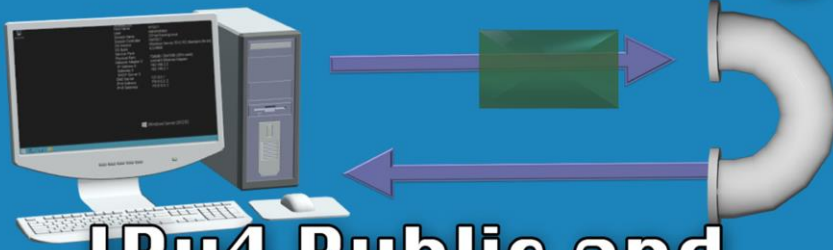


ITFreeTraining



IPv4 Public and Private Addresses

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IPv4 Public and Private Addresses

In this video from ITFreeTraining I will look at the different types of IPv4 addresses that are available and how they can be used on the internet and inside your company.

Access the rest of the course <http://ITFreeTraining.com/ipv4>

Download the PDF handout <http://ITFreeTraining.com/handouts/ipv4/public-private.pdf>

IPv4 Address

- Uses a 32bit 4 byte address
 - Gives to 2^{32} (4 294 967 296) addresses
- Not all useable and some poorly allocated
- IANA exhausted free pool on February 3rd 2011

IPv4 Address

0:12 - IPv4 uses a 32bit 4 byte address, which gives over 4 billion addresses. Not all of these are useable and some were originally poorly allocated. When the internet was first created, no one thought that it would take off the way it did and thus some wasteful allocation of IP Addresses occurred. In February 2011 the Internet Assigned Numbers Authority, the organization tasked with allocating IP Addresses, allocated the last free block of IPv4 addresses. Some of these blocks of addresses were allocated to ISPs but have not yet been allocated to customers. Also, there are a number of IP Address space saving technologies that have been developed to help get the most use out of an available IP Address space. For these reasons, IPv4 is not here to stay permanently, however it will certainly be here for quite a while longer. Let's now have a look at how these addresses are allocated.

Public and Private Addresses

Public

- Required to access internet
- Must be unique
- Routable on internet
- Assigned by IANA/RIR



Private

- Administrator can assign
- Not routable on internet
- Can be translated to access internet



Public and Private Addresses

1:13 - The first main split of addresses is public and private. Public addresses are required to access the Internet. Just like a telephone number, it must be unique. Since all public IP Addresses are unique, any router on the internet will route them to where they need to go. To ensure this process is correctly managed, Public IP Addresses are assigned by the Internet Assigned Number Authority and Regional Internet registries. These organizations are responsible for managing the IP Addresses globally and allocating them to regions, ISPs and organizations.

The second split of addresses is private addresses. With these addresses, an administrator is free to assign them as they wish to their own network entirely under their own control. Since there is no central control with these IP Addresses, they are not routable on the Internet. However, a private IP Address can be translated to access the Internet. For example, 100 computers in a company could be allocated private IP Addresses and use the one public IP Address to access the internet. The process from converting the private IP Address to a public IP Address is known as translating, more specifically Network Address Translation (NAT). It is one of the ways that IPv4 has been able to continue to be used when all the IP Addresses have been used. I will now have a closer look at how Public IP Addresses are allocated.

Public IP Addresses



Public IP Addresses

2:42 - As stated, IANA is responsible for allocating public IP Addresses. It does this with blocks. These blocks of IP Addresses are allocated to Regional Internet Registries. The regional internet registry is then free to allocate IP Addresses to ISPs and organizations according to their internal policies. You can see that despite the fact that the IANA has run out of IP Addresses, there still may be free IP Addresses with the Regional Internet Registries and ISPs. The important point to remember is that if you are allocated a public IP Address, it is routable to all other public IP Addresses on the internet. When you connect to an ISP, the ISP will give you a public IP Address that you can use to access all of the public internet. Next, I will have a closer look at the Private IP Addresses.

Private IP Addresses

- Can be configured by the administrator
- Not routable on the internet

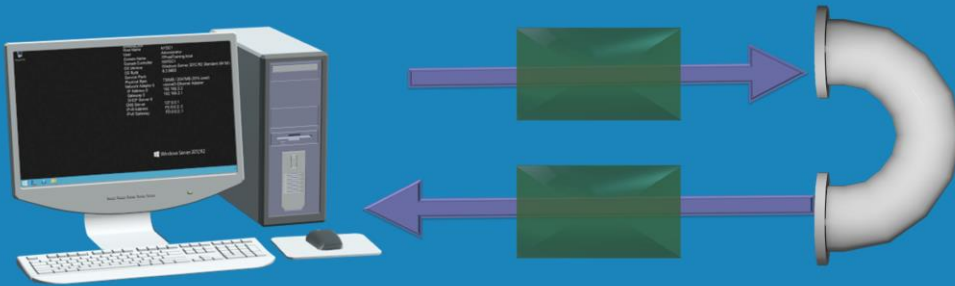
Start IP	End IP	Number of addresses	Subnet Mask
10.0.0.0	10.255.255.255	16,777,216	255.0.0.0
172.16.0.0	172.31.255.255	1,048,576	255.240.0.0
192.168.0.0	192.168.255.255	65,536	255.255.0.0

Private IP Addresses

3:37 - Shown here are the private IP Addresses. An administrator is free to configure these private IP Addresses on their network as they see fit. The point to remember with these IP Addresses is that they are not routable on the internet. If an internet router receives traffic with a destination of a private IP Address, it will simply drop the traffic. There are also some other groups of IP Addresses that you should be aware of.

Loopback Address

- Redirects data back to the source
- Any of the addresses 127.0.0.0/24
- Most commonly used 127.0.0.1
- Used mostly for troubleshooting



Loopback Address

4:07 - The first one that I will look at is the loopback address. This essentially redirects data back to their source without any additional processing or modification. Any IP Address that starts with 127 will be looped back to the source; however, administrators will commonly use the address 127.0.0.1. The loopback is mainly used for troubleshooting. For example, testing to make sure that the networking is installed and working. Since it does not require the computer to be physically connected to a network it is a good way to test the networking software and to test that its device drivers are installed and configured. Some administrators will start their troubleshooting by pinging the loopback address. If they get a response they know the network is installed and working. They will then start pinging local and then remote hosts in the troubleshooting process to find where the problems are. In some cases, the loopback address is used for configuration when the administrator wants a service to be used locally. For example, if a Server has the DNS service installed, you may want the server to use the local DNS service. To do this, configure the DNS settings to the loopback address. This way, even if the IP Address of the server were to change, the server would always use the local DNS service to resolve DNS names.

Link-Local Addressing

- 169.254.1.0 to 169.254.254.255
- Local network only
 - Allows computers on same network to communicate
 - Not routable at all
- Microsoft refers to this as
 - Automatic Private IP Addressing (APIPA)

Link-Local Addressing

5:34 – Link-Local addressing consists of the IP address range of 169.254.1.0 to 169.254.254.255. These IP Addresses are for local networks and designed to allow computers on the same network to communicate. Thus, Link-Local addresses are not routable. The idea behind this is that if a computer is connected to a network and there is no infrastructure on the network, the computer will be able to automatically allocate a random IP Address from this range. Other computers on the network will also allocate themselves a random IP Address from this range and thus the computers should be able to communicate with each other but not the internet or other networks. Microsoft refers to this as Automatic Private IP Addressing or APIPA. If you, for example, connect two Windows computers together so they are on the same network, however no other devices are on the network, both computers will get an IP Address from the Link-Local address range. The two computers will then be able to talk and communicate with each other but will be unable to access other networks even if they later become available. In order to do this, the IP Address the computers were using would need to change.

See <http://YouTube.com/ITFreeTraining> or <http://itfreetraining.com> for our always free training videos. This is only one video from the many free courses available on YouTube.

References

"Installing and Configuring Windows Server 2012 R2 Exam Ref 70-410" pg 201

"IPv4 Address exhaustion" https://en.wikipedia.org/wiki/IPv4_address_exhaustion

"Link-Local address" https://en.wikipedia.org/wiki/Link-local_address

"Regional Internet Registries world map"

https://commons.wikimedia.org/wiki/File:Regional_Internet_Registries_world_map.svg#/media/File:Regional_Internet_Registries_world_map.svg

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