Assignment 2: Subnetting Exercise

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Introduction

In this exercise, I will undertake the task of subnetting a Class C network and applying Fixed Length Subnet Masking (FLSM) to various IP address scenarios. By systematically deriving subnet details such as network addresses, usable IP ranges, and broadcast addresses, I aim to achieve an optimized and secure network segmentation. This approach not only ensures efficient IP address utilization but also enhances network performance and security.

Through this hands-on exercise, I intend to demonstrate the practical applications of subnetting techniques, highlighting their significance in the design and management of robust network infrastructures.

Part 1.

Subnetting a Class C Network

To subnet the given Class C network 192.168.5.0/24 into 5 subnets with specific host requirements, we need to calculate the subnet sizes based on the number of hosts required for each subnet and then allocate the subnets accordingly.

The given requirements are**:**

- **Net A**: 14 hosts
- **Net B**: 28 hosts
- **Net C**: 2 hosts
- **Net D**: 7 hosts
- **Net E**: 28 hosts

We must also note that when allocating subnets, the subnet masks should generally stay the same or increase (i.e., fewer host bits or more subnet bits) as you move to new subnets, rather than decrease. This is to ensure we don't overlap and we only increase the subnet mask length as we move forward.

To begin the calculation, we'll start with Net B because it requires the largest number of hosts.

- **Formula = Number of hosts per subnet = 2^h - 2 (where n is the number of host bits).**

1. **Net B** hosts = 28
   - Hosts required: 28
   - Formula: 2^h - 2 >= 28

- 2^5 = 32 – 2 = 30. 30 is > 28 therefore, we need 5 bits for hosts, and the subnet mask is /27 (because 32 - 5 = 27).

Therefore, this is how addresses will be allocated for **Net B:**

- **Network Address:** 192.168.5.0
- **First Usable IP:** 192.168.5.1
- **Last Usable IP:** 192.168.5.30
- **Broadcast Address:** 192.168.5.31
- **Hosts per Subnet**: 30

2. **Net E** hosts = 28
   - Hosts required: 28
   - Formula: 2^h - 2 >= 28
   - 2^5 = 32 – 2 = 30. 30 is > 28 therefore, we need 5 bits for hosts, and the subnet mask is /27 (because 32 - 5 = 27).

Therefore, this is how addresses will be allocated for **Net E:**

- **Subnet Mask**: /27
- **Network Address:** 192.168.5.32
- **First Usable IP:** 192.168.5.33
- **Last Usable IP:** 192.168.5.62
- **Broadcast Address:** 192.168.5.63
- **Hosts per Subnet:** 30

3. **Net A** = 14 hosts
   - Hosts required: 14
   - Formula: 2^h - 2 >= 14
   - Solve: 2^4 - 2 = 16 - 2 = 14
   - Therefore, we need 4 bits for hosts, and the subnet mask is /28 (because 32 - 4 = 28).

Therefore, this is how addresses will be allocated for **Net A:**

- **Subnet Mask:** /28
- **Network Address:** 192.168.5.64
- **First Usable IP:** 192.168.5.65
- **Last Usable IP:** 192.168.5.78
- **Broadcast Address:** 192.168.5.79
- **Hosts per Subnet:** 14

4. **Net D = 7 hosts:**

- Hosts required: 7
- Formula: 2^h - 2 >= 7
- Solve: 2^3 - 2 = 8 - 2 = 6 (so we need more bits)
- 2^4 - 2 = 16 - 2 = 14 (works)
- Therefore, we need 4 bits for hosts, and the subnet mask is /28 (because 32 - 4 = 28).

Therefore, this is how addresses will be allocated for **Net D**:

- **Subnet Mask:** /28
- **Network Address:** 192.168.5.80
- **First Usable IP:** 192.168.5.81
- **Last Usable IP:** 192.168.5.94
- **Broadcast Address:** 192.168.5.95
- **Hosts per Subnet:** 14

Net C = 2 hosts:

- Hosts required: 2
- Formula: 2^h - 2 >= 2
- Solve: 2^2 - 2 = 4 - 2 = 2
- Therefore, we need 2 bits for hosts, and the subnet mask is /30 (because 32 - 2 = 30).

Therefore, this is how addresses will be allocated for **Net C:**

- **Subnet Mask**: /30
- **Network Address**: 192.168.5.96
- **First Usable IP**: 192.168.5.97
- **Last Usable IP**: 192.168.5.98
- **Broadcast Address**: 192.168.5.99
- **Hosts per Subnet**: 2

Part 2.

Fixed Length Subnetting (FLSM)

For each of the following IP addresses, I carried out fixed length subnetting (FLSM) by applying the given subnet mask and utilizing additional masking bits borrowed from the default subnet mask. I determined the number of possible subnets per the given network ID but I've only stated the first three subnets, where possible. Additionally, in every subnet, I've determined the number of hosts, network address/ID, first and last usable IP, and the broadcast address.

a) 192.168.10.0 /25

Subnet Mask: 255.255.255.128 (/25)

Number of Subnets: 2 (because 1 bit borrowed, 2^1 = 2)

Hosts per Subnet: 126 (2^7 - 2 = 126)

Subnet 1:

- **Network Address:** 192.168.10.0
- **First Usable IP**: 192.168.10.1
- **Last Usable IP**: 192.168.10.126
- **Broadcast Address**: 192.168.10.127

Subnet 2:

- **Network Address:** 192.168.10.128
- **First Usable IP**: 192.168.10.129
- **Last Usable IP**: 192.168.10.254
- **Broadcast Address**: 192.168.10.255

b) 192.168.10.0 /28

Subnet Mask: 255.255.255.240 (/28)

Number of Subnets: 16 (because 4 bits borrowed, 2^4 = 16)

Hosts per Subnet: 14 (2^4 - 2 = 14)

Subnet 1:

- **Network Address:** 192.168.10.0
- **First Usable IP**: 192.168.10.1
- **Last Usable IP**: 192.168.10.14
- **Broadcast Address:** 192.168.10.15

Subnet 2:

- **Network Address:** 192.168.10.16
- **First Usable IP**: 192.168.10.17
- **Last Usable IP**: 192.168.10.30
- **Broadcast Address:** 192.168.10.31

Subnet 3:

- Network Address: 192.168.10.32
- **First Usable IP**: 192.168.10.33
- **Last Usable IP**: 192.168.10.46
- **Broadcast Address**: 192.168.10.47

c) 10.0.0.0 /30

Subnet Mask: 255.255.255.252 (/30)

Number of Subnets: 64 (because 6 bits borrowed, 2^6 = 64)

Hosts per Subnet: 2 (2^2 - 2 = 2)

Subnet 1:

- **Network Address:** 10.0.0.0
- **First Usable IP**: 10.0.0.1
- **Last Usable IP:** 10.0.0.2
- **Broadcast Address:** 10.0.0.3

Subnet 2:

- **Network Address:** 10.0.0.4
- **First Usable IP:** 10.0.0.5
- **Last Usable IP:** 10.0.0.6
- **Broadcast Address**: 10.0.0.7

Subnet 3:

- **Network Address:** 10.0.0.8
- **First Usable IP**: 10.0.0.9
- **Last Usable IP:** 10.0.0.10
- **Broadcast Address:** 10.0.0.11

d) 10.0.0.0 /16

Subnet Mask: 255.255.0.0 (/16)

Number of Subnets: 1 (No bits borrowed, 2^0 = 1)

Hosts per Subnet: 65534 (2^16 - 2 = 65534)

Subnet 1:

- **Network Address:** 10.0.0.0
- **First Usable IP**: 10.0.0.1
- **Last Usable IP:** 10.0.255.254
- **Broadcast Address**: 10.0.255.255

e) 172.16.0.0 /30

Subnet Mask: 255.255.255.252 (/30)

Number of Subnets: 1024 (because 10 bits borrowed, 2^10 = 1024)

Hosts per Subnet: 2 (2^2 - 2 = 2)

Subnet 1:

- **Network Address:** 172.16.0.0
- **First Usable IP**: 172.16.0.1
- **Last Usable IP:** 172.16.0.2
- **Broadcast Address**: 172.16.0.3

Subnet 2:

- **Network Address:** 172.16.0.4
- **First Usable IP**: 172.16.0.5
- **Last Usable IP**: 172.16.0.6
- **Broadcast Address**: 172.16.0.7

Subnet 3:

- **Network Address**: 172.16.0.8
- **First Usable IP**: 172.16.0.9
- **Last Usable IP**: 172.16.0.10
- **Broadcast Address:** 172.16.0.11

f) 172.16.0.0 /17

Subnet Mask: 255.255.128.0 (/17)

Number of Subnets: 32768 (because 15 bits borrowed, 2^15 = 32678)

Hosts per Subnet: 32766 (2^15 - 2 = 32766)

Subnet 1:

- **Network Address:** 172.16.0.0
- **First Usable IP:** 172.16.0.1
- **Last Usable IP:** 172.16.127.254
- **Broadcast Address:** 172.16.127.255

Subnet 2:

- **Network Address:** 172.16.128.0
- **First Usable IP:** 172.16.128.1
- **Last Usable IP:** 172.16.255.254
- **Broadcast Address:** 172.16.255.255

Subnet 3:

- **Network Address:** 172.17.0.0

- **First Usable IP:** 172.17.0.1
- **Last Usable IP:** 172.17.127.254
- **Broadcast Address:** 172.17.127.255

Conclusion

In conclusion, subnetting is a fundamental aspect of network design and management, allowing for efficient utilization of IP address space while facilitating effective communication and resource allocation. Through this exercise, I've demonstrated the process of subnetting a Class C network and performing Fixed Length Subnetting (FLSM) for various network IDs.

By subnetting a Class C network into five subnets and allocating IP addresses accordingly, I've ensured optimal utilization of resources while maintaining scalability and flexibility. Additionally, through FLSM calculations for different network IDs, I've illustrated how subnet masks and additional bits can be utilized to create multiple subnets with varying numbers of hosts.