East West University

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Assignment-01

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Section: 04

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Answer to the question no. 1

The encapsulation technique between source and destination below:

Frams are transmitted by layer Internet protocol stack techniq-ue.

There are 5 layers. Such as, Application, Transport, Network, Link and Physical.

Source and destination implements full 5 layers and transmit the data. But Router implements only 3 layers, which are Network, link and physical. Router just forwarding data. At last, source works top to bottom layer and receiver layer works bottom to top.

An encapsulation view draw in the next page:

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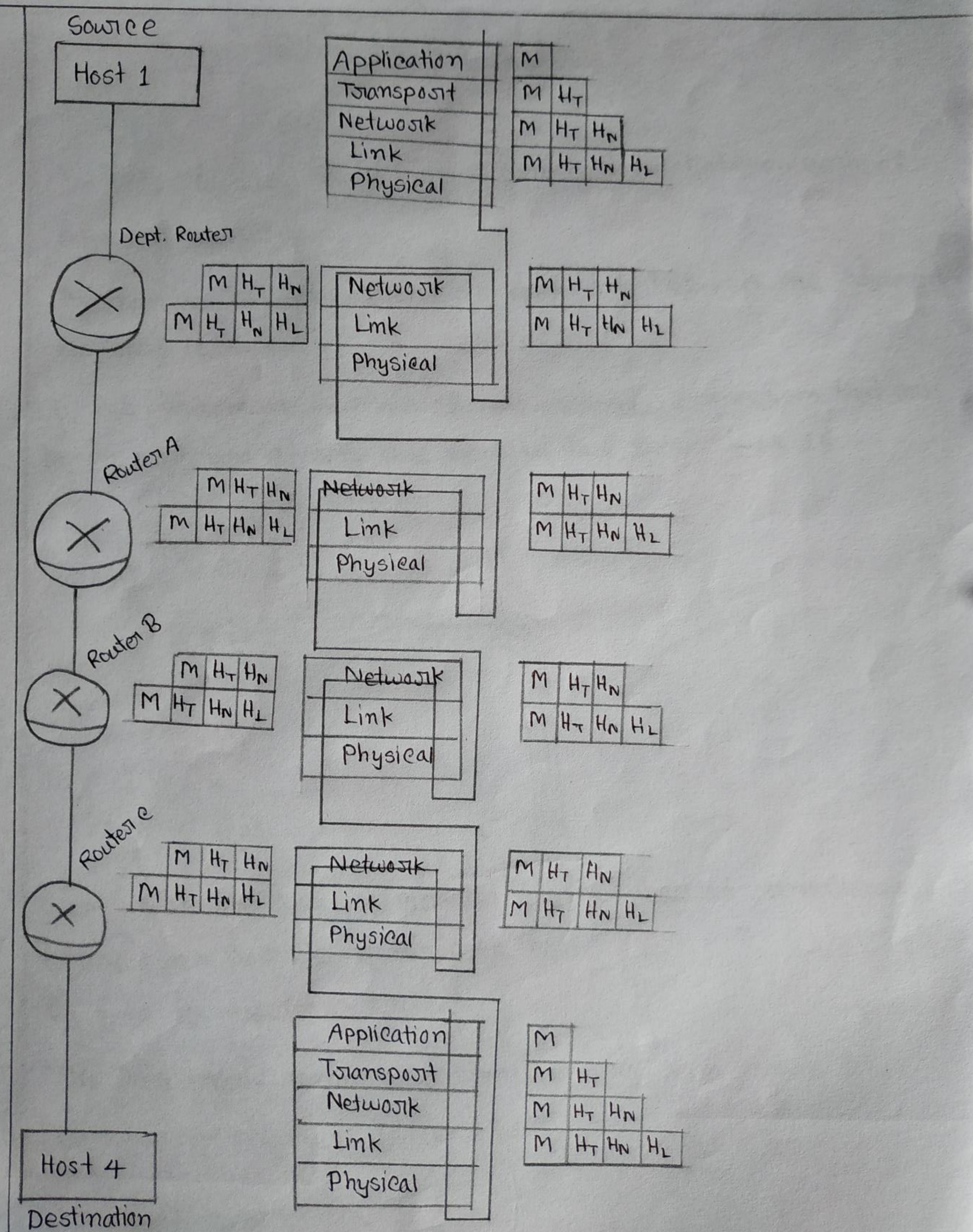

Source
Host 1
Application
Transport
Network
Link
Physical
M
M H_T
M H_T H_N
M H_T H_N H_L
Dept. Router
Network
Link
Physical
Router A
~~Network~~
Link
Physical
Router B
~~Network~~
Link
Physical
Router C
~~Network~~
Link
Physical
Application
Transport
Network
Link
Physical
Host 4
Destination

Answer to the question no. 2

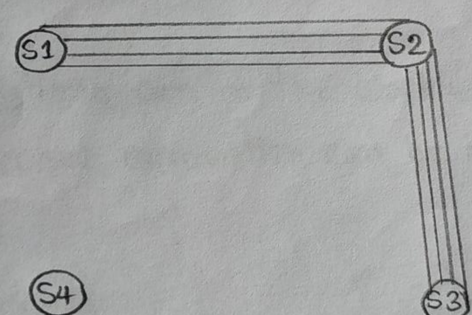
2.(a)

In this figure, there are 4 connections between each of adjacent switches.

The number of connections on each link between the adjacent switches is 4.

So, the maximum number of simultaneous connections that can be in progress at any one time in this network is 16.

2.(b)



When each link has n circuits, the number of simultaneous connections possible n for each host.

So total connection = 2n.

The maximum number of simultaneous connections that can be in progress is (2×4) = 8.

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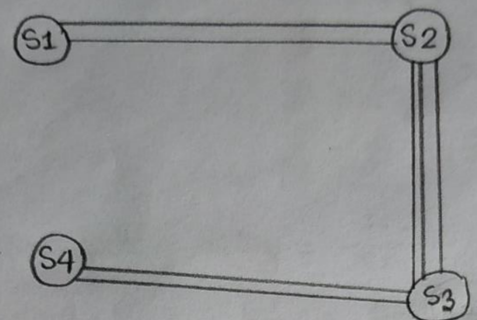
2.(c)



Yes, we can make three connections between S1 and S3 and another four connection between switches S2 and S4.

One link have four connections.

For S1 to S3,

Two connections can in the clock wise path from S1 to S2 and another one connection can be in clockwise from S2 to S3.

For S2 to S4,

Two connections can in the clockwise path from S2 to S3, and another two connection can be in clockwise from S3 to S4.

So, we can route these cells through the four links to accommodate all seven connections.

Answer to the question no. 3

1st link packet transmission delay $= \frac{L}{R_1}$

$$= \frac{1500 \times 8}{2 \times 10^6}$$

$$= 0.006 \text{ sec.}$$

1st link propagation delay $= \frac{d_1}{s_1}$

$$= \frac{5000 \times 10^3}{2.5 \times 10^8}$$

$$= 0.02 \text{ sec}$$

2nd link packet transmission delay $= \frac{L}{R_2}$

$$= \frac{1500 \times 8}{2 \times 10^6}$$

$$= 0.006 \text{ sec}$$

2nd link propagation delay $= \frac{d_2}{s_2}$

$$= \frac{4000 \times 10^3}{2.5 \times 10^8}$$

$$= 0.016 \text{ sec}$$

3rd link packet transmission delay $= \frac{L}{R_3}$

$= \frac{1500 \times 8}{2 \times 10^6}$

$= 0.006$ sec

3rd link propagation delay $= \frac{d_3}{S_3}$

$= \frac{1000 \times 10^3}{2.5 \times 10^8}$

$= 0.004$ sec

Given, delay time = 3 msec = 0.003 sec.

Total end-to-end delay $= L/R_1 + L/R_2 + L/R_3 + d_1/S_1 + d_2/S_2 + d_3/S_3 + d_{proc} + d_{proc}$

$= 0.006 + 0.006 + 0.006 + 0.02 + 0.016 + 0.004 + 0.003 + 0.003$

$= 0.064$ sec

∴ The end-to-end delay = 0.064 seconds.

Answer to the question no. 4

4.(a)

when circuit switching is used, 2 users can be supported. Because each user requires half of the link bandwidth.

4(b)

Given, Link speed is 2 Mbps which is shared and each user can transmits continuously at 1 Mbps.

If two or fewer user transmit simultaneously, a maximum of 2 Mbps will be required. The bandwidth of shared link is 2 Mbps, there will be no queuing delay before the link.

If three users transmit simultaneously, the bandwith required will be 3 Mbps, but available bandwidth is 2 Mbps which is less than required bandwidth.

So, In this case there will be queuing delay before the link.

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Answer to the question no. 5

5 (a)

Given,

$R1 = 500$ Kbps

$R2 = 2$ Mbps $= 2000$ Kbps

$R3 = 1$ Mbps $= 1000$ Kbps

We know, throughput is limited by the minimum of the capacity of the link. Here, minimum is R1.

So, Throughput is 500 kbps.

5 (b)

Given,

File size = 4 million bytes

$= 4 \times 10^6 \times 8$

Throughput = 500 kbps

$= 500 \times 10^3$

Transfer time, $t = \frac{4 \times 10^6 \times 8}{500 \times 10^3}$

$= 64$ sec.

5(c)

From (a) and (b), Throughput is 500 Kbps.

But now, Throughput is reduced to 100 kbps.

So, now throughput is 100 kbps

Transfer time, $t = \frac{4 \times 10^6 \times 8}{100 \times 10^3}$

$= 320$ sec.

$\therefore$ Link transfer time 320 sec.

Answer to the Question no. 6

6(a)

1. If only one node has data to transmit, throughput of that node will be R bps because there Is no need to passing token and complete transmission rate R can be used by that node only.

Thus, token passing protocol possess first characteristic.

2. If M node have data to transmit, token passing protocol passes the token to nodes in a fixed order such that each nodes gates equal chance to transmit the data. The only node that holds the token can transmit the data and thus at any instance of time only node can transmit the data. Thus, the average transmission rate will be nearly R/M bps.

Thus, token passing protocol possess second characteristic.

3. Token passing is fully decentralized since there is no master node and nodes need not be synchronized.

Thus, token passing protocol possess third characteristic.

4. Token passing is a simple protocol and highly efficient.
Thus, token passing protocol possess fourth characteristic.

Therefore, token passing protocol possess all four characteristics of desirable characteristics of a broad cast channel.

6(b)

1. If only one node has data to transmit, throughput of that node will be R bps, there will be no collision occurs. Because no other nodes want to trasmit data.

Thus, CSMA/CD protocol possess first characteristic.

3. CSMA/CD is also decentralized since there is no master node and nodes need to be synchronized.
Thus, CSMA/CD protocol possess third charactaristic.

4. CSMA/CD is a simple protocol but not highly efficient. It is inexpensive and widely available.

Thus, CSMA/CD protocol possess fourth characteristic.

Therefore, CSMA/CD protocol possess three characteristics of desirable characteristics of a broad cast channel.

Answer to the question no. 7.

7 (a)

Given, $K = 100$

For 10 Mbps broadcast channel,

$$\text{Adapter waiting time} = \frac{100 \times 512}{10 \times 10^3}$$

$$= 5.12 \text{ msec.}$$

7 (b)

Given data:

N = Nodes

R = Transmission Rate

d_{poll} = Polling delay

Q = Transmission of the polling round

∴ The length of polling round:

$$N\left(\frac{Q}{R} + d_{poll}\right)$$

The maximum thoroughput of the broadcast channel:

$$\frac{NQ}{N\left(\frac{Q}{R}+d_{poll}\right)}$$

$$= \frac{NQ}{\frac{NQ}{R} + N \cdot d_{poll}}$$

$$= \frac{1}{\frac{1}{R} + \frac{d_{poll}}{Q}}$$

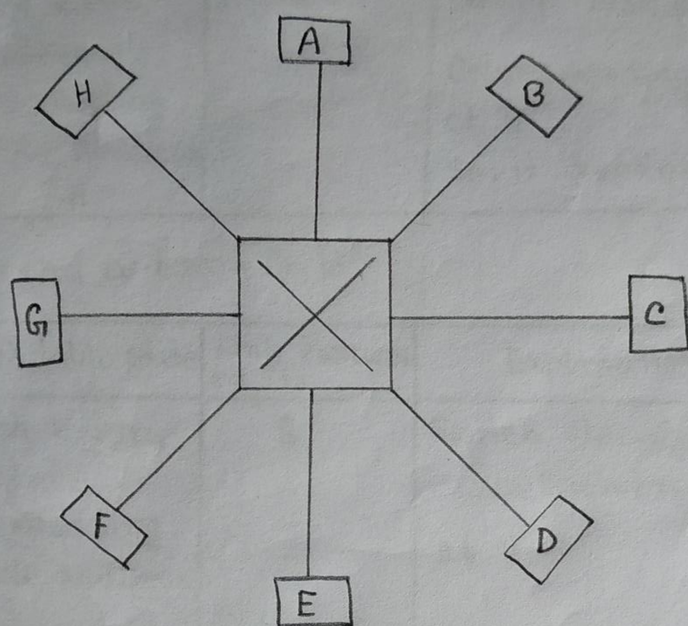
$$= \frac{R}{1 + \frac{R \cdot d_{poll}}{Q}}$$

So, maximum thoroughput of the broadcast channel

$$\frac{R}{1 + \frac{R \cdot d_{poll}}{Q}}$$

Answer to the question no. 8

A through H are star connected into an Ethernet switch.



(i) B sends a frame to H

Switch table state	Link Forwared to	Explanation
Switch learns interface corresponding to MAC address B	A, C, D. E, F, G, and H	The switch table is initially empty. So, switch does not know the interface corresponding to MAC address of H. Then switch forwards data all the node except source.

(ii) H replies with a frame to B.

Switch table state	Link Forwared to	Explanation
Switch learns interface corresponding to MAC address H	B	Switch already knows interface corresponding to MAC address of B. So, it replies H to B.

(iii) A send a fram to B

Switch table state	Link Forwarted to	Explanation
Switch learns interface corresponding to MAC address A	B	Switch already knows interface corresponding to MAC address of B.

(iv) B replies with a fram to A.

Switch table state	Link Forwared to	Explanation
Switch learns interface corresponding to MAC address B.	A	Switch already knows interface corresponding to MAC address A. So, it replies B to A.

(v) D sends a fram to C

Switch table state	Link Forwared to	Explanation
Switch learns interface corresponding to MAC address D	C	Switch already knows interface corresponding to MAC address C. So it sends data D to C

(vi) C replies with a fram to D

Switch table state	Link Forwared to	Explanation
Switch learns interface corresponding to MAC address C	D	Switch already knows interface corresponding to MAC address D. So, it replies C to D.

Answer to the question no. 9

Given,

The data rate = 10 Mbps

The distance between station A and C = 2000m

The propagation speed = 2×10^8 m/s

station A starts sending a long frame at time $t_1 = 0$

Station C starts sending a long frame at time $t_2 = 3\mu s$

9(a)

$$\text{The transmission time } (t_3 - t_1) = \frac{\text{distance}}{\text{propagation speed}}$$

$$= \frac{2000\ m}{2 \times 10^8\ m/s}$$

$$= 10\ \mu s.$$

Therefore,

$t_3 - t_1 = 10\ \mu s$

$t_3 = 10 + t_1$

$= (10 + 0)\ \mu s$

$= 10\ \mu s$

$\therefore$ The time when station C hears the collision $t_3 = 10\ \mu s$.

9(b)

The transmission time $(t_4 - t_2) = \frac{\text{distance}}{\text{propagation speed}}$

$$= \frac{2000\,m}{2 \times 10^8\,m/s}$$

$$= 10\,\mu s$$

Therefore,

$t_4 - t_2 = 10$

$t_4 = 10 + t_2$

$= 10 + 3$

$= 13\,\mu s$

∴ The time when station A hears the collision $t_4 = 13\,\mu s$.

9(c)

Transmission time of frame A $= t_4 - t_1$

$= (13 - 0)\,\mu s$

$= 13\,\mu s$

The number of bits station A has sent before detecting the collision $= 10\,Mbps \times 13\,\mu s$

$= 130$ bits.

9(d)

Transmission time of frame c $= t_3 - t_2$

$= (10 - 3)\,\mu s$

$= 7\,\mu s$

The number of bits station c has sent before detecting the collision $= 10\,Mbps \times 7\,\mu s$

$= 70$ bits.

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Answer to the question no. 10

Given,

Host A set elements = {0, 1, 2, 3}

Host B set elements = {0, 1, 2, 3, 4, 5, 6, 7}

Value of k :

Let, C-1

A	B
0	0
0	1
0	2
0	3
0	4
0	5
0	6
0	7

C-2

A	B
1	0
1	1
1	2
1	3
1	4
1	5
1	6
1	7

C-3

A	B
2	0
2	1
2	2
2	3
2	4
2	5
2	6
2	7

C-4

A	B
3	0
3	1
3	2
3	3
3	4
3	5
3	6
3	7

For C-1 combination:

When both A and B choose $K = 0$

Waiting time for A $= 0 \times T_{slot} = 0$

Waiting time for B $= 0 \times T_{slot} = 0$

Therefore, both Host A and B will transmit at the same time and hence collision occurs.

When A chooses $K=0$ and B chooses $K=1$

Waiting time for $A = 0 \times T_{slot} = 0$

Waiting time for $B = 1 \times T_{slot} = T_{slot}$

Therefore, A transmits the packet and B waits for time T_{slot} for Transmitting.

From (0,1) to (0,7) combination,
A transmits the data packet and B waits for time $T_{slot} \times (2-7)$ for transmitting.

For C-2 combination:

When A chooses $K=1$ and B chooses $K=0$

Waiting time for $A = 1 \times T_{slot} = T_{slot}$

Waiting time for $B = 0 \times T_{slot} = 0$

Therefore, B transmitts the packet and A waits for time T_{slot} for Transmitting.

When both A and B choose $K=1$

Waiting time for $A = 1 \times T_{slot} = T_{slot}$

Waiting time for $B = 1 \times T_{slot} = T_{slot}$

Therefore, both will wait for same time T_{slot} and then transmit. Hence collision occurs.

From (1,2) to (1,7) combination,

First,
Host A waits for time T_{slot} and then transmit. Then,
Host B waits for time $T_{slot} \times (2-7)$ then transmit.

For C-3 combination:

When A chooses $K=2$ and B chooses $K=0$

Waiting time for $A = 2 \times T_{slot} = 2\,T_{slot}$

Waiting time for $B = 0 \times T_{slot} = 0$

Therefore, B transmits the packet and A waits for time $2\,T_{slot}$ for transmitting.

From (2,3) to (2,7) combination,
First,
Host A waits for time $2 \times T_{slot}$ and then transmit. Then,
Host B waits for time $T_{slot} \times (3-7)$ then transmit.

For C-4 combination:

When A chooses $K=3$ and B chooses $K=3$

Waiting time for $A = 3 \times T_{slot} = 3\,T_{slot}$

Waiting time for $B = 3 \times T_{slot} = 3\,T_{slot}$

Therefore, both will trasmit at the same time and hence collision occurs.

From (3,0) to (3,2) combination,

First,
Host B waits for time $(0-2) \times T_{slot}$ and then transmit.

Then,
Host A waits for time $(3) \times T_{slot}$ and then transmit.

And,

From (3,4) to (3,7) combination,

First,
Host A waits for time $3 \times T_{slot}$ and then transmit.

Then,
Host B waits for time $(4-7) \times T_{slot}$ and then transmit.

After the all possible combination and calculation, we could see; how and when two hosts A and B get into collision consecutively.

Answer to the question no. 11

Given bit pattern = 1110 0110 0011 101

= 0111 0011 0001 1101

The minimum length checksum field should be 4x4 matrix.

Two dimensional even parity :

				P-bit
0	1	1	1	1
0	0	1	1	0
0	0	0	1	1
1	1	0	1	1
1	0	0	0	1

Answer to the question no. 12

Given, G = 10011

D = 1010101010

Here, error detection code is 5 bit. so, FCS = 4 bit

now, D is = 10101010100000

```
10011 | 10101010100000 | 101101110
        10011
        -----
         11001
         10011
         -----
          10100
          10011
          -----
            11110
            10011
            -----
             11010
             10011
             -----
              10010
              10011
              -----
                0100 → R
```

The value of R = 0100