

Assignment 4

Name: Kshitij Chandrakar

Batch: 5

SAP: 500124827

Theory

1. IP Addressing Basics

IPv4 and IPv6 Addressing

- **IPv4 (Internet Protocol Version 4):**
 - Uses a 32-bit addressing scheme
 - allows around 4.3 billion unique addresses
 - written in decimal format, separated by dots (For Ex: 192.168.1.1)
- **IPv6 (Internet Protocol Version 6):**
 - Uses a 128-bit addressing scheme
 - written in hexadecimal format, separated by colons (For Ex: 1011:09pa:00a2:0000:0000:9fe3:9102:4332).

Public vs. Private IP Addresses

- **Public IP Addresses:**
 - Routable on the internet and assigned by ISPs (For Ex 8.8.8.8).
- **Private IP Addresses:**
 - Used within local networks and not routable on the internet.
Their Address Ranges are:
 - Class A: 10.0.0.0 – 10.255.255.255
 - Class B: 172.16.0.0 – 172.31.255.255
 - Class C: 192.168.0.0 – 192.168.255.255

Subnet Masks

- A subnet mask defines the network and host portions of an IP address.
- For Ex: 255.255.0.0 indicates that the first two octets represent the network portion,

and the last two octet represents hosts.

2. Subnetting

CIDR Notation and Its Role in Subnetting:

- CIDR: Classless Inter-Domain Routing
- A method to allocate IP addresses efficiently by eliminating the rigid class-based addressing system.
- Expressed using a suffix (For Ex: 192.168.1.0/24 means 24 bits for the network, 8 bits for hosts).
- Subnetting allows networks to be divided into smaller subnetworks, improving security and reducing IP wastage.
- Example: Splitting 192.168.1.0/24 into four subnets:
 - 192.168.1.0/26
 - 192.168.1.64/26
 - 192.168.1.128/26
 - 192.168.1.192/26

3. Supernetting

Definition and Advantages:

- Supernetting: The process of combining multiple smaller networks into a larger one by modifying the subnet mask.
- Reduces the number of routing table entries, improving efficiency.
- Helps ISPs aggregate multiple customer networks.

Real-World Applications:

- Used in ISP route aggregation to reduce the number of advertised routes.
- Helps in enterprise network management by consolidating multiple subnets.
- Example: Combining four /26 networks (192.168.1.0/26, 192.168.1.64/26, 192.168.1.128/26, 192.168.1.192/26) into a single /24 network (192.168.1.0/24).

Practical

1. Subnetting a Corporate Network

Departments:

1. HR: 50 Hosts
2. IT: 100 Hosts

3. Finance: 30 Hosts

Subnets Sizes

Subnets Are Sized by Powers of 2. Therefore nearest power of 2 for each department.
Subnets are determined by the formula:

Subnet = 32 - Number of Bits

1. HR: 64 [6 Bits, /26 Subnet]
2. IT: 128 [7 Bits, /25 Subnet]
3. Finance: 32 [5 Bits, /27 Subnet]

Subnet Assignment:

(Allocating Sequentially We Have)

1. IT (/25)

- Network Address: 192.168.1.0/25
- Broadcast Address: 192.168.1.127
- Subnet Mask: 255.255.255.128
- Usable IPs: 192.168.1.1 – 192.168.1.126

2. HR (/26)

- Network Address: 192.168.1.128/26
- Broadcast Address: 192.168.1.191
- Subnet Mask: 255.255.255.192
- Usable IPs: 192.168.1.129 – 192.168.1.190

3. Finance (/27)

- Network Address: 192.168.1.192/27
- Broadcast Address: 192.168.1.223
- Subnet Mask: 255.255.255.224
- Usable IPs: 192.168.1.193 – 192.168.1.222

2. Subnetting an ISP Network

Supernetting combines multiple contiguous networks into a single network. This reduces the number of routing table entries, Thus improving efficiency.

Given Networks:

- 192.168.10.0/24
- 192.168.11.0/24
- 192.168.12.0/24

- 192.168.13.0/24

Finding Common Bits in the Network Address

Since the subnet is /24, the third octet changes and is relevant. Thus, we find common bits in the third octet.

Given Values in 8 Bits:

- 10 : 00001010
- 11 : 00001011
- 12 : 00001100
- 13 : 00001101

We can See here, that only the last 6 bits remain constant. thus, to include all 4 networks we need a /22 Mask. *(16 + 6 = 22) 16 for the first 2 octets, 6 for the 3rd one*

New Network addresses

Since the new Subnet mask is /22, The Network Address 192.168.10.0/22 would cover all the four networks.

Advantages

- For the router, it reduces the number of entries in the routing table. (from 4 /24 Entries to 1 /22)
- The lower entry count improves efficiency and simplifies the network Management for Larger Networks.

3. Subnetting a University Network

Departments:

1. Engineering: 2,000 hosts
2. Medical: 1,500 hosts
3. Management: 1,000 hosts
4. Library: 500 hosts
5. Admin: 300 hosts

Subnets Sizes

Subnets Are Sized by Powers of 2. Therefore nearest power of 2 for each department. Subnets are determined by the formula:

Number of Bits are the nearest larger power of 2.

Subnet = 32 - Number of Bits

1. Engineering: 2048 [11 Bits, /21 Subnet]
2. Medical: 2048 [11 Bits, /21 Subnet]
3. Management: 1024 [10 Bits, /22 Subnet]
4. Library: 512 [9 Bits, /23 Subnet]
5. Admin: 512 [9 Bits, /23 Subnet]

Subnet Assignment:

(Allocating Sequentially We Have)

1. Engineering (/21)

- Network Address: 172.16.0.0/21
- Broadcast Address: 172.16.7.255
- Usable IPs: 172.16.0.1 – 172.16.7.254
- Subnet Mask: 255.255.248.0

2. Medical (/21)

- Network Address: 172.16.8.0/21
- Broadcast Address: 172.16.15.255
- Usable IPs: 172.16.8.1 – 172.16.15.254
- Subnet Mask: 255.255.248.0

3. Management (/22)

- Network Address: 172.16.16.0/22
- Broadcast Address: 172.16.19.255
- Usable IPs: 172.16.16.1 – 172.16.19.254
- Subnet Mask: 255.255.252.0

4. Library (/23)

- Network Address: 172.16.20.0/23
- Broadcast Address: 172.16.21.255
- Usable IPs: 172.16.20.1 – 172.16.21.254
- Subnet Mask: 255.255.254.0

5. Admin (/23)

- Network Address: 172.16.22.0/23
- Broadcast Address: 172.16.23.255
- Usable IPs: 172.16.22.1 – 172.16.23.254
- Subnet Mask: 255.255.254.0