

Jupyter Lab environment construction

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1. Install Jupyter Lab
2. Open Jupyter Lab
3. Set up LAN access to jupyter lab
4. Set up access to jupyter lab
5. Set Jupyter Lab to start automatically

Jupyter Lab is a web-based interactive development environment that supports multiple programming languages. It provides a flexible workspace for data cleaning, visualization, machine learning modeling and other data science tasks.

Note: The factory image has already installed this environment, so there is no need to install it again. Just learn how to build it

1. Install Jupyter Lab

- Check the system python version

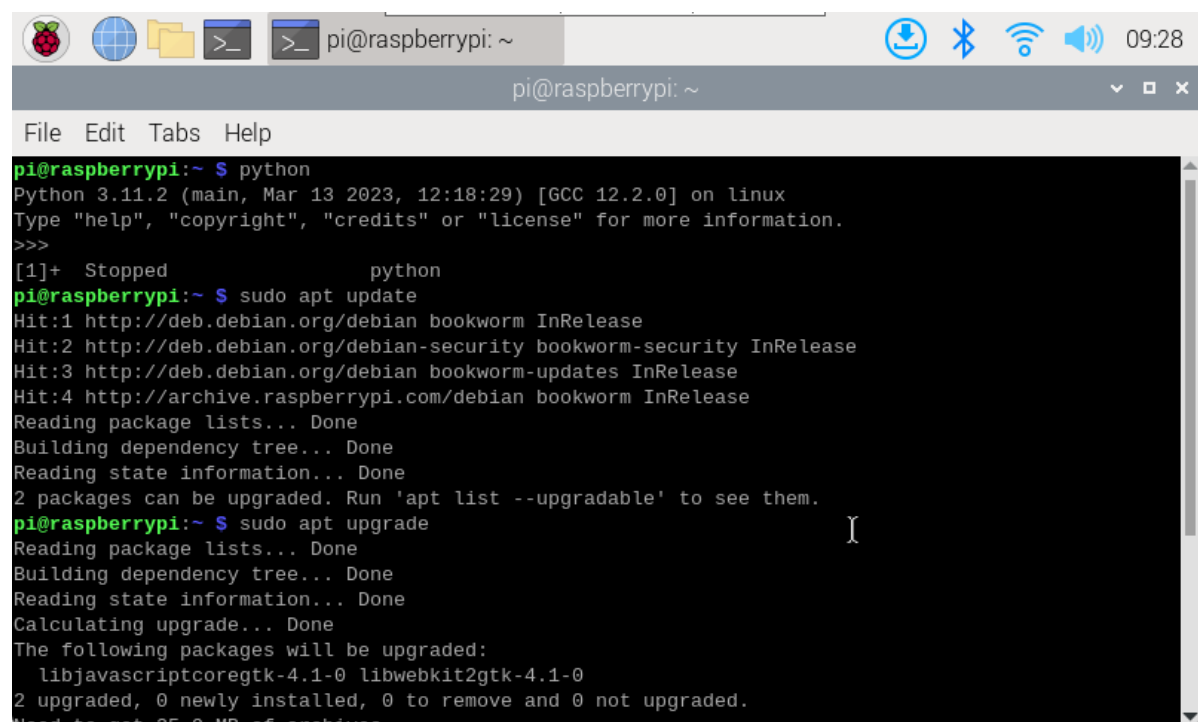
Enter the command in the terminal:

```
python
```

- Install Jupyter Lab

Update the repository list and software before installing the software:

```
sudo apt update  
sudo apt upgrade
```



The screenshot shows a terminal window on a Raspberry Pi. The window title is 'pi@raspberrypi: ~'. The terminal output shows the following commands and their results:

```
pi@raspberrypi:~ $ python  
Python 3.11.2 (main, Mar 13 2023, 12:18:29) [GCC 12.2.0] on linux  
Type "help", "copyright", "credits" or "license" for more information.  
>>>  
[1]+  Stopped                  python  
pi@raspberrypi:~ $ sudo apt update  
Hit:1 http://deb.debian.org/debian bookworm InRelease  
Hit:2 http://deb.debian.org/debian-security bookworm-security InRelease  
Hit:3 http://deb.debian.org/debian bookworm-updates InRelease  
Hit:4 http://archive.raspberrypi.com/debian bookworm InRelease  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
2 packages can be upgraded. Run 'apt list --upgradable' to see them.  
pi@raspberrypi:~ $ sudo apt upgrade  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
Calculating upgrade... Done  
The following packages will be upgraded:  
  libjavascriptcoregtk-4.1-0 libwebkit2gtk-4.1-0  
2 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.  
Need to get 25.0 MB of archives  
Use 'dpkg --get-selections' to see the status of installed packages.
```

Install Jupyter Lab in the Python 3 environment and enter the command in the terminal:

```
sudo pip3 install jupyterlab
```

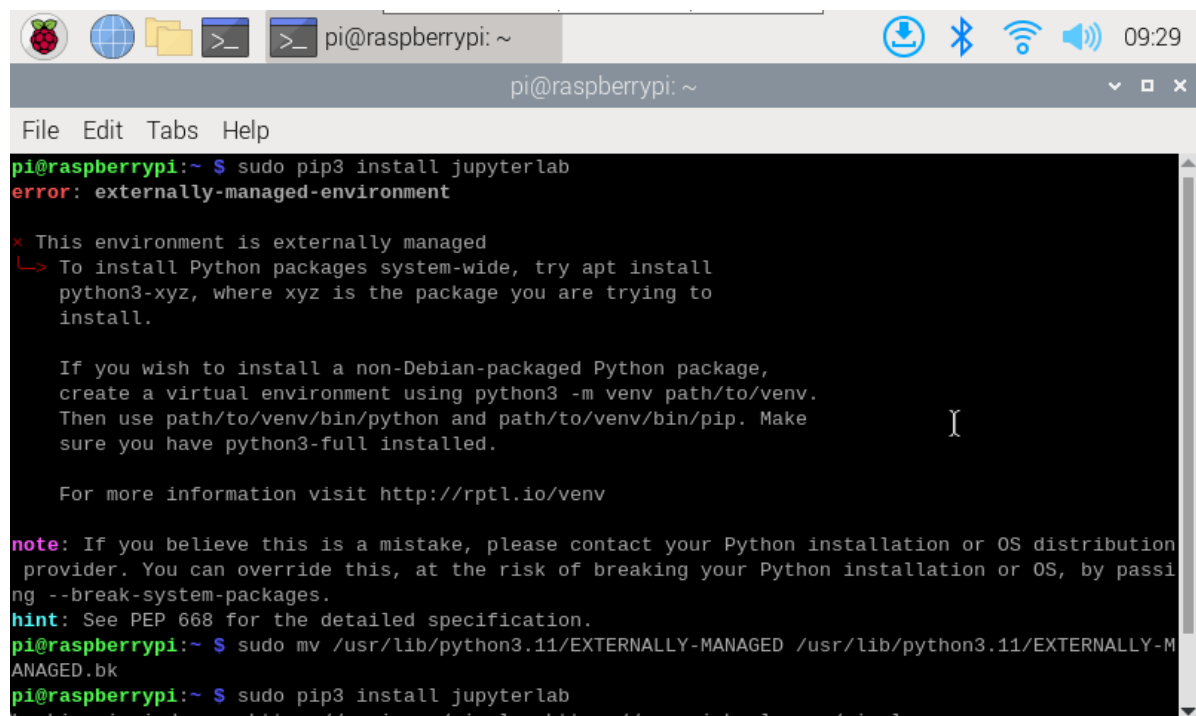
If multiple downloads fail, you can specify the Python package mirror address of Tsinghua University to speed up the domestic download speed:

```
sudo pip3 install jupyterlab -i https://pypi.tuna.tsinghua.edu.cn/simple
```

- Error solution

If you directly enter the Jupyter Lab installation command in the terminal, an error "error: externally-managed-environment" will appear. You can use the following command to solve it: The python version is modified according to the version of your system. My current system version is 3.11

```
sudo mv /usr/lib/python3.11/EXTERNALLY-MANAGED /usr/lib/python3.11/EXTERNALLY-MANAGED.bk
```



```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi:~$ sudo pip3 install jupyterlab  
error: externally-managed-environment  
  
× This environment is externally managed  
➤ To install Python packages system-wide, try apt install  
python3-xyz, where xyz is the package you are trying to  
install.  
  
If you wish to install a non-Debian-packaged Python package,  
create a virtual environment using python3 -m venv path/to/venv.  
Then use path/to/venv/bin/python and path/to/venv/bin/pip. Make  
sure you have python3-full installed.  
  
For more information visit http://rptl.io/venv  
  
note: If you believe this is a mistake, please contact your Python installation or OS distribution  
provider. You can override this, at the risk of breaking your Python installation or OS, by passi  
ng --break-system-packages.  
hint: See PEP 668 for the detailed specification.  
pi@raspberrypi:~$ sudo mv /usr/lib/python3.11/EXTERNALLY-MANAGED /usr/lib/python3.11/EXTERNALLY-M  
ANAGED.bk  
pi@raspberrypi:~$ sudo pip3 install jupyterlab  
Looking in indexes: https://pypi.org/simple, https://www.pi-hole.org/simple
```

- Installation success prompt

The following prompt indicates that the installation is successful.

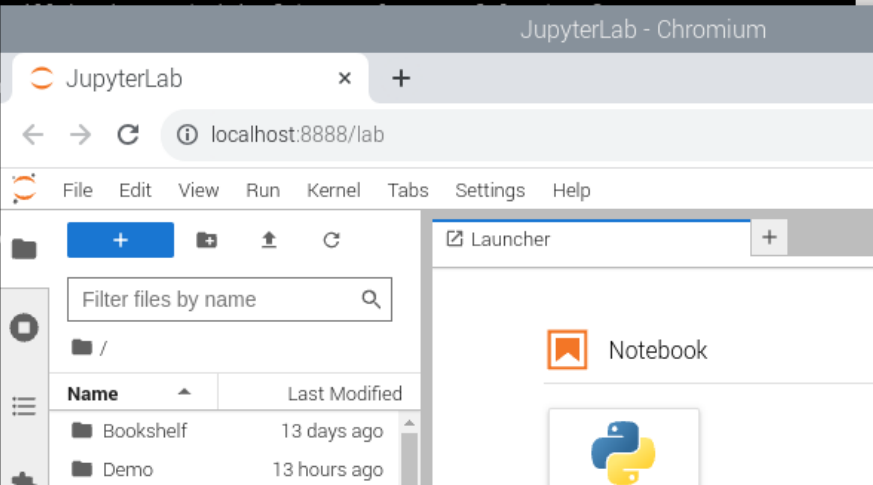
```
pi@raspberrypi: ~  
File Edit Tabs Help  
Can't uninstall 'Send2Trash'. No files were found to uninstall.  
Attempting uninstall: requests  
Found existing installation: requests 2.28.1  
Not uninstalling requests at /usr/lib/python3/dist-packages, outside environment /usr  
Can't uninstall 'requests'. No files were found to uninstall.  
Successfully installed anyio-4.2.0 argon2-cffi-23.1.0 argon2-cffi-bindings-21.2.0 arrow-1.3.0 asyn  
c-lru-2.0.4 attrrs-23.1.0 bleach-6.1.0 cffi-1.16.0 comm-0.2.0 debugpy-1.8.0 decorator-5.1.1 defused  
xml-0.7.1 executing-2.0.1 fastjsonschema-2.19.0 fqdn-1.5.1 ipykernel-6.27.1 ipython-8.18.1 isodura  
tion-20.11.0 json5-0.9.14 jsonpointer-2.4 jsonschema-4.20.0 jsonschema-specifications-2023.11.2 ju  
pyter-client-8.6.0 jupyter-core-5.5.1 jupyter-events-0.9.0 jupyter-lsp-2.2.1 jupyter-server-2.12.1  
jupyter-server-terminals-0.5.0 jupyterlab-4.0.9 jupyterlab-pygments-0.3.0 jupyterlab-server-2.25.  
2 matplotlib-inline-0.1.6 mistune-3.0.2 nbclient-0.9.0 nbconvert-7.13.0 nbformat-5.9.2 nest-asyncio-1.5.8 notebook-shim-0.2.3 overrides-7.4.0 packaging-23.2 pandocfilters-1.5.0 prometheus-client-0  
.19.0 prompt-toolkit-3.0.43 pure-eval-0.2.2 pycparser-2.21 python-dateutil-2.8.2 python-json-logge  
r-2.0.7 pyyaml-6.0.1 pyzmq-25.1.2 referencing-0.32.0 requests-2.31.0 rfc3339-validator-0.1.4 rfc39  
86-validator-0.1.1 rpds-py-0.15.2 send2trash-1.8.2 sniffio-1.3.0 stack-data-0.6.3 terminado-0.18.0  
tinytss2-1.2.1 tornado-6.4 traitlets-5.14.0 types-python-dateutil-2.8.19.14 uri-template-1.3.0 wc  
width-0.2.12 webcolors-1.13 websocket-client-1.7.0  
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour  
with the system package manager. It is recommended to use a virtual environment instead: https://  
pip.pypa.io/warnings/venv  
pi@raspberrypi:~$
```

2. Open Jupyter Lab

Input jupyter lab in the terminal. If a password is required, you can set the password according to the fourth step of the tutorial before using it!

```
jupyter lab
```

```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi:~$ jupyter lab  
[W 2023-12-19 09:32:14.012 ServerApp] A `_jupyter_server_extension_points` function was not found  
in jupyter_lsp. Instead, a `_jupyter_server_extension_paths` function was found and will be used f  
or now. This function name  
[W 2023-12-19 09:32:14.019  
in notebook_shim. Instead,  
for now. This function na  
[I 2023-12-19 09:32:14.019  
[I 2023-12-19 09:32:14.023  
[I 2023-12-19 09:32:14.027  
[I 2023-12-19 09:32:14.029  
e/jupyter/runtime/jupyter_1  
[I 2023-12-19 09:32:14.316  
[I 2023-12-19 09:32:14.336  
[I 2023-12-19 09:32:14.332  
[I 2023-12-19 09:32:14.332  
[I 2023-12-19 09:32:14.333  
-packages/jupyterlab  
[I 2023-12-19 09:32:14.333  
b  
[I 2023-12-19 09:32:14.334
```



Before installing jupyter lab, select the system default browser, otherwise jupyter lab will not be started directly from the browser;
Use the sudo command to install the jupyter lab command, and the warning message that appears can be ignored.

3. Set up LAN access to jupyter lab

- Create a configuration file

The generated configuration file path is the path to modify the file later

```
jupyter lab --generate-config
```

```
pi@raspberrypi:~ $ jupyter lab --generate-config  
Writing default config to: /home/pi/.jupyter/jupyter_lab_config.py
```

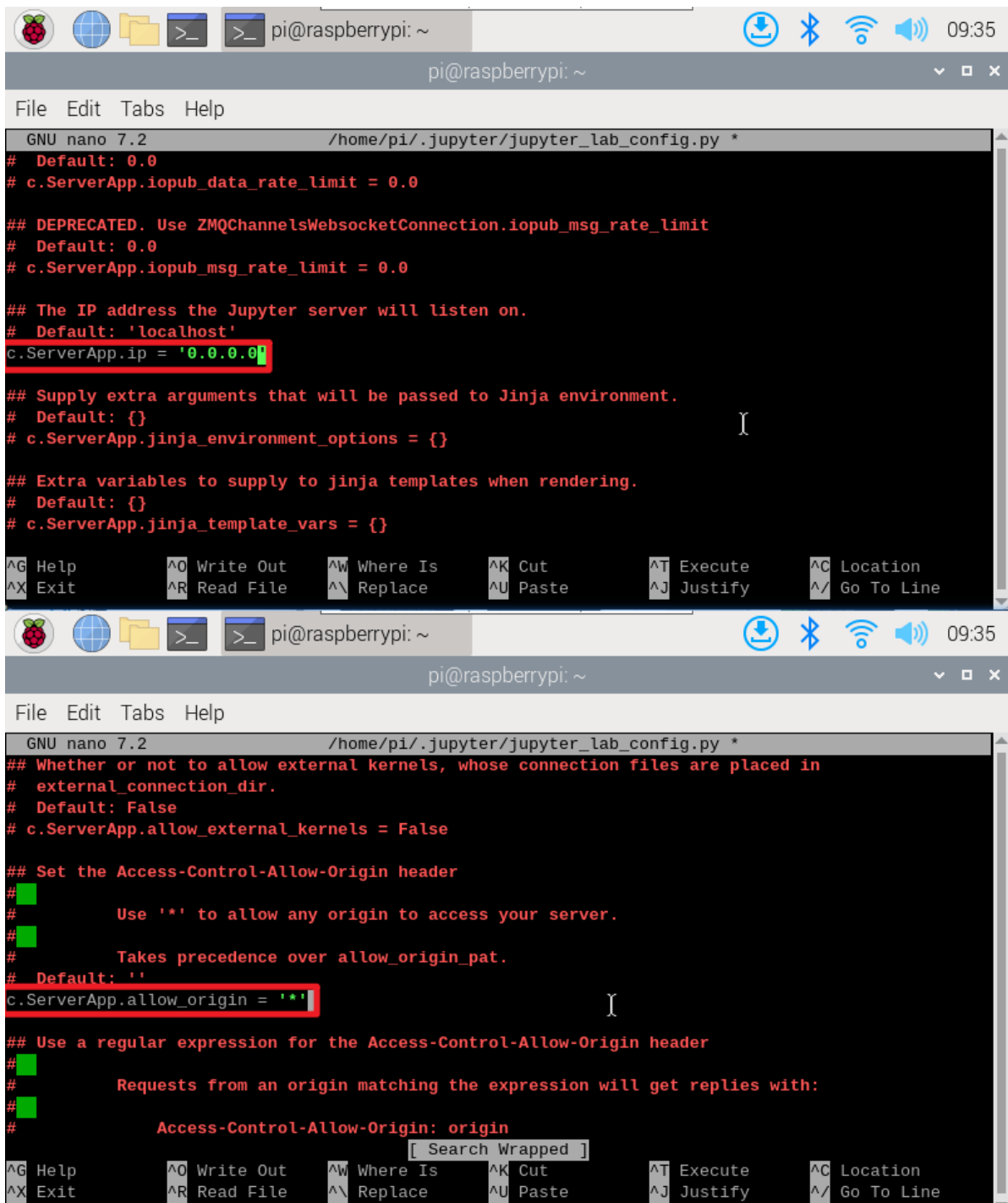
- Modify the configuration file

```
sudo nano /home/pi/.jupyter/jupyter_lab_config.py
```

Remove the comments from the file and modify it to the following: In the nano editor, you can use the Ctrl+W shortcut key to search for keywords

```
c.ServerApp.allow_origin = '*'  
c.ServerApp.ip = '0.0.0.0'
```

Press Ctrl+X, enter Y, and then press Enter to save and exit editing!



```
GNU nano 7.2 /home/pi/.jupyter/jupyter_lab_config.py *
# Default: 0.0
# c.ServerApp.iopub_data_rate_limit = 0.0

## DEPRECATED. Use ZMQChannelsWebsocketConnection.iopub_msg_rate_limit
# Default: 0.0
# c.ServerApp.iopub_msg_rate_limit = 0.0

## The IP address the Jupyter server will listen on.
# Default: 'localhost'
c.ServerApp.ip = '0.0.0.0'

## Supply extra arguments that will be passed to Jinja environment.
# Default: {}
# c.ServerApp.jinja_environment_options = {}

## Extra variables to supply to jinja templates when rendering.
# Default: {}
# c.ServerApp.jinja_template_vars = {}

AG Help      AO Write Out  AW Where Is  AK Cut       AT Execute   AC Location
AX Exit      AR Read File  W Replace   K Paste     J Justify    / Go To Line

GNU nano 7.2 /home/pi/.jupyter/jupyter_lab_config.py *
## Whether or not to allow external kernels, whose connection files are placed in
# external_connection_dir.
# Default: False
# c.ServerApp.allow_external_kernels = False

## Set the Access-Control-Allow-Origin header
#
# Use '*' to allow any origin to access your server.
#
# Takes precedence over allow_origin_pat.
# Default: ''
c.ServerApp.allow_origin = '*'

## Use a regular expression for the Access-Control-Allow-Origin header
#
# Requests from an origin matching the expression will get replies with:
#
# Access-Control-Allow-Origin: origin
[ Search Wrapped ]

AG Help      AO Write Out  AW Where Is  AK Cut       AT Execute   AC Location
AX Exit      AR Read File  W Replace   K Paste     J Justify    / Go To Line
```

4. Set up access to jupyter lab

Enter the command to set the password in the terminal. You need to enter it twice. The input content will not be displayed after entering the password

```
jupyter lab password
```

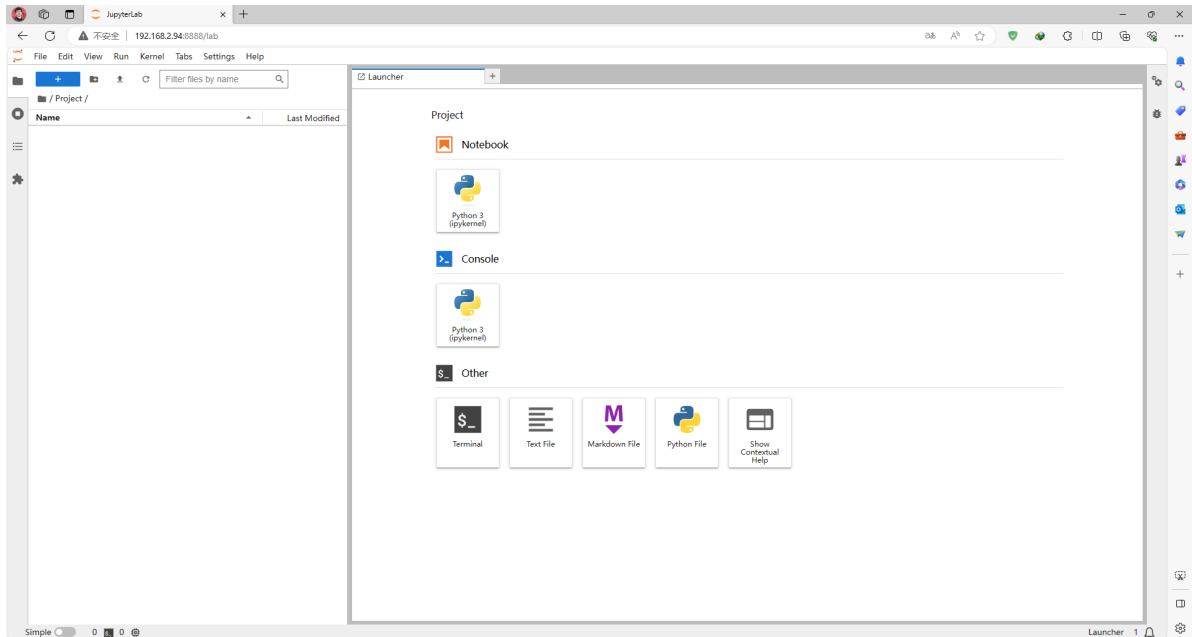
```
pi@raspberrypi:~$ jupyter lab password
Enter password:
Verify password:
[JupyterPasswordApp] Wrote hashed password to /home/pi/.jupyter/jupyter_server_config.json
```

Restart the Raspberry Pi after setting the password!

- Verification

Devices in the same LAN can enter IP:8888 in the browser to access!

The password is the password set before: yahboom



5. Set Jupyter Lab to start automatically

After completing the above steps, you need to enter the command in the terminal each time you use Jupyter Lab. For more convenient use, we can configure Jupyter Lab to start automatically.

- Configure startup items

Enter the following command in the terminal:

```
sudo nano /etc/systemd/system/jupyter.service
```

Add the following content to the file:

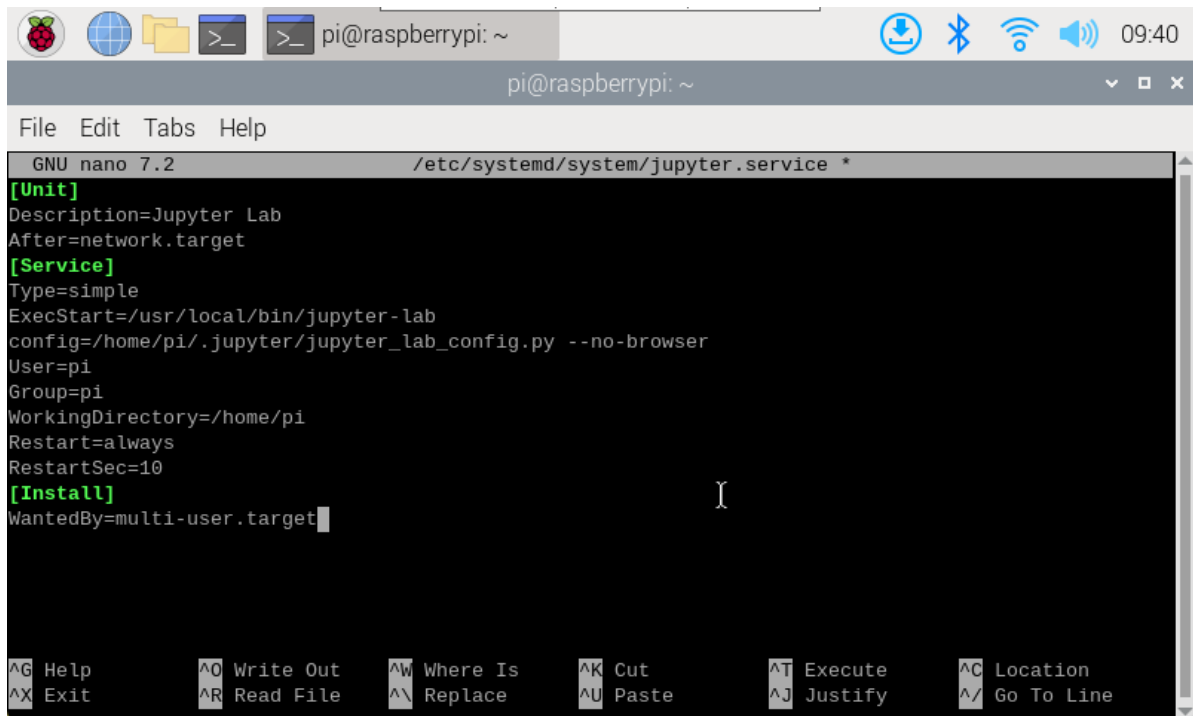
```
[Unit]
Description=Jupyter Lab
After=network.target
[Service]
Type=simple
ExecStart=/usr/local/bin/jupyter-lab
config=/home/pi/.jupyter/jupyter_lab_config.py --no-browser
User=pi
Group=pi
workingDirectory=/home/pi
Restart=always
RestartSec=10
[Install]
WantedBy=multi-user.target
```

pi: my current system user name

ExecStart: command to start Jupyter lab, change to JupyterLab installation path and configuration file path (if the steps are all in accordance with our operation, then enter the same path)

Check Jupyter-lab installation path: which jupyter-lab
The configuration file path refers to the path of the configuration file generated above

WorkingDirectory: Jupyter-lab's working directory, which can be changed at your own discretion



The screenshot shows a terminal window on a Raspberry Pi. The window title is 'pi@raspberrypi: ~'. The terminal is running the nano text editor, editing the file '/etc/systemd/system/jupyter.service'. The content of the file is as follows:

```
GNU nano 7.2 /etc/systemd/system/jupyter.service *
[Unit]
Description=Jupyter Lab
After=network.target
[Service]
Type=simple
ExecStart=/usr/local/bin/jupyter-lab
config=/home/pi/.jupyter/jupyter_lab_config.py --no-browser
User=pi
Group=pi
WorkingDirectory=/home/pi
Restart=always
RestartSec=10
[Install]
WantedBy=multi-user.target
```

The bottom of the terminal shows the nano editor's command shortcuts: ^G Help, ^O Write Out, ^W Where Is, ^K Cut, ^T Execute, ^C Location, ^X Exit, ^R Read File, ^_ Replace, ^U Paste, ^J Justify, ^_ Go To Line.

- jupyter.service service

Enable automatic startup

```
sudo systemctl enable jupyter
```

Disable automatic startup

```
sudo systemctl disable jupyter
```

Start the service

```
sudo systemctl start jupyter
```

Stop the service

```
sudo systemctl stop jupyter
```

Check the service status

```
sudo systemctl status jupyter
```

Enter the command to enable the jupyter.service service to start automatically and restart the Raspberry Pi system.

```
pi@raspberrypi:~ $ sudo nano /etc/systemd/system/jupyter.service
pi@raspberrypi:~ $ sudo systemctl enable jupyter
Created symlink /etc/systemd/system/multi-user.target.wants/jupyter.service → /etc/systemd/system/jupyter.service.
pi@raspberrypi:~ $ sudo systemctl start jupyter
```

After completing the above steps, you can access the LAN without entering jupyter lab in the terminal!