

# Visionary Course – Energy AI

## Week 04

Mar. 29, 2022  
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# Week 04b – Getting Started with AI on Jetson Nano

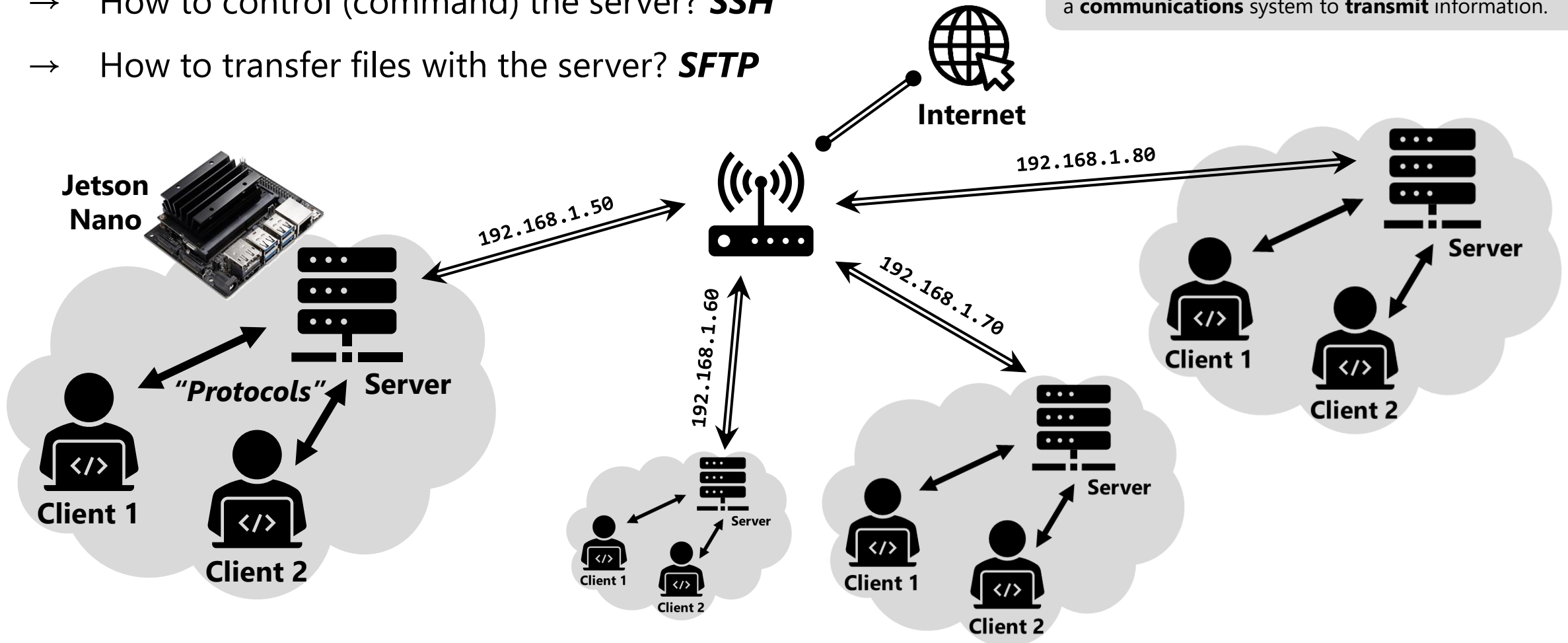
# Basic Development Environments for CS Engineering

## How to communicate remotely with a server?

- How to control (command) the server? **SSH**
- How to transfer files with the server? **SFTP**

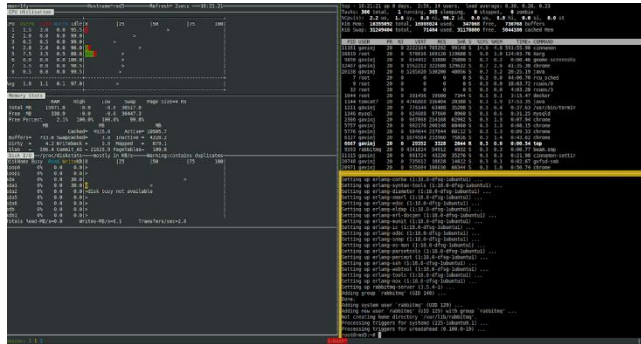
### Protocol?

→ A system of **rules** that allows two or more entities of a **communications** system to **transmit** information.



# SSH: Secure Shell Protocol

```
chris@ubuntu:~$ ssh chris@localhost
chris@ubuntu:~$ ssh chris@localhost
The authenticity of host 'localhost (127.0.0.1)' can't be established.
ECDSA key fingerprint is SHA256:k9RDUvinuNTILvr+10g2ADSwY7qVnEwTS3BeVGLW.
Are you sure you want to continue connecting (yes/no)?
```



# SFTP: Secure File Transfer Protocol

Keys, Commands, Data

**Encrypted Tunnel**

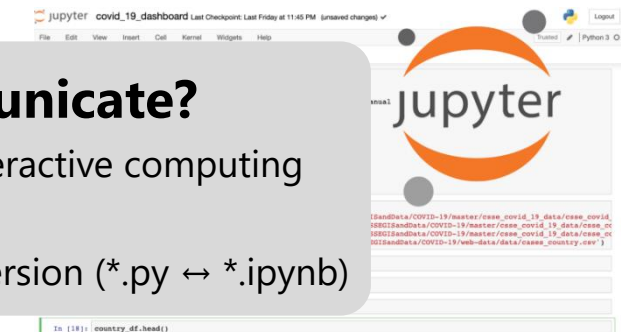
**SFTP Client**

Private Key

**SFTP Server**

Public Key

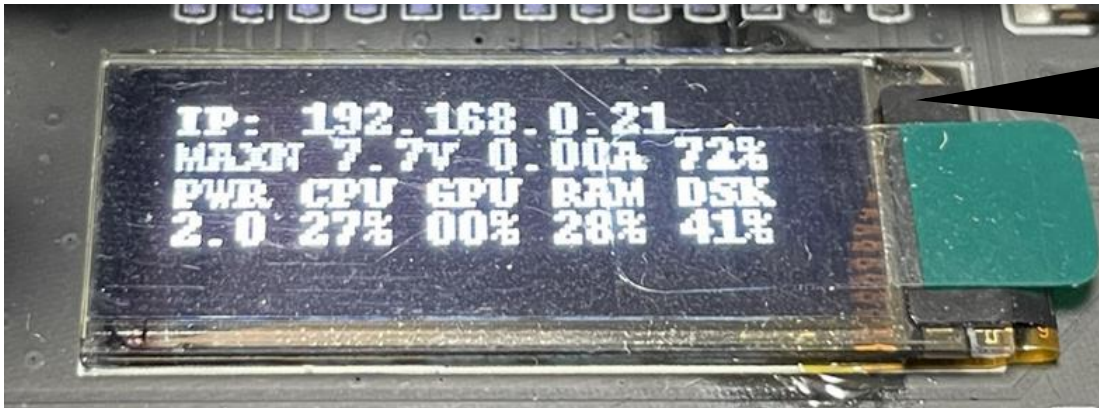
- **IPython** or **Jupyter**: web-based interactive computing
- Pros: easy to use, simple navigation
- Cons: not stable, only Python, conversion (\*.py ↔ \*.ipynb)



# Last Class, We Assembled the Board

## + How to connect WiFi:

- Connect display via HDMI → SSID: **VC\_AI**, PW: **kentech12345**
- You can check the IP address in your board.



IP: 192.168.\*\*\*.\*\*\*  
Battery: 7.7 V (72 %)  
CPU/GPU/RAM/DSK usage



\*Batteries will be distributed for the JetRacer Project.

\*Charge cut-off voltage **4.2V**, discharge cut-off voltage is **3.0V**.

- For teams who didn't/can't connect WiFi, please get helps from TA.

# Today, We Explore the Linux Server

## + Jupyter Notebook

→ Web-based terminal & code editor.

→ How to connect?

→ Open a new browser tab and navigate to `http://192.168.***.***:8888`

IP address

Port number  
for Jupyter

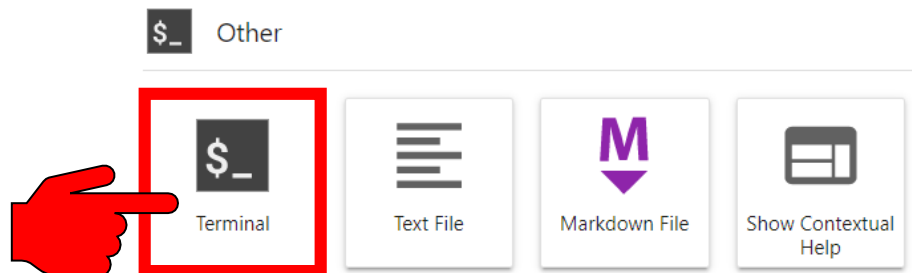
Passwd: jetson

## + Open Terminal, and please try some basic Linux commands

→ Example of basic Linux commands:

→ <https://view.kentech.ac.kr/lecture/2022s/supp/ref01>

→ <https://www.youtube.com/watch?v=-BQtLkZMXnA>



Directory Operations	
<code>pwd</code>	Show current directory
<code>mkdir dir</code>	Make directory <i>dir</i>
<code>cd dir</code>	Change directory to <i>dir</i>
<code>cd ..</code>	Go up a directory
<code>ls</code>	List files

# Examples of Linux Commands

<https://view.kentech.ac.kr/lecture/2022s/supp/ref01>
<https://www.youtube.com/watch?v=-BQtLkZMXnA>

```
jetson@jetson-desktop: ~  
jetson@jetson-desktop:~$ pwd  
/home/jetson  
jetson@jetson-desktop:~$ ls  
Desktop  examples.desktop  jetracer  Pictures  TF-models  torchvision  
Documents  jetcam  jupyter_clickable_image_widget  Public  torch-1.6.0-cp36-cp36m-linux_aarch64.whl  Videos  
Downloads  jetcard  Music  Templates  torch2trt  ws  
jetson@jetson-desktop:~$ python -V  
Python 2.7.17  
jetson@jetson-desktop:~$ python3 -V  
Python 3.6.9  
jetson@jetson-desktop:~$ ll  
total 262928  
drwxr-xr-x 30 jetson jetson 4096 3月 27 17:44 ./  
drwxr-xr-x 3 root root 4096 3月 9 2021 ../  
-rw-r--r-- 1 jetson jetson 8973 3月 27 18:48 .bash_history  
-rw-r--r-- 1 jetson jetson 220 3月 9 2021 .bash_logout  
-rw-r--r-- 1 jetson jetson 3771 3月 9 2021 .bashrc  
drwx----- 14 jetson jetson 4096 3月 11 2021 .cache/  
drwx----- 3 jetson jetson 4096 3月 10 2021 .compiz/  
drwx----- 16 jetson jetson 4096 3月 11 2021 .config/  
drwxr-xr-x 2 jetson jetson 4096 3月 9 2021 Desktop/  
drwxr-xr-x 2 jetson jetson 4096 3月 9 2021 Documents/  
drwxr-xr-x 2 jetson jetson 4096 3月 9 2021 Downloads/
```

```
$ pwd  
$ ls  
$ python -V  
$ python3 -V
```

```
jetson@jetson-desktop:~$ sudo adduser slee  
[sudo] password for jetson:  
Adding user `slee' ...  
Adding new group `slee' (1002) ...  
Adding new user `slee' (1001) with group `slee' ...  
Creating home directory `/home/slee' ...  
Copying files from `/etc/skel' ...  
Enter new UNIX password:  
Retype new UNIX password:  
passwd: password updated successfully  
Changing the user information for slee  
Enter the new value, or press ENTER for the default  
Full Name []:  
Room Number []:  
Work Phone []:  
Home Phone []:  
Other []:  
Is the information correct? [Y/n]  
Adding new user `slee' to extra groups ...  
Adding user `slee' to group `audio' ...  
Adding user `slee' to group `adm' ...  
Adding user `slee' to group `gpio' ...  
Adding user `slee' to group `i2c' ...  
Adding user `slee' to group `lightdm' ...  
Adding user `slee' to group `video' ...  
Adding user `slee' to group `weston-launch' ...  
jetson@jetson-desktop:~$ sudo usermod -aG sudo slee  
jetson@jetson-desktop:~$
```

User ID: "Your-Student-ID"  
Passwd: "Your-Student-ID"

```
jetson@jetson-desktop:~$ ifconfig  
eth0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500  
ether 48:b0:2d:5b:c1:d1 txqueuelen 1000 (Ethernet)  
RX packets 0 bytes 0 (0.0 B)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 0 bytes 0 (0.0 B)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
device interrupt 150 base 0xe000  
  
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536  
inet 127.0.0.1 netmask 255.0.0.0  
inet6 ::1 prefixlen 128 scopeid 0x10<host>  
loop txqueuelen 1 (Local Loopback)  
RX packets 1137 bytes 183842 (183.8 KB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 1137 bytes 183842 (183.8 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
rndis0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500  
inet6 fe80::f402:a6ff:fe86:e36d prefixlen 64 scopeid 0x20<link>  
ether f8:02:a6:86:e3:6d txqueuelen 1000 (Ethernet)  
RX packets 17806 bytes 1048774 (1.0 MB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 28535 bytes 43428645 (43.4 MB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
usb0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500  
ether f8:02:a6:86:e3:6f txqueuelen 1000 (Ethernet)  
RX packets 0 bytes 0 (0.0 B)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 0 bytes 0 (0.0 B)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
inet 192.168.0.21 netmask 255.255.255.0 broadcast 192.168.0.255  
inet6 fe80::1e95:b92e:ee1:fc21 prefixlen 64 scopeid 0x20<link>  
ether e8:84:a5:f5:e7:a4 txqueuelen 1000 (Ethernet)  
RX packets 149757 bytes 25076894 (25.0 MB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 228865 bytes 138651377 (138.6 MB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

```
$ ifconfig  
→ What is your IP?  
→ What is wlan?
```

**\*Please create an account for each team member following below commands.**

```
$ sudo adduser [your_student_id]  
$ sudo usermod -aG sudo [your_student_id]  
$ cat /etc/passwd
```



# Configure SSH/SFTP for Jetson Nano Projects

## SSH to connect Jetson remotely

→ Windows: *MobaXterm* / Mac: *Terminal* (basic app)

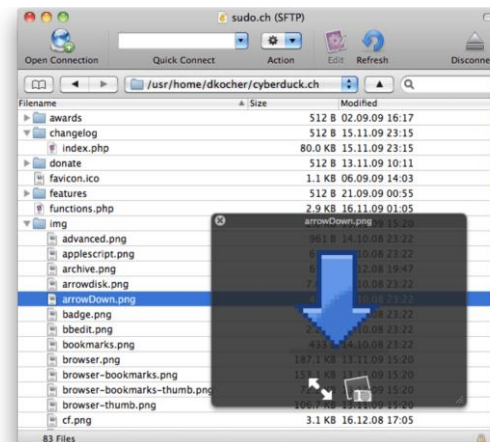
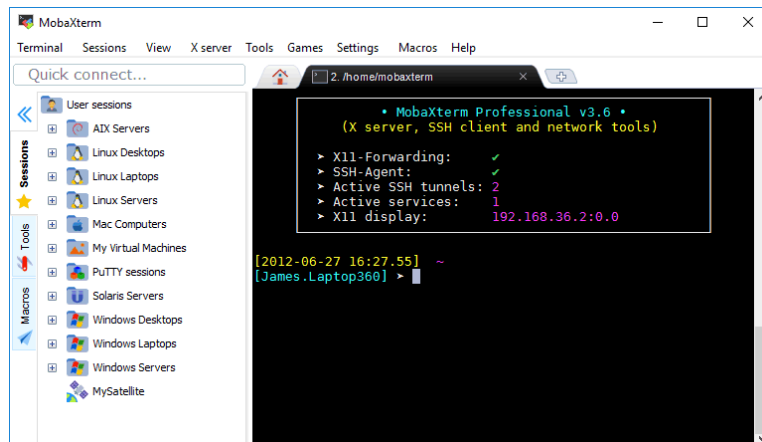
Mac is similar  
to Linux

## SFTP for file transfer

→ Windows: *MobaXterm* / Mac: *Cyberduck* ([link](#)), *Sharing* (basic app)

## Code editor

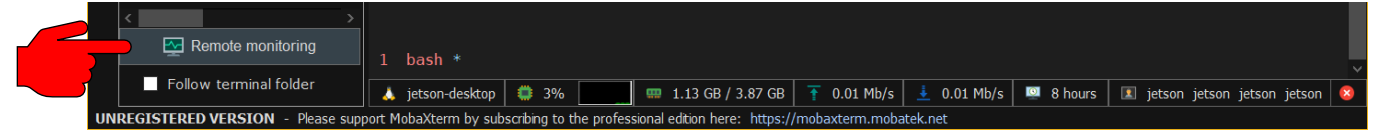
→ *Sublime Text*, *VS Code*





# Configure SSH/SFTP

## Windows: MobaXterm



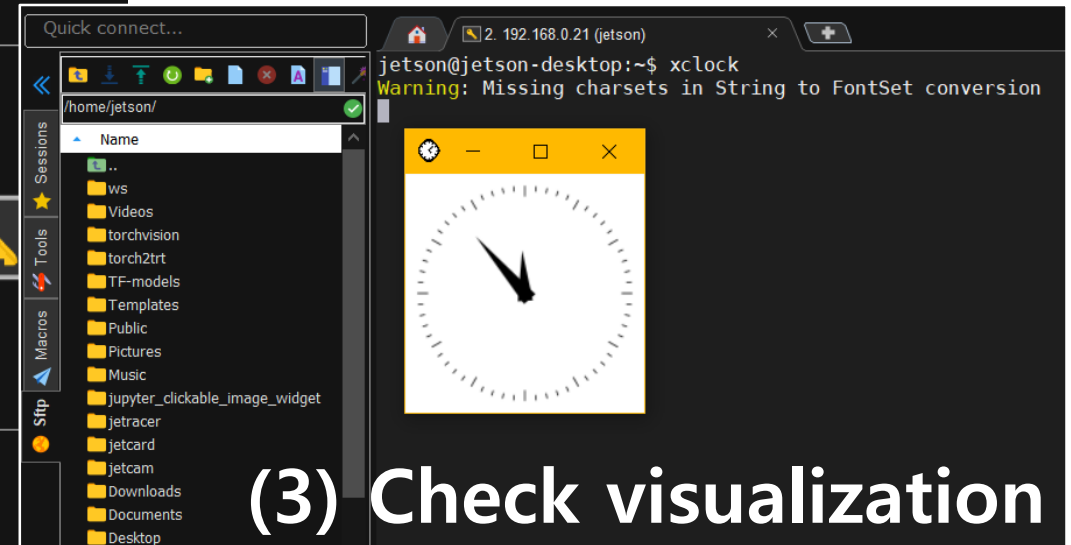
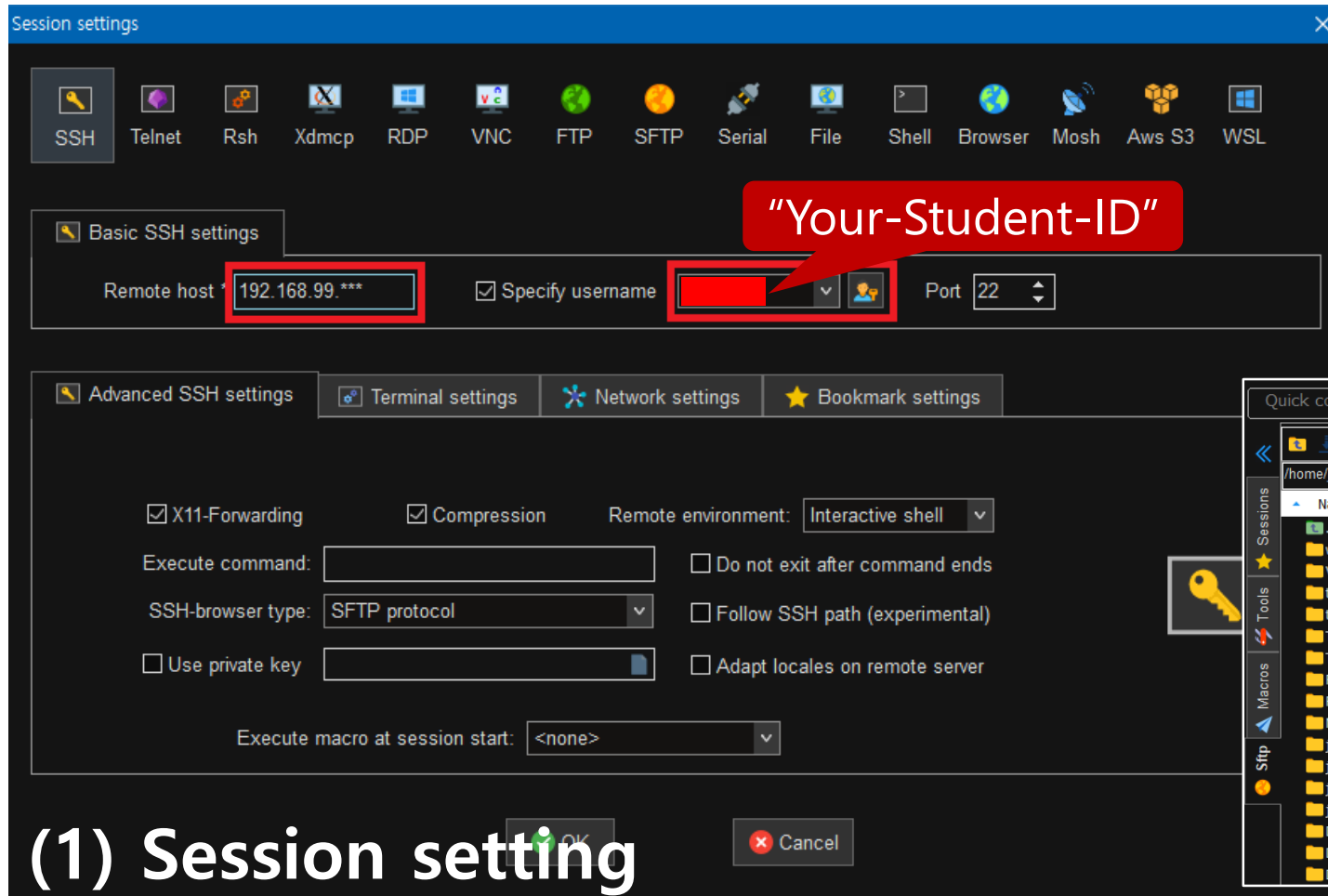
## (2) System monitoring

Type password `[your_student_id]`, and log in.

Check SFTP in the left panel.

Check visualization by typing below:

`$ xclock`     `$ xeyes`     `$ xcalc`



## (3) Check visualization

## (1) Session setting

# Configure SSH/SFTP

## Mac: Terminal or iTerm2

→ Open Terminal and type below commands:

```
$ ssh -p 22 [your_student_id]@192.168.***.***
```

```
C:\Users\Seokju>ssh
usage: ssh [-46AaCfGgKkMNnqsTtVvXxYy] [-B bind_interface]
          [-b bind_address] [-c cipher_spec] [-D [bind_address:]port]
          [-E log_file] [-e escape_char] [-F configfile] [-I pkcs11]
          [-i identity_file] [-J [user@]host[:port]] [-L address]
          [-l login_name] [-m mac_spec] [-O ctl_cmd] [-o option] [-p port]
          [-Q query_option] [-R address] [-S ctl_path] [-W host:port]
          [-w local_tun[:remote_tun]] destination [command]

C:\Users\Seokju>ssh -p 22 jetson@192.168.0.21
The authenticity of host '192.168.0.21 (192.168.0.21)' can't be established.
ECDSA key fingerprint is SHA256:X09ErpDwp9iMI8gati7GFng5rqDQCnJTDVvkzR+84plg.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.0.21' (ECDSA) to the list of known hosts.
jetson@192.168.0.21's password:
Welcome to Ubuntu 18.04.5 LTS (GNU/Linux 4.9.201-tegra aarch64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage
This system has been minimized by removing packages and content that are
not required on a system that users do not log into.

To restore this content, you can run the 'unminimize' command.

383 packages can be updated.
278 updates are security updates.

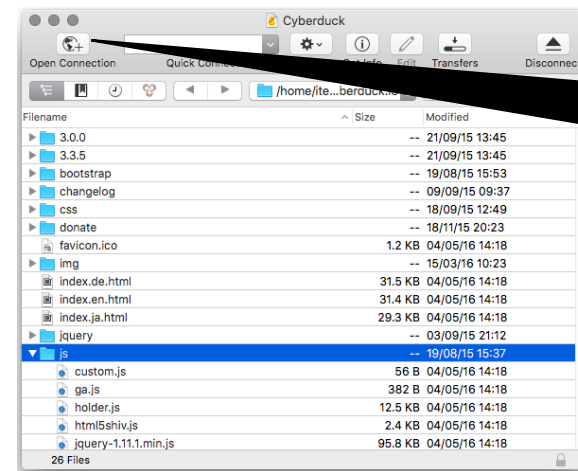
Last login: Sun Mar 27 17:44:24 2022 from 192.168.0.21
jetson@jetson-desktop:~$
```

(1) Session setting

→ If the visualization is not available,  
please refer below link:

- XQuartz solution: <https://www.cyberciti.biz/faq/apple-osx-mountain-lion-mavericks-install-xquartz-server/>

→ SFTP setting (Cyberduck, or VS Code)

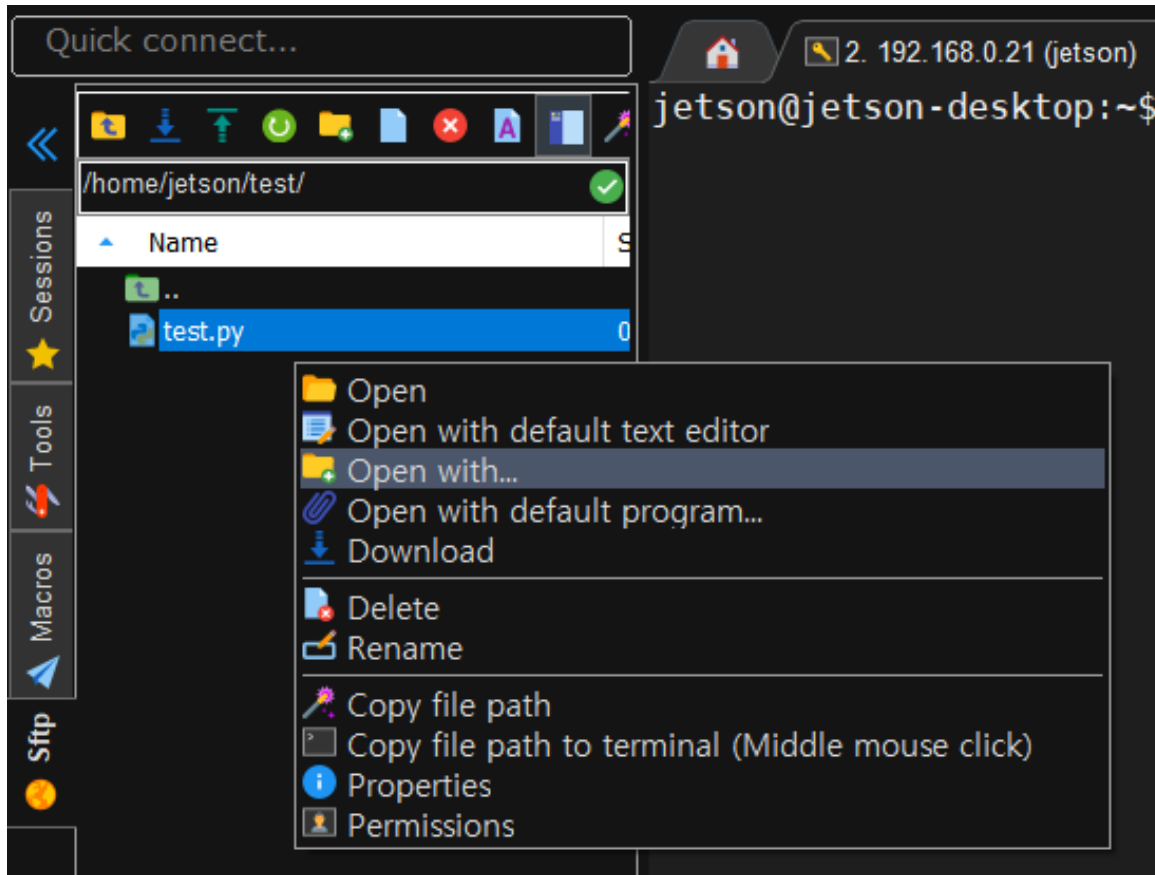


Click Open Connection,  
and configure your IP,  
port number, and ID/PW.

(2) SFTP setting

# Edit Files via SFTP

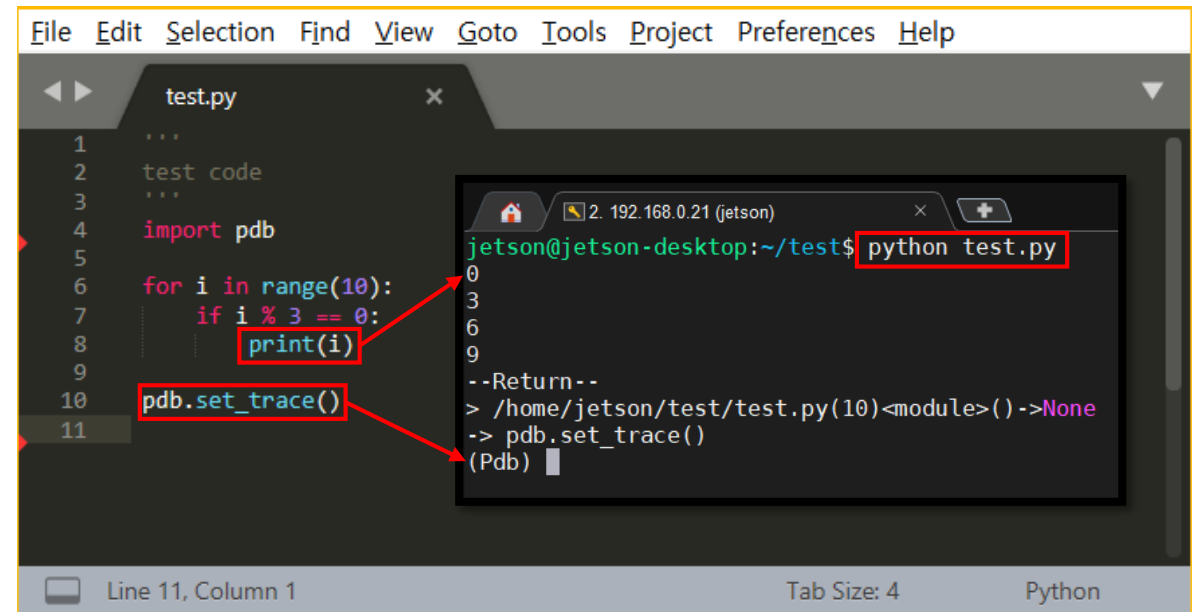
## Windows/Mac: Sublime Text



→ Right-click the filename, and click “**Open with...**”.

Select “**Sublime Text**” as a default program.

While saving the file, click “**Autosave**” for convenience.

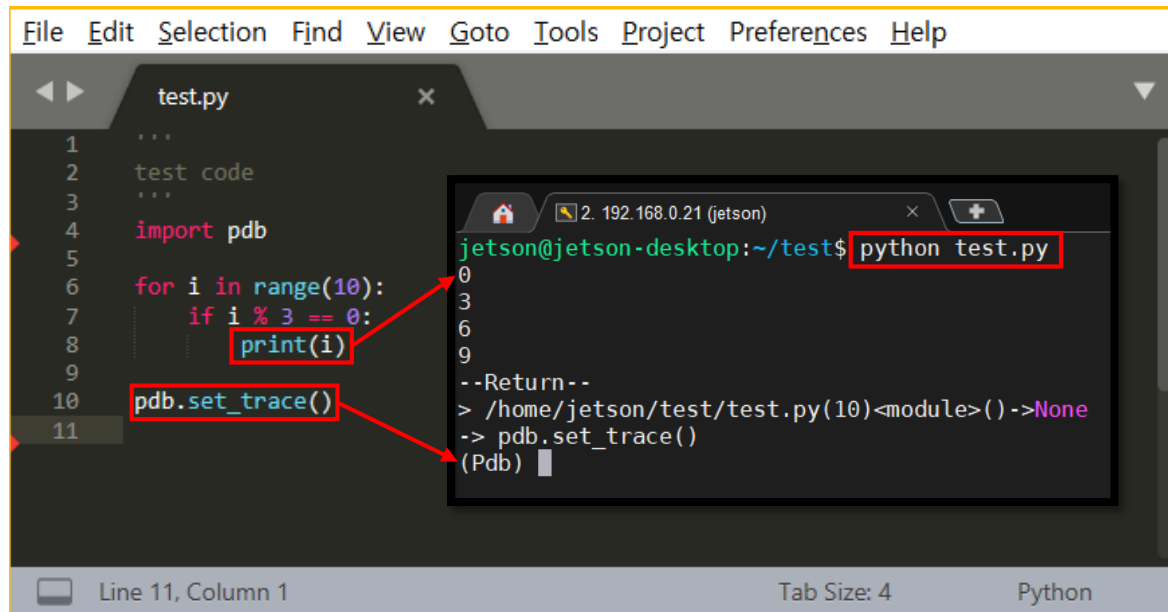


(line 4) `import pdb`; (line 10) `pdb.set_trace()`;

→ A **breakpoint** is an **intentional stopping** or **pausing place** in a program, put in place for **debugging** purposes.

# Discussions: Python Debugging – HW (1)

Please copy the below python code into your server and execute it.



The screenshot shows a Python IDE with a file named `test.py`. The code in the file is as follows:

```
1  ...
2  test code
3  ...
4  import pdb
5
6  for i in range(10):
7      if i % 3 == 0:
8          print(i)
9
10  pdb.set_trace()
11
```

Red boxes highlight `print(i)` on line 8 and `pdb.set_trace()` on line 10. A terminal window is open, showing the command `python test.py` being executed. The terminal output shows the values of `i` at the points where the debugger was set: 0, 3, 6, and 9. The terminal also shows the debugger's prompt `--Return--` and the command `> /home/jetson/test/test.py(10)<module>()->None` followed by `-> pdb.set_trace()` and the debugger prompt `(Pdb)`.

**Q1. What happens if you type "c", "n", or "p [variable]" in (Pdb)? Please discuss each role. Type "ctrl+d" or "q" to exit (Pdb).**

```
(Pdb) c
(Pdb) n
(Pdb) p i
```

**Q2. Please insert break points into *line 7* (right after the loop begins), and into *line 8* (right after the condition is satisfied). What is the value of "i" after each loop? Please trace the value.**

```
(Pdb) p i
(Pdb) c
```

**Q3. What is the meaning of the operator "%"?**

**Q4. Please implement a code to determine whether an input is a prime number or not.**

```
### script ###
n = int(input())
is_prime = True
for i in [2, 3, 4, 5, 6, 7, 8, 9, 10]:
    if n % i == 0:
        is_prime = False

print("{} is prime: {}".format(n, is_prime))
```

# Summary

## Communicate with Jetson Nano

- **SSH**: Secure Shell Protocol
- **SFTP**: Secure File Transfer Protocol
- Jupyter Notebook: Easy to use & simple navigation, but low stability
- Some basic Linux commands

## Debugging

- Break points with `pdb.set_trace()`
- Hope **debugging** makes you more computer friendly!