

Q#01

(a) Explain the Source Quench and Redirection errors in ICMP?

Source Quench and Redirection are two types of (ICMP) Internet Control Protocol that can be countered in network communication.

1- Source Quench Error:-

If you encounter a source quench error, it typically means that the router and host destination is indicating congestion and you should reduce the rate of sending packet to destination.

2. Redirection Error:-

If you receive redirection error, it means that router is suggesting a different route for your packets. The sender is expected to update its routing table.

It's worth nothing that both "source quench" and "redirection" ICMP are

Day:

Considered informative rather than actual.

c) (i)

- (b) Draw timeline diagram for
TCP connection establishment
and terminations

Draw illustrating the TCP connection establishment and termination process.

Establishment:-

- The client initiates the connection by sending a TCP SYN packet with $(Seq = X)$
- The server receives the SYN packet and responds with a SYN-ACK packet. It acknowledges the client's sequence number ($ACK = X+1$) and sends its own sequence number $(Seq = Y)$
- The client receives the SYN-ACK packet and acknowledges the server's sequence number ($ACK = Y+1$)

The connection is established and data transfer begin.

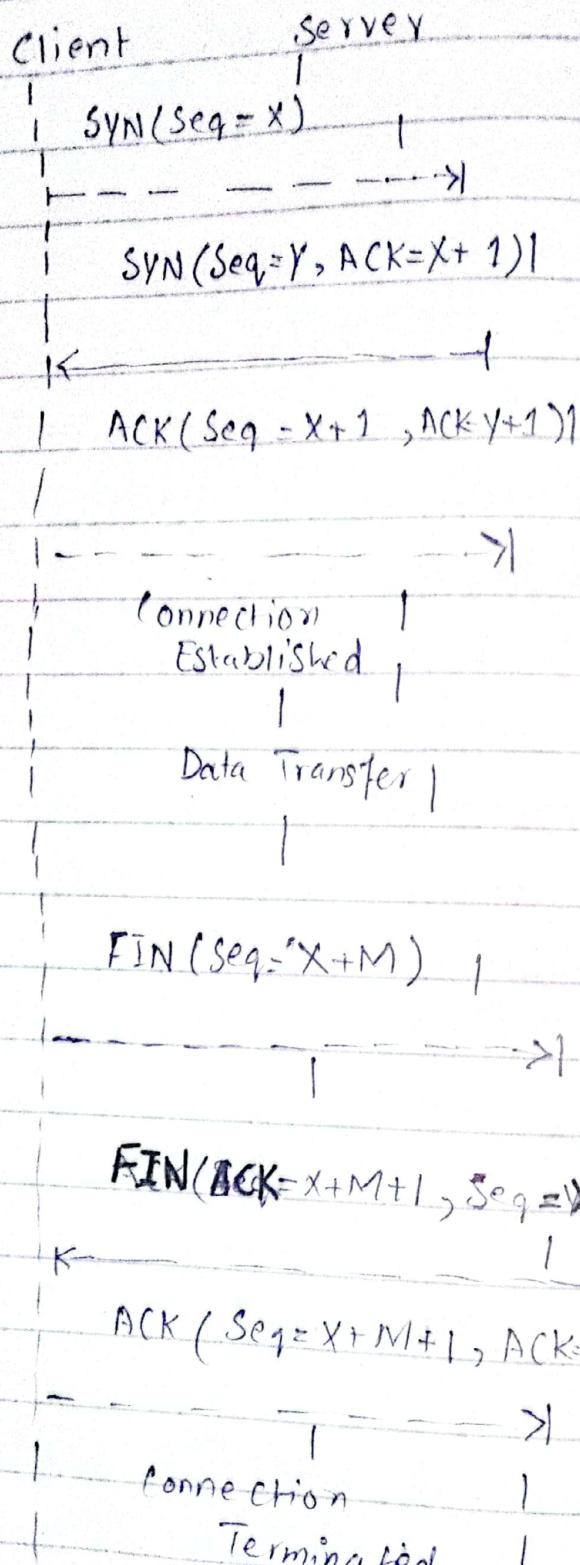
Termination:-

- When client wants to terminate the connection, it sends a TCP FIN packet with its current seq number $(Seq = X+M)$

- The server receives the FIN packet and sends an acknowledgement (ACK) for client's seq number ($ACK = X + M + 1$) and send its own seq number ($Seq = Y$)
- The client receive acknowledgement from server and acknowledged the server's sequence number ($ACK = Y + 1$)
- The connection is terminated both server and client can no longer send data.

Date: 1/120

Day:



Differentiate between connection-sets and connection-oriented data transmission.

Also describe what type of services are provided by User

Diagram protocol (UDP) and Transmission control-protocol (TCP)?

Connection-sets transmission

- Connection-sets refers to group of connections managed together by a network protocol.
- It allows for efficient management and control of multiple connections.
- Each connection within set has its own identifier such as port number.

Connection-oriented transmission

- It is communication mechanism provided by TCP.

- A reliable and ordered connection is established between sender and receiver.

- Packets are delivered in correct order, without loss or errors.

- User Datagram protocol services:-

UDP provides a connectionless, lightweight transport layer protocol that offers minimal services compared to connection-oriented protocols like TCP.

It focusses on simplicity and efficiency not ordering.

Some services are:-

- Connectionless communication
- Unreliable delivery
- Low overhead
- Broadcast and multi-cast support
- Transmission control protocol(TCP):-

Transmission control protocol is a connection oriented protocol that offers reliable, ordered and error-checked data transmission.

Some services provided by TCP are:-

- Reliable delivery
- Flow control
- Congestion control
- Connection establishment and communication

Q#03

Briefly Explain the Address resolution protocol (ARP) with a suitable diagram. Also draw its packet segments.

ANS:-

The address resolution protocol (ARP) is a protocol used to resolve IPv4 addresses to their corresponding Mac addresses in a local network.

It is essential for communication within the same network, to allow them to send packets to correct destination.

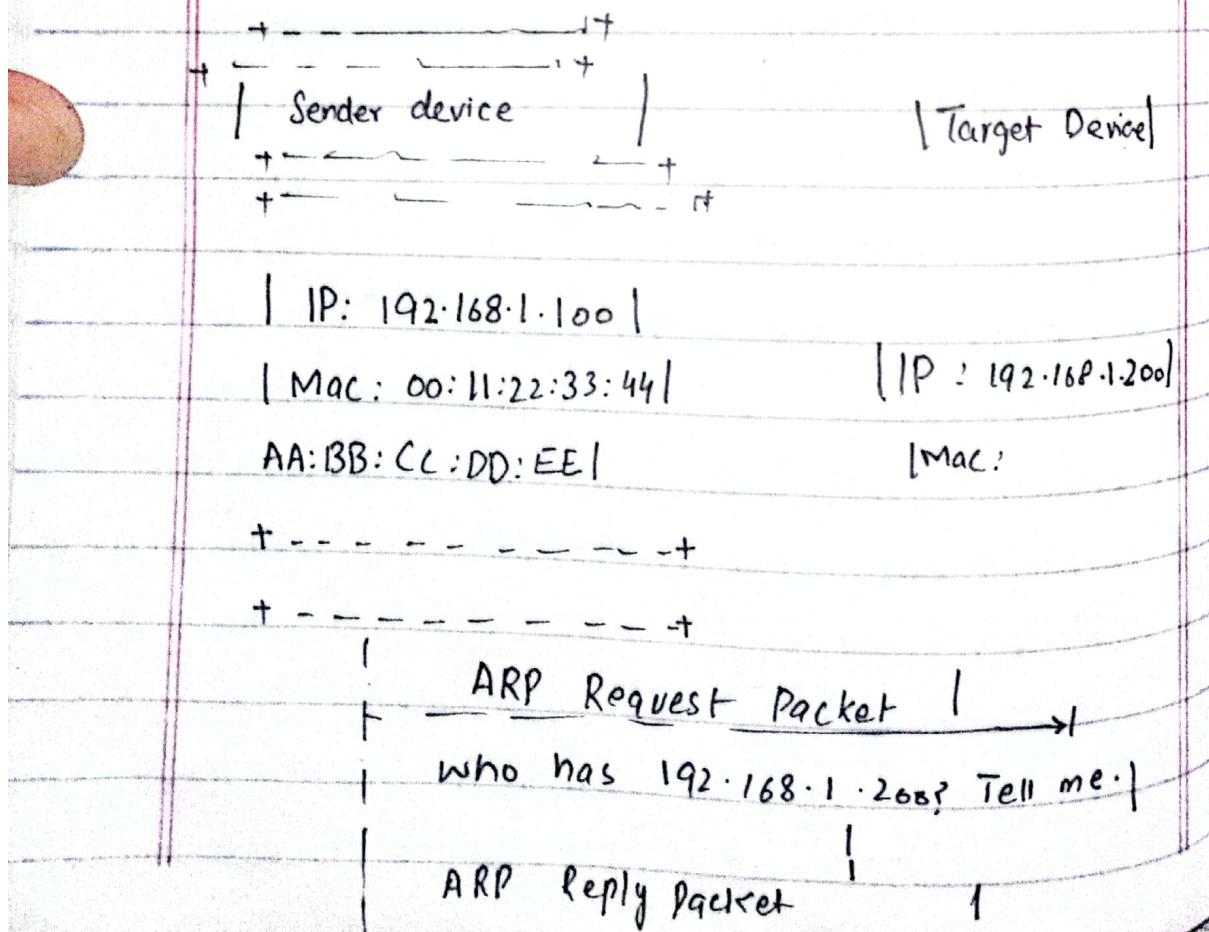
ARP Process:-

1- When a device wants to send a data packet to another device on the same network, it first checks its ARP cache which stores mapping of IP and Mac addresses. If mapping exists the device can directly use the Mac address for communication.

2- If mapping does not exist, the device sends ARP request to entire network asking "Who has this IP address?"

- Date: 1/120
- Day:
3. All devices on network receives the request but the only one reply which has IP address and Mac address.
 4. The matching IP address device sends directly to sender.
 5. The request sender receives the ARP packet and updates its ARP cache with new IP to Mac mapping and now send to data mapping.

ARP Diagram:-



192.168.1.200 has AA:BB:CC:DD:EE

Data Packet with |

Mac : AA:BB:CC:DD:EE |

ARP Packet Segment:-

The structure of ARP packet is as follows:-

| Hardware Type | Protocol Type | H/w Len | P Len | operation |

| 2 bytes | 2 bytes | 1 byte | 1 byte |
2 bytes |

| Sender Mac Address | Sender IP address |

| Target mac | Target IP address |

- Hardware type :- Specifies type of network wifi, Ethernet
- Protocol type :- Specific type of protocol IPv4 in this case.
- H/W Len :- Length of Hardware.
- P Len :- Length of protocol
- Operation :- Specifies whether packet is request or reply.
(1 for request) & (0 for reply)

Q#04

The E293 0087 00000001 00000000 5002
 07FF -- is a part of a
 TCP header dump in hexadecimal
 format.

(1) what is Source port number in decimal format?

To determine the source port number in decimal format we need to extract the relevant portion of hexadecimal value and convert it.

In TCP header, the source port is a 2 byte located in beginning of header.

5002 represent the source port no. Now change it in decimal

$$5 \times 16^3 + 0 \times 16^2 + 0 \times 16^1 + 2 \times 16^0$$

$$5 \times 4096 + 0 + 0 + 2$$

First 2 bytes is "50" so change it in decimal:-

$$5 \times 16^1 + 0 \times 16^0 = 80 + 0 = 80$$

then "02" change in decimal:

$$0 \times 16^1 + 2 \times 16^0 = 0 + 2 = 2$$

Combine it :-

$$80 + 2 = 82$$

Therefore the source port number in decimal format is 82.

Date: 1/1/2023
Ques: What is sequence number?

(ii) What is sequence number is 4 byte (32 bit)
Sequence number is represented in TCP header. Consider the sequence number is represented by:-

"E29300:70000000:00000000."

Breaking down into individual bytes:

- First byte "E2"
- 2nd byte "93"
- 3rd byte "00"
- 4th byte "70"
- 5th byte "00"
- 6th byte "00"
- 7th byte "00"
- 8th byte "00"

The Sequence number is:-

00:00:00:70:00:93:E2

Converting in decimal and rearranged:

E2 : 93 : 00 : 70 : 00 : 00 : 00

$$\begin{aligned} E2 &= E \times 16^6 + 2 \times 16^0 \\ &= 14 \times 16 + 2 \\ &= 224 + 2 = 226 \end{aligned}$$

$$93 = 9 \times 16^6 + 3 \times 16^0 = 144 + 3 = 147$$

$$7 \times 16 + 6 \times 16$$

112

So the sequence number is.

226: 147: 0: 112: 0: 0: 0

(ii) what is acknowledgement number?

Acknowledgement number is also

4-byte. The acknowledgement number is represented by

70000000

Breaking down individual byte:-

"70" — 1st byte

"00" — 2nd byte

"00" — 3rd "

"00" — 4th "

Combining it in little endian:-

00: 00: 00: 70

Rearrange and convert in decimal:-

70: 00: 00: 00

70 : $7 \times 16 + 6 \times 16$

112

So the acknowledgement number

is 112.

Ques 120
iv) what is the type of segment?
To determine segment we need
to examine the TCP header.
Flag field also known as
control bits field.
The control bits field.

Flag field represent "5002"

Break in byte and then convert
in binary

"50" — 1st byte
"02" — 2nd byte

~~2 50
2 25 - 0
2 12 - 1
2 6 - 0
2 3 - 0
1 - 0~~

$$50 = 00100010$$

$$02 = 00000010$$

$$50 = 01010000$$

Combining values:

~~2 5
2 2-1
1 - 0~~
00000000 0000 0010.

Examine control bit:

- 5th bit from right indicate SYN
Segment which is 0 so

"NO SYN Segment"

- 2nd bit from right is ACK
which is 1 so segment is ACK

Date: 1/120

Day:

(v) what is window size?

Window size is 2 byte located after acknowledgement number so it is "07FF".

Convert in decimal:-

$$\begin{aligned}07FF &= 0 \times 16^3 + 7 \times 16^2 + F \times 16^1 + F \times 16^0 \\&= 0 + 1792 + 240 + 15 = 2047\end{aligned}$$

So window size is 2047.