Lab Task 10 i221169

Question:01

- **IP address**: 172.168.1.0
- **Number of required hosts**: 160 hosts per subnet
- **Number of required subnets**: 60 subnets

Step 1: Identify the class of the IP address

- The IP address `172.168.1.0` belongs to **Class B** (as the first octet is between 128 and 191).
- The default subnet mask for **Class B** is: `255.255.0.0` Binary: `11111111.11111111.00000000.00000000`

Step 2: Calculate the upper bound for hosts and subnets

1. **Required hosts**: 160 hosts per subnet
    - The closest power of 2 that provides at least 160 usable IP addresses is `2^8 = 256`.
    - Subtract 2 for network and broadcast addresses: `256 - 2 = 254` usable hosts, which satisfies the requirement of 160 hosts.
2. **Required subnets**: 60 subnets
    - The closest power of 2 that provides at least 60 subnets is `2^6 = 64`.

Step 3: Check if subnetting is possible

- **Upper bound for hosts and subnets**:

  `2^8` (hosts) x `2^6` (subnets) = `2^14 = 16,384` total addresses.
- **Total available addresses for Class B**:

`2^16 = 65,536` total addresses in a Class B network.

Since `16,384` is less than `65,536`, subnetting is possible.

Step 4: Borrow bits from the host octets

- We will borrow 6 bits from the host portion to create the required subnets.
- **Starting with the default subnet mask**:

  `255.255.0.0` (binary: `11111111.11111111.00000000.00000000`)
- **Borrow 6 bits for subnets**:

  New subnet mask:

  `255.255.252.0` (binary: `11111111.11111111.11111100.00000000`)

Step 5: Calculate the number of zeros left

- In the new subnet mask, we have **10 zeros** left in the last octet, representing the host portion.
- **Number of hosts per subnet**: `2^10 = 1024` total addresses per subnet.Subtracting 2 for network and broadcast addresses: `1024 - 2 = 1022` usable IP addresses per subnet (more than enough for the requirement of 160 hosts).

Step 6: Determine the subnet ranges

The third octet will increment by **4** for each subnet (since `2^6 = 64 subnets` and `256 / 64 = 4`).

Now, we create the subnets:

1. **First subnet**:
   - Network Address: `172.168.0.0`
   - Range: `172.168.0.0 - 172.168.3.255`
   - Broadcast Address: `172.168.3.255`
2. **Second subnet**:
   - Network Address: `172.168.4.0`

- Range: `172.168.4.0 - 172.168.7.255`
- Broadcast Address: `172.168.7.255`

3. **Third subnet**:
   - Network Address: `172.168.8.0`
   - Range: `172.168.8.0 - 172.168.11.255`
   - Broadcast Address: `172.168.11.255`
4. **Fourth subnet**:
   - Network Address: `172.168.12.0`
   - Range: `172.168.12.0 - 172.168.15.255`
   - Broadcast Address: `172.168.15.255`
5. **Fifth subnet**:
   - Network Address: `172.168.16.0`
   - Range: `172.168.16.0 - 172.168.19.255`
   - Broadcast Address: `172.168.19.255`

... and so on, continuing until the 60 subnets are created.

Step 7: Determine which subnet contains the given IP address (172.168.1.0)

- The IP address `172.168.1.0` falls within the **first subnet**, which has a range of `172.168.0.0 - 172.168.3.255`.

Final Answer:

- **Network Address of containing subnet**: `172.168.0.0`
- **Range of containing subnet**: `172.168.0.0 - 172.168.3.255`
- **Broadcast Address**: `172.168.3.255`
- **Subnet Mask**: `255.255.252.0`

Question:02

- **IP address**: 10.10.20.0
- **Number of required hosts**: 100 hosts per subnet
- **Number of required subnets**: 100 subnets

Step 1: Identify the class of the IP address

- The IP address `10.10.20.0` belongs to **Class A** (since the first octet is between 1 and 126).
- The default subnet mask for **Class A** is: `255.0.0.0`Binary: `11111111.00000000.00000000.00000000`

Step 2: Calculate the upper bound for hosts and subnets

1. **Required hosts**: 100 hosts per subnet
    - The closest power of 2 that provides at least 100 usable IP addresses is `2^7 = 128`.
    - Subtract 2 for network and broadcast addresses: `128 - 2 = 126` usable hosts, which satisfies the requirement of 100 hosts.
2. **Required subnets**: 100 subnets
    - The closest power of 2 that provides at least 100 subnets is `2^7 = 128`.

Step 3: Check if subnetting is possible

- **Upper bound for hosts and subnets**:

  `2^7` (hosts) x `2^7` (subnets) = `2^14 = 16,384` total addresses.
- **Total available addresses for Class A**:

  `2^24 = 16,777,216` total addresses in a Class A network.

Since `16,384` is much smaller than `16,777,216`, subnetting is possible.

Step 4: Borrow bits from the host octets

- We need 7 bits for subnets (to create 128 subnets), and 7 bits for hosts (to provide 126 usable hosts).
- **Starting with the default subnet mask**:

  `255.0.0.0` (binary: `11111111.00000000.00000000.00000000`)
- **Borrow 7 bits for subnets**:

  New subnet mask:

  `255.255.255.128` (binary: `11111111.11111111.11111111.10000000`)

Step 5: Calculate the number of zeros left

- In the new subnet mask, we have **7 zeros** left in the last octet, representing the host portion.
- **Number of hosts per subnet**: `2^7 = 128` total addresses per subnet.Subtracting 2 for network and broadcast addresses: `128 - 2 = 126` usable IP addresses per subnet (more than enough for the requirement of 100 hosts).

Step 6: Determine the subnet ranges

The fourth octet will increment by **128** for each subnet (since `2^7 = 128 subnets`).

Now, we create the subnets:

1. **First subnet**:
   - Network Address: `10.10.20.0`
   - Range: `10.10.20.0 - 10.10.20.127`
   - Broadcast Address: `10.10.20.127`
2. **Second subnet**:
   - Network Address: `10.10.20.128`
   - Range: `10.10.20.128 - 10.10.20.255`
   - Broadcast Address: `10.10.20.255`
3. **Third subnet**:
   - Network Address: `10.10.21.0`

- Range: `10.10.21.0 - 10.10.21.127`
- Broadcast Address: `10.10.21.127`

4. **Fourth subnet**:
   - Network Address: `10.10.21.128`
   - Range: `10.10.21.128 - 10.10.21.255`
   - Broadcast Address: `10.10.21.255`

... and so on, continuing until the 100 subnets are created.

Step 7: Determine which subnet contains the given IP address (10.10.20.0)

- The IP address `10.10.20.0` falls within the **first subnet**, which has a range of `10.10.20.0 - 10.10.20.127`.

Final Answer:

- **Network Address of containing subnet**: `10.10.20.0`
- **Range of containing subnet**: `10.10.20.0 - 10.10.20.127`
- **Broadcast Address**: `10.10.20.127`
- **Subnet Mask**: `255.255.255.128`

Question:03

- **IP address**: `192.168.29.1`
- **Number of required hosts**: 100 hosts per subnet
- **Number of required subnets**: 60 subnets

Step 1: Identify the class of the IP address

- The IP address `192.168.29.1` belongs to **Class C** (since the first octet is between 192 and 223).
- The default subnet mask for **Class C** is: `255.255.255.0`Binary: `11111111.11111111.11111111.00000000`

Step 2: Calculate the upper bound for hosts and subnets

1. **Required hosts**: 100 hosts per subnet
    - The closest power of 2 that provides at least 100 usable IP addresses is `2^7 = 128`.
    - Subtract 2 for network and broadcast addresses: `128 - 2 = 126` usable hosts, which satisfies the requirement of 100 hosts.
2. **Required subnets**: 60 subnets
    - The closest power of 2 that provides at least 60 subnets is `2^6 = 64`.

Step 3: Check if subnetting is possible

- **Upper bound for hosts and subnets**:

  `2^7` (hosts) x `2^6` (subnets) = `2^13 = 8192` total addresses.
- **Total available addresses for Class C**:

  `2^8 = 256` total addresses in the last octet for a Class C network.

Since `8192` is much larger than `256`, subnetting is not possible.

Question:04

- **IP address**: `220.162.49.1`
- **Number of required hosts**: 30 hosts per subnet
- **Number of required subnets**: 60 subnets

Step 1: Identify the class of the IP address

- The IP address `220.162.49.1` belongs to **Class C** (since the first octet is between 192 and 223).
- The default subnet mask for **Class C** is: `255.255.255.0`Binary: `11111111.11111111.11111111.00000000`

Step 2: Calculate the upper bound for hosts and subnets

1. **Required hosts**: 30 hosts per subnet
   - The closest power of 2 that provides at least 30 usable IP addresses is `2^5 = 32`.
   - Subtract 2 for network and broadcast addresses: `32 - 2 = 30` usable hosts, which exactly satisfies the requirement of 30 hosts.
2. **Required subnets**: 60 subnets
   - The closest power of 2 that provides at least 60 subnets is `2^6 = 64`.

Step 3: Check if subnetting is possible

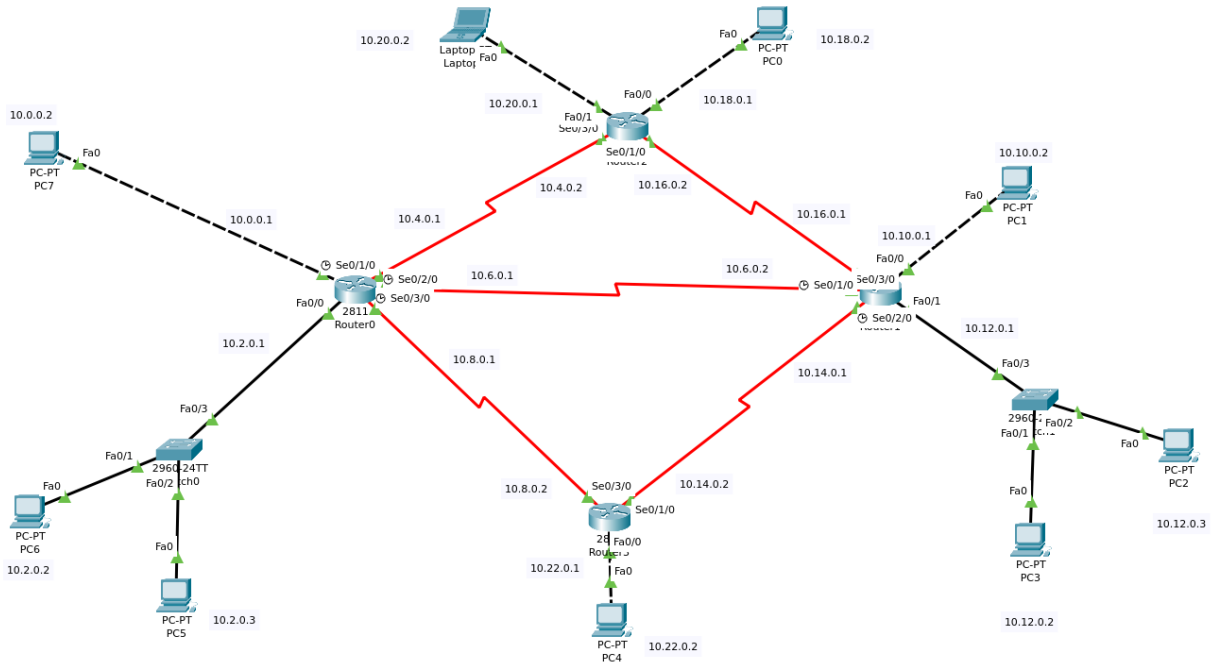
- **Upper bound for hosts and subnets**:

  `2^5` (hosts) x `2^6` (subnets) = `2^11 = 2048` total addresses.
- **Total available addresses for Class C**:

  `2^8 = 256` total addresses in the last octet for a Class C network.

Since `2048` is much larger than `256`, subnetting is not possible.

Lab Task Topology


10.20.0.2
Laptop
Fa0
Fa0
PC-PT
PC0
10.18.0.2
10.20.0.1
10.18.0.1
Fa0/0
Fa0/1
Se0/1/0
10.0.0.2
PC-PT
PC7
Fa0
10.0.0.1
10.4.0.2
10.16.0.2
10.4.0.1
10.16.0.1
10.10.0.2
Fa0
PC-PT
PC1
10.10.0.1
Fa0/0
Se0/1/0
Se0/2/0
Se0/3/0
10.6.0.1
10.6.0.2
Fa0/0
2811
Router0
Se0/3/0
Fa0/1
Se0/2/0
10.12.0.1
10.2.0.1
10.8.0.1
10.14.0.1
Fa0/3
Fa0/3
Fa0/1
Fa0/2
Fa0
PC-PT
PC2
Fa0
Fa0
Se0/3/0
Se0/1/0
10.8.0.2
10.14.0.2
Fa0
PC-PT
PC6
10.2.0.2
Fa0
Fa0/0
10.22.0.1
Fa0
PC-PT
PC3
10.12.0.3
PC-PT
PC5
10.2.0.3
PC-PT
PC4
10.22.0.2
10.12.0.2