CSE 5004

COMPUTER NETWORKS

Digital Assignment – II

B2 | PLB131

WINTER SEMESTER 2020-21

by

SHARADINDU ADHIKARI

19BCE2105

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

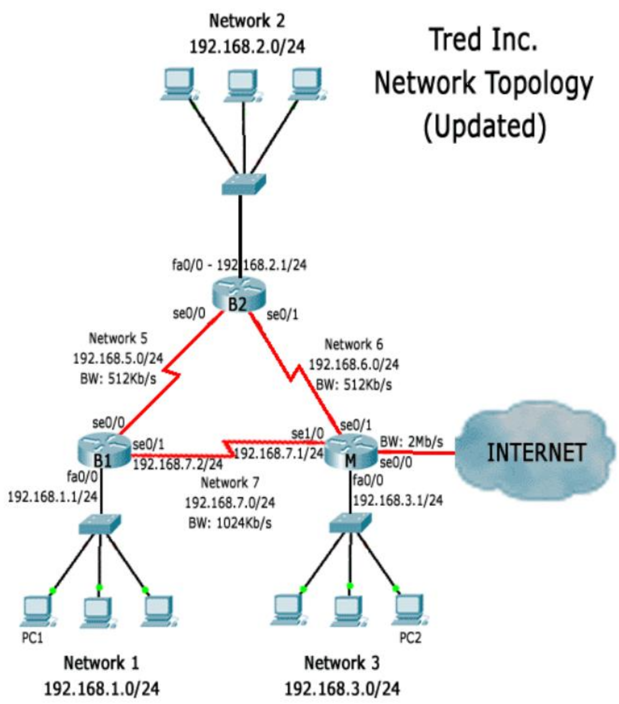
Tred has three departments, each of which is physically different. They are referred to as "networks" from a network perspective. B1 (first branch), B2 (second branch), and Main (third branch) (M).

The main office was the first to be established, and it is linked to the others. The internet. B1 and B2 connect to the Internet through M, as shown in the topology below.

Tred contracted with the telephony company for two 512Kb WAN links to connect all three locations. The first WAN link B1 is connected to B2, and B2 is connected to M and it is connected to the internet through a third 2Mb connection.

A third 1Mb/s connection was hired to provide a second redundant route to M. B1 is now connected by a new connection. M is contacted directly. M is in charge of providing Internet access to all Tred Inc. locations as well as packet routing to and from them. 3rd Network 192.1).

Since the WAN connections are point-to-point, they are actually wasting an entire class C network. Solve the following:-



Question (a)

a. You create a new IP addressing scheme that only uses one class C set to access Tred's entire network. It must ensure that each WAN link has two valid IP addresses and that the networks that support user PCs have 30 valid IP addresses.

Solution:

(a) Tred has 3 departments :

B1 → 1st branch

B2 → 2nd branch

M → 3rd branch

6 Networks : 3 serial links and 3 Ethernet User networks

Serial links : requires 2 valid addresses

Ethernet segments : 30 valid addresses (according to Tred's people).

  sharadindu.adhikari2019@vitstudent.ac.in

Here, we have to use only 1 class C set, such that each WLAN link has 2 valid IP addresses and that the networks that support User PCs will have 30 valid IP addresses.

We've class C block as 192.168.1.0/24 (assume)

With this block we can assign addresses to total 256 devices, and our requirement is $30 \times 3 + 2 \times 3 = 96$.

So requirement can easily be fulfilled with only 1 class C block.

192.168.1.0/24

In each network, total 30 valid addresses. So, 5 bits for hosts required.

So Net id will be of 27 bits.

Subnet mask : 255.255.255.224

$\boxed{B1}$ →

Net Id → 0 0 0 | 0 0 0 0 0 → 192.168.1.0/27

⋮

Broadcast Id → 0 0 0 | 1 1 1 1 1 → 192.168.1.31/27

Valid address range : 192.168.1.1 to 192.168.1.30 (total: 30)

$\boxed{B2}$ →

Net Id → 0 0 1 | 0 0 0 0 0 → 192.168.1.32/27

⋮

Broadcast Id → 0 0 1 | 1 1 1 1 1 → 192.168.1.63/27

© Sharadindu Adhikari, 19BCE2105

sharadindu.adhikari2019@vitstudent.ac.in

valid address range: 192.168.1.33 to 192.168.1.62 (total: 30)

$\boxed{M} \longrightarrow$

Net Id: 0 1 0 | 0 0 0 0 0 → 192.168.1.64/27

Broadcast Id: 0 1 0 | 1 1 1 1 1 → 192.168.1.95/27

valid address range for hosts: 197.168.1.65/27 to 197.168.1.94/27 (total: 30)

For next /27 block, ~~wise~~ we've to divide it for 3 other networks with 2 valid addresses.

· Link from B_1 to B_2 router (2 addresses required)

Net ID: 0 1 1 | 0 0 0 | 0 0
⋮
0 1 1 | 0 0 0 | 1 1

} 4 addresses.

Valid address range for hosts: 192.168.1.97/30 to 192.168.1.98/30 (total: 2)

Link from B1 to M router,

Out of 4 addresses available from 192.168.1.100/30 to 192.168.1.104/30

Here, 192.168.1.101/30 and 192.168.1.102/30 are used.

Link from B2 to M router:

Out of 4 addresses available from 192.168.1.105/30 to 192.168.1.108/30

Here,
192.168.1.106/30 and 192.168.1.107/30 are used for addresses for router interface IP.

In conclusion :-

B1 : 192.168.1.1/27 to 192.168.1.30/27

B2 : 192.168.1.32/27 to 192.168.1.63/27

M : 192.168.1.65/27 to 192.168.1.94/27

B1 → B2 link : 192.168.1.97/30 to 192.168.1.98/30

B1 → M link : 192.168.1.101/30 to 192.168.1.102/30

B2 → M link : 192.168.1.106/30 to 192.168.1.107/30

Question (b)

b. When segmenting a class C network with a /27 subnet mask, how many networks and hosts are possible?

Solution:

(b) /27 mask leads to $2^3 = 8$ sub-networks with $2^5 = 32$ addresses. Only $32-2 = 30$ addresses are valid addresses.

Based on the class C address 192.168.50.0/24 given to Tred, we can create the following sub-networks:

192.168.50.0/27 sub-netted with /27 mask:

1st subnet : 192.168.50.0/27 — 192.168.50.31/27

2nd subnet : 192.168.50.32/27 — 192.168.50.63/27

3rd subnet : 192.168.50.64/27 — 192.168.50.95/27

4th subnet : 192.168.50.96/27 — 192.168.50.127/27

5th subnet : 192.168.50.128/27 — 192.168.50.159/27

6th subnet : 192.168.50.160/27 — 192.168.50.191/27

7th subnet : 192.168.50.192/27 — 192.168.50.223/27

8th subnet : 192.168.50.224/27 — 192.168.50.255/27

Once the subnets are created, we map the first 3 subnets to the 3 Ethernet segments shown on the topology.

The mapping is as follows:

1st subnet (192.168.50.0/27) → Network 1

2nd subnet (192.168.50.32/27) → Network 2

3rd subnet (192.168.50.64/27) → Network 3

Once the Ethernet segments are addressed, it is time to create subnets to be applied to the serial links and we pick one of the unused remaining sub-networks to subnet it again.

We choose the last subnet (192.168.50.224/27) to work with and because the serial link will only have 2 addresses (each end of the point-to-point link) to choose to use a /30 subnet mask.

Question (c)

c. When segmenting a /27 network with a /30 subnet mask, how many networks and hosts are possible?

Solution:

(c) When applied to a /27 mask network, a /30 mask leads to $2^3 = 8$ sub-networks, with, $2^2 =$ 4 addresses each (only 2 of these 4 addresses are valid).

∴ No. of hosts per network = 2.

By working with a /30 subnet mask, we achieve 4 addresses per network: the 1st address is the network address and can't be assigned to devices. The 2nd and 3rd addresses are valid and can be assigned to devices. The 4th address is the broadcast address and can't be assigned to devices.

We subnet the last /27 subnet and document the result as follows:

192.168.50.224/27 sub-netted using /30 mask:

1st subnet: 192.168.50.224/30 — 192.168.50.227/30.

2nd subnet: 192.168.50.228/30 — 192.168.50.231/30

3rd subnet: 192.168.50.232/30 — 192.168.50.235/30

4th subnet : 192.168.50.236/30 — 192.168.50.239/30

5th subnet : 192.168.50.240/30 — 192.168.50.243/30

6th subnet : 192.168.50.244/30 — 192.168.50.247/30

7th subnet : 192.168.50.248/30 — 192.168.50.251/30

8th subnet : 192.168.50.252/30 — 192.168.50.255/30

Since each of the subnets above is an independent subnet, we map the first 3 to the 3 serial links of Tred's network. The mapping I've created is also documented below:

1st subnet (192.168.50.224/30) ⟶ Network 5

2nd subnet (192.168.50.228/30) ⟶ Network 6

3rd subnet (192.168.50.232/30) ⟶ Network 7

The 2nd and 3rd addresses of each /30 subnet will be assigned to the router interfaces.