

Python Network Applications with Sockets

What Exactly is the Internet?

- The **internet** is a global network of billions of electronic devices. It is one huge network made up of various smaller networks.
- All of the machines on the internet are either **servers** or **clients**. The machines that provide services to other machines are servers. The machines that are used to connect to those services are clients.
 - How do we distinguish one computer or device from another?
 - How do we send information from one computer or device to another?

WAN or LAN?

- A **WAN (Wide Area Network)** is a group of computers that span across a large scale geographic area making a large scale network. The internet is a great example of a WAN.
- A **LAN (Local Area Network)** is a group of computers connected in a limited geographic area making a smaller scale network. Your home network is a great example of a LAN.

IP Addresses

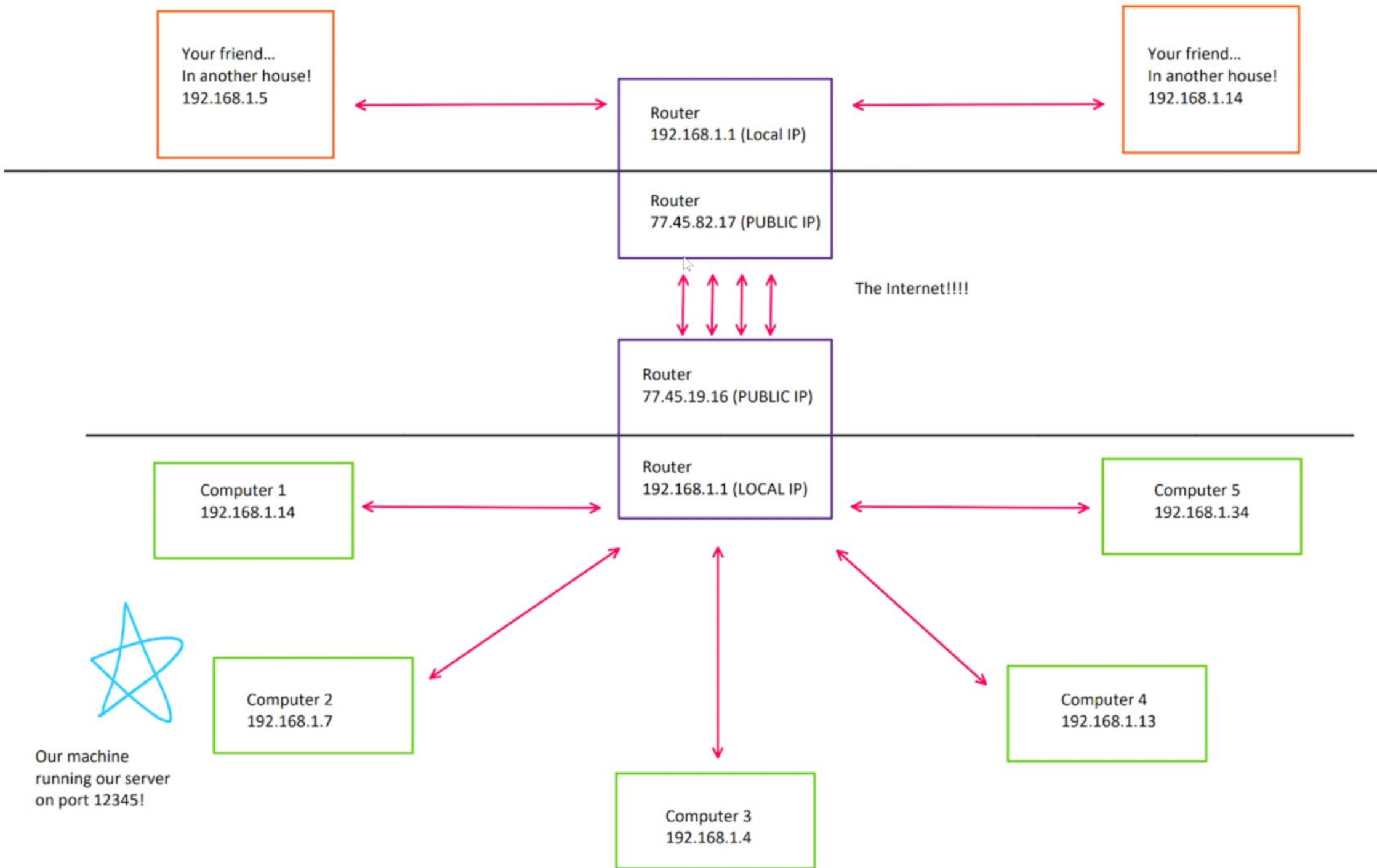
- If you are connected to the internet at your home you are most likely paying an Internet Service Provider for a **public IP address**. This is a unique address on the internet; your router/modem is the only device on the internet with this public IP address.
- Inside your home, your computer have most likely received a **local IP address** from the router. Inside your home, this is a unique IP address. However, on other networks (LANs) there can be other devices with that same local IP address.

Internet Protocol

- An **internet protocol address (IP address)** is a network address for your computer so the Internet (WAN) or your router (LAN) knows where to send data.
 - Public IP Address: 18.25.15.99 (Cambridge, Massachusetts)
 - Local IP Address: 192.168.1.7 (My house, my local network)
- The most common type of IP address is **IPv4 - Internet Protocol Version 4**. IPv4 consists of 4 numbers ranging from 0 to 255.
- We NEED a protocol for a common agreement on how information will be shared and expressed. We will use IPv4.

Finding Your IPv4 Address

- You can find your IP address by opening up a terminal, cmd, PowerShell...
 - Windows - ``ipconfig``
 - Linux - ``ip a`` or ``ifconfig``
 - Mac - ``ipconfig getifaddr en0``



Port Addresses

- If an IP address is the address of your computer on a given network, a **port address** is the address that a specific application or service runs on that given computer.
- Common ports and services:
 - Port 21 - FTP File Transfer Protocol
 - Port 22 - SSH Secure Shell
 - Port 25 - SMTP Simple Mail Transfer Protocol
 - Port 80 - HTTP Hyper Text Transfer Protocol
 - Port 443 - HTTPS Hyper Text Transfer Protocol Secure
- Your router may receive data to send to your computer for a website and for a file transfer using FTP. It will send both to your ip address, but it will send the data to different ports.
- Let's look at some services running using 'netstat -na'

Transmission Control Protocol Vs. User Datagram Protocol

- TCP and UDP are communication protocols.
- **TCP is a connection based protocol.** A connection must be made before any data is sent!
- It is used to establish a reliable, error free connection. It ensures that ALL data that was sent is received and it keeps all sent packets organized.
- **UDP is a connectionless protocol.** No connection has to be made before sending data.
- UDP tends to be faster but you may not receive the data in order and you could have missing data.

What is a Socket?

- A **socket** is one endpoint of a two-way communication channel between two programs running on a network.
- When we create a socket we must specify the internet protocol and the communication protocol the socket will use.
- If we create an IPv4, TCP socket we can have one socket (the server) listen for incoming connections at a specific location (IP/Port) and another socket (the client) connect to the specific ip/port address to open up a line of communication.
- If we create an IPv4, UDP socket, we simply send information back and forth to a location (IP/Port) without any connection.