

ME454

Dynamics System Programming

TA Session 1. Linux and ROS installation

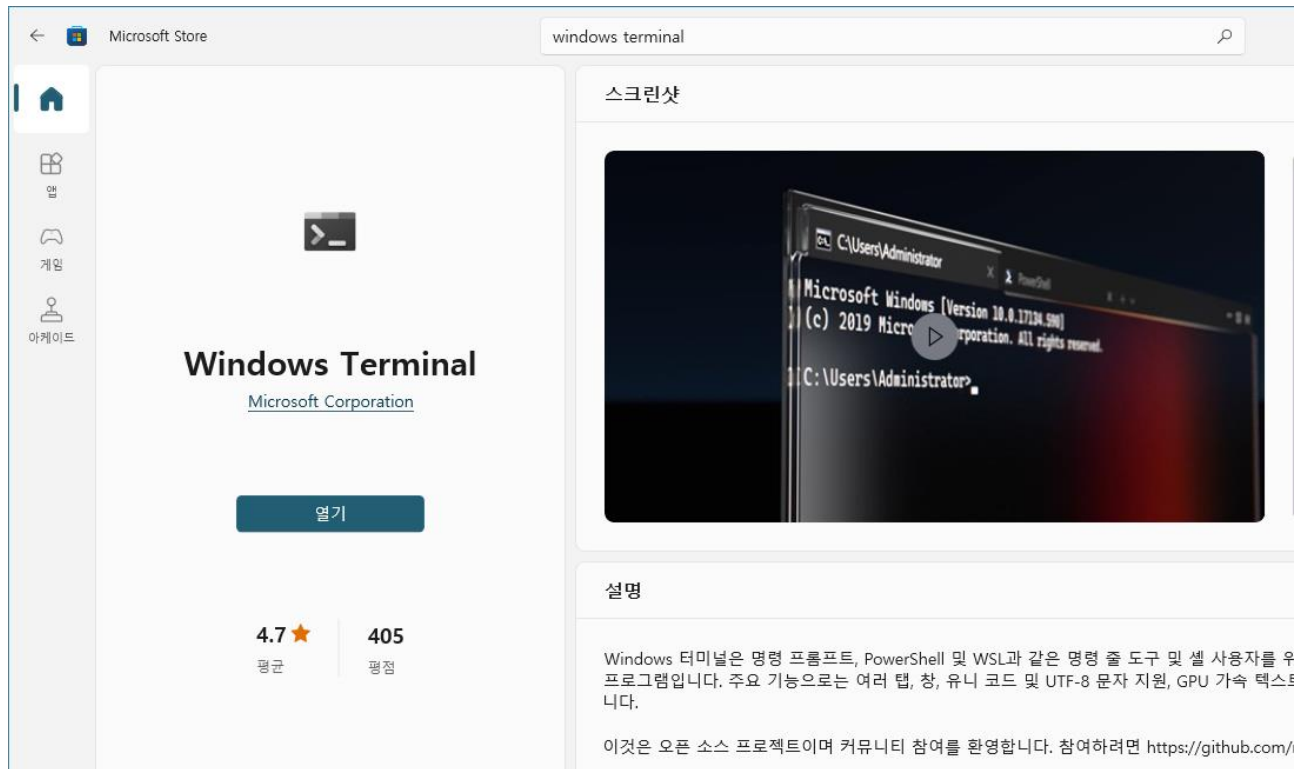
Class objectives

- ▶ Building Ubuntu system using WSL2
- ▶ Installing ROS & GAZEBO

Before Started

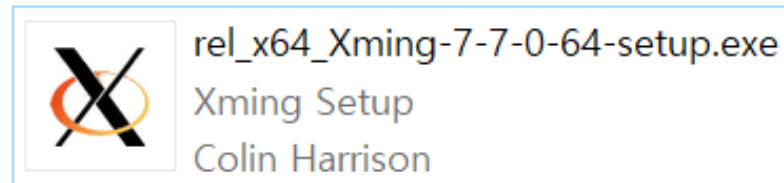
▶ Install Windows Terminal

- ▶ Go to Microsoft Store, find & install 'Windows Terminal'



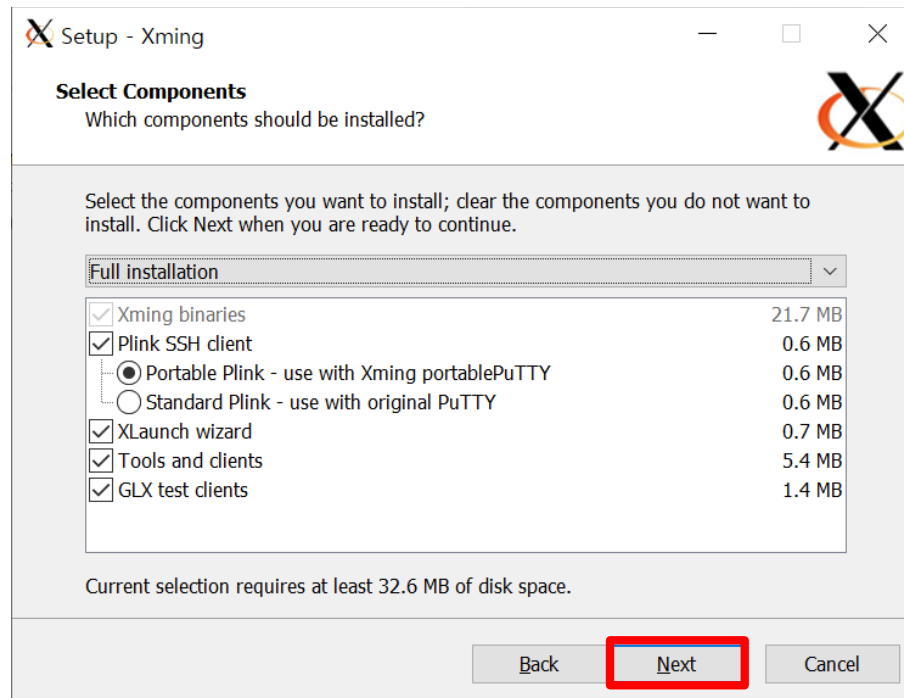
Before Started

- ▶ Install Xming X server for Windows
 - ▶ Download installation file on the KLMS (rel_x64_Xming-7-7-0-64-setup.exe)
 - ▶ You have to know where the xming.exe file is
 - ▶ Create Desktop shortcut is recommended



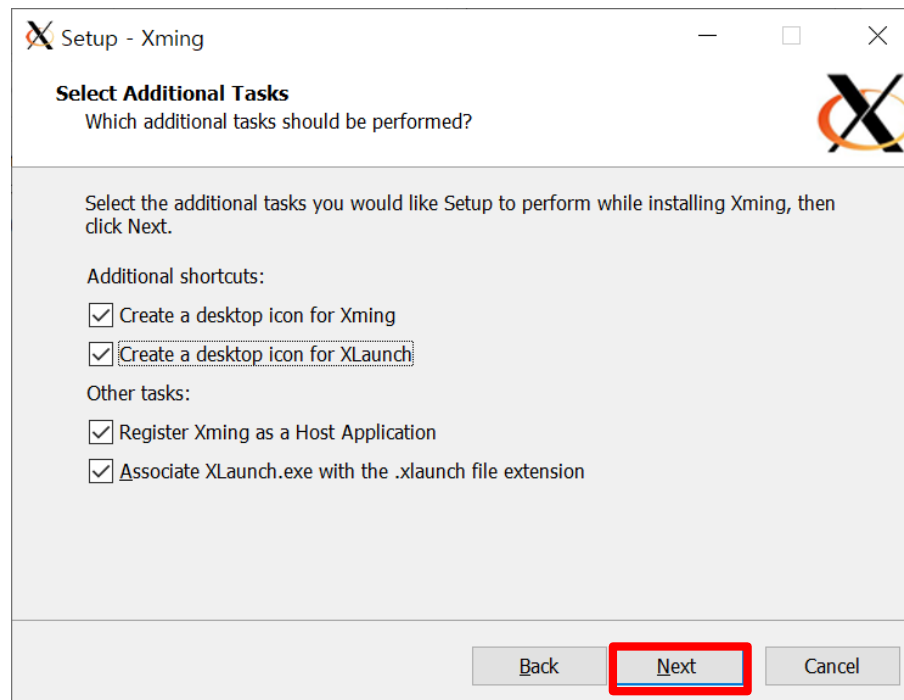
Before Started

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Before Started

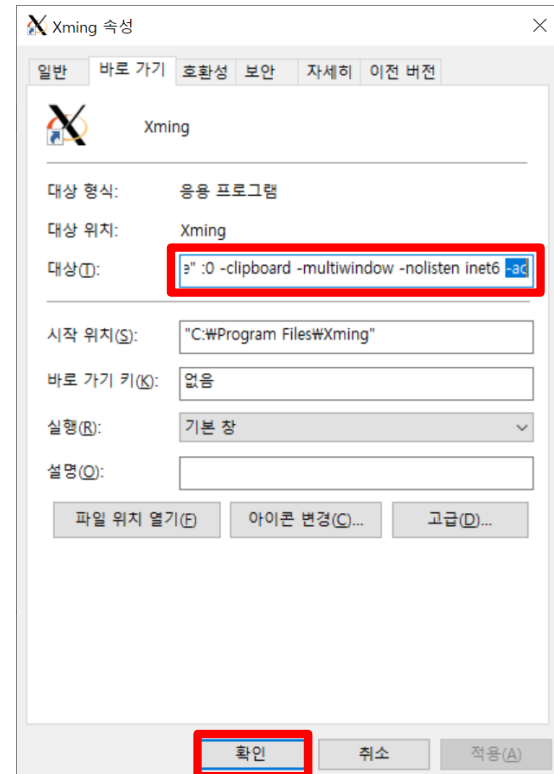
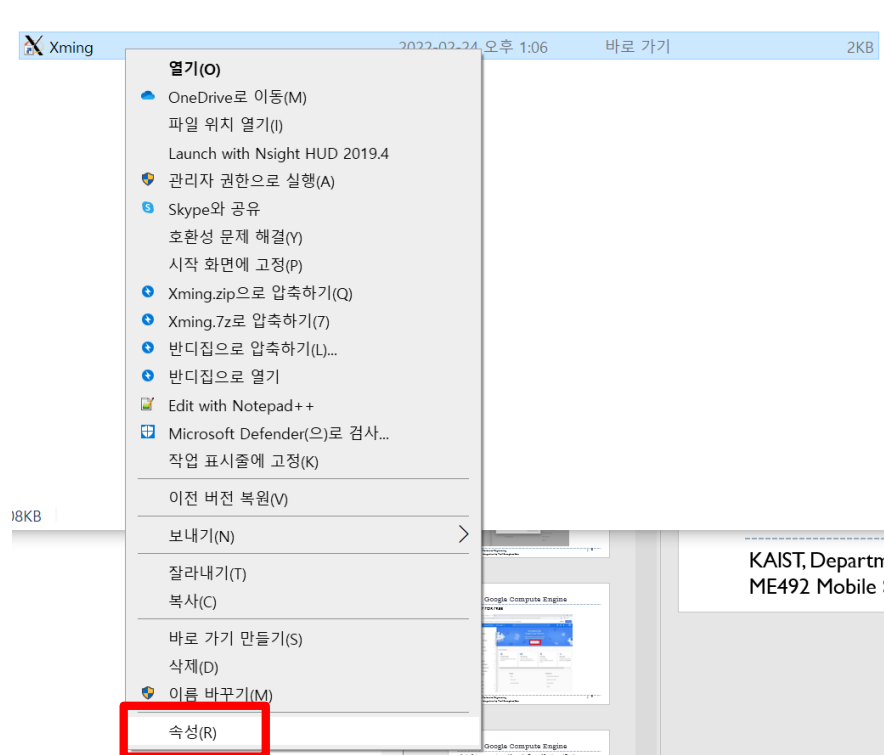
- ▶ Install Xming X server for Windows
 - ▶ Download installation file on the KLMS (rel_x64_Xming-7-7-0-64-setup.exe)
 - ▶ You have to know where the xming.exe file is. Create Desktop shortcut is recommended



Before Started

▶ Install Xming X server for Windows

- ▶ add the execute arguments “-ac” to the shortcut.
- ▶ “-ac” enable Xming to accept requests from external IPs Xming is configured to accept only requests from itself

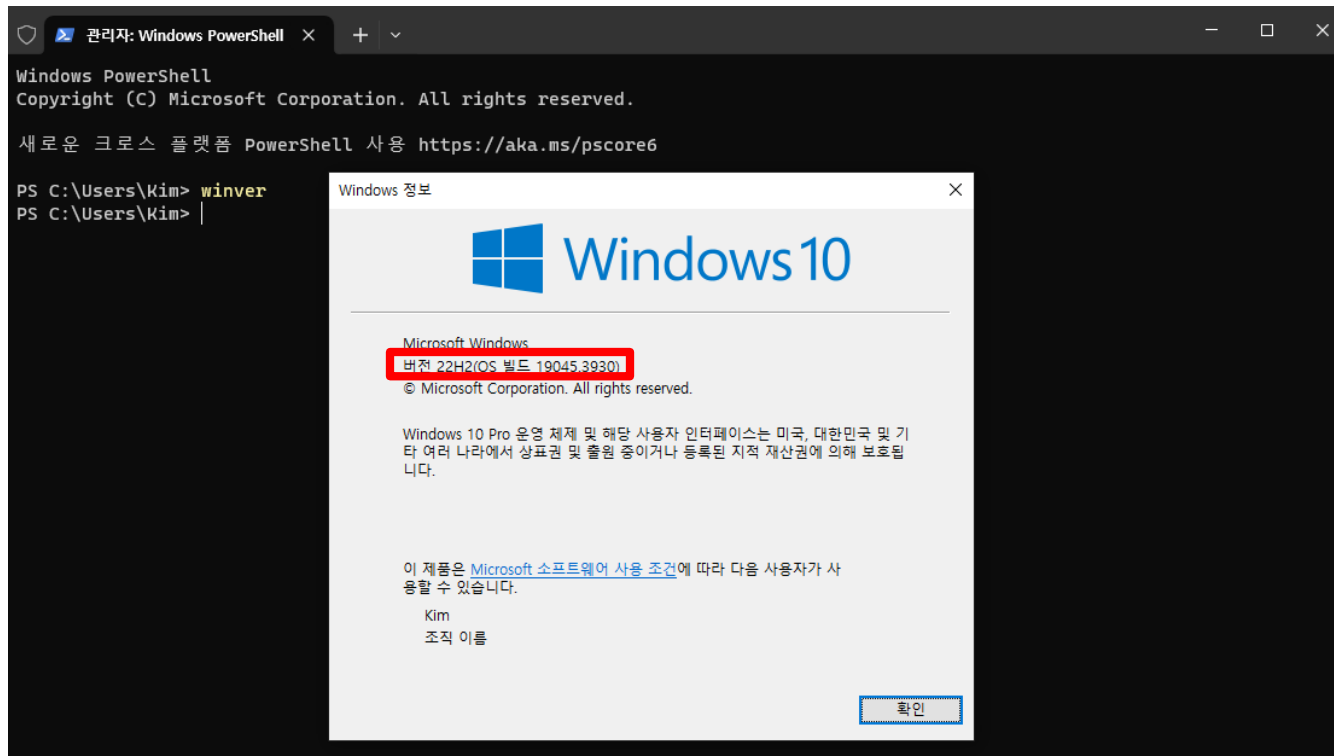


Requirements for WSL2

Go to windows terminal (Windows logo key + R)

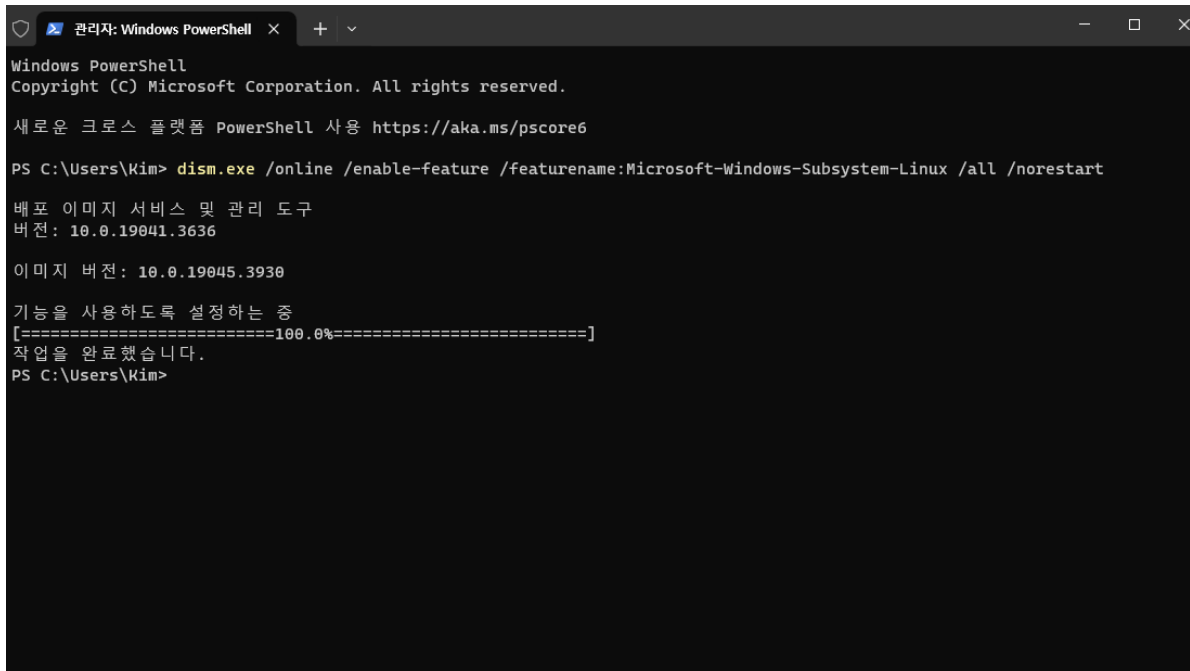
Type '**winver**' and check the version of installed Windows 10 OS

For x64 systems: **Version 1903** or higher, with **Build 18362** or higher.



Requirements for WSL2

- ▶ Enable WSL2-related features on Windows
 - ▶ `dism.exe /online /enable-feature /featurename:Microsoft-Windows-Subsystem-Linux /all /norestart`



```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

새로운 크로스 플랫폼 PowerShell 사용 https://aka.ms/pscore6

PS C:\Users\Kim> dism.exe /online /enable-feature /featurename:Microsoft-Windows-Subsystem-Linux /all /norestart

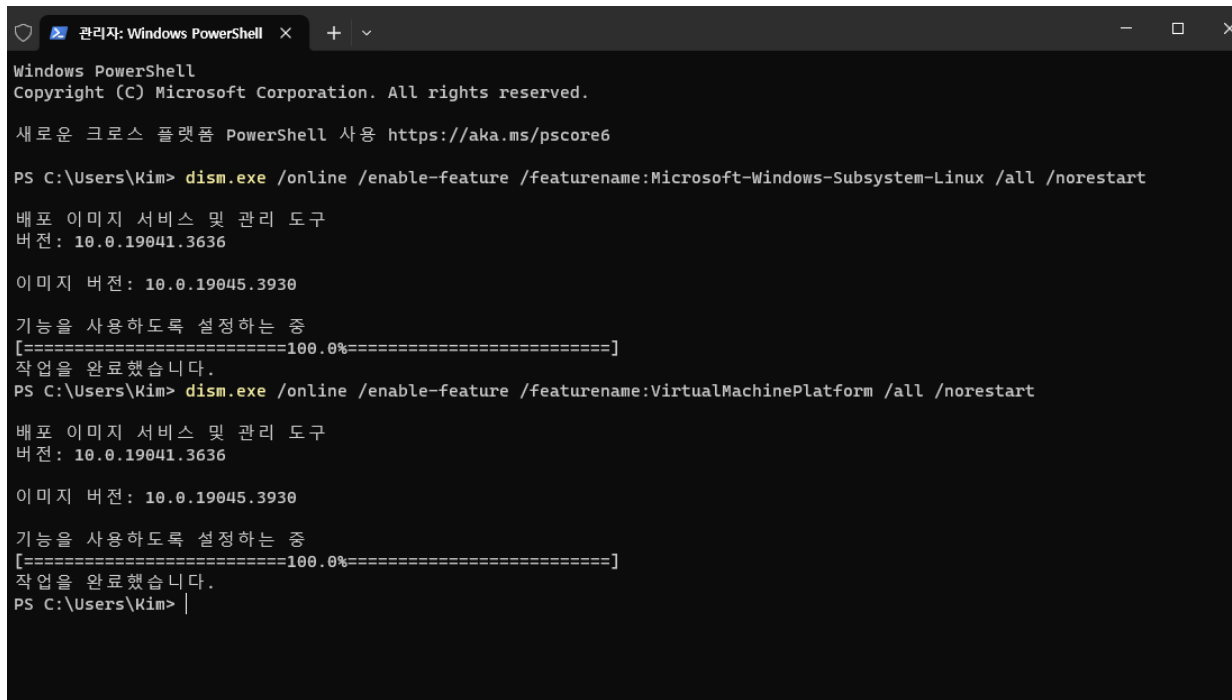
배포 이미지 서비스 및 관리 도구
버전: 10.0.19041.3636

이미지 버전: 10.0.19045.3930

기능을 사용하도록 설정하는 중
[=====100.0%=====]
작업을 완료했습니다.
PS C:\Users\Kim>
```

Requirements for WSL2

- ▶ Enable WSL2-related features on Windows
- ▶ `dism.exe /online /enable-feature /featurename:VirtualMachinePlatform /all /norestart`
- ▶ Then **reboot** once.



```
관리자: Windows PowerShell
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

새로운 크로스 플랫폼 PowerShell 사용 https://aka.ms/pscore6

PS C:\Users\Kim> dism.exe /online /enable-feature /featurename:Microsoft-Windows-Subsystem-Linux /all /norestart

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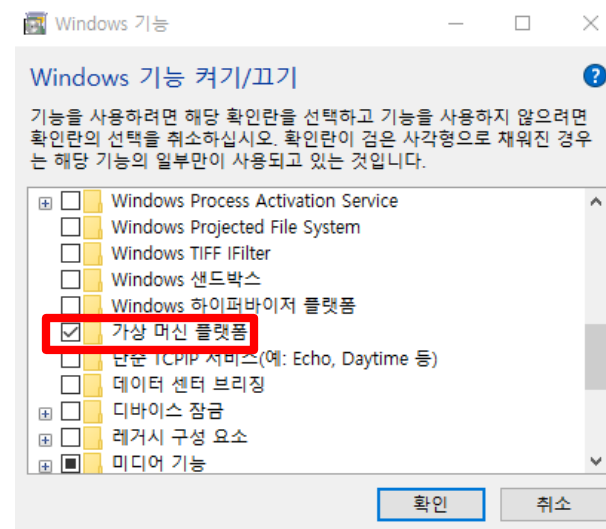
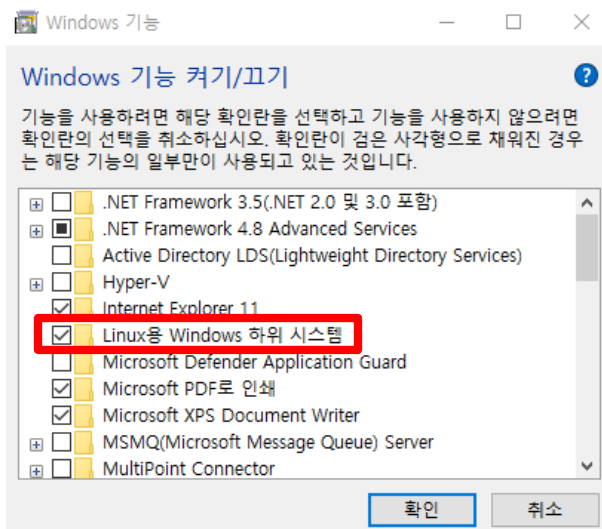
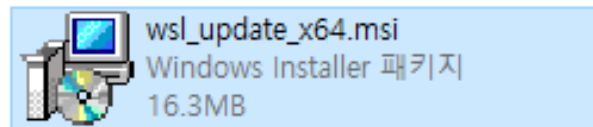
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버전: 10.0.19041.3636

이미지 버전: 10.0.19045.3930

기능을 사용하도록 설정하는 중
[=====100.0%=====]
작업을 완료했습니다.
PS C:\Users\Kim> |
```

Install WSL2

- ▶ Download the Linux kernel update package
- ▶ <https://docs.microsoft.com/en-us/windows/wsl/install-manual#step-4---download-the-linux-kernel-update-package>
- ▶ https://wslstorestorage.blob.core.windows.net/wslblob/wsl_update_x64.msi



Install WSL2

- ▶ Set WSL 2 as your default version
 - ▶ On the windows terminal, type this command
 - ▶ `wsl --set-default-version 2`

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

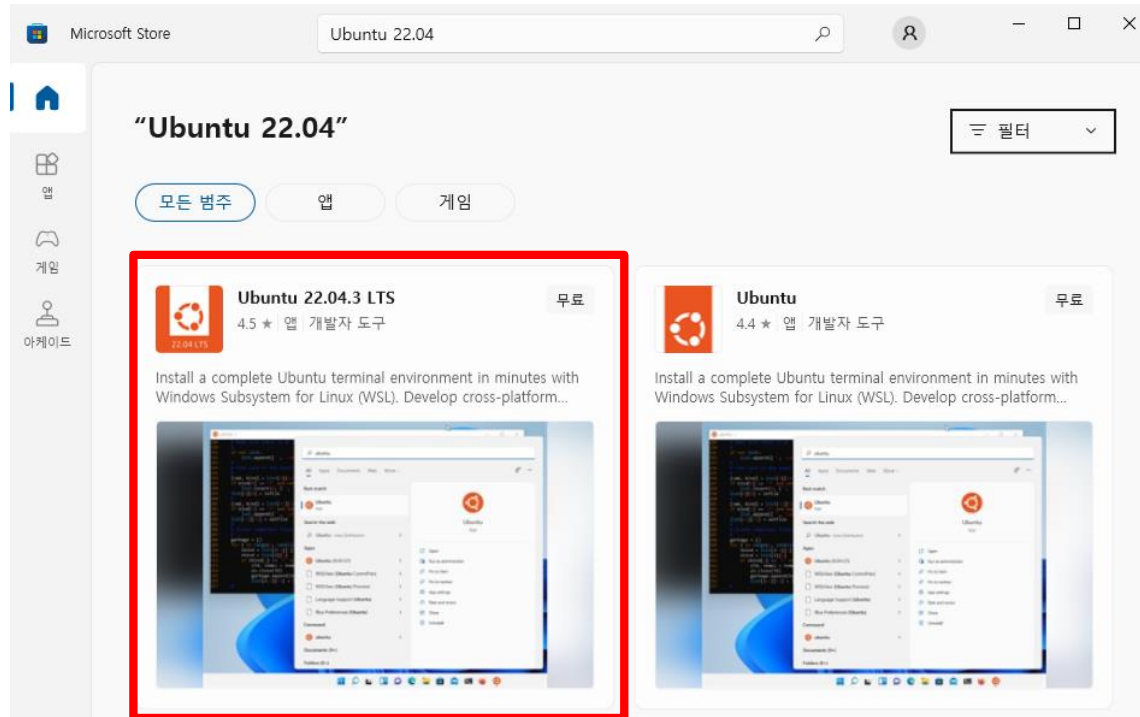
새로운 크로스 플랫폼 PowerShell 사용 https://aka.ms/pscore6

PS C:\Users\Kim> wsl --set-default-version 2
WSL 2와의 주요 차이점에 대한 자세한 내용은 https://aka.ms/wsl2를 참조하세요
작업을 완료했습니다.
PS C:\Users\Kim> |
```

- ▶ To set a version of specific Ubuntu distribution:
 - ▶ `wsl --set-version <distribution name> <versionNumber>`

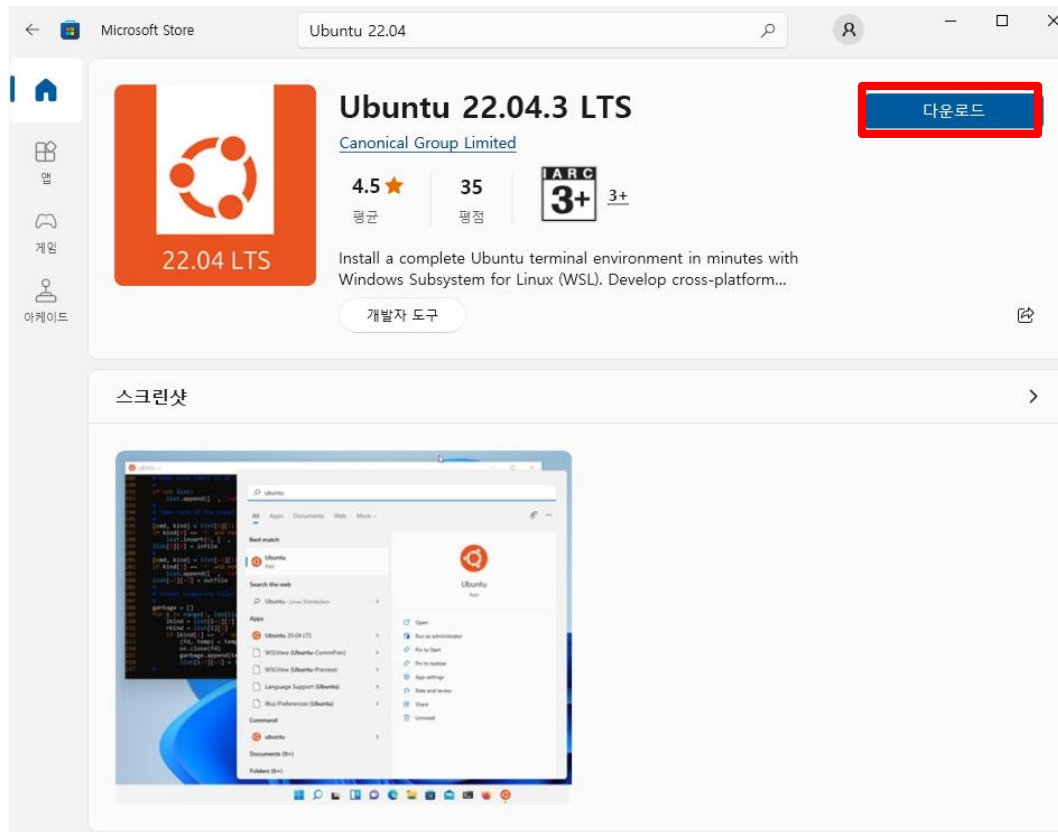
Install WSL2

- ▶ Install your Linux distribution of choice
 - ▶ Select ubuntu 22.04 and install from MS Store



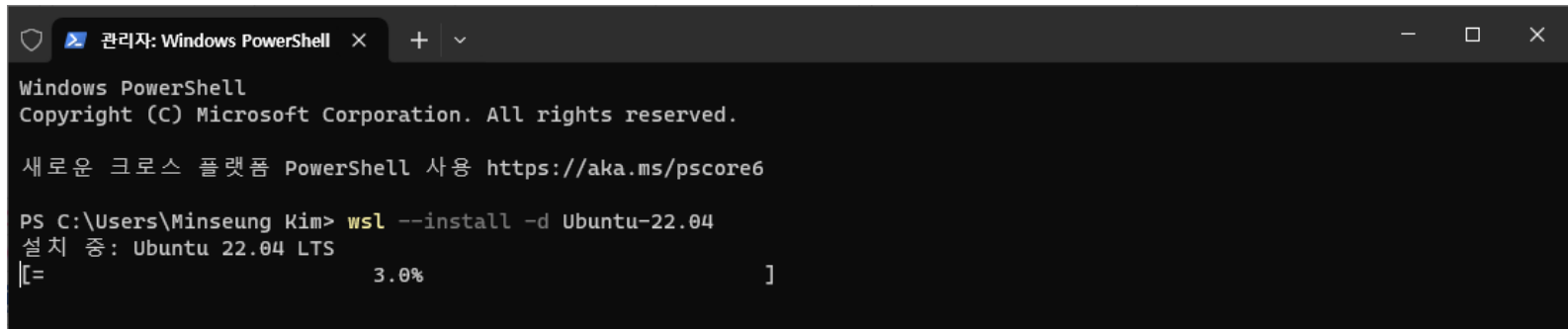
Install WSL2

- ▶ Install your Linux distribution of choice
 - ▶ Select ubuntu 22.04 and install from MS Store



Tips #1 (Recommended)

- ▶ If the downloading speed of the MS store is too slow,
 - ▶ Use the command below on the Windows PowerShell (administrator mode)
 - ▶ 'wsl' command in Windows PowerShell does not need an administrator authority
 - ▶ `wsl --install -d Ubuntu-22.04`



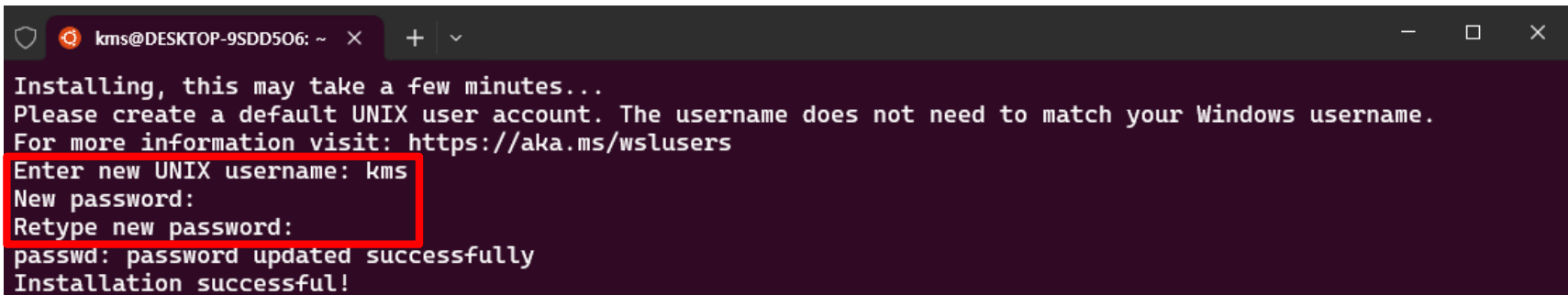
```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

새로운 크로스 플랫폼 PowerShell 사용 https://aka.ms/pscore6

PS C:\Users\Minseung Kim> wsl --install -d Ubuntu-22.04
설치 중: Ubuntu 22.04 LTS
[= 3.0% ]
```

Install WSL2

- ▶ Install your Linux distribution of choice
 - ▶ Set your username and password (for TA's case, username is kms)
 - ▶ The password is invisible during the settings, but it is there
 - ▶ The password is required when root privilege is needed



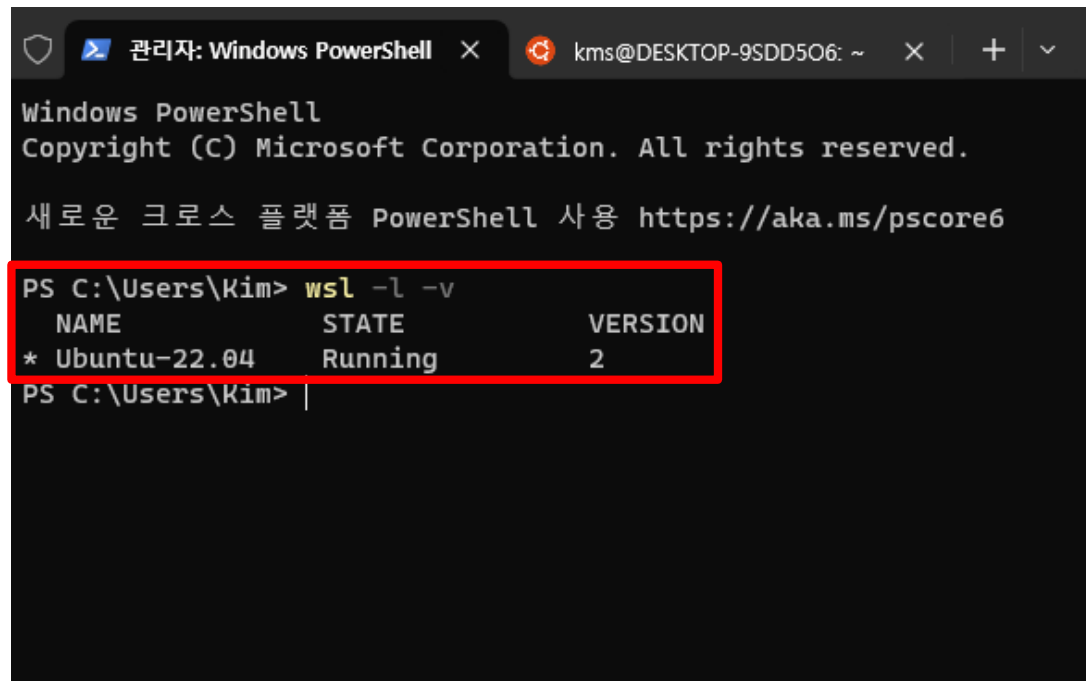
A screenshot of a Windows terminal window with a dark background. The title bar shows 'kms@DESKTOP-9SDD506: ~' and standard window controls. The terminal text is as follows:

```
Installing, this may take a few minutes...  
Please create a default UNIX user account. The username does not need to match your Windows username.  
For more information visit: https://aka.ms/wslusers  
Enter new UNIX username: kms  
New password:  
Retype new password:  
passwd: password updated successfully  
Installation successful!
```

The input lines 'Enter new UNIX username: kms', 'New password:', and 'Retype new password:' are highlighted with a red rectangular box.

Install WSL2

- ▶ Check if ubuntu is properly installed in WSL
 - ▶ `wsl -l -v`
 - ▶ The version should be '2'

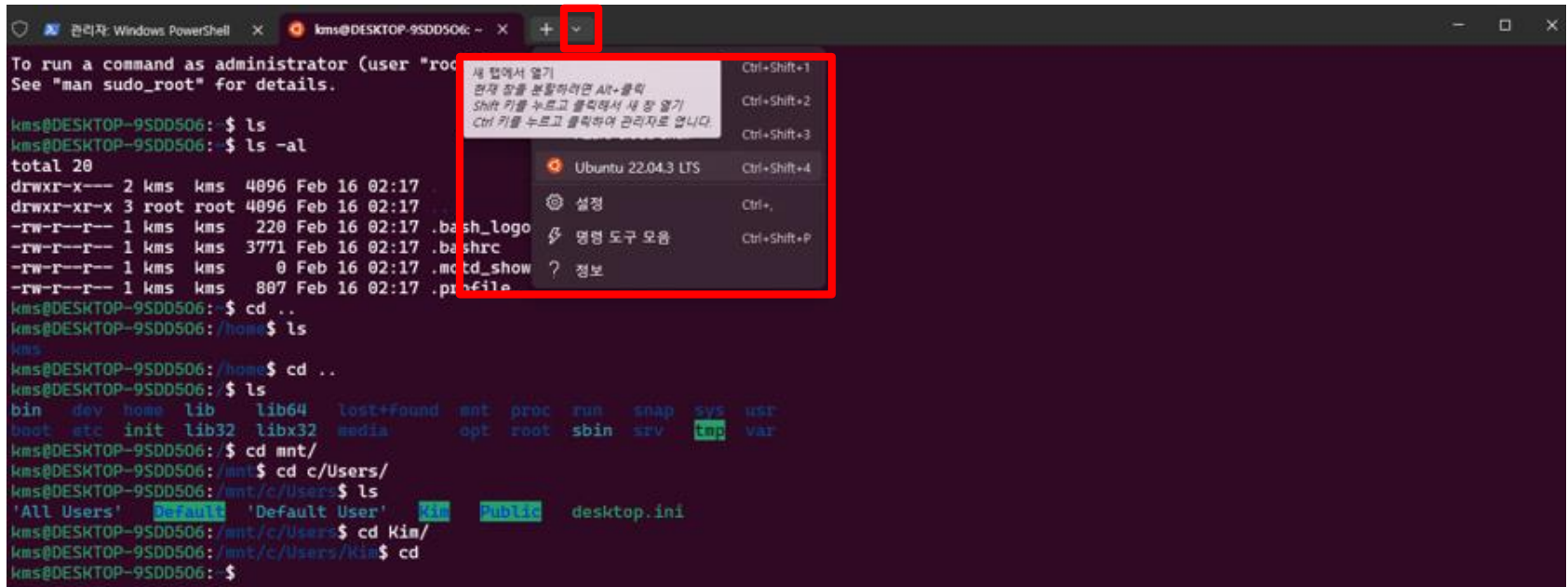


The screenshot shows a Windows PowerShell terminal window. The title bar indicates the user is 'kms@DESKTOP-9SDD5O6'. The terminal text includes the Windows PowerShell copyright notice and a link to the PowerShell website. The command `wsl -l -v` has been executed, and the output is a table showing the status of installed Linux distributions. The output is highlighted with a red rectangle.

NAME	STATE	VERSION
* Ubuntu-22.04	Running	2

Run WSL2

- ▶ Open windows terminal(Run as administrator)
 - ▶ Click v and select Ubuntu 22.04



The screenshot shows a Windows PowerShell terminal window titled "관리자: Windows PowerShell". The terminal is running the WSL2 Ubuntu 22.04 LTS environment. The prompt is "kms@DESKTOP-9SDD506: ~". The user has entered the command "ls" and the output shows the contents of the home directory. The user then enters "ls -al" and the output shows the detailed permissions and ownership of the files in the home directory. The user then enters "cd .." and the prompt changes to "kms@DESKTOP-9SDD506: /home". The user then enters "ls" and the output shows the contents of the /home directory. The user then enters "cd mnt/" and the prompt changes to "kms@DESKTOP-9SDD506: /mnt". The user then enters "cd c/Users/" and the prompt changes to "kms@DESKTOP-9SDD506: /mnt/c/Users". The user then enters "ls" and the output shows the contents of the /mnt/c/Users directory. The user then enters "cd Kim/" and the prompt changes to "kms@DESKTOP-9SDD506: /mnt/c/Users/Kim". The user then enters "cd" and the prompt changes to "kms@DESKTOP-9SDD506: ~". A red box highlights the terminal window title bar and the Ubuntu 22.04 LTS selection in the context menu.

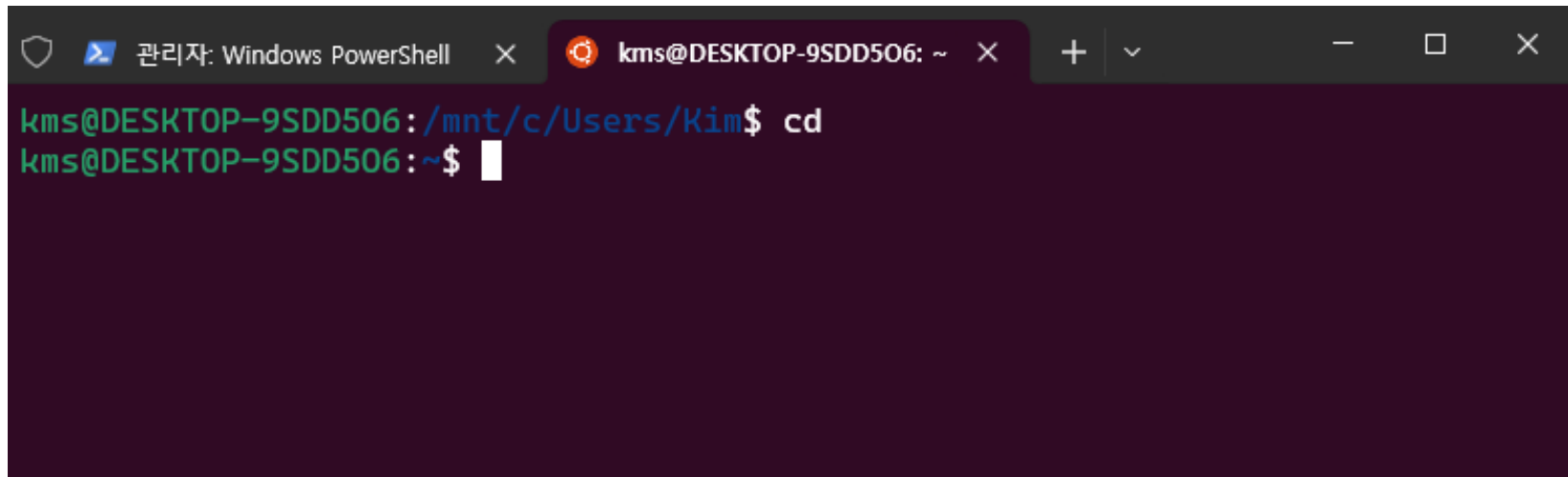
```
To run a command as administrator (user "root")
See "man sudo_root" for details.

kms@DESKTOP-9SDD506: ~$ ls
kms@DESKTOP-9SDD506: ~$ ls -al
total 20
drwxr-xr-x 2 kms kms 4096 Feb 16 02:17 .
drwxr-xr-x 3 root root 4096 Feb 16 02:17 ..
-rw-r--r-- 1 kms kms 220 Feb 16 02:17 .bash_logout
-rw-r--r-- 1 kms kms 3771 Feb 16 02:17 .bashrc
-rw-r--r-- 1 kms kms 0 Feb 16 02:17 .motd_show
-rw-r--r-- 1 kms kms 807 Feb 16 02:17 .profile

kms@DESKTOP-9SDD506: ~$ cd ..
kms@DESKTOP-9SDD506: /home$ ls
kms
kms@DESKTOP-9SDD506: /home$ cd ..
kms@DESKTOP-9SDD506: ~$ ls
bin dev home lib lib64 lost+found mnt proc run snap sys usr
boot etc init lib32 libx32 media opt root sbin srv tmp var
kms@DESKTOP-9SDD506: ~$ cd mnt/
kms@DESKTOP-9SDD506: /mnt$ cd c/Users/
kms@DESKTOP-9SDD506: /mnt/c/Users$ ls
'All Users' Default 'Default User' Kim Public desktop.ini
kms@DESKTOP-9SDD506: /mnt/c/Users$ cd Kim/
kms@DESKTOP-9SDD506: /mnt/c/Users/Kim$ cd
kms@DESKTOP-9SDD506: ~$
```

Run WSL2

- ▶ Type 'cd' to go to your home directory.
 - ▶ '~' is home directory and is same as /home/(username)



```
kms@DESKTOP-9SDD506:/mnt/c/Users/Kim$ cd
kms@DESKTOP-9SDD506:~$
```

Set X11 configuration

- ▶ Type these command in your home directory.
- ▶ `sudo nano ~/.bashrc` (or `vi ~/.bashrc`)
- ▶ `echo "export DISPLAY=$(cat /etc/resolv.conf | grep nameserver | awk '{print $2}'):0" >> ~/.bashrc`

```
export DISPLAY=$(cat /etc/resolv.conf | grep nameserver | awk '{print $2}'):0
export GAZEBO_IP=127.0.0.1
```

Or, give proper IP address directly to bash file

^G Help	^O Write Out	^W Where Is	^K Cut	^T Execute	^C Location	M-U Undo	M-A Set Mark
^X Exit	^R Read File	^_ Replace	^U Paste	^J Justify	^/ Go To Line	M-E Redo	M-6 Copy

- ▶ `echo "export GAZEBO_IP=127.0.0.1" >> ~/.bashrc`
 - ▶ `‘.bashrc’` : a script file that’s executed when a user logs in
 - ▶ contains a series of configurations for the terminal session
 - ▶ includes setting up or enabling: coloring, completion, shell history, command aliases, and more


Set X11 configuration

- ▶ `source .bashrc`
- ▶ `sudo apt update`
- ▶ `sudo apt install x11-apps`
- ▶ `xeyes`

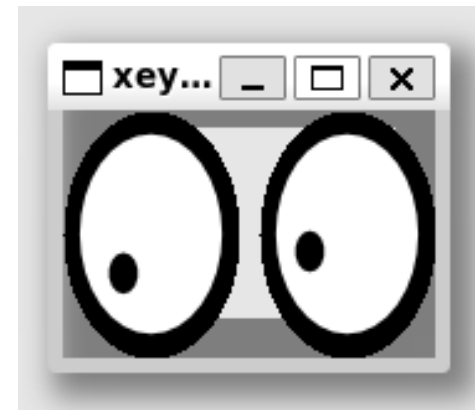


Tips #2

- ▶ If the Xming does not work (Visualize by wsl2)
 - ▶ Check the C:\Users\username\.wslconfig exists or not
 - ▶ If not, create the .wslconfig.txt file
 - ▶ Type 'guiApplications=true' and delete the .txt extension

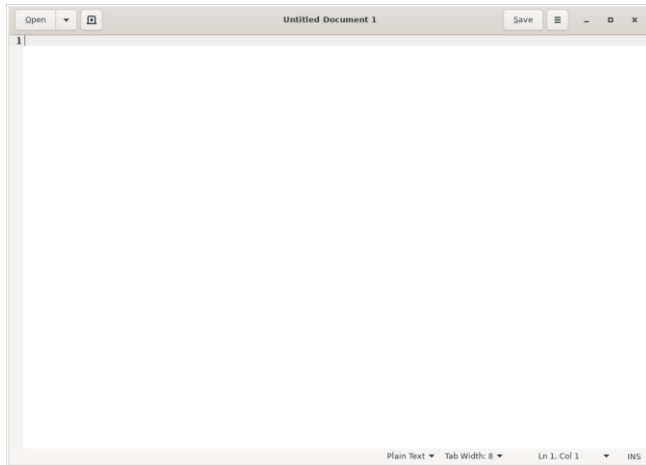
 **.wslconfig** 2024-02-27 오후 1:59 WSLCONFIG 파일 1KB

- ▶ Delete the 'Display=xxx.xxx.xxx.xxx' line from the bash file by editor
 - ▶ by sudo nano ~/.bashrc
 - ▶ or Sudo vi ~/.bashrc
 - ▶ Shutdown the wsl2 and restart
- ▶ source .bashrc
- ▶ xeyes

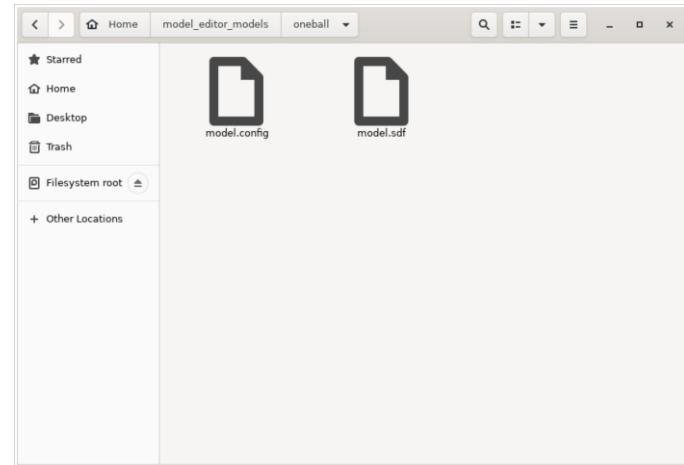


Set X11 configuration

- ▶ `sudo apt install gedit`
 - ▶ Simple GUI text editor
- ▶ `sudo apt install nautilus`
 - ▶ Simple GUI file explorer



gedit



nautilus

Installing ROS

Set Locale (To prevent the encoding error)

:UTF-8 (not POSIX or anything else)

locale # check for UTF-8

sudo apt update && sudo apt install locales

sudo locale-gen en_US en_US.UTF-8

sudo update-locale LC_ALL=en_US.UTF-8 LANG=en_US.UTF-8

export LANG=en_US.UTF-8

locale # verify settings

```
kms@DESKTOP-9SDD506:~$ locale
LANG=C.UTF-8
LANGUAGE=
LC_CTYPE="C.UTF-8"
LC_NUMERIC="C.UTF-8"
LC_TIME="C.UTF-8"
LC_COLLATE="C.UTF-8"
LC_MONETARY="C.UTF-8"
LC_MESSAGES="C.UTF-8"
LC_PAPER="C.UTF-8"
LC_NAME="C.UTF-8"
LC_ADDRESS="C.UTF-8"
LC_TELEPHONE="C.UTF-8"
LC_MEASUREMENT="C.UTF-8"
LC_IDENTIFICATION="C.UTF-8"
LC_ALL=
```

```
kms@DESKTOP-9SDD506:~$ locale
LANG=en_US.UTF-8
LANGUAGE=
LC_CTYPE="en_US.UTF-8"
LC_NUMERIC="en_US.UTF-8"
LC_TIME="en_US.UTF-8"
LC_COLLATE="en_US.UTF-8"
LC_MONETARY="en_US.UTF-8"
LC_MESSAGES="en_US.UTF-8"
LC_PAPER="en_US.UTF-8"
LC_NAME="en_US.UTF-8"
LC_ADDRESS="en_US.UTF-8"
LC_TELEPHONE="en_US.UTF-8"
LC_MEASUREMENT="en_US.UTF-8"
LC_IDENTIFICATION="en_US.UTF-8"
LC_ALL=
```


Installing ROS

<https://docs.ros.org/en/humble/Installation/Ubuntu-Install-Debians.html#>

Setup Sources

```
sudo apt install software-properties-common
```

```
sudo add-apt-repository universe
```

```
sudo apt update && sudo apt install curl
```

```
sudo curl -sSL https://raw.githubusercontent.com/ros/rosdistro/master/ros.key -o /usr/share/keyrings/ros-archive-keyring.gpg
```

```
echo "deb [arch=$(dpkg --print-architecture) signed-by=/usr/share/keyrings/ros-archive-keyring.gpg] http://packages.ros.org/ros2/ubuntu $(. /etc/os-release && echo $UBUNTU_CODENAME) main" | sudo tee /etc/apt/sources.list.d/ros2.list > /dev/null
```

Installing ROS

Installing

```
sudo apt update
```

```
sudo apt upgrade
```

```
sudo apt install ros-humble-desktop
```

```
sudo apt install ros-humble-ros-base
```

```
sudo apt install ros-dev-tools
```

Installing ROS (Task 1)

Check the sub/pub tutorial is works well

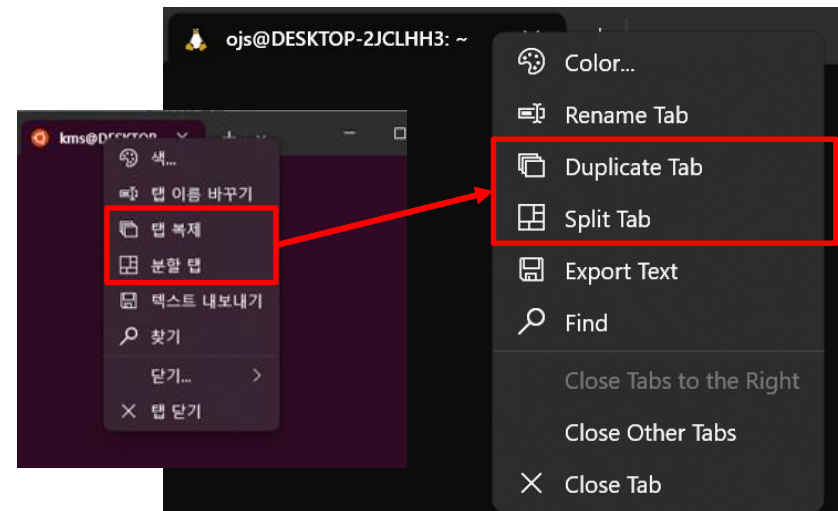
Open two ubuntu terminal tabs

Terminal 1

```
source /opt/ros/humble/setup.bash
ros2 run demo_nodes_cpp talker
```

Terminal 2

```
source /opt/ros/humble/setup.bash
ros2 run demo_nodes_py listener
```



```
관리자: Windows PowerShell  X kms@DESKTOP-9SDD506: ~ X kms@DESKTOP-9SDD506: ~ + -
kms@DESKTOP-9SDD506:~$ source /opt/ros/humble/setup.bash
kms@DESKTOP-9SDD506:~$ ros2 run demo_nodes_cpp talker
[INFO] [1708019733.759970180] [talker]: Publishing: 'Hello World: 1'
[INFO] [1708019734.760106383] [talker]: Publishing: 'Hello World: 2'
[INFO] [1708019735.759933068] [talker]: Publishing: 'Hello World: 3'
[INFO] [1708019736.759928569] [talker]: Publishing: 'Hello World: 4'
[INFO] [1708019737.759948342] [talker]: Publishing: 'Hello World: 5'

kms@DESKTOP-9SDD506:~$ source /opt/ros/humble/setup.bash
kms@DESKTOP-9SDD506:~$ ros2 run demo_nodes_py listener
[INFO] [1708019741.784826580] [listener]: I heard: [Hello World: 9]
[INFO] [1708019742.761916148] [listener]: I heard: [Hello World: 10]
[INFO] [1708019743.761893531] [listener]: I heard: [Hello World: 11]
[INFO] [1708019744.761987963] [listener]: I heard: [Hello World: 12]
[INFO] [1708019745.762068715] [listener]: I heard: [Hello World: 13]
```

Installing GAZEBO

https://gazebo-sim.org/docs/harmonic/install_ubuntu

Installing

```
sudo apt-get update
```

```
sudo apt-get install lsb-release wget gnupg
```

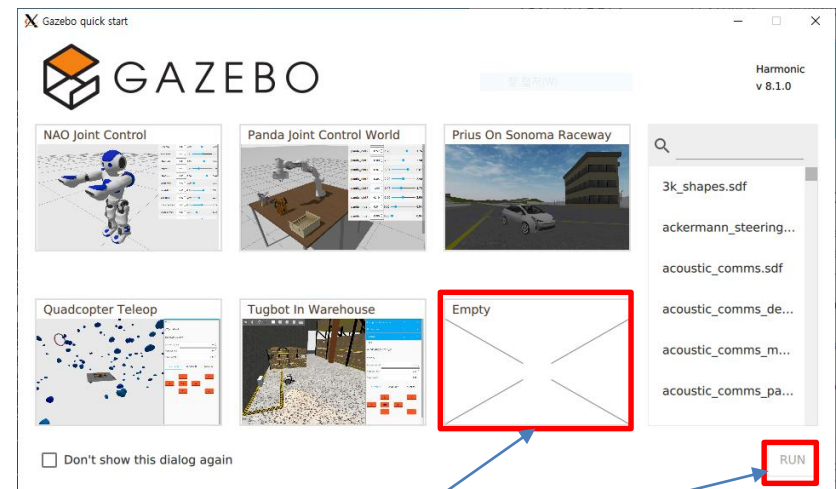
```
sudo wget https://packages.osrfoundation.org/gazebo.gpg -O /usr/share/keyrings/pkgs-osrf-archive-keyring.gpg
```

```
echo "deb [arch=$(dpkg --print-architecture) signed-by=/usr/share/keyrings/pkgs-osrf-archive-keyring.gpg] http://packages.osrfoundation.org/gazebo/ubuntu-stable $(lsb_release -cs) main" | sudo tee /etc/apt/sources.list.d/gazebo-stable.list > /dev/null
```

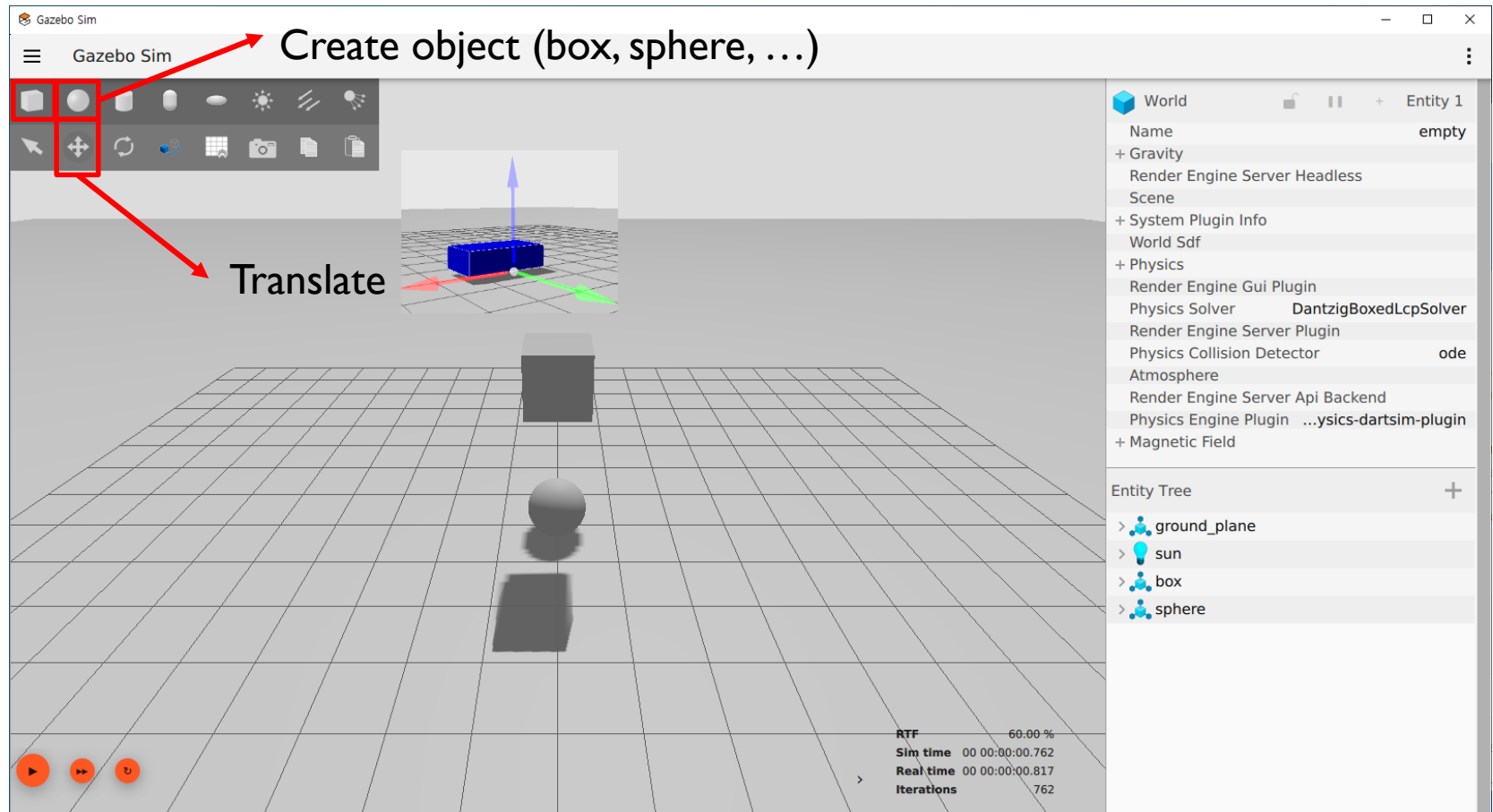
```
sudo apt-get update
```

```
sudo apt-get install gz-harmonic
```

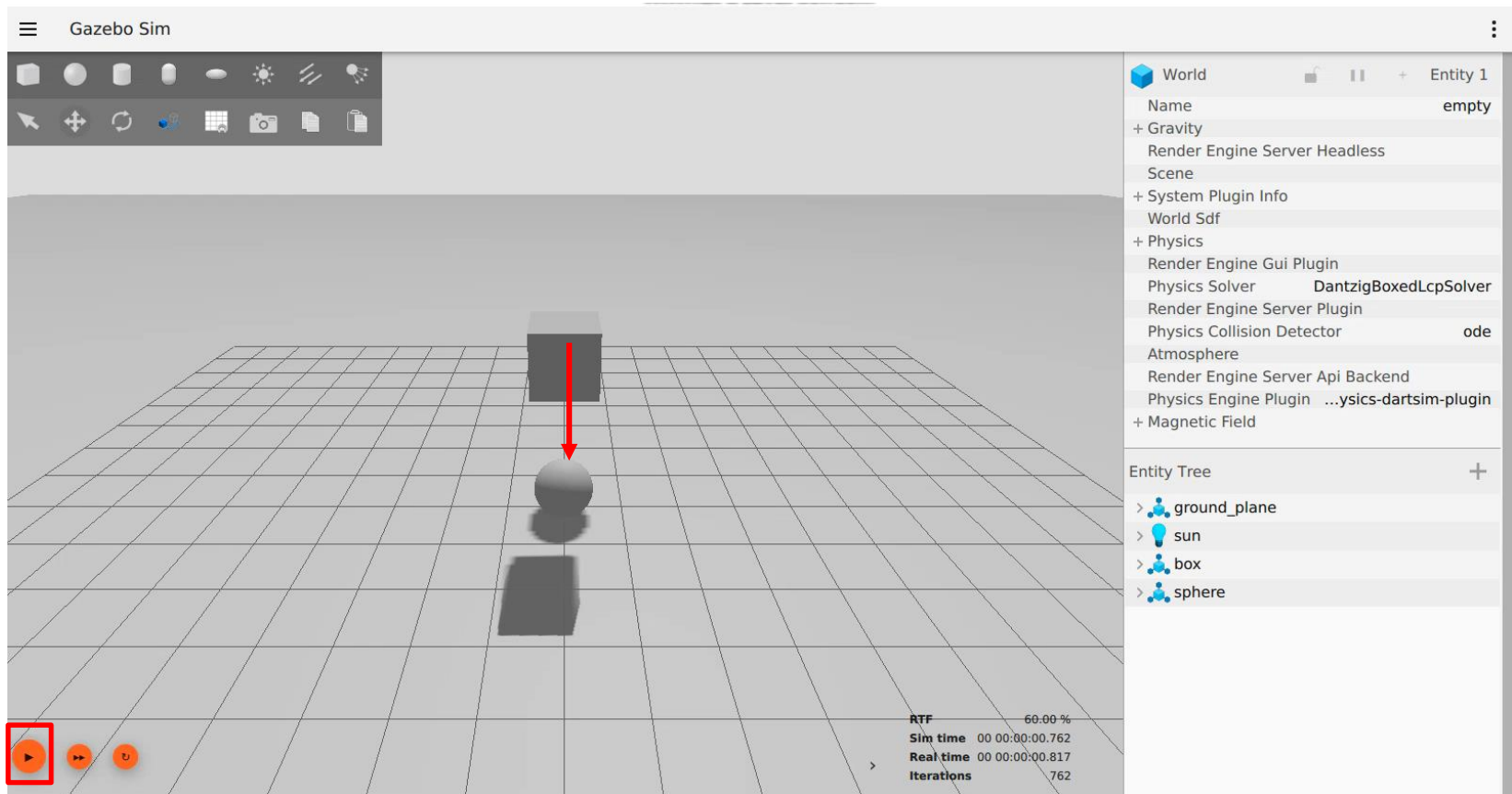
```
gz sim # start gazebo
```



Installing GAZEBO



Installing GAZEBO (Task 2)



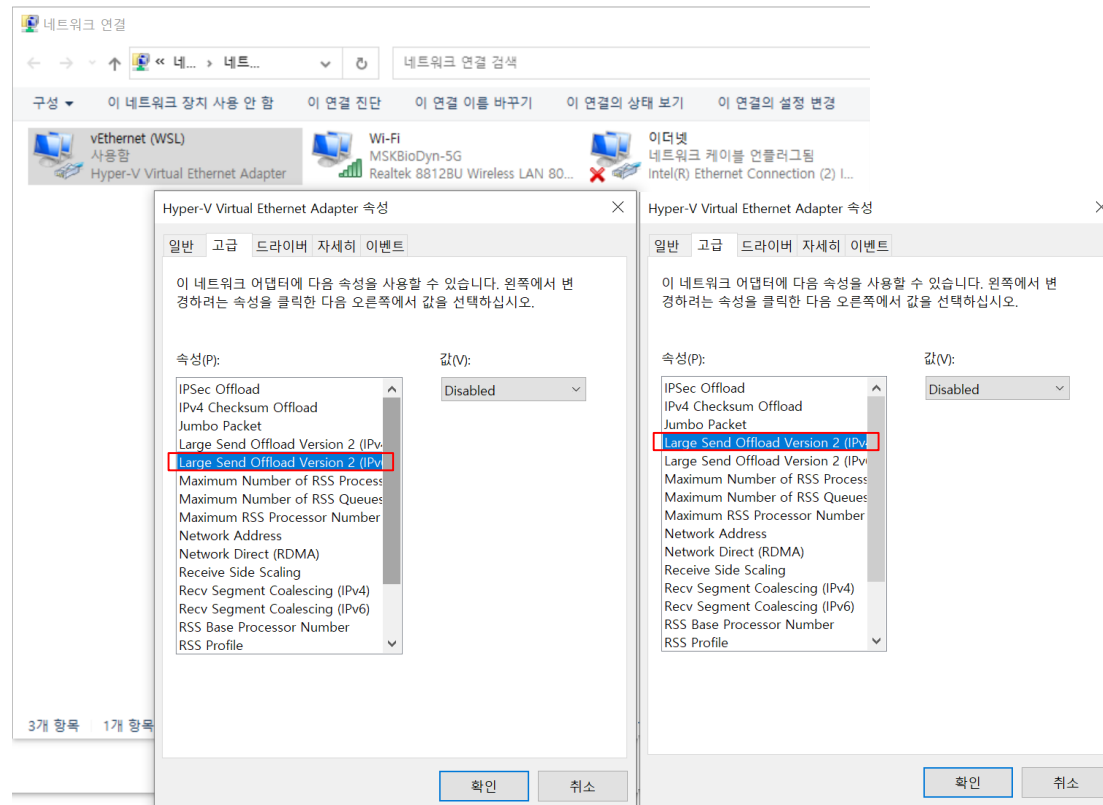
Tasks

- ▶ Run the ros talker & listener example (26 page)
- ▶ Simulate falling of the box or sphere in GAZEBO (29 page)

Tips #3

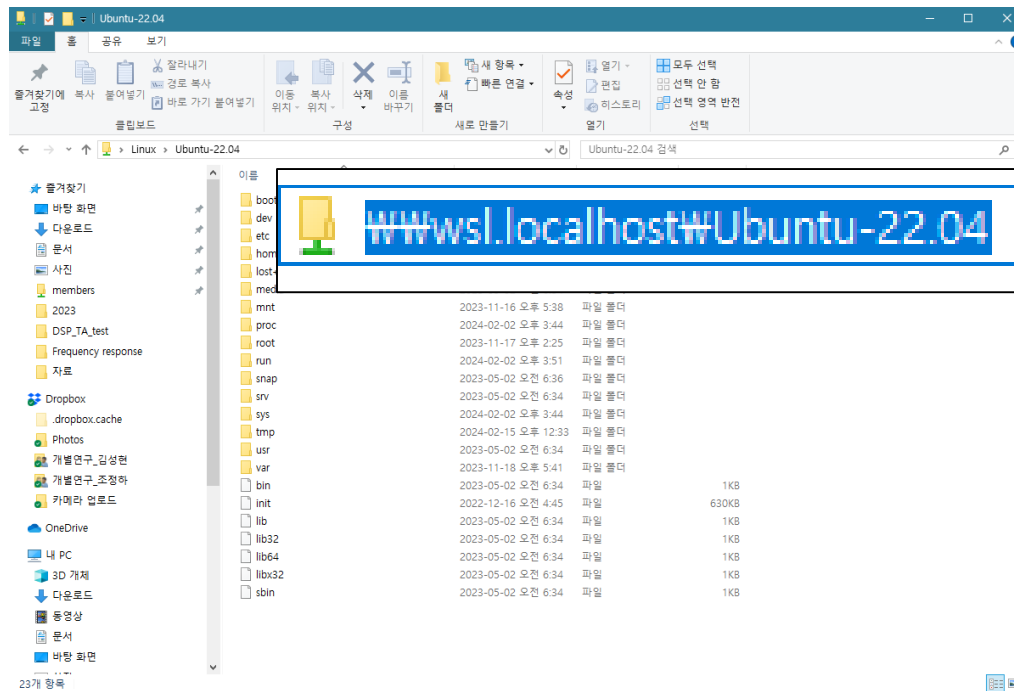
▶ If the internet on WSL2 is so slow

- ▶ Disable-NetAdapterLso -Name "vEthernet (WSL)" in Windows Powershell
- ▶ Same operation with disable 2 features(Large send offload....)



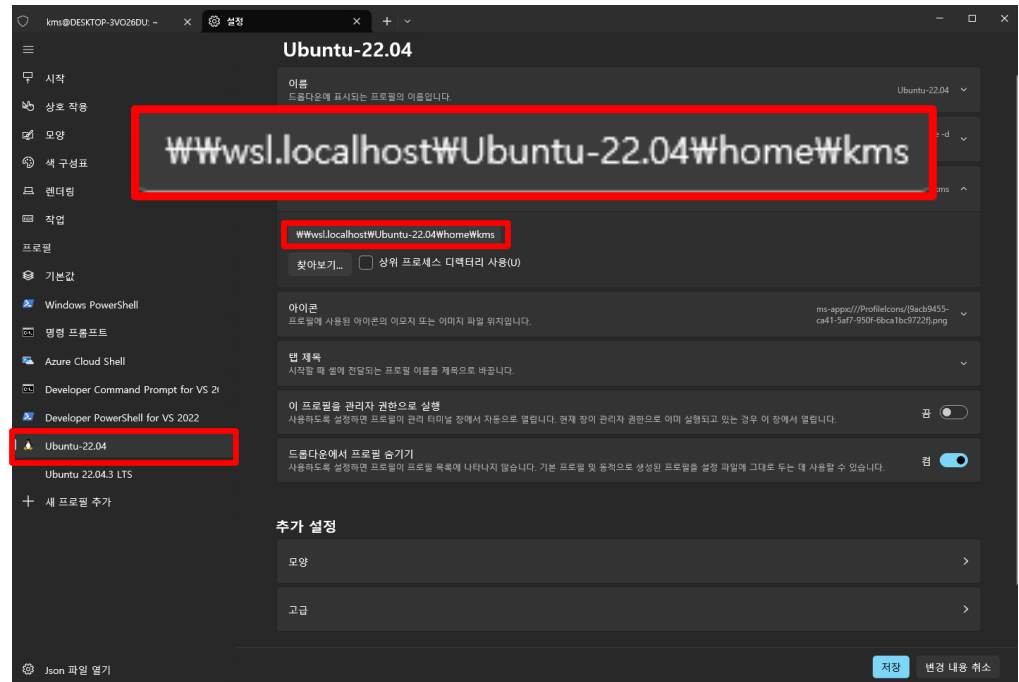
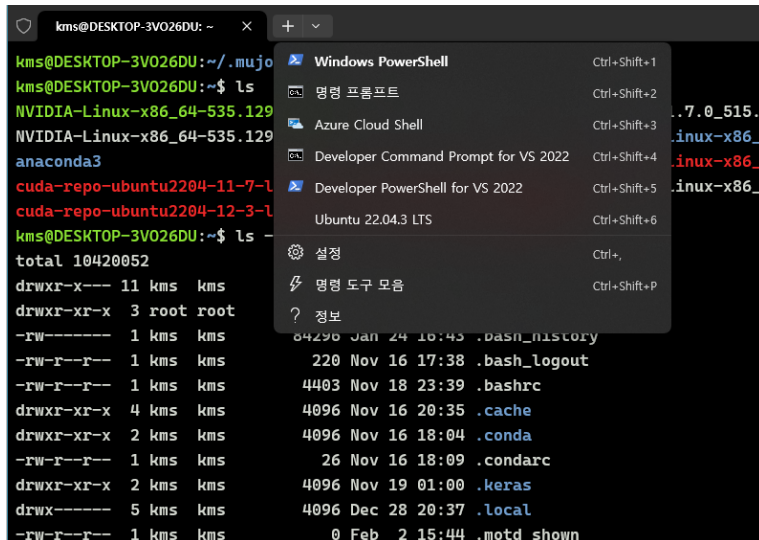
Tips #4

- ▶ If you want to access files on windows explorer
 - ▶ \\wsl.localhost\Ubuntu-22.04 is root directory(/) of ubuntu.
 - ▶ You can access, read/write, search the files



Tips #5

- ▶ Set home directory as starting directory in Windows terminal
 - ▶ go settings or Ctrl + , click Ubuntu-22.04 tab
 - ▶ Set as `\\wsl.localhost\Ubuntu-22.04\home\username`



Extra FAQs (After TA Session)

▶ 0x8000FFFF error

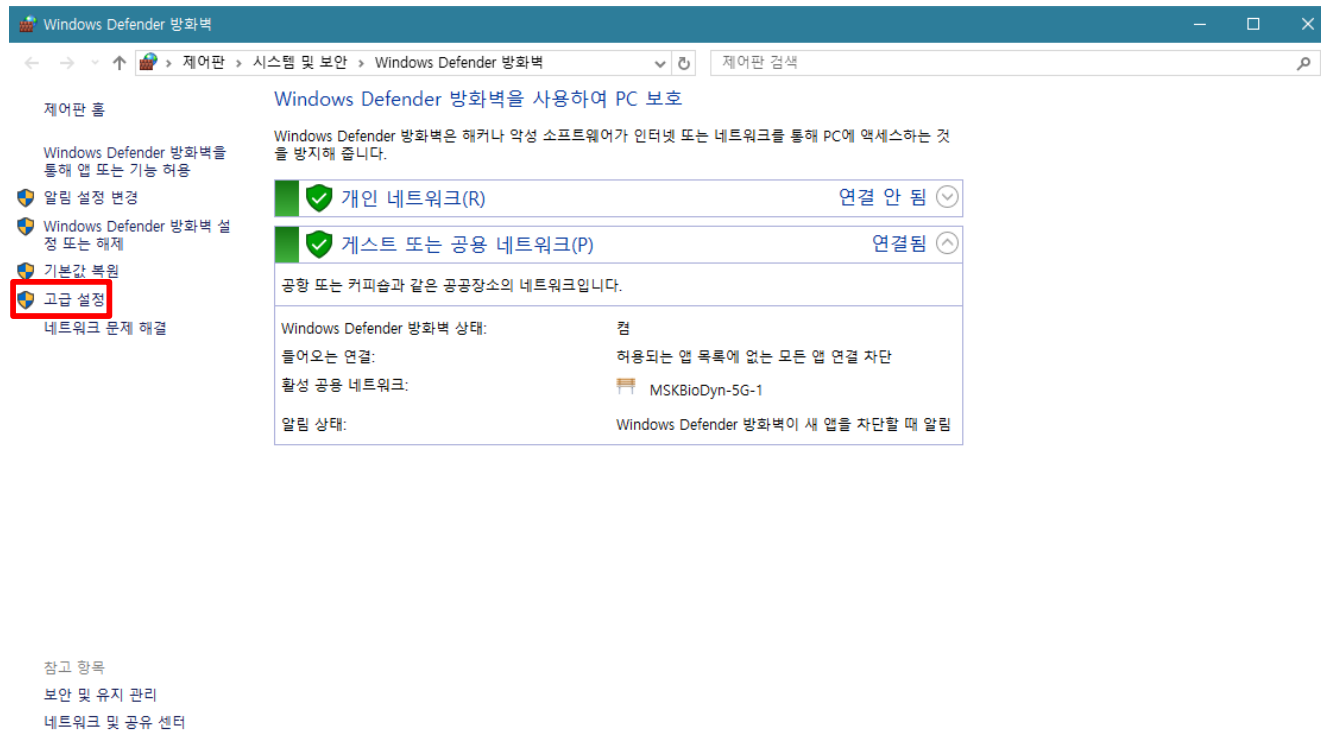
- ▶ Please try updating wsl2 using either of following command
 - ▶ try restart the system
 - ▶ run cmd or PowerShell without administrator permission

▶ Errors with gnu ~ message

- ▶ `export LIBGL_ALWAYS_SOFTWARE=1`

Extra FAQs (After TA Session)

- ▶ Windows Defender issue (When Xming does not work)
 - ▶ 'Windows Defender' in search tab



Extra FAQs (After TA Session)

- ▶ Windows Defender issue (When Xming does not work)
 - ▶ In the inbound rule, if Xming is marked with a red sign, click on them and delete

