

2022년 1학기 시스템프로그래밍 실습 2주차

Unix/Linux Commands

System Software Laboratory
College of Software and Convergence
Kwangwoon Univ.

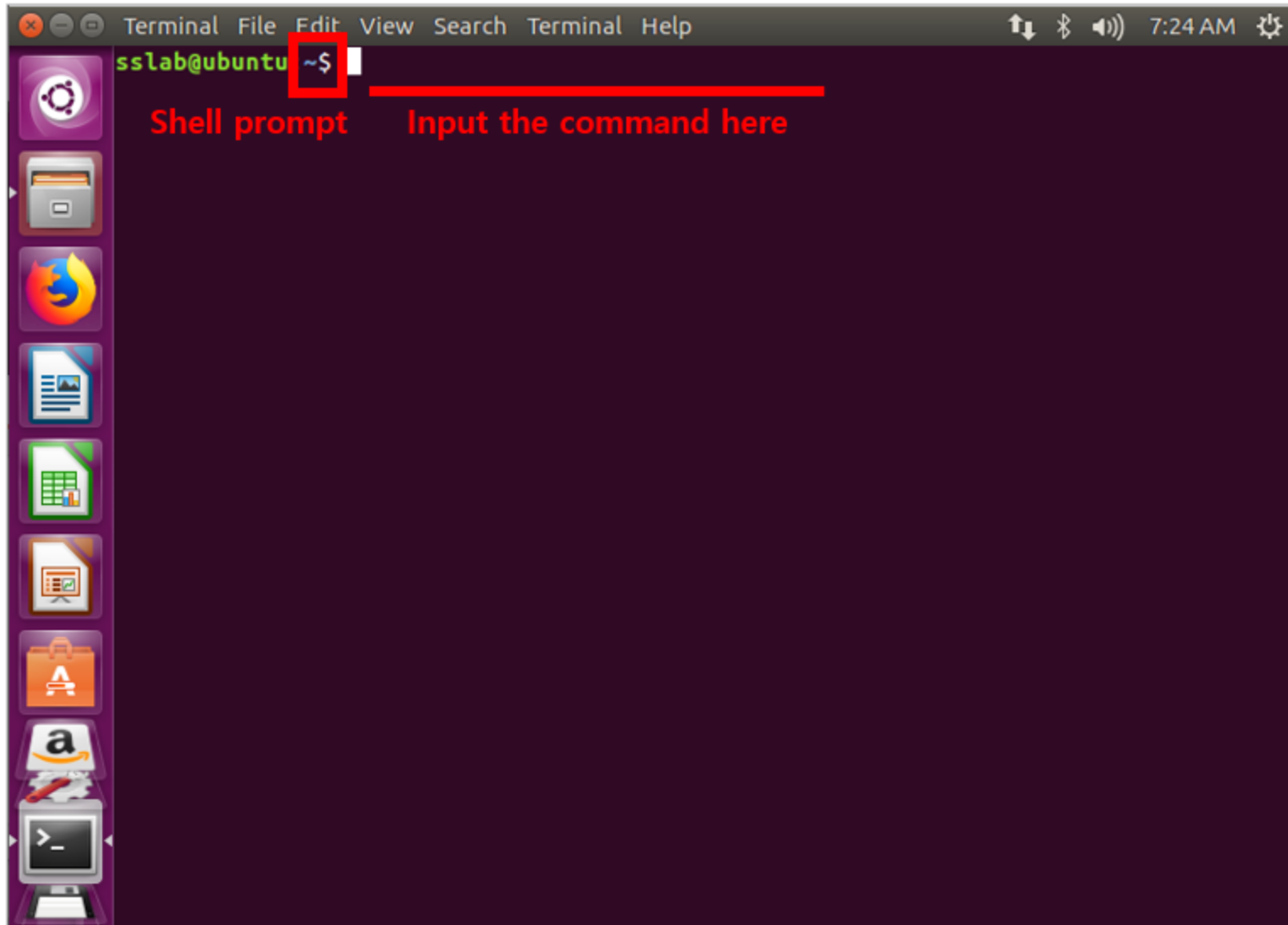
Preparation

- 같이 배포된 splab_commands 파일을 아래와 같이 실행
 - \$ chmod +x splab_commands
 - \$./splab_commands

```
sslab@ubuntu:~$ ls
Desktop  Documents  Downloads  examples.desktop  Music  Pictures  Public  splab_commands  Templates  Videos
sslab@ubuntu:~$ ls -l
total 48
drwxr-xr-x 2 sslab sslab 4096 Mar  7 22:33 Desktop
drwxr-xr-x 2 sslab sslab 4096 Feb 21 18:46 Documents
drwxr-xr-x 2 sslab sslab 4096 Feb 21 18:46 Downloads
-rw-r--r-- 1 sslab sslab 8980 Feb 21 18:26 examples.desktop
drwxr-xr-x 2 sslab sslab 4096 Feb 21 18:46 Music
drwxr-xr-x 2 sslab sslab 4096 Feb 21 18:46 Pictures
drwxr-xr-x 2 sslab sslab 4096 Feb 21 18:46 Public
-rwxrwxrwx 1 sslab sslab 2690 Sep  8 03:30 splab_commands
drwxr-xr-x 2 sslab sslab 4096 Feb 21 18:46 Templates
drwxr-xr-x 2 sslab sslab 4096 Feb 21 18:46 Videos
sslab@ubuntu:~$ chmod +x splab_commands
sslab@ubuntu:~$ ./splab_commands
sslab@ubuntu:~$ ls -l
total 52
drwxr-xr-x 2 sslab sslab 4096 Mar  7 22:33 Desktop
drwxr-xr-x 2 sslab sslab 4096 Feb 21 18:46 Documents
drwxr-xr-x 2 sslab sslab 4096 Feb 21 18:46 Downloads
-rw-r--r-- 1 sslab sslab 8980 Feb 21 18:26 examples.desktop
drwxr-xr-x 2 sslab sslab 4096 Feb 21 18:46 Music
drwxr-xr-x 2 sslab sslab 4096 Feb 21 18:46 Pictures
drwxr-xr-x 2 sslab sslab 4096 Feb 21 18:46 Public
-rwxrwxrwx 1 sslab sslab 2690 Sep  8 03:30 splab_commands
drwxr-xr-x 2 sslab sslab 4096 Feb 21 18:46 Templates
drwxr-xr-x 2 sslab sslab 4096 Feb 21 18:46 Videos
drwxrwxr-x 3 sslab sslab 4096 Mar  7 22:37 work
sslab@ubuntu:~$
```

Linux Terminal

- Command Line Interface



man (1/4)

- **Format and display the on-line manual pages**
 - usage: man [option] name ...
 - E.g.
 - \$ man ls
 - \$ man -k copy //keyword search
 - \$ man -a write //all manuals

man (2/4)

- e.g. \$ man kill

```
KILL(1) User Commands KILL(1)

NAME
    kill - send a signal to a process

SYNOPSIS
    kill [options] <pid> [...]

DESCRIPTION
    The default signal for kill is TERM. Use -l or -L to list available signals. Particularly useful signals include HUP, INT, KILL, STOP, CONT, and 0. Alternate signals may be specified in three ways: -9, -SIGKILL or -KILL. Negative PID values may be used to choose whole process groups; see the PGID column in ps command output. A PID of -1 is special; it indicates all processes except the kill process itself and init.

OPTIONS
    <pid> [...]
        Send signal to every <pid> listed.

    -<signal>
    -s <signal>
    --signal <signal>
        Specify the signal to be sent. The signal can be specified by using name or number. The behavior of signals is explained in signal(7) manual page.

    -l, --list [signal]
        List signal names. This option has optional argument, which will convert signal number to signal name, or other way round.

    -L, --table
        List signal names in a nice table.

NOTES
    Your shell (command line interpreter) may have a built-in kill command. You may need to run the command described here as /bin/kill to solve the conflict.

EXAMPLES
    kill -9 -1
        Kill all processes you can kill.

    kill -l 11
        Translate number 11 into a signal name.

    kill -L
        List the available signal choices in a nice table.
```

man (3/4)

- **Section description**
 - (1) General commands
 - (2) System calls
 - (3) C library functions
 - (4) Special files (usually devices) and drivers
 - (5) File formats and conventions
 - (6) Games and screensavers
 - (7) Miscellanea
 - (8) System administration commands and daemons
- **Examples**
 - ls(1), open(2), fopen(3)
 - write(1)/write(2)
 - \$ man 1 write
 - \$ man 2 write

man (4/4)

- **Manual layout**

- NAME
 - name of the command or function
- SYNOPSIS
 - command: how to run,
 - functions: parameter list
- DESCRIPTION
 - description of the functioning of the command or function.
- EXAMPLES
 - some examples of common usage.
- SEE ALSO
 - list of related commands or functions.
- OPTIONS, EXIT STATUS, ENVIRONMENT, KNOWN BUGS, FILES, AUTHOR, REPORTING BUGS, HISTORY and COPYRIGHT.

ls

- List directory contents

- usage: ls [OPTION]... [FILE]...
- useful options
 - a : hidden file을 포함한 모든 파일을 출력
 - F : 파일 종류 표시 (/는 디렉토리, *는 실행파일)
 - l : 파일 정보를 자세하게 출력

```
sslab@ubuntu:~$ ls
Desktop    Downloads    Music    Public    Templates    work
Documents  examples.desktop  Pictures  splab_commands  Videos

sslab@ubuntu:~$ ls -a
.           .config      .gconf      .profile    .viminfo
..          Desktop      .gnupg      Public      work
.bash_history .dmrc        .ICEauthority splab_commands .Xauthority
.bash_logout .Documents   .local      .sudo_as_admin_successful .xsession-errors
.bashrc      Downloads    Music       Templates   .xsession-errors.old
.cache       examples.desktop  Pictures    Videos

sslab@ubuntu:~$ ls -F
Desktop/    Downloads/    Music/    Public/    Templates/    work/
Documents/  examples.desktop  Pictures/  splab_commands*  Videos/

sslab@ubuntu:~$ ls -al
total 140
drwxr-xr-x 16 sslab sslab 4096 Mar 22 19:38 .
drwxr-xr-x  3 root  root 4096 Mar 17 05:32 ..
-rw-r--r--  1 sslab sslab 1174 Mar 17 07:09 .bash_history
-rw-r--r--  1 sslab sslab  220 Mar 17 05:32 .bash_logout
-rw-r--r--  1 sslab sslab 3771 Mar 17 05:32 .bashrc
```


| pwd

- **Print name of current working directory**
 - usage: pwd [OPTION]
 - e.g.

```
sslab@ubuntu:~$ pwd  
/home/sslab  
sslab@ubuntu:~$
```

cd

- **Change the current directory**

- usage : `cd [-L|-P] [dir]`
- Special filenames
 - `.` : current directory
 - `..` : parent directory
- e.g.

```
sslab@ubuntu:~$ pwd
/home/sslab
sslab@ubuntu:~$ ls
Desktop      Downloads      Music          Public          Templates      work
Documents    examples.desktop  Pictures      splab_commands  Videos
sslab@ubuntu:~$ cd work
sslab@ubuntu:~/work$ pwd
/home/sslab/work
sslab@ubuntu:~/work$ cd .
sslab@ubuntu:~/work$ cd ..
sslab@ubuntu:~$ cd work
sslab@ubuntu:~/work$ cd ~    $ cd ~ → is equivalent to 'cd'
sslab@ubuntu:~$ cd -        $ cd - → is equivalent to $OLDPWD
/home/sslab/work
sslab@ubuntu:~/work$
```

cat

- **Concatenate files and print on the standard output**
 - usage: cat [OPTION] [FILE]...
 - e.g.

```
sslab@ubuntu:~/work$ cat file1.txt
Hello This is file 1
sslab@ubuntu:~/work$ cat file2.txt
Hello This is file 2
sslab@ubuntu:~/work$ cat file1.txt file2.txt
Hello This is file 1
Hello This is file 2
sslab@ubuntu:~/work$
```

File permission

- 파일 허가 지정

- owner, group, others 세 종류에 대해 아래의 권한 부여
 - read
 - file: 파일 내용 열람/복사 가능, 수정/삭제 불가능
 - directory: 디렉토리 내의 파일이름 열람 가능(ls)
 - write
 - file: 파일 내용 수정/삭제 가능, 열람/복사 불가능
 - directory: 파일을 생성하거나 삭제할 수 있는 권리
 - execute
 - file: 실행시킬 권리의 유무
 - directory: 이동 가능 여부(cd)

chmod(1/2)

- Change file access permissions

- usage 1: chmod [OPTION]... MODE[,MODE]... FILE...

- MODE

- 대상

- u: user (owner)
- g: group
- o: other
- a: all

- 연산

- +: 추가
- : 제거
- =: 할당

- 권한

- r: read
- w: write
- x: execution

- e.g.

- chmod a=rwx test → test: 모든 대상에게 모든 권한 부여
- chmod a+r,o-w test → test: 모든 대상에게 읽기 부여, other는 write 제거

```
sslab@ubuntu:~/work$ ls -al
total 12
drwxrwxr-x  2 sslab sslab 4096 Mar  9 00:29 .
drwxr-xr-x 19 sslab sslab 4096 Mar  9 00:29 ..
-rw-rw-r--  1 sslab sslab  16 Mar  9 00:29 hello.txt
sslab@ubuntu:~/work$ chmod u-w,o-w,o-r hello.txt
sslab@ubuntu:~/work$ ls -l
total 4
-r--r----- 1 sslab sslab 16 Mar  9 00:29 hello.txt
sslab@ubuntu:~/work$ chmod 644 hello.txt
sslab@ubuntu:~/work$ ls -l
total 4
-rw-r--r--  1 sslab sslab 16 Mar  9 00:29 hello.txt
sslab@ubuntu:~/work$
```

chmod(2/2)

- Change file access permissions

- usage 2: chmod [OPTION]... **OCTAL**-MODE FILE...

- OCTAL**-MODE

- 8진수 숫자 세 개로 user(owner), group, other의 권한 표현
- 각 숫자는 다음의 합으로 표현

- 1: execute

- 2: write

- 4: read

- e.g.

- chmod 777 test

→ test: 모든 대상에게 모든 권한 부여

- chmod 701 test

→ test: 소유자에게 모든 권한, other는 execute만 가능

```
sslab@ubuntu:~/work$ ls -l
total 20
-rw-rw-r-- 1 sslab sslab 21 Mar 23 09:53 file1.txt
-rw-rw-r-- 1 sslab sslab 21 Mar 23 09:53 file2.txt
-rw-rw-r-- 1 sslab sslab 2001 Mar 23 09:53 file3.txt
-r--r----- 1 sslab sslab 41 Mar 23 09:53 hello.txt
drwxrwxr-x 2 sslab sslab 4096 Mar 23 09:53 SP_lab
sslab@ubuntu:~/work$ chmod 664 hello.txt
sslab@ubuntu:~/work$ ls -l
total 20
-rw-rw-r-- 1 sslab sslab 21 Mar 23 09:53 file1.txt
-rw-rw-r-- 1 sslab sslab 21 Mar 23 09:53 file2.txt
-rw-rw-r-- 1 sslab sslab 2001 Mar 23 09:53 file3.txt
-rw-rw-r-- 1 sslab sslab 41 Mar 23 09:53 hello.txt
drwxrwxr-x 2 sslab sslab 4096 Mar 23 09:53 SP_lab
```

mkdir

- **Make directories**

- usage: mkdir [OPTION] DIRECTORY...
- e.g.

```
sslab@ubuntu:~/work$ ls -l
total 24
-rw-rw-r-- 1 sslab sslab 1838 Mar 18 20:26 file1.txt
-rw-rw-r-- 1 sslab sslab 3167 Mar 18 20:26 file2.txt
-rw-rw-r-- 1 sslab sslab 2529 Mar 18 20:26 file3.txt
-rw-rw-r-- 1 sslab sslab 5112 Mar 18 20:26 hello.txt
drwxrwxr-x 2 sslab sslab 4096 Mar 18 20:26 SP_lab
sslab@ubuntu:~/work$ mkdir SP_lecture
sslab@ubuntu:~/work$ ls -l
total 28
-rw-rw-r-- 1 sslab sslab 1838 Mar 18 20:26 file1.txt
-rw-rw-r-- 1 sslab sslab 3167 Mar 18 20:26 file2.txt
-rw-rw-r-- 1 sslab sslab 2529 Mar 18 20:26 file3.txt
-rw-rw-r-- 1 sslab sslab 5112 Mar 18 20:26 hello.txt
drwxrwxr-x 2 sslab sslab 4096 Mar 18 20:26 SP_lab
drwxrwxr-x 2 sslab sslab 4096 Mar 22 19:45 SP_lecture
```


rmmdir

- **Remove empty directories**
 - usage: `rmmdir [OPTION]... DIRECTORY...`
 - e.g.

```
sslab@ubuntu:~/work$ ls -l
total 28
-rw-rw-r-- 1 sslab sslab 1838 Mar 18 20:26 file1.txt
-rw-rw-r-- 1 sslab sslab 3167 Mar 18 20:26 file2.txt
-rw-rw-r-- 1 sslab sslab 2529 Mar 18 20:26 file3.txt
-rw-r--r-- 1 sslab sslab 5112 Mar 18 20:26 hello.txt
drwxrwxr-x 2 sslab sslab 4096 Mar 18 20:26 SP_lab
drwxrwxr-x 2 sslab sslab 4096 Mar 22 19:54 SP_lecture
sslab@ubuntu:~/work$ rmmdir SP_lecture/
sslab@ubuntu:~/work$ ls -l
total 24
-rw-rw-r-- 1 sslab sslab 1838 Mar 18 20:26 file1.txt
-rw-rw-r-- 1 sslab sslab 3167 Mar 18 20:26 file2.txt
-rw-rw-r-- 1 sslab sslab 2529 Mar 18 20:26 file3.txt
-rw-r--r-- 1 sslab sslab 5112 Mar 18 20:26 hello.txt
drwxrwxr-x 2 sslab sslab 4096 Mar 18 20:26 SP_lab
```


rm(1/3)

- **Remove files or directories**
 - usage: rm [OPTION]... FILE...
 - e.g.

```
sslab@ubuntu:~/work$ ls -l
total 28
-rw-rw-r-- 1 sslab sslab  21 Mar 22 22:38 file1.txt
-rw-rw-r-- 1 sslab sslab  21 Mar 22 22:38 file2.txt
-rw-rw-r-- 1 sslab sslab 2001 Mar 22 22:38 file3.txt
-rw-rw-r-- 1 sslab sslab  16 Mar 22 22:42 fileA.txt
-rw-rw-r-- 1 sslab sslab  41 Mar 22 22:38 hello.txt
drwxrwxr-x 2 sslab sslab 4096 Mar 22 22:45 LINUX
drwxrwxr-x 2 sslab sslab 4096 Mar 22 22:41 SP_lab
sslab@ubuntu:~/work$ rm fileA.txt
sslab@ubuntu:~/work$ ls -l
total 24
-rw-rw-r-- 1 sslab sslab  21 Mar 22 22:38 file1.txt
-rw-rw-r-- 1 sslab sslab  21 Mar 22 22:38 file2.txt
-rw-rw-r-- 1 sslab sslab 2001 Mar 22 22:38 file3.txt
-rw-rw-r-- 1 sslab sslab  41 Mar 22 22:38 hello.txt
drwxrwxr-x 2 sslab sslab 4096 Mar 22 22:45 LINUX
drwxrwxr-x 2 sslab sslab 4096 Mar 22 22:41 SP_lab
```

rm (2/3)

- Remove files or directories
 - useful option
 - **-r** : remove the contents of directory recursively
 - e.g.

```
sslab@ubuntu:~/work$ ls -l
total 24
-rw-rw-r-- 1 sslab sslab  21 Mar 22 22:38 file1.txt
-rw-rw-r-- 1 sslab sslab  21 Mar 22 22:38 file2.txt
-rw-rw-r-- 1 sslab sslab 2001 Mar 22 22:38 file3.txt
-rw-rw-r-- 1 sslab sslab  41 Mar 22 22:38 hello.txt
drwxrwxr-x 2 sslab sslab 4096 Mar 22 22:45 LINUX
drwxrwxr-x 2 sslab sslab 4096 Mar 22 22:41 SP_lab
sslab@ubuntu:~/work$ rm -r LINUX
sslab@ubuntu:~/work$ ls -l
total 20
-rw-rw-r-- 1 sslab sslab  21 Mar 22 22:38 file1.txt
-rw-rw-r-- 1 sslab sslab  21 Mar 22 22:38 file2.txt
-rw-rw-r-- 1 sslab sslab 2001 Mar 22 22:38 file3.txt
-rw-rw-r-- 1 sslab sslab  41 Mar 22 22:38 hello.txt
drwxrwxr-x 2 sslab sslab 4096 Mar 22 22:41 SP_lab
sslab@ubuntu:~/work$
```

rm (3/3)

- Remove files or directories
 - useful option
 - **-i** : prompt before every removal
 - e.g.

```
sslab@ubuntu:~/work$ ls -l
total 20
-rw-rw-r-- 1 sslab sslab  17 Mar 22 22:51 file1.txt
-rw-rw-r-- 1 sslab sslab  21 Mar 22 22:38 file2.txt
-rw-rw-r-- 1 sslab sslab 2001 Mar 22 22:38 file3.txt
-rw-rw-r-- 1 sslab sslab  41 Mar 22 22:38 hello.txt
drwxrwxr-x 2 sslab sslab 4096 Mar 22 22:41 SP_lab
sslab@ubuntu:~/work$ rm -i *
rm: remove regular file 'file1.txt'? y
rm: remove regular file 'file2.txt'? n
rm: remove regular file 'file3.txt'? n
rm: remove regular file 'hello.txt'? n
rm: cannot remove 'SP_lab': Is a directory
sslab@ubuntu:~/work$ ls -l
total 16
-rw-rw-r-- 1 sslab sslab  21 Mar 22 22:38 file2.txt
-rw-rw-r-- 1 sslab sslab 2001 Mar 22 22:38 file3.txt
-rw-rw-r-- 1 sslab sslab  41 Mar 22 22:38 hello.txt
drwxrwxr-x 2 sslab sslab 4096 Mar 22 22:41 SP_lab
sslab@ubuntu:~/work$
```

cp

- **Copy files and directories**

- usage: `cp [OPTION]... SOURCE DEST`
`cp [OPTION]... SOURCE... DIRECTORY`

- e.g.

```
sslab@ubuntu:~/work$ ls -l
total 20
-rw-rw-r-- 1 sslab sslab 21 Mar 22 22:54 file1.txt
-rw-rw-r-- 1 sslab sslab 21 Mar 22 22:54 file2.txt
-rw-rw-r-- 1 sslab sslab 2001 Mar 22 22:54 file3.txt
-rw-rw-r-- 1 sslab sslab 41 Mar 22 22:54 hello.txt
drwxrwxr-x 2 sslab sslab 4096 Mar 22 22:54 SP_lab
sslab@ubuntu:~/work$ cp hello.txt hello_copy.txt
sslab@ubuntu:~/work$ ls -l
total 24
-rw-rw-r-- 1 sslab sslab 21 Mar 22 22:54 file1.txt
-rw-rw-r-- 1 sslab sslab 21 Mar 22 22:54 file2.txt
-rw-rw-r-- 1 sslab sslab 2001 Mar 22 22:54 file3.txt
-rw-rw-r-- 1 sslab sslab 41 Mar 22 22:55 hello_copy.txt
-rw-rw-r-- 1 sslab sslab 41 Mar 22 22:54 hello.txt
drwxrwxr-x 2 sslab sslab 4096 Mar 22 22:54 SP_lab
sslab@ubuntu:~/work$ cp SP_lab/* .
sslab@ubuntu:~/work$ ls -l
total 32
-rw-rw-r-- 1 sslab sslab 21 Mar 22 22:54 file1.txt
-rw-rw-r-- 1 sslab sslab 21 Mar 22 22:54 file2.txt
-rw-rw-r-- 1 sslab sslab 2001 Mar 22 22:54 file3.txt
-rw-rw-r-- 1 sslab sslab 15 Mar 22 22:55 fileA.txt
-rw-rw-r-- 1 sslab sslab 15 Mar 22 22:55 fileC.txt
-rw-rw-r-- 1 sslab sslab 41 Mar 22 22:55 hello_copy.txt
-rw-rw-r-- 1 sslab sslab 41 Mar 22 22:54 hello.txt
drwxrwxr-x 2 sslab sslab 4096 Mar 22 22:54 SP_lab
sslab@ubuntu:~/work$
```


mv

- **Move (rename) files**
 - usage: mv [OPTION]... SOURCE DEST
 - e.g.

```
sslab@ubuntu:~/work$ ls
ex file1.txt file2.txt file3.txt fileA.txt hello copy.txt hello.txt SP_lab
sslab@ubuntu:~/work$ mv hello_copy.txt /home/sslab/work/ex
sslab@ubuntu:~/work$ ls
ex file1.txt file2.txt file3.txt fileA.txt hello.txt SP_lab
sslab@ubuntu:~/work$ cd ex
sslab@ubuntu:~/work/ex$ ls
hello_copy.txt
sslab@ubuntu:~/work/ex$ cd ..
sslab@ubuntu:~/work$ mv ex LINUX
sslab@ubuntu:~/work$ ls
file1.txt file2.txt file3.txt fileA.txt hello.txt LINUX SP_lab
sslab@ubuntu:~/work$
```

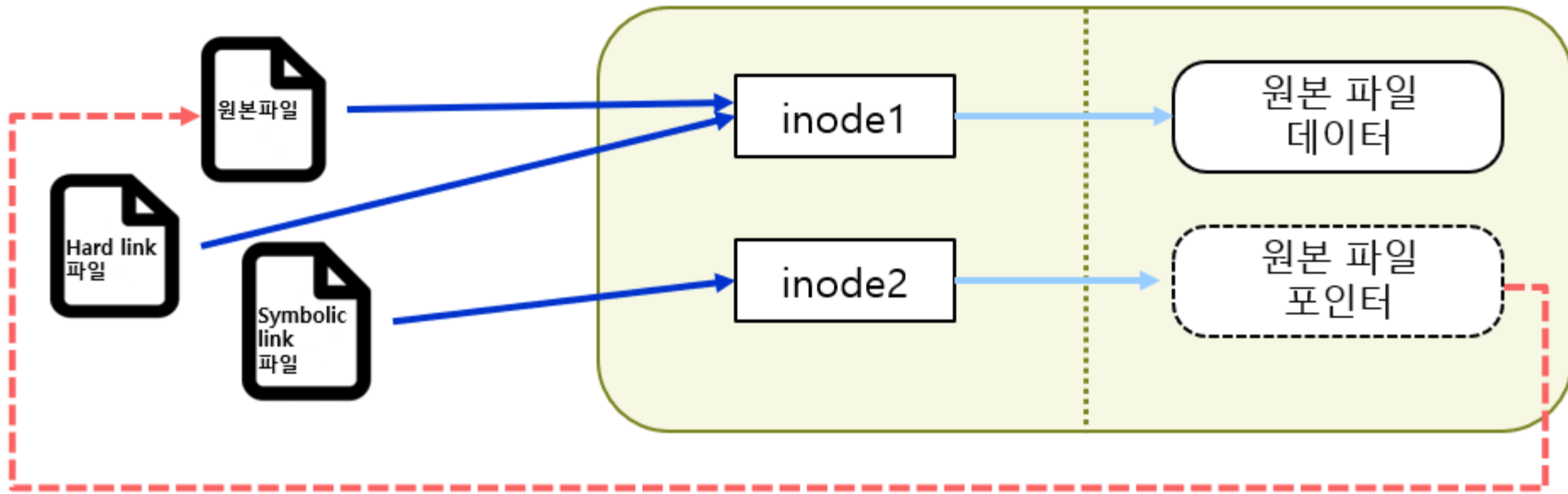
In (1/6)

- **Make links between files**

- Hard link, Symbolic link
- usage: `ln [OPTION]... TARGET [LINK_NAME]`
- useful option
 - `-s`: 심볼릭 링크 생성

사용자에게 보여지는 디렉터리

내부적으로 동작



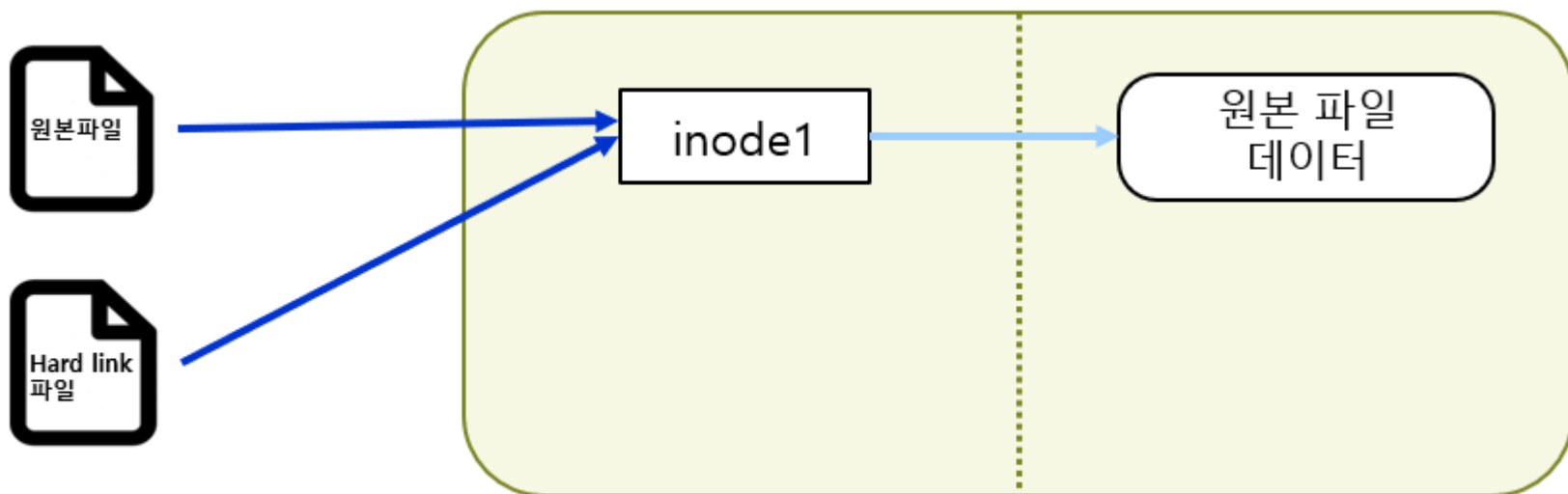
ln (2/6)

- **hard link**

- usage: ln [원본파일] [생성할 하드 링크 파일]

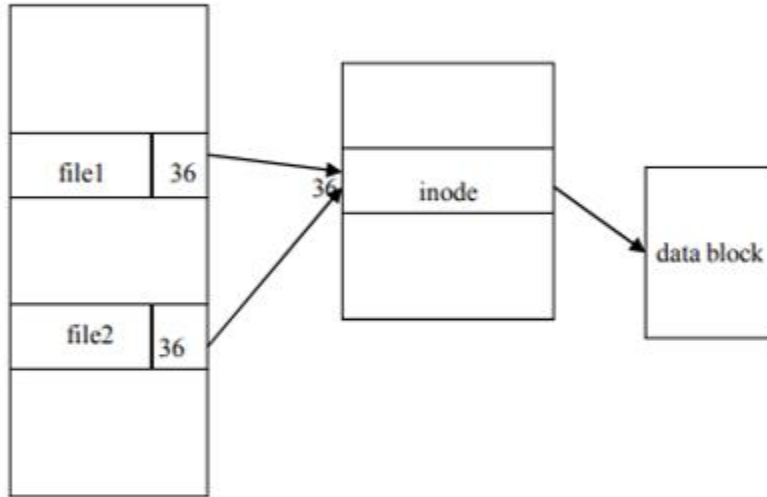
사용자에게 보여지는 디렉터리

내부적으로 동작

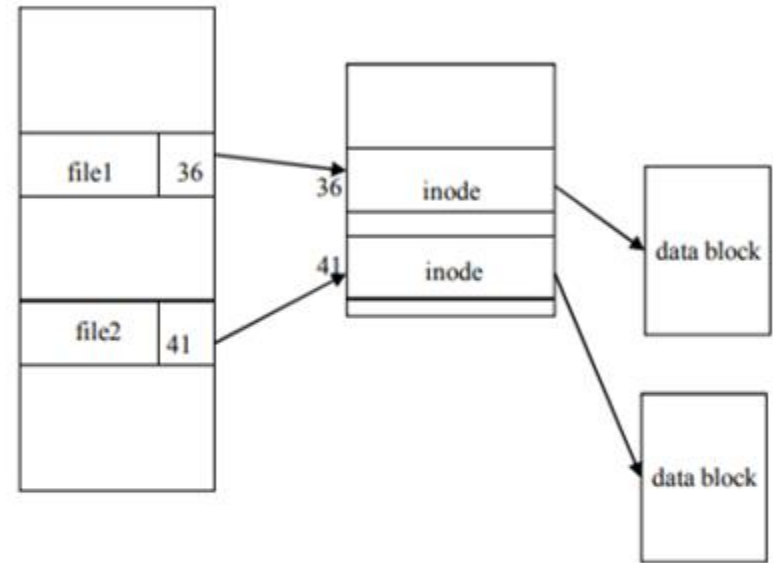


In (3/6)

- In(hard link) vs. cp



\$ ln file1 file2



\$ cp file1 file2

```
sslab@ubuntu:~/work/SP_lab$ ls
fileA.txt
sslab@ubuntu:~/work/SP_lab$ cat fileA.txt
This is file A
sslab@ubuntu:~/work/SP_lab$ ln fileA.txt fileB.txt
sslab@ubuntu:~/work/SP_lab$ cat fileB.txt
This is file A
sslab@ubuntu:~/work/SP_lab$ vi fileB.txt
sslab@ubuntu:~/work/SP_lab$ cat fileA.txt
This is file B after the change.
sslab@ubuntu:~/work/SP_lab$ cat fileB.txt
This is file B after the change.
sslab@ubuntu:~/work/SP_lab$
```

```
sslab@ubuntu:~/work/SP_lab$ cat fileC.txt
This is file C
sslab@ubuntu:~/work/SP_lab$ cp fileC.txt fileD.txt
sslab@ubuntu:~/work/SP_lab$ cat fileD.txt
This is file C
sslab@ubuntu:~/work/SP_lab$ vi fileD.txt
sslab@ubuntu:~/work/SP_lab$ cat fileC.txt
This is file C
sslab@ubuntu:~/work/SP_lab$ cat fileD.txt
This is file D after the change.
sslab@ubuntu:~/work/SP_lab$
```

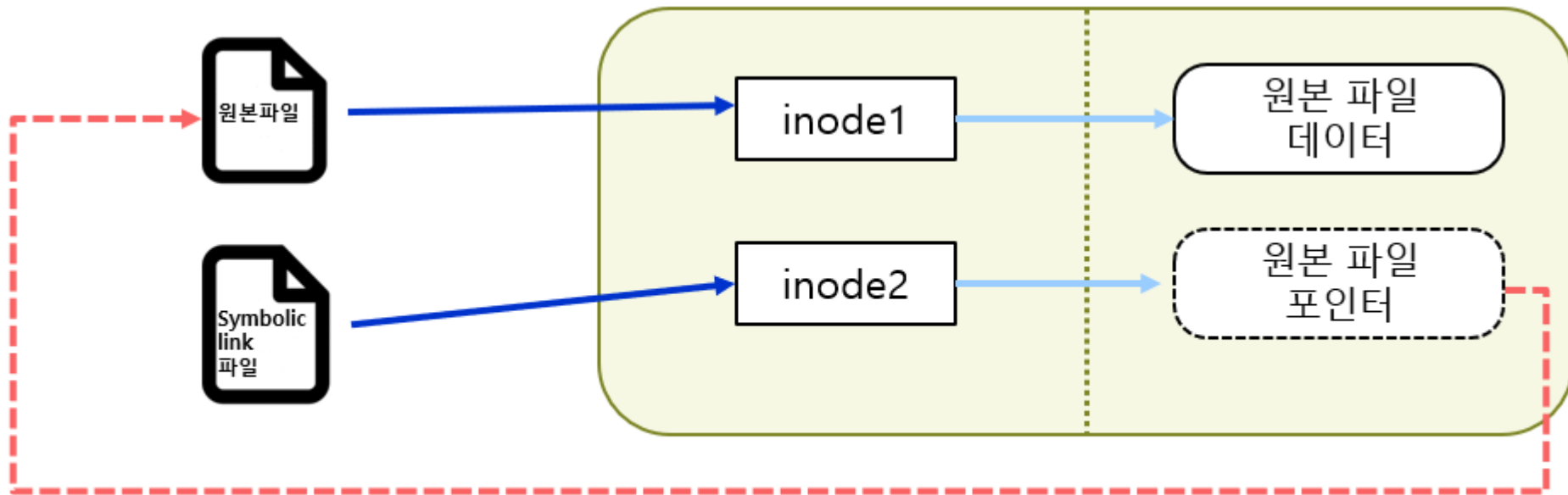

In (4/6)

- **Symbolic link**

- usage: `ln -s [원본파일] [생성할 심볼릭 링크 파일]`

사용자에게 보여지는 디렉터리

내부적으로 동작



In (5/6)

- **Symbolic link**

- usage: `ln -s [원본파일] [생성할 심볼릭 링크 파일]`
- e.g.

```
sslab@ubuntu:~/work/SP_lab$ cat fileC.txt
This is file C
sslab@ubuntu:~/work/SP_lab$ ln -s fileC.txt fileE.txt
sslab@ubuntu:~/work/SP_lab$ ls -l
total 16
-rw-rw-r-- 2 sslab sslab 32 Mar 23 12:25 fileA.txt
-rw-rw-r-- 2 sslab sslab 32 Mar 23 12:25 fileB.txt
-rw-rw-r-- 1 sslab sslab 15 Mar 23 07:42 fileC.txt
-rw-rw-r-- 1 sslab sslab 33 Mar 23 12:26 fileD.txt
lrwxrwxrwx 1 sslab sslab  9 Mar 23 12:34 fileE.txt -> fileC.txt
sslab@ubuntu:~/work/SP_lab$ cat fileE.txt
This is file C
sslab@ubuntu:~/work/SP_lab$ rm fileC.txt
sslab@ubuntu:~/work/SP_lab$ cat fileE.txt
cat: fileE.txt: No such file or directory
sslab@ubuntu:~/work/SP_lab$
```

In (6/6)

- **hard link vs Symbolic link**

| hard link | symbolic link |
|--|---|
| 파일에만 링크 가능 | 파일 또는 디렉터리에 링크 할 수 있음 |
| 존재하지 않는 파일에 대해 hard link를 작성 할 수 없음 | 존재하지 않는 파일에 대해 symbolic link을 작성할 수 있음 |
| 연결되어 있는 파일인지 알기 어려움 | 연결되어 있는 파일을 찾기 용이 |
| 같은 파일 시스템 간에서만 작성 가능 | 다른 파일 시스템 간에서도 작성 할 수 있음 |
| 원본파일과 i-node 같음 | 원본파일과 i-node 다름 |

touch

- **Make an empty file or change filestamps**

- Usage : touch [OPTION]... FILE...
- e.g.

```
sslslab@ubuntu:~/work$ ls
file1.txt file2.txt file3.txt hello.txt SP_lab
sslslab@ubuntu:~/work$ touch empty.txt
sslslab@ubuntu:~/work$ ls
empty.txt file1.txt file2.txt file3.txt hello.txt SP_lab
sslslab@ubuntu:~/work$ ls -l
total 20
-rw-rw-r-- 1 sslslab sslslab  0 Mar 22 22:23 empty.txt
-rw-rw-r-- 1 sslslab sslslab 22 Mar 22 22:03 file1.txt
-rw-rw-r-- 1 sslslab sslslab 22 Mar 22 22:03 file2.txt
-rw-rw-r-- 1 sslslab sslslab 2001 Mar 22 22:03 file3.txt
-rw-rw-r-- 1 sslslab sslslab  42 Mar 22 22:03 hello.txt
drwxrwxr-x 2 sslslab sslslab 4096 Mar 22 22:04 SP_lab
sslslab@ubuntu:~/work$ touch empty.txt
sslslab@ubuntu:~/work$ ls -l
total 20
-rw-rw-r-- 1 sslslab sslslab  0 Mar 22 22:26 empty.txt
-rw-rw-r-- 1 sslslab sslslab 22 Mar 22 22:03 file1.txt
-rw-rw-r-- 1 sslslab sslslab 22 Mar 22 22:03 file2.txt
-rw-rw-r-- 1 sslslab sslslab 2001 Mar 22 22:03 file3.txt
-rw-rw-r-- 1 sslslab sslslab  42 Mar 22 22:03 hello.txt
drwxrwxr-x 2 sslslab sslslab 4096 Mar 22 22:04 SP_lab
```

ps

- **Report process status**

- Usage: ps [options]
- e.g.

```
sslab@ubuntu:~$ ps
  PID TTY          TIME CMD
 2240 pts/12        00:00:00 bash
 3500 pts/12        00:00:00 ps
sslab@ubuntu:~$ ps -ef
UID          PID    PPID  C STIME TTY          TIME CMD
root           1         0  0 Mar08 ?        00:00:01 /sbin/init auto noprompt
root           2         0  0 Mar08 ?        00:00:00 [kthreadd]
root           4         2  0 Mar08 ?        00:00:00 [kworker/0:0H]
root           6         2  0 Mar08 ?        00:00:00 [mm_percpu_wq]
root           7         2  0 Mar08 ?        00:00:00 [ksoftirqd/0]
root           8         2  0 Mar08 ?        00:00:00 [rcu_sched]
root           9         2  0 Mar08 ?        00:00:00 [rcu_bh]
root          10         2  0 Mar08 ?        00:00:00 [migration/0]
root          11         2  0 Mar08 ?        00:00:00 [watchdog/0]
```

- Useful options
 - -e : select all processes
 - -f : full format listing

exit

- Cause the shell to exit

- Usage: exit
- e.g.

```
sslab@ubuntu:~$ sudo apt-get install csh
[sudo] password for sslab:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  csh
```

```
sslab@ubuntu:~$ ps
  PID TTY          TIME CMD
 2240 pts/12        00:00:00 bash
 3979 pts/12        00:00:00 ps
sslab@ubuntu:~$ csh
% ps
  PID TTY          TIME CMD
 2240 pts/12        00:00:00 bash
 3980 pts/12        00:00:00 csh
 3981 pts/12        00:00:00 ps
% exit
% exit
sslab@ubuntu:~$ ps
  PID TTY          TIME CMD
 2240 pts/12        00:00:00 bash
 3982 pts/12        00:00:00 ps
sslab@ubuntu:~$
```


- e.g.



- | : 이전 명령어의 **output**을 다음 명령어의 **Input**으로 연결
- tail : 파일의 끝 부분부터 10개의 행 출력

```

sslab@ubuntu: ~
sslab@ubuntu:~$ ps -e | tail
6060 ?      00:00:09 kworker/u256:3
6098 ?      00:00:00 kworker/0:1
6117 pts/14   00:00:00 bash
6168 pts/13   00:00:00 vi
6182 ?      00:00:05 kworker/u256:2
6188 ?      00:00:00 kworker/1:1
6237 pts/13   00:00:01 yes
6238 ?      00:00:00 kworker/u256:1
6243 pts/14   00:00:00 ps
6244 pts/14   00:00:00 tail
sslab@ubuntu:~$ kill 6237
sslab@ubuntu:~$ ps -e | tail
6046 ?      00:00:01 kworker/1:0
6060 ?      00:00:12 kworker/u256:3
6098 ?      00:00:00 kworker/0:1
6117 pts/14   00:00:00 bash
6168 pts/13   00:00:00 vi
6182 ?      00:00:06 kworker/u256:2
6188 ?      00:00:00 kworker/1:1
6238 ?      00:00:00 kworker/u256:1
6247 pts/14   00:00:00 ps
6248 pts/14   00:00:00 tail
sslab@ubuntu:~$

```

kill (2/2)

- Send a signal to a process
 - KILL signal (-9)
 - -9 : SIGKILL (process 강제 종료)
 - e.g.

Ctrl + Z

```
ssl@ubuntu:~$ ps
  PID TTY          TIME CMD
  6117 pts/14        00:00:00 bash
  6280 pts/14        00:00:00 ps
ssl@ubuntu:~$ vi hello

[1]+  Stopped                  vi hello
ssl@ubuntu:~$ ps
  PID TTY          TIME CMD
  6117 pts/14        00:00:00 bash
  6283 pts/14        00:00:00 vi
  6288 pts/14        00:00:00 ps
ssl@ubuntu:~$ kill -9 6283
ssl@ubuntu:~$ ps
  PID TTY          TIME CMD
  6117 pts/14        00:00:00 bash
  6289 pts/14        00:00:00 ps
[1]+  Killed                  vi hello
ssl@ubuntu:~$
```


passwd

- **Update a user's authentication tokens**
 - Usage: passwd [options]
 - e.g.

```
sslab@ubuntu:~$ passwd
Changing password for sslab.
(current) UNIX password:
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
sslab@ubuntu:~$
```

uname

- **Display system information**

- Usage: `uname [options]`
- e.g.

```
sslab@ubuntu:~$ uname
Linux
sslab@ubuntu:~$ uname -r
4.15.0-46-generic
sslab@ubuntu:~$ uname -m
x86_64
sslab@ubuntu:~$ uname -a
Linux ubuntu 4.15.0-46-generic #49~16.04.1-Ubuntu SMP Tue Feb 12 17:45:24 UTC 2019 x86_64
x86_64 x86_64 GNU/Linux
```

- Useful options
 - `-r` : print the kernel release
 - `-m`: print the machine hardware name
 - `-a` : print all information

WC

- **Print newline, word, and byte count for each file**
 - Usage: `wc [options]... [FILE]...`
 - e.g.

```
ssl@ubuntu:~/work$ cat hello.txt
hello world
My Name is N~~~
How are you?
ssl@ubuntu:~/work$ wc hello.txt
 3  9 41 hello.txt
```

echo

- **Display a line of text**
 - Usage: echo [OPTION]... [STRING]...
 - Display environment variable
 - e.g.

```
sslab@ubuntu:~$ echo helloworld
helloworld
sslab@ubuntu:~$ echo $HOME
/home/sslab
sslab@ubuntu:~$ echo ~
/home/sslab
sslab@ubuntu:~$
```

alias

- Enable a replacement of a word by another string
 - e.g. `$ alias myls='ls -al'`

```
sslab@ubuntu:~/work$ myls
No command 'mysl' found, did you mean:
  Command 'tyls' from package 'terminology' (universe)
  Command 'mmls' from package 'sleuthkit' (universe)
mysl: command not found
sslab@ubuntu:~/work$ alias myls='ls -al'
sslab@ubuntu:~/work$ myls
total 28
drwxrwxr-x  3 sslab sslab 4096 Mar  9 05:21 .
drwxr-xr-x 19 sslab sslab 4096 Mar  9 05:21 ..
-rw-rw-r--  1 sslab sslab   0 Mar  9 01:25 empty.txt
-rw-rw-r--  1 sslab sslab   7 Mar  9 01:21 file2.txt
-rw-rw-r--  1 sslab sslab   8 Mar  9 01:21 file3.txt
-rw-rw-r--  1 sslab sslab  46 Mar  9 04:52 file.txt
sslab@ubuntu:~/work$ alias
alias alert='notify-send --urgency=low -i "${[ $? = 0 ]}&& echo terminal || echo error" "$(history|tail -n1|sed -e '\''s/^\s*[0-9]\+\s*//;s/[\;|\&|]\s*alert$//'\''")'
alias egrep='egrep --color=auto'
alias fgrep='fgrep --color=auto'
alias grep='grep --color=auto'
alias l='ls -CF'
alias la='ls -A'
alias ll='ls -alF'
alias ls='ls --color=auto'
alias myls='ls -al'
sslab@ubuntu:~/work$
```

grep

- Search the named input FILES (or standard input if no files are named, or the file name is given) for lines containing a match to the given PATTERN
- Usage: `grep [options] [PATTEN] [FILE...]`
- e.g.

```
sslab@ubuntu:~/work$ cat text.txt
hello world
My Name is N~~~~
How are you?
sslab@ubuntu:~/work$ grep hello text.txt
hello world
sslab@ubuntu:~/work$
```

Unix commands

| | |
|---------------------------------|---|
| File and file system management | cat · cd · chmod · chown · chgrp · cmp · cp · du · df · file · fsck · ln · ls · mkdir · mount · mv · pwd · rm · rmdir · touch |
| Process management | exit · kill · killall · nice · ps · pstree · sleep · time · top · wait |
| User management /environment | finger · mesg · passwd · su · sudo · unmae · w · wall · who · whoami · write |
| Text Processing | awk · comm · ed · ex · head · less · more · sed · sort · tail · uniq · wc · xargs |
| Shell programming | alias · echo · expr · false · printf · test · true · unset |
| Communication | inetd · netstat · ping · rlogin · traceroute |
| Searching | find · grep · strings |
| Misecellaneous | dd · lp · man · size · yes |