HomeWork

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Question1:

Consider building a CSMA/CD network running at 1Gbps over a 1-km with no repeaters. The signal speed in the cable is 200,000km/sec. What's the minimum frame size?

Answer:

As a result for a 1km cable the one way propagation time

$$\tau = s/v = 1/200000 = 5 \times 10^{-6} s$$

so the length of a contention slot

$$t = 2\tau = 2 \times 5 \times 10^{-6} = 1 \times 10^{-5}$$

so the minimum frame size:

$$1Gbps \times t = 1Gbps \times 1 \times 10^{-5} = 10000b = 1250B$$

Question2:

Frames of 1000 bits are sent over a 1-Mbps channel using a geostationary satellite whose propagation time from the earth is 270 msec.Acknowledgements are always piggybacked onto data frames. The headers are very short. Three-bit sequence numbers are used. What is the maximum achievable channel utilization for:
(a) Stop-and-wait.
(b) Protocol 5.
(c) Protocol 6.

Answer:

The time for send a frame is: $t = 1000bits/1Mbps = 0.001s$
Round trip time: $R = 270ms \times 2 = 540ms$
Therefore, a transmission cycle is $R + 2 = 542s$
so if we can send k frame in $542s$, the channel utilization rate is $k/542$

(a) stop-and-wait: $k = 1$
so the maximum achievable channel utilization: $1/542 \approx 0.1001845 \approx 0.18\%$

(b) Protocao 5: $k = 7$
the maximum achievable channel utilization: $7/542 \approx 1.29\%$

(c) Protocol 6: $k = 4$
the maximum achievable channel utilization: $4/542 \approx 0.74\%$

Question3:

In some networks, the data link layer handles transmission errors by requesting damaged frames to be retranmitted. If the probability of a frame's being damaged is p, what is the mean number of transmissions required to send a frame? Assume that acknowledgements are never lost.

Answer:

We assume that a frame is transmitted k times before it is successfully transmitted. The probability of k-1 failures is p^{k-1}. The probability of kth successfully transmit is $(1-p)$. So the average number of of transmissuions for sending a successful frame is :

$$\sum kP_k = \sum k(1-p)p^{k-1} = \frac{1}{1-p}$$

Question4:

Assume the company has five departments A to E, There are 50 PCs in department A, 20 PCs in B, 30 in C, 14 in D and 20 in E. Enterprise information manager allocates a total network address of 192.168.2.0/24 to you, as network administrator, your task is to divide the subnet for each department. Write an IP subnet planning report based on the minimum waste of IP(filling out the table).

Answer:

Department	Start-stop IP/Subnet mask	Subnet number	The broadcast address
eg:A	192.168.2.1-62/26	192.168.2.0	192.168.2.63
B	192.168.2.65-126/26	192.168.2.64	192.168.2.127
C	192.168.2.129-190/26	192.168.2.128	192.168.2.191
D	192.168.2.193-222/27	192.168.2.192	192.168.2.223
E	192.168.2.225-254/27	192.168.2.224	192.168.2.255

Question5:

Suppose the routing table of router B in the network has the following items (the three columns represent "destination network", "distance" and "next hop router" respectively).

N1 7 A
N2 2 C
N6 8 F
N8 4 E
N9 4 F
Now B receives routing information from C(the two columns represent "destination network" and "distance" respectively);
N2 4
N3 8
N6 4
N8 3
N9 5
Try to find the updated routing table of router B.

Answer:

N1 7 A(Original routing, unchanged)
N2 5 C(the same next hop router, update and distance+1)
N3 9 C(new items, add)
N6 5 C(different next hop router, the distance is short, update)
N8 4 E(different next hop router, the distance is same, unchanged)
N9 4 F(different next hop router, the distance is long, unchanged)

Question:

Consider a link to which packets are served at a rate of 450 packets /sec and arrive as a Poisson process such that the time taken to service a packet is exponentially distributed. Suppose that the mean packet length is 250 bytes, and that the link capacity is 1 Mbps.
(a) What is the probability that the link's queue has 1,2 and 10 packets respectively?
(b) What is the mean number of packets in the system? What is the mean number in the queue? (c) What is the mean waiting time?

Answer:

(a) The packet length is 250 bytes = 2000bits, so that the link service rate of 1,000,000 bits/sec = 500 packets/sec. Therefore, the utilization is 450/500 = 0.9. When the link queue has 1 packet, it is in state j=2, because one packet is being served at that time. Thus, we need

$$p(1) = 0.9^2 \times 0.1 = 0.081$$

For the queue having two packets, we compute

$$P(2) = 0.9^3 \times 0.1 = 0.0729$$

For 10 packets in the queue, we compute

$$P(10) = 0.9^1 1 \times 0.1 = 0.031$$

(b) The mean number of packets in the system is $0.9/(1-0.9) = 9$, Of these, 8 are expected to be in the queue.

(c) The mean waiting time is

$$(1/500)/(1-0.9) = 0.002/0.1 = 0.02s$$