



Data communication and Networks

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Experiment- 4

- ❖ Quick recap on IP Addressing
- ❖ Subnetting and
- ❖ Supernetting

Experiment- 4

An IP address is a unique identifier assigned to each device connected to a network, used for communication between devices over an IP-based network

IPv4 Address Structure:

IPv4 addresses are 32 bits long and written in dotted decimal notation like this: 192.168.1.1

IPv4 Addresses

❖ IPv4 addresses are divided into **two parts**:

❖ **Network portion**: Identifies the network.

❖ **Host portion**: Identifies the specific device on the network.

IPv4 Classful Addressing

	First byte	Second byte	Third byte	Fourth byte
Class A	0			
Class B	10			
Class C	110			
Class D	1110			
Class E	1111			

a. Binary notation

	First byte	Second byte	Third byte	Fourth byte
Class A	0–127			
Class B	128–191			
Class C	192–223			
Class D	224–239			
Class E	240–255			

b. Dotted-decimal notation

Class	Binary	Dotted-Decimal	CIDR
A	11111111 00000000 00000000 00000000	255.0.0.0	/8
B	11111111 11111111 00000000 00000000	255.255.0.0	/16
C	11111111 11111111 11111111 00000000	255.255.255.0	/24

Default masks for classful addressing

IPv4 Usable Addressing

- ❖ The **first** address of a subnetwork is reserved as the **network address**, used to identify the entire network.
- ❖ The **last** address is designated as the **broadcast address**, which enables communication with all devices in the subnetwork.
- ❖ The addresses **between the network and broadcast addresses are the usable addresses** assigned to devices within the subnetwork

IPv4 *Addresses for private networks*

<i>Range</i>			<i>Total</i>
10.0.0.0	to	10.255.255.255	2^{24}
172.16.0.0	to	172.31.255.255	2^{20}
192.168.0.0	to	192.168.255.255	2^{16}

Purpose:

- ❖ These addresses are reserved for use within private networks.
- ❖ They are not routable on the public internet, meaning devices with private IP addresses need to use a router or a NAT (Network Address Translation) device to communicate with external networks.

IPv4 Loopback Address

Example:

```
ping 127.0.0.1  
ping localhost
```

Address Range: 127.0.0.1 to 127.255.255.254

Purpose:

- ❖ The loopback address is used to test the local network interface.
- ❖ When a device sends data to this address, it is routed back to itself.
- ❖ This is commonly used for testing software and network configurations on a local machine.

Subnetting

- ❖ It is the process of **dividing a large network into smaller subnetworks (subnets)**.
- ❖ This helps **optimize IP address allocation** and improves network performance and security.

Subnetting

- ❖ Subnetting involves modifying the **subnet mask** to **borrow bits from the host portion** to create more subnets.
- ❖ The **subnet mask** determines which part of the IP address belongs to the network and which part belongs to the host.

Example of Subnetting

- ❖ Consider the IP address **192.168.1.0/24**, which has **254 available host addresses** (since the default subnet mask is **/24**, allowing for 8 bits for hosts).
- ❖ If we want to create **four subnets**, we need to **borrow 2 bits from the host portion**.
- ❖ The new subnet mask becomes 255.255.255.**192** or **/26**

Example of Subnetting

The network is divided as:

Subnet 1:

192.168.1.0/26 (hosts: 192.168.1.1 - 192.168.1.62)

Subnet 2:

192.168.1.64/26 (hosts: 192.168.1.65 - 192.168.1.126)

Subnet 3:

192.168.1.128/26 (hosts: 192.168.1.129 - 192.168.1.190)

Subnet 4:

192.168.1.192/26 (hosts: 192.168.1.193 - 192.168.1.254)

Supernetting

- ❖ Supernetting (or route aggregation) is the opposite of subnetting.
- ❖ It involves combining multiple contiguous networks into a larger network, which reduces the size of the routing table and improves routing efficiency.

Example of Supernetting

❖ Consider you have four Class C networks:

192.168.0.0/24

192.168.1.0/24

192.168.2.0/24

192.168.3.0/24

To supernet these into a single large network, you can **combine them into a /22** network, using the subnet mask 255.255.**252**.0.

The network range becomes **192.168.0.0 to 192.168.3.255.**

Example of Supernetting

❖ Benefits of supernetting:

Old routing table:

192.168.0.0/24

192.168.1.0/24

192.168.2.0/24

192.168.3.0/24

New routing table after supernetting:

192.168.0.0 /22