Computer Networks

Devices in Computer Networks

CABLES

The cable is a physical media, through which an analog and digital data transfer take place

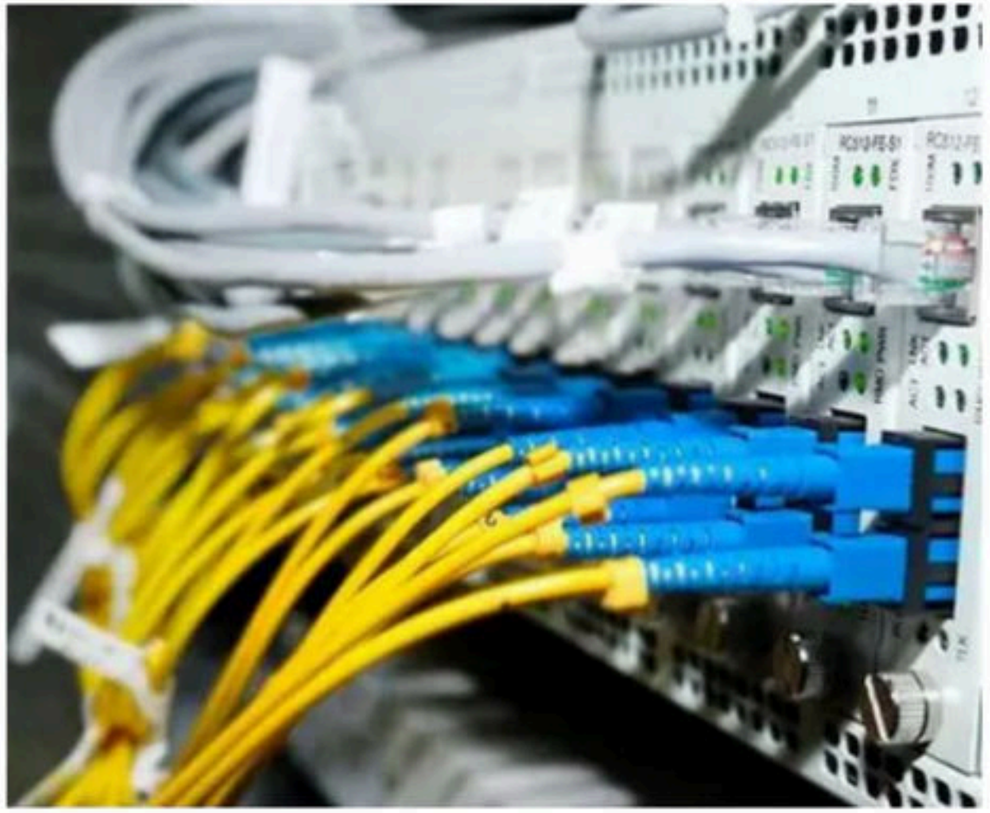
Types of Cables

- Twisted pair
- Coaxial
- Optical fiber

Operate at Physical Layer.

Have a problem of attenuation.

Collisions possible (Collision Domain is n)



REPEATER

A repeater operates at the physical layer.

Its job is to regenerate the signal over the same network before the signal becomes too weak or corrupted so as to extend the length to which the signal can be transmitted over the same network.

An important point to be noted about repeaters is that they do not amplify the signal.

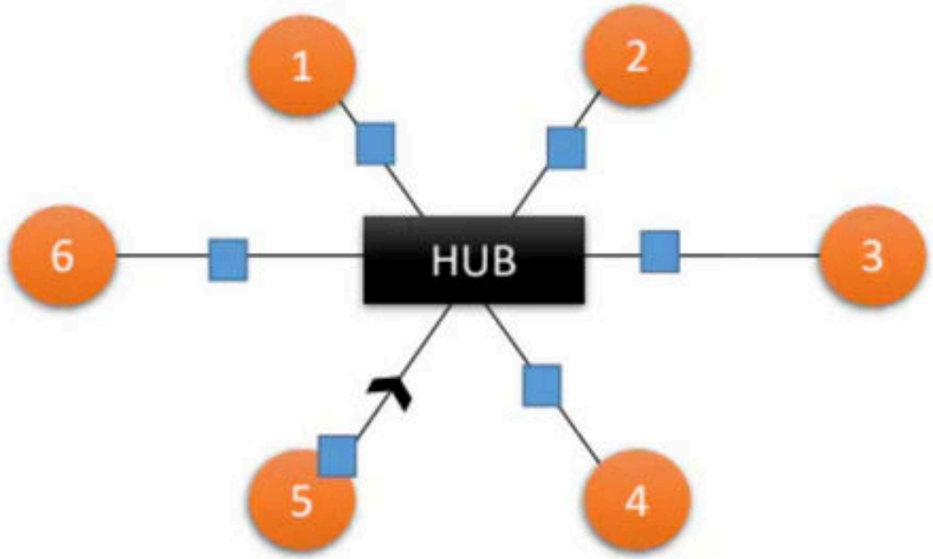
When the signal becomes weak, they copy the signal bit by bit and regenerate it at the original strength.

It is a 2 port device.

Collisions possible

HUBS

- A hub is basically a multiport repeater.
- A hub connects multiple wires coming from different branches
- Hubs cannot filter data, so data packets are sent to all connected devices.
- Traffic is High
- Collision are possible

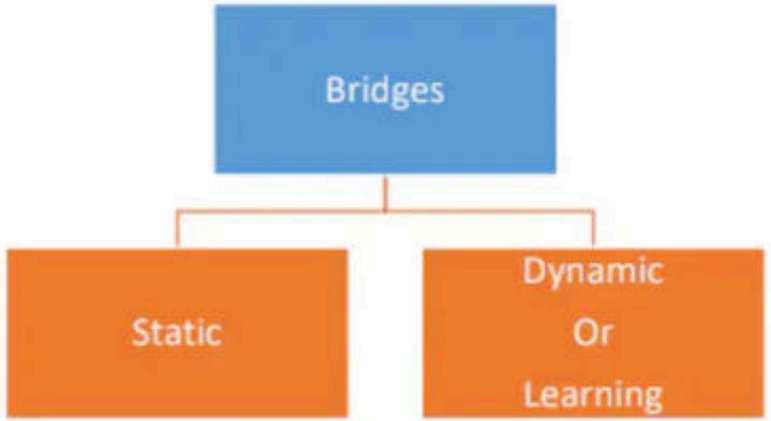


BRIDGE

- A bridge operates at Physical and data link layer.
- A bridge is a repeater, with add on the functionality of filtering content by reading the MAC addresses of source and destination.
- Features in include Filtering ,forwarding and flooding
- It is also used for interconnecting two LANs working on the same protocol.
- Collision Domain is reduced
- Store and Forward

BRIDGE

MAC	PORT
1	a
2	a
3	a
4	b
5	b
6	b



SWITCH

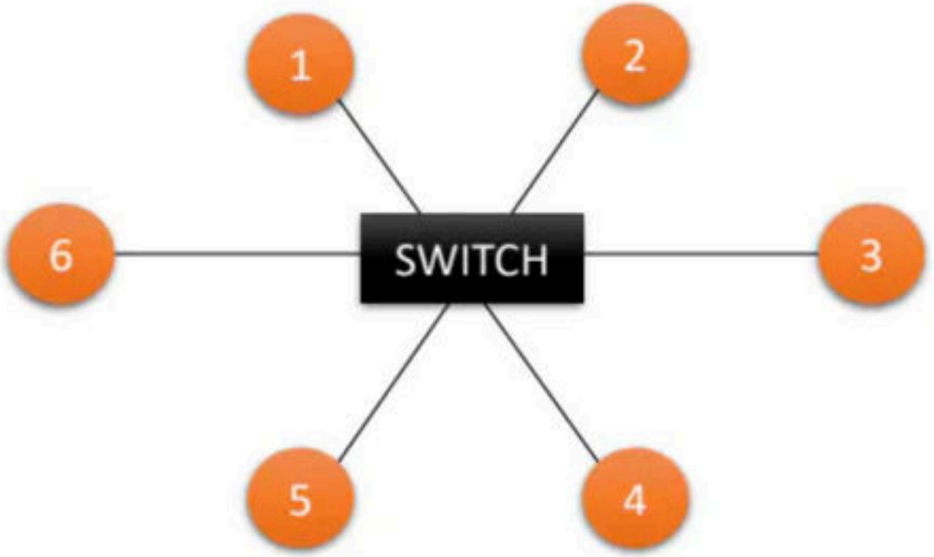
A switch is a multiport bridge with a buffer and a design that can boost its efficiency(a large number of ports imply less traffic) and performance.

A switch is a Physical and data link layer device.

The switch can perform error checking before forwarding data, that makes it very efficient as it does not forward packets that have errors.

No collisions

Traffic is low



ROUTER

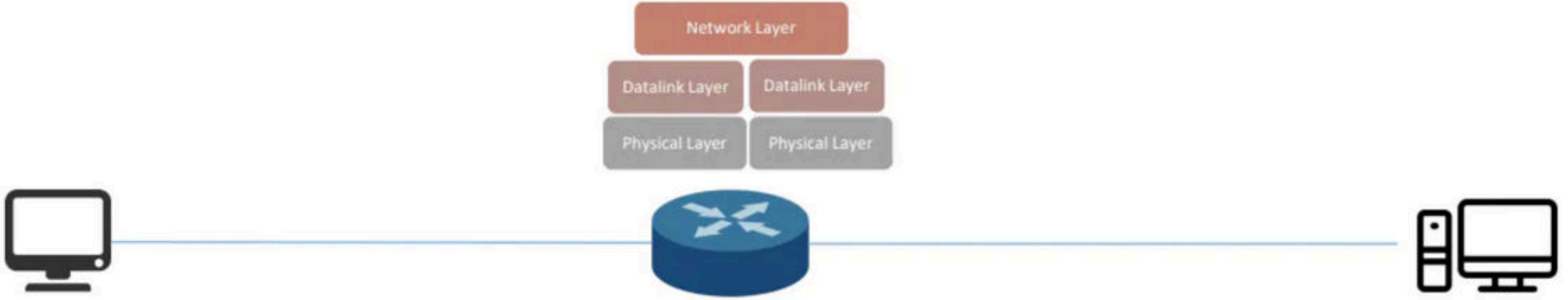
A router is a device that routes data packets based on their IP addresses.

Router is mainly a Network Layer device.

Routers normally connect LANs and WANs together and have a dynamically updating routing table based on which they make decisions on routing the data packets.

Features include Filtering, Flooding and Forwarding

No collisions



DEVICES	COLLISION DOMAIN	BROADCAST DOMAIN
Repeater	Same	Same
Hub	Same	Same
Bridge	Same	Reduces
Switch	Same	Reduces
Routers	Reduces	Reduces

Computer Networks

Revision of Application Layer and GATE Questions Part 3

REVISION

	DNS	HTTP	SMTP	POP	FTP
Stateful / Stateless	Stateless	Stateless	Stateless	Stateful	Stateful
Transport Protocol Used	UDP	TCP	TCP	TCP	TCP
Connectionless / Connection Oriented	Connectionless	Connectionless	Connection Oriented	Connection Oriented	Connection Oriented
Persistent / Non-persistent	Non-persistent	HTTP 1.0 is non-persistent. HTTP 1.1 is persistent.	Persistent	Persistent	Control connection is persistent. Data connection is non-persistent.
Port Number Used	53	80	25	110	20 for data connection. 21 for control connection.
In band / Out-of-band	In band	In band	In band	In band	Out-of-band

1.) Consider a TCP connection between a client and a server with the following specifications: the round trip time is 6 ms, the size of the receiver advertised window is 50 KB, slow start threshold at the client is 32 KB, and the maximum segment size is 2 KB. The connection is established at time t=0. Assume that there are no timeouts and errors during transmission. Then the size of the congestion window (in KB) at time t+60 ms after all acknowledgements are processed is _____. [GATE 2020]

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SOLUTION:
Threshold = 32 Kb, MSS = 2KB, RTT = 6ms
Here, t + 60 is nothing but at the 10 RTT (60/6 = 10), but here
it's asking after all acknowledgement are processed it means
after the 10th RTT, .i.e at the 11RTT
1st transmission: 2 KB
2nd transmission: 4 KB
3rd transmission: 8 KB
4th transmission: 16 KB
5th transmission: 32 KB (Threshold reached)
6th transmission: 34 KB
7th transmission: 36 KB
8th transmission: 38 KB
9th transmission: 40 KB
10th transmission: 42 KB
At the completion of 10th transmission RTT = 10*6 = 60 ms
For the 11th transmission, The congestion window size is 44 KB

2.)Consider the following statements regarding the slow start phase of the TCP congestion control algorithm. Note that cwnd stands for the TCP congestion window and MSS denotes the Maximum Segment Size.

(i) The cwnd increase by 2 MSS on every successful acknowledgement.
(ii) The cwnd approximately doubles on every successful acknowledgedment.
(iii) The cwnd increase by 1 MSS every round trip time.
(iv) The cwnd approximately doubles every round trip time.
Which one of the following is correct?

A.)Only (ii) and (iii) are true
B.)Only (i) and (iii) are true
C.)Only (iv) is true
D.)Only (i) and (iv) are true [GATE 2018]

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SOLUTION:
In Slow-start, the value of the Congestion Window will be increased by 1 MSS with each acknowledgement (ACK) received, and effectively doubling the window size each round-trip time
Initially, TCP starts with cwnd of 1 MSS. On every ack, it increases cwnd by 1 MSS.
That is, cwnd doubles every RTT.
Initially sends 1 segment. On ack, sends 2 segments.
After these 2 acks come back, sends 4 segments etc.
TCP rate increases exponentially during slow start.
Slow start continues till cwnd reaches threshold.
After threshold is reached, cwnd increases more slowly, by one 1 MSS every RTT.

3.) Which one of the following protocols is NOT used to resolve one form of address to another one?

A.)DNS
B.)ARP
C.)DHCP
D.)RARP [GATE 2016]

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A.)DNS
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C.)DHCP
D.)RARP [GATE 2016]

SOLUTION:
DHCP is dynamic host configuration protocol: allocates one of the unused IP address.
Except DHCP, remaining all the protocols are used to resolve one form of address to another one.
I. DNS is going to convert hostname to IP address.
II. ARP is going to convert IP to MAC.
III. DHCP is going to assign IP dynamically.
IV. RARP is going to convert MAC to IP.

4.)Which of the following is/are example(s) of stateful application layer protocols?
(i) HTTP
(ii) FTP
(iii) TCP
(iv) POP3
A.) (i) and (ii) only
B.) (ii) and (iii) only
C.) (ii) and (iv) only
D.) (iv) only [GATE 2016]

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B.) (ii) and (iii) only
C.) (ii) and (iv) only
D.) (iv) only [GATE 2016]

SOLUTION:
Stateless protocol is a communications protocol in which no information is retained by either sender or receiver.
A protocol that requires keeping of the internal state on the server is known as a stateful protocol.
Stateless - HTTP, IP
Stateful - FTP, SMTP, POP3, TCP
TCP is stateful as it maintains connection information across multiple transfers, but TCP is a Transport layer protocol.
FTP and POP3 is stateful Application layer protocol.

5.)For a host machine that uses the token bucket algorithm for congestion control, the token bucket has a capacity of 1 megabyte and the maximum output rate is 20 megabytes per second. Tokens arrive at a rate to sustain output at a rate of 10 megabytes per second. The token bucket is currently full and the machine needs to send 12 megabytes of data. The minimum time required to transmit the data is seconds _____. [GATE 2016]

A.)1.1 sec

B.)1.2 sec

C.)1.3 sec

D.)1.4 sec

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SOLUTION:

According to the token bucket algorithm, the minimum time required sending 1 MB of data or the maximum rate of data transmission is given by:

$S = C / (M - P)$

Where,

M = Maximum output rate,

C = capacity of the bucket,

P = Rate of arrival of a token,

Given, M=20 Mb, C=1Mbps, P=10 Mbps

Therefore, S= 1 Mb / (20-10) Mbps = 1/10 = 0.1 sec

Since, the bucket is initially full, it already has 1 Mb to transmit so it will be transmitted instantly.

So, we are left with only (12 – 1) Mb, i.e. 11 Mb of data to be transmitted.

Therefore, time required to send the 11 MB will be 11 * 0.1 = 1.1 sec