rnd-doc-1

IP Addressing:

IP Address

- IP address is layer 3 address assigned by admin, or may change within a subnet when using DHCP.
- Used to uniquely identify devices on a network and it's determined by routers where the device is.

IPv4:

- Layer 3 or network layer protocol.
- Connectionless protocol.
  - TCP is connection oriented.
- Packets are treated independently.
  - May take different paths determined by the router, based on -
    - Load balancing
    - Bandwidth -OSPF
    - Hopcount - RIP
- Hierarchical addressing structure.
  - Network and host part of the address.
  - Routers route based on the network portion of the ip.
- No built in session.
- No retransmission.
- No data recovery feature.

Format of IP

- IP - 32 bits. x.x.x.x each x is 8 bits and octet.
- Network vs Host portion of IP:
  - Network Portion(Network ID):
    - Identifies a specific network.
    - Routers maintain routing table that contains network addresses.
    - Look at destination address and match the network address.
  - Host Portion(Host ID):

- Identifies a specific endpoint of a network.
- server, printer, computer etc.

Classes of IPs

Address Classes:

- Divide IPv4 in 5 address classes.
- Class {A,B,C} - Unicast traffic.
- Class D - Multicast traffic.
- Class E - Reserved for future experimental purposes.
- IPv6 does not use classes.
- IPv4 address classes was replaced by CIDR.

Class A Network:

- First octet of the IP is network address.
- Range: 1.0.0.0 - 126.0.0.0 (1-126).
- 0 network is reserved for default network - 0.1.1.1
- 127 is reserved for loopback. - 127.0.0.1
- First 8 bits network address and last 24 bits are host potion.

Class B Network:

- First and second octet of the IP is network address.
- Range: 128.0.0.0 to 191.255.255.255 (128-191).
- First 16 bits is network address and last 16 is host.

Class C Network:

- First 3 octets of the network is network address.
- Range: 192.0.0.0 - 223.255.255.255 (192-223).
- First 24 bits are network address and last 8 bits are host address.

Class D Network:

- Multicast - One device talking to a group of devices.
- Range: 224.0.0.0 - 239.255.255.255
- 224.0.0.x - Link Local Multicast.
- Does not have a subnet mask.

Class E Network:

- Binary range: 240.0.0.0 to 255.255.255.255
- Reserved for testing and broadcast.

Special IPv4:

Directed Broadcast Address

- Host sends data to all the devices on a specific network.
- Binary 1s are in the entire host potion.
- Network 172.31.0.0
  - Directed broadcast address - 172.31.255.255
  - class B, 255 in binary 1111 1111 in host portion.
- Routers can route directed broadcast.
  - disabled by default.

Local Broadcast Address:

- Communicate with all the devices on a local network.
- Address is all binary 1s.
  - 255.255.255.255
- Example: A host requesting IP address form a DHCP server, the host will broadcast the request as it has no IP and it does not know the ip of the DHCP server.
- This request is always dropped by routers and switches.
  - DHCP forwarding or DHCP relay can be done.

Local Loopback Address:

- Used to let a system send message to itself for testing.
- This is very helpful to make sure the TCP/IP stack is correctly installed on a machine.
- 127.0.0.1 (all in range of 127)
- For IPv6 it's - :: 1
- NOTE: Routes have loopback address which are not similar as the local loopback address.

RFC1918-Address allocation for the private internet. Private IP address. Non routable on the internet.

Subnet Mask:

- Used to determine the network portion and the host portion.
- is a device remote or local?
- Network mask:
  - Allows us to determine the portion of the address which is the host and the network.
  - The network portion is all one's and rest is 0's are host part.
- cisco devices do not support discontiguous mask eg . =

240.255.31.91

- Only contiguous subnet mask are supported. = 255.240.192.0

CIDR Notation:(Classless Inter-Domain Routing)

- Replaces classful IP's.
- The subnet mask like 255.255.255.0 can be replaced by IP/24 or 255.0.0.0 can be IP/8
- CIDR allows us to implement variable length subnet mask.

IP Subnetting:

- We need to determine the following from a given IP address -
  - Subnet address
  - 1st Host address
  - Last host address
  - Broadcast address

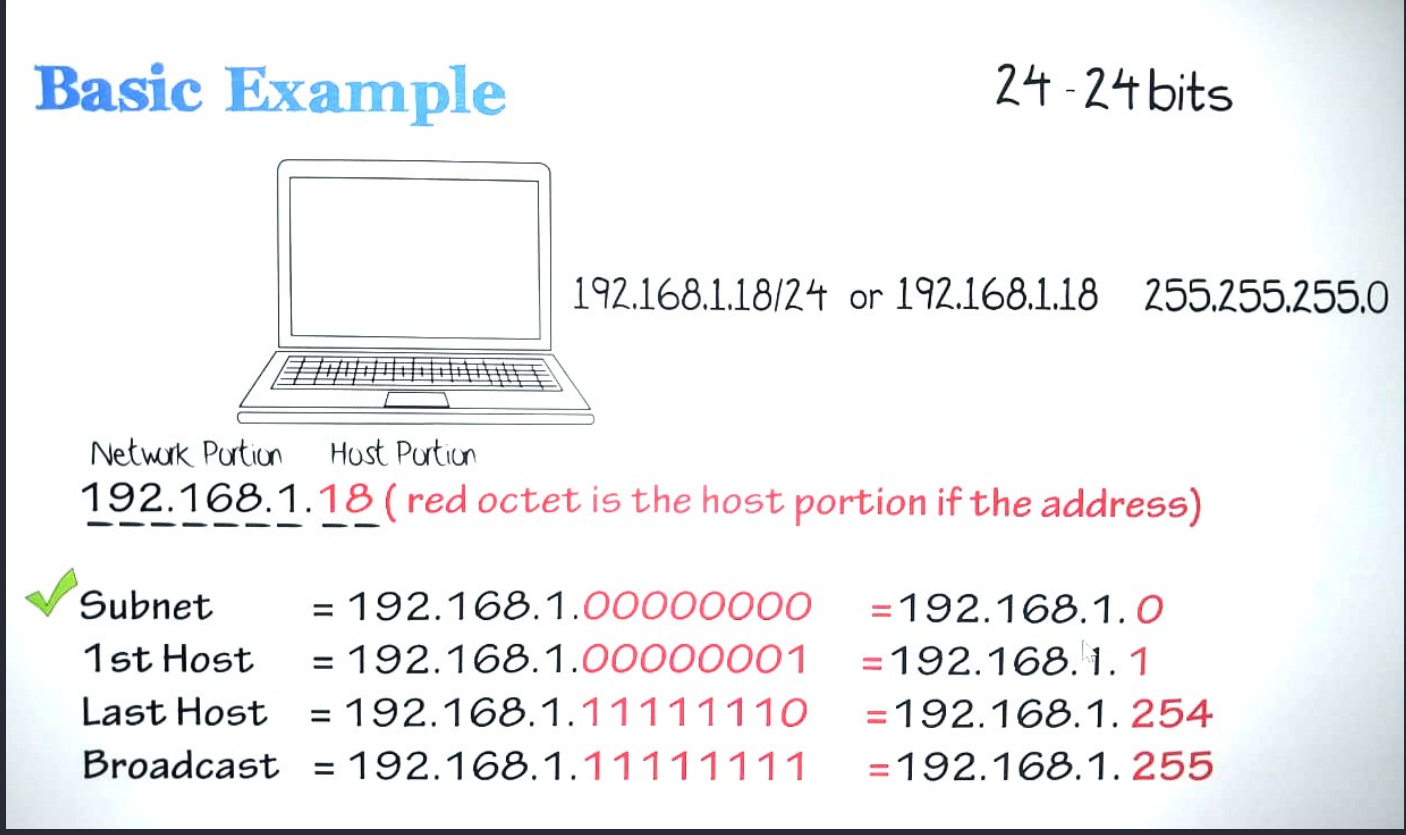
Subnetting Binary method

Binary Rules:

- Network address/ subnet address:
  - Fill the host portion of an address with binary 0's.
- Broadcast Address:
  - Fill the host portion of an address with binary 1's.
- First Host:
  - Fill the host portion of an address with binary 0's except for the last bit which is set to binary 1.
- Last Host:
  - Fill the host portion of an address with binary 1's except for the last bit which is set to binary 0.

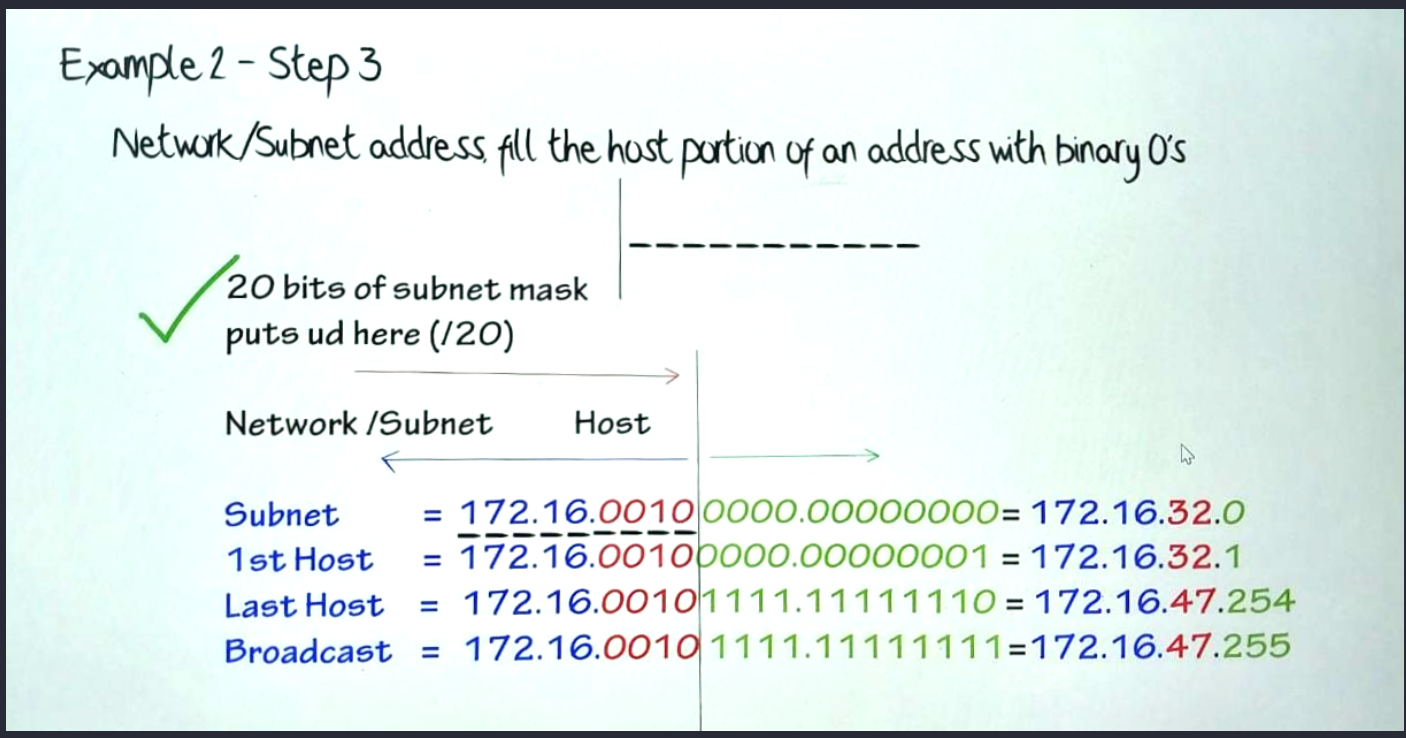
Example:

Basic:



Typical:

172.16.35.123/20



Quick method to subnetting:

Table to remember:

128	64	32	16	8	4	2	1
128	192	224	240	248	252	254	255

example - 172.16.35.123/20 or 172.16.35.123 255.255.240.0

1. Find out where the subnet mask is not 255.
    1. at 35 it's 240.

2. take a not for the octet where both the network and host portion resides.
    1. at 35
3. Subtract the subnet mask value (that is not 255) form 256.
    1. 256 -240 = 16 (Networks are incrementing in multiple of 16)
4. Work out where 35 is in the range of networks worked out in step 3:
    1. Multiple of 16: range of 35⟹ (16x2 =)32 to (16x3 =)48.
    2. Subnet/Host octet lies between 32 and 48.
5. **Subnet: 172.16.32.0** - first number in the range.
6. Next subnet of the network resides on *172.16.48.0* so**Broadcast address:172.16.47.255**
7. **1st Host: 172.16.32.1**
8. **Last Host: 172.47.254**

Subnetting a Network:

Involves:

- Stealing or taking away bits form the host portion of an address.
- Allocation the stolen bits to the network portion of a new network address.

Two Important Rules:

- When asked for the number of host: HOST = 2^n -2
    - Note: count the host bits form right to left.
- When asked for number of networks: 2^n
    - Note: count the network bits form left to right.

Example:

1. ABC Ltd has been allocated subnet 10.1.1.0/24 for a small office. The network admin needs to split this subnet into smaller subnets. Each subnets need to support 14 machines.

Host number is 14 so we know Host = 2^n -2 (n= number of bits required to cover the host)

therefore, 2^4 -2 =14 so 4 bits of the host bits need to be stolen to allocate it to the new network address.

10.1.1. 0000 | 0000
-------network host
so working out the subnet mask - 255.255.240.0 or 10.1.1.0/28

Working out the new diff network:
10.1.1.0/28
10.1.1.16/28
10.1.1.32/28
.....
10.1.1.240/28(Last network)

Number of bits in subnet is 4 so num of networks = 2^4=16