgrp** command executes, but does not fork, a new shell. If your login shell is a C shell and you invoke **newgrp**, you will have to press ⟨Ctrl⟩**d** when you wish to log out. Typing the **csh**(C) **logout** command will result in an error message. Note also that the **newgrp** command causes the **csh** history list to start again at 1.

A version of **newgrp** is built into the Korn shell (**ksh**(C)). Please refer to the **ksh**(C) entry for details. This command has been effectively superseded by the newer command **sg**(C), which should be used in preference to **newgrp** wherever possible.

Standards conformance

newgrp is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

news

print news items

Syntax

news [-a] [-n] [-s] [*items*]

Description

news is used to keep the user informed of current events. By convention, these events are described by files in the directory */usr/news*.

When invoked without arguments, **news** prints the contents of all current files in */usr/news*, the most recent first, with each preceded by an appropriate header. **news** stores the "currency" time as the modification date of a file named *.news_time* in the user's home directory (the identity of this directory is determined by the environment variable **$HOME**); only files more recent than this currency time are considered "current."

The **-a** option causes **news** to print all items, regardless of currency. In this case, the stored time is not changed.

The **-n** option causes **news** to report the names of the current items without printing their contents, and without changing the stored time.

The **-s** option causes **news** to report how many current items exist, without printing their names or contents, and without changing the stored time.

All other arguments are assumed to be specific news items that are to be printed.

If the INTERRUPT key is struck during the printing of a news item, printing stops and the next item is started. Another INTERRUPT within one second of the first causes the program to terminate.

Files

*/usr/news/**
$HOME/*.news_time*

See also

environ(M), **profile**(M)

Notes

This is not an interface for USENET news.

Standards conformance

news is conformant with:

AT&T SVID Issue 2.

nice

run a command at a different scheduling priority

Syntax

nice [*-increment*] *command* [*arguments*]

Description

The **nice** command is used to execute a command at a different scheduling priority than usual. Each process has a "nice value" which is used to calculate its priority. Nice values range from 0 to 39, with higher nice values resulting in lower priorities. By default, commands have a nice value of 20. **nice** executes *command* with a **nice** value equal to 20 plus *increment*. If no *increment* is given, an *increment* of 10 is assumed.

The super user may run commands with priority *higher* than normal by using a double negative increment. For example, an argument of **--10** would decrement the default to produce a nice value of 10, which is a higher scheduling priority than the default of 20.

See also

csh(C), **nice**(S), **nohup**(C)

Diagnostics

nice returns the exit status of *command*.

Notes

If the default **nice** value plus *increment* is larger than 39, a **nice** value of 39 will be used. If a **nice** value less than zero is requested, zero will be used.

Note also that this description of **nice** applies only to programs run under the Bourne Shell. The C-Shell has its own **nice** command, which is documented in **csh**(C).

Standards conformance

nice is conformant with:

AT&T SVID Issue 2.

nl

add line numbers to a file

Syntax

nl [**-h** *type*] [**-b** *type*] [**-f** *type*] [**-v** *start#*] [**-i** *incr*] [**-p**] [**-l** *num*] [**-s** *sep*] [**-w** *width*] [**-n** *format*] *file*

Description

The **nl** command reads lines from the named *file*, or the standard input if no *file* is named, and reproduces the lines on the standard output. Lines are numbered on the left in accordance with the command options in effect.

nl views the text it reads in terms of logical pages. Line numbering is reset at the start of each logical page. A logical page consists of a header, a body, and a footer section. Empty sections are valid. Different line numbering options are independently available for header, body, and footer (for example, no numbering of header and footer lines while numbering blank lines only in the body).

The start of logical page sections is signaled by input lines containing nothing but one or more pairs of backslash-followed-by-colon:

Page Section	Line Contents
Header	\:\:\:
Body	\:\:
Footer	\:

Unless signaled otherwise, **nl** assumes the text being read is in a single logical page body.

Command options may appear in any order and may be intermingled with an optional filename. Only one file may be named. The options are:

-b *type* Specifies which logical page body lines are to be numbered. Recognized *types* and their meaning are: **a**, number all lines; **t**, number lines with printable text only; **n**, no line numbering; **p***string*, number only lines that contain the regular expression specified in *string*. Default *type* for logical page body is **t** (text lines numbered).

-h *type* Same as **-b** *type* except for header. Default *type* for logical page header is **n** (no lines numbered).

-f *type* Same as **-b** *type* except for footer. Default for logical page footer is **n** (no lines numbered).

-p Does not restart numbering at logical page delimiters.

-v ***start#*** ***start#*** is the initial value used to number logical page lines. Default is 1.

-i ***incr*** ***incr*** is the increment value used to number logical page lines. Default is 1.

-s ***sep*** ***sep*** is the character(s) used in separating the line number and the corresponding text line. Default ***sep*** is a tab.

-w ***width*** ***width*** is the number of characters to be used for the line number. Default ***width*** is 6.

-n ***format*** ***format*** is the line numbering format. Recognized values are: **ln**, left justified, leading zeroes suppressed; **rn**, right justified, leading zeroes suppressed; **rz**, right justified, leading zeroes kept. Default ***format*** is **rn** (right justified).

-l ***num*** ***num*** is the number of blank lines to be considered as one. For example, **-l2** results in only the second adjacent blank being numbered (if the appropriate **-ha**, **-ba**, and/or **-fa** option is set). Default is 1.

See also

pr(C)

Standards conformance

nl is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

nohup

run a command immune to hangups and quits

Syntax

nohup ***command*** [***arguments***]

Description

The **nohup** command executes ***command*** with hangups and quits ignored. If output is not redirected by the user, it will be sent to *nohup.out*. If the user does not have write permission in the current directory, output is redirected to **$HOME**/*nohup.out*.

Note

The **nohup**(C) standalone program is used by the bourne shell **sh**. The other shells have built in **nohup** commands which behave slightly differently. For further details see **csh**(C) and **ksh**(C) repsectively.

See also

nice(C), **signal**(S)

Standards conformance

nohup is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

od

display files in octal format

Syntax

od [**-bcdox**] [*file*] [[**+**] *offset* [**.**] [**b**]]

Description

The **od** command displays *file* in one or more formats as selected by the first argument. If the first argument is missing, **-o** is the default. The meanings of the format options are:

-b Interprets bytes in octal.

-c Interprets bytes in ASCII. Certain nongraphic characters appear as C escapes: null=**\0**, backspace=**\b**, form feed=**\f**, newline=**\n**, return=**\r**, tab=**\t**; others appear as 3-digit octal numbers.

-d Interprets words in decimal.

-o Interprets words in octal.

-x Interprets words in hex.

The *file* argument specifies which file is to be displayed. If no *file* argument is specified, the standard input is used.

The *offset* argument specifies the offset in the file where displaying is to start. This argument is normally interpreted as octal bytes. If "." is appended, the offset is interpreted in decimal. If "b" is appended, the offset is interpreted in blocks. If the file argument is omitted, the offset argument must be preceded by "+".

The display continues until end-of-file.

See also

adb(CP), **hd**(C)

Standards conformance

od is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

pack, pcat, unpack

compress and expand files

Syntax

pack [**-**] ***name*** ...

pcat ***name*** ...

unpack ***name*** ...

Description

pack - Packs a file

pcat - Displays a packed file

unpack - Unpacks a file

The **pack** command attempts to store the specified files in a compressed form. Wherever possible, each input file ***name*** is replaced by a packed file ***name.z*** with the same access modes, access and modified dates, and the owner of ***name***. If **pack** is successful, ***name*** will be removed. Packed files can be restored to their original form using **unpack** or **pcat**.

pack uses Huffman (minimum redundancy) codes on a byte-by-byte basis. If the "**-**" argument is used, an internal flag is set that causes **pack** to display information about the file compression. Additional occurrences of "**-**" in place of ***name*** will cause the internal flag to be set and reset.

The amount of compression obtained depends on the size of the input file and the character frequency distribution. Because a decoding tree forms the first part of each .z file, it is usually not worthwhile to pack files smaller than three blocks, unless the character frequency distribution is very scattered, which may occur with printer plots or pictures.

Typically, text files are reduced to 60-75% of their original size. Load modules, which use a larger character set and have a more uniform distribution of characters, show little compression, the packed versions being about 90% of the original size.

pack returns a value that is the number of files that it failed to compress.

No packing will occur if:

- The file appears to be already packed
- The filename has more than 253 characters

- The file has links
- The file is a directory
- The file cannot be opened
- No disk storage blocks will be saved by packing
- A file called ***name.z*** already exists
- The *.z* file cannot be created
- An I/O error occurred during processing

The last segment of the filename must contain no more than 253 characters to allow space for the appended *.z* extension. Directories cannot be compressed.

pcat does for packed files what **cat**(C) does for ordinary files. The specified files are unpacked and written to the standard output. To view a packed file named ***name.z*** use:

pcat ***name.z***

or just:

pcat ***name***

To make an unpacked copy, say ***nnn***, of a packed file named ***name.z*** without destroying ***name.z***, enter the command:

pcat ***name*** > ***nnn***

pcat returns the number of files it was unable to unpack. Failure may occur if:

- The filename (exclusive of the *.z*) has more than 253 characters
- The file cannot be opened
- The file does not appear to be the output of **pack**

unpack expands files created by **pack**. For each file ***name*** specified in the command, a search is made for a file called ***name.z*** (or just ***name***, if ***name*** ends in *.z*). If this file appears to be a packed file, it is replaced by its expanded version. The new file has the *.z* suffix stripped from its name, and has the same access modes, access and modification dates, and owner as those of the packed file.

unpack returns a value that is the number of files it was unable to unpack. Failure may occur for the same reasons that it may in **pcat**, as well as in a file where the "unpacked" name already exists, or if the unpacked file cannot be created.

Standards conformance

pack, pcat and **unpack** are conformant with:

AT&T SVID Issue 2;
ANd X/Open Portability Guide, Issue 3, 1989.

passwd

change login, modem (dialup shell), filesystem, or group password

Syntax

passwd [-m] [-dluf] [-n *minimum*] [-x *expiration*] [-r *retries*] [*name*]

passwd -s [-a] [*name*]

Description

The **passwd** command is used by ordinary users to:

- Change or delete their own login password.
- List some of the attributes that apply to their account.

In addition, system administrators can use the **passwd** command to:

- Change or delete any user's login password.
- Change or delete modem (dialup shell), filesystem mount, and group passwords.
- Lock or unlock any user's account.
- Invalidate (lock) dialup shell, filesystem, and group passwords.
- List some of the attributes of all users, or any single user.
- Change some of the attributes of any user.

However, it is recommended that system administrators use the **sysadmsh**(ADM) Accounts selection to administrate passwords. A user is considered to be a system administrator if they have **auth** subsystem authorization. A user must have the **passwd** subsystem authorization to be able to change the password of any account.

Choosing a good password

Your login password is one of the most important defenses against security breaches. If a malicious person cannot log into a system, it is much harder for that person to steal or tamper with your data. Hence, by choosing a hard-to-guess password (either of your own invention or one suggested by the system), regularly changing it, and keeping it secret, you can protect your system.

In general, a password *should*:

- Consist of a mixture of upper- and lower-case letters, digits (0 - 9), and other non-letters (such as @, *, -, /, space, tab, and control characters).
- Be changed frequently (at least once every six months to a year, and more often as necessary).

- Be different on different machines.
- Be easy to remember, so you do not have to write it down.
- Be kept secret and known only by you.

Passwords *should not*:

- Be the name of a person, place, or thing; nor should a password be the same as any user's login name, any machine's name, or the name of any group.
- Be a correctly spelt word, street or telephone number, ZIP or postal code; nor should a password be a birthday or anniversary of you or anyone you know.
- Be written down (anywhere! - not on paper or in a file); nor should passwords be stored in the function keys of a terminal or memory of an intelligent modem.
- Be told to any other person (not even for use in an "emergency"); nor should a password be kept if you suspect someone else knows it.

Spelling a word backwards or appending a digit to a word do *not* turn a poor password choice into a "good" password. However, taking two or three unrelated words and combining them with some non-letters is a reasonable way of choosing an easy-to-remember but hard-to-crack password. On SCO UNIX System V/386, passwords can be up to 80 characters long, so nonsensical rhymes (for example) can also be used as passwords.

User login passwords

When **passwd** is used to change or delete the password for user ***name***, the old password (if any) is prompted for. (The password is not displayed as it is being entered.) System administrators are not prompted for the old password unless they are attempting to change their own password; the super user is never prompted for the old password. The **passwd** command can only be used to change or delete the password for user ***name*** by system administrators and the user authorized to change user ***name***'s password. Normally, users are authorized to change their own password.

Depending on how the system administrator has configured the account, the user may or may not be able to choose their own password, or may have a password chosen for them. If they can neither choose their own password nor have passwords generated for them, the password cannot be changed. If the user is able to do both, **passwd** asks which should be done.

A password is considered *valid* until it has *expired*. Passwords expire if they are not changed or deleted before the expiration time has passed. Once expired, the user is required to change (not delete) their password the next time they log in. If a user fails to do so before the password's lifetime has passed, the password is considered *dead* and the user's account is *locked*.

Once locked, the user may not log in, may not be **su**(C)'ed to, and no **at**(C), **batch**(C), or **cron**(C) jobs for that user may run. Only a system administrator can unlock a user with a dead password; a new password must be assigned.

To discourage re-use of the same password, the system administrator may set a *minimum change time.* After changing or deleting a password, the password may not be changed again (even by a system administrator) until at least that much time has elapsed.

Passwords may be deleted (or changed to be empty) only if the user is authorized to not have a password. Users without passwords are not recommended. (An empty password is prompted for when logging in, but a deleted password is not prompted for at login.)

If a password is being changed and the user has elected (or is forced) to choose a system-generated password, each suggested password is printed along with a hyphenated spelling that suggests how the password could be pronounced. To accept a suggested password, enter the password; if entered correctly, **passwd** will prompt for the suggested password to be entered again as confirmation. To reject a suggestion, just enter ⟨Return⟩; to abort the change altogether, either enter "quit" or interrupt **passwd**.

If a password is being changed and the user has elected (or is forced) to assign a password of their own choosing, the new password is prompted for twice. It is checked for being "obvious" after the first prompt, and if deemed to be acceptable is prompted for again. If the proposed password is successfully entered a second time, it becomes the new password for user ***name***.

Both system-generated and self-chosen passwords are checked for being easy-to-guess. See the section on "Checking for obvious passwords" (below) for a description of the checks.

When dealing with a user's login password, the following options are recognized:

-d Delete the password. A password may be deleted only if the user is authorized to not have a password. System administrators must always specify ***name***; otherwise, the name of the user who logged in is used.

-f Force user ***name*** to change their password the next time they log in. This option may be specified only by system administrators, and only when the user's password is not being changed or deleted; ***name*** must be explicitly given.

-l Lock user ***name*** out of the system by applying an administrative lock; only system administrators may do this and they must specify ***name***.

-u Remove any administrative lock applied to user ***name***; only system administrators may do this and they must specify ***name***.

-n ***minimum*** Set the amount of time which must elapse between password changes for user ***name*** to ***minimum*** days. Only system administrators may do this and they must specify ***name***.

-x ***expiration*** Set the amount of time which may elapse before the password of user ***name*** expires to ***expiration*** days. Only system administrators may do this and they must specify ***name***. Once a password has expired, the user must change it the next time they log in.

-r ***retries*** Up to ***retries*** attempts may be made to choose a new password for user ***name***.

-s Report the password attributes of user ***name*** (or, if the **-a** option is given, of all users). The format of the report is:

name status mm/dd/yy minimum expiration

where ***status*** is "PS" if the user has a password, "LK" if the user is administratively locked, or "NP" when the user does not have a password. The date of the last successful password change (or deletion) is shown as ***mm/dd/yy***. If neither ***name*** nor **-a** is specified, the name of the user who logged in is assumed. Only system administrators can examine the attributes of users other than themselves.

If no **-d**, **-f**, **-l**, **-u**, or **-s** option is specified, the password for user ***name*** is changed as described above. If no ***name*** is given and no option which requires ***name*** is given, then the ***name*** of the user who logged in is used. Only the **-a** option may be specified with the **-s** option.

Modem (dialup shell) passwords

When a user whose login shell is listed in */etc/d_passwd* with a (encrypted) password logs in on a terminal line listed in */etc/dialups*, the password in */etc/d_passwd* must be supplied before the login succeeds. The **-m** option to password allows system administrators to change, delete, or invalidate (lock) the passwords for login shell ***name***:

-d Delete the password.

-l Invalidate ("lock") the password by arranging so that no matter what the user enters, it will not be a valid password. Doing so causes the old password to be lost.

-r ***retries*** Up to ***retries*** attempts may be made to choose a new password.

The ***name*** must always be specified. If ***name*** begins with a slash (/) then only the password for the login shell which completely matches ***name*** is changed. Otherwise, the password for every shell listed in */etc/d_passwd* whose basename is ***name*** is changed.

Note: this does not mean that only one line is needed per shell in */etc/d_passwd*. For example, to have the option of using either **/bin/csh** or **/usr/local/csh**, each must be specified on a separate line in */etc/d_passwd*. However, the dialup **passwd** for both shells can be changed at once with the command:

passwd -m csh

If neither the **-d** nor **-l** option is specified, the password is changed. The new password is prompted for twice, and must pass checks similar to those for login passwords (see below).

Filesystem mount passwords

A password may be required when mounting a filesystem; see **mnt**(C). The options are the same as for modem passwords (see above).

Group passwords

A password may be required when a user changes their current working group; see **newgrp**(C).

Checking for obvious passwords

To discourage poor password choices, various checks are applied to reject unacceptable passwords. The checks which are applied depend on the type of password being checked and the system's configuration. Most of the checks for being easy-to-guess are configurable; see **goodpw**(ADM).

The check procedure is as follows (a password is *restricted* if, according to the **sysadmsh** Accounts selection, it is to be "checked for obviousness"):

1a. User login passwords only: the new password must not be the same as the old password. The password must not be empty (or be deleted) unless the user is not required to have a password.

1b. All other passwords: the new and old password can be the same. Empty passwords are treated as deleted passwords and are always acceptable.

2. All (non-empty) passwords: if the password is not empty, it must be at least **PASSLENGTH** characters long (see below).

3. All (non-empty) passwords: if the **goodpw** utility can be run, it is used to perform all further checks. If the file **CHECKDIR** exists (and can be read by **goodpw**) that file is used to modify the default settings in */etc/default/goodpw*. The **CHECKDIR** is specified by **CHECKDIR** in */etc/default/passwd* and ***type*** is the kind of password being checked (**user**, **modem**, **group**, or **filsys**). The ***strength*** is the degree of checking to be done: **secure** if the user is restricted (or, for all other password types, if the system default is restricted); otherwise **weak**.

4. When **goodpw** cannot be run (all passwords): if the password is not empty, it must contain at least one character which is not a lowercase letter (but must not consist solely of digits).

5. When **goodpw** cannot be run (user login passwords only): finally, for user login passwords which are restricted, the password must not be a palindrome, any user's login name, the name of any group, or a correctly spelled English word (American spelling); see **accept_pw**(S).

System-generated passwords are not checked unless the user is restricted (see above), in which case the generated password must pass the checks in step 5 before it is suggested to the user. Generated passwords are never checked by **goodpw**.

Defaults

Several parameters may be specified in */etc/default/passwd*. The various settings, and their default values are:

PASSLENGTH=*
: The minimum length of a password. The maximum length of a password is 80. Specifying **PASSLENGTH** overrides the computed value based on the lifetime of the password, delay between login attempts (and other variables - see **passlen**(S)). To use the computed value set **PASSLENGTH** to an asterisk (*).

RETRIES=3
: The maximum number of repeated attempts to change a password that has been rejected. If **RETRIES** is less than 1, then 1 is assumed.

ONETRY=YES
: If set to **YES**, a rejected password is added to the stop-list passed to **goodpw**. This prevents simplistic modifications of a rejected password from being accepted on a later attempt.

DESCRIBE=*/usr/lib/goodpw/describe*
: The contents of this file are shown once (before the new password is prompted for) and should describe the the difference between acceptable and unacceptable passwords.

SUMMARY=*/usr/lib/goodpw/summary*
: The contents of this file are shown each time a password is rejected, and should be a (short) reminder of what are and are not acceptable passwords.

CHECKDIR=*/usr/lib/goodpw/checks*
: A hierarchy of additional checks **goodpw** should perform, based on password type and restrictions (see above).

GOODPW=NO

Defines the location of the **goodpw** program. If set to **NO** then **goodpw** is not used and the simpler internal checks are applied instead. Under these circumstances the super user is not forced to comply with the password construction requirements; the only checks enabled are for minimum password length, and null passwords are allowed. If **GOODPW** is set to **YES** then **/usr/bin/goodpw** is used to perform password checks. Alternatively **GOODPW** can be set to the path of some other **goodpw**-style program.

The values for the default settings may be changed to reflect the system's security concerns.

If */etc/default/passwd* does not exist or is not readable, the above default values are used.

If the **DESCRIBE** or **SUMMARY** file defined in */etc/default/passwd* does not exist or cannot be read, short (and vague) descriptions or summaries are issued instead. In addition, if the user who logged in is a system administrator, an error message describing the problem is printed.

If the selected **GOODPW** program does not exist or is not executable, the simpler internal checks are performed (see above). In addition, if the user who logged in is a system administrator, an error message describing the problem is printed.

Files

/etc/passwd	List of user accounts.
*/tcb/files/auth/**initial**/**name***	Protected Password database entry for user ***name*** (where the first character in ***name*** is ***initial***).
/etc/group	List of groups.
/etc/d_passwd	List of dialup shells and passwords (one per line): ***shell*** : ***encrypted-password*** : ***reserved*** where ***shell*** is the pathname of a login shell as used in */etc/passwd*.
/etc/auth/system/files	File Control database.
/etc/auth/system/default	System Defaults database; contains default parameters.
/etc/default/passwd	Configurable settings (see above).

See also

accept_pw(S), **authcap**(F), **authsh**(ADM), **default**(F), **goodpw**(ADM), **group**(F), **login**(M), **mnt**(C), **newgrp**(C), **passlen**(S), **passwd**(FP)

Notes

Group passwords should be avoided; see **newgrp**(C) because not all systems support group passwords.

Not all systems support filesystem mount passwords.

Not all systems support modem (dialup shell) passwords.

The **-r** option is mostly useful during installation to force the newly-installed super user to have a password.

Value added

passwd includes extensions to AT&T System V provided by The Santa Cruz Operation, Inc.

paste

merge lines of files

Syntax

paste *file1 file2* ...

paste -d *list file1 file2* ...

paste -s [**-d** *list*] *file1 file2* ...

Description

In the first two forms, **paste** concatenates corresponding lines of the given input files *file1*, *file2*, etc. It treats each file as a column or columns of a table and pastes them together horizontally (parallel merging). It is the counterpart of **cat**(C) which concatenates vertically, that is, one file after the other. In the last form above, **paste** subsumes the function of an older command with the same name by combining subsequent lines of the input file (serial merging). In all cases, lines are "glued" together with the *tab* character, or with characters from an optionally specified ***list***. Output is to the standard output, so it can be used as the start of a pipe, or as a filter, if **"-"** is used in place of a filename.

The meanings of the options are:

-d Without this option, the new line characters of each but the last file (or last line in case of the **-s** option) are replaced by a tab character. This option allows replacing the tab character by one or more alternate characters (see below).

list One or more characters immediately following **-d** replace the default tab as the line concatenation character. The list is used circularly, that is, when exhausted, it is re-used. In parallel merging (that is, no **-s** option), the lines from the last file are always terminated with a new line character, not from the **list**. The list may contain the special escape sequences: **\n** (new line), **\t** (tab), **** (backslash), and **\0** (empty string, not a null character). Quoting may be necessary, if characters have special meaning to the shell (for example, to get one backslash, use **-d**).

-s Merges subsequent lines rather than one from each input file. Use **tab** for concatenation, unless a ***list*** is specified with **-d** option. Regardless of the list, the very last character of the file is forced to be a new line.

- May be used in place of any filename to read a line from the standard input. (There is no prompting.)

Examples

ls | paste -d"" -	Lists directory in one column
ls | paste - - - -	Lists directory in four columns
paste -s -d"\t\n" file	Combines pairs of lines into lines

See also

cut(C), **grep**(C), **pr**(C)

Diagnostics

`line too long`	Output lines are restricted to 511 characters.
`too many files`	Except for **-s** option, no more than 12 input files may be specified.

Standards conformance

paste is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

pax

portable archive exchange

Syntax

pax [**-cimopuvy**] [**-f** *archive*] [**-s** *replstr*] [**-t** *device*] [*pattern* ...]

pax -r [**-cimopuvy**] [**-f** *archive*] [**-s** *replstr*] [**-t** *device*] [*pattern* ...]

pax -w [**-adimuvyL**] [**-b** *blocking*] [**-f** *archive*] [**-s** *replstr*] [**-t** *device*] [**-x** *format*] [*pathname* ...]

pax -rw [**-ilmopuvyL**] [**-s** *replstr*] [*pathname* ...] *directory*

Description

The **pax** command reads and writes archive files which conform to the "Archive/Interchange File Format" specified in *IEEE Std. 1003.1-1988*. **pax** can also read, but not write, a number of other file formats in addition to those specified in the Archive/Interchange File Format description. Support for these traditional file formats, such as V7 **tar** and System V binary **cpio** format archives, is provided for backward compatibility and to maximize portability.

pax will also support traditional **cpio** and System V **tar** interfaces if invoked with the name "cpio" or "tar" respectively. See the **cpio**(C) or **tar**(C) manual pages for more details.

Combinations of the **-r** and **-w** command line arguments specify whether **pax** will read, write or list the contents of the specified archive, or move the specified files to another directory.

The command line arguments are:

-w writes the files and directories specified by ***pathname*** operands to the standard output together with the pathname and status information prescribed by the archive format used. A directory ***pathname*** operand refers to the files and (recursively) subdirectories of that directory. If no ***pathname*** operands are given, then the standard input is read to get a list of pathnames to copy, one pathname per line. In this case, only those pathnames appearing on the standard input are copied.

-r **pax** reads an archive file from the standard input. Only files with names that match any of the ***pattern*** operands are selected for extraction. The selected files are conditionally created and copied relative to the current directory tree, subject to the options described below. By default, the owner and group of selected files will be that of the invoking process, and the permissions and modification times will be the same as those in the archive.

The supported archive formats are automatically detected on input. The default output format is *ustar*, but may be overridden by the **-x** ***format*** option described below.

-rw **pax** reads the files and directories named in the ***pathname*** operands and copies them to the destination ***directory***. A directory ***pathname*** operand refers to the files and (recursively) subdirectories of that directory. If no ***pathname*** operands are given, the standard input is read to get a list of pathnames to copy, one pathname per line. In this case, only those pathnames appearing on the standard input are copied. The directory named by the ***directory*** operand must exist and have the proper permissions before the copy can occur.

If neither the **-r** or **-w** options are given, then **pax** will list the contents of the specified archive. In this mode, **pax** lists normal files one per line, hard link pathnames as

pathname == linkname

and symbolic link pathnames (if supported by the implementation) as

pathname -> linkname

where ***pathname*** is the name of the file being extracted, and ***linkname*** is the name of a file which appeared earlier in the archive.

If the **-v** option is specified, then **pax** lists normal pathnames in the same format used by the **ls** utility with the **-l** option. Hard links are shown as

<ls -l *listing*> == *linkname*

and symbolic links (if supported) are shown as

<ls -l *listing*> -> *linkname*

pax is capable of reading and writing archives which span multiple physical volumes. Upon detecting an end of medium on an archive which is not yet completed, **pax** will prompt the user for the next volume of the archive and will allow the user to specify the location of the next volume.

Options

The following options are available:

-a The files specified by ***pathname*** are appended to the specified archive.

-b ***blocking*** Block the output at ***blocking*** bytes per write to the archive file. A **k** suffix multiplies ***blocking*** by 1024, a **b** suffix multiplies ***blocking*** by 512 and an **m** suffix multiplies ***blocking*** by 1048576 (1 megabyte). If not specified, ***blocking*** is automatically determined on input and is ignored for **-rw**.

-c Complement the match sense of the ***pattern*** operands.

-d Intermediate directories not explicitly listed in the archive are not created. This option is ignored unless the **-r** option is specified.

-f *archive* The **-f *archive*** option specifies the pathname of the input or output archive, overriding the default of standard input for **-r** or standard output for **-w**.

-i Interactively rename files. Substitutions specified by **-s** options (described below) are performed before requesting the new filename from the user. A file is skipped if an empty line is entered and **pax** exits with an exit status of 0 if EOF is encountered.

-l Files are linked rather than copied when possible.

-m File modification times are not retained.

-o Restore file ownership as specified in the archive. The invoking process must have appropriate privileges to accomplish this.

-p Preserve the access time of the input files after they have been copied.

-L Follow symbolic links.

-s *replstr* Filenames are modified according to the substitution expression using the syntax of **ed**(C) as shown:

-s */old/new/***[*gp*]**

Any non null character may be used as a delimiter (a " / " is used here as an example). Multiple **-s** expressions may be specified; the expressions are applied in the order specified terminating with the first successful substitution. The optional trailing **p** causes successful mappings to be listed on standard error. The optional trailing **g** causes the *old* expression to be replaced each time it occurs in the source string. Files that substitute to an empty string are ignored both on input and output.

-t *device* The ***device*** option argument is an implementation-defined identifier that names the input or output archive device, overriding the default of standard input for **-r** and standard output for **-w**.

-u Copy each file only if it is newer than a pre-existing file with the same name. This implies **-a**.

-v List filenames as they are encountered. Produces a verbose table of contents listing on the standard output when both **-r** and **-w** are omitted; otherwise, the filenames are printed to standard error as they are encountered in the archive.

-x *format* Specifies the output archive format. The input format, which must be one of the following, is automatically determined when the **-r** option is used. The supported formats are:

cpio The extended **cpio** interchange format specified in "Extended CPIO Format" in *IEEE Std. 1003.1-1988.*

ustar The extended **tar** interchange format specified in "Extended TAR Format" in *IEEE Std. 1003.1-1988.* This is the default archive format.

-y Interactively prompt for the disposition of each file. Substitutions specified by **-s** options (described above) are performed before prompting the user for disposition. EOF or an input line starting with the character **q** caused **pax** to exit. Otherwise, an input line starting with anything other than **y** causes the file to be ignored. This option cannot be used in conjunction with the **-i** option.

Only the last of multiple **-f** or **-t** options take effect.

When writing to an archive, the standard input is used as a list of pathnames if no ***pathname*** operands are specified. The format is one pathname per line. Otherwise, the standard input is the archive file, which is formatted according to one of the specifications in "Archive/Interchange File Format" in *IEEE Std. 1003.1-1988*, or some other implementation-defined format.

The user ID and group ID of the process, together with the appropriate privileges, affect the ability of **pax** to restore ownership and permissions attributes of the archived files. (See *format-reading utility* in "Archive/Interchange File Format" in *IEEE Std. 1003.1-1988.*)

The options **-a**, **-c**, **-d**, **-i**, **-l**, **-p**, **-t**, **-u**, and **-y** are provided for functional compatibility with the historical **cpio** and **tar** utilities. The option defaults were chosen based on the most common usage of these options, therefore, some of the options have meanings different than those of the historical commands.

Operands

The following operands are available:

directory The destination directory pathname for copies when both the **-r** and **-w** options are specified. The directory must exist and be writable before the copy or error results.

pathname A file whose contents are used instead of the files named on the standard input. When a directory is named, all of its files and (recursively) subdirectories are copied as well.

pattern A ***pattern*** is given in the standard shell pattern matching notation. The default if no ***pattern*** is specified is "*", which selects all files.

Examples

The following command

pax -w -f /dev/rmt0 .

copies the contents of the current directory to tape drive 0.

The commands

mkdir newdir
cd olddir
pax -rw . newdir

copy the contents of ***olddir*** to ***newdir***.

The command

pax -r -s ',//*usr//*,,' -f pax.out

reads the archive *pax.out* with all files rooted in */usr* in the archive extracted relative to the current directory.

File

/dev/tty used to prompt the user for information when the **-i** or **-y** options are specified.

See also

cpio(C), **cpio**(M), **find**(C), **tar**(C), **tar**(F)

Diagnostics

pax will terminate immediately, without processing any additional files on the command line or in the archive.

pax will exit with one of the following values:

0 All files in the archive were processed successfully.

>0 **pax** aborted due to errors encountered during operation.

Notes

Special permissions may be required to copy or extract special files.

Device, user ID, and group ID numbers larger than 65535 cause additional header records to be output. These records are ignored by some historical version of **cpio**(C) and **tar**(C).

The archive formats described in "Archive/Interchange File Format" have certain restrictions that have been carried over from historical usage. For example, there are restrictions on the length of pathnames stored in the archive.

When getting an ls **-l** style listing on **tar** format archives, link counts are listed as zero since the *ustar* archive format does not keep link count information.

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pcpio

copy file archives in and out

Syntax

pcpio -o [BLacv]

pcpio -i [Bcdfmrtuv] [*pattern* **...]**

pcpio -p [aLdlmruv] *directory*

Description

The **pcpio** utility produces and reads files in the format specified by the **cpio Archive/Interchange File Format** specified in *IEEE Std. 1003.1-1988.*

The **pcpio -i** (copy in) utility extracts files from the standard input, which is assumed to be the product of a previous **pcpio -o**. Only files with names that match ***patterns*** are selected. Multiple ***patterns*** may be specified and if no ***patterns*** are specified, the default for ***patterns*** is "*", selecting all files. The extracted files are conditionally created and copied into the current directory, and possibly any levels below, based upon the options described below. The permissions of the files will be those of the previous **pcpio -o**. The owner and group of the files will be that of the current user unless the user has appropriate privileges, which causes **pcpio** to retain the owner and group of the files of the previous **pcpio -o**.

The **pcpio -p** (pass) utility reads the standard input to obtain a list of path names of files that are conditionally created and copied into the destination ***directory*** based upon the options described below.

If an error is detected, the cause is reported and the **pcpio** utility will continue to copy other files. **pcpio** will skip over any unrecognized files which it encounters in the archive.

The following restrictions apply to the **pcpio** utility:

1 Pathnames are restricted to 256 characters.

2 Appropriate privileges are required to copy special files.

3 Blocks are reported in 512-byte quantities.

Options

The following options are available:

-B Input/output is to be blocked 5120 bytes to the record. Can only be used with **pcpio -o** or **pcpio -i** for data that is directed to or from character special files.

-L Follow symbolic links.

-a Reset access times of input files after they have been copied. When the **-l** option is also specified, the linked files do not have their access times reset. Can only be used with **pcpio -o** or **pcpio -i**.

-c Write header information in ASCII character for portability. Can only be used with **pcpio -i** or **pcpio -o**. Note that this option should always be used to write portable files.

-d Creates directories as needed. Can only be used with **pcpio -i** or **pcpio -p**.

-f Copy in all files except those in ***patterns***. Can only be used with **pcpio -i**.

-l Whenever possible, link files rather than copying them. Can only be used with **pcpio -p**.

-m Retain previous modification times. This option is ineffective on directories that are being copied. Can only be used with **pcpio -i** or **pcpio -p**.

-r Interactively rename files. The user is asked whether to rename ***pattern*** each invocation. Read and write permissions for */dev/tty* are required for this option. If the user types a null line, the file is skipped. Should only be used with **pcpio -i** or **pcpio -o**.

-t Print a table of contents of the input. No files are created. Can only be used with **pcpio -i**.

-u Copy files unconditionally; usually an older file will not replace a new file with the same name. Can only be used with **pcpio -i** or **pcpio -p**.

-v Verbose: cause the names of the affected files to be printed. Can only be used with **pcpio -i**. Provides a detailed listing when used with the **-t** option.

Operands

The following operands are available:

patterns Simple regular expressions given in the name-generating notation of the shell.

directory The destination directory.

Exit status

The **pcpio** utility exits with one of the following values:

0 All input files were copied.

2 The utility encountered errors in copying or accessing files or directories. An error will be reported for nonexistent files or directories, or permissions that do not allow the user to access the source or target files.

It is important to use the **-depth** option of the **find** utility to generate pathnames for **pcpio**. This eliminates problems **pcpio** could have trying to create files under read-only directories.

The following command:

ls | pcpio -o > /tmp/newfile

copies out the files listed by the **ls** utility and redirects them to the file */tmp/newfile*.

The following command:

cat /tmp/newfile | pcpio -id "memo/al" "memo/b*"

uses the output file */tmp/newfile* from the **pcpio -o** utility, takes those files that match the patterns *memo/al* and *memo/b**, creates the directories below the current directory, and places the files in the appropriate directories.

The command

find . -depth -print | pcpio -pdlmv newdir

takes the file names piped to it from the **find** utility and copies or links those files to another directory named *newdir*, while retaining the modification time.

File

/dev/tty used to prompt the user for information when the **-i** or **-r** options are specified.

See also

find(C), **pax**(C), **tar**(C), **tar**(F)

Note

When you use **cpio** commands with **find**, if you use the **-L** option with **cpio**, then you must use the **-follow** option with **find** and vice-versa.

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Standards conformance

pcpio is conformant with:

IEEE POSIX Std 1003.1-1990 System Application Program Interface (API) [C Language] (ISO/IEC 9945-1);
and NIST FIPS 151-1.

pg

paginate display for soft-copy terminals

Syntax

pg [*-number*] [**-p** *string*] [**-cefns**] [*+linenumber*] [*+/pattern/*] [*files* ...]

Description

The **pg** command is a filter which allows the examination of ***files*** one screenful at a time on a soft-copy terminal. (The dash (-) command line option and/or NULL arguments indicate that **pg** should read from the standard input.) Each screenful is followed by a prompt. If you press the ⟨Return⟩ key, another page is displayed; other possibilities are listed below. This command is different from previous paginators because it allows you to back up and review something that has already passed.

To determine terminal attributes, **pg** scans the *termcap*(F) database for the terminal type specified by the environment variable **TERM**. If **TERM** is not defined, the terminal type **dumb** is assumed.

The command line options are:

-number Specifies the size (in lines) of the window that **pg** is to use instead of the default. (On a terminal containing 24 lines, the default window size is 23.)

-p ***string*** Causes **pg** to use ***string*** as the prompt. If the prompt string contains a "%d", the first occurrence of "%d" in the prompt will be replaced by the current page number when the prompt is issued. The default prompt string is a colon (:).

-c Homes the cursor and clears the screen before displaying each page. This option is ignored if **cl** (clear screen) is not defined for this terminal type in the *termcap*(F) database.

-e Causes **pg** *not* to pause at the end of each file.

-f Inhibits **pg** from splitting lines. In the absence of the **-f** option, **pg** splits lines longer than the screen width, but some sequences of characters in the displayed text (for example, escape sequences for underlining) give undesirable results.

-n Normally, commands must be terminated by pressing the ⟨Return⟩ key (ASCII newline character). This option causes an automatic end of command as soon as a command letter is entered.

-s Causes **pg** to display all messages and prompts in standout mode (usually inverse video).

+linenumber Starts up at ***linenumber***.

+/pattern/ Starts up at the first line containing the regular expression ***pattern***.

The responses that may be entered when **pg** pauses can be divided into three categories: those that cause further perusal, those that search, and those that modify the perusal environment.

Commands which cause further perusal normally take a preceding ***address*** (an optionally signed number indicating the point from which further text should be displayed). **pg** interprets this ***address*** in either pages or lines depending on the command. A signed ***address*** specifies a point relative to the current page or line, and an unsigned ***address*** specifies an address relative to the beginning of the file. Each command has a default address if no address is provided.

The perusal commands and their defaults are as follows:

(+1) ⟨Return⟩ Causes one page to be displayed. The ***address*** is specified in pages.

(+1) **l** With a signed ***address***, causes **pg** to simulate scrolling the screen, forward or backward, the number of lines specified. With an unsigned ***address*** this command displays a full screen of text beginning at the specified line.

(+1) **d** or ⟨Ctrl⟩**d** Simulates scrolling half a screen forward or backward.

The following perusal commands take no ***address***:

. or ⟨Ctrl⟩**l** Causes the current page of text to be redisplayed.

$ Displays the last screen of text in the file. Use with caution when the input is a pipe.

The following commands are available for searching for text patterns in the text. The regular expressions described in **ed**(C) are available. They must always be terminated by a newline character, even if the **-n** option is specified.

i /pattern/ Search forward for the ***i***th (default ***i***=1) occurrence of ***pattern***. Searching begins immediately after the current page and continues to the end of the current file, without wrap-around.

i ^pattern^
i ?pattern Search backwards for the ***i***th (default ***i***=1) occurrence of ***pattern***. Searching begins immediately before the current page and continues to the beginning of the current file, without wrap-around. The caret (^) notation is useful for terminals which will not properly handle the question mark (?).

After searching, **pg** displays the line found at the top of the screen. You can modify this by appending **m** or **b** to the search command to leave the line found in the middle or at the bottom of the window from now on. Use the suffix **t** to restore the original situation.

The following commands modify the environment of perusal:

***i* n** Begins perusing the *i*th next file in the command line. The default value of *i* is 1.

***i* p** Begins perusing the *i*th previous file in the command line. The default value of *i* is 1.

***i* w** Displays another window of text. If *i* is present, set the window size to *i*.

s *filename* Saves the input in the named file. Only the current file being perused is saved. The white space between the **s** and *filename* is optional. This command must always be terminated by a newline character, even if the **-n** option is specified.

h Help displays abbreviated summary of available commands.

q or **Q** Quit **pg**.

!*command* *command* is passed to the shell, whose name is taken from the **SHELL** environment variable. If this is not available, the default shell is used. This command must always be terminated by a newline character, even if the **-n** option is specified.

At any time when output is being sent to the terminal, the user can press the **QUIT** key (normally ⟨Ctrl⟩\) or the **INTERRUPT** key (normally ⟨Break⟩). This causes **pg** to stop sending output, and display the prompt. The user may then enter one of the above commands in the normal manner. Unfortunately, some output is lost when this is done, because any characters waiting in the terminal's output queue are flushed when the quit signal occurs.

If the standard output is not a terminal, then **pg** acts just like **cat**(C), except that a header is printed before each file (if there is more than one).

Example

To use **pg** to read system news, enter:

```
news | pg -p "(Page %d):"
```

Files

/etc/termcap	Terminal information database
*/tmp/pg**	Temporary file when input is from a pipe

See also

cat(C), **ed**(C), **grep**(C), **more**(C), **termcap**(F)

Notes

If terminal tabs are not set every eight positions, undesirable results may occur.

When using **pg** as a filter with another command that changes the terminal I/O options, terminal settings may not be restored correctly.

While waiting for terminal input, **pg** responds to ⟨Ctrl⟩⟨Break⟩ and ⟨Del⟩ by terminating execution. Between prompts, however, these signals interrupt **pg**'s current task and place you in prompt mode. Use these signals with caution when input is being read from a pipe, since an interrupt is likely to terminate the other commands in the pipeline.

The **z** and **f** commands used with **more**(C) are available, and the terminal slash (/), caret (^), or question mark (?) may be omitted from the searching commands.

Standards conformance

pg is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

pr

print files on the standard output

Syntax

pr [*options*] [*files*]

Description

The **pr** command prints the named files on the standard output. If *file* is "-", or if no files are specified, the standard input is assumed. By default, the listing is separated into pages, each headed by the page number, date and time of file creation or last modification, and the name of the file.

By default, columns are of equal width, separated by at least one space; lines which do not fit are truncated. If the **-s** option is used, lines are not truncated and columns are separated by the separation character.

If the standard output is associated with a terminal, error messages are withheld until **pr** has completed printing.

Options may appear singly or combined in any order. Their meanings are:

+*k* Begins printing with page *k* (default is 1).

-*k* Produces *k*-column output (default is 1). The options **-e** and **-i** are assumed for multi-column output.

-a Prints multi-column output across the page.

-m Merges and prints all files simultaneously, one per column (overrides the **-*k***, and **-a** options).

-d Double-spaces the output.

-e*ck* Expands **input** tabs to character positions *k*+1, 2**k*+1, 3**k*+1, etc. If *k* is 0 or is omitted, default tab settings at every 8th position are assumed. Tab characters in the input are expanded into the appropriate number of spaces. If *c* (any non-digit character) is given, it is treated as the input tab character (default for *c* is the tab character).

-i*ck* In **output**, replaces white space wherever possible by inserting tabs to character positions *k*+1, 2**k*+1, 3**k*+1, etc. If *k* is 0 or is omitted, default tab settings at every 8th position are assumed. If *c* (any non-digit character) is given, it is treated as the output tab character (default for *c* is the tab character).

-n*ck* Provides ***k***-digit line numbering (default for ***k*** is 5). The number occupies the first ***k***+1 character positions of each column of normal output or each line of **-m** output. If ***c*** (any non-digit character) is given, it is appended to the line number to separate it from whatever follows (default for ***c*** is a tab).

-w*k* Sets the width of a line to ***k*** character positions (default is 72 for equal-width multi-column output, no limit otherwise).

-o*k* Offsets each line by ***k*** character positions (default is 0). The number of character positions per line is the sum of the width and offset.

-l*k* Sets the length of a page to ***k*** lines (default is 66).

-h Uses the next argument as the header to be printed instead of the filename.

-p Pauses before beginning each page if the output is directed to a terminal (**pr** will ring the bell at the terminal and wait for a carriage return).

-f Uses form feed character for new pages (default is to use a sequence of linefeeds). Pauses before beginning the first page if the standard output is associated with a terminal.

-r Prints no diagnostic reports on failure to open files.

-t Prints neither the 5-line identifying header nor the 5-line trailer normally supplied for each page. Quits printing after the last line of each file without spacing to the end of the page.

-s*c* Separates columns by the single character ***c*** instead of by the appropriate number of spaces (default for ***c*** is a tab).

Examples

The following prints ***file1*** and ***file2*** as a double-spaced, three-column listing headed by "file list":

```
pr -3dh "file list" file1 file2
```

The following writes ***file1*** on ***file2***, expanding tabs to columns 10, 19, 28, 37... :

```
pr -e9 -t <file1 >file2
```

See also

cat(C)

Standards conformance

pr is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

prwarn

warn about password expiration

Syntax

prwarn [**-d** *days*] [**-t** *hh*[*mm*]] [*users*]

Description

prwarn issues a warning if the user's password must be changed within ***days*** and the user has not been warned of the impending expiry in the last ***hhmm***, where ***hh*** is hours and ***mm*** is minutes. By default, warnings will be issued if the password is due to expire within seven days, at six hour intervals.

If ***days*** is **infinite**, and no warning has been issued in the last ***hh*[*mm*]**, a warning is given. If ***hh*[*mm*]** is **always**, and the password must be changed within ***days***, a warning is issued. Thus:

prwarn -d infinite -t always

always issues a warning.

If no ***users*** are specified, then the logged-in user is assumed and the time that the last report was issued is the modification time of *.prwarn_time* in the user's home directory.

System administrators (users with the **auth** subsystem authorization or **passwd** secondary authorization) may check the password expiry status of other users; the time interval between reports being issued is not checked.

The number of days left before the password expires, the date at which the password expires, and whether the password can still be changed or is dead (expired and exceeded its lifetime) is reported.

Files

/usr/bin/prwarn
$HOME/*.prwarn_time* used to check time of last warning

See also

passwd(C)

Value added

prwarn is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

ps

report process status

Syntax

ps [*options*]

Description

The **ps** command prints certain information about active processes. Without *options*, information is printed about processes associated with the controlling terminal. Output consists of a short listing containing only the process ID, terminal identifier, cumulative execution time, and the command name. Otherwise, the information that is displayed is controlled by the selection of *options*.

Options accept names or lists as arguments. Arguments can be either separated from one another by commas or enclosed in double quotes and separated from one another by commas or spaces. Values for *proclist* and *grplist* must be numeric.

The *options* are given in descending order according to volume and range of information provided:

-e Print information about *every* process now running.

-d Print information about all processes except process group leaders.

-a Print information about *all* processes most frequently requested: all those except process group leaders and processes not associated with a terminal.

-f Generate a *full* listing (see below for significance of columns in a full listing).

-l Generate a *long* listing (see the following text).

-n *name* Valid only for users with a real user ID of *root* or a real group ID of *sys*. Takes argument signifying an alternate system *name* in place of */unix*.

-t *termlist* List only process data associated with the terminal given in *termlist*. Terminal identifiers may be specified in one of two forms: the device's filename (for example, *tty04*) or, if the device's filename starts with *tty*, just the digit identifier (for example, *04*).

-p ***proclist*** List only process data whose process ID numbers are given in ***proclist***.

-u ***uidlist*** List only process data whose user ID number or login name is given in ***uidlist***. In the listing, the numerical user ID will be printed unless you give the **-f** option, which prints the login name.

-g ***grplist*** List only process data whose process group leader's ID number(s) appears in ***grplist***. (A group leader is a process whose process ID number is identical to its process group ID number. A login shell is a common example of a process group leader.)

Under the **-f** option, **ps** tries to determine the command name and arguments given when the process was created by examining the user block. Failing this, the command name is printed, as it would have appeared without the **-f** option, in square brackets.

The column headings and the meaning of the columns in a **ps** listing are given in the following text; the letters "f" and "l" indicate the option (*full* or *long*, respectively) that causes the corresponding heading to appear; *all* means that the heading always appears. Note that these two options determine only what information is provided for a process; they do not determine which processes will be listed.

F (l) Flags (hexadecimal and additive) associated with the process

- 00 Process has terminated: process table entry now available.
- 01 A system process: always in primary memory.
- 02 Parent is tracing process.
- 04 Tracing parent's signal has stopped process: parent is waiting (**ptrace**(S)).
- 08 Process is currently in primary memory.
- 10 Process currently in primary memory: locked until an event completes.
- 20 Process can not be swapped.

S (l) The state of the process:

- O Process is running on a processor.
- S Sleeping: process is waiting for an event to complete.
- R Runnable: process is on run queue.
- I Idle: process is being created.
- Z Zombie state: process terminated and parent not waiting.
- T Traced: process stopped by a signal because parent is tracing it.
- X **SXBRK** state: process is waiting for more primary memory.

UID (f,l) The user ID number of the process owner (the login name is printed under the **-f** option).

PID (all) The process ID of the process (this number is needed in order to kill a process).

PPID (f,l) The process ID of the parent process.

C (f,l) Processor utilization for scheduling.

PRI (l) The priority of the process (higher numbers mean lower priority).

NI (l) Nice value, used in priority computation.

ADDR (l) The memory address of the process.

SZ (l) The size (in pages or clicks) of the swappable process's image in main memory.

WCHAN (l) The address of an event for which the process is sleeping, or in **SXBRK** state, (if blank, the process is running).

STIME (f) The starting time of the process, given in hours, minutes, and seconds. (A process begun more than twenty-four hours before the **ps** inquiry is executed is given in months and days.)

TTY (all) The controlling terminal for the process (the message "?" is printed when there is no controlling terminal).

TIME (all) The cumulative execution time for the process.

COMMAND (all) The command name (the full command name and its arguments are printed under the **-f** option).

A process that has exited and has a parent, but has not yet been waited for by the parent, is marked <defunct>.

Files

/dev	terminal ("tty") names searcher files
*/dev/sxt/**	
*/dev/tty**	
*/dev/xt/**	
/dev/kmem	kernel virtual memory
/dev/swap	the default swap device
/dev/mem	memory
/etc/passwd	UID information supplier
/etc/ps_data	internal data structure
/unix	system name list

See also

getty(ADM), **kill**(C), **nice**(C)

Notes

Things can change while **ps** is running; the snap-shot it gives is only true for a split-second, and it may not be accurate by the time you see it. Some data printed for defunct processes is irrelevant.

If no ***termlist***, ***proclist***, ***uidlist***, or ***grplist*** is specified, **ps** checks **stdin**, **stdout**, and **stderr** in that order, looking for the controlling terminal and will attempt to report on processes associated with the controlling terminal. In this situation, if **stdin**, **stdout**, and **stderr** are all redirected, **ps** will not find a controlling terminal, so there will be no report.

On a heavily loaded system, **ps** may report an **lseek**(S) error and exit. **ps** may seek to an invalid user area address: having obtained the address of a process' user area, **ps** may not be able to seek to that address before the process exits and the address becomes invalid.

ps -ef may not report the actual start of a tty login session, but rather an earlier time, when a getty was last respawned on the tty line.

Authorization

The behavior of this utility is affected by assignment of the **mem** authorization. Refer to the "Using a secure system" chapter of the *User's Guide* for more details.

Standards conformance

ps is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

pstat

reports system information

Syntax

pstat [-aipf] [-u | -U *ubase1 ubase2*] [-n *namelist*] [-s *swapfile*] [*file*]

Description

The **pstat** command interprets the contents of certain system tables. **pstat** searches for these tables in */dev/mem* and */dev/kmem*. With the ***file*** given, the tables are sought in the specified ***file*** rather than */dev/mem*. The required namelist is taken from */unix*.

pstat without options prints information for all three tables: the inode table, the process table, and the file table.

Options are:

-a Must be used with **-p**. Describe all process slots rather than just active ones.

-i Prints the inode table with these headings:

LOC The core location of this table entry.

FLAGS Miscellaneous state variables:

L Locked

U Update time must be corrected

A Access time must be corrected

M File system is mounted here

W Wanted by another process (L flag is on)

T Contains a text (executable image) file

C Changed time must be corrected

CNT Number of open file table entries for this inode.

DEVICE Major and minor device number of file system in which this inode resides.

INO I-number within the device.

FS Filesystem type. 1 indicates UNIX.

MODE Mode bits, see **chmod**(S).

NLK Number of links to this inode.

UID User ID of owner.

SIZE/DEV Number of bytes in an ordinary file, or major and minor device of special file.

-p Prints process table for active processes with these headings:

LOC The core location of this table entry.

S Run state encoded thus:

0 No process.

1 Awaiting an event.

2 Running.

3 Process terminated but not waited for.

4 Process stopped by debugger.

5 Intermediate state in process creation.

6 Process is being run on a processor.

7 Process being xswapped.

F Miscellaneous state variables, ORed together:

0x00000001 System (resident) process.

0x00000002 Process is being traced.

0x00000004 Ptraced process has been given to parent by **wait**(S); Don't return this process to parent again until it runs first.

0x00000008 Process cannot be awakened by a signal.

0x00000010 In core.

0x00000020 Process cannot be swapped.

0x00000040 Set when signal goes remote.

0x00000080 Process in stream poll or doing **select**().

0x00000100 Process is being stopped via /proc.

0x00000200 Signal or syscall tracing via /proc.

0x00000400 Doing I/O via /proc, so don't run.

0x00000800 Stop on **exec**.

0x00001000 Process is open via /proc.

0x00002000 U-block in core.

0x00004000 Set process running on last /proc close.

0x00008000 Proc asleep, stop not allowed.

0x00010000 Process is exiting via **ptrace**(S).

0x00020000 Proc is stopped within a call to **sleep**().

0x00040000 U-block is being swapped in or out.

0x00080000 Waiting for u-block swap to complete.

0x00100000 Restore old mask after taking signal.

0x00200000 Child of a **fork**, but no **exec** yet.

PRI Scheduling priority, see **nice**(C).

SIG Signals received (signals 1-16 coded in bits 0-15).

UID Real user ID.

TIM Time resident in seconds; times over 127 coded as 127.

CPU Weighted integral of CPU time, for scheduler.

NI Nice level, see **nice**(C).

PGRP Process number of root of process group (the opener of the controlling terminal).

PID The process ID number.

PPID The process ID of parent process.

ADDR1
ADDR2 If in core, the physical page frame numbers of the u-area of the process. These numbers can be translated into the addresses of the u-area, which is split and stored in two pages. If swapped out, the position in the swap area is measured in multiples of 1024 bytes.

WCHAN Wait channel number of a waiting process.

LINK Link pointer in list of runnable processes.

INODP Pointer to location of shared inode.

CLKT Countdown for **alarm**(S) measured in seconds.

-f Prints the open file table with these headings:

LOC The core location of this table entry.

FLAGS Miscellaneous state variables:

R Open for reading

W Open for writing

A Open for append

N No delay (non-blocking)

S Synchronized write operation

CNT Number of processes that know this open file.

INO The location of the inode table entry for this file.

OFFS The file offset, see **lseek**(S).

-u ***ubase1 ubase2***
Prints information about a user process. Information is drawn from the user area as defined in */usr/include/user.h*.

ubase1 and ***ubase2*** are the physical page frame numbers of the u-area of the process. The numbers may be obtained by using the long listing (**-l** option) of the **ps**(C) command. If the addresses ***ubase1*** and ***ubase2*** do not correspond to a valid u-page, then **pstat** exits with an error.

-U ***ubase1 ubase2***
-U is the same as **-u**, only it gets the u-area from the swap device.

-n ***namelist***
Use the file ***namelist*** as an alternate namelist in place of */unix*.

-s ***swapfile***
Use ***swapfile*** as the swapfile.

file Source of tables as an alternative to */dev/mem*.

Files

/unix	Default namelist
/dev/mem	Default source of tables
/dev/swap	Default swap device

See also

alarm(S), **chmod**(S), **filesystem**(FP), **lseek**(S), **nice**(C), **ps**(C), **stat**(S)

System Administrator's Guide

Authorization

The behavior of this utility is affected by assignment of the *mem* authorization. If you do not have this authorization, the output will be restricted to data pertaining to your activities only. Refer to the "Using a secure system" chapter of the *User's Guide* for more details.

Value added

pstat is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

ptar

process tape archives

Syntax

ptar -c [bLfvw] *device block filename ...*

ptar -r [bLvw] *device block* **[** *filename ...* **]**

ptar -t [fv] *device*

ptar -u [bLvw] *device block*

ptar -x [flmovw] *device* **[** *filename ...* **]**

Description

The **ptar** command reads and writes archive files which conform to the **Archive/Interchange File Format** specified in *IEEE Std. 1003.1-1988.*

Options

The following options are available:

-c Creates a new archive; writing begins at the beginning of the archive, instead of after the last file.

-r Writes named files to the end of the archive.

-t Lists the names of all of the files in the archive.

-u Causes named files to be added to the archive if they are not already there, or have been modified since last written into the archive. This implies the **-r** option.

-x Extracts named files from the archive. If a named file matches a directory whose contents had been written onto the archive, that directory is recursively extracted.

If a named file in the archive does not exist on the system, the file is created with the same mode as the one on the archive, unless the process does not have the appropriate privileges. In this case the access permissions are set in the same fashion that **creat** would have set them when given the "mode" argument, matching the file permissions supplied by the "mode" field of the **ptar** format. The set-user-id and get-group-id modes are not set unless the user has the appropriate privileges.

If the files exist, their modes are not changed except as described above. The owner, group and modification time are restored if possible. If no ***filename*** argument is given, the entire contents of the archive are extracted. Note that if several files with the same name are in the archive, the last one will overwrite all earlier ones.

-b Causes **ptar** to use the next argument on the command line as the blocking factor for tape records. The default is 1; the maximum is 20. This option should only be used with raw magnetic tape archives. Normally, the block size is determined automatically when reading tapes.

-L Causes **ptar** to follow symbolic links.

-f Causes **ptar** to use the next argument on the command line as the name of the archive instead of the default, which is usually a tape drive. If "-" is specified as a filename, **ptar** writes to the standard output or reads from the standard input, whichever is appropriate for the options given. Thus, **ptar** can be used as the head or tail of a pipeline.

-l Tells **ptar** to report if it cannot resolve all of the links to the files being archived. If **-l** is not specified, no error messages are written to the standard output. This modifier is only valid with the **-c**, **-r** and **-u** options.

-m Tells **ptar** not to restore the modification times. The modification time of the file will be the time of extraction. This modifier is invalid with the **-t** option.

-o Causes extracted files to take on the user and group identifier of the user running the program rather than those on the archive. This modifier is only valid with the **-x** option.

-v Causes **ptar** to operate verbosely. Usually, **ptar** does its work silently, but the **-v** modifier causes it to print the name of each file it processes, preceded by the option letter. With the **-t** option, **-v** gives more information about the archive entries than just the name.

-w Causes **ptar** to print the action to be taken, followed by the name of the file, and then wait for the user's confirmation. If a word beginning with **y** is given, the action is performed. Any other input means "no". This modifier is invalid with the **-t** option.

File

/dev/tty used to prompt the user for information when the **-i** or **-y** options are specified.

See also

cpio(C), **dd**(C), **find**(C), **pax**(C), **pcpio**(C)

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Standards conformance

ptar is conformant with:

IEEE POSIX Std 1003.1-1990 System Application Program Interface (API) [C Language] (ISO/IEC 9945-1);
and NIST FIPS 151-1.

purge

overwrite specified files

Syntax

purge [**-f**] [**-r**] [**-v**] [**-m** *num*] [**-suo**] [**-t** *type*] ... [**-z**] [*files*] ...

Description

The **purge** command is used to overwrite various parts of the system. It overwrites files specified on the command line, or those listed in a policy file maintained by the system administrator. The policy file defines types of files and devices which are purged as a group. The utility can be used to purge individual files, **divvy**(ADM) divisions, **fdisk**(ADM) partitions, or other devices like magnetic tapes and floppies. An option even exists to zero memory.

The optional flags are outlined below:

-f Do not warn about files which are not present or inaccessible. Attempts to purge a floppy which is inaccessible (for example, the door is open) will always generate a diagnostic on the system console.

-r Recursively purge directories. Without this flag no action is taken upon directories.

-v Verbose operation, list the name of each file as it is overwritten.

-m *num* Overwrite each *file* ***num*** times.

-s Overwrite files and devices designated as "system" in the policy file. (Equivalent to **-tsystem**.)

-u Overwrite files and devices designated as "user" in the policy file. (Equivalent to **-tuser**.)

-o Overwrite other (non-system and non-user) files and filesystems. This purges all entries in the policy file which are not of either type **system** or **user**. This flag, by the nature of its implicit definition, has no **-t** equivalent.

-t *type* Overwrite the files identified in the policy file as being part of group *type*.

-z Writes binary zeroes to system memory, including memory buffers of intelligent devices (that is, disk controller cache, etc.). This will close down the system immediately. This should only be done from single-user mode, or when no users are logged on. The system will autoboot if so configured (see **autoboot**(ADM)). Only the super user may use this option.

files Regular, directory or special files to purge.

Similarly to regular files, most special files can be purged by being placed in the policy file or with the command **purge /dev/*special_file***. Block special files and some character special files can be overwritten. The console, ttys, printers and other "infinite output" devices cannot be purged with this command. Disks, floppies and magnetic tapes can be overwritten. Tape devices are first erased once and then overwritten the specified number of times.

When both ***types*** and ***files*** are specified on the command line, all of the indicated files are overwritten by the utility. In particular, first the files selected from the policy file, and then those specified on the command line, are overwritten.

Each line in the policy file (*/etc/default/purge*) designates a file, filesystem or device as a member of some ***type***. The syntax of a line is:

file type [***count***]

The optional ***count*** field is the number of times to overwrite ***file***. The default ***count*** is one. The utility will overwrite ***file*** any time the command

purge -t *type*

is given.

Blank lines in the policy file and lines beginning with "**#**" are ignored.

File

*/etc/default/purge*The policy file

See also

autoboot(ADM), **dd**(C), **hd**(C), **od**(C), **rm**(C), **purge**(F), **sysadmsh**(ADM)

Diagnostics

`purge: warning: invalid entry in policy file (line` ***n***`)`

An invalid line was read from the policy file where ***n*** is the number of the incorrectly formatted line.

`purge:` ***filename*** `is a directory`

If the **-r** switch is not specified no action is taken upon directories and this diagnostic is displayed.

`purge: only the superuser can zero memory`

This message is displayed when a user other than the super user tries to use the **-z** option.

Notes

When files are overwritten multiple times, the first pass writes binary zeros. Subsequent passes alternate writing binary ones and binary zeros.

After being overwritten, **od**(C), **dd**(C), or **hd**(C) may be used to verify that no data remains on the device or in the file.

Only the super user may use the **-z** option to zero the system's memory.

Value added

purge is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

pwd

print working directory name

Syntax

pwd

Description

pwd prints the pathname of the working (current) directory.

Note

A version of **pwd** is built into the Korn shell (**ksh**(C)). It differs slightly from the program described here. For further information refer to the **ksh**(C) entry.

See also

cd(C)

Diagnostics

"`Cannot open ...`" and "`Read error in ...`" indicate possible file system trouble. In such cases, see the *System Administrator's Guide* for information on fixing the filesystem.

Standards conformance

pwd is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

quot

summarize file system ownership

Syntax

quot [*option*] ... [*filesystem*]

Description

quot prints the number of blocks in the named *filesystem* currently owned by each user. If no *filesystem* is named, the file systems given in */etc/mnttab* are examined.

The following options are available:

-n Processes standard input. This option makes it possible to produce a list of all files and their owners with the following command:

ncheck *filesystem* | **sort +0n** | **quot -n** *filesystem*

-c Prints three columns giving file size in blocks, number of files of that size, and cumulative total of blocks in files of that size or smaller. Data for files of size greater than 499 blocks is included in the figures for files of exactly size 499.

-f Prints a count of the number of files as well as space owned by each user.

Files

/etc/passwd	Gets user names
/etc/mnttab	Contains list of mounted file systems

See also

cmchk(C), **du**(C), **ls**(C), **machine**(HW)

Notes

Holes in files are counted as if they actually occupied space.

Blocks are reported in 512 byte blocks.

See also "Notes" under **mount**(ADM).

Value added

quot is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

random

generate a random number

Syntax

random [**-s**] [*scale*]

Description

The **random** command generates a random number on the standard output. and returns the number as its exit value. By default, this number is either 0 or 1 (that is, *scale* is 1 by default). If *scale* is given a value between 1 and 255, then the range of the random value is from 0 to *scale*. If *scale* is greater than 255, an error message is printed.

When the **-s**, "silent" option is given, the random number is returned as an exit value but is not printed on the standard output. If an error occurs, **random** returns an exit value of zero.

See also

rand(S)

Notes

This command does not perform any floating point computations.

random uses the time of day as a seed.

rcp

copy files across systems

Syntax

rcp [***options***] [***srcmachine***:] ***srcfile*** [***destmachine***:] ***destfile***

Description

The **rcp** command copies files between systems in a Micnet network. The command copies the ***srcmachine:srcfile*** to ***destmachine:destfile***, where ***srcmachine***: and ***destmachine***: are optional names of systems in the network, and ***srcfile*** and ***destfile*** are pathnames of files. If a machine name is not given, the name of the current system is assumed. If "-" is given in place of ***srcfile***, **rcp** uses the standard input as the source. Directories named on the destination machine must have write permission, and directories and files named on a remote source machine must have read permission.

The available options are:

-m Mails and reports completion of the command, whether there is an error or not.

-u [***machine***:]***user***
Any mail goes to the named ***user*** on ***machine***. The default ***machine*** is the machine on which the **rcp** command is completed or on which an error was detected. If an alias for ***user*** exists in the system alias files on that ***machine***, the mail will be redirected to the appropriate mailbox(es). Since system alias files are usually identical throughout the network, any specified ***machine*** will most likely be overridden by the aliasing mechanism. To prevent aliasing, ***user*** must be escaped with at least two "\" characters (at least four if given as a shell command).

rcp is useful for transferring small numbers of files across the network. The network consists of daemons that periodically awaken and send files from one system to another. The network must be installed using **netutil**(ADM) before **rcp** can be used.

Also, to enable transfer of files from a remote system, either:

This line should be in */etc/default/micnet* on the systems in the network:

```
rcp=/usr/bin/rcp
```

Or, these lines should be in that file:

```
executeall
execpath=PATH=path
```

where ***path*** must contain */usr/bin*.

Example

rcp -m machine1:/etc/mnttab /tmp/vtape

See also

mail(C), **micnet**(FP), **netutil**(ADM), **remote**(C)

Diagnostics

If an error occurs, mail is sent to the user.

Notes

Full pathnames must be specified for remote files.

rcp handles binary data files transparently: no extra options or protocols are needed to handle them. Wildcards are not expanded on the remote machine.

Value added

rcp is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

rcvalert

mail-receipt notification

Syntax

/usr/bin/rcvalert [*size*]

Description

The **rcvalert** command displays a line of mail header information on your screen when a letter is received. MMDF invokes **rcvalert** for you rather than you running it yourself. This command is run when you insert a pipe entry to **rcvalert** in your *.maildelivery* file in your home directory. The **rcvalert** command checks to see if you are logged on and if your terminal may be written to. If so, **rcvalert** prints a scan listing of the message on your terminal.

The scan line rings the terminal's bell and then prints the number of characters in the message and the contents of the "From:" and "Subject:" components, if present. If the "Subject:" component is not present or is very short, some of the initial text from the body of the message is included.

The *size* argument to **rcvalert** specifies the size of the message.

Example

The following entry in the *.maildelivery* file invokes **rcvalert**:

```
*    -    pipe    R    rcvalert $(size)
```

Specify the full pathname of the **rcvalert** program, if the */usr/bin* directory is not in your search path.

Files

/etc/utmp used to see who is logged in
$HOME/*.maildelivery* your delivery specification file

See also

rcvtrip(C), **maildelivery**(F)

Credit

This utility was written by David H. Crocker.

MMDF was developed at the University of Delaware and is used with permission.

rcvfile

put message into named file

Syntax

/usr/bin/rcvfile ***directory*** **[-l***logfile* **] [-m]**

Description

This program is intended to be invoked from your **$HOME/***.maildelivery* file. This command examines the "Subject:" field of a mail message and stores the message in a file if the "Subject:" line contains the **rcvfile** keyword as the first word in the line. The **rcvfile** command can be invoked manually if desired, and a mail message piped into the command.

To have mail filed by **rcvfile**, format the "Subject:" line as follows:

```
Subject: rcvfile output-filename
```

The destination file name is created by concatenation of the ***directory*** value, a slash (/), and the filename given in the subject field after the **rcvfile** keyword. The filename from the subject field is not allowed to contain any " .. " directory components. If any are found, **rcvfile** quits. When a message is stored, the message headers are removed and only the text is stored in the specified file.

The ***directory*** argument is required. The **-l** option sets the logfile where a record of **rcvfile** activity is made. The file must already exist and be writable to the recipient. The **-m** option enables the creation of missing directories in the pathname of a file to be created. The created directories are given permission modes of 0755.

The owner of the created file is notified by mail when a file is delivered, with information about who sent it and other relevant facts. It is possible that the owner may not be the recipient if the referenced file existed, was owned by another user, and was writable. If the file delivery fails for any reason, the message is delivered as normal mail.

Example

A typical entry in your *.maildelivery* can be:

```
subject    rcvfile      pipe    A    rcvfile
```

or

```
Addr       user=file    pipe    A    rcvfile
```

Specify the full pathname of **rcvfile** if */usr/bin* is not in your search path.

File

$HOME/*.maildelivery*

See also

maildelivery(F)

Credit

This utility was written by David H. Crocker.

MMDF was developed at the University of Delaware and is used with permission.

rcvprint

print message automatically

Syntax

/usr/bin/rcvprint

Description

This command is intended to be run from your **$HOME**/*.maildelivery* file. The purpose of **rcvprint** is to pipe the body of the message into a program that prints the message on a line printer. The **rcvprint** program tries a variety of different programs until it finds one that will execute. It then waits to see how the program coped and reports back to the local channel.

Example

A typical entry in your **$HOME**/*.maildelivery* file is:

```
subject    printer    pipe    A    rcvprint
```

Specify the full pathname of **rcvprint** if the */usr/bin* directory is not in your search path.

File

$HOME/*.maildelivery*

See also

maildelivery(F)

Credit

This utility was written by David H. Crocker.

MMDF was developed at the University of Delaware and is used with permission.

rcvtrip

notify mail sender that recipient is away

Syntax

/usr/bin/rcvtrip [**-d**] [*address*]

Description

The **rcvtrip** command makes it possible for you to notify the sender of a message that you are away on a trip and you won't be answering your mail for some time. MMDF runs **rcvtrip** on your behalf rather than you running it directly.

To enable use of **rcvtrip**, put the following line in your *.maildelivery* file:

```
*    -    pipe    R    rcvtrip $(sender)
```

Make sure that your *.maildelivery* file is not writable by anyone but you. You may also place a "custom" reply message in a file named *tripnote*. Finally, you should create an empty *triplog* file.

When **rcvtrip** processes a message, it performs the following steps:

1. Decide if this type of message should receive a reply.
2. Decide to whom the reply should be sent.
3. Decide whether this sender has already received a reply.

The **rcvtrip** command decides whether this is the type of message that should get a reply by looking at the contents of the "Resent-To:", "Resent-Cc:", "To:" and "Cc:" header fields. If the recipient has an *.alter_egos* file (described next), then one of the addresses in that file must appear in one of these header fields for a reply to be sent. If the recipient does not have an *.alter_egos* file, then the recipient's name or a first-order alias of the recipient's name (for example, dlong-->long) must appear in one of these header fields for a reply to be sent. This procedure ensures that **rcvtrip** will not reply to messages sent to mailing lists, unless the recipient's name (or some variant of the recipient's name) is explicitly mentioned in a header field.

If **rcvtrip** decides it should send a reply to the message, it looks at several other address fields to determine to whom the reply should be sent. It uses, in order of precedence:

1. addresses in "Resent-Reply-To:"
2. addresses in "Resent-From:" and, if present, "Resent-Sender:"
3. addresses in "Reply-To:"
4. addresses in "From:" and either "Sender:", if present, or the ***address*** argument from the command line.

The **rcvtrip** command notifies any originator of mail who has not previously been notified unless you pre-load their address into the *triplog* file (refer to the "Files" section). The reply begins with some standard text (supplied by **rcvtrip**) followed by whatever text the user has placed in the *tripnote* file, or the following message if the *tripnote* file is missing:

```
Your mail has been received by the Mail System.
The person you are trying to contact is not here right now.
The Mail System does not know where to forward your message,
so it will be stored here until the recipient returns to read it.
This may take some time.
```

The originators' names are recorded in *triplog*, along with the date and time the message came in, an indication of whether it was answered ("+" = yes), and the first few characters of the subject. This appears as:

```
+ jpo@nott.ac.uk    Wed Oct 8 16:08 >> about your last message
```

Files

$HOME/*tripnote*	contains a reply message to be sent to those sending you mail.
$HOME/*triplog*	contains a list of who sent a message, what was its subject, when it arrived, and if a response was sent. It can also be initialized by hand to contain the addresses, one per line, which are not to receive replies.
$HOME/*logfile*	if it exists, becomes an output file for logging diagnostic information. If the **-d** option is specified, then extensive output is generated for debugging purposes. It is not a good idea to leave **-d** enabled if this file is left lying around, as the output can be quite voluminous.
$HOME/*.alter_egos*	an optional file composed of ***"user@domain"*** lines for all addresses to be considered 'you'. This is needed if you have multiple hosts forwarding their mail to you. If this file is present, then the standard comparisons against your username and first-level aliases of your username do not occur.
$HOME/*.maildelivery*	is your mail delivery specification file. The previous example shows the line that should be added to *.maildelivery* to enable use of **rcvtrip**. In this line, the $(sender) argument is optional (but recommended). You may need to give the full pathname of **rcvtrip** if it is not in your search path.

See also

maildelivery(F)

Credit

MMDF was developed at the University of Delaware and is used with permission.

remote

execute commands on a remote system

Syntax

remote [-] [-f *file*] [-m] [-u *user*] *machine command* [*arguments*]

Description

remote is a limited networking facility that permits execution of UNIX commands across serial lines. Commands on any connected system may be executed from the host system using **remote**. A command line consisting of ***command*** and any blank-separated ***arguments*** is executed on the remote ***machine***. A machine's name is located in the file */etc/systemid*. Note that wild cards are *not* expanded on the remote machine, so they should not be specified in ***arguments***. The optional **-m** switch causes mail to be sent to the user telling whether the command is successful.

The available options follow:

- A dash signifies that standard input is used as the standard input for ***command*** on the remote ***machine***. Standard input comes from the local host and not from the remote machine.

-f *file* Use the specified ***file*** as the standard input for ***command*** on the remote ***machine***. The ***file*** exists on the local host and not on the remote machine.

-m Mails the user to report completion of the command. By default, mail reports only errors.

-u *user* Any mail goes to the named ***user*** on ***machine***. The default ***machine*** is the machine on which an error was detected, or on which the **remote** command was completed. The mail will be redirected to the appropriate mailbox(es), if an alias for ***user*** exists in the system alias files on that ***machine***. Since system alias files are usually identical throughout the network, any specified ***machine*** will most likely be overridden by the aliasing mechanism. To prevent aliasing, ***user*** must be escaped with at least two " \ " characters (at least four if given as a shell command).

Before **remote** can be used successfully, a network of systems must be set up and the proper daemons initialized using **netutil**(ADM). Also, entries for the command to be executed using **remote** must be added to the */etc/default/micnet* files on each remote machine.

Example

The following command executes an **ls** command on the directory */tmp* of the machine *machine1*:

remote machine1 ls /tmp

See also

mail(C), **micnet**(F), **netutil**(ADM), **rcp**(C)

Note

The **mail** command uses the equivalent of **remote** to send mail between machines.

resend

redistribute mail using the Resent- notation

Syntax

resend [-rw] [--*subargs*] *addresses* [-t *addresses*] [-c *addresses*]

Description

The **resend** command is responsible for taking as input a standard mail message, adding the various Resent- components to it, and then handing it over to **submit**(ADM).

The usual method of operation is to pipe a message into **resend** and supply the addresses to which to resend the message on the command line. The default behavior can be changed with the following flags:

-r This specifies that error returns for this message are not required.

-w This flag enables you to follow the delivery attempt. **submit** and its children will print out what they are doing.

-- Any argument starting in this manner is passed directly to **submit** after losing the **--**.

After the flags have been processed, the address lists for the message are built up. Normally all addresses are put onto one "Resent-To:" line, but they can be broken up onto several "Resent-To:" lines by prefixing a block of addresses with the **-t** flag. Alternatively the **-c** flag will start building up a list of "Resent-Cc:" addresses. **resend** looks after all the other headers, such as "Resent-Date", "Resent-From" etc.

File

login directory*/.*fullname

See also

submit(ADM)

rm

remove files or directories

Syntax

rm [**-fri**] *file* ...

Description

The **rm** command removes the entries for one or more files from a directory. If an entry was the last link to the file, the file is destroyed. Removal of a file requires write permission in its directory, but neither read nor write permission on the file itself. If a file is a symbolic link, the link will be removed, but the file or directory to which it refers will not be deleted.

If the user does not have write permission on a specified file and the standard input is a terminal, the user is prompted for confirmation. The file's name and permissions are printed and a line is read from the standard input. If that line begins with **y**, the file is deleted; otherwise, the file remains. If the **-f** option is given or if the standard input is not a terminal, no messages are issued; files are simply removed.

rm will not delete directories unless the **-r** option is used.

Options

The following options are recognized.

-f When invoked with the **-f** option, **rm** does not prompt the user for confirmation for files on which the user does not have write permission. The files are simply removed.

-r The **-r** (recursive) option causes **rm** to recursively delete the entire contents of the any directories specified, and the directories themselves. Symbolic links encountered with this option will not be traversed. Note that the **rmdir**(C) command is a safer way of removing directories.

-i The **-i** (interactive) option causes **rm** to ask whether to delete each file, and if the **-r** option is in effect, whether to examine each directory.

The special option "**--**" can be used to delimit options. For example, a file named "**-f**" could not be removed by **rm** because the hyphen is interpreted as an option; the command **rm -f** would do nothing, since no file is specified. Using **rm -- -f** removes the file successfully.

See also

chmod(C), **rmdir**(C)

Notes

It is forbidden to remove the file .. to avoid the consequences of inadvertently doing something like:

rm -r .*

It is also forbidden to remove the root directory of a given file system.

No more than 17 levels of subdirectories can be removed using the **-r** option.

If the "sticky" (**t**) bit is set on a directory, only the owner of a file can remove that file from the directory. See **chmod**(C) for more information about "sticky" bits.

Standards conformance

rm is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

rmdir

remove directories

Syntax

rmdir [**-p**] [**-s**] *dirname* ...

Description

The **rmdir** command removes the entries for one or more sub-directories from a directory. A directory must be empty before it can be removed. (Note that the **rm -r** *dir* command is a more dangerous alternative to **rmdir**.) If the parent directory has the "sticky" bit set, removal occurs only if one of the following is true:

- the parent directory is owned by the user
- the *dirname* directory is owned by the user
- the *dirname* directory is writable to the user
- the user is the super user

The **-p** option allows users to remove the directory *dirname* and its parent directories which become empty. A message is printed on standard output as to whether the whole path is removed or part of the path remains for some reason.

The **-s** option is used to suppress the message printed on standard error when **-p** is in effect.

rmdir will refuse to remove the root directory of a mounted filesystem.

See also

rm(C)

Diagnostics

rmdir returns an exit code of 0 if all the specified directories are removed successfully. Otherwise, it returns a non-zero exit code.

Standards conformance

rmdir is conformant with:

AT&T SVID Issue 2.

rsh

invoke a restricted shell (command interpreter)

Syntax

rsh [*flags*] [*name* [*arg1* ...]]

Description

rsh is a restricted version of the standard command interpreter **sh**(C). It is used to set up login names and execution environments whose capabilities are more controlled than those of the standard shell. The actions of **rsh** are identical to those of **sh**, except that changing directory with **cd**, setting the value of **$PATH**, using command names containing slashes, and redirecting output using > and >> are all disallowed.

When invoked with the name **-rsh**, **rsh** reads the user's *.profile* (from **$HOME**/*.profile*). It acts as the standard **sh** while doing this, except that an interrupt causes an immediate exit, instead of causing a return to command level. The restrictions above are enforced after *.profile* is interpreted.

When a command to be executed is found to be a shell procedure, **rsh** invokes **sh** to execute it. Thus, it is possible to provide shell procedures to the end user that have access to the full power of the standard shell, while restricting the user to a limited menu of commands; this scheme assumes that the end user does not have write and execute permissions in the same directory.

The net effect of these rules is that the writer of the *.profile* has complete control over user actions, by performing guaranteed setup actions, then leaving the user in an appropriate directory (probably *not* the login directory).

rsh is actually just a link to **sh** and any *flags* arguments are the same as for **sh**(C).

The system administrator often sets up a directory of commands that can be safely invoked by **rsh**.

See also

sh(C), **profile**(M)

sddate

print and set backup dates

Syntax

sddate [***name lev date***]

Description

If no argument is given to **sddate** the contents of the backup date file */etc/ddate* are printed. The backup date file is maintained by **backup**(C) and contains the date of the most recent backup for each backup level for each filesystem.

If arguments are given, an entry is replaced or made in */etc/ddate*. ***name*** is the last component of the device pathname, ***lev*** is the backup level number (from 0 to 9), and ***date*** is a time in the form taken by **date**(C):

***mmddhhmm*[*yy*]**

where the first ***mm*** is a two-digit month in the range 01-12, ***dd*** is a two-digit day of the month from 01-31, ***hh*** is a two-digit military hour from 00-23, and the final ***mm*** is a two-digit minute from 00-59. An optional two-digit year, ***yy***, is presumed to be an offset from the year 1900, that is, 19***yy***.

Some sites may wish to back up filesystems by copying them in their entirety to backup media. **sddate** could be used to make a "level 0" entry in */etc/ddate*, which would then allow incremental backups.

For example:

sddate rhd0 5 10081520

makes an */etc/ddate* entry showing a level 5 backup of */dev/rhd0* on October 8, at 3:20 pm.

File

/etc/ddate

See also

backup(C), **date**(C), **dump**(C)

Diagnostics

`bad conversion` If the date set is syntactically incorrect.

Value added

sddate is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

sdiff

compare files side-by-side

Syntax

sdiff [*options ...*] *file1 file2*

Description

The **sdiff** command uses the output of **diff**(C) to produce a side-by-side listing of two files indicating those lines that are different. Each line of the two files is printed with a blank gutter between them if the lines are identical, a "<" in the gutter if the line only exists in *file1*, a ">" in the gutter if the line only exists in *file2*, and a " | " for lines that are different.

For example:

```
x       |       y
a               a
b       <
c       <
d               d
        >       c
```

The following options exist:

-w *n* Uses the next argument, *n*, as the width of the output line. The default line length is 130 characters.

-l Only prints the left side of any lines that are identical.

-s Does not print identical lines.

-o *output* Uses the next argument, *output*, as the name of a third file that is created as a user-controlled merging of *file1* and *file2*. Identical lines of *file1* and *file2* are copied to *output*. Sets of differences, as produced by **diff**(C), are printed where a set of differences share a common gutter character. After printing each set of differences, **sdiff** prompts the user with a % and waits for one of the following user-entered commands:

- **l** Appends the left column to the output file
- **r** Appends the right column to the output file
- **s** Turns on silent mode; does not print identical lines
- **v** Turns off silent mode

e l Calls the editor with the left column

e r Calls the editor with the right column

e b Calls the editor with the concatenation of left and right

e Calls the editor with a zero length file

q Exits from the program

On exit from the editor, the resulting file is concatenated on the end of the ***output*** file.

See also

diff(C), **ed**(C)

sed

invoke the stream editor

Syntax

sed [**-n**] [**-e** *script*] [**-f** *sfile*] [*files*]

Description

The **sed** command copies the named *files* (standard input default) to the standard output, edited according to a script of commands. The **-e** option causes the script to be read literally from the next argument, which is usually quoted to protect it from the shell. The **-f** option causes the script to be taken from file *sfile*; these options accumulate. If there is just one **-e** option and no **-f** options, the flag **-e** may be omitted. The **-n** option suppresses the default output. A script consists of editing commands, one per line, of the following form:

[*address* [, *address*]] *function* [*arguments*]

In normal operation, **sed** cyclically copies a line of input into a pattern space (unless there is something left after a **D** command), applies in sequence all commands whose addresses select that pattern space, and at the end of the script copies the pattern space to the standard output (except under **-n**) and deletes the pattern space.

A semicolon (;) can be used as a command delimiter.

Some of the commands use a hold space to save all or part of the pattern space for subsequent retrieval.

An address is either a decimal number that counts input lines cumulatively across files, a "$" that addresses the last line of input, or a context address, that is, a */regular expression/* in the style of **ed**(C) modified as follows:

- In a context address, the construction *\?regular expression?*, where "?" is any character, is identical to */regular expression/*. Note that in the context address *\xabc\xdefx*, the second *x* stands for itself, so that the standard expression is *abcxdef*.
- The escape sequence \n matches a newline embedded in the pattern space.
- A dot (.) matches any character except the terminal newline of the pattern space.
- A command line with no addresses selects every pattern space.
- A command line with one address selects each pattern space that matches the address.

- A command line with two addresses separated by a comma selects the inclusive range from the first pattern space that matches the first address through the next pattern space that matches the second. (If the second address is a number less than or equal to the line number first selected, only one line is selected.) Thereafter, the process is repeated, looking again for the first address.

Editing commands can be applied only to nonselected pattern spaces by use of the negation function "!" (below).

In the following list of functions, the maximum number of permissible addresses for each function is indicated in parentheses.

The ***text*** argument consists of one or more lines, all but the last of which end with backslashes to hide the newlines. Backslashes in text are treated like backslashes in the replacement string of an **s** command, and may be used to protect initial blanks and tabs against the stripping that is done on every script line. The ***rfile*** or ***wfile*** argument must terminate the command line and must be preceded by one blank. Each ***wfile*** is created before processing begins. There can be at most 10 distinct ***wfile*** arguments.

(1) **a** ***text*** Appends ***text***, placing it on the output before reading the next input line.

(2) **b** ***label*** Branches to the **:** command bearing the ***label***. If ***label*** is empty, branches to the end of the script.

(2) **c** ***text*** Changes text by deleting the pattern space and then appending ***text***. With 0 or 1 address or at the end of a 2-address range, places ***text*** on the output and starts the next cycle.

(2) **d** Deletes the pattern space and starts the next cycle.

(2) **D** Deletes the initial segment of the pattern space through the first newline and starts the next cycle.

(2) **g** Replaces the contents of the pattern space with the contents of the hold space.

(2) **G** Appends the contents of the hold space to the pattern space.

(2) **h** Replaces the contents of the hold space with the contents of the pattern space.

(2) **H** Appends the contents of the pattern space to the hold space.

(1) **i** ***text*** Insert. Places ***text*** on the standard output.

(2) **l** Lists the pattern space on the standard output with nonprinting characters spelled in two-digit ASCII and long lines folded.

(2) **n** Copies the pattern space to the standard output. Replaces the pattern space with the next line of input.

(2) **N** Appends the next line of input to the pattern space with an embedded newline. (The current line number changes.)

(2) **p** Prints (copies) the pattern space on the standard output.

(2) **P** Prints (copies) the initial segment of the pattern space through the first newline to the standard output.

(1) **q** Quits **sed** by branching to the end of the script. No new cycle is started.

(2) **r** *rfile* Reads the contents of *rfile* and places them on the output before reading the next input line.

(2) **s** */regular expression/replacement/flags*
Substitutes the *replacement* string for instances of the *regular expression* in the pattern space. Any character may be used instead of " / ". For a more detailed description, see **ed**(C). *Flags* is zero or more of:

- *n* *n*=1-512. Substitute for just the *n*th occurrence of the *regular expression.*
- **g** Globally substitutes for all non-overlapping instances of the *regular expression* rather than just the first one.
- **p** Prints the pattern space if a replacement was made.
- **w** *wfile* Writes the pattern space to *wfile* if a replacement was made.

(2) **t** *label* Branches to the colon (:) command bearing *label* if any substitutions have been made since the most recent reading of an input line or execution of a **t** command. If *label* is empty, **t** branches to the end of the script.

(2) **w** *wfile* Writes the pattern space to *wfile.*

(2) **x** Exchanges the contents of the pattern and hold spaces.

(2) **y** */string1/string2/*
Replaces all occurrences of characters in *string1* with the corresponding characters in *string2.* The lengths of *string1* and *string2* must be equal.

(2) **!** *function*
Applies the *function* (or group, if *function* is "{") only to lines NOT selected by the address(es).

(0) **:** ***label*** This command does nothing; it bears a ***label*** for **b** and **t** commands to branch to.

(1) **=** Places the current line number on the standard output as a line.

(2) **{** Executes the following commands through a matching "**}**" only when the pattern space is selected.

(0) An empty command is ignored.

See also

awk(C), **ed**(C), **grep**(C)

Notes

This command is explained in detail in the *User's Guide.*

Standards conformance

sed is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

setcolor, setcolour

set screen color and other screen attributes

Syntax

setcolor - [**knbrgopc**] *argument* [*argument*]

Description

setcolor - Sets screen colors and other attributes

setcolour - Sets screen colours and other attributes

The **setcolor** command allows the user to set the screen color on a color screen. Both foreground and background colors can be set independently in a range of 16 colors. **setcolor** can also set the reverse video and graphics character colors. **setcolor** with no arguments produces a usage message that displays all available colors, then resets the screen to its previous state.

For example, the following strings are possible colors.

blue	magenta	brown	black
lt_blue	lt_magenta	yellow	gray
cyan	white	green	red
lt_cyan	hi_white	lt_green	lt_red

The following flags are available. In the arguments below, ***color*** is taken from the above list.

-n [*color* [*color*]] Reset the screen to default settings, and switch off **-k** option. If no arguments are given the screen is set to white characters on a black background; otherwise the specified colors are used.

color [*color*] Set the foreground to the first color. Sets background to second color if a second color choice is specified.

-b *color* Set the background to the specified color.

-k Switch on keyclick option.

-r *color* [*color*] Set the foreground reverse video characters to the first color. Set reverse video characters' background to second color.

-g *color* [*color*] Set the foreground graphics characters to the first color. Set graphics characters' background to second color.

-o Set the color of the screen border (overscan region). This only works on CGA adaptors.

-p ***pitch duration*** Set the pitch and duration of the bell. Pitch is the period in microseconds, and duration is measured in fifths of a second. When using this option, a ⟨Ctrl⟩**g** (bell) must be echoed to the screen for the command to work. For example:

```
setcolor -p 2500 2
echo ^G
```

-c ***first last*** Set the first and last scan lines of the cursor. (For more information see **screen**(HW).)

Notes

The ability of **setcolor** to set any of these described functions is ultimately dependent on the ability of devices to support them. **setcolor** emits an escape sequence that may or may not have an effect on monochrome devices.

Occasionally changing the screen color can help prolong the life of your monitor.

See also

screen(HW)

Value added

setcolor and **setcolour** are extensions of AT&T System V provided by The Santa Cruz Operation, Inc.

setkey

assign the function keys

Syntax

setkey ***keynum string***

Description

The **setkey** command assigns the given ANSI ***string*** to be the output of the computer function key given by ***keynum***. For example, the command:

setkey 1 date

assigns the string "date" as the output of function key 1. The ***string*** can contain control characters, such as a newline character, and should be quoted to protect it from processing by the shell. For example, the command:

setkey 2 "pwd ; lc\n"

assigns the command sequence "pwd ; lc" to function key 2. Notice how the newline character is embedded in the quoted string. This causes the commands to be carried out when function key 2 is pressed. Otherwise, the ⟨Enter⟩ key would have to be pressed after pressing the function key, as in the previous example.

setkey translates "^" into "^^", which, when passed to the screen driver, is interpreted as a right angle bracket (>), or greater than key.

Notes

setkey works only on the console keyboard and on terminals running in scancode mode.

The function keys are defined in the string mapping table. This is an array of 512 bytes (typedef **strmap_t**) where null terminated strings can be put to redefine the function keys. The first null terminated string is assigned to the first string key, the second to the second string key, and so on. There is one string mapping table per multi-screen.

Although the size of the **setkey** string mapping table is 512 bytes, there is a limit of 30 characters that can be assigned to any individual function key.

Assigning more than 512 characters to the string mapping table causes the function key buffer to overflow. When this happens, the sequences sent by the arrow keys are overwritten, effectively disabling them. Once the function key buffer overflows, the only way to enable the arrow keys is to reboot the system.

The table below lists the ***keynum*** values for the function keys:

Function key	keynum	Function key	keynum
⟨F1⟩	1	⟨Ctrl⟩⟨F10⟩	34
⟨F2⟩	2	⟨Ctrl⟩⟨F11⟩	35
⟨F3⟩	3	⟨Ctrl⟩⟨F12⟩	36
⟨F4⟩	4	⟨Ctrl⟩⟨Shift⟩⟨F1⟩	37
⟨F5⟩	5	⟨Ctrl⟩⟨Shift⟩⟨F2⟩	38
⟨F6⟩	6	⟨Ctrl⟩⟨Shift⟩⟨F3⟩	39
⟨F7⟩	7	⟨Ctrl⟩⟨Shift⟩⟨F4⟩	40
⟨F8⟩	8	⟨Ctrl⟩⟨Shift⟩⟨F5⟩	41
⟨F9⟩	9	⟨Ctrl⟩⟨Shift⟩⟨F6⟩	42
⟨F10⟩	10	⟨Ctrl⟩⟨Shift⟩⟨F7⟩	43
⟨F11⟩	11	⟨Ctrl⟩⟨Shift⟩⟨F8⟩	44
⟨F12⟩	12	⟨Ctrl⟩⟨Shift⟩⟨F9⟩	45
⟨Shift⟩⟨F1⟩	13	⟨Ctrl⟩⟨Shift⟩⟨F10⟩	46
⟨Shift⟩⟨F2⟩	14	⟨Ctrl⟩⟨Shift⟩⟨F11⟩	47
⟨Shift⟩⟨F3⟩	15	⟨Ctrl⟩⟨Shift⟩⟨F12⟩	48
⟨Shift⟩⟨F4⟩	16		
⟨Shift⟩⟨F5⟩	17	Numeric Key-Pad	keynum
⟨Shift⟩⟨F6⟩	18		
⟨Shift⟩⟨F7⟩	19	7	49
⟨Shift⟩⟨F8⟩	20	8	50
⟨Shift⟩⟨F9⟩	21	9	51
⟨Shift⟩⟨F10⟩	22	-	52
⟨Shift⟩⟨F11⟩	23	4	53
⟨Shift⟩⟨F12⟩	24	5	54
⟨Ctrl⟩⟨F1⟩	25	6	55
⟨Ctrl⟩⟨F2⟩	26	+	56
⟨Ctrl⟩⟨F3⟩	27	1	57
⟨Ctrl⟩⟨F4⟩	28	2	58
⟨Ctrl⟩⟨F5⟩	29	3	59
⟨Ctrl⟩⟨F6⟩	30	0	60
⟨Ctrl⟩⟨F7⟩	31		
⟨Ctrl⟩⟨F8⟩	32		
⟨Ctrl⟩⟨F9⟩	33		

For a table of the escape sequences, refer to **keyboard**(HW).

File

/bin/setkey

See also

keyboard(HW), **scancode**(HW)

Value added

setkey is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

sg

set groups

Syntax

sg [**-e**] [**-t**] [**-v**] [**-g** *group*] [**-a** *grouplist*] [**-r** *grouplist*] [**-s** *grouplist*] [**-c** *command*]

Description

The **sg** command allows users to run shells and commands with a different group ID and a modified supplemental group list.

You are limited to working with the groups of which you are a member.

You are a member of a group if any one of the following conditions is true:

- You are the super user. (The super user is considered a member of all groups.)
- The group is your login group, listed in */etc/passwd*.
- You are listed as a member of the group in */etc/group*.
- The group is the current real (RGID) or effective group ID (EGID).
- The group is in the current effective supplemental group access list.
- The group has a password which you know.

Options

-e Display the supplemental group access list of the current process. This is the default.

-t Display the user's login group plus any groups the user is a member of in */etc/group*. The super user is considered to be a member of all groups listed in the group file.

-v Display the new supplemental group access list before each command or shell is run. With **-a** or **-s**, **-v** warns if a group to be added is already in the supplemental group access list or if a group cannot be added because the supplemental group access list is full. With the **-r** option, it warns if a group to be removed is not in the supplemental group access list.

-g *group* Set the real and effective group ID to *group* for subsequent commands to be executed by **sg**. *group* can be a group name or a group ID, but must be a group of which the user is a member.

-a ***grouplist*** Add groups to the supplemental group list. See below for the syntax of ***grouplist***.

-r ***grouplist*** Remove groups from the supplemental group list. See below for the syntax of ***grouplist***. (You do not need to be a member of the group being removed. Neither is there a requirement that the group being removed is actually in the supplemental group list.)

-s ***grouplist*** Set the supplemental group list to ***grouplist***. See below for the syntax of ***grouplist***.

-c ***command*** Pass ***command*** to the user's login shell for execution with the specifed supplemental group and/or group ID modifications. The shell must support the **-c** ***command*** syntax similar to **sh**(C). Giving the empty string "" as the argument to **-c** causes the user's shell to be run. Exiting that shell will resume execution of **sg**.

A ***grouplist*** is a comma- or whitespace- (tab or space) separated list of group names and group IDs. The user must be a member of any groups specified in ***grouplist***.

If ***group*** or ***grouplist*** are an empty string "", or just contain separators, the **-s** option sets the supplemental group access list to empty, and **-a**, **-r**, and **-s** have no effect.

sg reads its options from left to right and performs them as they are read. The **-g**, **-a**, **-r** and **-s** options are cumulative, but they only take effect when a command is executed by the **-c** option.

If at least one of the **-g**, **-a**, **-r** or **-s** options has been specified since the previous **-c** option was performed, and the end of the argument list is reached, the user's shell is invoked with the specified group ID and supplemental group access list.

When **sg** terminates, the user's original shell and supplemental group access list will be in effect.

Examples

Assuming the user is listed as a member of groups *work* and *eng* (with group IDs of 100 and 200), to execute a shell with both groups added to the current supplemental group access list:

```
sg -a work,eng  -c ""
```

This can also be achieved by:

```
sg -a "100 200"
```

To execute **yourprog** with a group ID of 100 and an empty supplemental group access list:

```
sg -g work -s "" -c yourprog
```

Files

/etc/group	Group file
/etc/passwd	Password file

See also

login(M), **newgrp**(C), **sh**(C)

Diagnostics

If **sg** detects an error, it displays an appropriate error message and exits with a status greater than zero. If no errors are encountered, **sg** exits with a status of zero.

Notes

Each process has a supplemental group access list (maintained by the kernel), which is used in determining file access permissions in addition to the effective group ID. The maximum number of group IDs which can be held in the supplemental group access list is defined by the tunable kernel parameter **NGROUPS**.

sg can potentially output very long lines on systems with a large value of **NGROUPS** configured. **sg** executes as setuid zero, resetting the effective user ID to the real user ID before executing any commands.

Authorization

The **execsuid** kernel authorization is required to run **sg**.

Value added

sg is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

sh

invoke the shell command interpreter

Syntax

sh [**-aceiknrstuvx**] [*args*]

Description

The shell is the standard command programming language that executes commands read from a terminal or a file. See "Invocation" below for the meaning of arguments to the shell.

Commands

A *simple-command* is a sequence of nonblank *words* separated by *blanks* (a *blank* is a tab or a space). The first word specifies the name of the command to be executed. Except as specified below, the remaining words are passed as arguments to the invoked command. The command name is passed as argument 0 (see **exec**(S)). The *value* of a simple-command is its exit status if it terminates normally, or (octal) 1000+***status*** if it terminates abnormally. See **signal**(S) for a list of status values.

A *pipeline* is a sequence of one or more *commands* separated by a vertical bar (|). (The caret (^), is an obsolete synonym for the vertical bar and should not be used in a pipeline. Scripts that use "^" for pipelines are incompatible with the Korn shell.) The standard output of each command but the last is connected by a **pipe**(S) to the standard input of the next command. Each command is run as a separate process; the shell waits for the last command to terminate.

A *list* is a sequence of one or more pipelines separated by ;, &, &&, or ||, and optionally terminated by ; or &. Of these four symbols, ; and & have equal precedence, which is lower than that of && and ||. The symbols && and || also have equal precedence. A semicolon (;) causes sequential execution of the preceding pipeline; an ampersand (&) causes asynchronous execution of the preceding pipeline (that is, the shell does *not* wait for that pipeline to finish). The symbol && (||) causes the *list* following it to be executed only if the preceding pipeline returns a zero (nonzero) exit status. An arbitrary number of newlines may appear in a *list*, instead of semicolons, to delimit commands.

A *command* is either a simple-command or one of the following commands. Unless otherwise stated, the value returned by a command is that of the last simple-command executed in the command:

for *name* [**in** *word* ...]
do
    list
done

Each time a **for** command is executed, *name* is set to the next *word* taken from the **in** *word* list. If **in** *word* is omitted, then the **for** command executes the **do** *list* once for each positional parameter that is set (see "Parameter substitution" below). Execution ends when there are no more words in the list.

case *word* **in**
[*pattern* [| *pattern*] ...) *list*
    ;;]
esac

A **case** command executes the *list* associated with the first *pattern* that matches *word*. The form of the patterns is the same as that used for filename generation (see "Filename generation" below).

if *list*
then
    list
[**elif** *list* **then**
    list]
...
[**else** *list*]
fi

The *list* following **if** is executed and, if it returns a zero exit status, the *list* following the first **then** is executed. Otherwise, the *list* following **elif** is executed and, if its value is zero, the *list* following the next **then** is executed. Failing that, the **else** *list* is executed. If no **else** *list* or **then** *list* is executed, then the **if** command returns a zero exit status.

while *list*
do
    list
done

A **while** command repeatedly executes the **while** *list* and, if the exit status of the last command in the list is zero, executes the **do** *list*; otherwise the loop terminates. If no commands in the **do** *list* are executed, then the **while** command returns a zero exit status; **until** may be used in place of **while** to negate the loop termination test.

until *list*
do
    list
done

until is similar to **while**, only **until** continues execution until the first *list* returns a zero exit status. In other words, **until** works until the test condition succeeds (it works the whole time the command is failing); **while** works until the test condition fails. **until** is useful when you are waiting for a particular event to occur.

(*list***)**

Executes *list* in a subshell.

{*list;***}**

list is simply executed.

name **( ) {***list;***}**

Define a function which is referenced by ***name***. The body of functions is the *list* of commands between { and }. Execution of functions is described later (see "Execution".)

The following words are recognized only as the first word of a command and when not quoted:

if	**then**	**else**	**elif**	**fi**	**case**	**esac**
for	**while**	**until**	**do**	**done**	**{**	**}**

Comments

A word beginning with # causes that word and all the following characters up to a newline to be ignored.

Command substitution

The standard output from a command enclosed between grave accents (` `) may be used as part or all of a word; trailing newlines are removed.

No interpretation is done on the command string before the string is read, except to remove backslashes (\) used to escape other characters. Backslashes may be used to escape grave accents (`) or other backslashes and are removed before the command string is read. Escaping grave accents allows nested command substitution. If the command substitution lies within a pair of double quotes ( " ` ... ` "), backslashes used to escape a double quote (\") will be removed; otherwise, they will be left intact.

If a backslash is used to escape a newline character, both the backslash and the newline are removed (see the section on "Quoting"). In addition, backslashes used to escape dollar signs (**\$**) are removed. Since no interpretation is done on the command string before it is read, inserting a backslash to escape a dollar sign has no effect. Backslashes that precede characters other than \, `, ", **newline**, and $ are left intact.

Parameter substitution

The character **$** is used to introduce substitutable *parameters*. There are two types of parameters, positional and keyword. If *parameter* is a digit, it is a positional parameter. Positional parameters may be assigned values by **set**. Keyword parameters, (also known as variables) may be assigned values by writing:

name **=** ***value*** **[** ***name*** **=** ***value*** **]** **...**

Pattern-matching is not performed on ***value***. There cannot be a function and a variable with the same name.

${*parameter***}**

A ***parameter*** is a sequence of letters, digits, or underscores (a *name*), a digit, or any of the characters *, @, #, ?, -, $, and !. The value, if any, of the parameter is substituted. The braces are required only when ***parameter*** is followed by a letter, digit, or underscore that is not to be interpreted as part of its name. A *name* must begin with a letter or underscore. If ***parameter*** is a digit then it is a positional parameter. If ***parameter*** is * or @, then all the positional parameters, starting with **$1**, are substituted (separated by spaces). Parameter **$0** is set from argument zero when the shell is invoked.

${*parameter***:-***word***}**

If ***parameter*** is set and is not a null argument, substitute its value; otherwise substitute ***word***.

${*parameter***:=***word***}**

If ***parameter*** is not set or is null, then set it to ***word***; the value of the parameter is then substituted. Positional parameters may not be assigned to in this way.

${*parameter***:?***word***}**

If ***parameter*** is set and is not a null argument, substitute its value; otherwise, print ***word*** and exit from the shell. If ***word*** is omitted, the message "parameter null or not set" is printed.

${*parameter***:+***word***}**

If ***parameter*** is set and is not a null argument, substitute ***word***; otherwise substitute nothing.

In the above, ***word*** is not evaluated unless it is to be used as the substituted string, so that in the following example, **pwd** is executed only if **d** is not set or is null:

echo ${d:-`pwd`}

If the colon (:) is omitted from the above expressions, then the shell only checks whether ***parameter*** is set.

The following parameters are automatically set by the shell:

The number of positional parameters in decimal

- Flags supplied to the shell on invocation or by the **set** command

? The decimal value returned by the last synchronously executed command

$ The process number of this shell

! The process number of the last background command invoked

The following parameters are used by the shell:

CDPATH Defines search path for the **cd** command. See the section "cd" under "Special commands" below.

HOME The default argument (home directory) for the **cd** command

PATH The search path for commands (see "Execution" below)

MAIL If this variable is set to the name of a mail file, then the shell informs the user of the arrival of mail in the specified file

MAILCHECK This parameter specifies how often (in seconds) the shell will check for the arrival of mail in the files specified by the **MAILPATH** or **MAIL** parameters. The default value is 600 seconds (10 minutes). If set to 0, the shell will check before each prompt.

MAILPATH A colon (**:**) separated list of filenames. If this parameter is set, the shell informs the user of the arrival of mail in any of the specified files. Each filename can be followed by "**%**" and a message that will be printed when the modification time changes. The default message is "`you have mail`".

PS1 Primary prompt string, by default "**$** "

PS2 Secondary prompt string, by default "**>** "

IFS Internal field separators, normally **space**, **tab**, and **newline**

SHELL When the shell is invoked, it scans the environment (see "Environment" below) for this name. If it is found and there is an 'r' in the file name part of its value, the shell becomes a restricted shell.

The shell gives default values to **PATH**, **PS1**, **PS2**, and **IFS**, while **HOME** and **MAIL** are not set at all by the shell (although **HOME** *is* set by **login**(M)).

Blank interpretation

After parameter and command substitution, the results of substitution are scanned for internal field separator characters (those found in **IFS**) and split into distinct arguments where such characters are found. Explicit null arguments ("" or '') are retained. Implicit null arguments (those resulting from *parameters* that have no values) are removed.

Filename generation

Following substitution, each command *word* is scanned for the characters *, ?, and [. If one of these characters appears, the word is regarded as a *pattern*. The word is replaced with alphabetically sorted filenames that match the pattern. If no filename is found that matches the pattern, the word is left unchanged. The character "." at the start of a filename or immediately following a "/", as well as the character "/" itself, must be matched explicitly. These characters and their matching patterns are:

* Matches any string, including the null string.

? Matches any single character.

[...] Matches any one of the enclosed characters. A pair of characters separated by "-" matches any character lexically between the pair, inclusive. If the first character following the opening bracket ([) is an exclamation mark (!), then any character not enclosed is matched.

Quoting

The following characters have a special meaning to the shell and cause termination of a word unless quoted:

; & ( ) | ^ < > newline space tab

A character may be *quoted* (that is, made to stand for itself) by preceding it with a "\". The pair **\newline** is ignored. All characters enclosed between a pair of single quotation marks (' '), except a single quotation mark, are quoted. Inside double quotation marks (" "), parameter and command substitution occurs and "\" quotes the characters \, `, ", and $. **"$***" is equivalent to **"$1 $2 ..."**, whereas **"$@"** is equivalent to **"$1" "$2"** ...

Prompting

When used interactively, the shell prompts with the value of **PS1** before reading a command. If at any time a newline is typed and further input is needed to complete a command, the secondary prompt (that is, the value of **PS2**) is issued.

Spelling checker

When using **cd**(C) the shell checks spelling. For example, if you change to a different directory using **cd** and misspell the directory name, the shell responds with an alternative spelling of an existing directory. Enter "y" and press RETURN (or just press RETURN) to change to the offered directory. If the offered spelling is incorrect, enter "n", then retype the command line. In this example the **sh**(C) response is boldfaced:

```
$ cd /usr/spol/uucp
cd /usr/spool/uucp?y
ok
```

Input/Output

Before a command is executed, its input and output may be redirected using a special notation interpreted by the shell. The following may appear anywhere in a simple-command or may precede or follow a command. They are *not* passed on to the invoked command; substitution occurs before ***word*** or ***digit*** is used:

<*word* Use file ***word*** as standard input (file descriptor 0).

>*word* Use file ***word*** as standard output (file descriptor 1). If the file does not exist, it is created; otherwise, it is truncated to zero length.

>>*word* Use file ***word*** as standard output. If the file exists, output is appended to it (by first seeking the end-of-file); otherwise, the file is created.

<<[-]*word* The shell input is read up to a line that is the same as ***word***, or to an end-of-file. The resulting document becomes the standard input. If any character of ***word*** is quoted, no interpretation is placed upon the characters of the document; otherwise, parameter and command substitution occurs, (unescaped) **\newline** is ignored, and " \ " must be used to quote the characters \, **$**, `, and the first character of ***word***. If "-" is appended to <<, all leading tabs are stripped from ***word*** and from the document.

<&*digit* The standard input is duplicated from file descriptor ***digit*** (see **dup**(S)). Similarly for the standard output using >.

<&- The standard input is closed. Similarly for the standard output using >.

If one of the above is preceded by a digit, the file descriptor created is that specified by the digit (instead of the default 0 or 1). For example:

... 2>&1

creates file descriptor 2 that is a duplicate of file descriptor 1.

If a command is followed by "&", the default standard input for the command is the empty file */dev/null*. Otherwise, the environment for the execution of a command contains the file descriptors of the invoking shell as modified by input/output specifications.

Environment

The *environment* (see **environ**(M)) is a list of name-value pairs that is passed to an executed program in the same way as a normal argument list. The shell interacts with the environment in several ways. On invocation, the shell scans the environment and creates a parameter for each name found, giving it the corresponding value. Executed commands inherit the same environment. If the user modifies the values of these parameters or creates new ones, none of these affect the environment unless the **export** command is used to bind the shell's parameter to the environment. The environment seen by any executed command is composed of any unmodified name-value pairs originally inherited by the shell, minus any pairs removed by **unset**, plus any modifications or additions, all of which must be noted in **export** commands.

The environment for any *simple-command* may be augmented by prefixing it with one or more assignments to parameters. Thus:

TERM=wy60 ***cmd args***

and

(export TERM; TERM=wy60; ***cmd args*****)**

are equivalent (as far as the above execution of ***cmd*** is concerned).

If the **-k** flag is set, *all* keyword arguments are placed in the environment, even if they occur after the command name.

Signals

The **INTERRUPT** and **QUIT** signals for an invoked command are ignored if the command is followed by "&"; otherwise signals have the values inherited by the shell from its parent, with the exception of signal 11. See the **trap** command below.

Execution

Each time a command is executed, the above substitutions are carried out. If the command name does not match a *Special Command*, but matches the name of a defined function, the function is executed in the shell process (note how this differs from the execution of shell procedures). The positional parameters **$1, $2**, ... are set to the arguments of the function. If the command name matches neither a *Special Command* nor the name of a defined function, a new process is created and an attempt is made to execute the command via **exec**(S).

The shell parameter **PATH** defines the search path for the directory containing the command. Alternative directory names are separated by a colon (:). The default path is *:/bin:/usr/bin* (specifying the current directory, */bin*, and */usr/bin*, in that order). Note that the current directory is specified by a null pathname, which can appear immediately after the equal sign or between the colon delimiters anywhere else in the path list. If the command name contains a " / ", then the search path is not used. Otherwise, each directory in the path is searched for an executable file. If the file has execute permission but is not an *a.out* file, it is assumed to be a file containing shell commands. A subshell (that is, a separate process) is spawned to read it. A parenthesized command is also executed in a subshell.

Shell procedures are often used by users running the **csh**. However, if the first character of the procedure is a " #" (comment character), **csh** assumes the procedure is a **csh** script, and invokes **/bin/csh** to execute it. Always start **sh** procedures with some other character if **csh** users are to run the procedure at any time. This invokes the standard shell **/bin/sh**.

The location in the search path where a command was found is remembered by the shell (to help avoid unnecessary **execs** later). If the command was found in a relative directory, its location must be re-determined whenever the current directory changes. The shell forgets all remembered locations whenever the **PATH** variable is changed or the **hash -r** command is executed (see **hash** in next section).

Special commands

Input/output redirection is permitted for these commands:

: No effect; the command does nothing. A zero exit code is returned.

. ***file*** Reads and executes commands from ***file*** and returns. The search path specified by **PATH** is used to find the directory containing ***file***.

break [***n***]
Exits from the enclosing **for**, **while**, or **until** loop, if any. If ***n*** is specified, it breaks ***n*** levels.

continue [***n***]
Resumes the next iteration of the enclosing **for**, **while**, or **until** loop. If ***n*** is specified, it resumes at the ***n***-th enclosing loop.

cd [***arg***]
Changes the current directory to ***arg***. The shell parameter **HOME** is the default ***arg***. The shell parameter **CDPATH** defines the search path for the directory containing ***arg***. Alternative directory names are separated by a colon (:). The default path is <null> (specifying the current directory). Note that the current directory is specified by a null path name, which can appear immediately after the equal sign or between the colon delimiters anywhere else in the path list. If ***arg*** begins with a " / ", the search path is not used. Otherwise, each directory in the path is searched for ***arg***.

If the shell is reading its commands from a terminal, and the specified directory does not exist (or some component cannot be searched), spelling correction is applied to each component of *directory*, in a search for the "correct" name. The shell then asks whether or not to try and change directory to the corrected directory name; an answer of **n** means "no", and anything else is taken as "yes".

echo [*arg*]
Writes arguments separated by blanks and terminated by a newline on the standard output. Arguments may be enclosed in quotes. Quotes are required so that the shell correctly interprets these special escape sequences:

\b	Backspace
\c	Prints line without newline.
\f	Form feed
\n	Newline
\r	Carriage return
\t	Tab
\v	Vertical tab
****	Backslash
\n	The 8-bit character whose ASCII code is the 1, 2 or 3-digit octal number ***n***. ***n*** must start with a zero.

eval [*arg* ...]
The arguments are read as input to the shell and the resulting command(s) executed.

exec [*arg* ...]
The command specified by the arguments is executed in place of this shell without creating a new process. Input/output arguments may appear and, if no other arguments are given, cause the shell input/output to be modified.

exit [*n*]
Causes the shell to exit with the exit status specified by ***n***. If ***n*** is omitted, the exit status is that of the last command executed. An end-of-file will also cause the shell to exit.

export [*name* ...]
The given ***name***s are marked for automatic export to the *environment* of subsequently executed commands. If no arguments are given, a list of all names that are exported in this shell is printed.

getopts
Used in shell scripts to support command syntax standards (see **Intro**(C)); it parses positional parameters and checks for legal options. See **getopts**(C) for usage and description.

hash [**-r**] [*name* ...]
For each *name*, the location in the search path of the command specified by *name* is determined and remembered by the shell. The **-r** option causes the shell to forget all remembered locations. If no arguments are given, information about remembered commands is presented. "Hits" is the number of times a command has been invoked by the shell process. "Cost" is a measure of the work required to locate a command in the search path. There are certain situations which require that the stored location of a command be recalculated. Commands for which this will be done are indicated by an asterisk (*) adjacent to the "hits" information. "Cost" will be incremented when the recalculation is done.

newgrp [*arg* ...]
Equivalent to **exec newgrp** *arg* ...

pwd
Print the current working directory. See **pwd**(C) for usage and description.

read [*name* ...]
One line is read from the standard input and the first word is assigned to the first *name*, the second word to the second *name*, etc., with leftover words assigned to the last *name*. The return code is 0 unless an end-of-file is encountered.

readonly [*name* ...]
The given *name*s are marked **readonly** and the values of these *name*s may not be changed by subsequent assignment. If no arguments are given, a list of all **readonly** names is printed.

return [*n*]
Causes a function to exit with the return value specified by *n*. If *n* is omitted, the return status is that of the last command executed.

set [**-aefhknuvx** [*arg* ...]]

-a Mark variables which are modified or created for export.

-e If the shell is noninteractive, exits immediately if a command exits with a nonzero exit status.

-f Disables filename generation.

-h Locates and remembers function commands as functions are defined (function commands are normally located when the function is executed).

For example, if **h** is set, */bin/tty* is added to the hash table when:

```
showtty(){
        tty
}
```

is declared. If **h** is unset, the function is not added to the hash table until showtty is called.

-k Places all keyword arguments in the environment for a command, not just those that precede the command name.

-n Reads commands but does not execute them.

-u Treats unset variables as an error when substituting.

-v Prints shell input lines as they are read.

-x Prints commands and their arguments as they are executed. Although this flag is passed to subshells, it does not enable tracing in those subshells.

-- Does not change any of the flags; useful in setting $1 to "-".

Using "+" rather than "-" causes these flags to be turned off. These flags can also be used upon invocation of the shell. The current set of flags may be found in **$-**. The remaining arguments are positional parameters and are assigned, in order, to **$1**, **$2**, ... If no arguments are given, the values of all names are printed.

shift [*n*]
The positional parameters from **$2** ... are renamed **$1** ...

If *n* is specified, shift the positional parameters by *n* places.

shift is the only way to access positional parameters above **$9**.

test
Evaluates conditional expressions. See **test**(C) for usage and description.

times
Prints the accumulated user and system times for processes run from the shell.

trap [*arg*] [*n*] ...
arg is a command to be read and executed when the shell receives signal(s) *n*. (Note that *arg* is scanned once when the trap is set and once when the trap is taken.) Trap commands are executed in order of signal number. The highest signal number allowed is 16. Any attempt to set a trap on a signal that was ignored on entry to the current shell is ineffective. An attempt to trap on signal 11 (memory fault) produces an error. If *arg* is absent, all trap(s) *n* are reset to their original values. If *arg* is the null string, this signal is ignored by the shell and by the commands it invokes. If *n* is 0, the command *arg* is executed on exit from the shell. The **trap** command with no arguments prints a list of commands associated with each signal number.

type [*name* ...]
For each *name*, indicate how it would be interpreted if used as a command name.

ulimit [*n*]
imposes a size limit of *n* blocks on files written by the shell and its child processes (files of any size may be read). Any user may decrease the file size limit, but only the super user (*root*) can increase the limit. With no argument, the current limit is printed. If no option is given and a number is specified, **-f** is assumed.

unset [*name* ...]
For each *name*, remove the corresponding variable or function. The variables **PATH, PS1, PS2, MAILCHECK** and **IFS** cannot be unset.

umask [*ooo*]
The user file-creation mask is set to the octal number *ooo* where *o* is an octal digit (see **umask**(C)). If *ooo* is omitted, the current value of the mask is printed.

wait [*n*]
Waits for the specified process to terminate, and reports the termination status. If *n* is not given, all currently active child processes are waited for. The return code from this command is always 0.

Invocation

If the shell is invoked through **exec**(S) and the first character of argument 0 is "-", commands are initially read from */etc/profile* and then from **$HOME**/*.profile*, if such files exist. Thereafter, commands are read as described below, which is also the case when the shell is invoked as **/bin/sh**. The flags below are interpreted by the shell on invocation only; note that unless the **-c** or **-s** flag is specified, the first argument is assumed to be the name of a file containing commands, and the remaining arguments are passed as positional parameters to that command file:

-c ***string*** If the **-c** flag is present, commands are read from ***string***.

-s If the **-s** flag is present or if no arguments remain, commands are read from the standard input. Any remaining arguments specify the positional parameters. Shell output is written to file descriptor 2.

-t If the **-t** flag is present, a single command is read and executed, and the shell exits. This flag is intended for use by C programs only and is not useful interactively.

-i If the **-i** flag is present or if the shell input and output are attached to a terminal, this shell is *interactive*. In this case, **TERMINATE** is ignored (so that **kill 0** does not kill an interactive shell) and **INTERRUPT** is caught and ignored (so that **wait** is interruptible). In all cases, **QUIT** is ignored by the shell.

-r If the **-r** flag is present, the shell is a restricted shell (see **rsh**(C)).

The remaining flags and arguments are described under the **set** command above.

Exit status

Errors detected by the shell, such as syntax errors, cause the shell to return a nonzero exit status. If the shell is being used noninteractively, execution of the shell file is abandoned. Otherwise, the shell returns the exit status of the last command executed. See the **exit** command above.

Files

/etc/profile	system default *profile*, read by login shells before **$HOME**/*.profile*
$HOME/*.profile*	read by login shell at login
*/tmp/sh**	temporary file for <<
/dev/null	source of empty file

See also

a.out(FP), **cd**(C), **dup**(S), **env**(C), **environ**(M), **exec**(S), **fork**(S), **ksh**(C), **login**(M), **newgrp**(C), **pipe**(S), **profile**(M), **rsh**(C), **signal**(S), **test**(C), **umask**(C), **umask**(S), **wait**(S)

Notes

The command **readonly** (without arguments) produces the same type of output as the command **export**.

If << is used to provide standard input to an asynchronous process invoked by **&**, the shell gets mixed up about naming the input document; a garbage file */tmp/sh** is created and the shell complains about not being able to find that file by another name.

If a command is executed, and a command with the same name is installed in a directory in the search path before the directory where the original command was found, the shell will continue to **exec** the original command. Use the **hash** command to correct this situation.

If you move the current directory or one above it, **pwd** may not give the correct response. Use the **cd** command with a full pathname to correct this situation.

When a **sh** user logs in, the system reads and executes commands in */etc/profile* before executing commands in the user's **$HOME**/*.profile*. You can, therefore, modify the environment for all **sh** users on the system by editing */etc/profile*.

The shell doesn't treat the high (eighth) bit in the characters of a command line argument specially, nor does it strip the eighth bit from the characters of error messages. Previous versions of the shell used the eighth bit as a quoting mechanism.

Existing programs that set the eighth bit of characters in order to quote them as part of the shell command line should be changed to use of the standard shell quoting mechanisms (see the section on "Quoting").

Words used to specify filenames in input/output redirection are not expanded for filename generation (see the section on "Filename generation"). For example, **cat file1 > a*** will create a file named *a**.

Because commands in pipelines are run as separate processes, variables set in a pipeline have no effect on the parent shell.

If you get the error message:

```
fork failed - too many processes
```

try using the **wait**(C) command to clean up your background processes. If this doesn't help, the system process table is probably full or you have too many active foreground processes (there is a limit to the number of processes that be can associated with your login, and the number the system can keep track of).

Warnings

Not all processes of a 3 or more stage pipeline are children of the shell, and thus cannot be waited for.

For **wait** *n*, if *n* is not an active process id, all your shell's currently active background processes are waited for and the return code will be zero.

Standards conformance

sh is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

shl

shell layer manager

Syntax

shl

Description

The **shl** command allows a user to interact with more than one shell from a single terminal. The user controls these shells, known as **layers**, using the commands described below.

The *current layer* is the layer that can receive input from the keyboard. Other layers attempting to read from the keyboard are blocked. Output from multiple layers is multiplexed onto the terminal. To have the output of a layer blocked when it is not current, the **stty**(C) option **loblk** may be set within the layer.

The **stty** character **swtch** (set to ⟨Ctrl⟩**z** if NUL) is used to switch control to **shl** from a layer. **shl** has its own prompt, ">>>", to help distinguish it from a layer.

A *layer* is a shell that has been bound to a virtual tty device (*/dev/sxt??[0-7]* or */dev/sxt/??[0-7]*). The virtual device can be manipulated like a real tty device using **stty**(C) and **ioctl**(S). Each layer has its own process group id.

Definitions

A *name* is a sequence of characters delimited by a blank, tab or newline. Only the first eight characters are significant. The *names* **(1)** through **(7)** cannot be used when creating a layer. They are used by **shl** when no name is supplied. They may be abbreviated to just the digit.

Commands

The following commands may be issued from the **shl** prompt level. Any unique prefix is accepted.

create [***name***]
: Create a layer called ***name*** and make it the current layer. If no argument is given, a layer will be created with a name of the form "(#)" where "#" is the last digit of the virtual device bound to the layer. The shell prompt variable **PS1** is set to the name of the layer followed by a space, or, if super user, the name followed by a sharp (#) and a space. A maximum of seven layers can be created.

block *name* [*name* ...]
For each *name*, block the output of the corresponding layer when it is not the current layer. This is equivalent to setting the **stty** option **loblk** within the layer.

delete *name* [*name* ...]
For each *name*, delete the corresponding layer. All processes in the process group of the layer are sent the **SIGHUP** signal (see **signal**(S)).

help (or **?**)
Print the syntax of the **shl** commands.

layers [**-l**] [*name* ...]
For each *name*, list the layer name and its process group. The **-l** option produces a **ps**(C)-like listing. If no arguments are given, information is presented for all existing layers.

resume [*name*]
Make the layer referenced by *name* the current layer. If no argument is given, the last existing current layer will be resumed.

toggle Resume the layer that was current before the last current layer.

unblock *name* [*name* ...]
For each *name*, do not block the output of the corresponding layer when it is not the current layer. This is equivalent to setting the **stty** option **loblk** within the layer.

quit Exit **shl**. All layers are sent the **SIGHUP** signal.

name Make the layer referenced by *name* the current layer.

Files

/dev/sxt??[0-7] or */dev/sxt/??[0-7]*	Virtual tty devices
$SHELL	Variable containing pathname of the shell to use (default is */bin/sh*).

See also

ioctl(S), **mkdev**(ADM), **sh**(C), **signal**(S), **stty**(C), **sxt**(M)

Note

It is inadvisable to kill **shl**.

shl normally accesses *sxt???* devices correctly at all times. Other programs may be able to work with these devices if they have the correct protocol and device name; however some programs may not expect devices to be located outside */dev*, and some programs may expect all terminal devices to begin with the prefix *tty*.

If **shl** does not run properly on a particular terminal, you may have to set **istrip** for that terminal's line by entering the following command at the terminal:

stty istrip

By default, the Operating System is not configured for shell layers. To add this to kernel, use the command:

mkdev shl

This executes a script which prompts you for the number of sessions desired. The script also allows you to relink the kernel. The new session limit becomes effective after the kernel is rebooted. (For more information, see **mkdev**(ADM).)

Standards conformance

shl is conformant with:

AT&T SVID Issue 2.

sleep

suspend execution for an interval

Syntax

sleep *time*

Description

The **sleep** command suspends execution for *time* seconds. It is used to execute a command after a certain amount of time as in:

```
(sleep 105; command)&
```

or to execute a command every so often, as in:

```
while true
        do
                command
                sleep 37
        done
```

See also

alarm(S), **sleep**(S)

Notes

It is recommended that *time* be less than 65536 seconds. If this amount is exceeded, *time* will be arbitrarily set to some value less than 65536 seconds.

Standards conformance

sleep is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

slot

read the microchannel configuration registers

Syntax

/etc/slot [-a *adid*] [-s *slot*] [-f *adnamesfile*]

Description

The **slot** command displays the contents of the configuration POS registers on a microchannel architecture machine, and names the adapter cards currently configured in each slot.

For each of the eight adapter slots, **slot** shows the slot number, the unique adapter id (four digits in hexadecimal from registers 0x100 and 0x101), the contents of the remaining six POS registers (two hexadecimal digits each), followed by the adapter card name.

The default slot display looks similar to this:

```
Slot    AdID    Regs    0x102-0x107   Adapter Name
1       ----    -- --   -- -- -- --   Empty Slot
2       0f1f    01 3b   f7 31 ff ff   Adaptec 1640 SCSI Host Adapter
3       ----    -- --   -- -- -- --   Empty Slot
4       6bbc    81 00   00 85 ff ff   Apricot Synchronous Communications Adapter
5       6bba    81 00   00 b6 ff ff   Apricot Ethernet Controller
6       dfbf    05 02   ff ff ff ff   IBM 6157 Streaming Tape
7       ----    -- --   -- -- -- --   Empty Slot
8       ----    -- --   -- -- -- --   Empty Slot
```

The available **slot** options select a particular adapter id, a particular slot, or select an alternative names file.

-a *adid* shows only the information for those slots in which an adapter of that id is configured (no display if no such adapter). *adid* should be specified in hexadecimal. For example, **/etc/slot -a dfbf** shows only those slots which contain an IBM 6157 Streaming Tape adapter card.

-s *slot* shows only the information for that slot (no display if that slot is empty). For example, **/etc/slot -s 6** shows only the information for slot 6.

-f *adnamesfile* the text displayed by **/etc/slot** is normally read from the file */etc/default/slot*. This option redirects it to read from an alternative file ***adnamesfile***. For example, **/etc/slot -f /dev/null** shows only the register contents of occupied slots, without the accompanying text, which can be useful when processing the output automatically in a shell script.

Diagnostics

Returns 0 upon successful completion. Returns 1 if incorrectly invoked, if the machine is not a microchannel architecture machine (*/dev/mcapos* unreadable), if the selected adapter id is not found, or if the selected slot is empty.

Files

/etc/default/slot This file contains the headers, footers and adapter names shown by the **slot** utility. The text in this file may be translated, or extended as new adapters are announced. The display of header lines, empty slots, and footers may be suppressed by omitting their text.

/dev/mcapos The **slot** utility reads the 64 bytes of MCA POS register configuration information from this device.

Notes

If run on a machine which does not have the microchannel architecture, **slot** reports "not an MCA machine" and exits with diagnostic 1.

If an adapter id is not listed in */etc/default/slot*, **slot** reports "Unknown card" for that slot. The System Administrator should add an entry for that adapter id to */etc/default/slot*.

slot reports what adapter is configured in which slot. No indication is given as to whether that adapter is working, nor whether that adapter is connected to working hardware. No indication is given as to whether the current SCO UNIX System V/386 kernel supports that adapter, nor whether a driver for that adapter is available for SCO UNIX System V/386.

slot cannot be used to change the configuration shown. To change the configuration, use the setup disk supplied with your machine. Consult the hardware documentation supplied with your machine for details concerning the use of the setup disk.

See also

hwconfig(C)

Value added

slot is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

sort

sort and merge files

Syntax

sort [**-cmu**] [**-o***output*] [**-y***kmem*] [**-z***recsz*] [**-dfiMnr**] [**-b**] [**-t***x*] [**+***pos1*] [**-***pos2*] [*files*]

Description

sort sorts lines of all the named *files* together and writes the result on the standard output. The standard input is read if "-" is used as a file name or if no input files are named.

Comparisons are based on one or more sort keys extracted from each line of input. By default, there is one sort key, the entire input line, and ordering is determined by the collating sequence defined by the locale (see **locale**(M)).

The following options alter the default behavior:

-c Check that the input file is sorted according to the ordering rules; give no output unless the file is out of sort.

-m Merge only, the input files are already sorted.

-u Unique: suppress all but one in each set of lines having equal keys. This option can result in unwanted characters placed at the end of the sorted file.

-o*output* The argument given is the name of an output file to use instead of the standard output. This file may be the same as one of the inputs. There may be optional blanks between **-o** and ***output***.

-y*kmem* The amount of main memory used by the sort has a large impact on its performance. Sorting a small file in a large amount of memory is a waste. If this option is omitted, **sort** begins using a system default memory size, and continues to use more space as needed. If this option is presented with a value, ***kmem***, **sort** will start using that number of kilobytes of memory, unless the administrative minimum or maximum is violated, in which case the corresponding extremum will be used. Thus, **-y0** is guaranteed to start with minimum memory. By convention, **-y** (with no argument) starts with maximum memory.

-z*recsz* Causes **sort** to use a buffer size of *recsz* bytes for the merge phase. Input lines longer than the buffer size will cause **sort** to terminate abnormally. Normally, the size of the longest line read during the sort phase is recorded and this maximum is used as the record size during the merge phase, eliminating the need for the **-z** option. However, when the sort phase is omitted (**-c** or **-m** options) a system default buffer size is used, and if this is not large enough, the **-z** option should be used to prevent abnormal termination.

The following options override the default ordering rules.

-d "Dictionary" order: only letters, digits and blanks (spaces and tabs) are significant in comparisons. Dictionary order is defined by the locale setting (see **locale**(M)).

-f Fold lowercase letters into uppercase. Conversion between lowercase and uppercase letters are governed by the locale setting (see **locale**(M)).

-i Ignore non-printable characters in non-numeric comparisons. Non-printable characters are defined by the locale setting (see **locale**(M)).

-M Compare as months. The first three non-blank characters of the field are folded to uppercase and compared so that "JAN" < "FEB" < ... < "DEC". Invalid fields compare low to "JAN". The **-M** option implies the **-b** option (see below).

-n An initial numeric string, consisting of optional blanks, an optional minus sign, and zero or more digits with optional decimal point, is sorted by arithmetic value. The **-n** option implies the **-b** option (see below). Note that the **-b** option is only effective when restricted sort key specifications are in effect.

-r Reverse the sense of comparisons.

When ordering options appear before restricted sort key specifications, the requested ordering rules are applied globally to all sort keys. When attached to a specific sort key (described below), the specified ordering options override all global ordering options for that key.

The notation ***+pos1 -pos2*** restricts a sort key to one beginning at ***pos1*** and ending at ***pos2***. The characters at positions ***pos1*** and ***pos2*** are included in the sort key (provided that ***pos2*** does not precede ***pos1***). A missing ***-pos2*** means the end of the line.

Specifying *pos1* and *pos2* involves the notion of a field (a minimal sequence of characters followed by a field separator or a newline). By default, the first blank (space or tab) of a sequence of blanks acts as the field separator. All blanks in a sequence of blanks are considered to be part of the next field; for example, all blanks at the beginning of a line are considered to be part of the first field. The treatment of field separators can be altered using the options:

-t*x* Use *x* as the field separator character; *x* is not considered to be part of a field (although it may be included in a sort key). Each occurrence of *x* is significant (for example, *xx* delimits an empty field).

-b Ignore leading blanks when determining the starting and ending positions of a restricted sort key. If the **-b** option is specified before the first **+***pos1* argument, it will be applied to all **+***pos1* arguments. Otherwise, the **b** flag may be attached independently to each **+***pos1* or **-***pos2* argument (see below).

pos1 and *pos2* each have the form *m.n* optionally followed by one or more of the flags **b**, **d**, **f**, **i**, **n**, or **r**. A starting position specified by **+***m.n* is interpreted to mean the *n*+1st character in the *m*+1st field. A missing *.n* means .0, indicating the first character of the **m**+1st field. If the **b** flag is in effect, *n* is counted from the first non-blank in the *m*+1st field; **+***m*.0**b** refers to the first non-blank character in the *m*+1st field.

A last position specified by **-***m.n* is interpreted to mean the *n*th character (including separators) after the last character of the *m*th field. A missing *.n* means .0, indicating the last character of the *m*th field. If the **b** flag is in effect, *n* is counted from the last leading blank in the *m*+1st field; **-***m*.0**b** refers to the first non-blank in the *m*+1st field.

When there are multiple sort keys, later keys are compared only after all earlier keys compare equal. Lines that otherwise compare equal are ordered with all bytes significant.

Examples

Sort the contents of *infile* with the second field as the sort key:

sort +1 -2 infile

Sort, in reverse order, the contents of *infile1* and *infile2*, placing the output in *outfile* and using the first character of the second field as the sort key:

sort -r -o outfile +1.0 -1.2 infile1 infile2

Sort, in reverse order, the contents of *infile1* and *infile2* using the first non-blank character of the second field as the sort key:

sort -r +1.0b -1.1b infile1 infile2

Print the password file (*passwd*(F)) sorted by the numeric user ID (the third colon-separated field):

sort -t: +2n -3 /etc/passwd

Print the lines of the already sorted file *infile*, suppressing all but the first occurrence of lines having the same third field (the options **-um** with just one input file make the choice of a unique representative from a set of equal lines predictable):

sort -um +2 -3 infile

Files

/usr/tmp/stm???

See also

coltbl(M), **comm**(C), **join**(C), **locale**(M), **uniq**(C)

Diagnostics

Comments and exits with non-zero status for various trouble conditions (for example, when input lines are too long), and for disorders discovered under the **-c** option.

When the last line of an input file is missing a newline character, **sort** appends one, prints a warning message, and continues.

Standards conformance

sort is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

spell, hashmake, spellin, hashcheck

find spelling errors

Syntax

spell [**-v**] [**-b**] [**-x**] [**-l**] [**-i**] [*+local_file*] [*files*]

/usr/lib/spell/hashmake

/usr/lib/spell/spellin *n*

/usr/lib/spell/hashcheck *spelling_list*

Description

spell - Checks spelling against a hashed spelling list.

hashmake - Generates hash codes for a list of words.

spellin - Writes a spelling list from hash codes.

hashcheck - Recreates the hash codes in a hashed spelling list.

The **spell** command collects words from the named *files* and looks them up in a spelling list. Words that neither occur among nor are derivable (by applying certain inflections, prefixes, and/or suffixes) from words in the spelling list are printed on the standard output. If no *files* are named, words are collected from the standard input.

spell ignores most **troff**(CT), **tbl**(CT), and **eqn**(CT) constructions.

Under the **-v** option, all words not literally in the spelling list are printed, and plausible derivations from the words in the spelling list are indicated.

Under the **-b** option, British spelling is checked. Besides preferring *centre*, *colour*, *programme*, *speciality*, *travelled*, etc., this option insists upon *-ise* in words like *standardise*.

Under the **-x** option, every plausible stem is printed with " = " for each word.

By default, **spell** (like **deroff**(CT)) follows chains of included files (**.so** and **.nx** **troff** requests), *unless* the names of such included files begin with */usr/lib*. Under the **-l** option, **spell** will follow the chains of *all* included files. Under the **-i** option, **spell** will ignore all chains of included files.

Under the *+local_file* option, words found in *local_file* are removed from **spell**'s output. *local_file* is the name of a user-provided file that contains a sorted list of words, one per line. With this option, the user can specify a set of words that are correct spellings (in addition to **spell**'s own spelling list) for each job.

The spelling list is based on many sources, and while more haphazard than an ordinary dictionary, it is also more effective with respect to proper names and popular technical words. Coverage of the specialized vocabularies of biology, medicine, and chemistry is light.

Pertinent auxiliary files may be specified by name arguments, indicated below with their default settings (see "Files"). Copies of all output are accumulated in the history file. The stop list filters out misspellings (for example, thier=thy-y+ier) that would otherwise pass.

Three routines help maintain and check the hash lists used by **spell**:

hashmake Reads a list of words from the standard input and writes the corresponding nine-digit hash codes on the standard output.

spellin ***n*** Reads ***n*** hash codes from the standard input and writes a compressed, or hashed ***spelling_list*** such as */usr/lib/spell/hlista* or */usr/lib/spell/hlistb*, on the standard output. Information about the hash coding is printed on standard error.

hashcheck Reads a compressed, or hashed ***spelling_list***, such as */usr/lib/spell/hlista* or */usr/lib/spell/hlistb*, and recreates the nine-digit hash codes for all the words in it, writing these codes on the standard output.

Examples

This example adds the words in *newwords* to the on-line dictionary (*/usr/lib/spell/hlista*):

```
cd /usr/lib/spell
cat newwords | ./hashmake | sort -u > newcodes
cat hlista | ./hashcheck > hashcodes
cat newcodes hashcodes | sort -u > newhash
cat newhash | ./spellin 'cat newhash | wc -l' > hlist

mv hlista hlista.00
mv hlist hlista

cd /usr/dict
cat newwords words | sort -du > tempwords
mv words words.00
mv tempwords words
```

Remember to remove all temporary files after you are sure everything works.

The following example removes words from the on-line dictionary. You should first make a copy of */usr/dict/words* that does not have the words you want to remove. Make sure the file is sorted in alphabetical order. Then, follow these steps:

```
cd /usr/lib/spell
cat /usr/dict/words | ./hashmake > hashcodes
cat hashcodes | ./spellin 'cat hashcodes | wc -l' > newhlist

mv hlista hlista.00
mv newhlist hlista
```

Note that when you are manipulating large text, hash and hash code files, you should use **cat**(C) to open the files, since they may be extremely large.

Files

D_SPELL=*/usr/lib/spell/hlist[ab]*	hashed spelling lists, American & British
S_SPELL=*/usr/lib/spell/hstop*	hashed stop list
H_SPELL=*/usr/lib/spell/spellhist*	history file
/usr/lib/spell/spellprog	program

See also

deroff(CT), **eqn**(CT), **sed**(C), **sort**(C), **tbl**(CT), **tee**(C), **troff**(CT)

Notes

The spelling list coverage is uneven; new installations will probably wish to monitor the output for several months to gather local additions; typically, these are kept in a separate local file that is added to the hashed ***spelling_list*** via **spellin**.

By default, logging of errors to */usr/lib/spell/spellhist* is turned off.

D_SPELL and **S_SPELL** can be overridden by placing alternate definitions in your environment.

Standards conformance

hashcheck, hashmake and **spellin** are conformant with:
AT&T SVID Issue 2.

spell is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

spline

interpolate smooth curve

Syntax

spline [*option*] ...

Description

The **spline** command takes pairs of numbers from the standard input as abscissas and ordinates of a function. It produces a similar set, which is approximately equally spaced and includes the input set, on the standard output. The cubic spline output has two continuous derivatives, and enough points to look smooth when plotted.

The following options are recognized, each as a separate argument.

-a *n* Supplies abscissas automatically (they are missing from the input); spacing is given by the next argument, or is assumed to be 1 if next argument is not a number.

-k *n* The constant *n* used in the boundary value computation

$$y_0'' = ky_1', \ldots, y_n'' = ky_{n-1}'$$

is set by the next argument. By default $n = 0$.

-n *n* Spaces output points so that approximately *n* intervals occur between the lower and upper x limits. (Default $n = 100$.)

-p Makes output periodic, that is, matches derivatives at ends. First and last input values should normally agree.

-x *l* [*u*] Next 1 (or 2) arguments are lower (and upper) x limits. Normally these limits are calculated from the data. Automatic abscissas start at lower limit (default 0).

Diagnostics

When data is not strictly monotone in *x*, **spline** reproduces the input without interpolating extra points.

Note

A limit of 1000 input points is silently enforced.

split

split a file into pieces

Syntax

split [**-n**] [*file* [*name*]]

Description

The **split** command reads *file* and writes it in as many *n*-line pieces as necessary (default 1000), onto a set of output files. The name of the first output file is *name* with *aa* appended, and so on lexicographically. If no output name is given, *x* is default.

If no input file is given, or if a dash (-) is given instead, the standard input file is used.

See also

bfs(C), **csplit**(C)

Standards conformance

split is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

strings

find the printable strings in an object file

Syntax

strings [**-**] [**-o**] [***-number***] ***filename*** ...

Description

The **strings** command looks for ASCII strings in a binary file. A string is any sequence of four or more printing characters ending with a newline or a null character. Unless the "**-**" flag is given, **strings** only looks in the initialized data space of object files. If the **-o** flag is given, then each string is preceded by its decimal offset in the file. If the ***-number*** flag is given then ***number*** is used as the minimum string length rather than 4.

strings is useful for identifying random object files and many other things.

See also

hd(C), **od**(C)

Credit

This utility was developed at the University of California at Berkeley and is used with permission.

stty, STTY

set the options for a terminal

Syntax

stty [**-a**] [**-g**] [*options*]

Description

STTY - set the options for a terminal. **STTY** is a link to **stty**.

The **stty** command sets certain terminal I/O options for the device that is the current standard input; without arguments, it reports the settings of certain options. With the **-a** option, **stty** reports all of the option settings. The **-g** option causes **stty** to output the current stty settings of the terminal as a list of fourteen hexadecimal numbers separated by colons. This output may be used as a command line argument to **stty** to restore these settings later on. It is a more compact form than **stty -a**. For example, the following shell script uses **stty -g** to store the current stty settings, then turns off character echo while reading a line of input. The stored stty values are then restored to the terminal:

```
:
echo "Enter your secret code: \c"
old=`stty -g`
stty -echo intr '^a'
read code
stty $old
```

The various modes are discussed in several groups that follow. Detailed information about the modes listed in the first four groups may be found in **termio**(M). *Options* in the last group are implemented using multiple *options* in the previous groups. Refer to **vidi**(C) for hardware specific information that describes control modes for the video monitor and other display devices.

Common control modes

parenb (-parenb) Enables (disables) parity generation and detection.

parodd (-parodd) Selects odd (even) parity.

cs5 cs6 cs7 cs8 Selects character size (see **termio**(M)).

0 Hangs up phone line immediately.

50 75 110 134 150 200 300 600 1200 1800 2400 4800 9600 19200 38400
Sets terminal baud rate to the number given, if possible.

ospeed 50 75 110 134 150 200 300 600 1200 1800 3400 4800 9600 19200 38400
Sets terminal output baud rate separately.

ispeed 50 75 110 134 150 200 300 600 1200 1800 3400 4800 9600 19200 38400
Sets terminal input baud rate separately.

hupcl (-hupcl) Hangs up (does not hang up) phone connection on last close.

hup (-hup) Same as **hupcl (-hupcl)**.

cstopb (-cstopb) Uses two(one) stop bits per character.

cread (-cread) Enables (disables) the receiver.

clocal (-clocal) Assumes a line without (with) modem control.

ctsflow (-ctsflow) Enables CTS protocol for a modem or non-modem line.

rtsflow (-rtsflow) Enables RTS signaling for a modem or non-modem line.

Input modes

ignbrk (-ignbrk) Ignores (does not ignore) break on input.

brkint (-brkint) Signals (does not signal) **INTERRUPT** on break.

ignpar (-ignpar) Ignores (does not ignore) parity errors.

parmrk (-parmrk) Marks (does not mark) parity errors (see **termio**(M)).

inpck (-inpck) Enables (disables) input parity checking.

istrip (-istrip) Strips (does not strip) input characters to 7 bits.

inlcr (-inlcr) Maps (does not map) **NL** to CR on input.

igncr (-igncr) Ignores (does not ignore) **CR** on input.

icrnl (-icrnl) Maps (does not map) **CR** to **NL** on input.

iuclc (-iuclc) Maps (does not map) uppercase alphabetics to lowercase on input.

ixon (-ixon) Enables (disables) **START/STOP** output control. Output is stopped by sending an ASCII DC3 and started by sending an ASCII DC1.

ixany (-ixany) Allows any character (only DC1) to restart output.

ixoff (-ixoff) Requests that the system send (not send) **START/STOP** characters when the input queue is nearly empty/full.

isscancode (-isscancode)
Expect the terminal device to send (not send) PC scancodes.

xscancode (-xscancode)
Translate (do not translate) PC scancodes to characters on input.

cs2scancode (-cs2scancode)
Put console keyboard into codeset 2/(AT) mode (or codeset 1/(XT) mode) and interpret the transmitted codes accordingly.

Do not use the **-iscancode** or **-xscancode** options on the console, as the console keyboard always sends scancodes and needs them translated.

Some console keyboards do not support AT mode. Use **kbmode**(C) to determine whether your keyboard supports this mode.

The **stty -a** command displays these option settings (along with the settings of all other options). However, if the tty is in **-isscancode** mode, **stty -a** does not display the state of **xscancode cs2scancode**.

Output modes

opost (-opost) Post-processes output (does not post-process output; ignores all other output modes).

olcuc (-olcuc) Maps (does not map) lowercase alphabetics to uppercase on output.

onlcr (-onlcr) Maps (does not map) **NL** to **CR-NL** on output.

ocrnl (-ocrnl) Maps (does not map) **CR** to **NL** on output.

onocr (-onocr) Does not (does) output **CR**s at column zero.

onlret (-onlret) On the terminal **NL** performs (does not perform) the **CR** function.

ofill (-ofill) Uses fill characters (uses timing) for delays.

ofdel (-ofdel) Fill characters are **DELETE**s (**NUL**s).

cr0 cr1 cr2 cr3 Selects style of delay for **RETURN**s (see **termio**(M)).

nl0 nl1 Selects style of delay for **LINEFEED**s (see **termio**(M)).

tab0 tab1 tab2 tab3 Selects style of delay for horizontal **TAB**s (see **termio**(M)).

bs0 bs1 Selects style of delay for **BACKSPACE**s (see **termio**(M)).

ff0 ff1 Selects style of delay for **FORMFEED**s (see **termio**(M)).

vt0 vt1 Selects style of delay for vertical **TAB**s (see **termio**(M)).

Local modes

isig (-isig) Enables (disables) the checking of characters against the special control characters **INTERRUPT**, **SWITCH** and **QUIT**.

icanon (-icanon) Enables (disables) canonical input (**ERASE** and **KILL** processing).

xcase (-xcase) Canonical (unprocessed) upper/lowercase presentation.

echo (-echo) Echoes back (does not echo back) every character typed.

echoe (-echoe) Echoes (does not echo) **ERASE** character as a **backspace, space, backspace** sequence. Note: this mode will erase the **ERASE** character on many CRT terminals; however, it does **not** keep track of column position and, as a result, may be confusing on escaped characters, **TAB**s, and **BACKSPACE**s.

echok (-echok) Echoes (does not echo) **NL** after **KILL** character.

lfkc (-lfkc) The same as **echok (-echok)**; obsolete.

echonl (-echonl) Echoes (does not echo) **NL**.

noflsh (-noflsh) Disables (enables) flush after **INTERRUPT** or **QUIT**.

iexten (-iexten) Enables extended implementation (implementation-defined) functions.

tostop (-tostop) Disables/enables background process group to write to controlling terminal (only if job control is supported).

Control assignments

control-character C Sets ***control-character*** to ***C***, where ***control-character*** is **erase, kill, intr** (interrupt), **quit, eof, eol, swtch** (switch), start**, stop or susp.**

start and **stop** are available as possible control characters for the ***control-character C*** assignment.

If ***C*** is preceded by a caret (^) (escaped from the shell), then the value used is the corresponding control character (for example, **^D** is a ⟨Ctrl⟩**d**; **^?** is interpreted as **DELETE** and **^-** is interpreted as undefined.)

min *i*, time *i* (0 < *i* < 127) When **-icanon** is set, and one character has been received, read requests are not satisfied until at least **min** characters have been received or the timeout value **time** has expired and one character has been received. See **termio**(M).

line *i* Sets the line discipline to ***i*** (0 < ***i*** < 127).

Combination modes

evenp or **parity** — Enables **parenb** and **cs7**.

oddp — Enables **parenb**, **cs7**, and **parodd**.

-parity, **-evenp**, or **-oddp** — Disables **parenb**, and sets **cs8**.

raw (**-raw** or **cooked**) — Enables (disables) raw input and output (no **ERASE**, **KILL**, **INTERRUPT**, **QUIT**, **EOT**, or output post-processing).

nl (**-nl**) — Unsets (sets) **icrnl**, **onlcr**. In addition **-nl** unsets **inlcr**, **igncr**, **ocrnl**, and **onlret**.

lcase (**-lcase**) — Sets (unsets) **xcase**, **iuclc**, and **olcuc**.

LCASE (**-LCASE**) — Same as **lcase** (**-lcase**).

tabs (**-tabs** or **tab3**) — Preserves (expands to spaces) tabs when printing.

ek — Resets **ERASE** and **KILL** characters back to normal ⟨Ctrl⟩**h** and ⟨Ctrl⟩u.

sane — Resets all modes to some reasonable values. Useful when a terminal's settings have been hopelessly scrambled. This includes setting **xscancode** if **isscancode** is set.

term — Sets all modes suitable for the terminal type *term*, where *term* is one of **tty33**, **tty37**, **vt05**, **tn300**, **ti700**, or **tek**.

See also

console(M), **ioctl**(S), **scancode**(HW), **scanon**(M), **scanoff**(M), **termio**(M), **termios**(M), **tty**(M), **kbmode**(C), **vidi**(C)

Note

Many combinations of options make no sense, but no checking is performed.

Standards conformance

stty is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

su

make the user a super user or another user

Syntax

su [**-**] [*name* [*arg* ...]]

Description

The **su** command allows authorized users to change their user id to that of another user without logging off. The default user *name* is *root* (that is, super user).

If a user has **su** authorization they can **su** to any account, providing they know the password for that account. If the user does not have **su** authorization, they can **su** only to their own account or to another account that they own, or to an account that has the same owner as the current account.

To use **su**, the appropriate password must be supplied (unless you are already the super user). If the password is correct, **su** will execute a new shell with the user ID, group ID, and supplemental group list set to those of the specified user. The new shell also has the kernel and subsystem authorizations of the specified user, although the LUID is not changed. The new shell will be the optional program named in the shell field of the specified user's password file (**/bin/sh** if none is specified (see **sh**(C))). To restore normal user ID privileges, press EOF ⟨Ctrl⟩**d** to exit the new shell.

Any additional arguments given on the command line are passed to the program invoked as the shell. When using programs like **sh**(C), an *arg* of the form **-c** *string* executes *string* via the shell and an *arg* of **-r** gives the user a restricted shell. You must specify a username with the **-c** option; for example, **su root -c sysadmsh**. When you exit the system administration shell, you will no longer be *root*.

The following statements are true only if the optional program named in the shell field of the specified user's password file entry is like **sh**. If the first argument to **su** is a "**-**", the environment is changed to what would be expected if the user actually logged in as the specified user. This is done by invoking the program used as the shell with an *arg0* value whose first character is "**-**", thus causing first the system's profile (*/etc/profile*) and then the specified user's profile (*.profile* in the new **HOME** directory) to be executed. Otherwise, the environment is passed along with the possible exception of **$PATH**, which is set to */bin:/etc:/usr/bin* for *root*. The "**-**" option should never be used in **/etc/rc** scripts.

Note that if the optional program used as the shell is **/bin/sh**, the user's *.profile* can check *arg0* for **-sh** or **-su** to determine if it was invoked by **login**(M) or **su**, respectively. If the user's program is other than **/bin/sh**, then *.profile* is invoked with an *arg0* of *-program* by both **login** and **su**.

The file */etc/default/su* can be used to control several aspects of how **su** is used. Several entries can be placed in */etc/default/su*:

SULOG Name of log file to record all attempts to use **su**. Usually */usr/adm/sulog*. If this is not set, no logfile is kept. (See below.)

PATH The **PATH** environment variable to set for non-*root* users. If not set, it defaults to *:/bin:/usr/bin*. The current **PATH** environment variable is ignored.

SUPATH The **PATH** environment variable to set for *root*. If not set, it defaults to */bin:/etc:/usr/bin*. The current **PATH** is ignored.

CONSOLE Attempts to use **su** are logged to the named device, independently of **SULOG**.

For example, if you want to log all attempts by users to become *root*, edit the file */etc/default/su*. In this file, place a string similar to:

```
SULOG=/usr/adm/sulog
```

This causes all attempts by any user to switch user IDs to be recorded in the file */usr/adm/sulog*. This filename is arbitrary. The **su** logfile records the original user, the UID of the **su** attempt, and the time of the attempt. If the attempt is successful, a plus sign (+) is placed on the line describing the attempt. A minus sign (-) indicates an unsuccessful attempt.

Examples

To become user *bin* while retaining your previously exported environment, enter:

su bin

To become user *bin* but change the environment to what would be expected if *bin* had originally logged in, enter:

su - bin

To execute ***command*** with the temporary environment and permissions of user *bin*, enter:

su - bin -c *command args*

Files

/etc/passwd	The system password file
/etc/default/su	File containing control options
/etc/profile	The system profile
$HOME/*.profile*	The user profile

See also

auths(C), **nv**(C), **environ**(M), **login**(M), **passwd**(FP), **profile**(M), **sh**(C), **sg**(C)

Standards conformance

su is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

sum

calculate a checksum and count the blocks in a file

Syntax

sum [**-rl**] [*file*] ...

Description

The **sum** command calculates and prints a checksum for the named *file*, and also prints the number of 512-byte blocks in the file.

If no *file* is named, standard input is used.

Options are:

-l Print a long (32-bit) checksum. (The default is to print a short (16-bit) checksum.)

-r Use an alternate (older) algorithm to compute the checksum. This alternate algorithm is sensitive to the order of the bytes in the data; the standard algorithm is not.

sum is typically used to validate data after being transported across unreliable media. It is also useful when you want to reduce the contents of a file into a representative value.

See also

cmchk(C), **machine**(HW), **wc**(C)

Diagnostics

"Read error" is indistinguishable from "End-of-file" on most devices, so you need to check the block count.

Standards conformance

sum is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

swconfig

produce a list of the software modifications to the system

Syntax

swconfig [-a] [-p]

Description

The **swconfig** command displays the modifications to the system software since its initialization, in much the same way that **hwconfig** tells the user what hardware is installed on the system. The program can tell the user what sets have been installed or removed from the system, as well as what release and what parts of the packages were installed at that time.

Options

Additional flags let the user ask to see all of the description of each installation on the system.

The default behavior is simple so that the information is displayed quickly. Additional flags can be used to perform more complex manipulations. Updates are recognized and noted as such. The release number is displayed in all cases.

Without options, **swconfig** generates a display similar to the following example:

```
Set                              Release    Notes
---                              -------    -----
Operating System                 2.3.1a     partially removed
International XENIX O.S. Supplem 2.0.0e     partially installed
Development System               2.3.0b     removed
```

-a The **-a** flag lists all the information contained in */usr/lib/custom/history*, but sorted by date. It groups products that were installed at the same time, but displays entries in reverse chronological order.

-p The flag **-p** is used to display package information in addition to the default information. A list of all the packages in a set is stored and their installed status tracked by the sequence of information in */usr/lib/custom/history*.

Examples

Here is a sample output using the **-a** option:

```
Set: Operating System (prd = xos)
  Fri Mar 17 07:51:02 PST 1989
  removed successful              Release 2.3.1a        Type: 386GT
  Packages: HELP MOUSE

  Fri Mar 17 10:43:09 PST 1989
  removed successful              Release 2.3.1a        Type: 386GT
  Packages: VSH

Set: International XENIX O.S. Supplement (prd = sup.os)
  Fri Dec 16 10:32:53 PST 1988
  installed successful            Release 2.0.0e        Type: n286
  Packages: RTSUP BASE SYSADM FILE

  Fri Dec 16 11:03:37 PST 1988
  installed successful            Release 2.0.0e        Type: n286
  Packages: MAPFILE
```

Here is a sample output generated by the **-p** option:

```
Set                              Release   Notes       Packages
---                              -------   -----       --------
Operating System                 2.3.1a    removed     HELP MOUSE
Operating System                 2.3.1a    removed     VSH
International XENIX O.S. Supplem 2.0.0e    installed   RTSUP BASE
                                                       SYSADM FILE
International XENIX O.S. Supplem 2.0.0e    installed   MAPFILE
Develoment System                2.3.0b    removed     ALL
```

See also

custom(ADM)

Value added

swconfig is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

tabs

set tabs on a terminal

Syntax

tabs [*tabspec*] [**-T***type*] [**+m***n*]

Description

The **tabs** command sets the tab stops on the user's terminal according to the tab specification *tabspec*, after clearing any previous settings. The user's terminal must have remotely-settable hardware tabs.

tabspec Four types of tab specification are accepted for *tabspec*. They are described below: **canned** (*-code*), **repetitive** (*-n*), **arbitrary** (*n1,n2,...*), and **file** (*--file*). If no *tabspec* is given, the default value is "-8", that is, "standard" UNIX tabs. The lowest column number is 1. Note that for **tabs**, column 1 always refers to the leftmost column on a terminal, even one whose column markers begin at 0, for example, the DASI 300, DASI 300s, and DASI 450.

-code Use one of the codes listed below to select a **canned** set of tabs. The legal codes and their meanings are as follows:

-a 1,10,16,36,72
Assembler, IBM S/370, first format

-a2 1,10,16,40,72
Assembler, IBM S/370, second format

-c 1,8,12,16,20,55
COBOL, normal format

-c2 1,6,10,14,49
COBOL compact format (columns 1-6 omitted). Using this code, the first typed character corresponds to card column 7, one space gets you to column 8, and a tab reaches column 12. Files using this tab setup should include a format specification as follows (see **fspec**(F)): **<:t-c2 m6 s66 d:>**

-c3 1,6,10,14,18,22,26,30,34,38,42,46,50,54,58,62,67
COBOL compact format (columns 1-6 omitted), with more tabs than **-c2.** This is the recommended format for COBOL. The appropriate format specification is (see **fspec**(F)): **<:t-c3 m6 s66 d:>**

-f 1,7,11,15,19,23
FORTRAN

-p 1,5,9,13,17,21,25,29,33,37,41,45,49,53,57,61
PL/I

-s 1,10,55
SNOBOL

-u 1,12,20,44
UNIVAC 1100 Assembler

-n A **repetitive** specification requests tabs at columns 1+*n*, 1+2**n*, etc. Of particular importance is the value **8**: this represents the "standard" UNIX tab setting, and is the most likely tab setting to be found at a terminal. Another special case is the value **0**, implying no tabs at all.

n1,n2,... The **arbitrary** format permits the user to type any chosen set of numbers, separated by commas, in ascending order. Up to 40 numbers are allowed. If any number (except the first one) is preceded by a plus sign, it is taken as an increment to be added to the previous value. Thus, the formats **1,10,20,30**, and **1,10,+10,+10** are considered identical.

--file If the name of a *file* is given, **tabs** reads the first line of the file, searching for a format specification (see **fspec**(F)). If it finds one there, it sets the tab stops according to it: otherwise it sets them as **-8**. This type of specification may be used to make sure that a tabbed file is printed with correct tab settings, and would be used with the **pr**(C) command:

tabs -- *file*; pr *file*

Any of the following also may be used; if a given flag occurs more than once, the last value given takes effect:

-T*type* **tabs** usually needs to know the type of terminal in order to set tabs and always needs to know the type to set margins. ***type*** is a name listed in **term**(M). If no **-T** flag is supplied, **tabs** uses the value of the environment variable **TERM**. If **TERM** is not defined in the environment (see **environ**(M)), **tabs** tries a sequence that will work for many terminals.

+m*n* The margin argument may be used for some terminals. It causes all tabs to be moved over *n* columns by making column *n*+**1** the left margin. If **+m** is given without a value of *n*, the value assumed is **10**. For a TermiNet, the first value in the tab list should be **1**, or the margin will move even further to the right. The normal (leftmost) margin on most terminals is obtained by **+m0**. The margin for most terminals is reset only when the **+m** flag is given explicitly.

Tab and margin setting is performed via the standard output.

Examples

tabs -a example using *-code* (**canned** specification) to set tabs to the settings required by the IBM assembler:
columns 1, 10, 16, 36, 72.

tabs -8 example of using *-n* (**repetitive** specification), where *n* is **8**, causes tabs to be set every eighth position:
1+(1*8), 1+(2*8), ... which evaluate to columns 9, 17, ...

tabs 1,8,36 example of using *n1,n2,...* (**arbitrary** specification) to set tabs at columns 1, 8, and 36.

tabs --$HOME/fspec.list/att4425
example of using *--file* (**file** specification) to indicate that tabs should be set according to the first line of **$HOME**/*fspec.list/att4425* (see **fspec**(F)).

Diagnostics

`illegal tabs` when arbitrary tabs are ordered incorrectly

`illegal increment` when a zero or missing increment is found in an arbitrary specification

`unknown tab code` when a **canned** code cannot be found

`can't open` if *--file* option used and *file* can't be opened

`file indirection` if *--file* option used and the specification in that *file* points to yet another file. Indirection of this form is not permitted.

See also

environ(M), **fspec**(F), **newform**(C), **pr**(C), **terminfo**(F), **term**(M), **tput**(C)

Notes

There is no consistency among different terminals regarding ways of clearing tabs and setting the left margin.

The **tabs** command clears only 20 tabs (on terminals requiring a long sequence), but is willing to set 64.

The *tabspec* used with the **tabs** command is different from the one used with the **newform**(C) command. For example, **tabs -8** sets every eighth position; whereas **newform -i-8** indicates that tabs are set every eighth position.

Standards conformance

tabs is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

tail

display the last part of a file

Syntax

tail [±[*number*] [lbc] [-f]] [*file*]

Description

The **tail** command copies the named file to the standard output beginning at a designated place. If no file is named, the standard input is used.

Copying begins at distance ***+number*** from the beginning, or ***-number*** from the end of the input (if ***number*** is null, the value 10 is assumed). ***number*** is counted in units of lines, blocks, or characters, according to the appended option **l**, **b**, or **c**. When no units are specified, counting is by lines.

With the **-f** ("follow") option, if the input file is not a pipe, the program will not terminate after the last line of the input file has been copied, but will enter an endless loop, in which it sleeps for a second and then attempts to read and copy further records from the input file. Thus it may be used to monitor the growth of a file that is being written by some other process. For example, the command:

tail -f file

will print the last ten lines of *file*, followed by any lines that are appended to *file* between the time **tail** is initiated and killed.

See also

dd(C)

Notes

Tails relative to the end of the file are kept in a buffer, and thus are limited to approximately 300 lines. Unpredictable results can occur if character special files are "tailed."

Standards conformance

tail is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

tape, mcart

magnetic tape maintenance program

Syntax

tape [**-csf8i**] [**-a** *arg*] *command* [*device*]

mcart *command* [*device*]

Description

tape - sends commands to, and receives status from, the tape subsystem

mcart - sends commands to, and receives status from, the Irwin tape driver

The **tape** command sends commands to, and receives status from, the tape subsystem. **tape** can communicate with QIC-02 cartridge tape drives, SCSI tape drives, and QIC-40, QIC-80 and Irwin mini-cartridge tape drives. (The **mcart** program is automatically invoked by **tape** when options specific to the Irwin driver are used.)

The **tape** command reads */etc/default/tape* to find the default device name for sending commands and receiving status. For example, the following line in */etc/default/tape* will cause **tape** to communicate with the QIC-02 cartridge tape device:

```
device = /dev/xct0
```

If a device name is specified on the command line, it overrides the default device. **tape** queries the device to determine its device type. If the device does not respond to the query, **tape** will print a warning message and assume the device is a QIC-02 cartridge tape.

The Irwin driver has a special default file */etc/default/mcconfig* that contains special driver options (see **mcconfig**(F) for details). In addition, the Irwin driver uses a daemon startup program, **/etc/mcdaemon**, to provide background ECC encode/decode.

Options

You can explicitly specify the type of the device by using the device type flags, as follows:

-c	QIC-02 cartridge tape
-s	SCSI tape
-f	QIC-40 mini-cartridge tape
-8	QIC-80 mini-cartridge tape
-i	Irwin mini-cartridge tape

The **-a** flag allows you to pass an argument to commands that can use them. The command to format a DAT tape into two partitions requires the size to be passed as an argument. The **-a** option can also be used with the **format** command (used only with QIC-40, QIC-80, and Irwin tape drives) and the **setblk** command (only valid with SCSI drives).

The following commands can be used with the various tape drivers supported under UNIX. The letters following each description indicate which drivers support each command:

A	All drivers
C	QIC-02 cartridge tape driver
S	SCSI tape driver
F	QIC-40 and QIC-80 mini-cartridge tape drivers
I	Irwin mini-cartridge tape driver

amount Report amount of data in current or last transfer. (C,S,F)

erase Erase and retension the tape cartridge. (C,S,F)

load Load the tape cartridge. (S)

reset Reset tape controller and tape drive. Clears error conditions and returns tape subsystem to power-up state. (C,S,F)

reten Retension tape cartridge. Should be used periodically to remedy slack tape problems. Tape slack can cause an unusually large number of tape errors. (A)

rewind Rewind to beginning of tape (BOT). (For HP DAT tapes: if the tape is partitioned, the logical partition is rewound to the logical BOT. (See **dat**(HW) for details.) (A)

status The status output looks like this:

```
status: status message
soft errors: n
underruns: m
```

Status is a report of the current status of the drive; "no cartridge", "write protected", or "beginning of tape" are typical ***status messages***.

Soft errors is the number of recoverable errors that occurred during the last tape operation. A recoverable error is one which is correctable by the drive or controller. An example of a non-recoverable "hard" error is an attempt to write to a write-protected cartridge. Note that if the number of soft errors greatly exceeds the manufacturer's specifications, the drive may require service or replacement, or you may be using a defective tape.

Underruns is the number of times the tape drive had to stop and restart due to tape buffer underflows. Underruns are not an error indication; they mean that the data transfer did not occur at the drive's maximum data transfer rate. The number of underruns can be affected by system load. (C,S,F)

partition Partition an HP DAT tape into logical partitions 1 and 2. The size (in megabytes) of partition 2 is specified on the command line. (The size of partition 1 is the remainder of the tape.) For example: **tape -a 200 partition** creates a 200 megabyte partition (in partition 2) while partition 1 comprises the rest of the tape. (For a 1300 megabyte unformatted DAT tape, partition 1 contains approximately 1100 megabytes of data.) (HP DAT only. See **dat**(HW) for additional information.)

unload Unloads the tape cartridge. (S)

format Format the tape cartridge. Floppy controller-based tapes must be formatted before they can be used. This command takes approximately one minute per megabyte of tape capacity. If an argument is provided with the **-a** flag, the number of tracks specified by the argument will be formatted. Only even numbers less than or equal to the number of tracks on the tape are allowed. (See **tape**(HW) for more information.) If no argument is given, the entire tape will be formatted. (F,I)

Reformatted tapes are available and highly recommended. Preformatted tapes are more reliable than user-formatted tapes. Before reformatting a used tape, you must erase it with a bulk eraser. Proper use of a bulk eraser is not trivial; refer to the documentation for your bulk eraser.

getbb Prints a list of bad tape blocks detected during the last tape operation. This listing can be saved in a file for use by the **putbb** command. (F)

map Prints out a map of the bad blocks on the tape. The format is a series of lines of the format:

```
track n: ------------X------...
```

Each "-" represents a good block on the track; an "X" represents a block marked as bad. (F)

putbb Reads a list of bad tape blocks from the standard input and adds them to the bad block table on the tape. The format expected by **putbb** is the same as generated by the **getbb** command. (F)

rfm Wind tape forward to the next file mark. (C,S)

rsm Position tape forward to the next setmark. (HP DAT only. See the **dat**(HW) manual page for more information.)

wfm Write a file mark at the current tape position. (C,S)

wsm Write a setmark at the current tape position. (HP DAT only. See the **dat**(HW) manual page for more information.)

eod Position the tape to the EOD (the end of written data) (HP DAT only. See the **dat**(HW) manual page for more information.)

setblk Set the tape block size to a specified byte size (S). For example, the following command sets the tape block size to 512 Bytes:

tape -a 512 setblk

Irwin-specific commands

The following commands are all specific to Irwin drives.

drive displays information about the Irwin driver and the tape drive. An example display is:

```
Special file: /dev/rctmini
Driver version: 1.0.6a
Drive type: 285XL
Drive firmware: A0
Controller type: SYSFDC
Unit select (0-3): 3
```

Special file is the name of the special file used to access the driver.

Driver version is the version of the driver linked with the kernel.

Drive type is an "equivalent" tape drive model number as determined by the MC driver. Since the exact model number of the tape drive depends on the drive's form factor and whether the drive is mounted in its own cabinet, the equivalent model number may not be the exact model of the installed tape drive. The following is a list of equivalent drives:

110: 110, 310, 410

120[XL]: 120, 220, 320, 420, 720, 2020

125: 125, 225, 325, 425, 725

145[XL]: 145, 245, 345, 445, 745, 2040

165: 165, 265, 465, 765

285XL: 285, 485, 785, 2080

287XL: 287, 487, 787, 2120

The brackets in the 120[XL] and 145[XL] mean the letters "XL" may or may not be present. When the letters "XL" appear, the drive is capable of servo writing extra long (that is, 307.5 foot DC2120) tapes.

Note: When this field displays "125/145," either a 125 drive or an early model 145 drive with a DC1000 is present: the driver can't distinguish between the two. A 125 drive will only accept a DC1000 cartridge (a DC2000 or DC2120 will not fit). A 145 drive will accommodate DC1000, DC2000, or DC2120 cartridges.

Drive firmware is the firmware part number and revision level. This line is present only for drives which report this information.

Controller type is a mnemonic for the floppy controller to which the tape drive is attached:

Mnemonic	Description
SYSFDC	System floppy controller
ALTFDC	Alternate floppy controller
4100MC	Irwin 4100MC Micro Channel controller
4100MCB	Second 4100MC Micro Channel controller
4100	Irwin 4100 PC Bus controller
4100B	Second 4100 PC Bus controller

Unit select (0-3) gives the controller's unit select, in the range 0 through 3. The unit select selects the drive.

info displays Irwin cartridge information. For example:

```
Cartridge state: Formatted
Cartridge format: 145
Write protect slider position: RECORD
```

Cartridge state is the current state of the cartridge's format.

Cartridge format indicates the format on the cartridge's tape. The format is given in a code which is the same as the drive model on which the cartridge was originally formatted (see **drive** and **tape**(HW) for details). When the cartridge is blank, the code has the format which would be applied by the **format** command.

Write protect slider position is **RECORD** or **PROTECT**.

capacity cartridge capacity in 512-byte blocks.

kapacity cartridge capacity in 1024-byte blocks.

These two commands give the total usable data storage capacity of a formatted tape cartridge. Variations in cartridge capacity are due to differing numbers of bad blocks.

Files

Devices:

/dev/rStp0	*/dev/rct0*	*/dev/erct0*	*/dev/rmc1*
/dev/nrStp0	*/dev/nrct0*	*/dev/xct0*	*/dev/mcdaemon*
/dev/xStp0	*/dev/rct2*	*/dev/rctmini*	
/dev/rft0	*/dev/nrct2*	*/dev/xctmini*	
/dev/xft0	*/dev/xct0*	*/dev/rmc0*	

/etc/default/tape
/etc/default/mcconfig
/etc/mcdaemon

For DAT tapes:

/dev/urStp0.0	*/dev/urStp0.1*
/dev/nurStp0.0	*/dev/nurStp0.1*
/dev/nrStp0.0	*/dev/nrStp0.1*
/dev/xStp0.0	*/dev/xStp0.1*

The DAT partition 1 is linked to the default SCSI tape device locations:

/dev/rStp0	linked to	*/dev/nurStp0.0*
/dev/rStp0.0	linked to	*/dev/nurStp0.0*
/dev/nrStp0	linked to	*/dev/nrStp0.0*
/dev/xStp0	linked to	*/dev/xStp0.0*
/dev/urStp0	linked to	*/dev/urStp0.0*
/dev/rStp0.1	linked to	*/dev/nurStp0.1*

Note that if you have not installed a cartridge tape on your system, SCSI tapes device are linked to */dev/rct0*.

Include files:

/usr/include/sys/tape.h
/usr/include/sys/ct.h
/usr/include/sys/ft.h
/usr/include/sys/ir.h

See also

backup(ADM), **cpio**(C), **dd**(C), **mcconfig**(F), **mcdaemon**(F), **restore**(ADM), **tape**(HW), **tar**(C), **xbackup**(ADM), **xrestore**(ADM)

Notes

See **tape**(HW) and the *Release Notes* for a list of supported tape drives.

The **amount** and **reset** commands can be used while the tape is busy with other operations. All other commands wait until the currently executing command has been completed before proceeding.

If you use the status command while the tape drive is busy, no message is displayed until the drive is free.

When you are using the non-rewinding tape device or the **tape** commands **rfm** and **wfm**, the tape drive light remains on after the command has been completed, indicating that more operations may be performed on the tape. The **tape rewind** command may be used to clear this condition.

For more information on device files, (listed above), see the **tape**(HW) manual page.

Value added

tape and **mcart** are extensions of AT&T System V provided by The Santa Cruz Operation, Inc.

tapecntl

AT&T tape control for QIC-24/QIC-02 tape device

Syntax

tapecntl [-etrw] [-p *arg*]

Description

tapecntl will send the optioned commands to the tape device driver sub-device */dev/rmt/c0s0* for all commands except "position", which will use sub-device */dev/rmt/c0s0n* using the **ioctl** command function. Sub-device */dev/rmt/c0s0* provides a rewind on close capability, while */dev/rmt/c0s0n* allows for closing of the device without rewind. Error messages will be written to standard error.

The following options are available:

-e erase tape

-t retension tape

-r reset tape device

-w rewind tape

-p[*n*] position tape to "end of file" mark - ***n***

Erasing the tape causes the erase bar to be activated while moving the tape from end to end, causing all data tracks to be erased in a single pass over the tape.

Retensioning the tape causes the tape to be moved from end to end, thereby repacking the tape with the proper tension across its length.

Reset of the tape device initializes the tape controller registers and positions the tape at the beginning of the tape mark (BOT).

Rewinding the tape will move the tape to the BOT.

Positioning the tape command requires an integer argument. Positioning the tape will move the tape forward relative to its current position to the end of the specified file mark. The positioning option used with an argument of zero will be ignored. Illegal or out-of-range value arguments to the positioning command will leave the tape positioned at the end of the last valid file mark.

Options may be used individually or strung together with selected options being executed sequentially from left to right in the command line.

Files

/usr/lib/tape/tapecntl
/dev/rmt/c0s0n
/dev/rmt/c0s0

Notes

Exit codes and their meanings are as follows:

exit (1) device function could not initiate properly due to misconnected cables or poorly inserted tape cartridge.

exit (2) device function failed to complete properly due to unrecoverable error condition, either in the command setup or due to mechanical failure.

exit (3) device function failed due to the cartridge being write protected or to the lack of written data on the tape.

exit (4) device */dev/rmt/c0s0n* or */dev/rmt/c0s0* failed to open properly due to already being opened or claimed by another process.

Value added

tapecntl is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

tapedump

dump magnetic tape to output file

Syntax

tapedump [-a | -e] [-o | -h] [-btsn*num*] *tape_device output_file*

Description

The **tapedump** command dumps the contents of magnetic tapes according to the options specified. Options include conversion from input format to user specified output format, specification of input and output blocksize, and the ability to specify that the dump begin at a specific start block on the tape and proceed for a specified number of blocks.

Options

tape_device	The input tape device.
-a	Convert from EBCDIC input to ASCII output.
-e	Convert from ASCII input to EBCDIC output.
-o	Display tape output in octal format.
-h	Display tape output in hexadecimal format.
-s *num*	Skip *num* input records before starting dump.
-t *num*	Specify which tape file to begin dump from, where *num* is the tape file sequence number.
-b *num*[**bkw**]	Set both input and output block size. *num* is the number of blocks, which can include **b**, **k**, or **w** to indicate the block size, which correspond to 1024-, 512-, or 2-byte blocks, respectively. If block size is not specified, **b** is assumed.
-n *num*	Specify dump of only *num* blocks.
output_file	The output filename; standard output is the default.

Examples

This command reads a tape starting at block 400 and outputs the results in hexadecimal format into a user specified file called */tmp/hex.dump*:

tapedump -b400 -h /dev/rct0 /tmp/hexdump

This command reads an EBCDIC tape and converts the standard output to ASCII:

tapedump -a /dev/rct0

See also

sysadmsh(ADM), **dd**(C), **hd**(C), **od**(C), **tape**(C)

Note

The output file may be specified to be another tape device.

Value added

tapedump is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

tar

archive files

Syntax

tar [***key***] [***files***]

Description

The **tar** command saves and restores files to and from an archive medium, which is typically a floppy disk or tape, or a standard file. Its actions are controlled by the ***key*** argument. The ***key*** is a string of characters containing at most one function letter and possibly one or more function modifiers. Valid function letters are **r**, **x**, **t**, **u**, **c**, and **e**. Other arguments to the command are ***files*** (or directory names) specifying which files are to be backed up or restored. In all cases, a directory name refers to the files and (recursively) the subdirectories of that directory. The **r** and **u** options cannot be used with tape devices.

The function portion of the key is specified by one of the following letters:

r The named ***files*** are written to the end of an existing archive.

x The named ***files*** are extracted from the archive. If a named file matches a directory whose contents had been written onto the archive, this directory is (recursively) extracted. The owner, modification time, and mode are restored (if possible). If no ***files*** argument is given, the entire contents of the archive are extracted. Note that if several files with the same name are on the archive, the last one overwrites all earlier ones.

t The names of the specified files are listed each time that they occur on the archive. If no ***files*** argument is given, all the names on the archive are listed.

u The named ***files*** are added to the archive if they are not already there, or if they have been modified since last written on that archive.

c Creates a new archive; writing begins at the beginning of the archive, instead of after the last file.

The following characters may be used in addition to the letter that selects the desired function:

0,...,9999 This modifier selects the drive on which the archive is mounted. The default is found in the file */etc/default/tar*.

v Normally, **tar** does its work silently. The **v** (verbose) option causes it to display the name of each file it treats, preceded by the function letter. With the **t** function, **v** gives more information about the archive entries than just the name.

w Causes **tar** to display the action to be taken, followed by the name of the file, and then wait for the user's confirmation. If a word beginning with "y" is given, the action is performed. Any other input means "no".

f Causes **tar** to use the next argument as the name of the archive instead of the default device listed in */etc/default/tar*. If the name of the file is a dash (-), **tar** writes to the standard output or reads from the standard input, whichever is appropriate. Thus, **tar** can be used as the head or tail of a pipeline. **tar** can also be used to move hierarchies with the command:

cd fromdir; tar cf - . | (cd todir; tar xf -)

b Causes **tar** to use the next argument as the blocking factor for archive records. The default is 1, the maximum is 20. This option should only be used with raw magnetic tape archives (see **f** above). The block size is determined automatically when reading tapes (key letters **x** and **t**).

F Causes **tar** to use the next argument as the name of a file from which succeeding arguments are taken.

l Tells **tar** to display an error message if it cannot resolve all of the links to the files being backed up. If **l** is not specified, no error messages are displayed.

m Tells **tar** not to restore the modification times. The modification time of the file is the time of extraction.

k Causes **tar** to use the next argument as the size of an archive volume in kilobytes. The minimum value allowed is 250. Very large files are split into "extents" across volumes. When restoring from a multi-volume archive, **tar** only prompts for a new volume if a split file has been partially restored. To override the value of **k** in the default file, specify **k** as 0 on the command line.

e Prevents files from being split across volumes (tapes or floppy disks). If there is not enough room on the present volume for a given file, **tar** prompts for a new volume. This is only valid when the **k** option is also specified on the command line.

n Indicates the archive device is not a magnetic tape. The **k** option implies this. Listing and extracting the contents of an archive are faster because **tar** can seek over files it wishes to skip. Sizes are printed in kilobytes instead of tape blocks.

p Indicates that files are extracted using their original permissions. It is possible that a non-super user may be unable to extract files because of the permissions associated with the files or directories being extracted.

A Suppresses absolute filenames. Any leading "**/**" characters are removed from filenames. During extraction arguments given should match the relative (rather than the absolute) pathnames. With the **c**, **r**, and **u** options, the **A** option can be used to inhibit putting leading slashes in the archive headers.

q During extraction causes **tar** to exit immediately after each file on the command line has been extracted, rather than continuing to look for additional files of the same name.

L Follow symbolic links. By default, symbolic links are not followed; when **tar** encounters a symbolic link, it issues a warning message, skips over the link, and continues with the rest of the files.

tar reads */etc/default/tar* to obtain default values for the device, blocking factor, volume size, and the device type (tape or non-tape). If no numeric key is specified on the command, **tar** looks for a line in the default file beginning with the string **archive=**. Following this pattern are 4 blank separated strings indicating the values for the device, blocking factor, volume size and device type, in that order. A volume size of '0' indicates infinite volume length. This entry should be modified to reflect the size of the tape volumes used.

For example, the following is the default device entry from */etc/default/tar*:

```
archive=/dev/fd096ds15 10 1200 n
```

The **n** in the last field means that this device is not a tape. Use **y** for tape devices. Any default value may be overridden on the command line. The numeric keys (0-9999) select the line from the default value beginning with **archive#=**, where # is the numeric key. When the **f** key letter is specified on the command line, the entry **archivef=** is used. In this case, the default file entry must still contain 4 strings, but the first entry (specifying the device) is not significant. The default file */etc/default/tar* need not exist if a device is specified on the command line.

A critical consideration when creating a tar volume involves the use of absolute or relative pathnames. Consider the following **tar** command examples, as executed from the directory */u/target*:

tar cv /u/target/arrow
tar cv arrow

The first command creates a tar volume with the absolute pathname: */u/target/arrow*. The second yields a tar volume with a relative pathname: *./arrow*. (The ./ is implicit and shown here as an example; ./ should not be specified when retrieving the file from the archive.) When restored, the first example results in the file *arrow* being written to the directory */u/target* (if it exists and you have write permission) no matter what your working directory. The second example simply writes the file *arrow* to your present working directory.

Absolute pathnames specify the location of a file in relation to the root directory (/); relative pathnames are relative to the current directory. This must be taken into account when making a tar tape or disk. Backup volumes use absolute pathnames so that they can be restored to the proper directory. Use relative pathnames when creating a tar volume where absolute pathnames are unnecessary.

Examples

If the name of a floppy disk device is */dev/fd1*, then a tar format file can be created on this device by entering:

assign /dev/fd
tar cvfk /dev/fd1 360 ***files***

where ***files*** are the names of files you want archived and 360 is the capacity of the floppy disk in kilobytes. Note that arguments to key letters are given in the same order as the key letters themselves, thus the **fk** key letters have corresponding arguments */dev/fd1* and 360. If you **assign**(C) the disk at the beginning, remember to **deassign** it when you have finished.

To display a listing of the archive, enter:

tar tvf /dev/fd1

At some later time you may want to extract the files from the archive floppy. You can do this by entering:

tar xvf /dev/fd1

The above command extracts all files from the archive, using the exact same pathnames as used when the archive was created. Because of this behavior, it is normally best to save archive files with relative pathnames rather than absolute ones, since directory permissions may not let you read the files into the absolute directories specified. (See the **A** flag under "Options".)

In the above examples, the **v** verbose option is used simply to confirm the reading or writing of archive files on the screen. Also, a normal file could be substituted for the floppy device */dev/fd1* shown in the examples.

Files

/etc/default/tar	Default devices, blocking and volume sizes, device type
*/tmp/tar**	

See also

assign(C)

Diagnostics

Displays an error message about bad key characters and archive read/write errors.

Displays an error message if not enough memory is available to hold the link tables.

Notes

There is no way to ask for the *n*th occurrence of a file.

tar does not verify the selected media type.

The **u** option can be slow.

The limit on filename length is 100 characters.

When archiving a directory that contains subdirectories, **tar** will only access those subdirectories that are within 17 levels of nesting. Subdirectories at higher levels will be ignored after **tar** displays an error message.

When using **tar** with a raw device, specify the block size with the **b** option as a multiple of 512 bytes. For example, to use a 9K block size, enter:

tar cvfb /dev/rfd0 18 *file*

Do not enter:

tar xfF - -

This would imply taking two things from the standard input at the same time.

Use error-free floppy disks for best results with **tar**.

Standards conformance

tar is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

tee

create a tee in a pipe

Syntax

tee [**-i**] [**-a**] [**-u**] [*file*] ...

Description

The **tee** command transcribes the standard input to the standard output and makes copies in the *files*. The **-i** option ignores interrupts; the **-a** option causes the output to be appended to the **files** rather than overwriting them. The **-u** option causes the output to be unbuffered.

Examples

The following example illustrates the creation of temporary files at each stage in a pipeline:

grep ABC | tee ABC.grep | sort | tee ABC.sort | more

This example shows how to **tee** output to the terminal screen:

grep ABC | tee /dev/tty | sort | uniq >final.file

Standards conformance

tee is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

test

test conditions

Syntax

test ***expr***

[***expr*** **]**

Description

[- test conditions

The **test** command evaluates the expression ***expr***, and if its value is true, returns a zero (true) exit status; otherwise, **test** returns a non-zero exit status if there are no arguments. The following primitives are used to construct ***expr***:

-r ***file*** True if ***file*** exists and is readable.

-w ***file*** True if ***file*** exists and is writable.

-x ***file*** True if ***file*** exists and is executable.

-f ***file*** True if ***file*** exists and is a regular file.

-d ***file*** True if ***file*** exists and is a directory.

-h ***file*** True if ***file*** exists and is a symbolic link. With all other primitives (except **-L** ***file***), the symbolic links are followed. This primitive is identical to **-L**.

-c ***file*** True if ***file*** exists and is a character special file.

-b ***file*** True if ***file*** exists and is a block special file.

-u ***file*** True if ***file*** exists and its set-user-ID bit is set.

-g ***file*** True if ***file*** exists and its set-group-ID bit is set.

-k ***file*** True if ***file*** exists and its sticky bit is set.

-s ***file*** True if ***file*** exists and has a size greater than zero.

-t [***fildes***] True if the open file whose file descriptor number is ***fildes*** (1 by default) is associated with a terminal device.

-z ***s1*** True if the length of string ***s1*** is zero.

-ns *s1* True if the length of string *s1* is non-zero.

-L *file* True if *file* exists and is a symbolic link. With all other primitives (except **-h** *file*), the symbolic links are followed by default. This primitive is identical to **-h**.

s1 = *s2* True if strings *s1* and *s2* are identical.

s1 != *s2* True if strings *s1* and *s2* are *not* identical.

s1 True if *s1* is *not* the null string.

n1 **-eq** *n2* True if the integers *n1* and *n2* are algebraically equal. Any of the comparisons **-ne**, **-gt**, **-ge**, **-lt**, and **-le** may be used in place of **-eq**.

These primaries may be combined with the following operators:

! Unary negation operator

-a Binary and operator

-o Binary or operator (**-a** has higher precedence than **-o**)

(*expr***)** Parentheses for grouping

Notice that all the operators and flags are separate arguments to **test**. Notice also, that parentheses are meaningful to the shell and, therefore, must be escaped.

Note

A version of **test** is built into **sh**(C) and **ksh**(C). For details, refer to the appropriate section.

See also

find(C), **sh**(C)

Warning

In the second form of the command (that is, the one that uses **[ ]**, rather than the word **test**), the square brackets must be delimited by blanks.

Standards conformance

test is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

tic

terminfo compiler

Syntax

tic [**-v** [*n*]] [**-c**] *file*

Description

The **tic** command translates a *terminfo*(F) file from the source format into the compiled format. The results are placed in the directory */usr/lib/terminfo*. The compiled format is necessary for use with the library routines described in **curses**(S).

-v *n* (verbose) output to standard error trace information showing **tic**'s progress. The optional integer *n* is a number from 1 to 10, inclusive, indicating the desired level of detail of information. If *n* is omitted, the default level is 1. If *n* is specified and greater than 1, the level of detail is increased.

-c only check *file* for errors. Errors in **use=** links are not detected.

file contains one or more *terminfo*(F) terminal descriptions in source format (see **terminfo**(F)). Each description in the file describes the capabilities of a particular terminal. When a "use=entry-name" field is discovered in a terminal entry currently being compiled, **tic** reads in the binary from */usr/lib/terminfo* to complete the entry. (Entries created from *file* will be used first. If the environment variable **TERMINFO** is set, that directory is searched instead of */usr/lib/terminfo*.) **tic** duplicates the capabilities in "entry-name" for the current entry, with the exception of those capabilities that are explicitly defined in the current entry.

If the environment variable **TERMINFO** is set, the compiled results are placed there instead of */usr/lib/terminfo*.

Files

*/usr/lib/terminfo/?/** compiled terminal description database

See also

captoinfo(ADM), **curses**(S), **infocmp**(ADM), **term**(F), **terminfo**(F)

Notes

Total compiled entries cannot exceed 4096 bytes. The name field cannot exceed 128 bytes.

Terminal names exceeding 14 characters will be truncated to 14 characters and a warning message will be printed.

When the **-c** option is used, duplicate terminal names will not be diagnosed; however, when **-c** is not used, they will be.

To allow existing executables from the previous release of the UNIX system to continue to run with the compiled *terminfo* entries created by the new *terminfo* compiler, cancelled capabilities will not be marked as cancelled within the *terminfo* binary unless the entry name has a "+" within it. (Such terminal names are only used for inclusion within other entries via a *use*= entry. Such names would not be used for real terminal names.)

For example:

```
4415+nl, kf1@, kf2@, ....

4415+base, kf1=\EOc, kf2=\EOd, ....

4415-nl|4415 terminal without keys,
    use=4415+nl, use=4415+base,
```

The above example works as expected; the definitions for the keys do not show up in the **4415-nl** entry. However, if the entry **4415+nl** did not have a plus sign within its name, the cancellations would not be marked within the compiled file and the definitions for the function keys would not be cancelled within **4415-nl**.

Diagnostics

Most diagnostic messages produced by **tic** during the compilation of the source file are preceded with the approximate line number and the name of the terminal currently being worked on.

`mkdir ... returned bad status`
The named directory could not be created.

`File does not start with terminal names in column one`
The first thing seen in the file, after comments, must be the list of terminal names.

`Token after an lseek(S) not NAMES`
Somehow the file being compiled changed during the compilation.

`Not enough memory for use_list element`
or
`Out of memory`
Not enough free memory was available (malloc(S) failed).

`Can't open ...`
The named file could not be created.

`Error in writing ...`
The named file could not be written to.

`Can't link ... to ...`
A link failed.

`Error in re-reading compiled file ...`
The compiled file could not be read back in.

`Premature EOF`
The current entry ended prematurely.

`Backspaced off beginning of line`
This error indicates an error happened within **tic**.

`Unknown Capability - "..."`
The named invalid capability was found within the file.

`Wrong type used for capability "..."`
For example, a string capability was given a numeric value.

`Unknown token type`
Tokens must be followed by "@" to cancel, "," for Booleans, "#" for numbers, or "=" for strings.

`"...": bad term name`
or
`Line ...: Illegal terminal name - "..."`
`Terminal names must start with a letter or digit`
The given name was invalid. Names must not contain white space or slashes, and must begin with a letter or digit.

`"...": terminal name too long.`
An extremely long terminal name was found.

`"...": terminal name too short.`
A one-letter name was found.

`"..." filename too long, truncating to "..."`
The given name was truncated to 14 characters due to UNIX system file name length limitations.

`"..." defined in more than one entry. Entry being used is "...".`
An entry was found more than once.

`Terminal name "..." synonym for itself`
A name was listed twice in the list of synonyms.

`At least one synonym should begin with a letter.`
At least one of the names of the terminal should begin with a letter.

`Illegal character - "..."`
The given invalid character was found in the input file.

`New-line in middle of terminal name`
The trailing comma was probably left off the list of names.

`Missing comma`
A comma was missing.

`Missing numeric value`
The number was missing after a numeric capability.

`NULL string value`
The proper way to say that a string capability does not exist is to cancel it.

`Very long string found. Missing comma?`
A comma was anticipated but not found.

`Unknown option. Usage is:`
An invalid option was entered.

`Too many file names. Usage is:`
or
`"..." nonexistent or permission denied`
The given directory could not be written into.

`"..." is not a directory`
or
`"...": Permission denied`
Access denied.

`"...": Not a directory`
tic wanted to use the given name as a directory, but it already exists as a file

`SYSTEM ERROR!! Fork failed!!!`
A fork(S) failed.

`Error in following up use-links. Either there is a loop in the links or they reference nonexistent terminals. The following is a list of the entries involved:`
A *terminfo*(F) entry with a "use=name" capability either referenced a nonexistent terminal called *name* or *name* somehow referred back to the given entry.

Standards conformance

tic is conformant with:

AT&T SVID Issue 2.

time

time a command

Syntax

time ***command***

Description

The given ***command*** is executed; after it is complete, **time** prints the elapsed time during the command, the time spent in the system, and the time spent in execution of the command. Times are reported in seconds.

The times are printed on the standard error.

Note

This command is dupicated internally by the Korn shell (**ksh**(C)).

See also

times(S), **ksh**(C).

Standards conformance

time is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

touch

update access and modification times of a file

Syntax

touch [**-amc**] [*mmddhhmm*[*yy*]] *files*

Description

The **touch** command causes the access and modification times of each argument to be updated. If no time is specified (see **date**(C)) the current time is used. If a new file is created using **touch**, the modification and access times can be set to any time. However, the creation time is automatically set to the current time at the time of creation, and cannot be changed. The first ***mm*** refers to the month, ***dd*** refers to the day, ***hh*** refers to the hour, the second ***mm*** refers to the minute, and ***yy*** refers to the year. The **-a** and **-m** options cause touch to update only the access or modification times respectively (default is **-am**). The **-c** option silently prevents **touch** from creating the file if it did not previously exist.

The return code from **touch** is the number of files for which the times could not be successfully modified (including files that did not exist and were not created).

See also

date(C) , **utime**(S)

Standards conformance

touch is conformant with:

AT&T SVID Issue 2;
and X/ Open Portability Guide, Issue 3, 1989.

tput

query the terminfo database

Syntax

tput [**-T** *type*] [**-S**] *capname* [*parms* ...]
tput [**-T** *type*] [**-S**] **it**
tput [**-T** *type*] [**-S**] **reset**
tput [**-T** *type*] [**-S**] **longname**

Description

The **tput** command uses the **terminfo**(F) database to make the values of terminal-dependent capabilities and information available to the shell (see **sh**(C)), to initialize or reset the terminal, or return the long name of the requested terminal type. **tput** outputs a string if the attribute (*cap*ability *name*) is of type string, or an integer if the attribute is of type integer. If the attribute is of type Boolean, **tput** simply sets the exit code (0 for **TRUE** if the terminal has the capability, 1 for **FALSE** if it does not), and produces no output. Before using a value returned on standard output, the user should test the exit code (**$?**, see **sh**(C)) to be sure it is 0. (See "Exit codes" and "Diagnostics" below.) For a complete list of capabilities and the *capname* associated with each, see **terminfo**(F).

-T *type* indicates the *type* of terminal. Normally, this option is unnecessary because the default is taken from the environment variable **TERM**. If **-T** is specified, then the shell variables **LINES** and **COLUMNS** and the layer size (see **layers**(C)) will not be referenced.

-S causes the *capname* to be read in from standard input instead of from the command line.

capname indicates the attribute from the **terminfo**(F) database.

parms If the attribute is a string that takes parameters, the arguments *parms* will be inserted into the string. An all numeric argument will be passed to the attribute as a number.

init If the **terminfo**(F) database is present and an entry for the user's terminal exists (see **-T** *type*, above), the following will occur:

- if present, the terminal's initialization strings will be output (**is1**, **is2**, **is3**, **if**, **iprog**),
- any delays (for example, new line) specified in the entry will be set in the tty driver,

- tabs expansion will be turned on or off according to the specification in the entry,
- if tabs are not expanded, standard tabs will be set (every 8 spaces).

If an entry does not contain the information needed for any of the four above activities, that activity will be silently skipped.

reset Instead of putting out initialization strings, the terminal's reset strings will be output, if present (**rs1**, **rs2**, **rs3**, **rf**). If the reset strings are not present, but initialization strings are, the initialization strings will be output. Otherwise, **reset** acts identically to **init**.

longname If the **terminfo**(F) database is present and an entry for the user's terminal exists (see **-T** *type* above), then the long name of the terminal will be output. The long name is the last name in the first line of the terminal's description in the **terminfo**(F) database (see **term**(M)).

Examples

tput init Initialize the terminal according to the type of terminal in the environmental variable **TERM**. This command should be included in everyone's *.profile* after the environmental variable **TERM** has been exported, as illustrated on the manual page.

tput -T5620 reset Reset an AT&T 5620 terminal, overriding the type of terminal in the environment variable **TERM**.

tput cup 0 0 Send the sequence to move the cursor to row 0, column 0 (the upper left corner of the screen, usually known as the "home" cursor position).

tput clear Echo the clear-screen sequence for the current terminal.

tput cols Print the number of columns for the current terminal.

tput -Twy60 cols Print the number of columns for a Wyse 60 terminal.

bold=`tput smso`
offbold=`tput rmso` Set the shell variables **bold** to begin stand-out mode sequence, and **offbold** to end stand-out mode sequence, for the current terminal. This might be followed by a prompt:

```
echo "${bold}Please type in your name: ${offbold}\c"
```

tput hc Set exit code to indicate if the current terminal is a hardcopy terminal.

tput cup 23 4	Send the sequence to move the cursor to row 23, column 4.
tput longname	Print the long name from the **terminfo**(F) database for the type of terminal specified in the environmental variable **TERM**.

Files

*/usr/lib/terminfo/?/**	compiled terminal description database
/usr/include/curses.h	**curses**(S) header file
/usr/include/term.h	**terminfo**(F) header file
*/usr/lib/tabset/**	tab settings for some terminals, in a format appropriate to be output to the terminal (escape sequences that set margins and tabs); for more information, see the "Tabs and initialization" section of **terminfo**(F)

See also

profile(ADM), **stty**(C), **tabs**(C), **terminfo**(F)

Exit codes

If ***capname*** is of type Boolean, a value of 0 is set for **TRUE** and 1 for **FALSE**.

If ***capname*** is of type string, a value of 0 is set if the ***capname*** is defined for this terminal ***type*** (the value of ***capname*** is returned on standard output); a value of 1 is set if ***capname*** is not defined for this terminal ***type*** (a null value is returned on standard output).

If ***capname*** is of type integer, a value of 0 is always set, whether or not ***capname*** is defined for this terminal ***type***. To determine if ***capname*** is defined for this terminal ***type***, the user must test the value of standard output. A value of -1 means that ***capname*** is not defined for this terminal ***type***.

Any other exit code indicates an error; see "Diagnostics", below.

Diagnostics

tput prints the following error messages and sets the corresponding exit codes:

exit code	error message
0	-1 (capname is a numeric value that is not specified in the **terminfo**(F) database for this terminal type, for example, tput -T450 lines and tput -T2621 xmc)
1	no error message is printed, see "Exit codes" above
2	usage error
3	unknown terminal type or no **terminfo**(F) database
4	unknown **terminfo**(F) capability capname

Standards conformance

tput is conformant with AT&T SVID Issue 2.

tr

translate characters

Syntax

tr [**-cds**] [***string1*** [***string2***]]

Description

The **tr** command copies the standard input to the standard output with substitution or deletion of selected characters. Input characters found in ***string1*** are mapped into the corresponding characters of ***string2***. Any combination of the options **-cds** may be used:

-c Complements the set of characters in ***string1*** with respect to the universe of characters whose ASCII codes are 001 through 377 octal

-d Deletes all input characters in ***string1***

-s Squeezes all strings of repeated output characters that are in ***string2*** to single characters

The following abbreviation conventions may be used to introduce ranges of characters or repeated characters into the strings:

[a-z] Stands for the string of characters whose ASCII codes run from character "a" to character "z", inclusive.

[*an]** Stands for ***n*** repetitions of ***a***. If the first digit of ***n*** is 0, ***n*** is considered octal; otherwise, ***n*** is taken to be decimal. A zero or missing ***n*** is taken to be huge; this facility is useful for padding ***string2***.

The escape character "\" may be used as in the shell to remove special meaning from any character in a string. In addition, "\" followed by 1, 2, or 3 octal digits, stands for the character whose ASCII code is given by those digits.

The following example creates a list of all the words in *file1*, one per line in *file2*, where a word is taken to be a maximal string of alphabetics. The strings are quoted to protect the special characters from interpretation by the shell; 012 is the ASCII code for newline:

```
tr -cs "[A-Z][a-z]" "[\012*]" <file1 >file2
```

See also

ascii(M), **ed**(C), **sh**(C)

Notes

tr will not handle ASCII NUL in ***string1*** or ***string2***; it always deletes NUL from the input.

Standards conformance

tr is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

translate

translate files from one format to another

Syntax

translate *option* [*infile*] [*outfile*]

Description

The **translate** command translates files according to the options specified.

translate uses standard input and standard output unless otherwise specified via the optional filename arguments, *infile* and *outfile*.

Options

-ea	From EBCDIC to ASCII.
-ae	From ASCII to EBCDIC.
-fe *format*	From a user defined format to EBCDIC format.
-fa *format*	From a user defined format to ASCII format.
-ef *format*	From EBCDIC format to a user defined format.
-af *format*	From ASCII format to a user defined format.
-bm	From binary/object code to mailable ASCII **uuencode** format.
-mb	From mailable ASCII **uuencode** format to original binary.

format is assumed to be a file in the directory */usr/lib/translate* if a full pathname is not provided.

Files

*/usr/lib/translate/**

See also

dd(C), **mapchan**(M), **sysadmsh**(ADM), **uuencode**(C)

Notes

The **-bm** and **-mb** options are, for example, used to translate executable object code format to ASCII for transfer across communications networks.

The syntax for the user defined format file is the same as the syntax for the mapping files for **mapchan**(M) and **trchan**.

Use **dd** to convert character and file formats (especially tapes) to the format specified. For example:

dd if=/dev/rmt0 of=outfile ibs=800 cbs=80 conv=ascii,lcase

This command reads an EBCDIC tape, blocked ten 80-byte EBCDIC card images per record, into the ASCII file ***outfile***. For more information on conversion options, refer to **dd**(C) in the *User's Reference*.

Value added

translate is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

true

return with a zero exit value

Syntax

true

Description

true does nothing except return with a zero exit value. **false**(C), **true**'s counterpart, does nothing except return with a nonzero exit value. **true** is typically used in shell procedures such as:

```
while true
do
        command
done
```

See also

false(C), **sh**(C)

Diagnostics

true has exit status zero.

Standards conformance

true is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

tset

set terminal modes

Syntax

tset [-] [**-hrsuIQS**] [**-e**[*c*]] [**-E**[*c*]] [**-k**[*c*]]
[**-m** [*ident*] [*test baudrate*]:*type*] [*type*]

Description

The **tset** command allows the user to set a terminal's ERASE and KILL characters, and define the terminal's type and capabilities by creating values for the **TERM** environment variable. It is driven by the */etc/ttytype* file and the *terminfo* database.

tset initializes or resets the terminal with **tput**(C).

The type of terminal is specified by the ***type*** argument. The type may be any type given in the *terminfo* database. If the ***type*** is not specified with the **-s** option, **tset** creates information for a terminal of the type defined by the value of the environment variable, **TERM**, unless the **-h** or **-m** option is given. If the **TERM** variable is defined, **tset** uses the *terminfo* database entry. If the **-h** or **-m** options are used, **tset** searches the */etc/ttytype* file for the terminal type corresponding to the current serial port; it then creates information for a terminal based on this type. If the serial port is not found in */etc/ttytype*, the terminal type is set to *unknown*.

When the tty is in **isscancode** mode, **tset** invokes **mapstr** to read the function key values. These values are in a **mapstr** format file in */usr/lib/keyboard/strings.d* that corresponds to the terminal type. The **mapstr** utility then issues an **ioctl**(S) call to put the values into the kernel.

tset is most useful when included in the *.login* (for **csh**) or *.profile* (for **sh** or **ksh**) file executed automatically at login, with **-m** mapping used to specify the terminal type you most frequently dial in on.

tset displays the created information on standard output. The information is in a form that can be used to set the current environment variables. The exact form depends on the login shell from which **tset** was invoked.

There are the following options:

-e[*c*] Sets the ERASE character to *c* on all terminals. The default setting is the BACKSPACE, or CTRL-H.

-E[*c*] Identical to the **-e** command except that it only operates on terminals that can BACKSPACE.

-k[*c*] Sets the KILL character to *c*, defaulting to CTRL-U.

- Prints the terminal type on the standard output.

-s Outputs the **setenv** commands (for **csh**(C)), or **export** and assignment commands (for **sh**(C) or **ksh**(C)). The type of commands are determined by the user's login shell.

For **sh**, set up the terminal with:

```
eval `tset -s`
```

-h Forces **tset** to search */etc/ttytype* for information and to overlook the environment variable, **TERM**.

-S Only outputs the strings to be placed in the environment variables, without the shell commands printed for **-s**.

To use this information to set up a terminal in **csh**, enter:

```
set noglob
set term=(`tset -S`)
setenv TERM $term[1]
setenv TERMCAP $term[2]
unset term
unset noglob
```

-r Prints the terminal type on the diagnostic output.

-Q Suppresses the printing of the "Erase set to" and "Kill set to" messages.

-I Suppresses printing of the terminal initialization strings, for example, spawns **tput reset** instead of **tput init**. If the terminal is in **scancode** mode, **set -I** will prevent the invocation of **mapstr**(S).

-m[*ident*][*test baudrate*]:*type*
Allows a user to specify how a given serial port is to be mapped to an actual terminal type. The option applies to any serial port in */etc/ttytype* whose type is indeterminate (for example, **dialup**, **plugboard**, etc.). The *type* specifies the terminal type to be used, and *ident* identifies the name of the indeterminate type to be matched. If no *ident* is given, all indeterminate types are matched. The *test baudrate* defines a test to be performed on the serial port before the type is assigned. The *baudrate* must be as defined in **stty**(C).

The *test* may be any combination of: >, =, <, @, and !. If the *type* begins with a question mark, the user is asked if they really want that type. A null response means to use that type; otherwise, another type can be entered which will be used instead. The question mark must be escaped to prevent filename expansion by the shell. If more than one **-m** option is given, the first correct mapping prevails.

Examples

Set the terminal type to **gt42**:

```
tset gt42
```

Use the **-m** option to map the "dialup" terminal type:

```
tset -mdialup\>300:adm3a -mdialup:dw2 -Qr -e#
```

If the entry in */etc/ttytype* corresponding to the login port is "dialup", and the port speed is greater than 300 baud, set the termianl type to **adm3a**. If the */etc/ttytype* entry is "dialup" and the port speed is less than or equal to 300 baud, set the terminal type to **dw2**. Set the erase character to **"#"**, and display the terminal type (but not the erase or kill characters) on standard error.

```
tset -m dial:ti733 -m plug:\?hp2621 -m unknown:\? -e -k^U
```

If the */etc/ttytype* entry begins with "dial", the terminal type becomes **ti733**. If the entry begins with "plug", **tset** prompts with:

```
TERM = (hp2621)
```

You would then press ⟨Return⟩ to accept **hp2621** or type in an alternate terminal type and ⟨Return⟩. If the entry is "unknown", **tset** prompts with:

```
TERM = (unknown)
```

In any case, erase is set to the terminal's backspace character, kill is set to CTRL-U, and the terminal type is displayed on standard error.

Files

/etc/ttytype	Port name to terminal type map database
*/usr/lib/terminfo/**	Terminal capability database

See also

csh(C), **ksh**(C), **sh**(C), **stty**(C), **terminfo**(F), **termio**(M), **tput**(C), **tty**(M)

Credit

This utility was developed at the University of California at Berkeley and is used with permission.

tty

get the terminal's name

Syntax

tty [-s]

Description

The **tty** command prints the pathname of the user's terminal on the standard output. The **-s** option inhibits printing, allowing you to test just the exit code.

Exit codes

0 if the standard input is a terminal, 1 otherwise.

Diagnostics

`not a tty` If the standard input is not a terminal and **-s** is not specified

Standards conformance

tty is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

umask

set file-creation mode mask

Syntax

umask [***mask***]

Description

The user file-creation mode mask is set to ***mask***. ***mask*** consists of three octal digits which refer to read/write/execute permissions for **owner**, **group**, and **others**, respectively. Only the low-order 9 bits of **cmask** and the file mode creation mask are used. The value of each specified digit is "subtracted" from the corresponding "digit" specified by the system for the creation of any file (see **umask**(S) or **creat**(S). This is actually a binary masking operation, and thus the name "umask". In general, binary ones remove a given permission, and zeros have no effect at all. For example, **umask 022** removes **group** and **others** write permission (files normally created with mode 777 become mode 755 ; files created with mode 666 become mode 644).

If ***mask*** is omitted, the current value of the mask is printed.

umask is recognized and executed by the shell. By default, login shells have a umask of 022.

umask is built in to **csh** and **sh**.

See also

chmod(C), **chmod**(S), **creat**(S), **csh**(C), **sh**(C), **umask**(S)

Standards conformance

umask is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

uname

print the name of the current system

Syntax

uname [**-snrvmaX**]
uname [**-S** *system name*]

Description

The **uname** command prints the current system name of the UNIX system on the standard output file. It is mainly useful to determine which system one is using. The options cause selected information returned by **uname**(S) to be printed:

-s print *system name* (default).

-n print *nodename* (the nodename is the name by which the system is known to a communications network).

-r print the operating system release.

-v print the operating system version.

-m print the machine hardware name.

-a print all the above information.

-X print all the above information, plus OEM number, kernel ID, bus type, serial number, processor, license (2-user or unlimited), origin number, and number of CPUs.

-S *system name*
On your computer, the system name and the nodename may be changed by specifying a *system name* argument to the **-S** option. (The system name and the nodename will then be the same.) The *system name* argument is restricted to 8 characters. Only the super user is allowed this capability.

See also

uname(S)

Standards conformance

uname is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

uniq

report repeated lines in a file

Syntax

uniq [**-udc** [*+n*] [*-n*]] [*input* [*output*]]

Description

The **uniq** command reads the *input* file and compares adjacent lines. In the normal case, the second and succeeding copies of repeated lines are removed and the lines are compared according to the collating sequence defined by the current locale (see **locale**(M)); the remainder is written to the output file. *input* and *output* should always be different. Note that repeated lines must be adjacent in order to be found; see **sort**(C). If the **-u** flag is used, just the lines that are not repeated in the original file are output. The **-d** option specifies that one copy of just the repeated lines is to be written. The normal mode output is the union of the **-u** and **-d** mode outputs.

The **-c** option supersedes **-u** and **-d** and generates an output report in default style but with each line preceded by a count of the number of times it occurred.

The *n* arguments specify skipping an initial portion of each line in the comparison:

-n The first *n* fields together with any blanks before each are ignored. A field is defined as a string of nonspace, nontab characters separated by tabs and spaces from its neighbors.

+n The first *n* characters are ignored. Fields are skipped before characters.

See also

comm(C), **sort**(C)

Standards conformance

uniq is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

units

convert units

Syntax

units

Description

The **units** command converts quantities expressed in various standard scales to their equivalents in other scales. It works interactively in this fashion:

```
You have:  inch
You want:  cm
        * 2.540000e+00
        / 3.937008e-01
```

A quantity is specified as a multiplicative combination of units optionally preceded by a numeric multiplier. Powers are indicated by suffixed positive integers, division is shown by the usual sign:

```
You have:  15 lbs force/in2
You want:  atm
        * 1.020689e+00
        / 9.797299e-01
```

units only does multiplicative scale changes; thus it can convert Kelvin to Rankine, but not Centigrade to Fahrenheit. Most familiar units, abbreviations, and metric prefixes are recognized, as well as the following:

pi	Ratio of circumference to diameter
c	Speed of light
e	Charge on an electron
g	Acceleration of gravity
force	Same as g
mole	Avogadro's number
water	Pressure head per unit height of water
au	Astronomical unit

Pound is not recognized as a unit of mass; **lb** is. Compound names are run together, (for example, **lightyear**). British units that differ from their US counterparts are prefixed with "br". For a complete list of units, enter:

cat /usr/lib/unittab

File

/usr/lib/unittab

uptime

display information about system activity

Syntax

uptime

Description

The **uptime** command prints the current time of day, the length of time the system has been up, the number of users logged onto the system, and load averages. Load averages are the number of processes in the run queue averaged over 1, 5, and 15 minutes. All of this information is also contained in the first line of the **w**(C) command.

See Also

w(C)

Value Added

uptime is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

usemouse

map mouse input to keystrokes

Syntax

usemouse [-f *conffile* **| -t** *type* **] [-h** *horiz_sens* **] [-v** *vert_sens* **] [-c** *cmd* **]**
[-b] ***parameters***

Description

The **usemouse** command merges data from a mouse into the input stream of a tty. The mouse data is translated to arrow keys or any other arbitrary ASCII strings. Mouse movements up, down, left, right, up-left, up-right, down-left, and down-right, as well as individual up and down button transitions, are programmable. This permits the mouse to be used with programs that are not designed to accept mouse input.

usemouse with no arguments sets the mouse for use with the default map */etc/default/usemouse*. A new shell is invoked. To terminate **usemouse**, exit the shell with ⟨Ctrl⟩**d**.

Alternate map files can be found in the directory */usr/lib/mouse*. Users can create their own map files based on the default file. Quoted strings may be used in a map file, as well as the octal sequences found in the **ascii**(M) manual page. Map files can be located anywhere on the system and accessed with the **-f** option (see below).

The default map file has the following values:

Mouse	Keystroke
Left Button	**vi** top of file (1G) command
Middle Button	**vi** delete character (x) command
Right Button	**vi** bottom of file (G) command
Up	Up Arrow Key
Down	Down Arrow Key
Left	Left Arrow Key
Right	Right Arrow Key
Up and Left	not defined
Up and Right	not defined
Down and Left	not defined
Down and Right	not defined
Bells	no

Options

-f ***conffile*** Select an alternate configuration file, ***conffile***. ***conffile*** should use the format of */etc/default/usemouse*.

-t ***type*** Select a predefined configuration file. ***type*** can be any file in */usr/lib/mouse*, such as *vi*, *rogue*, or *sysadmsh*. These files are identical in format to */etc/default/usemouse*.

The **vi**-specific map maps the traditional h-j-k-l direction keys to the mouse movements. The terminal bell is automatically silenced by the **vi** map entry **bells=no**. This is done to prevent the bell being activated continuously when the user generates a spurious command with the mouse.

-h ***horiz_sens*** Defines the horizontal sensitivity. Horizontal mouse movements smaller than this threshold are ignored. Mouse movements that are multiples of this value generate multiple strings. The sensitivity defaults to 5 units. The minimum value is 1 unit, and the maximum is 100 units. The lower the value, the more sensitive your mouse is to motion. Note that setting a high value may cause your mouse to behave as though it is not functioning, due to the large motion required to generate a signal.

-v ***vert_sens*** Defines the vertical sensitivity. Vertical mouse movements smaller than this threshold are ignored. Mouse movements that are multiples of this value generate multiple strings. The sensitivity defaults to 5 units. The minimum value is 1 unit, and the maximum is 100 units. The lower the value, the more sensitive your mouse is to motion. Note that setting a high value may cause your mouse to behave as though it is not functioning, due to the large motion required to generate a signal.

-c ***cmd*** Run ***cmd*** with **usemouse**. ***cmd*** defaults to the shell specified in the **SHELL** environment variable. If **SHELL** is unspecified, */bin/sh* is used. Note that the command given with this flag can contain blank spaces if the entire command is placed within double quotes. For example:

usemouse -c "vi /etc/termcap"

is valid. When ***cmd*** terminates, **usemouse** terminates as well.

-b Suppresses bell (^G) for the duration of mouse usage. Useful with **vi**(C).

parameters These are *name=value* pairs indicating what ASCII string to insert into the tty input stream, when the given event is received. Valid parameters include:

rbu=*string*	String to generate on right button up
rbd=*string*	String to generate on right button down
mbu=*string*	String to generate on middle button up
mbd=*string*	String to generate on middle button down
lbu=*string*	String to generate on left button up
lbd=*string*	String to generate on left button down
rt=*string*	String to generate on mouse right
lt=*string*	String to generate on mouse left
up=*string*	String to generate on mouse up
dn=*string*	String to generate on mouse down
ul=*string*	String to generate on mouse up-left
ur=*string*	String to generate on mouse up-right
dr=*string*	String to generate on mouse down-right
dl=*string*	String to generate on mouse down-left
hsens=*num*	Sensitivity to horizontal motion
vsens=*num*	Sensitivity to vertical motion
bells=*yes/no*	Whether to remove ^G characters

Parameters may be specified in any order. They may contain octal escapes. They should be quoted with single or double quotes if they contain blank spaces. Any parameter may be omitted; its value is then taken from the configuration file.

Examples

To set up the mouse for use with **vi**, type: **usemouse -t vi**. This will not start **vi**.

To start up the mouse for use with **vi**, and start **vi**, type: **usemouse -t vi -c vi**. This invokes the **vi** map along with the command; when you quit out of **vi** the mouse disengages.

To start up **vi** using the default mouse map, but redefining the middle button (mbd) to be **insert** in **vi**, type: **usemouse -c vi mbd=i**. To start the mouse in **vi** using the customized map **mine**, type: **usemouse -f mine -c vi**

Files

/dev/mouse	Directory for mouse-related special device files.
/etc/default/usemouse	Default map file for mouse-generated characters.
/usr/lib/event/devices	File containing device information for mice.
/usr/lib/event/ttys	File listing ttys eligible to use mice.
*/usr/lib/mouse/**	Alternate map files for mice.

See also

ascii(M), **mouse**(HW), **vi**(C)

Value added

usemouse is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

uucp, uulog, uuname

UNIX-to-UNIX system copy

Syntax

uucp [**-c** | **-C**] [**-d** | **-f**] [**-g***grade*] [**-j**] [**-m**] [**-n***user*] [**-r**] [**-s***file*] [**-x***debug_level*] *source-files destination-file*

uulog [**-s***system*] [**-x**]

uulog -f*system* [**-***number*] [**-x**]

uuname [**-l**] [**-c**]

Description

uucp - Performs a UNIX-to-UNIX copy

uulog - Queries a log of **uucp** or **uuxqt** transactions

uuname - Lists names of systems known to **uucp**

The **uucp** command copies files named by the ***source-file*** arguments to the ***destination-file*** argument. A filename may be a pathname on your machine, or may have the form:

system-name!*pathname*

where ***system-name*** is taken from a list of system names that **uucp** knows about. The ***system-name*** may also be a list of names such as

system-name!*system-name*!...!*system-name*!*pathname*

in which case an attempt is made to send the file via the specified route, to the destination. See "Notes" below for restrictions. Care should be taken to ensure that intermediate nodes in the route are willing to forward information.

The shell metacharacters "?", "*" and [...] appearing in ***pathname*** will be expanded on the appropriate system.

Pathnames may be one of:

1. a full pathname;
2. a pathname preceded by ~***user*** where ***user*** is a login name on the specified system and is replaced by that user's login directory;

3. a pathname preceded by ~/***destination*** where ***destination*** is appended to */usr/spool/uucppublic*; this destination will be treated as a filename unless more than one file is being transferred by this request or the destination is already a directory. To ensure that ***destination*** is a directory, follow the destination with a " / " For example, *~/dan/* as the destination will make the directory */usr/spool/uucppublic/dan* if it does not exist and put the requested file(s) in that directory.

4. anything else, which gets prefixed by the current directory.

If the result is an erroneous pathname for the remote system, the copy will fail. If the ***destination-file*** is a directory, the last part of the ***source-file*** name is used.

If a simple ~***user*** destination is inaccessible to **uucp**, data is copied to a spool directory and the user is notified by **mail**(C).

uucp preserves execute permissions across the transmission and gives 0666 read and write permissions (see **chmod**(C)).

The following options are interpreted by **uucp**:

-c Do not copy local file to the spool directory for transfer to the remote machine (default).

-C Force the copy of local files to the spool directory for transfer.

-d Make all necessary directories for the file copy (default).

-f Do not make intermediate directories for the file copy.

-g*grade* ***grade*** is a single letter/number; lower ASCII sequence characters will cause the job to be transmitted earlier during a particular conversation.

-j Print the job identification ASCII string on standard output. This job identification can be used by **uustat** to obtain the status or terminate a job.

-m Send mail to the requester when the copy is completed.

The **-m** option will only work when sending files or receiving a single file. Receiving multiple files specified by special shell characters " ? ", " * ", [...] will not activate the **-m** option.

-n*user* Notify ***user*** on the remote system that a file was sent.

-r Do not start the file transfer, just queue the job.

-s*file* Report status of the transfer to ***file***. Note that the ***file*** must be a full pathname.

-xdebug_level
Produce debugging output on standard output. The ***debug_level*** is a number between 0 and 9; higher numbers give more detailed information.

uulog queries a log file of **uucp** or **uuxqt**(ADM) transactions in a file */usr/spool/uucp/.Log/uucico/**system***, or */usr/spool/uucp/.Log/uuxqt/**system***.

The options cause **uulog** to print logging information:

-ssystem Print information about file transfer work involving system ***system.***

-fsystem Does a **tail -f** of the file transfer log for ***system.*** (You must press **DELETE** or **BREAK** to exit this function.)

Other options used in conjunction with the above:

-x Look in the *uuxqt* log file for the given system, instead of the *uucico* log file (default).

-number Indicates that a **tail** command of ***number*** lines should be executed.

uuname lists the names of systems known to **uucp**. The **-c** option returns the names of systems known to **cu**. (The two lists are the same, unless your machine is using different *Systems* files for **cu** and **uucp**. See **sysfiles**(F).) The **-l** option returns the local system name.

Files

/usr/spool/uucp	spool directories
*/usr/spool/uucppublic/**	public directory for receiving and sending
*/usr/lib/uucp/**	other data and program files

See also

chmod(S), **mail**(C), **sysfiles**(F), **uustat**(C), **uux**(C), **uuxqt**(ADM)

Notes

The domain of remotely accessible files can (and for obvious security reasons, usually should) be severely restricted. You may be unable to fetch files by pathname; ask a responsible person on the remote system to send them to you. For the same reasons, you may not be able to send files to arbitrary pathnames. As distributed, the remotely accessible files are those whose names begin */usr/spool/uucppublic* (equivalent to ~/).

All files received by **uucp** will be owned by **uucp**.

Protected files and files that are in protected directories that are owned by the requester can be sent by **uucp**. However, if the requester is *root*, and the directory is not searchable by "other" or the file is not readable by "other", the request will fail.

The forwarding of files through other systems may not be compatible with older (non-HDB) versions of **uucp**. If forwarding is used, all systems in the route must have the same version of **uucp**.

Standards conformance

uucp, **uulog**, and **uuname** are conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

uuencode, uudecode

encode/decode a binary file for transmission via mail

Syntax

uuencode [*source*] *remotedest* | **mail** *sys1!sys2!..!decode*
uudecode [*file*]

Description

uuencode - Encodes a binary file for mail transmission

uudecode - Decodes a uuencoded binary file

The **uuencode** and **uudecode** commands are used to send a binary file via **uucp**(C) (or other) mail. This combination can be used over indirect mail links.

uuencode takes the named *source* file (default standard input) and produces an encoded version on the standard output. The encoding uses only printing ASCII characters, and includes the mode of the file and the *remotedest* for recreation on the remote system.

uudecode reads an encoded *file*, strips off any leading and trailing lines added by mailers, and recreates the original file with the specified mode and name.

The encode file has an ordinary text form and can be edited by any text editor to change the mode or *remotedest* decoded name.

See also

mail(C), uucp(C), uux(ADM)

Restrictions

The file is expanded by 35% (3 bytes become 4 plus control information) causing it to take longer to transmit.

The user on the remote system who is invoking **uudecode** (often **uucp**) must have write permission on the specified file.

uustat

uucp status inquiry and job control

Syntax

uustat [-a]
uustat [-m]
uustat [-p]
uustat [-q]
uustat [-k*jobid*]
uustat [-r*jobid*]
uustat [-s*system*] [-u*user*]

Description

The **uustat** command will display the status of, or cancel, previously specified **uucp** commands, or provide general status on UUCP connections to other systems. Only one of the following options can be specified with **uustat** per command execution:

-a Output all jobs in queue.

-m Report the status of accessibility of all machines.

-p Execute a "ps -flp" for all the process-ids that are in the lock files.

-q List the jobs queued for each machine. If a status file exists for the machine, its date, time and status information are reported. In addition, if a number appears in ( ) next to the number of *C* or *X* files, it is the age in days of the oldest *C./X.* file for that system. The Retry field represents the number of hours until the next possible call. The Count is the number of failure attempts.

NOTE: for systems with a moderate number of outstanding jobs, this could take 30 seconds or more of real-time to execute. As an example of the output produced by the **-q** option:

```
eagle     3C     04/07-11:07     NO DEVICES AVAILABLE
mh3bs3    2C     07/07-10:42     SUCCESSFUL
```

The above output tells how many command files are waiting for each system. Each command file may have zero or more files to be sent (zero means to call the system and see if work is to be done). The date and time refer to the previous interaction with the system followed by the status of the interaction.

-k*jobid* Kill the **uucp** request whose job identification is ***jobid***. The killed **uucp** request must belong to the person issuing the **uustat** command unless one is the super user.

-r*jobid* Rejuvenate ***jobid***. The files associated with ***jobid*** are **touch**ed so that their modification time is set to the current time. This prevents the cleanup daemon from deleting the job until the jobs' modification time reaches the limit imposed by the daemon.

Either or both of the following options can be specified with **uustat**:

-s*system* Report the status of all **uucp** requests for remote system ***system***.

-u*user* Report the status of all **uucp** requests issued by ***user***.

Output for both the **-s** and **-u** options has the following format:

```
eaglen0000      4/07-11:01:03   (POLL)
eagleN1bd7      4/07-11:07      S       eagle   dan     522 /usr/dan/A
eagleC1bd8      4/07-11:07      S       eagle   dan     59 D.3b2a12ce4924
                4/07-11:07      S       eagle   dan     rmail mike
```

With the above two options, the first field is the ***jobid*** of the job. This is followed by the date/time. The next field is either an 'S' or 'R' depending on whether the job is to send or request a file. This is followed by the user-id of the user who queued the job. The next field contains the size of the file, or in the case of a remote execution (**rmail** - the command used for remote mail), the name of the command. When the size appears in this field, the file name is also given. This can either be the name given by the user or an internal name (for example, *D.3b2alce4924*) that is created for data files associated with remote executions (**rmail** in this example).

When no options are given, **uustat** outputs the status of all **uucp** requests issued by the current user.

File

*/usr/spool/uucp/** spool directories

See also

uucp(C)

Standards conformance

uustat is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

uuto, uupick

public UNIX-to-UNIX system file copy

Syntax

uuto [**-mp**] *source-files destination*
uupick [**-s** *system*]

Description

uuto - Sends files via UUCP

uupick - Accepts or rejects the files transmitted to the user

uuto sends *source-files* to *destination*. **uuto** uses the **uucp**(C) facility to send files, while it allows the local system to control the file access. A source-file name is a pathname on your machine. *destination* has the form:

system!*user*

where *system* is taken from a list of system names that UUCP knows about (see "uuname"). *user* is the login name of someone on the specified system.

Options are:

-m Send mail to the sender when the copy is complete.

-p Copy the source file into the spool directory before transmission.

The files (or sub-trees if directories are specified) are sent to */usr/spool/uucppublic*. Specifically, the files are sent to:

/usr/spool/uucppublic/receive/user/mysystem/files.

The destined recipient is notified by **mail**(C) of the arrival of files.

uupick accepts or rejects the files transmitted to the user. Specifically, **uupick** searches */usr/spool/uucppublic* for files destined for the user. For each entry (file or directory) found, the following message is printed on the standard output:

```
from system : [ file filename ] [ dir dirname ] ?
```

uupick then reads a line from the standard input to determine the disposition of the file:

<newline> Go on to next entry.

d Delete the entry.

m [*dir*]	Move the entry to named directory *dir*. If *dir* is not specified as a complete pathname (in which **$HOME** is legitimate), a destination relative to the current directory is assumed. If no destination is given, the default is the current directory.
a [*dir*]	Same as **m** except move all the files sent from *system*.
p	Print the content of the file.
q	Quit.
EOT ⟨Ctrl⟩**d**	Same as **q**.
!*command*	Escape to the shell to do *command*.
*	Print a command summary.

uupick invoked with the **-s***system* option will only search */usr/spool/uucppublic* for files sent from *system*.

File

/usr/spool/uucppublic	public directory

See also

mail(C), **uuclean**(ADM), **uucp**(C), **uustat**(C), **uux**(C)

Notes

In order to send files that begin with a dot (for example, *.profile*) the files must by qualified with a dot. For example: *.profile*, *.prof**, *.profil?* are correct; whereas **prof**, ?profile* are incorrect.

Standards conformance

uupick and **uuto** are conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

uux

UNIX-to-UNIX system command execution

Syntax

uux [*options*] *command-string*

Description

uux will gather zero or more files from various systems, execute a command on a specified system and then send standard output to a file on a specified system.

NOTE: For security reasons, most installations limit the list of commands executable on behalf of an incoming request from **uux**, permitting only the receipt of mail (see **mail**(C)). (Remote execution permissions are defined in */usr/lib/uucp/Permissions*.)

The ***command-string*** is made up of one or more arguments that look like a shell command line, except that the command and file names may be prefixed by ***system-name***. A null system-name is interpreted as the local system.

File names may be one of

1. a full path name;
2. a path name preceded by *~xxx* where *xxx* is a login name on the specified system and is replaced by that user's login directory;
3. anything else is prefixed by the current directory.

As an example, the command

uux "!diff usg!/usr/dan/file1 pwba!/a4/dan/file2 > !~/dan/file.diff"

will get the *file1* and *file2* files from the *usg* and *pwba* machines, execute a **diff**(C) command and put the results in *file.diff* in the local **PUBDIR**/*dan*/ directory.

Any special shell characters such as **< > ;** and **|** should be quoted either by quoting the entire command-string, or quoting the special characters as individual arguments.

uux will attempt to get all files to the execution system. For files that are output files, the filename must be escaped using parentheses. For example, the command

uux a!cut -f1 b!/usr/file \ (c!/usr/file)

gets */usr/file* from system *b* and sends it to system *a*, performs a **cut** command on that file and sends the result of the **cut** command to system *c*.

uux will notify you if the requested command on the remote system was disallowed. This notification can be turned off by the **-n** option. The response comes by remote mail from the remote machine.

The following options are interpreted by **uux**:

- The standard input to **uux** is made the standard input to the command-string.

-a*name* Use ***name*** as the user identification replacing the initiator user-id. (Notification will be returned to the user.)

-b Return whatever standard input was provided to the **uux** command if the exit status is non-zero.

-c Do not copy local file to the spool directory for transfer to the remote machine (default).

-C Force the copy of local files to the spool directory for transfer.

-g *grade* ***grade*** is a single letter/number; lower ASCII sequence characters will cause the job to be transmitted earlier during a particular conversation.

-j Output the jobid ASCII string on the standard output which is the job identification. This job identification can be used by **uustat** to obtain the status or terminate a job.

-n Do not notify the user if the command fails.

-p Same as "**-**"; the standard input to **uux** is made the standard input to the command-string.

-r Do not start the file transfer, just queue the job.

-s*file* Report status of the transfer-in ***file***.

-x*debug_level*
Produce debugging output on the standard output. The ***debug_level*** is a number between 0 and 9; higher numbers give more detailed information.

-z Send success notification to the user.

Files

*/usr/spool/uucp/**	spool directories
/usr/lib/uucp/Permissions	remote execution permissions
*/usr/lib/uucp/**	other data and programs

See also

mail(C), **uucp**(C), **uustat**(C)

Warnings

Only the first command of a shell pipeline may have a ***system-name***. All other commands are executed on the system of the first command.
The use of the shell metacharacter "*" will probably not do what you want it to do. The shell tokens "<<" and ">>" are not implemented.

The execution of commands on remote systems takes place in an execution directory known to the **uucp** system. All files required for the execution will be put into this directory unless they already reside on that machine. Therefore, the simple file name (without path or machine reference) must be unique within the **uux** request. The following command will NOT work:

uux "a!diff b!/usr/dan/xyz c!/usr/dan/xyz > !xyz.diff"

but the command

uux "a!diff a!/usr/dan/xyz c!/usr/dan/xyz > !xyz.diff"

will work (if **diff** is a permitted command).

Notes

Protected files and files that are in protected directories that are owned by the requester can be sent in commands using **uux**. However, if the requester is *root*, and the directory is not searchable by "other", the request will fail.

Standards conformance

uux is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

vi, view, vedit

invoke a screen-oriented display editor

Syntax

vi [*-option* ...] [*command* ...] [*filename* ...]

view [*-option* ...] [*command* ...] [*filename* ...]

vedit [*-option* ...] [*command* ...] [*filename* ...]

Description

vi - Invokes a screen-oriented display editor

view - Invokes a read-only **vi**

vedit - Invokes a novice version of **vi**

The **vi** command offers a powerful set of text editing operations based on a set of mnemonic commands. Most commands are single keystrokes that perform simple editing functions. **vi** displays a full screen "window" into the file you are editing. The contents of this window can be changed quickly and easily within **vi**. While editing, visual feedback is provided (the name vi itself is short for "visual").

The **view** command is the same as **vi** except that the read-only option (**-R**) is set automatically. The file cannot be changed with **view**.

The **vedit** command is the same as **vi** except for differences in the option settings. **vedit** uses **novice** mode, turns off the **magic** option, sets the option **report=1** and turns on the options **showmode** and **redraw**.

The **showmode** option informs the **vedit** user, in a message in the lower right hand corner of the screen, which mode is being used. For instance after the ⟨Esc⟩**i** command is used, the message reads `INSERT MODE`.

Note that you can not set the **novice** option from within **vi** or **ex**. If you want to use the **novice** option you must use the **vedit** utility. (It is possible to set the **nonovice** option from within **vedit**.)

vi and the line editor **ex** are one and the same editor: the names **vi** and **ex** identify a particular user interface rather than any underlying functional difference. The differences in user interface, however, are quite striking. **ex** is a powerful line-oriented editor, similar to the editor **ed**. However, in both **ex** and **ed**, visual updating of the terminal screen is limited, and commands are entered on a command line. **vi**, on the other hand, is a screen-oriented editor

designed so that what you see on the screen corresponds exactly and immediately to the contents of the file you are editing. In the following discussion, **vi** commands and options are printed in boldface type.

Options available on the **vi** command line include:

-x Encryption option; when used, the file will be encrypted as it is being written and will require an encryption key to be read. **vi** makes an educated guess to determine if a file is encrypted or not. See **crypt**(C). Also, see the "Warnings" section at the end of this manual page.

-C Encryption option; the same as **-x** except that **vi** assumes files are encrypted.

-c ***command*** Begin editing by executing the specified editor ***command*** (usually a search or positioning command).

-t ***tag*** Equivalent to an initial ***tag*** command; edits the file containing ***tag*** and positions the editor at its definition.

-r ***file*** Used in recovering after an editor or system crash, retrieves the last saved version of the named file.

-l Specific to editing LISP, this option sets the **showmatch** and **lisp** options.

-L List the names of all files saved as a result of an editor or system crash. Files may be recovered with the **-r** option.

-w*n* Sets the default window size to ***n***. Useful on dialups to start in small windows.

-R Sets a read-only option so that files can be viewed but not edited.

The editing buffer

vi performs no editing operations on the file that you name during invocation. Instead, it works on a copy of the file in an "editing buffer".

When you invoke **vi** with a single filename argument, the named file is copied to a temporary editing buffer. The editor remembers the name of the file specified at invocation, so that it can later copy the editing buffer back to the named file. The contents of the named file are not affected until the changes are copied back to the original file.

Modes of operation

Within **vi** there are three distinct modes of operation:

Command Mode — Within command mode, signals from the keyboard are interpreted as editing commands.

Insert Mode — Insert mode can be entered by typing any of the **vi** insert, append, open, substitute, change, or replace commands. Once in insert mode, letters typed at the keyboard are inserted into the editing buffer.

ex Escape Mode — The **vi** and **ex** editors are one and the same editor differing mainly in their user interface. In **vi**, commands are usually single keystrokes. In **ex**, commands are lines of text terminated by a RETURN. **vi** has a special "escape" command that gives access to many of these line-oriented **ex** commands. To use the **ex** escape mode, type a colon (:). The colon is echoed on the status line as a prompt for the **ex** command. An executing command can be aborted by pressing INTERRUPT. Most file manipulation commands are executed in **ex** escape mode (for example, the commands to read in a file and to write out the editing buffer to a file).

Special keys

There are several special keys in **vi**. The following keys are used to edit, delimit, or abort commands and command lines.

⟨Esc⟩ — Used to return to **vi** command mode or to cancel partially formed commands.

⟨Return⟩ — Terminates **ex** commands when in **ex** escape mode. Also used to start a newline when in insert mode.

INTERRUPT — Often the same as the ⟨Del⟩ or RUBOUT key on many terminals. Generates an interrupt, telling the editor to stop what it is doing. Used to abort any command that is executing.

/ — Used to specify a string to be searched for. The slash appears on the status line as a prompt for a search string. The question mark (?) works exactly like the slash key, except that it is used to search backward in a file instead of forward.

: — The colon is a prompt for an **ex** command. You can then type in any **ex** command, followed by an ⟨Esc⟩ or ⟨Return⟩, and the given **ex** command is executed.

The following characters are special in insert mode:

⟨Bksp⟩ Backs up the cursor one character on the current line. The last character typed before the ⟨Bksp⟩ is removed from the input buffer, but remains displayed on the screen.

⟨Ctrl⟩U Moves the cursor back to the first character of the insertion and restarts insertion.

⟨Ctrl⟩**V** Removes the special significance of the next typed character. Use ⟨Ctrl⟩**V** to insert control characters. Linefeed and ⟨Ctrl⟩**J** cannot be inserted in the text except as newline characters. Both ⟨Ctrl⟩**Q** and ⟨Ctrl⟩**S** are trapped by the operating system before they are interpreted by **vi**, so they too cannot be inserted as text.

⟨Ctrl⟩**W** Moves the cursor back to the first character of the last inserted word.

⟨Ctrl⟩**T** During an insertion, with the **autoindent** option set and at the beginning of the current line, entering this character will insert ***shiftwidth*** whitespace.

⟨Ctrl⟩@ If entered as the first character of an insertion, it is replaced with the last text inserted, and the insertion terminates. Only 128 characters are saved from the last insertion. If more than 128 characters were inserted, then this command inserts no characters. A ⟨Ctrl⟩@ cannot be part of a file, even if quoted.

Starting and exiting vi

To enter **vi**, enter:

vi	Edits empty editing buffer
vi ***file***	Edits named file
vi +123 ***file***	Goes to line 123
vi + 45 ***file***	Goes to line 45
vi +/word ***file***	Finds first occurrence of "word"
vi +/tty ***file***	Finds first occurrence of "tty"

There are several ways to exit the editor:

:wq This command writes the editing buffer to the file you are editing, quits the editor, and returns to the UNIX shell.

ZZ The editing buffer is written to the file *only* if any changes were made.

:x The editing buffer is written to the file *only* if any changes were made.

:q! Cancels an editing session. The exclamation mark (!) tells **vi** to quit unconditionally. In this case, the editing buffer is not written out.

vi commands

vi is a visual editor with a window on the file. What you see on the screen is **vi**'s notion of what the file contains. Commands do not cause any change to the screen until the complete command is entered. Most commands may take a preceding count that specifies repetition of the command. This count parameter is not given in the following command descriptions, but is implied unless overridden by some other prefix argument. When **vi** gets an improperly formatted command, it rings a bell.

Cursor movement

The cursor movement keys allow you to move your cursor around in a file. Note in particular the direction keys (if available on your terminal), the h, j, k, l, and cursor keys, and ⟨Space⟩, ⟨Bksp⟩, ⟨Ctrl⟩**N**, and ⟨Ctrl⟩**P**. These three sets of keys perform identical functions.

Forward Space - l, ⟨Space⟩, or right direction key

Syntax: **l**
⟨Space⟩
right direction key

Function: Moves the cursor forward one character. If a count is given, move forward ***count*** characters. You cannot move past the end of the line.

Backspace - h, ⟨Bksp⟩, or left direction key

Syntax: **h**
⟨Bksp⟩
left direction key

Function: Moves cursor backward one character. If a count is given, moves backward ***count*** characters. Note that you cannot move past the beginning of the current line.

Next Line - +, ⟨Return⟩, j, ⟨Ctrl⟩N, ⟨LF⟩, and down direction key

Syntax: **+**
⟨Return⟩

Function: Moves the cursor down to the beginning of the next line.

Syntax: **j**
⟨Ctrl⟩**N**
⟨LF⟩
down direction key

Function: Moves the cursor down one line, remaining in the same column. Note the difference between these commands and the preceding set of next line commands which move to the *beginning* of the next line.

Previous Line - k, ⟨Ctrl⟩P, and up direction key

Syntax: **k**
⟨Ctrl⟩**P**
up direction key

Function: Moves the cursor up one line, remaining in the same column. If a count is given, the cursor is moved ***count*** lines.

Syntax: **-**

Function: Moves the cursor up to the beginning of the previous line. If a count is given, the cursor is moved up ***count*** lines.

Beginning of Line - 0 and ^

Syntax: **^**
0

Function: Moves the cursor to the beginning of the current line. Note that **0** always moves the cursor to the first character of the current line. The caret (^) works somewhat differently: it moves to the first character on a line that is not a tab or a space. This is useful when editing files that have a great deal of indentation, such as program texts.

End of Line - $

Syntax: **$**

Function: Moves the cursor to the end of the current line. Note that the cursor resides on top of the last character on the line. If a count is given, the cursor is moved forward ***count***-1 lines to the end of the line.

Goto Line - G

Syntax: [*linenumber*]**G**

Function: Moves the cursor to the beginning of the line specified by ***linenumber***. If no ***linenumber*** is given, the cursor moves to the beginning of the *last* line in the file. To find the line number of the current line, use ⟨Ctrl⟩**G**.

Column - |

Syntax: [*column*]**|**

Function: Moves the cursor to the column in the current line given by ***column***. If no ***column*** is given, the cursor is moved to the first column in the current line.

Word Forward - w and W

Syntax: **w**
W

Function: Moves the cursor forward to the beginning of the next word. The lowercase **w** command searches for a word defined as a string of alphanumeric characters separated by punctuation or whitespace (that is, tab, newline, or space characters). The uppercase **W** command searches for a word defined as a string of nonwhitespace characters.

Back Word - b and B

Syntax: **b**
B

Function: Moves the cursor backward to the beginning of a word. The lowercase **b** command searches backward for a word defined as a string of alphanumeric characters separated by punctuation or whitespace (that is, tab, newline, or space characters). The uppercase **B** command searches for a word defined as a string of nonwhitespace characters. If the cursor is already within a word, it moves backward to the beginning of that word.

End - e and E

Syntax: **e**
E

Function: Moves the cursor to the end of a word. The lowercase **e** command moves the cursor to the last character of a word, where a word is defined as a string of alphanumeric characters separated by punctuation or whitespace (that is, tab, newline, or space characters). The uppercase **E** moves the cursor to the last character of a word

where a word is defined as a string of nonwhitespace characters. If the cursor is already within a word, it moves to the end of that word.

Sentence - (and)

Syntax: **(**
)

Function: Moves the cursor to the beginning (left parenthesis) or end of a sentence (right parenthesis). A sentence is defined as a sequence of characters ending with a dot (.), question mark (?), or exclamation mark (!) followed by either two spaces or a newline. A sentence begins on the first nonwhitespace character following a preceding sentence. Sentences are also delimited by paragraph and section delimiters. See below.

Paragraph - { and }

Syntax: **}**
{

Function: Moves the cursor to the beginning " { " or end " } " of a paragraph. A paragraph is defined with the **paragraphs** option. By default, paragraphs are delimited by the nroff macros .IP, .LP, .P, .QP, and .bp. Paragraphs also begin after empty lines.

Section - [[and]]

Syntax: **]]**
[[

Function: Moves the cursor to the beginning " [[" or end "]] " of a section. A section is defined with the **sections** option. By default, sections are delimited by the nroff macros .NH and .SH. Sections also start at formfeeds (1L) and at lines beginning with a brace ({).

Match Delimiter - %

Syntax: **%**

Function: Moves the cursor to a matching delimiter, where a delimiter is a parenthesis, a bracket, or a brace. This is useful when matching pairs of nested parentheses, brackets, and braces.

Home - H

Syntax: [*offset*]**H**

Function: Moves the cursor to the upper left corner of the screen. Use this command to move quickly to the top of the screen. If an ***offset*** is given, the cursor is homed *offset*-1 number of lines from the top of the screen. Note that the command **dH** deletes all lines from the current line to the top line shown on the screen.

Middle Screen - M

Syntax: **M**

Function: Moves the cursor to the beginning of the screen's middle line. Use this command to move quickly to the middle of the screen from either the top or the bottom. Note that the command **dM** deletes from the current line to the line specified by the **M** command.

Lower Screen - L

Syntax: [*offset*]**L**

Function: Moves the cursor to the lowest line on the screen. Use this command to quickly move to the bottom of the screen. If an ***offset*** is given, the cursor is homed *offset*-1 number of lines from the bottom of the screen. Note that the command **dL** deletes all lines from the current line to the bottom line shown on the screen.

Previous Context - `` and ''

Syntax: ''

'*character*

``

`*character*

Function: Moves the cursor to previous context or to context marked with the **m** command. If the single quotation mark or back quotation mark is doubled, the cursor is moved to previous context. If a single character is given after either quotation mark, the cursor is moved to the location of the specified mark as defined by the **m** command. The previous context is the location in the file of the last "nonrelative" cursor movement. The single quotation mark (') syntax is used to move to the beginning of the line representing the previous context. The back quotation mark (`) syntax is used to move to the previous context *within* a line.

The screen commands

The screen commands are *not* cursor movement commands and cannot be used in delete commands as the delimiters of text objects. However, the screen commands do move the cursor and are useful in paging or scrolling through a file. These commands are described below:

Scroll- ⟨Ctrl⟩U and ⟨Ctrl⟩D

Syntax: [*size*]⟨Ctrl⟩**U**
[*size*]⟨Ctrl⟩**D**

Function: Scrolls the screen up a half window (⟨Ctrl⟩**U**) or down a half window (⟨Ctrl⟩**D**). If ***size*** is given, the scroll is ***size*** number of lines. This value is remembered for all later scrolling commands.

Page - ⟨Ctrl⟩F and ⟨Ctrl⟩B

Syntax: ⟨Ctrl⟩**F**
⟨Ctrl⟩**B**

Function: Pages screen forward and backward. Two lines of continuity are kept between pages if possible. A preceding count gives the number of pages to move forward or backward.

Status - ⟨Ctrl⟩G

Syntax: **BELL**
⟨Ctrl⟩**G**

Function: Displays **vi** status on status line. This gives you the name of the file you are editing, whether it has been modified, the current line number, the number of lines in the file, and the percentage of the file (in lines) that precedes the cursor.

Zero Screen - z

Syntax: [***linenumber***]**z**[***size***]⟨Return⟩
[***linenumber***]**z**[***size***]**.**
[***linenumber***]**z**[***size***]**-**

Function: Redraws the display with the current line placed at or "zeroed" at the top, middle, or bottom of the screen, respectively. If you give a ***size***, the number of lines displayed is equal to ***size***. If a preceding ***linenumber*** is given, the given line is placed at the top of the screen. If the last argument is a ⟨Return⟩, the current line is placed at the top of the screen. If the last argument is a dot (.), the current line is placed in the middle of the screen. If the last argument is a minus sign (-), the current line is placed at the bottom of the screen.

Redraw - ⟨Ctrl⟩R or ⟨Ctrl⟩L

Syntax: ⟨Ctrl⟩**R**
⟨Ctrl⟩**L**
(Command depends on terminal type.)

Function: Redraws the screen. Use this command to erase any system messages or line noise that may scramble your screen. Note that system messages do not affect the file you are editing.

Text insertion

The text insertion commands always place you in insert mode. Exit from insert mode is always done by pressing ⟨Esc⟩. The following insertion commands are *pure* insertion commands; no text is deleted when you use them. This differs from the text modification commands, change, replace, and substitute, which delete and then insert text in one operation.

Insert - i and I

Syntax: **i**[***text***]⟨Esc⟩
I[***text***]⟨Esc⟩

Function: Insert ***text*** in editing buffer. The lowercase **i** command places you in insert mode. ***Text*** is inserted *before* the character beneath the cursor. To insert a newline, press a ⟨Return⟩. Exit insert mode by typing the ⟨Esc⟩ key. The uppercase **I** command places you in insert mode, but begins text insertion at the beginning of the current line, rather than before the cursor. (The beginning of the line here is the first non-blank character on the line.)

Append - a and A

Syntax: **a**[***text***]⟨Esc⟩
A[***text***]⟨Esc⟩

Function: Appends ***text*** to the editing buffer. The lowercase **a** command works exactly like the lowercase **i** command, except that text insertion begins after the cursor and not before. This is the only way to add text to the end of a line. The uppercase **A** command begins appending text at the end of the current line rather than after the cursor.

Open New Line - o and O

Syntax: **o**[*text*]⟨Esc⟩
O[*text*]⟨Esc⟩

Function: Opens a new line and inserts text. The lowercase **o** command opens a new line below the current line; uppercase **O** opens a new line *above* the current line. After the new line has been opened, both these commands work like the **I** command.

Text deletion

Many of the text deletion commands use the "d" key as an operator. This operator deletes text objects delimited by the cursor and a cursor movement command. Deleted text is always saved in a buffer. The delete commands are described below:

Delete Character - x and X

Syntax: **x**
X

Function: Deletes a character. The lowercase **x** command deletes the character beneath the cursor. With a preceding count, ***count*** characters are deleted to the right beginning with the character beneath the cursor. This is a quick and easy way to delete a few characters. The uppercase **X** command deletes the character just before the cursor. With a preceding count, ***count*** characters are deleted backward, beginning with the character just before the cursor.

Delete - d and D

Syntax: **d*cursor-movement***
dd
D

Function: Deletes a text object. The lowercase **d** command takes a ***cursor-movement*** as an argument. If the ***cursor-movement*** is an intraline command, deletion takes place from the cursor to the end of the text object delimited by the ***cursor-movement***. Deletion forward deletes the character beneath the cursor; deletion backward does not. If the ***cursor-movement*** is a multi-line command, deletion takes place from and including the current line to the text object delimited by the ***cursor-movement***.

The **dd** command deletes whole lines. The uppercase **D** command deletes from and including the cursor to the end of the current line.

Deleted text is automatically pushed on a stack of buffers numbered 1 through 9. The most recently deleted text is also placed in a special delete buffer that is logically buffer 0. This special buffer is the default buffer for all (put) commands using the double quotation mark (") to specify the number of the buffer for delete, put, and yank commands. The buffers 1 through 9 can be accessed with the **p** and **P** (put) commands by appending the double quotation mark (") to the number of the buffer. For example:

"4p

puts the contents of delete buffer number 4 in your editing buffer just below the current line. Note that the last deleted text is "put" by default and does not need a preceding buffer number.

Text modification

The text modification commands all involve the replacement of text with other text. This means that some text will necessarily be deleted. All text modification commands can be "undone" with the **u** command:

Undo - u and U

Syntax: **u**
U

Function: Undoes the last insert or delete command. The lowercase **u** command undoes the last insert or delete command. This means that after an insert, **u** deletes text; and after a delete, **u** inserts text. For the purposes of undo, all text modification commands are considered insertions.

The uppercase **U** command restores the current line to its state before it was edited, no matter how many times the current line has been edited since you moved to it.

Repeat -.

Syntax: **.**

Function: Repeats the last insert or delete command. A special case exists for repeating the **p** and **P** "put" commands. When these commands are preceded by the name of a delete buffer, successive **u** commands display the contents of the delete buffers.

Change - c and C

Syntax: **c***cursor-movement* ***text*** ⟨Esc⟩
C*text* ⟨Esc⟩
cc*text* ⟨Esc⟩

Function: Changes a text object and replaces it with ***text***. Text is inserted as with the **i** command. A dollar sign ($) marks the extent of the

change. The **c** command changes arbitrary text objects delimited by the cursor and a ***cursor-movement***. **C** affects from the cursor to the end of the line, **cc** affects the whole line; otherwise, they are identical in function.

Replace - r and R

Syntax: **r*char***
R*text* ⟨Esc⟩

Function: Overstrikes character or line with ***char*** or ***text***, respectively. Use **r** to overstrike a single character and **R** to overstrike a whole line. A count multiplies the replacement text count times.

Substitute - s and S

Syntax: **s*text*** ⟨Esc⟩
S*text* ⟨Esc⟩

Function: Substitutes current character or current line with ***text***. Use **s** to replace a single character with new text. Use **S** to replace the current line with new text. If a preceding count is given, ***text*** substitutes for count number of characters or lines depending on whether the command is **s** or **S**, respectively.

Filter - !

Syntax: **!*cursor-movement cmd*** ⟨Return⟩

Function: Filters the text object delimited by the cursor and ***cursor-movement*** through the UNIX command, ***cmd***. For example, the following command sorts all lines between the cursor and the bottom of the screen, substituting the designated lines with the sorted lines:

!Lsort

Arguments and shell metacharacters may be included as part of ***cmd***; however, standard input and output are always associated with the text object being filtered.

Join Lines - J

Syntax: **J**

Function: Joins the current line with the following line. If a ***count*** is given, ***count*** lines are joined.

Shift - < and >

Syntax: >[*cursor-movement*]
<[*cursor-movement*]
>>
<<

Function: Shifts text right (>) or left (<). Text is shifted by the value of the option **shiftwidth**, which is normally set to eight spaces. Both the > and < commands shift all lines in the text object delimited by the current line and *cursor-movement*. The >> and << commands affect whole lines. All versions of the command can take a preceding count that acts to multiply the number of objects affected.

Text movement

The text movement commands move text in and out of the named buffers *a*-*z* and out of the delete buffers *1*-*9*. These commands either "yank" text out of the editing buffer and into a named buffer or "put" text into the editing buffer from a named buffer or a delete buffer. By default, text is put and yanked from the "unnamed buffer", which is also where the most recently deleted text is placed. Thus it is quite reasonable to delete text, move your cursor to the location where you want the deleted text placed, and then put the text back into the editing buffer at this new location with the **p** or **P** command.

The named buffers are most useful for keeping track of several sections of text that you want to keep on hand for later access, movement, or rearrangement. These buffers are named with the letters *a* through *z*. To refer to one of these buffers (or one of the numbered delete buffers) in a command, use a quotation mark. For example, to yank a line into the buffer named *a*, enter:

"ayy

To put this text back into the file, enter:

"ap

If you delete text in the buffer named *A* rather than *a*, text is appended to the buffer named *a* (that is, *A* and *a* refer to the same buffer but are handled differently).

Note that the contents of the named buffers are not destroyed when you switch files. Therefore, you can delete or yank text into a buffer, switch files, and then do a put. Buffer contents are *destroyed* when you exit the editor, so be careful.

Put - p and P

Syntax: ["*alphanumeric*]**p**
["*alphanumeric*]**P**

Function: Puts text from a buffer into the editing buffer. If no buffer name is specified, text is put from the unnamed buffer. The lowercase **p** command puts text either below the current line or after the

cursor, depending on whether the buffer contains a partial line or not. The uppercase **P** command puts text either above the current line or before the cursor, again depending on whether the buffer contains a partial line or not.

Yank - y and Y

Syntax: **["*letter*]y*cursor-movement***
["*letter*]yy
["*letter*]

Function: Copies text in the editing buffer to a named buffer. If no buffer name is specified, text is yanked into the unnamed buffer. If an uppercase ***letter*** is used, text is appended to the buffer and does not overwrite and destroy the previous contents. When a ***cursor-movement*** is given as an argument, the delimited text object is yanked. The **Y** and **yy** commands yank a single line, or, if a preceding count is given, multiple lines can be yanked.

Searching

The search commands search either forward or backward in the editing buffer for text that matches a given regular expression.

Search - / and ?

Syntax: **/[*pattern*]/[*offset*]**⟨Return⟩
/[*pattern*]⟨Return⟩
?[*pattern*]?[*offset*]⟨Return⟩
?[*pattern*]⟨Return⟩

Function: Searches forward (/) or backward (?) for ***pattern***. A string is actually a regular expression. The trailing delimiter is not required. If no ***pattern*** is given, then the last ***pattern*** searched for is used. After the second delimiter, an ***offset*** may be given, specifying the beginning of a line relative to the line on which ***pattern*** was found. For example:

/word/-

finds the beginning of the line immediately preceding the line containing ***word*** and the following command:

/word/+2

finds the beginning of the line two lines after the line containing ***word***. See also the **ignorecase** and **magic** options.

Next String - n and N

Syntax: **n**
N

Function: Repeats the last search command. The **n** command repeats the search in the same direction as the last search command. The **N** command repeats the search in the opposite direction of the last search command.

Find Character - f and F

Syntax: **f***char*
F*char*
;
,

Function: Finds character ***char*** on the current line. The lowercase **f** searches forward on the line; the uppercase **F** searches backward. The semicolon (;) repeats the last character search. The comma (,) reverses the direction of the search.

To Character - t and T

Syntax: **t***char*
T*char*
;
,

Function: Moves the cursor up to but not on ***char***. The semicolon (;) repeats the last character search. The comma (,) reverses the direction of the search.

Mark - m

Syntax: **m***letter*

Function: Marks a place in the file with a lowercase ***letter***. You can move to a mark using the "to mark" commands described below. It is often useful to create a mark, move the cursor, and then delete from the cursor to the mark "a" with the following command:

d´a

To Mark - ´ and `

Syntax: ***´letter***
`letter

Function: Move to ***letter***. These commands let you move to the location of a mark. Marks are denoted by single lowercase alphabetic characters. Before you can move to a mark, it must first be created with the **m** command. The back quotation mark (`) moves you to the exact location of the mark within a line; the forward quotation mark (') moves you to the beginning of the line containing the mark. Note that these commands are also legal cursor movement commands.

Exit and escape commands

There are several commands that are used to escape from **vi** command mode and to exit the editor. These are described in the following section.

ex Escape - :

Syntax: **:**

Function: Enters **ex** escape mode to execute an **ex** command. The colon appears on the status line as a prompt for an **ex** command. You then can enter an **ex** command line terminated by either a ⟨Return⟩ or an ⟨Esc⟩ and the **ex** command will execute. You are then prompted to type ⟨Return⟩ to return to **vi** command mode. During the input of the **ex** command line or during execution of the **ex** command, you may press INTERRUPT to stop what you are doing and return to **vi** command mode.

Exit Editor - ZZ

Syntax: **ZZ**

Function: Exit **vi** and write out the file if any changes have been made. This returns you to the shell from which you started **vi**.

Quit to ex - Q

Syntax: **Q**

Function: Enters the **ex** editor. When you do this, you will still be editing the same file. You can return to **vi** by entering the **vi** command from **ex**.

ex commands

Entering the colon (:) escape command when in command mode produces a colon prompt on the status line. This prompt is for a command available in the line-oriented editor, **ex**. In general, **ex** commands let you write out or read in files, escape to the shell, or switch editing files.

Many of these commands perform actions that affect the "current" file by default. The current file is normally the file that you named when you started **vi**, although the current file can be changed with the "file" command, **f**, or with the "next" command, **n**. In most respects, these commands are identical to similar commands for the editor, **ed**. All such **ex** commands are aborted by either ⟨Return⟩ or INTERRUPT. We shall use ⟨Return⟩ in our examples. Command entry is terminated by typing INTERRUPT.

Command structure

Most **ex** command names are English words, and initial prefixes of the words are acceptable abbreviations. In descriptions, only the abbreviation is discussed, since this is the most frequently used form of the command. The ambiguity of abbreviations is resolved in favor of the more commonly used commands. As an example, the command **substitute** can be abbreviated **s**, while the shortest available abbreviation for the **set** command is **se**.

Most commands accept prefix addresses specifying the lines in the file that they are to affect. A number of commands also may take a trailing ***count*** specifying the number of lines to be involved in the command. Counts are rounded down if necessary. Thus, the command **10p** displays the tenth line in the buffer while **move 5** moves the current line after line 5.

Some commands take other information or parameters, stated after the command name. Examples might be option names in a **set** command, such as **set number**, a filename in an **edit** command, a regular expression in a **substitute** command, or a target address for a **copy** command. For example:

1,5 copy 25

A number of commands have variants. The variant form of the command is invoked by placing an exclamation mark (!) immediately after the command name. Some of the default variants may be controlled by options; in this case, the exclamation mark turns off the meaning of the default.

In addition, many commands take flags, including the characters **p** and **l**. A **p** or **l** must be preceded by a blank or tab. In this case, the command abbreviated by these characters is executed after the command completes. Since **ex** normally displays the new current line after each change, **p** is rarely necessary. Any number of plus (+) or minus (-) characters may also be given with these flags. If they appear, the specified offset is applied to the current line value before the printing command is executed.

Most commands that change the contents of the editor buffer give feedback if the scope of the change exceeds a threshold given by the **report** option. This feedback helps to detect undesirably large changes so that they may be quickly and easily reversed with the **undo** command. After commands with global effect, you will be informed if the net change in the number of lines in the buffer during this command exceeds this threshold.

Command addressing

The following specifies the line addressing syntax for **ex** commands:

. The current line. Most commands leave the current line as the last line which they affect. The default address for most commands is the current line, thus "." is rarely used alone as an address.

n The *n*th line in the editor's buffer, lines being numbered sequentially from 1.

$ The last line in the buffer.

% An abbreviation for "**1,$**", the entire buffer.

+n or ***-n*** An offset, ***n*** relative to the current buffer line. The forms ".+3" "+3" and "+++" are all equivalent. If the current line is line 100 they all address line 103.

/pattern/ or ***?pattern?***
Scan forward and backward respectively for a text matching the regular expression given by ***pattern***. Scans normally wrap around the end of the buffer. If all that is desired is to print the next line containing ***pattern***, the trailing slash (/) or question mark (?) may be omitted. If ***pattern*** is omitted or explicitly empty, the string matching the last specified regular expression is located. The forms "⟨Return⟩" and "?⟨Return⟩" scan using the last named regular expression. After a substitute, "⟨Return⟩" and "??⟨Return⟩" would scan using that substitute's regular expression.

´´ or **´x** Before each nonrelative motion of the current line dot (.), the previous current line is marked with a label, subsequently referred to with two single quotation marks (´´). This makes it easy to refer or return to this previous context. Marks are established with the **vi m** command, using a single lowercase letter as the name of the mark. Marked lines are later referred to with the following notation:

´x.

where ***x*** is the name of a mark.

Addresses to commands consist of a series of addresses, separated by a comma (,) or a semicolon (;). Such address lists are evaluated left to right. When addresses are separated by a semicolon (;) the current line (.) is set to the value of the previous addressing expression before the next address is interpreted. If more addresses are given than the command requires, all but the last one or two are ignored. If the command takes two addresses, the first addressed line must precede the second in the buffer. Null address specifications are permitted in a list of addresses, the default in this case is the current line (.); thus ",100" is equivalent to ".,100". It is an error to give a prefix address to a command which expects none.

Command format

The following is the format for all **ex** commands:

[***address***] [***command***] [**!**] [***parameters***] [***count***] [***flags***]

All parts are optional depending on the particular command and its options. The following section describes specific commands.

Argument list commands

The argument list commands allow you to work on a set of files, by remembering the list of filenames that are specified when you invoke **vi**. The **args** command lets you examine this list of filenames. The **file** command gives you information about the current file. The **n** (next) command lets you either edit the next file in the argument list or change the list. The **rewind** command lets you restart editing the files in the list. All of these commands are described below:

args The members of the argument list are displayed, with the current argument delimited by brackets.

For example, a list might look like this:

file1 file2 [*file3*] *file4 file5*

The current file is *file3*.

f Displays the current filename, whether it has been modified since the last **write** command, whether it is read-only, the current linenumber, the number of lines in the buffer, and the percentage of the buffer that you have edited. In the rare case that the current file is "[Not edited]", this is noted also; in this case you have to use **w!** to write to the file, since the editor is not sure that a **w** command will not destroy a file unrelated to the current contents of the buffer.

f *file* The current filename is changed to *file* which is considered "[Not edited]".

n The next file in the command line argument list is edited.

n! This variant suppresses warnings about the modifications to the buffer not having been written out, discarding irretrievably any changes that may have been made.

n [+*command*] *filelist*
The specified *filelist* is expanded and the resulting list replaces the current argument list; the first file in the new list is then edited. If *command* is given (it must contain no spaces), then it is executed after editing the first such file.

rew The argument list is rewound, and the first file in the list is edited.

rew! Rewinds the argument list discarding any changes made to the current buffer.

If you use C-Shell and set the **prompt** variable to output a prompt for non-interactive shells, the prompt is interpreted as a filename when you use these commands. This causes unexpected problems. To avoid these problems, the default **prompt** should be set as shown in */usr/lib/mkuser/csh/cshrc*.

Edit commands

To edit a file other than the one you are currently editing, you will often use one of the variations of the **e** command.

In the following discussions, note that the name of the current file is always remembered by **vi** and is specified by a percent sign (%). The name of the *previous* file in the editing buffer is specified by a number sign (#).

The edit commands are described below:

e *file* — Used to begin an editing session on a new file. The editor first checks to see if the buffer has been modified since the last **w** command was issued. If it has been, a warning is issued and the command is aborted. The command otherwise deletes the entire contents of the editor buffer, makes the named file the current file, and displays the new filename. After ensuring that this file is sensible, (that is, it is not a binary file, directory, or a device), the editor reads the file into its buffer. If the read of the file completes without error, the number of lines and characters read is displayed on the status line. If no errors occurred, the file is considered edited. If the last line of the input file is missing the trailing newline character, it is supplied and a complaint issued. The current line is initially the first line of the file.

e! *file* — This variant form suppresses the complaint about modifications having been made and not written from the editor buffer, thus discarding all changes that have been made before editing the new file.

e +*n file* — Causes the editor to begin editing at line ***n*** rather than at the first line. The argument **n** may also be an editor command containing no spaces; for example, "+/pattern".

⟨Ctrl⟩^ — This is a shorthand equivalent for **:e #**⟨Return⟩ which returns to the previous position in the last edited file. If you do not want to write the file, you should use **:e!** #⟨Return⟩ instead.

Write commands

The write commands let you write out all or part of your editing buffer to either the current file or to some other file. These are described below:

w ***file*** — Writes changes made back to ***file***, displaying the number of lines and characters written. Normally, ***file*** is omitted and the buffer is written to the name of the current file. If ***file*** is specified, text is written to that file. The editor writes to a file only if it is the current file and is edited, or if the file does not exist. Otherwise, you must give the variant form **w!** to force the write. If the file does not exist it is created. The current filename is changed only if there is no current filename; the current line is never changed.

If an error occurs while writing the current and edited file, the editor displays:

```
No write since last change
```

even if the buffer had not previously been modified.

w>> ***file*** Appends the buffer contents at the end of an existing file. Previous file contents are not destroyed.

w! ***name*** Overrides the checking of the normal **write** command, and writes to any file that the system permits.

w !*command* Writes the specified lines into ***command***. Note the difference in spacing between

w! ***file***

which overrides checks and

w !*cmd*

which writes to a command. (A blank or tab before the exclamation mark is mandatory.) The output of this command is displayed on the screen and not inserted in the editing buffer.

Read commands

The read commands let you read text into your editing buffer at any location you specify. The text you read in must be at least one line long, and can be either a file or the output from a command.

r ***file*** Places a copy of the text of the given file in the editing buffer after the specified line. If no file is given, the current filename is used. The current filename is not changed unless there is none, in which case the file becomes the current name. If the file buffer is empty and there is no current name, this is treated as an **e** command.

Address 0 is legal for this command and causes the file to be read at the beginning of the buffer. Statistics are given as for the **e** command when the **r** successfully terminates. After an **r** the current line is the last line read.

r !*command* Reads the output of ***command*** into the buffer after the specified line. A blank or tab before the exclamation mark (!) is mandatory.

Quit commands

There are several ways to exit **vi**. Some abort the editing session, some write out the editing buffer before exiting, and some warn you if you decide to exit without writing out the buffer. All of these ways of exiting are described below:

q Exits **vi**. No automatic write of the editor buffer to a file is performed. However, **vi** displays a warning message if the file has changed since the last **w** command was issued, and does not quit. **vi** also displays a diagnostic if there are more files in the argument list left to edit. Normally, you will wish to save your changes, and you should enter a **w** command. If you wish to discard them, enter the **q!** command variant.

q! Quits from the editor, discarding changes to the buffer without complaint.

wq *name* Like a **w** and then a **q** command.

wq! *name* Overrides checking normally made before execution of the **w** command to any file. For example, if you own a file but do not have write permission turned on, the **wq!** allows you to update the file anyway.

x *name* If any changes have been made and not written, writes the buffer out and then quits. Otherwise, it just quits.

Global and substitute commands

The global and substitute commands allow you to perform complex changes to a file in a single command. Learning how to use these commands is a must for an experienced **vi** user.

g/pattern/cmds The **g** command has two distinct phases. In the first phase, each line matching ***pattern*** in the editing buffer is marked. Next, the given command list is executed with the current line, dot (.), initially set to each marked line.

The command list consists of the remaining commands on the current input line and may continue to multiple lines by ending all but the last such line with a backslash (\). This multiple-line option will not work from within **vi**. You must switch to **ex** to do it. The **vi** command **Q** can be used to exit to **ex**, and the **ex** command **vi** will return you to visual mode. If ***cmds*** (or the trailing slash (/) delimiter) is omitted, each line matching ***pattern*** is displayed.

The **g** command itself may not appear in ***cmds***. The options **autoprint** and **autoindent** are inhibited during a global command and the value of the **report** option is temporarily infinite, in deference to a **report** for the entire global. Finally, the context mark (') or (`) is set to the value of the current line (.) before the global command begins and is not changed during a global command.

The following global commands, most of them substitutions, cover the most frequent uses of the global command.

g/*s1*/p This command simply prints all lines that contain the string ***s1***.

g/*s1*/s//*s2*/ This command substitutes the *first* occurrence of ***s1*** on all lines that contain it with the string ***s2***.

g/*s1*/s//*s2*/g This command substitutes all occurrences of ***s1*** with the string ***s2***. This includes multiple occurrences of ***s1*** on a line.

g/*s1*/s//*s2*/gp This command works the same as the preceding example, except that in addition, all changed lines are displayed on the screen.

g/*s1*/s//*s2*/gc This command prompts you to confirm that you want to make each substitution of the string ***s1*** with the string ***s2***. If you enter a **Y**, the given substitution is made, otherwise it is not.

g/*s0*/s/*s1*/*s2*/g This command marks all those lines that contain the string ***s0***, and then for those lines only, substitutes all occurrences of the string ***s1*** with ***s2***.

g!/*pattern*/*cmds* This variant form of **g** runs ***cmds*** at each line not matching ***pattern***.

g/^/s// /g This command inserts blank spaces at the beginning of each line in a file.

s/*pattern*/*repl*/*options*

On each specified line, the first instance of text matching the regular expression ***pattern*** is replaced by the replacement text ***repl***. If the **global** indicator option character **g** appears, all instances on a line are substituted. If the **confirm** indication character **c** appears, before each substitution the line to be substituted is printed on the screen with the string to be substituted marked with caret (^) characters. By entering **Y**, you cause the substitution to be performed; any other input causes no change to take place. After an **s** command, the current line is the last line substituted.

v/*pattern*/*cmds* A synonym for the **global** command variant **g!**, running the specified ***cmds*** on each line that does not match ***pattern***.

Text movement commands

The text movement commands are largely superseded by commands available in **vi** command mode. However, the following two commands are still quite useful:

co *addr flags* A copy of the specified lines is placed after ***addr***, which may be "0". The current line (.) addresses the last line of the copy.

[***range***]**m*addr*** The **m** command moves the lines specified by ***range*** after the line given by ***addr***. For example, **m+** swaps the current line and the following line, since the default range is just the current line. The first of the moved lines becomes the current line (dot).

Shell escape commands

You will often want to escape from the editor to execute normal UNIX commands. You may also want to change your working directory so that your editing can be done with respect to a different working directory. These operations are described below:

cd *directory* The specified ***directory*** becomes the current directory. If no directory is specified, the current value of the **home** option is used as the target directory. After a **cd**, the current file is not considered to have been edited so that write restrictions on preexisting files still apply.

sh A new shell is created. You may invoke as many commands as you like in this shell. To return to **vi**, enter a ⟨Ctrl⟩**D** to terminate the shell.

!*command* The remainder of the line after the exclamation (!) is sent to a shell to be executed. Within the text of ***command***, the characters "%" and "#" are expanded as the filenames of the current file and the last edited file and the character "!" is replaced with the text of the previous command. Thus, in particular, "!!" repeats the last such shell escape. If any such expansion is performed, the expanded line is echoed. The current line is unchanged by this command.

If there has been "[No write]" of the buffer contents since the last change to the editing buffer, a diagnostic is displayed before the command is executed, as a warning. A single exclamation (!) is displayed when the command completes.

If you use C-Shell and set the **prompt** variable to output a prompt for non-interactive shells, the prompt is interpreted as an argument for ***command*** in shell escapes. This causes unexpected problems. To avoid these problems, use the default **prompt** value as shown in */usr/lib/mkuser/csh/cshrc*.

Other commands

The following command descriptions explain how to use miscellaneous **ex** commands that do not fit into the above categories.

The **abbr, map,** and **set** commands can also be defined with the **EXINIT** environment variable, which is read by the editor each time it starts up. For more information, see **environ**(M). Alternatively, these commands can be placed in a *.exrc* file in your home directory, which the editor reads if **EXINIT** is not defined.

abbr Maps the first argument to the following string. For example, the following command

:abbr rainbow yellow green blue red

maps "rainbow" to "yellow green blue red". Abbreviations can be turned off with the **unabbreviate** command, as in:

:una rainbow

map, map! Maps any character or escape sequence to a command sequence. For example, the following command maps the ⟨Ctrl⟩**A** key to a shell escape that runs the **clear**(C) command:

map ^A:!clear^M

To include the ⟨Ctrl⟩A and ⟨Ctrl⟩M characters in the mapping, you must use **vi**'s ⟨Ctrl⟩**V** escape.

Characters mapped with **map** work in command mode, while characters mapped with **map!** work in insert mode. Characters mapped with **map!** cannot be unmapped using **unmap**.

nu Displays each specified line preceded by its buffer line number. The current line is left at the last line displayed. To get automatic line numbering of lines in the buffer, set the **number** option.

preserve The current editor buffer is saved as though the system had just crashed. This command is for use only in emergencies when a **w** command has resulted in an error and you do not know how to save your work.

= Displays the line number of the addressed line. The current line is unchanged.

recover ***file*** Recovers ***file*** from the system save area. The system saves a copy of the editing buffer only if you have made changes to the file, the system crashes, or you execute a **preserve** command. When you use **preserve**, you are notified by mail.

set ***argument*** With no arguments, **set** displays those options whose values have been changed from their defaults; with the argument **all**, it displays all of the option values.

Giving an option name followed by a question mark (?) causes the current value of that option to be displayed. The question mark is unnecessary unless the option is a Boolean value. Switch options are given values either with:

set ***option***

to turn them on or:

set no*option*

to turn them off. String and numeric options are assigned with:

set ***option=value***

More than one option can be given to **set**; all are interpreted from left to right. See "Options" for a complete list and descriptions.

tag ***label*** The focus of editing switches to the location of ***label***. If necessary, **vi** will switch to a different file in the current directory to find ***label***. If you have modified the current file before giving a **tag** command, you must first write it out. If you give another **tag** command with no argument, the previous ***label*** is used.

Similarly, if you press ⟨Ctrl⟩**]**, **vi** searches for the word immediately after the cursor as a tag. This is equivalent to entering ":tag", the word following the cursor, and then pressing the ⟨Return⟩ key.

The tags file is normally created by a program such as **ctags**, and consists of a number of lines with three fields separated by blanks or tabs. The first field gives the name of the tag, the second the name of the file where the tag resides, and the third gives an addressing form which can be used by the editor to find the tag. This field is usually a contextual scan using */pattern/* to be immune to minor changes in the file. Such scans are always performed as if the **nomagic** option was set. The tag names in the tags file must be sorted alphabetically.

unmap Unmaps any character or escape sequence that has been mapped using the **map** command.

Options

There are a number of options that can be set to affect the **vi** environment. These can be set with the **ex set** command while editing, with the **EXINIT** environment variable, or in the **vi** start-up file, *.exrc*. This file normally sets the user's preferred options so that they do not need to be set manually each time you invoke **vi**.

The first thing that must be done before you can use **vi**, is to set the terminal type so that **vi** understands how to talk to the particular terminal you are using.

There are only two kinds of options: switch options and string options. A switch option is either on or off. A switch is turned off by prefixing the word *no* to the name of the switch within a **set** command. String options are strings of characters that are assigned values with the syntax ***option=string***. Multiple options may be specified on a line. **vi** options are listed below:

autoindent, ai (default: **noai**)
Can be used to ease the preparation of structured program text. For each line created by an append, change, insert, open, or substitute operation, **vi** looks at the preceding line to determine and insert an appropriate amount of indentation. To back the cursor up to the preceding tab stop, press ⟨Ctrl⟩**D**. The tab stops going backward are defined as multiples of the **shiftwidth** option. You cannot backspace over the indent, except by pressing ⟨Ctrl⟩**D**.

Specially processed in this mode is a line with no characters added to it, which turns into a completely blank line (the whitespace provided for the **autoindent** is discarded). Also, specially processed in this mode are lines beginning with a caret (^) and immediately followed by a ⟨Ctrl⟩**D**. This causes the input to be repositioned at the beginning of the line, but retains the previous indent for the next line. Similarly, a "0" followed by a ⟨Ctrl⟩**D**, repositions the cursor at the beginning without retaining the previous indent. **Autoindent** does not happen in global commands.

autoprint ap (default: **ap**)
Causes the current line to be displayed after each **ex copy**, **move**, or **substitute** command. This has the same effect as supplying a trailing "p" to each such command. **Autoprint** is suppressed in globals, and only applies to the last command on a line.

autowrite, aw (default: **noaw**)
Causes the contents of the buffer to be automatically written to the current file if you have modified it when you give a **next**, **rewind**, **tag**, or **!** command, or a ⟨Ctrl⟩^ (switch files) or ⟨Ctrl⟩**]** (**goto** *tag*) command.

beautify, bf (default: **nobeautify**)
Causes all control characters except tab, newline and formfeed to be discarded from the input. A complaint is registered the first time a backspace character is discarded. **Beautify** does not apply to command input.

directory, dir (default: **dir=***/tmp*)
Specifies the directory in which **vi** places the editing buffer file. If the directory does not have write permission, the editor will exit abruptly when it fails to write to the buffer file.

edcompatible (default: **noedcompatible**)
Causes the presence or absence of **g** and **c** suffixes on substitute commands to be remembered, and to be toggled on and off by repeating the suffixes. The suffix **r** causes the substitution to be like the tilde (~) command, instead of like the ampersand (&) command.

errorbells, eb (default: **noeb**)
Error messages are preceded by a bell. If possible, the editor always places the error message in inverse video instead of ringing the bell.

hardtabs, ht (default: **ht=8**)
Gives the boundaries on which terminal hardware tabs are set or on which tabs the system expands.

ignorecase, ic (default: **noic**)
Maps all uppercase characters in the text to lowercase in regular expression matching. In addition, all uppercase characters in regular expressions are mapped to lowercase except in character class specifications enclosed in brackets.

lisp (default: **nolisp**)
Autoindent indents appropriately for LISP code, and the **( ) { } [[** and **]]** commands are modified to have meaning for LISP.

list (default: **nolist**)
All printed lines are displayed, showing tabs and end-of-lines.

magic (default: **magic**)
If **nomagic** is set, the number of regular expression metacharacters is greatly reduced, with only caret (^) and dollar sign ($) having special effects. In addition, the metacharacters tilde (~) and ampersand (&) in replacement patterns are treated as normal characters. All the normal metacharacters may be made **magic** when **nomagic** is set by preceding them with a backslash (\).

mesg (default: **nomesg**)
Causes write permission to be turned off to the terminal while you are in visual mode, if **nomesg** is set. This prevents people writing to your screen with the UNIX **write** command and scrambling your screen as you edit.

number, n (default: **nonumber**)
Causes all output lines to be printed with their line numbers.

optimize, opt (default: **optimize**)
Output of text to the screen is expedited by setting the terminal so that it does not perform automatic carriage returns when displaying more than one line of output, thus greatly speeding output on terminals without addressable cursors when text with leading whitespace is printed.

paragraphs, para (default: **para =IPLPPPQPP TPbp**)
Specifies paragraph delimiters for the { and } operations. The pairs of characters in the option's value are the names of the nroff macros that start paragraphs.

prompt (default: **prompt**)
ex input is prompted for with a colon (:). If **noprompt** is set, when **ex** command mode is entered with the **Q** command, no colon prompt is displayed on the status line.

redraw (default: **noredraw**)
The editor simulates (using great amounts of output), an intelligent terminal on a dumb terminal. Useful only at very high speed.

remap (default: **remap**)
If on, mapped characters are repeatedly tried until they are unchanged. For example, if *o* is mapped to *O* and *O* is mapped to *I*, *o* will map to *I* if remap is set, and to *O* if **noremap** is set.

report (default: **report=5**)
Specifies a threshold for feedback from commands. Any command that modifies more than the specified number of lines will provide feedback as to the scope of its changes. For global commands and the undo command, the net change in the number of lines in the buffer is presented at the end of the command. Thus notification is suppressed during a **g** command on the individual commands performed.

scroll (default: **scroll=½ window**)
Determines the number of logical lines scrolled when ⟨Ctrl⟩**D** is received from a terminal input in command mode, and the number of lines displayed by a command mode **z** command (double the value of **scroll**).

sections (default: **sections=SHNHH HU**)
Specifies the section macros for the **[[** and **]]** operations. The pairs of characters in the option's value are the names of the nroff macros that start sections.

shell, sh (default: **sh=***/bin/sh*)
Gives the pathname of the shell forked for the shell escape (!) command, and by the **shell** command. The default is taken from **SHELL** in the environment, if present.

shiftwidth, sw (default:**sw=8**)
Gives the width of a software tab stop, used in reverse tabbing with ⟨Ctrl⟩**D** when using **autoindent** to append text, and by the shift commands.

showmatch, sm (default: **nosm**)
When a "**)**" or "**}**" is typed, moves the cursor to the matching "**(**" or "**{**" for one second if this matching character is on the screen.

showmode (default:**noshowmode**)
Causes the message `INPUT MODE` to appear on the lower right corner of the screen when insert mode is activated.

slowopen (default: **noslowopen**)
Postpones update of the display during inserts.

tabstop, ts (default: **ts=8**)
The editor expands tabs in the input file to be on ***n*** boundaries for the purposes of display.

taglength, tl (default: **tl=0**)
The first ***n*** characters in a tag name are significant, but all others are ignored. A value of zero (the default) means that all characters are significant.

tags (default: **tags**=*tags /usr/lib/tags*)
A path of files to be used as tag files for the **tag** command. A requested tag is searched for in the specified files, sequentially. By default, files named *tags* are searched for in the current directory and in */usr/lib*.

term (default=value of shell **TERM** variable)
The terminal type of the output device.

terse (default: **noterse**)
Shorter error diagnostics are produced for the experienced user.

timeout [=***n***], to [=***n***] (default: **to**=***xxx***)
Milliseconds to wait for subsequent input characters. This is the maximum allowed waiting time between characters in "multicharacter" sequences, such as arrow keys or **:map** functions. If no value is given, **vi** determines the timeout period from the type and speed of the terminal connection; setting **notimeout** requires the next character to be input, and is not the same as setting **timeout** to "0" (never waiting).

warn (default: **warn**)
Warn if there has been "[No write since last change]" before a shell escape command **!**.

window (default: **window** = speed dependent)
This specifies the number of lines in a text window. The default is 8 at slow speeds (600 baud or less), 16 at medium speed (1200 baud), and the full screen (minus one line) at higher speeds.

w300, w1200, w9600
These are not true options but set **window** (above) only if the speed is slow (300), medium (1200), or high (9600), respectively.

wrapscan, ws (default: **ws**)
Searches, using the regular expressions in addressing, will wrap around past the end of the file.

wrapmargin, wm (default: **wm=0**)
Defines the margin for automatic insertion of newlines during text input. The value specified is the width of the margin at the right-hand side of the screen within which word wrap will be carried out. A newline will be inserted immediately after a word that ends in the margin. A value of zero specifies no wrap margin.

writeany, wa (default: **nowa**)
Inhibits the checks normally made before **write** commands, allowing a write to any file that the system protection mechanism will allow.

Regular expressions

A regular expression specifies a set of strings of characters. A member of this set of strings is said to be "matched" by the regular expression. **vi** remembers two previous regular expressions: the previous regular expression used in a **substitute** command and the previous regular expression used elsewhere, referred to as the previous *scanning* regular expression. The previous regular expression can always be referred to by a null regular expression: for example, " // " or " ?? ".

The regular expressions allowed by **vi** are constructed in one of two ways depending on the setting of the **magic** option. The **ex** and **vi** default setting of **magic** gives quick access to a powerful set of regular expression metacharacters. The disadvantage of **magic** is that the user must remember that these metacharacters are **magic** and precede them with the backslash (\) to use them as "ordinary" characters. With **nomagic** set, regular expressions are much simpler, there being only two metacharacters. The power of the other metacharacters is still available by preceding the now ordinary character with a " \ ". Note that " \ " is always a metacharacter. In this discussion, the **magic** option is assumed. With **nomagic**, the only special characters are the caret (^) at the beginning of a regular expression, the dollar sign ($) at the end of a regular expression, and the backslash (\). The tilde (~) and the ampersand (&) also lose their special meanings related to the replacement pattern of a substitute.

The following basic constructs are used to construct **magic** mode regular expressions.

char An ordinary character matches itself. Ordinary characters are any characters except a caret (^) at the beginning of a line, a dollar sign ($) at the end of line, a star (*) as any character other than the first, and any of the following characters:

. \ [~

These characters must be preceded by a backslash (\) if they are to be treated as ordinary characters.

^ At the beginning of a pattern, forces the match to succeed only at the beginning of a line.

$ At the end of a regular expression, forces the match to succeed only at the end of the line.

. Matches any single character except the newline character.

\< Forces the match to occur only at the beginning of a "word"; that is, either at the beginning of a line, or just before a letter, digit, or underline and after a character not one of these.

\> Similar to \<, but matching the end of a "word", that is, either the end of the line or before a character which is not a letter, a digit, or the underline character.

[*string*] Matches any single character in the class defined by ***string***. Most characters in ***string*** define themselves. A pair of characters separated by a dash (-) in **string** defines the set of characters between the specified lower and upper bounds, thus "[a-z]" as a regular expression matches any single lowercase letter. If the first character of ***string*** is a caret (^) then the construct matches those characters which it otherwise would not. Thus "[^a-z]" matches anything but a lowercase letter or a newline. To place any of the characters caret, left bracket, or dash in ***string*** they must be escaped with a preceding backslash (\).

The concatenation of two regular expressions first matches the leftmost regular expression and then the longest string that can be recognized as a regular expression. The first part of this new regular expression matches the first regular expression and the second part matches the second. Any of the single character matching regular expressions mentioned above may be followed by a star (*) to form a regular expression that matches zero or more adjacent occurrences of the characters matched by the prefixing regular expression. The tilde (~) may be used in a regular expression to match the text that defined the replacement part of the last **s** command. A regular expression may be enclosed between the sequences "\(" and "\)" to remember the text matched by the enclosed regular expression. This text can later be interpolated into the replacement text using the following notation:

\ ***digit***

where ***digit*** enumerates the set of remembered regular expressions.

The basic metacharacters for the replacement pattern are the ampersand (&) and the tilde (~); these are given as "\ &" and "\ ~" when **nomagic** is set. Each instance of the ampersand is replaced by the characters matched by the search pattern. In the replacement pattern, the tilde stands for the text of the previous replacement pattern.

Other metasequences possible in the replacement pattern are always introduced by a backslash (\). The sequence "\ ***n***" is replaced by the text matched by the ***n***th regular subexpression enclosed between "\ (" and "\ )". When nested, parenthesized subexpressions are present, ***n*** is determined by counting occurrences of "\ (" starting from the left. The sequences "\ u" and "\ l" cause the immediately following character in the replacement to be converted to uppercase or lowercase, respectively, if this character is a letter. The sequences "\ U" and "\ L" turn such conversion on, either until "\ E" or "\ e" is encountered, or until the end of the replacement pattern.

Files

/tmp	default directory where temporary work files are placed; it can be changed using the **directory** option (see the **ex**(C) **set** command).
*/usr/lib/terminfo/?/**	compiled terminal description database

Credit

This utility was developed at the University of California at Berkeley and is used with permission.

Notes

The */usr/lib/expreserve* program can be used to restore **vi** buffer files that were lost as a result of a system crash. The program searches the */tmp* directory for **vi** buffer files and places them in the directory */usr/preserve*. The owner can retrieve these files using the **-r** option.

The */usr/lib/expreserve* program must be placed in the system startup file, */etc/rc.d/3/recovery*, before the command that cleans out the */tmp* directory. See the *System Administrator's Guide* for more information on the **/etc/rc2** scripts.

Two options, although they continue to be supported, have been replaced in the documentation by the options that follow the Command Syntax Standard (see **Intro**(C)). A **-r** option that is not followed with an argument has been replaced by **-L**, and ***+command*** has been replaced by **-c *command***.

vi does not strip the high bit from 8-bit characters read in from text files, text insertion, and editing commands. It does not look for "magic numbers" of object files when reading in a text file. It also writes out text and displays text without stripping the high bit.

vi uses the **LC_CTYPE** environment variable to determine if a character is printable, displaying the octal codes of non-printable 8-bit characters. It also uses **LC_CTYPE** and **LANG** to convert between upper and lowercase characters for the tilde command and for the **ignorecase** option.

When the percent sign (%) is used in a shell escape from **vi** via the exclamation mark (!), the "%" is replaced with the name of the file being edited. In previous versions of **vi**, each character in this replacement had the high bit set to 1 to quote it; in the current version of **vi** it is left alone.

Warnings

Tampering with the entries in */usr/lib/terminfo/?/** (for example, changing or removing an entry) can affect programs such as **vi** that expect all entries to be present and correct. In particular, removing the "dumb" terminal entry may cause unexpected problems.

Software tabs using **^T** work only immediately after the **autoindent**.

Left and right shifts on intelligent terminals do not make use of insert and delete operations in the terminal.

Refer to the **crypt**(C) page for information about restrictions on the availability of encryption options.

Standards conformance

vedit and **view** are conformant with:

AT&T SVID Issue 2.

vi is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

vidi

set the font and video mode for a video device

Syntax

vidi [**-d**] [**-f** *fontfile*] *font*

vidi *mode*

Description

The **vidi** command has two functions. With arguments it loads/extracts a font or sets the video mode for the current standard input device. Without arguments, it lists all of the valid video mode and font commands.

Font options

Some video cards support changeable character fonts. Available fonts are font8x8, font8x14, and font8x16. The font options are used as follows:

vidi *font* loads *font* from */usr/lib/vidi/font*.

vidi -d *font* writes *font* to the standard output.

vidi -d -f *font fontfile* writes *font* to *fontfile*.

vidi -f *fontfile font* loads *font* from *fontfile* instead of default directory.

Mode options

vidi also sets the mode of the video adapter connected to the standard input. The modes are:

mono move current screen to the monochrome adapter.

cga move current screen to the Color Graphics adapter.

ega move current screen to the Enhanced Graphics adapter.

vga move current screen to the Video Graphics adapter.

internal activate the internal monitor on Compaq portable with a plasma screen.

external activate the external monitor on Compaq portable with a plasma screen.

Text and graphics modes

The following tables list the available modes.

Text Modes

Mode	Cols	Rows	Font	Adapter
c40x25	40	25	8x8	CGA (EGA VGA)
e40x25	40	25	8x14	EGA (VGA)
v40x25	40	25	8x16	VGA
m80x25	80	25	8x14	MONO (EGA_MONO VGA_MONO)
c80x25	80	25	8x8	CGA (EGA VGA)
em80x25	80	25	8x14	EGA_MONO (VGA_MONO)
e80x25	80	25	8x14	EGA (VGA)
vm80x25	80	25	8x16	VGA_MONO
v80x25	80	25	8x16	VGA
e80x43	80	43	8x14	EGA (VGA)

Graphics Modes

Mode	Pixel Resolution	Colors	Adapter
mode5	320x200	4	CGA (EGA VGA)
mode6	640x200	2	CGA (EGA VGA)
modeD	320x200	16	EGA (VGA)
modeE	640x200	16	EGA (VGA)
modeF	640x350	2 (mono)	EGA (VGA)
mode10	640x350	16	EGA (VGA)
mode11	640x480	2	VGA
mode12	640x480	16	VGA
mode13	320x200	256	VGA

See also

screen(HW)

Note

The **internal** and **external** commands should only be used on Compaq compatible displays.

Value added

vidi is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

vmstat

report paging and system statistics

Syntax

vmstat [**-fs**] [**-n** ***namelist***] [**-l** ***lines***] [***interval*** [***count***]]

Description

vmstat reports some statistics kept by the system on processes, demand paging, and cpu and trap activity. Three types of reports are available:

(default) A summary of the number of processes in various states, paging activity, system activity, and cpu cycle consumption.

-f Number of **fork**(S)s done.

-s A verbose listing of paging and trap activity.

If no ***interval*** or ***count*** is specified, the totals since system bootup are displayed.

If an ***interval*** is given, the number of events that have occurred in the last ***interval*** seconds is shown. If no ***count*** is specified, this display is repeated forever every ***interval*** seconds. Otherwise, when a ***count*** is also specified, the information is displayed ***count*** times.

Other flags that may be specified include:

-n ***namelist*** Use file ***namelist*** as an alternate symbol table instead of */unix*.

-l ***lines*** For the default display, repeat the header every ***lines*** reports (default is 20).

The fields in the default report are:

procs The number of processes which are:

- **r** In the run queue.
- **b** Blocked waiting for resources.
- **w** Swapped out.

These values always reflect the current situation, even if the totals since boot are being displayed.

paging — Reports on the performance of the demand paging system. Unless the totals since boot are being displayed, this information is averaged over the preceding ***interval*** seconds:

frs	Free swap space.
dmd	Demand zero and demand fill pages.
sw	Pages on swap.
cch	Pages in cache.
fil	Pages on file.
pft	Protection faults.
frp	Pages freed.
pos	Processes swapped out successfully.
pif	Processes swapped out unsuccessfully.
rso	Regions swapped out.
rsi	Regions swapped in.

system — Reports on the general system activity. Unless the totals since boot are being shown, these figures are averaged over the last ***interval*** seconds:

sy	Number of system calls.
cs	Number of context switches.

cpu — Percentage of cpu cycles spent in various operating modes:

us	User.
su	System.
id	Idle.

The **-f** and **-s** reports are a series of lines of the form:

number description

which means that ***number*** of the items described by ***description*** happened (either since boot or in the last ***interval*** seconds, as appropriate). These reports should be self-explanatory.

Files

/unix	Default namelist.
/dev/kmem	Default source of statistics.

See also

fork(S), **ps**(C), **pstat**(C)

Authorization

The behavior of this utility is affected by assignment of the **mem** authorization. If you do not have this authorization, the command will not work. Refer to the "Using a secure system" chapter of the *User's Guide* for more details.

Value added

vmstat is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

w

display information about who is on the system and what they are doing

Syntax

w [**-hlqtw**] [**-n** *namelist*] [**-s** *swapdev*] [**-u** *utmpfile*] [*users* ...]

Description

The **w** command prints a summary of the current activity on the system, including what each user is doing. The heading line shows the current time of day, how long the system has been up, the number of users logged onto the system, and load averages. Load averages are the number of processes in the run queue averaged over 1, 5, and 15 minutes.

The options are:

-h Do not print the heading or title lines.

-l Long format (default): for each user, **w** outputs the user's login name, the terminal or pseudo terminal the user is currently using, when the user logged onto the system, the number of minutes the user has been idle (how much time has expired since the user last typed anything), the CPU time used by all processes and their children attached to the terminal, the CPU time used by the currently active process, and the name and arguments of the currently active process.

-q Quick format: for each user, **w** outputs the user's login name, the terminal or pseudo terminal the user is currently using, the number of minutes the user has been idle, and the name of the currently active process.

-t Only the heading line is output (equivalent to **uptime**(C)).

-w Both the heading line and the summary of users is output.

-n*namelist* The argument is taken as the name of an alternate ***namelist*** (*/unix* is the default).

-s*swapdev* Uses the file ***swapdev*** in place of */dev/swap*. This is useful when examining a *corefile.*

-u*utmpfile* The file ***utmpfile*** is used instead of */etc/utmp* as a record of who is currently logged in.

If any ***users*** are given, the user summary is restricted to reporting on those users.

Files

/unix
/etc/utmp
/dev/kmem
/dev/swap

See also

date(C), **finger**(C), **ps**(C), **uptime**(C), **who**(C), **whodo**(C)

Notes

The "currently active process" is only an approximation and is not always correct. Pipelines can produce strange results, as can some background processes. If **w** is completely unable to guess at the currently active process, it prints "-".

Authorization

The behavior of this utility is affected by assignment of the **mem** authorization, which is usually reserved for system administrators. If you do not have this authorization, the output will be restricted to data pertaining to your activities only. Refer to the "Using a secure system" chapter of the *User's Guide* for more details.

Value added

w is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

wait

await completion of background processes

Syntax

wait

Description

The **wait** command waits until all background processes started with an ampersand (&) have finished, and reports on abnormal terminations.

wait is built in to **csh** and **sh**.

Because the **wait**(S) system call must be executed in the parent process, the shell itself executes **wait**, without creating a new process.

See also

csh(C), **sh**(C)

Notes

Not all the processes of a pipeline with three or more stages are children of the shell, and thus cannot be waited for.

Standards conformance

wait is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

wc

counts lines, words and characters

Syntax

wc [-lwc] [*names*]

Description

The **wc** command counts lines, words and characters in the named files, or in the standard input if no **names** appear. It also keeps a total count for all named files. A word is a maximal string of characters delimited by spaces, tabs, or newlines.

The options **l**, **w**, and **c** may be used in any combination to specify that a subset of lines, words, and characters are to be reported. The default is **-lwc**.

When **names** are specified on the command line, they are printed along with the counts.

Standards conformance

wc is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

what

identifies files

Syntax

what *files*

Description

The **what** command searches the given files for all occurrences of the pattern **@(#)** and prints out what follows until the first tilde (~), greater-than sign (>), new-line, backslash (\) or null character. The SCCS command **get**(CP) substitutes this string as part of the **@(#)** string.

For example, if the shell procedure in file *print* contains

```
#  @(#)this is the print program
#  @(#)syntax: print [files]
pr $* | lpr
```

then the command

what print

displays the name of the file *print* and the identifying strings in that file:

```
print:
        this is the print program
        syntax: print [files]
```

what is intended to be used with the **get**(CP) command, which automatically inserts identifying information, but it can also be used where the information is inserted manually.

See also

admin(CP), **get**(CP)

Standards conformance

what is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

who

list who is on the system

Syntax

who [-uATHldtasqbrfp] [*file*]

who am i

who am I

Description

The **who** command can list the user's name, terminal line, login time, and the elapsed time since activity occurred on the line; it also lists the process ID of the command interpreter (shell) for each current user. It examines the */etc/inittab* file to obtain information for the Comments column, and */etc/utmp* to obtain all other information. If *file* is given, that file is examined. Usually, *file* will be */etc/wtmp*, which contains a history of all the logins since the file was last created.

who with the **am i** or **am I** option identifies the invoking user.

Except for the default **-s** option, the general format for output entries is:

name [*state*] *line time activity pid* [*comment*] [*exit*]

With options, **who** can list logins, logoffs, reboots, and changes to the system clock, as well as other processes spawned by the **init** process. These options are:

-u This option lists only those users who are currently logged in. The "name" is the user's login name. The "line" is the name of the line as found in the directory */dev*. The "time" is the time that the user logged in. The "activity" is the number of hours and minutes since activity last occurred on that particular line. A dot (.) indicates that the terminal has seen activity in the last minute and is therefore "current." If more than twenty-four hours have elapsed or the line has not been used since boot time, the entry is marked "old." This field is useful when trying to determine whether a person is working at the terminal or not. The "pid" is the process ID of the user's shell. The "comment" is the comment field. It can contain information about where the terminal is located, the telephone number of the dataset, the type of terminal if hard-wired, etc.

-A This option displays UNIX accounting information.

-T This option is the same as the **-u** option, except that the "state" of the terminal line is printed. The "state" describes whether someone else can write to that terminal. A plus character (+) appears if the terminal is writable by anyone; a minus character (-) appears if it is not. *root* can write to all lines having a plus character or a minus character in the "state" field. If a bad line is encountered, a question mark (?) is displayed.

-H This option displays column headings above the regular output.

-l This option lists only those lines on which the system is waiting for someone to login. The "name" field is LOGIN in such cases. Other fields are the same as for user entries except that the "state" field does not exist.

-d This option displays all processes that have expired and have not been respawned by **init**. The "exit" field appears for dead processes and contains the termination and exit values (as returned by **wait**(C)), of the dead process. This can be useful in determining why a process terminated.

-t This option indicates the last change to the system clock (via the **date**(C)command) **su**(C).

-a This option processes the */etc/utmp* file or the named ***file*** with all options turned on.

-s This option is the default and lists only the "name", "line", and "time" fields.

-q This is a quick **who**, displaying only the names and the number of users currently logged on. When this option is used, all other options are ignored.

-b This option indicates the time and date of the last reboot.

-r This option indicates the current run level of the **init** process. In addition, it produces the process termination status, process id, and process exit status (see **utmp**(F)) under the "idle", "pid", and "comment" headings, respectively.

-f The **-f** option will suppress psuedo-ttys from **who** output, except for remote logins.

-p This option lists any other process which is currently active and has been previously spawned by **init**. The "name" field is the name of the program executed by **init** as found in */etc/inittab*. The "state", "line", and "idle" fields have no meaning. The "comment" field shows the "id" field of the line from */etc/inittab* that spawned this process. See **inittab**(F).

Files

/etc/utmp
/etc/wtmp
/etc/inittab

See also

date(C), **inittab**(F), **login**(M), **mesg**(C), **su**(C), **utmp**(F), **wait**(S)

Standards conformance

who is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

whodo

determine who is doing what

Syntax

/bin/whodo

Description

The **whodo** command produces merged, reformatted, and dated output from the **who**(C) and **ps**(C) commands.

See also

ps(C), **who**(C)

Authorization

The behavior of this utility is affected by assignment of the **mem** authorization. If you do not have this authorization, the output will be restricted to data pertaining to your activities only. Refer to the "Using a secure system" chapter of the *User's Guide* for more details.

Standards conformance

whodo is conformant with:

AT&T SVID Issue 2.

write

write to another user

Syntax

write *user* [*tty*]

Description

The **write** command copies lines from your terminal to that of another user. When first called, it sends the message:

```
Message from your-logname your-tty ...
```

The recipient of the message should write back at this point. Communication continues until an end-of-file is read from the terminal or an interrupt is sent. At that point, **write** displays:

```
(end of message)
```

on the other terminal and exits.

If you want to write to a user who is logged in more than once, the *tty* argument may be used to indicate the appropriate terminal.

Permission to receive messages from other users of the system may be granted or denied by use of the **mesg**(C) command. By default, users are not allowed to receive messages (this is for security). This may be altered by issuing the **mesg** command from the *.login* script.

If the character "!" is found at the beginning of a line, **write** calls the shell to execute the rest of the line as a command. Output from the command is sent to the terminal; it is not sent to the remote user.

The following protocol is suggested for using **write**: when you first write to another user, wait for him or her to write back before starting to send. Each party should end each message with a distinctive signal (**(o)** for "over" is conventional), indicating that the other may reply; **(oo)** for "over and out" is suggested when conversation is to be terminated.

Files

/etc/utmp	To find user
/bin/sh	To execute "!"

See also

hello(C), **mail**(C), **mesg**(C), **who**(C)

Standards conformance

write is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

x286emul

emulate XENIX 80286

Syntax

x286emul [*arg* . . .] *prog286*

Description

x286emul is an emulator that allows programs from XENIX System V/286 Release 2.3 or XENIX System V/286 Release 2.3.2 on the Intel 80286 to run on the Intel 80386 processor under UNIX System V Release 3.2 or later.

The UNIX system recognizes an attempt to **exec**(S) a 286 program, and automatically **exec**'s the 286 emulator with the 286 program name as an additional argument. It is not necessary to specify the **x286emul** emulator on the command line. The 286 programs can be invoked using the same command format as on the XENIX System V/286.

x286emul reads the 286 program's text and data into memory and maps them through the LDT (via **sysi86**(S)) as 286 text and data segments. It also fills in the jam area, which is used by XENIX programs to do system calls and signal returns. **x286emul** starts the 286 program by jumping to its entry point.

When the 286 program attempts to do a system call, **x286emul** takes control. It does any conversions needed between the 286 system call and the equivalent 386 system call, and performs the 386 system call. The results are converted to the form the 286 program expects, and the 286 program is resumed.

The following are some of the differences between a program running on a 286 and a 286 program using **x286emul** on a 386:

- Attempts to unlink or write on the 286 program will fail on the 286 with **ETXTBSY**. Under **x286emul**, they will not fail.
- **ptrace**(S) is not supported under **x286emul**.
- The 286 program must be readable for the emulator to read it.

File

/bin/x286emul The emulator must have this name and be in */bin* if it is to be automatically invoked when **exec**(S) is used on a 286 program.

xargs

construct and execute commands

Syntax

xargs [*flags*] [*command* [*initial-arguments*]]

Description

The **xargs** command combines the fixed *initial-arguments* with arguments read from the standard input to execute the specified *command* one or more times. The number of arguments read for each *command* invocation and the manner in which they are combined are determined by the flags specified.

command, which may be a shell file, is searched for using the shell **$PATH** variable. If *command* is omitted, **/bin/echo** is used.

Arguments read in from standard input are defined to be contiguous strings of characters delimited by one or more blanks, tabs, or newlines; empty lines are always discarded. Blanks and tabs may be embedded as part of an argument if escaped or quoted: Characters enclosed in quotes (single or double) are taken literally, and the delimiting quotes are removed. Outside of quoted strings, a backslash (\) will escape the next character.

Each argument list is constructed starting with the *initial-arguments*, followed by some number of arguments read from standard input (exception: see **-i** flag). Flags **-i**, **-l**, and **-n** determine how arguments are selected for each command invocation. When none of these flags are coded, the *initial-arguments* are followed by arguments read continuously from standard input until an internal buffer is full, and *command* is executed with the accumulated args. This process is repeated until there are no more args. When there are flag conflicts (for example, **-l** vs. **-n**), the last flag has precedence. *flag* values are:

-l*number* *command* is executed for each *number* lines of nonempty arguments from the standard input. This is instead of the default single line of input for each *command*. The last invocation of *command* will be with fewer lines of arguments if fewer than *number* remain. A line is considered to end with the first newline *unless* the last character of the line is a blank or a tab; a trailing blank/tab signals continuation through the next nonempty line. If *number* is omitted, 1 is assumed. Option **-x** is forced.

-i*replstr* Insert mode: ***command*** is executed for each line from the standard input, taking the entire line as a single argument, inserting it in ***initial-arguments*** for each occurrence of ***replstr***. A maximum of 5 arguments in ***initial-arguments*** may each contain one or more instances of ***replstr***. Blanks and tabs at the beginning of each line are thrown away. Constructed arguments may not grow larger than 255 characters, and option **-x** is also forced. "{}" is assumed for ***replstr*** if not specified.

-n*number* Executes ***command***, using as many standard input arguments as possible, up to the ***number*** of arguments maximum. Fewer arguments are used if their total size is greater than ***size*** characters, and for the last invocation if there are fewer than ***number*** arguments remaining. If option **-x** is also coded, each ***number*** of arguments must fit in the ***size*** limitation, or **xargs** terminates execution.

-t Trace mode: the ***command*** and each constructed argument list are echoed to file descriptor 2 just prior to their execution.

-p Prompt mode: the user is prompted whether to execute ***command*** at each invocation. Trace mode (**-t**) is turned on to display the command instance to be executed, followed by a "?..." prompt. A reply of "y" (optionally followed by anything), will execute the command; anything else, including a carriage return, skips that particular invocation of ***command***.

-x Causes **xargs** to terminate if any argument list would be greater than ***size*** characters; **-x** is forced by the options **-i** and **-l**. When none of the options **-i**, **-l**, or **-n** are coded, the total length of all arguments must be within the ***size*** limit.

-s*size* The maximum total size of each argument list is set to ***size*** characters; ***size*** must be a positive integer less than or equal to 470. If **-s** is not coded, 470 is taken as the default. Note that the character count for ***size*** includes one extra character for each argument and the count of characters in the command name.

-e*eofstr* ***eofstr*** is taken as the logical end-of-file string. Underscore (_) is assumed for the logical EOF string if **-e** is not coded. **-e** with no ***eofstr*** coded turns off the logical EOF string capability (underscore is taken literally). **xargs** reads standard input until either end-of-file or the logical EOF string is encountered.

xargs terminates if it either receives a return code of **-1** from, or if it cannot execute, ***command***. When ***command*** is a shell program, it should explicitly **exit** (see **sh**(C)) with an appropriate value to avoid accidentally returning with **-1**.

Examples

The following will move all files from directory $1 to directory $2, and echo each move command just before doing it:

```
ls $1 | xargs -i -t mv $1/{} $2/{}
```

The following will combine the output of the parenthesized commands onto one line, which is then echoed to the end-of-file *log*:

```
(logname; date; echo $0 $*) | xargs >>log
```

The user is prompted to enter which files in the current directory are to be printed and prints them one at a time:

```
ls | xargs -p -l lpr
```

or many at a time:

```
ls | xargs -p -l | xargs lpr
```

The following will execute **diff**(C) with successive pairs of arguments originally entered as shell arguments:

```
echo $* | xargs -n2 diff
```

Standards conformance

xargs is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

xtod

change file format from UNIX to MS-DOS

Syntax

xtod [*filename*] > [*output.file*]

Description

The **xtod** command converts a file from UNIX format to MS-DOS format. The MS-DOS files terminate a line of text with a carriage return and a linefeed, while UNIX files terminate a line with a linefeed only. Also MS-DOS places a ⟨Ctrl⟩**z** at the end of a file, while UNIX does not. Some programs and utilities are sensitive to this difference and some are not. If a text or data file is not being interpreted correctly, use the **dtox** and **xtod** conversion utilities. The **xtod** command adds the extra carriage return to the end of each line and adds the ⟨Ctrl⟩**z** to the end of the file. This utility is not required for converting binary object files.

If no filename is specified on the command line, **xtod** takes input from standard input. Output of the utility goes to standard output.

See also

dtox(C)

xtract

extract a file from a cpio archive and stop.

Syntax

extract *cpio_options pattern archive*

Description

xtract is used to extract a single file from a **cpio** archive. Unlike using **cpio** directly, this allows for the quick extraction of a single file without reading the entire archive. The extraction is performed using the **-iv** options.

See also

cpio(C)

Standards conformance

xtract is conformant with:

AT&T SVID Issue 2.

yes

print string repeatedly

Syntax

yes [*string*]

Description

yes repeatedly outputs "y", or if a single string argument is given, **arg** is output repeatedly. The command will continue indefinitely unless aborted. This is useful in pipes to commands that prompt for input and require a "y" response for a yes. In this case, **yes** terminates when the command it pipes to terminates, so that no infinite loop occurs.

Miscellaneous (M)

Intro

introduction to miscellaneous features and files

Description

This section contains miscellaneous information useful in maintaining the system. Included are descriptions of files, devices, tables and programs that are important in maintaining the entire system.

aio

Asynchronous Disk I/O ioctl commands

Syntax

#include <sys/async.h>
int ioctl (*fildes, command, arg*)
int *fildes, command, arg;*

Description

AIO I/O control commands (ioctls) are a subset of **ioctl**(S) system calls that perform asynchronous I/O operations on raw disk partitions. This allows a program to do other processing while the kernel performs the I/O requests; a later **ioctl** command polls the status of issued operations. A program may have several disk partitions open, and have multiple AIO requests issued to each partition.

Use of AIO requires disk driver support; all SCO hard disk drivers support AIO. The **DKIOCASTAT ioctl** can be used to query whether a given open file descriptor supports AIO.

AIO supports the option of locking an area of physical memory for the use of AIO transfers; this can be configured by the UNIX system administrator by using the */usr/lib/aiomemlock* file and the **/etc/aiolkinit** command. AIO can be performed whether or not such a lock is available.

Command functions

DKIOCMLOCK Signals the intent of the program to perform AIO on the provided file descriptor; this call also locks physical memory if this is permitted for the user. The ***arg*** argument to **ioctl** points to the following structure:

```
typedef struct  asyncmlock
{
    char  *avaddr;  /* starting user virtual addr */
    uint   asize;    /* size of area to be locked */
} ASYNCMLOCK;
```

The area of memory spanned by the **ASYNCMLOCK** structure must already be allocated to the calling program, for example, by a previous call to **malloc**(S). If **asize** is 0, or the user does not have AIO memory lock privileges, **DKIOCMLOCK** does not lock physical memory, but returns without an error. Possession of memory locking privileges by a user does not affect the success or failure of a locking call, but determines whether or not the call does anything.

Similarly, a memory locking length of zero is not an error, but is treated as a no-op.

If the program is doing AIO to multiple partitions, **DKIOCMLOCK** must be called on each open file descriptor. The **DKIOCMLOCK** for all calls by one process must refer to the same area of memory, and **DKIOCMLOCK** should only be called once for each file descriptor. Memory should not be locked more than once for any file descriptor.

On failure, **errno** is set to one of the following values:

[EAGAIN] No internal AIO per-process structure could be allocated (too many processes doing AIO).

[EFAULT] The ***arg*** pointer is not within the user's space, or the memory area specified is not within the user's space.

[EINVAL] **DKIOCMLOCK** has been called with different **ASYNCMLOCK** values than a previous call, or AIO is not supported for this fd, or AIO has not been linked into the running kernel.

[ENOMEM] Not enough memory was available to satisfy the lock request.

DKIOCASTRT Initiates an AIO request. ***arg*** is a pointer to the following structure:

```
typedef struct  areqbuf {
        long    au_cmd;
        long    au_daddr;
        char    *au_maddr;
        long    au_size;
        char    *au_ref;
} AREQBUF;

/*
 * Command bits
 */

#define AU_READ          01
#define AU_WRITE         02
```

`au_cmd` is set to either **AU_READ** or **AU_WRITE**.

`au_daddr` is the (512 byte) disk block number where the I/O is to start from.

`au_maddr` is the user's address for I/O.

`au_size` is the length in bytes of the transfer.

`ar_ref` is a context pointer for the caller's use. It is returned with the status from the I/O request.

The AIO facility imposes restrictions on the I/O request parameters. `au_size` must be a multiple of 512 (that is, only multiples of 512 byte disk blocks are permitted). `au_maddr` must be aligned on a 512 byte address boundary. The entire transfer must fit within an MMU page, that is, within a 4K aligned page in the user's space. Finally, for a given process doing asynchronous I/O only one memory range can be locked, and the same range must be specified for all file descriptors; otherwise an error will result.

On failure, AIO sets **errno** to one of the following values (the disk driver itself may set other values on errors).

[EFAULT] The arg pointer is not within the user's space, or the transfer address is not in the user's space.

[EINVAL] One of the above alignment restrictions has been violated, `au_cmd` is unrecognized, the user has locked AIO memory and the transfer is not within this locked range, AIO is not supported for this file descriptor, or AIO has not been linked into the running kernel.

[EAGAIN] Some AIO resource could not be allocated (for example, too many AIO requests for the system, or for this user).

[ENXIO] The disk block was beyond the range of the partition.

DKIOCASTAT Returns information for any completed requests (up to 15) on this file descriptor. If more than 15 requests have been issued on this file descriptor, or if all the requests have not completed, then **DKIOCASTAT** will need to be called more than once.

DKIOCASTAT also determines whether a particular open file descriptor supports AIO. If AIO is not supported, the ioctl returns -1, and **errno** is set to **EINVAL**.

arg is a pointer to an **ASYNCSTATUS** structure, which is filled in by the **ioctl** system call:

```
#define MAXSTATUS       15

typedef struct asyncstatus
{
        long            acount;
        IOSTAT          astatus[MAXSTATUS];
} ASYNCSTATUS;


typedef struct aiostat
{
        short   iostatus;
        short   iobsize;
        char    *iomaddr;
        char    *ioref;
} IOSTAT;
```

`acount` is set to the number of **IOSTAT** structures actually returned in this call. `iostatus` is set to 0 for a successful I/O request, and to nonzero (typically a valid **errno** code) on an error. `iobsize` is set to the number of bytes transferred. `iomaddr` is the user's transfer address as given in the **AREQBUF** structure, and `ioref` is the context pointer; these two values associate the returned status with the initial request.

On failure, AIO sets **errno** to one of the following values:

[EFAULT]

1 The *arg* pointer is not within the user's space.

2 AIO is not supported by this driver, or AIO is not configured into the kernel.

Diagnostics

The AIO ioctls return 0 on success, and -1 on error.

See also

aio(F), **aioinfo**(ADM), **aiolkinit**(ADM), **aiomemlock**(F)

ascii

map of the ASCII character set

Description

ascii is a map of the 7-bit ASCII character set. It lists both octal and hexadecimal equivalents of each character. It contains:

Octal

000 nul	001 soh	002 stx	003 etx	004 eot	005 enq	006 ack	007 bel
010 bs	011 ht	012 nl	013 vt	014 np	015 cr	016 so	017 si
020 dle	021 dc1	022 dc2	023 dc3	024 dc4	025 nak	026 syn	027 etb
030 can	031 em	032 sub	033 esc	034 fs	035 gs	036 rs	037 us
040 sp	041 !	042 "	043 #	044 $	045 %	046 &	047 '
050 (	051)	052 *	053 +	054 ,	055 -	056 .	057 /
060 0	061 1	062 2	063 3	064 4	065 5	066 6	067 7
070 8	071 9	072 :	073 ;	074 <	075 =	076 >	077 ?
100 @	101 A	102 B	103 C	104 D	105 E	106 F	107 G
110 H	111 I	112 J	113 K	114 L	115 M	116 N	117 O[
120 P	121 Q	122 R	123 S	124 T	125 U	126 V	127 W
130 X	131 Y	132 Z	133 [	134 \	135]	136 ^	137 _
140 '	141 a	142 b	143 c	144 d	145 e	146 f	147 g
150 h	151 i	152 j	153 k	154 l	155 m	156 n	157 o
160 p	161 q	162 r	163 s	164 t	165 u	166 v	167 w
170 x	171 y	172 z	173 {	174 |	175 }	176 ~	177 del

Hexadecimal

00 nul	01 soh	02 stx	03 etx	04 eot	05 enq	06 ack	07 bel
08 bs	09 ht	0a nl	0b vt	0c np	0d cr	0e so	0f si
10 dle	11 dc1	12 dc2	13 dc3	14 dc4	15 nak	16 syn	17 etb
18 can	19 em	1a sub	1b esc	1c fs	1d gs	1e rs	1f us
20 sp	21 !	22 "	23 #	24 $	25 %	26 &	27 '
28 (	29)	2a *	2b +	2c ,	2d -	2e .	2f /
30 0	31 1	32 2	33 3	34 4	35 5	36 6	37 7
38 8	39 9	3a :	3b ;	3c <	3d =	3e >	3f ?
40 @	41 A	42 B	43 C	44 D	45 E	46 F	47 G
48 H	49 I	4a J	4b K	4c L	4d M	4e N	4f O
50 P	51 Q	52 R	53 S	54 T	55 U	56 V	57 W
58 X	59 Y	5a Z	5b [	5c \	5d]	5e ^	5f _
60 '	61 a	62 b	63 c	64 d	65 e	66 f	67 g
68 h	69 i	6a j	6b k	6c l	6d m	6e n	6f o
70 p	71 q	72 r	73 s	74 t	75 u	76 v	77 w
78 x	79 y	7a z	7b {	7c |	7d }	7e ~	7f del

The extended 8-bit ASCII character set is shown here, again with the octal and hexadecimal value of each character. The **mapchan**(C) utility allows access to these characters. Display of these characters is dependent on the capabilities of the hardware device. (A ▩ indicates an unassigned character.)

Octal

200 ▩	201 ▩	202 ▩	203 ▩	204 ind	205 nel	206 ssa	207 esa
210 hts	211 htj	212 vts	213 pld	214 plu	215 ri	216 ss2	217 ss3
220 dcs	221 pu1	222 pu2	223 sts	224 cch	225 mw	226 spa	227 epa
230 ▩	231 ▩	232 ▩	233 csi	234 st	235 osc	236 pm	237 apc
240 nbsp	241 ¡	242 ¢	243 £	244 ¤	245 ¥	246 ¦	247 §
250 ¨	251 ©	252 ª	253 «	254 ¬	255 shy	256 ®	257 ¯
260 °	261 ±	262 ²	263 ³	264 ´	265 µ	266 ¶	267 ·
270 ¸	271 ¹	272 º	273 »	274 ¼	275 ½	276 ¾	277 ¿
300 À	301 Á	302 Â	303 Ã	304 Ä	305 Å	306 Æ	307 Ç
310 È	311 É	312 Ê	313 Ë	314 Ì	315 Í	316 Î	317 Ï
320 Ð	321 Ñ	322 Ò	323 Ó	324 Ô	325 Õ	326 Ö	327 ▩
330 Ø	331 Ù	332 Ú	333 Û	334 Ü	335 Ý	336 Þ	337 ß
340 à	341 á	342 â	343 ã	344 å	345 æ	346 æ	347 ç
350 è	351 é	352 ê	353 ë	354 ì	355 í	356 î	357 ï
360 ð	361 ñ	362 ò	363 ó	364 ô	365 õ	366 ö	367 ▩
370 ø	371 ù	372 ú	373 û	374 ü	375 ý	376 þ	377 ÿ

Hexadecimal

80 ▩	81 ▩	82 ▩	83 ▩	84 ind	85 nel	86 ssa	87 esa
88 hts	89 htj	8a vts	8b pld	8c plu	8d ri	8e ss2	8f ss3
90 dcs	91 pu1	92 pu2	93 sts	94 cch	95 mw	96 spa	97 epa
98 ▩	99 ▩	9a ▩	9b csi	9c st	9d osc	9e pm	9f apc
a0 nbsp	a1 ¡	a2 ¢	a3 £	a4 ¤	a5 ¥	a6 ¦	a7 §
a8 ¨	a9 ©	aa ª	ab «	ac ¬	ad shy	ae ®	af ¯
b0 °	b1 ±	b2 ²	b3 ³	b4 ´	b5 µ	b6 ¶	b7 ·
b8 ¸	b9 ¹	ba º	bb »	bc ¼	bd ½	be ¾	bf ¿
c0 À	c1 Á	c2 Â	c3 Ã	c4 Ä	c5 Å	c6 Æ	c7 Ç
c8 È	c9 É	ca Ê	cb Ë	cc Ì	cd Í	ce Î	cf Ï
d0 Ð	d1 Ñ	d2 Ò	d3 Ó	d4 Ô	d5 Õ	d6 Ö	d7 ▩
d8 Ø	d9 Ù	da Ú	db Û	dc Ü	dd Ý	de Þ	df ß
e0 à	e1 á	e2 â	e3 ã	e4 ä	e5 å	e6 æ	e7 ç
e8 è	e9 é	ea ê	eb ë	ec ì	ed í	ee î	ef ï
f0 ð	f1 ñ	f2 ò	f3 ó	f4 ô	f5 õ	f6 ö	f7 ▩
f8 ø	f9 ù	fa ú	fb û	fc ü	fd ý	fe þ	ff ÿ

File

/usr/pub/ascii

chrtbl

create a ctype locale table

Syntax

chrtbl [*specfile*]

Description

The utility **chrtbl** is provided to allow new **LC_CTYPE** locales to be defined; it reads a specification file, containing definitions of the attributes of characters in a particular character set, and produces a binary table file, to be read by **setlocale**(S), which determines the behavior of the **ctype**(S) and **conv**(S) routines.

The information supplied in the specification file consists of lines in the following format:

char type conv

The three fields, which are separated by space or tab characters, have the following meanings and syntax:

char This is the character which is being defined. It may be specified in one of six different ways (the following examples all specify the ASCII character "A"):

65	decimal
0101	octal
0x41	hexadecimal
'A'	quoted character
'\101'	quoted octal
'\x41'	quoted hexadecimal

type This specifies the classification of the character, as reported by the **ctype**(S) routines. There are 7 basic classifications:

C	iscntrl
D	sdigit
L	islower
P	ispunct
S	isspace
U	isupper
X	isxdigit

Other ctype macros use combinations of these 7 basic classifications. Zero, one or more of these classification letters can be specified, in any order, although only certain combinations are logically reasonable, as follows:

C	control character
CS	spacing control character
U	uppercase alphabetic
UX	uppercase alphabetic hex digit
UL	dual case character
L	lowercase alphabetic
LX	lowercase alphabetic hex digit
DX	decimal and hex digit
S	spacing character
P	punctuation (all other printing chars)
blank	undefined (all classifications false)

conv This optional field specifies the corresponding uppercase character for a lowercase character, or the corresponding lowercase character for an uppercase character. Dual case characters should have their own values repeated in this field.

The syntax is as for the ***char*** field.

All characters following a hash (#) are treated as a comment and ignored up to the end of the line, unless the hash is within a quoted character.

The initial **LC_CTYPE** table used is that for the **ascii**(M) character set, with the entries for the higher 128 characters (0x80 - 0xff) set to zero (that is, all classifications false). Thus an empty specification file will result in a table for US ASCII. Any specifications found in the input to **chrtbl** will overwrite the specifications for that character only, thus additions and modifications to the ASCII table can be made without respecifying those characters which are unchanged.

The binary table output is placed in a file named *ctype*, within the current directory. This file should be copied or linked to the correct place in the *setlocale* file tree (see **locale**(M)). To prevent accidental corruption of the output data, the file is created with no write permission; if the **chrtbl** utility is run in a directory containing a write-protected "ctype" file, the utility will ask if the existing file should be replaced; any response other than "yes" or "y" will cause **chrtbl** to terminate without overwriting the existing file.

If the ***specfile*** argument is missing, the specification information is read from the standard input.

Diagnostics

If the input table file cannot be opened for reading, processing will terminate with the error message, "Cannot open specification file".

Any lines in the specification file which are syntactically incorrect will cause an error message to be issued to the standard error output, specifying the line number on which the error was detected. The line will be ignored, and processing will continue.

If the output file, "ctype", cannot be opened for writing, processing will terminate with the error message, "Cannot create table file."

Any error conditions encountered will cause the program to exit with a non-zero return code; successful completion is indicated with a zero return code.

Specification file format

The **chrtbl** specification file has the following format (the order of the specifications is not significant):

```
#
# chrtbl file for TVI 7-bit Spanish character set
# Note that only non-ASCII characters need be specified
#
'@'     P               # inverted ?
'['     L       ']'     # n tilde
'\\'    P               # inverted !
']'     U       '['     # N tilde
'~'     P               # degree sign
```

File

/usr/include/ctype.h

See also

ascii(M), **conv**(S), **ctype**(S), **locale**(M), **setlocale**(S)

Value added

chrtbl is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

clone

open any minor device on a STREAMS driver

Description

clone is a STREAMS software driver that finds and opens an unused minor device on another STREAMS driver. The minor device passed to **clone** during the open is interpreted as the major device number of another STREAMS driver for which an unused minor device is to be obtained. Each such open results in a separate stream to a previously unused minor device.

The **clone** driver consists solely of an open function. This open function performs all of the necessary work so that subsequent system calls (including **close**(S)) require no further involvement of **clone**.

clone will generate an **ENXIO** error, without opening the device, if the minor device number provided does not correspond to a valid major device, or if the driver indicated is not a STREAMS driver.

clone will generate an **ENODEV** error, without opening the device, if a pipe cannot be created.

Warnings

Multiple opens of the same minor device cannot be done through the **clone** interface. Executing **stat**(S) on the file system node for a cloned device yields a different result from executing **fstat**(S) using a file descriptor obtained from opening the node.

See also

log(M), **pipe**(ADM), **pipe**(S)

STREAMS Programmer's Guide

coltbl

create a collation locale table

Syntax

coltbl [*specfile*]

Description

The utility **coltbl** is provided to allow **LC_COLLATE** locales to be defined. It reads in a specification file (or standard input if *specfile* is not defined), containing definitions for a particular locale's collation ordering, and produces a concise format table file, to be read by **setlocale**(S).

In general, characters may be specified in one of six different ways (the following examples all specify the ASCII character "A"):

65	decimal
0101	octal
0x41	hexadecimal
'A'	quoted character
'\101'	quoted octal
'\x41'	quoted hexadecimal

The information in the specification file is to an extent free format. A particular type of definition is started by one of the following keywords:

PRIM: ZERO: EQUIV: DOUBLE:

The keywords, **PRIM:**, **ZERO:** and **EQUIV:**, are concerned directly with the setting of the collation ordering of characters.

A group of characters which are to be collated as equal, unless all other characters in a pair of strings are also equal, are grouped together with the **PRIM:** keyword. The position of a particular group in the specification file is significant as far as the collation ordering is concerned. Collating elements following the **PRIM:** keyword are separated by white spaces. A two-character collating element can be specified here by *(ab)*, where *a* and *b* are the two characters making up the sequence. The order of the collating elements defined in one group is significant in secondary collation ordering. It is also possible to define a range of characters, for example:

PRIM: *'a' - 'z'*

Collating elements following the **ZERO:** keyword, are to be ignored when collating. The format of the definitions is the same as with **PRIM:**. Ranges of characters can also be defined, as for example:

ZERO: 0x80 - 0x9f

EQUIV: is used to give two collating elements identical positions in the collation ordering. The syntax is:

EQUIV: *a* = *b*

where *a* and *b* are the two equal collating elements. There can be only one definition for each occurrence of this keyword.

Single characters which are to be collated as two characters, for example the German sharp s, are defined with the **DOUBLE:** keyword. The syntax is:

DOUBLE: *a* = (*b c*)

where *a* is the single character, and *b* and *c* are the two characters in the collating sequence. There can be only one definition for each occurrence of this keyword. The single character *a* must not also appear after a **PRIM:**, a **ZERO:** or an **EQUIV:** keyword.

All characters following the hash character are treated as a comment and ignored up to the end of the line, unless the hash is within a quoted string.

The concise format locale table is placed in a file named *collate* in the current directory. This file should be copied or moved to the correct place in the **setlocale**(S) file tree (see **locale**(M)). To prevent accidental corruption of the output data, the file is created with no write permission; if the **coltbl** utility is run in a directory containing a write-protected *collate* file, the utility will ask if the existing file should be replaced - any response other than "yes" or "y" will cause **coltbl** to terminate without overwriting the existing file.

See also

chrtbl(M), **collation**(S), **locale**(M), **mestbl**(M), **montbl**(M), **numtbl**(M), **setlocale**(S), **timtbl**(M)

Diagnostics

All error messages printed are self explanatory.

Value added

coltbl is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

console

system console device

Description

The file */dev/console* is the device used by the system administrator for system maintenance (single-user) operations. It is the tty to which the first default shell is attached.

The system console device can be either a terminal (a serial adapter device, *tty1a*) or a sytem keyboard display adapter monitor (*tty01*).

Many programs, such as the UNIX kernel, redirect error messages to */dev/console*. Initially */dev/console* is linked to */dev/systty*.

File

/dev/console

See also

boot(HW), **screen**(HW), **systty**(M), **tty**(M)

Notes

/dev/console should not be enabled: instead either the the display adapter (*tty01*) or the serial adapter device (*tty1a*) should be enabled.

A serial console cannot be attached to a multiport card or one that uses special drivers; it must be on a standard COM1 card.

daemon.mn

micnet mailer daemon

Syntax

/usr/lib/mail/daemon.mn [-ex]

Description

The mailer daemon performs the "backend" networking functions of the **mail**, **rcp**, and **remote** commands by establishing and servicing the serial communication link between computers in a Micnet network.

When invoked, the daemon creates multiple copies of itself, one copy for each serial line used in the network. Each copy opens the serial line, creates a startup message for the *LOG* file, and waits for a response from the daemon at the other end. The startup message lists the names of the machines to be connected, the serial line to be used, and the current date and time. If the daemon receives a correct response, it establishes the serial link and adds the message "first handshake complete" to the *LOG* file. If there is no response, the daemon waits indefinitely.

If invoked with the **-x** switch, the daemon records each transmission in the *LOG* file. A transmission entry shows the direction of the transmission (tx for transmit, rx for receive), the number of bytes transmitted, the elapsed time for the transmission (in minutes and seconds), and the time of day of the transmission (in hours, minutes, and seconds). Each entry has the form:

```
direction  byte_count  elapsed_time  time_of_day
```

The daemon also records the date and time every hour. The date and time have the same format as described for the **date** command.

If invoked with the **-e** switch, the daemon records all transmission errors in the *LOG* file. An error entry shows the cause of the error preceded by the name of the daemon subroutine which detected the error.

The mailer daemon is normally invoked by the **start** option of the **netutil** command and is stopped by the **stop** option.

During the normal course of execution, the mailer daemon uses several files in the */usr/spool/micnet/remote* directory. These files provide storage for *LOG* entries, commands issued by the **remote**(C) command, and a list of processes under daemon control.

Files

/usr/lib/mail/daemon.mn
/usr/spool/micnet/remote//LOG*
/usr/spool/micnet/remote//mn*
*/usr/spool/micnet/remote/local/mn**
/usr/spool/micnet/remote/lock
/usr/spool/micnet/remote/pids

See also

netutil(ADM)

Value added

daemon.mn is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

environ

the user environment

Description

The user environment is a collection of information about a user, such as login directory, mailbox, and terminal type. The environment is stored in special "environment variables," which can be assigned character values, such as names of files, directories, and terminals. These variables are automatically made available to programs and commands invoked by the user. The commands can then use the values to access the user's files and terminal.

The following is a short list of commonly used environment variables.

PATH Defines the search path for the directories containing commands. The system searches these directories whenever a user types a command without giving a full pathname. The search path is one or more directory names separated by colons (:). Initially, **PATH** is set to *:/bin:/usr/bin*.

HOME Names the user's login directory. Initially, **HOME** is set to the login directory given in the user's *passwd* file entry.

EDITOR Used to set the editor. The default editor is **ed**(C). Using **vi** as an example, for Bourne Shell users, the syntax is:

EDITOR = /bin/vi

For C-Shell users, the syntax is:

setenv EDITOR /bin/vi

EXINIT Used to set **vi** options and define **vi** abbreviations and mappings. For Bourne Shell users, the syntax is:

EXINIT = *'set options'*

For C-Shell users, the syntax is:

setenv EXINIT *'set options'*

For example, a C-Shell user might place the following command in **$HOME**/*.cshrc*:

setenv EXINIT 'set wm=24 | map g 1G'

This would automatically set **vi**'s wrapmargin option to 24 and would define the "g" key to move to the top of the file (just as "G" moves to the bottom of the file).

You can set more than one option with the same **set** command. If you define abbreviations or mappings with this environment variable, you must separate the **abbr** and **map** commands from the **set** command and from each other with a bar (|). The function of the bar is similar to that of the semicolon that separates commands on a shell command line.

If you are defining many customizations, you might prefer to use the *.exrc* file, where each command can be listed one per line (see **vi**(C)).

TERM Defines the type of terminal being used. This information is used by commands such as **more**(C) which rely on information about the capabilities of the user's terminal. The variable may be set to any valid terminal name (see **terminals**(M)) directly or by using the **tset**(C) command.

TZ Defines time zone information. This information is used by **date**(C) to display the appropriate time. The variable may have any value of the form:

std offset [***dst*** [***offset***],[***start*** [***/time***], ***end*** [***/time***]]]

(You may also have:

std offset [***dst*** [***offset***];[***start*** [***/time***], ***end*** [***/time***]]]

which is the XENIX format. Note that this format is not POSIX compatible.)

std, the standard local time zone abbreviation (1-9 characters), and ***offset***, the difference between the local time and GMT, are the only mandatory fields.

offset should be specified as:

[+ | -] ***hh*** [***:mm*** [***:ss***]]

where ***hh*** is hours (0-24), ***mm*** is minutes (0-59), and ***ss*** is seconds (0-59). Only the hours field is mandatory. If ***offset*** is preceded by a minus (-), it is east of the Prime Meridian, otherwise it is assumed to be west (this can be specified with an optional plus (+)).

dst is a 1-9 character abbreviation for the local summertime timezone. If ***dst*** is not specified, the system will not be aware of summertime; it will always be on standard time.

The ***offset*** after ***dst*** is the difference between local standard time and local summertime. If you do not specify an offset, it is assumed to be one hour. (This is usually what you want.)

Everything following the second ***offset*** is the rule for when to change from standard to summertime. ***start/time*** is when the change to summertime occurs; ***end/time*** is when the time changes back. (Note that, for systems in the Southern Hemisphere, ***start/time*** does not have to come earlier in the year than ***end/time***.)

start and ***end*** describe the day, while ***time*** specifies the time. **time** is specified in the same way as ***offset*** (see above), but the leading "+" or "-" is not valid. If ***time*** is not specified, it is assumed to be 02:00:00 (2 A.M.).

start and ***end*** can be specified in any of the following ways:

J*n* The Julian day (1-365). Leap years are not counted; February 28 is day 59 and March 1 is day 60, always.

n The zero-based Julian day (0-365); you can refer to February 29 in a leap year.

W*n.d* The *d*th day (0-6, where 0 is Sunday) of week ***n*** (1-4).

M*m.n.d* The *d*th day (0-6, where 0 is Sunday) of week ***n*** (1-5) of month ***m*** (1-12). If you specify the week (***n***) as 5, this means the last ***d*** day in ***m*** month, as in M8.5.1 which would be the last Monday in August.

If you specify the comma starting off the summertime rule, it is advisable to specify the rest of the rule.

A sample **TZ** for Eastern Standard Time, EST, might look like this:

```
EST5:00:00EDT4:00:00,M4.1.0/2:00:00,M10.5.0/2:00:00.
```

We start off with "EST5:00": this names our time zone and defines it as five hours west of Greenwich Mean Time. Summertime in this locale is called EDT (Eastern Daylight Time), and is four hours ahead of GMT. Summertime starts on a Sunday in the first week in April at 2 A.M., and standard time resumes on the last Sunday in October at 2 A.M.

Refer to the **tz**(M) and **timezone**(F) manual pages for more information on **TZ**.

HZ Defines, with a numerical value, the number of clock interrupts per second. The value of this variable is dependent on the hardware, and configured in the file */etc/initscript*. If **HZ** is not defined, programs which depend on this hertz value, such as **prof**(CP) and **times**(S), will not run.

LANG Represents the international **locale** in the format ***language_territory.codeset***. This is used by **setlocale**(S) to establish the default **locale** on program startup.

Individual locale-specific functions can be affected independently using the following optional environment variables:

LC_CTYPE Locale affecting character classification routines (**ctype**(S)).

LC_NUMERIC Locale affecting numeric formatting.

LC_TIME Locale affecting time and date format.

LC_COLLATE Locale affecting collation/sorting sequence.

LC_MESSAGES Locale affecting message language.

LC_MONETARY Locale affecting currency formatting.

The environment can be changed by assigning a new value to a variable. An assignment has the form:

name = value

For example, the assignment:

TERM=h29

sets the **TERM** variable to the value "h29". The new value can be "exported" to each subsequent invocation of a shell by exporting the variable with the **export** command (see **sh**(C)) or by using the **env**(C) command.

You may also add variables to the environment, but you must be sure that the new names do not conflict with exported shell variables such as **MAIL, PS1, PS2,** and **IFS.** Placing assignments in the *.profile* file is a useful way to change the environment automatically before a session begins.

Note that the environment is made available to all programs as an array of strings. Each string has the form:

name=value

where the ***name*** is the name of an exported variable and the ***value*** is the variable's current value. For programs started with a **exec**(S) call, the environment is available through the external pointer **environ.** For other programs, individual variables in environment are available through **getenv**(S) calls.

See also

env(C), **exec**(S), **getenv**(S), **initscript**(F), **locale**(M), **login**(M), **profile**(M), **setlocale**(S), **sh**(C), **timezone**(F), **tz**(F)

Standards conformance

environ is conformant with:

AT&T SVID Issue 2;
IEEE POSIX Std 1003.1-1990 System Application Program Interface (API) [C Language] (ISO/IEC 9945-1);
and NIST FIPS 151-1.

error

kernel error output device

Description

System error messages are collected and made available to error logging daemons through the */dev/error* device. */dev/error* is a read-only device which returns one error per read and no EOF character. The **/etc/rc2** scripts use a utility to read messages from */dev/error* and write them to the system error log file */usr/adm/messages*:

```
/etc/logger /dev/error /usr/adm/messages &
```

Any process can read */dev/error* or arrange to be signaled when errors are queued in */dev/error*. The following **ioctl** causes the error device to signal the process with **SIGUSR1** when an error message is queued in */dev/error*.

```
#include <signal.h>
#include <sys/eio.h>
#include <fcntl.h>
...
int fd;
...
fd = open("/dev/error", O_RDONLY);
ioctl(fd, EMSG_SIG, SIGUSR1);
```

Before exiting, the process must return */dev/error* to its normal state. Do this with the following **ioctl**:

```
...
ioctl(fd,EMSG_NOSIG, 0);
...
```

Panic error messages are not logged in */dev/error*.

File

/dev/error

Value added

error is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

fcntl

file control options

Syntax

#include <fcntl.h>

Description

The **fcntl**(S) function provides for control over open files. This include file describes requests and arguments to **fcntl** and **open**(S).

```
/* Flag values accessible to open(S) and fcntl(S) */
/*  (The first three can only be set by open) */
#define  O_RDONLY   0
#define  O_WRONLY   1
#define  O_RDWR     2
#define  O_NDELAY   04       /* Non-blocking I/O */
#define  O_APPEND   010      /* append (writes guaranteed at the end) */
#define  O_SYNC     020      /* synchronous write option */

/* Flag values accessible only to open(S) */
#define  O_CREAT    00400    /* open with file create (uses third open arg)*/
#define  O_TRUNC    01000    /* open with truncation */
#define  O_EXCL     02000    /* exclusive open */

/* fcntl(S) requests */
#define  F_DUPFD    0        /* Duplicate fildes */
#define  F_GETFD    1        /* Get fildes flags */
#define  F_SETFD    2        /* Set fildes flags */
#define  F_GETFL    3        /* Get file flags */
#define  F_SETFL    4        /* Set file flags */
#define  F_GETLK    5        /* Get file lock */
#define  F_SETLK    6        /* Set file lock */
#define  F_SETLKW   7        /* Set file lock and wait */
#define  F_CHKFL    8        /* Check legality of file flag changes */

/* file segment locking control structure */
struct flock {
         short   l_type;
         short   l_whence;
         long    l_start;
         long    l_len;      /* if 0 then until EOF */
         short   l_sysid;    /* returned with F_GETLK*/
         short   l_pid;      /* returned with F_GETLK*/
}

/* file segment locking types */
#define  F_RDLCK    01       /* Read lock */
#define  F_WRLCK    02       /* Write lock */
#define  F_UNLCK    03       /* Remove locks */
```

See also

fcntl(S), **open**(S)

Standards conformance

fcntl is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

getclk

get string from real-time clock

Syntax

/etc/getclk

Description

getclk gets a string suitable for **date**(C) from the real-time clock and writes it to *stdout*. It returns exit code 1 if it doesn't work, or 0 if successful.

See also

date(C)

getty, uugetty

set terminal type, modes, speed, and line discipline

Syntax

/etc/getty [-h] [-t *timeout*] *line* [*speed* [*type* [*linedisc*]]]

/etc/getty -c *file*

/usr/lib/uucp/uugetty [-a[-d *dialer*]] [-t *timeout*] *line* [*speed* [*type* [*linedisc*]]]

/usr/lib/uucp/uugetty -c *file*

Description

uugetty - permit logins over bidirectional lines

getty is a program that is invoked by **init**(M). It is the second process in the series, (**init-getty-login-shell**), that ultimately connects a user with the UNIX system. **getty** uses **initcond**(ADM) to secure the terminal for logins.

In previous versions, **getty** was complemented by the command **uugetty**, which allowed bidirectional line use. In this release of UNIX, **uugetty** exists as a shell script that calls **getty**, which now recognizes all the arguments required by **uugetty**.

Initially **getty** displays the login message field for the entry it is using from */etc/gettydefs*. **getty** reads the user's login name and invokes the **login**(M) command with the user's name as argument. While reading the name, **getty** attempts to adapt the system to the speed and type of device being used.

line is the name of a tty line in */dev* to which **getty** is to attach itself. **getty** uses this string as the name of a file in the */dev* directory to open for reading and writing.

The available options are as follows:

-a Enables automatic baud rate detection. The baud rate is detected by reading the dialer entry in */usr/lib/uucp/Devices* (or the equivalent file if the system has been customized).

-d *dialer* Specifies ***dialer*** to be used for automatic baud rate detection. This option is ignored if the dialer entry is present in */usr/lib/uucp/Devices* or the equivalent file.

-t *timeout* Specifies that **getty** should exit if the open on the line succeeds and there is no response to the login prompt in ***timeout*** seconds.

line Defines the name of the line to which **getty** will attach itself. The line name will point to an entry in the */dev* directory: for example, */dev/tty00*.

speed Defines the entry to use from the */etc/gettydefs* file. The entry defines the line speed, the login message, the initial tty setting, and the next speed to try if the user says the speed is inappropriate (by sending a break character). If no speed is supplied, the first entry in */etc/gettydefs* is used. If */etc/gettydefs* cannot be read, a default *speed* of 300 baud is used.

type Defines the type of terminal connected to the line. The default terminal is **none**, representing a normal terminal unknown to the system. For terminal type to have any meaning, the virtual terminal handlers must be compiled into the operating system. They are available, but not compiled in the default condition.

linedisc Sets the line discipline to use on the line. The hooks for line disciplines are available in the operating system; four are available, numbered **LDISC0 - LDISC4**. The default is **LDISC0**.

-h This argument is provided for internal use by **ct**, and is not documented here.

-c *file* Checks the speed and tty definitions in *file* and sends the results to standard output. Unrecognized modes and improperly constructed entries are reported. For correct entries, flag values are printed. *file* is replaced by */etc/gettydefs* or a similarly structured file.

getty displays the login message before reading the user's name a character at a time. If a null character (or framing error) is received, it is assumed to be the result of the user pressing the ⟨Break⟩ key. This will cause **getty** to attempt the next *speed* in the series determined by what it finds in the file */etc/gettydefs*.

The user's name is terminated by a new-line or carriage-return character. This is used to define the subsequent treatment of carriage returns (see **ioctl**(S)).

The user's name is scanned to see if it contains any lowercase alphabetic characters. **getty** suggests that the user use all lowercase characters. If the user uses uppercase characters, the system is told to map any future uppercase characters into the corresponding lowercase characters.

Finally, **login** is executed with the user's name as an argument. Additional arguments may be typed after the login name. These are passed to **login**, which will place them in the environment (see **login**(M)).

A check option is provided. When **getty** is invoked with the **-c** option and *file*, it scans the file as if it were scanning */etc/gettydefs* and prints out the results to the standard output. If there are any unrecognized modes or improperly constructed entries, it reports these. If the entries are correct, it displays the values of the various flags. See **ioctl**(S) to interpret the values. Note that some values are added to the flags automatically.

Files

/etc/gettydefs
/etc/issue
/usr/lib/uucp/Devices

See also

ct(C), **cu**(C), **dial**(ADM), **gettydefs**(F), **init**(M), **initcond**(ADM), **inittab**(F), **ioctl**(S), **login**(M), **tty**(HW), **uucico**(ADM).

Notes

While **getty** understands simple single character quoting conventions, it is not possible to quote certain special control characters used by **getty**. Thus, you cannot log in via **getty** and type a #, @, /, !, _, ^U, ^D, & or backspace as part of your login name or arguments. **getty** uses them to determine when the end of the line has been reached, which protocol is being used, and what the erase character is. They will always be interpreted as having these special meanings.

ct will not work when **[uu]getty** is used with an intelligent modem such as penril or ventel.

In order for a line to be used in both directions, there must be an entry for that line in */usr/lib/uucp/Devices*.

If a line is being used in both directions, **[uu]getty** will wait to read a character before it outputs the login message, thus preventing two **getty**s from looping.

[uu]getty allows users to log in on bidirectional lines, but if the line is free **uucico**, **cu**, or **ct** can use it for dialing out. The implementation depends on the fact that **uucico**, **cu**, and **ct** create lock files when devices are used. When the open returns (or when the first character is read when the line is being used in both directions) the status of the lock file indicates whether the line is being used by **uucico**, **cu**, **ct**, or by someone trying to log in. Note that when the line is being used in both directions, several carriage-return characters may be required before the login message is output. Human users should be able to handle this slight inconvenience. **uucico** trying to log in will have to be told by using the following login script:

```
"" \r\d\r\d\r\d\r in:--in: ...
```

where the ... is whatever would normally be used for the login sequence.

If */etc/gettydefs* is unreadable, **getty** sets the ***speed*** of the interface to 300 baud, specifies that raw mode will be used (awaken on every character), that echo will be suppressed, either parity allowed, that new-line characters will be converted to carriage return-line feed, and that tab expansion is performed on the standard output.

If there is a **getty** on one end of a direct line between two machines, there must be a **getty** or **uugetty** on the other end as well. Here is an */etc/inittab* entry using **getty** on an intelligent modem or direct line:

```
30:2:respawn:/usr/lib/uucp/uugetty -t 60 tty00 1200
```

init, telinit

process control initialization

Syntax

/etc/init [0123456SsQqabc]

/bin/telinit [0123456SsQqabc]

Description

init - A general process spawner started during the last phase of kernel initialization.

telinit - **telinit** is a link to init. When the command **telinit** is run, **init** is invoked.

init is a general process spawner. Its primary role is to create processes from information stored in the file */etc/inittab* (see **inittab**(F) for further details).

At any given time, the system is in one of eight possible run-levels. A run-level is a software configuration of the system under which only a selected group of processes exist. The processes spawned by **init** for each of these run-levels are defined in */etc/inittab*. **init** can be in one of eight run-levels, **0-6** and **S** or **s** (run-levels **S** and **s** are identical). The run-level changes when a privileged user runs **/etc/init**. This user-spawned **init** sends appropriate signals to the original **init** spawned by the operating system when the system was booted, telling it which run-level to change to.

If the file */etc/default/boot* contains the string **MAPKEY=YES**, **init** invokes the **mapkey** program (see **mapkey**(M)) to map the console keyboard. If the call to **mapkey** succeeds, the console is set to 8-bits no parity. If the call fails, and the string **SERIAL8=YES** appears in */etc/default/boot*, a serial console device is assumed and set to 8-bits no parity. For additional information on keywords, see the "Default file Settings" section of **boot**(HW).

The following are the arguments to **init**:

0 shut the machine down so it is safe to remove the power. Have the machine remove power if it can. This state can be executed only from the console.

1 put the system in single-user mode. Unmount all file systems except *root*. All user processes are killed except those connected to the console. This state can be executed only from the console.

2 put the system in multiuser mode. All multiuser environment terminal processes and daemons are spawned. This state is commonly referred to as the multiuser state.

3 start the remote file sharing processes and daemons. Mount and advertise remote resources. Run-level **3** extends multiuser mode and is known as the remote-file-sharing state.

4 is available to be defined as an alternative multiuser environment configuration. It is not necessary for system operation and is usually not used.

5 Stop the UNIX system and go to the firmware monitor.

6 Stop the UNIX system and reboot to the state defined by the **initdefault** entry in */etc/inittab*.

a,b,c process only those */etc/inittab* entries having the **a, b** or **c** run-level set. These are pseudo-states, which may be defined to run certain commands, but which do not cause the current run-level to change.

Q,q re-examine */etc/inittab*.

S,s enter single-user mode. When this occurs, the terminal which executed this command becomes the system console (see "Notes" for more information about console device assignment). This is the only run-level that doesn't require the existence of a properly formatted */etc/inittab* file. If this file does not exist, then by default the only legal run-level that **init** can enter is the single-user mode. When the system enters **S** or **s**, all mounted file systems remain mounted and only processes spawned by **init** are killed.

When a UNIX system is booted, **init** is invoked and the following occurs. **init** first looks in */etc/default/boot* to determine if **autoboot** on panic is desired. **init** then looks to see if **DEFAULT_LEVEL=*n*** is specified in */etc/default/boot*. If it is, then ***n*** is the default level, otherwise, the user is prompted to see if they wish to go to multiuser or system maintenance mode (single-user mode). In the single-user state, the virtual console terminal is assigned to the user's terminal and is opened for reading and writing. The **sulogin** command, which requires the user to enter the *root* password, is invoked and a message is generated on the physical console saying where the virtual console has been relocated. Use either **init** or **telinit** to signal **init** to change the run-level of the system. Note that if the shell is terminated (via an end-of-file), **init** will only re-initialize to the single-user state if the */etc/inittab* file does not exist.

If a **0** through **6** is entered, **init** enters the corresponding run-level. Note that, on the 80386 computer, the run-levels **0, 1, 5,** and **6** are reserved states for shutting the system down; the run-levels **2, 3,** and **4** are available as normal operating states.

On your computer, the run-levels **0** and **1** are reserved states for shutting the system down, and run-levels **2, 3,** and **4** are available as normal operating states.

If this is the first time since power up that **init** has entered a run-level other than single-user state, **init** first scans */etc/inittab* for **boot** and **bootwait** entries (see **inittab**(F)). These entries are performed before any other processing of */etc/inittab* takes place, providing that the run-level entered matches that of the entry. In this way, any special initialization of the operating system, such as mounting filesystems, can take place before users are allowed onto the system. **init** then scans */etc/inittab* and executes all other entries that are to be processed for that run-level.

In a multiuser environment, */etc/inittab* is set up so that **init** will create a **getty** process for each terminal that the administrator sets up to respawn.

To spawn each process in */etc/inittab*, **init** reads each entry and for each entry that should be respawned, it forks a child process. **init** spawns each process by forking a shell to run the job in. To set up the environment for this shell, **init** uses the */etc/initscript* file which contains the definitions of some global variables, for example, **TZ**, **HZ**, and **PATH**. (For more information about */etc/initscript*, see **initscript**(F).)

After **init** has spawned all of the processes specified by */etc/inittab*, it waits for one of its descendant processes to die, a powerfail signal, or a signal from another **init** or **telinit** process to change the system's run-level. When one of these conditions occurs, **init** re-examines */etc/inittab*. New entries can be added to */etc/inittab* at any time; however, **init** still waits for one of the above three conditions to occur before re-examining */etc/inittab*. To get around this, an **init Q** or **init q** command wakes **init** to re-examine */etc/inittab* immediately.

When **init** comes up at boot time and whenever the system changes from the single-user state to another run state, **init** sets the **ioctl**(S) states of the virtual console to those modes saved in the file */etc/ioctl.syscon*. This file is written by **init** whenever the single-user state is entered.

When a run-level change request is made, **init** sends the warning signal (**SIGTERM**) to all processes that are undefined in the target run-level. **init** waits 5 seconds before forcibly terminating these processes via the kill signal (**SIGKILL**).

The shell running on each terminal will terminate when the user types an end-of-file or hangs up. When **init** receives a signal telling it that a process it spawned has died, it records the fact and the reason it died in */etc/utmp* and */etc/wtmp* if it exists (see **who**(C)). A history of the processes spawned is kept in */etc/wtmp*.

If **init** receives a "powerfail" signal (**SIGPWR**) it scans */etc/inittab* for special entries of the type "powerfail" and "powerwait". These entries are invoked (if the run-levels permit) before any further processing takes place. In this way **init** can perform various cleanup and recording functions during the power-down of the operating system. Note that in the single-user states, **S** and **s**, only "powerfail" and "powerwait" entries are executed. **telinit**, which is linked to **/etc/init**, is used to direct the actions of **init**. It takes a one-character argument and signals **init** to take the appropriate action.

Files

/etc/default/boot
/etc/inittab
/etc/utmp
/etc/wtmp
/etc/ioctl.syscon
/etc/initscript
/dev/console
/dev/contty

See also

boot(HW), **disable**(C), **enable**(C), **getty**(M), **gettydefs**(F), **initcond**(ADM), **initscript**(F), **inittab**(F), **kill**(S), **login**(M), **sh**(C), **shutdown**(M), **stty**(C), **sulogin**(ADM), **termio**(HW), **utmp**(F), **who**(C)

Diagnostics

If **init** finds that it is respawning an entry from */etc/inittab* more than 10 times in 2 minutes, it will assume that there is an error in the command string in the entry, and generate an error message on the system console. It will then refuse to respawn this entry until either 5 minutes has elapsed or it receives a signal from a user-spawned **init (telinit)**. This prevents **init** from eating up system resources when someone makes a typographical error in the *inittab* file or a program is removed that is referenced in */etc/inittab*.

When attempting to boot the system, failure of **init** to prompt for a new run-level may be because the virtual system console is linked to a device other than the physical system console.

Notes

init and **telinit** can be run only by someone who is super user.

The **S** or **s** state must not be used indiscriminately in the */etc/inittab* file. A good rule to follow when modifying this file is to avoid adding this state to any line other than the **initdefault**.

The assignment of the console device may seem confusing at first. Whenever the system is rebooted, the first boot up messages will be displayed on the "normal" system console (*tty01*), then the prompt for going multiuser will be displayed on the the tty from which **init S** was last invoked, which could be any tty on the system. The system console device (*/dev/syscon*) remains linked to the tty from which the last **init S** is invoked. Rebooting the system does **not** reset this to *tty01*.

If the */etc/initscript* file is not present, **init** will print a warning on the console and spawn the job without setting up the global environment.

The change to */etc/gettydefs* described in the "Notes" section of the **gettydefs**(F) manual page will permit terminals to pass 8 bits to the system as long as the system is in multiuser state (run-level greater than 1). When the system changes to single-user state, the **getty** is killed and the terminal attributes are lost. To permit a terminal to pass 8 bits to the system in single-user state, after you are in single-user state, type:

stty -istrip cs8

The */etc/TIMEZONE* file should exist. **/etc/initscript** tries to execute this file to set the correct **TZ** variable for the system.

Standards conformance

init is conformant with:

AT&T SVID Issue 2.

isverify

verify ISAM database records

Syntax

isverify [-Iilpyn] ***tablelist***

Description

isverify detects and, if specified, repairs inconsistencies between ISAM (Indexed Sequential Access Method) data (*.dat*) files and index (*.idx*) files. The **isverify** utility checks that every valid record in the data file is properly represented in the index file; it also checks that every index entry points to a valid data record.

tablelist is the list of tables to be checked by **isverify**. The *.dat* and *.idx* suffixes should not be included in the ***tablelist***.

Options

You can specify any of the following flags when invoking **isverify**:

-I after a system restore, an ISAM application can fail with the message:

```
Error: Incorrect SCO Runtime System installed
```

You can correct this situation by logging in as *root* and invoking **isverify -I**.

-i check only the index file (as opposed to checking both the index and the data files) for consistency. Use this option as a quick check if you think the data files are probably not corrupted.

-l prints a long listing of the information for each defined key (index), along with the associated data record pointer. The key value for each data record is displayed by key part, along with the byte position of the data record in the data file. This information is useful only if you understand the Indexed Sequential Access Method (ISAM).

-p pauses after displaying information about each index. If you select this option, you must press the ⟨Bksp⟩ key before the **isverify** process continues.

-y causes **isverify** to assume a "yes" answer to each error state and to attempt to make the specified correction. It is recommended that you use this flag so that the **isverify** utility attempts to correct any discrepancies automatically.

-n causes **isverify** to assume a "no" answer to each error state and to leave the files unchanged. It also allows you see where errors are by displaying them on the screen.

Whether or not you use **isverify** with the **-l** or **-p** flags, if an error is detected, you have the option of making a correction or leaving the files unchanged. If no errors are detected, no response is required. If you choose to make a correction, **isverify** attempts to repair the files. Unless the **-y** or **-n** flags are specified on the command line, you must choose interactively whether or not to make each correction.

jagent

host control of windowing terminal

Syntax

#include <sys/jioctl.h>

ioctl (*cntlfd*, **JAGENT**, &*arg*)
int *cntlfd*
struct bagent *arg*

Description

The **ioctl**(S) system call, when performed on an **xt**(HW) device with the **JAGENT** request, allows a host program to send information to a windowing terminal.

ioctl has three arguments:

cntlfd the **xt** control channel file descriptor

JAGENT the **xt ioctl** request to invoke a windowing terminal agent routine.

arg the address of a **bagent** structure, defined in *<sys/jioctl.h>* as follows:

```
struct  bagent {
  long  size;  /* size of src in & dest out */
  char  *src;  /* the source byte string */
  char  *dest; /* the destination byte string */
};
```

The `src` pointer must be initialized to point to a byte string which is sent to the windowing terminal. See **layers**(M) for a list of **JAGENT** strings recognized by windowing terminals. Likewise, the `dest` pointer must be initialized to the address of a buffer to receive a byte string returned by the terminal. When **ioctl** is called, the `size` argument must be set to the length of the `src` string. Upon return, `size` is set by **ioctl** to the length of the destination byte string, `dest`.

See also

ioctl(S), **layers**(M), **libwindows**(S), **xt**(HW)

Diagnostics

Upon successful completion, the size of the destination byte string is returned. If an error occurs, -1 is returned.

layers

protocol used between host and windowing terminal under layers(C)

Syntax

#include <sys/jioctl.h>

Description

layers are asynchronous windows supported by the operating system in a windowing terminal. Communication between the UNIX system processes and terminal processes under **layers**(C) occurs via multiplexed channels managed by the respective operating systems using a protocol as specified in **xtproto**(M).

To use **layers**, you must have configured the *xt* driver. This is done using the **mkdev layers** script. For more information, see **mkdev**(ADM).

The contents of packets transferring data between a UNIX system process and a layer are asymmetric. Data sent from the UNIX system to a particular terminal process is undifferentiated and it is up to the terminal process to interpret the contents of packets.

Control information for terminal processes is sent via channel 0. Process 0 in the windowing terminal performs the designated functions on behalf of the process connected to the designated channel. These packets take the form:

command, channel

except for **timeout** and **jagent** information which take the form:

command, data...

The commands are the bottom eight bits extracted from the following **ioctl**(S) codes:

JBOOT Prepare to load a new terminal program into the designated layer.

JTERM Kill the downloaded layer program and restore the default window program.

JTIMO Set the timeout parameters for the protocol. The data consists of two bytes: the value of the receive timeout in seconds and the value of the transmit timeout in seconds.

JTIMOM Set the timeout parameters for the protocol. The data consists of four bytes in two groups: the value of the receive timeout in milliseconds (the low eight bits followed by the high eight bits) and the value of the transmit timeout (in the same format).

JZOMBOOT Like **JBOOT**, but do not execute the program after loading.

JAGENT Send a source byte string to the terminal agent routine and wait for a reply byte string to be returned.

The data are from a **bagent** structure (see **jagent**(M)) and consists of a one-byte size field followed by a two-byte agent command code and parameters. Two-byte integers transmitted as part of an agent command are sent with the high-order byte first. The response from the terminal is generally identical to the command packet, with the two command bytes replaced by the return code: 0 for success, -1 for failure. Note that the routines in the **libwindows**(S) library all send parameters in an **agentrect** structure. The agent command codes and their parameters are as follows:

A_NEWLAYER followed by a two-byte channel number and a rectangle structure (four two-byte coordinates).

A_CURRENT followed by a two-byte channel number.

A_DELETE followed by a two-byte channel number.

A_TOP followed by a two-byte channel number.

A_BOTTOM followed by a two-byte channel number.

A_MOVE followed by a two-byte channel number and a point to move to (two two-byte coordinates).

A_RESHAPE followed by a two-byte channel number and the new rectangle (four two-byte coordinates).

A_NEW followed by a two-byte channel number and a rectangle structure (four two-byte coordinates).

A_EXIT no parameters needed.

A_ROMVERSION no parameters needed. The response packet contains the size byte, two-byte return code, two unused bytes, and the parameter part of the terminal id string (for example, "8;7;3").

Packets from the windowing terminal to the UNIX system all take the following form:

command, data...

The single-byte commands are as follows:

C_SENDCHAR Send the next byte to the UNIX system process.

C_NEW Create a new UNIX system process group for this layer. Remember the window size parameters for this layer. The data for this command is in the form described by the **jwinsize** structure. The size of the window is specified by two 2-byte integers, sent low byte first.

C_UNBLK Unblock transmission to this layer. There is no data for this command.

C_DELETE Delete the UNIX system process group attached to this layer. There is no data for this command.

C_EXIT Exit. Kill all UNIX system process groups associated with this terminal and terminate the session. There is no data for this command.

C_DEFUNCT Layer program has died: send a terminate signal to the UNIX system process groups associated with this terminal. There is no data for this command.

C_SENDNCHARS The rest of the data are characters to be passed to the UNIX system process.

C_RESHAPE The layer has been reshaped. Change the window size parameters for this layer. The data takes the same form as for the **C_NEW** command.

See also

jagent(M), **layers**(C), **libwindows**(S), **mkdev**(ADM), **xt**(HW), **xtproto**(M)

ld, idld

invoke the link editor

Syntax

ld [*options*] *filename*

Description

idld - invoke the link editor

The **ld** command combines several object files into one, performs relocation, resolves external symbols, and supports symbol table information for symbolic debugging. It creates an executable program by combining one or more object files and copying the executable result to the file *a.out*. The ***filename*** must name an object or library file. By convention these names have the ".o" (for object) or ".a" (for archive library) extensions. If more than one name is given, the names must be separated by one or more spaces. If any input file, ***filename***, is not an object file, **ld** assumes it is either an archive library or a text file containing link editor directives. By default, the file *a.out* is executable if no errors occurred during the load. If errors occur while linking, **ld** displays an error message; the resulting *a.out* file is unexecutable.

ld concatenates the contents of the given object files in the order given in the command line. Library files in the command line are examined only if there are unresolved external references encountered from previous object files.

The library is searched iteratively to satisfy as many references as possible and only those routines that define unresolved external references are concatenated. The library (archive) symbol table (see **ar**(F)) is searched sequentially with as many passes as are necessary to resolve external references which can be satisfied by library members. Thus, the ordering of library members is functionally unimportant, unless multiple library members exist defining the same external symbol. The library may be either a relocatable archive library or a shared library. Object and library files are processed at the point they are encountered in the argument list, so the order of files in the command line is important. In general, all object files should be given before library files. **ld** sets the entry point of the resulting program to the beginning of the first routine.

ld should be invoked using the **cc**(CP) command instead of invoking it directly. **cc** invokes **ld** as the last step of compilation, providing all the necessary C-language support routines. Invoking **ld** directly is not recommended since failure to give command line arguments in the correct order can result in errors.

Generating COFF vs. x.out binaries

When **ld** is called, it scans all the object files that are to be linked. If they are all COFF objects, then the resulting binary will be in COFF format. If any of the object files to be linked are in *x.out* format, any COFF modules in the group will be converted to *x.out* and the resulting binary will be in *x.out* format.

Common options

The following options are recognized by **ld**, and are common to producing both COFF and *x.out* binaries. Refer to the sections "Linking COFF binaries" and "Linking x.out binaries" for options specific to producing these binaries.

-o ***name*** Sets the executable program filename to ***name*** instead of *a.out*.

-r XENIX VERSION: invokes the incremental linker, **/lib/ldr**, with the arguments passed to **ld** to produce a relocatable output file.

AT&T VERSION: retains relocation entries in the output object file. Relocation entries must be saved if the output file is to become an input file in a subsequent **ld** run. The link editor will not complain about unresolved references, and the output file will not be executable.

-s Strips line number entries and symbol table information from the output object file.

-u ***symbol*** Designates the specified ***symbol*** as undefined. This is useful for loading entirely from a library, since initially the symbol table is empty and an unresolved reference is needed to force the loading of the first routine. The placement of this option on the **ld** line is significant; it must be placed before the library which will define the symbol.

-V Outputs a message giving information about the version of **ld** being used.

Linking COFF binaries

The following options are recognized by **ld** for linking COFF binaries:

-e ***epsym*** Set the default entry point address for the output file to be that of the symbol ***epsym***.

-f ***fill*** Set the default fill pattern for "holes" within an output section as well as initialized **bss** sections. The argument ***fill*** is a two-byte constant.

-l*x* Search a library *libx.a*, where ***x*** is up to nine characters. A library is searched when its name is encountered, so the placement of a **-l** is significant. By default, libraries are located in **LIBDIR** or **LLIBDIR**.

-m Produce a map or listing of the input/output sections on the standard output.

-a Create an absolute file. This is the default if the **-r** option is not used. Used with the **-r** option, **-a** allocates memory for common symbols.

-t Turn off the warning about multiply-defined symbols that are not the same size.

-x Do not preserve local symbols in the output symbol table; enter external and static symbols only. This option saves some space in the output file.

-z Do not bind anything to address zero. This option will allow runtime detection of null pointers.

-L *dir* Change the algorithm of searching for *libx.a* to look in ***dir*** before looking in **LIBDIR** and **LLIBDIR**. This option is effective only if it precedes the **-l** option on the command line.

-M Output a message for each multiply-defined external definition.

-N Put the text section at the beginning of the text segment rather than after all header information, and put the data section immediately following text in the core image.

-VS *num* Use ***num*** as a decimal version stamp identifying the *a.out* file that is produced. The version stamp is stored in the optional header.

-Y[LU],*dir* Change the default directory used for finding libraries. If **L** is specified, the first default directory which **ld** searches, **LIBDIR**, is replaced by ***dir***. If **U** is specified and **ld** has been built with a second default directory, **LLIBDIR**, then that directory is replaced by ***dir***. If **ld** was built with only one default directory and **U** is specified, a warning is printed and the option is ignored.

Linking x.out binaries

The user must make sure that the most recent library versions have been processed with **ranlib**(CP) before linking. Library files for *x.out* format binaries must be in **ranlib**(CP) format: that is, the first member must be named **__.SYMDEF**, which is a dictionary for the library. **ld** compares the modification dates of the library and the **__.SYMDEF** entry, so if object files have been added to the library since **__SYMDEF** was created, the link may result in an "invalid object module" that cannot run.

The following options are recognized by **ld** for linking *x.out* binaries:

-A ***num*** Creates a standalone program whose expected load address (in hexadecimal) is ***num***. This option sets the absolute flag in the header of the *a.out* file. Such program files can only be executed as standalone programs. Options **-A** and **-F** are mutually exclusive.

-B ***num*** Sets the text selector bias to the specified hexadecimal number.

-c ***num*** Alters the default target CPU in the *x.out* header. ***num*** can be 0, 1, 2, or 3 indicating 8086, 80186, 80286 and 80386 processors, respectively. The default on 8086/80286 systems is 0. The default on 80386 systems is 3. Note that this option only alters the default; if object modules containing code for a higher numbered processor are linked, then that will take precedence over the default.

-C Causes the link editor to ignore the case of symbols.

-D ***num*** Sets the data selector bias to the specified hexadecimal number.

-F ***num*** Sets the size of the program stack to ***num*** bytes where num is a hexadecimal number. This option is ignored for 80386 programs which have a variable sized stack. By default 8086 programs have a variable stack located at the top of the first data segment, and 80286 programs have a fixed size 4096 byte stack. The **-F** option is incompatible with the **-A** option that cannot be opened by more than one user at the same time.

-g Includes symbolic information for **sdb**.

-i Creates separate instruction and data spaces for small model programs. When the output file is executed, the program text and data areas are allocated separate physical segments. The text portion will be read-only and shared by all users executing the file.

-La Sets advisory file locking. Advisory locking is used on files with access modes that do not require mandatory locking.

-Lm Sets mandatory file locking. Mandatory file locking is used on files that cannot be opened by more than one process at a time.

-m*name* Creates a link map file named ***name*** that includes public symbols.

-M*x* Specifies the memory model. ***x*** can have the following values:

s	small
m	middle
l	large
h	huge
e	mixed

-n *num* Truncates symbols to the length specified by **num**.

-N *num* Sets the pagesize to hex-**num** (which should be a multiple of 512) - the default is 1024 for 80386 programs. 8086/80186/80286 programs do not normally have page-aligned *x.out* files and the default for these is 0.

-P Disables packing of segments

-R Ensures that the relocation table is of non-zero size. Important for 8086 compatibility.

-Rd *num* Specify the data segment relocation offset (80386 only). ***num*** is hexadecimal.

-Rt *num* Specify the text segment relocation offset (80386 only). ***num*** is hexadecimal.

*-S **num*** Sets the maximum number of segments to ***num***. If no argument is given, the default is 128.

Files

/bin/ld	
LIBDIR/*libx.a*	libraries
LLIBDIR/*libx.a*	libraries
a.out	output file
LIBDIR	usually */lib*
LLIBDIR	usually */usr/lib*

See also

a.out(FP), **ar**(F), **as**(CP), **cc**(CP), **end**(S), **exit**(S), **masm**(CP), **mkshlib**(CP), **ranlib**(CP)

Notes

Through its options and input directives, the common link editor gives users great flexibility; however, those who use the input directives must assume some added responsibilities. Input directives and options should insure the following properties for programs:

- C defines a zero pointer as null.
- A pointer to which zero has been assigned must not point to any object.

To satisfy this, users must not place any object at virtual address zero in the program's address space.

When the link editor is called through **cc**(CP), a startup routine is linked with the user's program. This routine calls **exit**() (see **exit**(S)) after execution of the main program. If the user calls the link editor directly, then the user must insure that the program always calls **exit**() rather than falling through the end of the entry routine.

The symbols **etext**, **edata**, and **end** (see **end**(S)) are reserved and are defined by the link editor. It is incorrect for a user program to redefine them.

If the link editor does not recognize an input file as an object file or an archive file, it will assume that it contains link editor directives and will attempt to parse it. This will occasionally produce an error message complaining about "syntax errors".

Arithmetic expressions may only have one forward referenced symbol per Expression.

If you are using XENIX binaries, please refer to the manual entry for this utility in the *XENIX Development Guide* for information on the appropriate usage with XENIX binaries.

Standards conformance

ld is conformant with:

AT&T SVID Issue 2.

locale

the international locale

Syntax

language [_ [***territory***] [. [***codeset***]]]

"C"

Description

The international locale is a definition of the local conventions to be used by UNIX libraries (and hence utilities and applications) for features whose behavior varies internationally.

The locale is specified by a character string of the form:

language_territory.codeset

where:

language represents both the language of text files being used, and the preferred language for messages (where the utility or application is capable of displaying messages in many languages),

territory represents the geographical location (usually the country) determining such factors as currency and numeric formats, and

codeset represents the character set in use for the internal representation of text.

The locale string "french_canada.8859" could therefore represent a Canadian user using the French language, processing data using the ISO 8859/1 standard international character set.

Each element (***language***, ***territory*** or ***codeset***) can be up to 14 characters long, and should use only alphanumeric ASCII characters (see **ascii**(M)).

Note that the locale is not required to be completely specified: ***territory*** and ***codeset*** are optional. When a locale is incompletely specified, missing values are sought in the following sequence:

1. For each subclass, such as **LC_TIME**, in an environment variable of the same name as the subclass.
2. In the **LANG** environment variable.
3. In the file */etc/default/lang*.

The special locale string "C", used to represent the minimal environment needed for the C programming language, is taken to be equivalent to "english_us.ascii".

The format of the file */etc/default/lang* is at least one line, of the form:

LANG="*language_territory.codeset*"

A partly specified locale string will be expanded to the first **LANG=** entry in which the specified locale fields match.

Thus if the */etc/default/lang* file contains the following:

```
LANG=english_us.ascii
LANG=english_uk.8859
LANG=french_france.8859
```

A locale string "english_uk" will get expanded to "english_uk.8859", whereas a locale string "french" will get expanded to "french_france.8859".

The information used to configure a particular locale is generated by the utilities **chrtbl**(M), **coltbl**(M), **mestbl**(M), **montbl**(M), **numtbl**(M) and **timtbl**(M). The output files produced by these utilities (*ctype*, *collate*, *currency*, *messages*, *numeric* and *time* respectively) must be installed in the correct place in the directory structure */usr/lib/lang*. The correct directory name is found by substituting the language, territory and codeset names into the string "*/usr/lib/lang/language/territory/codeset*". The files should be installed into this directory with their existing file name (such as *ctype*).

A suggested naming convention for locales is as follows:

language The name of the language, in English, such as: english, french, german.

territory The name of the nation, in English, such as: us, uk, canada, france, germany, switzerland.

codeset An identification of the codeset, such as: ascii, 8859.

See also

chrtbl(M), **coltbl**(M), **environ**(M), **mestbl**(M), **montbl**(M), **numtbl**(M), **setlocale**(S), **timtbl**(M)

Value added

locale is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

log

interface to STREAMS error logging and event tracing

Description

log is a STREAMS software device driver that provides an interface for the STREAMS error logging and event tracing processes (see **strerr**(ADM), **strace**(ADM)). **log** presents two separate interfaces: a function call interface in the kernel through which STREAMS drivers and modules submit **log** messages; and a subset of **ioctl**(S) system calls and STREAMS messages for interaction with a user level error logger, a trace logger, or processes that need to submit their own **log** messages.

Kernel interface

log messages are generated within the kernel by calls to the function **strlog**:

```
strlog(mid, sid, level, flags, fmt, arg1, ...)
short mid, sid;
char level;
ushort flags;
char *fmt;
unsigned arg1;
```

Required definitions are contained in <*sys/strlog.h*> and <*sys/log.h*>. **mid** is the STREAMS module id number for the module or driver submitting the **log** message. **sid** is an internal sub-id number usually used to identify a particular minor device of a driver. **level** is a tracing level that allows for selective screening out of low priority messages from the tracer. **flags** are any combination of **SL_ERROR** (the message is for the error logger), **SL_TRACE** (the message is for the tracer), **SL_FATAL** (advisory notification of a fatal error), and **SL_NOTIFY** (request that a copy of the message be mailed to the system administrator). **fmt** is a **printf**(C) style format string, except that %s, %e, %E, %g, and %G conversion specifications are not handled. Up to **NLOGARGS** (currently 3) numeric or character arguments can be provided.

User interface

log is opened via the clone interface, */dev/log*. Each open of */dev/log* obtains a separate *stream* to **log**. In order to receive **log** messages, a process must first notify **log** whether it is an error logger or trace logger via a STREAMS **I_STR ioctl** call (see below). For the error logger, the **I_STR ioctl** has an `ic_cmd` field of **I_ERRLOG** with no accompanying data. For the trace logger, the **ioctl** has an `ic_cmd` field of **I_TRCLOG**, and must be accompanied by a data buffer containing an array of one or more **struct trace_ids** elements. Each **trace_ids** structure specifies an **mid**, **sid**, and **level** from which messages will be accepted. **strlog** will accept messages whose **mid** and **sid** exactly match those in the **trace_ids** structure, and whose level is less than or equal to the level given in the **trace_ids** structure. A value of -1 in any of the fields of the **trace_ids** structure indicates that any value is accepted for that field.

At most one trace logger and one error logger can be active at a time. Once the logger process has identified itself via the **ioctl** call, **log** will begin sending up messages subject to the restrictions noted above. These messages are obtained via the **getmsg**(S) system call. The control part of this message contains a `log_ctl` structure, which specifies the **mid**, **sid**, **level**, **flags**, time in ticks since boot that the message was submitted, the corresponding time in seconds since Jan. 1, 1970, and a sequence number. The time in seconds since 1970 is provided so that the date and time of the message can be easily computed, and the time in ticks since boot is provided so that the relative timing of **log** messages can be determined.

Different sequence numbers are maintained for the error and trace logging *streams*, and are provided so that gaps in the sequence of messages can be determined (during times of high message traffic, some messages may not be delivered by the logger to avoid hogging system resources). The data part of the message contains the unexpanded text of the format string (null terminated), followed by **NLOGARGS** words for the arguments to the format string, aligned on the first word boundary following the format string.

A process may also send a message of the same structure to **log**, even if it is not an error or trace logger. The only fields of the `log_ctl` structure in the control part of the message that are accepted are the `level` and `flags` fields; all other fields are filled in by **log** before being forwarded to the appropriate logger. The data portion must contain a null terminated format string, and any arguments (up to **NLOGARGS**) must be packed one word each, on the next word boundary following the end of the format string.

Attempting to issue an **I_TRCLOG** or **I_ERRLOG** when a logging process of the given type already exists will result in the error **ENXIO** being returned. Similarly, **ENXIO** is returned for **I_TRCLOG** **ioctl**s without any `trace_ids` structures, or for any unrecognized **I_STR** **ioctl** calls. Incorrectly formatted **log** messages sent to the driver by a user process are silently ignored (no error results).

Examples

Example of **I_ERRLOG** notification:

```
struct strioctl ioc;

ioc.ic_cmd = I_ERRLOG;
ioc.ic_timout = 0;              /* default timeout (15 secs.) */
ioc.ic_len = 0;
ioc.ic_dp = NULL;

ioctl(log, I_STR, &ioc);XXX
```

Example of I_TRCLOG notification:

```
struct trace_ids tid[2];

tid[0].ti_mid = 2;
tid[0].ti_sid = 0;
tid[0].ti_level = 1;

tid[1].ti_mid = 1002;
tid[1].ti_sid = -1;     /* any sub-id will be allowed */
tid[1].ti_level = -1;   /* any level will be allowed */

ioc.ic_cmd = I_TRCLOG;
ioc.ic_timout = 0;
ioc.ic_len = 2 * sizeof(struct trace_ids);
ioc.ic_dp = (char *)tid;

ioctl(log, I_STR, &ioc);
```

Example of submitting a **log** message (no arguments):

```
struct strbuf ctl, dat;
struct log_ctl lc;
char *message = "Don't forget to pick up some milk on the way home";

ctl.len = ctl.maxlen = sizeof(lc);
ctl.buf = (char *)&lc;

dat.len = dat.maxlen = strlen(message);
dat.buf = message;

lc.level = 0;
lc.flags = SL_ERROR|SL_NOTIFY;

putmsg(log, &ctl, &dat, 0);
```

Files

/dev/log
<sys/log.h>
<sys/strlog.h>

See also

clone(M), **getmsg**(S), **intro**(S), **putmsg**(S), **strace**(ADM), **strerr**(ADM)

STREAMS Programmer's Guide

Value added

log is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

login

give access to the system

Syntax

login [*name* [*env-var*]]

login [**-r** *remotehost remotename localname*] ...

Description

The **login** command is used at the beginning of each terminal session to identify users and allow them access to the system. It cannot be invoked except when a connection is first established, or after the previous user has logged out by sending an end-of-file (⟨Ctrl⟩**d**) to their initial shell.

login asks for a user name (if not supplied as an argument), and, if appropriate, the user's password and a dialup password. (For information on dialup passwords, refer to **passwd**(C)). Echoing is turned off (where possible) during the typing of the passwords, so it will not appear on the written record of the session.

If the user makes a mistake in the login procedure the user will receive the message "Login incorrect" and a new login prompt will appear. The number of login attempts the user is allowed is configurable. If the user makes too many unsuccessful login attempts, the user or the terminal can be locked out.

If the login sequence is not completed successfully within a configurable period of time (for example, one minute), the user is returned to the "login:" prompt or silently disconnected from a dial-in line.

The **-r** form of the command is used for remote logins across a network. The remote login must supply parameters in the order indicated; these are the name of the remote host from which the login is being attempted, the user's name on the remote host, and the user's name on the local host (on which the login process is running). This form of the login command is intended for use by network software rather than users.

After a successful login, accounting files (*/etc/utmp* and */etc/wtmp*) are updated, the user is notified if they have mail, and the start-up shell files (*.profile* for the Bourne shell or *.login* for the C-shell) if any, are executed.

Login sets the user's supplemental groups list. If the file *.suppgroups* is in the user's home directory, the supplemental groups list is taken from this. The *.suppgroups* file contains a list of group names, one per line. Groups are verified before they are added to the supplemental group list. To able to use a group, a user must either be explicitly listed in that group in */etc/group*, or the group must have the group ID listed for the user in the */etc/passwd* file. If no *.suppgroups* file is found, the supplemental groups list is set from the */etc/group* file plus the login group ID.

If the hushlogin feature is enabled in */etc/default/login* and a file named *.hushlogin* exists in the user's home directory, **login** suppresses the printing of the last successful and last unsuccessful login times and the copyright messages. **login** also sets the environment variable **HUSHLOGIN** to **TRUE**, so the system and user initialization files are aware a hushlogin is taking place and can suppress output as appropriate (typically the message of the day, and the calling of **mail**(C) and **news**(C) are suppressed). The *.hushlogin* file itself does not need to contain anything; it only needs to exist.

login checks */etc/default/login* for the following definitions of the form **DEFINE=*value***:

ALTSHELL If **ALTSHELL** is set to **YES** or if it is not present in */etc/default/login*, then the **SHELL** environment variable is set to whatever shell is specified in the user's */etc/passwd* entry. If **ALTSHELL** is set to **NO**, then the **SHELL** environment variable is set only if the shell is defined in the */usr/lib/mkuser* directory (which is list of recognized shells).

CONSOLE The **CONSOLE=*device*** entry means that root can only log in on the device listed. For example, **CONSOLE=***/dev/console* restricts *root* logins to the console device.

ALLOWHUSH The **ALLOWHUSH** entry is used to enable or disable the hushlogin feature on a system-wide basis. If **ALLOWHUSH=YES**, **login** checks for the existence of a *.hushlogin* file in the user's home directory. If the file exists, the environment variable **HUSHLOGIN** is set to **TRUE** and a quiet login takes place. If **ALLOWHUSH=NO** or **ALLOWHUSH=YES** and there is no *.hushlogin* file in the user's home directory, the environment variable **HUSHLOGIN** is set to **FALSE** and the normal login messages appear. If there is no **ALLOWHUSH** entry, the **HUSHLOGIN** environment variable is not set and the normal login messages appear.

IDLEWEEKS If a password has expired, the user is prompted to choose a new one. If it has expired beyond **IDLEWEEKS**, the user is not allowed to log in, and must consult system administrator. This works in conjunction with **passwd**(C). See cautions under "Notes".

OVERRIDE This allows root to log in on the console even if the Protected Password database entry for root is corrupted. **login** checks */etc/default/login* to see if there is an entry similar to the following, which identifies the tty to be used when doing an override login for root:

```
OVERRIDE=tty01
```

PASSREQ If **PASSREQ=YES**, a password is required. Users who do not have a password will be forced to select one. **PASSREQ=NO** allows users to have accounts without passwords. See cautions under "Notes".

SUPATH If a user's UID is 0 (that is, if this is the super user), the **PATH** variable is set to **SUPATH**, if **SUPATH** is specified in */etc/default/login*. It is not advisable for **SUPATH** to include the current directory symbol ".". Note that an empty directory ("::" or ":" at the beginning or end) is equivalent to ".".

ULIMIT This variable defines the maximum allowable file size. The default is 2,097,152 blocks, or 1 gigabyte. When setting **ULIMIT**, be sure to specify even numbers, as the **ULIMIT** variable accepts a number of 512-byte blocks.

UMASK This is the default file creation mask (see **umask**(C)).

login initializes the user and group IDs and the working directory, then executes a command interpreter (usually **sh**(C)) according to specifications found in the */etc/passwd* file. Argument 0 of the command interpreter is a dash (-) followed by the last component of the interpreter's pathname. The basic environment (see **environ**(M)) is initialized to:

HOME= ***user-login-directory***
SHELL=*last field of passwd entry*
MAIL=*/usr/spool/mail/**user-login-name***

Possible **HUSHLOGIN=TRUE** or **FALSE**

Initially, **umask** is set to octal 022 by **login.**

Files

/etc/utmp	Information on current logins
/etc/wtmp	History of logins since last multiuser
*/usr/spool/mail/**name***	Mailbox for user ***name***
/etc/motd	Message of the day
/etc/default/login	Default values for environment variables and login behavior
/etc/passwd	Password file
/etc/profile	System profile for Bourne or Korn shell
$HOME/*.profile*	Personal profile for Bourne or Korn shell
$HOME/*.login*	Personal C shell login file
$HOME/*.cshrc*	Personal C shell initialization file
$HOME/*.suppgroups*	Supplemental groups file
$HOME/*.hushlogin*	Make login quieter

See also

environ(M), **getty**(ADM), **initscript**(F), **machine**(HW), **mail**(C), **newgrp**(C), **passwd**(C), **passwd**(F), **profile**(M), **sh**(C), **sg**(C), **su**(C), **ulimit**(S), **umask**(C), **who**(C)

Diagnostics

`Not on system console`
: **login** is set up to allow root to log on to the console only, and the user is not on the system console.

`Login incorrect`
: The login or dialup password is incorrect.

`Unable to change directory to dir`
: **login** cannot change directories to the home directory as specified by */etc/passwd*.

`No utmp entry. You must exec 'login' from the lowest level 'sh'.`
: **init** did not put an entry in *utmp*.

`No Root Directory`
: The shell field starts with a "`*`", and the attempt to do a **chroot** to the home directory failed.

`You don't have a password.`
: A password is required and it has not been set previously.

`Protected Password information suddenly vanished`
: During the course of working with the Protected Password database information the pointer pointing to the static version of the information has suddenly disappeared.

`Cannot execute passwd program`
: The password program cannot be executed for some reason.

`Login aborted due to no password.`
: The password program has returned an error while setting a password, as when the ⟨Del⟩ key is pressed.

`Can't rewrite Protected Password entry for user name,`
`Authentication error; see Account Administrator`
: The login program cannot update the Protected Password database entry.

`Protected Password database problem`
: After updating Protected Password data, login reads the information again and the entry cannot be read. This can be caused by redundant database backup files and/or lockfiles; these may be distinguished by a **-t** suffix. See **tcbck**(ADM) for information on these files and how to remove them from the system.

`Account is disabled but console login is allowed.`
`Account is disabled -- see Account Administrator.`
: If the account is locked, but root is logging in on the console (OVERRIDE tty), the first message is displayed; an ordinary user will see the second.

`Account has been retired -- logins are no longer allowed.`
: The account is retired - see **unretire**(ADM) and **rmuser**(ADM) on how to unretire or remove an account.

`Cannot set terminal mode.`
: The **chmod** of the tty failed.

`Bad login user id.`
: No UID has been set. This can be due to a missing critical database file, such as */etc/auth/system/authorize*. Run **authck**(ADM) and check any error messages. This message will also be issued if login is run from an established login session rather that from **init**(M).

`Wait for login retry.`
`Wait for login exit.`
: A login attempt has failed, and the system is configured to enforce a delay between login attempts.

`user appears in /etc/passwd but not in Protected Password database`
: If the user is in */etc/passwd* but not in the Protected Password database, there is no message printed, but **login** generates the audit record shown above.

`Cannot obtain database information on this terminal`
: **login** cannot get information from */etc/auth/system/ttys* for the tty line.

`Error in terminal setup.`
: Something is wrong with the terminal setup (for example, *stdin*, *stdout*, and *stderr* are the same thing.)

`Cannot obtain settings for this terminal`
: The **ioctl**(S) on the tty device failed.

`No login program on root`
: When attempting to do a sublogin (chrooting to a subtree for a restricted login), no login program was found.

`Can't rewrite terminal control entry for tty,`
`Authentication error; see Account Administrator`
: The information for the login tty cannot be updated.

`Terminal Control information suddenly vanished`
: During the course of working with the terminal database information the pointer pointing to the static version of the information suddenly disappeared.

`Bad priority setting.`
: **nice** failed to set the **nice** value specified in the Protected Password entry for the user.

`Bad supplemental group list.`
: The call to **setgroups** failed.

`Bad group id.`
: The call to **setgid** failed.

`Bad user id.`
: The call to **setuid** failed.

`Unable to set kernel authorizations.`
: The call to set the kernel authorizations failed.

`Login timed out`
: **login** received an **ALARM** signal. Note: **login** sets this itself, but it could conceivably come from somewhere else.

`Terminal is disabled but root login is allowed.`
`Terminal is disabled -- see Account Administrator.`
: If the terminal is disabled and root attempts to login on the (**OVERRIDE**) tty the first message is displayed; the second message is displayed when any other user attempts to login on a disabled terminal.

`The security databases are corrupt.`
`However, root login at terminal tty is allowed,`
: This is the message displayed when the **OVERRIDE** tty is used during a security problem.

`Impossible to execute /bin/sh!`
: **login** cannot execute the shell program for doing an **OVERRIDE**.

Notes

login cannot be executed from a shell.

Environment variables such as **HZ**, **PATH**, and so forth should not be defined in */etc/default/login*. Instead use */etc/initscript* to set global variables.

Sublogins (indicated by a shell of "*") are not supported and cause a warning.

Although **IDLEWEEKS** and **PASSREQ** are supported for compatibility with other UNIX systems, their use is not recommended. The proper way to set the behavior defined by these variables is by use of the **sysadmsh**(ADM) Accounts selection.

mapchan

configure tty device mapping

Syntax

mapchan [**-ans**] [**-f** ***mapfile***] [***channels*** ...]

mapchan [[**-o**] [**-d**]] [***channel***]

Description

The **mapchan** utility configures the mapping of information input and output. **mapchan** is intended for users of applications that employ languages other than English (character sets other than 7-bit ASCII).

mapchan translates codes sent by peripheral devices, such as terminals, to the internal character set used by the UNIX system. **mapchan** can also map codes in the internal character set to other codes, for output to peripheral devices (such as terminals, printers, console screen, etc.). Note that PC keyboard configuration is accomplished through the **mapkey**(M) utility.

mapchan has several uses: to map a ***channel*** (**-a** or **-s**); to unmap a ***channel*** (**-n** and optionally **-a**); or to display the map on a channel (optionally **-o**, **-d**, ***channels***).

mapchan with no options displays the map on the user's ***channel***. The map displayed is suitable as input for **mapchan**.

The options are:

-a when used alone, sets all ***channels*** given in the default file (*/etc/default/mapchan*) with the specified map. When used with **-n**, it refers to all ***channels*** given in the default file. Super user maps or unmaps all ***channels***, other users map only ***channels*** they own. **-a** cannot be used with **-d**, **-o**, or **-s**.

-d causes the mapping table currently in use on the given device, ***channel***, to be displayed in decimal instead of the default hexadecimal. An ASCII version is displayed on standard output. This output is suitable as an input file to **mapchan** for another channel. Mapped values are displayed. Identical pairs are not output. **-d** cannot be used with **-a**, **-f**, **-n**, **-o**, or **-s**.

-f causes the current ***channel*** or list of ***channels*** to be mapped with ***mapfile***. **-f** cannot be used with **-d**, **-n**, **-s**, or **-o**.

-n causes null mapping to be performed. All codes are input and output as received. Mapping is turned off for the user's channel or for other ***channels***, if given. **-a** used with **-n** will turn mapping off on all channels given in the default file. This is the default mapping for all channels unless otherwise configured. **-n** cannot be used with **-d**, **-f**, **-o**, or **-s**.

-o causes the mapping table currently in use on the given device, ***channel***, to be displayed in octal instead of the default hexadecimal. An ASCII version is displayed on standard output. This output is suitable as an input file to **mapchan** for another port. Mapped values are displayed. Identical pairs are not output. **-o** cannot be used with **-a**, **-d**, **-f**, **-n**, or **-s**.

-s sets the user's current ***channel*** with the ***mapfile*** given in the default file. **-s** can not be used with any other option.

The user must own the ***channel*** in order to map it. The super user can map any channel. Read or write permission is required to display the map on a channel.

Each tty device channel (display adapter and video monitor on computer, parallel port, serial port, etc.) can have a different map. When UNIX boots, mapping is off for all channels.

mapchan is usually invoked in the **/etc/rc2** scripts. These scripts are executed when the system enters multi-user mode and sets up the default mapping for the system. Users can invoke **mapchan** when they log in by including a **mapchan** command line in their *.profile* or *.login* file. In addition, users can remap their channel at any time by invoking **mapchan** from the command line. Channels not listed in the default file are not automatically mapped. Channels are not changed on logout. Whatever mapping was in place for the last user remains in effect for the next user, unless they modify their *.profile* or *.login* file.

For example, the default file */etc/default/mapchan* can contain:

```
tty02          ibm
tty1a
tty2a          wy60.ger
lp             ibm
```

The default directory containing mapfiles is */usr/lib/mapchan*. The default directory containing channel files is */dev*. Full pathnames may be used for ***channels*** or ***mapfiles***. If a channel has no entry, or the entry field is blank, no mapping is enabled on that channel. Additional channels added to the system, (for example, adding a serial or parallel port) are not automatically entered in the **mapchan** default file. If mapping is required, the system administrator must make the entries.

The format of the ***mapfiles*** is documented in the **mapchan**(F) manual page.

Using a mapped channel

The input information is assumed to be 7- or 8-bit codes sent by the peripheral device. The device may make use of "dead" or "compose" keys to produce the codes. If the device does not have dead or compose keys, these keys can be simulated using **mapchan.**

One-to-one mapped characters are displayed when the key is pressed, and the mapped value is passed to the kernel.

Certain keys are designated as dead keys in the mapfile. Dead key sequences are two keystrokes that produce a single mapped value that is passed to the kernel. The dead key is usually a diacritical character, the second key is usually the letter being modified. For example, the sequence ´ **e** could be mapped to the ASCII value 0xE9, and display as é.

One key is designated as the compose key in the mapfile. Compose key sequences are made up of three keystrokes that produce a single mapped value that is passed to the kernel. The compose key is usually a seldom-used character or ⟨Ctrl⟩**letter** combination. The second key is usually the letter being modified. The third key may be another character being combined, or a diacritical character. For example, if "@" is the compose key, the sequence **@ c O** could be mapped to the ASCII value 0xA9, and display as ©.

Characters are not echoed to the screen during a dead or compose sequence. The mapped character is echoed and passed to the kernel once the sequence is correctly completed.

Characters are always put through the input map, even when part of dead or compose sequences. The character is then checked for the internal value. The value may also be mapped on output. This should be kept in mind when preparing mapfiles.

The following conditions will cause an error during input:

- non-recognized (not defined in the ***mapfile***) dead or compose sequence
- restarting a compose sequence before completion by pressing the compose key in the middle of a dead or compose sequence. This is an error, but a new compose sequence is initiated.

If the mapfile contains the keyword **beep**, a bell sounds when either of the above conditions occurs. In either case, the characters are not echoed to the screen, or passed to the kernel.

In order to allow for character sequences sent to control the terminal (move the cursor, and so on) rather than to print characters on the screen, **mapchan** allows character sequences to be specified as special sequences which are not passed through the normal mapping procedure. Two sections may be specified, one for each of the input (keyboard) and output (screen) controls.

Character sets

The internal character set used is defined by the mapfiles used. By default, this is the ISO 8859/1 character set which is also known as the dpANS X3.4.2 and ISO/TC97/SC2. It supports most of the Latin alphabet and can represent most European languages.

Several partial mapfiles are provided as examples. They must be modified for use with specific peripheral devices. Consult your hardware manual for the codes needed to display the desired characters. Two mapfiles are provided for use with the console device: */usr/lib/mapchan/ibm* for systems with a standard PC character set ROM, and */usr/lib/mapchan/iso* for systems with an optional ISO 8859/1 character set ROM.

Care should be taken that the **stty**(C) settings are correct for 8-bit terminals. The */etc/gettydefs* file may require modification to allow logging in with the correct settings.

7-bit U.S. ASCII (ANSI X3.4) should be used if no mapping is enabled on the ***channel***.

Files

/etc/default/mapchan
*/usr/lib/mapchan/**

See also

ascii(M), **keyboard**(HW), **lp**(C), **lpadmin**(ADM), **mapchan**(F), **mapkey**(M), **parallel**(HW), **screen**(HW), **serial**(HW), **setkey**(C), **trchan**(M), **tty**(M)

Notes

Some non-US keyboards and display devices do no support characters commonly used by UNIX command shells and the C programming language. It is not recommended that these devices be used for system administration tasks.

Printers can be mapped, output only, and can either be sent 8-bit codes or one-to-many character strings using **mapchan**. Line printer spooler interface scripts can be used (**setuid** *root*) to change the output map on the printer when different maps are required (as in changing print wheels to display a different character set). See **lp**(C) and **lpadmin**(ADM) for information on installing and administering interface scripts.

Not all terminals or printers can display all the characters that can be represented using this utility. Refer to the device's hardware manual for information on the capabilities of the peripheral device.

Warnings

Use of mapfiles that specify a different "internal" character set per-channel, or a set other than the 8-bit ISO 8859 set supplied by default can cause strange side effects. It is especially important to retain the 7-bit ASCII portion of the character set (see **ascii**(M)). UNIX utilities and many applications assume these values.

Media transported between machines with different internal code set mappings may not be portable as no mapping is performed on block devices, such as tape and floppy drives. However, **trchan** with an appropriate mapfile can be used to "translate" from one internal character set to another.

Do not set **ISTRIP** (see **stty**(C)) when using **mapchan**. This option causes the eighth bit to be stripped before mapping occurs.

Value added

mapchan is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

mapkey, mapscrn, mapstr, convkey

configure monitor screen mapping

Syntax

mapkey [**-adox**] [*datafile*]

mapscrn [**-d**] [*datafile*]

mapstr [**-d**] [*datafile*] [**-f**] [*termtype*]

convkey [*in* [*out*]]

Description

mapkey - Configures keyboard mapping

mapscrn - Configures monitor screen mapping

mapstr - Configures function key mapping

convkey - Translates an old-style mapkey file into the current format

mapscrn configures the output mapping of the monitor screen on which it is invoked. **mapkey** and **mapstr** configure the mapping of the keyboard and string keys (for example, function keys) of the monitor and terminals running with the scancode facility enabled. The super user can map or unmap any terminal device, while other users can map only the terminal devices that they own.

mapstr functions on a per-screen basis. If the **mapstr -f** command does not specify a terminal type, **mapstr** gets the terminal type from the **TERM** environment variable. The **tset** utility calls **mapstr -f** to set function keys. **mapstr** reads the function key values from the file in */usr/lib/keyboard/string.d* that corresponds to the terminal type and passes them to **tset**. Mapping strings on one screen does not affect any other screen.

The **mapstr** utility expects 12 function keys. If your terminal uses more or less than 12 function keys, your function keys might have unexpected effects when you run your terminal in scancode mode. For example, function keys above ⟨F12⟩ might behave like shifted function keys below ⟨F12⟩ (that is, ⟨Shift⟩⟨F1⟩, ⟨Shift⟩⟨F2⟩, and so on).

If a file name is given on the argument line the respective mapping table is configured from the contents of the input file. If no file is given, the default files in */usr/lib/keyboard* and */usr/lib/console* are used. The **-d** option causes the mapping table to be read from the kernel instead of written and an ASCII version to be displayed on the standard output. The format of the output is suitable for input files to **mapscrn**, **mapkey**, or **mapstr**. Non-super users can run **mapkey** and **mapstr** when the **-d** option is given.

With the **-o** or **-x** options, **mapkey** displays the mapping table in octal or hexadecimal.

The **-a** option sets mapping according to the file */etc/default/mapkey*. Each line in this file names a tty line and a file in the */usr/lib/keyboard* directory; for example:

```
tty01     keys.fr
```

If **mapkey -a** is run with the above entry in */etc/default/mapkey*, the terminal device */dev/tty01* is mapped using the file */usr/lib/keyboard/keys.fr*. A common use for the **mapkey -a** command is to include it in a directory under */etc/rc.d*, so that it is executed as part of system startup.

convkey translates an old-style **mapkey** file into the current format. If ***in*** or ***out*** are missing, they default to *stdin* or *stdout*.

Files

*/usr/lib/keyboard/**
*/usr/lib/console/**

Notes

There is no way to specify that the map utilities read their configuration tables from standard input.

If **mapkey -a** is run but the correct tty line cannot be found in */etc/default/mapkey*, **mapkey** reads the default file */usr/lib/keyboard/keys*. Likewise, if no key file is specified against the appropriate tty entry in */etc/default/mapkey* **mapkey -a** uses */usr/lib/keyboard/keys*.

See also

keyboard(HW), **scancode**(HW), **screen**(HW), **setkey**(C), **tset**(C)

Value added

convkey, **mapkey**, **mapscrn** and **mapstr** are extensions of AT&T System V provided by The Santa Cruz Operation, Inc.

math

math functions and constants

Syntax

#include <math.h>

Description

This file contains declarations of all the functions in the Development System Math Library as well as various functions in the C Library that return floating-point values.

It defines the structure and constants used by the **matherr**(S) error-handling mechanisms, including the following constant used as an error-return value:

HUGE The maximum value of a single-precision floating-point number.

The following mathematical constants are defined for user convenience:

M_E The base of natural logarithms (*e*).

M_LOG2E The base-2 logarithm of *e*.

M_LOG10E The base-10 logarithm of *e*.

M_LN2 The natural logarithm of 2.

M_LN10 The natural logarithm of 10.

M_PI π, the ratio of the circumference of a circle to its diameter.

M_PI_2 $\pi/2$.

M_PI_4 $\pi/4$.

M_1_PI $1/\pi$.

M_2_PI $2/\pi$.

M_2_SQRTPI $2/\sqrt{\pi}$.

M_SQRT2 The positive square root of 2.

M_SQRT1_2 The positive square root of ½.

For the definitions of various machine-dependent "constants," see the description of the *<values.h>* header file.

See also

intro(S), **matherr**(S), **values**(M)

Standards conformance

math is conformant with:

X/Open Portability Guide, Issue 3, 1989.

mestbl

create a messages locale table

Syntax

mestbl [*specfile*]

Description

The utility **mestbl** is provided to allow **LC_MESSAGES** locales to be defined. It reads in a specification file (or standard input if ***specfile*** is not defined), containing a definition for a particular locale's response strings to yes/no queries, and produces a concise format table file, to be read by **setlocale**(S).

The response strings may be specified as a string held within double quotes or as a series of characters which are specified in one of six different ways (the following examples all specify the ASCII character "A"):

65 - decimal
0101 - octal
0x41 - hexadecimal
'A' - quoted character
'\101' - quoted octal
'\x41' - quoted hexadecimal

or a combination of both methods, for example:

'y' "es"

is identical to:

"yes"

To specify the response strings, the above string definitions must be preceded by the keyword **YESSTR=** for affirmative responses, and **NOSTR=** for negative responses.

If a hash character (#) appears in any line, all characters following the hash character are treated as a comment and ignored up to the end of the line, unless the hash is within a quoted string.

The concise format locale table is placed in a file named *messages* in the current directory. This file should be copied or moved to the correct place in the **setlocale**(S) file tree (see **locale**(M)). To prevent accidental corruption of the output data, the file is created with no write permission; if the **mestbl** utility is run in a directory containing a write-protected *messages* file, the utility will ask if the existing file should be replaced - any response other than "yes" or "y" will cause **mestbl** to terminate without overwriting the existing file.

See also

chrtbl(M), **coltbl**(M), **locale**(M), **montbl**(M), **numtbl**(M), **setlocale**(S), **timtbl**(M)

Diagnostics

All error messages printed are self-explanatory.

Value added

mestbl is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

montbl

create a currency locale table

Syntax

montbl [*specfile*]

Description

curtbl - create a currency locale table

The utility **montbl** is provided to allow new **LC_MONETARY** locales to be defined; it reads a specification file, containing a definition of the currency symbol for a particular locale, and produces a binary table file, to be read by **setlocale**(S), which determines the behavior of the **nl_langinfo**(S) routine.

The information supplied in the specification file consists of a line in the following format:

CRNCYSTR = *string*

The "=" can be separated from the keyword and string fields by zero or more space or tab characters.

The *string* is a sequence of characters surrounded by quotes ("). The first character of the string should be "-" if the symbol is to precede the currency value, or "+" if it should appear after the value. Characters within the string can be specified both literally and using "\" escapes; the following three strings are equivalent:

"+DM"	literal
"+\x44M"	hexadecimal escapes
"+D\115"	octal escapes

All characters following a hash (#) are treated as a comment and ignored up to the end of the line, unless the hash is within a quoted string.

The binary table output is placed in a file named *currency*, within the current directory. This file should be copied or linked to the correct place in the *setlocale* file tree (see **locale**(M)). To prevent accidental corruption of the output data, the file is created with no write permission; if the **montbl** utility is run in a directory containing a write-protected *currency* file, the utility will ask if the existing file should be replaced — any response other than "yes" or "y" will cause **montbl** to terminate without overwriting the existing file.

If the *specfile* argument is missing, the specification information is read from the standard input.

See also

chrtbl(M), **locale**(M), **msgtbl**(M), **nl_langinfo**(S), **numtbl**(M), **setlocale**(S), **timtbl**(M)

Diagnostics

If the input table file cannot be opened for reading, processing will terminate with the error message, "Cannot open specification file".

Any lines in the specification file which are syntactically incorrect, or contain an unrecognized value instead of **CRNCYSTR**, will cause an error message to be issued to the standard error output, specifying the line number on which the error was detected. The line will be ignored, and processing will continue.

If the output file, *currency*, cannot be opened for writing, processing will terminate with the error message, "Cannot create table file".

Any error conditions encountered will cause the program to exit with a non-zero return code; successful completion is indicated with a zero return code.

Notes

This utility was formerly known as **curtbl**. A link with this name is provided to maintain backward compatability.

Value added

montbl is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

mscreen

serial multiscreens utility

Syntax

mscreen [-s] [-n *number*] [-t]

Description

mscreen allows a serial terminal to have multiple login screens similar to the **multiscreen**(M) console.

Note: For full **mscreen** support the terminal must have the ability to switch internal screen pages on command and it must retain a separate cursor position for each screen page.

The options are as follows:

-s Silent mode. This flag suppresses the startup messages, and on "dumb" terminals it suppresses the screen switch messages.

-n Selects the number of serial multiscreens desired up to the maximum defined for the terminal type.

-t Disables the transparent tty checking. **mscreen** normally exits silently if the terminal device name starts with the characters "ttyp". Device names beginning with "ttyp" are used as slave devices for **mscreen**. The correct names for the master tty devices begin with "ptyp".

mscreen can be used on both "smart" and "dumb" terminals. Although it is optimized to take advantage of smart terminals with screen memory, **mscreen** also works on dumb terminals, although the screen images are not saved during screen changes. **mscreen** also supports terminals with two (or more) serial ports that are connected to different computers.

mscreen is designed to be invoked from the *.profile* or *.login* files. Use **mscreen** in place of the **SHELL** variable so that serial multiscreens can be automatic at login time. The "stop" and "quit" keys allow you to logout from all screens with a single keystroke.

Configuration

mscreen determines the terminal type of the terminal it is invoked from by examining the environment variable **TERM**. **mscreen** looks in */etc/mscreencap* or in the filename contained in the environment variable **MSCREENCAP** to get the capabilities for the terminal type.

The pseudo terminals assigned to the user are automatically determined at startup by **mscreen**. Manual assignment of ttys can be accomplished by creating a file in the user's home directory called *.mscreenrc*.

mscreencap format

mscreencap contains an entry for each terminal type supported. An entry may have several names if the support for several terminal types is the same. Within an entry are the key mappings for each potential pseudo terminal. Each pseudo terminal has a help key string, an input string (the sequence generated by the key that selects this screen), and an optional output string (the sequence to send to the terminal that will cause a page switch). The input and output strings are in a termcap like format: (the backslash and caret are special lead in (escape) characters).

nnn	an octal number, one to three digits are allowed
\n	newline
\r	carriage return
\t	tab
\b	backspace
\f	form feed
\E	escape (hex 1b octal 33).
\\	enter backslash as a data character
\^	enter caret as a data character
\^*x*	⟨Ctrl⟩*x*, where *x* can be: @ABCDEFGHIJKLMNOPQRSTUVWXYZ[]^_ Effectively the caret can generate hex 01 through hex 1f.

If a terminal type has no output strings then it is assumed to be a dumb terminal that does not have multiple internal memory pages.

There are five special entries that allow the user to define keys to support the other functions of **mscreen**. They are the "help" key (prints a list of all of the keys that are currently available and their functions), the "who" key (prints the name of the current screen), the "stop" key (terminates **mscreen** and returns a good (zero) shell return code), and "quit" key (terminates **mscreen** and returns a bad (non-zero) shell return code and the dummy entry that is used for terminals with multiple ports.

The format is:

```
#this is a comment and may only appear between entries
entryname|alias1|alias1...|aliasn:
        :specialname,helpname,inputstring,pageselectstring:
        :specialname,helpname,inputstring,pageselectstring:
entryname|alias1|alias1...|aliasn:
        :specialname,helpname,inputstring,pageselectstring:
        :specialname,helpname,inputstring,pageselectstring:
```

The specialname is empty for real screen entries. See the provided */etc/mscreencap* for examples.

.mscreenrc format

.mscreenrc contains a list of ttynames if the user wants to allocate a fixed set of ttys for use:

ttyp0
ttyp1
ttypn

Shell return codes and auto login/logout

mscreen exits with a bad (non-zero) return code if there is an error or when the "quit" key is pressed. The "stop" key causes **mscreen** to exit with a good (zero) return code. This allows users to place **mscreen** in the *.login* or *.profile* files. The *.login* or *.profile* files should set up an automatic logout if the **mscreen** return code is good (zero). The following is a **csh** sample invocation of **mscreen** for a *.login* file:

mscreen -n 4
if ($status == 0) logout

The single key logout feature of **mscreen** works as if a normal logout was entered on each pseudo-terminal. A hangup signal is sent to all of the processes on all the pseudo terminals.

Multiple port option

mscreen provides a dummy entry type. It allows **mscreen** to be placed in an inactive state while the user uses his terminal to converse through another (physical) I/O port to another computer. See the provided */etc/mscreentermmap* for an example. To use it, you must take the example and configure it for your needs.

mscreen driver

The **mscreen** driver is already installed in the UNIX kernel with eight pseudo terminals available for use. You must enable a pseudo terminal before you can use it. See the link-kit instructions for relinking the kernel to have more available pseudo terminals.

Notes

mscreen has a VTIM timeout of 1/5 second for input strings.

mscreen has a limit of twenty multiscreens per user.

You should not switch screen pages in **mscreen** when output is occurring because if an escape sequence is cut in half it may leave the terminal in an indeterminate state and distort the screen image.

Terminals that save the cursor location for each screen often do not save states such as insert mode, inverse video, and others. For example, you should not change screens if you are in insert mode in **vi**, and you should not change screens during an inverse video output sequence.

For inactive screens (screens other than the current one) **mscreen** saves the last 2048 characters of data (2K). Data older than this is lost. This limit occasionally results in errors for programs that require a memory of more data than this. The user-defined screen redraw key restores the screen to normal appearance.

mscreen depends on the pseudo terminal device names starting with "ttyp" for the slave devices and "ptyp" for the master devices. The number of trailing characters in the device name is not significant.

See also

enable(C), **multiscreen**(M)

"Administering serial terminals" in the *System Administrator's Guide*

Value added

mscreen is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

multiscreen

multiple screens (device files)

Syntax

⟨Alt⟩⟨F*n*⟩
⟨Alt⟩⟨Ctrl⟩⟨F*n*⟩
⟨Alt⟩⟨Shift⟩⟨F*n*⟩
⟨Alt⟩⟨Ctrl⟩⟨Shift⟩⟨F*n*⟩

Description

With the **multiscreen** feature, a user can access up to twelve different "screens," each corresponding to a separate device file. Each screen can be viewed one at a time through the primary monitor video display.

The number of screens on a system depends upon the amount of memory in the computer. The system displays the number of enabled screens during the boot process.

Access

To see the next consecutive screen, enter:

⟨Ctrl⟩⟨PrtSc⟩

To move to any screen from any other screen, enter:

⟨Alt⟩⟨F*n*⟩ or ⟨Alt⟩⟨Ctrl⟩⟨F*n*⟩ or
⟨Alt⟩⟨Shift⟩⟨F*n*⟩
⟨Alt⟩⟨F*n*⟩ or ⟨Alt⟩⟨Ctrl⟩⟨F*n*⟩ (screens 1-12)
⟨Alt⟩⟨Shift⟩⟨F*n*⟩ or ⟨Alt⟩⟨Ctrl⟩⟨Shift⟩⟨F*n*⟩ (screens 11-16, 7-12)

where *n* is the number of one of the "F" function keys on the primary monitor keyboard. For example:

⟨Alt⟩⟨F2⟩

selects tty02, and all output in that device's screen buffer is displayed on the monitor screen.

The second form (using the ⟨Shift⟩ key) permits access to screens 11 and 12 on keyboards that have only ten function keys. It is possible to configure the kernel for up to 16 screens, but 12 is the default.

The function key combinations used to display the various screens are defined in the keyboard mapping file. The */usr/lib/keyboard/keys* or other **mapkey**(ADM) file can be modified to allow different key combinations to change multiscreens. Use the **mapkey** utility to create a new keyboard map.

File

/dev/tty[01-12]	multiscreen devices (number available depends on system memory)

See also

mapkey(ADM), **keyboard**(HW), **screen**(HW), **serial**(HW), **stty**(C)

Notes

Any system error messages are normally output on the console device file (*/dev/console*). When an error message is output, the video display reverts to the console device file, and the message is displayed on the screen. The console device is the only teletype device open during the system boot sequence and when in single-user, or system maintenance mode.

Limitations to the number of multiscreens available on a system does not affect the number of serial lines or devices available. See **serial**(M) for information on available serial devices.

Note that the keystrokes given here are the default, but your keyboard may be different. If so, see **keyboard**(M) for the appropriate substitutes. Also, any key can be programmed to generate the screen switching sequences by using the **mapkey** utility.

Value added

multiscreen is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

numtbl

create a numeric locale table

Syntax

numtbl [***table_file*** **]**

Description

This utility will create a numeric locale table to be interpreted by the **setlocale**(S) system call.

The ***table_file*** contains information about the numeric locale in a user readable form.

At present, two pieces of information can be supplied. These are: the character to be used as a decimal place marker (radix character), and the character to be used as a thousands delimiter, for example the commas in 1,000,000. To specify these, there must be lines, in the table file, of the form:

```
DECIMAL=d
THOUSANDS=tXXX
```

Where "d" is the character to be used as the decimal place mark and "t" is the character to be used as the thousands delimiter. The characters "d" and "t" may be specified in six different ways. The following lines show different formats for the letter "b".

```
98      - decimal
0142    - octal
0x62    - hexadecimal
'b'     - quoted character
'\0142' - quoted octal
'\x62'  - quoted hexadecimal
```

Any line starting with a hash (#) is treated as a comment.

The output is a file, called *numeric*, which is placed in the current directory. This file is in a form which can be interpreted by the **setlocale**(S) system call. For more information on where this file should be placed, please see **locale**(M).

If no table file is specified, the information is taken from the standard input. The format of the information is identical.

If either DECIMAL or THOUSANDS is not specified, its value will default to "." or ",", respectively.

See also

locale(M), **environ**(M)

Diagnostics

Any lines of input which are in the wrong format will cause a warning to be issued on the terminal, but will not terminate the program.

"Character syntax error" will be issued on the terminal if the format of the character specification does not match one of those specified above. The program will then terminate.

If the input table file cannot be opened for reading, the program will also terminate with the error message, "Cannot open table file".

If the output file, *numeric*, cannot be opened for writing, the program will terminate with the error message, "Cannot create numeric locale file".

Notes

The thousands delimiter is not currently used within any of the standard UNIX libraries or utilities, although it can be accessed by application programs using the **nl_langinfo**(S) function.

The string **RADIXCHAR** may be used as an alternative to DECIMAL, and **THOUSEP** as an alternative to THOUSANDS, if required. These alternatives are provided for consistency with the identifiers used by **nl_langinfo**(S).

Value added

numtbl is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

prof

profile within a function

Syntax

#define MARK
#include <prof.h>

void MARK (*name*)

Description

MARK will introduce a mark called ***name*** that will be treated the same as a function entry point. Execution of the mark will add to a counter for that mark, and program-counter time spent will be accounted to the immediately preceding mark or to the function if there are no preceding marks within the active function.

name may be any valid C identifier. Each ***name*** in a single compilation must be unique, but may be the same as any ordinary program symbol.

For marks to be effective, the symbol **MARK** must be defined before the header file *<prof.h>* is included. This may be defined by a preprocessor directive as in the synopsis or by a command line argument, that is:

cc -p -DMARK foo.c

If **MARK** is not defined, the **MARK(*name*)** statements may be left in the source files containing them and will be ignored.

Examples

In this example, marks can be used to determine how much time is spent in each loop. Unless this example is compiled with **MARK** defined on the command line, the marks are ignored.

```
#include <prof.h>
foo( )
{
        int i, j;
        .
        .
        .
        MARK(loop1);
        for (i = 0; i < 2000; i++) {
                . . .
        }
        MARK(loop2);
        for (j = 0; j < 2000; j++) {
                . . .
        }
}
```

See also

prof(C), **profil**(S), **monitor**(S)

profile

set up an environment at login time

Description

The optional file, *.profile*, permits automatic execution of commands whenever a user logs in. The file is generally used to personalize a user's work environment by setting exported environment variables and terminal mode (see **environ**(M)).

When a user logs in, the user's login shell looks for *.profile* in the login directory. If found, the shell executes the commands in the file before beginning the session. The commands in the file must have the same format as if they were entered at the keyboard. Any line beginning with the number sign (#) is considered a comment and is ignored. The following is an example of a typical file:

```
# Tell me when new mail comes in
MAIL=/usr/mail/myname
# Add my /bin directory to the shell search sequence
PATH=$PATH:$HOME/bin
# Make some environment variables global
export MAIL PATH TERM
# Set file creation mask
umask 22
```

Note that the file */etc/profile* is a system-wide profile that, if it exists, is executed for every user before the user's *.profile* is executed.

Files

$HOME/*.profile*
/etc/profile

See Also

env(C), **login**(M), **mail**(C), **sh**(C), **stty**(C), **su**(C), **environ**(M)

ptmx, pts???

STREAMS master pseudo-tty device

Description

The file */dev/ptmx* is the device node used by applications to open STREAMS-based master pseudo-tty devices. This is a single device node which allows access to multiple devices via the **clone**(M) driver. Successive **open**(S) calls to */dev/ptmx* return different file descriptors, each referring to a new cloned device.

The master pseudo-tty device opened is used to transfer data between the application and one of the slave pseudo-tty nodes */dev/pts???*, where *???* is a 3 digit decimal number with leading zeros.

Files

/dev/ptmx
/dev/pts???

See also

clone(M)

STREAMS Programmer's Guide
STREAMS Primer

Notes

Although */dev/ptmx* is referred to as a pseudo-tty, the master device does not have tty characteristics and therefore cannot become the controlling tty of a process group. The slave side of the connection does have the characteristics of a real tty and can become the controlling tty of a process group.

rmb

remove extra blank lines from a file

Syntax

/usr/bin/rmb

Description

/usr/bin/rmb acts as a filter to remove any series of blank lines greater than two lines in length. This means that all long sequences of blank lines will be reduced to two blank lines. This is particularly useful for cleaning **nroff**(CT) output of blank lines before putting the output in a file.

See also

man(C), **nroff**(CT)

Notes

Because **/usr/bin/rmb** is a filter, it must be used within a piped command sequence as shown in the following examples:

cat infile | /usr/bin/rmb > outfile

nroff infile | /usr/bin/rmb > outfile

It cannot be used in the form **/usr/bin/rmb** *filename*.

Value added

rmb is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

scanon, scanoff

enable and disable scancode-to-character mapping

Syntax

scanon [/dev/*ttyline* . . .]

scanoff [/dev/*ttyline* . . .]

Description

The **scanon** script simultaneously sets the terminal and the serial line to send PC scancodes (turns on PC-scancode mode). The **scanoff** script turns off PC-scancode mode. With no arguments, **scanon** and **scanoff** affect the current tty.

scanon also calls the **mapstr** function to set up the strings for the terminals function keys.

Files

/etc/ttype
*/usr/lib/keyboard/strings.d/**

Notes

When **scanon** or **scanoff** are called without parameters, the **$TERM** environment variable is used to determine the terminal type. When a device is specified on the command line, the connect terminal type for the device must be entered in the */etc/ttytype* file for the command to work correctly. Note that for a Wyse-60 terminal the type (or **$TERM**, if the command is run from the terminal itself) must be set to **wy60-pc**.

See also

stty(C), **tput**(C), **mapstr**(M), **ttytype**(F)

streamio

STREAMS **ioctl** commands

Syntax

#include<*stropts.h*>
int ioctl (*fildes, command, arg*)
int *fildes, command;*

Description

STREAMS (see **intro**(S)) **ioctl** commands are a subset of **ioctl**(S) system calls which perform a variety of control functions on "streams". The arguments ***command*** and ***arg*** are passed to the file designated by ***fildes*** and are interpreted by the "stream head". Certain combinations of these arguments may be passed to a module or driver in the stream.

fildes is an open file descriptor that refers to a stream. ***command*** determines the control function to be performed as described below. ***arg*** represents additional information that is needed by this command. The type of ***arg*** depends upon the command, but it is generally an integer or a pointer to a ***command***-specific data structure.

Since these STREAMS commands are a subset of **ioctl**, they are subject to the errors described there. In addition to those errors, the call will fail with **errno** set to **EINVAL**, without processing a control function, if the stream referenced by ***fildes*** is linked below a multiplexer, or if ***command*** is not a valid value for a stream.

Also, as described in **ioctl**, STREAMS modules and drivers can detect errors. In this case, the module or driver sends an error message to the stream head containing an error value. This causes subsequent system calls to fail with **errno** set to this value.

Command functions

The following **ioctl** commands, with error values indicated, are applicable to all STREAMS files:

I_PUSH — Pushes the module whose name is pointed to by ***arg*** onto the top of the current stream, just below the stream head. It then calls the open routine of the newly-pushed module. On failure, **errno** is set to one of the following values:

- **[EINVAL]** Invalid module name.
- **[EFAULT]** ***arg*** points outside the allocated address space.
- **[ENXIO]** Open routine of new module failed.
- **[ENXIO]** Hangup received on ***fildes***.

I_POP Removes the module just below the stream head of the stream pointed to by ***fildes***. ***arg*** should be 0 in an **I_POP** request. On failure, **errno** is set to one of the following values:

[EINVAL] No module present in the stream.

[ENXIO] Hangup received on ***fildes***.

I_LOOK Retrieves the name of the module just below the stream head of the stream pointed to by ***fildes***, and places it in a null terminated character string pointed at by ***arg***. The buffer pointed to by ***arg*** should be at least **FMNameSZ**+1 bytes long. An **#include <sys/conf.h>** declaration is required. On failure, **errno** is set to one of the following values:

[EFAULT] ***arg*** points outside the allocated address space.

[EINVAL] No module present in stream.

I_FLUSH This request flushes all input and/or output queues, depending on the value of ***arg***. Legal ***arg*** values are:

FLUSHR Flush read queues.

FLUSHW Flush write queues.

FLUSHRW Flush read and write queues.

On failure, **errno** is set to one of the following values:

[ENOSR] Unable to allocate buffers for flush message due to insufficient STREAMS memory resources.

[EINVAL] Invalid ***arg*** value.

[ENXIO] Hangup received on ***fildes***.

I_SETSIG Informs the stream head that the user wishes the kernel to issue the **SIGPOLL** signal (see **signal**(S) and **sigset**(S)) when a particular event has occurred on the stream associated with ***fildes***. **I_SETSIG** supports an asynchronous processing capability in **STREAMS**. The value of ***arg*** is a bitmask that specifies the events for which the user should be signaled. It is the bitwise-OR of any combination of the following constants:

S_INPUT A non-priority message has arrived on a stream head read queue, and no other messages existed on that queue before this message was placed there. This is set even if the message is of zero length.

S_HIPRI A priority message is present on the stream head read queue. This is set even if the message is of zero length.

S_OUTPUT The write queue just below the stream head is no longer full. This notifies the user that there is room on the queue for sending (or writing) data downstream.

S_MSG A STREAMS signal message that contains the **SIGPOLL** signal has reached the front of the stream head read queue.

A user process may choose to be signaled only of priority messages by setting the *arg* bitmask to the value **S_HIPRI**.

Processes that wish to receive **SIGPOLL** signals must explicitly register to receive them using **I_SETSIG**. If several processes register to receive this signal for the same event on the same Stream, each process will be signaled when the event occurs.

If the value of *arg* is zero, the calling process will be unregistered and will not receive further **SIGPOLL** signals. On failure, **errno** is set to one of the following values:

[EINVAL] *arg* value is invalid or *arg* is zero and process is not registered to receive the **SIGPOLL** signal.

[EAGAIN] Allocation of a data structure to store the signal request failed.

I_GETSIG Returns the events for which the calling process is currently registered to be sent a **SIGPOLL** signal. The events are returned as a bitmask pointed to by *arg*, where the events are those specified in the description of **I_SETSIG** above. On failure, **errno** is set to one of the following values:

[EINVAL] Process not registered to receive the **SIGPOLL** signal.

[EFAULT] *arg* points outside the allocated address space.

I_FIND Compares the names of all modules currently present in the stream to the name pointed to by *arg*, and returns 1 if the named module is present in the stream. It returns 0 if the named module is not present. On failure, **errno** is set to one of the following values:

[EFAULT] *arg* points outside the allocated address space.

[EINVAL] *arg* does not contain a valid module name.

I_PEEK Allows a user to retrieve the information in the first message on the stream head read queue without taking the message off the queue. *arg* points to a **strpeek** structure which contains the following members:

```
struct strbuf   ctlbuf;
struct strbuf   databuf;
long            flags;
```

The `maxlen` field in the `ctlbuf` and `databuf` **strbuf** structures (see **getmsg**(S)) must be set to the number of bytes of control information and/or data information, respectively, to retrieve. If the user sets `flags` to **RS_HIPRI**, **I_PEEK** will only look for a priority message on the stream head read queue.

I_PEEK returns 1 if a message was retrieved, and returns 0 if no message was found on the stream head read queue, or if the **RS_HIPRI** flag was set in `flags` and a priority message was not present on the stream head read queue. It does not wait for a message to arrive. On return, `ctlbuf` specifies information in the control buffer, `databuf` specifies information in the data buffer, and `flags` contains the value 0 or **RS_HIPRI**. On failure, **errno** is set to one of the following values:

[EFAULT] *arg* points, or the buffer area specified in `ctlbuf` or `databuf` is, outside the allocated address space.

[EBADMSG] Queued message to be read is not valid for **I_PEEK**

I_SRDOPT Sets the read mode using the value of the argument *arg*. Legal *arg* values are:

RNORM Byte-stream mode, the default.

RMSGD Message-discard mode.

RMSGN Message-nondiscard mode.

Read modes are described in **read**(S). On failure, **errno** is set to the following value:

[EINVAL] *arg* is not one of the above legal values.

I_GRDOPT Returns the current read mode setting in an **int** pointed to by the argument *arg*. Read modes are described in **read**(S). On failure, **errno** is set to the following value:

[EFAULT] *arg* points outside the allocated address space.

I_NREAD Counts the number of data bytes in data blocks in the first message on the stream head read queue, and places this value in the location pointed to by *arg*. The return value for the command is the number of messages on the stream head read queue. For example, if zero is returned in *arg*, but the **ioctl** return value is greater than zero, this indicates that a zero-length message is next on the queue. On failure, **errno** is set to the following value:

[EFAULT] *arg* points outside the allocated address space.

I_FDINSERT Creates a message from user specified buffer(s), adds information about another stream and sends the message downstream. The message contains a control part and an optional data part. The data and control parts to be sent are distinguished by placement in separate buffers, as described below.

arg points to a **strfdinsert** structure which contains the following members:

```
struct strbuf   ctlbuf;
struct strbuf   databuf;
long            flags;
int             fildes;
int             offset;
```

The `len` field in the `ctlbuf` **strbuf** structure (see **putmsg**(S)) must be set to the size of a pointer plus the number of bytes of control information to be sent with the message. `fildes` in the **strfdinsert** structure specifies the file descriptor of the other stream. `offset`, which must be word-aligned, specifies the number of bytes beyond the beginning of the control buffer where **I_FDINSERT** will store a pointer. This pointer will be the address of the read queue structure of the driver for the stream corresponding to `fildes` in the **strfdinsert** structure. The `len` field in the `databuf` **strbuf** structure must be set to the number of bytes of data information to be sent with the message or zero if no data part is to be sent.

`flags` specifies the type of message to be created. A non-priority message is created if `flags` is set to 0, and a priority message is created if `flags` is set to **RS_HIPRI**. For non-priority messages, **I_FDINSERT** will block if the stream write queue is full due to internal flow control conditions. For priority messages, **I_FDINSERT** does not block on this condition. For non-priority messages, **I_FDINSERT** does not block when the write queue is full and **O_NDELAY** is set. Instead, it fails and sets **errno** to **EAGAIN**.

I_FDINSERT also blocks, unless prevented by lack of internal resources, waiting for the availability of message blocks in the stream, regardless of priority or whether **O_NDELAY** has been specified. No partial message is sent. On failure, **errno** is set to one of the following values:

[EAGAIN] A non-priority message was specified, the **O_NDELAY** flag is set, and the stream write queue is full due to internal flow control conditions.

[ENOSR] Buffers could not be allocated for the message that was to be created due to insufficient STREAMS memory resources.

[EFAULT] *arg* points, or the buffer area specified in `ctlbuf` or `databuf` is, outside the allocated address space.

[EINVAL] One of the following: `fildes` in the **strfdinsert** structure is not a valid, open stream file descriptor; the size of a pointer plus `offset` is greater than the `len` field for the buffer specified through `ctlptr`; `offset` does not specify a properly aligned location in the data buffer; an undefined value is stored in `flags`.

[ENXIO] Hangup received on ***fildes*** of the **ioctl** call or `fildes` in the **strfdinsert** structure.

[ERANGE] The `len` field for the buffer specified through `databuf` does not fall within the range specified by the maximum and minimum packet sizes of the topmost stream module, or the `len` field for the buffer specified through `databuf` is larger than the maximum configured size of the data part of a message, or the `len` field for the buffer specified through `ctlbuf` is larger than the maximum configured size of the control part of a message.

I_FDINSERT can also fail if an error message was received by the stream head of the stream corresponding to `fildes` in the **strfdinsert** structure. In this case, **errno** will be set to the value in the message.

I_STR Constructs an internal STREAMS **ioctl** message from the data pointed to by ***arg*** and sends that message downstream.

This mechanism is provided to send user **ioctl** requests to downstream modules and drivers. It allows information to be sent with the **ioctl** and will return to the user any information sent upstream by the downstream recipient. **I_STR** blocks until the system responds with either a positive or negative acknowledgment message or until the request "times out" after some period of time. If the request times out, it fails with **errno** set to **ETIME**.

At most, one **I_STR** can be active on a stream. Further **I_STR** calls will block until the active **I_STR** completes at the stream head. The default timeout interval for these requests is 15 seconds. The **O_NDELAY** (see **open**(S)) flag has no effect on this call.

To send requests downstream, ***arg*** must point to a **strioctl** structure which contains the following members:

```
int     ic_cmd;         /* downstream command */
int     ic_timout;      /* ACK/NAK timeout */
int     ic_len;         /* length of data arg */
char    *ic_dp;         /* ptr to data arg */
```

`ic_cmd` is the internal **ioctl** command intended for a downstream module or driver; and `ic_timout` is the number of seconds (-1 = infinite, 0 = use default, >0 = as specified) an **I_STR** request will wait for acknowledgment before timing out. `ic_len` is the number of bytes in the data argument and `ic_dp` is a pointer to the data argument. The `ic_len` field has two uses: on input, it contains the length of the data argument passed in, and on return from the command, it contains the number of bytes being returned to the user (the buffer pointed to by `ic_dp` should be large enough to contain the maximum amount of data that any module or the driver in the stream can return).

The stream head will convert the information pointed to by the **strioctl** structure to an internal **ioctl** command message and send it downstream.

On failure, **errno** is set to one of the following values:

[ENOSR] Unable to allocate buffers for the **ioctl** message due to insufficient STREAMS memory resources.

[EFAULT] ***arg*** points, or the buffer area specified by `ic_dp` and `ic_len` (separately for data sent and data returned), is outside the allocated address space.

[EINVAL] `ic_len` is less than 0 or `ic_len` is larger than the maximum configured size of the data part of a message or `ic_timout` is less than -1.

[ENXIO] Hangup received on ***fildes***.

[ETIME] A downstream **ioctl** timed out before acknowledgment was received.

An **I_STR** can also fail while waiting for an acknowledgment if a message indicating an error or a hangup is received at the stream head. In addition, an error code can be returned in the positive or negative acknowledgment message, in the event that the **ioctl** command sent downstream fails. For these cases, **I_STR** will fail with **errno** set to the value in the message.

I_SENDFD Requests the stream associated with ***fildes*** to send a message, containing a file pointer, to the stream head at the other end of a stream pipe. The file pointer corresponds to ***arg***, which must be an integer file descriptor.

I_SENDFD converts ***arg*** into the corresponding system file pointer. It allocates a message block and inserts the file pointer in the block. The user id and group id associated with the sending process are also inserted. This message is placed directly on the read queue (see **intro**(S)) of the stream head at the other end of the stream pipe to which it is connected. On failure, **errno** is set to one of the following values:

[EAGAIN] The sending stream is unable to allocate a message block to contain the file pointer.

[EAGAIN] The read queue of the receiving stream head is full and cannot accept the message sent by **I_SENDFD**.

[EBADF] *arg* is not a valid, open file descriptor.

[EINVAL] *fildes* is not connected to a stream pipe.

[ENXIO] Hangup received on *fildes*.

I_RECVFD Retrieves the file descriptor associated with the message sent by an **I_SENDFD ioctl** over a stream pipe. *arg* is a pointer to a data buffer large enough to hold an **strrecvfd** data structure containing the following members:

```
int fd;
unsigned short uid;
unsigned short gid;
char fill[8];
```

`fd` is an integer file descriptor. `uid` and `gid` are the user id and group id, respectively, of the sending *stream*.

If **O_NDELAY** is not set (see **open**(S)), **I_RECVFD** will block until a message is present at the stream head. If **O_NDELAY** is set, **I_RECVFD** will fail with **errno** set to **EAGAIN** if no message is present at the stream head.

If the message at the stream head is a message sent by an **I_SENDFD**, a new user file descriptor is allocated for the file pointer contained in the message. The new file descriptor is placed in the `fd` field of the **strrecvfd** structure. The structure is copied into the user data buffer pointed to by *arg*. On failure, **errno** is set to one of the following values:

[EAGAIN] A message was not present at the stream head read queue, and the **O_NDELAY** flag is set.

[EBADMSG] The message at the stream head read queue was not a message containing a passed file descriptor.

[EFAULT] *arg* points outside the allocated address space.

[EMFILE] No *files* file descriptors are currently open.

[ENXIO] Hangup received on *fildes*.

The following two commands are used for connecting and disconnecting multiplexed STREAMS configurations.

I_LINK Connects two streams, where *fildes* is the file descriptor of the stream connected to the multiplexing driver, and *arg* is the file descriptor of the stream connected to another driver. The stream designated by *arg* gets connected below the multiplexing driver. **I_LINK** requires the multiplexing driver to send an acknowledgment message to the stream head regarding the linking operation. This call returns a multiplexer ID number (an identifier used to disconnect the multiplexer, see **I_UNLINK**) on success, and a -1 on failure. On failure, **errno** is set to one of the following values:

- **[ENXIO]** Hangup received on *fildes*.
- **[ETIME]** Time out before acknowledgment message was received at stream head.
- **[EAGAIN]** Temporarily unable to allocate storage to perform the **I_LINK**.
- **[ENOSR]** Unable to allocate storage to perform the **I_LINK** due to insufficient STREAMS memory resources.
- **[EBADF]** *arg* is not a valid, open file descriptor.
- **[EINVAL]** *fildes* stream does not support multiplexing.
- **[EINVAL]** *arg* is not a stream, or is already linked under a multiplexer.
- **[EINVAL]** The specified link operation would cause a "cycle" in the resulting configuration; that is, if a given stream head is linked into a multiplexing configuration in more than one place.

An **I_LINK** can also fail while waiting for the multiplexing driver to acknowledge the link request, if a message indicating an error or a hangup is received at the stream head of *fildes*. In addition, an error code can be returned in the positive or negative acknowledgment message. For these cases, **I_LINK** will fail with **errno** set to the value in the message.

I_UNLINK Disconnects the two streams specified by *fildes* and *arg*. *fildes* is the file descriptor of the stream connected to the multiplexing driver. *fildes* must correspond to the stream on which the **ioctl I_LINK** command was issued to link the stream below the multiplexing driver. *arg* is the multiplexer ID number that was returned by the **I_LINK**. If *arg* is -1, then all streams which were linked to *fildes* are disconnected. As in **I_LINK**, this command requires the multiplexing driver to acknowledge the unlink. On failure, **errno** is set to one of the following values:

[ENXIO] Hangup received on ***fildes***.

[ETIME] Time out before acknowledgment message was received at stream head.

[ENOSR] Unable to allocate storage to perform the **I_UNLINK** due to insufficient STREAMS memory resources.

[EINVAL] ***arg*** is an invalid multiplexer ID number or ***fildes*** is not the stream on which the **I_LINK** that returned ***arg*** was performed.

An **I_UNLINK** can also fail while waiting for the multiplexing driver to acknowledge the link request, if a message indicating an error or a hangup is received at the stream head of ***fildes***. In addition, an error code can be returned in the positive or negative acknowledgment message. For these cases, **I_UNLINK** will fail with **errno** set to the value in the message.

See also

close(S), **fcntl**(S), **getmsg**(S), **intro**(S), **ioctl**(S), **open**(S), **poll**(S), **putmsg**(S), **read**(S), **signal**(S), **sigset**(S), **write**(S)

STREAMS Programmer's Guide
STREAMS Primer

Diagnostics

Unless specified otherwise above, the return value from **ioctl** is 0 upon success and -1 upon failure with **errno** set as indicated.

string

access boot, configuration, or package string

Description

There are three string devices (the number in the first column is the string device's minor device number):

1. */dev/string/boot* Read/write access to the bootstring.
2. */dev/string/pkg* Read-only access to the package string.
3. */dev/string/cfg* Read-only access to the configuration string.

The bootstring (**bootstring**) is the string built by **/boot** from user input and from */etc/default/boot*. The package string (**pkgstring**) lists what has been linked into the kernel at boot time. The configuration string (**cfgstring**) is a concatenation of all the output from **printcfg**(K).

The routines **getbsvalue**(K), **getbsflag**(K), **getpkgvalue**(K), and **getpkgflag**(K) provide an interface to */dev/string/boot* and */dev/string/pkg*. */dev/string/cfg* can only be accessed directly.

Reading from the devices is non-blocking and non-destructive.

See also

boot(HW), **cfgstart**(K), **close**(S), **getbsflag**(K), **getbsflag**(S), **getbsvalue**(K), **getbsvalue**(S), **getcfgline**(K), **getpkgvalue**(K), **getpkgvalue**(S), **getpkgflag**(K), **getpkgflag**(S), **open**(S), **printcfg**(K), **read**(S), **write**(S)

Device Drivers Writer's Guide

Value added

/dev/string is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

subsystem

security subsystem component description

Description

The operating system includes extensions to the UNIX system that segregate commands and data which are used to implement system services. Many of these commands have been grouped into subsystems. A group of commands and data performing similar security relevant tasks or together protecting a set of resources is termed a *protected subsystem.*

The operating system has the following protected subsystems:

- Memory
- Terminal
- Line Printer
- Backup
- Authentication
- Cron
- Audit

The description of each subsystem includes the following information:

Group and Subsystem Authorization Name
: Each subsystem is associated with a subsystem authorization. The commands and files associated with the subsystem take the subsystem authorization name as their group name. Users wishing to use the subsystem must have the appropriate subsystem authorization.

Commands
: Each subsystem has a set of commands.

Helper Programs
: Some subsystems use helper programs. These are programs which call other programs.

Data Files
: A subsystem's programs use permanent and temporary data files.

The administrative functions associated with each subsystem can be selected from the **sysadmsh** menu. Help information is available with each option.

The memory subsystem

The **mem** subsystem authorization is defined to grant users the ability to use the memory subsystem commands to view total system activity. Users without this authorization may only view their own processes. Traditional UNIX allowed any user to view total system activity. This authorization was introduced to allow the administrator to isolate users, and restrict their ability to sense the activity of other users.

Mem authorization and group name

In order to look at information in the **mem** subsystem, an administrator must have the **mem** authorization. The administrator responsible for maintaining users' processes should be the only person with this authorization. This administrator may need to list users' processes in order to select one or more of them for removal (using the **kill**(C) command). The following is a table of command modifications managed by the **mem** authorization:

Command	With mem	Without mem
ps	lists all processes (standard behavior)	list processes owned by login user ID, or owned by real user ID of current process on current terminal
whodo	lists all processes (standard behavior)	list processes on terminals owned by user
ipcs	lists all objects (standard behavior)	list objects for which user is creator or owner or for which user has read access

sysadmsh selection

The Memory subsystem does not have a **sysadmsh** selection as the Printer subsystem does. The Memory subsystem includes the system tables that contain information about memory and processes, which is accessed by several commonly-used UNIX utilities.

Commands

ps An administrator with **mem** authorization can use the **ps**(C) command to list all users' processes. Using the command without the **mem** authorization shows only those processes associated with the user invoking it.

whodo An administrator with **mem** authorization can use the **whodo**(ADM) command to list processes by terminal. Someone using the command without **mem** authorization sees only the processes associated with their terminal.

ipcs An administrator with **mem** authorization can use this command to view active semaphores, shared memory segments and message queues (known collectively as IPC entities). Without **mem** authorization, a user is restricted to viewing IPC entities that they own or created and those which have read permission. Even entities that are writable, but not readable, cannot be displayed.

crash An administrator with **mem** authorization can run the **crash** program to report information on kernel data structures. The report includes security information.

An administrator can search for information by running **crash** and specifying an identifier name.

Helper programs

timex Because **timex** uses internal kernel data structures, it must be run from an account in the **mem** group.

Accounting programs

Accounting programs such as **sa**(ADM), **acctcom**(ADM), and **sar**(ADM) also use information in the **mem** subsystem. These programs must be run from an account in the **mem** group.

Data files

All files through which programs may access kernel memory are protected with owner *root*, group **mem**, and mode -r--r-----. As for all files, the *root* account bypasses the discretionary check on these files, and root programs may violate the System Architecture requirement. All *root* programs (those running with effective ID equal to *root*) must take care when running other programs, because those programs inherit the right to modify the running copy of the TCB. The following files are protected by the **mem** subsystem according to the above owner, group, and mode:

/etc/ps.data cache relevant parts of the kernel symbol table to avoid lengthy lookups for each run of **ps**.

/dev/mem special device allowing access to physical memory including the operating system and all resident processes.

/dev/kmem special device allowing access to the operating system image.

/dev/swap special file for the disk partition used as the system swap device, storing memory images of non-resident processes.

/unix executable file containing the binary copy of the operating system. Writing this file modifies the executing copy of the TCB when the system is rebooted.

The terminal subsystem

The **terminal** subsystem protects the use of terminals by restricting the use of the **write**(C) and **mesg**(C) commands.

Terminal authorization and group name

In order to send information from one terminal to another, the user sending information must have the **terminal** authorization and the receiving terminal must be configured to accept information from other terminals.

All terminals belong to the **terminal** group. Each terminal is owned by and can only be used by a given user identity.

sysadmsh selection

The **terminal** subsystem does not control **sysadmsh** functions.

Commands

When an unauthorized user uses the **write** command, any special control codes or escape sequences he sends are trapped and converted to presentable ASCII characters. All control codes are output as

^⟨*char*⟩

where ⟨*char*⟩ is the character whose ASCII code is the character sent plus 0100. For instance, ASCII NUL (0), SOH (1), and ACK (6) are output as ^@ (@ is 0100), **^A** (A is 0101) and **^F** respectively on the recipient's terminal. The ASCII ESC (033) character writes as **^[** and the DEL (0177) character writes as **^?**.

As an example of using the trusted write command, assume there is a hypothetical terminal that silently stores any string between two ASCII DC4 (024) characters. This string is transmitted from the same hypothetical terminal to the computer when the terminal receives a DC2 (022) character. Assume that a devious user knows the recipient of a **write** command has this terminal and tries to corrupt the recipient's session by sending a damaging message. If this user did not have the terminal authorisation, the recipient would see the message:

```
How are y^Trm *^Tou today^E?
```

The recipient would be alerted to an attempt on his session. In addition, the **terminal** subsystem audits this event so you can locate suspect activity. On the other hand, if the sending user has the **terminal** authorization, the recipient would see the message:

```
How are you today?
```

The following commands are modified to support the terminal subsystem.

Command	With Terminal	Without Terminal
write	unrestricted (standard behavior)	control codes output as ^⟨char⟩
mesg	changes sense of group write permission only	same

A person with **terminal** authorization can use the **write**(C) command to write to another terminal and send control codes and escape sequences. A malicious user might use the command to send malicious commands and breach system security.

Without the authorization, a user can use the **write**(C) command, but control codes and escape sequences are displayed on the receiving terminal in their ASCII form, thus warning the recipient of suspicious activity. Such activity is recorded by the audit facilities.

The **mesg y** form of the command allows messages, but sets write permission for the terminal device group that has been set to **terminal** by the login program. The new write command is SGID to **terminal**, which allows it to send characters to user terminals that have used **mesg y** of the file enough for the **terminal** group to write to the terminal. The new **write** command handles this change. Unlike the less trusted **mesg**, UNIX **mesg** never allows any permission to all users.

Data files

The data files for the terminal subsystem are the terminals themselves. They belong to the terminal group at the start and end of each session, and all access is denied except to the user. The preferred way for a user to open and close access to a terminal is to use the **mesg** command. When a session is not in progress on a terminal, only the super user can access the device file. Some terminal files are presented below.

/dev/console This is the system console. Use of this terminal as a user terminal is discouraged because:

- Messages from the kernel appear on */dev/console*. To avoid losing these messages or intermixing them with user messages, it is better to use the console solely for the message output.
- On some systems, physical access to the console is equivalent to having access to the entire system. Use another terminal unless the system configuration prevents this. In any event, allow physical access to */dev/console* only to the most trusted users of the system.

*/dev/tty** Most of the terminals on the system are named */dev/tty1*, */dev/tty2*, */dev/tty3*, ... These devices may at times be owned by a protected subsystem (such as **uucp** or **terminal**) and be unavailable for general use. You have the option of configuring the terminals for login sessions, protected subsystems, or for nothing.

Line printer subsystem

The purpose of the **lp** subsystem is to provide an administrative role that has control over printing facilities. Unlike the less trusted version of the **lp** commands, the trusted version does not require a special printer account that owns and executes (with the SUID bit set) all the printer programs. Instead, there is an **lp** group with multiple users as its members.

Authorization/Group name

The **lp** authorization allows the user to be a printer administrator. This allows multiple Printer administrators. They force the administrator to have a login userid (LUID) of 0 or a login name of **lp**, a scheme that does not allow you much flexibility in account setups or individual accountability.

All printer administrators are allowed to execute some commands that non-authorized users cannot, and can perform certain actions within commands that are restricted from other users. Only administrators may run **accept**, **lpadmin**, **lpmove**, **lpsched**, **lpshut**, **reject** and **topq**. For the other commands, enhancements due to **lp** authorization are detailed under each command heading.

sysadmsh selection

The **lp** authorization allows access to the printing functions under the System ➪ Printer selection as described in the "Using Printers" chapter.

Commands

To determine the invoker, the Printer subsystem command uses the immutable login user ID (LUID). Less trusted versions use various other schemes, all of which could be fooled. The commands listed here perform exactly like their traditional (less trusted) versions except where noted:

accept The **accept** command may only be used by printer administrators.

cancel The less trusted version of **cancel** allowed any user to cancel any job. The originating user is notified of the cancellation via mail. The trusted version of **cancel** gives this right to printer administrators only. Mail is still sent to the originator when a job is canceled by the printer administrator. Other users can only remove jobs they submitted.

disable The **disable** command operates without change from the less trusted version.

enable The **enable** command operates without change from the less trusted version.

lp The trusted version of the **lp** command, with the **-w** option enabled by you, never writes to the terminal directly as does the less trusted version of **lp**. The trusted version of **lp** knows that the system prohibits direct writing to another user's terminal. Instead, the **write**(C)program refer to the previous discussion of **write** in the **terminal** subsystem.

The trusted version of the **lp** command creates an output label for each file submitted. The output label contains the system label (the same as seen on most terminals), the owner, group, and mode of the file. To accurately determine the output label, the **lp** command cannot accept input from pipes. This is because the discretionary attributes of a file are not available if the file was accessed on the other end of a pipe. Note that input redirection and temporary files may still be printed.

Printer files are always copied to the printer spool by assuming the **-c** (copy) option, even if the user did not explicitly request it. By doing this, the **lp** subsystem ensures that the file cannot be altered between the time the request was made and the time it is printed. (The less trusted version of **lp** does not guarantee that the file cannot be updated, even while the printer is running.) As added protection, the file being copied is locked during the formation of the output label and the copy operation, so that the file and label output accurately reflects the file being printed.

lpadmin This command may only be used by printer administrators.

lpforms The **lpforms** command operates without change from the less trusted version.

lpmove This command may only be used by printer administrators.

lpsched The **lpsched** command may only be used by printer administrators. When the **lpsched** command uses a printer device dedicated to the **lp** subsystem, the subsystem guarantees exclusive use of the printer device each time it is used. Any prior activity (outside the **lp** subsystem) on that device is forcibly stopped. In this way, the **lp** subsystem ensures that the file being output is not interspersed with other output, unlike less trusted versions.

lpshut The **lpshut** command may only be used by printer administrators.

lpstat The trusted version of **lpstat** does not display other users' jobs if the invoking user does not have the **lp** authorization. Knowing the jobs of other users is not necessary since unauthorized users cannot hold or cancel those jobs anyway. Printer administrators see all printer jobs, and they can hold or cancel any job that has been submitted.

reject This command may only be used by printer administrators.

topq The **topq** command may only be used by printer administrators.

Data file

/usr/spool/lp All the files in this file hierarchy have the same formats and purposes as their counterparts in less trusted versions of UNIX. In the trusted version, the files are accessible by any printer administrator, so that the group permissions are the only ones of true importance. In all cases, the spool, its directories, and all data files allow no access to the user population. Hence, a user can be assured that a private file that is spooled for printing cannot be accessed or changed by untrusted users.

Backup subsystem

The purpose of the **backup** subsystem is to provide a full set of disk and tape management tools without requiring detailed knowledge of UNIX. The backup administrator assumes responsibility of file system maintenance. The backup administrator is responsible for all actions which do not modify the format of file systems, while the *root* account is still responsible for formatting, configuring, and maintaining the consistency of file system disk partitions.

Authorization/Group name

The user with **backup** authorization, a Backup administrator, may perform file backups. Restorations can only be made by the root user. The following authorizations are defined for the backup subsystem:

Authorization	Type	Purpose
backup	primary	enables system backup command
queryspace	secondary	allows use of **df** program

All disk partitions are protected with owner *root*, group **backup** and mode -r--r---. The mount table (*/etc/mnttab*) is publicly readable, modified only by the **mount** command. The **df** program is SGID to **backup**, which enforces the **queryspace** and **backup** authorizations.

sysadmsh selection

The **backup** authorization allows access to the backup functions under the Backups selection.

Commands

df The **df** command may only be used by Backup administrators. Otherwise, the options and output format remain the same as the less trusted version.

mkfs The **mkfs** command may only be used by a member of the **backup** group (or by the super user, which is discouraged). As always, this command must be used to initialize a filesystem after the partitions are laid out. Immediately after **mkfs** is run, you should run **labelit** to complete the initialization.

labelit The **labelit** program, documented in **volcopy**(ADM), associates the filesystem with a directory mount point.

Helper programs

/etc/mount This program is used by **backupif** to display and modify the mounted file systems.

/etc/fsck This is used by **backup** to check and repair filesystems.

/usr/bin/backup This program is used to copy entire UNIX and XENIX filesystems to either magtape or cartridge tape.

/bin/xbackup This program is used to copy entire XENIX disk filesystems to either magtape or cartridge tape.

/bin/xrestore This program is used to replace entire XENIX filesystem images on magtape or cartridge tape to a clean (newly formatted with **mkfs**)

/usr/bin/restore This program is used to replace entire XENIX or UNIX filesystem images on magtape or cartridge tape.

/usr/bin/cpio This is the default backup program. **cpio** makes non-filesystem specific copies of filesystem data.

Data files

/etc/default/filesys This file contains the relationship between mounted filesystem devices and the directories on which they are mounted (mount points). It is used to display that relationship in both **df** and the **backup** selection. Because altering this file would display erroneous information to backup administrators and reading this file defaults the access protection created for the **backup** subsystem, this file must be accessible to the **backup** group only.

*/dev/[r]d[s]k** These block and character special files are the buffered interfaces to the disk partitions you have set up. They are used for mounting the filesystem they contain onto a directory. The **backup** group must be able to read and write these files. It is a severe security breach if others can access these files in any way.

Authentication subsystem

The Authentication subsystem provides you with an exhaustive set of account management services. These services are:

- self-checking to prevent dangerous actions, and
- monitored extensively by the auditing system.

Authorization/Group name

The **auth** authorization allows an Authentication administrator to perform sensitive actions on the Authentication database. This database contains all information on account ownership, types, authorizations, locked status, login times, password change times, and various other parameters.

With the **auth** authorization, an Authentication administrator may alter Authentication parameters for other users. Because this database directly controls the attributes of any account on the system, this subsystem controls user access to your system. The trust you place in the system can be no greater than that placed in the Authentication administrators. Not only must they be trustworthy people, but they must also not leave any uncorrected mistakes when assigning authorizations to the accounts they manage.

sysadmsh selection

The **auth** authorization allows access to the user account management functions under Accounts.

Commands

passwd The **passwd** command in UNIX has been greatly enhanced for both security and flexibility. The trusted system checks on system-wide password parameters as well as user-specific ones and, depending on the results found, the user has a choice of choosing their own password or having one chosen for them. You can set each account to do either one of these, or do both. A closely related change is that, regardless of the method for getting the password, you can have the system screen passwords that are probable guesses by intruders. The password selection method, as well as the optional restriction screening, are set by Authentication administrators in **sysadmsh** for a single account or for system-wide use.

login The **login** command is no longer available as a command used in a session to start a new session. Instead, a user must first log out before logging in as another user.

Sublogins are forbidden since the LUID of a session may not change once it is set. This is to guarantee to you that the owner of a session is known at all times. If the **login** program were allowed to be run from a session, the login USERID would have to change and the guarantee would be broken.

The **login** program is still invoked from **getty** to start a user session. The procedure for logging in is almost the same. The user supplies a login name and the system requests a password. Once the password is entered, the system either lets the user log in or rejects the login attempt. A user may be rejected for a number of reasons:

1. The account does not exist.
2. The password was entered incorrectly.
3. The password lifetime has been passed.
4. The number of unsuccessful attempts made to the account has surpassed a system or account threshold.
5. The number of unsuccessful attempts made to the terminal has surpassed a system or terminal threshold.
6. An Authentication administrator has unconditionally locked the account.

Reasons 3 through 6 notify the user that the Authentication administrator has locked the account.

If the user enters the correct login name/password combination, the last successful and unsuccessful login times are displayed on the terminal. The user should view the dates and times of each to determine if someone else has used the account. These dates may also be used to determine whether a Trojan horse program is simulating the **login** procedure to obtain a password. A user with doubts about the authenticity of the login dates and times should report it to you. The earlier you take action on this, the better you can use fresh audit trails and people's recollections to find the source of the problem.

su The **su** program has been strengthened a great deal for security. It now uses information from the Authentication database in determining whether or not to allow a user to "switch" to another user. The following rules apply:

- A user cannot use **su** to enter an account that has been locked.
- The **su** command cannot be used as a means to bypass the lock-checking done by **login, at,** and **cron.**

newgrp The **newgrp** command operates without change from the less trusted version.

auths The **auths** command is especially tailored for UNIX to allow all users to adjust their authorizations. No user can increase authorizations, but one can temporarily decrease authorizations in order to run an untrusted program or to prevent mistakes. More details on the authorizations and syntax are given in the man page for **auths**(C).

Data files

/usr/adm/sulog This file keeps track of the history of use of the **su** program. Each line represents an attempt to run the **su** program. The date and time are first recorded on the line. Then, a "-" means the attempt failed; a "+" means the attempt succeeded. After the "-" or "+" code, the terminal of the attempt is provided. Last, the login name (using the login UID) of the invoker of **su**, together with the login name of the (attempted) changed real UID is presented. As an example, the following log excerpt presents some interesting situations:

```
SU 02/29 19:19 + tty?? root-lp
SU 03/01 20:22 + tty2 blf-root
SU 03/04 04:13 + tty2 fred-proj1
SU 03/07 20:30 - tty2 reese-star
SU 03/07 20:30 + tty2 reese-star
SU 03/07 21:38 + modem auth-root
SU 03/07 21:39 + tty2 blf-root
SU 03/07 21:39 - tty7 daa-root
SU 03/07 21:40 - tty7 daa-root
SU 03/07 21:40 - tty7 daa-root
SU 03/07 21:41 - tty7 daa-root
SU 03/07 21:41 - tty7 daa-root
SU 03/07 21:47 + tty2 fred-proj1
```

- Foremost, it appears as though the user *daa* is attempting to break into the *root* account, for there are many unsuccessful attempts (denoted with the "-" attribute) in rapid succession. That should be investigated further.
- The **su** program does not require one to become the *root* user. In the log above, users *root*, *fred* and *reese* chose to assume the identities of other users.
- In the effort by *reese* to become the *star* user, the first attempt failed and the next immediately succeeded. This occurs frequently and is quite natural when users mistype the password of the other account. You should get suspicious, however, when the number of unsuccessful attempts becomes large. Such attempts, like the case with *daa* above, probably means a breach of security.
- The **su** program was used by *root* to enter the **lp** account. This occurrence was detached from any terminal, because of the special terminal designation of *tty??*. This particular case occurred from **/etc/rc** where the **lpsched** daemon is run.

The */usr/adm/sulog* file needs attention periodically. It should be examined and then pruned, saving the most recent entries. The entries removed from the file should be archived if possible rather than completely deleted.

/tcb/files/auth This directory consists of subdirectories that contain private account data for all the accounts in the system. There is a file for each account. Because of the sensitive nature of the data here, all these files are completely protected from the users.

/etc/auth/system This directory contains the system-wide authorization data for the machine. The */etc/auth/system* directory contains the Terminal Control database, the File Control database, the Command Control database and the System Defaults database. This information is accessible to the users but not writable. The */etc/auth/subsystems* directory contains one file per protected subsystem, each containing the user permissions for that protected subsystem. This permissions file may only be read by the programs that are part of that protected subsystem, and is written by the *auth* user.

cron subsystem

The purpose of the **cron** subsystem is to allow **cron, at,** and **batch** services that are audited as closely as normal login sessions. The **cron** subsystem provides a useful interface for controlling these facilities.

Authorization/Group name

The authorization for the **cron** subsystem is given to cron administrators who are allowed to view or alter the authority for users to run the services associated with the **cron** subsystem. A user may run the programs of the **cron** subsystem (excluding the use of the **sysadmsh** selections) without the authorization, provided that a **cron** administrator has granted the authority.

sysadmsh selection

The **cron** authorization allows access to the process management functions under Jobs.

Commands

at, batch, crontab These **at** commands operate in the same way as the less trusted version, except that the LUID (login UID), rather than the real UID, is used by **at** in determining the user. Because the LUID cannot be altered during a session, it promotes better accountability. **at** and **batch** jobs run with all of the login, real, and effective UIDs set to that of the login user.

Helper programs

/tcb/lib/cron This is the **cron** daemon that actually runs all **at, batch,** and **crontab** jobs. The **at, batch,** and **crontab** commands merely queue the jobs for the **cron** daemon to run. This daemon validates the account (ensures the account is not locked) before running the job.

Data files

Although enumerated here, these data files are not manipulated directly by the **cron** administrator because of the arcane rules historically applied to them by the **cron** subsystem programs. Instead, the **sysadmsh** provides a more coherent interface, reducing the possibility that users or permissions are set up incorrectly.

/usr/lib/cron — This is the directory containing all the **cron** administrative files.

/usr/lib/cron/at.allow — This file lists the users allowed to execute the **at** or **batch** programs. If this file exists, it is used to determine the user's authority.

/usr/lib/cron/at.deny — This file lists the users denied access to the **at** or **batch** programs. If */usr/lib/cron/at.allow* does not exist, */usr/lib/cron/at.deny* is used to determine the user's authority. You should be aware that an empty *at.deny* file permits access for all users.

/usr/lib/cron/cron.allow — This file lists the users allowed to execute the **crontab** program. If this file exists, it is used to determine the user's authority.

/usr/lib/cron/cron.deny — This file lists the users denied access to the **crontab** program. If */usr/lib/cron/cron.allow* does not exist, */usr/lib/cron/cron.deny* is used to determine the user's authority. You should be aware that an empty *cron.deny* file permits access for all users.

/usr/lib/cron/.proto — This file contains a list of commands that are executed before every **at** job. It contains commands primarily used to fix and restrict the environment of the user before running the job submitted.

/usr/lib/cron/.proto.b — This file contains a list of commands that are executed before every **batch** job. It contains commands primarily used to fix and restrict the environment of the user before running the job submitted.

/usr/lib/cron/log — This is a log of all **at**, **batch**, and **crontab** activity reported by the **cron** daemon since the system was rebooted. It provides an accurate ASCII log of all user initiated non-terminal activity. If the system is up for a very long time and there are many job submissions or **crontab** activity, this file should be periodically examined, pruned, and archived.

/usr/lib/cron/OLDlog — This is the log associated with the last time the system was up. Upon startup, the **cron** daemon moves any */usr/lib/cron/log* file here.

/usr/spool/cron — This is the root of the subtree where all **at**, **crontab**, and **batch** jobs are stored. **at** and **batch** jobs are automatically cleared when they have finished executing. The **-r** option of **crontab** removes a **crontab** job.

Audit subsystem

The purpose of the **audit** subsystem is to provide an administrative role that has control over auditing facilities.

Authorization/Group name

The **audit** authorization allows the user to be the audit administrator. The audit administrator can enable and disable auditing, examine audit records, generate reports and alter audit parameters.

sysadmsh selection

The **audit** authorization allows access to the audit functions under the System ➪ Audit selection as described in the "Maintaining system security" chapter.

Commands

auditcmd — The command interface for audit subsystem activation, termination, statistic retrieval, and subsystem notification.

auditd — The **auditd** utility is the daemon that runs when auditing is enabled.

reduce — This program performs audit data analysis and reduction.

Data files

/tcb/files/audit/audit_parms — Audit parameters file.

*/tcb/files/audit/** — Audit log file directory.

/tcb/audittmp — Audit compaction file directory.

Creating a new subsystem

The system administrator can create additional subsystems as desired.

To create a new subsystem, do the following:

1. Add a line to */etc/auth/system/authorize* of the following format:

   subsystem*:*class1*,*class2*,...,*classn

   where:

subsystem	the name of your new subsystem
class1...n	optional name(s) of the authorizations

   For example:

   ```
   backup:dump,freespace
   ```

   This defines the "backup" subsystem (used to control read access to filesystems), which has two special cases: "dump", actually make a backup of the filesystem, and "freespace", ability to read the filesystem to determine how full it is (but for no other reason).

2. Create a group with the same name as the subsystem. Make the (empty) file */etc/auth/subsystems/**subsystem***, owner *auth* or *bin*, and the group owner is the new group ***subsystem*** with a mode of at least 440 (the mode must not grant any write permission to "other").

You are finished creating the new subsystem. It should be automatically recognized and understood by the system and the **sysadmsh**. There can be at most 32 subsystems and all names must be unique.

See also

audit(HW), **auditcmd**(ADM), **auditd**(ADM), **authck**(ADM), **auths**(C), **authcap**(F), **chg_audit**(ADM), **integrity**(ADM), **reduce**(ADM)

"Maintaining System Security" in the *System Administrator's Guide*

Value added

subsystem is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

sxt

pseudo-device driver

Description

sxt is a pseudo-device driver that interposes a discipline between the standard **tty** line disciplines and a real device driver. The standard disciplines manipulate *virtual* tty structures (channels) declared by the **sxt** driver. **sxt** acts as a discipline manipulating a *real* tty structure declared by a real device driver. The **sxt** driver is currently only used by the **shl**(C) command.

Virtual ttys are named */dev/sxt??* or */dev/sxt/??* (where *??* is a combination of two digits, each in the range 0 ..7) and are allocated in groups of up to eight. Filenames end in three digits, where the first two digits represent the group and the last digit represents the virtual tty number of the group. The */dev/sxt* form of the name increases the size of */dev*, which adversely affects some commands; the */dev/sxt/* form is not understood by most commands. To allocate a group, a program should exclusively open a file with a name of the form */dev/sxt??0* (channel 0) or */dev/sxt/??0* and then execute a **SXTIOCLINK ioctl** call to initiate the multiplexing.

Only one channel, the *controlling* channel, can receive input from the keyboard at a time; others attempting to read will be blocked.

There are two groups of **ioctl**(S) commands supported by **sxt**. The first group contains the standard **ioctl** commands described in **termio**(M), with the addition of the following:

TIOCEXCL Set *exclusive use* mode: no further opens are permitted until the file has been closed.

TIOCNXCL Reset *exclusive use* mode: further opens are once again permitted.

The second group are directives to **sxt** itself. Some of these may only be executed on channel 0.

SXTIOCLINK Allocate a channel group and multiplex the virtual ttys onto the real tty. The argument is the number of channels to allocate. This command may only be executed on channel 0. Possible errors include:

- **EINVAL** The argument is out of range.
- **ENOTTY** The command was not issued from a real tty.
- **ENXIO** **linesw** is not configured with **sxt**.

EBUSY An **SXTIOCLINK** command has already been issued for this real tty.

ENOMEM There is no system memory available for allocating the virtual tty structures.

EBADF Channel 0 was not opened before this call.

SXTIOCSWTCH Set the controlling channel. Possible errors include:

EINVAL An invalid channel number was given.

EPERM The command was not executed from channel 0.

SXTIOCWF Cause a channel to wait until it is the controlling channel. This command will return the error, EINVAL, if an invalid channel number is given.

SXTIOCUBLK Turn off the **loblk** control flag in the virtual tty of the indicated channel. The error **EINVAL** will be returned if an invalid number or channel 0 is given.

SXTIOCSTAT Get the status (blocked on input or output) of each channel and store in the **sxtblock** structure referenced by the argument. The error **EFAULT** will be returned if the structure cannot be written.

SXTIOCTRACE Enable tracing. Tracing information is written to the console. This command has no effect if tracing is not configured.

SXTIOCNOTRACE Disable tracing. This command has no effect if tracing is not configured.

Files

/dev/sxt??[0-7]	virtual tty devices
/dev/sxt/??[0-7]	
/usr/include/sys/sxt.h	driver specific definitions

See also

ioctl(S), **open**(S), **shl**(C), **stty**(C), **termio**(M)

systty

system maintenance device

Description

The file */dev/systty* is the device on which system error messages are displayed. The actual physical device accessed via */dev/systty* is selected during boot, and is typically the device used to control the bootup procedure. The default physical device */dev/systty* is determined by **boot**(HW) when the system is brought up.

Initially */dev/console* is linked to */dev/systty*.

File

/dev/systty

See also

boot(HW), **console**(M)

term

conventional names for terminals

Description

These names are used by certain commands (for example, **man**(C), **tabs**(C), **tput**(C), **vi**(C) and **curses**(S)) and are maintained as part of the shell environment in the environment variable **TERM** (see **sh**(C), **profile**(F), and **environ**(M)).

Entries in **terminfo**(F) source files consist of a number of comma-separated fields. (To obtain the source description for a terminal, use the **-I** option of **infocmp**(ADM).) White space after each comma is ignored. The first line of each terminal description in the **terminfo**(F) database gives the names by which **terminfo**(F) knows the terminal, separated by bar (|) characters. The first name given is the most common abbreviation for the terminal (this is the one to use to set the environment variable **TERMINFO** in **$HOME**.*profile*; see **profile**(F)). The last name given should be a long name fully identifying the terminal, and all others are understood as synonyms for the terminal name. All names but the last should contain no blanks and must be unique in the first 14 characters; the last name may contain blanks for readability.

Terminal names (except for the last, verbose entry) should be chosen using the following conventions. The particular piece of hardware making up the terminal should have a root name chosen. For example, for the AT&T 4425 terminal, the root name is *att4425*. This name should not contain hyphens, except that synonyms may be chosen that do not conflict with other names. Up to 8 characters, chosen from [a-z0-9], make up a basic terminal name. Names should generally be based on original vendors, rather than local distributors. A terminal acquired from one vendor should not have more than one distinct basic name. Terminal sub-models, operational modes that the hardware can be in, or user preferences, should be indicated by appending a hyphen and an indicator of the mode. Thus, an AT&T 4425 terminal in 132 column mode would be *att4425-w*. The following suffixes should be used where possible:

Suffix	Meaning	Example
-w	Wide mode (more than 80 columns)	att4425-w
-am	With auto. margins (usually default)	vt100-am
-nam	Without automatic margins	vt100-nam
-n	Number of lines on the screen	aaa-60
-na	No arrow keys (leave them in local)	c100-na
***-n*p**	Number of pages of memory	c100-4p
-rv	Reverse video	att4415-rv

To avoid conflicts with the naming conventions used in describing the different modes of a terminal (for example, **-w**), it is recommended that a terminal's root name not contain hyphens. Further, it is good practice to make all terminal names used in the **terminfo**(F) database unique. Terminal entries that are present only for inclusion in other entries via the **use=** facilities should have a "+" in their name, as in *4415+nl*.

Some of the known terminal names may include the following (for a complete list, type: **ls -C /usr/lib/terminfo/?**):

2621,hp2621	Hewlett-Packard 2621 series
2631	Hewlett-Packard 2631 line printer
2631-c	Hewlett-Packard 2631 line printer - compressed mode
2631-e	Hewlett-Packard 2631 line printer - expanded mode
2640,hp2640	Hewlett-Packard 2640 series
2645,hp2645	Hewlett-Packard 2645 series
3270	IBM Model 3270
33,tty33	AT&T TELETYPE Model 33 KSR
35,tty35	AT&T TELETYPE Model 35 KSR
37,tty37	AT&T TELETYPE Model 37 KSR
4000a	Trendata 4000a
4014,tek4014	TEKTRONIX 4014
40,tty40	AT&T TELETYPE Dataspeed 40/2
43,tty43	AT&T TELETYPE Model 43 KSR
4410,5410	AT&T 4410/5410 terminal in 80-column mode - version 2
4410-nfk,5410-nfk	AT&T 4410/5410 without function keys - version 1
4410-nsl,5410-nsl	AT&T 4410/5410 without pln defined
4410-w,5410-w	AT&T 4410/5410 in 132-column mode
4410v1,5410v1	AT&T 4410/5410 terminal in 80-column mode - version 1
4410v1-w,5410v1-w	AT&T 4410/5410 terminal in 132-column mode - version 1
4415,5420	AT&T 4415/5420 in 80-column mode
4415-nl,5420-nl	AT&T 4415/5420 without changing labels
4415-rv,5420-rv	AT&T 4415/5420 80 columns in reverse video
4415-rv-nl,5420-rv-nl	AT&T 4415/5420 reverse video without changing labels
4415-w,5420-w	AT&T 4415/5420 in 132-column mode
4415-w-nl,5420-w-nl	AT&T 4415/5420 in 132-column mode without changing labels
4415-w-rv,5420-w-rv	AT&T 4415/5420 132 columns in reverse video
4415-w-rv-nl,5420-w-rv-nl	AT&T 4415/5420 132 columns reverse video without changing labels
4418,5418	AT&T 5418 in 80-column mode
4418-w,5418-w	AT&T 5418 in 132-column mode
4420	AT&T TELETYPE Model 4420
4424	AT&T TELETYPE Model 4424
4424-2	AT&T TELETYPE Model 4424 in display function group ii
4425,5425	AT&T 4425/5425

(Continued on next page)

(Continued)

4425-fk,5425-fk	AT&T 4425/5425 without function keys
4425-nl,5425-nl	AT&T 4425/5425 without changing labels in 80-column mode
4425-w,5425-w	AT&T 4425/5425 in 132-column mode
4425-w-fk,5425-w-fk	AT&T 4425/5425 without function keys in 132-column mode
4425-nl-w,5425-nl-w	AT&T 4425/5425 without changing labels in 132-column mode
4426	AT&T TELETYPE Model 4426S
450	DASI 450 (same as Diablo 1620)
450-12	DASI 450 in 12-pitch mode
500,att500	AT&T-IS 500 terminal
510,510a	AT&T 510/510a in 80-column mode
513bct,att513	AT&T 513 bct terminal
5320	AT&T 5320 hardcopy terminal
5420_2	AT&T 5420 model 2 in 80-column mode
5420_2-w	AT&T 5420 model 2 in 132-column mode
5620,dmd	AT&T 5620 terminal 88 columns
5620-24,dmd-24	AT&T TELETYPE Model DMD 5620 in a 24x80 layer
5620-34,dmd-34	AT&T TELETYPE Model DMD 5620 in a 34x80 layer
610,610bct	AT&T 610 bct terminal in 80-column mode
610-w,610bct-w	AT&T 610 bct terminal in 132-column mode
7300,pc7300,unix_pc	AT&T UNIX PC Model 7300
735,ti	Texas Instruments TI735 and TI725
745	Texas Instruments TI745
dumb	generic name for terminals that lack reverse line-feed and other special escape sequences
hp	Hewlett-Packard (same as 2645)
lp	generic name for a line printer
pt505	AT&T Personal Terminal 505 (22 lines)
pt505-24	AT&T Personal Terminal 505 (24-line mode)
sync	generic name for synchronous TELETYPE Model 4540-compatible terminals

Commands whose behavior depends on the type of terminal should accept arguments of the form **-T***term* where ***term*** is one of the names given above; if no such argument is present, such commands should obtain the terminal type from the environment variable **TERM**, which, in turn, should contain **term**.

File

/usr/lib/terminfo/?	compiled terminal description database

See also

curses(S), **profile**(F), **terminfo**(M), **terminfo**(F), **environ**(M), **infocmp**(ADM), **sh**(C), **stty**(C), **tabs**(C), **tput**(C), **tplot**(ADM), **vi**(C)

Notes

Not all programs follow the above naming conventions.

terminals

list of supported terminals

Description

The following list, derived from the file */etc/termcap*, shows the terminal name (suitable for use as a **TERM** shell variable), and a short description of the terminal. The advice in **termcap**(F) will assist users in creating termcap entries for terminals not currently supported.

Name	Terminal
1200	Terminet 1200
1620	Diablo 1620
1640	Diablo 1640
2392	239x series
2392an	Hp 239x in ansi mode
2392ne	239x series
2621	HP 2621
2621k45	HP 2621 with 45 keyboard
2621nl	HP 2621 with no labels
2621nt	HP 2621 w/no tabs
2621wl	HP 2621 with labels
2622	HP 2622
262x	HP 262x series
2640	HP 2640a
2640b	HP 264x series
300	Terminet 300
3045	Datamedia 3045a
33	Model 33 teletype
37	Model 37 teletype
40	Teletype dataspeed 40/2
4025	Tektronix 4024/4025/4027
4025-17	Tek 4025 17 line window
4025-17ws	Tek 4025 17 line window in workspace
4025ex	Tek 4025 w/!
43	Model 43 teletype
515	AT&T-IS 515 terminal in native mode
5410	5410 terminal 80 columns
5410-nfk	Version 1 tty5410 entry without function keys
5410132	5410 132 columns
5420132	5420 132columns
5425	AT&T Teletype 5425 80 columns
5425-w	AT&T Teletype 5425 132 columns
610bct	AT&T 610; 80 column; 98key keyboard

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Name	Terminal
615mt	AT&T 615; 80 column; 98key keyboard
620mtg	AT&T 620; 80 column; 98key keyboard
7900	NCR 7900-1
8001	Intecolor
912b	New Televideo
925	Newer Televideo
925so	Newer Televideo with attribute byte workaround
ATT5620	5620 terminal 88 columns
Ma2	Ampex Model 232 / 132 lines
TWO	Altos Computer Systems II
a980	Adds Consul 980
aa	Ann Arbor
aaa	Ann Arbor Ambassador/48 lines
aaa30	Ann Arbor Ambassador 30/destructive backspace
aaa48db	Ann Arbor Ambassador 48/destructive backspace
aaadb	Ann Arbor Ambassador 48/destructive backspace
act5s	Skinny act5
adds	Adds Viewpoint
adds25	Adds Regent 25 with local printing
adm11	Lsi adm11
adm12	Lsi adm12
adm2	Lsi adm2
adm3	Lsi adm3
adm31	Lear Siegler ADM31
adm3a	Lsi adm3a
adm3a+	Lsi adm3a+
adm3a19.2	Lsi adm3a at 19.2 baud
adm3aso	Lsi adm3a with {} for standout
adm42	Lsi adm42
adm5	Lsi adm5
aj830	Anderson Jacobson
altos3	Altos III
altos4	Altos IV
altos5	Altos V
am219w	Ampex 132 Cols
amp219	Ampex with Automargins
amp232	Ampex Model 232
ampex	Ampex dialogue 80
ansi	Ansi standard crt
ansi-nam	Ansi standard crt without automargin
arpanet	Network
at386	At/386 console
at386-m	At/386 console
atarist	Atari ST vt52

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Name	Terminal
att513	AT&T-IS 513 Business Communications Terminal 80 columns
att513-w	AT&T-IS 513 Business Communications Terminal 132 columns
att605	AT&T 605 BCT
att630	AT&T 630 windowing terminal
bct500	Teletype 5541
bh3m	BeehiveIIIm
big2621	48 line 2621
c100	Concept 100
c1004p	c100 w/4 pages
c100rv	c100 rev video
c100rv4p	c100 w/4 pages
c100rv4pna	c100 with no arrows
c100rv4ppp	c100 with printer port
c100rvs	Slow reverse concept 100
c100s	Slow concept 100
c3102	Cromemco 3102
carlock	Klc
cci	Cci 4574
cdc456	Cdc
cdc456tst	Cdc456tst
cdi	Cdi1203
cie467	C.Itoh 467, 414 Graphics
cit80	C.Itoh 80
cit80nam	C.Itoh 80 without automargins
compucolor	CompucolorII
d132	Datagraphix 132a
datapoint	Datapoint 3360
delta	Delta data 5000
dg	Data general 6053
digilog	Digilog 333
dm1520	Datamedia 1520
dm1521	Datamedia 1521
dm2500	Datamedia 2500
dm3025	Datamedia 3025a
dmterm	Tandy deskmate terminal
dosansi	ANSI.SYS standard crt
dt100	Tandy DT-100 terminal
dt100w	Tandy DT-100 terminal
dt200	Tandy DT-200
dt80	Datamedia dt80/1
dt80132	Datamedia dt80/1 in 132 char mode

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Name	Terminal
dtc300s	Dtc 300s
du	Dialup
dumb	Unknown
dw1	Decwriter I
dw2	Decwriter II
ep40	Execuport 4000
ep48	Execuport 4080
esp925	Esprit tvi925 emulation
espHA	Esprit 6310 in hazeltine emulation mode
ethernet	Network
exidy	Exidy sorcerer as dm2500
fos	Fortune system
fox	Perkin Elmer 1100
free100	Liberty Freedom 100
free110	Freedom 110
ft1024	Forward Technology graphics controller
gt40	Dec gt40
gt42	Dec gt42
h1500	Hazeltine 1500
h1510	Hazeltine 1510
h1520	Hazeltine 1520
h1552	Hazeltine 1552
h1552rv	Hazeltine 1552 reverse video
h19	Heathkit h19 w/ function keypad
h19a	Heathkit h19 ansi mode
h19nk	Heathkit w/numeric keypad (not function keys)
h2000	Hazeltine 2000
hp	HP 264x series
hp2626	HP 2626
hp2648	HP 2648a graphics terminal
hpansi	Hewlett Packard 700/44 in HP-PCterm mode, PC character set
hpansi-24	HP 700/44 in HP-PCterm 24 line mode, PC character set
hpex	HP extended capabilites
hpsub	HP terminals -- capability subset
i100	General Terminal 100A (formerly Infoton 100)
ibm3101	IBM 3101-10
ibm3151	3151
ibm3161	3161
ibm3163	3163
ibm3164	3164
ibm5151	IBM console
ibmcons	Ansi standard with EGA

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Name	Terminal
ibmcons-43	Ansi EGA console in 43 line mode
intext	ISC modified owl 1200
ipc	Intel IPC
k10	Kaypro 10
kn	Kt70pcix
kt7ix	Kimtron kt-7
lisa	Apple Lisa xenix console display (white on black)
m100	Radio Shack model 100
macterm	Macintosh MacTerm in vt-100 mode
macterm-nam	MacTerm in vt-100 mode with automargin NOT set
mdl110	Cybernex mdl-110
microb	Micro Bee series
microterm	Microterm act iv
microterm5	Microterm act v
mime	Microterm mime1
mime2a	Microterm mime2a (emulating an enhanced vt52)
mime2as	Microterm mime2a (emulating an enhanced soroc iq120)
mime3a	Mime1 emulating 3a
mime3ax	Mime1 emulating enhanced 3a
mimefb	Full Bright Mime1
mimehb	Half Bright Mime1
mt70	Morrow mt70
nabu	Nabu terminal
netx	Netronics
nucterm	NUC homebrew
oadm31	Old adm31
omron	Omron 8025AG
ot80	Onyx ot80
owl	Perkin Elmer 1200
pe550	Perkin Elmer 550
pixel	Pixel terminal
plasma	Plasma panel
pt1500	Convergent Technologies PT
pt210	Tandy TRS-80 PT-210 printing terminal
qume5	Qume Sprint 5
qvt101	Qume QVT-101 vers c
qvt101+	Qume QVT-101 Plus vers c
qvt101+so	Qume QVT-101+ with protected mode/standout
qvt101b	QVT-101 with cursor set to blinking underline
qvt102	Qume QVT 102
qvt103	Qume QVT-103
qvt108	QVT-108
qvt109	QVT-109
qvt119	Qume QVT-119

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Name	Terminal
qvt119+	Qume QVT-119 Plus vers c
qvt201	Qume QVT-201
qvt202	Qume QVT-202
qvt203	Qume QVT 203 PLUS
regent	Adds Regent series
regent100	Adds Regent 100
regent20	Adds Regent 20
regent25	Adds Regent 25
regent25a	Adds Regent 25a
regent40	Adds Regent 40
regent60	Adds Regent 60
regent60na	Regent 60 w/no arrow keys
rx303	Rexon 303 terminal
sb1	Beehive Super Bee
sb2	Fixed Super Bee
sexidy	Exidy Smart
sk8620	Seiko 8620
soroc	Soroc 120
sun	Sun Microsystems Workstation console
sun-cmd	Sun Microsystems Workstation console with scrollable history
sun-nic	Sun Microsystems Workstation console without insert character
sun1	old Sun Microsystems Workstation console
superbeeic	Super Bee with insert char
svt100	1220/PC, Sperry in VT100 mode
svt1210	Sperry 1210, standard setup
svt1220	Sperry 1220, standard setup
svt52	1210/1220/PC, Sperry in VT52 mode
switch	Intelligent switch
swtp	Southwest Technical Products ct82
t1061	Teleray 1061
t1061f	Teleray 1061 with fast PROMs
t3700	Dumb Teleray 3700
t3800	Teleray 3800 series
td200	Tandy 200
tek	Tektronix 4012
tek4013	Tektronix 4013
tek4014	Tektronix 4014
tek4014sm	Tektronix 4014 in small font
tek4015	Tektronix 4015
tek4015sm	Tektronix 4015 in small font
tek4023	Tektronix 4023

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Name	Terminal
tek4107	Tektronix 4107
teletec	Teletec Datascreen
terak	Terak emulating Datamedia 1520
ti	Ti silent 700
ti745	Ti silent 745
ti924	Texas Instruments 924 VDT 7 bit
ti924-8	Texas Instruments 924 VDT 8 bit
ti926	Texas Instruments 926 VDT
ti931	Texas Instruments 931 VDT
trs100	Tandy TRS-80 Model 100
trs16	Tandy trs-80 model 16 console
trs600	Tandy Model 600
tty4420	Teletype 4420
tty4424	Teletype 4424
tty4424-w	Teletype 4424 in display function group ii
tty5410	Teletype 5410 terminal in 80 column mode
tty5410-w	Teletype 5410 in 132 column mode
tvi910	old Televideo 910
tvi910+	Televideo 910 PLUS
tvi912	old Televideo
tvi9220	Televideo 9220 w/status line @ bottom
tvi9220w	Televideo 9220 132 col w/status line @ bottom
tvi924	Televideo924
tvi950	Televideo950
tvi950-2p	TVI 950 w/2 pages
tvi950-4p	TVI 950 w/4 pages
tvi950-ap	TVI 950 w/alt pages
tvi950b	bare TVI950 no is
tvi950ns	TVI950 w/no standout
v50	Visual 50 emulation of DEC VT52
v55	Visual 55 emulation of DEC VT52 (called V55)
vi200	Visual 200 with function keys
vi200f	Visual 200 no function keys
vi200ic	Visual 200 using insert char
vi200rv	Visual 200 reverse video
vi200rvic	Visual 200 reverse video using insert char
vi50	Visual 50 in ADDS viewpoint emulation
vi55	Visual 55 using ADDS emulation
vis613	Visual 613
vs100	Xterm terminal emulator
vs100s	Xterm terminal emulator (small screen 24x80)
vt100	DEC vt100
vt100n	VT100 w/no init
vt100nam	DEC VT100 without automargins

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Name	Terminal
vt100s	DEC vt100 132 cols 14 lines
vt100w	DEC vt100 132 cols
vt102	DEC vt102
vt131	DECdec vt131
vt132	VT-132
vt220	DEC vt220 generic
vt220d	DEC VT220 in vt100 mode with DEC function key labeling
vt50	DEC vt50
vt50h	DEC vt50h
vt52	DEC vt52
vt52so	DEC vt52 with brackets added for standout use
vtz	Zilog vtz 2/10
w2110A	Wang 2110 Asynch Data Entry Terminal - 80 column
ws584	Olivetti WS584
ws584fr	Olivetti WS584 with French keyboard
ws584gr	Olivetti WS584 with German keyboard
ws584nr	Olivetti WS584 with Norwegian/Danish keyboard
ws584sp	Olivetti WS584 with Spanish keyboard
ws584sw	Olivetti WS584 with Swedish/Finnish keyboard
ws584uk	Olivetti WS584 with U.K. keyboard
ws584us	Olivetti WS584 with U.S.A. keyboard
ws685	Olivetti WS685
wy100	Wyse 100
wy120	Wyse 120
wy120-25	Wyse 120 80-column 25-lines
wy120-vb	Wyse 120 Visible bell
wy120-wvb	Wyse120-wvb
wy120w	Wyse 120 132-column
wy120w-25	Wyse 120 132-column 25-lines
wy150	Wyse 150
wy150-25	Wyse 150 80-column 25-lines
wy150-vb	Wyse 150 Visible bell
wy150-wvb	Wyse150-wvb
wy150w	Wyse 150 132-column
wy150w-25	Wyse 150 132-column 25-lines
wy30	Wyse WY-30 in wy30 mode
wy30-vb	Wyse 30 Visible bell
wy350	Wyse 350 80 column color terminal emulating wy50
wy350-vb	Wyse 350 Visible bell
wy350-wvb	Wyse 350 132-column Visible bell
wy350w	Wyse 350 132 column color terminal emulating wy50
wy50	Wyse 50/80 Wyse WY-50 with 80 column screen

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Name	Terminal
wy50-wvb	Wyse 50 132-column Visible bell
wy50l	Wyse WY-60 with 80 column/43 line screen in WY50+ mode
wy50n	Wyse WY-50 - 80 column screen, no automargin
wy50vb	Wyse WY-50/80vb Wyse WY-50/80 with visible bell
wy50w	Wyse WY-50/132 Wyse WY-50 with 132 column screen
wy60	Wyse WY-60 with 80 column/24 line screen in wy60 mode
wy60-25	Wyse 60 80-column 25-lines
wy60-42	Wyse 60 80-column 42-lines
wy60-43	Wyse 60 80-column 43-lines
wy60-vb	Wyse 60 Visible bell
wy60ak	Wyse 60 in wy60 mode with ANSI arrow keys +
wy60w	Wyse WY-60 with 132 column/24 line screen in wy60 mode
wy60w-25	Wyse 60 132-column 25-lines
wy60w-42	Wyse 60 132-column 42-lines
wy60w-43	Wyse 60 132-column 43-lines
wy60w-vb	Wyse 60 132-column Visible bell
wy75	Wyse WY-75 with 80 column line
wy75-mc	Wyse 75 with magic cookies
wy75-vb	Wyse 75 with visible bell
wy75-wvb	Wyse 75 with visible bell 132 columns
wy75ap	Wyse WY-75 with Applications and Cursor keypad modes
wy75w	Wyse WY-75 in 132 column mode
wy75x	Wyse WY-75 with 132 column lines in vi editor mode
wy85	Wyse 85 in 80 column mode, vt100 emulation
wy85-vb	Wyse 85 with visible bell
wy85-wvb	Wyse 85 with visible bell 132-columns
wy85w	Wyse 85 in 132 column mode, vt100 emulation
wy85w	Wyse 85 in 132-column mode
wy99gt	Wyse 99gt
wy99gt-25	Wyse 99gt 80-column 25-lines
wy99gt-25-w	Wyse 99gt 132-column 25-lines
wy99gt-vb	Wyse 99gt Visible bell
wy99gt-w	Wyse 99gt 132-column
wy99gt-w-vb	Wyse99gt-wvb
wyse120ak	Wyse 120 with ANSI key values
x1720	Xerox 1720
xitex	Xitex sct-100
z29	Zenith z29
z39	Zenith Z-39

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Name	Terminal
zen30	Zentec 30
zen40	Zentec 40
zen50	Zentec 50
zephyr	Zentec zephyr220 in vt100 mode
zephyrnam	Zentec zephyr220 in vt100 mode w/out automargins

File

/etc/termcap

See also

tset(C), **environ**(M), **termcap**(F)

terminfo

terminal capability database

Syntax

*/usr/lib/terminfo/?/**

Description

terminfo is a compiled database (see **tic**(C)) describing the capabilities of terminals. Terminals are described in *terminfo* source descriptions by giving a set of capabilities which they have, by describing how operations are performed, by describing padding requirements, and by specifying initialization sequences. This database is used, for example, by **vi**(C) and **curses**(S), so they can work with a variety of terminals without changes to the programs. To obtain the source description for a terminal, use the **-I** option of **infocmp**(ADM). When doing an **infocmp** for the terminal you are on, there is no difference between **infocmp** and **infocmp -I**.

Entries in *terminfo* source files consist of a number of fields separated by commas. White space after each comma is ignored. The first line of each terminal description in the *terminfo* database gives the name by which *terminfo* knows the terminal, separated by bar (|) characters. The first name given is the most common abbreviation for the terminal (this is the one to use to set the environment variable **TERM** in **$HOME.profile**; see **profile**(F)); the last name given should be a long name fully identifying the terminal, and all others are understood as synonyms for the terminal name. All names but the last should contain no blanks and must be unique in the first 14 characters; the last name may contain blanks for readability.

Terminal names (except for the last verbose entry) should be chosen using the following conventions. The particular piece of hardware making up the terminal should have a root name chosen, for example, for the AT&T 4425 terminal, *att4425*. Modes that the hardware can be in, or user preferences, should be indicated by appending a hyphen and an indicator of the mode. See **term**(M) for examples and more information on choosing names and synonyms.

PART 1: TERMINAL CAPABILITIES

Capabilities in *terminfo* are of three types: boolean capabilities (which show that the terminal has some particular feature), numeric capabilities (which specify the size of the terminal or particular features), and string capabilities (which provide a sequence that can be used to perform particular terminal operations).

In the following tables, a "Variable" is the name by which a C programmer accesses a capability (at the *terminfo* level). A "Capname" is the short name for a capability used in the source description. It is used by a person updating the database and by the **tput**(C) command when asking what the value of the capability is for a particular terminal. A "Termcap Code" is a two-letter code that corresponds to the old *termcap* capability name.

Capability names have no hard length limit, but an informal limit of five characters has been adopted to keep them short. Whenever possible, names are chosen to be the same as or similar to those specified by the ANSI X3.64-1979 standard. Semantics are also intended to match those of the ANSI standard.

All string capabilities listed below may have padding specified, with the exception of those used for input. Input capabilities, listed under the "Strings" section in the following table, have names beginning with **key_**. The following indicators may appear at the end of the "Description" for a variable.

(G) indicates that the string is passed through **tparm**( ) with parameters (parms) as given ($\#_i$)

(*) indicates that padding may be based on the number of lines affected

($\#_i$) indicates the ith parameter

(**) not present in all versions of *termcap*.

Booleans

Variable	Cap-name	Termcap Code	Description
auto_left_margin	bw	bw	**cub1** wraps from column 0 to last column
auto_right_margin	am	am	Terminal has automatic margins
back_color_erase	bce	be	Screen erased with background color
can_change	ccc	cc	Terminal can re-define existing color
ceol_standout_glitch	xhp	xs	Standout not erased by overwriting (hp)
col_addr_glitch	xhpa	YA	Only positive motion for **hpa/mhpa** caps
cpi_changes_res	cpix	YF	Changing character pitch changes resolution
cr_cancels_micro_mode	crxm	YB	Using **cr** turns off micro mode
eat_newline_glitch	xenl	xn	Newline ignored after 80 columns (*Concept*)
erase_overstrike	eo	eo	Can erase overstrikes with a blank
generic_type	gn	gn	Generic line type (for example, dialup, switch)
hard_copy	hc	hc	Hardcopy terminal
hard_cursor	chts	HC	Cursor is hard to see
has_meta_key	km	km	Has a meta key (shift, sets parity bit)
has_print_wheel	daisy	YC	Printer needs operator to change character set
has_status_line	hs	hs	Has extra "status line"
hue_lightness_saturation	hls	hl	Terminal uses only HLS color notation (Tektronix)
insert_null_glitch	in	in	Insert mode distinguishes nulls
lpi_changes_res	lpix	YG	Changing line pitch changes resolution
memory_above	da	da	Display may be retained above the screen
memory_below	db	db	Display may be retained below the screen
move_insert_mode	mir	mi	Safe to move while in insert mode
move_standout_mode	msgr	ms	Safe to move in standout modes
needs_xon_xoff	nxon	nx	Padding won't work, xon/xoff required
no_esc_ctlc	xsb	xb	Beehive (f1=escape, f2=ctrl C)
no_pad_char	npc	NP	Pad character doesn't exist
non_dest_scroll_region	ndscr	ND	Scrolling region is non-destructive
non_rev_rmcup	nrrmc	NR	**smcup** does not reverse **rmcup**
over_strike	os	os	Terminal overstrikes on hard-copy terminal
prtr_silent	mc5i		
row_addr_glitch	xvpa	YD	Only positive motion for **vpa/mvpa** caps
semi_auto_right_margin	sam	YE	Printing in last column causes **cr**
status_line_esc_ok	eslok	es	Escape can be used on the status line
dest_tabs_magic_smso	xt	xt	Destructive tabs, magic **smso** char (t1061)
tilde_glitch	hz	hz	Hazeltine; cannot print tilde (~)
transparent_underline	ul	ul	Underline character overstrikes
xon_xoff	xon	xo	Terminal uses xon/xoff handshaking

Numbers

Variable	Cap-name	Termcap Code	Description
buffer_capacity	bufsz	Ya	Number of bytes buffered before printing
columns	cols	co	Number of columns in a line
dot_vert_spacing	spinv	Yb	Spacing of pins vertically in pins per inch
dot_horz_spacing	spinh	Yc	Spacing of dots horizontally in dots per inch
init_tabs	it	it	Tabs initially every # spaces
label_height	lh	lh	Number of rows in each label
label_width	lw	lw	Number of columns in each label
lines	lines	li	Number of lines on a screen or a page
lines_of_memory	lm	lm	Lines of memory if > **lines**; **0** means varies
magic_cookie_glitch	xmc	sg	Number of blank characters left by **smso** or **rmso**
max_attributes	ma	ma	Maximum combined video attributes terminal can display
max_colors	colors	Co	Maximum number of colors on the screen
max_micro_address	maddr	Yd	Maximum value in **micro_..._address**
max_micro_jump	mjump	Ye	Maximum value in **parm_..._micro**
max_pairs	pairs	pa	Maximum number of color-pairs on the screen
maximum_windows	wnum	MW	Maximum number of definable windows
micro_col_size	mcs	Yf	Character step size when in micro mode
micro_line_size	mls	Yg	Line step size when in micro mode
no_color_video	ncv	NC	Video attributes that can't be used with colors
number_of_pins	npins	Yh	Number of pins in print-head
num_labels	nlab	Nl	Number of labels on screen (start at 1)
output_res_char	orc	Yi	Horizontal resolution in units per character
output_res_line	orl	Yj	Vertical resolution in units per line
output_res_horz_inch	orhi	Yk	Horizontal resolution in units per inch
output_res_vert_inch	orvi	Yl	Vertical resolution in units per inch
padding_baud_rate	pb	pb	Lowest baud rate where padding needed
print_rate	cps	Ym	Print rate in characters per second
virtual_terminal	vt	vt	Virtual terminal number (UNIX system)
wide_char_size	widcs	Yn	Character step size when in double wide mode
width_status_line	wsl	ws	Number of columns in status line

Strings

Variable	Cap-name	Termcap Code	Description
acs_chars	acsc	ac	Graphic charset pairs aAbBcC - def=vt100
back_tab	cbt	bt	Back tab
bell	bel	bl	Audible signal (bell)
carriage_return	cr	cr	Carriage return (*)
change_char_pitch	cpi	ZA	Change number of characters per inch**
change_line_pitch	lpi	ZB	Change number of lines per inch**
change_res_horz	chr	ZC	Change horizontal resolution**
change_res_vert	cvr	ZD	Change vertical resolution**
change_scroll_region	csr	cs	Change to lines #1 through #2 (vt100) (G)
char_padding	rmp	rP	Like **ip** but when in replace mode
char_set_names	csnm	Zy	List of character set names
clear_all_tabs	tbc	ct	Clear all tab stops
clear_margins	mgc	MC	Clear all margins (top, bottom, and sides)
clear_screen	clear	cl	Clear screen and home cursor (*)
clr_bol	el1	cb	Clear to beginning of line, inclusive
clr_eol	el	ce	Clear to end of line
clr_eos	ed	cd	Clear to end of display (*)
column_address	hpa	ch	Horizontal position absolute (G)
command_character	cmdch	CC	Terminal settable cmd character in prototype
create_window	cwin	CW	Define win #1 to go from #2,#3to #4,#5
cursor_address	cup	cm	Move to row #1 col #2 (G)
cursor_down	cud1	do	Down one line
cursor_home	home	ho	Home cursor (if no **cup**)
cursor_invisible	civis	vi	Make cursor invisible
cursor_left	cub1	le	Move left one space
cursor_mem_address	mrcup	CM	Memory relative cursor addressing (G)
cursor_normal	cnorm	ve	Make cursor appear normal (undo **vs/vi**)
cursor_right	cuf1	nd	Non-destructive space (cursor or carriage right)
cursor_to_ll	ll	ll	Last line, first column (if no **cup**)
cursor_up	cuu1	up	Upline (cursor up)
cursor_visible	cvvis	vs	Make cursor very visible
define_char	defc	ZE	Define a character in a character set **
delete_character	dch1	dc	Delete character (*)
delete_line	dl1	dl	Delete line (*)
delete_phone	dial	DI	Dial phone number #1
dis_status_line	dsl	ds	Disable status line
display_clock	dclk	DK	Display time-of-day clock
display_pc_char	dispc	S1	Displays PC character
down_half_line	hd	hd	Half-line down (forward 1/2 linefeed)
ena_acs	enacs	eA	Enable alternate character set
enter_alt_charset_mode	smacs	as	Start alternate character set
enter_am_mode	smam	SA	Turn on automatic margins

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Variable	Cap-name	Termcap Code	Description
enter_blink_mode	blink	mb	Turn on blinking
enter_bold_mode	bold	md	Turn on bold (extra bright) mode
enter_ca_mode	smcup	ti	String to begin programs that use **cup**
enter_delete_mode	smdc	dm	Delete mode (enter)
enter_dim_mode	dim	mh	Turn on half-bright mode
enter_doublewide_mode	swidm	ZF	Enable double wide printing
enter_draft_quality	sdrfq	ZG	Set draft quality print
enter_insert_mode	smir	im	Insert mode (enter)
enter_italics_mode	sitm	ZH	Enable italics
enter_leftward_mode	slm	ZI	Enable leftward carriage motion
enter_micro_mode	smicm	ZJ	Enable micro motion capabilities
enter_near_letter_quality	snlq	ZK	Set near-letter quality print
enter_normal_quality	snrmq	ZL	Set normal quality print
enter_pc_charset_mode	smsc	S4	Enables PC-scancode mode
enter_protected_mode	prot	mp	Turn on protected mode
enter_reverse_mode	rev	mr	Turn on reverse video mode
enter_secure_mode	invis	mk	Turn on blank mode (characters invisible)
enter_shadow_mode	sshm	ZM	Enable shadow printing
enter_standout_mode	smso	so	Begin standout mode
enter_subscript_mode	ssubm	ZN	Enable subscript printing
enter_superscript_mode	ssupm	ZO	Enable superscript printing
enter_underline_mode	smul	us	Start underscore mode
enter_upward_mode	sum	ZP	Enable upward carriage motion
enter_xon_mode	smxon	SX	Turn on xon/xoff handshaking
erase_chars	ech	ec	Erase #1 characters (G)
exit_alt_charset_mode	rmacs	ae	End alternate character set
exit_am_mode	rmam	RA	Turn off automatic margins
exit_attribute_mode	sgr0	me	Turn off all attributes
exit_ca_mode	rmcup	te	String to end programs that use **cup**
exit_delete_mode	rmdc	ed	End delete mode
exit_doublewide_mode	rwidm	ZQ	Disable double wide printing
exit_insert_mode	rmir	ei	End insert mode
exit_italics_mode	ritm	ZR	Disable italics
exit_leftward_mode	rlm	ZS	Enable rightward (normal) carriage motion
exit_micro_mode	rmicm	ZT	Disable micro motion capabilities
exit_pc_charset_mode	rmsc	S5	Disables PC-scancode mode
exit_shadow_mode	rshm	ZU	Disable shadow printing
exit_standout_mode	rmso	se	End standout mode
exit_subscript_mode	rsubm	ZV	Disable subscript printing
exit_superscript_mode	rsupm	ZW	Disable superscript printing
exit_underline_mode	rmul	ue	End underscore mode
exit_upward_mode	rum	ZX	Enable downward (normal) carriage motion
exit_xon_mode	rmxon	RX	Turn off xon/xoff handshaking

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Variable	Cap-name	Termcap Code	Description
fixed_pause	pause	PA	Pause for 2-3 seconds
flash_hook	hook	fh	Flash the switch hook
flash_screen	flash	vb	Visible bell (may not move cursor)
form_feed	ff	ff	Hardcopy terminal page eject (*)
from_status_line	fsl	fs	Return from status line
goto_window	wingo	WG	Got to window #1
hangup	hup	HU	Hang-up phone
init_1string	is1	i1	Terminal or printer initialization string
init_2string	is2	is	Terminal or printer initialization string
init_3string	is3	i3	Terminal or printer initialization string
init_file	if	if	Name of initialization file
init_prog	iprog	iP	Path name of program for initialization
initialize_color	initc	Ic	Initialize the definition of color
initialize_pair	initp	Ip	Initialize color-pair
insert_character	ich1	ic	Insert character
insert_line	il1	al	Add new blank line (*)
insert_padding	ip	ip	Insert pad after character inserted (*)
key_a1	ka1	K1	KEY_A1, 0534, upper left of keypad
key_a3	ka3	K3	KEY_A3, 0535, upper right of keypad
key_b2	kb2	K2	KEY_B2, 0536, center of keypad
key_backspace	kbs	kb	KEY_BACKSPACE, 0407, sent by backspace key
key_beg	kbeg	@1	KEY_BEG, 0542, sent by beg(inning) key
key_btab	kcbt	kB	KEY_BTAB, 0541, sent by back-tab key
key_c1	kc1	K4	KEY_C1, 0537, lower left of keypad
key_c3	kc3	K5	KEY_C3, 0540, lower right of keypad
key_cancel	kcan	@2	KEY_CANCEL, 0543, sent by cancel key
key_catab	ktbc	ka	KEY_CATAB, 0526, sent by clear-all-tabs key
key_clear	kclr	kC	KEY_CLEAR, 0515, sent by clear-screen or erase key
key_close	kclo	@3	KEY_CLOSE, 0544, sent by close key
key_command	kcmd	@4	KEY_COMMAND, 0545, sent by cmd (command) key
key_copy	kcpy	@5	KEY_COPY, 0546, sent by copy key
key_create	kcrt	@6	KEY_CREATE, 0547, sent by create key
key_ctab	kctab	kt	KEY_CTAB, 0525, sent by clear-tab key
key_dc	kdch1	kD	KEY_DC, 0512, sent by delete-character key
key_dl	kdl1	kL	KEY_DL, 0510, sent by delete-line key
key_down	kcud1	kd	KEY_DOWN, 0402, sent by terminal down-arrow key
key_eic	krmir	kM	KEY_EIC, 0514, sent by **rmir** or **smir** in insert mode
key_end	kend	@7	KEY_END, 0550, sent by end key
key_enter	kent	@8	KEY_ENTER, 0527, sent by enter/send key
key_eol	kel	kE	KEY_EOL, 0517, sent by clear-to-end-of-line key
key_eos	ked	kS	KEY_EOS, 0516, sent by clear-to-end-of-screen key
key_exit	kext	@9	KEY_EXIT, 0551, sent by exit key
key_f0	kf0	k0	KEY_F(0), 0410, sent by function key f0

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Variable	Cap-name	Termcap Code	Description
key_f1	kf1	k1	KEY_F(1), 0411, sent by function key f1
key_f2	kf2	k2	KEY_F(2), 0412, sent by function key f2
key_f3	kf3	k3	KEY_F(3), 0413, sent by function key f3
key_f4	kf4	k4	KEY_F(4), 0414, sent by function key f4
key_f5	kf5	k5	KEY_F(5), 0415, sent by function key f5
key_f6	kf6	k6	KEY_F(6), 0416, sent by function key f6
key_f7	kf7	k7	KEY_F(7), 0417, sent by function key f7
key_f8	kf8	k8	KEY_F(8), 0420, sent by function key f8
key_f9	kf9	k9	KEY_F(9), 0421, sent by function key f9
key_f10	kf10	k;	KEY_F(10), 0422, sent by function key f10
key_f11	kf11	F1	KEY_F(11), 0423, sent by function key f11
key_f12	kf12	F2	KEY_F(12), 0424, sent by function key f12
key_f13	kf13	F3	KEY_F(13), 0425, sent by function key f13
key_f14	kf14	F4	KEY_F(14), 0426, sent by function key f14
key_f15	kf15	F5	KEY_F(15), 0427, sent by function key f15
key_f16	kf16	F6	KEY_F(16), 0430, sent by function key f16
key_f17	kf17	F7	KEY_F(17), 0431, sent by function key f17
key_f18	kf18	F8	KEY_F(18), 0432, sent by function key f18
key_f19	kf19	F9	KEY_F(19), 0433, sent by function key f19
key_f20	kf20	FA	KEY_F(20), 0434, sent by function key f20
key_f21	kf21	FB	KEY_F(21), 0435, sent by function key f21
key_f22	kf22	FC	KEY_F(22), 0436, sent by function key f22
key_f23	kf23	FD	KEY_F(23), 0437, sent by function key f23
key_f24	kf24	FE	KEY_F(24), 0440, sent by function key f24
key_f25	kf25	FF	KEY_F(25), 0441, sent by function key f25
key_f26	kf26	FG	KEY_F(26), 0442, sent by function key f26
key_f27	kf27	FH	KEY_F(27), 0443, sent by function key f27
key_f28	kf28	FI	KEY_F(28), 0444, sent by function key f28
key_f29	kf29	FJ	KEY_F(29), 0445, sent by function key f29
key_f30	kf30	FK	KEY_F(30), 0446, sent by function key f30
key_f31	kf31	FL	KEY_F(31), 0447, sent by function key f31
key_f32	kf32	FM	KEY_F(32), 0450, sent by function key f32
key_f33	kf33	FN	KEY_F(33), 0451, sent by function key f13
key_f34	kf34	FO	KEY_F(34), 0452, sent by function key f34
key_f35	kf35	FP	KEY_F(35), 0453, sent by function key f35
key_f36	kf36	FQ	KEY_F(36), 0454, sent by function key f36
key_f37	kf37	FR	KEY_F(37), 0455, sent by function key f37
key_f38	kf38	FS	KEY_F(38), 0456, sent by function key f38
key_f39	kf39	FT	KEY_F(39), 0457, sent by function key f39
key_f40	kf40	FU	KEY_F(40), 0460, sent by function key f40
key_f41	kf41	FV	KEY_F(41), 0461, sent by function key f41
key_f42	kf42	FW	KEY_F(42), 0462, sent by function key f42
key_f43	kf43	FX	KEY_F(43), 0463, sent by function key f43

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Variable	Cap-name	Termcap Code	Description
key_f44	kf44	FY	KEY_F(44), 0464, sent by function key f44
key_f45	kf45	FZ	KEY_F(45), 0465, sent by function key f45
key_f46	kf46	Fa	KEY_F(46), 0466, sent by function key f46
key_f47	kf47	Fb	KEY_F(47), 0467, sent by function key f47
key_f48	kf48	Fc	KEY_F(48), 0470, sent by function key f48
key_f49	kf49	Fd	KEY_F(49), 0471, sent by function key f49
key_f50	kf50	Fe	KEY_F(50), 0472, sent by function key f50
key_f51	kf51	Ff	KEY_F(51), 0473, sent by function key f51
key_f52	kf52	Fg	KEY_F(52), 0474, sent by function key f52
key_f53	kf53	Fh	KEY_F(53), 0475, sent by function key f53
key_f54	kf54	Fi	KEY_F(54), 0476, sent by function key f54
key_f55	kf55	Fj	KEY_F(55), 0477, sent by function key f55
key_f56	kf56	Fk	KEY_F(56), 0500, sent by function key f56
key_f57	kf57	Fl	KEY_F(57), 0501, sent by function key f57
key_f58	kf58	Fm	KEY_F(58), 0502, sent by function key f58
key_f59	kf59	Fn	KEY_F(59), 0503, sent by function key f59
key_f60	kf60	Fo	KEY_F(60), 0504, sent by function key f60
key_f61	kf61	Fp	KEY_F(61), 0505, sent by function key f61
key_f62	kf62	Fq	KEY_F(62), 0506, sent by function key f62
key_f63	kf63	Fr	KEY_F(63), 0507, sent by function key f63
key_find	kfnd	@0	KEY_FIND, 0552, sent by find key
key_help	khlp	%1	KEY_HELP, 0553, sent by help key
key_home	khome	kh	KEY_HOME, 0406, sent by home key
key_ic	kich1	kI	KEY_IC, 0513, sent by ins-char/enter ins-mode key
key_il	kil1	kA	KEY_IL, 0511, sent by insert-line key
key_left	kcub1	kl	KEY_LEFT, 0404, sent by terminal left-arrow key
key_ll	kll	kH	KEY_LL, 0533, sent by home-down key
key_mark	kmrk	%2	KEY_MARK, 0554, sent by mark key
key_message	kmsg	%3	KEY_MESSAGE, 0555, sent by message key
key_move	kmov	%4	KEY_MOVE, 0556, sent by move key
key_next	knxt	%5	KEY_NEXT, 0557, sent by next key
key_npage	knp	kN	KEY_NPAGE, 0522, sent by next-page key
key_open	kopn	%6	KEY_OPEN, 0560, sent by open key
key_options	kopt	%7	KEY_OPTIONS, 0561, sent by options key
key_ppage	kpp	kP	KEY_PPAGE, 0523, sent by previous-page key
key_previous	kprv	%8	KEY_PREVIOUS, 0562, sent by previous-object key
key_print	kprt	%9	KEY_PRINT, 0532, sent by print or copy key
key_redo	krdo	0	KEY_REDO, 0563, sent by redo key
key_reference	kref	&1	KEY_REFERENCE, 0564, sent by ref(erence) key
key_refresh	krfr	&2	KEY_REFRESH, 0565, sent by refresh key
key_replace	krpl	&3	KEY_REPLACE, 0566, sent by replace key
key_restart	krst	&4	KEY_RESTART, 0567, sent by restart key

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Variable	Cap-name	Termcap Code	Description
key_resume	kres	&5	KEY_RESUME, 0570, sent by resume key
key_right	kcuf1	kr	KEY_RIGHT, 0405, sent by terminal right-arrow key
key_save	ksav	&6	KEY_SAVE, 0571, sent by save key
key_sbeg	kBEG	&9	KEY_SBEG, 0572, sent by shifted beginning key
key_scancel	kCAN	&0	KEY_SCANCEL, 0573, sent by shifted cancel key
key_scommand	kCMD	*1	KEY_SCOMMAND, 0574, sent by shifted command key
key_scopy	kCPY	*2	KEY_SCOPY, 0575, sent by shifted copy key
key_screate	kCRT	*3	KEY_SCREATE, 0576, sent by shifted create key
key_sdc	kDC	*4	KEY_SDC, 0577, sent by shifted delete-char key
key_sdl	kDL	*5	KEY_SDL, 0600, sent by shifted delete-line key
key_select	kslt	*6	KEY_SELECT, 0601, sent by select key
key_send	kEND	*7	KEY_SEND, 0602, sent by shifted end key
key_seol	kEOL	*8	KEY_SEOL, 0603, sent by shifted clear-line key
key_sexit	kEXT	*9	KEY_SEXIT, 0604, sent by shifted exit key
key_sf	kind	kF	KEY_SF, 0520, sent by scroll-forward/down key
key_sfind	kFND	*0	KEY_SFIND, 0605, sent by shifted find key
key_shelp	kHLP	#1	KEY_SHELP, 0606, sent by shifted help key
key_shome	kHOM	#2	KEY_SHOME, 0607, sent by shifted home key
key_sic	kIC	#3	KEY_SIC, 0610, sent by shifted input key
key_sleft	kLFT	#4	KEY_SLEFT, 0611, sent by shifted left-arrow key
key_smessage	kMSG	%a	KEY_SMESSAGE, 0612, sent by shifted message key
key_smove	kMOV	%b	KEY_SMOVE, 0613, sent by shifted move key
key_snext	kNXT	%c	KEY_SNEXT, 0614, sent by shifted next key
key_soptions	kOPT	%d	KEY_SOPTIONS, 0615, sent by shifted options key
key_sprevious	kPRV	%e	KEY_SPREVIOUS, 0616, sent by shifted prev key
key_sprint	kPRT	%f	KEY_SPRINT, 0617, sent by shifted print key
key_sr	kri	kR	KEY_SR, 0521, sent by scroll-backward/up key
key_sredo	kRDO	%g	KEY_SREDO, 0620, sent by shifted redo key
key_sreplace	kRPL	%h	KEY_SREPLACE, 0621, sent by shifted replace key
key_sright	kRIT	%i	KEY_SRIGHT, 0622, sent by shifted right-arrow key
key_srsume	kRES	%j	KEY_SRSUME, 0623, sent by shifted resume key
key_ssave	kSAV	!1	KEY_SSAVE, 0624, sent by shifted save key
key_ssuspend	kSPD	!2	KEY_SSUSPEND, 0625, sent by shifted suspend key
key_stab	khts	kT	KEY_STAB, 0524, sent by set-tab key
key_sundo	kUND	!3	KEY_SUNDO, 0626, sent by shifted undo key
key_suspend	kspd	&7	KEY_SUSPEND, 0627, sent by suspend key
key_undo	kund	&8	KEY_UNDO, 0630, sent by undo key
key_up	kcuu1	ku	KEY_UP, 0403, sent by terminal up-arrow key
keypad_local	rmkx	ke	Out of "keypad-transmit" mode
keypad_xmit	smkx	ks	Put terminal in "keypad-transmit" mode
lab_f0	lf0	l0	Labels on function key f0 if not f0
lab_f1	lf1	l1	Labels on function key f1 if not f1

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Variable	Cap-name	Termcap Code	Description
lab_f2	lf2	l2	Labels on function key f2 if not f2
lab_f3	lf3	l3	Labels on function key f3 if not f3
lab_f4	lf4	l4	Labels on function key f4 if not f4
lab_f5	lf5	l5	Labels on function key f5 if not f5
lab_f6	lf6	l6	Labels on function key f6 if not f6
lab_f7	lf7	l7	Labels on function key f7 if not f7
lab_f8	lf8	l8	Labels on function key f8 if not f8
lab_f9	lf9	l9	Labels on function key f9 if not f9
lab_f10	lf10	la	Labels on function key f10 if not f10
label_format	fln	Lf	Label format
label_off	rmln	LF	Turn off soft labels
label_on	smln	LO	Turn on soft labels
meta_off	rmm	mo	Turn off "meta mode"
meta_on	smm	mm	Turn on "meta mode" (8th bit)
micro_column_address	mhpa	ZY	Like **column_address** for micro adjustment **
micro_down	mcud1	ZZ	Like **cursor_down** for micro adjustment
micro_left	mcub1	Za	Like **cursor_left** for micro adjustment
micro_right	mcuf1	Zb	Like **cursor_right** for micro adjustment
micro_row_address	mvpa	Zc	Like **row_address** for micro adjustment **
micro_up	mcuu1	Zd	Like **cursor_up** for micro adjustment
newline	nel	nw	Newline (behaves like **cr** followed by **lf**)
order_of_pins	porder	Ze	Matches software bits to print-head pins
orig_colors	oc	oc	Set all color(-pair)s to the original ones
orig_pair	op	op	Set default color-pair to the original one
pad_char	pad	pc	Pad character (rather than null)
parm_dch	dch	DC	Delete #1 chars (G*)
parm_delete_line	dl	DL	Delete #1 lines (G*)
parm_down_cursor	cud	DO	Move down #1 lines. (G*)
parm_down_micro	mcud	Zf	Like **parm_down_cursor** for micro adjust. (G*)
parm_ich	ich	IC	Insert #1 blank chars (G*)
parm_index	indn	SF	Scroll forward #1 lines. (G)
parm_insert_line	il	AL	Add #1 new blank lines (G*)
parm_left_cursor	cub	LE	Move cursor left #1 spaces (G)
parm_left_micro	mcub	Zg	Like **parm_left_cursor** for micro adjust. **
parm_right_cursor	cuf	RI	Move right #1 spaces. (G*)
parm_right_micro	mcuf	Zh	Like **parm_right_cursor** for micro adjust. **
parm_rindex	rin	SR	Scroll backward #1 lines. (G)
parm_up_cursor	cuu	UP	Move cursor up #1 lines. (G*)
parm_up_micro	mcuu	Zi	Like **parm_up_cursor** for micro adjust. **
pkey_key	pfkey	pk	Prog funct key #1 to type string #2
pkey_local	pfloc	pl	Prog funct key #1 to execute string #2
pkey_xmit	pfx	px	Prog funct key #1 to xmit string #2
plab_norm	pln	pn	Prog label #1 to show string #2

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Variable	Cap-name	Termcap Code	Description
print_screen	mc0	ps	Print contents of the screen
prtr_non	mc5p	pO	Turn on the printer for #1 bytes
prtr_off	mc4	pf	Turn off the printer
prtr_on	mc5	po	Turn on the printer
pulse	pulse	PU	Select pulse dialing
quick_dial	qdial	QD	Dial phone number #1, without progress detection
remove_clock	rmclk	RC	Remove time-of-day clock
repeat_char	rep	rp	Repeat char #1 #2 times (G*)
req_for_input	rfi	RF	Send next input char (for ptys)
reset_1string	rs1	r1	Reset terminal completely to sane modes
reset_2string	rs2	r2	Reset terminal completely to sane modes
reset_3string	rs3	r3	Reset terminal completely to sane modes
reset_file	rf	rf	Name of file containing reset string
restore_cursor	rc	rc	Restore cursor to position of last sc
row_address	vpa	cv	Vertical position absolute (G)
save_cursor	sc	sc	Save cursor position
scroll_forward	ind	sf	Scroll text up
scroll_reverse	ri	sr	Scroll text down
select_char_set	scs	Zj	Select character set **
set_attributes	sgr	sa	Define the video attributes (G) #1-#9
set_background	setb	Sb	Set current background color
set_bottom_margin	smgb	Zk	Set bottom margin at current line
set_bottom_margin_parm	smgbp	Zl	Set bottom margin at line #1**
set_clock	sclk	SC	Set time-of-day clock
set_color_pair	scp	sp	Set current color-pair
set_foreground	setf	Sf	Set current foreground color1
set_left_margin	smgl	ML	Set left margin at current line
set_left_margin_parm	smglp	Zm	Set left margin at column #1**
set_right_margin	smgr	MR	Set right margin at current column
set_right_margin_parm	smgrp	Zn	Set right margin at column #1**
set_tab	hts	st	Set a tab in all rows, current column
set_top_margin	smgt	Zo	Set top margin at current line
set_top_margin_parm	smgtp	Zp	Set top margin at line #1**
set_window	wind	wi	Current window is lines #1-#2cols #3-#4(G)
start_bit_image	sbim	Zq	Start printing bit image graphics **
start_char_set_def	scsd	Zr	Start definition of a character set **
stop_bit_image	rbim	Zs	End printing bit image graphics
stop_char_set_def	rcsd	Zt	End definition of a character set
subscript_characters	subcs	Zu	List of "subscript-able" characters
superscript_characters	supcs	Zv	List of "superscript-able" characters
tab	ht	ta	Tab to next 8-space hardware tab stop
these_cause_cr	docr	Zw	Printing any of these chars causes cr
to_status_line	tsl	ts	Go to status line, col #1 (G)

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Variable	Cap-name	Termcap Code	Description
tone	tone	TO	Select touch tone dialing
underline_char	uc	uc	Underscore one char and move past it
up_half_line	hu	hu	Half-line up (reverse 1/2 linefeed)
user0	u0	u0	User string 0
user1	u1	u1	User string 1
user2	u2	u2	User string 4
user3	u3	u3	User string 3
user4	u4	u4	User string 4
user5	u5	u5	User string 5
user6	u6	u6	User string 6
user7	u7	u7	User string 7
user8	u8	u8	User string 8
user9	u9	u9	User string 9
wait_tone	wait	WA	Wait for dial tone
xoff_character	xoffc	XF	X-off character
xon_character	xonc	XN	X-on character
xon_character	xonc	XN	Alternate XON character (scancode mode)
xoff_character	xoffc	XF	Alternate XOFF character (scancode mode)
zero_motion	zerom	Zx	No motion for the subsequent character

Booleans

Cap-name	Variable	Termcap Code	Description
am	auto_right_margin	am	Terminal has automatic margins
bw	auto_left_margin	bw	**cub1** wraps from column 0 to last column
ccc	can_change	cc	Terminal can re-define existing color
chts	hard_cursor	HC	Cursor is hard to see
cpix	cpi_changes_res	YF	Changing character pitch changes resolution
cps	print_rate	Ym	Print rate in characters per second
crxm	cr_cancels_micro_modem	YB	Using **cr** turns off micro mode
cwin	create_window	CW	Define win #1 to go from #2,#3to #4,#5
da	memory_above	da	Display may be retained above the screen
daisy	has_print_wheel	YC	Printer needs operator to change character set
dclk	display_clock	DK	Display time-of-day clock
db	memory_below	db	Display may be retained below the screen
dial	dial_phone	DI	Dial phone number #1
eo	erase_overstrike	eo	Can erase overstrikes with a blank
eslok	status_line_esc_ok	es	Escape can be used on the status line
gn	generic_type	gn	Generic line type (e.g., dialup, switch)
hc	hard_copy	hc	Hardcopy terminal
hls	hue_lightness_saturation	hl	Terminal uses only HLS color notation (Tektronix)
hs	has_status_line	hs	Has extra "status line"
hz	tilde_glitch	hz	Hazeltine; can't print tilde (~)
in	insert_null_glitch	in	Insert mode distinguishes nulls
km	has_meta_key	km	Has a meta key (shift, sets parity bit)
lpix	lpi_changes_res	YG	Changing line pitch changes resolution
mc5i	prtr_silent		
mir	move_insert_mode	mi	Safe to move while in insert mode
msgr	move_standout_mode	ms	Safe to move in standout modes
npc	no_pad_char	NP	Pad character doesn't exist
nrrmc	non_rev_rmcup	NR	**smcup** does not reverse **rmcup**
nxon	needs_xon_xoff	nx	Padding won't work, xon/xoff required
os	over_strike	os	Terminal overstrikes on hard-copy terminal
sam	semi_auto_right_margin	YE	Printing in last column causes **cr**
ul	transparent_underline	ul	Underline character overstrikes
xenl	eat_newline_glitch	xn	Newline ignored after 80 columns (*Concept*)
xhp	ceol_standout_glitch	xs	Standout not erased by overwriting (hp)
xhpa	col_addr_glitch	YA	Only positive motion for **hpa/mhpa** caps
xon	xon_xoff	xo	Terminal uses xon/xoff handshaking
xsb	no_esc_ctlc	xb	Beehive (f1=escape, f2=ctrl C)
xt	dest_tabs_magic_smso	xt	Destructive tabs, magic **smso** char (t1061)
xvpa	row_addr_glitch	YD	Only positive motion for **vpa/mvpa** caps

Numbers

Cap-name	Variable	Termcap Code	Description
bufsz	buffer_capacity	Ya	Number of bytes buffered before printing
colors	max_colors	Co	Maximum number of colors on the screen
cols	columns	co	Number of columns in a line
cps	print_rate	Ym	Average print rate in characters per second
it	init_tabs	it	Tabs initially every # spaces
lh	label_height	lh	Number of rows in each label
lines	lines	li	Number of lines on a screen or a page
lm	lines_of_memory	lm	Lines of memory if > **lines**; **0** means varies
lw	label_width	lw	Number of columns in each label
maddr	max_micro_address	Yd	Maximum value in **micro_..._address**
mcs	micro_col_size	Yf	Character step size when in micro mode
mjump	max_micro_jump	Ye	Maximum value in **parm_..._micro**
mls	micro_line_size	Yg	Line step size when in micro mode
ncv	no_color_video	NC	Video attributes that can't be used with colors
nlab	num_labels	Nl	Number of labels on screen (start at 1)
npins	number_of_pins	Yh	Number of pins in print-head
orc	output_res_char	Yi	Horizontal resolution in units per character
orhi	output_res_horz_inch	Yk	Horizontal resolution in units per inch
orl	output_res_line	Yj	Vertical resolution in units per line
orvi	output_res_vert_inch	Yl	Vertical resolution in units per inch
pairs	max_pairs	pa	Maximum number of color-pairs on the screen
pb	padding_baud_rate	pb	Lowest baud rate where padding needed
spinh	dot_horz_spacing	Yc	Spacing of dots horizontally in dots per inch
spinv	dot_vert_spacing	Yb	Spacing of pins vertically in pins per inch
vt	virtual_terminal	vt	Virtual terminal number (UNIX system)
widcs	wide_char_size	Yn	Character step size when in double wide mode
wsl	width_status_line	ws	Number of columns in status line
xmc	magic_cookie_glitch	sg	Number of blank characters left by **smso** or **rmso**

Strings

Cap-name	Variable	Termcap Code	Description
acsc	acs_chars	ac	Graphic charset pairs aAbBcC - def=vt100
bel	bell	bl	Audible signal (bell)
blink	enter_blink_mode	mb	Turn on blinking
bold	enter_bold_mode	md	Turn on bold (extra bright) mode
cbt	back_tab	bt	Back tab
chr	change_res_horz	ZC	Change horizontal resolution**
civis	cursor_invisible	vi	Make cursor invisible
clear	clear_screen	cl	Clear screen and home cursor (*)
cmdch	command_character	CC	Terminal settable cmd character in prototype
cnorm	cursor_normal	ve	Make cursor appear normal (undo **vs/vi**)
cpi	change_char_pitch	ZA	Change number of characters per inch**
cr	carriage_return	cr	Carriage return (*)
csnm	char_set_names	Zy	List of character set names
csr	change_scroll_region	cs	Change to lines #1 through #2 (vt100) (G)
cub	parm_left_cursor	LE	Move cursor left #1 spaces (G)
cub1	cursor_left	le	Move left one space.
cud	parm_down_cursor	DO	Move down #1 lines. (G*)
cuf	parm_right_cursor	RI	Move right #1 spaces. (G*)
cuf1	cursor_right	nd	Non-destructive space (cursor or carriage right)
cup	cursor_address	cm	Move to row #1 col #2 (G)
cuu	parm_up_cursor	UP	Move cursor up #1 lines. (G*)
cvr	change_res_vert	ZD	Change vertical resolution**
cvvis	cursor_visible	vs	Make cursor very visible
dch	parm_dch	DC	Delete #1 chars (G*)
dch1	delete_character	dc	Delete character (*)
defc	define_char	ZE	Define a character in a character set
dim	enter_dim_mode	mh	Turn on half-bright mode
dl	delete_line	dl1	Delete line (*)
dl	parm_delete_line	DL	Delete #1 lines (G*)
do	cursor_down	do	Down one line
docr	these_cause_cr	Zw	Printing any of these chars causes **cr**
dsl	dis_status_line	ds	Disable status line
ech	erase_chars	ec	Erase #1 characters (G)
ed	clr_eos	cd	Clear to end of display (*)
el	clr_eol	ce	Clear to end of line
el1	clr_bol	cb	Clear to beginning of line, inclusive
enacs	ena_acs	eA	Enable alternate character set
ff	form_feed	ff	Hardcopy terminal page eject (*)
flash	flash_screen	vb	Visible bell (may not move cursor)
fln	label_format	Lf	Label format
fsl	from_status_line	fs	Return from status line
hd	down_half_line	hd	Half-line down (forward 1/2 linefeed)

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Cap-name	Variable	Termcap Code	Description
home	cursor_home	ho	Home cursor (if no **cup**)
hook	flash_hook	fh	Flash the switch hook
hpa	column_address	ch	Horizontal position absolute (G)
ht	tab	ta	Tab to next 8-space hardware tab stop
hts	set_tab	st	Set a tab in all rows, current column
hu	up_half_line	hu	Half-line up (reverse 1/2 linefeed)
hup	hangup	HU	Hang-up phone
ich	parm_ich	IC	Insert #1 blank chars (G*)
ich1	insert_character	ic	Insert character
if	init_file	if	Name of initialization file
il	parm_insert_line	AL	Add #1 new blank lines (G*)
il1	insert_line	al	Add new blank line (*)
ind	scroll_forward	sf	Scroll text up
indn	parm_index	SF	Scroll forward #1 lines. (G)
initc	initialize_color	Ic	Initialize the definition of color
initp	initialize_pair	Ip	Initialize color-pair
invis	enter_secure_mode	mk	Turn on blank mode (characters invisible)
ip	insert_padding	ip	Insert pad after character inserted (*)
iprog	init_prog	iP	Path name of program for initialization
is1	init_1string	i1	Terminal or printer initialization string
is2	init_2string	is	Terminal or printer initialization string
is3	init_3string	i3	Terminal or printer initialization string
kBEG	key_sbeg	&9	KEY_SBEG, 0572, sent by shifted beginning key
kCAN	key_scancel	&0	KEY_SCANCEL, 0573, sent by shifted cancel key
kCMD	key_scommand	*1	KEY_SCOMMAND, 0574, sent by shifted command key
kCPY	key_scopy	*2	KEY_SCOPY, 0575, sent by shifted copy key
kCRT	key_screate	*3	KEY_SCREATE, 0576, sent by shifted create key
kDC	key_sdc	*4	KEY_SDC, 0577, sent by shifted delete-char key
kDL	key_sdl	*5	KEY_SDL, 0600, sent by shifted delete-line key
kEND	key_send	*7	KEY_SEND, 0602, sent by shifted end key
kEOL	key_seol	*8	KEY_SEOL, 0603, sent by shifted clear-line key
kEXT	key_sexit	*9	KEY_SEXIT, 0604, sent by shifted exit key
kFND	key_sfind	*0	KEY_SFIND, 0605, sent by shifted find key
kHLP	key_shelp	#1	KEY_SHELP, 0606, sent by shifted help key
kHOM	key_shome	#2	KEY_SHOME, 0607, sent by shifted home key
kIC	key_sic	#3	KEY_SIC, 0610, sent by shifted input key
kLFT	key_sleft	#4	KEY_SLEFT, 0611, sent by shifted left-arrow key
kMOV	key_smove	b	KEY_SMOVE, 0613, sent by shifted move key
kMSG	key_smessage	%a	KEY_SMESSAGE, 0612, sent by shifted message key
kNXT	key_snext	%c	KEY_SNEXT, 0614, sent by shifted next key
kOPT	key_soptions	%d	KEY_SOPTIONS, 0615, sent by shifted options key
kPRT	key_sprint	%f	KEY_SPRINT, 0617, sent by shifted print key
kPRV	key_sprevious	%e	KEY_SPREVIOUS, 0616, sent by shifted prev key

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Cap-name	Variable	Termcap Code	Description
kRDO	key_sredo	%g	KEY_SREDO, 0620, sent by shifted redo key
kRES	key_srsume	%j	KEY_SRSUME, 0623, sent by shifted resume key
kRIT	key_sright	%i	KEY_SRIGHT, 0622, sent by shifted right-arrow key
kRPL	key_sreplace	%h	KEY_SREPLACE, 0621, sent by shifted replace key
kSAV	key_ssave	!1	KEY_SSAVE, 0624, sent by shifted save key
kSPD	key_ssuspend	!2	KEY_SSUSPEND, 0625, sent by shifted suspend key
kUND	key_sundo	!3	KEY_SUNDO, 0626, sent by shifted undo key
ka1	key_a1	K1	KEY_A1, 0534, upper left of keypad
ka3	key_a3	K3	KEY_A3, 0535, upper right of keypad
kb2	key_b2	K2	KEY_B2, 0536, center of keypad
kbeg	key_beg	@1	KEY_BEG, 0542, sent by beg(inning) key
kbs	key_backspace	kb	KEY_BACKSPACE, 0407, sent by backspace key
kc1	key_c1	K4	KEY_C1, 0537, lower left of keypad
kc3	key_c3	K5	KEY_C3, 0540, lower right of keypad
kcan	key_cancel	@2	KEY_CANCEL, 0543, sent by cancel key
kcbt	key_btab	kB	KEY_BTAB, 0541, sent by back-tab key
kclo	key_close	@3	KEY_CLOSE, 0544, sent by close key
kclr	key_clear	kC	KEY_CLEAR, 0515, sent by clear-screen or erase key
kcmd	key_command	@4	KEY_COMMAND, 0545, sent by cmd (command) key
kcpy	key_copy	@5	KEY_COPY, 0546, sent by copy key
kcrt	key_create	@6	KEY_CREATE, 0547, sent by create key
kctab	key_ctab	kt	KEY_CTAB, 0525, sent by clear-tab key
kcub1	key_left	kl	KEY_LEFT, 0404, sent by terminal left-arrow key
kcud1	key_down	kd	KEY_DOWN, 0402, sent by terminal down-arrow key
kcuf1	key_right	kr	KEY_RIGHT, 0405, sent by terminal right-arrow key
kcuu1	key_up	ku	KEY_UP, 0403, sent by terminal up-arrow key
kdch1	key_dc	kD	KEY_DC, 0512, sent by delete-character key
kdl1	key_dl	kL	KEY_DL, 0510, sent by delete-line key
ked	key_eos	ked	KEY_EOS, 0516, sent by clear-to-end-of-screen key
kel	key_eol	kE	KEY_EOL, 0517, sent by clear-to-end-of-line key
kend	key_end	@7	KEY_END, 0550, sent by end key
kent	key_enter	@8	KEY_ENTER, 0527, sent by enter /send key
kext	key_exit	@9	KEY_EXIT, 0551, sent by exit key
kf0	key_f0	k0	KEY_F(0), 0410, sent by function key f0
kf1	key_f1	k1	KEY_F(C), 0411, sent by function key f1
kf10	key_f10	k;	KEY_F(ADM), 0422, sent by function key f10
kf11	key_f11	F1	KEY_F(ADM), 0423, sent by function key f11
kf12	key_f12	F2	KEY_F(ADM), 0424, sent by function key f12
kf13	key_f13	F3	KEY_F(ADM), 0425, sent by function key f13
kf14	key_f14	F4	KEY_F(ADM), 0426, sent by function key f14
kf15	key_f15	F5	KEY_F(ADM), 0427, sent by function key f15
kf16	key_f16	F6	KEY_F(ADM), 0430, sent by function key f16

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Cap-name	Variable	Termcap Code	Description
kf17	key_f17	F7	KEY_F(ADM), 0431, sent by function key f17
kf18	key_f18	F8	KEY_F(ADM), 0432, sent by function key f18
kf19	key_f19	F9	KEY_F(ADM), 0433, sent by function key f19
kf2	key_f2	k2	KEY_F(S), 0412, sent by function key f2
kf20	key_f20	FA	KEY_F(20), 0434, sent by function key f20
kf21	key_f21	FB	KEY_F(21), 0435, sent by function key f21
kf22	key_f22	FC	KEY_F(22), 0436, sent by function key f22
kf23	key_f23	FD	KEY_F(23), 0437, sent by function key f23
kf24	key_f24	FE	KEY_F(24), 0440, sent by function key f24
kf25	key_f25	FF	KEY_F(25), 0441, sent by function key f25
kf26	key_f26	FG	KEY_F(26), 0442, sent by function key f26
kf27	key_f27	FH	KEY_F(27), 0443, sent by function key f27
kf28	key_f28	FI	KEY_F(28), 0444, sent by function key f28
kf29	key_f29	FJ	KEY_F(29), 0445, sent by function key f29
kf3	key_f3	k3	KEY_F(S), 0413, sent by function key f3
kf30	key_f30	FK	KEY_F(S), 0446, sent by function key f30
kf31	key_f31	FL	KEY_F(S), 0447, sent by function key f31
kf32	key_f32	FM	KEY_F(S), 0450, sent by function key f32
kf33	key_f33	FN	KEY_F(ADM), 0451, sent by function key f33
kf34	key_f34	FO	KEY_F(S), 0452, sent by function key f34
kf35	key_f35	FP	KEY_F(S), 0453, sent by function key f35
kf36	key_f36	FQ	KEY_F(S), 0454, sent by function key f36
kf37	key_f37	FR	KEY_F(S), 0455, sent by function key f37
kf38	key_f38	FS	KEY_F(S), 0456, sent by function key f38
kf39	key_f39	FT	KEY_F(S), 0457, sent by function key f39
kf4	key_f4	k4	KEY_F(F), 0414, sent by function key f4
kf40	key_f40	FU	KEY_F(40), 0460, sent by function key f40
kf41	key_f41	FV	KEY_F(41), 0461, sent by function key f41
kf42	key_f42	FW	KEY_F(42), 0462, sent by function key f42
kf43	key_f43	FX	KEY_F(43), 0463, sent by function key f43
kf44	key_f44	FY	KEY_F(44), 0464, sent by function key f44
kf45	key_f45	FZ	KEY_F(45), 0465, sent by function key f45
kf46	key_f46	Fa	KEY_F(46), 0466, sent by function key f46
kf47	key_f47	Fb	KEY_F(47), 0467, sent by function key f47
kf48	key_f48	Fc	KEY_F(48), 0470, sent by function key f48
kf49	key_f49	Fd	KEY_F(49), 0471, sent by function key f49
kf5	key_f5	k5	KEY_F(M), 0415, sent by function key f5
kf50	key_f50	Fe	KEY_F(50), 0472, sent by function key f50
kf51	key_f51	Ff	KEY_F(51), 0473, sent by function key f51
kf52	key_f52	Fg	KEY_F(52), 0474, sent by function key f52
kf53	key_f53	Fh	KEY_F(53), 0475, sent by function key f53
kf54	key_f54	Fi	KEY_F(54), 0476, sent by function key f54
kf55	key_f55	Fj	KEY_F(55), 0477, sent by function key f55

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Cap-name	Variable	Termcap Code	Description
kf56	key_f56	Fk	KEY_F(56), 0500, sent by function key f56
kf57	key_f57	Fl	KEY_F(57), 0501, sent by function key f57
kf58	key_f58	Fm	KEY_F(58), 0502, sent by function key f58
kf59	key_f59	Fn	KEY_F(59), 0503, sent by function key f59
kf6	key_f6	k6	KEY_F(6), 0416, sent by function key f6
kf60	key_f60	Fo	KEY_F(60), 0504, sent by function key f60
kf61	key_f61	Fp	KEY_F(61), 0505, sent by function key f61
kf62	key_f62	Fq	KEY_F(62), 0506, sent by function key f62
kf63	key_f63	Fr	KEY_F(63), 0507, sent by function key f63
kf7	key_f7	k7	KEY_F(7), 0417, sent by function key f7
Kf8	key_f8	k8	KEY_F(8), 0420, sent by function key f8
kf9	key_f9	k9	KEY_F(9), 0421, sent by function key f9
kfnd	key_find	@0	KEY_FIND, 0552, sent by find key
khlp	key_help	%1	KEY_HELP, 0553, sent by help key
khome	key_home	kh	KEY_HOME, 0406, sent by home key
khts	key_stab	kT	KEY_STAB, 0524, sent by set-tab key
kich1	key_ic	kI	KEY_IC, 0513, sent by ins-char/enter ins-mode key
kil1	key_il	kA	KEY_IL, 0511, sent by insert-line key
kind	key_sf	kF	KEY_SF, 0520, sent by scroll-forward/down key
kll	key_ll	kH	KEY_LL, 0533, sent by home-down key
kmov	key_move	%4	KEY_MOVE, 0556, sent by move key
kmrk	key_mark	%2	KEY_MARK, 0554, sent by mark key
kmsg	key_message	%3	KEY_MESSAGE, 0555, sent by message key
knp	key_npage	kN	KEY_NPAGE, 0522, sent by next-page key
knxt	key_next	%5	KEY_NEXT, 0557, sent by next-object key
kopn	key_open	%6	KEY_OPEN, 0560, sent by open key
kopt	key_options	%7	KEY_OPTIONS, 0561, sent by options key
kpp	key_ppage	kP	KEY_PPAGE, 0523, sent by previous-page key
kprt	key_print	%9	KEY_PRINT, 0532, sent by print or copy key
kprv	key_previous	%8	KEY_PREVIOUS, 0562, sent by previous-object key
krdo	key_redo	%0	KEY_REDO, 0563, sent by redo key
kref	key_reference	&1	KEY_REFERENCE, 0564, sent by ref(erence) key
kres	key_resume	&5	KEY_RESUME, 0570, sent by resume key
krfr	key_refresh	&2	KEY_REFRESH, 0565, sent by refresh key
kri	key_sr	kR	KEY_SR, 0521, sent by scroll-backward/up key
krmir	key_eic	kM	KEY_EIC, 0514, sent by **rmir** or **smir** in insert mode
krpl	key_replace	&3	KEY_REPLACE, 0566, sent by replace key
krst	key_restart	&4	KEY_RESTART, 0567, sent by restart key
ksav	key_save	&6	KEY_SAVE, 0571, sent by save key
kslt	key_select	*6	KEY_SELECT, 0601, sent by select key
kspd	key_suspend	&7	KEY_SUSPEND, 0627, sent by suspend key
ktbc	key_catab	ka	KEY_CATAB, 0526, sent by clear-all-tabs key
kund	key_undo	&8	KEY_UNDO, 0630, sent by undo key

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Cap-name	Variable	Termcap Code	Description
lf0	lab_f0	l0	Labels on function key f0 if not f0
lf1	lab_f1	l1	Labels on function key f1 if not f1
lf10	lab_f10	la	Labels on function key f10 if not f10
lf2	lab_f2	l2	Labels on function key f2 if not f2
lf3	lab_f3	l3	Labels on function key f3 if not f3
lf4	lab_f4	l4	Labels on function key f4 if not f4
lf5	lab_f5	l5	Labels on function key f5 if not f5
lf6	lab_f6	l6	Labels on function key f6 if not f6
lf7	lab_f7	l7	Labels on function key f7 if not f7
lf8	lab_f8	l8	Labels on function key f8 if not f8
lf9	lab_f9	l9	Labels on function key f9 if not f9
ll	cursor_to_ll	ll	Last line, first column (if no **cup**)
lpi	change_line_pitch	ZB	Change number of lines per inch**
ma	max_attributes	ma	Maximum combined video attributes terminal can display
mc0	print_screen	ps	Print contents of the screen
mc4	prtr_off	pf	Turn off the printer
mc5	prtr_on	po	Turn on the printer
mc5p	prtr_non	pO	Turn on the printer for #1 bytes
mcub	parm_left_micro	Zg	Like **parm_left_cursor** for micro adjust.**
mcub1	micro_left	Za	Like **cursor_left** for micro adjustment
mcud	parm_down_micro	Zf	Like **parm_down_cursor** for micro adjust. (G*)
mcud1	micro_down	ZZ	Like **cursor_down** for micro adjustment
mcuf	parm_right_micro	Zh	Like **parm_right_cursor** for micro adjust.**
mcuf1	micro_right	Zb	Like **cursor_right** for micro adjustment
mcuu	parm_up_micro	Zi	Like **parm_up_cursor** for micro adjust.**
mcuu1	micro_up	Zd	Like **cursor_up** for micro adjustment
mgc	clear_margins	MC	Clear all margins (top, bottom, and sides)
mhpa	micro_column_address	ZY	Like **column_address** for micro adjustment**
mrcup	cursor_mem_address	CM	Memory relative cursor addressing (G)
mvpa	micro_row_address	Zc	Like **row_address** for micro adjustment**
ndscr	non_dest_scroll_region	ND	Scrolling region is non-destructive
nel	newline	nw	Newline (behaves like **cr** followed by **lf**)
oc	orig_colors	oc	Set all color(-pair)s to the original ones
op	orig_pair	op	Set default color-pair to the original one
pad	pad_char	pc	Pad character (rather than null)
pause	fixed_pause	PA	Pause for 2-3 seconds
pfkey	pkey_key	pk	Prog funct key #1 to type string #2
pfloc	pkey_local	pl	Prog funct key #1 to execute string #2
pfx	pkey_xmit	px	Prog funct key #1 to xmit string #2
pln	plab_norm	pn	Prog label #1 to show string #2
porder	order_of_pins	Ze	Matches software bits to print-head pins
prot	enter_protected_mode	mp	Turn on protected mode
pulse	pulse	PU	Select pulse dialing

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Cap-name	Variable	Termcap Code	Description
qdial	quick_dial	QD	Dial phone number #1, without progress detection
rbim	stop_bit_image	Zs	End printing bit image graphics
rc	restore_cursor	rc	Restore cursor to position of last sc
rcsd	stop_char_set_def	Zt	End definition of a character set
rep	repeat_char	rp	Repeat char #1 #2 times (G*)
rev	enter_reverse_mode	mr	Turn on reverse video mode
rf	reset_file	rf	Name of file containing reset string
rfi	req_for_input	RF	Send next input char (for ptys)
ri	scroll_reverse	sr	Scroll text down
rin	parm_rindex	SR	Scroll backward #1 lines. (G)
ritm	exit_italics_mode	ZR	Disable italics
rlm	exit_leftward_mode	ZS	Enable rightward (normal) carriage motion
rmacs	exit_alt_charset_mode	ae	End alternate character set
rmam	exit_am_mode	RA	Turn off automatic margins
rmclk	remove_clock	RC	Remove time-of-day clock
rmcup	exit_ca_mode	te	String to end programs that use **cup**
rmdc	exit_delete_mode	ed	End delete mode
rmicm	exit_micro_mode	ZT	Disable micro motion capabilities
rmir	exit_insert_mode	ei	End insert mode
rmkx	keypad_local	ke	Out of "keypad-transmit" mode
rmln	label_off	LF	Turn off soft labels
rmm	meta_off	mo	Turn off "meta mode"
rmp	char_padding	rP	Like **ip** but when in replace mode
rmso	exit_standout_mode	se	End standout mode
rmul	exit_underline_mode	ue	End underscore mode
rmxon	exit_xon_mode	RX	Turn off xon/xoff handshaking
rs1	reset_1string	r1	Reset terminal completely to sane modes
rs2	reset_2string	r2	Reset terminal completely to sane modes
rs3	reset_3string	r3	Reset terminal completely to sane modes
rshm	exit_shadow_mode	ZU	Disable shadow printing
rsubm	exit_subscript_mode	ZV	Disable subscript printing
rsupm	exit_superscript_mode	ZW	Disable superscript printing
rum	exit_upward_mode	ZX	Enable downward (normal) carriage motion
rwidm	exit_doublewide_mode	ZQ	Disable double wide printing
sbim	start_bit_image	Zq	Start printing bit image graphics**
sc	save_cursor	sc	Save cursor position
sclk	set_clock	SC	Set time-of-day clock
scp	set_color_pair	sp	Set current color-pair
scs	select_char_set	Zj	Select character set**
scsd	start_char_set_def	Zr	Start definition of a character set**
sdrfq	enter_draft_quality	ZG	Set draft quality print
setb	set_background	Sb	Set current background color
setf	set_foreground	Sf	Set current foreground color

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Cap-name	Variable	Termcap Code	Description
sgr	set_attributes	sa	Define the video attributes #1-#9(G)
sgr0	exit_attribute_mode	me	Turn off all attributes
sitm	enter_italics_mode	ZH	Enable italics
slm	enter_leftward_mode	ZI	Enable leftward carriage motion
smacs	enter_alt_charset_mode	as	Start alternate character set
smam	enter_am_mode	SA	Turn on automatic margins
smcup	enter_ca_mode	ti	String to begin programs that use **cup**
smdc	enter_delete_mode	dm	Delete mode (enter)
smgb	set_bottom_margin	Zk	Set bottom margin at current line
smgbp	set_bottom_margin_parm	Zl	Set bottom margin at line #1 **
smgl	set_left_margin	ML	Set left margin at current line
smglp	set_left_margin_parm	Zm	Set left margin at column #1 **
smgr	set_right_margin	MR	Set right margin at current column
smgrp	set_right_margin_parm	Zn	Set right margin at column #1 **
smgt	set_top_margin	Zo	Set top margin at current line
smgtp	set_top_margin_parm	Zp	Set top margin at line #1 **
smicm	enter_micro_mode	ZJ	Enable micro motion capabilities
smir	enter_insert_mode	im	Insert mode (enter)
smkx	keypad_xmit	ks	Put terminal in "keypad-transmit" mode
smln	label_on	LO	Turn on soft labels
smm	meta_on	mm	Turn on "meta mode" (8th bit)
smso	enter_standout_mode	so	Begin standout mode
smxon	enter_xon_mode	SX	Turn on xon/xoff handshaking
snlq	enter_near_letter_quality	ZK	Set near-letter quality print
snrmq	enter_normal_quality	ZL	Set normal quality print
sshm	enter_shadow_mode	ZM	Enable shadow printing
ssubm	enter_subscript_mode	ZN	Enable subscript printing
ssupm	enter_superscript_mode	ZO	Enable superscript printing
subcs	subscript_characters	Zu	List of "subscript-able" characters
sum	enter_upward_mode	ZP	Enable upward carriage motion
supcs	superscript_characters	Zv	List of "superscript-able" characters
swidm	enter_doublewide_mode	ZF	Enable double wide printing
tbc	clear_all_tabs	ct	Clear all tab stops
tone	tone	TO	Select touch tone dialing
tsl	to_status_line	ts	Go to status line, col #1 (G)
u0	user0	u0	User string 0
u1	user1	u1	User string 1
u2	user2	u2	User string 2
u3	user3	u3	User string 3
u4	user4	u4	User string 4
u5	user5	u5	User string 5
u6	user6	u6	User string 6
u7	user7	u7	User string 7

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Cap-name	Variable	Termcap Code	Description
u8	user8	u8	User string 8
u9	user9	u9	User string 9
uc	underline_char	uc	Underscore one char and move past it
up	cursor_up	cuu1	Upline (cursor up)
vpa	row_address	cv	Vertical position absolute (G)
wait	wait_tone	WA	Wait for dial tone
wind	set_window	wi	Current window is lines #1-#2cols #3-#4(G)
wingo	goto_window	WG	Got to window #1
wnum	maximum_windows	MW	Maximum number of definable windows
xoffc	xoff_character	XF	X-off character
xonc	xon_character	XN	X-on character
zerom	zero_motion	Zx	No motion for the subsequent character

Sample entry

The following entry, which describes the AT&T 610 terminal, is among the more complex entries in the *terminfo* file at this time.

```
610 | 610bct | ATT610 | att610 | AT&T 610; 80 column; 98key keyboard
        am, eslok, hs, mir, msgr, xenl, xon,
        cols#80, it#8, lh#2, lines#24, lw#8, nlab#8, wsl#80,
        acsc=``aaffggjjkkllmmnnooppqqrrssttuuvvwwxxyyzz{{ | | }}~~,
        bel=^G, blink=\E[5m, bold=\E[1m, cbt=\E[Z,
        civis=\E[?25l, clear=\E[H\E[J, cnorm=\E[?25h\E[?12l,
        cr=\r, csr=\E[%i%p1%d;%p2%dr, cub=\E[%p1%dD, cub1=\b,
        cud=\E[%p1%dB, cud1=\E[B, cuf=\E[%p1%dC, cuf1=\E[C,
        cup=\E[%i%p1%d;%p2%dH, cuu=\E[%p1%dA, cuu1=\E[A,
        cvvis=\E[?12;25h, dch=\E[%p1%dP, dch1=\E[P, dim=\E[2m,
        dl=\E[%p1%dM, dl1=\E[M, ed=\E[J, el=\E[K, el1=\E[1K,
        flash=\E[?5h$<200>\E[?5l, fsl=\E8, home=\E[H, ht=\t,
        ich=\E[%p1%d@, il=\E[%p1%dL, il1=\E[L, ind=\ED,
        invis=\E[8m,
        is1=\E[8;0 | \E[?3;4;5;13;15l\E[13;20l\E[?7h\E[12h\E(B\E)0,
        is2=\E[0m^O, is3=\E(B\E)0, kLFT=\E[\s@, kRIT=\E[\sA,
        kbs=\b, kcbt=\E[Z, kclr=\E[2J, kcub1=\E[D, kcud1=\E[B,
        kcuf1=\E[C, kcuu1=\E[A, kf1=\EOc, kf10=\ENp,
        kf11=\ENq, kf12=\ENr, kf13=\ENs, kf14=\ENt, kf2=\EOd,
        kf3=\EOe, kf4=\EOf, kf5=\EOg, kf6=\EOh, kf7=\EOi,
        kf8=\EOj, kf9=\ENo, khome=\E[H, kind=\E[S, kri=\E[T,
        ll=\E[24H, mc4=\E[?4i, mc5=\E[?5i, nel=\EE,
        pfx=\E[%p1%d;%p2%l%02dq\s\s\sF%p1%ld\s\s\s\s\s
\s\s\s\s\s\s%p2%s,
        pln=\E[%p1%d;0;0;0q%p2%:-16.16s, rc=\E8, rev=\E[7m,
        ri=\EM, rmacs=^O, rmir=\E[4l, rmln=\E[2p, rmso=\E[m,
        rmul=\E[m, rs2=\Ec\E[?3l, sc=\E7,
        sgr=\E[0%?%p6%t;1%;%?%p5%t;2%;%?%p2%t;4%;%?%p4%t;5%;
%?%p3%p1% | %t;7%;%?%p7%t;8%;m%?%p9%t^N%e^O%;,
        sgr0=\E[m^O, smacs=^N, smir=\E[4h, smln=\E[p,
        smso=\E[7m, smul=\E[4m, tsl=\E7\E[25;%i%p1%dx,
```

Types of capabilities in the sample entry

The sample entry shows the formats for the three types of *terminfo* capabilities listed: Boolean, Numeric, and String. The names of Boolean capabilities are often listed as abbreviations or acronyms, such as **am** (short for "automatic margins") in the sample entry. ("Automatic margins" is a short description of an automatic return and linefeed when the end of a line is reached.)

Numeric capabilities are followed by the character "**#**" and then the value. Thus, in the sample, **cols** (which shows the number of columns available on a terminal) gives the value **80** for the AT&T 610. (Values for numeric capabilities may be specified in decimal, octal or hexadecimal, using normal C conventions.)

Finally, string-valued capabilities such as **el** (clear to end-of-line sequence) are listed by a two- to five-character capname, an "**=**", and a string ended by the next occurrence of a comma. A delay in milliseconds may appear anywhere in such a capability, enclosed in **$<..>** brackets, as in **el=\EK$<3>**. Padding characters are supplied by **tputs**( ). The delay can be any of the following: a number (**5**), a number followed by a "*****" (5*), a number followed by a "**/**" (5/), or a number followed by both (5*/). A "*****" shows that the padding required is proportional to the number of lines affected by the operation, and the amount given is the per-affected-unit padding required. (In the case of insert characters, the factor is still the number of lines affected. This is always 1 unless the terminal has **in** and the software uses it.) When a "*****" is specified, it is sometimes useful to give a delay of the form **3.5** to specify a delay per unit to tenths of milliseconds. (Only one decimal place is allowed.)

A "**/**" indicates that the padding is mandatory. Absence of a "**/**" is not shown, if the terminal has **xon** defined. Padding information is advisory and will be used only for cost estimates or when the terminal is in raw mode. Mandatory padding will be transmitted regardless of the setting of **xon**.

A number of escape sequences are provided in the string valued capabilities for easy encoding of characters there. Both **\E** and **\e** map to an ESCAPE character, **^***x* maps to a control-*x* for any appropriate *x*, and the sequences **\n**, **\l**, **\r**, **\t**, **\b**, **\f**, and **\s** give a newline, linefeed, return, tab, backspace, formfeed, and space, respectively. Other escapes include: **\^** for caret (**^**); **** for backslash (****); **\,** for comma (**,**); **\:** for colon (**:**); and **\0** for null. (**\0** will actually produce **\200**, which does not terminate a string but behaves as a null character on most terminals.) Finally, characters may be given as three octal digits after a backslash (for example, \123).

Sometimes individual capabilities must be commented out. To do this, put a period before the capability name. For example, see the second **ind** in the example above. Note that capabilities are defined in a left-to-right order and, therefore, a prior definition will override a later definition.

Preparing descriptions

The most effective way to prepare a terminal description is by imitating the description of a similar terminal in *terminfo* and building up a description gradually, using partial descriptions with **vi**(C) to check that they are correct. Be aware that a very unusual terminal may expose deficiencies in the ability of the *terminfo* file to describe it or the inability of **vi**(C) to work with that terminal. To test a new terminal description, set the environment variable **TERMINFO** to a pathname of a directory containing the compiled description you are working on: programs will then look there rather than in */usr/lib/terminfo*. To get the padding for insert-line correct (if the terminal manufacturer did not document it) a severe test is to comment out **xon**, edit a large file at 9600 baud with **vi**(C), delete 16 or so lines from the middle of the screen, then hit the ⟨u⟩ key several times quickly. If the display is corrupted, more padding is usually needed. A similar test can be used for insert-character.

Section 1-1: Basic capabilities

The number of columns on each line for the terminal is given by the **cols** numeric capability. If the terminal has a screen, then the number of lines on the screen is given by the **lines** capability. If the terminal can clear its screen, leaving the cursor in the home position, then this is given by the **clear** string capability. If the terminal overstrikes (rather than clearing a position when a character is struck over) then it should have the **os** capability. If the terminal is a printing terminal, with no soft copy unit, give it both **hc** and **os**. (**os** applies to storage scope terminals, such as the Tektronix 4010 series, as well as hard-copy and APL terminals.) If there is a code to move the cursor to the left edge of the current row, give this as **cr**. (Normally this will be carriage return, control M.) If there is a code to produce an audible signal (such as a bell or a beep), specify it as **bel**. If the terminal uses the xon-xoff flow-control protocol, like most terminals, specify **xon**.

If there is a code to move the cursor one position to the left (such as backspace), that capability should be given as **cub1**. Similarly, codes to move to the right, up, and down should be given as **cuf1**, **cuu1**, and **cud1**. These local cursor motions should not alter the text they pass over; for example, you would not normally use "**cuf1**=\s" because the space would erase the character moved over.

A very important point here is that the local cursor motions encoded in *terminfo* are undefined at the left and top edges of a screen terminal. Programs should never attempt to backspace around the left edge, unless **bw** is given, and should never attempt to go up locally off the top. In order to scroll text up, a program will go to the bottom left corner of the screen and send the **ind** (index) string.

To scroll text down, a program goes to the top left corner of the screen and sends the **ri** (reverse index) string. The strings **ind** and **ri** are undefined when not on their respective corners of the screen.

Parameterized versions of the scrolling sequences are **indn** and **rin** which have the same semantics as **ind** and **ri** except that they take one parameter, and scroll that many lines. They are also undefined except at the appropriate edge of the screen.

If the terminal wraps around to the beginning of the next line when it reaches the right margin, then it should have the **am** capability. The **am** capability tells whether the cursor sticks at the right edge of the screen when text is output, but this does not necessarily apply to a **cuf1** from the last column. The only local motion which is defined from the left edge is if **bw** is given: then a **cub1** from the left edge will move to the right edge of the previous row. If **bw** is not given, the effect is undefined. This is useful for drawing a box around the edge of the screen, for example. If the terminal has switch selectable automatic margins, the *terminfo* file usually assumes that this is on; that is, **am**. If the terminal has a command which moves to the first column of the next line, that command can be given as **nel** (newline). It does not matter if the command clears the remainder of the current line, so if the terminal has no **cr** and **lf** it may still be possible to craft a working **nel** out of one or both of them.

These capabilities suffice to describe hardcopy and screen terminals. Thus the model 33 teleprinter is described as:

```
hc, os, xon
   cols#72,
   bel=^G, cr=\r, cud1=\n, ind=\n,
```

while the Lear Siegler ADM-3 is described as:

```
   adm3|lsi adm3,
   am, bel=^G, clear=^Z, cols#80, cr=^M, cub1=^H,
   cud1=^J, ind=^J, lines#24,
```

Section 1-2: Parameterized strings

Cursor addressing and other strings requiring parameters in the terminal are described by a parameterized string capability, with **printf**(S) -like escapes (**%x**) in it. For example, to address the cursor, the **cup** capability is given, using two parameters: the row and column to address to. (Rows and columns are numbered from zero and refer to the physical screen visible to the user, not to any unseen memory.) If the terminal has memory-relative cursor addressing, that can be indicated by **mrcup**.

The parameter mechanism uses a stack and special **%** codes to manipulate it in the manner of a Reverse Polish Notation (postfix) calculator. Typically, a sequence will push one of the parameters onto the stack and then print it in some format. Often more complex operations are necessary. Binary operations are in postfix form with the operands in the usual order. That is, to get x-5 one would use **%gx%{5}%-**.

The % encodings have the following meanings:

%%	outputs '%'
%[[:]*flags*][*width*[.*precision*]][**doxXs**]	as in printf, flags are **[-+#]** and space
%c	print pop() gives %c
%p[1-9]	push i^{th} parm
%P[a-z]	set variable [a-z] to pop()
%g[a-z]	get variable [a-z] and push it
%'*c*'	push char constant *c*
%{*nn*}	push decimal constant *nn*
%l	push strlen(pop())
%+ %- %* %/ %m	arithmetic (%m is mod): push(pop() op pop())
%& %| %^	bit operations: push(pop() op pop())
%= %> %<	logical operations: push(pop() op pop())
%A %O	logical operations: and, or
%! %~	unary operations: push(op pop())
%i	(for ANSI terminals) add 1 to first parm, if one parm present, or first two parms, if more than one parm present

%? expr %t thenpart %e elsepart %;
if-then-else, %e elsepart is optional;
else-if's are possible ala Algol 68:
%? c_1 %t b_1 %e c_2 %t b_2 %e c_3 %t b_3 %e c_4 %t b_4 %e b_5%;
c_i are conditions, b_i are bodies.

If the "-" flag is used with "%[doxXs]", then a colon (:) must be placed between the "%" and the "-" to differentiate the flag from the binary "%-" operator, for example, "%:-16.16s".

Consider the Hewlett-Packard 2645, which, to get to row 3 and column 12, needs to be sent **\E&a12c03Y** padded for 6 milliseconds. Note that the order of the rows and columns is inverted here, and that the row and column are zero-padded as two digits. Thus its **cup** capability is "**cup**=\E&a%p2%2.2dc%p1%2.2dY$<6>".

The Micro-Term ACT-IV needs the current row and column sent preceded by a **^T**, with the row and column simply encoded in binary, "**cup**=^T%p1%c%p2%c". Terminals which use "%c" need to be able to backspace the cursor (**cub1**), and to move the cursor up one line on the screen (**cuu1**). This is necessary because it is not always safe to transmit **\n**, **^D**, and **\r**, as the system may change or discard them. (The library routines dealing with *terminfo* set tty modes so that tabs are never expanded, so **\t** is safe to send. This turns out to be essential for the Ann Arbor 4080.)

A final example is the LSI ADM-3a, which uses row and column offset by a blank character, thus "**cup**=\E=%p1%'\s'%+%c%p2%'\s'%+%c". After sending "\E=", this pushes the first parameter, pushes the ASCII value for a space (S), adds them (pushing the sum on the stack in place of the two previous values), and outputs that value as a character. Then the same is done for the second parameter. More complex arithmetic is possible using the stack.

Section 1-3: Cursor motions

If the terminal has a fast way to home the cursor (to very upper left corner of screen) then this can be given as **home**; similarly a fast way of getting to the lower left-hand corner can be given as **ll**; this may involve going up with **cuu1** from the home position, but a program should never do this itself (unless **ll** does) because it can make no assumption about the effect of moving up from the home position. Note that the home position is the same as addressing to (0,0): to the top left corner of the screen, not of memory. (Thus, the **\EH** sequence on Hewlett-Packard terminals cannot be used for **home** without losing some of the other features on the terminal.)

If the terminal has row or column absolute-cursor addressing, these can be given as single parameter capabilities **hpa** (horizontal position absolute) and **vpa** (vertical position absolute). Sometimes these are shorter than the more general two-parameter sequence (as with the Hewlett-Packard 2645) and can be used in preference to **cup**. If there are parameterized local motions (for example, move *n* spaces to the right) these can be given as **cud**, **cub**, **cuf**, and **cuu** with a single parameter indicating how many spaces to move. These are primarily useful if the terminal does not have **cup**, such as the Tektronix 4025.

Section 1-4: Area clears

If the terminal can clear from the current position to the end of the line, leaving the cursor where it is, this should be given as **el**. If the terminal can clear from the beginning of the line to the current position inclusive, leaving the cursor where it is, this should be given as **el1**. If the terminal can clear from the current position to the end of the display, then this should be given as **ed**. **ed** is only defined from the first column of a line. (Thus, it can be simulated by a request to delete a large number of lines, if a true **ed** is not available.)

Section 1-5: Insert/delete line

If the terminal can open a new blank line before the line where the cursor is, this should be given as **il1**; this is done only from the first position of a line. The cursor must then appear on the newly blank line. If the terminal can delete the line which the cursor is on, then this should be given as **dl1**; this is done only from the first position on the line to be deleted. Versions of **il1** and **dl1** which take a single parameter and insert or delete that many lines can be given as **il** and **dl**.

If the terminal has a settable destructive scrolling region (like the VT100) the command to set this can be described with the **csr** capability, which takes two parameters: the top and bottom lines of the scrolling region. The cursor position is, unfortunately, undefined after using this command. It is possible to

get the effect of insert or delete line using this command -- the **sc** and **rc** (save and restore cursor) commands are also useful. Inserting lines at the top or bottom of the screen can also be done using **ri** or **ind** on many terminals without a true insert/delete line, and is often faster even on terminals with those features.

To determine whether a terminal has destructive scrolling regions or non-destructive scrolling regions, create a scrolling region in the middle of the screen, place data on the bottom line of the scrolling region, move the cursor to the top line of the scrolling region, and do a reverse index (**ri**) followed by a delete line (**dl1**) or index (**ind**). If the data that was originally on the bottom line of the scrolling region was restored into the scrolling region by the **dl1** or **ind**, then the terminal has non-destructive scrolling regions. Otherwise, it has destructive scrolling regions. Do not specify **csr** if the terminal has non-destructive scrolling regions, unless **ind**, **ri**, **indn**, **rin**, **dl**, and **dl1** all simulate destructive scrolling.

If the terminal has the ability to define a window as part of memory, which all commands affect, it should be given as the parameterized string **wind**. The four parameters are the starting and ending lines in memory and the starting and ending columns in memory, in that order.

If the terminal can retain display memory above, then the **da** capability should be given; if display memory can be retained below, then **db** should be given. These indicate that deleting a line or scrolling a full screen may bring non-blank lines up from below or that scrolling back with **ri** may bring down non-blank lines.

Section 1-6: Insert/delete character

There are two basic kinds of intelligent terminals with respect to insert/delete character operations which can be described using *terminfo*. The most common insert/delete character operations affect only the characters on the current line and shift characters off the end of the line rigidly. Other terminals, such as the Concept 100 and the Perkin Elmer Owl, make a distinction between typed and untyped blanks on the screen, shifting upon an insert or delete only to an untyped blank on the screen which is either eliminated, or expanded to two untyped blanks. You can determine the kind of terminal you have by clearing the screen and then typing text separated by cursor motions. Type "**abc def**" using local cursor motions (not spaces) between the **abc** and the **def**. Then position the cursor before the **abc** and put the terminal in insert mode. If typing characters causes the rest of the line to shift rigidly and characters to fall off the end, then your terminal does not distinguish between blanks and untyped positions. If the **abc** shifts over to the **def** which then move together around the end of the current line and onto the next as you insert, you have the second type of terminal, and should give the capability **in**, which stands for "insert null". While these are two logically separate attributes (one line versus multiline insert mode, and special treatment of untyped spaces) no terminals whose insert mode cannot be described with the single attribute have been seen.

terminfo can describe both terminals which have an insert mode and terminals which send a simple sequence to open a blank position on the current line. Give as **smir** the sequence to get into insert mode. Give as **rmir** the sequence to leave insert mode. Now give as **ich1** any sequence needed to be sent just before sending the character to be inserted. Most terminals with a true insert mode will not give **ich1**; terminals which send a sequence to open a screen position should give it here. (If your terminal has both, insert mode is usually preferable to **ich1**. Do not give both unless the terminal actually requires both to be used in combination.) If post-insert padding is needed, give this as a number of milliseconds padding in **ip** (a string option). Any other sequence which may need to be sent after an insert of a single character may also be given in **ip**. If your terminal needs both to be placed into an 'insert mode' and a special code to precede each inserted character, then both **smir/rmir** and **ich1** can be given, and both will be used. The **ich** capability, with one parameter, ***n***, will insert ***n*** blanks.

If padding is necessary between characters typed while not in insert mode, give this as a number of milliseconds padding in **rmp**.

It is occasionally necessary to move around while in insert mode to delete characters on the same line (for example, if there is a tab after the insertion position). If your terminal allows motion while in insert mode you can give the capability **mir** to speed up inserting in this case. Omitting **mir** will affect only speed. Some terminals (notably Datamedia's) must not have **mir** because of the way their insert mode works.

Finally, you can specify **dch1** to delete a single character, **dch** with one parameter, ***n***, to delete ***n*** characters, and delete mode by giving **smdc** and **rmdc** to enter and exit delete mode (any mode the terminal needs to be placed in for **dch1** to work).

A command to erase ***n*** characters (equivalent to outputting ***n*** blanks without moving the cursor) can be given as **ech** with one parameter.

Section 1-7: Highlighting, underlining, and visible bells

Your terminal may have one or more kinds of display attributes that allow you to highlight selected characters when they appear on the screen. The following display modes (shown with the names by which they are set) may be available: a blinking screen (*blink*), bold or extra-bright characters (*bold*), dim or half-bright characters (*dim*), blanking or invisible text (*invis*), protected text (*prot*), a reverse-video screen (*rev*), and an alternate character set (**smacs** to enter this mode and **rmacs** to exit it). (If a command is necessary before you can enter alternate character set mode, give the sequence in **enacs** or "enable alternate-character-set" mode.) Turning on any of these modes singly may or may not turn off other modes.

If you set any display attributes for highlighting, you will also want to provide the capability for turning them off. To do so, set **sgr0**.

You should choose one display method as *standout mode* (see **curses**(S)) and use it to highlight error messages and other kinds of text to which you want to draw attention. Choose a form of display that provides strong contrast but that is easy on the eyes. (We recommend reverse-video plus half-bright or reverse-video alone.) The sequences to enter and exit standout mode are given as **smso** and **rmso**, respectively. If the code to change into or out of standout mode leaves one or even two blank spaces on the screen, as the TVI 912 and Teleray 1061 do, then **xmc** should be given to tell how many spaces are left.

Codes to begin underlining and end underlining can be given as **smul** and **rmul**, respectively. If the terminal has a code to underline the current character and move the cursor one space to the right, such as the Micro-Term MIME, this can be given as **uc**.

For historical reasons, some programs interpret **rmso**, **rmul** to mean "turn off all attributes", not just standout and underline, respectively.

If there is a sequence to set arbitrary combinations of modes, this should be given as **sgr** (set attributes), taking nine parameters. Each parameter is either **0** or non-zero, as the corresponding attribute is on or off. The nine parameters are, in order: standout, underline, reverse, blink, dim, bold, blank, protect, alternate character set. Not all modes need to be supported by **sgr**; only those for which corresponding separate attribute commands exist should be supported. (See the example at the end of this section.)

Terminals with the "magic cookie" glitch (**xmc**) deposit special "cookies" when they receive mode-setting sequences, which affect the display algorithm rather than having extra bits for each character. Some terminals, such as the Hewlett-Packard 2621, automatically leave standout mode when they move to a new line or the cursor is addressed. Programs using standout mode should exit standout mode before moving the cursor or sending a newline, unless the **msgr** capability, asserting that it is safe to move in standout mode, is present.

If the terminal has a way of flashing the screen to indicate an error quietly (a bell replacement), then this can be given as **flash**; it must not move the cursor. A good flash can be done by changing the screen into reverse video, pad for 200 ms, then return the screen to normal video.

If the cursor needs to be made more visible than normal when it is not on the bottom line (for example, to make a non-blinking underline into an easier-to-find block or blinking underline) give this sequence as **cvvis**. The boolean **chts** should also be given. If there is a way to make the cursor completely invisible, give that as **civis**. The capability **cnorm** should be given which undoes the effects of either of these modes.

If the terminal needs to be in a special mode when running a program that uses these capabilities, the codes to enter and exit this mode can be given as **smcup** and **rmcup**. This arises, for example, from terminals, such as the Concept, with more than one page of memory. If the terminal has only memory

relative cursor addressing and not screen relative cursor addressing, a one screen-sized window must be fixed into the terminal for cursor addressing to work properly. This is also used for the Tektronix 4025, where **smcup** sets the command character to be the one used by *terminfo*. If the **smcup** sequence will not restore the screen after a **rmcup** sequence is output (to the state prior to outputting **rmcup**), specify **nrrmc**.

If your terminal generates underlined characters by using the underline character (with no special codes needed) even though it does not otherwise overstrike characters, then you should give the capability **ul**. For terminals where a character overstriking another leaves both characters on the screen, give the capability **os**. If overstrikes are erasable with a blank, then this should be indicated by giving **eo**.

Example of highlighting: assume that the terminal under question needs the following escape sequences to turn on various modes.

tparm parameter	attribute	escape sequence
	none	\E[0m
p1	standout	\E[0;4;7m
p2	underline	\E[0;3m
p3	reverse	\E[0;4m
p4	blink	\E[0;5m
p5	dim	\E[0;7m
p6	bold	\E[0;3;4m
p7	invis	\E[0;8m
p8	protect	not available
p9	altcharset	^O (off) ^N(on)

Note that each escape sequence requires a **0** to turn off other modes before turning on its own mode. Also note that, as suggested above, *standout* is set up to be the combination of *reverse* and *dim*. Also, because this terminal has no *bold* mode, *bold* is set up as the combination of *reverse* and *underline*. In addition, to allow combinations, such as *underline+blink*, the sequence to use would be **\E[0;3;5m**. The terminal does not have *protect* mode, either, but that cannot be simulated in any way, so **p8** is ignored. The *altcharset* mode is different in that it is either **^O** or **^N**, depending on whether it is off or on. If all modes were to be turned on, the sequence would be **\E[0;3;4;5;7;8m^N**.

Now look at when different sequences are output. For example, **;3** is output when either **p2** or **p6** is true; that is, if either *underline* or *bold* modes are turned on. Writing out the above sequences, along with their dependencies, gives the following:

sequence	when to output	terminfo translation
\E[0	always	\E[0
;3	if p2 or p6	%?%p2%p6%|%t;3%;
;4	if p1 or p3 or p6	%?%p1%p3%|%p6%|%t;4%;
;5	if p4	%?%p4%t;5%;
;7	if p1 or p5	%?%p1%p5%|%t;7%;
;8	if p7	%?%p7%t;8%;
m	always	m
^N or ^O	if p9 ^N, else ^O	%?%p9%t^N%e^O%;

Putting this all together into the **sgr** sequence gives:

sgr=\E[0%?%p2%p6%|%t;3%;%?%p1%p3%|%p6%|%t;4%;%?%p5%t;5%;
%?%p1%p5%|%t;7%;%?%p7%t;8%;m%?%p9%t ^N%e^O%;,

Section 1-8: Keypad

If the terminal has a keypad that transmits codes when the keys are pressed, this information can be given. Note that it is not possible to handle terminals where the keypad only works in local (this applies, for example, to the unshifted Hewlett-Packard 2621 keys). If the keypad can be set to transmit or not transmit, give these codes as **smkx** and **rmkx**. Otherwise the keypad is assumed to transmit.

The codes sent by the left arrow, right arrow, up arrow, down arrow, and home keys can be given as **kcub1**, **kcuf1**, **kcuu1**, **kcud1**, and **khome** respectively. If there are function keys such as f0, f1, ..., f63, the codes they send can be given as **kf0**, **kf1**, ..., **kf63**. If the first 11 keys have labels other than the default f0 through f10, the labels can be given as **lf0**, **lf1**, ..., **lf10**. The codes transmitted by certain other special keys can be given: **kll** (home down), **kbs** (backspace), **ktbc** (clear all tabs), **kctab** (clear the tab stop in this column), **kclr** (clear screen or erase key), **kdch1** (delete character), **kdl1** (delete line), **krmir** (exit insert mode), **kel** (clear to end of line), **ked** (clear to end of screen), **kich1** (insert character or enter insert mode), **kil1** (insert line), **knp** (next page), **kpp** (previous page), **kind** (scroll forward/down), **kri** (scroll backward/up), **khts** (set a tab stop in this column). In addition, if the keypad has a 3 by 3 array of keys including the four arrow keys, the other five keys can be given as **ka1**, **ka3**, **kb2**, **kc1**, and **kc3**. These keys are useful when the effects of a 3 by 3 directional pad are needed. Further keys are defined above in the capabilities list.

Strings to program function keys can be given as **pfkey**, **pfloc**, and **pfx**. A string to program their soft-screen labels can be given as **pln**. Each of these strings takes two parameters: the function key number to program (from 0 to 10) and the string to program it with. Function key numbers out of this range may program undefined keys in a terminal-dependent manner. The difference between the capabilities is that **pfkey** causes pressing the given key to give the same result as the user typing the given string; **pfloc** causes the string to be executed by the terminal in local mode; and **pfx** causes the string to be transmitted to the computer. The capabilities **nlab**, **lw**, and **lh** define how many soft labels there are and their width and height. If there are commands to turn the labels on and off, give them in **smln** and **rmln**. **smln** is normally output after one or more **pln** sequences to make sure that the change becomes visible.

Section 1-9: Tabs and initialization

If the terminal has hardware tabs, the command to advance to the next tab stop can be given as **ht** (usually control I). A "backtab" command which moves left to the next tab stop can be given as **cbt**. By convention, if the teletype modes indicate that tabs are being expanded by the computer rather than being sent to the terminal, programs should not use **ht** or **cbt** even if they are present, since the user may not have the tab stops properly set. If the terminal has hardware tabs which are initially set every ***n*** spaces when the terminal is powered up, the numeric parameter **it** is given, showing the number of spaces the tabs are set to. This is normally used by **tput init** (see **tput**(C)) to determine whether to set the mode for hardware tab expansion and whether to set the tab stops. If the terminal has tab stops that can be saved in nonvolatile memory, the *terminfo* description can assume that they are properly set. If there are commands to set and clear tab stops, they can be given as **tbc** (clear all tab stops) and **hts** (set a tab stop in the current column of every row).

Other capabilities include: **is1**, **is2**, and **is3**, initialization strings for the terminal; **iprog**, the path name of a program to be run to initialize the terminal; and **if**, the name of a file containing long initialization strings. These strings are expected to set the terminal into modes consistent with the rest of the *terminfo* description. They must be sent to the terminal each time the user logs in and be output in the following order: run the program **iprog**; output **is1**; output **is2**; set the margins using **mgc**, **smgl**, and **smgr**; set the tabs using **tbc** and **hts**; print the file **if**; and finally output **is3**. This is usually done using the **init** option of **tput**(C); see **profile**(F).

Most initialization is done with **is2**. Special terminal modes can be set up without duplicating strings by putting the common sequences in **is2** and special cases in **is1** and **is3**. Sequences that do a harder reset from a totally unknown state can be given as **rs1**, **rs2**, **rf**, and **rs3**, analogous to **is1**, **is2**, **is3**, and **if**. (The method using files, **if** and **rf**, is used for a few terminals, from */usr/lib/tabset/**; however, the recommended method is to use the initialization and reset strings.) These strings are output by **tput reset**, which is used when the terminal gets into a wedged state. Commands are normally placed in **rs1**, **rs2**, **rs3**, and **rf** only if they produce annoying effects on the screen and are not necessary when logging in.

For example, the command to set a terminal into 80-column mode would normally be part of **is2**, but on some terminals it causes an annoying glitch on the screen and is not normally needed since the terminal is usually already in 80-column mode.

If a more complex sequence is needed to set the tabs than can be described by using **tbc** and **hts**, the sequence can be placed in **is2** or **if**.

Any margin can be cleared with **mgc**. (For instructions on how to specify commands to set and clear margins, see "Margins" below under "PRINTER CAPABILITIES".)

Section 1-10: Delays

Certain capabilities control padding in the **tty**(7) driver. These are primarily needed by hard-copy terminals, and are used by **tput init** to set tty modes appropriately. Delays embedded in the capabilities **cr**, **ind**, **cub1**, **ff**, and **tab** can be used to set the appropriate delay bits to be set in the tty driver. If **pb** (padding baud rate) is given, these values can be ignored at baud rates below the value of **pb**.

Section 1-11: Status lines

If the terminal has an extra "status line" that is not normally used by software, this fact can be indicated. If the status line is viewed as an extra line below the bottom line, into which one can cursor address normally (such as the Heathkit h19's 25th line, or the 24th line of a VT100 which is set to a 23-line scrolling region), the capability **hs** should be given. Special strings that go to a given column of the status line and return from the status line can be given as **tsl** and **fsl**. (**fsl** must leave the cursor position in the same place it was before **tsl**. If necessary, the **sc** and **rc** strings can be included in **tsl** and **fsl** to get this effect.) The capability **tsl** takes one parameter, which is the column number of the status line the cursor is to be moved to.

If escape sequences and other special commands, such as tab, work while in the status line, the flag **eslok** can be given. A string which turns off the status line (or otherwise erases its contents) should be given as **dsl**. If the terminal has commands to save and restore the position of the cursor, give them as **sc** and **rc**. The status line is normally assumed to be the same width as the rest of the screen, for example, **cols**. If the status line is a different width (possibly because the terminal does not allow an entire line to be loaded) the width, in columns, can be indicated with the numeric parameter **wsl**.

Section 1-12: Line graphics

If the terminal has a line drawing alternate character set, the mapping of glyph to character would be given in **acsc**. The definition of this string is based on the alternate character set used in the DEC VT100 terminal, extended slightly with some characters from the AT&T 4410v1 terminal.

glyph name	vt100+ character
arrow pointing right	+
arrow pointing left	,
arrow pointing down	.
solid square block	0
lantern symbol	I
arrow pointing up	-
diamond	`
checker board (stipple)	a
degree symbol	f
plus/minus	g
board of squares	h
lower right corner	j
upper right corner	k
upper left corner	l
lower left corner	m
plus	n
scan line 1	o
horizontal line	q
scan line 9	s
left tee (├)	t
right tee (┤)	u
bottom tee (┴)	v
top tee (┬)	w
vertical line	x
bullet	~

The best way to describe a new terminal's line graphics set is to add a third column to the above table with the characters for the new terminal that produce the appropriate glyph when the terminal is in the alternate character set mode. For example,

glyph name	vt100+ character	new tty character
upper left corner	l	R
lower left corner	m	F
upper right corner	k	T
lower right corner	j	G
horizontal line	q	,
vertical line	x	.

Now write down the characters left to right, as in "**acsc=**lRmFkTjGq\,x.".

In addition, *terminfo* allows you to define multiple character sets. See Section 2-5 for details.

Section 1-13: Color manipulation

There are two methods of color manipulation: the HP method and the Tektronix method. Most existing color terminals belong to one of these two classes.

The Tektronix method uses a set of *N* predefined colors (usually 8) from which a user can select "current" foreground and background colors. Thus the terminal can support up to *N* colors mixed into *N*N* color-pairs to be displayed on the screen at the same time.

The HP method restricts the user from defining the foreground independently of the background, or vice-versa. Instead, the user must define an entire color-pair at once. Up to *M* color-pairs, made from 2**M* different colors, can be defined this way.

The numeric variables **colors** and **pairs** define the number of colors and color-pairs that can be displayed on the screen at the same time. If a terminal can change the definition of a color (for example, the Tektronix 4100 and 4200 series terminals can do this), this should be specified with **ccc** (can change color). To change the definition of a color (Tektronix method), use **initc** (initialize color). It requires four arguments: color number (ranging from 0 to **colors**-1) and three RGB (red, green, and blue) values (ranging from 0 to 1,000).

Tektronix 4100 series terminals use a type of color notation called HLS (Hue Lightness Saturation) instead of RGB color notation. For such terminals one must define a boolean variable **hls**. The last three arguments to the **initc** string would then be HLS values: *H*, ranging from 0 to 360; and *L* and *S*, ranging from 0 to 100.

If a terminal can change the definitions of colors, but uses a color notation different from RGB and HLS, a mapping to either RGB or HLS must be developed.

To set current foreground or background to a given color, use **setf** (set foreground) and **setb** (set background). They require one parameter: the number of the color. To initialize a color-pair (HP method), use **initp** (initialize pair). It requires seven parameters: the number of a color-pair (range = 0 to **pairs**-1), and six RGB values: three for the foreground followed by three for the background. (Each of these groups of three should be in the order RGB.) When **initc** or **initp** are used, RGB or HLS arguments should be in the order "red, green, blue" or "hue, lightness, saturation"), respectively. To make a color-pair current, use **scp** (set color-pair). It takes one parameter, the number of a color-pair.

Some terminals (for example, most color terminal emulators for PCs) erase areas of the screen with current background color. In such cases, **bce** (background color erase) should be defined. The variable **op** (original pair) contains a sequence for setting the foreground and the background colors to what they were at the terminal start-up time. Similarly, **oc** (original colors) contains a control sequence for setting all colors (for the Tektronix method) or color-pairs (for the HP method) to the values they had at the terminal start-up time.

Some color terminals substitute color for video attributes. Such video attributes should not be combined with colors. Information about these video attributes should be packed into the **ncv** (no color video) variable. There is a one-to-one correspondence between the nine least significant bits of that variable and the video attributes. The following table depicts this correspondence.

Attribute	NCV Bit Number
A_STANDOUT	0
A_UNDERLINE	1
A_REVERSE	2
A_BLINK	3
A_DIM	4
A_BOLD	5
A_INVIS	6
A_PROTECT	7
A_ALTCHARSET	8

When a particular video attribute should not be used with colors, the corresponding **ncv** bit should be set to 1; otherwise it should be set to zero. For example, if the terminal uses colors to simulate reverse video and bold, bits 2 and 5 should be set to 1. The resulting values for **ncv** will be 22.

Section 1-14: Miscellaneous

If the terminal requires other than a null (zero) character as a pad, then this can be given as **pad**. Only the first character of the **pad** string is used. If the terminal does not have a pad character, specify **npc**.

If the terminal can move up or down half a line, this can be indicated with **hu** (half-line up) and **hd** (half-line down). This is primarily useful for superscripts and subscripts on hardcopy terminals. If a hardcopy terminal can eject to the next page (form feed), give this as **ff** (usually control L).

If there is a command to repeat a given character a given number of times (to save time transmitting a large number of identical characters) this can be indicated with the parameterized string **rep**. The first parameter is the character to be repeated and the second is the number of times to repeat it. Thus, **tparm(repeat_char, 'x', 10)** is the same as **xxxxxxxxxx**.

If the terminal has a settable command character, such as the Tektronix 4025, this can be indicated with **cmdch**. A prototype command character is chosen which is used in all capabilities. This character is given in the **cmdch** capability to identify it. The following convention is supported on some UNIX systems: If the environment variable **CC** exists, all occurrences of the prototype character are replaced with the character in **CC**.

Terminal descriptions that do not represent a specific kind of known terminal, such as **switch**, **dialup**, **patch**, and **network**, should include the **gn** (generic) capability so that programs can complain that they do not know how to talk

to the terminal. (This capability does not apply to **virtual** terminal descriptions for which the escape sequences are known.) If the terminal is one of those supported by the UNIX system virtual terminal protocol, the terminal number can be given as **vt**. A line-turn-around sequence to be transmitted before doing reads should be specified in **rfi**.

If the terminal uses xon/xoff handshaking for flow control, give **xon**. Padding information should still be included so that routines can make better decisions about costs, but actual pad characters will not be transmitted. Sequences to turn on and off xon/xoff handshaking may be given in **smxon** and **rmxon**. If the characters used for handshaking are not **^S** and **^Q**, they may be specified with **xonc** and **xoffc**.

If the terminal has a "meta key" which acts as a shift key, setting the 8th bit of any character transmitted, this fact can be indicated with **km**. Otherwise, software will assume that the 8th bit is parity and it will usually be cleared. If strings exist to turn this "meta mode" on and off, they can be given as **smm** and **rmm**.

If the terminal has more lines of memory than will fit on the screen at once, the number of lines of memory can be indicated with **lm**. A value of **lm#0** indicates that the number of lines is not fixed, but that there is still more memory than fits on the screen.

Media copy strings which control an auxiliary printer connected to the terminal can be given as **mc0**: print the contents of the screen, **mc4**: turn off the printer, and **mc5**: turn on the printer. When the printer is on, all text sent to the terminal will be sent to the printer. A variation, **mc5p**, takes one parameter, and leaves the printer on for as many characters as the value of the parameter, then turns the printer off. The parameter should not exceed 255. If the text is not displayed on the terminal screen when the printer is on, specify **mc5i** (silent printer). All text, including **mc4**, is transparently passed to the printer while an **mc5p** is in effect.

Section 1-15: Special cases

The working model used by *terminfo* fits most terminals reasonably well. However, some terminals do not completely match that model, requiring special support by *terminfo*. These are not to be construed as deficiencies in the terminals; they are just differences between the working model and the actual hardware. They may be unusual devices or, for some reason, do not have all the features of the *terminfo* model implemented.

Terminals which can not display tilde (~) characters, such as certain Hazeltine terminals, should indicate **hz**.

Terminals which ignore a linefeed immediately after an **am** wrap, such as the *Concept* 100, should indicate **xenl**. Those terminals whose cursor remains on the right-most column until another character has been received, rather than wrapping immediately upon receiving the right-most character, such as the VT100, should also indicate **xenl**.

If **el** is required to get rid of standout (instead of writing normal text on top of it), **xhp** should be given.

Those Teleray terminals whose tabs turn all characters moved over to blanks, should indicate **xt** (destructive tabs). This capability is also taken to mean that it is not possible to position the cursor on top of a "magic cookie" therefore, to erase standout mode, it is instead necessary to use delete and insert line.

Those Beehive Superbee terminals which do not transmit the escape or control-C characters, should specify **xsb**, indicating that the ⟨F1⟩ key is to be used for escape and the ⟨F2⟩ key for ⟨Ctrl⟩**c**.

Section 1-16: Similar terminals

If there are two very similar terminals, one can be defined as being just like the other with certain exceptions. The string capability **use** can be given with the name of the similar terminal. The capabilities given before **use** override those in the terminal type invoked by **use**. A capability can be canceled by placing *xx*@ to the left of the capability definition, where *xx* is the capability. For example, the entry

```
att4424-2|Teletype 4424 in display function group ii,
rev@, sgr@, smul@, use=att4424,
```

defines an AT&T 4424 terminal that does not have the **rev**, **sgr**, and **smul** capabilities, and hence cannot do highlighting. This is useful for different modes for a terminal, or for different user preferences. More than one **use** capability may be given.

PART 2: PRINTER CAPABILITIES

The *terminfo* database allows you to define capabilities of printers as well as terminals. To find out what capabilities are available for printers as well as for terminals, see the two lists under "TERMINAL CAPABILITIES" that list capabilities by variable and by capability name.

Section 2-1: Rounding values

Because parameterized string capabilities work only with integer values, we recommend that *terminfo* designers create strings that expect numeric values that have been rounded. Application designers should note this and should always round values to the nearest integer before using them with a parameterized string capability.

Section 2-2: Printer resolution

A printer's resolution is defined to be the smallest spacing of characters it can achieve. In general printers have independent resolution horizontally and vertically. Thus the vertical resolution of a printer can be determined by measuring the smallest achievable distance between consecutive printing baselines, while the horizontal resolution can be determined by measuring the smallest achievable distance between the left-most edges of consecutive printed, identical, characters.

All printers are assumed to be capable of printing with a uniform horizontal and vertical resolution. The view of printing that the *terminfo* currently presents is one of printing inside a uniform matrix: All characters are printed at fixed positions relative to each "cell" in the matrix; furthermore, each cell has the same size given by the smallest horizontal and vertical step sizes dictated by the resolution. (The cell size can be changed as will be seen later.)

Many printers are capable of "proportional printing", where the horizontal spacing depends on the size of the character last printed. The *terminfo* does not make use of this capability, although it does provide enough capability definitions to allow an application to simulate proportional printing.

A printer must not only be able to print characters as close together as the horizontal and vertical resolutions suggest, but also of "moving" to a position an integral multiple of the smallest distance away from a previous position. Thus printed characters can be spaced apart a distance that is an integral multiple of the smallest distance, up to the length or width of a single page.

Some printers can have different resolutions depending on different "modes". In "normal mode", the existing *terminfo* capabilities are assumed to work on columns and lines, just like a video terminal. Thus the old **lines** capability would give the length of a page in lines, and the **cols** capability would give the width of a page in columns. In "micro mode", many *terminfo* capabilities work on increments of lines and columns. With some printers the micro mode may be concomitant with normal mode, so that all the capabilities work at the same time.

Section 2-3: Specifying printer resolution

The printing resolution of a printer is given in several ways. Each specifies the resolution as the number of smallest steps per distance:

Specification of Printer Resolution

Characteristic	Number of smallest steps
orhi	Steps per inch horizontally
orvi	Steps per inch vertically
orc	Steps per column
orl	Steps per line

When printing in normal mode, each character printed causes movement to the next column, except in special cases described later; the distance moved is the same as the per-column resolution. Some printers cause an automatic movement to the next line when a character is printed in the rightmost position; the distance moved vertically is the same as the per-line resolution. When printing in micro mode, these distances can be different, and may be zero for some printers.

Specification of Printer Resolution

Automatic motion after printing	
Normal Mode:.	
orc	Steps moved horizontally
orl	Steps moved vertically
Micro Mode:	
mcs	Steps moved horizontally
mls	Steps moved vertically

Some printers are capable of printing wide characters. The distance moved when a wide character is printed in normal mode may be different from when a regular width character is printed. The distance moved when a wide character is printed in micro mode may also be different from when a regular character is printed in micro mode, but the differences are assumed to be related: If the distance moved for a regular character is the same whether in normal mode or micro mode (**mcs=orc**), then the distance moved for a wide character is also the same whether in normal mode or micro mode. This doesn't mean the normal character distance is necessarily the same as the wide character distance, just that the distances do not change with a change in normal to micro mode. However, if the distance moved for a regular character is different in micro mode from the distance moved in normal mode5 (**mcs<orc**), the micro mode distance is assumed to be the same for a wide character printed in micro mode, as the table below shows.

Specification of Printer Resolution

Automatic Motion after Printing Wide Character	
Normal Mode or Micro Mode (**mcs = orc**):	
widcs	Steps moved horizontally
Micro Mode (**mcs < orc**):	
mcs	Steps moved horizontally

There may be control sequences to change the number of columns per inch (the character pitch) and to change the number of lines per inch (the line pitch). If these are used, the resolution of the printer changes, but the type of change depends on the printer:

Specification of Printer Resolution

Changing the Character/Line Pitches	
cpi	Change character pitch
cpix	If set, **cpi** changes **orhi**, otherwise changes **orc**
lpi	Change line pitch
lpix	If set, **lpi** changes **orvi**, otherwise changes **orl**
chr	Change steps per column
cvr	Change steps per line

The **cpi** and **lpi** string capabilities are each used with a single argument, the pitch in columns (or characters) and lines per inch, respectively. The **chr** and **cvr** string capabilities are each used with a single argument, the number of steps per column and line, respectively.

Using any of the control sequences in these strings will imply a change in some of the values of **orc**, **orhi**, **orl**, and **orvi**. Also, the distance moved when a wide character is printed, **widcs**, changes in relation to **orc**. The distance moved when a character is printed in micro mode, **mcs**, changes similarly, with one exception: if the distance is 0 or 1, then no change is assumed (see item marked with ** in the following table).

Programs that use **cpi**, **lpi**, **chr**, or **cvr** should recalculate the printer resolution (and should recalculate other values — see "Section 2-7: Effect of changing printing resolution").

Specification of Printer Resolution

Effects of Changing the Character/Line Pitches	
Before	After
Using **cpi** *with* **cpix** *clear:*	
orhi ′	**orhi**
orc ′	**orc**=$\frac{\textbf{orhi}}{V_{cpi}}$
Using **cpi** *with* **cpix** *set:*	
orhi ′	**orhi**=**orc**·V_{cpi}
orc ′	**orc**
Using **lpi** *with* **lpix** *clear:*	
orvi ′	**orvi**
orl ′	**orl**=$\frac{\textbf{orvi}}{V_{lpi}}$
Using **lpi** *with* **lpix** *set:*	
orvi ′	**orvi**=**orl**·V_{lpi}
orl ′	**orl**
Using **chr:**	
orhi ′	**orhi**
orc ′	V_{chr}
Using **cvr:**	
orvi ′	**orvi**
orl ′	V_{cvr}
Using **cpi** *or* **chr:**	
widcs ′	**widcs**=**widcs**′$\frac{\textbf{orc}}{\textbf{orc}'}$
mcs ′**	**mcs**=**mcs**′$\frac{\textbf{orc}}{\textbf{orc}'}$

V_{cpi}, V_{lpi}, V_{chr}, and V_{cvr} are the arguments used with **cpi**, **lpi**, **chr**, and **cvr** respectively. The ** mark indicates the old value.

Section 2-4: Capabilities that cause movement

In the following descriptions, "movement" refers to the motion of the "current position". With video terminals this would be the cursor; with some printers this is the carriage position. Other printers have different equivalents. In general, the current position is where a character would be displayed if printed.

terminfo has string capabilities for control sequences that cause movement a number of full columns or lines. It also has equivalent string capabilities for control sequences that cause movement a number of smallest steps.

String Capabilities for Motion	
mcub1	Move 1 step left
mcuf1	Move 1 step right
mcuu1	Move 1 step up
mcud1	Move 1 step down
mcub	Move *N* steps left
mcuf	Move *N* steps right
mcuu	Move *N* steps up
mcud	Move *N* steps down
mhpa	Move *N* steps from the left
mvpa	Move *N* steps from the top

The latter six strings are each used with a single argument, ***N***.

Sometimes the motion is limited to less than the width or length of a page. Also, some printers do not accept absolute motion to the left of the current position. *terminfo* has capabilities for specifying these limits.

Limits to Motion	
mjump	Limit on use of **mcub1, mcuf1, mcuu1, mcud1**
maddr	Limit on use of **mhpa, mvpa**
xhpa	If set, **hpa** and **mhpa** can't move left
xvpa	If set, **vpa** and **mvpa** can't move up

If a printer needs to be in a "micro mode" for the motion capabilities described above to work, there are string capabilities defined to contain the control sequence to enter and exit this mode. A boolean is available for those printers where using a carriage return causes an automatic return to normal mode.

Entering/Exiting Micro Mode	
smicm	Enter micro mode
rmicm	Exit micro mode
crxm	Using **cr** exits micro mode

The movement made when a character is printed in the rightmost position varies among printers. Some make no movement, some move to the beginning of the next line, others move to the beginning of the same line. *terminfo* has boolean capabilities for describing all three cases.

What Happens After Character Printed in Rightmost Position	
sam	Automatic move to beginning of same line

Some printers can be put in a mode where the normal direction of motion is reversed. This mode can be especially useful when no capabilities exist for leftward or upward motion, because those capabilities can be built from the motion reversal capability and the rightward or downward motion capabilities. It is best to leave it up to an application to build the leftward or upward capabilities, though, and not enter them in the *terminfo* database. This allows several reverse motions to be strung together without intervening wasted steps that leave and reenter reverse mode.

Entering/Exiting Reverse Modes	
slm	Reverse sense of horizontal motions
rlm	Restore sense of horizontal motions
sum	Reverse sense of vertical motions
rum	Restore sense of vertical motions
While sense of horizontal motions reversed:	
mcub1	Move 1 step right
mcuf1	Move 1 step left
mcub	Move *N* steps right
mcuf	Move *N* steps left
cub1	Move 1 column right
cuf1	Move 1 column left
cub	Move *N* columns right
cuf	Move *N* columns left
While sense of vertical motions reversed:	
mcuu1	Move 1 step down
mcud1	Move 1 step up
mcuu	Move *N* steps down
mcud	Move *N* steps up
cuu1	Move 1 line down
cud1	Move 1 line up
cuu	Move *N* lines down
cud	Move *N* lines up

The reverse motion modes should not affect the **mvpa** and **mhpa** absolute motion capabilities. The reverse vertical motion mode should, however, also reverse the action of the line "wrapping" that occurs when a character is printed in the right most position. Thus printers that have the standard *terminfo* capability **am** defined should experience motion to the beginning of the previous line when a character is printed in the right-most position under reverse vertical motion mode.

The action when any other motion capabilities are used in reverse motion modes is not defined; thus, programs must exit reverse motion modes before using other motion capabilities.

Two miscellaneous capabilities complete the list of new motion capabilities. One of these is needed for printers that move the current position to the beginning of a line when certain control characters, like "line-feed" or "form-feed", are used. The other is used for the capability of suspending the motion that normally occurs after printing a character.

Miscellaneous Motion Strings	
docr	List of control characters causing **cr**
zerom	Prevent auto motion after printing next single character

Margins

terminfo provides two strings for setting margins on terminals: one for the left and one for the right margin. Printers, however, have two additional margins, for the top and bottom margins of each page. Furthermore, some printers do not require using motion strings to move the current position to a margin and fixing the margin there, as with the existing capabilities, but require the specification of where a margin should be regardless of the current position. Therefore *terminfo* offers six additional strings for defining margins with printers.

Setting	Margins
smgl	Set left margin at current column
smgr	Set right margin at current column
smgb	Set soft bottom margin at current line
smgt	Set soft top margin at current line
smgbp	Set soft bottom margin at line ***N***
smglp	Set soft left margin at column ***N***
smgrp	Set soft right margin at column ***N***
smgtp	Set soft top margin at line ***N***

The last four strings are used with a single argument, ***N***, that gives the line or column number, where line 0 is the top line and column 0 is the leftmost column.

Note: Not all printers use 0 for the top line or the leftmost column.

All margins can be cleared with **mgc**.

Shadows, italics, wide characters, superscripts, subscripts

Five new sets of strings are used to describe the capabilities printers have of enhancing printed text.

Enhanced Printing	
sshm	Enter shadow-printing mode
rshm	Exit shadow-printing mode
sitm	Enter italicizing mode
ritm	Exit italicizing mode
swidm	Enter wide character mode
rwidm	Exit wide character mode
ssupm	Enter superscript mode
rsupm	Exit superscript mode
supcs	List of characters available as superscripts
ssubm	Enter subscript mode
rsubm	Exit subscript mode
subcs	List of characters available as subscripts

If a printer requires the **sshm** control sequence before every character to be shadow-printed, the **rshm** string is left blank. Thus programs that find a control sequence in **sshm** but none in **rshm** should use the **sshm** control sequence before every character to be shadow-printed; otherwise, the **sshm** control sequence should be used once before the set of characters to be shadow-printed, followed by **rshm**. The same is also true of each of the **sitm/ritm**, **swidm/rwidm**, **ssupm/rsupm**, and **ssubm/rsubm** pairs.

Note that *terminfo* also has a capability for printing emboldened text (**bold**). While shadow printing and emboldened printing are similar in that they "darken" the text, many printers produce these two types of print in slightly different ways. Generally, emboldened printing is done by overstriking the same character one or more times. Shadow printing likewise usually involves overstriking, but with a slight movement up and/or to the side so that the character is "fatter".

It is assumed that enhanced printing modes are independent modes, so that it would be possible, for instance, to shadow print italicized subscripts.

As mentioned earlier, the amount of motion automatically made after printing a wide character should be given in **widcs**.

If only a subset of the printable ASCII characters can be printed as superscripts or subscripts, they should be listed in **supcs** or **subcs** strings, respectively. If the **ssupm** or **ssubm** strings contain control sequences, but the corresponding **supcs** or **subcs** strings are empty, it is assumed that all printable ASCII characters are available as superscripts or subscripts.

Automatic motion made after printing a superscript or subscript is assumed to be the same as for regular characters. Thus, for example, printing any of the following three examples will result in equivalent motion:

Bi B_i B^i

Note that the existing **msgr** boolean capability describes whether motion control sequences can be used while in "standout mode". This capability is extended to cover the enhanced printing modes added here. **msgr** should be set for those printers that accept any motion control sequences without affecting shadow, italicized, widened, superscript, or subscript printing. Conversely, if **msgr** is not set, a program should end these modes before attempting any motion.

Section 2-5: Alternate character sets

In addition to allowing you to define line graphics (described in Section 1-12), *terminfo* also lets you define alternate character sets. The following capabilities cover printers and terminals with multiple selectable or definable character sets.

Alternate Character Sets	
scs	Select character set ***N***
scsd	Start definition of character set ***N***, ***M*** characters
defc	Define character ***A***, ***B*** dots wide, descender ***D***
rcsd	End definition of character set ***N***
csnm	List of character set names
daisy	Printer has manually changed print-wheels

The **scs**, **rcsd**, and **csnm** strings are used with a single argument, ***N***, a number from 0 to 63 that identifies the character set. The **scsd** string is also used with the argument ***N*** and another, ***M***, that gives the number of characters in the set. The **defc** string is used with three arguments: ***A*** gives the ASCII code representation for the character, ***B*** gives the width of the character in dots, and ***D*** is zero or one depending on whether the character is a "descender" or not. The **defc** string is also followed by a string of "image-data" bytes that describe how the character looks (see below).

Character set 0 is the default character set present after the printer has been initialized. Not every printer has 64 character sets, of course; using **scs** with an argument that does not select an available character set should cause a null result from **tparm**( ).

If a character set has to be defined before it can be used, the **scsd** control sequence is to be used before defining the character set, and the **rcsd** is to be used after. They should also cause a null result from **tparm**( ) when used with an argument ***N*** that doesn't apply. If a character set still has to be selected after being defined, the **scs** control sequence should follow the **rcsd** control sequence. By examining the results of using each of the **scs**, **scsd**, and **rcsd** strings with a character set number in a call to **tparm**( ), a program can determine which of the three are needed.

Between use of the **scsd** and **rcsd** strings, the **defc** string should be used to define each character. To print any character on printers covered by *terminfo*, the ASCII code is sent to the printer. This is true for characters in an alternate set as well as "normal" characters. Thus the definition of a character includes the ASCII code that represents it. In addition, the width of the character in dots is given, along with an indication of whether the character should descend below the print line (like the lower case letter "g" in most character sets). The width of the character in dots also indicates the number of image-data bytes that will follow the **defc** string. These image-data bytes indicate where in a dot-matrix pattern ink should be applied to "draw" the character; the number of these bytes and their form are defined below under "Dot-mapped graphics".

It is easiest for the creator of *terminfo* entries to refer to each character set by number; however, these numbers will be meaningless to the application developer. The **csnm** string alleviates this problem by providing names for each number.

When used with a character set number in a call to **tparm**( ), the **csnm** string will produce the equivalent name. These names should be used as a reference only. No naming convention is implied, although anyone who creates a *terminfo* entry for a printer should use names consistent with the names found in user documents for the printer. Application developers should allow a user to specify a character set by number (leaving it up to the user to examine the **csnm** string to determine the correct number), or by name, where the application examines the **csnm** string to determine the corresponding character set number.

These capabilities are likely to be used only with dot-matrix printers. If they are not available, the strings should not be defined. For printers that have manually changed print-wheels or font cartridges, the boolean **daisy** is set.

Section 2-6: Dot-matrix graphics

Dot-matrix printers typically have the capability of reproducing "raster-graphics" images. Three new numeric capabilities and three new string capabilities can help a program draw raster-graphics images independent of the type of dot-matrix printer or the number of pins or dots the printer can handle at one time.

Dot-Matrix Graphics	
npins	Number of pins, ***N***, in print-head
spinv	Spacing of pins vertically in pins per inch
spinh	Spacing of dots horizontally in dots per inch
porder	Matches software bits to print-head pins
sbim	Start printing bit image graphics, ***B*** bits wide
rbim	End printing bit image graphics

The **sbim** string is used with a single argument, ***B***, the width of the image in dots.

The model of dot-matrix or raster-graphics that the *terminfo* presents is similar to the technique used for most dot-matrix printers: each pass of the printer's print-head is assumed to produce a dot-matrix that is ***N*** dots high and ***B*** dots wide. This is typically a wide, squat, rectangle of dots. The height of this rectangle in dots will vary from one printer to the next; this is given in the **npins** numeric capability. The size of the rectangle in fractions of an inch will also vary; it can be deduced from the **spinv** and **spinh** numeric capabilities. With these three values an application can divide a complete raster-graphics image into several horizontal strips, perhaps interpolating to account for different dot spacing vertically and horizontally.

The **sbim** and **rbim** strings are used to start and end a dot-matrix image, respectively. The **sbim** string is used with a single argument that gives the width of the dot-matrix in dots. A sequence of "image-data bytes" are sent to the printer after the **sbim** string and before the **rbim** string. The number of bytes is an integral multiple of the width of the dot-matrix; the multiple and the form of each byte is determined by the **porder** string as described below.

The **porder** string is a comma separated list of pin numbers; the position of each pin number in the list corresponds to a bit in a data byte. The pins are numbered consecutively from 1 to **npins**, with 1 being the top pin. Note that the term "pin" is used loosely here; "ink-jet" dot-matrix printers do not have pins, but can be considered to have an equivalent method of applying a single dot of ink to paper. The bit positions in **porder** are in groups of 8, with the first position in each group the most significant bit and the last position the least significant bit.

The "image-data bytes" are to be computed from the dot-matrix image, mapping vertical dot positions in each print-head pass into eight-bit bytes, using a 1 bit where ink should be applied and 0 where no ink should be applied. If a position is skipped in **porder**, a 0 bit is used. There must be a multiple of 8 bit positions used or skipped in **porder**; if not, 0 bits are used to fill the last byte in the least significant bits.

Section 2-7: Effect of changing printing resolution

If the control sequences to change the character pitch or the line pitch are used, the pin or dot spacing may change:

Dot-Matrix Graphics Changing the Character/Line Pitches	
cpi	Change character pitch
cpix	If set, **cpi** changes **spinh**
lpi	Change line pitch
lpix	If set, **lpi** changes **spinv**

Programs that use **cpi** or **lpi** should recalculate the dot spacing:

Dot-Matrix Graphics Effects of Changing the Character/Line Pitches	
Before	After
Using **cpi** *with* **cpix** *clear:* **spinh'**	**spinh**
Using **cpi** *with* **cpix** *set:* **spinh'**	**spinh=spinh'** $\cdot \frac{\textbf{orhi}}{\textbf{orhi'}}$
Using **lpi** *with* **lpix** *clear:* **spinv'**	**spinv**
Using **lpi** *with* **lpix** *set:* **spinv'**	**spinv=spinv'** $\cdot \frac{\textbf{orhi}}{\textbf{orhi'}}$
Using **chr:** **spinh'**	**spinh**
Using **cvr:** **spinv'**	**spinv**

orhi' and **orhi** are the values of the horizontal resolution in steps per inch, before using **cpi** and after using **cpi**, respectively. Likewise, **orvi'** and **orvi** are the values of the vertical resolution in steps per inch, before using **lpi** and after using **lpi**, respectively. Thus, the changes in the dots per inch for dot-matrix graphics follow the changes in steps per inch for printer resolution.

Section 2-8: Print quality

Many dot-matrix printers can alter the dot spacing of printed text to produce near "letter quality" printing or "draft quality" printing. Usually, it is important to be able to choose one or the other because the rate of printing generally falls off as the quality improves. There are three new strings used to describe these capabilities.

Print Quality	
snlq	Set near-letter quality print
snrmq	Set normal quality print
sdrfq	Set draft quality print

The capabilities are listed in decreasing levels of quality. If a printer does not have all three levels, one or two of the strings should be left blank as appropriate.

Section 2-9: Printing rate and buffer size

Because there is no standard protocol that can be used to keep a program synchronized with a printer, and because modern printers can buffer data before printing it, a program generally cannot determine at any time what has been printed. Two new numeric capabilities can help a program estimate what has been printed.

Print Rate/Buffer Size	
cps	Nominal print rate in characters per second
bufsz	Buffer capacity in characters

cps is the nominal or average rate at which the printer prints characters; if this value is not given, the rate should be estimated at one-tenth the prevailing baud rate. **bufsz** is the maximum number of subsequent characters buffered before the guaranteed printing of an earlier character, assuming proper flow control has been used. If this value is not given it is assumed that the printer does not buffer characters, but prints them as they are received.

As an example, if a printer has a 1000-character buffer, then sending the letter "a" followed by 1000 additional characters is guaranteed to cause the letter "a" to print. If the same printer prints at the rate of 100 characters per second, then it should take 10 seconds to print all the characters in the buffer, less if the buffer is not full. By keeping track of the characters sent to a printer, and knowing the print rate and buffer size, a program can synchronize itself with the printer.

Note that most printer manufacturers advertise the maximum print rate, not the nominal print rate. A good way to get a value to put in for **cps** is to generate a few pages of text, count the number of printable characters, then see how long it takes to print the text.

Applications that use these values should recognize the variability in the print rate. Straight text, in short lines, with no embedded control sequences will probably print at close to the advertised print rate and probably faster than the rate in **cps**. Graphics data with a lot of control sequences, or very long lines of text, will print at well below the advertised rate and below the rate in **cps**. If the application is using **cps** to decide how long it should take a printer to print a block of text, the application should pad the estimate. If the application is using **cps** to decide how much text has already been printed, it should shrink the estimate. The application will thus err in favor of the user, who wants, above all, to see all the output in its correct place.

Files

*/usr/lib/terminfo/?/**	compiled terminal description database
*/usr/lib/.COREterm/?/**	subset of compiled terminal description database
*/usr/lib/tabset/**	tab settings for some terminals, in a format appropriate to be output to the terminal (escape sequences that set margins and tabs)

See also

captoinfo(ADM), **curses**(S), **infocmp**(ADM), **printf**(S), **profile**(F), **term**(M), **terminfo**(F), **tic**(C), **tput**(C), **vi**(C)

Warning

As described in the "Tabs and initialization" section above, a terminal's initialization strings, **is1**, **is2**, and **is3**, if defined, must be output before a **curses**(S) program is run. An available mechanism for outputting such strings is **tput init** (see **tput**(C) and **profile**(F)).

If a null character (\0) is encountered in a string, the null and all characters after it are lost. Therefore it is not possible to code a null character (\0) and send it to a device (either terminal or printer). The suggestion of sending a \0200, where a \0 (null) is needed can succeed only if the device (terminal or printer) ignores the eighth bit. For example, because all eight bits are used in the standard international ASCII character set, devices that adhere to this standard will treat \0200 differently from \0.

Tampering with entries in */usr/lib/.COREterm/?/** or */usr/lib/terminfo/?/** (for example, changing or removing an entry) can affect programs such as **vi**(C) that expect the entry to be present and correct. In particular, removing the description for the "dumb" terminal will cause unexpected problems.

termio

general terminal interface

Description

All asynchronous communications ports use the same general interface, no matter what hardware is involved. The remainder of this section discusses the common features of this interface.

When a terminal file is opened, it normally causes the process to wait until a connection is established. In practice, users' programs seldom open these files; they are opened by **getty**(M) and become a user's standard input, output, and error files. (To do this, **getty**(M) opens the terminal for read/write access, then **FDUP**'s it twice.) The very first terminal file opened by the process group leader of a terminal file not already associated with a process group becomes the "control terminal" for that process group. The control terminal plays a special role in handling quit and interrupt signals, as discussed below. The control terminal is inherited by a child process during a **fork**(S). A process can break this association by changing its process group using **setpgrp**(S).

A terminal associated with one of these files ordinarily operates in full-duplex mode. Characters can be entered at any time, even while output is occurring, and are only lost when the system's character input buffers become completely full, which is rare, or when the user has accumulated the maximum allowed number of input characters that have not yet been read by some program. Currently, this limit is 256 characters. When the input limit is reached, all the saved characters are thrown away without notice.

Normally, terminal input is processed in units of lines. A line is delimited by a newline (ASCII LF) character, an end-of-file (ASCII EOT) character, or an end-of-line character. This means that a program attempting to read will be suspended until an entire line has been entered. Also, no matter how many characters are requested in the read call, one line will be returned at most. It is not, however, necessary to read a whole line at once; any number of characters, even one, may be requested in a read without losing information.

Erase and kill processing is normally performed during input. By default, a ⟨Ctrl⟩**h** or ⟨Bksp⟩ erases the last character typed, except that it will not erase beyond the beginning of the line. By default, a ⟨Ctrl⟩**u** kills (deletes) the entire input line, and optionally outputs a newline character. Both these characters operate on a keystroke basis, independent of any backspacing or tabbing that may have been done. Both the erase and kill characters may be entered literally by preceding them with the escape character (\). In this case, the escape character is not read. The erase and kill characters may be changed (see **stty**(C)).

Certain characters have special functions on input. These functions and their default character values are summarized as follows:

INTR (Rubout or ASCII DEL) Generates an interrupt signal which is sent to all processes with the associated control terminal. Normally, each such process is forced to terminate, but arrangements may be made either to ignore the signal or to receive a trap to an agreed-upon location; see **signal**(S).

QUIT (⟨Ctrl⟩\ or ASCII FS) Generates a **quit** signal. Its treatment is identical to the interrupt signal except that, unless a receiving process has made other arrangements, it will not only be terminated, but a core image file (called *core*) will be created in the current working directory.

SWTCH (ASCII NUL) Is used by the shell layers facility, **shl**(C), to change the current layer to the control layer.

ERASE (⟨Ctrl⟩**h**) Erases the preceding character. It will not erase beyond the start of a line, as delimited by an NL, EOF, or EOL character.

KILL (⟨Ctrl⟩**u**) Deletes the entire line, as delimited by a NL, EOF, or EOL character.

EOF (⟨Ctrl⟩**d** or ASCII EOT) May be used to generate an end-of-file from a terminal. When received, all the characters waiting to be read are immediately passed to the program, without waiting for a newline, and the EOF is discarded. Thus, if there are no characters waiting, which is to say the EOF occurred at the beginning of a line, zero characters will be passed back, which is the standard end-of-file indication.

NL (ASCII LF) Is the normal line delimiter. It cannot be changed or escaped.

EOL (ASCII NUL) Is an additional line delimiter, like NL. It is not normally used.

STOP (⟨Ctrl⟩**s** or ASCII DC3) Temporarily suspends output. It is useful with CRT terminals to prevent output from disappearing before it can be read. While output is suspended, STOP characters are ignored and not read.

START (⟨Ctrl⟩**q** or ASCII DC1) Resumes output which has been suspended by a STOP character. While output is not suspended, START characters are ignored and not read. The START/STOP characters cannot be changed or escaped within **termio** (but see **termios**(M) for further information).

The character values for INTR, QUIT, SWTCH, ERASE, KILL, EOF, and EOL may be changed to suit individual tastes. The ERASE, KILL, and EOF characters may be escaped by a preceding backslash (\) character, in which case no special function is carried out.

When the carrier signal from the dataset drops, a "hangup" signal is sent to all processes that have this terminal as the control terminal. Unless other arrangements have been made, this signal causes the processes to terminate. If the hangup signal is ignored, any subsequent read returns with an end-of-file indication. Thus, programs that read a terminal and test for an end-of-file can terminate appropriately when hung up on.

When one or more characters are written, they are transmitted to the terminal as soon as the previously typed characters have been entered. Input characters are echoed by putting them in the output queue as they arrive. If a process produces characters more rapidly than they can be typed, it will be suspended when its output queue exceeds a given limit. When the queue has drained down to the given threshold, the program is resumed.

Several **ioctl**(S) system calls apply to terminal files. The primary calls use the following structure, defined in the file *<termio.h>*:

```
#define NCC     8
struct  termio {
        unsigned short c_iflag;   /* input modes */
        unsigned short c_oflag;   /* output modes */
        unsigned short c_cflag;   /* control modes */
        unsigned short c_lflag;   /* local modes */
        char           c_line;    /* line discipline */
        unsigned char  c_cc[NCC]; /* control chars */
};
```

The special control characters are defined by the array **c_cc**. The relative positions and initial values for each function are as follows:

0	VINTR	DEL
1	VQUIT	FS
2	VERASE	Ctrl-H
3	VKILL	Ctrl-U
4	VEOF/VMIN	EOT
5	VEOL/VTIME	NUL
6	VEOL2	EOL
7	VSWTCH	NUL

The `c_iflag` field describes the basic terminal input control:

```
IGNBRK  0000001 Ignores break condition
BRKINT  0000002 Signals interrupt on break
IGNPAR  0000004 Ignores characters with parity errors
PARMRK  0000010 Marks parity errors
INPCK   0000020 Enables input parity check
ISTRIP  0000040 Strips high bit from character
INLCR   0000100 Maps NL to CR on input
IGNCR   0000200 Ignores CR
ICRNL   0000400 Maps CR to NL on input
IUCLC   0001000 Maps uppercase to lowercase on input
IXON    0002000 Enables start/stop output control
IXANY   0004000 Enables any character to restart output
IXOFF   0010000 Enables start/stop input control
```

If **IGNBRK** is set, the break condition (a character framing error with data all zeros) is ignored, that is, not put on the input queue and therefore not read by any process. Otherwise, if **BRKINT** is set, the break condition will generate an interrupt signal and flush both the input and output queues. If **IGNPAR** is set, characters with other framing and parity errors are ignored.

If **PARMRK** is set, a character with a framing or parity error which is not ignored is read as the 3-character sequence: 0377, 0,*X*, where *X* is the data of the character received in error. To avoid ambiguity in this case, if **ISTRIP** is not set, a valid character of 0377 is read as 0377, 0377. If **PARMRK** is not set, a framing or parity error which is not ignored is read as the character NUL (0).

If **INPCK** is set, input parity checking is enabled. If **INPCK** is not set, input parity checking is disabled. This allows output parity generation without input parity errors.

If **ISTRIP** is set, valid input characters are first stripped to 7 bits, otherwise all 8 bits are processed.

If **INLCR** is set, a received NL character is translated into a CR character. If **IGNCR** is set, a received CR character is ignored (not read). Otherwise, if **ICRNL** is set, a received CR character is translated into a NL character.

If **IUCLC** is set, a received uppercase alphabetic character is translated into the corresponding lowercase character.

If **IXON** is set, start/stop output control is enabled. A received STOP character will suspend output and a received START character will restart output. All start/stop characters are ignored and not read. If **IXANY** is set, any input character will restart output which has been suspended.

If **IXOFF** is set, the system will transmit START characters when the input queue is nearly empty and STOP characters when nearly full.

The initial input control value is all bits clear.

The `c_oflag` field specifies the system treatment of output:

```
OPOST   0000001 Postprocesses output
OLCUC   0000002 Maps lowercase to uppercase on output
ONLCR   0000004 Maps NL to CR-NL on output
OCRNL   0000010 Maps CR to NL on output
ONOCR   0000020 No CR output at column 0
ONLRET  0000040 NL performs CR function
OFILL   0000100 Uses fill characters for delay
OFDEL   0000200 Fills is DEL, else NUL
NLDLY   0000400 Selects newline delays:
NL0     0
NL1     0000400
CRDLY   0003000 Selects carriage return delays:
CR0     0
CR1     0001000
CR2     0002000
CR3     0003000
TABDLY  0014000 Selects horizontal tab delays:
TAB0    0
TAB1    0004000
TAB2    0010000
TAB3    0014000 Expands tabs to spaces
BSDLY   0020000 Selects backspace delays:
BS0     0
BS1     0020000
VTDLY   0040000 Selects vertical tab delays:
VT0     0
VT1     0040000
FFDLY   0100000 Selects form feed delays:
FF0     0
FF1     0100000
```

If **OPOST** is set, output characters are post-processed as indicated by the remaining flags, otherwise characters are transmitted without change.

If **OLCUC** is set, a lowercase alphabetic character is transmitted as the corresponding uppercase character. This function is often used in conjunction with **IUCLC**.

If **ONLCR** is set, the NL character is transmitted as the CR-NL character pair. If **OCRNL** is set, the CR character is transmitted as the NL character. If **ONOCR** is set, no CR character is transmitted when at column 0 (first position). If **ONLRET** is set, the NL character is assumed to perform the carriage return function and the column pointer is set to 0 and the delays specified for CR will be used. Otherwise, the NL character is assumed to perform the linefeed function; the column pointer will remain unchanged. The column pointer is also set to 0 if the CR character is actually transmitted.

The delay bits specify how long transmission stops to allow for mechanical or other movement when certain characters are sent to the terminal. In all cases, a value of 0 indicates no delay. If **OFILL** is set, fill characters will be transmitted for delay instead of a timed delay. This is useful for high baud rate terminals which need only a minimal delay. If **OFDEL** is set, the fill character is DEL, otherwise NUL.

If a form feed or vertical tab delay is specified, it lasts for about 2 seconds.

Newline delay lasts about 0.10 seconds. If **ONLRET** is set, the carriage return delays are used instead of the newline delays. If **OFILL** is set, 2 fill characters will be transmitted.

Carriage return delay type 1 is dependent on the current column position, type 2 is about 0.10 seconds, and type 3 is about 0.15 seconds. If **OFILL** is set, delay type 1 transmits 2 fill characters, and type 2 transmits 4 fill characters.

Horizontal tab delay type 1 is dependent on the current column position. Type 2 is about 0.10 seconds. Type 3 specifies that tabs are to be expanded into spaces. If **OFILL** is set, 2 fill characters will be transmitted for any delay.

Backspace delay lasts about 0.05 seconds. If **OFILL** is set, 1 fill character will be transmitted.

The actual delays depend on line speed and system load.

The initial output control value is all bits clear.

The `c_cflag` field describes the hardware control of the terminal:

```
CBAUD   0000017 Baud rate:
B0      0       Hang up
B50     0000001 50 baud
B75     0000002 75 baud
B110    0000003 110 baud
B134    0000004 134.5 baud
B150    0000005 150 baud
B200    0000006 200 baud
B300    0000007 300 baud
B600    0000010 600 baud
B1200   0000011 1200 baud
B1800   0000012 1800 baud
B2400   0000013 2400 baud
B4800   0000014 4800 baud
B9600   0000015 9600 baud
EXTA    0000016 External A
EXTB    0000017 External B
```

```
CSIZE   0000060 Character size:
CS5     0       5 bits
CS6     0000020 6 bits
CS7     0000040 7 bits
CS8     0000060 8 bits
CSTOPB  0000100 Sends two stop bits, else one
CREAD   0000200 Enables receiver
PARENB  0000400 Parity enable
PARODD  0001000 Odd parity, else even
HUPCL   0002000 Hangs up on last close
CLOCAL  0004000 Local line, else dial-up
LOBLK   0010000 Block layer output
CTSFLOW 0020000 Enables CTS protocol for a modem line
RTSFLOW 0040000 Enables RTS signaling for a modem line
CRTSFL  0100000 Enables bidirectional hardware flow control
```

If **CTSFLOW** and **RTSFLOW** are set, **IXON** and **IXANY** should not be set (or vice versa) so that these two types of flow control do not interfere with each other.

CTSFLOW and **RTSFLOW** are available for modem lines which support CTS/RTS signaling. **RTSFLOW, CTSFLOW** or **-RTSFLOW, -CTSFLOW** are the only permissable settings. (The RS-232 line must also be wired correctly for RTS/CTS handshaking.) The use of these settings is strictly hardware dependant and should only be used between devices capable of supporting CTS/RTS signalling.

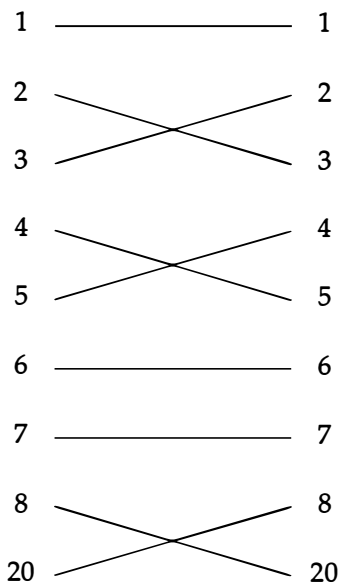
The RTS and CTS lines for the RS-232 (that is, serial) interface were originally intended as handshaking signals between a Data Terminal Equipment (DTE) device (computer, printer, etc,) and a Data Communications Equipment (DCE) device (almost always a modem). The RTS (Ready To Send) line is asserted by the DTE when it is ready to send data to the DCE. The DCE asserts the CTS (Clear To Send) line when it is ready to receive data. If the CTS line goes low, then the DTE should stop sending data until CTS goes high again.

CRTSFL is a new (in Release 3.2 v4) `c_cflag`. **CRTSFL** controls the flow of data along the modem line using hardware signals. The RTS and CTS lines can be used to transfer binary files in raw mode if required.

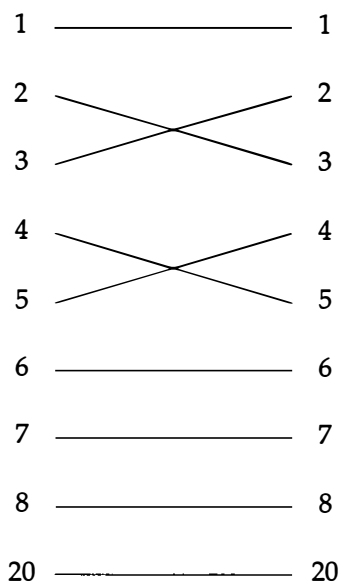
CRTSFL enables bidirectional hardware flow control between the computer and a modem-style device or another computer. Before setting **CRTSFL** check that:

- The RS-232C line has the following connections:

For direct lines:



For modem connections:



- **CTSFLOW** and **RTSFLOW** are not set. If either **CTSFLOW** or **RTSFLOW** are set, **CRTSFL** is disabled.

Back to back connection with a device supporting RTS/CTS flow control is possible as long as the device does not send data when its incoming CTS line is low, and asserts RTS while it has room in its buffer cache for more data.

The **CBAUD** bits specify the baud rate. The zero baud rate, B0, is used to hang up the connection. If B0 is specified, the data-terminal-ready signal will not be asserted. Without this signal, the line is disconnected if it is connected through a modem. For any particular hardware, impossible speed changes are ignored.

The **CSIZE** bits specify the character size in bits for both transmission and reception. This size does not include the parity bit, if any. If **CSTOPB** is set, 2 stop bits are used, otherwise 1 stop bit. For example, at 110 baud, 2 stops bits are required.

If **PARENB** is set, parity generation and detection is enabled and a parity bit is added to each character. If parity is enabled, the **PARODD** flag specifies odd parity if set, otherwise even parity is used.

If **CREAD** is set, the receiver is enabled. Otherwise no characters will be received.

If **HUPCL** is set, the line will be disconnected when the last process with the line open closes it or terminates: that is, the data-terminal-ready signal will not be asserted.

If **CLOCAL** is set, the line is assumed to be a local, direct connection with no modem control. The data-terminal-ready and request-to-send signals are asserted, but incoming modem signals are ignored. If **CLOCAL** is not set, modem control is assumed. This means the data-terminal-ready and request-to-send signals are asserted. Also, the carrier-detect signal must be returned before communications can proceed.

If **LOBLK** is set, the output of a shell layer will be blocked when it is not the current layer. Otherwise the output generated by that layer will be multiplexed onto the current layer.

The initial hardware control value after open is **B9600, CS8, CREAD, HUPCL.**

The `c_lflag` field of the argument structure is used by the line discipline to control terminal functions. The basic line discipline (0) provides the following:

```
ISIG    0000001 Enable signals
ICANON  0000002 Canonical input (erase and kill processing)
XCASE   0000004 Canonical upper/lower presentation
ECHO    0000010 Enables echo
ECHOE   0000020 Echoes erase character as BS-SP-BS
ECHOK   0000040 Echoes NL after kill character
ECHONL  0000100 Echoes NL
NOFLSH  0000200 Disables flush after interrupt or quit
XCLUDE  0100000 Exclusive use of the line
```

If **ISIG** is set, each input character is checked against the special control characters **INTR**, **SWTCH** and **QUIT**. If an input character matches one of these control characters, the function associated with that character is performed (that is, the signal associated with that character is generated)'. If **ISIG** is not set, no checking is done. Thus, these special input functions are possible only if **ISIG** is set. These functions may be disabled individually by changing the value of the control character to an unlikely or impossible value (for example, 0377).

If **ICANON** is set, canonical processing is enabled. This enables the erase and kill edit functions, and the assembly of input characters into lines delimited by NL, EOF and EOL. If **ICANON** is not set, read requests are satisfied directly from the input queue. A read will not be satisfied until at least **VMIN** characters have been received or the timeout value **VTIME** has expired and at least one character has been input. This allows fast bursts of input to be read efficiently while still allowing single character input. (See the discussion of **VMIN** and **VTIME** below.)

The **VMIN** and **VTIME** values are stored in the position for the EOF and EOL characters respectively. **VMIN** and **VTIME** are interpreted as EOF and EOL if **ICANON** is set. Default **VMIN** and **VTIME** values are stored in the */usr/include/sys/termio.h* file. To change these values, set **ICANON** to off and use **stty**(C) to change the **VMIN** and **VTIME** values as represented by EOF and EOL. The **VTIME** value represents tenths of seconds.

If **XCASE** and **ICANON** are set, an uppercase letter is accepted on input by preceding it with a " \ " character, and is output preceded by a " \ " character. In this mode, the following escape sequences are generated on output and accepted on input:

For:	Use:
"	\"
|	\!
~	\^
{	\(
}	\)
\	\\

For example, A is input as \a, \n as \\n, and \N as \\\n.

If **ECHO** is set, characters are echoed when they are received.

When **ICANON** is set, the following echo functions are possible. If **ECHO** and **ECHOE** are set, the erase character is echoed as ASCII BS SP BS, which will clear the last character from a CRT screen. If **ECHOE** is set and **ECHO** is not set, the erase character is echoed as ASCII SP BS. If **ECHOK** is set, the NL character will be echoed after the kill character to emphasize that the line will be deleted. Note that an escape character preceding the erase or kill character removes any special function. If **ECHONL** is set, the NL character will be echoed even if **ECHO** is not set. This is useful for terminals set to local echo (so-called half duplex). Unless escaped, the EOF character is not echoed. Because EOT is the default EOF character, this prevents terminals that respond to EOT from hanging up.

If **NOFLSH** is set, the normal flush of the input and output queues associated with the quit and interrupt characters will not be done.

If **XCLUDE** is set, any subsequent attempt to open the tty device using **open**(S) will fail for all users except the super-user. If the call fails, it returns **EBUSY** in **errno**. **XCLUDE** is useful for programs which must have exclusive use of a communications line. It is not intended for the line to the program's controlling terminal. **XCLUDE** must be cleared before the setting program terminates, otherwise subsequent attempts to open the device will fail.

VMIN represents the minimum number of characters that should be received when the read is satisfied (that is, the characters are returned to the user). **VTIME** is a timer of 0.10 second granularity used to time-out bursty and short-term data transmissions. The four possible values for **VMIN** and **VTIME** and their interactions are:

VMIN > 0, **VTIME** > 0

In this case, **VTIME** serves as an inter-character timer activated after the first character is received, and reset upon receipt of each character. **VMIN** and **VTIME** interact as follows:

As soon as one character is received the inter-character timer is started.

If **VMIN** characters are received before the inter-character timer expires the read is satisfied.

If the timer expires before **VMIN** characters are received the characters received to that point are returned to the user.

A **read**(S) operation will sleep until the **VMIN** and **VTIME** mechanisms are activated by the receipt of the first character; thus, at least one character must be returned.

VMIN > 0, **VTIME** = 0

In this case, because **VTIME** = 0, the timer plays no role and only **VMIN** is significant. A **read**(S) operation is not satisfied until **VMIN** characters are received.

VMIN = 0, **VTIME** > 0

In this case, because **VMIN** = 0, **VTIME** no longer serves as an inter-character timer, but now serves as a read timer that is activated as soon as the **read**(S) operation is processed. A **read**(S) operation is satisfied as soon as a single character is received *or the* timer expires, in which case, the **read**(S) operation will not return any characters.

VMIN = 0, **VTIME** = 0

In this case, return is immediate. If characters are present, they will be returned to the user.

The initial line-discipline control value is all bits clear.

The primary **ioctl**(S) system calls have the form:

ioctl (*fildes, command, arg*)
struct termio **arg;*

The commands using this form are:

TCGETA Gets the parameters associated with the terminal and stores them in the **termio** structure referenced by ***arg***.

TCSETA Sets the parameters associated with the terminal from the structure referenced by ***arg***. The change is immediate.

TCSETAW Waits for the output to drain before setting the new parameters. This form should be used when changing parameters that will affect output.

TCSETAF Waits for the output to drain, then flushes the input queue and sets the new parameters.

Additional **ioctl**(S) calls have the form:

ioctl (*fildes, command, arg*)
int ***arg***

The commands using this form are:

TCSBRK Waits for the output to drain. If ***arg*** is 0, then sends a break (zero bits for 0.25 seconds).

TCXONC Starts/stops control. If ***arg*** is 0, suspends output; if 1, restarts suspended output; if 2, block; if 3, unblock.

TCFLSH If ***arg*** is 0, flushes the input queue; if 1, flushes the output queue; if 2, flushes both the input and output queues.

Files

/dev/tty
*/dev/tty**
/dev/console

See also

fork(S), **getty**(M), **ioctl**(S), **mapchan**(F), **mapchan**(M), **read**(S), **setgprp**(S), **shl**(C), **signal**(S), **stty**(C), **termios**(M), **tty**(M)

Standards conformance

termio is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

termios

POSIX general terminal interface

Description

This entry discusses the POSIX **termios** extensions to the **termio**(M) interface. Only those functions not described in **termio**(M) are described here.

Certain characters have special functions on input. These functions and their default character values are summarized as follows:

SUSP (Unset by default) If the **ISIG** flag is enabled, receipt of the **SUSP** character causes a **SIGTSTP** signal to be sent to the current process group. The **SUSP** character is discarded when processed. It is often set to Ctrl-Z.

Several library functions apply to terminal files. The primary calls use the following structure, defined in the file *<termios.h>*:

```
#define NCCS    13
struct termios {
    tcflag_t      c_iflag;     /* input modes */
    tcflag_t      c_oflag;     /* output modes */
    tcflag_t      c_cflag;     /* control modes */
    tcflag_t      c_lflag;     /* local (line discipline) modes */
    char          c_line;      /* line discipline */
    cc_t          c_cc[NCCS];  /* control chars */
    char          c_ispeed;    /* input baud rate */
    char          c_ospeed;    /* output baud rate */
};
```

The additional special control characters defined by the array **c_cc.** are:

```
10      VSUSP   NUL
11      VSTART  DC1
12      VSTOP   DC3
```

The following additional line discipline (0) functions are available in the `c_lflag` field:

```
IEXTEN  0000400 enable extended functions
TOSTOP  0001000 SIGTTOU on background output
```

If **IEXTEN** is set, additional non-POSIX functions are recognized. This is the default. If **IEXTEN** is not set, the modes **ICANON, ISIG, IXON,** and **IXOFF** are assumed.

If **TOSTOP** is set, the signal **SIGTTOU** is sent to the process group of a process that tries to write to its controlling terminal if it is not the foreground process group. By default, this signal stops the members of the process group. If **TOSTOP** is not set, the output generated by the process is output to the current output stream.

The associated library functions are found in **tcattr**(S) and **tcflow**(S).

Files

/dev/tty
*/dev/tty**
/dev/console

See also

ioctl(S), **signal**(S), **stty**(C), **tcattr**(S), **tcflow**(S), **termio**(M), **tty**(M)

Standards conformance

termios is conformant with:

IEEE POSIX Std 1003.1-1990 System Application Program Interface (API) [C Language] (ISO/IEC 9945-1);
and X/Open Portability Guide, Issue 3, 1989.

Value added

termios is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

timod

Transport Interface cooperating STREAMS module

Description

timod is a STREAMS module for use with the Transport Interface (TI) functions of the Network Services library. The **timod** module converts a set of **ioctl**(S) calls into STREAMS messages that may be consumed by a transport protocol provider which supports the Transport Interface. This allows a user to initiate certain TI functions as atomic operations.

The **timod** module must only be pushed (see "Streams primer") onto a *stream* terminated by a transport protocol provider which supports the TI.

All STREAMS messages, with the exception of the message types generated from the **ioctl** commands described below, will be transparently passed to the neighboring STREAMS module or driver. The messages generated from the following **ioctl** commands are recognized and processed by the **timod** module. The format of the **ioctl** call is:

```
<#include <sys/stropts.h>
                -
                -
struct strioctl strioctl;
                -
                -
strioctl.ic_cmd = cmd;
strioctl.ic_timeout = INFTIM;
strioctl.ic_len = size;
strioctl.ic_dp = (char *)buf
ioctl(fildes, I_STR, &strioctl);
```

where, on issuance, ***size*** is the size of the appropriate TI message to be sent to the transport provider and on return, ***size*** is the size of the appropriate TI message from the transport provider in response to the issued TI message. ***buf*** is a pointer to a buffer large enough to hold the contents of the appropriate TI messages. The TI message types are defined in *<sys/tihdr.h>*. The possible values for the ***cmd*** field are:

TI_BIND Bind an address to the underlying transport protocol provider. The message issued to the **TI_BIND ioctl** is equivalent to the TI message type **T_BIND_REQ** and the message returned by the successful completion of the **ioctl** is equivalent to the TI message type **T_BIND_ACK**.

TI_UNBIND Unbind an address from the underlying transport protocol provider. The message issued to the **TI_UNBIND ioctl** is equivalent to the TI message type **T_UNBIND_REQ** and the message returned by the successful completion of the **ioctl** is equivalent to the TI message type **T_OK_ACK**.

TI_GETINFO Get the TI protocol specific information from the transport protocol provider. The message issued to the **TI_GETINFO** **ioctl** is equivalent to the TI message type **T_INFO_REQ** and the message returned by the successful completion of the **ioctl** is equivalent to the TI message type **T_INFO_ACK**.

TI_OPTMGMT Get, set, or negotiate protocol specific options with the transport protocol provider. The message issued to the **TI_OPTMGMT** **ioctl** is equivalent to the TI message type **T_OPTMGMT_REQ**, and the message returned by the successful completion of the **ioctl** is equivalent to the TI message type **T_OPTMGMT_ACK**.

Files

<sys/timod.h>
<sys/tiuser.h>
<sys/tihdr.h>
<sys/errno.h>

See also

tirdwr(M)

STREAMS Primer
STREAMS Programmer's Guide
Network Programmer's Guide

Diagnostics

If the **ioctl** system call returns with a value greater than 0, the lower 8 bits of the return value will be one of the TI error codes as defined in *<sys/tiuser.h>*. If the TI error is of type **TSYSERR**, then the next 8 bits of the return value will contain an error as defined in *<sys/errno.h>* (see **Intro**(S)).

timtbl

create a time locale table

Syntax

timtbl [*specfile*]

Description

The utility **timtbl** is provided to allow new **LC_TIME** locales to be defined. It reads a specification file, which contains definitions of the way in which time and date information is presented for a particular locale, and produces a binary table file, to be read by **setlocale**(S), which determines the behavior of the **strftime**(S) routine.

The information supplied in the specification file consists of lines in the following format:

item = string

The "=" can be separated from the item and string fields by zero or more space or tab characters. The following values are meaningful for *item*:

DATE_FMT specification of the format string for representing the date. It will contain "%" directives representing variable items such as the month number, as used in the format string for **strftime**(S).

TIME_FMT specification of the format string for representing the time of day.

F_NOON string indicating 12-hour clock times before midday, for example "AM".

A_NOON string indicating 12-hour clock times after midday, for example "PM".

D_T_FMT string for formatting combined date and time.

DAY_1 full name of the first day of the week (Sunday).

.
.
.

DAY_7 full name of the seventh day of the week.

ABDAY_1 abbreviated name of the first day of the week, for example "Sun".

.
.
.

ABDAY_7 abbreviated name of the seventh day of the week.

MON_1 full name of the first month in the Gregorian calendar.

.
.
.

MON_12 full name of the twelfth month.

ABMON_1 abbreviated name of the first month.

.
.
.

ABMON_12 full name of the twelfth month.

The ***string*** is a sequence of characters surrounded by quotes ("). Characters within the string can be specified both literally and using "\" escapes; the following three strings are equivalent:

"Tuesday"	- literal
"\x54ue\x73da\x79"	- hexadecimal escapes
"\124ue\163da\171"	- octal escapes

The ***string***s for the ***item***s **DATE_FMT, TIME_FMT** and **D_T_FMT** will also include "**%**" directives as detailed in the **strftime**(S) manual page, to specify variable portions of the string.

All characters following a hash (#) are treated as a comment and ignored up to the end of the line, unless the hash is within a quoted string.

The various ***item***s may be specified in any order. If any items are not specified, a warning message will be produced, and the null string ("") substituted.

The binary table output is placed in a file named "time", within the current directory. This file should be copied or linked to the correct place in the **setlocale** file tree (see **locale**(M)). To prevent accidental corruption of the output data, the file is created with no write permission; if the **timtbl** utility is run in a directory containing a write-protected "ctype" file, the utility will ask if the existing file should be replaced: any response other than "yes" or "y" will cause **timtbl** to terminate without overwriting the existing file.

If the ***specfile*** argument is missing, the specification information is read from the standard input.

See also

chrtbl(M), **locale**(M), **numtbl**(M), **setlocale**(S), **strftime**(S)

Diagnostics

If the input table file cannot be opened for reading, processing will terminate with the error message, "Cannot open specification file".

Any lines in the specification file which are syntactically incorrect, or contain an unrecognized value for the *item*, will cause an error message to be issued to the standard error output, specifying the line number on which the error was detected. The line will be ignored, and processing will continue.

If a particular *item* is specified more than once, a warning message will be produced, and processing will continue.

If the specification file does not contain specifications for all possible *items*, a warning message will be produced.

If the output file, *time*, cannot be opened for writing, processing will terminate with the error message, "Cannot create table file".

Any error conditions encountered will cause the program to exit with a non-zero return code; successful completion is indicated with a zero return code.

Notes

The strings **D_FMT**, **T_FMT**, **AM_STR** and **PM_STR** may be used as alternatives to **DATE_FMT**, **TIME_FMT**, **F_NOON** and **A_NOON** respectively, if required. These alternatives are provided for consistency with the identifiers used by **nl_langinfo**(S).

Value added

timtbl is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

tirdwr

Transport Interface read/write interface STREAMS module

Description

tirdwr is a STREAMS module that provides an alternate interface to a transport provider which supports the Transport Interface (TI) functions of the Network Services library (see Section 3N). This alternate interface allows a user to communicate with the transport protocol provider using the **read**(S) and **write**(S) system calls. The **putmsg**(S) and **getmsg**(S) system calls may also be used. However, **putmsg** and **getmsg** can only transfer data messages between user and *stream*.

The **tirdwr** module must only be pushed (see **I_PUSH** in **streamio**(M)) onto a *stream* terminated by a transport protocol provider which supports the TI. After the **tirdwr** module has been pushed onto a *stream*, none of the Transport Interface functions can be used. Subsequent calls to TI functions will cause an error on the *stream*. Once the error is detected, subsequent system calls on the *stream* will return an error with **errno** set to **EPROTO**.

The following are the actions taken by the **tirdwr** module when pushed on the *stream*, popped (see **I_POP** in **streamio**(M)) off the *stream*, or when data passes through it.

push When the module is pushed onto a *stream*, it will check any existing data destined for the user to ensure that only regular data messages are present. It will ignore any messages on the *stream* that relate to process management, such as messages that generate signals to the user processes associated with the *stream*. If any other messages are present, the **I_PUSH** will return an error with **errno** set to **EPROTO**.

write The module will take the following actions on data that originated from a **write** system call:

- All messages with the exception of messages that contain control portions (see the **putmsg** and **getmsg** system calls) will be transparently passed onto the module's downstream neighbor.
- Any zero length data messages will be freed by the module and they will not be passed onto the module's downstream neighbor.
- Any messages with control portions will generate an error, and any further system calls associated with the *stream* will fail with **errno** set to **EPROTO**.

read The module will take the following actions on data that originated from the transport protocol provider:

- All messages with the exception of those that contain control portions (see the **putmsg** and **getmsg** system calls) will be transparently passed onto the module's upstream neighbor.
- The action taken on messages with control portions will be as follows:
  - Messages that represent expedited data will generate an error. All further system calls associated with the *stream* will fail with **errno** set to **EPROTO**.
  - Any data messages with control portions will have the control portions removed from the message prior to passing the message to the upstream neighbor.
  - Messages that represent an orderly release indication from the transport provider will generate a zero length data message, indicating the end-of-file, which will be sent to the reader of the *stream*. The orderly release message itself will be freed by the module.
  - Messages that represent an abortive disconnect indication from the transport provider will cause all further **write** and **putmsg** system calls to fail with **errno** set to **ENXIO**. All further **read** and **getmsg** system calls will return zero length data (indicating end of file) once all previous data has been read.
  - With the exception of the above rules, all other messages with control portions will generate an error and all further system calls associated with the *stream* will fail with **errno** set to **EPROTO**.
- Any zero length data messages will be freed by the module and they will not be passed onto the module's upstream neighbor.

pop When the module is popped off the *stream* or the *stream* is closed, the module will take the following action:

- If an orderly release indication has been previously received, then an orderly release request will be sent to the remote side of the transport connection.

See also

streamio(M), **timod**(M), **intro**(S), **getmsg**(S), **putmsg**(S), **read**(S), **write**(S), **intro**(S)

STREAMS Primer
STREAMS Programmer's Guide
Network Programmer's Guide

trchan

translate character sets

Syntax

trchan [**-ciko**] *mapfile*

Description

trchan performs mapping as a filter, using the same format of **mapfile** as **mapchan**(M) (described in **mapchan**(F)). This allows a file consisting of one internal character set to be "translated" to another internal character set.

trchan reads standard input, maps it, and writes to standard output. A **mapfile** must be given on the command line. Errors cause **trchan** to stop processing unless **-c** is specified.

The following options can be used with **trchan**:

-c causes errors to be echoed on *stderr*, and processing is continued.

-i specifies that the "input" section of the **mapfile** is used when translating data.

-k specifies that the "dead" and "compose" sections of the **mapfile** are used when translating data.

-o specifies that the "output" section of the **mapfile** is used when translating data.

The **-i**, **-k** and **-o** options can be specified in any combination; if none are specified, **trchan** uses the entire **mapfile**, as if all three were specified together.

File

*/usr/lib/mapchan/**

See also

ascii(M), **mapchan**(F), **mapchan**(M)

Note

trchan currently ignores the **control** sections of the **mapfile**.

Value added

trchan is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

tty

special terminal interface

Description

The file */dev/tty* is, in each process, a synonym for the control terminal associated with the process group of that process, if any. It is useful for programs or shell sequences that wish to be sure of writing messages on the terminal no matter how output has been redirected. It can also be used for programs that demand the name of a file for output, when typed output is desired, and when it is tiresome to find out what terminal is currently in use.

The general terminal interface is described in **termio**(M).

Files

/dev/tty
*/dev/tty**

See also

termio(M)

Standards conformance

tty is conformant with:

AT&T SVID Issue 2;
and X/Open Portability Guide, Issue 3, 1989.

tz

time zone environment variable

Syntax

/etc/tz

Description

TZ is the shell environment variable for the time zone of the system and is set in the file */etc/TIMEZONE* (see **timezone**(F) for a complete description of the syntax for defining **TZ**).

The shell script **/etc/tz**, generally run during installation, prompts for the correct time zone, prompts for the dates when time is shifted from standard to daylight time and back, and for the number of hours to shift (partial hours in the form of hh:mm:ss are acceptable). and sets **TZ** correctly in the appropriate files. The following files are examined to see if they read from */etc/TIMEZONE* to set **TZ** for their environment:

/etc/cshrc
/etc/profile
/etc/rc2
/.profile

If these files do not read from */etc/TIMEZONE*, a warning is issued.

Users living in a time zone different than that of the host machine may change **TZ** in their **$HOME**/*.profile* or **$HOME**/*.login* files.

To change the time zone for the entire system, run the shell script **/etc/tz** (as *root*) or use an editor to change the variable **TZ** in the file */etc/TIMEZONE*.

Files

/etc/rc2
/etc/default/login
/etc/tz
$HOME/*.profile*
$HOME/*.login*

See also

ctime(S), **date**(C), **environ**(M), **timezone**(F)

Notes

The **date**(C) automatically switches from Standard Time to Summer Time (Daylight Saving Time). Leap days are properly accounted for.

Changes to **TZ** are immediately effective, (that is, if a process changes the **TZ** variable, the next call to a **ctime**(S) routine returns a value based on the new value of the variable).

Value added

tz is an extension of AT&T System V provided by The Santa Cruz Operation, Inc.

undocumented

programs not documented elsewhere in these manuals

Description

Several programs distributed with SCO UNIX System V/386 are not fully documented. In general, these programs fall into two categories: programs retained to provide compatability with earlier versions of SCO UNIX System V/386, and programs intended for execution by other programs, which are rarely of interest to the end user.

This page lists undocumented programs, together with brief notes on their functionality and relevance. Note that this list is likely to change with future releases of SCO UNIX System V/386. We strongly recommend that you make no attempt to use or remove programs on this list; doing so may interfere with the functionality of other programs.

Undocumented but useful programs are as follows:

/etc/cleanup	Shell script occasionally run by the root *crontab* file to clean up log files.
/etc/memsize	Called directly by **crash**(ADM).
/etc/utmp_getty	Provided for **mscreen**(M) support.
/usr/bin/menu_add	Link to **/bin/true**.
/usr/bin/menu_del	Link to **/bin/true**.
/usr/bin/message	Used by **installpkg**(ADM), **displaypkg**(ADM), and **removepkg**(ADM).
/usr/bin/pwdmenu	Used by **backup**(ADM).
/bin/idas	Program used by Link Kit during Kernel builds.
/bin/mt	Lists the drive model number. Specific to (obsolete) Intel tape drive.
/etc/brand	Used by installation scripts; documented in Product Engineering Toolkit.
/etc/debrand	Used by installation scripts; documented in Product Engineering Toolkit.
/usr/bin/checkeq	**eqn**(CT) macro checker.
/usr/bin/ibmlpopt	Used by the print service; displays **lp** options specific to the IBM ProPrinter.

The following unsupported binaries are included in the operating system because they are part of the base distribution.

/usr/bin/asa

/usr/bin/cpset

/usr/bin/dsconfig

/usr/bin/update

/usr/bin/mlist

/usr/bin/newmail

/usr/bin/fixshlib

/usr/bin/inipcrm

/etc/ckbupscd

/etc/_fst

/usr/lib/emactovi

/etc/frec

/etc/fsba

/etc/rstab

/etc/setclk

/etc/fsanck

See also

Intro(ADM), **Intro**(C), **Intro**(F), **Intro**(HW), **Intro**(M)

values

machine-dependent values

Syntax

#include <*values.h*>

Description

This file contains a set of manifest constants, conditionally defined for particular processor architectures.

The model assumed for integers is binary representation (ones or twos complement), where the sign is represented by the value of the high-order bit.

BITS(***type***) — The number of bits in a specified ***type*** (for example, **int**).

HIBITS — The value of a short integer with only the high-order bit set (in most implementations, 0x8000).

HIBITL — The value of a long integer with only the high-order bit set (in most implementations, 0x80000000).

HIBITI — The value of a regular integer with only the high-order bit set (usually the same as **HIBITS** or **HIBITL**).

MAXSHORT — The maximum value of a signed short integer (in most implementations, 0x7FFF ≡ 32767).

MAXLONG — The maximum value of a signed long integer (in most implementations, 0x7FFFFFFF ≡ 2147483647).

MAXINT — The maximum value of a signed regular integer (usually the same as **MAXSHORT** or **MAXLONG**).

MAXFLOAT
LN_MAXFLOAT — The maximum value of a single-precision floating-point number, and its natural logarithm.

MAXDOUBLE
LN_MAXDOUBLE — The maximum value of a double-precision floating-point number, and its natural logarithm.

MINFLOAT
LN_MINFLOAT — The minimum positive value of a single-precision floating-point number, and its natural logarithm.

MINDOUBLE
LN_MINDOUBLE The minimum positive value of a double-precision floating-point number, and its natural logarithm.

FSIGNIF The number of significant bits in the mantissa of a single-precision floating-point number.

DSIGNIF The number of significant bits in the mantissa of a double-precision floating-point number.

See also

Intro(S), **limits**(F), **math**(M)

Standards conformance

values is conformant with:

X/Open Portability Guide, Issue 3, 1989.

xtproto

multiplexed channels protocol used by xt(HW) driver

Description

The **xt**(HW) driver contains routines which implement a multiplexed, multi-buffered, full-duplex protocol with guaranteed delivery of ordered data via an 8-bit byte data stream. This protocol is used for communication between multiple UNIX system host processes and an AT&T windowing terminal operating under **layers**(C).

The protocol uses packets with a 2-byte header containing a 3-bit sequence number, 3-bit channel number, control flag, and data size. The data part of a packet may not be larger than 32 bytes. The trailer contains a CRC-16 code in 2 bytes. Each channel is double-buffered.

Correctly received packets in sequence are acknowledged with a control packet containing an **ACK**; however, out of sequence packets generate a control packet containing a **NAK**, which will cause the retransmission in sequence of all unacknowledged packets.

Unacknowledged packets are retransmitted after a timeout interval which is dependent on baud rate. Another timeout parameter specifies the interval after which incomplete receive packets are discarded.

File

/usr/include/sys/xtproto.h channel multiplexing protocol definitions

See also

layers(M), **layers**(C), **xt**(HW)

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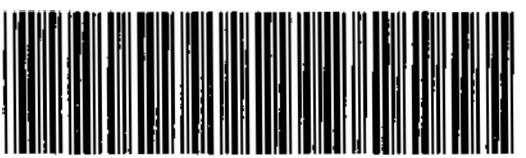

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