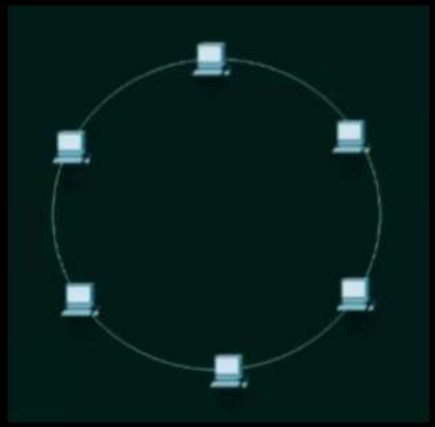
QUESTIONS ON NETWORK TOPOLOGIES:

QUESTION 1:

Identify the given topology and determine how many cables and ports are required to have such network?



Number of Nodes (N)	Number of Cables (=N)	Number of ports/device (NOPD)	Total Number of ports in the network (TNOP = N X NOPD)
2	2	2	2 x 2 = 4
3	3	2	3 x 2 = 6
4	4	2	4 x 2 = 8
N	N	2	N x NOPD = TNOP

SOLUTION:

(Here N = 6)

Topology: Ring Topology

No. of cables = N

No. of cables = 6

TNOP = N x NOPD

Here N = 6, NOPD=2

TNOP = 6 x 2 = 12

QUESTION 2:

Traffic problems can be minimized using?

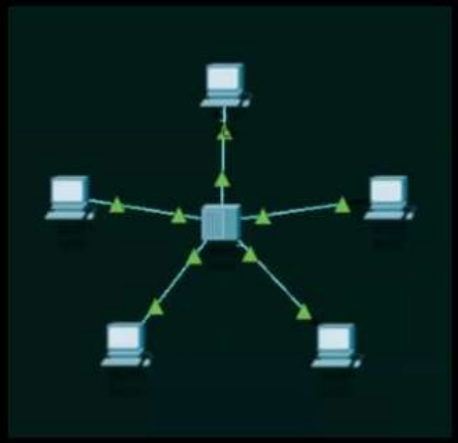
- ☐ Star
- ☐ Bus
- ☐ Ring
- ☑ Mesh

SOLUTION:

- In star topology, all the traffic have to go through certral hub or switch so it cannot be used to minimize traffic.
- In bus topology, the data flow bidirectionally, also a single backbone cable is used to send data to other nodes so its also not a good option.
- In ring topology, the communication is unidirectional, so not a good option.
- In mesh topology, each node have a dedicated link with the other node, so the traffic here is the least.

QUESTION 3:

How many ports and cables links are needed for this star topology?



Number of Nodes (N) Connected to central device	Number of Cables (=N)	Number of ports/device (NOPD)	Total number of ports in the network (TNOP = 2 X N)
2	2	1	2 x 2 = 4
3	3	1	2 x 3 = 6
4	4	1	2 x 4 = 8
N	N	1	2 x N = TNOP

SOLUTION:

No. of cables = N

No. of cables = 5

No. of ports = 2 x N

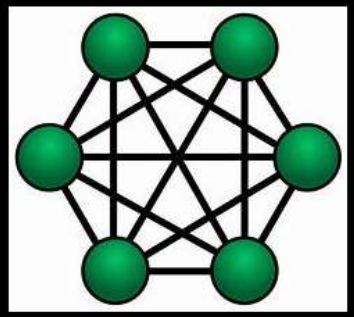
No. of ports = 2 x 5

No. of ports = 10

QUESTION 4:

Assume six devices are arranged in a mesh topology.

(i)How many cables are needed?
(ii) How many ports are needed for each device?
(iii) How many ports are there in the entire network?



Number of Nodes (N)	Number of ports/device (NOPD)	Number of Cables (C)	Total number of ports in the network (TNOP = N x NOPD)
4	4 - 1 = 3	(4 / 2) x 3 = 6	4 x 3 = 12
5	5 - 1 = 4	(5 / 2) x 4 = 10	5 x 4 = 20
6	6 - 1 = 5	(6 / 2) x 5 = 15	6 x 5 = 30
N	N - 1 = NOPD	(N / 2) x NOPD	N x NOPD = TNOP

SOLUTION:

No. of cables (C) = (N / 2) x NOPD
No. of cables (C) = (6 / 2) x 5
No. of cables (C) = 15

No. of ports needed for each device (NOPD) = N - 1
No. of ports needed for each device (NOPD) = 6 - 1
No. of ports needed for each device (NOPD) = 5

Total number of ports in the entire network (TNOP) = N x NOPD
Total number of ports in the entire network (TNOP) = 6 x 5
Total number of ports in the entire network (TNOP) = 30

(i) Cables Needed = 15
(ii) Number of ports needed for each device = 5
(iii) Number of ports in the entire network = 30

BASICS OF IP ADDRESSING:

IP ADDRESS:

IP stands for internet protocol. IP address have 2 versions (IPv4 and IPv6)

IP ADDRESS (IPV4):

★ Every node in the computer network is identified with the help of IP address.
★ Logical address (Not a permanent address, changes based on the logic or location of the device).
★ Can change based on the location of the device.
★ Assigned by manually or dynamically.
★ Represented in decimal and it has 4 octets (x.x.x.x).

★ Its ranges from 0.0.0.0 to 255.255.255.255 (32 bits).
★ To see IP address in windows type "ipconfig" command in the command prompt, or "ifconfig" in case of linux.

• Identify the valid and invalid IP addresses in the following set

a. 24.25.26.8 Valid

b. 10.3.156.256 Invalid (Last octet is 256, limit is 255)

c. 0.0.0.0 Valid

d. 255.255.255.255 Valid

e. 100.2.6.345.456 Invalid (It has 5 octets, secondly 3rd and 4th octet exceeds 255)

f. 16.2e.45.67 Invalid (2nd octet has hexamedecimal letter)

BASICS OF MAC ADDRESS:

★ MAC stands for media access control.
★ The address used for node-to-node delivery or hop-by-hop delivery is known as MAC adress.
★ There is always a link beween any 2 nodes, through mac address the data takes hop from one node to the other. This link is called media. The router have access to media (Control on access to the media) and get contol of it to forward the data. But this control on access to the media is done with the help of a 48 bits address called MAC address, and this is also the reason why this address is called so (Basically, name according to the function).

★ MAC address is also called Physical address or Hardware Address.
★ Every device has a unique MAC address.
★ Cannot be changed.
★ Assigned by the manufacturer.
★ Represented in hexadecimal.
★ Example: 70-20-84-00-ED-FC (48 bits).
★ Separator: hyphen(-), period(.), and colon(:).
★ To see mac address in windows use "ipconfig/all" command and in linux "ifconfig".

DIFFERENCE BETWEEN IP ADDRESS AND MAC ADDRESS:

IP Address	MAC Address
Needed for communication.	Needed for communication.
It is 32 bits address.	It is 48 bits address.
Represented in decimal.	Represented in hexadecimal.
Router needs IP address to forward the data.	Switches need MAC address to forward the data by maintaing MAC address table.
Example: 10.10.10.23	Example: EF-21-E2-B6-FF-34

PORT ADDRESS OR PORT NUMBER:

★ In a node, many processes will be running.
★ Data which are sent/received must reach the right process.

★ Every process in a node is uniquely identified using port numbers.
★ Port is the Communication endpoint.
★ Fixed port numbers and dynamic port numbers (0-65535)
★ Every process is identified with the help of port numbers.
★ To see port numbers of the processes running in the system, In windows we can use the app "Resource Monitor".

EXAMPLES:

Fixed port numbers: 25, 80 etc.
OS assigned dynamic port numbers: 62414.

IP, MAC AND PORT ADDRESS:

- Reaching our city = Reaching our network. (IP Address)
- Reaching our Apartment = Reaching the host. (MAC Address)
- Reaching the right person = Reaching the right process. (Port Address)

Before sending the data, any node must:

- Attach source IP address and destination IP address.
- Attach source MAC address and destination MAC address.
- Attach source port number and destination port number.

SWITCHING:

★ Switching in computer network helps in deciding the best route for data transmission if there are multiple paths in a larger network.

SWITCHING TECHNIQUES:

There are 3 switching techniques for data transfer.

- ☐ Circuit Switching
- ☐ Message Switching
- ☐ Packet Switching
  - Datagram Approach
  - Virtual Circuit Approach

CIRCUIT SWITCHING:

★ A dedicated path is established between the sender and receiver.
★ Before data transfer, connection will be established first.
★ Example: Telephone network.

3 PHASES OF CIRCUIT SWITCHING:

1. Connection establishment.
2. Data transfer
3. Connection Disconnection.

MESSAGE SWITCHING:

★ This type of switching uses Store and forward mechanism for data transfer.
★ Message is transferred as a complete unit and forwarded using store and forward mechanism at the intermediary node.
★ First the message is stored at the intermediary node, after its processing that which node should be it get transferred to from the current node, then it is forwarded to the next node.
★ Not suited for streaming media and real-time applications because of delay in it and the reason for delay is that for example if a node receives data from a node it first stores it for processing, if the data is larger, then it is going to occupy more space. And due to this occupation if at the same time another node sends data to this node, and if it has defficiency of storage then the 2nd node has to wait untill the processing of data of 1st node is done.

PACKET SWITCHING:

★ The internet is a packet switched network.
★ Message is broken into individual chunks called as packets.
★ Each packet is sent individually.
★ Each packet will have source and destination IP address with sequence number.
★ Sequence numbers will help the receiver to reorder the packets, detect missing packets and send acknowledgments to the sender so that the sender identify the packets which are not received by the receiver and after the response timout the sender the send the packet again.

APPROACHES OF PACKET SWITCHING:

Packet switching has 2 approaches:

☐ Datagram approach
☐ Virtual Circuit approach

PACKET SWITCHING DATAGRAM APPROACH:

★ Datagram Packet Switching is also known as connectionless switching.
★ Each independent entity is called as datagram.
★ Datagrams contain destination information and the intermediary devices uses this information to forward datagrams to right destination.
★ In Datagram Packet Switching approach, the path is not fixed.
★ Intermediate nodes take the routing decisions to forward the packets.

PACKET SWITCHING VIRTUAL CIRCUIT APPROACH:

★ Virtual Circuit Switching is also known as connection-oriented switching.
★ In the case of Virtual circuit switching, a preplanned route is established before the messages are sent.
★ Call request and call accept are special packets which are used to establish the connection between sender and receiver.