Ch1 Overview of Operating Systems

- **character user interface (CUI)**

~ **Operating Systems** ~

Application user interface (AUI)
- Applications: Compilers, word processors, spreadsheets, FTP, SSH, Web browsers, etc.
- UNIX shell: Bourne shell, C shell, Bash, etc.

Application programmer interface (API)
- Language libraries: C, C++, Java, FORTRAN, etc.
- System call interface (entry points into kernel)

Operating system

UNIX kernel:
- File management
- Interprocess communication (IPC)
- Process management
- Primary and secondary storage management
- CPU scheduler

Device drivers: Mouse driver, printer driver, CD-ROM driver, hard disk driver, etc.

Hardware: Wires, capacitors, resistors, transistors, ICs, mouse, display monitor, keyboard, CPU, RAM, hard disk, CD-ROM, printer, USB, etc.

- **Single-user, single-process system**
  - Run only one process at a time
  - Only one user at a time to use the computer system
- **Single-user, multiprocess system**
  - Only a single user to use the computer system
  - Run multiple processes simultaneously
- **Multiuser, multiprocess system**
  - Use a computer system simultaneously
  - Run multiple processes at the same time

Ch2 A "Quick Start" into the UNIX Operating System

~Viewing the Contents of Files~

- **cat** :
  step 1 :
      cat > filename
  step 2 :
      輸入內容
  step 3 :
      Ctrl+D(退出 cat)
  step 4 :
      Cat filename(檢視 file 內的內容)

```
s110056030@s110056030-VirtualBox:~$ cat > myfile
try
pwd
s110056030@s110056030-VirtualBox:~$ cat myfile
try
pwd
```

- **more** :

檢視 file 內容

- The more command shows one screen of a file at a time
- If the file is several pages long :
  - 按 space : 下一頁
  - 按 Q : quit

```
s110056030@s110056030-VirtualBox:~$ more myfile
try
pwd
```

- **cp** :

copy file1 to file2

```
s110056030@s110056030-VirtualBox:~$ cp myfile file1
s110056030@s110056030-VirtualBox:~$ ls
Desktop     Downloads          file1  myfile     Public      Videos
Documents   examples.desktop   Music  Pictures   Templates
```

- **mv** :

move file1 to file2

```
s110056030@s110056030-VirtualBox:~$ mv myfile file2
s110056030@s110056030-VirtualBox:~$ ls
Desktop     Downloads        file1  Music      Public      Videos
Documents   examples.desktop file2  Pictures   Templates
```

- **rm** :

删除 `file`

rm -r :

删除非空的 `file` 下所有檔案

```
s110056030@s110056030-VirtualBox:~$ rm file1
rm: cannot remove 'file1': Is a directory
s110056030@s110056030-VirtualBox:~$ rm -r file1
s110056030@s110056030-VirtualBox:~$ ls
Desktop     Downloads        file2  Pictures   Templates
Documents   examples.desktop Music  Public     Videos
```

- **ls** :

Managing Files

ls -F

```
s110056030@s110056030-VirtualBox:~$ ls -F
Desktop/     Downloads/        file2/  Pictures/   Templates/
Documents/   examples.desktop  Music/  Public/     Videos/
```

ls -l

```
s110056030@s110056030-VirtualBox:~$ ls -l
total 48
drwxr-xr-x 2 s110056030 s110056030 4096  二 13 14:22 Desktop
drwxr-xr-x 2 s110056030 s110056030 4096  二 13 14:22 Documents
drwxr-xr-x 2 s110056030 s110056030 4096  二 13 14:22 Downloads
-rw-r--r-- 1 s110056030 s110056030 8980  二 13 14:19 examples.desktop
drwxrwxr-x 2 s110056030 s110056030 4096  四 16 17:11 file2
drwxr-xr-x 2 s110056030 s110056030 4096  二 13 14:22 Music
drwxr-xr-x 2 s110056030 s110056030 4096  二 13 14:22 Pictures
drwxr-xr-x 2 s110056030 s110056030 4096  二 13 14:22 Public
drwxr-xr-x 2 s110056030 s110056030 4096  二 13 14:22 Templates
drwxr-xr-x 2 s110056030 s110056030 4096  二 13 14:22 Videos
```

ls -i

```
s110056030@s110056030-VirtualBox:~$ ls -i
1181028 Desktop     1062942 examples.desktop  1316643 Pictures    1316644 Videos
1316641 Documents   1062375 file2             1316640 Public
1316638 Downloads   1316642 Music             1316639 Templates
```

ls -a

可以顯示 hidden 資料

```
s110056030@s110056030-VirtualBox:~$ ls -a
.               Desktop         .ICEauthority   .sudo_as_admin_successful
..              Documents       .local          Templates
.bash_history   Downloads       .mozilla        .test.swo
.bash_logout    examples.desktop Music           .thunderbird
.bashrc         .exrc           Pictures        Videos
.cache          file2           .profile
.config         .gnupg          Public
```

ls -la

與 ls -l 差別是 a 有 hidden 的資料

```
s110056030@s110056030-VirtualBox:~$ ls -la
total 100
drwxr-xr-x 17 s110056030 s110056030 4096  四 16 17:12 .
drwxr-xr-x  4 root       root       4096  二 13 14:25 ..
-rw-------  1 s110056030 s110056030    0  四 15 23:42 .bash_history
-rw-r--r--  1 s110056030 s110056030  220  二 13 14:19 .bash_logout
-rw-r--r--  1 s110056030 s110056030 3771  二 13 14:19 .bashrc
drwx------ 13 s110056030 s110056030 4096  四 15 19:01 .cache
drwx------ 13 s110056030 s110056030 4096  四 15 19:04 .config
drwxr-xr-x  2 s110056030 s110056030 4096  二 13 14:22 Desktop
drwxr-xr-x  2 s110056030 s110056030 4096  二 13 14:22 Documents
drwxr-xr-x  2 s110056030 s110056030 4096  二 13 14:22 Downloads
-rw-r--r--  1 s110056030 s110056030 8980  二 13 14:19 examples.desktop
-rw-rw-r--  1 s110056030 s110056030    0  四 16 16:18 .exrc
drwxrwxr-x  2 s110056030 s110056030 4096  四 16 17:11 file2
drwx------  3 s110056030 s110056030 4096  二 13 14:22 .gnupg
-rw-------  1 s110056030 s110056030 4114  四 16 15:02 .ICEauthority
drwx------  3 s110056030 s110056030 4096  二 13 14:22 .local
```

ls -ld

```
s110056030@s110056030-VirtualBox:~$ ls -ld
drwxr-xr-x 17 s110056030 s110056030 4096  四 16 17:12 .
```

- **mkdir :**

mkdir 創建資料夾

- **cd :**

change the current working directory

```
s110056030@s110056030-VirtualBox:~$ cd file2
s110056030@s110056030-VirtualBox:~/file2$
```

cd ~

```
s110056030@s110056030-VirtualBox:~/file2$ cd ~
s110056030@s110056030-VirtualBox:~$
```

cd .. (回上一層目錄)

```
s110056030@s110056030-VirtualBox:~/file2/try$ cd ..
s110056030@s110056030-VirtualBox:~/file2$
```

可以顯示 hidden 資料

- **pwd** :

查看現在的 workplace

```
s110056030@s110056030-VirtualBox:~/file2$ pwd
/home/s110056030/file2
```

- **rmdir** :

刪除空目錄

```
s110056030@s110056030-VirtualBox:~/file2$ rmdir try
```

- **man** :

查 command 使用方法

- **whatis** :

簡短查

```
s110056030@s110056030-VirtualBox:~/file2$ whatis man
man (1)              - an interface to the on-line reference manuals
man (7)              - macros to format man pages
s110056030@s110056030-VirtualBox:~/file2$ whatis ls
ls (1)               - list directory contents
```

- **whereis** :

找路徑

- **whoami** :

```
s110056030@s110056030-VirtualBox:~$ whoami
s110056030
```

- **hostname** :

```
s110056030@s110056030-VirtualBox:~$ hostname
s110056030-VirtualBox
```

- **lpr** :

Print 出來

- **[]** :

```
s110056030@s110056030-VirtualBox:~/file1$ ls
123.txt  2345.txt  234.txt  456.txt
s110056030@s110056030-VirtualBox:~/file1$ rm [0-3]*.txt
s110056030@s110056030-VirtualBox:~/file1$ ls
456.txt
```

- **cal :**

```
s110056030@s110056030-VirtualBox:~$ cal
      四月 2023
日 一 二 三 四 五 六
                  1
 2  3  4  5  6  7  8
 9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30
```

- **alias :**

create pseudonyms, or nicknames, for commands
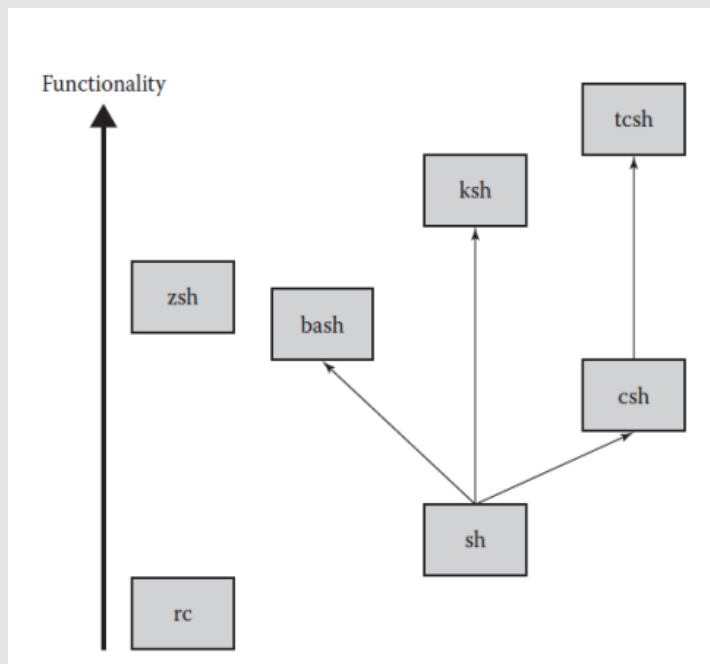
```
s110056030@s110056030-VirtualBox:~$ alias calnow='cal 4 2023'
s110056030@s110056030-VirtualBox:~$ calnow
      四月 2023
日 一 二 三 四 五 六
                  1
 2  3  4  5  6  7  8
 9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30
```

- **unalias :**

取消 alias

```
s110056030@s110056030-VirtualBox:~$ unalias calnow
s110056030@s110056030-VirtualBox:~$ calnow
calnow: command not found
```

~ Shell~

Ch3 Editing Text Files

~vi 基本操作~

Step 1:

A

Step 2:

輸入內容

Step 3:

Esc

Step 4:

:wq

Step 5:

sh 執行 vi 這個 shell

```
s110056030@s110056030-VirtualBox:~$ vi test
s110056030@s110056030-VirtualBox:~$ sh test
/home/s110056030
```

~vi 複製貼上~

yy 複製那一行

p 貼上 (yy123p : 複製貼上 123 次)

:set number

~vi 基本操作~

Key	Action
a	Appends text after the character the cursor is on
A	Appends text after the last character of the current line
c	Begins a change operation, allowing you to modify text
C	Changes from the cursor position to the end of the current line
i	Inserts text before the character the cursor is on
I	Inserts text at the beginning of the current line
o	Opens a blank line below the current line and puts the cursor on that line
O	Opens a blank line above the current line and puts the cursor on that line
R	Begins overwriting text
s	Substitutes single characters
S	Substitutes whole lines

o =>在 current line 下開一行新的   I =>在那行開頭插入新字元

O =>在 current line 前一行插入 new line   I =>在游標處插入

~vi 游標位置~

Command	Action
1G	Moves the cursor to the first line of the file
G	Moves the cursor to the last line of the file
0 (zero)	Moves the cursor to the first character of the current line
<Ctrl+G>	Reports the position of the cursor in terms of line # and column #
$	Moves the cursor to the last character of the current line
w	Moves the cursor forward one word at a time
b	Moves the cursor backward one word at a time
x	Deletes the character at the cursor position
dd	Deletes the line at the current cursor position
u	Undoes the most recent change
r	Replaces the character at the current cursor location with what is typed next

1G =>到第一行　　　200G =>到第 200 行　　　G =>到最後一行
0(zero) =>移到那一行開頭　　　$ =>移到這行最後一個字
w =>往前一個　　　b =>往後一個　　　r =>取代
u =>類似 ctrl+z　　x =>刪除游標那個字　　dd =>刪一行
ctrl+G =>回報游標位置

~vi 存檔~

Command	Action
: n, m w file	Write lines n to m to new file.
: n, m w >> file	Append lines n to m to existing file.
:r filename	Reads and inserts the contents of the file filename at the current cursor position
:wq	Saves the buffer and quits
:w	Saves the current buffer and remains in the editor.
:w filename	Saves the current buffer to filename
:w! filename	Overwrites filename with the current text
:w!	Write file (overriding protection).
:w! file	Overwrite file with current text.
:w %.new	Write current buffer named **file** as **file.new**.
:q	Quit vi (fails if changes were made).
:q!	Quit vi without saving the buffer.
:Q	Quit vi and invoke ex.
:vi	Return to vi after Q command.
ZZ	Quits vi, saving the file only if changes were made since the last save
%	Replaced with current filename in editing commands.
#	Replaced with alternate filename in editing commands.

~vi 游標位置~

~vi 刪除修改~

刪 70~90 行

```
        99  4110056030
:70,90d
```

修改 70~77 行的 4110056030 -> 4110056030ya

```
:70,77s/4110056030/4110056030ya/g
```

Ch4 Files and File System Structure

~TYPES OF FILES~

• UNIX supports seven types of files:
- Simple/ordinary file
- Directory
- Symbolic (soft) link
- Character special file
- Block special file
- Named pipe (FIFO)
- Socket

ls -l / 可以查看 file type

```
$ ls -l /
total 46
-r--r--r--    1 root   root   6142 Feb 25 01:20 COPYRIGHT
drwxr-xr-x    2 root   root     47 Feb 25 01:19 bin
```

• Simple/Ordinary File

Extension	Contents of File
.bmp, .jpg, jpeg, .gif	Graphics
.c	C Source code
.C, .cpp, .cc	C++ Source code
.java	Java source code
.class	Java class file
.html, .htm	File for a Web page
.o	Object code
.ps	Postscript code
.Z, .gz	Compressed

• Simple/Ordinary File

When you create a new file, the UNIX kernel allocates an inode to it
every unique file in UNIX has a unique inode (and inode number)

Inode number	File name

• Link File

A file of type link "points to" an existing file

- Special (Device) File

Special files are divided into <u>two types</u>:

- Character special files
  - Correspond to character-oriented devices, such as a **keyboard**
- Block special files
 - Correspond to block-oriented devices, such as a **disk**

- Named Pipe (FIFO)

A FIFO is a file (of named pipe type) that allows two processes to communicate with each other if the processes are on the same computer

- Socket
  - A socket can be used by processes on the same computer or on different computers to communicate with each other
  - Sockets can belong to different address families, each specifying the protocol suite to be used by processes to communicate

----

~File System Organization~
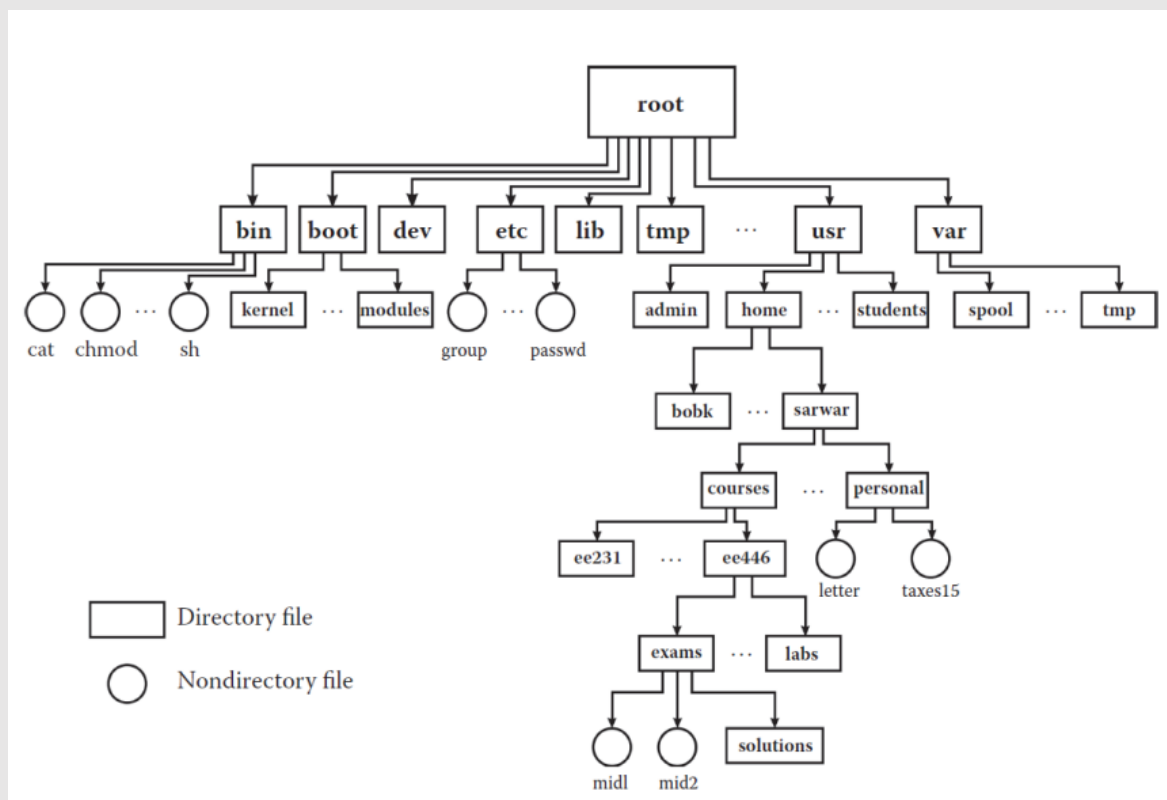
- **Root directory (/):**
  - **/bin**: binary directory, the /bin directory contains binary (i.e., executable) images of most UNIX programs/commands
  - **/boot**: This directory contains the programs and configuration files that are used during the bootstrap process of your system

- **/dev**: The **/dev** directory, which is also known as the device directory(設備目錄), contains files corresponding to the devices connected to the computer
- **/etc**: The **/etc** directory contains commands, files, and scripts needed for system configuration and administration
- **/lib**: The library directory contains a collection of related files for a given language in a single file called an archive
- **/tmp**: Used by several commands and applications, the **/tmp** directory contains temporary files(臨時文件)
- **/usr**: The **/usr** directory contains subdirectories(子目錄) that hold, among other things, most of the utilities, system daemons
- **/var**: The **/var** directory contains multipurpose log, temporary, and spool files

----

echo $HOME

pwd

```
s110056030@s110056030-VirtualBox:~$ echo $HOME
/home/s110056030
s110056030@s110056030-VirtualBox:~$ pwd
/home/s110056030
```

----

rmdir 刪除 dir,無法刪除內有資料的 dir

----

ls -F

  identify directories

  executable files

  symbolic links

```
s110056030@s110056030-VirtualBox:~$ ls -F /
bin/   etc/   lib/   mnt/   run/   swapfile   var/
boot/   home/   lib64/   opt/   sbin/   sys/   vmlinuz@
cdrom/   initrd.img@ lost+found/   proc/   snap/   tmp/
dev/   initrd.img.old@ media/   root/   srv/   usr/
```

------------------------------------------------------------------

**file /\***

types of the contents of all the files in the root directory are displayed

```
s110056030@s110056030-VirtualBox:~$ file /*
/bin:            directory
/boot:           directory
/cdrom:          directory
/dev:            directory
/etc:            directory
/home:           directory
/initrd.img:     symbolic link to boot/initrd.img-5.4.0-84-generic
/initrd.img.old: symbolic link to boot/initrd.img-5.4.0-84-generic
/lib:            directory
/lib64:          directory
/lost+found:     directory
/media:          directory
/mnt:            directory
/opt:            directory
/proc:           directory
/root:           directory
/run:            directory
/sbin:           directory
/snap:           directory
/srv:            directory
/swapfile:       regular file, no read permission
/sys:            directory
/tmp:            sticky, directory
/usr:            directory
/var:            directory
/vmlinuz:        symbolic link to boot/vmlinuz-5.4.0-84-generic
```

~STANDARD FILES AND FILE DESCRIPTORS~
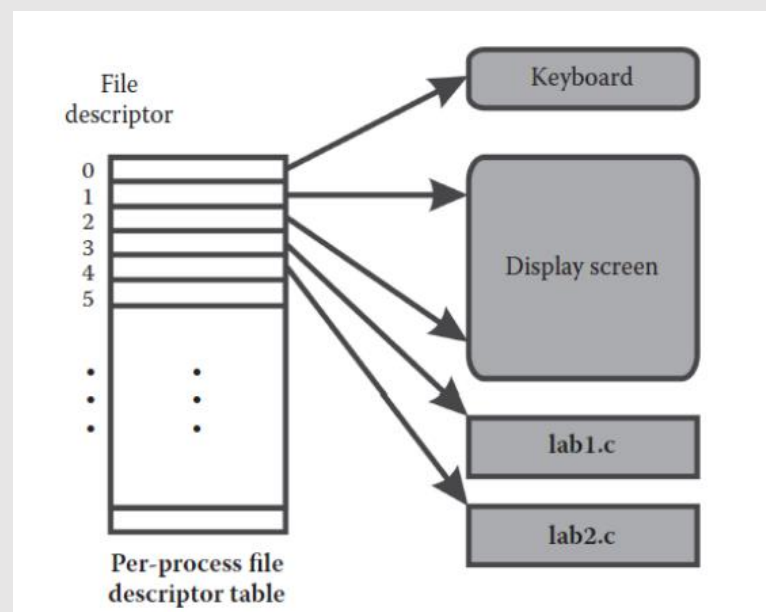
Ch5 File Security

User Type	Permission Type		
	Read (r)	Write (w)	Execute (x)
User (u)	X	X	X
Group (g)	X	X	X
Others (o)	X	X	X

```
chmod 700 *

chmod 740 courses

chmod 751 ~/courses

chmod 700 ~

chmod u=rwx courses

chmod ugo-rw sample
 chmod a-rw sample
chmod a+x sample
chmod g=u sample
chmod go= sample
```

chmod => 控制權限

```
mkdir file
```
兩種模式:
1.(以二進位判斷)
```
chmod 700 file
ls -ld file
```

r	w	x	Octal Digit for Permission	Meaning
0	0	0	0	No permission
0	0	1	1	Execute-only permission
0	1	0	2	Write-only permission
0	1	1	3	Write and execute permissions
1	0	0	4	Read-only permission
1	0	1	5	Read and execute permissions
1	1	0	6	Read and write permissions
1	1	1	7	Read, write, and execute permissions

```
s110056030@s110056030-VirtualBox:~$ chmod 700 SASA
s110056030@s110056030-VirtualBox:~$ ls -ld SASA
drwx------ 2 s110056030 s110056030 4096  四  16 00:14 SASA
```

2.(=,-,+)
```
chmod a+w file
ls -ld file
```

Who	Operator	Privilege
u User	+ Add privilege	r Read bit
g Group	– Remove privilege	w Write bit
o Other	= Set privilege	x Execute/search bit
a All		u User's current privileges
ugo All		g Group's current privileges
		o Others' current privileges
		l Locking privilege bit
		s Sets user or group ID mode bit
		t Sticky bit

```
s110056030@s110056030-VirtualBox:~$ chmod a+w SASA
s110056030@s110056030-VirtualBox:~$ ls -ld SASA
drw--w--w- 2 s110056030 s110056030 4096  四  16 00:14 SASA
```


~The means~

```
drwx--x--x 2 s110056030 s110056030 4096  四  16 00:14 SASA
```

```
drwxr-x---  2 sarwar  faculty  512 Jan 23 09:37 courses
[    1    ] [2][  3  ] [  4  ] [ 5 ] [     6     ] [   7   ]
```

	Attributes
1	File type and access permissions
2	Number of hard links
3	Owner's login name
4	Owner's group name
5	File size in bytes
6	Date and time of last modification
7	File name

~ENCRYPTION-BASED PROTECTION~

加密/解密

• The encryption and decryption processes
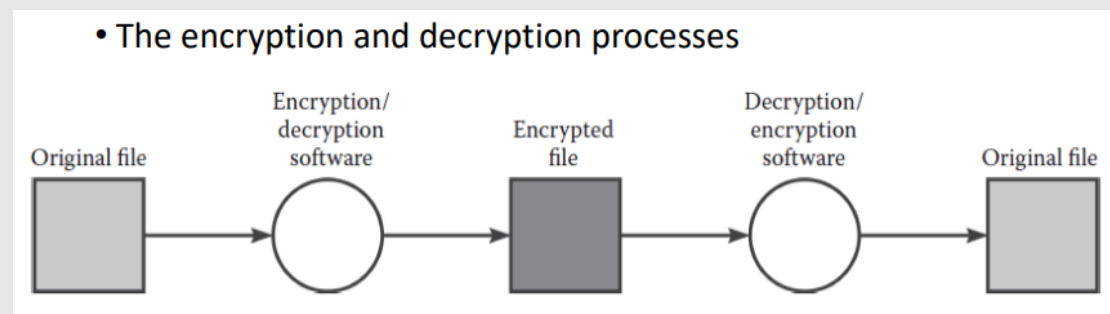
The outputs of the **ls -l** commands in the following session show that the **/etc/passwd** file is read-only for everyone on the system except root, who has read and write permissions

```
s110056030@s110056030-VirtualBox:~$ ls -l /etc/passwd
-rw-r--r-- 1 root root 2465  二  13 14:29 /etc/passwd
```

----

chmod a-w * : a 所有的 file 都-w
chmod 700 [l-t]* : 所有 l 到 t 開頭的 file 都設為 700

```
$ chmod a-w *
$ ls -l
dr-xr-x---  2   sarwar  faculty  512 Apr  23  09:37  courses
-r-xr-xr-x  1   sarwar  faculty   12 May  01  13:22  labs
-r-xr-r---  1   sarwar  faculty  163 May  05  23:13  temp
$ chmod 700 [l-t]*
$ ls -l
dr-xr-x---  2   sarwar  faculty  512 Apr  23  09:37  courses
-rwx------  1   sarwar  faculty   12 May  01  13:22  labs
-rwx------  1   sarwar  faculty  163 May  05  23:13  temp
$
```

----

chmod -R 700 file：把 file 下的所有檔案權限全改成 700

----

umask : 0002 => o 的 2 被設定為 0

       0077 => g,o 的 7 被設為 0

```
s110056030@s110056030-VirtualBox:~$ umask
0002
s110056030@s110056030-VirtualBox:~$ umask -S
u=rwx,g=rwx,o=rx
s110056030@s110056030-VirtualBox:~$ umask 077
s110056030@s110056030-VirtualBox:~$ umask
0077
s110056030@s110056030-VirtualBox:~$ umask -S u=rwx,g=,o=
u=rwx,g=,o=
s110056030@s110056030-VirtualBox:~$ umask
0077
```

----

grep

```
ls -l / | grep tmp
```

```
s110056030@s110056030-VirtualBox:~$ ls -l / | grep tmp
drwxrwxrwt  15 root root        4096  四  16 15:13 tmp
```

```
grep -c s4110056030 test
```
數 test 裡面有幾個 s4110056030

```
s110056030@s110056030-VirtualBox:~$ vi test
s110056030@s110056030-VirtualBox:~$ grep -c s4110056030 test
21
```