Malik Mustafa
19K-1096
SE-B

CN Tasks # 5 & 6

Q1 In a logically centralized Control plane, a Remote controller interacts with local control agents (CAs) in routers to compute forwarding tables. In thes case, the control plane & the data plane are implemented in separate devices. This is because, by seperating the control plane to the controller and the data plane to the routers & switches, we Can achieve external network management, Scaleability & reliability.

Q2

Distance Vector	link state
1. Routers recieve topological info from the neighbours.	1. Routers recieve complete information of the topology.
2. It computes the least-cost path in an interative & distributed way.	2. It computes the least Cost path from source to destination with complete Knowledge of the network.
3. The shortest path is calculated using Bellman ford algorithm	3. The shortest path is calculated using dijkstras algorithm.
4. RIP is an example.	4. DSPF is an example
5. DV calculates best route based on the fewest no of hops.	5. LS calcute best route based on the least Costly.
6. Convergence time varies may have count to infinity problem.	6. $O(n^2)$ algorithm, $O(n^2)$ messages.

control.
2: Scale

OSPF is centralized routing algorithm as it has the complete topological review.
RIP is a decentralized algorithm as it only views the local routing information.

Q3

The 'count to infinity' problem occur in DVR protocols when there arises routing loops. These routing loops usually happen due to breakage of links or a high increase in cost. As a result the routers get stuck in a loop of updating their route costs from the neighbour distance vectors.
The count-to-infinity problem will not occur if the cost of a link is decreased. Because in this case a loop is not formed & the least cost path is selected.
Connecting two nodes which do not have a link is equivalent to decreasing the link cost from infinite to finite - still, in this case a loop is not formed.

Q4 Reasons for different inter-AS & intra AS protocols:-

1. Policy :- The policy issues of the both lead to the usage of different protocols. In inter-AS, the traffic is from different ASes, & there might be policies to prevent passage of traffic through specific ASes. The BGP is responsible for the controlled distribution of routing information, making it a policy based routing system. However, in intra AS, policies are less important since the AS is under the same

Control.

2. Scaleability :-

Scaleability is difficult to achieve in inter-AS due to large number of ASes. however in intra-AS, due to a smaller network, scaleability is achieved easier.

3. Performance :- policy dominates over performance in case of inter-AS- While in intra AS performance is more focused upon as its a single AS.

It is not necessary for every AS to use the same intra-AS protocol as each As has administrative control over its own As.

Q5 False.

OSIF routing constructs complete topology map by each router for the entire autonomous system this is not only to the beq neighbouring router. Therefore the statement is false.

Q6 In an OSTF As, the system' is divided hierarchially into areas, Each area Consists of connected routers - This helps in broadcasting the link states to the routers in the area by the OSPF link state algorithm.

The concept of area was introduced in OSTF to separate the backbone routers so the LS flooding is done inside the areas only. In Case packets are to be sent outside the area, the border router broadcasts it - This way, backbone routers

OSPF is limited to the backbone area only, & the local OSTF to local areas .

Q7 False

It is not necessary for the BGP router to add its own identity, as BGP is a policy based routing protocol. so if their policy is against advertising the path, then their identity is not added.

Q8 BGP uses the next hop attribute as follows:-

1. The Next hop is the router interface that initiates the AS-PATH. This is the ip of the first router along.
2. The NEXT-HOP attribute is used in the forwarding tables.

BGP uses the AS-PATH attributes as follows.

1. Detect & prevent already present ASes in the As list.
2. Choose among the path with same prefix.

Q9 The layer would be the network-control apps layer as it is the layer in which the control functions such as routing, access control & load balancing are implemented.

Q10

step	N	D(t)	D(U)	D(V)	D(W)	D(Y)	D(Z)
0	X	∞	∞	3,x	6,x	6,x	8.x
1	XV	7,V	6,V	3,x	6,x	6,x	8,x
2	XVU	7,V	6,V	3,x	6,X	6,x	8,X
3	XVUW	7,V	6,V	3·X	6,X	6,X	8,X
4	XVUWY	7,V	6,V	3,x	6,X	6,X	8.x
5	XUVWYt	7,V	6,V	3,x	6,X	6,X	8,x
6	XVUWYtZ	7,V	6,V	3,x	6,x	6,x	8,x

shortest path :- XVUWYtZ

Q11 :-

a) eBGP
b) iBGP
c) eBGP
d) iBGP

Q12 :- Services offered by link layer protocol.

1) link access
2) Reliable delivery
3) Framing
4) Error detection & correction.

In IP :-

1) link access
2) Framing
3) Error detection & correction.

In TCP

1) link access
2) Framing
3) Reliable delivery
4) Error detection & correction.

Q13

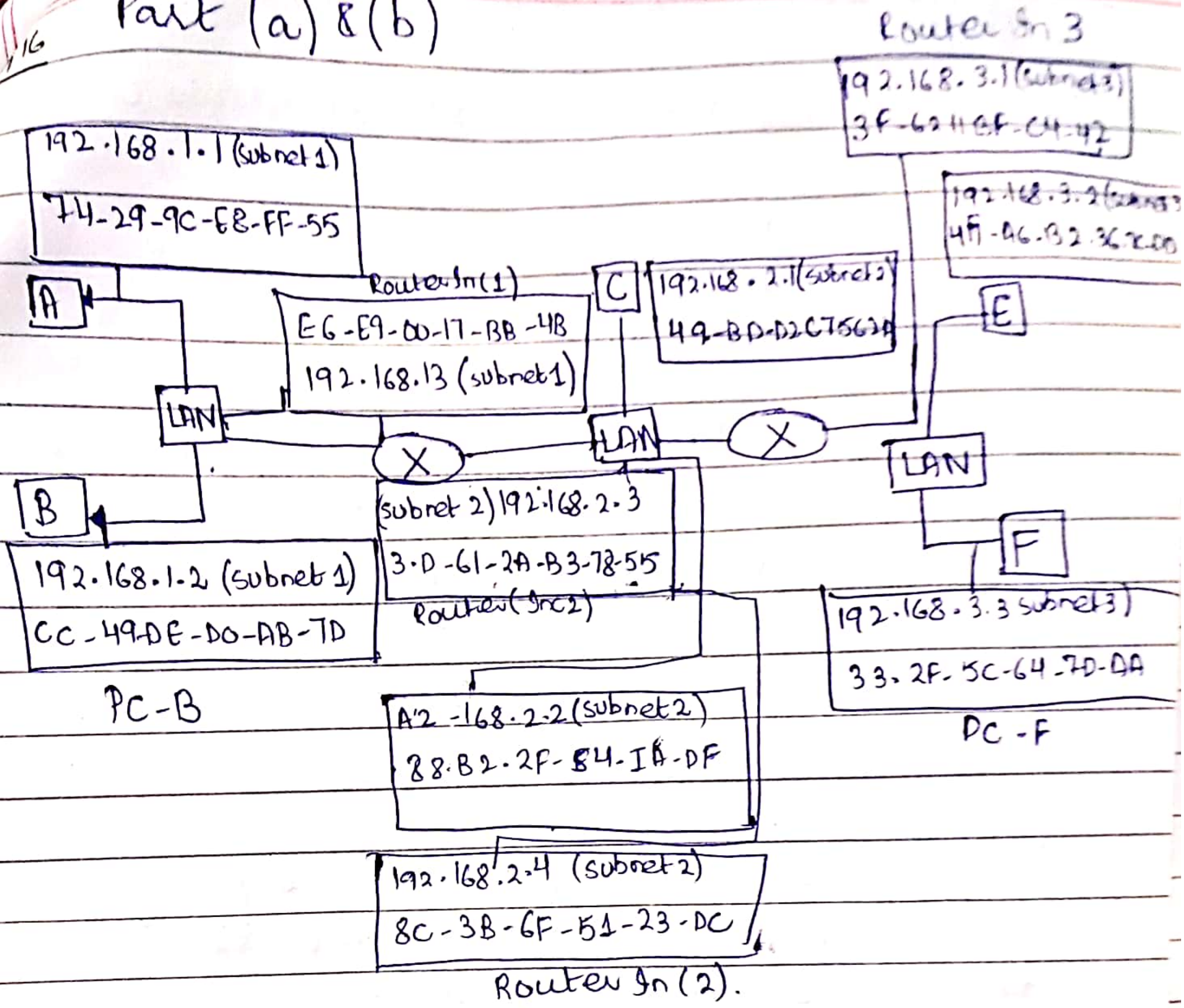
MAC address space = 2^{48}
IPv4 address space = 2^{32}
IPV6 address space = 2^{128}

Q14

In the first case C's adapter will process the frames but will not pass it up the network layer - however if the LAN broadcast address is used, then C's adapter will process & pass the datagrams up the layers.

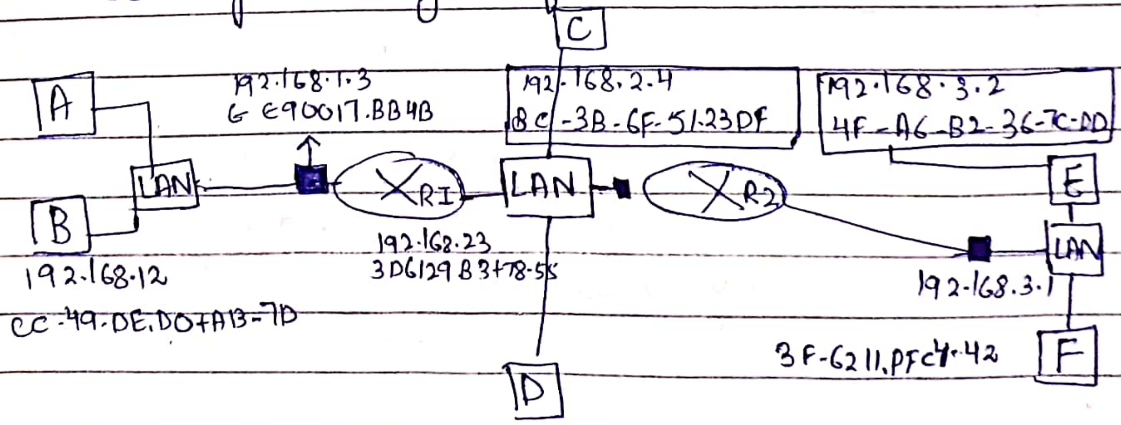
Q15 To send an IP datagram, the sender needs to know both the IP & MAC address - So in order to get the MAC addeess, an ARP query is broadcasted across the LAN - The node at which the ARP modules Matches the IP address is the destined node. So this node sends back an ARP response with it's MAC address inside the packet frame.

Part (a) & (b)



Part (c)

Sending IP datagram from E to B ~



Since all ARP tables are upto date we know the destination MAC address.

The steps are :-

1) E creates IP datagram with IP source E & Destination ~~Mac address~~ B .

IP src : 192.168.3.2
IP dest: 192.168.1.2

2) E creates link layer Frame containing E-B-IP datagram & Router 2's MAC address.

MAC src : 4F-A6-B2-36-7C-DD
MAC dest : 3F-62-11-BF-CF-42
IP src : 192.168.3.Z
IP dest : 192.168.1.2

3) Router 2 determines outgoing interface through ARP table & create a frame with E-BIP datagram & Router 1's Mac address.

Mac src = 8C-3B-6F-51-23-DC
MAC dest = 3D-61-2A-B3-78-55
IP's same.

4) Finally, Router 2 determines interface & send it to B's Mac address with the E-B IP datagram.

MAC src : E6-E9-00-17-BB-4B
MAC dest : CC-44-DE-D0-AB-7D

↓

Now B has recieved the frame & passes it up to IP layer to extract the datagram.

d)

Now, the ARP table of E is empty. So E sends an ARP query to B's IP address (192.168.1.2)
Essentially, the steps are almost the same, expect now the ARP query is broadcasted to all the hosts in the LANs.
so the IP's are matched with each host to find the destination MAC address.
Currently at E, the ARP query has:-

MAC src	:	4F-A6-B2-36-7C-PD
MAC dest	:	FF-FF-FF-FF-FF-FF
IP src	:	192.168.3.2
IP dest	:	192.168.1.2

Now, since we assume that the router's ARP table is upto date. so there is no need to broadcast the ARP query it can be sent to the router 2, to recieve an ARP response from the router, containing the MAC address of the Host B.
And once host E recieves the ARP response the exact steps from part (c) are followed.

Q17

1) PC uses DHCP to obtain IP address. This is done by creating a special IP datagram with the destination 255.255.255.255 in the DHCP server discovery step. This datagram become an Ethernet frame & broadcast in the LAN.

then following the DHCP protocol, the PC gets an IP with a lease time.

2) Since the PC's ARP cache is empty, It uses ARP query to get MAC address of the first Hop router & the local DNS.

3) The DHCP request is encapsulated in UDP, then in IP & then in 802.3 Ethernet. The DHCP server then formulate DHCP ACK with the client's IP address - IP address of first Hop router & local DNS. The frame is then demuxed at client.

4) Now to send HTTP request, DNS of the Web page is needed. So a DNS query is encapsulated to UDP/TCP. then in IP & then in Ethernet to the router first Hop. This IP datagram is fowarded to the gateway.

5) Now this datagram is routed to another Network through RIP/OSPF or BGP routing protocolos & then to its DN's server.

6) Now the actual HTTP request is sent by opening a TCP socket to the Web server. TCP SYN, SYN-AG & ACK (3-way-handshake) takes place. This is converted to an IP datagram & sent to the Web page.

7) Web seerver response (HTTP res) is routed back to client in an IP datagram, which is recieved by the Ethernet.

Now the client Can visit the site.