

LINUX 作業系統實務

06. Command Basics

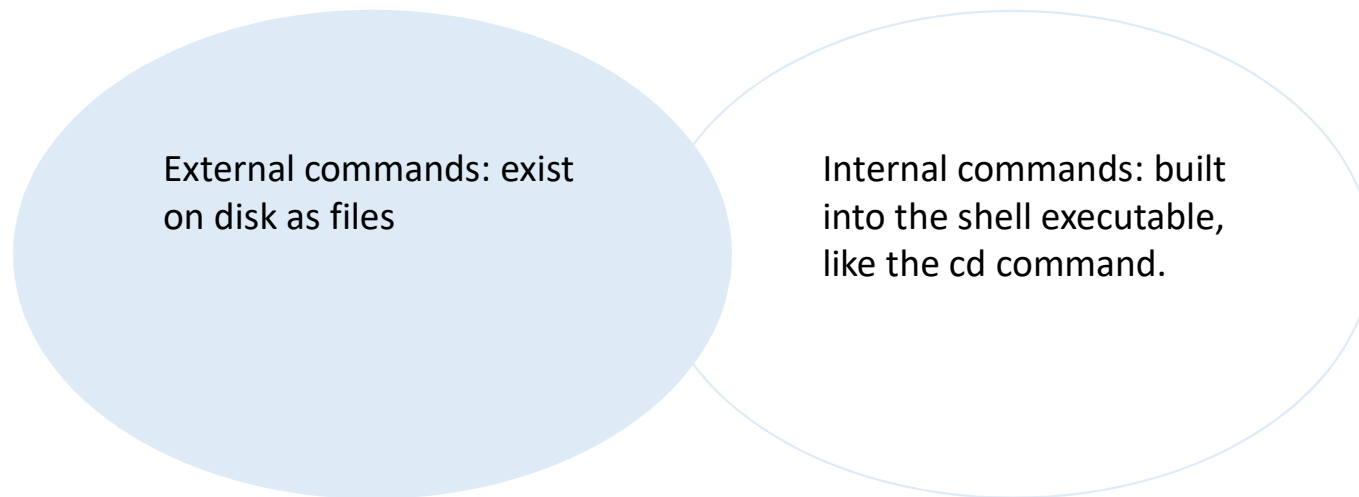
2020 TKU

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All are files!

- UNIX commands are disk files: lowercase, < 4 letters (copy can be short-formed to cp, but grep can't)
- No extensions (like .exe, .com, etc.)
- Java and C programs need to have .c and .java extensions but shell and Perl scripts don't need.
- The shell command is invoked all the way since you log in.

External and internal commands



PATH – an environment variable

```
$ echo $PATH  
/bin:/usr/bin:/usr/ucb:usr/xpg4/bin:.
```

- A list of colon-delimited directories.
- Notice the red dot above, it represents the current directory.
- When a command is entered, the shell looks in each of these directories to locate the file with that name.

```
$ netscape  
bash: netscape: not found
```

(The Bash shell prints this error message, after failing to locate the file.)

How to fix the command file not found error

- Fix the PATH value to include that directory.
- Use a pathname when call that command (e.g. /usr/local/bin/netscape).
- Switch to that directory and call the command.

Note:

- Windows use ; as delimiter for the PATH variable.
- Why shall we put the . (current directory) at the end of PATH?
 - Execute system command first if you have named duplicate command.
 - You can use ./cat if you want to run your own cat.

Where are the system commands?

- General UNIX commands: /bin and /usr/bin
- Graphical output commands: usr/X11R6/bin or /usr/dt/bin
- System administration commands: /sbin and usr/sbin

Note:

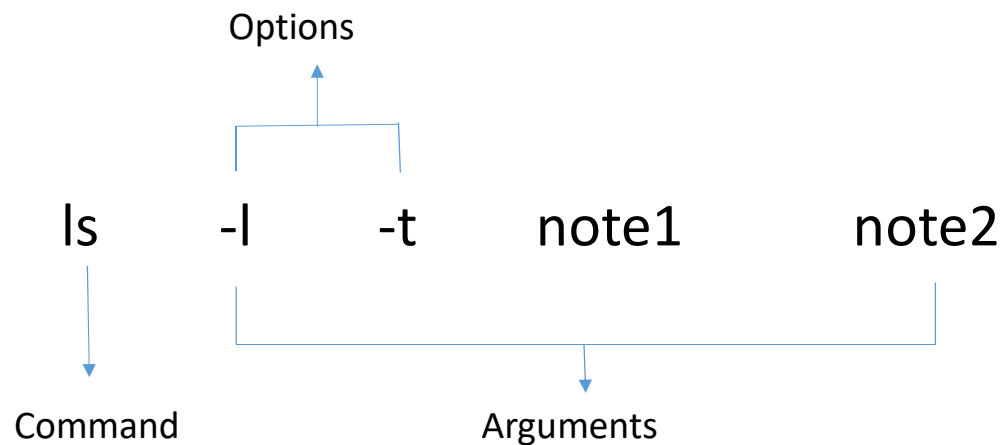
- How to find the location of commands: **which**, **whereis** and **type**.

```
$ which grep  
/usr/bin/grep
```

```
$ whereis ls  
ls: /usr/bin/ls /usr/ucb/ls
```

```
For shell command:  
$ which echo  
/usr/bin/echo (not very true since there is no echo file)  
$ type echo  
Echo is a shell builtin
```

Structure of UNIX command



- Separated by space(s)
- Never create a filename that begins with a hyphen (-)
- Expanded options in Linux: double hyphen (--classify)

Some hints

- “ls -l -a -t” can be written as: “ls -lat” or “ls -tal”
- Can enter multiple commands on the same line:
 - who ; ls note
 - Later commands no need to wait for the earlier commands to finish
- Can separate a long command into several lines (if there is unmatched quote or parenthesis:

Shell: \$ echo “This is [Enter]

➤ a three-line[Enter]

➤ Text message” [Enter]

C shell: % echo “This is\ [Enter]

? a three-line\[Enter]

?Text message” [Enter]

- Can interrupt this process with [Ctrl-c] or [Ctrl-u]

man: On-Line Help

- To view the manual page of the wc command, use **man** with wc as argument:
 - `man wc`
- This command sends the manual as output to a pager program.
- 'f' or spacebar to advance by one screen.
- 'b' moves back one screen.
- `/searchword[Enter]` to search, repeat the search by pressing 'n'.
- Press 'q' to quit this pager.

More options for the command *man*

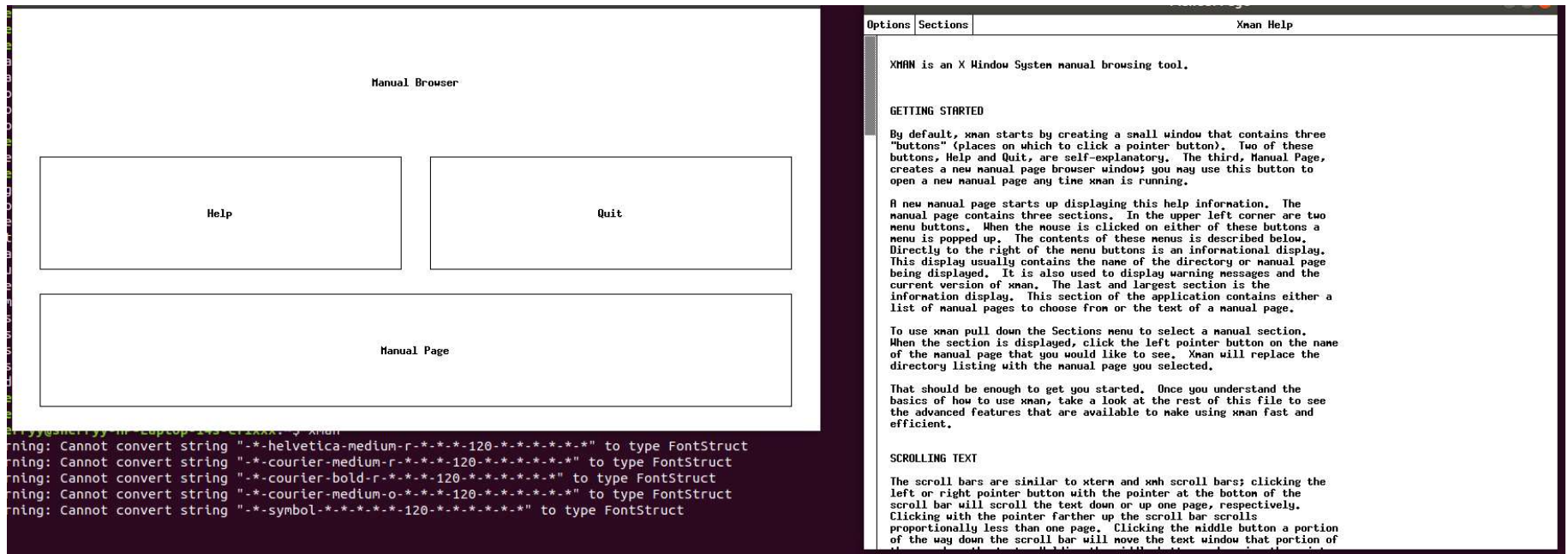
- `man -k`
Searches the NAME section of all man pages that containing this keyword
E.g. `$ man -k cron`
`cron` `-cron (1m)` `-clock daemon`
`crontab` `crontab(1)` `-user crontab file`
`queuedefs` `queuedefs (4)` `-queue description file for at, batch, and cron`
- `man -f grep`
Displays a one-line header from the NAME section.
`grep` `grep(1)` `-search a file for a pattern`
- `man 4 passwd`
Display the command manual in section 4

Organization of the man documentation

Section	Subject (Solaris)	Subject (Linux)
1	User programs	User programs
2	Kernel's system calls	Kernel's system calls
3	Library functions	Library functions
4	Administrative file formats	Special files (in /dev)
5	Miscellaneous	Administrative file formats
6	Games	Games
7	Special files (in /dev)	Macro packages and conventions
8	Administration commands	Administration commands

xman in X Window system

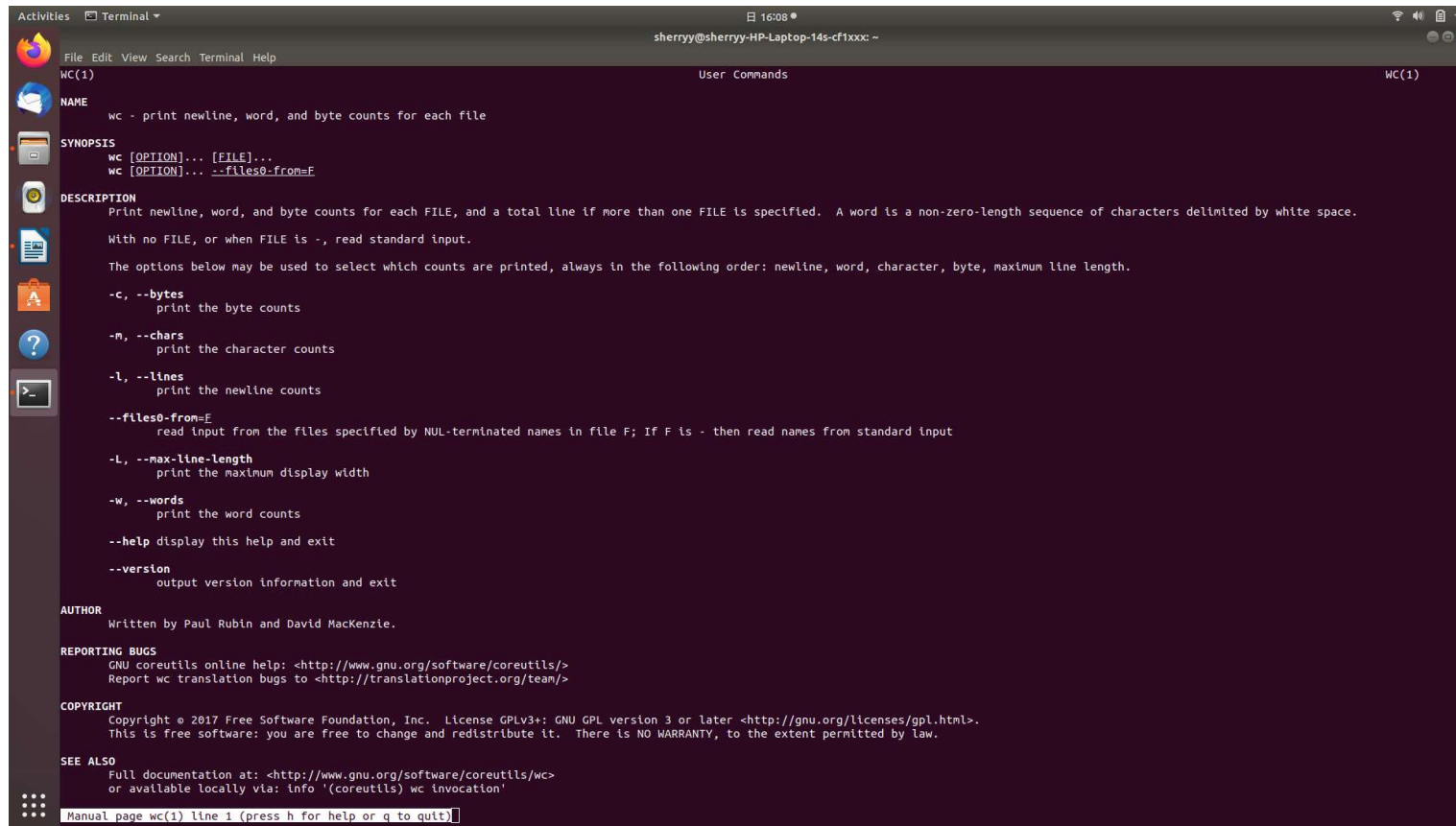
- A graphic client to view man pages, just use it in any terminal window.



Man page sections

- NAME: a one-line introduction to the command
- SYNOPSIS: shows the syntax used by the command
 - If a command argument is enclosed in [...], then it is optional, otherwise it is required.
 - The ellipsis (...) implies that there can be more instances of the preceding word. E.g. wc can be used with more than one filename as argument.
 - A pipe (|) character means that only one of the options shown on either side of the pipe can be used. E.g. only one of the options, -c, -m and -C, can be used.
- DESCRIPTION: provides a detailed description
- EXIT STATUS: lists possible error conditions and their numeric representation (useful for writing shell scripts and C programs).

Sample: wc command



The screenshot shows a terminal window with the title bar "sherry@sherry-HP-Laptop-14s-cf1xxx: ~". The terminal displays the manual page for the 'wc' command. The left sidebar contains icons for file manager, applications, and help. The main content area is titled "wc(1)" and "User Commands".

```
WC(1)
NAME
    wc - print newline, word, and byte counts for each file

SYNOPSIS
    wc [OPTION]... [FILE]...
    wc [OPTION]... --files0-from=F

DESCRIPTION
    Print newline, word, and byte counts for each FILE, and a total line if more than one FILE is specified. A word is a non-zero-length sequence of characters delimited by white space.
    With no FILE, or when FILE is -, read standard input.
    The options below may be used to select which counts are printed, always in the following order: newline, word, character, byte, maximum line length.

    -c, --bytes
        print the byte counts

    -m, --chars
        print the character counts

    -l, --lines
        print the newline counts

    --files0-from=F
        read input from the files specified by NUL-terminated names in file F; If F is - then read names from standard input

    -L, --max-line-length
        print the maximum display width

    -w, --words
        print the word counts

    --help
        display this help and exit

    --version
        output version information and exit

AUTHOR
    Written by Paul Rubin and David MacKenzie.

REPORTING BUGS
    GNU coreutils online help: <http://www.gnu.org/software/coreutils/>
    Report wc translation bugs to <http://translationproject.org/team/>

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    This is free software: you are free to change and redistribute it. There is NO WARRANTY, to the extent permitted by law.

SEE ALSO
    Full documentation at: <http://www.gnu.org/software/coreutils/wc>
    or available locally via: info '(coreutils) wc invocation'

Manual page wc(1) line 1 (press h for help or q to quit)
```

Only man can understand man

- Set the pager used by man:

```
PAGER=less ; export PAGER
```

Set this shell variable and export it before you run man. (only valid for this session)

```
man wc
```

- Evaluate the value of PAGER:

```
echo $PAGER
```

```
Activities Terminal 16:14 ● sherry@sherry-HP-Laptop-14s-cf1xxx: ~
File Edit View Search Terminal Help
MAN(1) Manual pager utils MAN(1)

NAME
man - an interface to the on-line reference manuals

SYNOPSIS
man [-C file] [-d] [-D] [--warnings[=warnings]] [-R encoding] [-L locale] [-m system[,...]] [-M path] [-S list] [-e extension] [-i|-I] [--regex|--wildcard] [--names-only] [-a] [-u] [--no-sub-pages] [-P pager] [-r prompt] [-7] [-E encoding] [--no-hyphenation] [--no-justification] [-p string] [-t] [-T[device]] [-H[browser]] [-X[dpi]] [-Z] [[section] page[.section] ...] ...
man -k [apropos options] regexp ...
man -K [-w|-W] [-S list] [-i|-I] [--regex] [section] term ...
man -f [whatis options] page ...
man -l [-C file] [-d] [-D] [--warnings[=warnings]] [-R encoding] [-L locale] [-P pager] [-r prompt] [-7] [-E encoding] [-p string] [-t] [-T[device]] [-H[browser]] [-X[dpi]] [-Z] file ...
man -w|-W [-C file] [-d] [-D] page ...
man -c [-C file] [-d] [-D] page ...
man [-?V]

DESCRIPTION
man is the system's manual pager. Each page argument given to man is normally the name of a program, utility or function. The manual page associated with each of these arguments is then found and displayed. A section, if provided, will direct man to look only in that section of the manual. The default action is to search in all of the available sections following a pre-defined order ("1 n l 8 3 2 3postx 3pm 3perl 3am 5 4 9 6 7" by default, unless overridden by the SECTION directive in /etc/manpath.config), and to show only the first page found, even if page exists in several sections.

The table below shows the section numbers of the manual followed by the types of pages they contain.

1 Executable programs or shell commands
2 System calls (functions provided by the kernel)
3 Library calls (functions within program libraries)
4 Special files (usually found in /dev)
5 File formats and conventions eg /etc/passwd
6 Games
7 Miscellaneous (including macro packages and conventions), e.g. man(7), groff(7)
8 System administration commands (usually only for root)
9 Kernel routines [Non standard]

A manual page consists of several sections.

Conventional section names include NAME, SYNOPSIS, CONFIGURATION, DESCRIPTION, OPTIONS, EXIT STATUS, RETURN VALUE, ERRORS, ENVIRONMENT, FILES, VERSIONS, CONFORMING TO, NOTES, BUGS, EXAMPLE, AUTHORS, and SEE ALSO.

The following conventions apply to the SYNOPSIS section and can be used as a guide in other sections.

bold text           type exactly as shown.
italic text        replace with appropriate argument.
[-abc]              any or all arguments within [ ] are optional.
-a|b               options delimited by | cannot be used together.
argument ...       argument is repeatable.
[expression] ...   entire expression within [ ] is repeatable.

Exact rendering may vary depending on the output device. For instance, man will usually not be able to render italics when running in a terminal, and will typically use underlined or coloured text instead.

The command or function illustration is a pattern that should match all possible invocations. In some cases it is advisable to illustrate several exclusive invocations as is shown in the SYNOPSIS section of this manual page.

Manual page man(1) line 1 (press h for help or q to quit)
```


Other help resources

- Info

It is GNU's info reader for browsing Texinfo documentation.

It is of tree nodes structure, use the [Tab] key to move to a node and hit [Enter]

```
File Edit View Search Terminal Help
Next: Introduction, Up: (dir)

grep
****

'grep' prints lines that contain a match for a pattern.

This manual is for version 3.1 of GNU Grep.

This manual is for 'grep', a pattern matching engine.

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the section entitled "GNU Free Documentation License".

* Menu:

* Introduction::      Introduction.
* Invoking::          Command-line options, environment, exit status.
* Regular Expressions:: Regular Expressions.
* Usage::             Examples.
* Performance::       Performance tuning.
* Reporting Bugs::    Reporting Bugs.
* Copying::           License terms for this manual.
* Index::             Combined index.
```

```
File Edit View Search Terminal Help
Next: Invoking, Prev: Top, Up: Top

1 Introduction
*****

'grep' searches input files for lines containing a match to a given
pattern list. When it finds a match in a line, it copies the line to
standard output (by default), or produces whatever other sort of output
you have requested with options.

Though 'grep' expects to do the matching on text, it has no limits on
input line length other than available memory, and it can match
arbitrary characters within a line. If the final byte of an input file
is not a newline, 'grep' silently supplies one. Since newline is also a
separator for the list of patterns, there is no way to match newline
characters in a text.
```

Basic navigation commands of info

- n: visits the next node
- p: visits the previous node
- u: returns to the previous level where [Enter] was pressed
- l: moves to the previously visited node
- q: quit info
- h: see the complete list of key sequences

--help

- It displays all options as a list.
- E.g. `find --help`

```
sherry@sherry-HP-Laptop-14s-cf1xxx:~$ find --help
Usage: find [-H] [-L] [-P] [-Olevel] [-D debugopts] [path...] [expression]

default path is the current directory; default expression is -print
expression may consist of: operators, options, tests, and actions:
operators (decreasing precedence; -and is implicit where no others are given):
    ( EXPR )  ! EXPR  -not EXPR  EXPR1 -a EXPR2  EXPR1 -and EXPR2
    EXPR1 -o EXPR2  EXPR1 -or EXPR2  EXPR1 , EXPR2
positional options (always true): -daystart -follow -regextype

normal options (always true, specified before other expressions):
    -depth --help -maxdepth LEVELS -mindepth LEVELS -mount -noleaf
    --version -xdev -ignore_readdir_race -noignore_readdir_race
tests (N can be +N or -N or N): -amin N -anewer FILE -atime N -cmin N
    -cnewer FILE -ctime N -empty -false -fstype TYPE -gid N -group NAME
    -ilname PATTERN -iname PATTERN -inum N -iwholename PATTERN -iregex PATTERN
    -links N -lname PATTERN -mmin N -mtime N -name PATTERN -newer FILE
    -nouser -nogroup -path PATTERN -perm [-/]MODE -regex PATTERN
    -readable -writable -executable
    -wholename PATTERN -size N[bcwkMG] -true -type [bcdpflsD] -uid N
    -used N -user NAME -xtype [bcdpfls] -context CONTEXT

actions: -delete -print0 -printf FORMAT -fprintf FILE FORMAT -print
    -fprint0 FILE -fprint FILE -ls -fls FILE -prune -quit
    -exec COMMAND ; -exec COMMAND {} + -ok COMMAND ;
    -execdir COMMAND ; -execdir COMMAND {} + -okdir COMMAND ;

Valid arguments for -D:
exec, help, opt, rates, search, stat, time, tree
Use '-D help' for a description of the options, or see find(1)

Please see also the documentation at http://www.gnu.org/software/findutils/.
You can report (and track progress on fixing) bugs in the "find"
program via the GNU findutils bug-reporting page at
https://savannah.gnu.org/bugs/?group=findutils or, if
you have no web access, by sending email to <bug-findutils@gnu.org>.
sherry@sherry-HP-Laptop-14s-cf1xxx:~$
```

echo: displaying messages

```
$ echo $SHELL
```

```
    /bin/bash
```

```
$ echo "Enter filename: \c"
```

```
Enter filename: $ _
```

\c is an escape sequence, the cursor is placed at the end of the output string rather than on the next line.

in BSD: -n option is an alternative to the \c sequence, echo -n "Enter filename: "

in Linux Bash, -e must be used: echo -e "Enter filename: \c"

\t: a tab which pushes text to the right by eight character positions.

\n: a newline which creates the effect of pressing [Enter]

\r: carriage return

printf: alternative to echo in Bash

- Use `\n` to explicitly specify a newline

```
$ printf "No filename entered\n"
```

```
No filename entered
```

- Format specifiers `%s`:

```
$ printf "My current shell is %s\n" $SHELL
```

```
My current shell is /bin/bash
```

script: recording your session

```
$ script
```

```
Script started, file is typescript
```

```
$ exit
```

```
Script done, file is typescript
```

- Then can view this file with the cat command
- Script overwrites any previous typescript that may exist. What if you want to append to it? Go check the man page to find the answer.
- The file created by script contains the [Ctrl-m] character, which shows in vi as ^M.

We can view it with cat -v and remove it using vi or sed.

mailx

- It is the only mail utility that POSIX requires all UNIX system to support.
- 可移植作業系統介面（英語：Portable Operating System Interface，縮寫為**POSIX**）是**IEEE**為要在各種**UNIX**作業系統上執行軟體，而定義**API**的一系列互相關聯的標準的總稱，其正式稱呼為**IEEE Std 1003**，而國際標準名稱為**ISO/IEC 9945**。

Email headers

henry: user henry on same host

henry@saturn: on a different host

henry@heavens.com: on the internet

- Received mail is deposited in a mailbox, a text file that may contain binary attachments in encoded form.
- When message has been viewed, it moves from the mailbox to mbox.

Sending mail

```
$ mailx charlie
```

```
Subject: New System
```

```
The new system arrives soon – henry
```

```
[Ctrl-d] or dot
```

```
EOT
```

```
mailx -s "New System" -c "jpm,sumit" -b andrew charlie < message.txt
```

-s: the subject

The mail body is obtained from the file message.txt using redirection.

-c: carbon copy

-b: blind carbon copy

Receiving mail

- mailbox: a text file named after the user-id of the recipient located in /var/mail (/var/spool/mail in Linux)
- You will be prompted to read the mailbox by:
You have new mail in /var/mail/Charlie
- To read the mails, invoke:
\$mailx
>means the current mail
Type [Enter] or the mail number to view the message body.
q: quit the mail reading
r: reply to mail
w: save message
 w note3 Appends current message to note3
 w 1 2 3 note3 Appends first three messages to note3
 view the saved messages: mailx -f note3
d: delete mail

Internal commands used by mailx

- N Message number n.
- + The next undeleted message, or the next deleted message for the undelete command.
- - The next previous undeleted message, or the next previous deleted message for the undelete command.
- . The current message.
- ^ The first undeleted message, or the first deleted message for the undelete command.
- \$ The last message.
- * All messages.
- n-m An inclusive range of message numbers.
- Address All messages from address; any address as shown in a header summary will be matchable in this form.
- /string All messages with string in the subject line (case ignored).
- :c All messages of type c, where c must be one of:
 - D deleted messages
 - N new messages
 - O old messages (any not in state read or new)
 - R read messages
 - U unread messages

passwd: change your password

- Console or telnet users: /etc/shadow (or /etc/passwd) stores the passwords
- SSH users: public key based cryptography
- uname: displays certain features of the os running on the machine.
 - uname -r: os version
 - uname -n: machine name or hostname
- who: users logged in
 - user-ids, filenames of the devices associated with the respective terminals, date time of logging
 - who am i: the user who invoked the who command

date: system date

- The battery backup stores the number of seconds elapsed since the Epoch: January 1, 1970.
- A 32-bit counter stores these seconds (except on 64-bit machines), and it overflows in 2038.
 - date +%m: print only the month
 - date +%h: print only the month name
 - date +"%h %m": Aug 08
 - d: day of the month; y: last two digits of the year; H, M and S: the hour, minute and second; D: date in format mm/dd/yy; T: time in format hh:mm:ss

stty: when things go wrong

- It shows the settings of several keywords:
 - Speed of the terminal
 - Keyword = value
 - Keyword = or –keyword. – means the option is turned off.

```
sherry@sherry-HP-Laptop-14s-cf1xxx:~$ stty -a
speed 38400 baud; rows 55; columns 204; line = 0;
intr = ^C; quit = ^\; erase = ^?; kill = ^U; eof = ^D; eol = <undef>; eol2 = <undef>; swch = <undef>; start = ^Q; stop = ^S; susp = ^Z; rpnt = ^R; werase = ^W; lnext = ^V; discard = ^O;
min = 1; time = 0;
-parenb -parodd -cmspar cs8 -hupcl -cstopb cread -cllocal -crtcts
-ignbrk -brkint -ignpar -parmrk -inpck -istrip -inlcr -igncr icrnl ixon -ixoff -iucrc -ixany -imaxbel iutf8
opost -olcuc -ocrnl onlcr -onocr -onlret -ofill -ofdel nl0 cr0 tab0 bs0 vt0 ff0
isig icanon iexten echo echoe echok -echonl -noflsh -xcase -tostop -echoprnt echoctl echoke -flusho -extproc
```

- `stty intr DEL`
 - Define the delete key as interrupt key.
- `eof`: end of file for mailx
- `erase`: `stty erase [Backspace]`
 - Define the backspace key
- `stty sane` or `reset`: reset the key values to default

Ptt 歷史

- 1995年9月14日，當時就讀國立臺灣大學資工系二年級學生的杜奕瑾，在宿舍內，以一台486個人電腦，利用Linux及開放原始碼軟體，架設了BBS站，PTT，擔任創站首任站長。
- 台大批踢踢的英語簡稱「PTT」的來源，是來自杜奕瑾開站時的個人ID。ID典故是他因為常熬夜而有熊貓眼，所以綽號是Panda Tu（Tu為姓氏），縮寫為PT；但他覺得PT太短，有兩個T唸起來比較好聽好記，所以把ID取為Ptt
- <https://zh.wikipedia.org/wiki/%E6%9D%9C%E5%A5%95%E7%91%BE>
- 批踢踢與批踢踢兔作業系統則是Debian GNU/Linux，批踢踢參目前則架設在Microsoft Azure提供的雲端服務上

登入方式

PTT 使用 UTF-8 登入的方式有下述兩種：

- telnet -8 ptt.cc
- 登入 PTT 時，在 ID 結尾處多加上一個逗號 (,) 的話，就會進入 UTF-8 模式。 ex:
- 帳號：user,
- 密碼：xxx
- 註：進入時還會是亂碼，登入後就會是 UTF-8 的版本
- ssh bbsu@ptt.cc # 這樣就直接進入 UTF-8 模式，我是使用此方式
- <https://tonytonyjan.net/2015/12/08/login-ptt-everyday-automatically/>