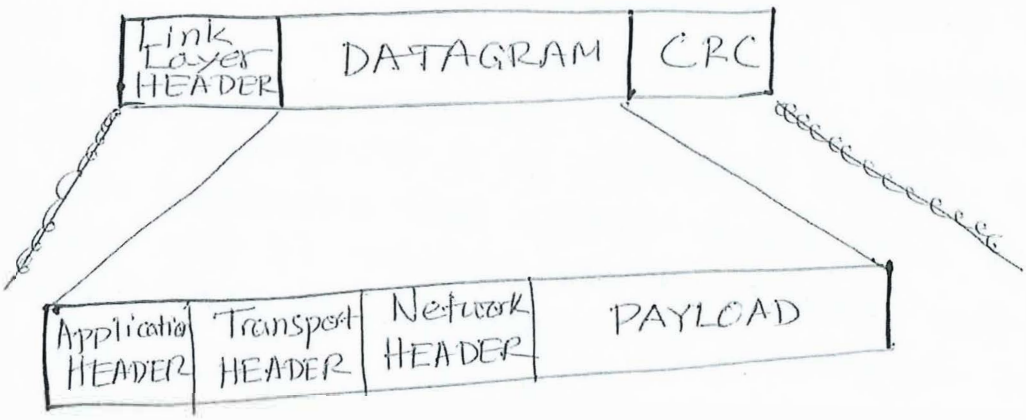
Tutorial - 10

Solution

10-1 The frame generated by the link layer which encapsulate the datagram by combining with the link layer header and the error bits/ CRC bits. No more signalling or data bits are added, only preamble is added with the frame generated by the link layer. The PHY layer adds the preamble before transmission.



9-2 Packet transmission time $X = \frac{L}{R}$

if $d_{prop} < X$

NOT USED

In this case the packet transmission goes for longer ~~period~~ duration than the propagation time. If no carrier sensing or channel sensing technique is used; a collision will happen because a new packet could interfer with the current transmission.

In case of the CSMA protocol collision can still happen but overall efficiency will be better.

9-3 In this case binary exponential backoff algorithm is used. For nth collison, a node chooses the value of K at random from the following set of values $\{0, 1, 2 \cdots 2^{n-1}\}$

In case of 5th collison the ~~data~~ value of K will be selected from the following set { ~~0, 1, 2, 3, 4, 5, 6, 7, 8~~ }
Assume K value of 4 is selected (random selection).
The wait time/ backoff time $D_{BO} = K * 512/R$

$$\Rightarrow D_{BO} = \frac{4 \times 512}{10 \times 10^6} = 2.048 \times 10^{-4} \text{ sec}$$

9-3 ARP query is transmitted by a host seeking the MAC address. A LAN may be one or more ARP server which will return the requested MAC address. An ARP server operates in a transparent mode. A broadcast will reach every host connected to a LAN. Hence, the broadcast mechanism is the most efficient approach to implement the ARP procedure. Response frame is sent in a unicast mode sending information to the requested host/node.

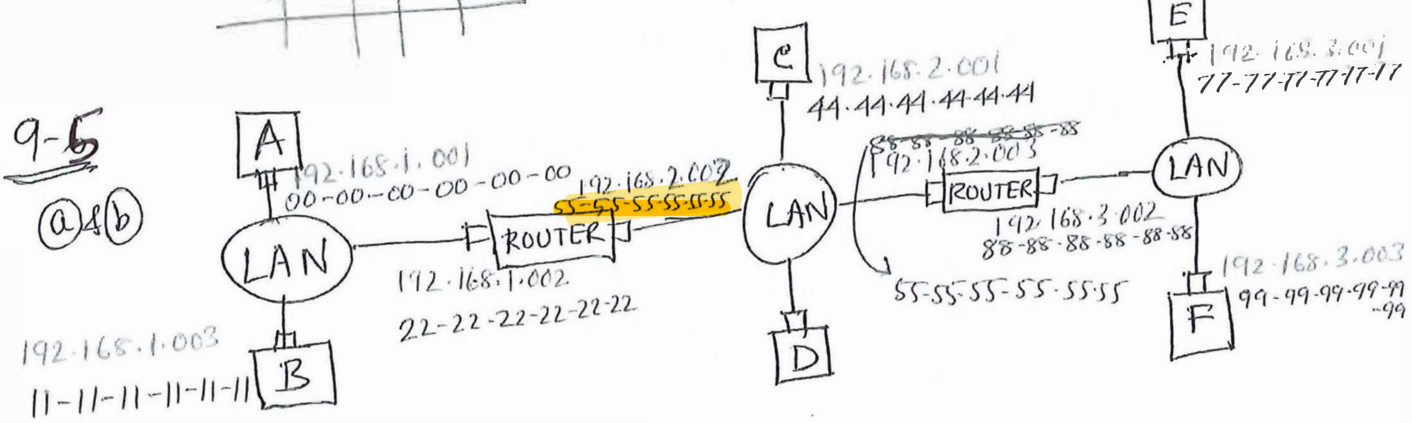
9-4 Data string : 1010 0111 0101 1001

Using even parity

Parity bit

1	0	1	0	0
0	1	1	1	1
0	1	0	1	0
1	0	0	1	0
0	0	0	1	1

9-5
(a)&(b)



(c) (i) Forwarding table E determines that the datagram should be routed to interface 192.168.3.002

(ii) The adapter in E creates an ethernet packet with the Ethernet destination address 88-88-88-88-88-88

(iii) Router 2 receives the packet and extracts the datagram. The forwarding table in this router indicates that the datagram is to be routed to 192.162.2.002

(iv) Router 2 then sends the Ethernet packet with the destination address 33-33-33-33-33-33 by including 55-55-55-55-55-55 as the ~~interface~~ source address via its interface with IP address of 192.168.2.003

(v) This process continues until the packet has reached the host B.

9-6:

Four nodes/department

Three departments

Total number of nodes, $N = 4 \times 3 + 2$ (servers)

$\Rightarrow N = 14$

In this network each node is connected by their dedicated link to the switch, the link speed is 120 Mbps.

Hence, the aggregated throughput is 14×120

$= 1680$ Mbps

$= 1.68$ Gbps

9-8 We allocate following IP addresses to three EE computers (Left to right allocation)

111.111.1.1, 111.111.1.2 and 111.111.1.3 the subnet mask is 111.111.2/24

The router's interface card that connects to port 1 can be configured to contain two sub-interface IP addresses 111.111.1.0 and 111.111.2.0. The first address is for the EE subnet and the second one for the CS subnet. Each IP address is associated with a VLAN ID. Suppose 111.111.1.0 is associated with VLAN 11 and 111.111.2.0 is associated with VLAN 12. Hence, each frame that comes from subnet 111.111.1/24 will be added with an 802.1q tag with the VLAN ID 11 and each frame that comes from 111.111.2/24 will be added ~~on~~ with an 802.1q tag with the VLAN ID 12.

Suppose that an EE node A 111.111.1.1 wants to send an IP datagram to a CS node 111.111.2.1, ~~node~~. Node A first encapsulate the IP datagram into a frame with the destination MAC address equal to the MAC address of the router's interface card that connects port 1 of the switch. Once the router receives the frame, then it passes the frame to the IP layer which then decides that the datagram should be forwarded to subnet 111.111.2/24 via the interface 111.111.2.0. Then the router encapsulates the IP datagram into a frame and sends it to port 1. Note that this frame has an 802.1q tag of VLAN ID 12. Once the switch receives the frame from port 1, it knows that this frame is destined to VLAN 12. ~~Once the switch receives the frame port~~ So the switch will send the frame to node B in the CS department. Once frame is received the 802.1q tag will be removed.

5

9-8: (a) Probability that node A succeds for the first time in slot 5.

~~p(success) = p(A) (1 − p(A))~~ Assume p is the probability of transmission.

$P(\text{success}) = p(\text{A transmits and B, C, D don't transmit})$

$= p(\text{A transmit})\, p(\text{B don't transmit})\, p(\text{c don't})\, P(\text{D don't})$

$= p(1-p)(1-p)(1-p)$

$= p(1-p)^3$

Hence, p(A) succeeds in first time in slot

$P_5(\text{success}) = (1-p(A))^4 p(A)$

$\cancel{= [1 - p(A)}$ $= [1 - p(1-p)^3]^4 \, p(1-p)^3$

(b) $p(\text{A succeeds in slot 4}) = p(1-p)^3$

same for other nodes

$p(\text{either A or B or C or D succeeds in slot 4}) = 4p(1-p)^3$

↳ Above events are mutually exclusive

~~(c) p(some node succeeds in a slot) = 4p(1−p)^3~~

~~p(no node succeds in a slot) = 1 − 4p(1−p)^3~~

— X —