Networking Foundations

IP Addressing

- This is used to uniquely identify a system connected to a network
- There are two popular Ip Addressing formats
    - IP Version 4
    - IP Version 6
- IP v4 address structure:
    - This a 32 bits divided into 4 eight bit Octet (group of eight)
    - IP v4 is represented in a format called as dot-decimal format

```
Binary Value:
10101001.11100011.00011001.11011010
Decimal value: 169.227.25.218
```

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    - ip v4 addresses will be in the following range in dot decimal format

```
0.0.0.0 to 255.255.255.255
```

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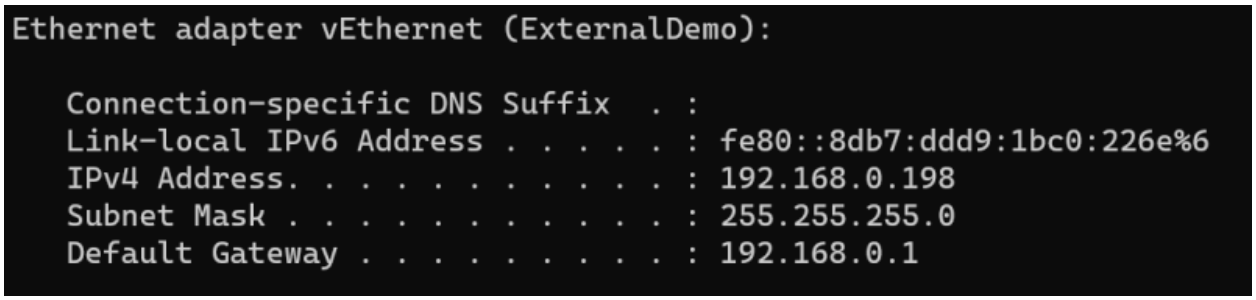
- Using IpV4 to create networks Classfull IP addressing was introduced

Address Class	From	To	Network Addresse	Hosts per network
A	1.0.0.0	126.255.255.255	126	1,67,77,214
B	128.0.0.0	191.255.255.255	16382	65,534
C	192.0.0.0	223.255.255.255	2097150	254
D	224.0.0.0	239.255.255.255	Reserved for multicasting	
E	240.0.0.0	254.255.255.255	Experimental and research	

- IP Address:



- IP Address is combination of two addresses network id and host id. Just by looking at ip address we cannot specify what is network id and what is host id

```
ip: 192.168.0.10
```

- To determine network id and host id we need subnet mask

```
ip: 192.168.0.10
sm: 255.255.0.0
nid: 192.168.0.0
hid: 0.10
network size => number of hosts that can be
connected to this network
hid size => 2 octets => 16 bits => 2^16-2 (one
for network id and one for broadcast address)
=> 65536-2 => 65534
```

```
ip: 10.11.25.10
sm: 255.255.255.0
nid: 10.11.25.0
hid: 10
```

```
network size => 1 octet => 2^8-2 => 254
```

```
ip: 172.16.0.9
sm: 255.255.255.0
nid: 172.16.0
hid: 9
network size=> 1 octet => 8 positions => 2^8-2
=> 256-2 =>254
```

- If we follow this convention we have 3 possible networks

```
network 1 SM => 255.255.255.0 => Network size =
254
network2 SM => 255.255.0.0 => 65534
network 3 SM => 255.0.0.0 => 16777214
```

- Scenario: In my office network i want to connect 500 devices
    - So as per the above ip addressing you have to go with network 2 which is of size 65534 whereas we require only 500 devices
    - Other approach can be create two networks of size 254 each
- Now Lets under CIDR (Classless Interdomain routing) addressing scheme
- Till now we are looking at SM octets as decimal, if we start looking at SM as binary numbers

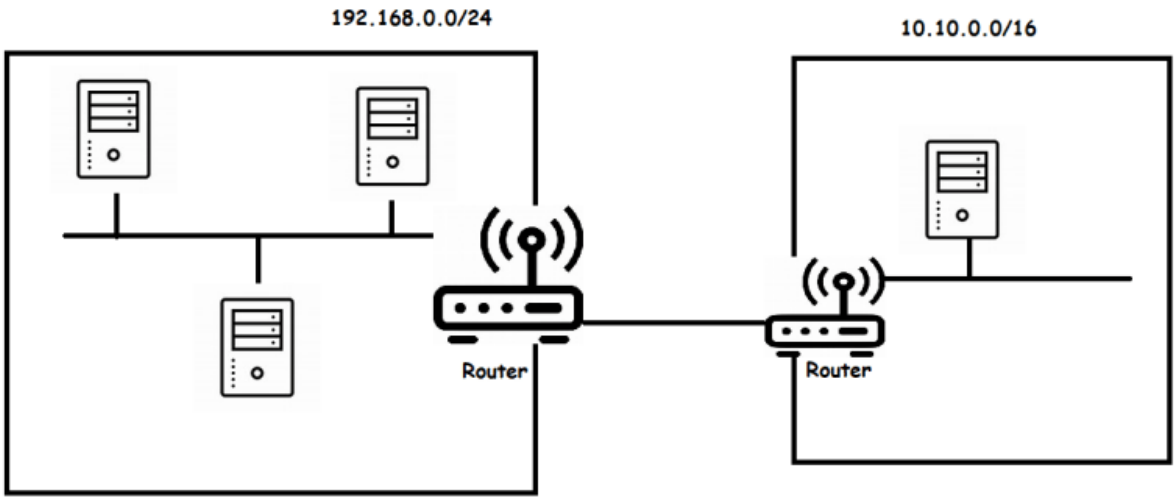
```
ip: 192.168.0.10
SM => 11111111.11111111.11111111.00000000
n/w size => 2^8-2 = 254
```

```
cidr => 192.168.0.10/24

ip: 192.168.0.10
SM => 11111111.11111111.11111110.00000000 =>
255.255.254.0
n/w size => 2^9-2 => 512-2 => 510
cidr => 192.168.0.10/23

ip: 192.168.0.10
SM => 11111111.11111111.11111000.00000000 =>
255.255.248.0
n/w size => 2^11-2 => 2048-2 => 2046
cidr => 192.168.0.10/21


ip: 192.168.34.193
SM: 255.255.255.240
SM: 11111111.11111111.11111111.11110000
n/w => 2^4-2 =>14
cidr: 192.168.34.193/28
```

- How does two systems in a network know that they belong to the same network?

- Two systems are considered to be in a same network when their n/w id is same

- Basic Networking rule: A system can communicate with other systems in the same network. Network packets can travel only with in a network
- Two networks cannot communicate directly, we need a router to forward packets from one network to other



- In the ip config we have the default gateway is the ip address of the router.