Configure and Verify IPv4 Addressing:

- IP stand for Internet Protocols & internet means international Network.
- Protocols are set of rules and regulation.
- V stand for version, where V1, V2, V3, V5 and V6.
- V1, V2, and V3 were all test versions that were improved.
- IPv5 also called the internet steam protocol developed in 1980s.
- IP address is a logical address for a Network Adapter.
- The IP address uniquely identifies computers on a TCP/IP Network.
- IP address is a numeric identifier that is assigned to a device for communication.
- The designers of the Internet Protocol defined an IP address as a 32-bit number.
- IPv4 address consists of 32 bits, which limits the address space to 4294967296 (2^{32}).
- IP address consists of four decimal numbers, which separated by dots or decimal points.
- Hence, we also called IP Address version 4 **dotted-decimal notation**.
- For example, 192.168.1.0 is an IP address written in dotted-decimal notation.
- The binary version of 192.168.1.0 is 11000000 10101000 00000001 00000000.
- Each decimal numbers of IP address represents 8-bit, and called an **octet**.
- Hence, an IP address represents 32-bit (or 4 bytes).
- The range of each octet is between 0 and 255.
- IPV4 address start from 0.0.0.0 and end with 255.255.255.255.
- It is also called 32 bit, logical, network, variable, software, layer 3 address.

IPV4 Classes:

- IPv4 address space can be subdivided into five **classes**.
- IPv4 class are class A, class B, class C, class D and class E.
- IPv4 each class consists of subset of the overall IPv4 address range.
- IPv4 class A, class B and class C used for Unicast ranges.
- IPv4 Class D used for Multicast Range.
- IPv4 Class E reserved for Research purpose.
- IPv4 Class E network is reserved for "experimental use".
- IPv4 Class E should not be assigned to host devices.
- IPv4 address range from 0.0.0.0 through 0.255.255.255 cannot work.

Class	Range	Full Range	Binary Start-up Bit
A	1-127	1.0.0.0 – 127.0.0.0	0
B	128-191	128.0.0.0 – 191.0.0.0	10
C	192-223	192.0.0.0 – 223.0.0.0	110
D	224-239	224.0.0.0 – 239.0.0.0	1110
E	240-255	240.0.0.0 – 255.0.0.0	1111

Loopback Address:

- Address beginning with 127 is unacceptable to assign them any network host.
- From **127.0.0.0** to **127.255.255.255** is fully reserved for loopback purpose.
- Loopback interface allows IT professionals to test IP software broken or corrupted.
- Loopback addresses are used for checking and troubleshooting purposes.

Unicast Address Type:

- One to one communication is called Unicast Communication.
- Type of communication where data is sent from one computer to another computer.
- Unicast is a one-to-one type of network communication.
- Different data streams are generated for each Unicast connection.
- In Unicast type of communication, there is only one sender, and only one receiver.

Multicast Address Type:

- One to a specific group communication is called Multicast Communication.
- Type of communication where multicast traffic addressed for a group of devices.
- IP multicast traffic are sent to a group and only members of that group receive.
- Devices, interested in a particular Multicast traffic, must join to that Multicast group.
- IP Multicast Groups are identified by Multicast IP Addresses Class D Addresses.
- In Multicast, the sender transmits only one copy of data and delivered many devices.
- Address range from 224.0.0.0 to 255.255.255.255 cannot assignment to network hosts.
- IP version 4-class D network is reserved for **multicasting**.

Broadcast Address Type:

- One to all communication is called Broadcast Communication.
- Type of communication where data is sent from one computer and copy to all devices.
- In Broadcast, there is only one sender and the data is sent only once.
- However, the Broadcast data is delivered to all connected devices.
- Switches forward the broadcast traffic and Routers drop the broadcast traffic.

Subnet Mask:

- Class A's default mask is 255.0.0.0, or /8
- Class B's default mask is 255.255.0.0, or /16
- Class C's default mask is 255.255.255.0, or /24
- 255.0.0.0 in binary is 11111111 00000000 00000000 00000000.
- 255.255.0.0 in binary is 11111111 11111111 00000000 00000000.
- 255.255.255.0 in binary is 11111111 11111111 11111111 00000000.
- Class A = /8 = 2^{24} (16,600,000) Addresses for hosts
- Class B = /16 = 2^{16} (65,000) Addresses for hosts
- Class C = /24 = 2^{8} (256) Addresses for hosts

Network and Host Portions:

- Internet Protocol version 4 Class A network mask 255.0.0.0.
- 255 means the first octet of the address is the network portion.
- And the final three octets are the host portion.
- Internet Protocol version 4 Class B network mask 255.255.0.0.
- 255.255 means the first two octets of the address are the network portion,
- Moreover, the final two octets are the host portion.
- Internet Protocol version 4 Class C network mask 255.255.255.0.
- 255.255.255.0 Means the first three octets are the network portion.
- In addition, the final one octet is the host portion.

Network Mask:

- Network mask or NetMask is a 32-bit binary number.
- Network mask is usually written in dotted-decimal format.
- Network mask defines the size of the host part of an IP address,
- Representing the host part of the IP address with binary 0s in the mask.

Class	Network Part	Host Part	Default Mask
A	8	24	255.0.0.0
B	16	16	255.255.0.0
C	24	8	255.255.255.0

Network Address:

- Network address or network number is a number that uses dotted-decimal notation.
- The number it represents all hosts in a single Class A, B, or C IP network.
- For example, an IP address 192.168.0.1 with network mask 255.255.255.0,
- In the given IP address, the network address will be 192.168.0.0.
- Network address, use logical AND operation between IP address & network mask.
- For example, an IP address 192.168.0.1 with network masks 255.255.255.0.
- Convert the IP address 192.168.0.1 to binary format.
- We get 11000000 10101000 00000000 00000001.
- Convert 255.255.255.0 to binary, get 11111111 11111111 11111111 00000000.
- Logical AND operation we get 11000000 10101000 00000000 00000000.

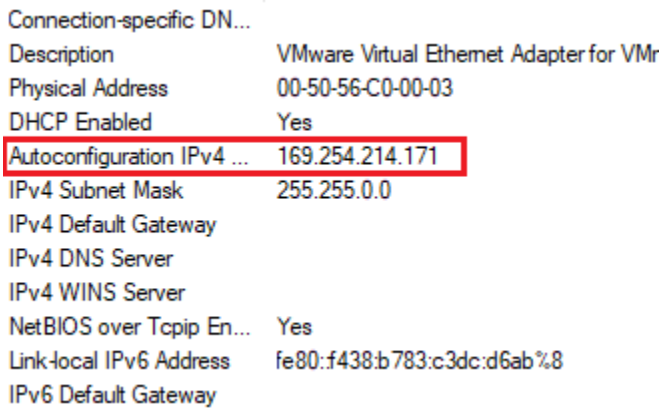
Private Addresses:

- Private IP addresses are used inside the LAN for Private Communication.
- Private IP Addresses are also called Non Routable IP addresses.
- Specific address ranges within Class A, Class B, & Class C reserved for private networks.
- A private IP address is a non-Internet facing IP address on an internal network.
- Large companies use Class A as it allows more than 16 million hosts.
- Class B manages 16,384 hosts per network where Class C is used 254 hosts.

Class	Private Start Address	Private End Address
A	10.0.0.0	10.255.255.255
B	172.16.0.0	172.31.255.255
C	192.168.0.0	192.168.255.255
B APIPA	169.254.0.0	169.254.255.255

APIPA:

- APIPA stand for Automatic Private IP Addressing.
- Windows computer assign itself an IP address if a DHCP is not available.
- For example, this could occur on a network without a DHCP server.
- On a network, if a DHCP server is temporarily down for maintenance.
- With this feature, a Windows computer can assign itself IP address.
- If a DHCP server is not available or does not exist on the network.
- This feature makes configuring and supporting LAN running TCP/IP less difficult.



Class Full IP Address:

- Those IPv4 addresses which use default subnet mask.

Class	IP Address	Subnet Mask
A	10.0.1.1	255.0.0.0
B	172.16.0.2	255.255.0.0
C	192.168.0.5	255.255.255.0

Classes IP Address:

- Those IPv4 addresses, which does not use default subnet mask.
- Those IPV4 addresses which subnetting are done.

Class	IP Address	Subnet Mask
A	10.0.1.1	255.255.0.0
B	172.16.0.2	255.255.255.0