KWANGWOON UNIVERSITY

2025년 1학기 **시스템프로그래밍 실습 2주차**

Unix/Linux Commands

System Software Laboratory
College of Software and Convergence
Kwangwoon Univ.

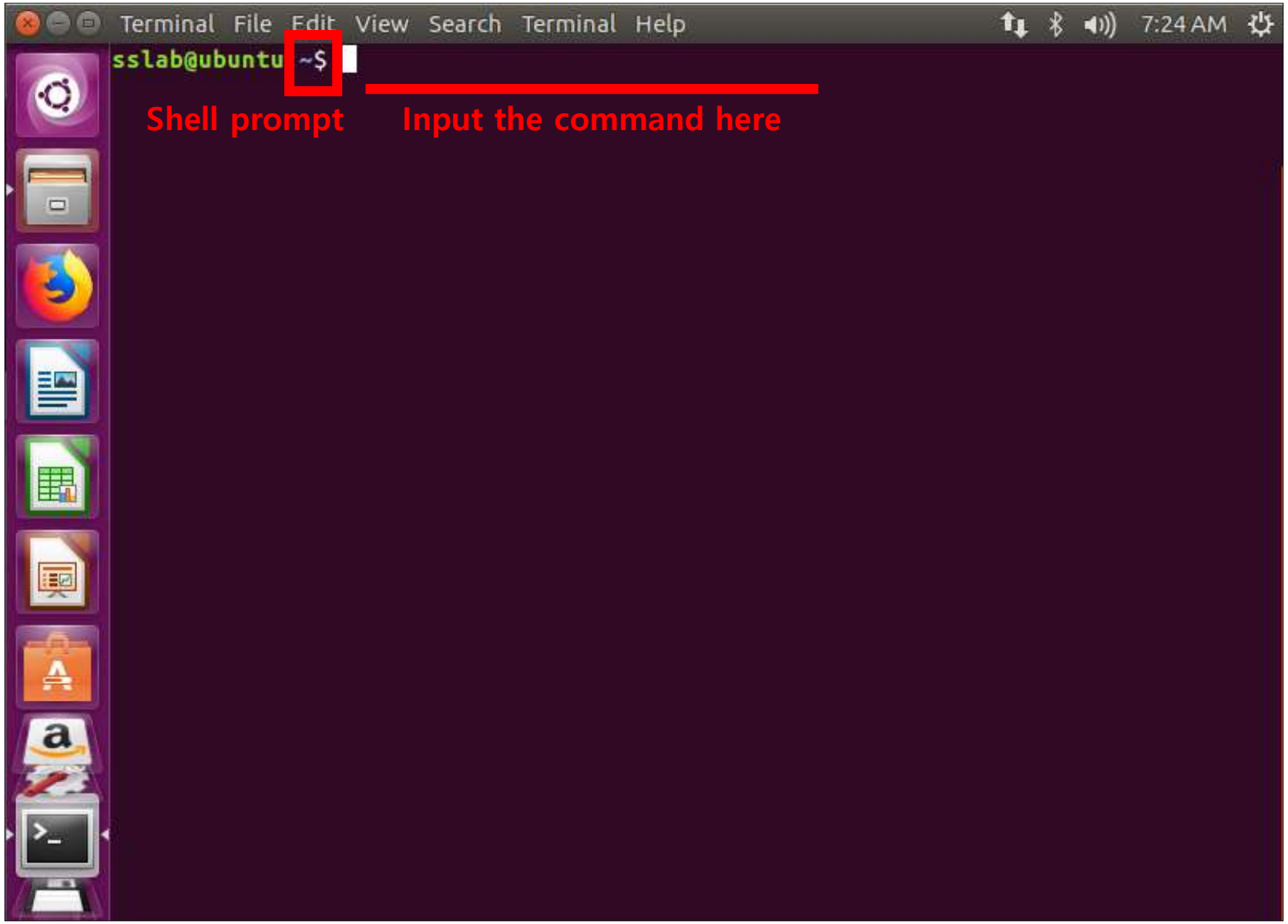
Preparation

- 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-------  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.

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 ~
sslab@ubuntu:~$ cd -
/home/sslab/work
sslab@ubuntu:~/work$
```

$ cd ~ → is equivalent to 'cd'

$ cd - → is equivalent to $OLDPWD

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,g-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
```

rmdir

- **Remove empty directories**
  - usage: rmdir [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$ rmdir 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

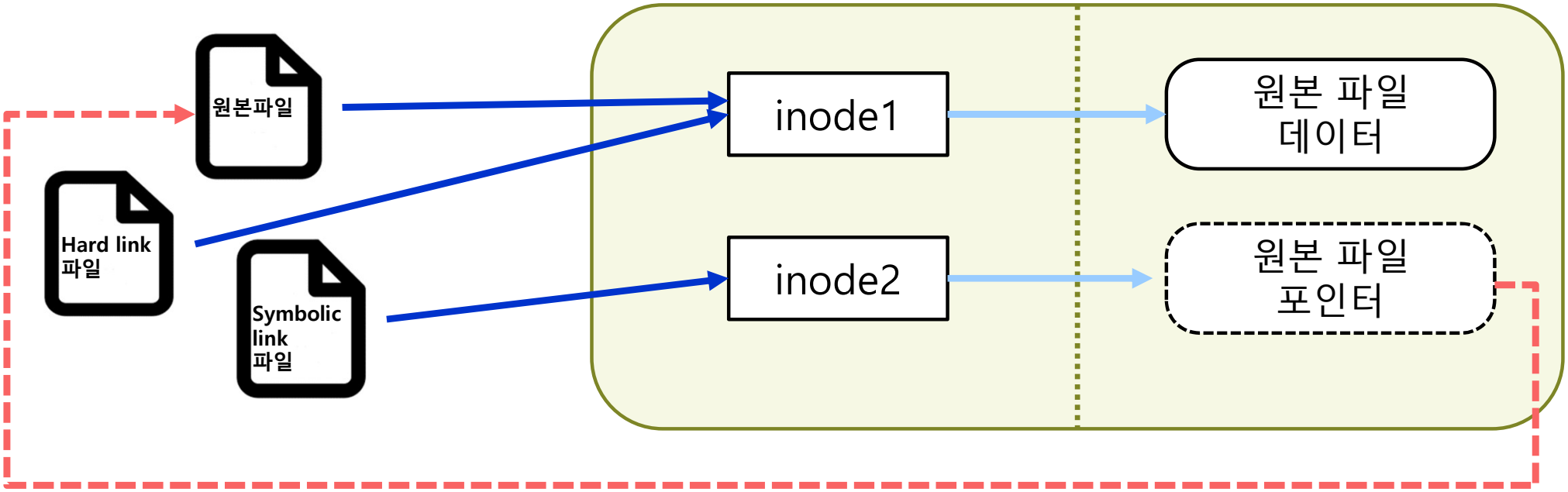
- **Move (rename) files**
  - usage: mv [OPTION]... SOURCE DEST
  - e.g.

```
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$
```

ln (1/6)

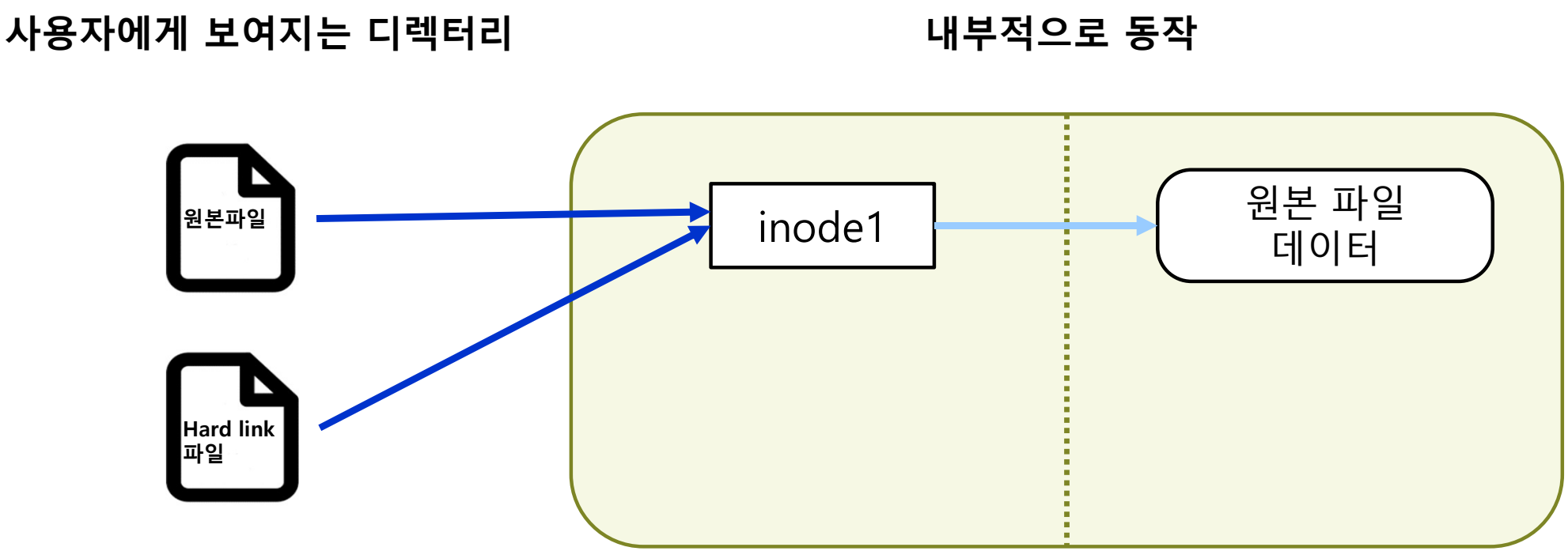
- **Make links between files**
  - Hard link, Symbolic link
  - usage: ln [OPTION]... TARGET [LINK_NAME]
  - useful option
    - -s: 심볼릭 링크 생성

사용자에게 보여지는 디렉터리 **내부적으로 동작**



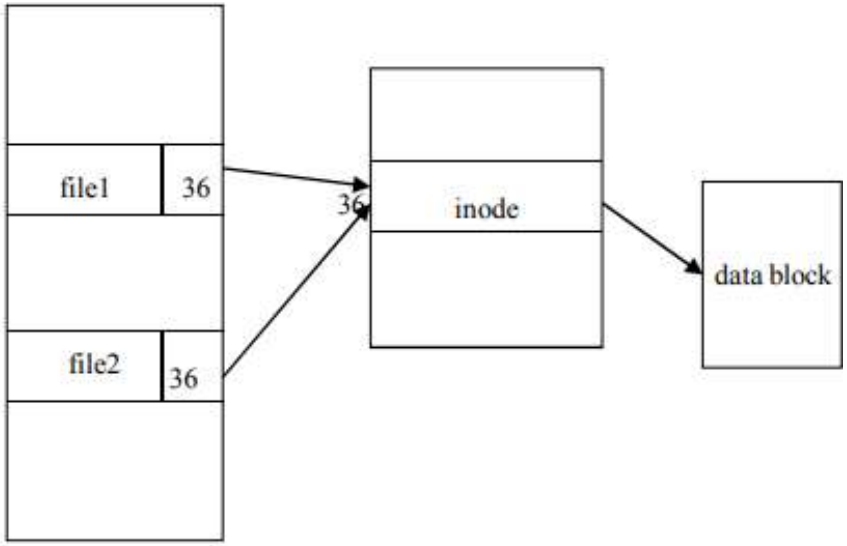
ln (2/6)

- **hard link**
  - usage: ln [원본파일] [생성할 하드 링크 파일]

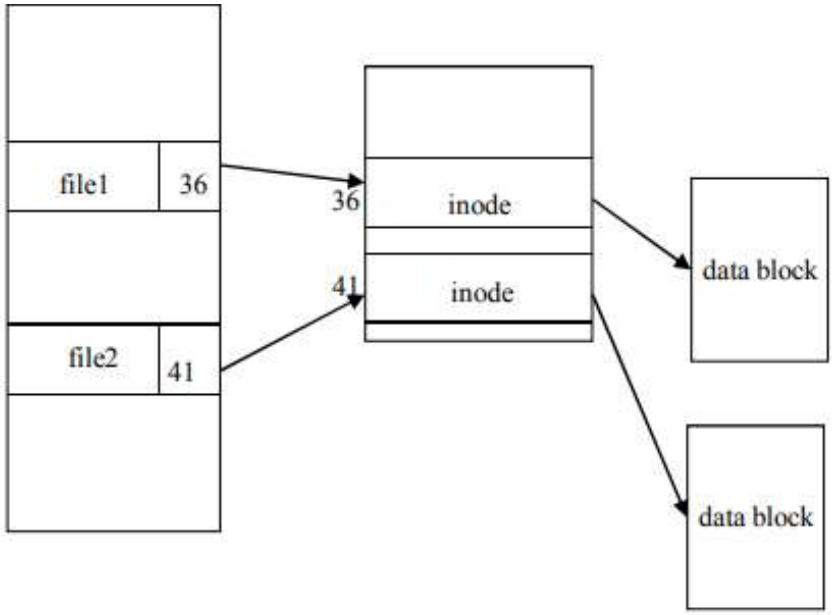


ln (3/6)

- **ln(hard link) vs. cp**



$ ln file1 file2



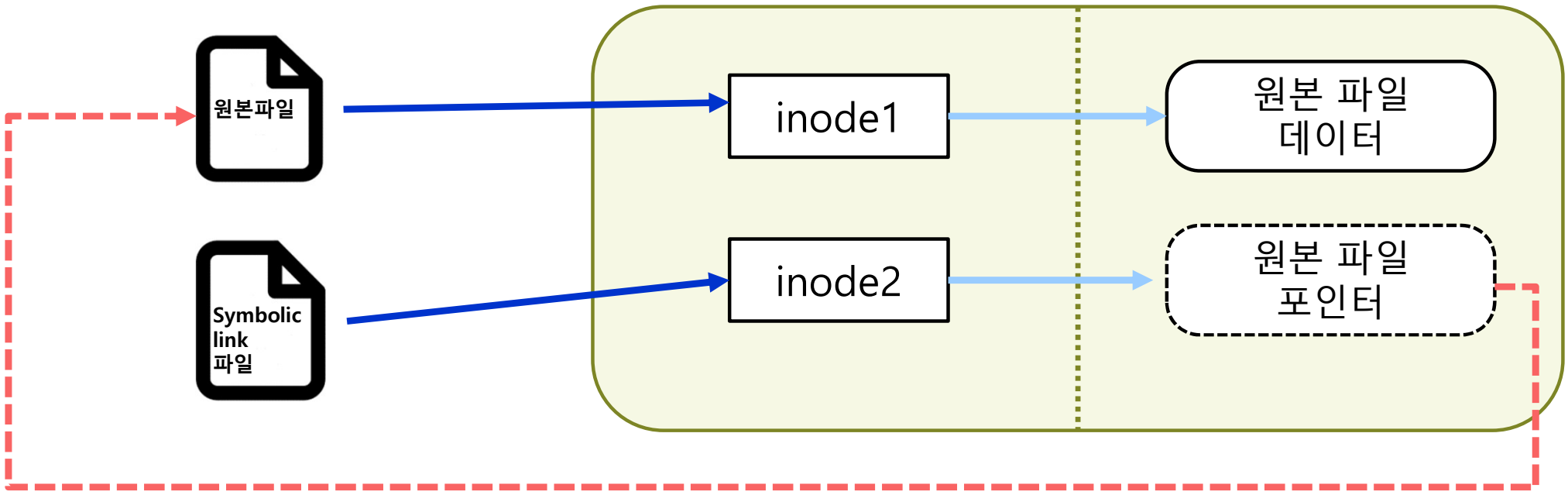
$ cp file1 file2

```
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$
```

ln (4/6)

- **Symbolic link**
  - usage: ln -s [원본파일] [생성할 심볼릭 링크 파일]



ln (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$
```

ln (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.

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

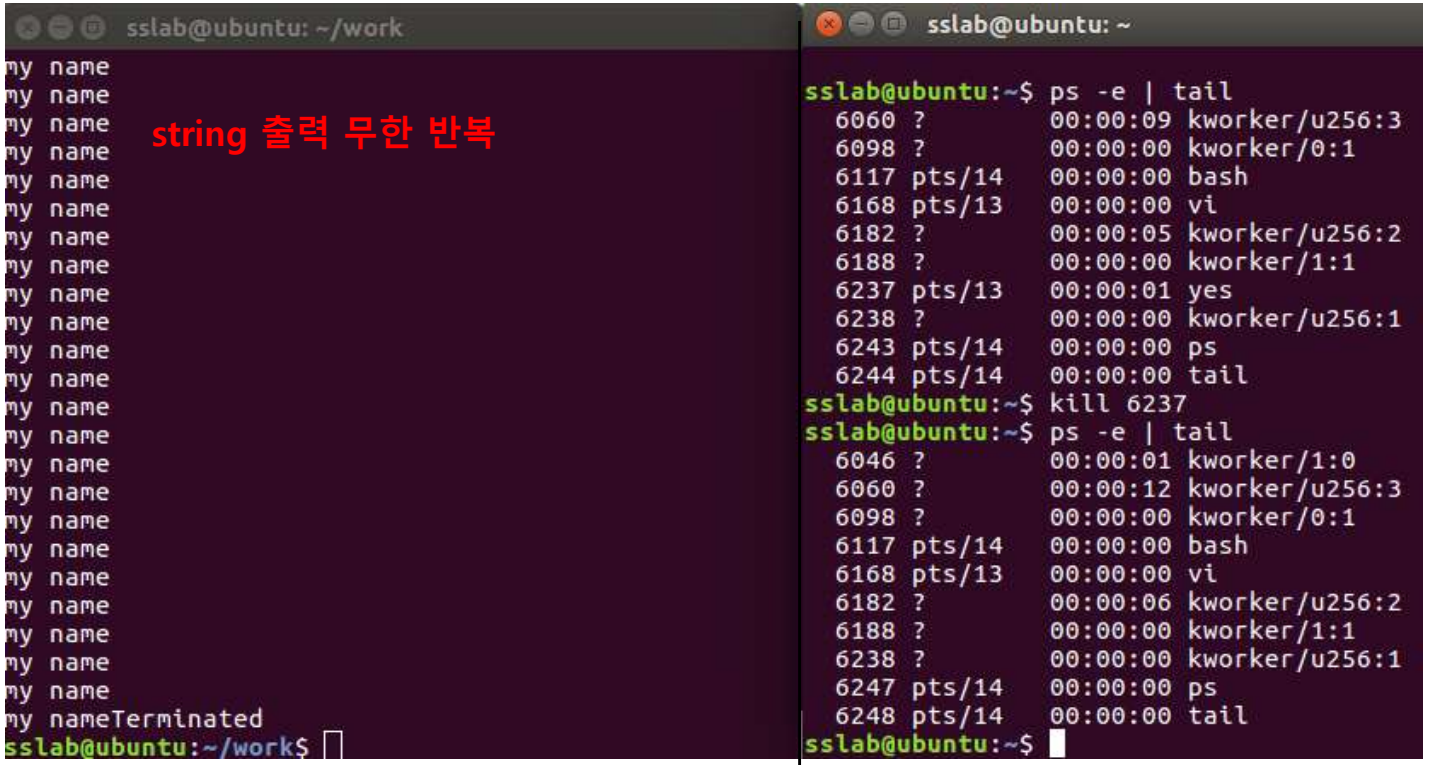
```
sslab@ubuntu:~$ ps
   PID TTY          TIME CMD
  2240 pts/12   00:00:00 bash
  3979 pts/12   00:00:00 ps
sslab@ubuntu:~$ csh
% ps
   PID TTY          TIME CMD
  2240 pts/12   00:00:00 bash
  3980 pts/12   00:00:00 csh
  3981 pts/12   00:00:00 ps
% exit
% exit
sslab@ubuntu:~$ ps
   PID TTY      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

kill (1/2)

- **Send a signal to a process**
  - Usage: kill [-s signal | -p] [-a] [--] pid ...
    - The default signal for kill is TERM. (i.e. Terminate process)
  - e.g.

| : 이전 명령어의 output을 다음 명령어의 Input으로 연결

tail : 파일의 끝 부분부터 10개의 행 출력



kill (2/2)

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

Ctrl + Z

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

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

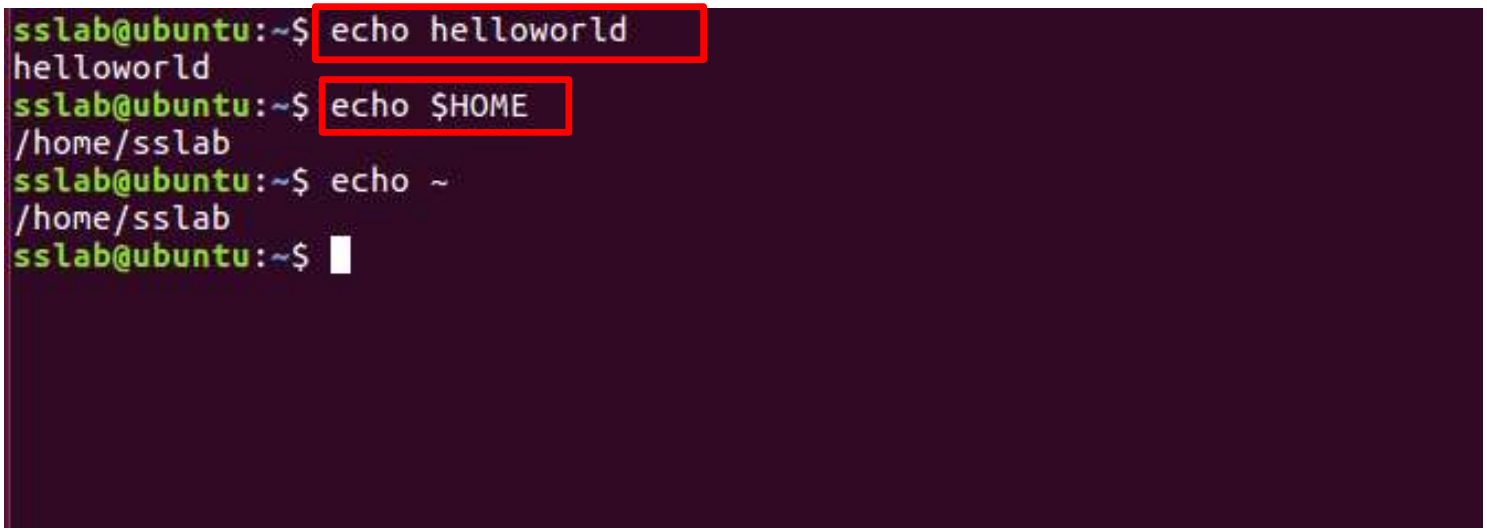
wc

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

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



alias

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

```
sslab@ubuntu:~/work$ myls
No command 'myls' found, did you mean:
 Command 'tyls' from package 'terminology' (universe)
 Command 'mmls' from package 'sleuthkit' (universe)
myls: 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 "$([ $? = 0 ] && echo terminal || echo er
ror)" "$(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.

Unix commands

File and file system management	cat · cd · chmod · chown · charp · 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

KWANGWOON UNIVERSITY

2025년 1학기 **시스템프로그래밍 & 시스템 프로그래밍 실습**

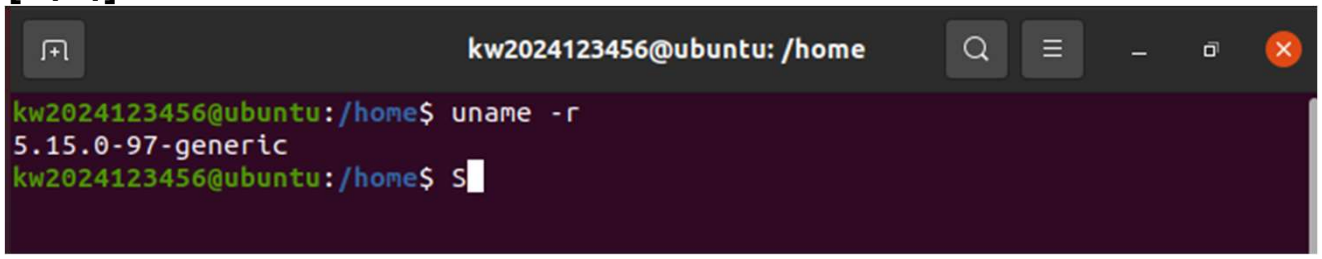
Basic

System Software Laboratory
College of Software and Convergence
Kwangwoon Univ.

Contents

- Basic-1. Ubuntu Installation
- Basic-2. Linux Commands
- Basic-3. Linux based Programming
- Report Requirements

Basic-1. Ubuntu Installation

- **과제 내용**
  - Vmware 설치 과정 및 Ubuntu를 설치하는 과정을 캡처하고 설명
- **조건**
  - 설치 하는 방법(multi-booting, virtual machine, …)은 무관
    - 단, Virtual machine을 사용할 경우, tool(VMWare, …) 설치 과정은 과제에서 제외
  - **Ubuntu 로그인 계정 설정 시 본인 학번 앞에 'kw' 입력 후 학번 입력**
    - **ex) kw2024123456**
    - **$uname –r 명령어 실행**
  - **터미널 화면 캡처하여 보고서에 첨부**
  - **[예시]**
  - 

- 실습 강의자료 참고할 것.
  - [실습강의자료]1. Introduction

Basic-2. Linux Commands

- **과제 내용**
  - 실습 시간에 배운 Linux 명령어를 사용하고, 이를 캡처하고 설명

- **조건**
  - 아래의 명령어를 **모두** 사용하고, 과정을 **캡처** 및 **핵심 내용에 대한 설명 필수**
  - **man, ls, pwd, cd , cat, chmod, mkdir, rmdir, rm, cp, mv, ln, touch, ps, exit, kill, ps, passwd, uname, wc, echo, alias, grep**

  - **다음 아래 명령어는 과제 수행 시 지정한 옵션 반드시 사용**
    - **ls, ln, uname**
      - **강의 자료에 명시 된 옵션만 사용**
    - **rm**
      - **-r 옵션만 사용**

- 실습 강의자료 참고할 것.
  - [실습강의자료]2. Unix/Linux commands

Basic-3. Linux based Programing

- **과제 내용**
  - 실습 시간에 배운 vi, make 사용하고, 이를 캡처하고 설명
- **조건**
  - Vi editor
    - **각 단계 수행 후 사용한 명령어 설명과 결과 화면 캡처 필수**
      1. 1라인: 본인 학번, 2라인: 본인 이름, 3라인: Kwangwoon University 입력
      2. Kwangwoon University 복사 후 본인 학번 다음 라인에 복사 붙어 놓기
      3. 편집기에 라인 표시
      4. 본인 학번을 파일 이름으로 저장
  - Make
    - 본인의 학번, 이름이 출력되는 c파일 Makefile로 컴파일
    - kw_hello.c : 본인 학번과 이름이 출력하는 프로그램(printf() 사용)
    - 실행 파일명: hello
    - **실행 결과, Makefile, kw_hello.c 캡처 필수**
- 실습 강의자료 참고할 것.
  - [실습강의자료]3. Linux-based Programming

Report Requirements

- **Ubuntu 20.04.6 Desktop 64bits 환경에서 채점**
- **Copy 발견 시 0점 처리**
- **보고서 구성**
  - **보고서 표지**
    - 수업 명, 과제 이름, 담당 교수님, 학번, 이름 필히 명시
      - 과제 이름 ➔ Basic
  - **과제 내용**
    - Introduction
      - 과제 소개 - 4줄 이상(background 제외) 작성
    - 결과화면
      - 수행한 내용을 캡처 및 설명
    - 고찰
      - 과제를 수행하면서 느낀점 작성
    - Reference
      - 과제를 수행하면서 참고한 내용을 구체적으로 기록
      - 강의자료만 이용한 경우 생략 가능

Report Requirements

- **Softcopy Upload**
  - 제출 파일
    - 보고서를 **pdf로 변환**하여 제출
    - **보고서 이름은 *Basic_수강분류코드_학번_이름* 으로 작성**

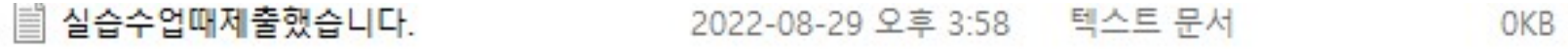
수강요일	이론1 월5수6	이론2 목4	실습1 목12	실습2 금12	실습3 금34
수강분류 코드	A	B	C	D	E

    - **예시1 –이론1만 수강하는 학생인 경우**
      - **Basic_A_2024123456_홍길동.pdf**
    - **예시2 –이론1 & 실습1을 수강하는 학생인 경우**
      - **이론 :** 실습수업때제출했습니다. 2022-08-29 오후 3:58 텍스트 문서 0KB
      - **실습 : Basic_C_2024123456_홍길동.pdf**
    - **예시3 –실습1만 수강하는 학생인 경우**
      - **Basic_C_2024123456_홍길동.pdf**

  - **양식에 따르지 않을 시 감점**

Report Requirements

- **실습 수업을 수강하는 학생인 경우**
  - 실습 과목에 과제를 제출
  - 이론 과목에 간단한 .txt 파일로 제출



    - **이론 과목에 .txt 파일 미 제출 시 감점**

- **과제 제출**
  - **KLAS – 강의 과제 제출**
  - **2025년 3월 27일 목요일 23:59까지 제출**
    - **딜레이 받지 않음**
      - 제출 마감 시간 내 미제출시 해당 과제 **0점 처리**
      - 교내 서버 문제 발생 시, 메일로 과제 제출 허용(**제출 기한 내**)