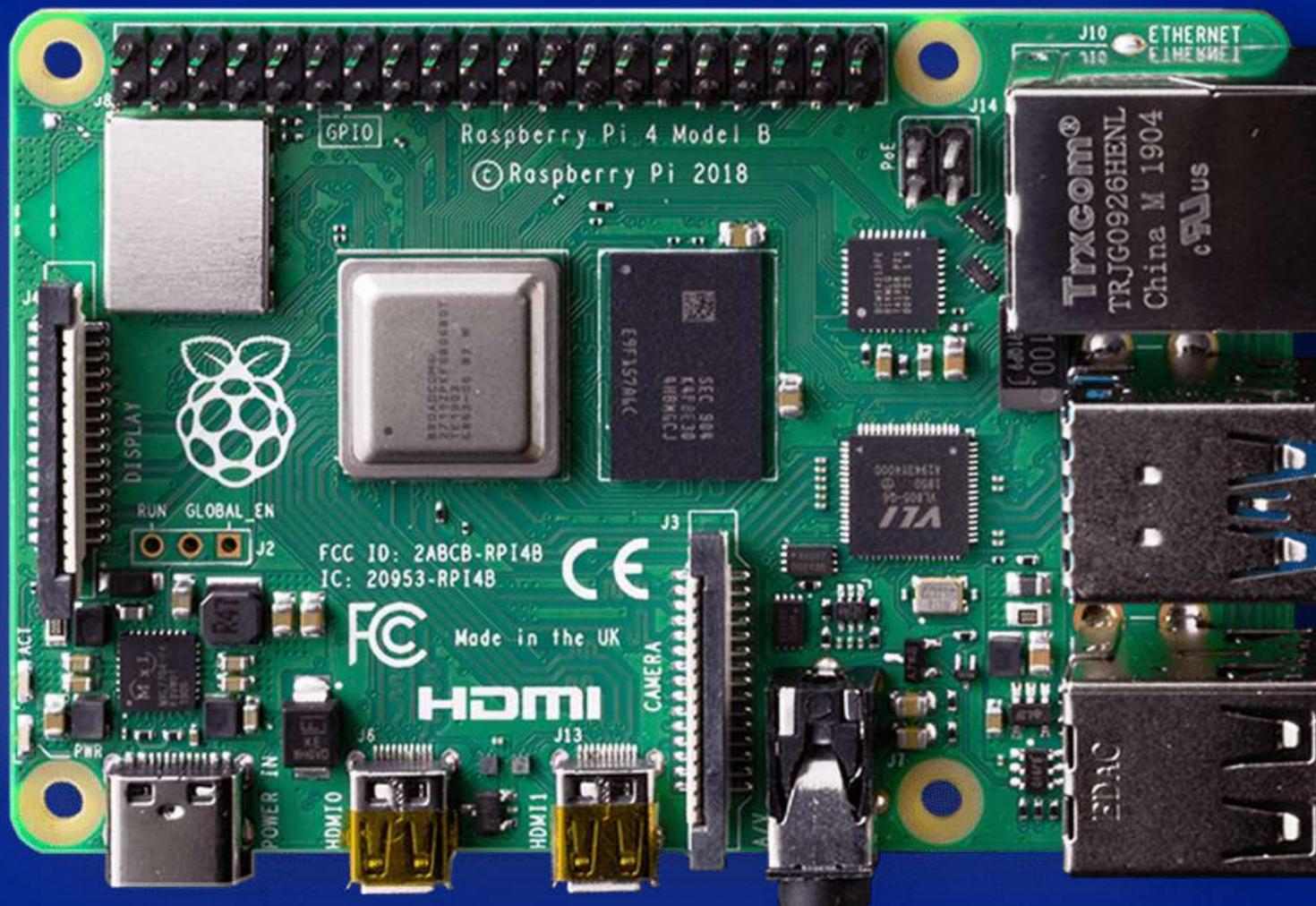
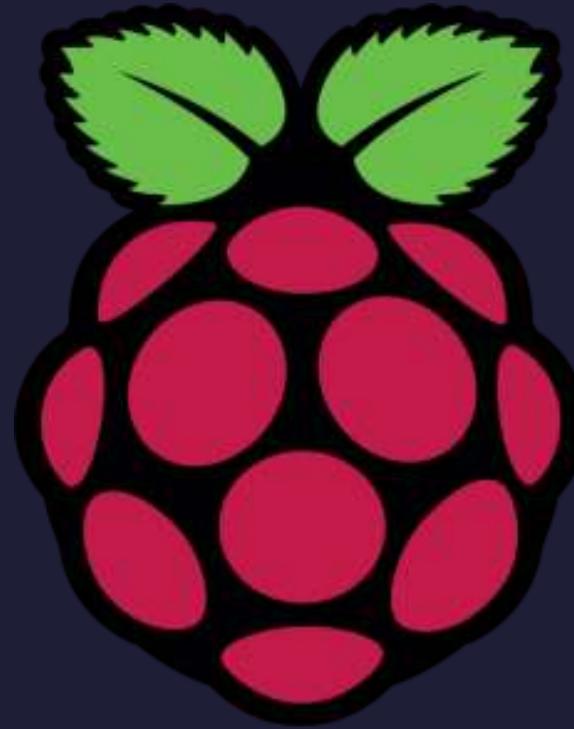


# Learn Linux with Raspberry Pi

## Exposing your local service to the internet over NAT





# Network Topology

# @HOME



@HOME



@HOME



**Home Gateway  
(Router → NAT)**

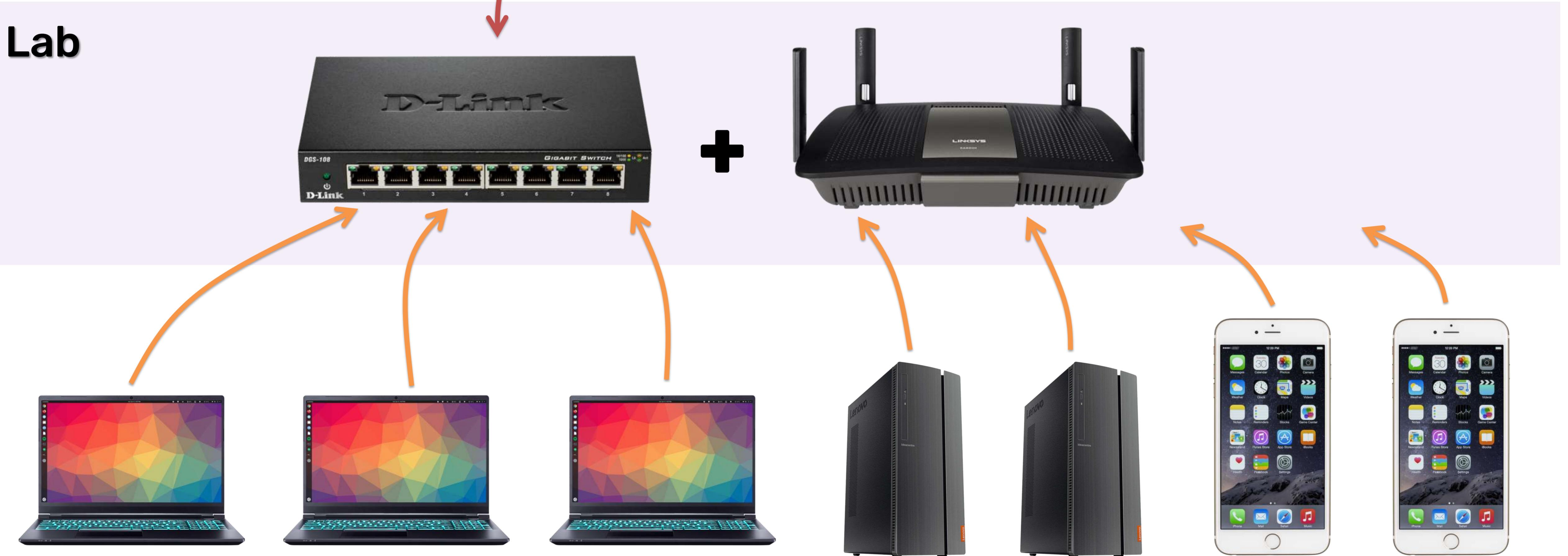




@SCHOOL

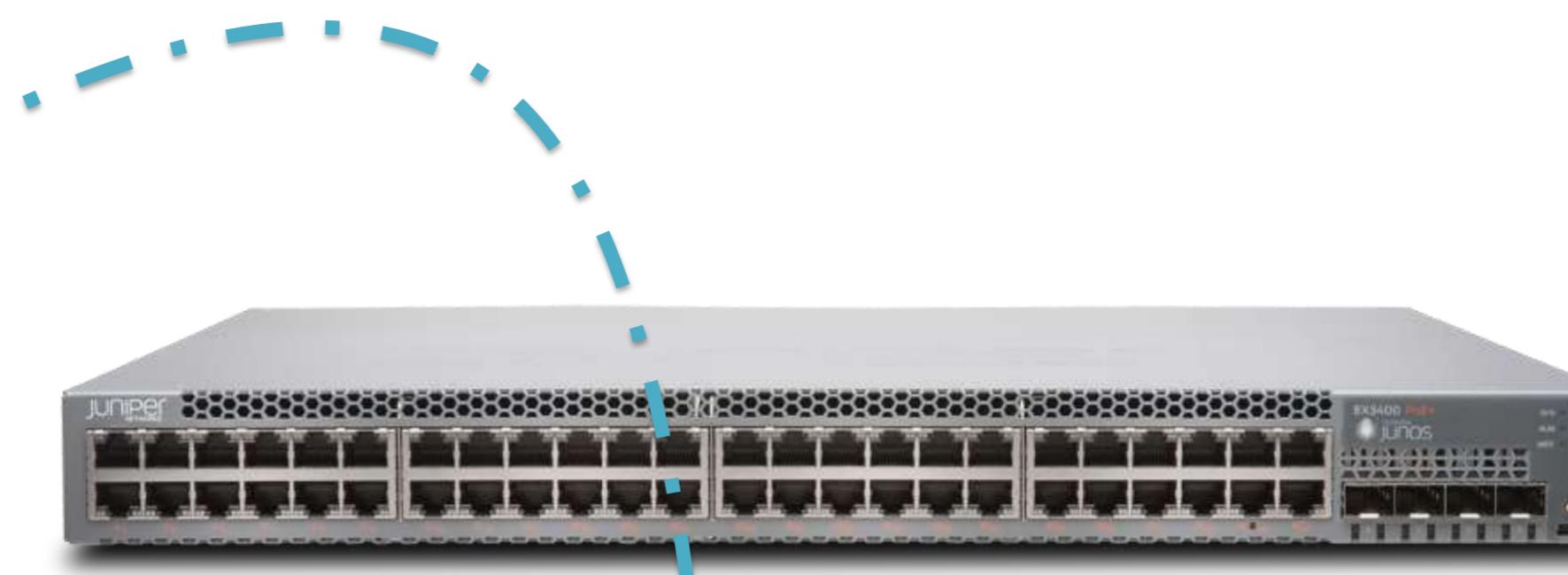


Other  
Department/Lab





@SCHOOL



@SCHOOL



**@HOME1**



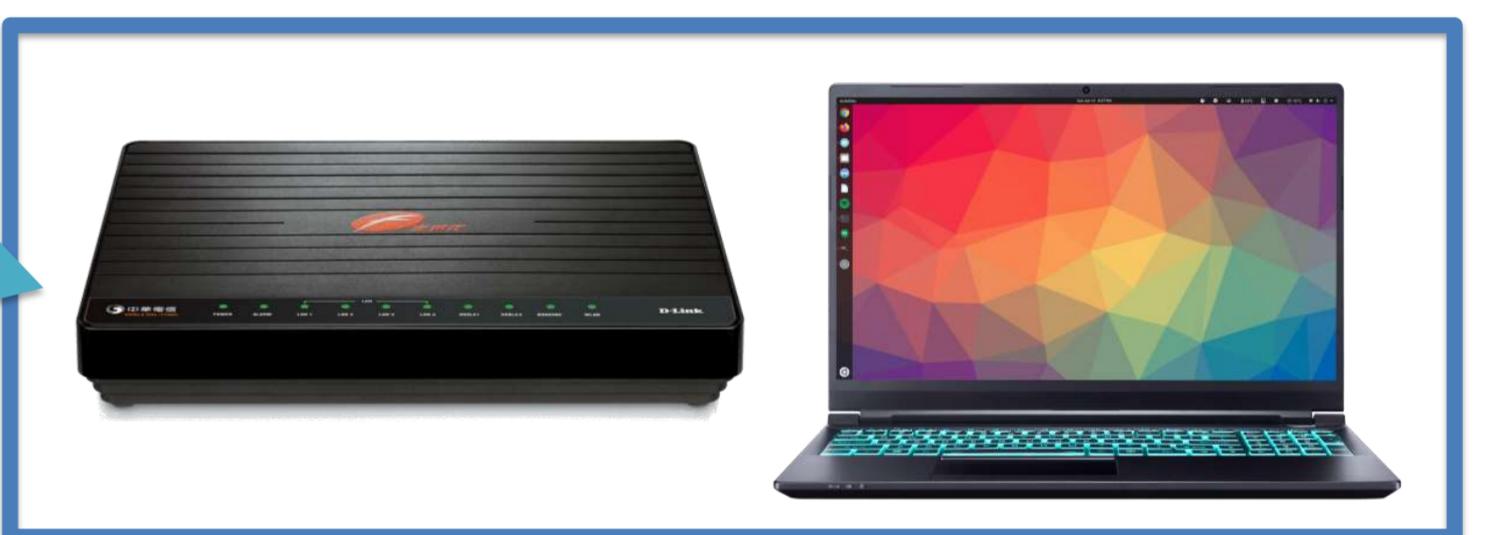
**@SCHOOL1**



**@HOME2**



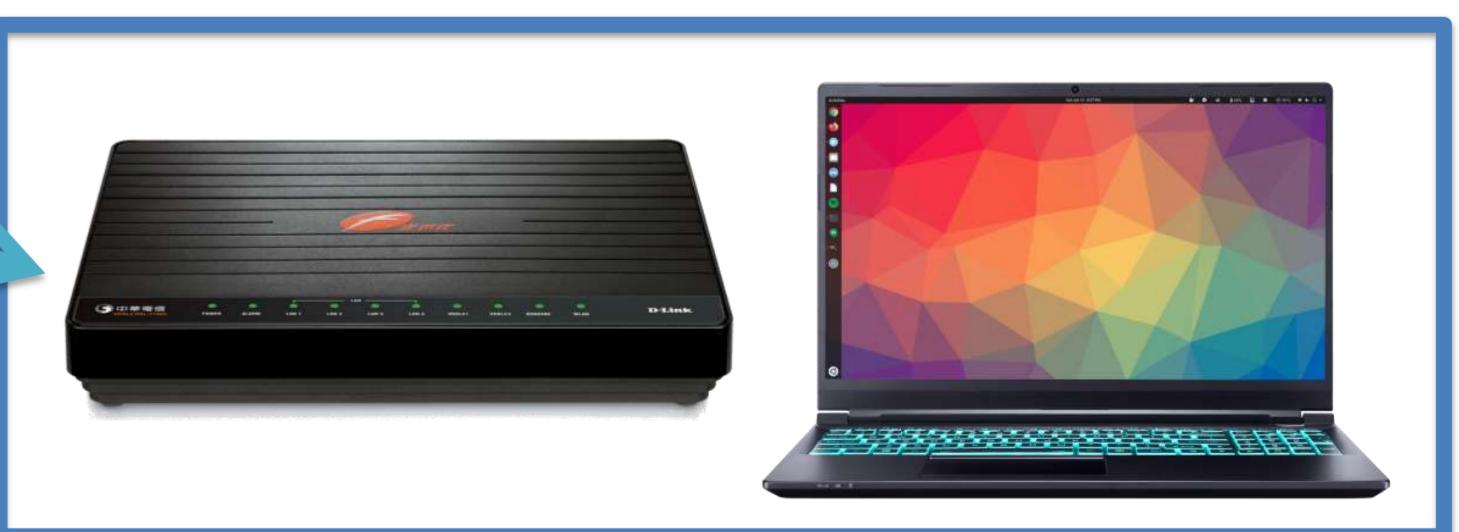
**@SCHOOL2**

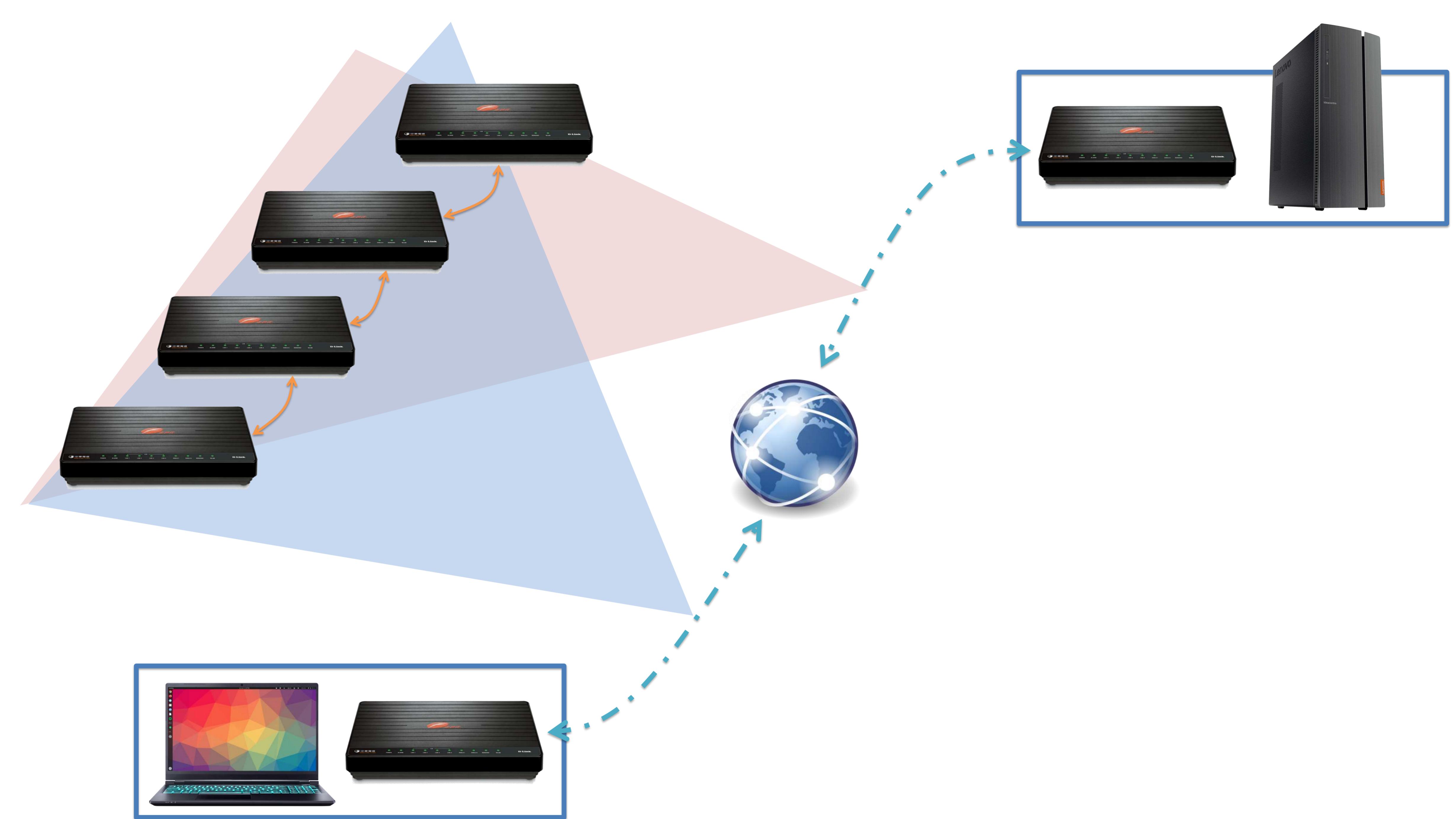


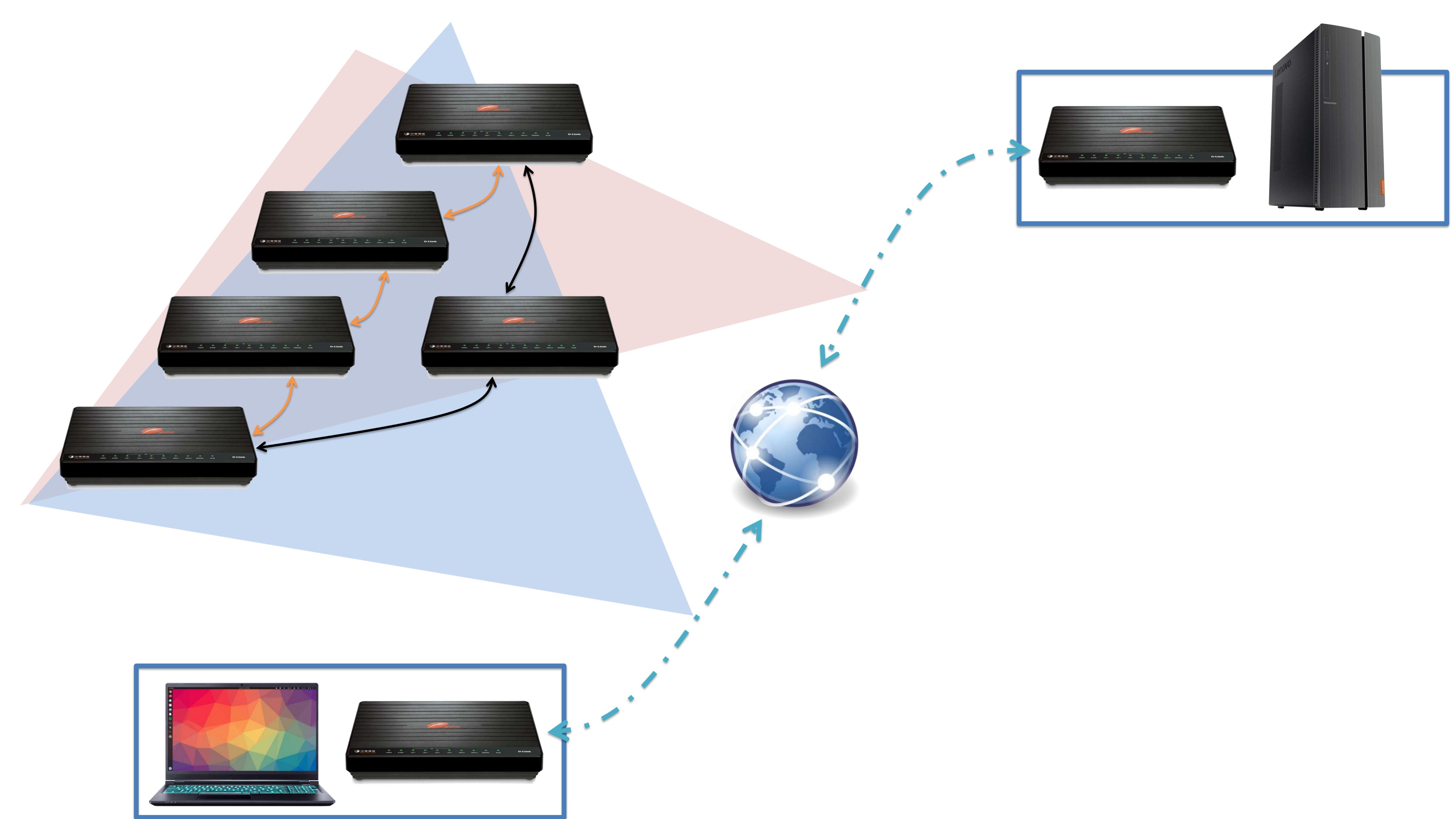
**@HOME3**

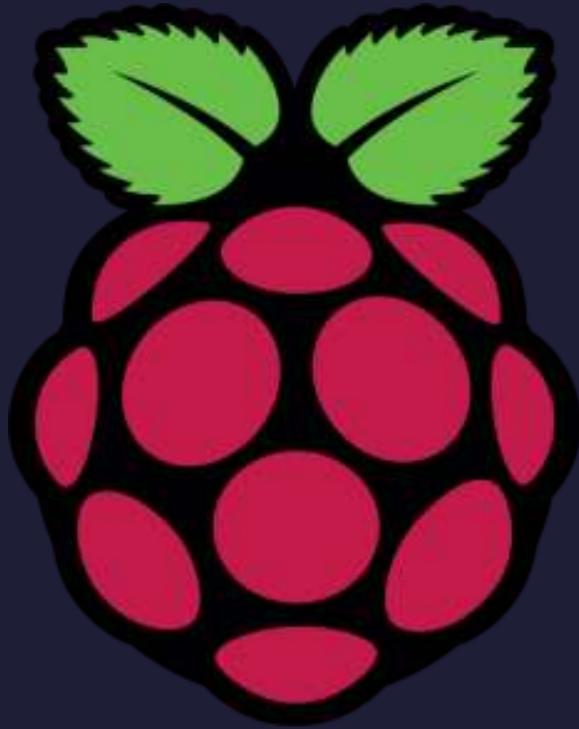


**@SCHOOL3**







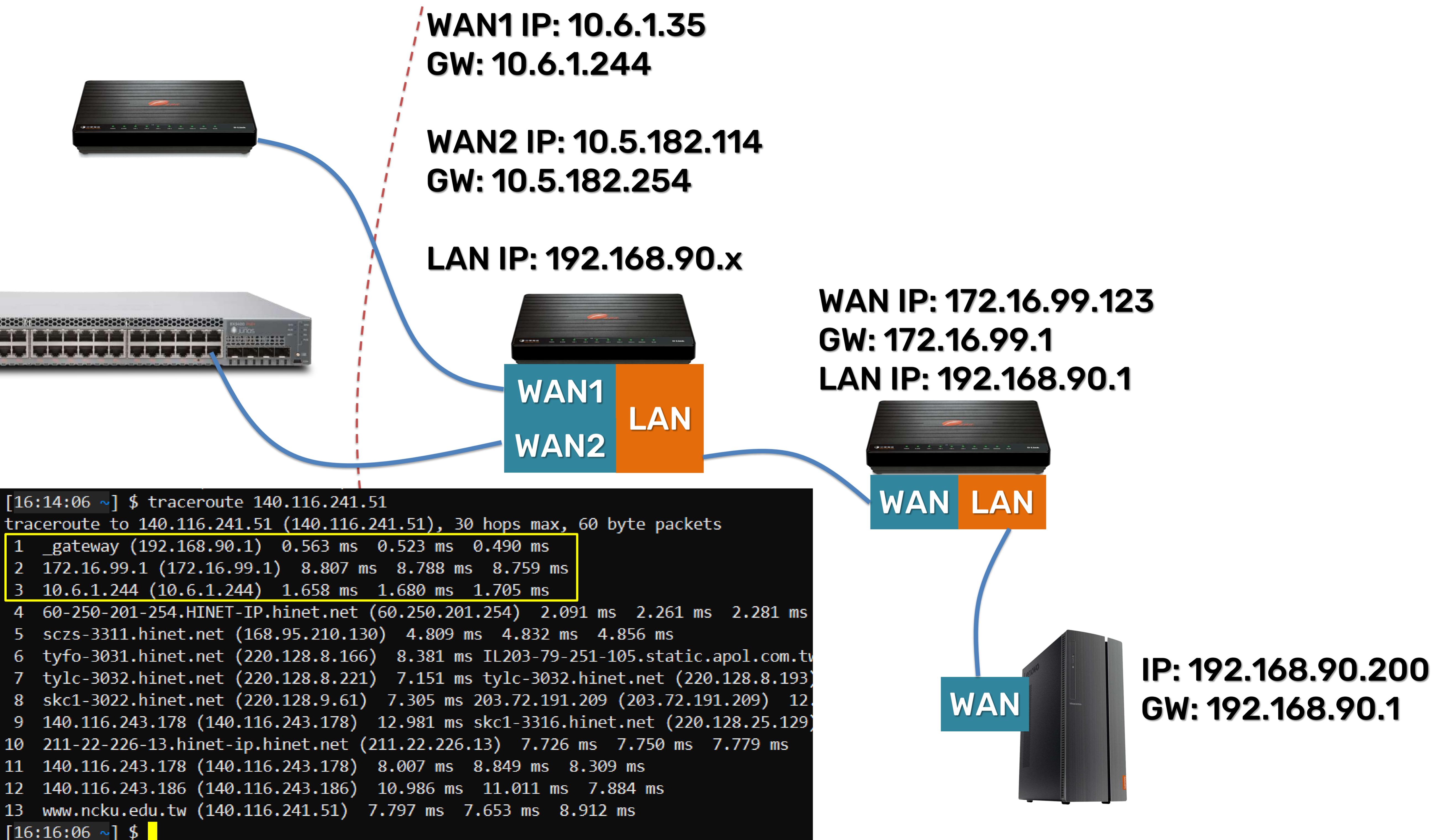


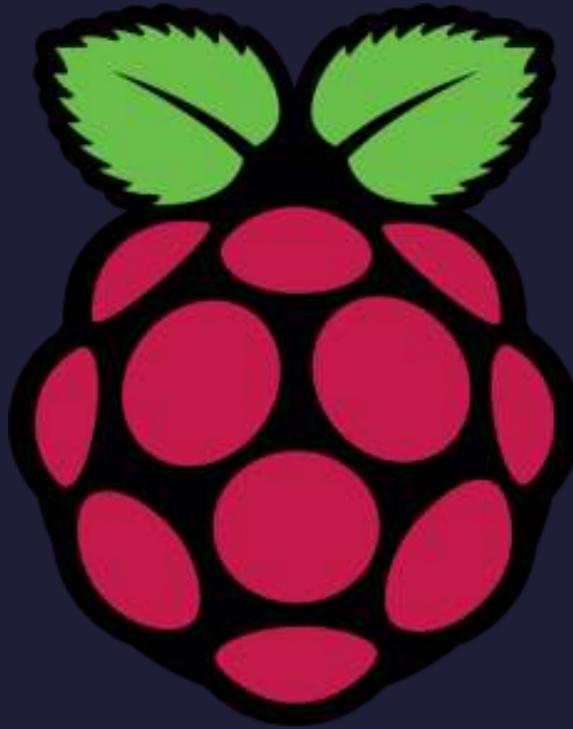
# LAB: Trace Route



```
$ ifconfig  
$ route -n  
$ ping  
$ traceroute
```

```
> ipconfig  
> route PRINT  
> ping  
> tracert
```

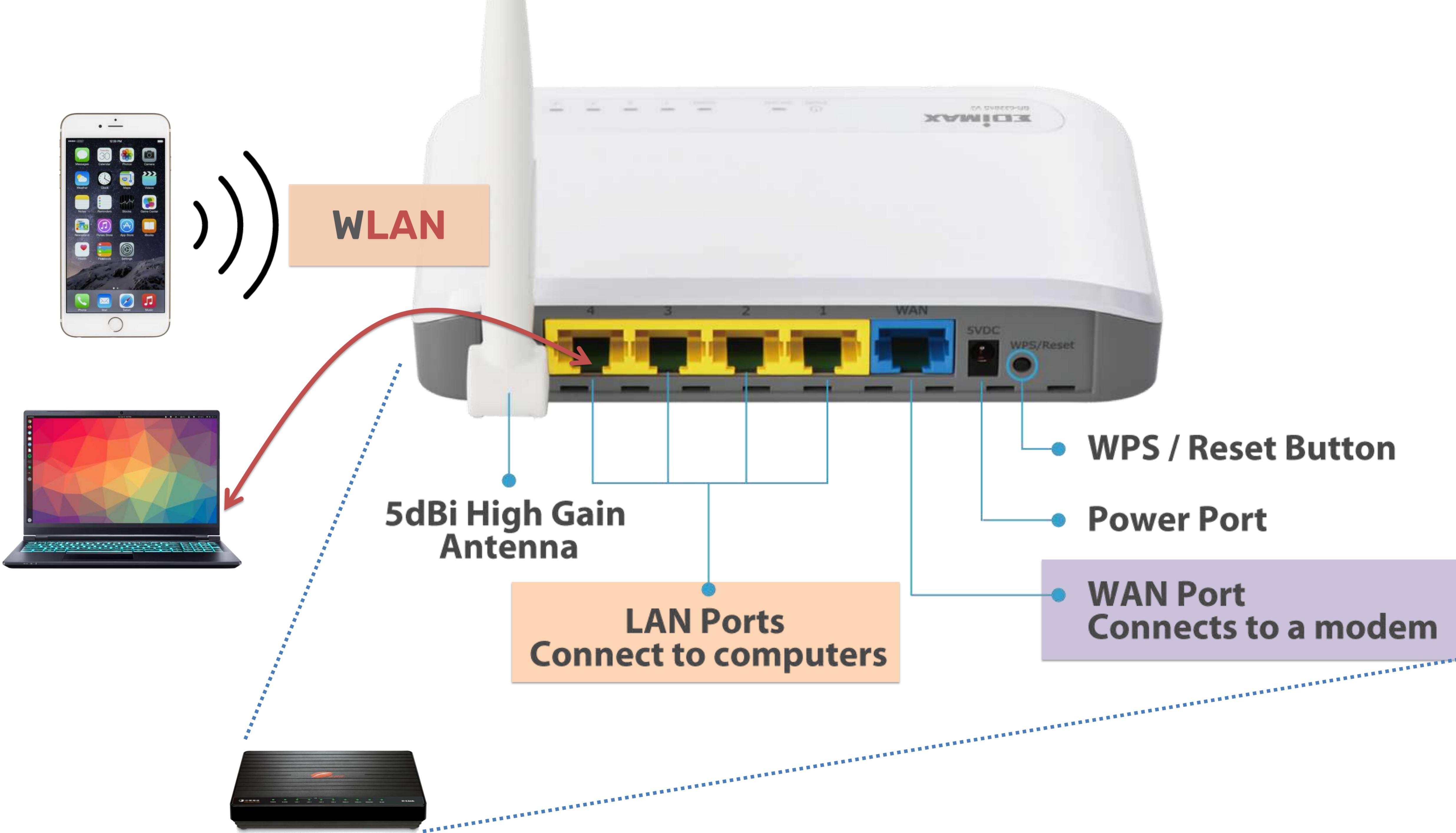


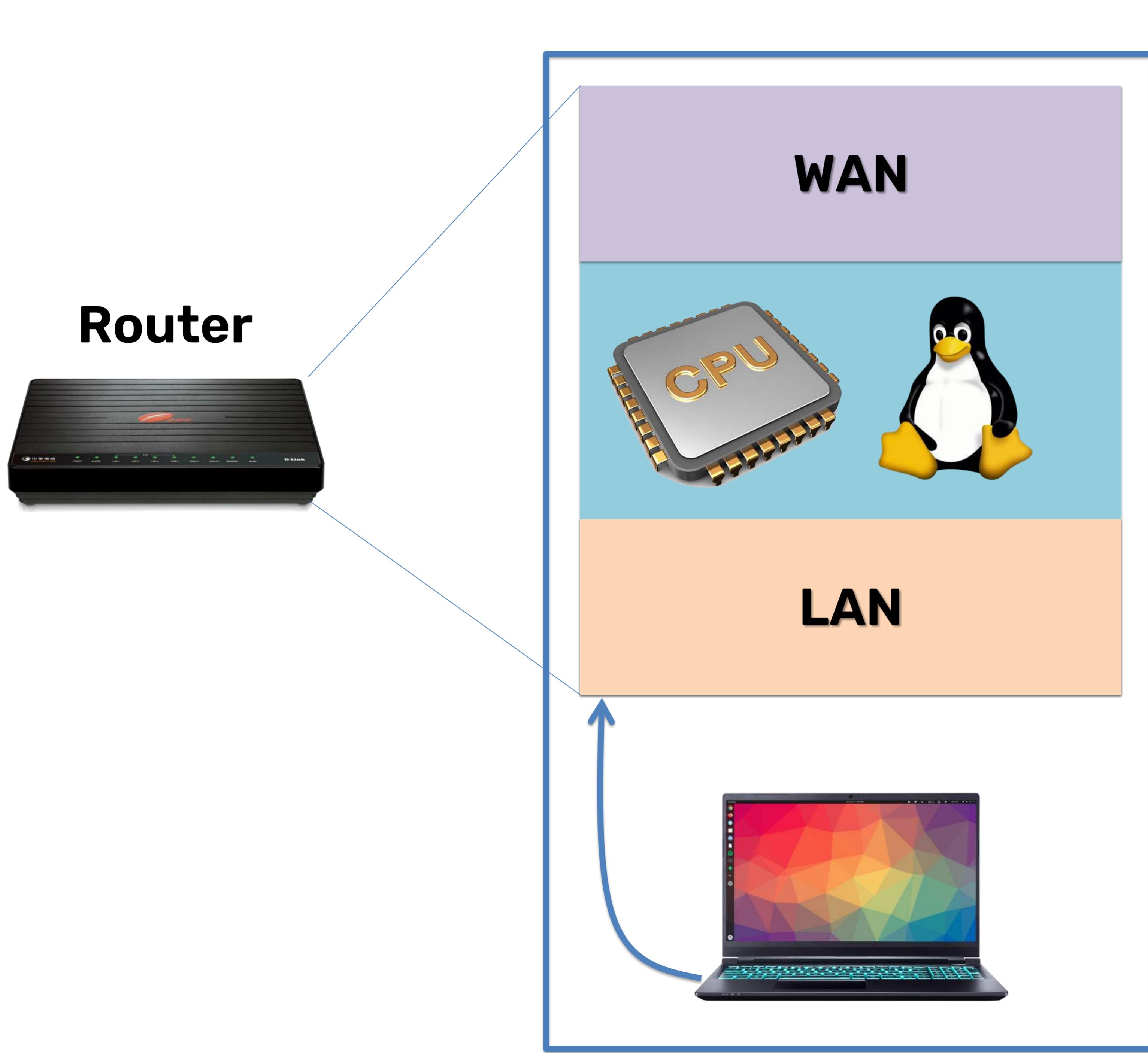


# LAB: “what is my IP address”

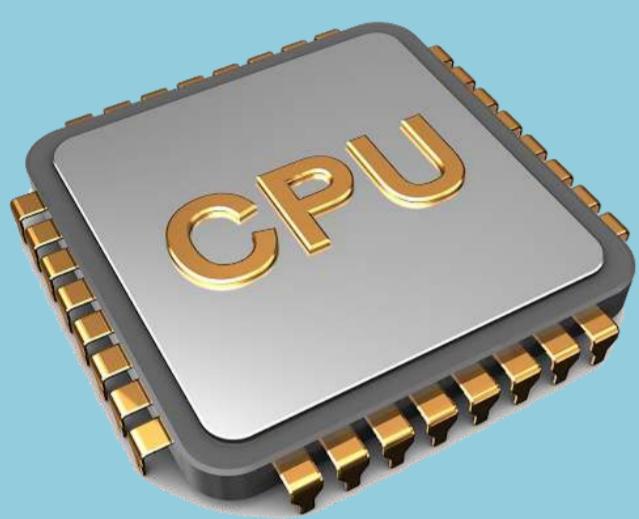


```
$ curl ifconfig.me
```





**WAN**



**LAN (DHCP)**



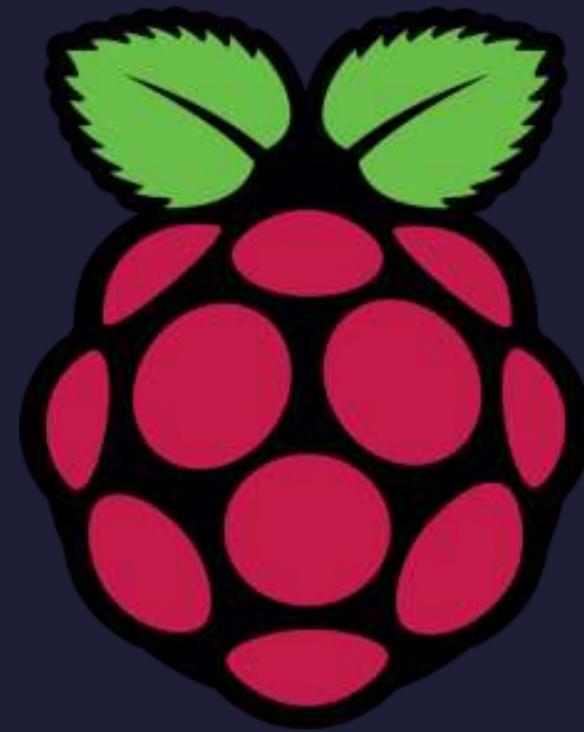
**WAN interface IP: 60.250.201.19**

**LAN interface IP: 192.168.90.1**

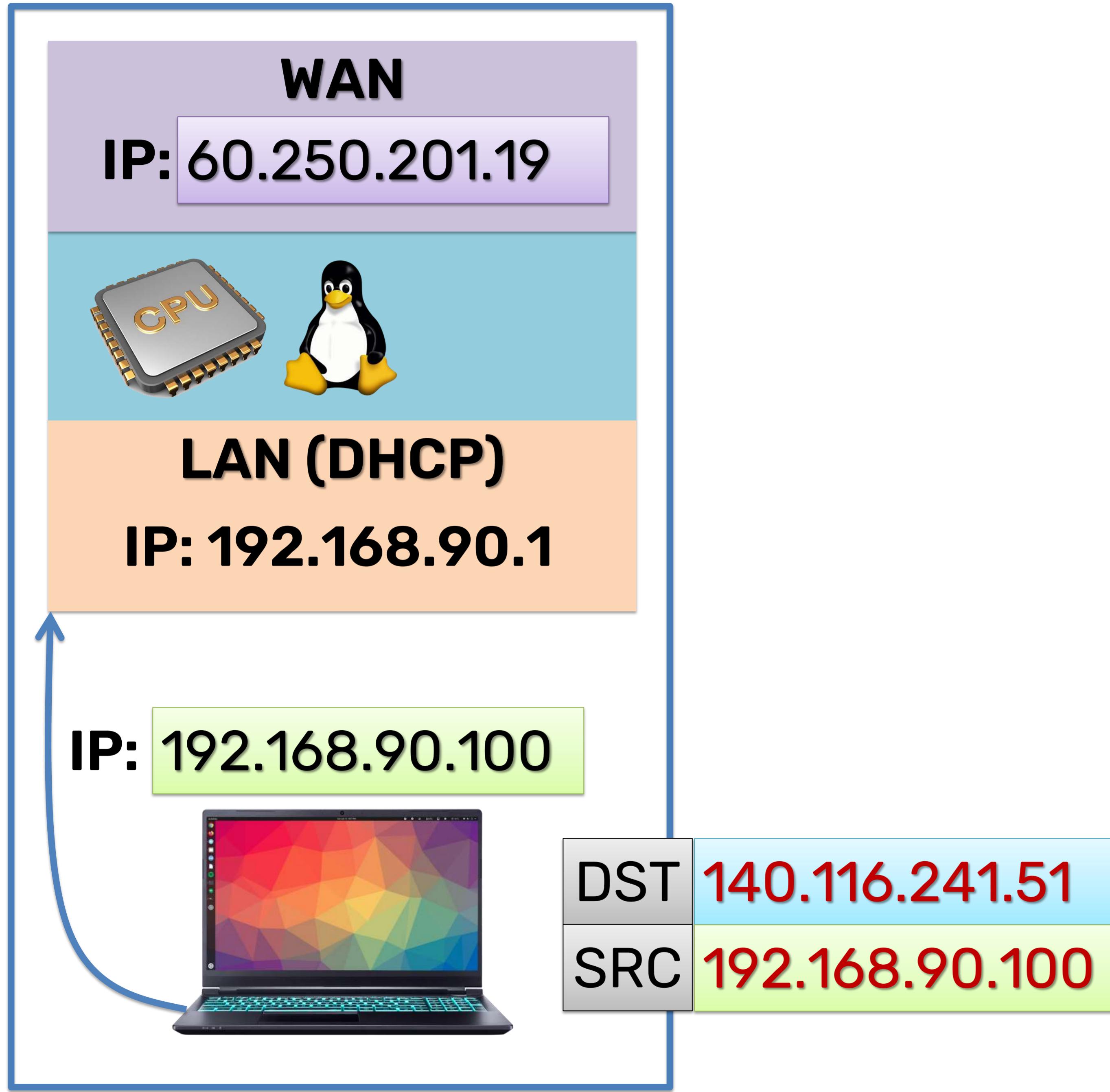
**Ethernet interface IP: 192.168.90.100**

乙太網路卡 LAN:

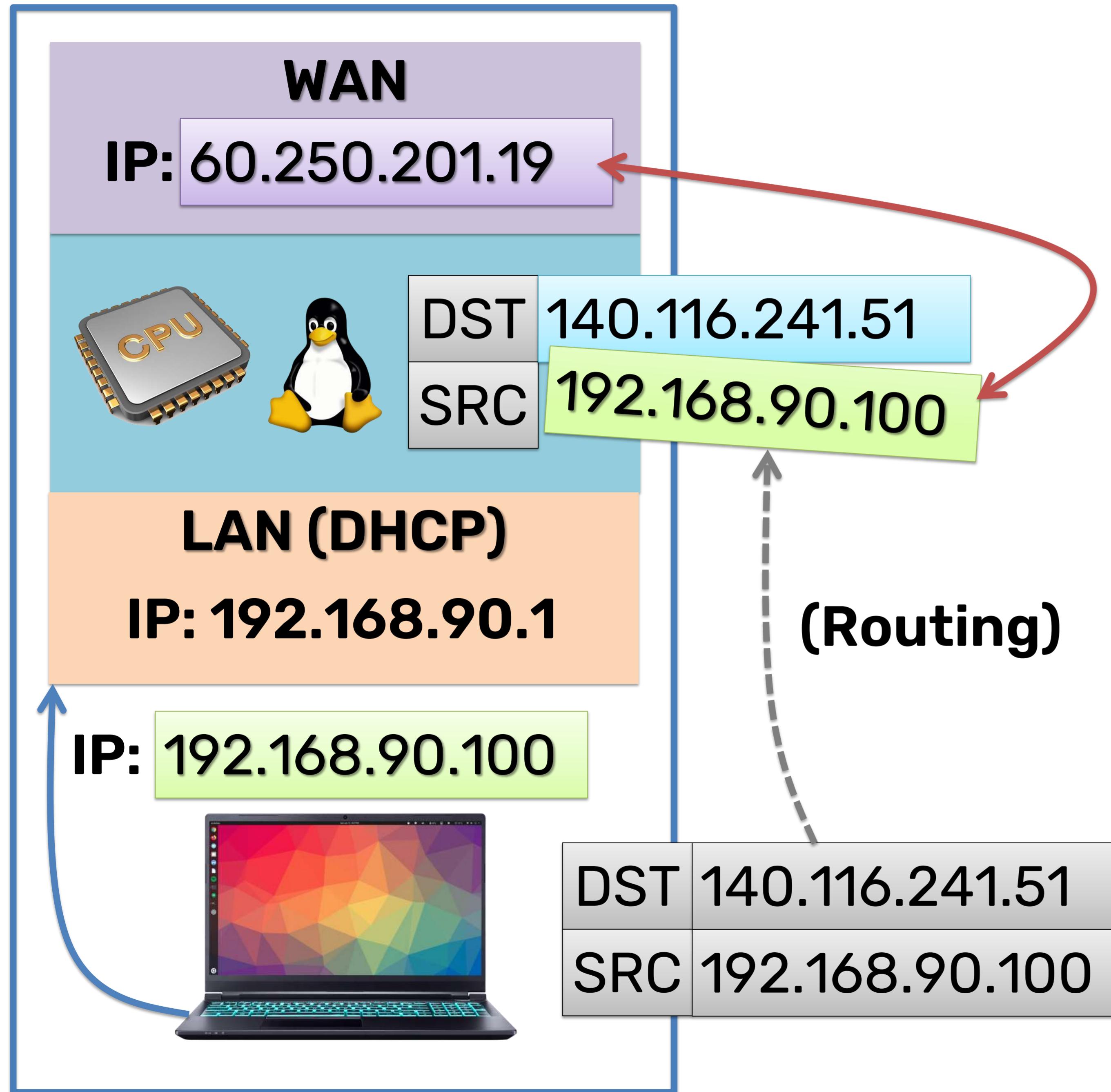
連線特定 DNS 尾碼	:	..	..	..	..	..	..
連結-本機 IPv6 位址	:	..	..	..	..	..	..
IPv4 位址	:	..	..	..	..	..	192.168.90.100
子網路遮罩	:	..	..	..	..	..	255.255.255.0
預設閘道	:	..	..	..	..	..	192.168.90.1



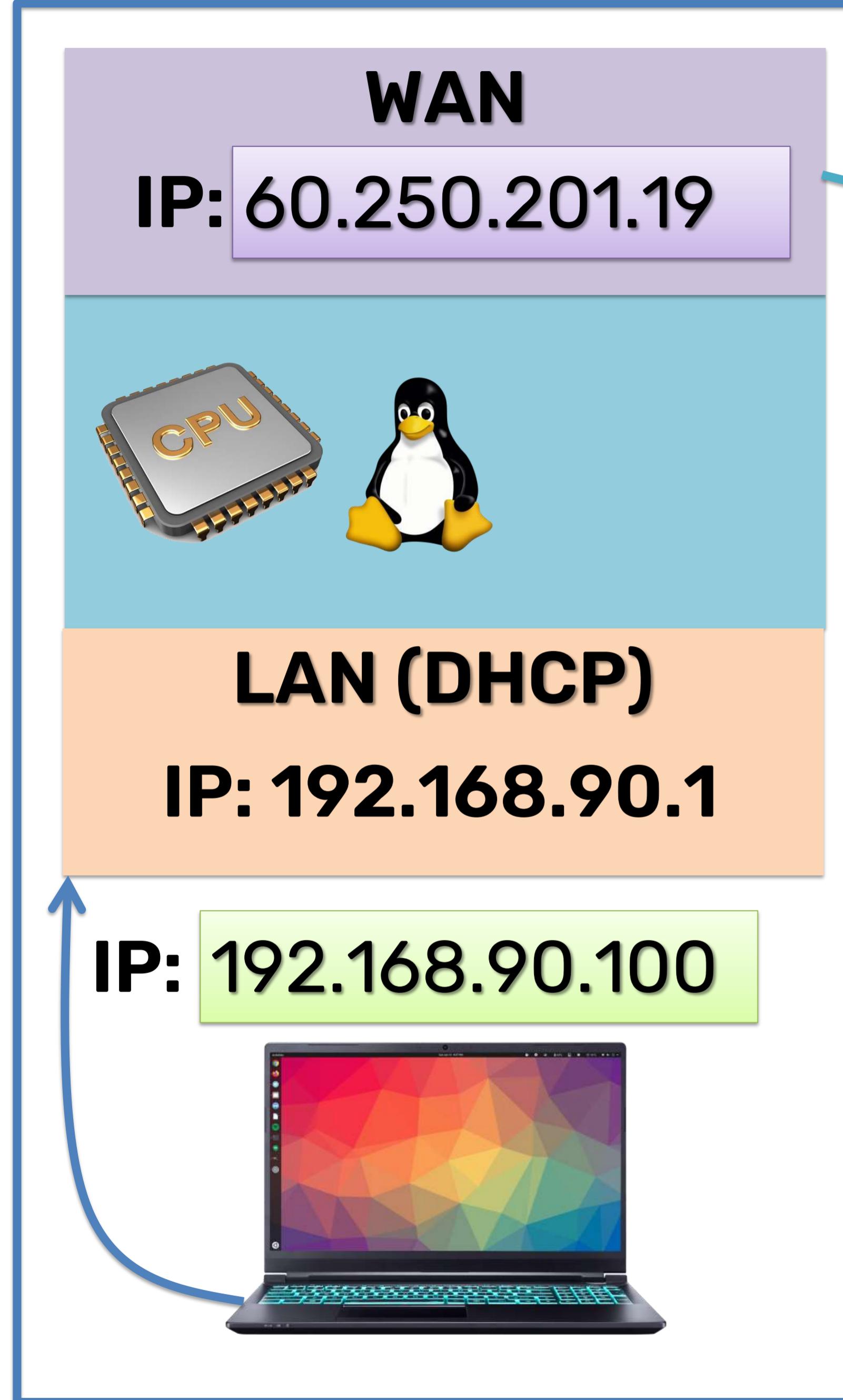
# NAT



**www.ncku.edu.tw**  
**140.116.241.51**



**www.ncku.edu.tw**  
**140.116.241.51**



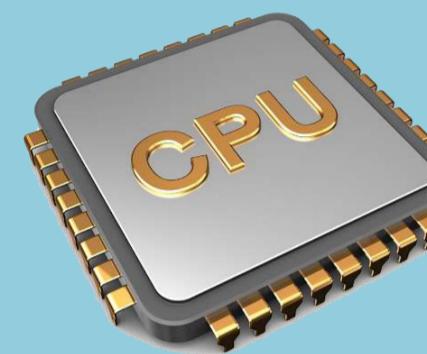
DST	140.116.241.51
SRC	60.250.201.19



[www.ncku.edu.tw](http://www.ncku.edu.tw)  
140.116.241.51

**WAN**

**IP: 60.250.201.19**



**LAN (DHCP)**

**IP: 192.168.90.1**

**IP: 192.168.90.100**



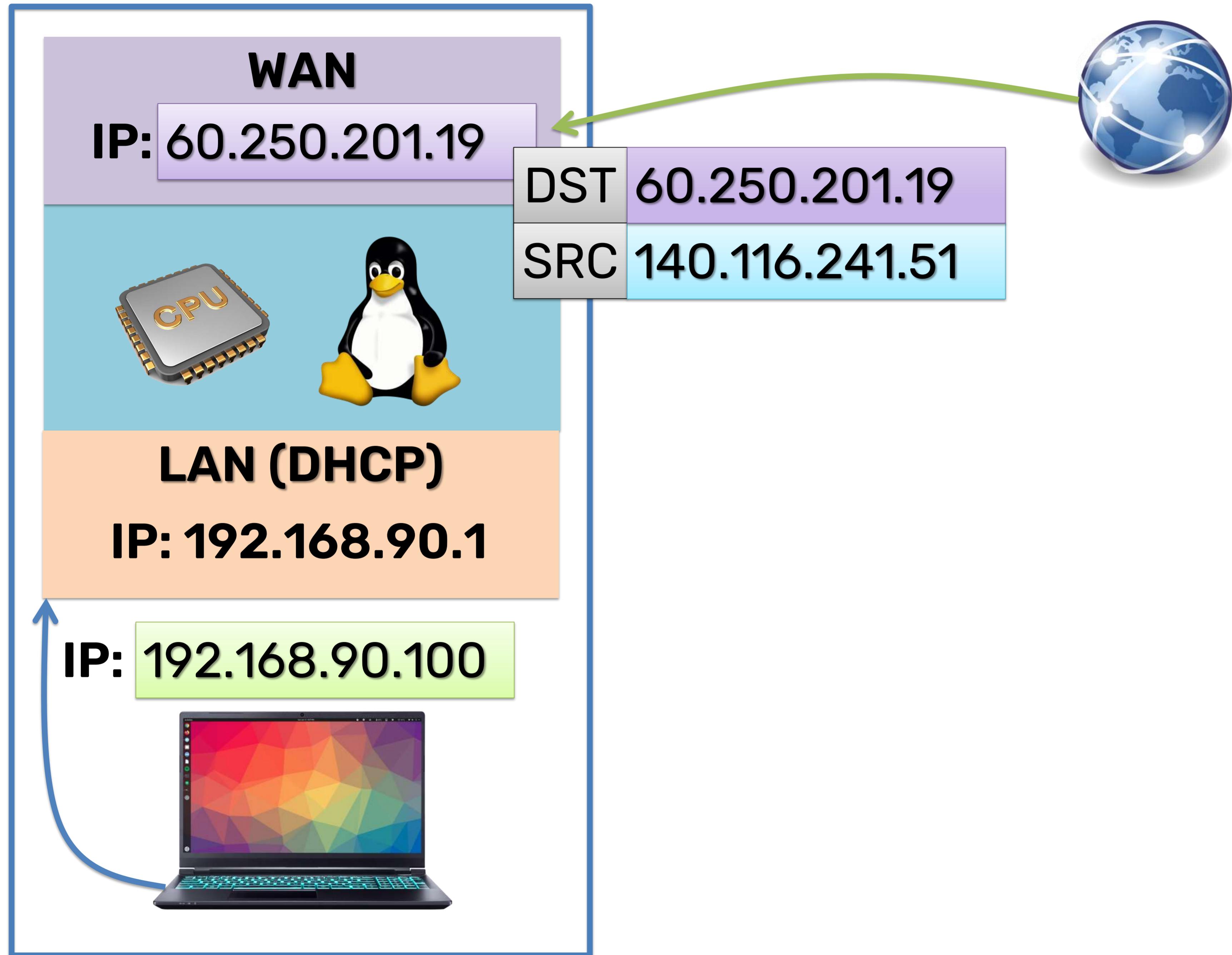
DST	60.250.201.19
SRC	140.116.241.51



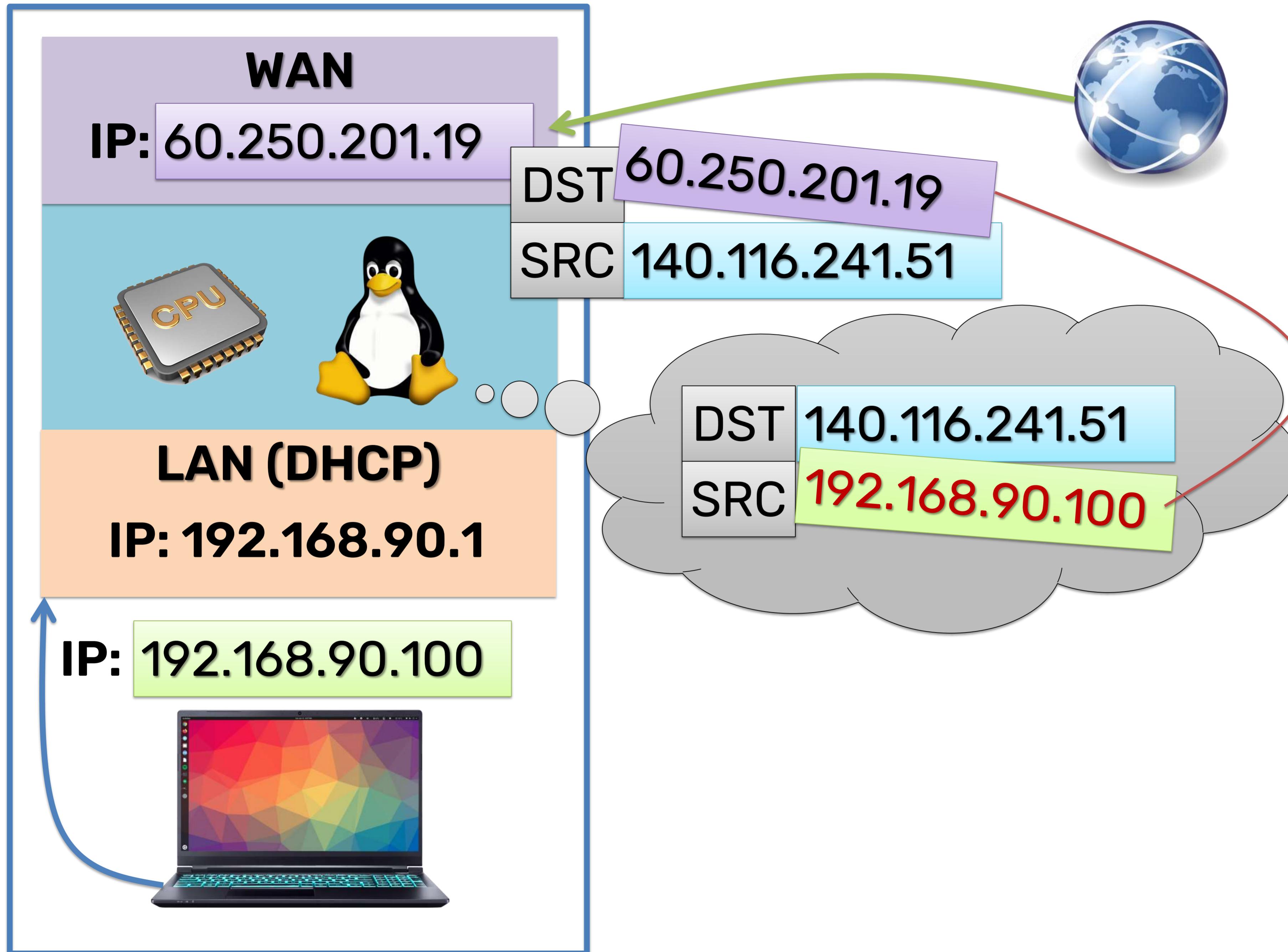
**www.ncku.edu.tw**

**140.116.241.51**

DST	140.116.241.51
SRC	60.250.201.19

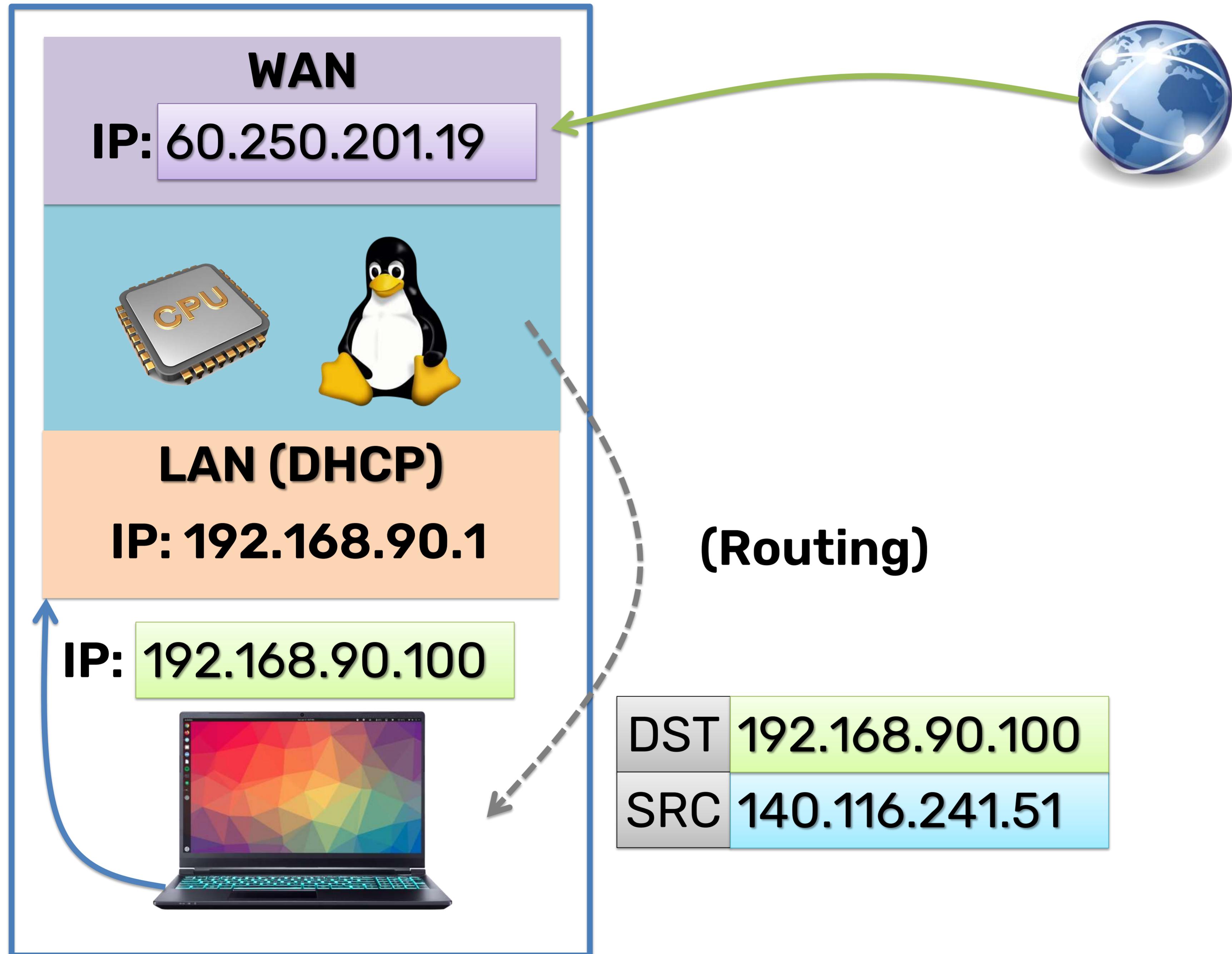


[www.ncku.edu.tw](http://www.ncku.edu.tw)  
140.116.241.51

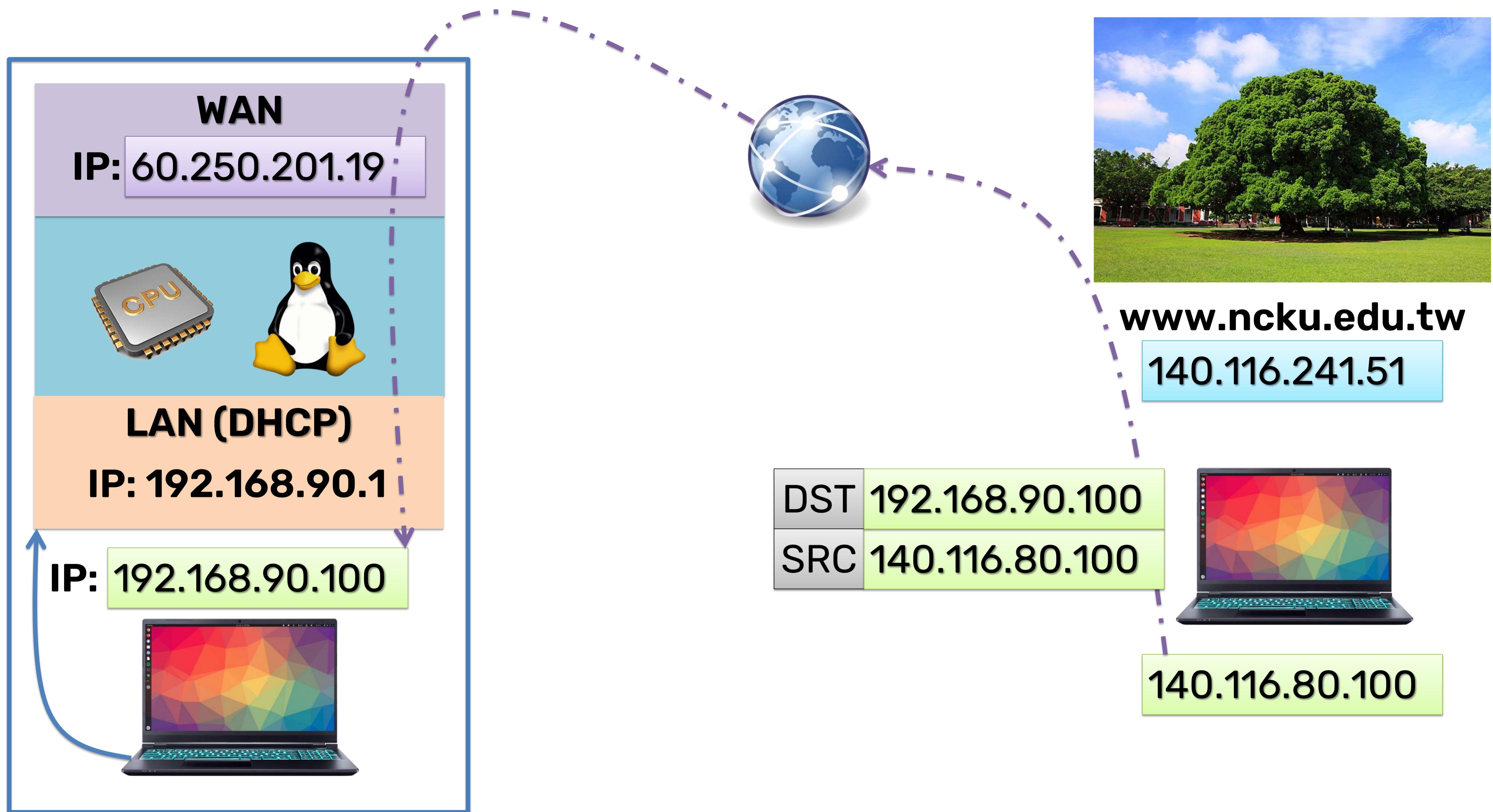


[www.ncku.edu.tw](http://www.ncku.edu.tw)

140.116.241.51

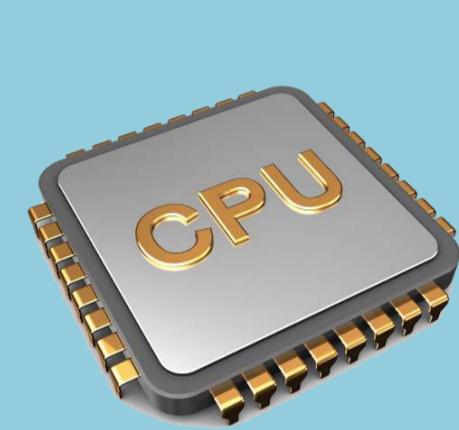


[www.ncku.edu.tw](http://www.ncku.edu.tw)  
140.116.241.51



**WAN**

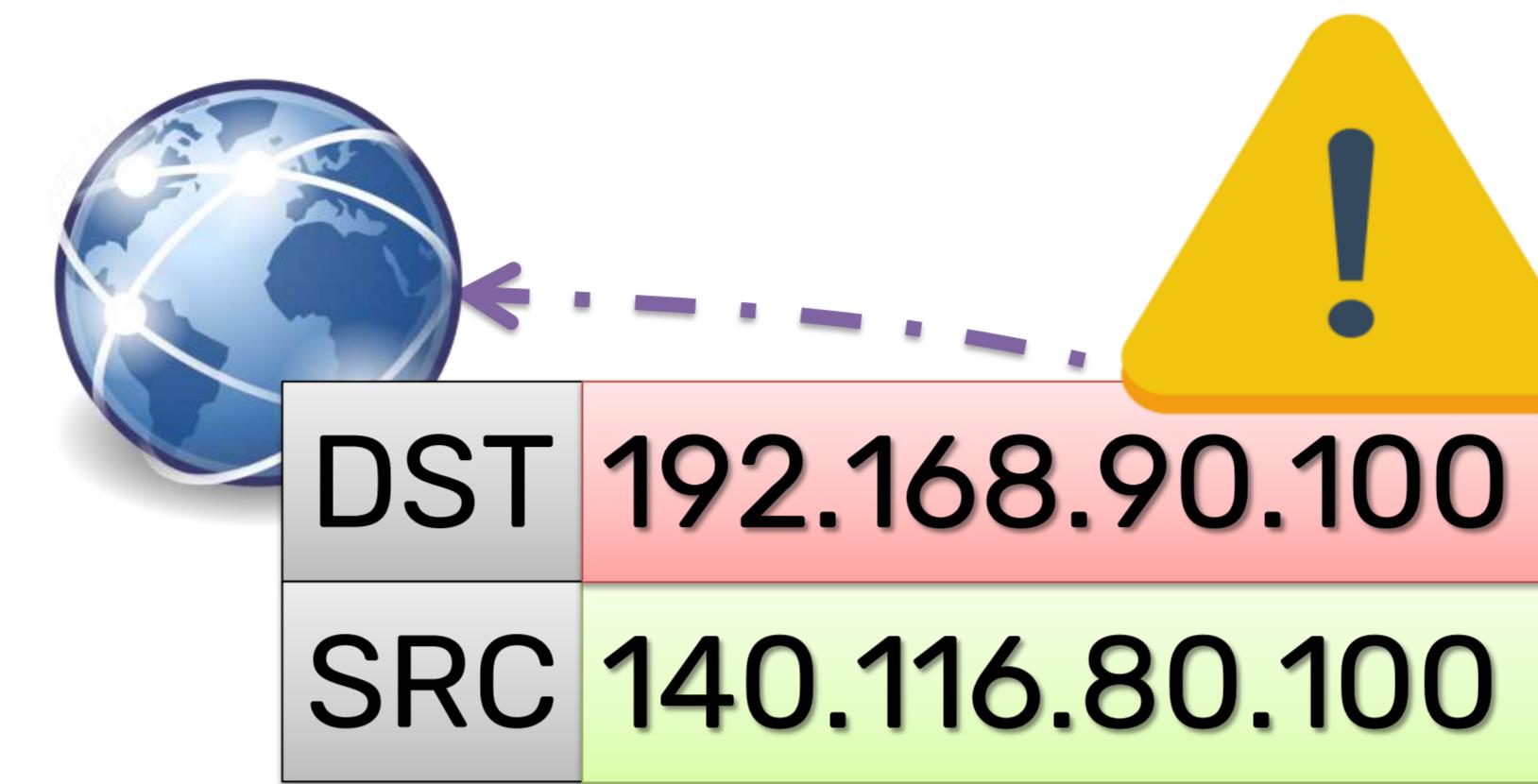
**IP: 60.250.201.19**



**LAN (DHCP)**

**IP: 192.168.90.1**

**IP: 192.168.90.100**

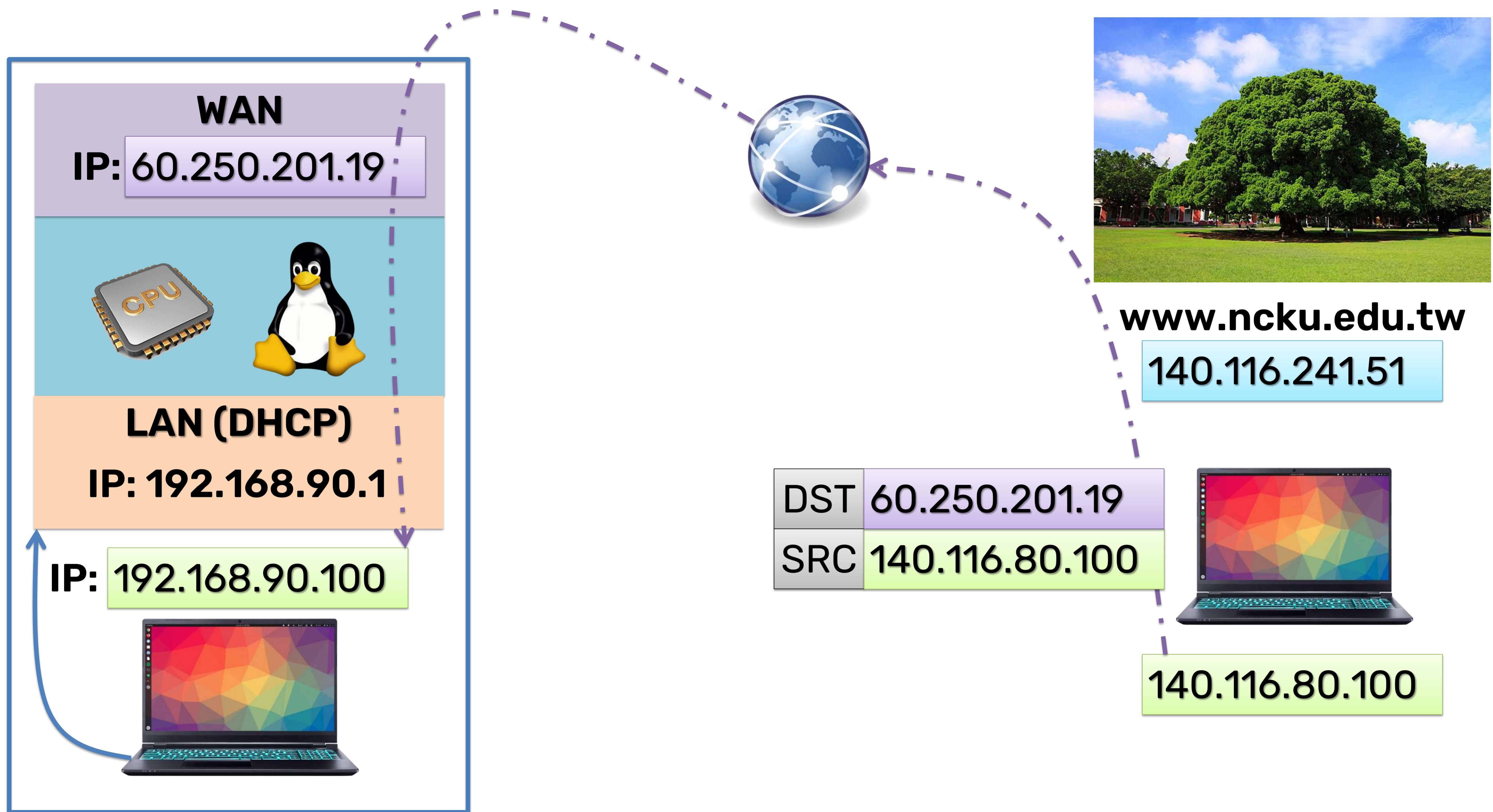


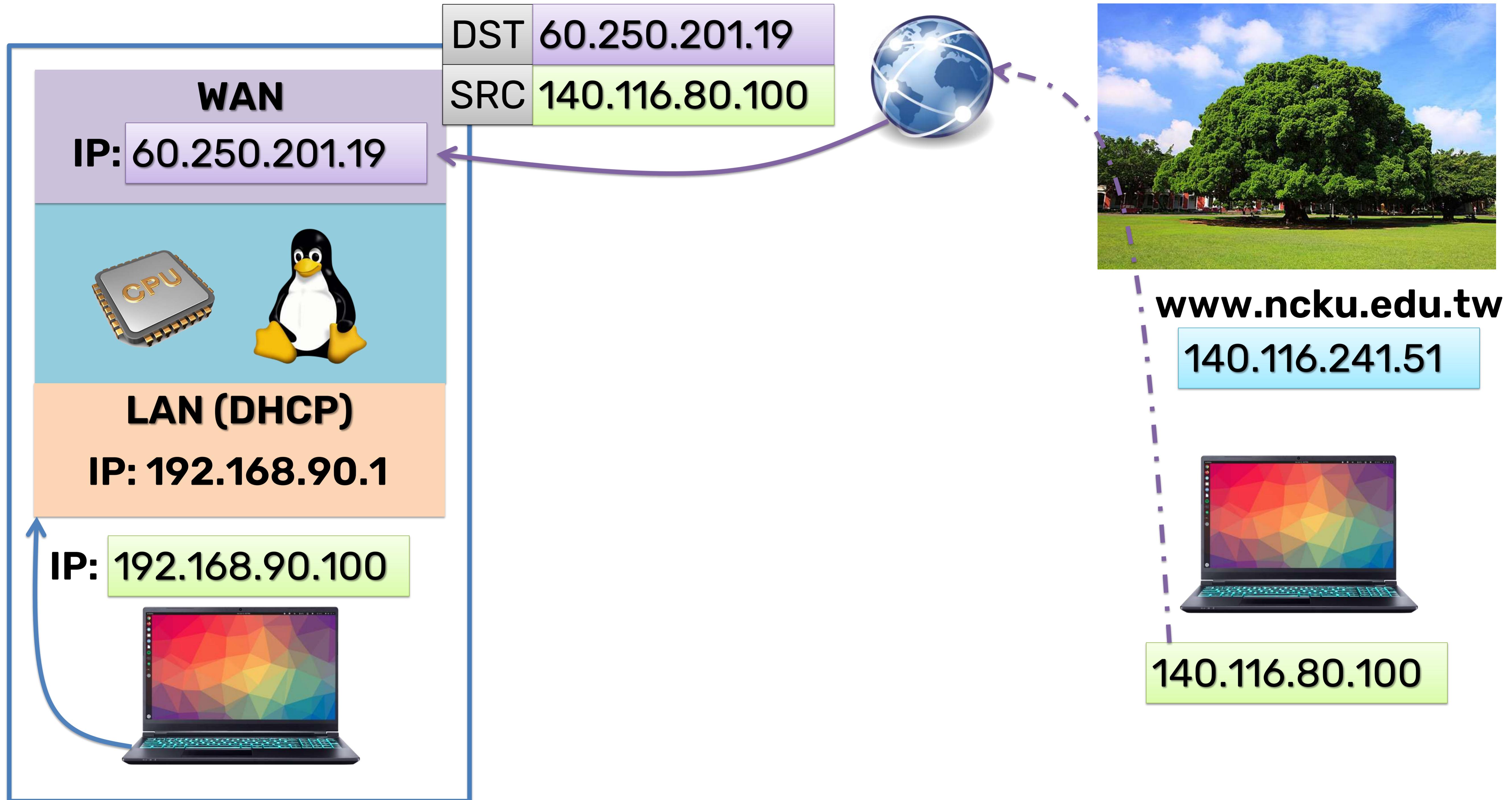
**www.ncku.edu.tw**

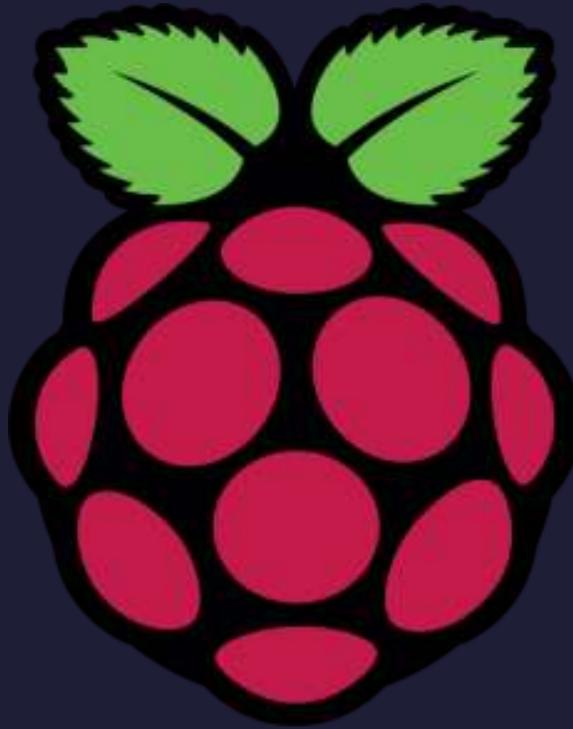
**140.116.241.51**



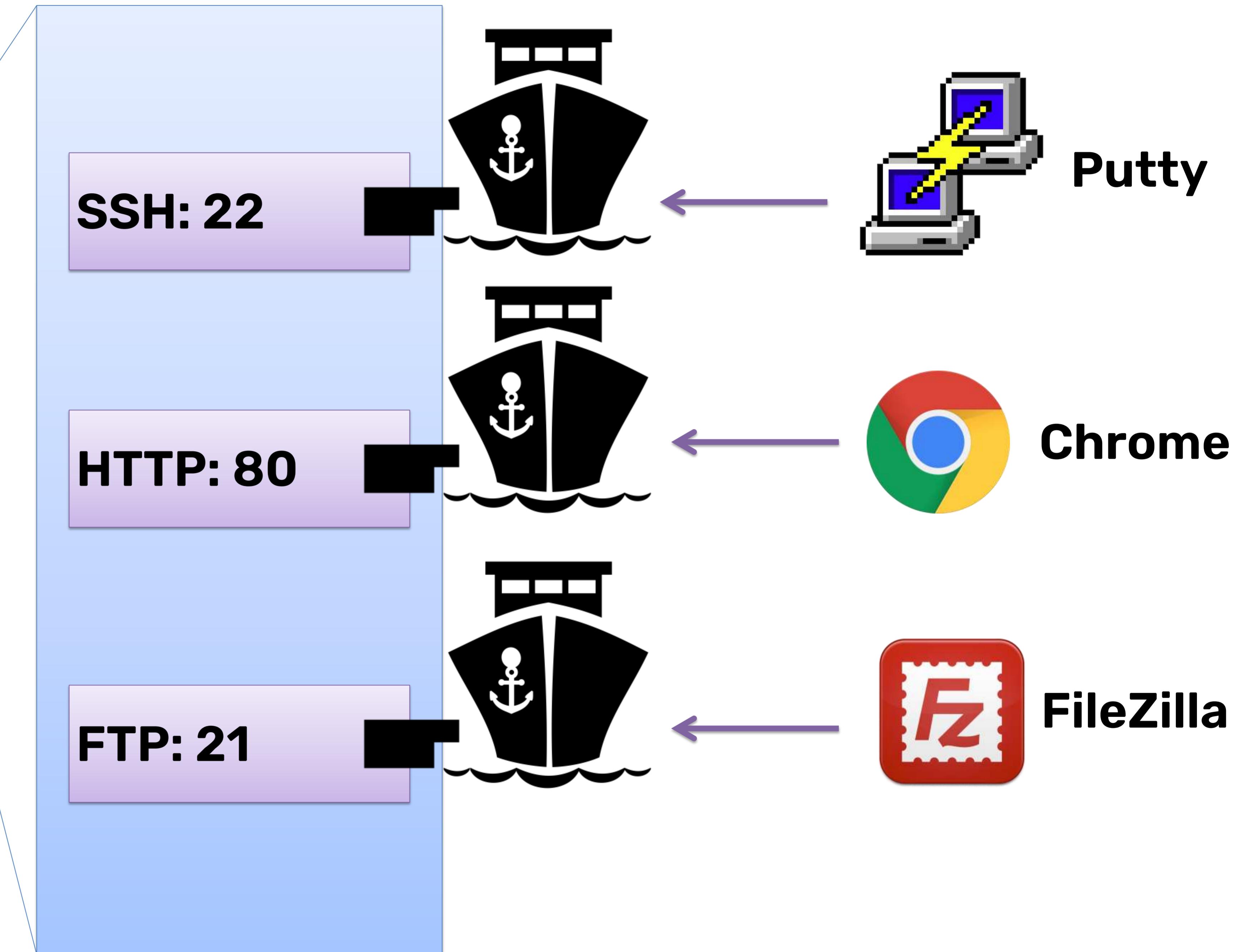
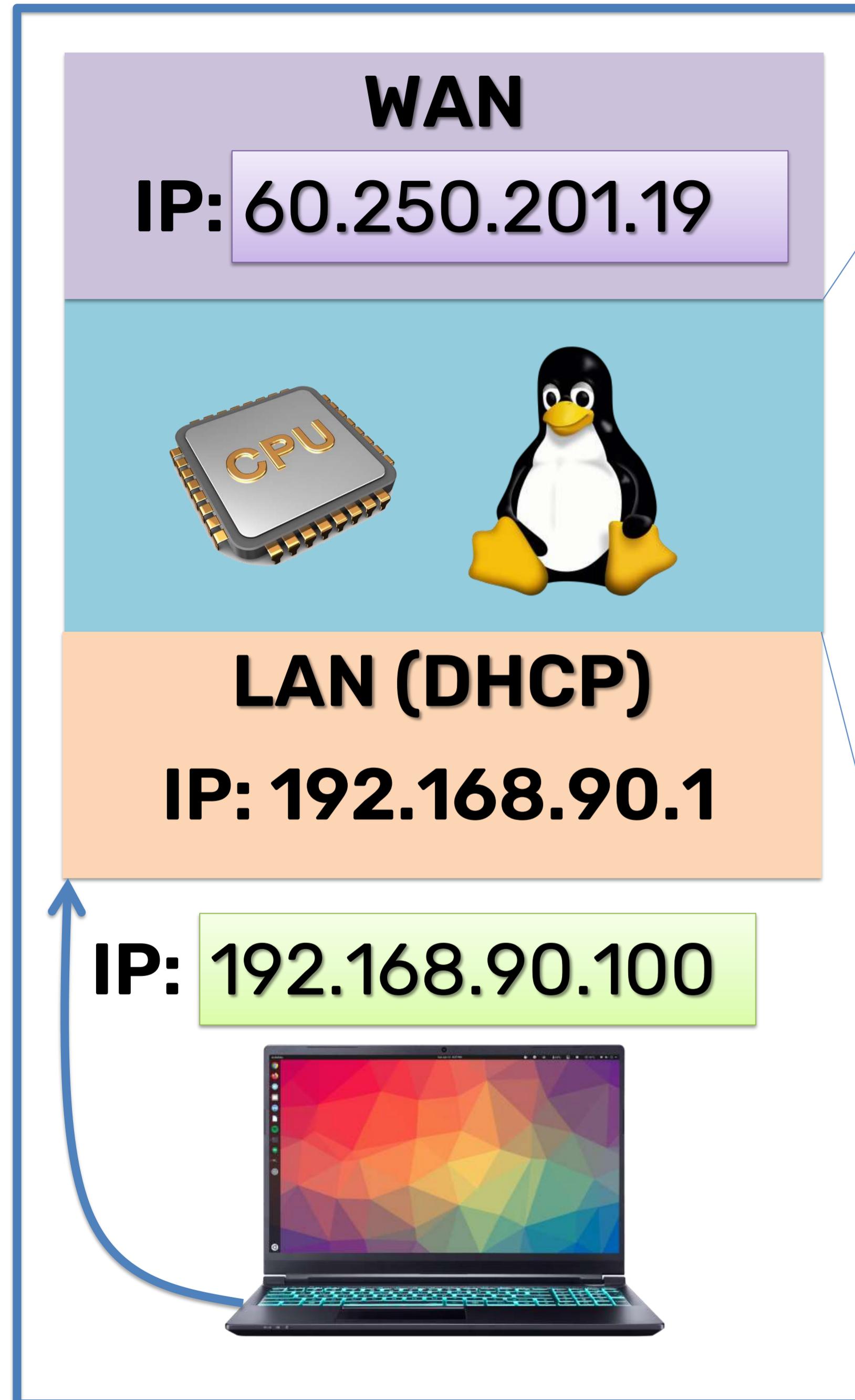
**140.116.80.100**



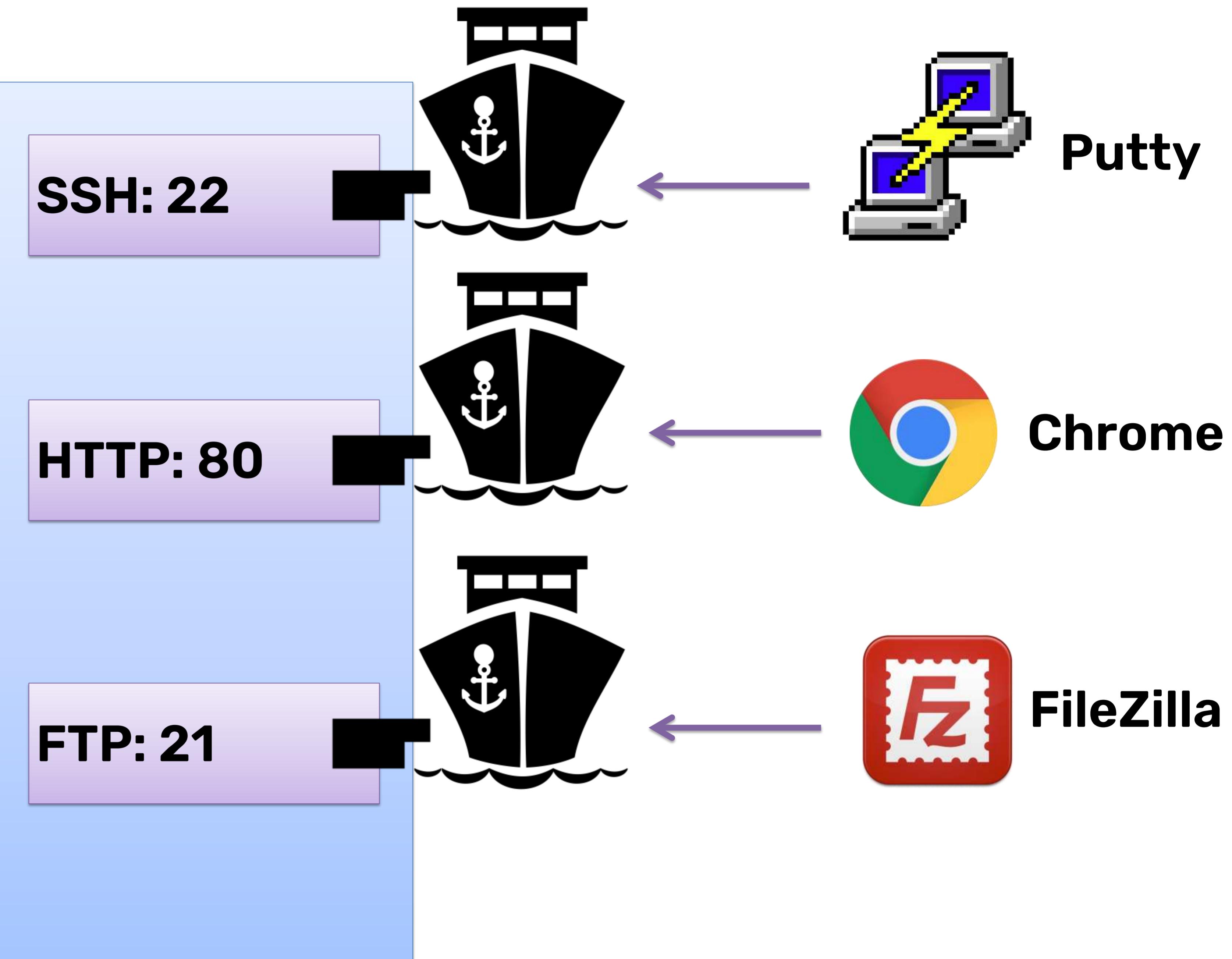




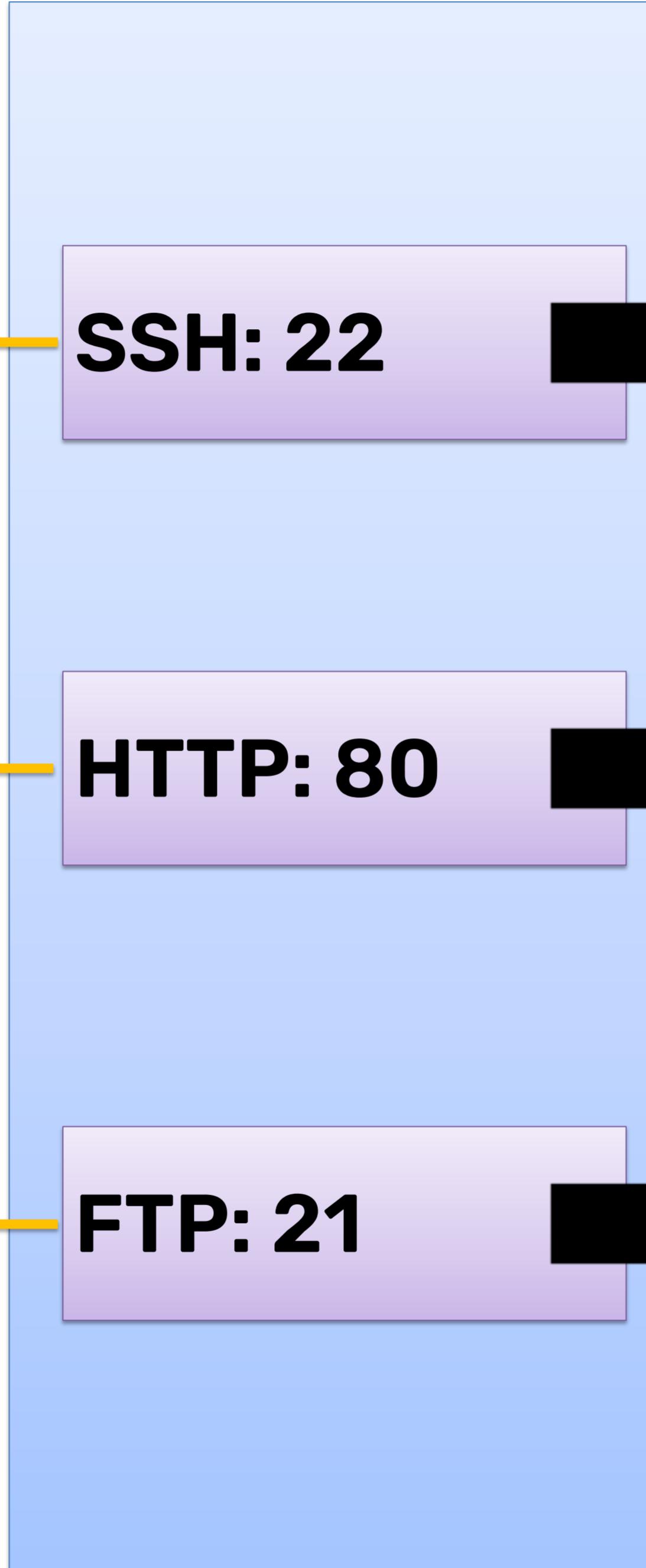
# Port & Port Forwarding



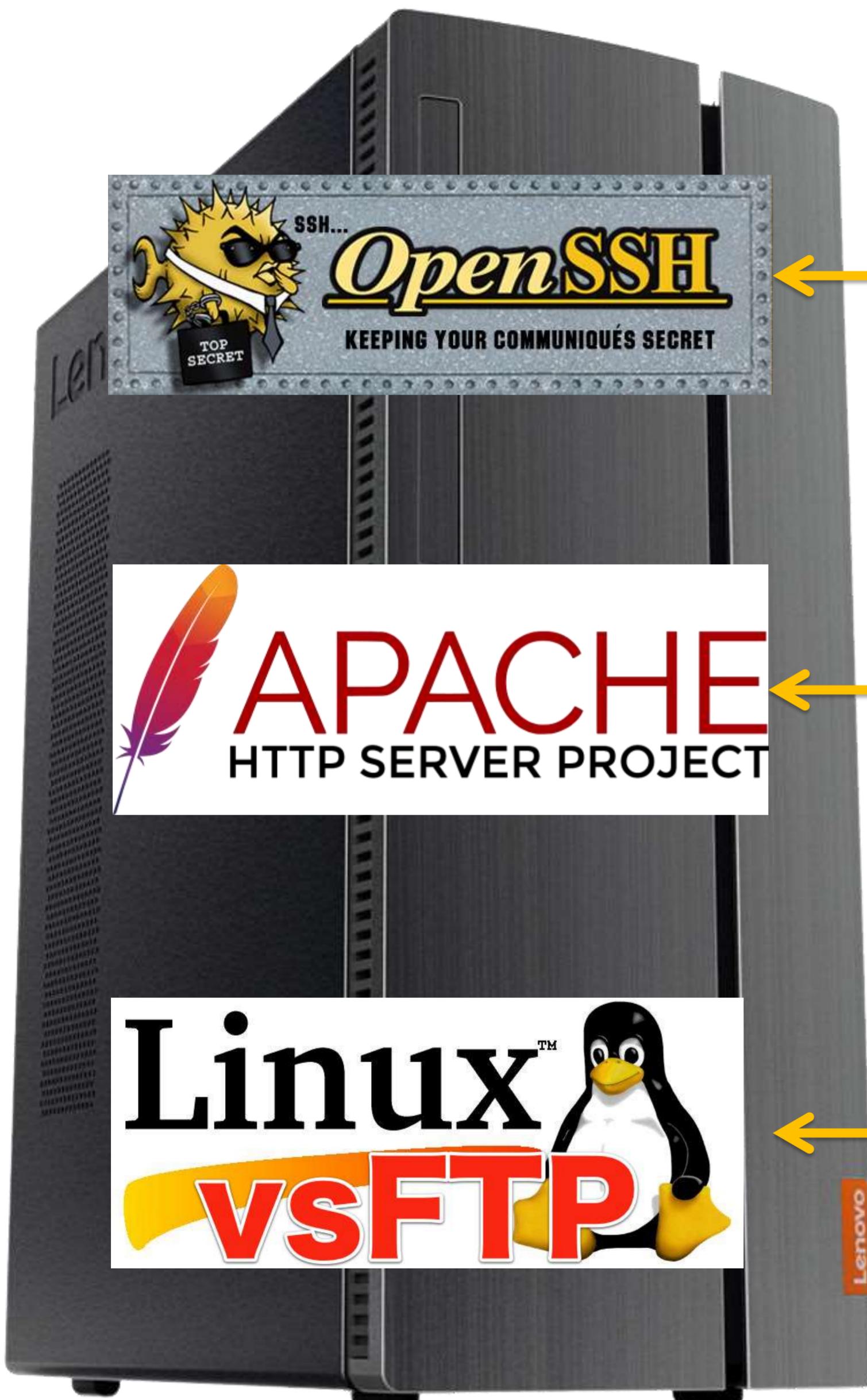
# “Service ↔ Port”



60.250.201.19



60.250.201.19



60.250.201.19:22



Putty

60.250.201.19:80



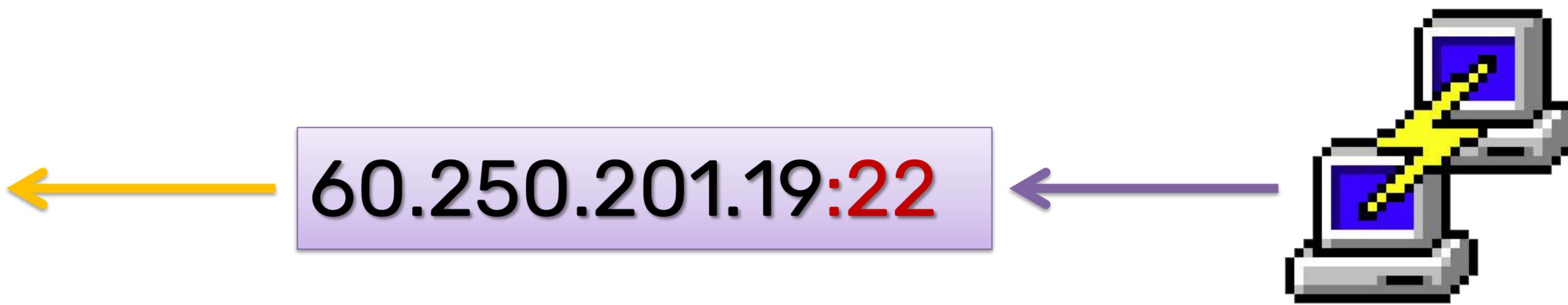
Chrome

60.250.201.19:21

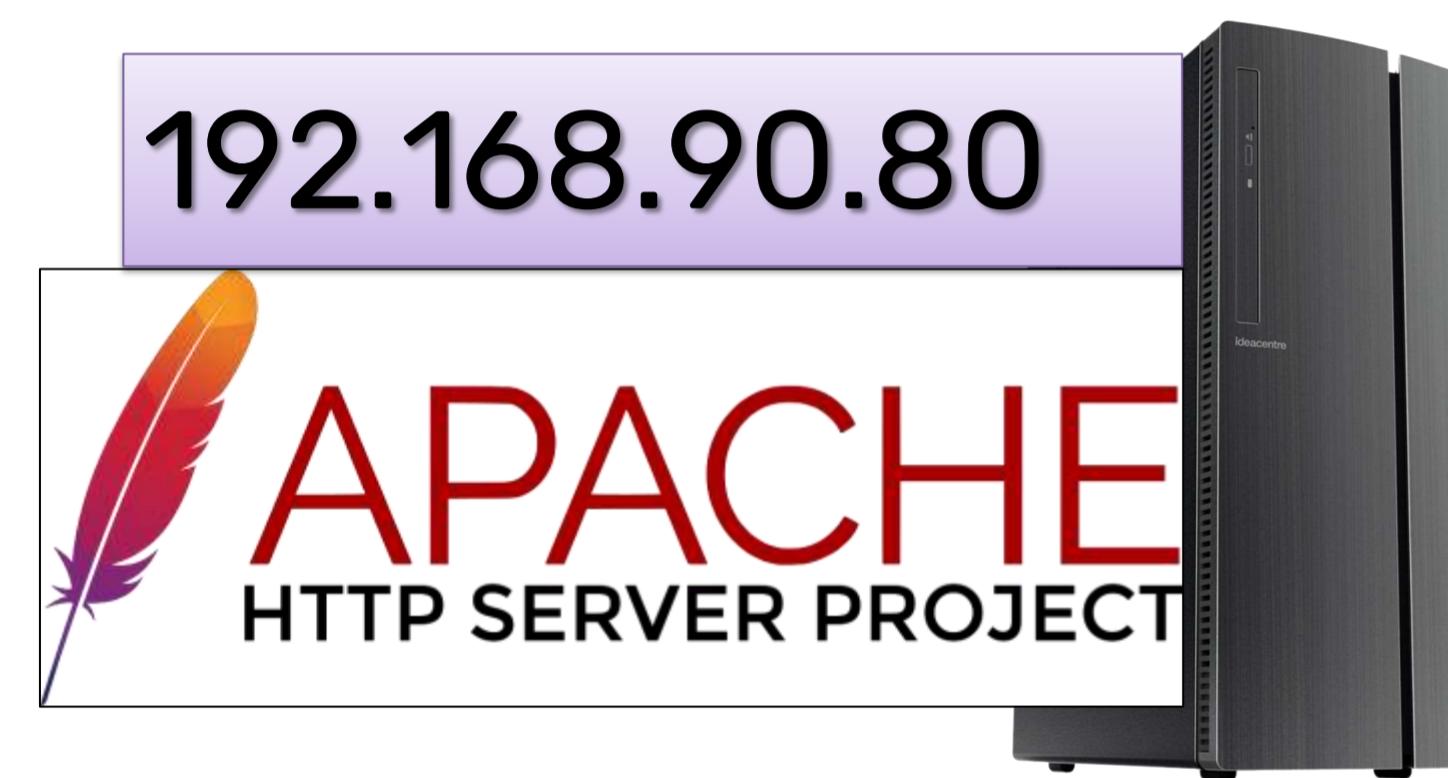


FileZilla

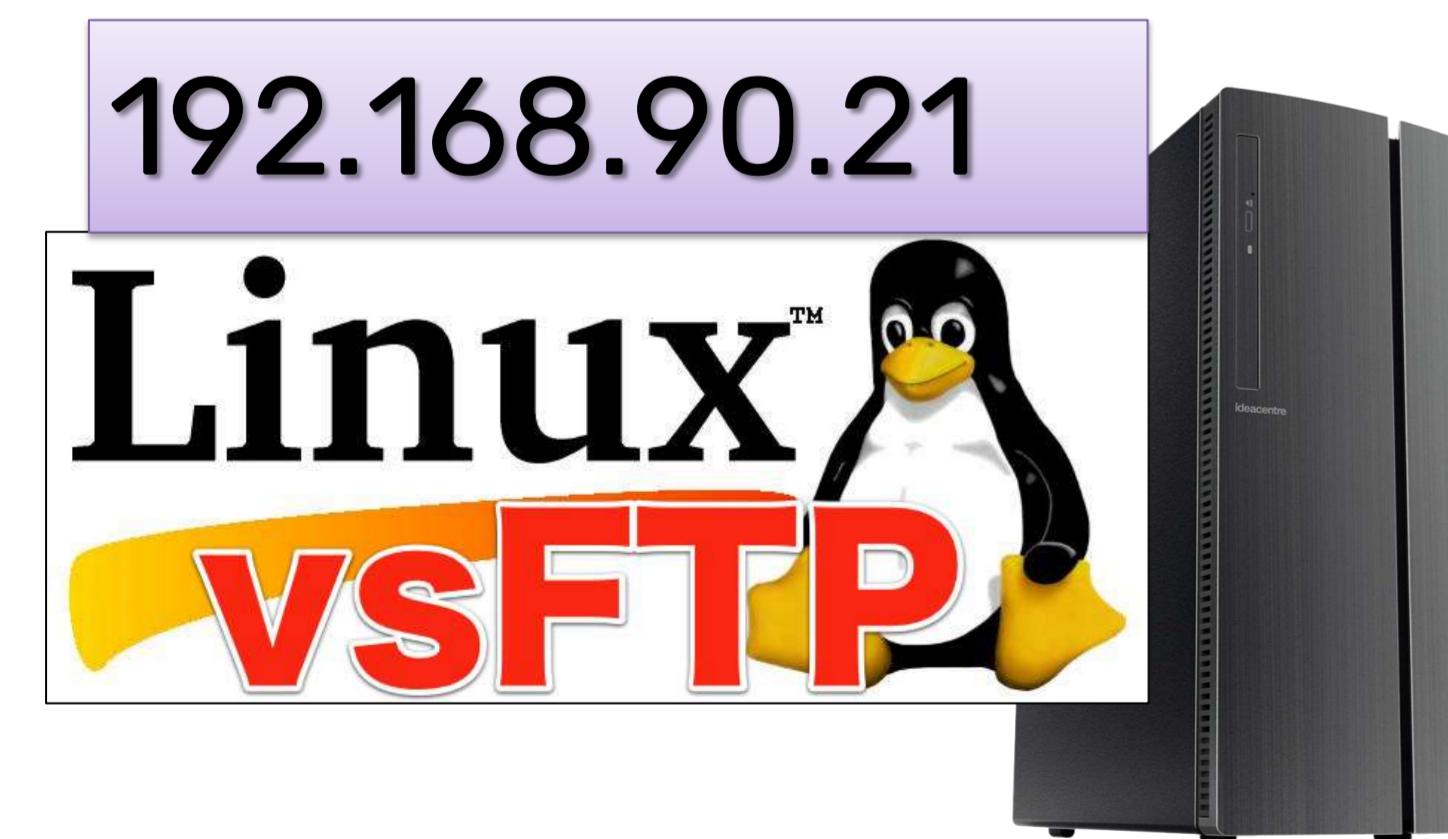
## (Load Balancing)



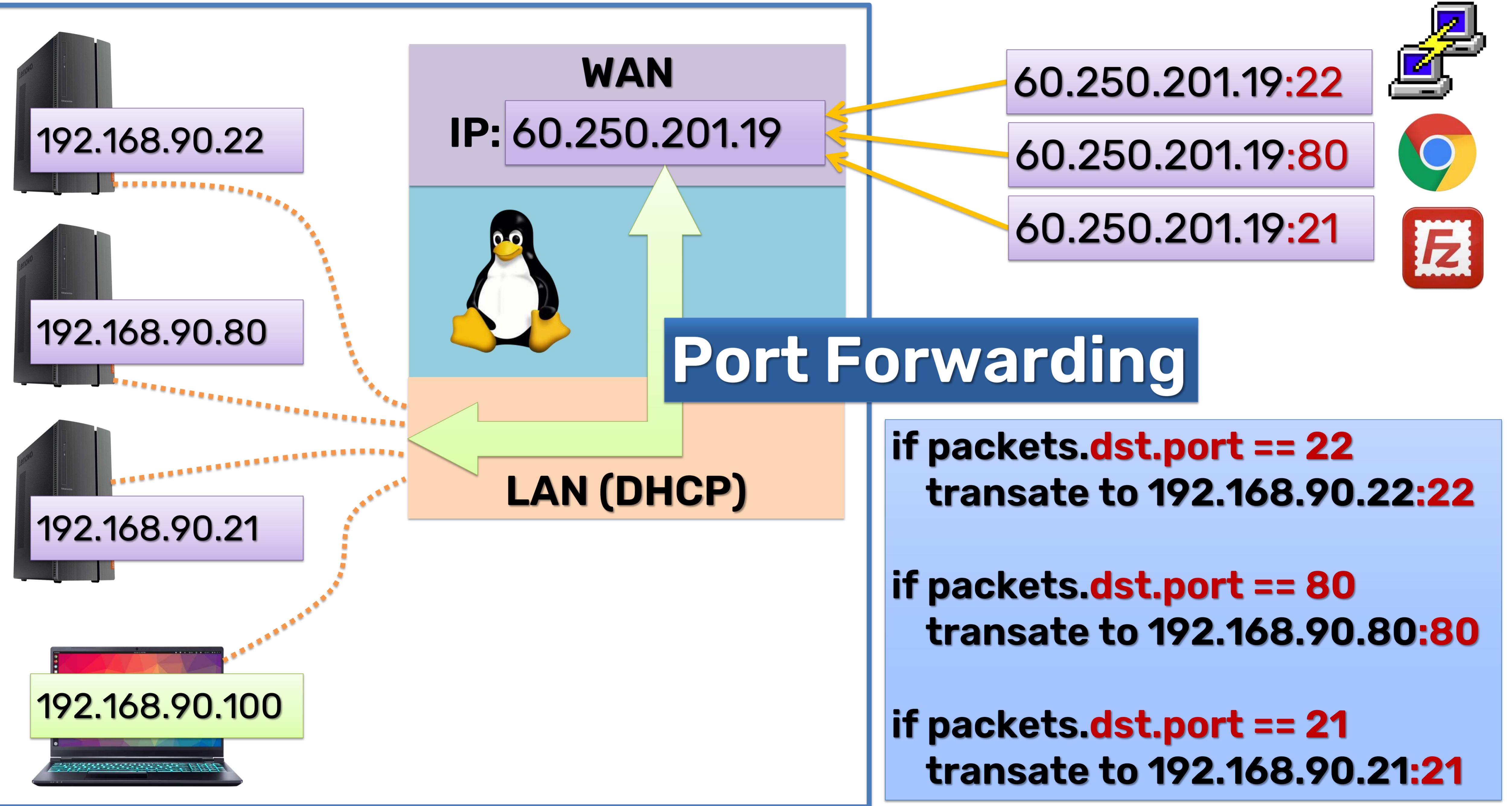
Putty

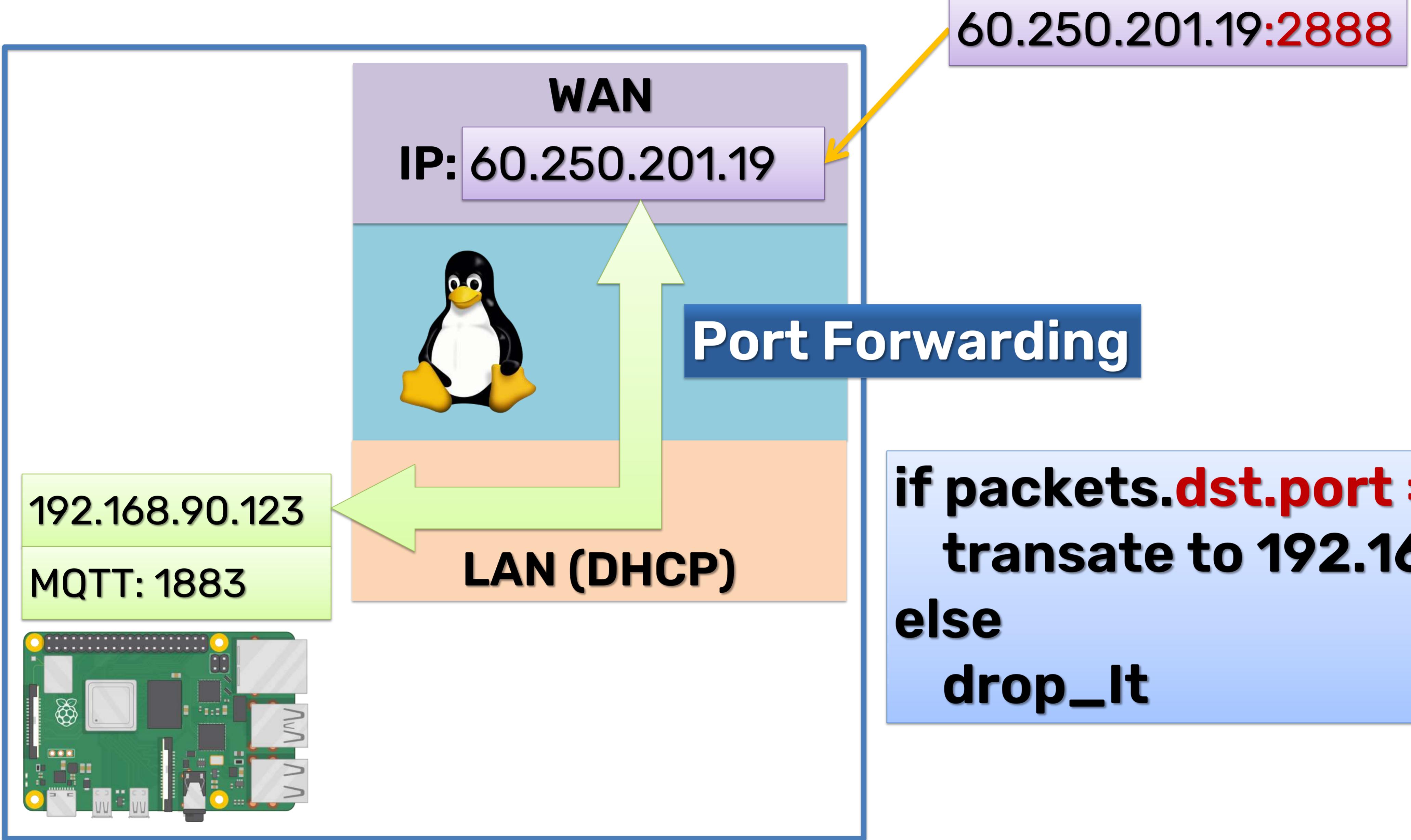


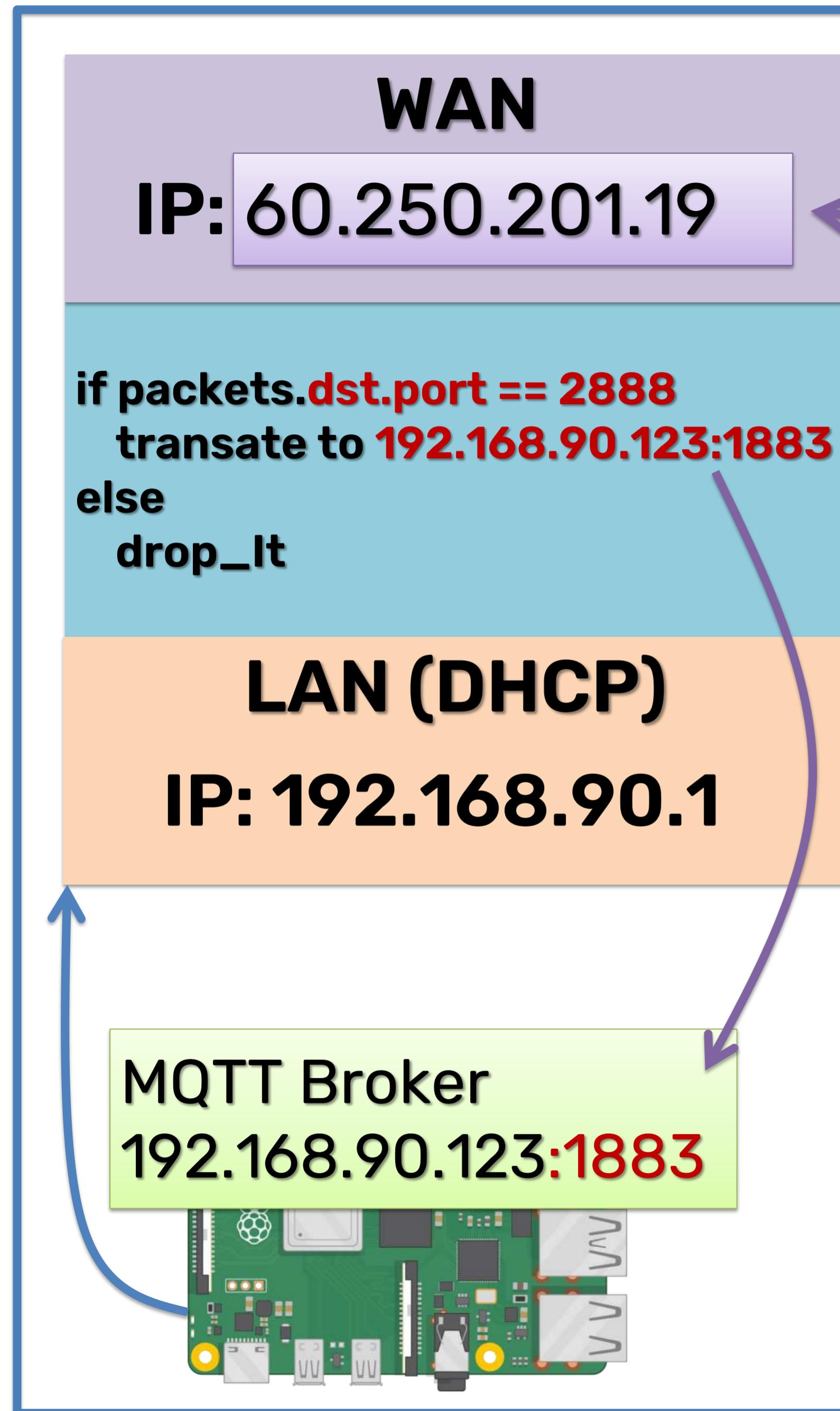
Chrome



FileZilla



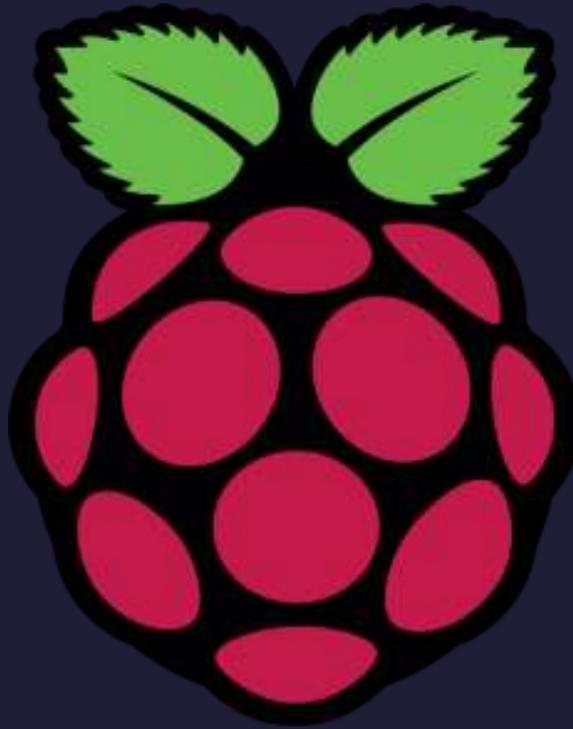




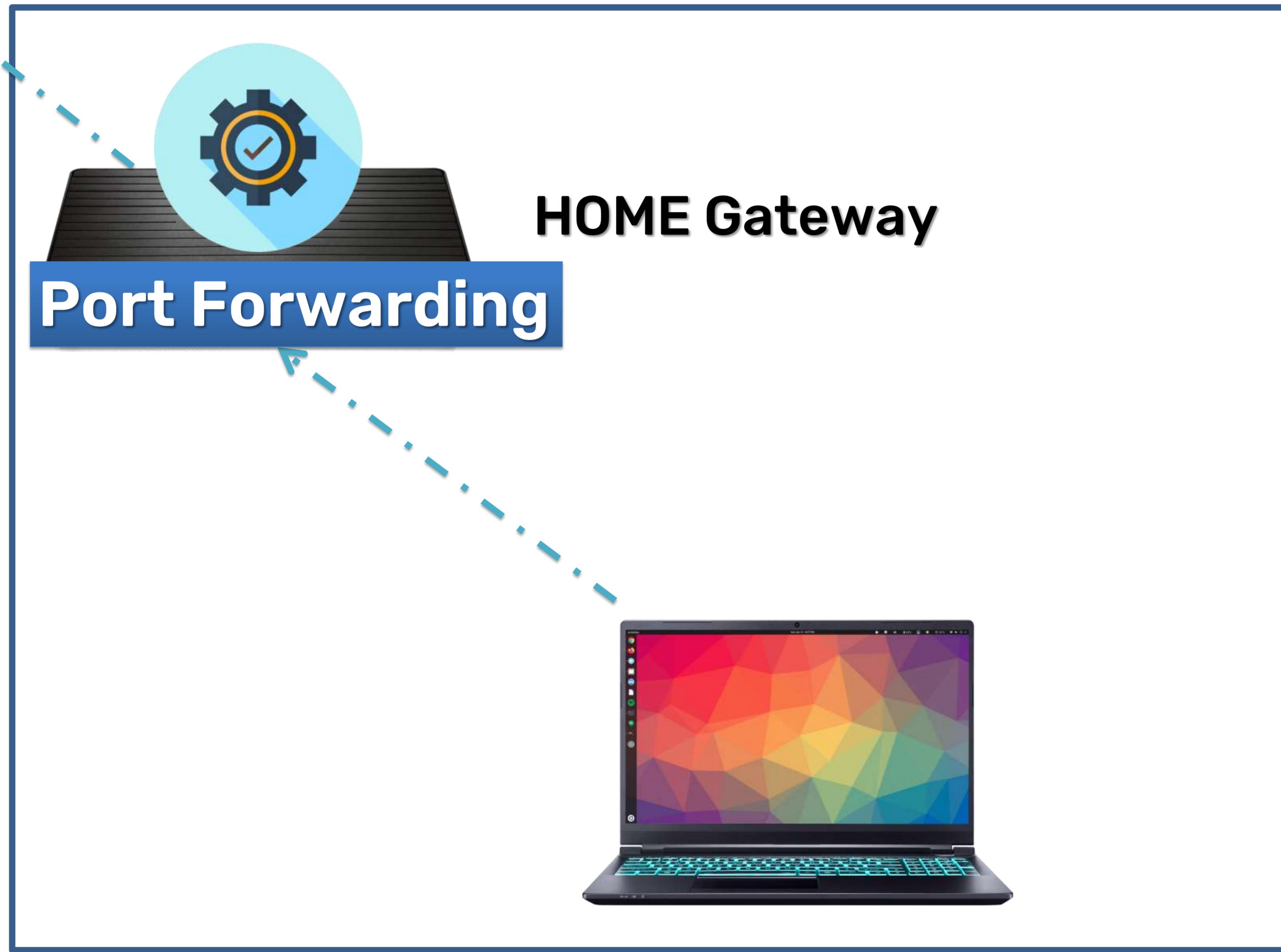
**www.ncku.edu.tw**  
140.116.241.51

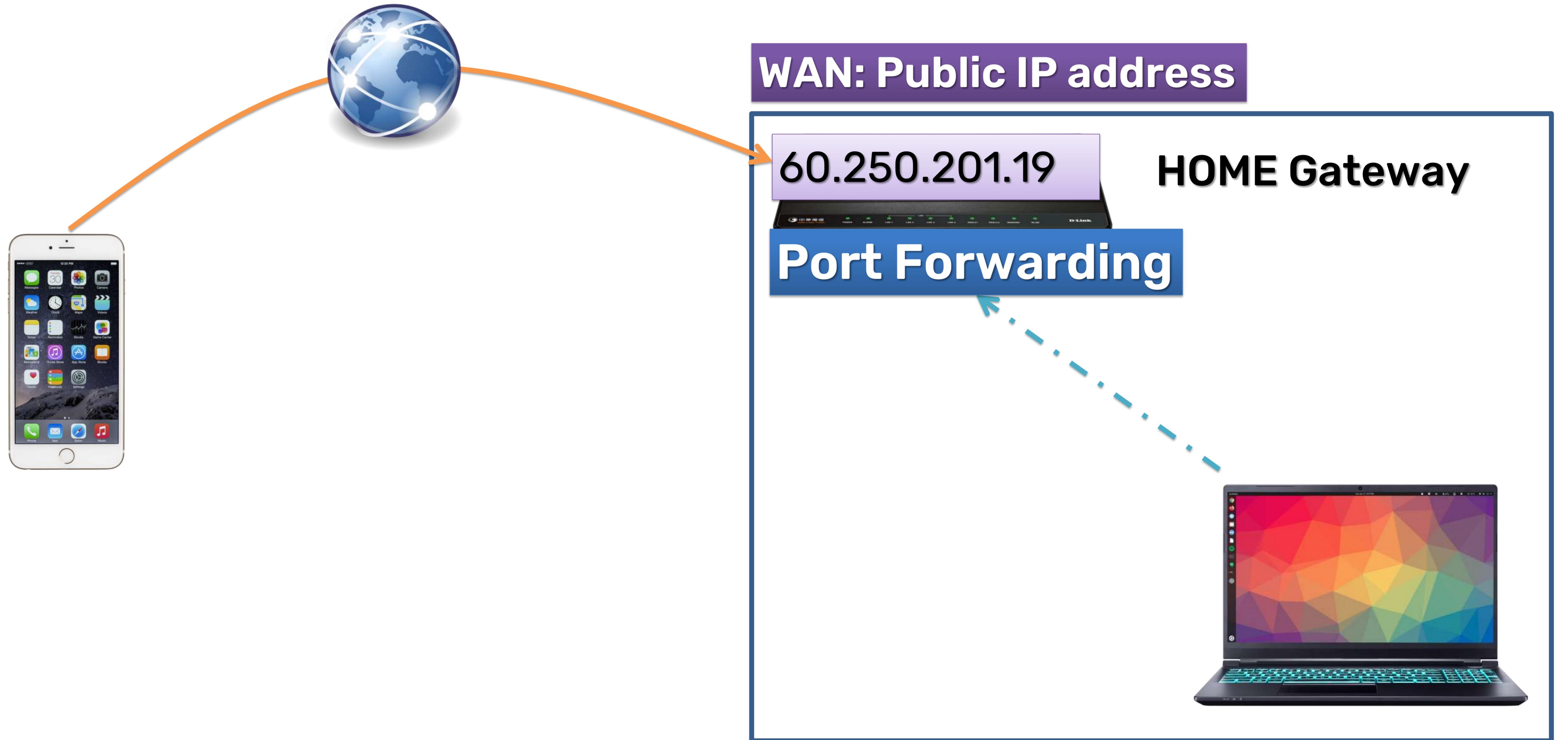


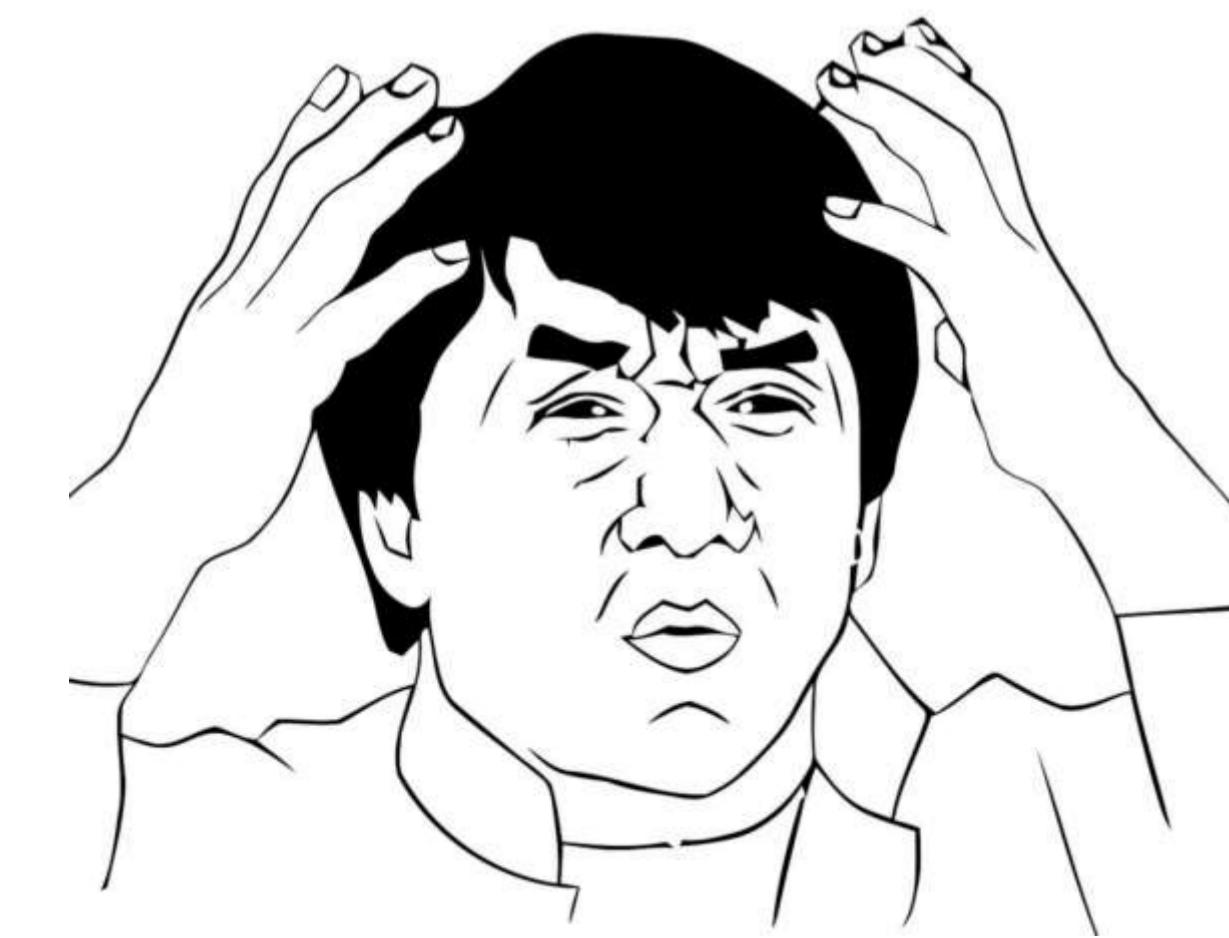
140.116.80.100



# The Reality & DDNS







60.\*.\*.?



PPPoE

WAN: Public IP address



Port Forwarding

60.250.201.19

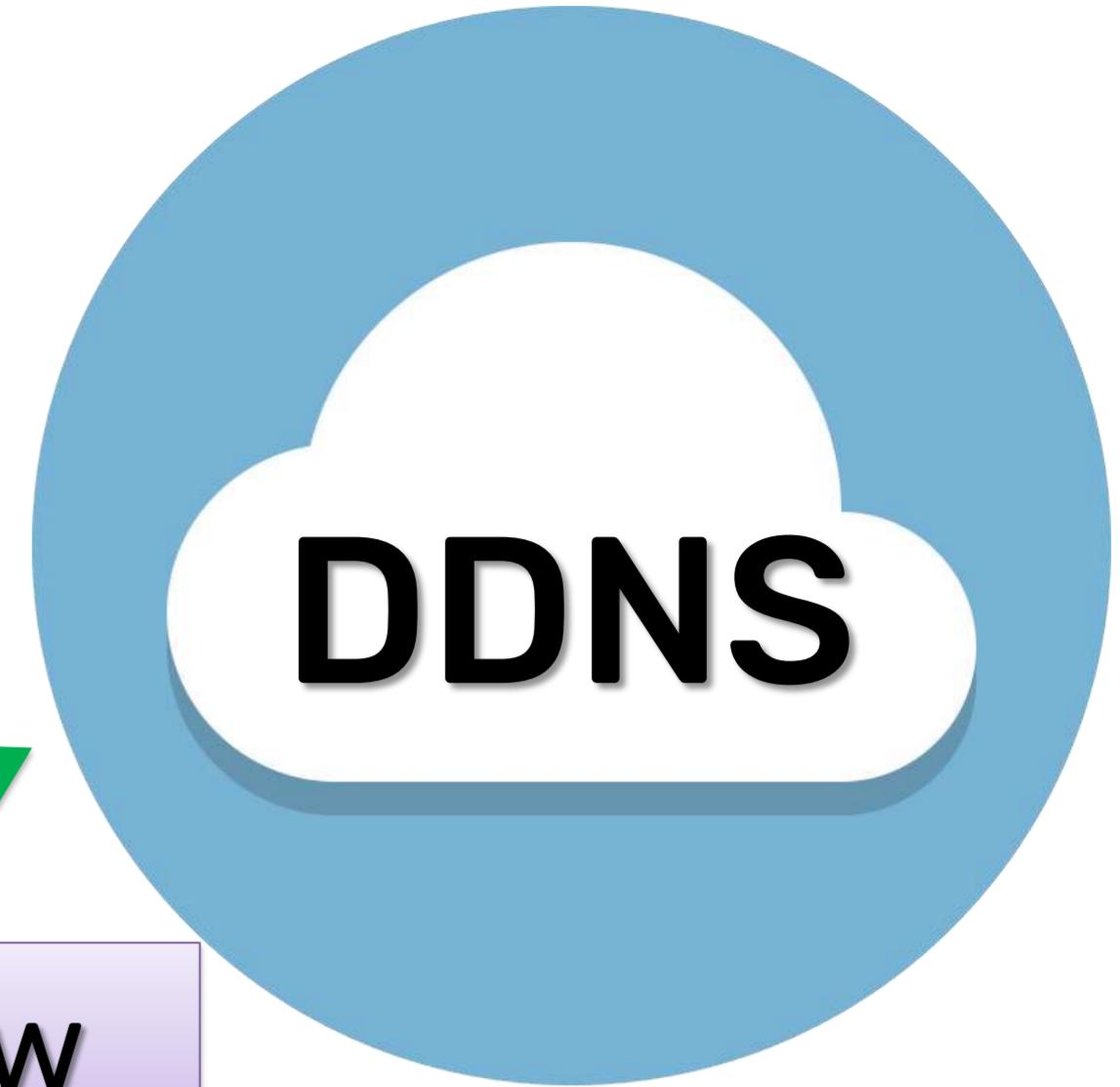
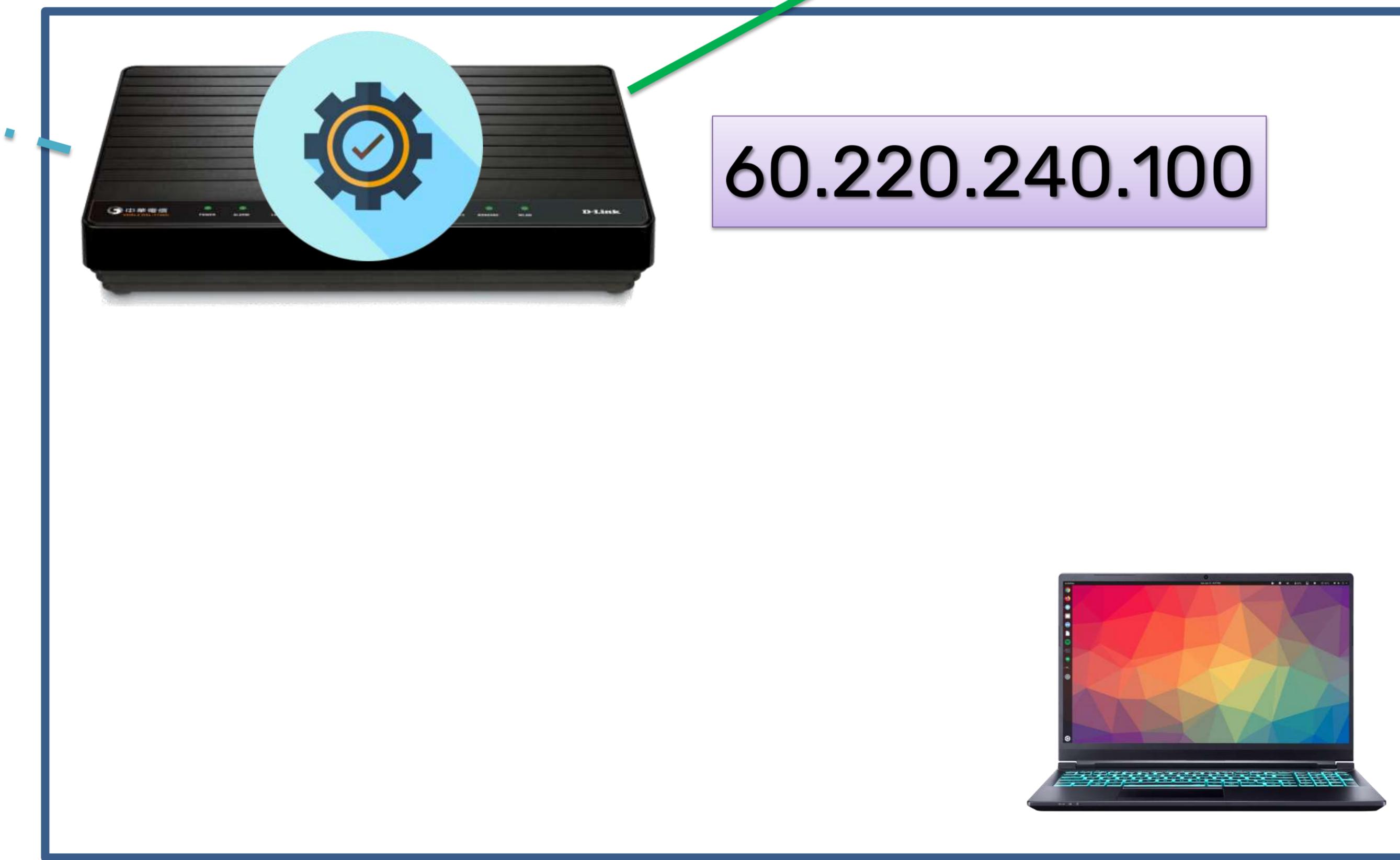
60.250.220.23

60.220.240.100



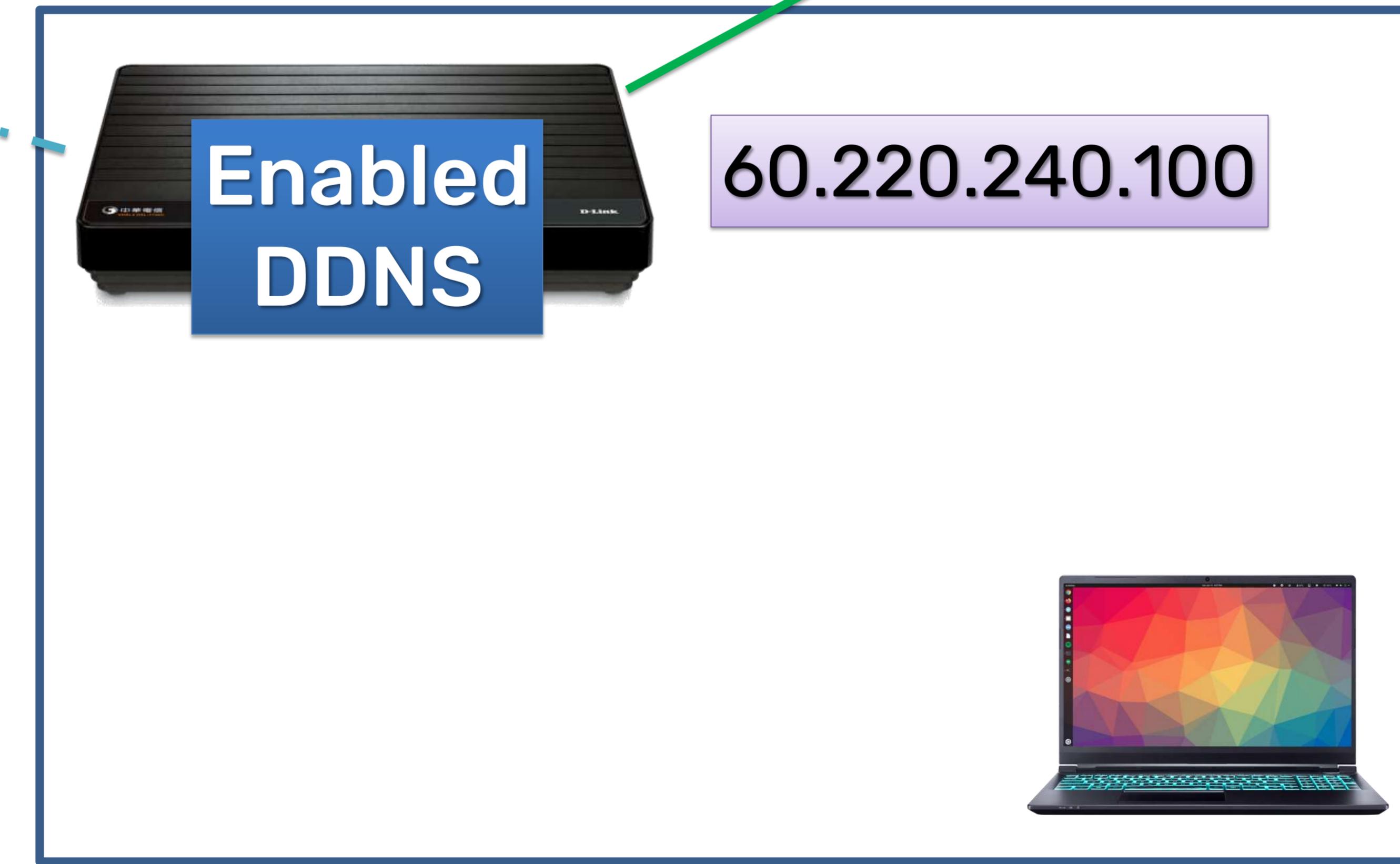


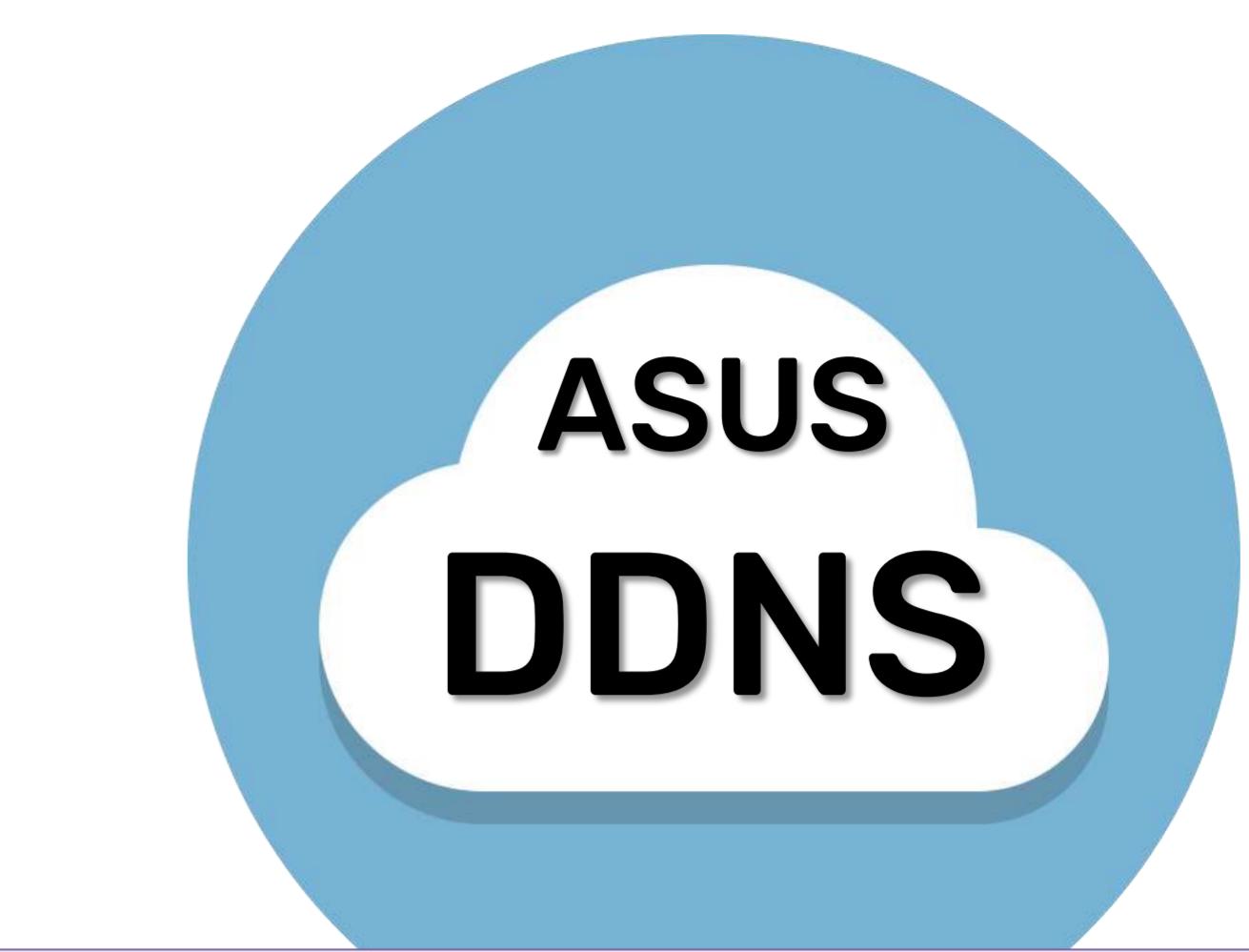
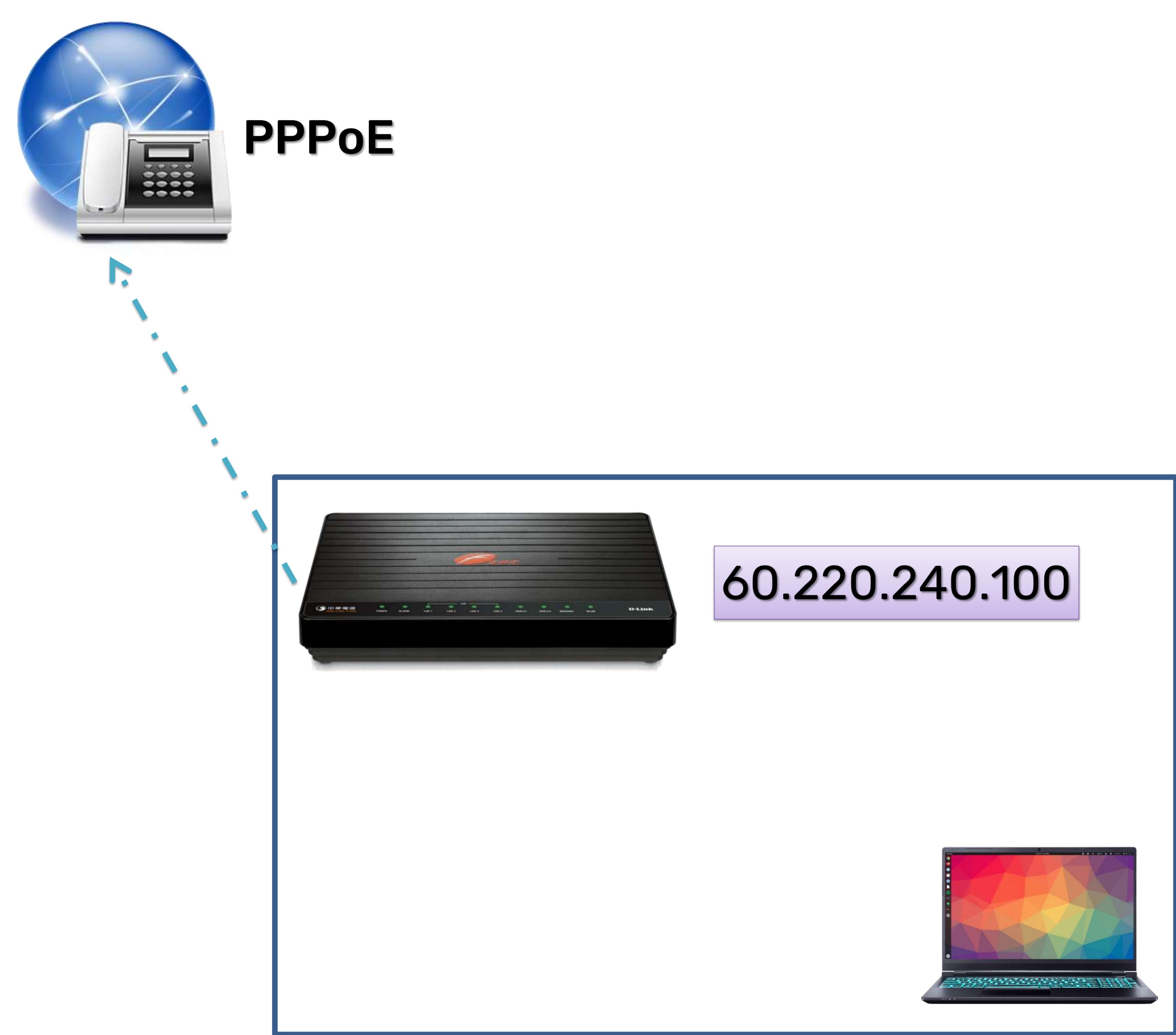
**PPPoE**





**PPPoE**





OK, Mapping  
60.220.240.100 to  
**andrewiot.asuscomm.com**



**andrewiot.asuscomm.com**



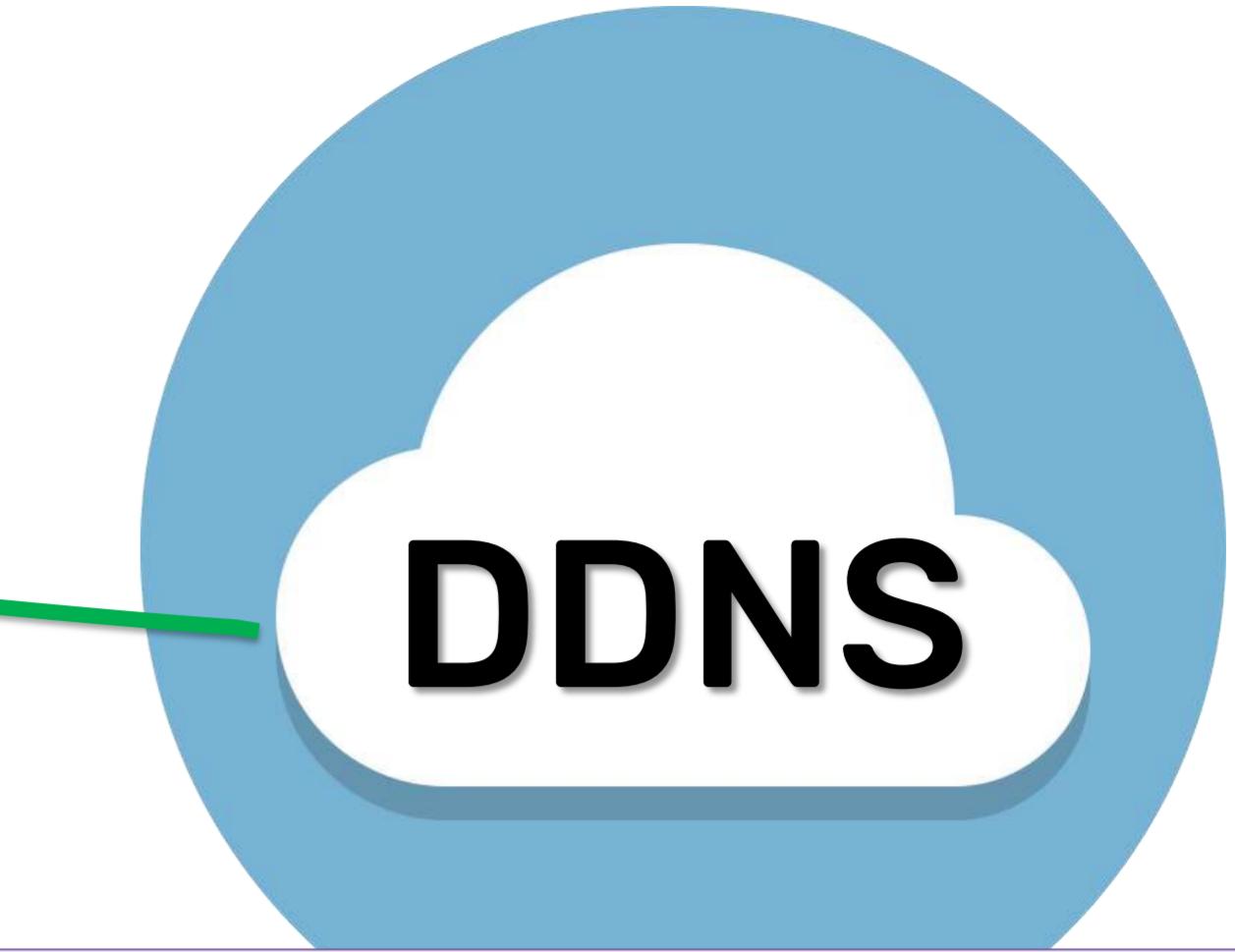
**60.220.240.100**



Mapping  
60.220.240.100 to  
andrewiot.asuscomm.com



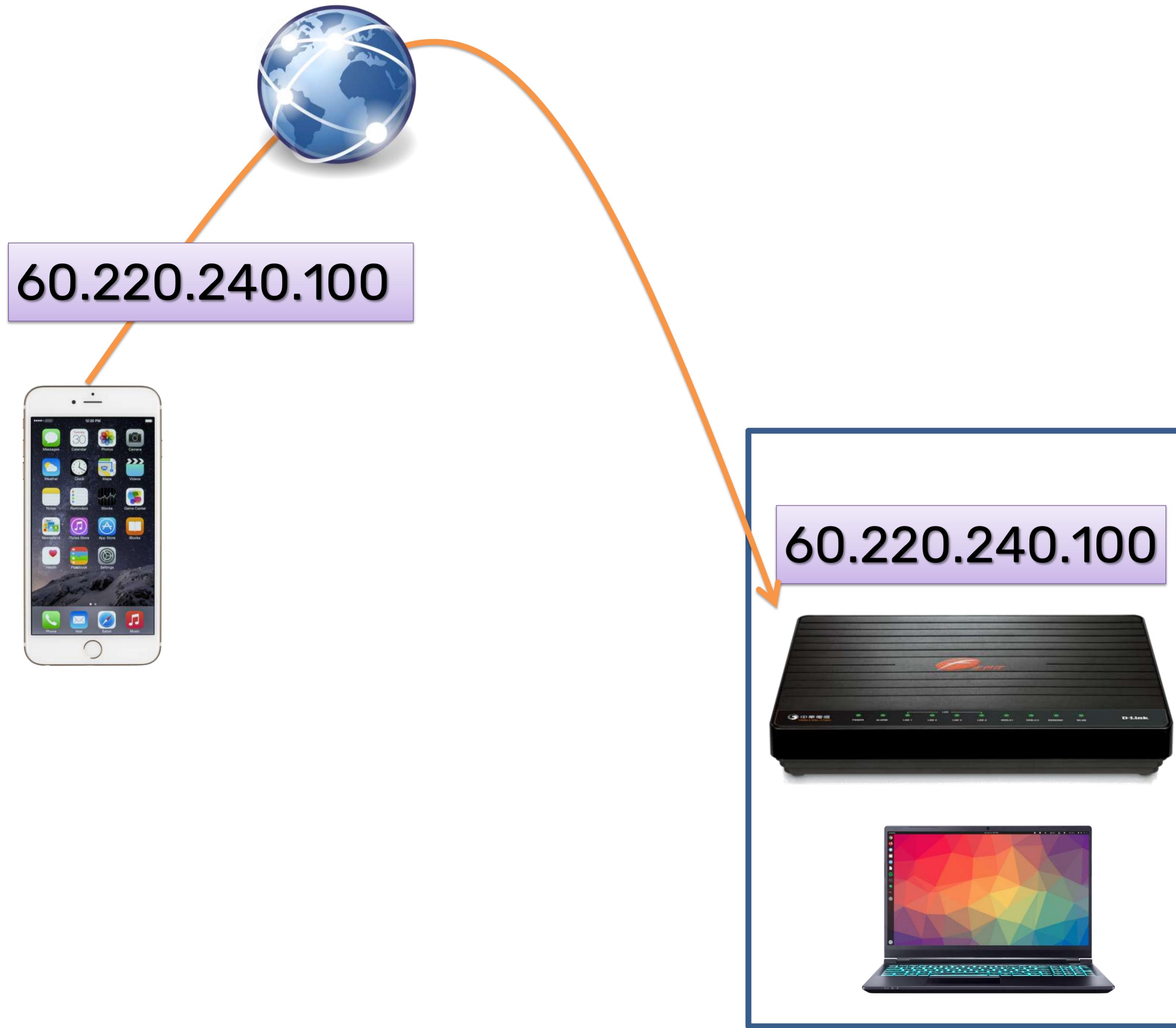
**60.220.240.100**



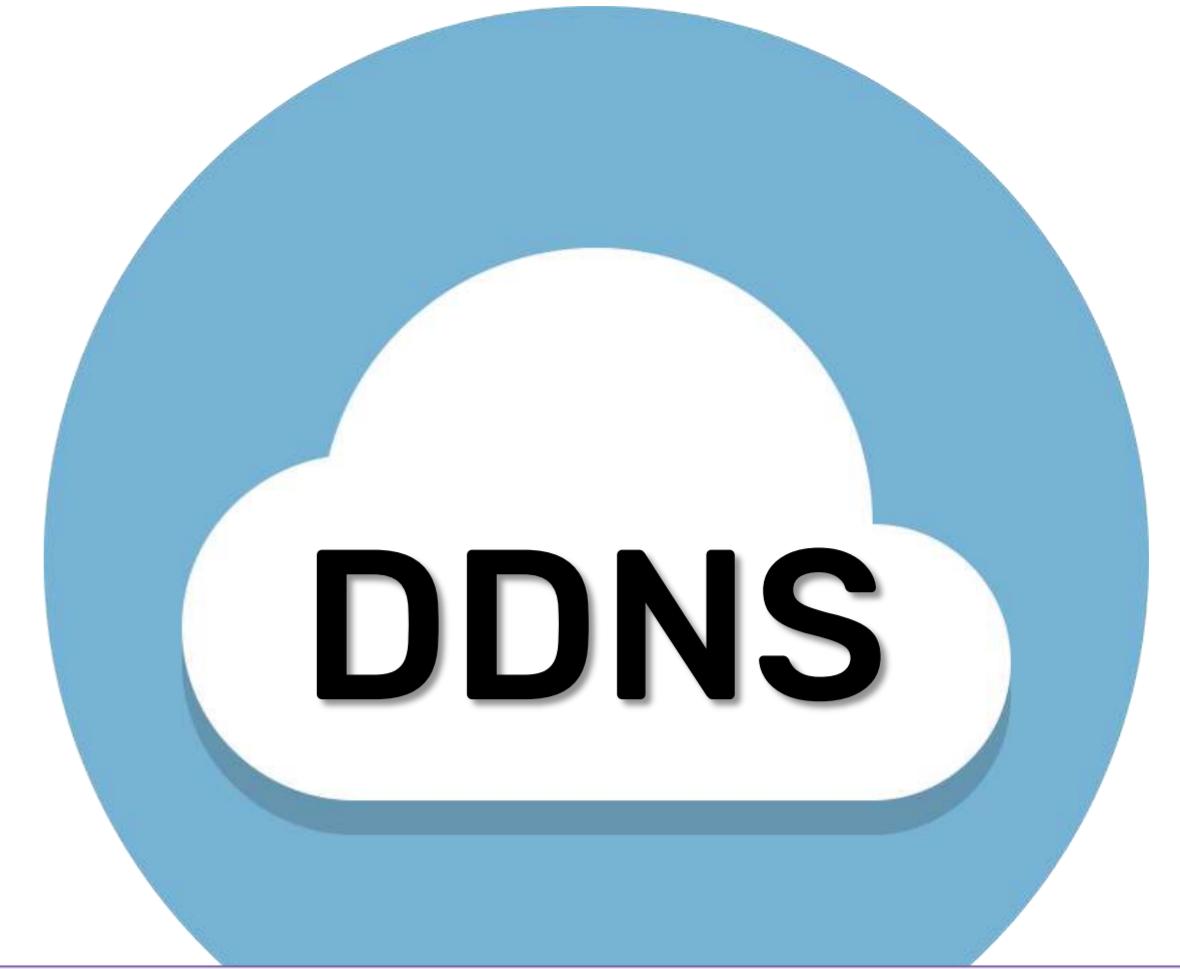
**Mapping  
60.220.240.100 to  
andrewiot.asuscomm.com**



**60.220.240.100**



**Mapping  
60.220.240.100 to  
andrewiot.asuscomm.com**





**PPPoE**



**(Update)**



**Mapping**  
~~60.220.240.100 to~~  
**60.250.220.23 to**  
**andrewiot.asuscomm.com**



**WAN1 IP: 10.6.1.35**  
**GW: 10.6.1.244**

**WAN2 IP: 10.5.182.114**  
**GW: 10.5.182.254**

**LAN IP: 192.168.90.x**



**WAN1**  
**WAN2**

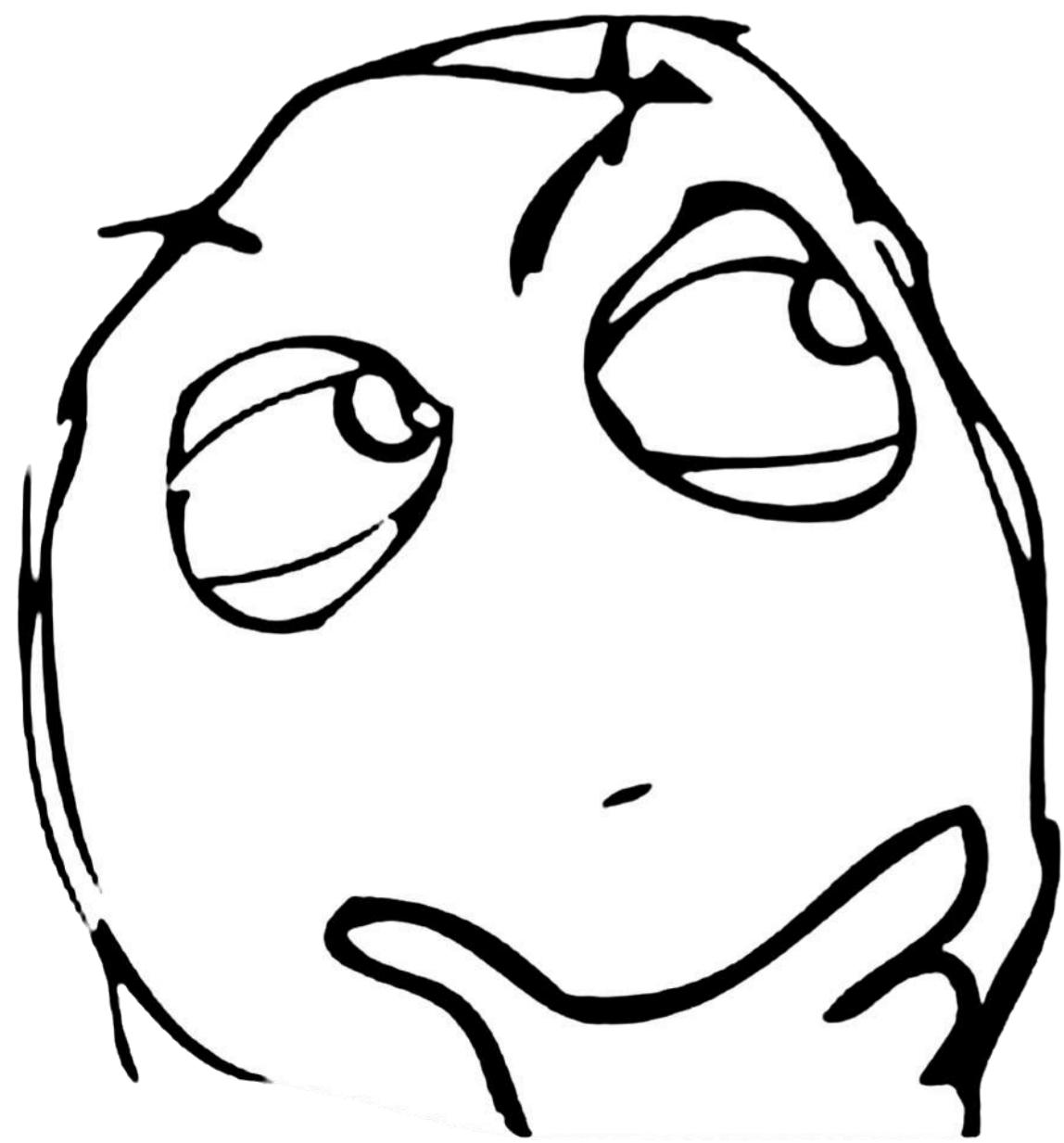
**LAN**

**WAN IP: 172.16.99.123**  
**GW: 172.16.99.1**  
**LAN IP: 192.168.90.1**

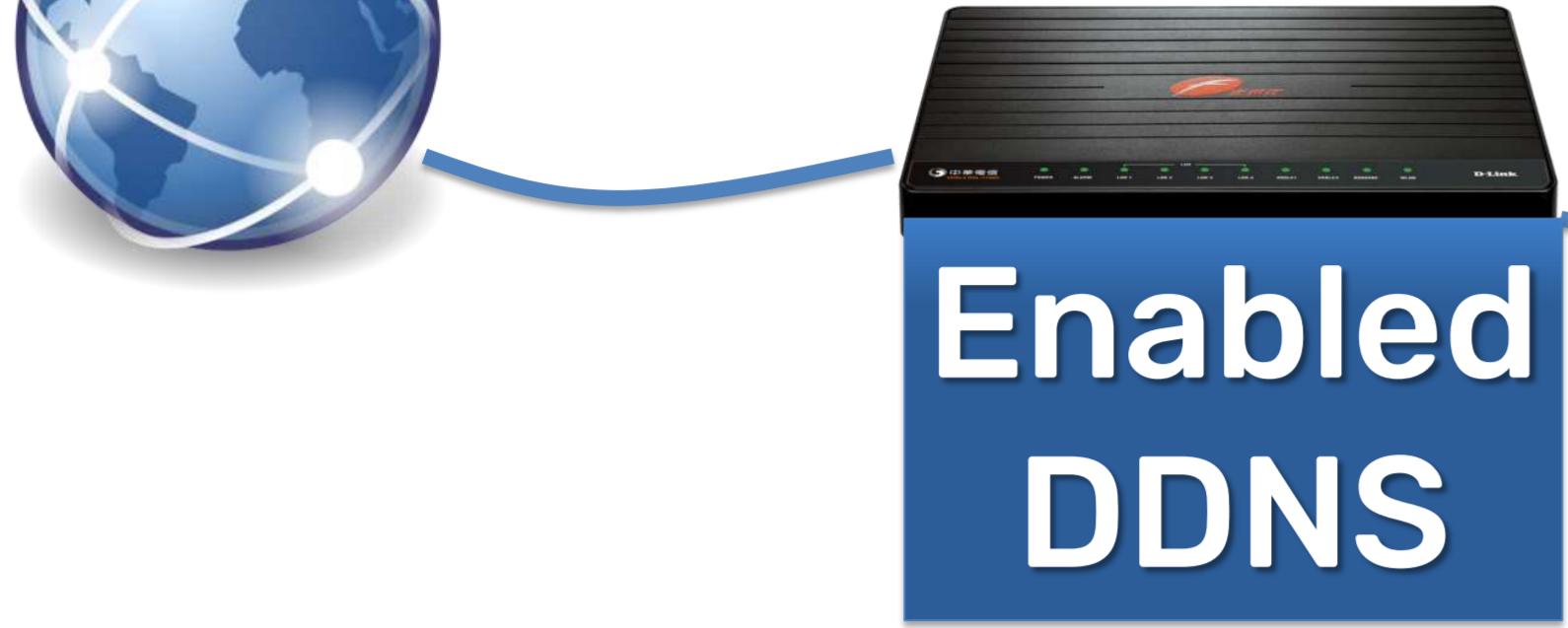


**WAN**  
**LAN**

**IP: 192.168.90.200**  
**GW: 192.168.90.1**



# WAN: Public IP address



**WAN1 IP: 10.6.1.35**  
**GW: 10.6.1.244**

**WAN2 IP: 10.5.182.114**  
**GW: 10.5.182.254**

**LAN IP: 192.168.90.x**

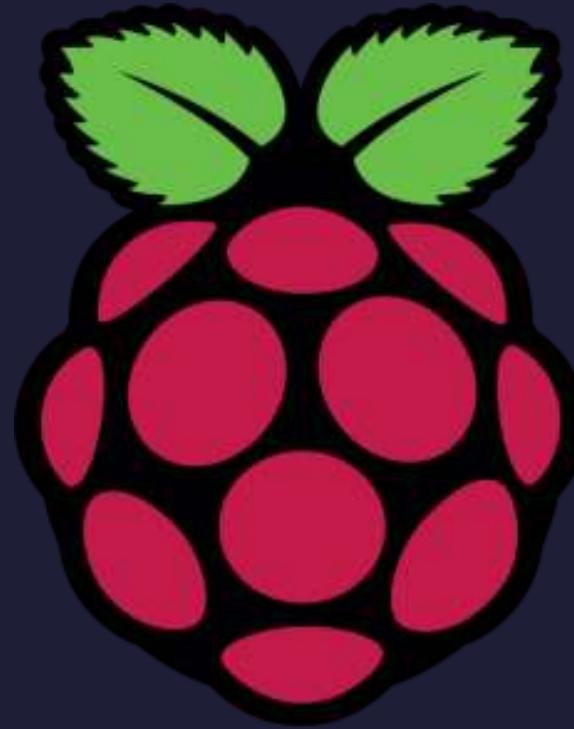


**WAN IP: 172.16.99.123**  
**GW: 172.16.99.1**  
**LAN IP: 192.168.90.1**



**IP: 192.168.90.200**  
**GW: 192.168.90.1**





# The Reality



**Public IP address**

**School/Apartment  
Gateway**



**Private IP address**

**Your Room**



**Private IP address**





**Public IP address**

**School/Apartment  
Gateway**

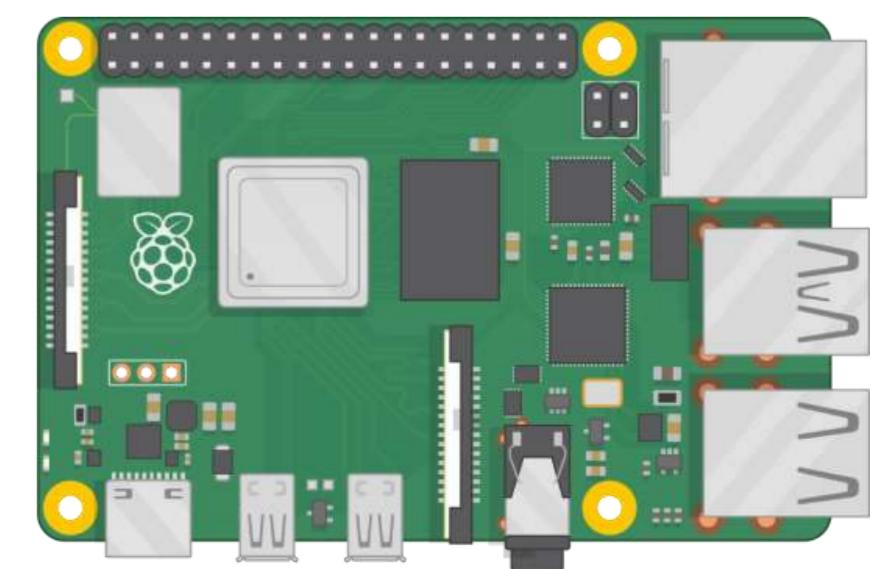


**Private IP address**

**Your Room**



**Private IP address**





Public IP address

School/Apartment  
Gateway

Port Forwarding  
to NEXT router  
Enabled DDNS



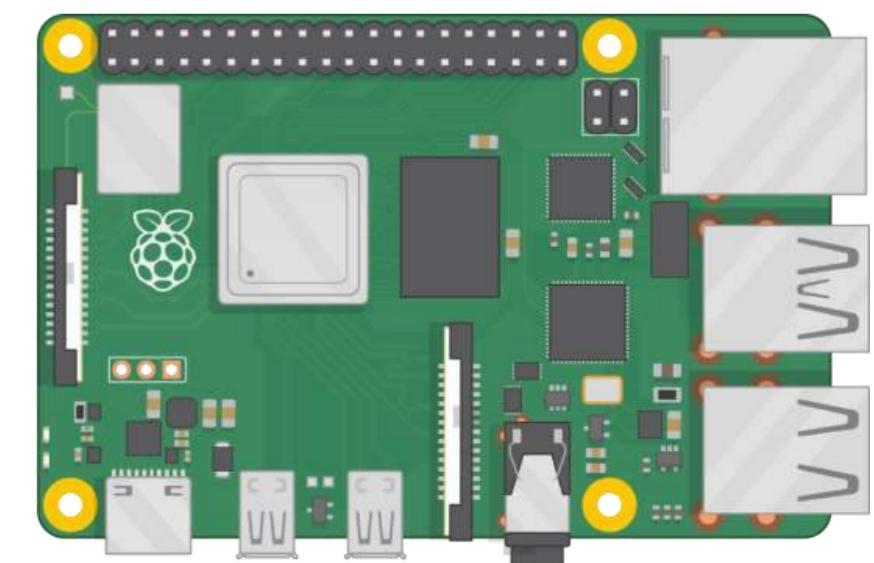
Private IP address

Port Forwarding  
to Raspberry Pi



Your Room

Private IP address





Public IP address



School/Apartment  
Gateway

Port Forwarding  
to NEXT router  
Enabled DDNS

Private IP address



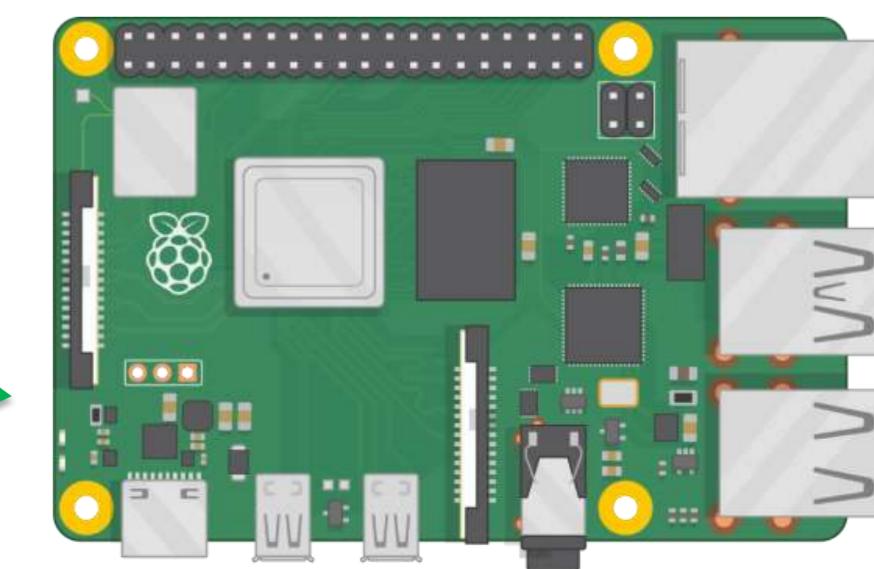
Network  
Administrator

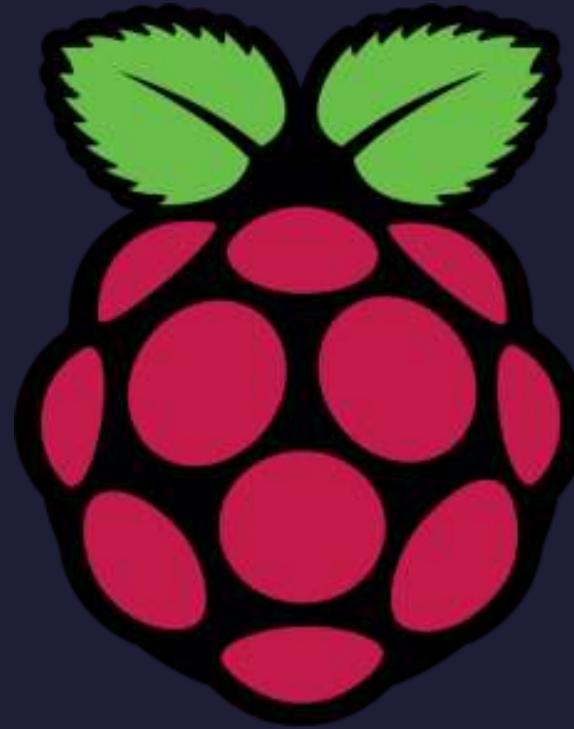
Port Forwarding  
to Raspberry Pi



Your Room

Private IP address





# Reverse Proxy

# Cloud Services



School/Apartment

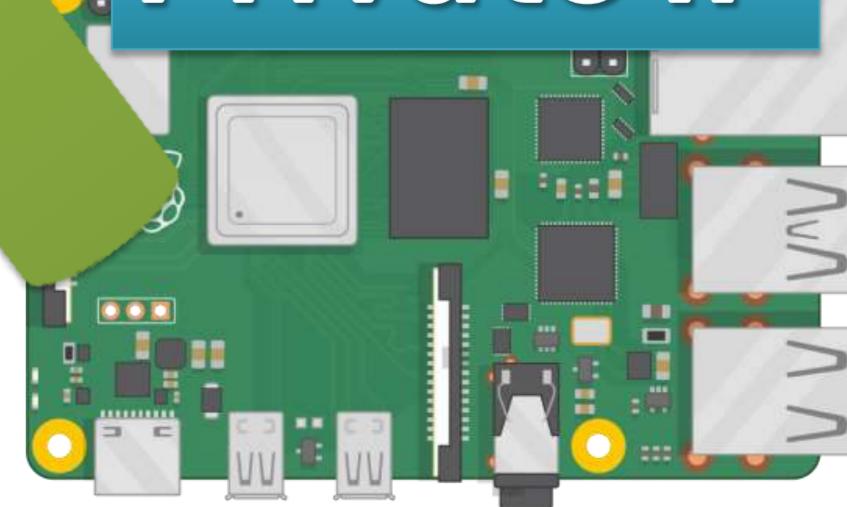


Private IP

Your Room



Private IP



# Cloud Services

Forwarding  
**tcp://0.tcp.cloud.io:15566**  
To  
**localhost:1883**



**localhost:1883**

# School/Apartment



**Private IP**

# Your Room

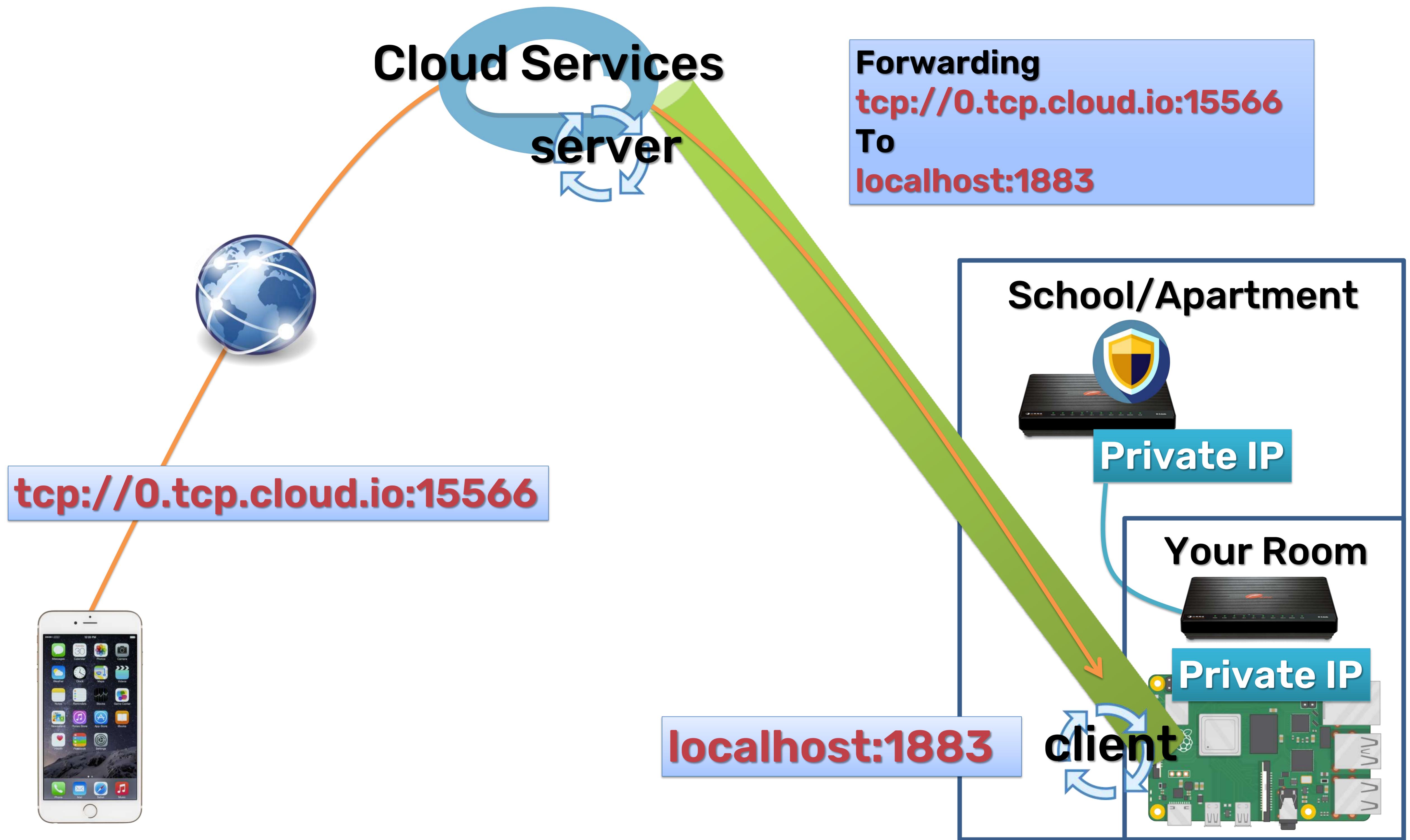


**Private IP**



**client**







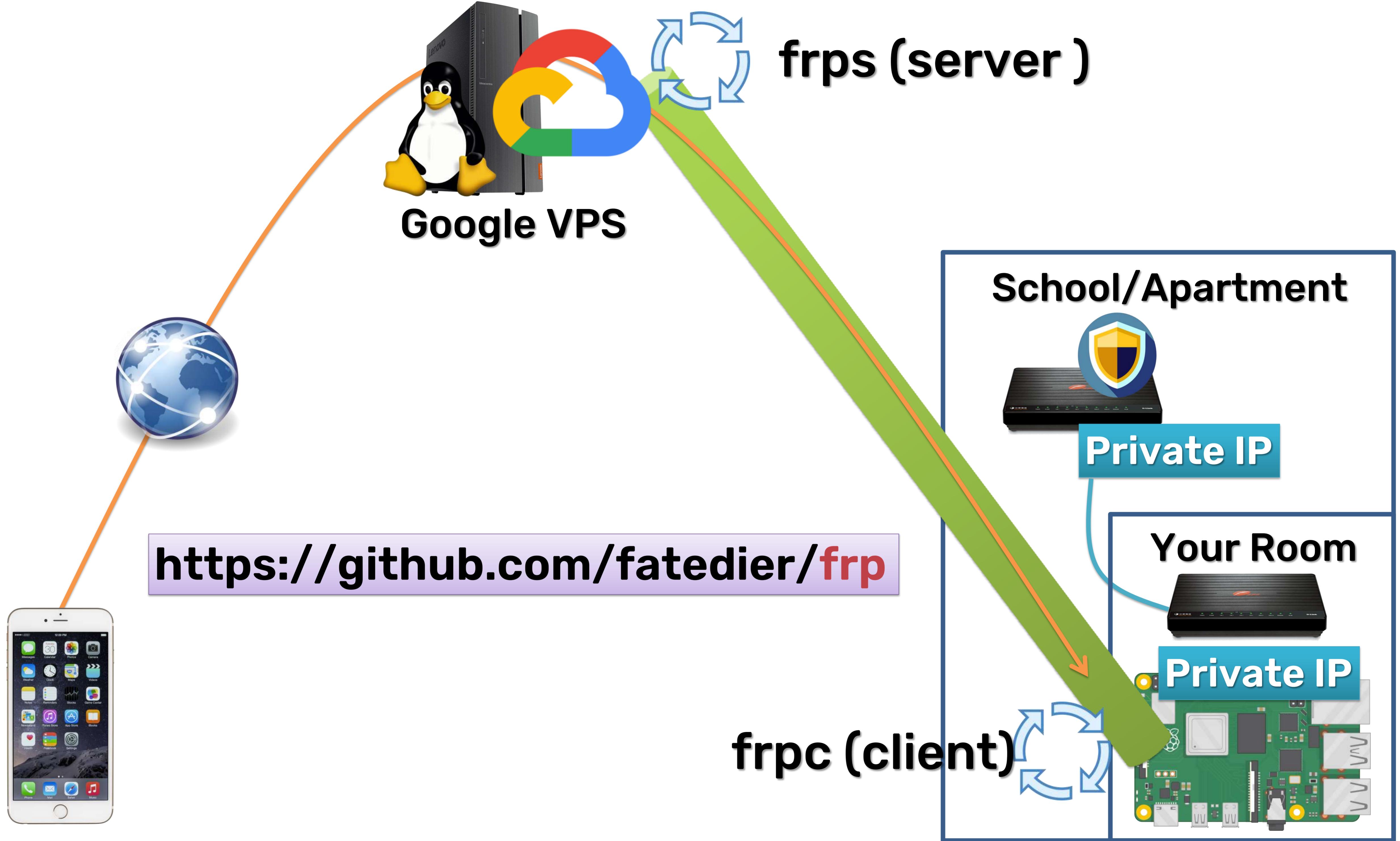
**Cloud  
Services**

**<https://ngrok.com/>**

**[https://github.com/fatedier/  
frp](https://github.com/fatedier/frp)**

**Sakura Frp**

**ssh command (-R)**





<https://www.natfrp.com/>

**Generate for client:**  
• Configuration  
• Commands



School/Apartment



Private IP

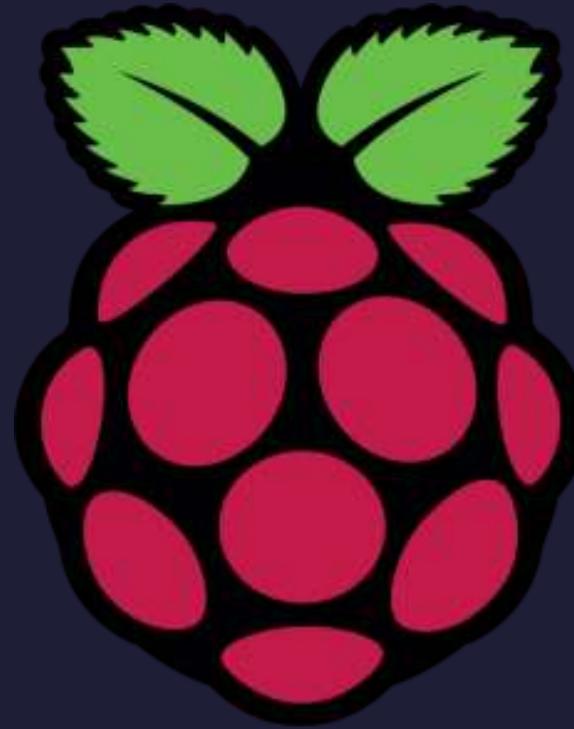
Your Room



Private IP

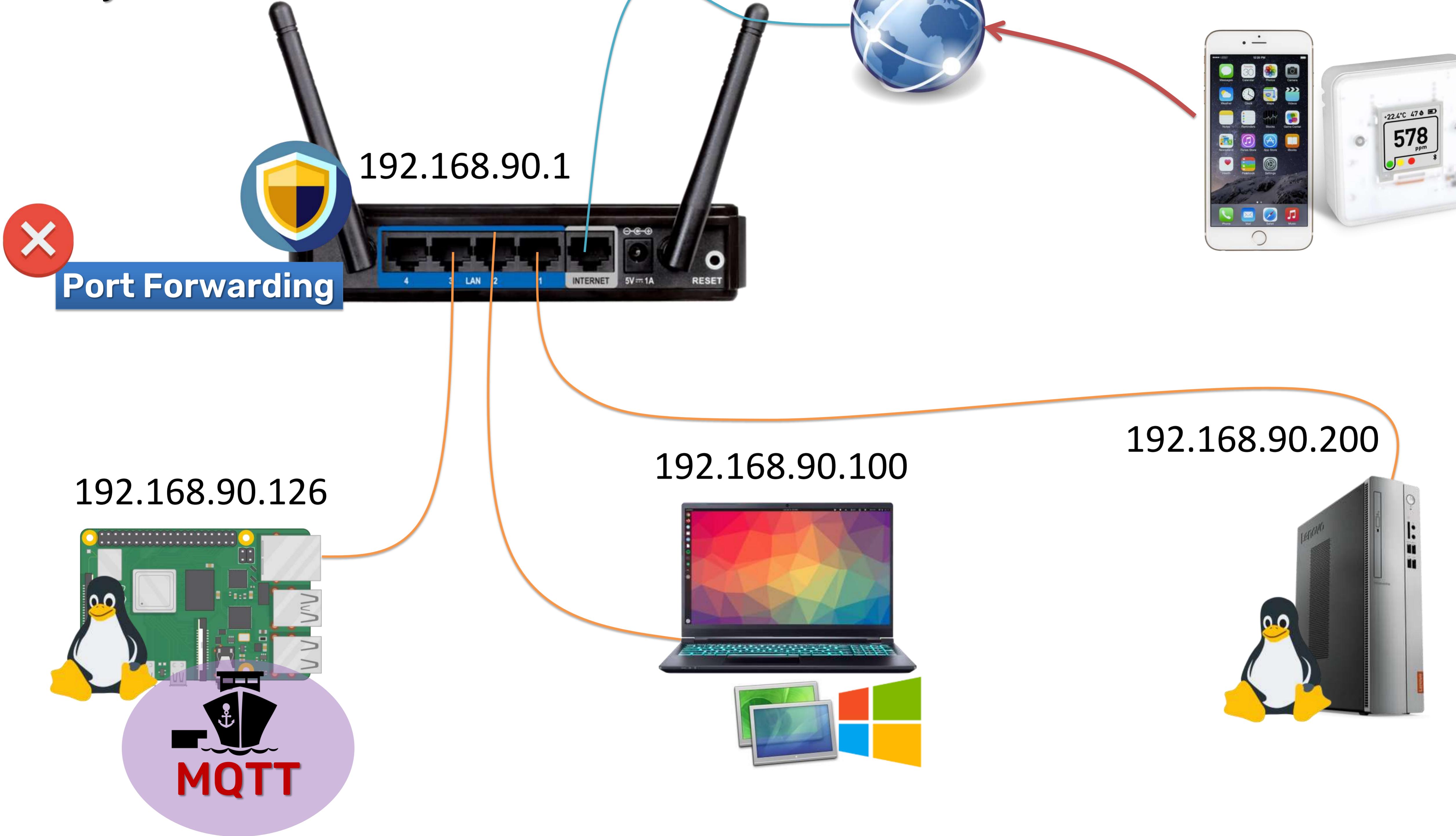
frpc (client)



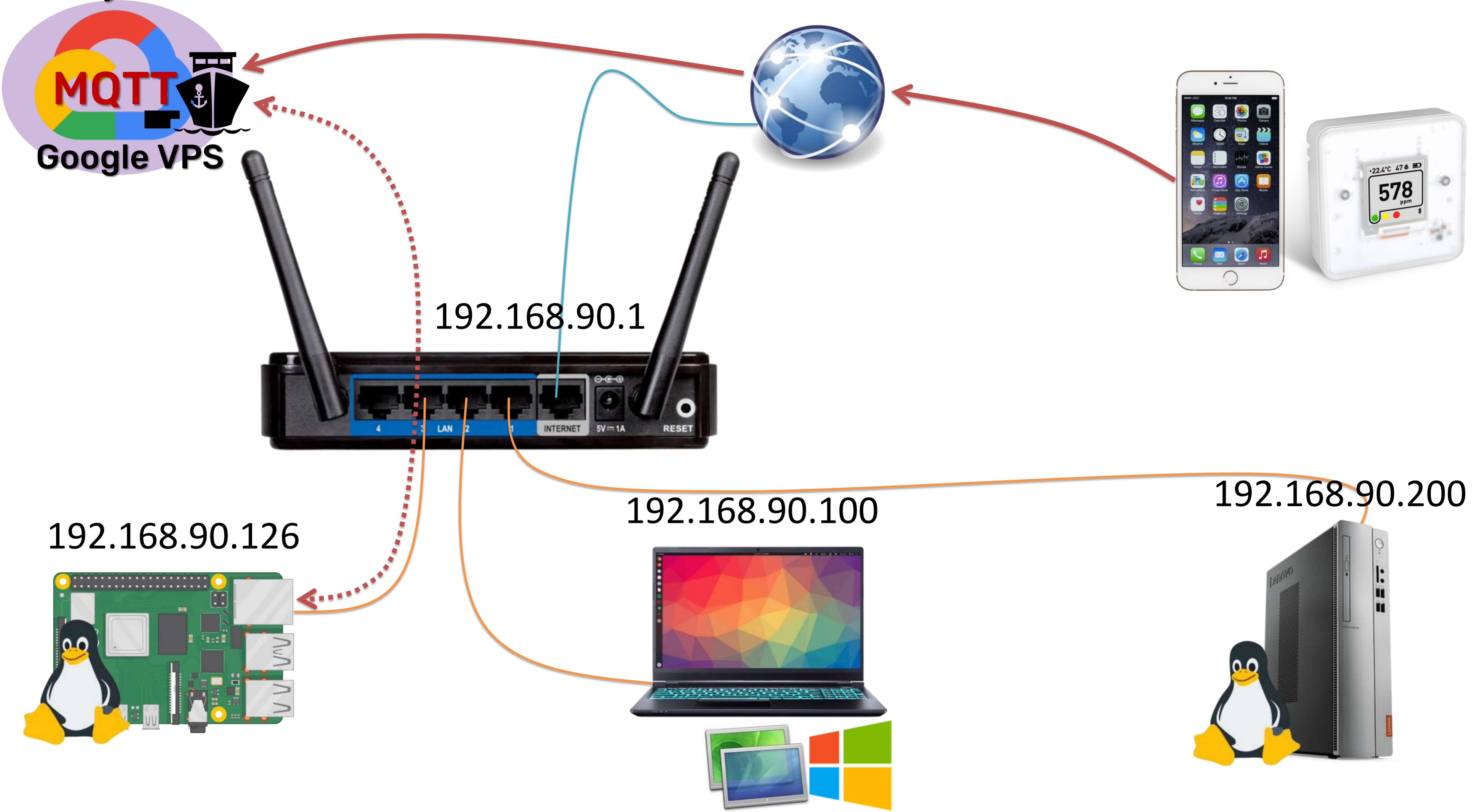


# LAB: ngrok

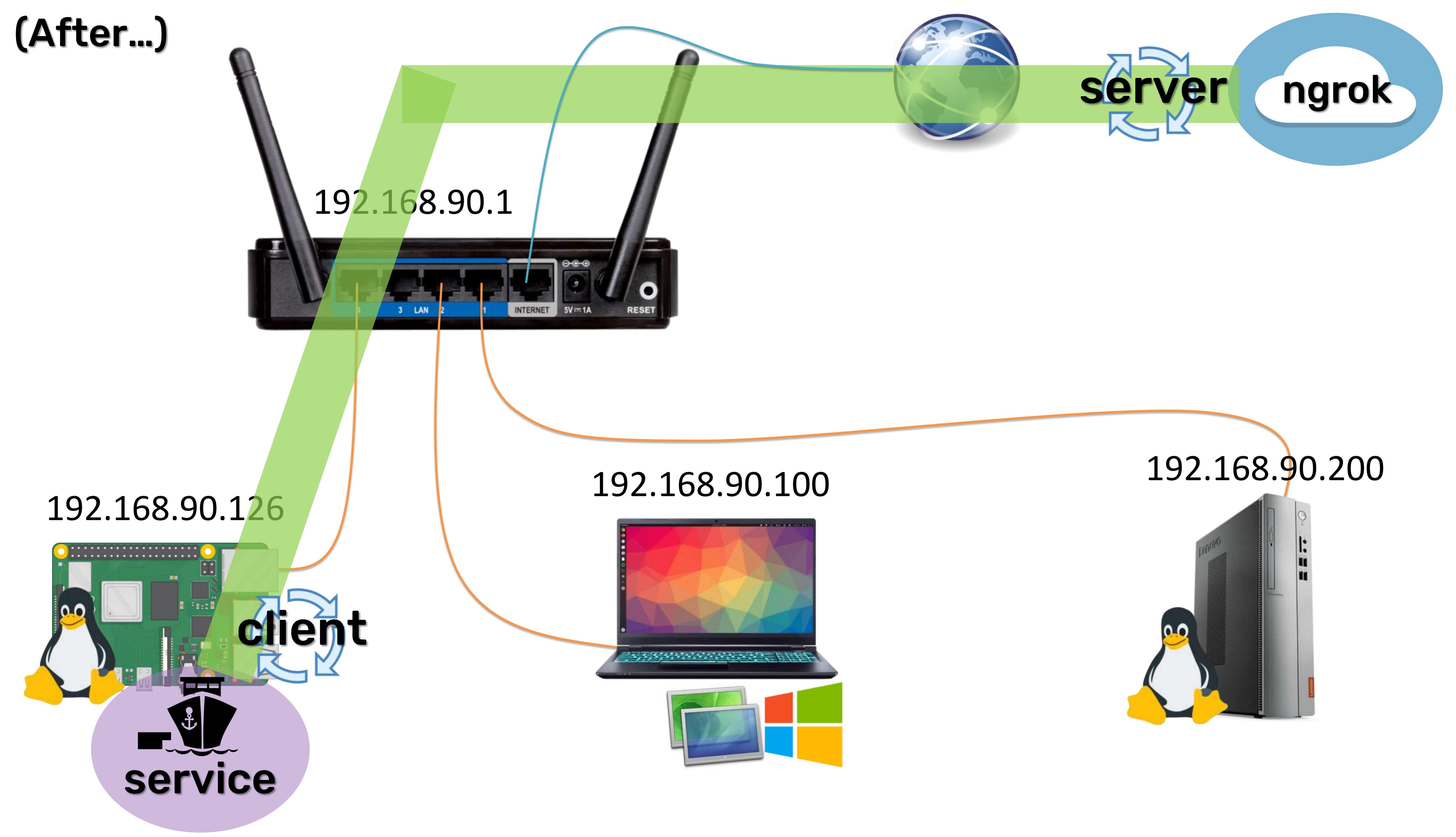
**(Before...)**



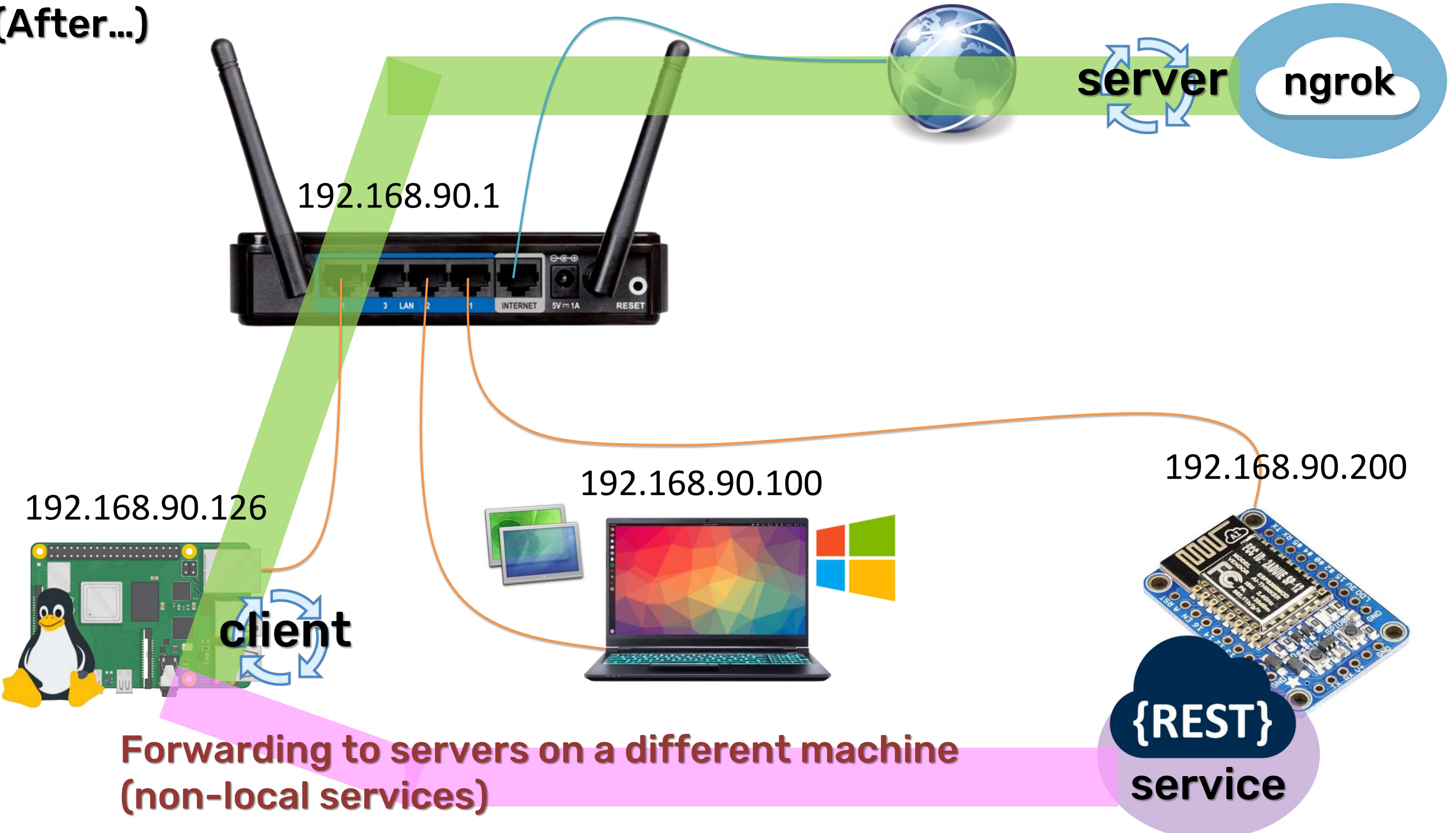
**(Before...)**

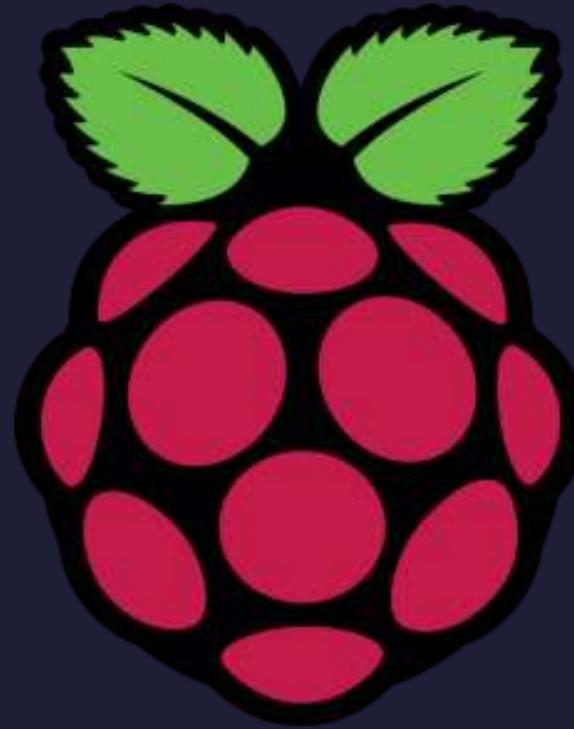


(After...)

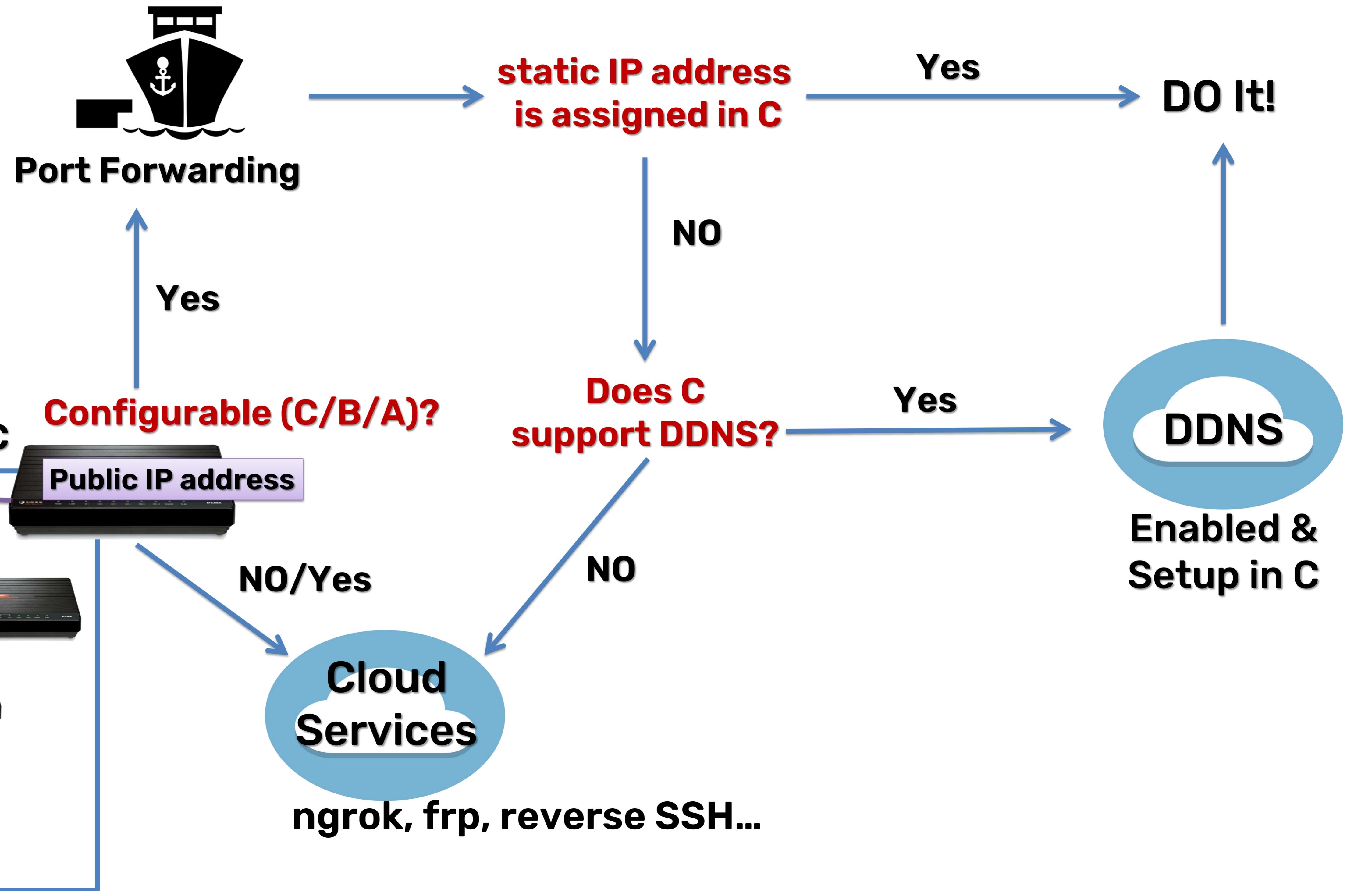


(After...)





# Summary

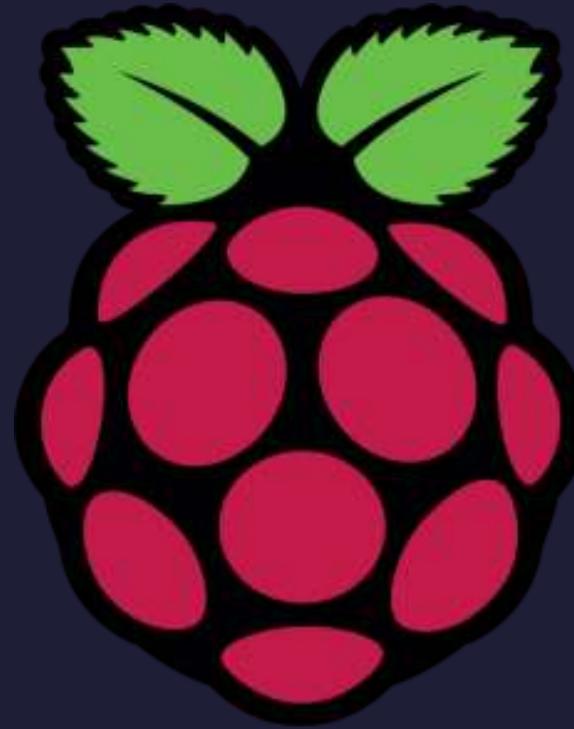




# Case: Exhibition in Airport

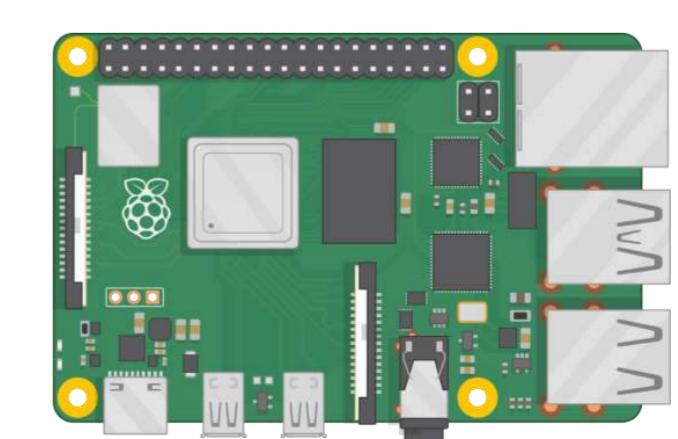
+ systemd



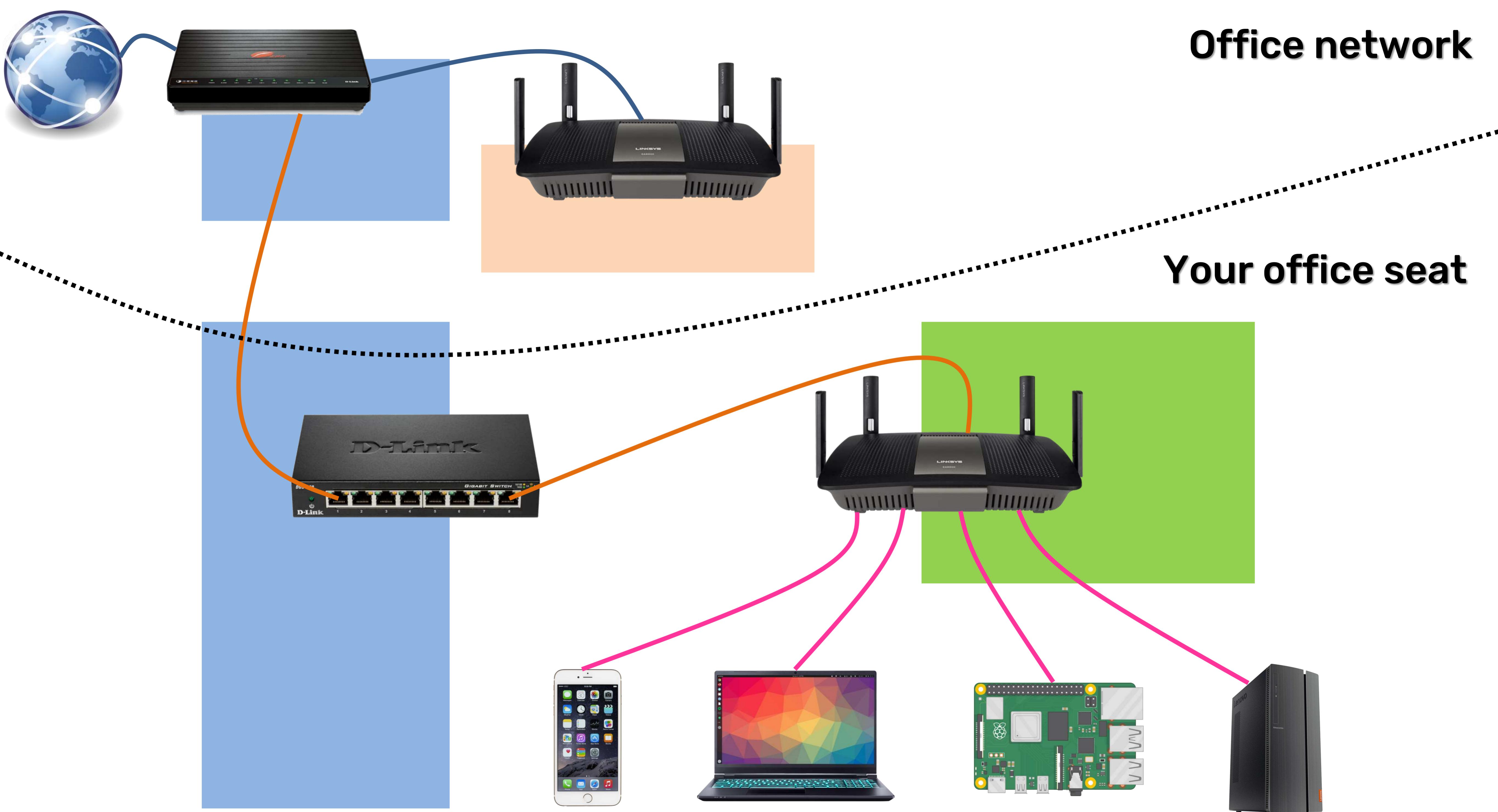


# Tips for Development

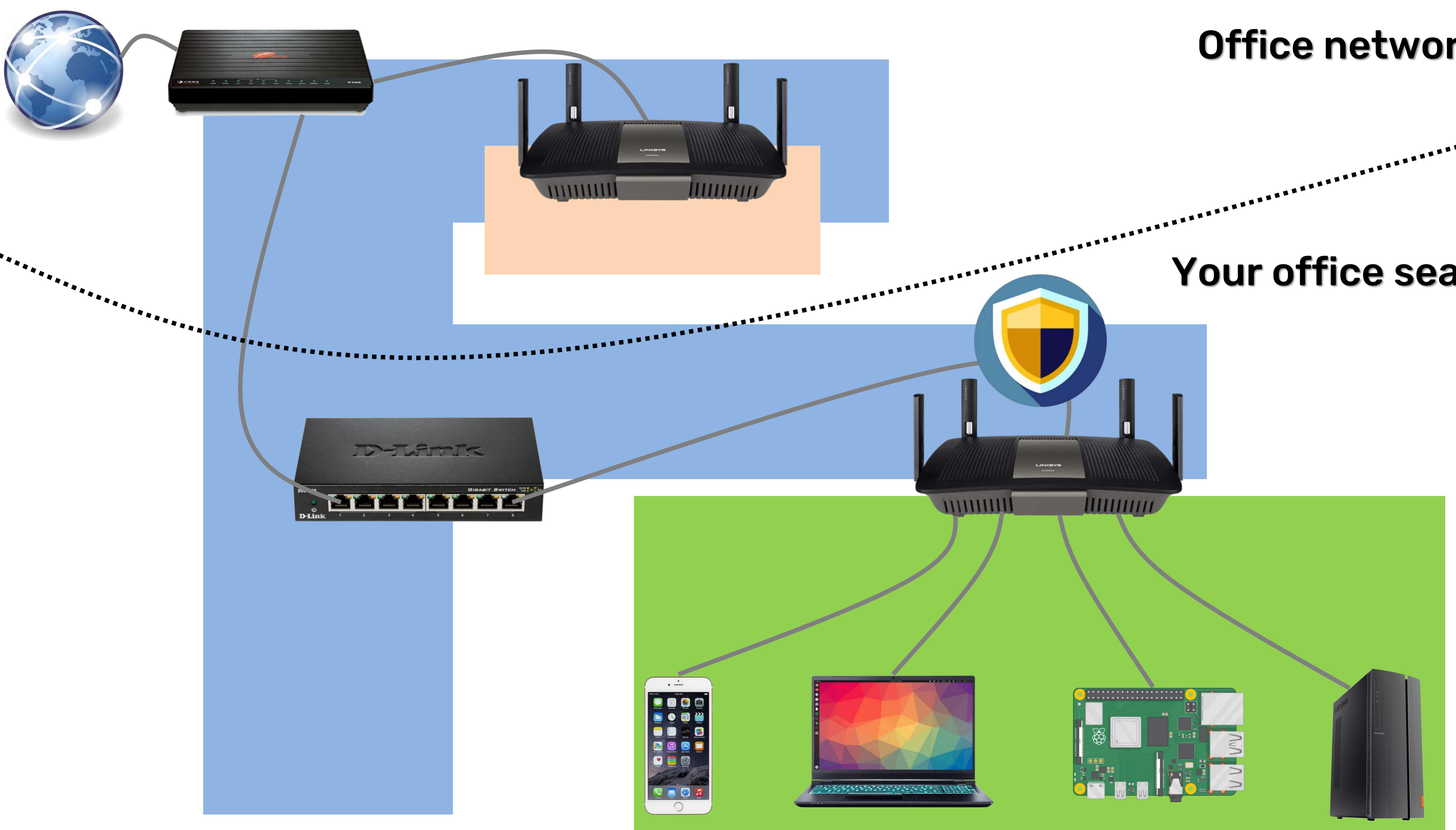
# Office network



# Office network

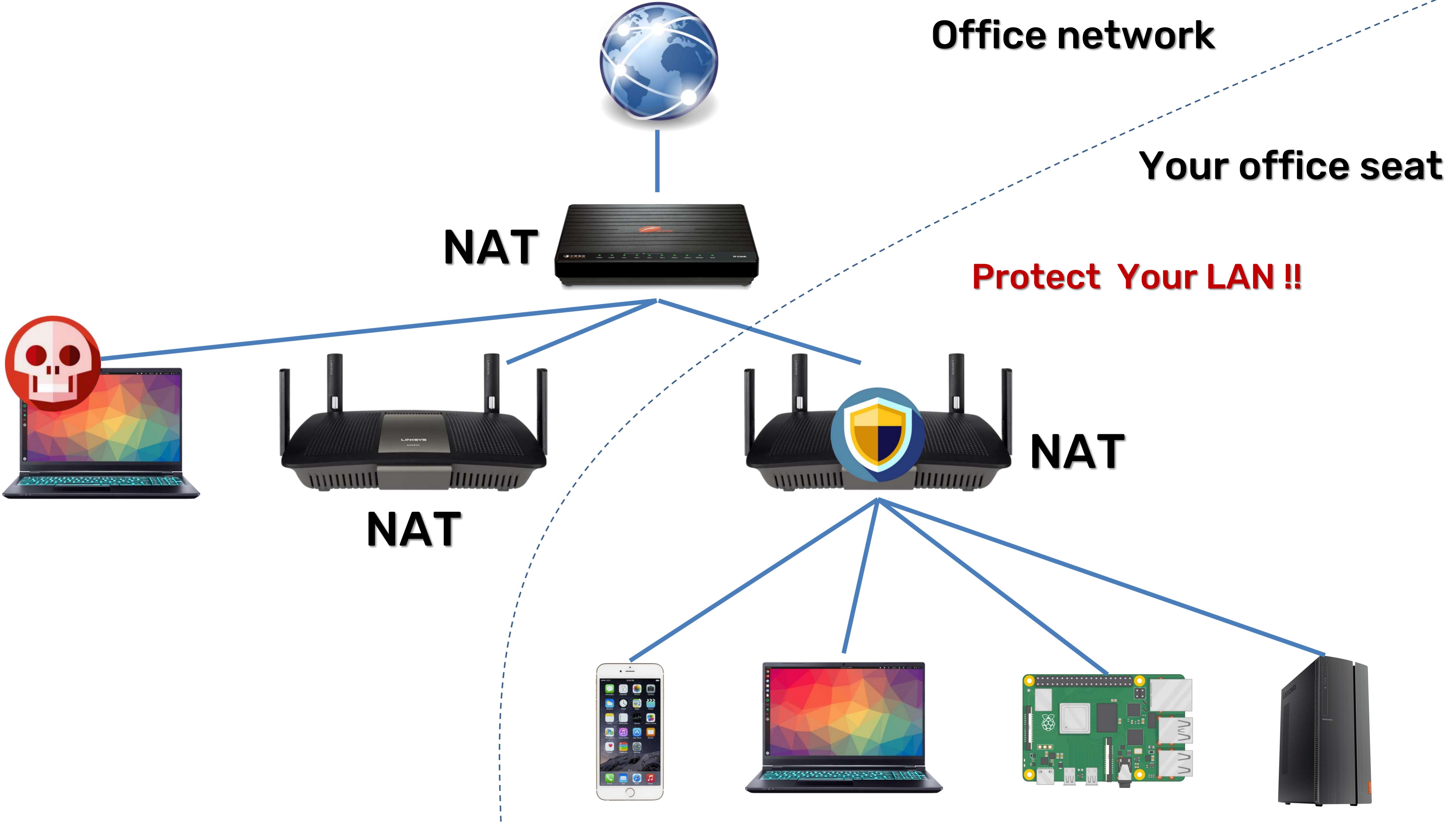


# Office network

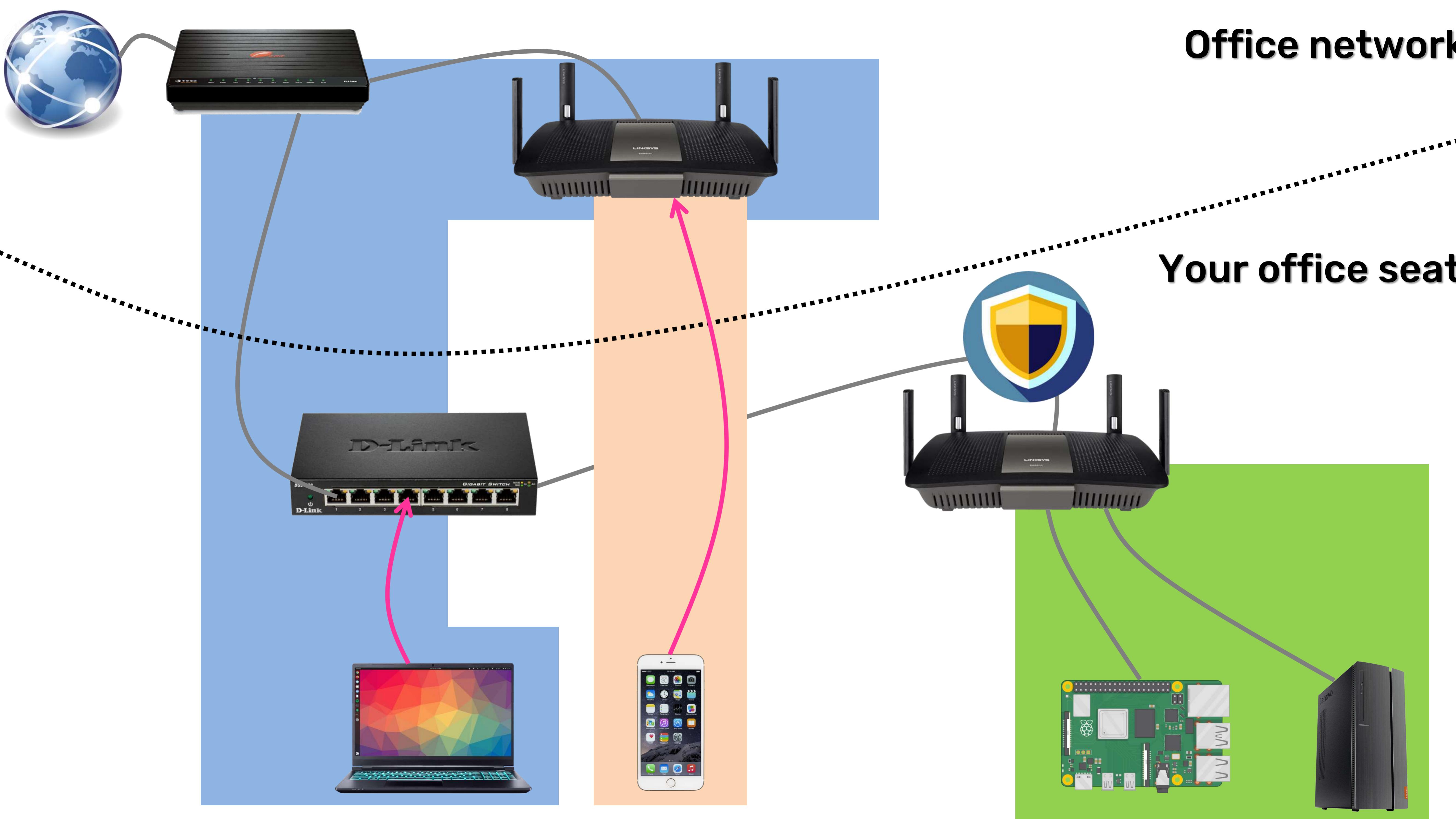


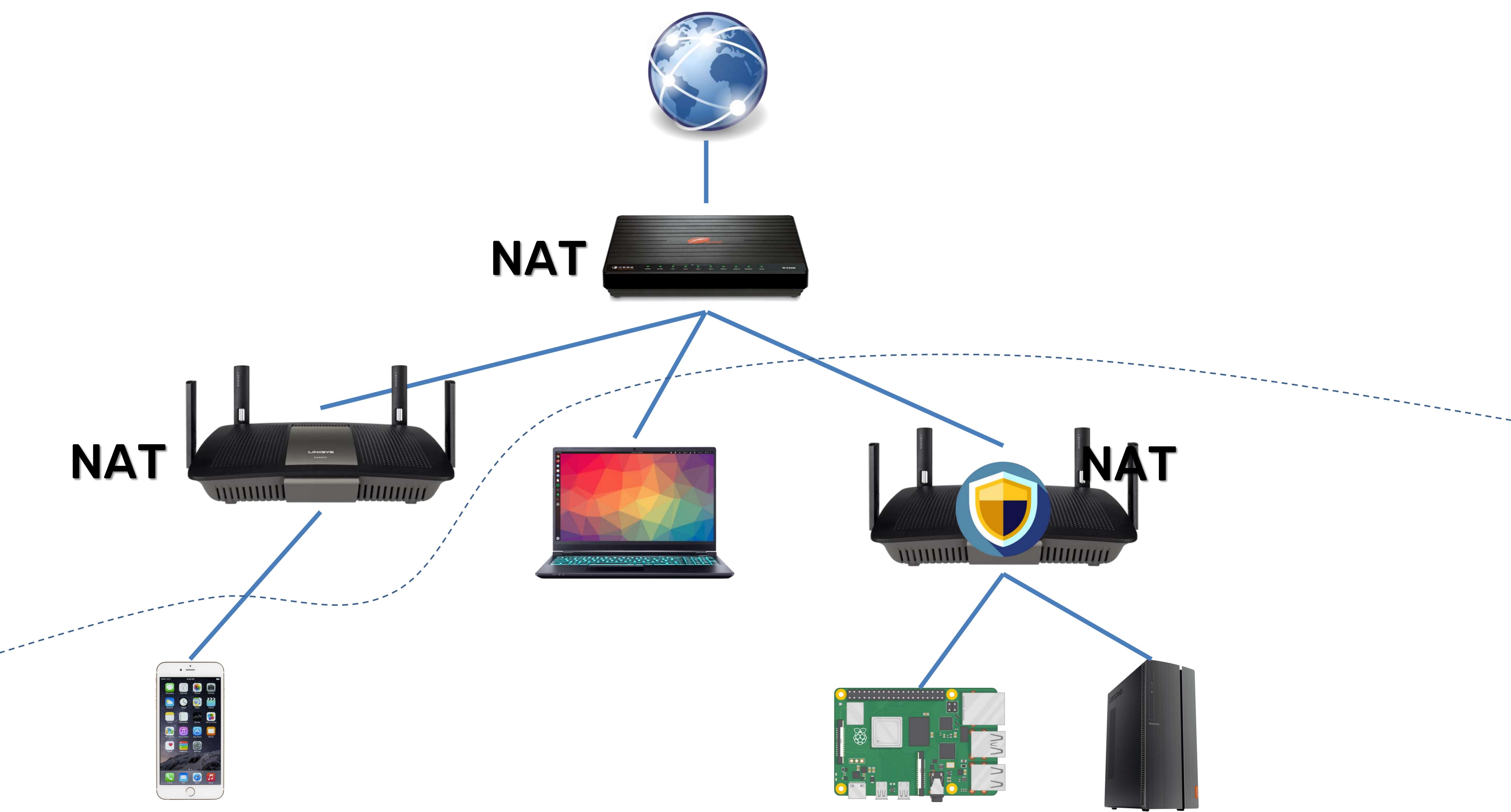
**Office network**

**Your office seat**



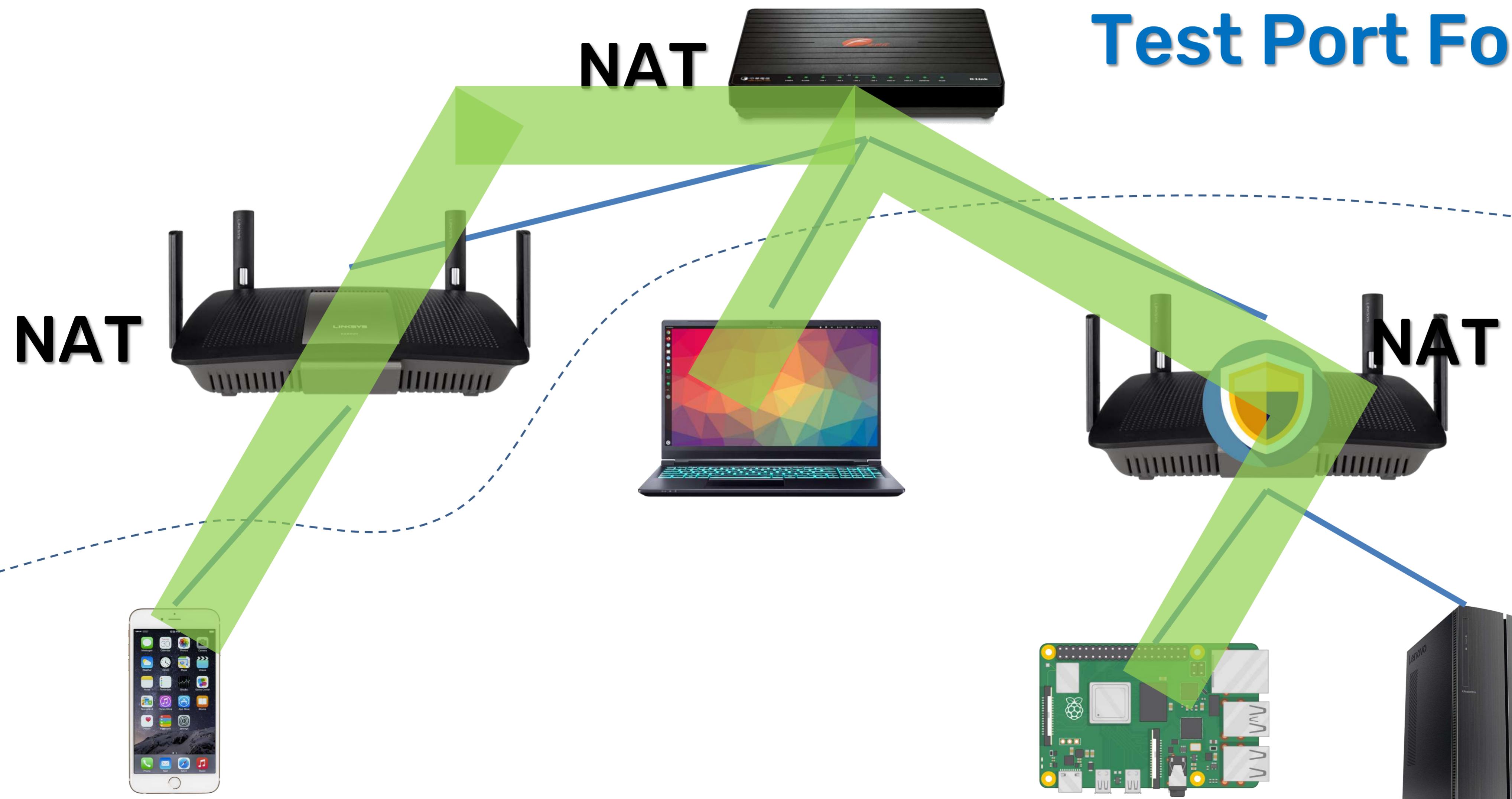
# Office network







## Test Port Forwarding



# Test Reverse Proxy

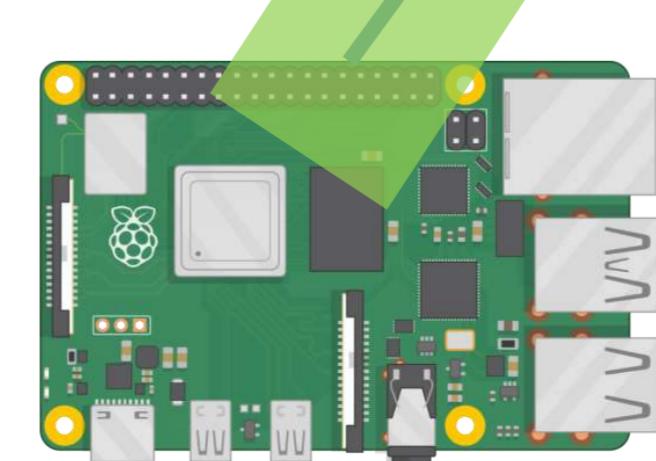
Cellular  
4G/5G

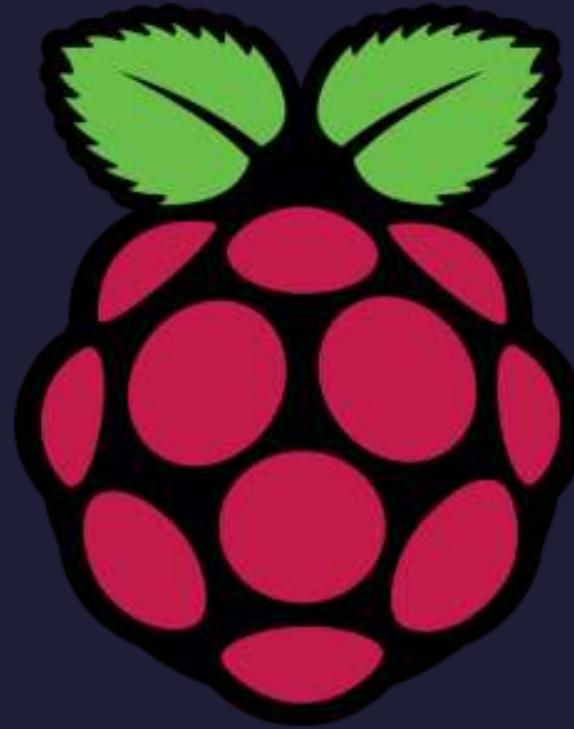


Cloud  
Services

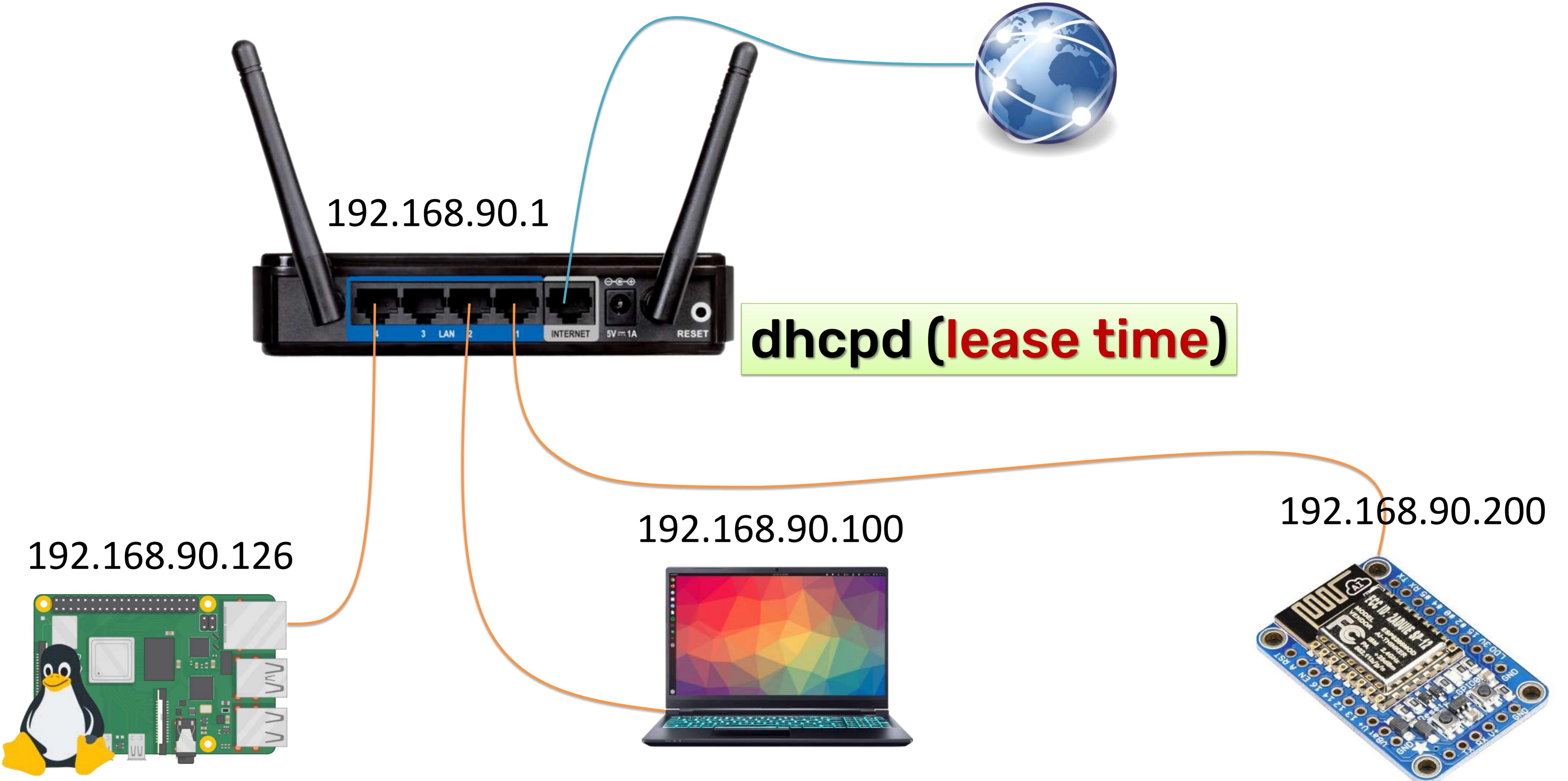
(tunnel)

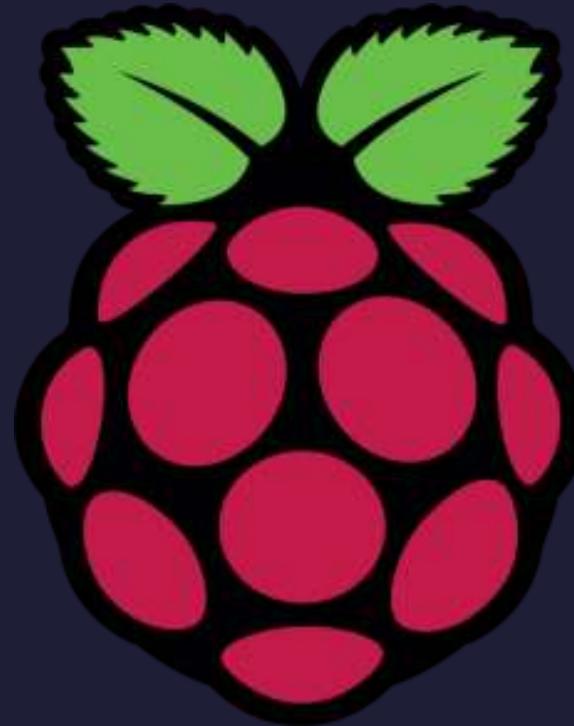
NAT





# DHCP Binding





# Choose a Wi-Fi Router

網際網路設定 | 通訊埠觸發程式 | 虛擬伺服器 | DMZ | DDNS | NAT Passthrough

一般設定

網路地圖

訪客網路

流量管理

家長電腦控制程式

USB 應用

AiCloud

## 外部網路(WAN) - DDNS

動態 DNS (DDNS) 讓您即使在沒有靜態 IP 位址的情況下，仍可使用特定名稱連線到無線路由器。無線路由器內建華碩 DDNS 服務與其他 DDNS 服務。

目前無線路由器使用一個私人的 WAN IP 位址 (192.168.x.x, 10.x.x.x, or 172.16.x.x)。

此路由器可能處於多層 NAT 網路中，而 DDNS 服務不能在此環境下工作。請聯絡您的網路管理人員處理此問題。

啟用 DDNS Client

是  否

啟用萬用字元 (wildcard)

是  否

套用本頁面設定

Save Settings

Don't Save Settings

# DDNS

TOOLS

## DYNAMIC DNS

Web, FTP, Game Server, etc...) using a domain name that you have purchased  
assigned IP address. Most broadband Internet Service Providers assign  
dynamic (changing) IP addresses. Using a DDNS service provider, your friends can enter your host name to connect to your game  
server no matter what your IP address is.

### DYNAMIC DNS SETTINGS

Enable Dynamic DNS :

Server Address :

<<

Select Dynamic DNS Server ▼

Host Name :

Username :

Password :

...

Verify Password :

...

Timeout :

576 (Times)

Status : Disconnected



DIR-819

ADVANCED

PORT FORWARDING

PORT FORWARDING

## PORT FORWARDING

This option is used to open multiple ports or a range of ports in your router and redirect data through those ports to a single PC on your network. This feature allows you to enter ports in the format, Port Ranges (100-150), Individual Ports (80, 68, 888), or Mixed (1020-5000, 689). This option is only applicable to the INTERNET session.

## 24 -- PORT FORWARDING RULES

Remaining number of rules that can be created: 24

		Ports to Open	
Name	Application Name	TCP	Schedule
<input type="checkbox"/>		<input type="text"/>	Always
IP Address	Computer Name	UDP	Inbound Filter
<input type="checkbox"/>		<input type="text"/>	Allow All

## Port Forwarding

運作模式: 無線路由器 韌體版本: 3.0.0.4.220 SSID: ASUS ASUS\_5G

網路設定精靈

- 一般設定
- 網路地圖
- 訪客網路
- 流量管理
- 家長電腦控制程式
- USB 應用
- AiCloud

外部網路(WAN) - 虛擬伺服器

通訊埠轉發允許遠程電腦在一個私人的區域網路內連接至一個具體的電腦或服務。欲加速連線，一些P2P應用程式（如BitTorrent）也需要您設定通訊埠轉發。更多資訊請參考P2P應用程式使用手冊。

若您要為同一個網路中的用戶端指定埠範圍，請輸入服務名稱、埠範圍（10200:10300）、網路IP位址，但不要填寫本地埠。

- 在關閉防火牆時設定HTTP伺服器，且設定外網(WAN端)通訊埠為80，會與RT-AC66U的管理介面伺服器使用的通訊埠衝突。
- 當使用RT-AC66U內建的FTP伺服器功能時，設定外網(WAN端)通訊埠為20:21，會與RT-AC66U內建的FTP伺服器使用的通訊埠衝突。

虛擬伺服器 FAQ

基本設定

開啟虛擬伺服器	<input checked="" type="radio"/> 是 <input type="radio"/> 否
內建的伺服器應用	請選擇
內建的遊戲應用	請選擇
FTP 伺服器埠號	2021

虛擬伺服器清單

服務名稱	通訊埠範圍	本地IP	本地通訊埠	通訊協定	Add / Delete
				TCP	<input type="button"/>

目前沒有資料

運作模式: 無線路由器 | 版本: 3.0.0.4.220 | SSID: ASUS ASUS\_5G

網路設定範例

內網位址設定 | DHCP 伺服器 | 路由設定 | IPTV | Switch Control

一般設定

內部網路(LAN) - DHCP 伺服器

DHCP 動態主機設定協議為使用在 IP 位址的自動設定所制定的協議。DHCP 伺服器會自動分配給每一個用戶端 IP 位址並指定 DNS 伺服器 IP 與 預設閘道 IP 給 用戶端。

手動指定 IP 的 DHCP 清單 FAQ

基本設定

啟用 DHCP 伺服器: 是

RT-AC66U 的網域名稱: RT-AC66U

IP Pool 啟始位址: 192.168.1.2

IP Pool 結束位址: 192.168.1.254

租約時間: 86400

預設閘道器:

DNS 及 WINS 伺服器設定

DNS 伺服器:

WINS 伺服器:

啟用手動指定功能

啟用手動指定功能: 否

手動指定 IP 的 DHCP 清單

MAC 位址	IP 位址	Add / Delete
		(+)

目前沒有資料

套用本頁面設定

**ADD DHCP RESERVATION**

Enable:

Computer Name:  << Computer Name

IP Address:

MAC Address:

Clone Your PC's MAC Address

Add / Update | Clear

# DHCP Binding/Reservation

**NETWORK SETTINGS**

**ROUTER SETTINGS**

Use this section to configure the internal network settings of your router. The IP address that is configured here is the IP address that you use to access the Web-based management interface. If you change the IP address here, you may need to adjust your PC's network settings to access the network again.

Router IP Address: 192.168.0.1

Default Subnet Mask: 255.255.255.0

Host Name: dlinkrouter

Local Domain Name: (optional)

Enable DNS Relay:

**DHCP SERVER SETTINGS**

Use this section to configure the built-in DHCP server to assign IP address to the computers on your network.

Enable DHCP Server:

DHCP IP Address Range: 100 to 200 (addresses within the LAN subnet)

DHCP Lease Time: 10080 (minutes)

Always broadcast:  (compatibility for some DHCP Clients)

**ADD DHCP RESERVATION**

Enable:

Computer Name:  << Computer Name

IP Address:

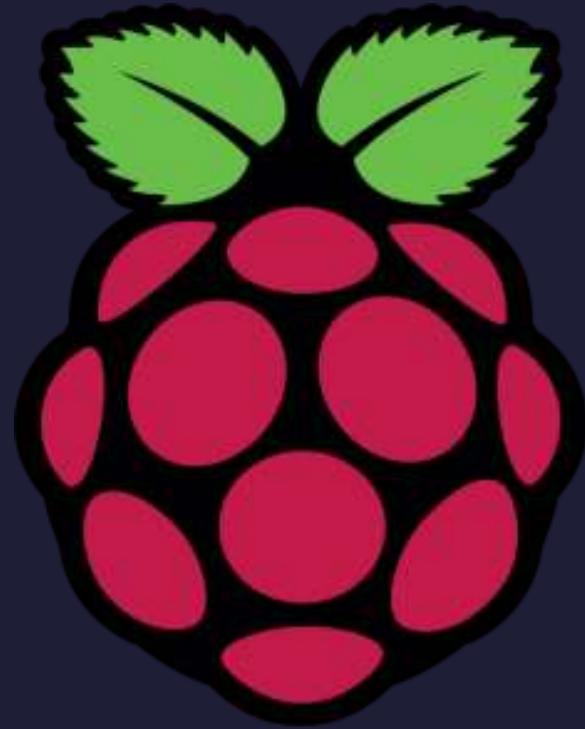
MAC Address:

Clone Your PC's MAC Address

Add / Update | Clear

**DHCP RESERVATIONS LIST**

Enable	Host Name	IP Address



Thank You ~ ☺