# 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

External commands: exist on disk as files

Internal commands: built into the shell executable, like the cd command.
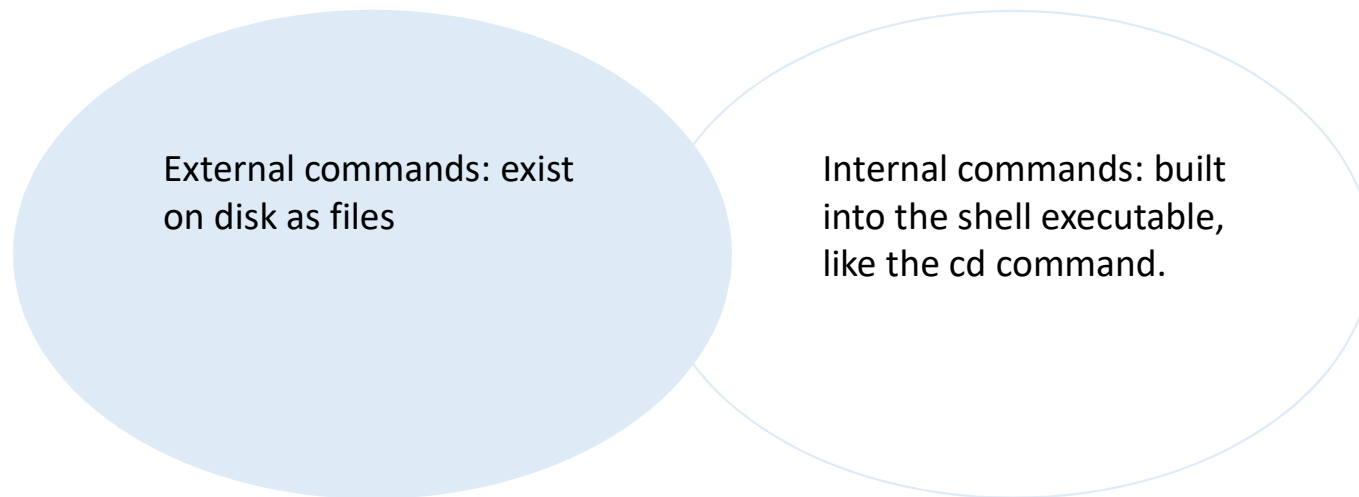
PATH – an environment variable

$ 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
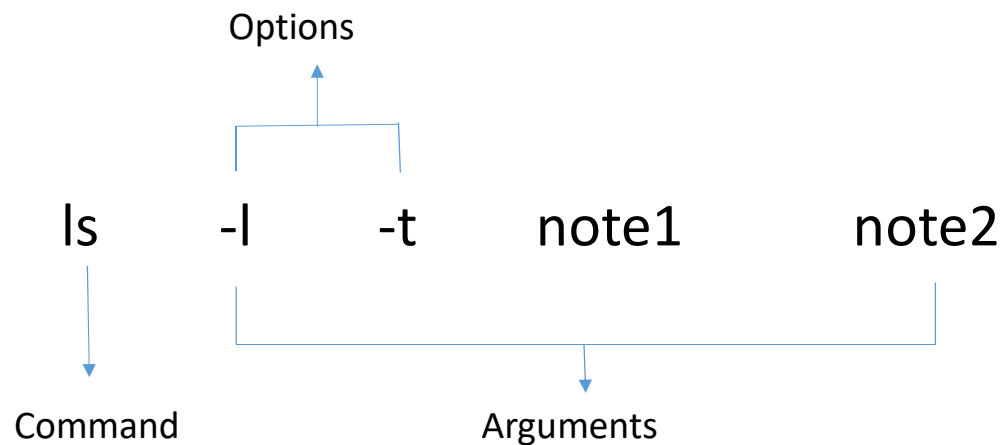- System administration commands: /sbin and usr/sbin

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

Options

ls   -l   -t   note1   note2

Command   Arguments

- 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 un-matched 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
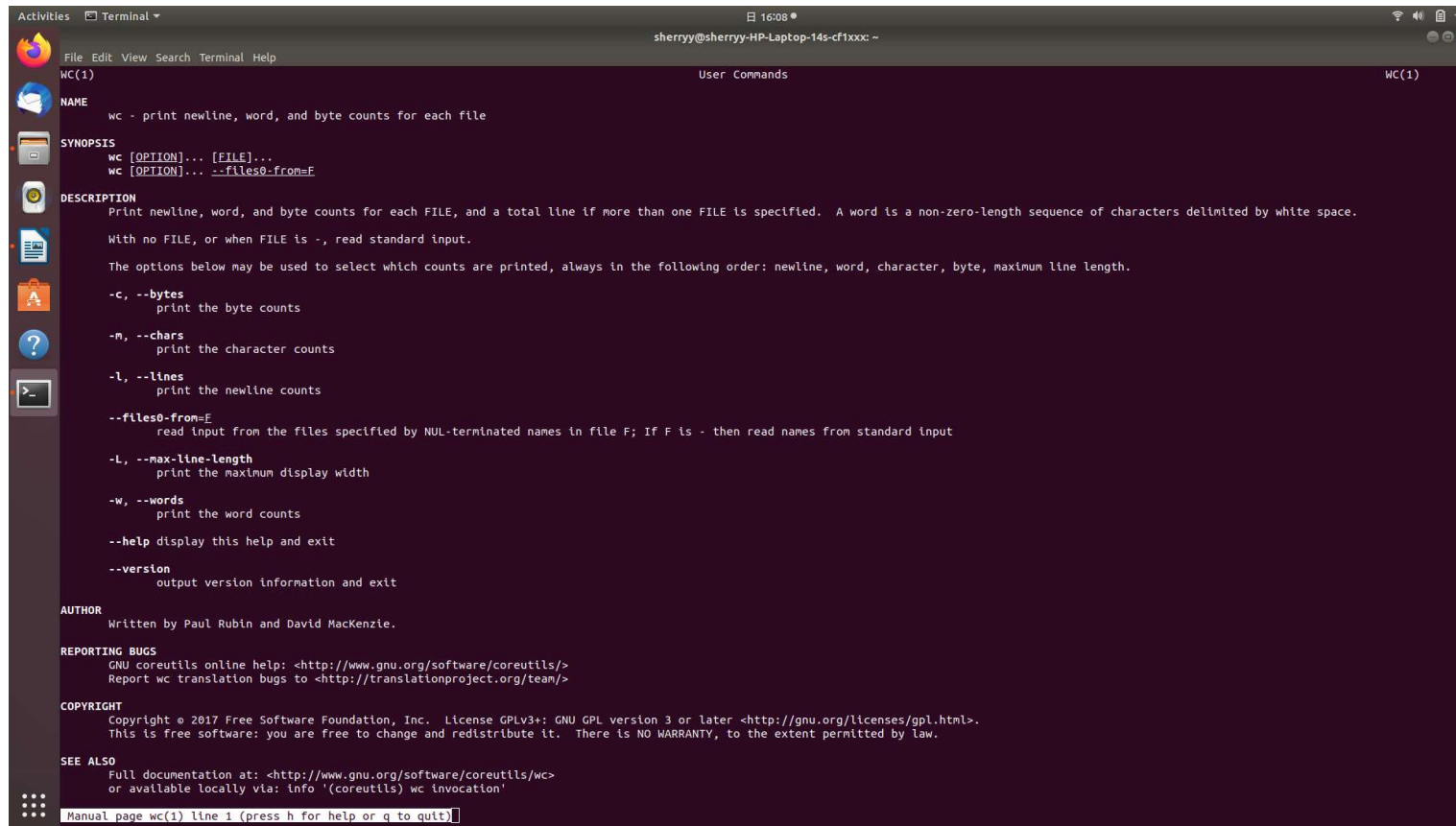
- A graphic client to view man pages, just use it in any terminal window.
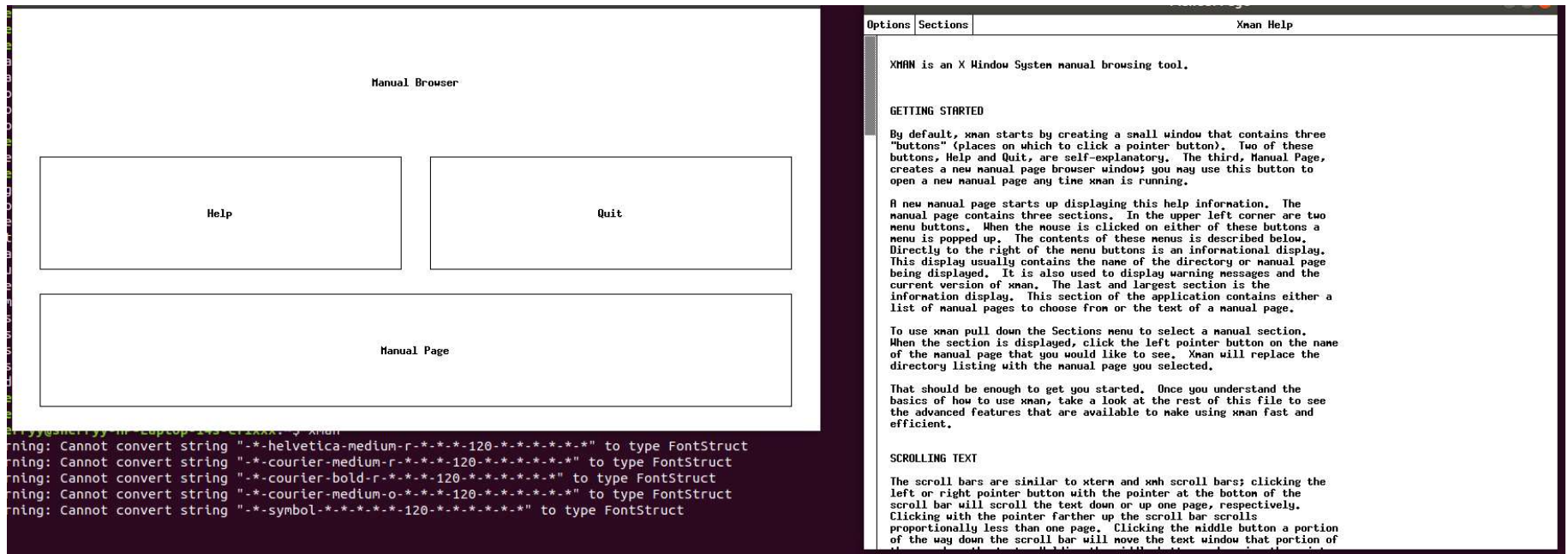
Man page sections

- 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 elliptis (…) 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

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

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 3posix 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]

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

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 ouput 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 hwo 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.

```
sherryy@sherryy-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>; swtch = <undef>; start = ^Q; stop = ^S; susp = ^Z; rprnt = ^R; werase = ^W; lnext = ^V; discard = ^O;
min = 1; time = 0;
-parenb -parodd -cmspar cs8 -hupcl -cstopb cread -clocal -crtscts
-ignbrk -brkint -ignpar -parmrk -inpck -istrip -inlcr -igncr icrnl ixon -ixoff -iuclc -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 -echoprt echoctl echoke -flusho -extproc
```

- stty intr DEL
  - Define the delete key as interrupt key.
- eof: end of file for mailx
- erase: sty 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/