

ALL PROGRAMMABLE

ANY MEDIA

5G

4K/8K

ANY STANDARD

ANY MACHINE

ANY NETWORK

5G Wireless • Embedded Vision • Industrial IoT • Cloud Computing



First steps with PYNQ-Z1

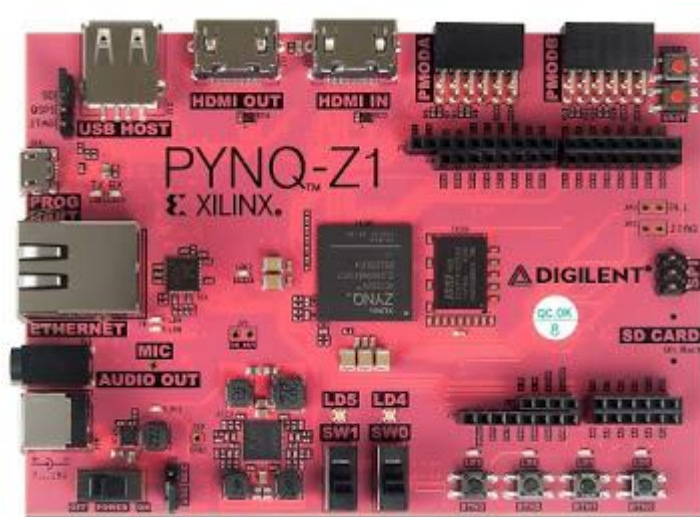


Agenda

- Configure board, SD card
- Connect to the board
- Login in to portal
- Jupyter Notebook

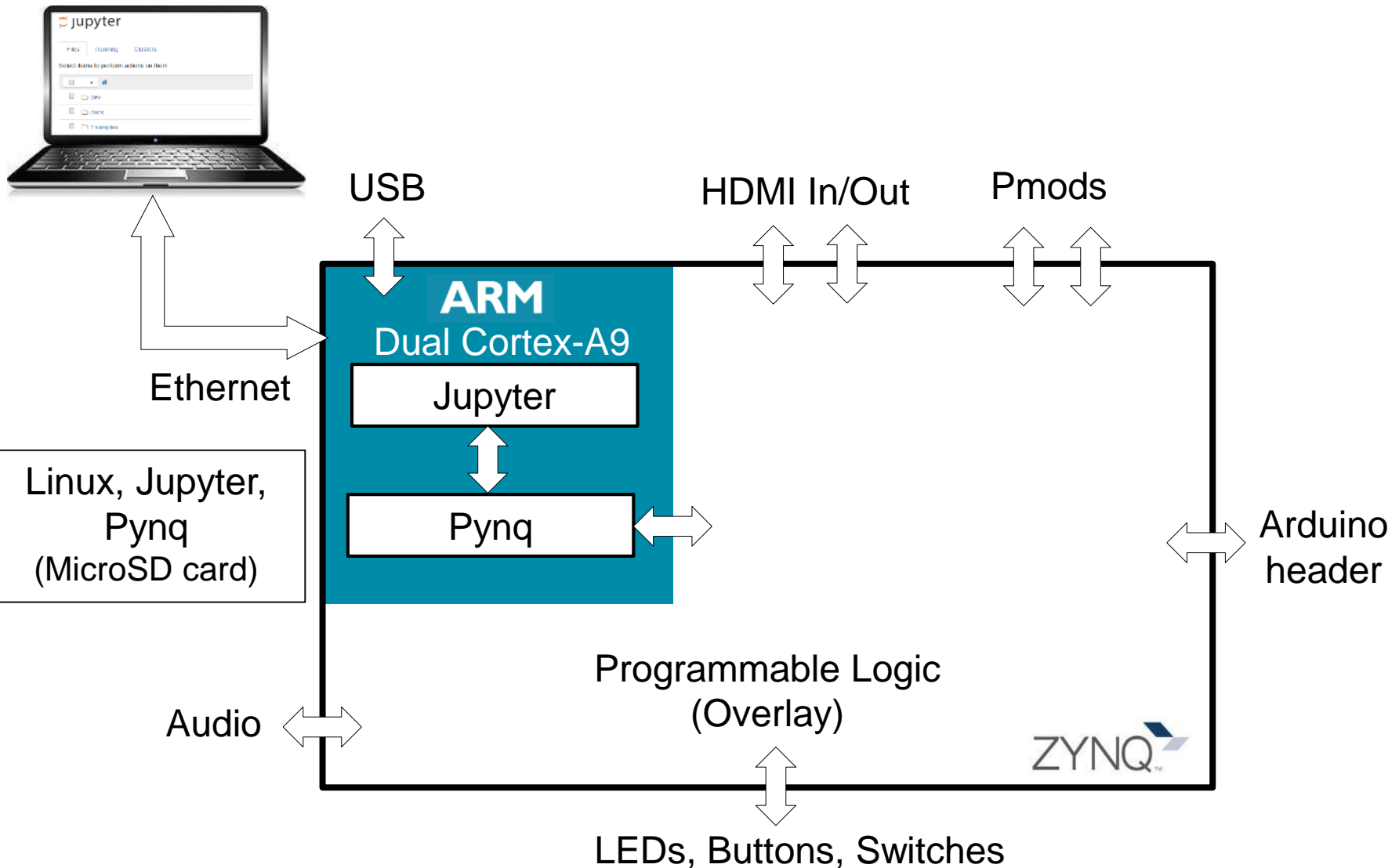
Prerequisites

- PYNQ-Z1 board
- SD Card with preloaded Image*
- Ethernet Cable
- USB cable and available USB port



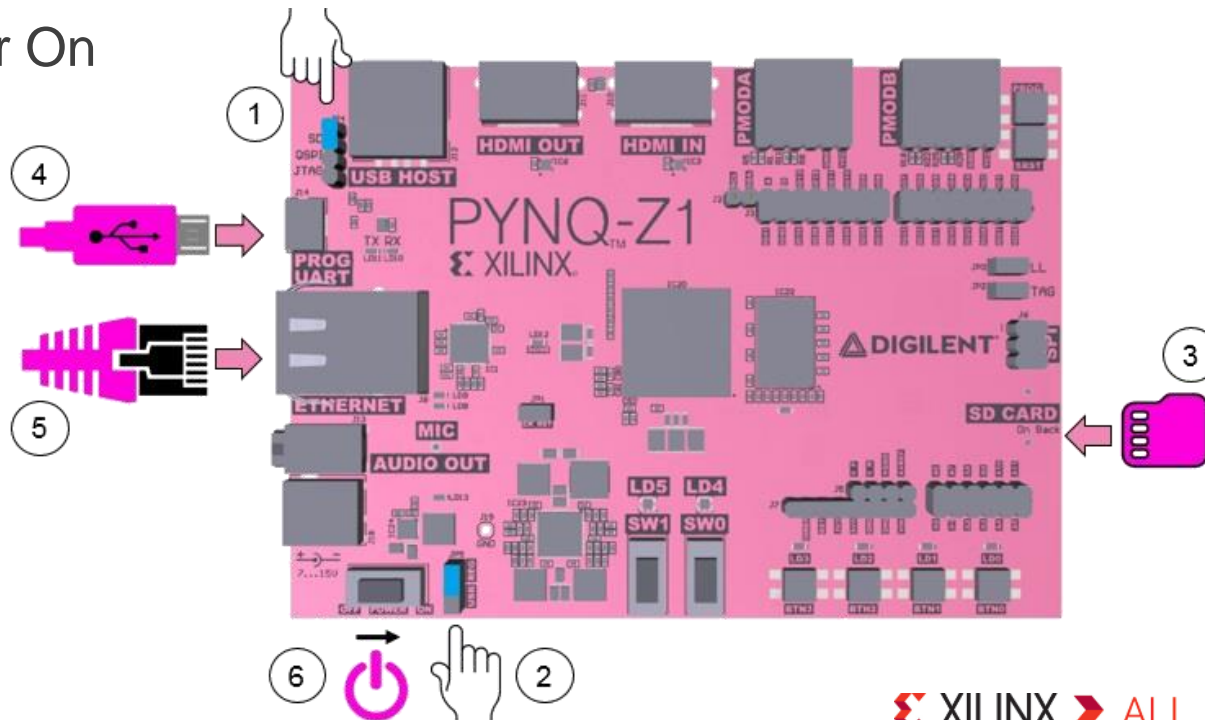
*Instructions to download and prepare SD card:
http://pynq.readthedocs.io/en/latest/getting_started.html

Pynq overview



Connecting to the board

1. Configure board to boot from SD Card
2. Set Jumper to power from USB
3. Insert SD Card
4. Connect USB cable
5. Connect Ethernet cable to PC or to a Switch/Router
6. Power On



Connecting to the board – Direct connection

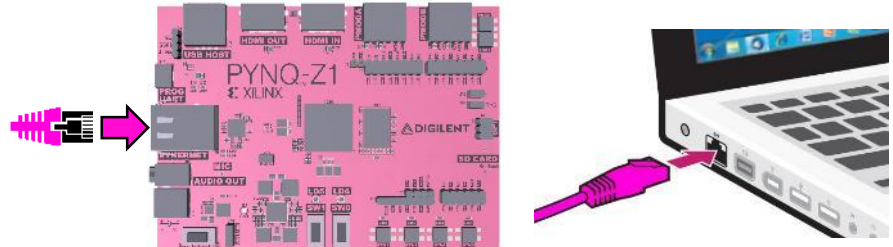
➤ Connect board directly to Ethernet port on PC

- USB to Ethernet adapter if no Ethernet port available

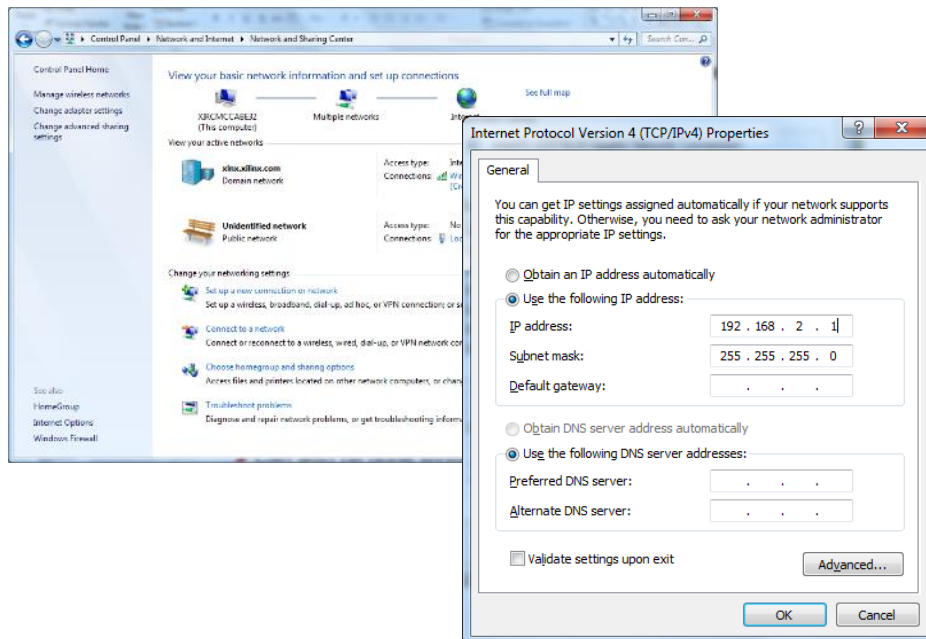
➤ Board IP will default to 192.168.2.99

➤ Manually specify static IP for PC

- Must be in same range as board:
 - E.g. 192.168.2.1
- No internet access unless you bridge network connections (packages can't be updated)

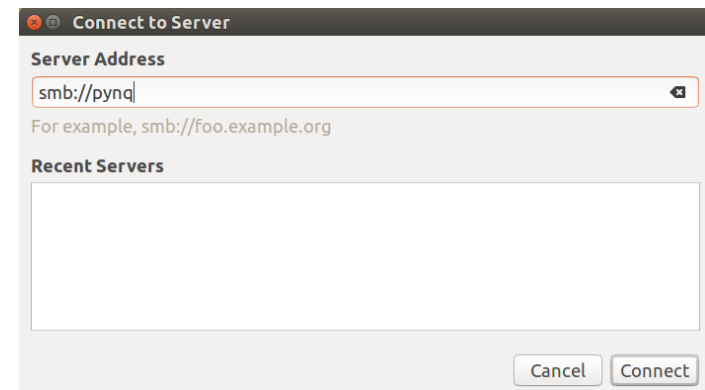
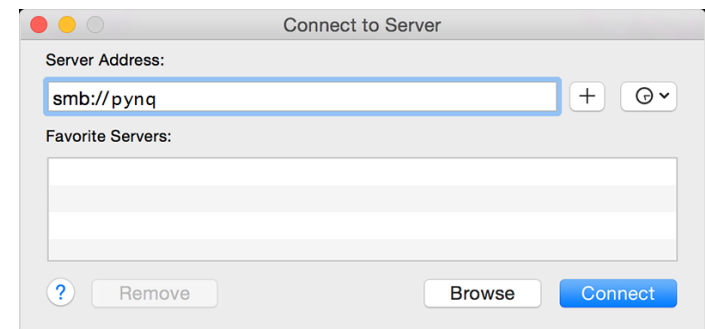
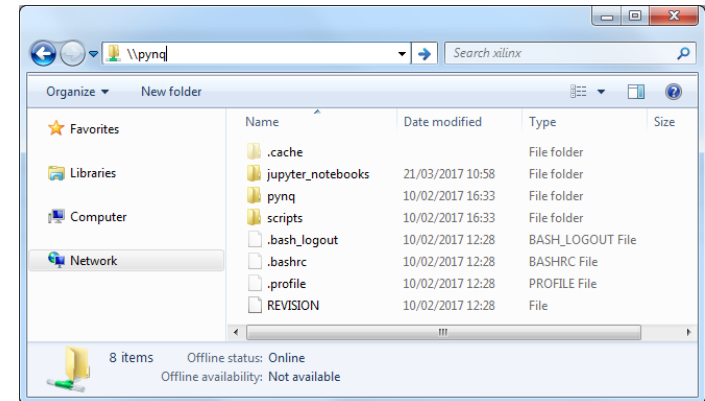


Connect board directly to PC



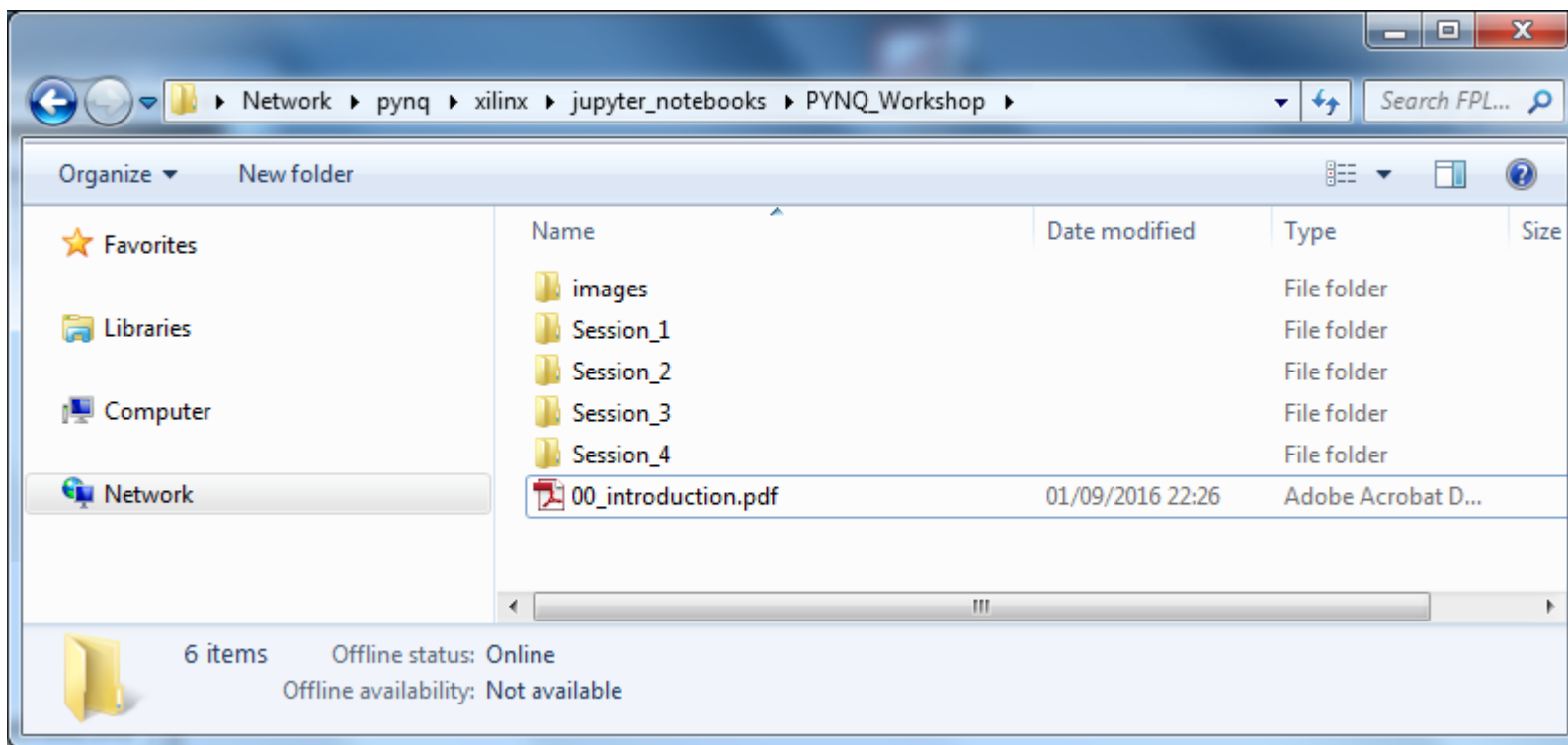
Samba share

- Board can also be accessed as a shared drive
 - Windows: \\pynq\xilinx
 - Linux: smb://pynq/Xilinx
 - MAC OS: smb://pynq/Xilinx
 - Hit Command+K to bring up the 'Connect to Server' window
 - Substitute IP address for pynq if static IP is used
 - username:password = xilinx:xilinx
- Copy files between PC and board



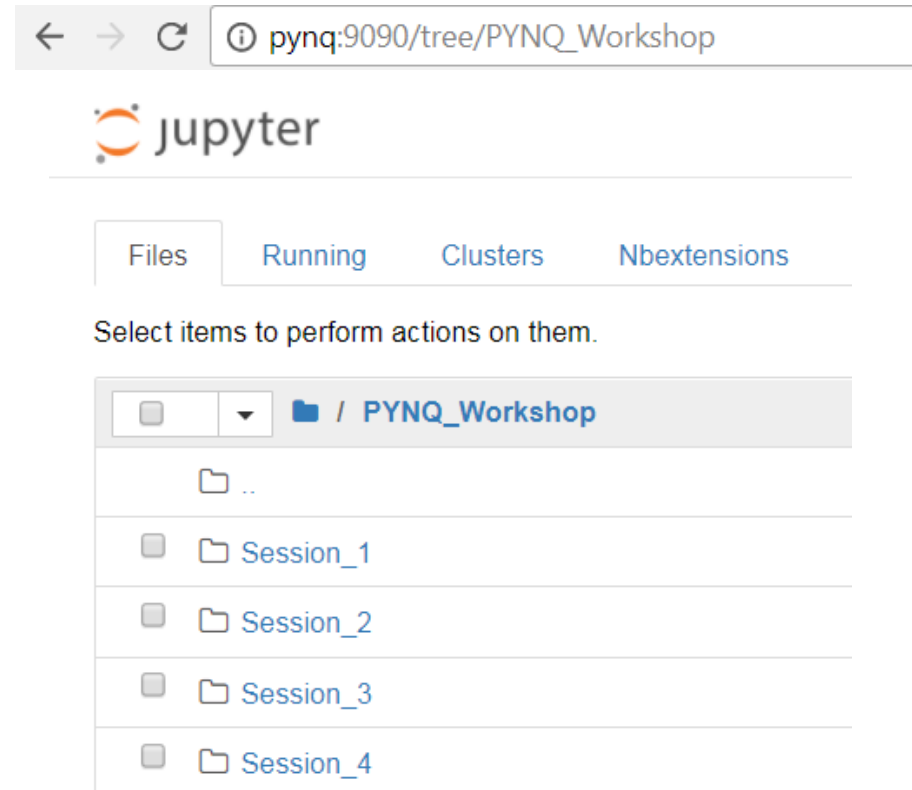
Introduction to Jupyter notebooks

- Copy PYNQ_Workshop folder from USB to:
\\pynq\xilinx\jupyter_notebooks



Log in to portal

- Open a browser*
 - Chrome (preferred)
- Browse to: `http://pynq:9090` and log in
 - Where *pynq* is the hostname of the board
 - Use the IP address instead of the hostname for direct connection
- password = xilinx
- Browse to *PYNQ_Workshop* folder



* <http://jupyter-notebook.readthedocs.io/en/latest/notebook.html#browser-compatibility>

Lab exercises: Session 1 (1)

➤ Getting started with Jupyter Notebooks

- Notebook's browser-based interface
- Writing text with Markdown
- Writing and running Python scripts
- The IPython interpreter

➤ Getting started with IPython

- Executing OS shell commands
- The Ipython magic commands

Lab exercises: Session 1 (2)

➤ Exploring PYNQ-Z1

- Getting CPU information
- Getting network status

➤ Programming on-board peripherals

- Controlling on-board LEDs
- Interacting with buttons, switches, and LEDs

Lab Review

➤ Jupyter Notebook

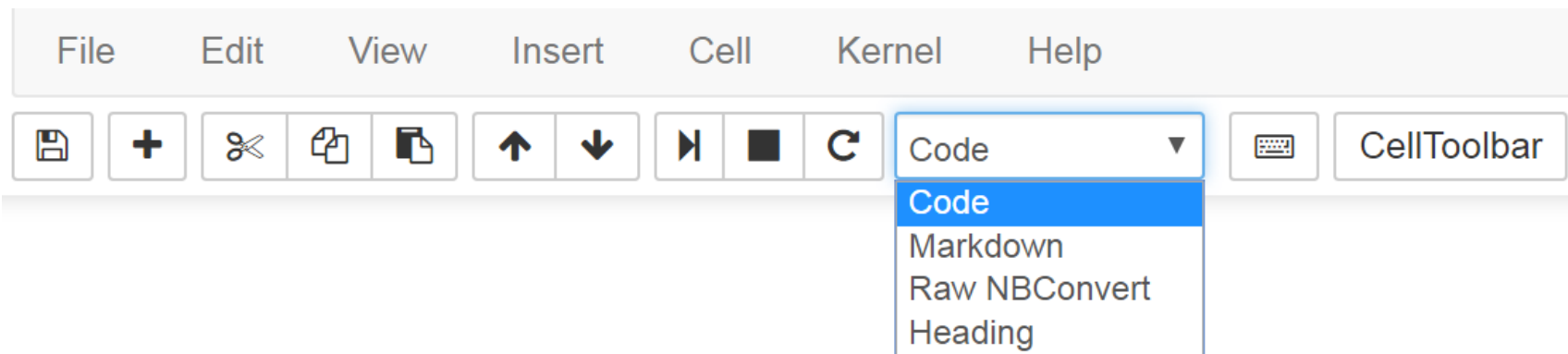
- Web application/server
- Create and share documents
 - Live code, equations, visualizations, explanatory text/comments, results

➤ Make a copy of notebook before editing

➤ Sharing Notebooks

- Save the iPython Notebook .ipynb
- Save as... HTML to share results

Notebook Cells



- Code
 - Python
- Markdown
 - Comments and notes
- Execute cells to run code/render
- Split and reorder cells
- Output printed after cell

```
In [1]: import time
         for i in range (1,9):
             print(i*i)
             time.sleep(0.5)
```

1
4
9
16
25
36
49
64

Markdown cells

➤ # Headings

➤ * *Italics* *

➤ ** **bold** **

* Bullet points

* Bullet points

➤ <html></html>

➤ Not just comments. Explanatory text, notes, documentation.

Notes, comments and Markdown

You can write notes and comments using the `Markdown Language`.

This cell is a Markdown cell. Double click it now to see the raw markdown.

This is **bold**, this is *italic* and you can see how headings and sub-headings are indicated above using "#". You can also use `html` in markdown.

Execute the cell to render the markdown.

* Note in the dropdown box in the toolbar that this is a Markdown cell.

Shell commands, Cell magics

- Execute shell commands directly from notebook
- Prefix !

```
!uname -a
!whoami
!pwd
!ls
!ping www.xilinx.com
```

- Built in Cell magics

```
%lsmagic
```

Available line magics:

```
%alias %alias_magic %autocall %automagic %autosave %bookmark %cat %cd %
clear %colors %config %connect_info %cp %debug %dhist %dirs %doctest_mo
de %ed %edit %env %gui %hist %history %killbgscripts %ldir %less %lf
%lk %ll %load %load_ext %loadpy %logoff %logon %logstart %logstate %l
ogstop %ls %lsmagic %lx %macro %magic %man %matplotlib %mkdir %more %
mv %notebook %page %pastebin %pdb %pdef %pdoc %pfile %pinfo %pinfo2 %
popd %pprint %precision %profile %prun %psearch %psource %pushd %pwd %
pycat %pylab %qtconsole %quickref %recall %rehashx %reload_ext %rep %re
run %reset %reset_selective %rm %rmdir %run %save %sc %set_env %store
%sx %system %tb %time %timeit %unalias %unload_ext %who %who_ls %whos
%xdel %xmode
```

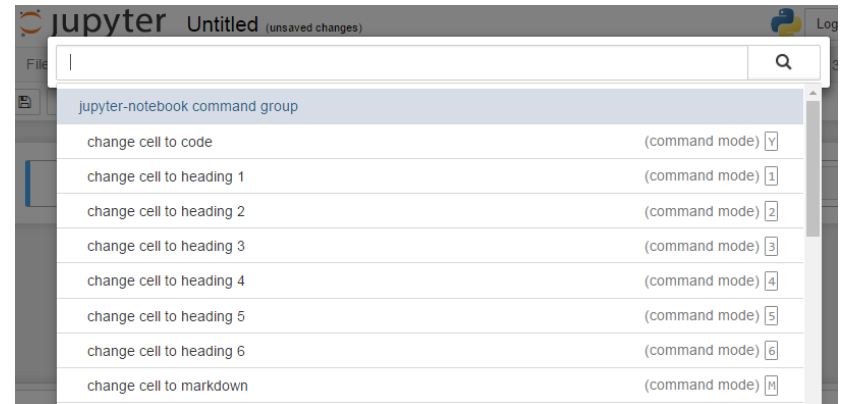
Available cell magics:

```
%%! %%HTML %%SVG %%bash %%capture %%debug %%file %%html %%javascript %
%js %%latex %%perl %%prun %%pypy %%python %%python2 %%python3 %%ruby %
%script %%sh %%svg %%sx %%system %%time %%timeit %%writefile
```

Automagic is ON, % prefix IS NOT needed for line magics.

Help

- Command palette:
Ctrl + Shift + p keys
- Python help:
 - Execute “?” In a cell
 - help()
- %magic – learn about Ipython magics
 - %lsmagic – get list of magics
 - %quickref



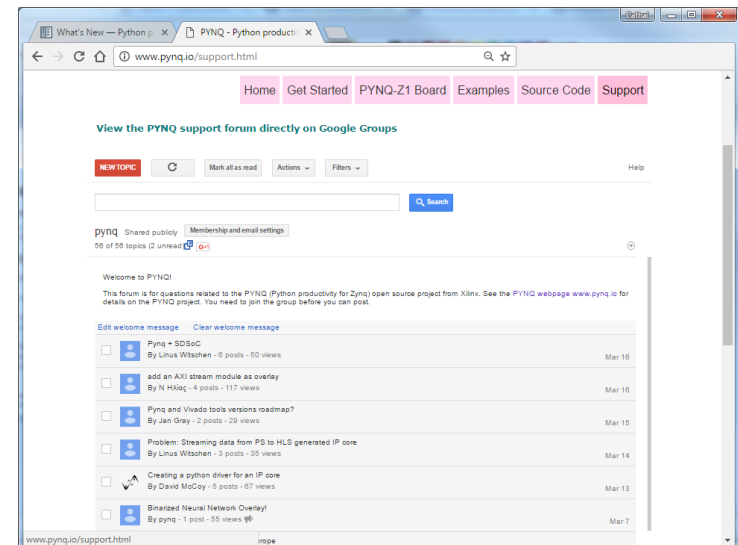
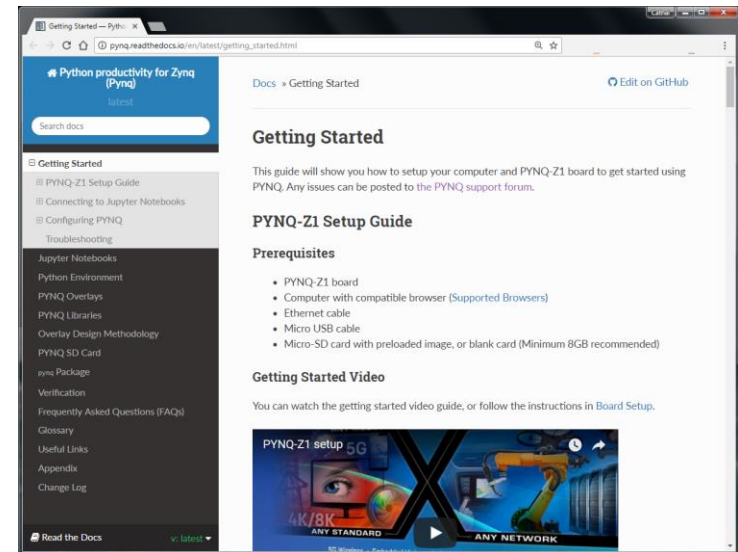
```
In [6]: %lsmagic
Out[6]: Available line magics:
%alias %alias_magic %autocall %automagic %autosave %bookmark %cat %cd %
clear %colors %config %connect_info %cp %debug %dhist %dirs %doctest_mo
de %ed %edit %env %gui %hist %history %killbgscripts %ldir %less %lf
%lk %ll %load %load_ext %loadpy %logoff %logon %logstart %logstate %l
ogstop %ls %lsmagic %lx %macro %magic %man %matplotlib %mkdir %more %
mv %notebook %page %pastebin %pdb %pdef %pdof %pfile %pinfo %pinfo2 %
popd %pprint %precision %profile %prun %psearch %psource %pushd %pwd %
pycat %pylab %qtconsole %quickref %recall %rehashx %reload_ext %rep %re
run %reset %reset_selective %rm %rmdir %run %save %sc %set_env %store
%sx %system %tb %time %timeit %unalias %unload_ext %who %who_ls %whos
%xdel %xmode

Available cell magics:
%%! %%HTML %%SVG %%bash %%capture %%debug %%file %%html %%javascript %
%js %%latex %%perl %%prun %%pypy %%python %%python2 %%python3 %%ruby %
%script %%sh %%svg %%sx %%system %%time %%timeit %%writefile

Automagic is ON, % prefix IS NOT needed for line magics.
```

Documentation and Support

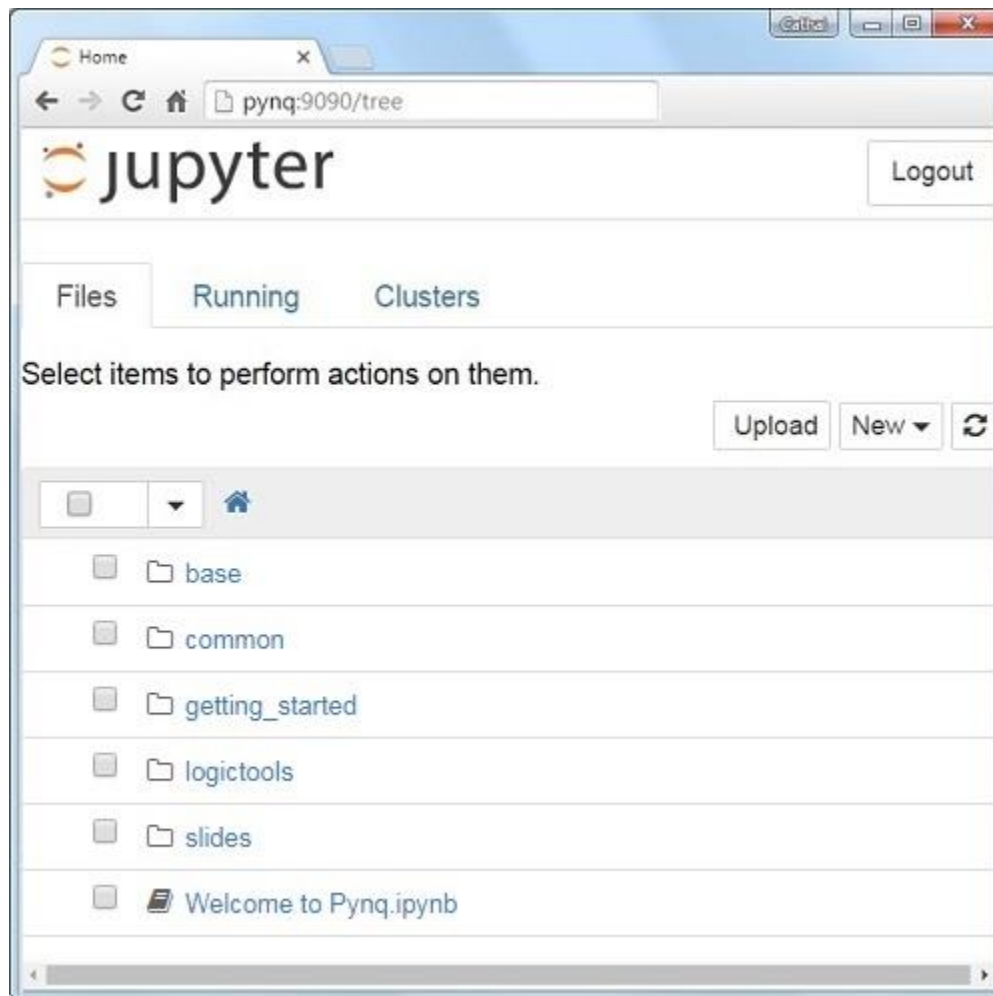
- Documentation
 - <http://pynq.readthedocs.io>
- Support
 - <http://www.pynq.io/support>
- GitHub
 - Issue tracker



Next steps

➤ examples/

- How to use overlays
- Peripherals, Grove, Pmod
- Other peripherals, PS/PL
- Logictools



Questions?

Troubleshooting: LEDs, serial connection

➤ Status LEDs

- Power On: Red LED
 - Check the power source jumper is correctly set
- Bitstream Loaded (Pynq booting): Green “Done” LED
 - Make sure that the boot source is set to SD card and the SD card is inserted

➤ Serial connection to the board

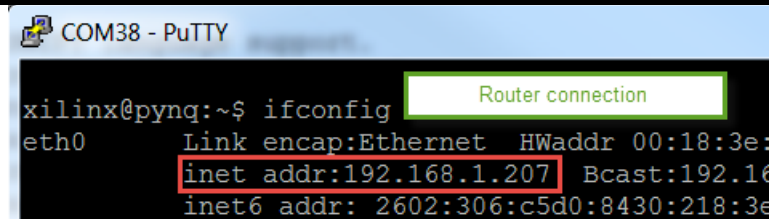
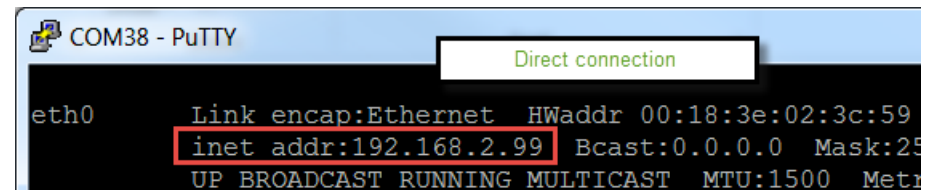
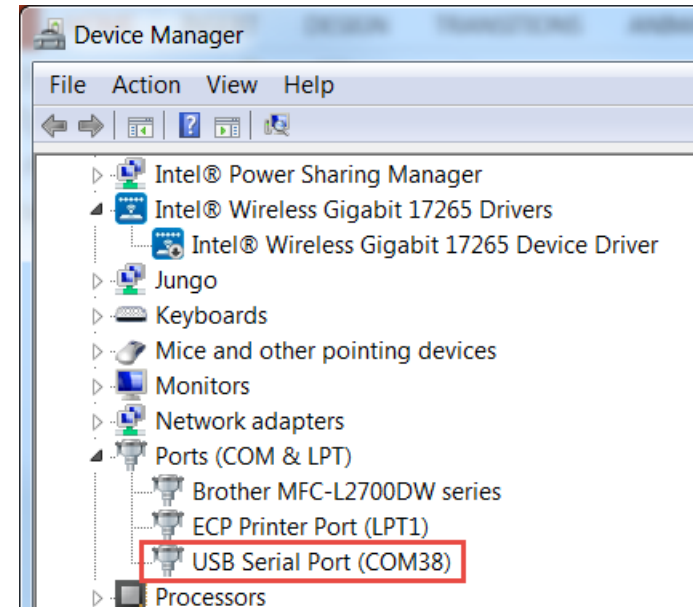
- 115200 baud (data:8 bit, stop bits:1)
- Windows: Device manager to get COM port
- Check board has booted
 - Is Linux shell available on terminal?

➤ Web browser connection

- Check/Modify board IP
- *ifconfig* to check network settings

➤ Clearing browser cache

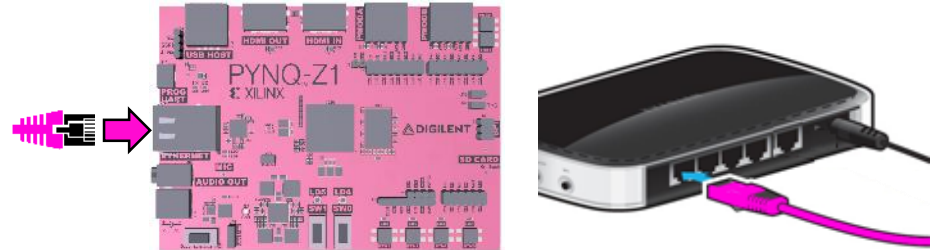
- Shift+Ctrl+Del



Connecting to the board – Via network switch



- Board is connected to network (switch/router)
 - If DHCP server running on network board will get IP from DHCP server

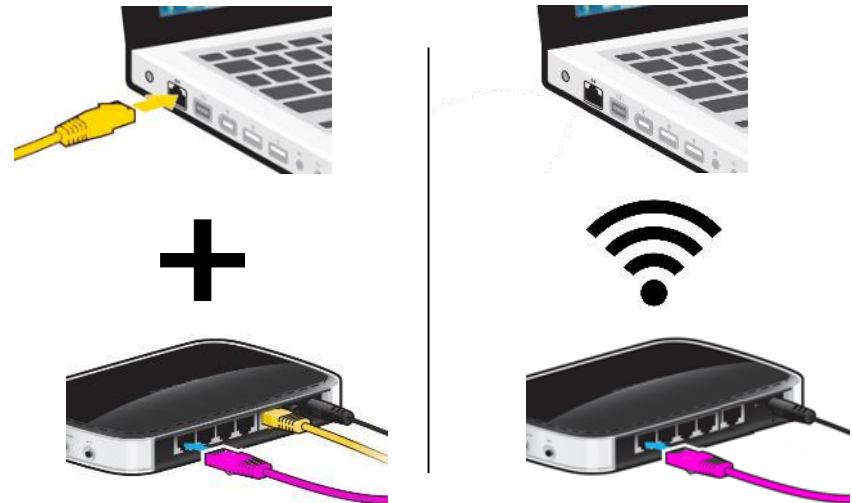


① Connect board to switch/router

- Internet access via network allows Python packages to be installed/updated

- PC can connect to same network

- Wired
- WiFi

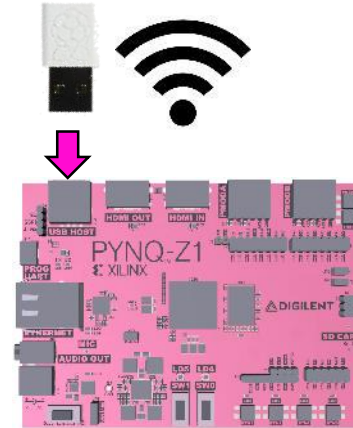


② PC connected to router via cable or wireless

Connecting to the board – Via WiFi



- Connect USB WiFi dongle to board
- Connect board and PC to wireless hotspot
 - Router, Mobile Phone
- Need to configure board to connect to WiFi network
 - Notebook available to do configuration
 - `usb_wifi.ipynb`
 - Manually configure from terminal
 - `Modify /etc/network/interfaces.d/`
 - `iwconfig` in next release



- ① Connect WiFi dongle to board
- ② Connect board and PC to wireless hotspot

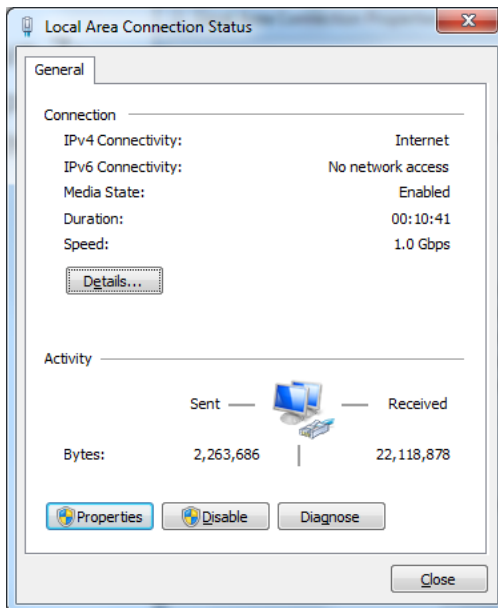
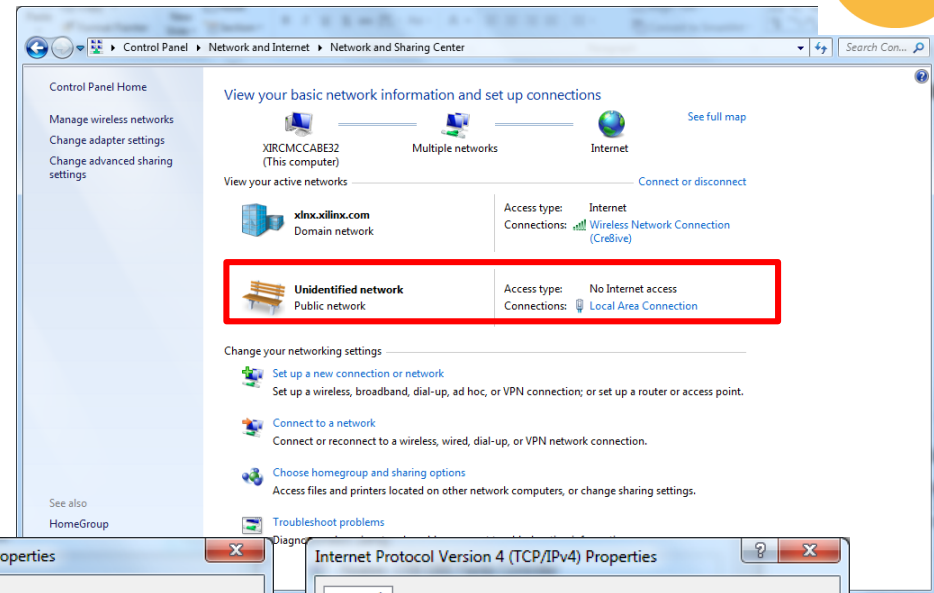


Configure Ethernet - Windows

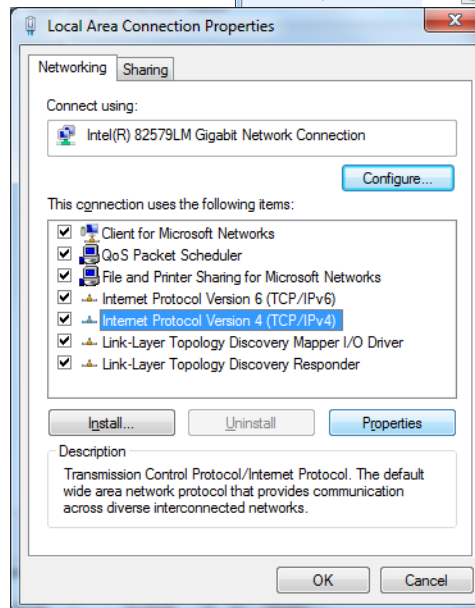


➤ Windows 7:

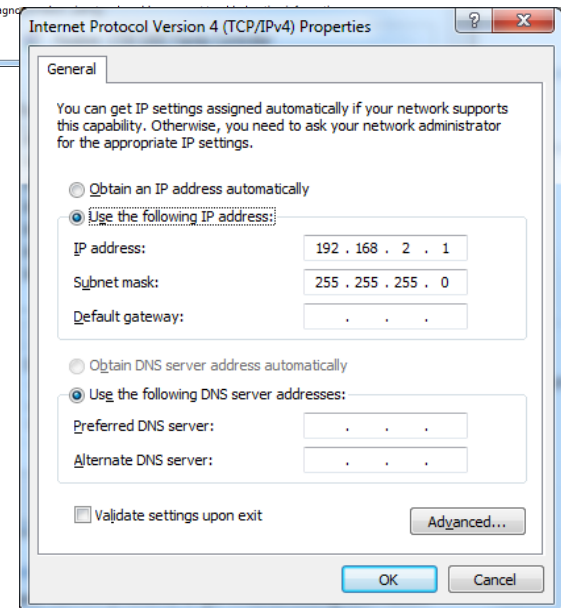
- Control Panel\Network and Internet\Network and Sharing Center



Properties



TCP/IPv4→Properties



Set IP address

Configure Ethernet - Mac



➤ Mac OS:

- **Apple menu > System Preferences > Network**
- **Select interface > Advanced**
- **Command + K**

