CSE 421

Computer Networks

Assignment - 02

Spring 24 (Set-A)

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Q1. Root network 3.255.192.0/19

$R_1 \rightarrow 1000$

$R_2 \rightarrow 512$

$R_3 \rightarrow 255$

(i) max no. of subnets

- root net: a/19
- IPv4 has 32 bits
- remaining bits $32 - 19 = 13$

$\therefore$ max subnets $= 2^{13-2}$

$= 2^{11}$

$= 2048$

(11) R_1 (1000)

needs $2^{10} - 2 = 1022$ usable IP's

required mask /22

R_2 (512)

needs $2^{10} - 2 = 1022$

A /23 provides $2^9 - 2 = 510$ usable IPS. Since 512 hosts are required, A/23 is insufficient by 2 IP's. we must use A/22

R_3 (255)

needs $2^9 - 2 = 510$ usable IPs

A/24 provides $2^8 - 2 = 254$ usable IP's. Since 255 hosts required A/24 is insufficient. We must use A/23.

Network	req hosts	CIDR	block size	Net Add	Broad Add
R1	1000	/22	1024	3.255.192.0	3.255.195.255
R2	512	/22	1024	3.255.196.0	3.255.199.255
R3	255	/23	512	3.255.200.0	3.255.201.255

Q2. Attached to R2

LAN 5 : 198.44.128.0/20

LAN 6 : 198.44.144.0/20

LAN 7 : 198.44.160.0/20

LAN 8 : 198.44.176.0/20

conversion to binary

128 => 10000000

144 => 10010000

160 => 10100000

176 => 10110000

New mask :

First 2 octets = 16 bits

+2 common bits = 16+2

= 18 bits

• Summarized Network: 198.44.128.0 /18

Static Route command for R_1:

The destination is the summary net 198.44.128.0 with mask 255.255.192.0/18

The next hop from R_1 to reach R2 is R2's interface IP. R_1 is connected to R2 via 20.2.1.0/30 net is .1 (S0) and R2 is .2 (S0)

command:

ip route 198.44.128.0 255.255.192.0 20.2.1.2

Goal : creating a backup default route that is only used if the primary fails

Analysis : R3 → (S1) → R2
via

The alternative path to ISP is via R1. R3 connects to R1 via 20.2.2.0/30 net. R1's IP is 20.2.2.2 (S0) and R3 is 20.2.2.1 (S1)

mechanism : Floating routes use a higher AD than the primary route (static AD = 1)

command : ip route 0.0.0.0 0.0.0.0 20.2.2.1 10

Q3.

(i) total packet size = 4080 bytes

mtu = 540 bytes

IP header = 20 bytes

$\therefore$ max payload = mtu - header

$= (540 - 20)$ bytes

$= 520$ bytes

$\therefore$ total data = total packet - header

$= 4080 - 20 = 4060$ bytes

$\therefore$ fragments $= \frac{4060}{520} = 7.8 \approx 8$ (answer)

(ii) Data sent by 3 fragments $= 3 \times 520$ bytes

$= 1560$ bytes

$\therefore$ offset value $= \frac{1560}{8}$

$= 195$

(iii) since there are 8 fragments so 4th one isn't the last one and mf bit is 1

Q4.

Source MAC → Router's interface

Dest. MAC → my mobile (client)

Subnet Mask : 255. 255. 255. 0

Router : IP address to access the internet

DNS Server : IP address for domain name resolution

Lease time : The duration for which the IP is valid

Mobile's reply : After receiving the offer, my mobile will reply a dhcp request message.

95.

Dipu (client):

Public IP 173.253.138.221

Port 49153

R2 (router):

Public interface 201.113.13.221

Web Server:

Private IP 192.168.1.2

Port 80

Communication is achieved through Port Forwarding (a form of Static NAT/PAT)

- mapping (Public IP of specific port) to (Private IP of service port)
- request (Dipu opens a connection to router) 201.113.13.221 on port 8080.
- translation (when R2 receives the packet, it looks up its NAT table, mapping changes from dest IP. 192.168.1.2 to Dest Port 80)

Q6.

In Link State, router first establishes adjacencies using "Hello" packets.

- Discovery => R3 $\xrightarrow{\text{Sends}}$ Hello
- Adjacency => only routers connected to S1 (connected to R2) and S0 (connected to R1) respond to Hello packets.
- Flooding => R3 recognises on S1 & S0

Q7. Given Add : 2000 : B0B : 80 : A8FF : FE03 : 4566

(1) Identify MAC Add : by Inserting EUI- 64 addresses form FFFE

- extract the interface ID : The last 64 bits are 0080 : A8FF : FE03 : 4566
- remove FFFE : The sequence is

in the middle.

- 0080 : A8 FF:FF 03: 4566 → 0080: A8 and 03 : 4566
- restored hex :- 00 80 A8 03 45 66

flip 7th Bit : The first byte is 00 (binary 0000 0000). Fliping the 7th bit :-
0000 0010 (Hex 02) / 2_{16}

∴ The MAC Add is 02: 80 : A8 :03: 45:66

(11) Identify the subnet ID In a standard global unicast address, the subnet ID is the 16 bits located between the global routing prefix (usually 48 bits) and interface ID

- Address: 2000 : 0000 : 0000 : 0B0B: - · · ·
- The 4th hextet is the Subnet ID

∴ The Subnet ID 0B0B

Q.8

PC2 → PC4

PC2 is on their incoming interface

PC2 → PC6 All switches refresh / learn

PC6 → PC2 (reply) ⇒ PC6 replies. Switches forward unicast to PC2

Q.9 AD measures the trustworthiness of a routing source. Lower is better

- RIP (Distance vector): Determines the best path using only hop count

- LSP (OSPPF/IS-IS): Uses cost as a metric.

Q.10

(i) Network devices can change; a laptop might leave the network, or a network card might be replaced, changing the MAC address for a specific IP. TTL ensures that ARP cache is flushed periodically.

(ii) ARP is a Layer-2 protocol relying on broadcasts (FF: FF: FF: FF: FF: FF). By design, routers block broadcasts to prevent them flooding the entire internet. ARP is only meant to resolve addresses within local LAN segment.

Q11

IPv6 uses 'extension headers' to handle optional info. The main IPV6 header remains a fixed 40 bytes

- mechanism: The main header contains a field called next header

• chaining : If options are needed, the 'next header' field points to an extension header.

Q12. MAC :- AF : CC : FE : 12 : 23 : 40

(i) Locally Administreted

A → 1010

first byte → 1010 1111

The universal / Local bit is the second least significant bit of first byte.

here, the bit is 1

(ii) A MAC add is physically burned into the network interface (NIC). It's not dependent on network location (unlike an IP which changes by moving a different wifi networks)

Q.3.

(i)
- hop count
- IP add / Domain name
- RTT (round trip time)

(ii)
- Pinpointing failure
- latency analysis