Sri Lanka Institute of Information Technology

Computer Networks 2nd Year, 1st Semester 2020

Tutorial 3 – VLSM and IPv6

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01. An ISP supplies a class C network of 195.100.50.0 to an enterprise that requires 5 networks each to support 12 users and 4 networks supports 2 usable IP addresses.

    a. What is the subnet mask that would be configured in each workstation?

    For a class C network (195.100.50.0), the default subnet mask is 255.255.255.0.
    Since you need 5 networks with 12 users each and 4 networks with 2 usable IP addresses, you need to subnet further.

    For 5 networks with 12 users each:

    You need to accommodate at least 12 users per subnet, which requires at least 4 bits for hosts (2^4= 16, where 2 addresses are reserved for network and broadcast).
    So, the subnet mask for these networks would be 255.255.255.240 (/28 in CIDR notation).

    For 4 networks with 2 usable IP addresses each:

    You need at least 2 usable IP addresses per subnet, which requires at least 2 bits for hosts (2^2 = 4, where 2 addresses are reserved for network and broadcast).
    So, the subnet mask for these networks would be 255.255.255.252 (/30 in CIDR notation).

    b. Identify the sub-network addresses.

    For the /28 subnets:

    195.100.50.0/28
    195.100.50.16/28
    195.100.50.32/28
    195.100.50.48/28
    195.100.50.64/28

For the /30 subnets:
195.100.50.80/30
195.100.50.84/30
195.100.50.88/30
195.100.50.92/30

c. Calculate the WAN Link addresses.

WAN links typically use a point-to-point connection, which means they need only two usable IP addresses.

- **195.100.50.81 & 195.100.50.82**
- **195.100.50.85 & 195.100.50.86**
- **195.100.50.89 & 195.100.50.90**
- **195.100.50.93 & 195.100.50.94**

02. 132.16.128.0/17 main network need to be separated into subnetworks based on the following requirements.

a. 3 subnets with 25 devices each.

To accommodate 25 devices in each subnet, we need to allocate enough host bits to support at least 25 hosts. Since $2^5 = 32$, we need 5 host bits for each subnet to support 25 devices. This leaves us with 10 bits for the sub-network portion.

The subnet mask for the new subnets will be /27 (32 - 5 = 27).
There can be 2^{10} /27 subnetworks.

Subnet 0: 132.16.128.0/27
Subnet 1: 132.16.128.32/27
Subnet 2: 132.16.128.64/27

b. 4 WAN links to inter-connect the sub networks.

Since we need to connect the subnetworks with WAN links, each link will require a separate subnet. Since we have 3 subnets already, we'll need one more subnet for the WAN links.

We can use a /30 subnet for each WAN link, as it provides 2 usable IP addresses (one for each end of the link), which is sufficient for point-to-point connections.

Subnet 3: 132.16.128.96/30
Subnet 4: 132.16.128.100/30
Subnet 5: 132.16.128.104/30
Subnet 6: 132.16.128.108/30

03. An ISP supplies a class B network of 136.210.0.0 to an enterprise that requires ten networks each to support 110 users. What is the network mask that would be configured in each workstation and what would be the NetID, Subnet Number?

Class B Network

- Class B networks have a default subnet mask of 255.255.0.0.
- Class B networks have the first two octets as the network portion, leaving the last two octets for host addressing.

Subnetting

- Allocate 7 bits as host bits as we need only 110 addresses (110 < 128).
- Thus, remaining 9 bits are allocated as subnet bits. (16 – 7 = 9)

Subnet Mask Calculation

- Default Class B mask: 255.255.0.0
- Adding 9 bits for subnetting, so the mask in binary will be 11111111.11111111.11111111.10000000
- Therefore, the subnet mask is 255.255.255.128

Number of Subnets and Hosts

- With 9 bits for subnetting, the number of subnets is 2^9 = 512.
- With 7 bits for hosts, the number of hosts per subnet is 2^7 - 2 = 128 - 2 = 126 (subtracting 2 for network and broadcast addresses).

NetID and Subnet Number Calculation

1. Subnet 0
   - Network Address: 136.210.0.0
   - First Host: 136.210.0.1
   - Last Host: 136.210.0.126
   - Broadcast Address: 136.210.0.127

2. Subnet 1
   - Network Address: 136.210.0.128
   - First Host: 136.210.0.129
   - Last Host: 136.210.0.254

- Broadcast Address: 136.210.0.255

3. Subnet 2
    - Network Address: 136.210.1.0
    - First Host: 136.210.1.1
    - Last Host: 136.210.1.126
    - Broadcast Address: 136.210.1.127

4. Subnet 3
    - Network Address: 136.210.1.128
    - First Host: 136.210.1.129
    - Last Host: 136.210.1.254
    - Broadcast Address: 136.210.1.255

5. Subnet 4
    - Network Address: 136.210.2.0
    - First Host: 136.210.2.1
    - Last Host: 136.210.2.126
    - Broadcast Address: 136.210.2.127

6. Subnet 5
    - Network Address: 136.210.2.128
    - First Host: 136.210.2.129
    - Last Host: 136.210.2.254
    - Broadcast Address: 136.210.2.255

7. Subnet 6
    - Network Address: 136.210.3.0
    - First Host: 136.210.3.1
    - Last Host: 136.210.3.126
    - Broadcast Address: 136.210.3.127

8. Subnet 7
    - Network Address: 136.210.3.128
    - First Host: 136.210.3.129
    - Last Host: 136.210.3.254
    - Broadcast Address: 136.210.3.255

9. Subnet 8
    - Network Address: 136.210.4.0
    - First Host: 136.210.4.1
    - Last Host: 136.210.4.126
    - Broadcast Address: 136.210.4.127

10. Subnet 9
    - Network Address: 136.210.4.128
    - First Host: 136.210.4.129
    - Last Host: 136.210.4.254
    - Broadcast Address: 136.210.4.255

04. Calculate the EUI-64 interface ID for IPv6 address for the following device MAC addresses.

    a. 3463:ADAD:ADAD → **3663:ADFF:FEAD:ADAD**

    b. 2C55:CAFE:ABCD → **2E55:CAFF:FEFE:ABCD**

05. Write the simplified version of the following IPv6 addresses.

    a. 2001:0DB8:85A3:0000:0000:8A2E:0370:7334 →

    2001:DB8:85A3::8A2E:370:7334

    b. 2001:0000:85A3:0000:0000:8A2E:0370:7334 →

    2001:0:85A3::8A2E:370:7334

06. Calculate the original IPv6 address of the following compressed IPv6 addresses.

    - 52:8D30:0:2345::190
        - **0052:8D30:0000:2345:0000:0000:0000:0190**
    - A052:30::3567:0:0:CD9
        - **A052:0030:0000:0000:3567:0000:0000:0CD9**
    - A052:30:3:40:3567:5640::
        - **A052:0030:0003:0040:3567:5640:0000:0000**