What is an IP Address?

An Internet Protocol Address is like a phone number. Is a number that they use to talk to each other inside of a network. Also, it gives the devices in the network the ability to connect to the internet.

If we want to see our IP Address this is what we type:

Windows

PS C:\Users\Mike Ehl\Desktop> ipconfig

Windows IP Configuration

PPP adapter McAfee VPN:

Connection-specific DNS Suffix . :

IPv4 Address. . . . . . . . . . . : 10.0.0.44

Subnet Mask . . . . . . . . . . . : 255.255.255.255

Default Gateway . . . . . . . . . : 0.0.0.0

Ethernet adapter VirtualBox Host-Only Network:

Connection-specific DNS Suffix . :

Link-local IPv6 Address . . . . . : fe80::44f2:f2b1:168b:a36b%7

IPv4 Address. . . . . . . . . . . : 192.168.56.1

Subnet Mask . . . . . . . . . . .: 255.255.255.0

Default Gateway . . . . . . . . . :

Unknown adapter McAfee VPN:

.

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Wireless LAN adapter Wi-Fi:

Connection-specific DNS Suffix . :

Link-local IPv6 Address . . . . . : fe80::1957:8beb:b3da:e1e3%9

IPv4 Address. . . . . . . . . . . : 10.20.15.223

Subnet Mask . . . . . . . . . . . : 255.255.240.0

Default Gateway . . . . . . . . . : 10.20.0.1

Ethernet adapter Bluetooth Network Connection:

Media State . . . . . . . . . . . : Media disconnected

Connection-specific DNS Suffix . :

PS C:\Users\Mike Ehl\Desktop>

Linux (or MAC os)

┌──(alice㉿Alice)-[~]

└─$ ip addr

1: lo: <LOOPBACK,UP,LOWER\_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000

link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00

inet 127.0.0.1/8 scope host lo

valid\_lft forever preferred\_lft forever

inet6 ::1/128 scope host

valid\_lft forever preferred\_lft forever

2: eth0: <BROADCAST,MULTICAST,UP,LOWER\_UP> mtu 1500 qdisc pfifo\_fast state UP group default qlen 1000

link/ether 08:00:27:55:0c:2e brd ff:ff:ff:ff:ff:ff

inet 10.0.2.15/24 brd 10.0.2.255 scope global dynamic noprefixroute eth0

valid\_lft 86375sec preferred\_lft 86375sec

inet6 fe80::a00:27ff:fe55:c2e/64 scope link noprefixroute

valid\_lft forever preferred\_lft forever

┌──(alice㉿Alice)-[~]

└─$

Along with the IP Addresses we have other two important data, The **Subnet Mask**, and the **Default Gateway**.

**Router and the IP Addresses:**

The router as we said before, is a layer device, is a device that understand the IP Addresses and can locate the devices in its network, or in other networks by using this data. But the important thing to point here is that the router is also who assigns IP addresses to the devices in its network.

Network and Host:

Whenever we are the ones broadcasting an IP Address, meaning we are the router, that means that to us, we don’t know the place of the planet that we are. We oversee providing with IP Addresses to all devices underneath us. So is not really that important the first part of the network if is not going to change, what is important is the host part. In the 192.168.1.48 IP for example:

[192.168.1] Network Part [.48] Host Part

If there is another Router which is built in the same way as this one, the network part of the IP addresses that this router is going to provide will be the same. We can think of it like a house. All houses are built the same, the have living rooms, bathrooms and so; but the people who live inside are different. Routers work the same…if we are moving from a house to another constantly of course.

What is we want to send something outside?

In our networks, we usually have a router, who is also our switch; but for better understanding what is going on let’s separate them into two devices like old school style. The switch is the one that has the devices connected to each other in the same network. Let’s remember that the Default Gateway is always the first IP Address, and that if we want to send a message to someone who is outside, we just must use our router, or our Default Gateway to get to the WAN and get the message there.

Special IP Addresses:

* .0 Can’t be used
* .1 Default Gateway
* .255 broad cast

**Sub net Mask:**

This is the value that determines how big a network can be. Meaning, how many numbers will remain the same. What do I mean?

An IP Address with a subnet mask of 255.255.255.0 has a range of 256 including the zero, less the three untouchable IP Addresses that gives us 253 IP addresses.

An IP Address with a subnet mask of 255.0.0.0 has a range of 256^3 including the zero, less the three untouchable IP Addresses for each place that has a zero, that gives us 253^3 = **16,777,216** possible IP addresses, **just for one network**

|  |  |  |
| --- | --- | --- |
| **Class** | **Range** | **Host Address** |
| A | 1.0.0.0 - 126.255.255.255 | 255.0.0.0 |
| B | 128.0.0.0 - 191.255.0.0 | 255.255.0.0 |
| C | 192.0.0.0 - 233.255.255.0 | 255.255.255.0 |
| D | 244.0.0.0 - 239.255.255.255 |  |
| E | 240.0.0.0 - 255.255.255.255 |  |

Sub-Classes or classless networks:

Mayor companies like telephone companies own the 16M type of IP Addresses. It is possible that you have found a 10 IP Address, like 10.7.0.48, being Class A, with a Subnet Mask of 255.255.255.0. This is because we can create classless network of a class and divide our big network into smaller networks.

Classes D and E we can’t Use them.

The 127.0.0.0:

As we can notice there is an entre A class IP Address lost. The 127.0.0.0 refers to the localhost, this IP addresses are inside our devices. This is also known as loopback address.

PS C:\Users\Mike Ehl\Desktop> ping 127.0.0.1

Pinging 127.0.0.1 with 32 bytes of data:

Reply from 127.0.0.1: bytes=32 time<1ms TTL=128

Reply from 127.0.0.1: bytes=32 time<1ms TTL=128

Reply from 127.0.0.1: bytes=32 time<1ms TTL=128

Reply from 127.0.0.1: bytes=32 time<1ms TTL=128

Ping statistics for 127.0.0.1:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round-trip times in milli-seconds:

Minimum = 0ms, Maximum = 0ms, Average = 0ms

PS C:\Users\Mike Ehl\Desktop>

**IMPORTANT:**

As we can see, there is an entire Class A of IP Addresses being misused. If you ping yourself in the 127.0.0.0-127.255.255.255 range, the response will be the same. This means that there are 16M of IP addresses that are not being used.

How did we Fix it?

The answer to that question is **Private IP Addresses** and **NAT**. This us when the 192.168.0.0 comes into play.

**Private IP Addresses:**

What we did was that we took a chunk of the IP Addresses that we already had, and made them “Privates”. This are the IP Addresses we are going to see the most, like:

**10.0.0.0 – 10.255.255.255 255.0.0.0 A**

**172.16.0.0 – 172.31.255.255 255.255.0.0 B**

**192.168.0.0 – 192.168.255.255 255.255.255.0 C**

That’s how we are almost always sure that the IP Address we have when we look from “above” is the **C** class IP Address 192.168.0.0/24, because this is the one that most of the routers use as **Private IP Address**. This solves the problem because Public IP addresses can’t never be the same; Private IP Addresses on the other hand they can and they are most of the time, the same.

The other mayor difference is that you can’t access Internet with just Private IP Address and this is where NAT comes into play.

**NAT (Network Address Translation):**

As we said before it’d be basically impossible to assign a public IP Address to each device in your home network because we don’t have enough IP Addresses. So what we do is that we have our router give Private IP Addresses to each of our devices and that’s OK. The problem is that they can’t really connect to the internet with Private IP Addresses.

Here we need to ask to our Internet Provider to Give us a public IP address using NAT, and then through only this one IP Address, all of our devices can connect to the internet.

**CONTENT STILL MISSING>>>>>NAT WILL BE COVER LATER**

IPv4 and IPv6:

Here I just want to point that obviously, all this is just a temporary solution, and that the real solution is well **IPv6**, which is in other words, larger IP address so we can have more devices connected.