

# ROS2 강습회

대한기계학회 IT융합부문

명지대학교 최동일

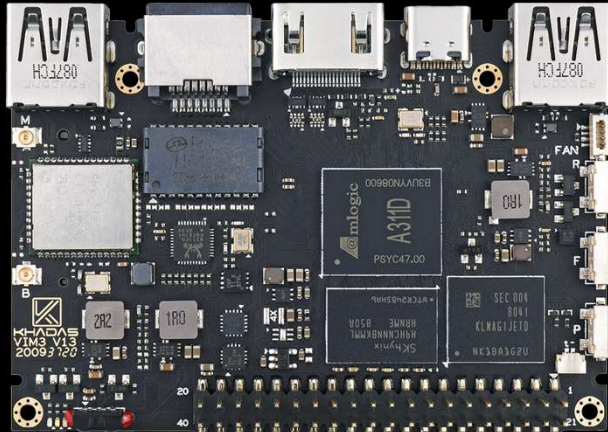
[dongilc@mju.ac.kr](mailto:dongilc@mju.ac.kr)

2023. 08. 11

# 2교시

리눅스 운영체제 기본 명령어 사용법 실습

# VIM3 SBC (Single Board Computer)



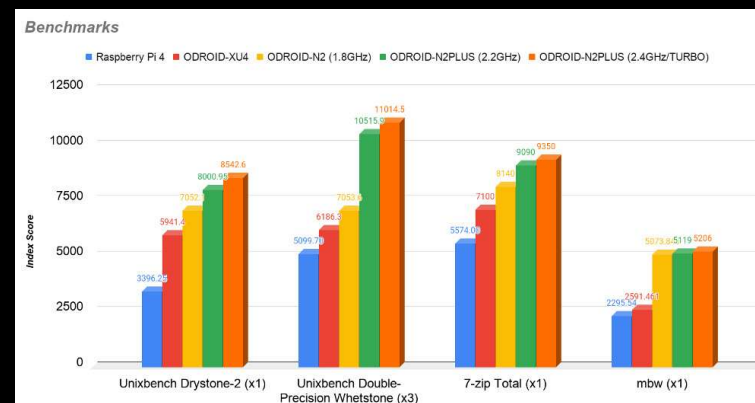
<https://www.khadas.com/vim3>



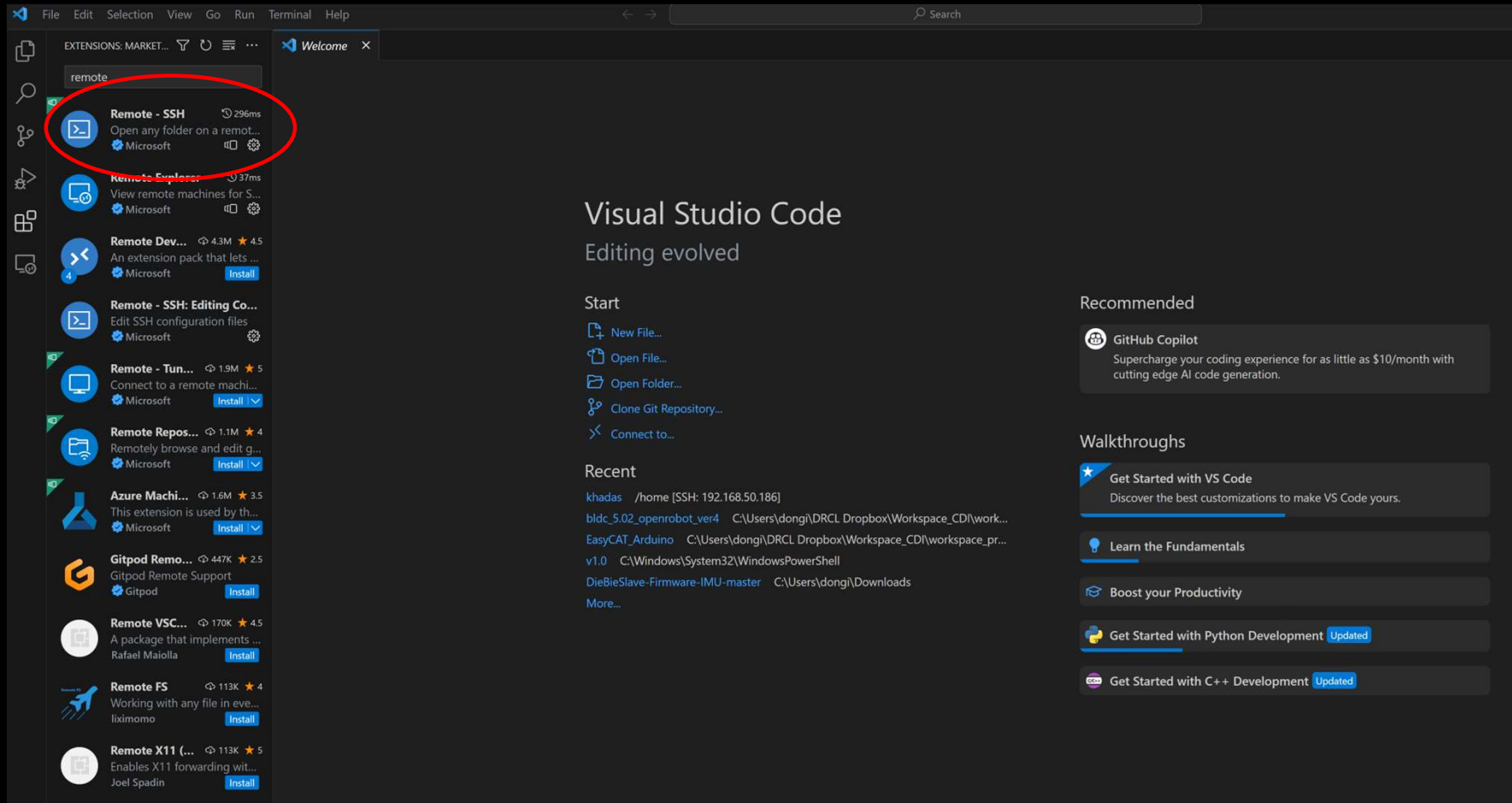
VIM3 Pro (Left), Raspberry Pi 4 (Right)



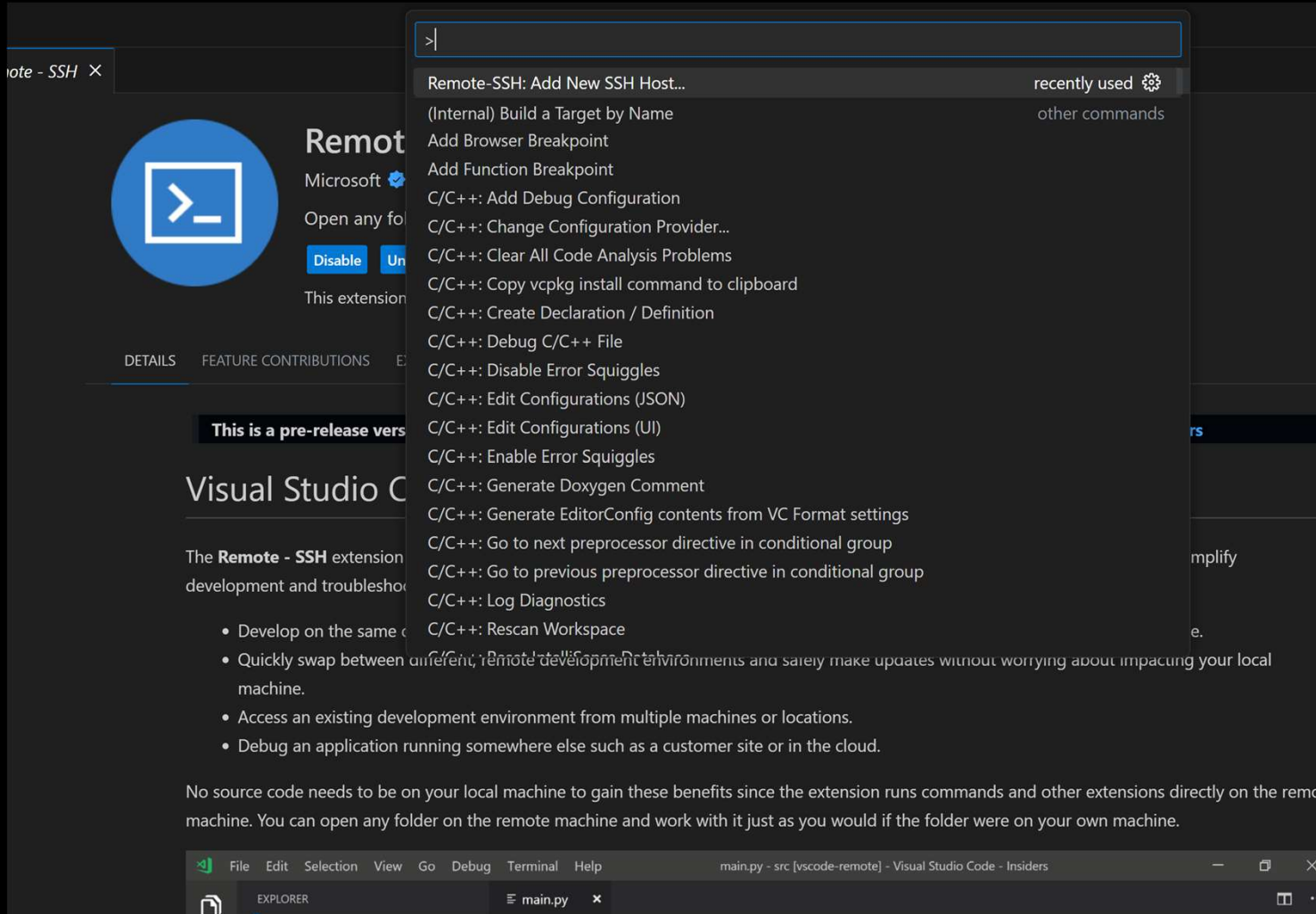
Odroid-XU4



# VS Code 를 이용하여 리눅스 환경 원격접속



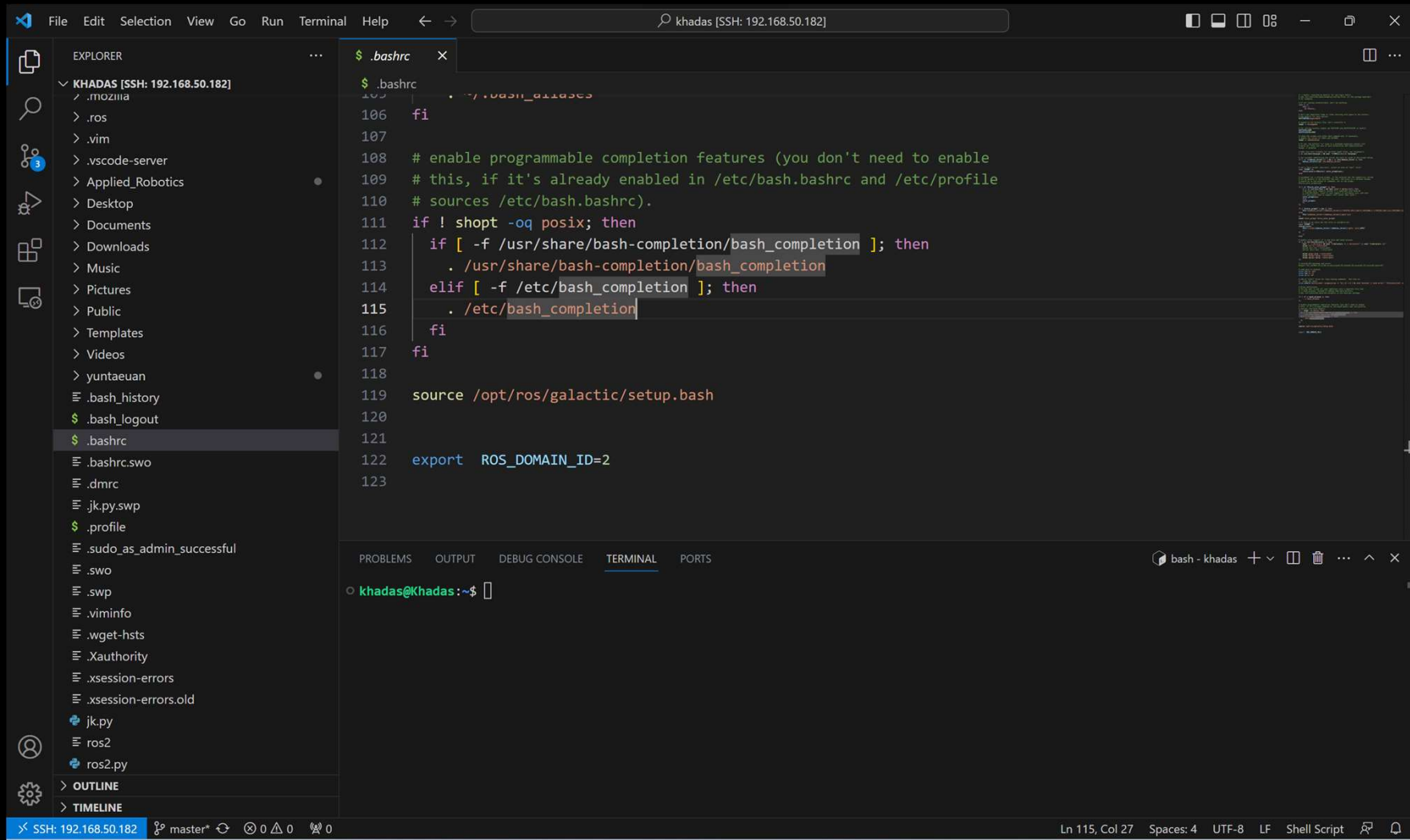
# VS Code 를 이용하여 리눅스 환경 원격접속




ssh [khadas@192.168.50.xxx](mailto:khadas@192.168.50.xxx)





비번 khadas

# VS Code 를 이용하여 리눅스 환경 원격접속



# MobaXterm을 이용하여 리눅스 환경 원격접속

 MobaXterm


Home Demo Features **Download** Plugins Help Contact    


Customer area Buy

---

## MobaXterm Home Edition

Download MobaXterm Home Edition (current version):

 MobaXterm Home Edition v23.2  
(Portable edition)

 MobaXterm Home Edition v23.2  
(Installer edition)


Download previous stable version: [MobaXterm Portable v23.1](#) [MobaXterm Installer v23.1](#)

You can also get early access to the latest features and improvements by downloading MobaXterm Preview version:

MobaXterm Preview Version

By downloading MobaXterm software, you accept [MobaXterm terms and conditions](#)

You can download the third party plugins and components sources [here](#)



If you use MobaXterm inside your company, you should consider subscribing to [MobaXterm Professional Edition](#): your subscription will give you access to professional support and to the "Customizer" software. This customizer will allow you to generate personalized versions of MobaXterm including your own logo, your default settings and your welcome message.  
Please [contact us](#) for more information.

<https://mobaxterm.mobatek.net/download-home-edition.html>

## 1 환경설정

### 1.1 터미널

## 2 Ubuntu의 폴더 관련 기본 명령어

### 2.1 폴더를 만들기 - mkdir

### 2.2 폴더를 이동하기 - cd

### 2.3 삭제 명령 - rm

## 3 bashrc

### 3.1 Shell 셸

### 3.2 .bashrc

### 3.3 .bashrc에 명령 입력해 두기

## 4 .bashrc에서 alias 설정

### 4.1 alias 설정

### 4.2 galactic 설정을 alias로 지정하기

### 3.3 source/~.bashrc도 alias로 지정하기

## 5 ROS2 도메인 설정



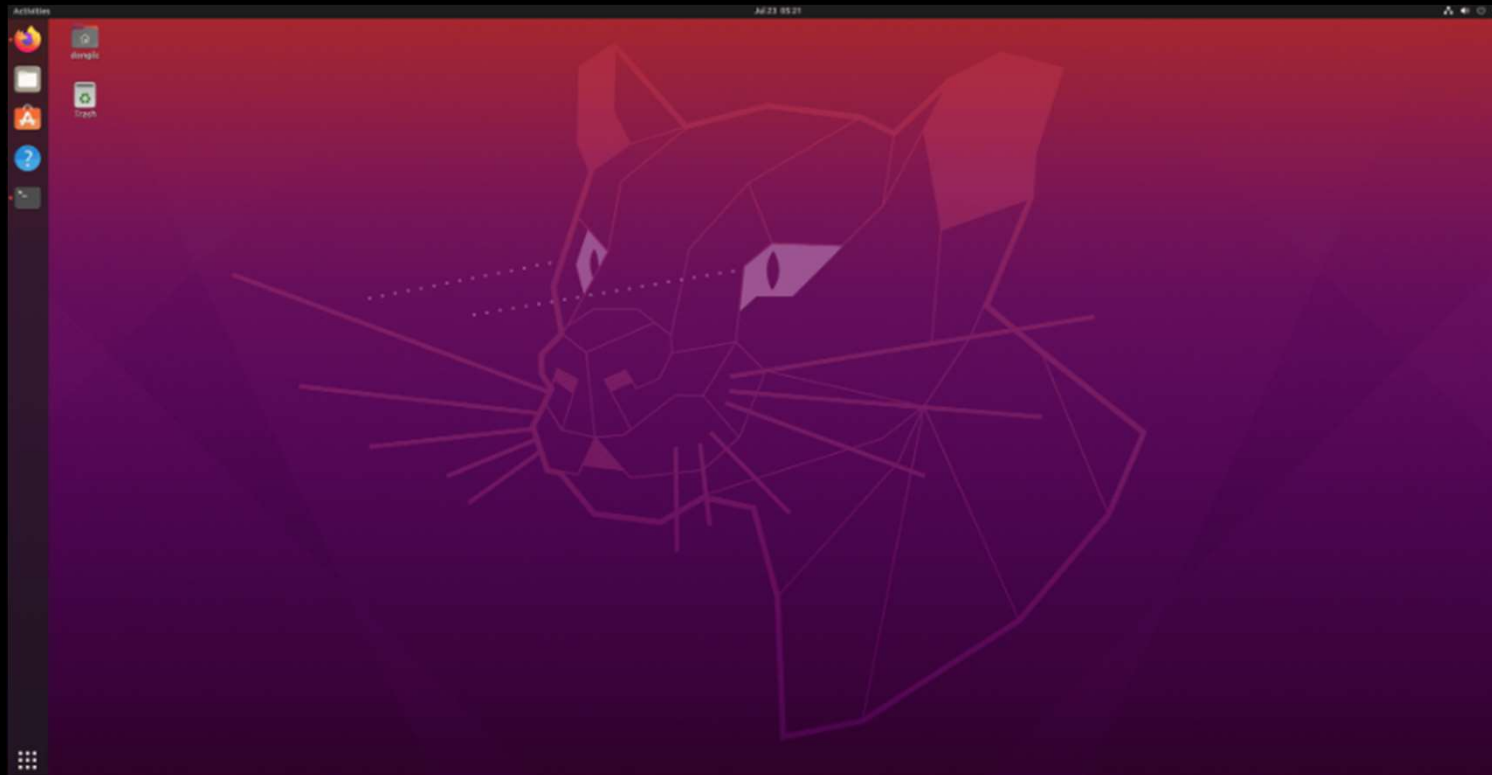
# 환경설정

1

터미널

# 터미널

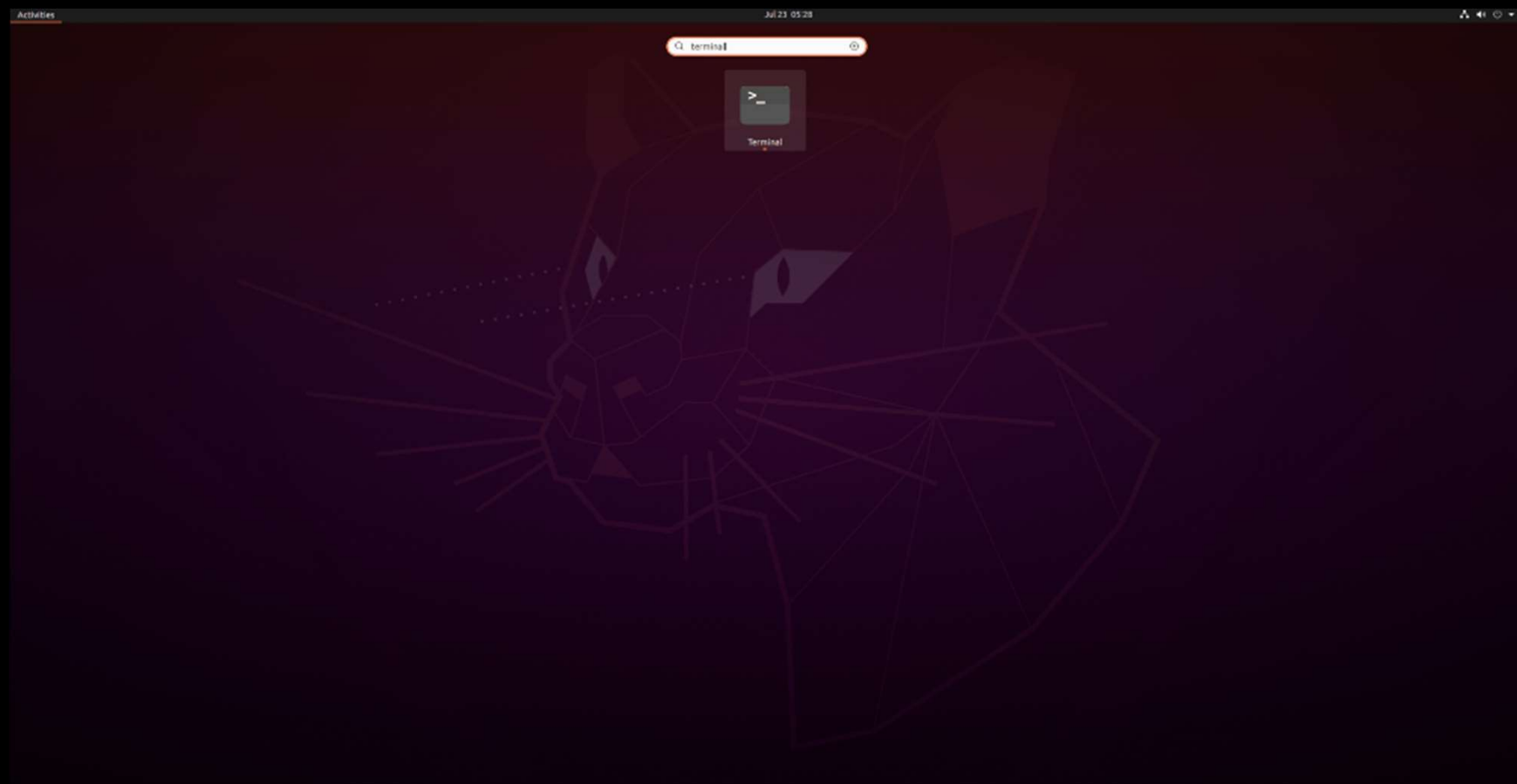
## 기본 터미널 실행하기



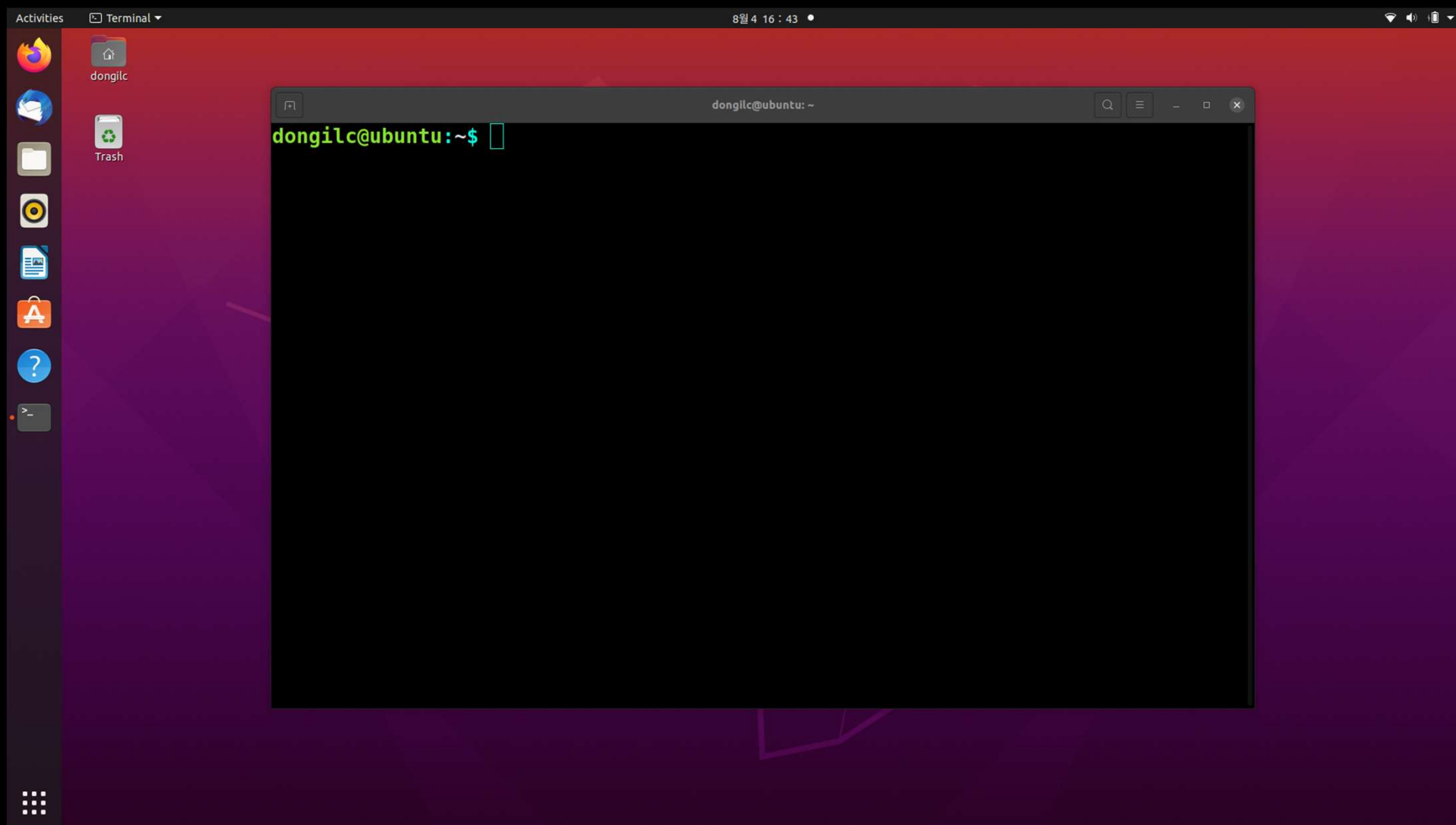
[우분투 20.04의 바탕화면]



[Show Application 버튼의 위치]



[Terminal 아이콘을 검색을 통해 찾은 경우]



[우분투에서 Terminal을 실행한 모습]

## 단축키

**Ctrl+Alt+T**

[View more](#)

- **Ctrl+Alt+T** 키를 사용해서 터미널 실행 가능

# Ubuntu의 폴더 관련 기본 명령어

cd

폴더를 이동하는 명령어

1

mkdir

폴더를 만드는 명령어

2

3

rm

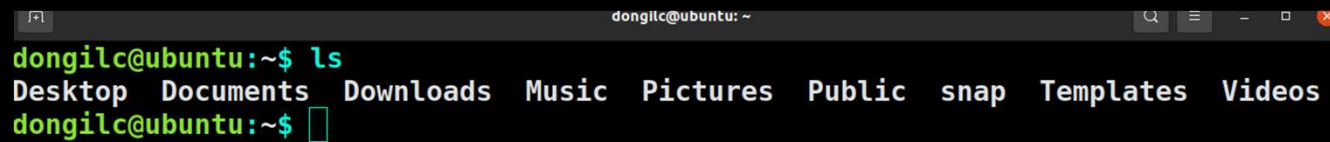
폴더를 삭제하는 명령어

# 폴더 만들기- mkdir

- 터미널을 열고 ls 명령으로 현재 폴더의 상황을 확인

ls

[View more](#)



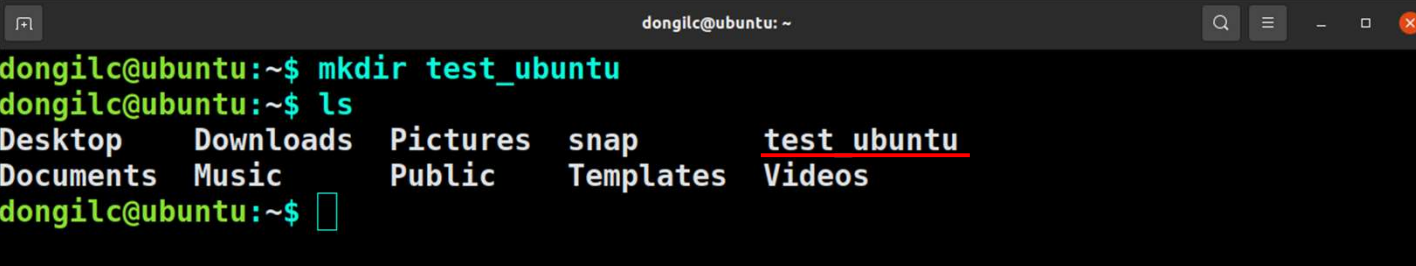
```
dongilc@ubuntu: ~  
dongilc@ubuntu:~$ ls  
Desktop Documents Downloads Music Pictures Public snap Templates Videos  
dongilc@ubuntu:~$
```

[처음 터미널을 열고 ls 명령을 입력한 하면]



- mkdir로 test\_ubuntu라는 폴더 생성

```
mkdir test_ubuntu
```

A terminal window titled 'dongilc@ubuntu: ~' with standard window controls. It shows the execution of 'mkdir test\_ubuntu' followed by 'ls', which lists the new directory among others. The 'test ubuntu' entry in the ls output is underlined.

```
dongilc@ubuntu:~$ mkdir test_ubuntu
dongilc@ubuntu:~$ ls
Desktop    Downloads  Pictures   snap       test ubuntu
Documents Music      Public     Templates  Videos
dongilc@ubuntu:~$
```

[홈 폴더에 test\_ubuntu라는 이름으로 폴더를 만드는 장면]

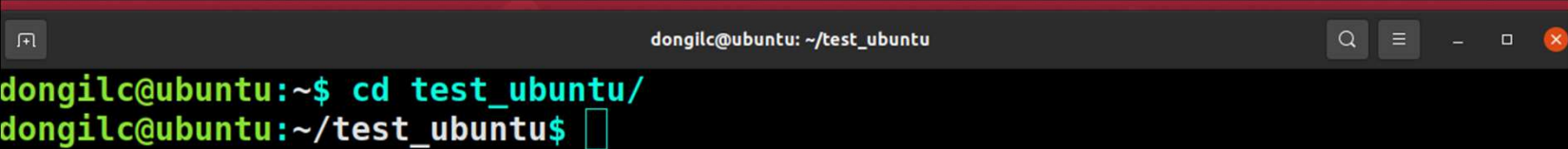
# Ubuntu Tip - <TAB>

<TAB>키는 입력할 나머지 부분을 완성해줌.

- **test\_ubuntu** 폴더를 입력하고 싶을때 '**tes**' 까지만 입력하고 <TAB>키를 누르면 나머지는 자동으로 완성
- **cd**명령 후에 한 칸 띄어고 <TAB>키를 두 번 연속해서 누르면 입력할 수 있는 목록이 나타남

# 폴더를 이동하기 - cd

- 폴더를 이동하고 싶으면 **cd** 명령을 사용함
- 폴더를 이동하기 위해서는 **cd** 명령으로 **test\_ubuntu** 를 지정

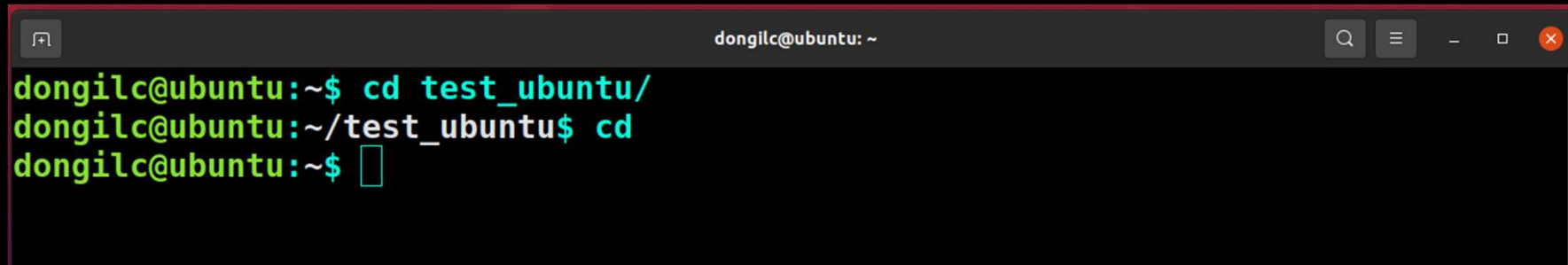


```
dongilc@ubuntu: ~$ cd test_ubuntu/  
dongilc@ubuntu: ~/test_ubuntu$
```

A terminal window with a dark background and a red title bar. The title bar contains the text 'dongilc@ubuntu: ~/test\_ubuntu' and standard window controls (search, menu, zoom, close). The terminal shows the command 'cd test\_ubuntu/' being executed, changing the prompt from '~\$' to '~/test\_ubuntu\$'.


[cd test\_ubuntu 명령을 실행한 한 화면]

- **cd** 명령을 사용 하거나 **cd~** 명령을 사용하면 HOME 폴더로 이동함

A terminal window titled 'dongilc@ubuntu: ~' with search, menu, and window control icons in the title bar. The terminal shows the following commands and output:

```
dongilc@ubuntu:~$ cd test_ubuntu/  
dongilc@ubuntu:~/test_ubuntu$ cd  
dongilc@ubuntu:~$
```

[ cd 명령만 실행한 모습]

A terminal window titled 'dongilc@ubuntu: ~' with search, menu, and window control icons in the title bar. The terminal shows the following commands and output:

```
dongilc@ubuntu:~$ cd test_ubuntu/  
dongilc@ubuntu:~/test_ubuntu$ cd ~  
dongilc@ubuntu:~$
```

[cd~ 명령을 실행한 모습]

# 삭제 명령 - rm

- 파일이나 폴더를 삭제하는 명령 **rm**
- 폴더를 삭제하는 경우 **r** 옵션을 사용
- **f** 옵션을 사용하면 경고 없이 삭제

```
dongilc@ubuntu: ~  
dongilc@ubuntu:~$ ls  
Desktop    Downloads  Pictures  snap      test_ubuntu  
Documents  Music      Public    Templates Videos  
dongilc@ubuntu:~$ rm test_ubuntu/  
rm: cannot remove 'test_ubuntu/': Is a directory  
dongilc@ubuntu:~$
```

[rm 명령을 그냥 폴더에 사용하여 에러가 난 화면]

```
dongilc@ubuntu: ~  
dongilc@ubuntu:~$ ls  
Desktop    Downloads  Pictures  snap      test_ubuntu  
Documents  Music      Public    Templates Videos  
dongilc@ubuntu:~$ rm -r test_ubuntu/  
dongilc@ubuntu:~$ ls  
Desktop Documents Downloads Music Pictures Public snap Templates Videos  
dongilc@ubuntu:~$
```

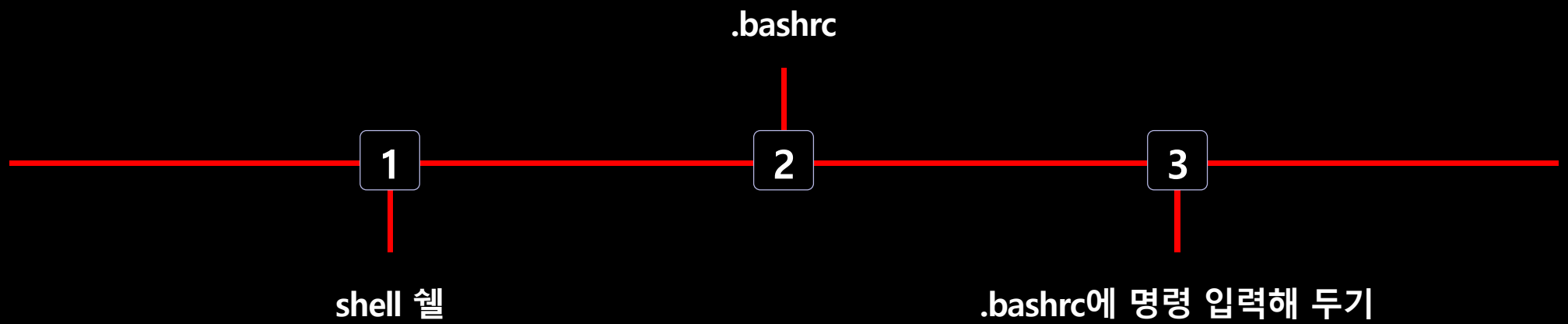
[rm에 -r 옵션을 붙여 폴더를 삭제하는 화면]

- 폴더에 유저가 삭제할 권한이 없는 경우 **sudo(관리자 권한)**를 붙여 삭제

`rm -rf ./*` -> 현재 폴더 하위에 있는 내용 모두 삭제

`sudo rm -rf /` -> root 이하의 모든 내용 삭제

# bashrc

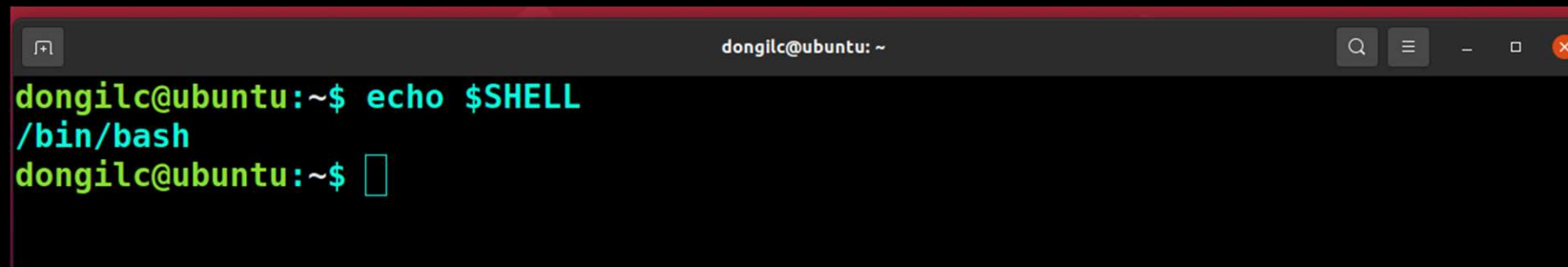


# shell 셸

- 내가 사용하는 셸의 종류가 궁금하면 **echo**명령으로 **Shell**을 확인하면 됨.

**echo \$SHELL**

[View more](#)

A terminal window titled 'dongilc@ubuntu: ~' with standard window controls. The prompt is 'dongilc@ubuntu:~\$'. The command 'echo \$SHELL' is entered and executed, resulting in the output '/bin/bash'. The prompt then returns to 'dongilc@ubuntu:~\$' with a cursor.

```
dongilc@ubuntu:~$ echo $SHELL
/bin/bash
dongilc@ubuntu:~$
```

[echo \$SHELL로 현재 shell을 확인하는 장면]



# .bashrc

- 로그인한 사용자 개별로 지정한 설정을 저장해 두는 것이 **bashrc** 파일임
- 파일 이름 앞에 **점(.)**이 붙어서 시작되면 숨긴 파일
- 텍스트에디터로 **.bashrc**를 열고 싶으면 **vim ~/.bashrc**를 입력

```
vim ~/.bashrc
```

```
~/bashrc - Sublime Text (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help

.bashrc
1 # ~/.bashrc: executed by bash(1) for non-login shells.
2 # see /usr/share/doc/bash/examples/startup-files (in the package bash-doc)
3 # for examples
4
5 # If not running interactively, don't do anything
6 case $- in
7     *) ;;
8     *) return;;
9 esac
10
11 # don't put duplicate lines or lines starting with space in the history.
12 # See bash(1) for more options
13 HISTCONTROL=ignoreboth
14
15 # append to the history file, don't overwrite it
16 shopt -s histappend
17
18 # for setting history length see HISTSIZE and HISTFILESIZE in bash(1)
19 HISTSIZE=1000
20 HISTFILESIZE=2000
21
22 # check the window size after each command and, if necessary,
23 # update the values of LINES and COLUMNS.
24 shopt -s checkwinsize
25
26 # If set, the pattern "*" used in a pathname expansion context will
27 # match all files and zero or more directories and subdirectories.
28 #shopt -s globstar
29
30 # make less more friendly for non-text input files, see lesspipe(1)
31 [ -x /usr/bin/lesspipe ] && eval "$(SHELL=/bin/sh lesspipe)"
32
33 # set variable identifying the chroot you work in (used in the prompt below)
34 if [ -z "${debian_chroot:-}" ] && [ -r /etc/debian_chroot ]; then
35     debian_chroot=$(cat /etc/debian_chroot)
36 fi
37
38 # set a fancy prompt (non-color, unless we know we "want" color)
39 case "$TERM" in
40     xterm-color|*-256color) color_prompt=yes;;
41 esac
42
43 # uncomment for a colored prompt, if the terminal has the capability; turned
44 # off by default to not distract the user: the focus in a terminal window
45 # should be on the output of commands, not on the prompt
46 #force_color_prompt=yes
47
48 if [ -n "$force_color_prompt" ]; then
49     if [ -x /usr/bin/tput ] && tput setaf 1 >/dev/null; then
50         # We have color support; assume it's compliant with Ecma-48
51         # (ISO/IEC-6429). (Lack of such support is extremely rare, and such
52         # a case would tend to support setf rather than setaf.)
53         color_prompt=yes
54     else
55         color_prompt=no
56     fi
57 fi
```

[초반 HOME 폴더의 .bashrc의 내용]

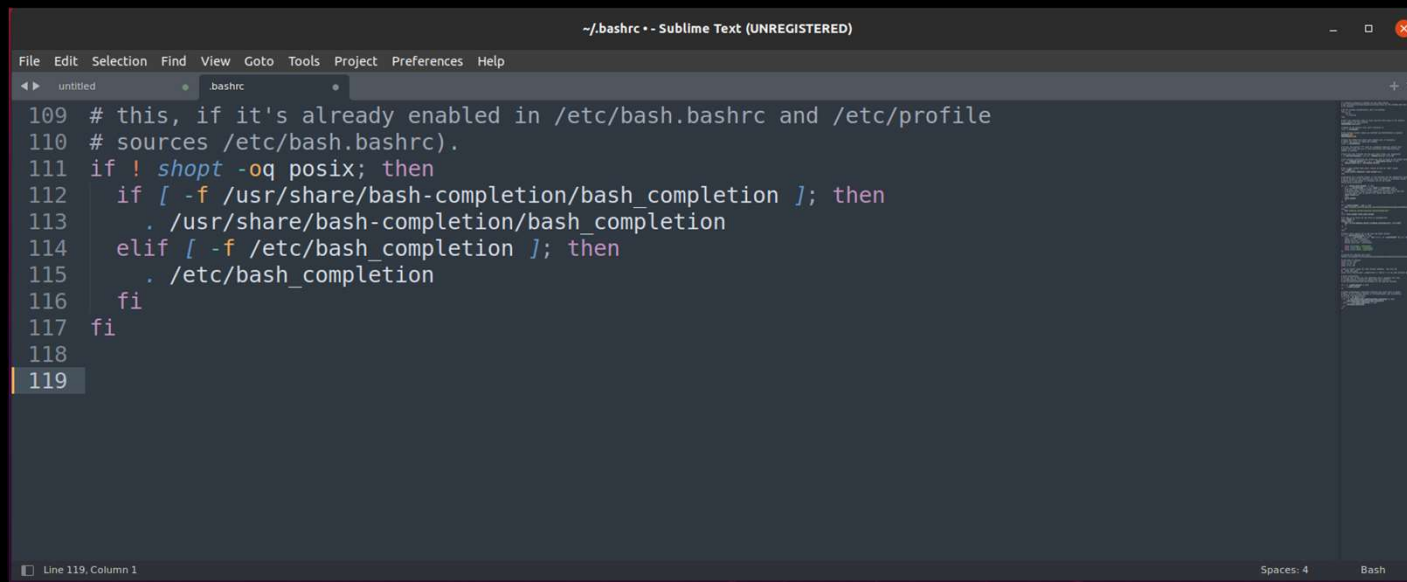
ROS2를 설치하고 설치를 확인

```
source /opt/ros/galactic/setup.bash
```

터미널을 실행할 때마다 명령어를 입력해야함

# .bashrc에 명령 입력해 두기

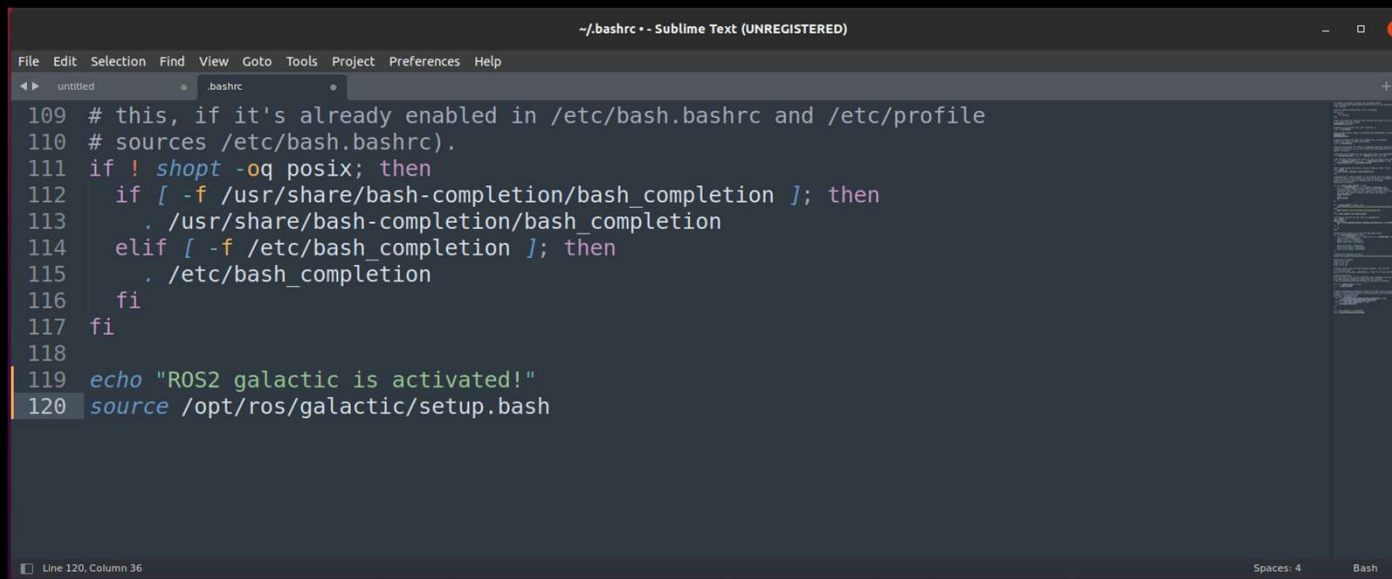
- ROS를 사용하기 위해 명령을 터미널을 실행할 때마다 입력
- 필요한 명령을 **.bashrc**에 등록



```
~/bashrc - Sublime Text (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help
untitled .bashrc
109 # this, if it's already enabled in /etc/bash.bashrc and /etc/profile
110 # sources /etc/bash.bashrc).
111 if ! shopt -oq posix; then
112     if [ -f /usr/share/bash-completion/bash_completion ]; then
113         . /usr/share/bash-completion/bash_completion
114     elif [ -f /etc/bash_completion ]; then
115         . /etc/bash_completion
116     fi
117 fi
118
119
```

[화면 제일 아래로 이동한 화면]

```
echo "ROS2 galactic is activated!"  
source /opt/ros/galactic/setup.bash
```



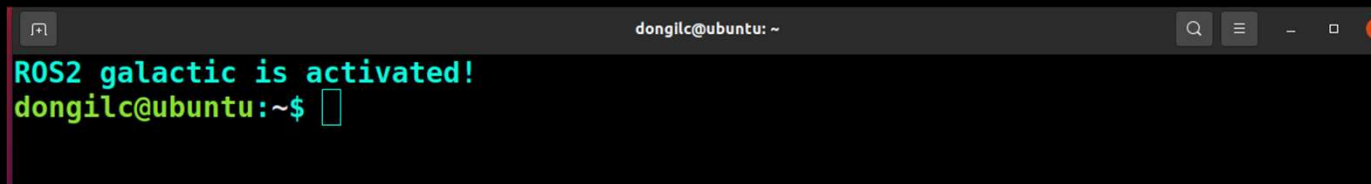
The screenshot shows a Sublime Text editor window titled "~/.bashrc - Sublime Text (UNREGISTERED)". The editor displays the contents of the ~/.bashrc file. Lines 119 and 120 are highlighted in yellow, corresponding to the commands shown in the first block: `echo "ROS2 galactic is activated!"` and `source /opt/ros/galactic/setup.bash`. The status bar at the bottom indicates "Line 120, Column 36", "Spaces: 4", and "Bash".

```
109 # this, if it's already enabled in /etc/bash.bashrc and /etc/profile  
110 # sources /etc/bash.bashrc).  
111 if ! shopt -oq posix; then  
112     if [ -f /usr/share/bash-completion/bash_completion ]; then  
113         . /usr/share/bash-completion/bash_completion  
114     elif [ -f /etc/bash_completion ]; then  
115         . /etc/bash_completion  
116     fi  
117 fi  
118  
119 echo "ROS2 galactic is activated!"  
120 source /opt/ros/galactic/setup.bash
```

[bashrc galactic의 setup.bash를 읽도록 하는 코드를 입력해 둔 화면]

- **ehco** 명령은 글자를 출력하는 명령어.
- 터미널을 끄고 다시 실행하거나 터미널에서 **source ~/.bashrc**라고 입력하면 **bashrc**를 읽어옴

```
source ~/.bashrc
```

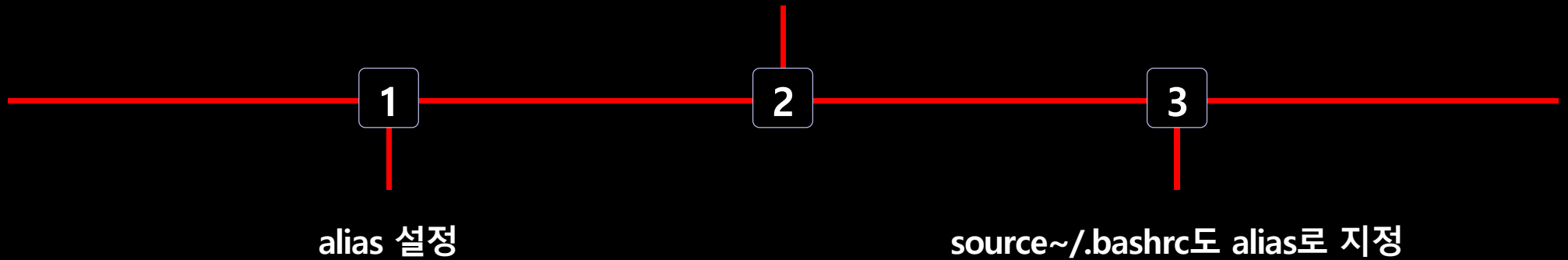
A terminal window with a dark background. The title bar shows 'dongilc@ubuntu: ~'. The terminal output shows 'ROS2 galactic is activated!' in green text, followed by the prompt 'dongilc@ubuntu:~\$' and a cursor. The window has standard Ubuntu window controls (search, menu, zoom, maximize, close) on the right.

```
ROS2 galactic is activated!  
dongilc@ubuntu:~$
```

[터미널을 끄고 다시 실행했을 때면]

# .bashrc에서 alias 설정

galactic 설정을 alias로 지정



# alias 설정

- 버전을 바꾸고 싶을 때 마다 **.bashrc**를 수행해야 하는 번거로움
- 이럴 때 쓰는 방법 **alias**를 설정

```
alias alias_test="echo \" Alias test\""
```

```
112 if [ -f /usr/share/bash-completion/bash_completion ]; then
113     . /usr/share/bash-completion/bash_completion
114 elif [ -f /etc/bash_completion ]; then
115     . /etc/bash_completion
116 fi
117 fi
118
119
120 echo "ROS2 galactic is activated!"
121 source /opt/ros/galactic/setup.bash
122
123
124 alias alias_test="echo \"Alias test\""
125
```

[bashrc에 alias\_test라는 이름으로 alias를 지정하는 장면]



-터미널에 **source ~/.bashrc**라고 입력 다음 **alias\_test**라고 입력

```
source ~/.bashrc
```

```
alias_test
```

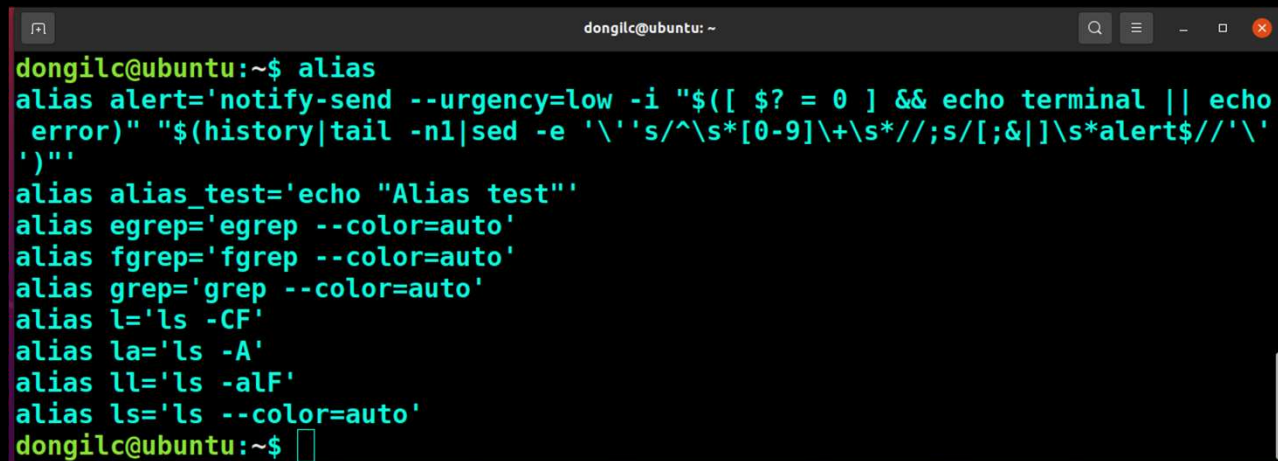
A terminal window titled 'dongilc@ubuntu: ~' with standard window controls. The terminal shows a sequence of commands and their outputs: 'source ~/.bashrc' outputs 'ROS2 galactic is activated!', and 'alias\_test' outputs 'Alias test'. The prompt 'dongilc@ubuntu:~\$' is repeated four times, with a cursor visible on the last line.

```
dongilc@ubuntu:~$  
dongilc@ubuntu:~$ source ~/.bashrc  
ROS2 galactic is activated!  
dongilc@ubuntu:~$ alias_test  
Alias test  
dongilc@ubuntu:~$  
dongilc@ubuntu:~$  
dongilc@ubuntu:~$  
dongilc@ubuntu:~$
```

[설정된 alias\_test를 테스트하는 장면]

- alias 설정 전체를 확인하고 싶다 터미널에서 **alias**라고만 입력하면 됨

## alias

A terminal window titled 'dongilc@ubuntu: ~' showing the output of the 'alias' command. The output lists several aliases: 'alert' (a complex notification command), 'alias\_test' (echoes 'Alias test'), 'egrep', 'fgrep', 'grep' (all with --color=auto), and 'l', 'la', 'll', 'ls' (various ls command shortcuts).

```
dongilc@ubuntu:~$ 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$/\s*\''\''
)'"'
alias alias_test='echo "Alias test"'
alias egrep='egrep --color=auto'
alias fgrep='fgrep --color=auto'
alias grep='grep --color=auto'
alias l='ls -CF'
alias la='ls -A'
alias ll='ls -aF'
alias ls='ls --color=auto'
dongilc@ubuntu:~$
```

[alias 명령을 통해 설정된 alias 목록을 조회하는 장면]

# galactic 설정을 alias로 지정하기

-방금 만든 `alias_test`는 삭제

-`galactic` 버전을 활성화하기 위해 두 줄의 코드를 `alias` 설정

```
alias galactic="source /opt/ros/galactic/setup.bash; echo ₩"ROS2 Galactic is activated.₩ ""
```

```
alias galactic="source /opt/ros/galactic/setup.bash;  
echo \"ROS2 Galactic is activated. \""
```

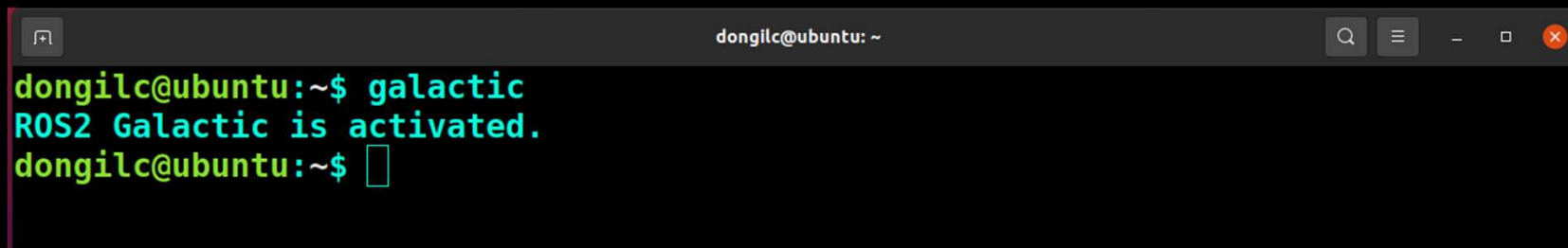
```
113 . /usr/share/bash-completion/bash_completion
114 elif [ -f /etc/bash_completion ]; then
115 . /etc/bash_completion
116 fi
117 fi
118
119
120
121 alias galactic="source /opt/ros/galactic/setup.bash; echo \"ROS2 galactic is activated!\""
122
```

[alias명령으로 galactic 설정을 활성화하도록 변경한 장면]

- 터미널을 실행하면 **ROS2 galactic is activated**라는 메시지가 나타나지 않음
- **galactic**이라고 입력해야 나타남

**galactic**

[View more](#)

A terminal window titled 'dongilc@ubuntu: ~' with search, menu, and window control icons. It shows the command 'galactic' being executed, resulting in the message 'ROS2 Galactic is activated.' followed by a new prompt.

```
dongilc@ubuntu:~$ galactic
ROS2 Galactic is activated.
dongilc@ubuntu:~$
```

[설정후 galactic을 실행하는는 장면]

## source ~/.bashrc도 alias로 지정하기

- source ~/.bashrc를 alias로 지정함

```
alias sb="source ~/.bashrc; echo \"bashrc is reloaded. \""
```



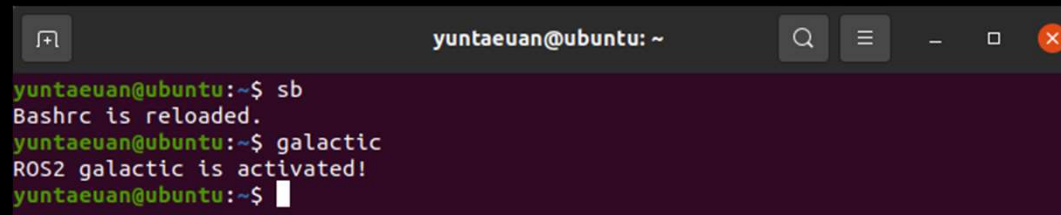
```

116 fi
117 fi
118
119
120
121 alias sb="source ~/.bashrc; echo \"Bashrc is reloaded.\""
122 alias galactic="source /opt/ros/galactic/setup.bash; echo \"ROS2 galactic is activated!\""
123

```

[source ~/.bashrc를 sb라고 alias지정을 한 장면]

- bashrc는 사용자가 매번 다시 입력 해야됨
- Echo를 추가해도 source ~/.bashrc를 한 번 입력해야됨



A terminal window titled 'yuntaeuan@ubuntu: ~' showing the following commands and output:

```

yuntaeuan@ubuntu:~$ sb
Bashrc is reloaded.
yuntaeuan@ubuntu:~$ galactic
ROS2 galactic is activated!
yuntaeuan@ubuntu:~$

```

[sb라는 alias를 실행한 장면]

# ROS2 도메인 설정

1

ROS2 도메인 설정

# ROS2 도메인 설정

- ROS2는 ROS master가 없어지고 DDS(Data Distribution System)를 이용

데이터 분산 서비스 DDS(Data Distribution System)는 실시간 시스템의 실시간성(real-time), 규모가변성(scalable), 안전성(dependable), 고성능(high performance)을 가능하게 하는 object Management Group(OMG) 표준 출판/구독(publish/Subscribe) 네트워크 커뮤니케이션 미들웨어이다.

- 출처: 위키백과 DDS 문서

- 이 시스템의 사용으로 여러 장점이 생겼지만 한 가지 문제 발생.
- 한 AP(Access Point)에 여러 사람이 동시에 ROS2를 공부하는 경우
- 같은 노드의 이름, 같은 토픽의 이름이 충돌 가능.

- 본인 시스템의 도메인을 별도로 지정 필요
- 터미널에서 본인의 ID를 정함
- 같은 도메인의 ROS2노드들은 서로를 발견하고 메시지를 주고받는게 가능함

```
export ROS_DOMAIN_ID=<ID>
```

```
~/bashrc -- Sublime Text (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help
.bashrc
109 # this, if it's already enabled in /etc/bash.bashrc and /etc/profile
110 # sources /etc/bash.bashrc).
111 if ! shopt -oq posix; then
112     if [ -f /usr/share/bash-completion/bash_completion ]; then
113         . /usr/share/bash-completion/bash_completion
114     elif [ -f /etc/bash_completion ]; then
115         . /etc/bash_completion
116     fi
117 fi
118
119 alias sb="source ~/.bashrc; echo \"Bashrc is reloaded.\""
120 alias galactic="source /opt/ros/galactic/setup.bash; ros_domain; echo \"ROS2 galactic is activated!\""
121 alias ros_domain="export ROS_DOMAIN_ID=13"
```

Line 121, Column 43      Spaces: 4      Bash

[bashrc에 ROS\_DOMAIN\_ID를 설정]

감사합니다.