Lovelin Anand Edward Paul
B00669954
Computer Networks Assignment - 2

1. The Stop-and-Wait protocol is used for a 10 Mbps link over a 2000 km long cable to send frames of 1000 bytes each. The signal propagation speed is 2 × 10 ^ 8 meters per second. Suppose ACK send time and processing time for both send and receive are negligible. What is the link utilization?

Bandwidth = 10Mbps
Cable Length = 2000 km
Packet size = 1000 bytes
Signal Propagation = 2 * 10 ^ 8 m/s

Propagation Delay = 2000 km / 2 * 10 ^ 8 meters/s = 10 ms
Transmission time of single packet, T1 = 1000 bytes / 10 Mbps = 0.1ms
Transmission time from start to end, T2 = Transmission time of single packet + propagation delay + Transmission time of ack packet
= 0.1 + 10 + 10
= 20.1ms
Link Utilization = T1/ T2
= 10 ms / 20.1ms
= 0.4975 %

The Link Utilization is 0.4975 %

2. Suppose you are designing a sliding window protocol for a 1-Mbps point-to-point link to the stationary satellite revolving around the Earth at an altitude of 3 × 10^4 km. Assuming that each frame carries 1000 bytes of data, what is the minimum number of bits you need for the sequence number in the following cases? Assume the speed of light is 3 × 10^8 m/s.
(a) Go-back-N, where RWS=1
(b) Selective repeat, where RWS=SWS

Latency of the link = 100msec
Propagation delay = 3 * 10 ^ 7 / 3 * 10 ^ 8
= 0.1 s
Round Trip Time = 0.2 s
B (fps) = Bandwidth / Size of frame
= 1 Mbps / 1000 bytes
= 125
Bandwidth-delay product = 125 * 0.2
= 25 packets
So, the SWS should be large to hold at least 25 packets

a) If RWS = 1,

The receiver can handle only one frame at a time, so we need to have 25 unique frames sequence. So, **5 bits are needed.**

b) If RWS = SWS,

The sender can send twice as many frames since the receiver can store more. Thus, 50 unique frames can be sent. So, **6 bits are needed**

3. Consider a hypothetical Ethernet standard xBaseAB with the following specifications.

1. A maximum of 10 segments of cable, each 500 meters long, can be cascaded by 9 repeaters to form a network diameter of 5,000 meters.

2. Signal propagation speed is 2 × 10 ^ 8 meters per second.

3. Per repeater delay is 0.5 μsec.

4. Minimum frame length is 40 bytes.

5. Data rate is 10 Mbps. Determine whether collision detection would work with xBaseAB. (Calculations are mandatory.)

Propagation Delay for each segment = 500 / 2 * 10 ^ 8

= 2.5 μs

Propagation Delay for 10 segments = 25μs

Per repeater delay = 0.5 μs

9 repeaters delay = 9 * 0.5 = 4.5μs

Total Delay = 25 μs + 4.5 μs

= 29.5μs

Round Trip Delay = 29.5 * 2 = 59 μs

Minimum frame length = 40 bytes = 320 bits

Time to transmit 320 bit in 10 Mbps = 32 μs

To detect collision, the other end should sense transmission before transmission ends.

Since time to transmit minimum frame is less than round trip delay**, Collision detection would not work with xBaseAB**

4. Why are acknowledgments used in 802.11 but not in wired Ethernet?

There is no packet loss in wired Ethernet. A packet is guaranteed to be received in the other end. But in 802.11, there are lots of chances of packet loss due to noise, out of range. So to provide proper transmissions, ACKs are required.

5. What does CA stand for in CSMA/CA? Why cannot collision detection be used in wireless networks?

CA stands for Collision avoidance. Wireless network devices cannot send and receive in same channel at the same time. So it is impossible to detect collision in wireless networks.

6. In IEEE 802.11 protocol, RTS and CTS frames are used to reserve access to the channel. Suppose the RTS and CTS frames are as long as the standard DATA and ACK frames. Will there be any advantages using the RTS/CTS frames?

No, there will be no advantage if the RTS and CTS are as long as standard DATA and ACK frames. It would be same as using a standard DATA frame and the channel will be wasted for colliding frames.

7. In the 802.11 CSMA/CA protocol, if a station has received an acknowledgement frame from the destination, it knows that its frame has been correctly received at the destination station. If this station has another frame to send, instead of listening to the medium and transmit after the medium has been idle for DIFS duration, it immediately begins the binary exponential backoff phase. What has caused the designers of the CSMA/CA protocol to not have such a station transmit the second frame immediately (if the medium is sensed idle)?

This has been designed in this way so that fairness will be maintained across multiple stations. If station A wants to transmit large number of packets to another station C, It will request C to send and will send a packet. In the middle of transmission, if another station B wants to transmit, it will sense the channel is busy and back off immediately. After receiving ack from C, A will begin binary exponential backoff. If A does not backoff, It will be sending packets continuously to C and B will be waiting forever. To avoid this, this method was designed.

8.Consider hosts X, Y, Z, W and learning bridges B1, B2, B3, with initially empty forwarding tables, as in Figure 1.
(a) Suppose X sends to W. Which bridges learn where X is? Does Y's network interface see this packet?
(b) Suppose Z now sends to X. Which bridges learn where Z is? Does Y's network interface see this packet?
(c) Suppose Y now sends to X. Which bridges learn where Y is? Does Z's network interface see this packet?
(d) Finally, suppose W sends to Y. Which bridges learn where W is? Does Z's network interface see this packet

a) When X sends to W, being empty forwarding table, it is transmitted to all bridges. So all bridges B1, B2, B3 will learn where X is.
Yes, Y network interface can see this packet.

b) Since all bridges know where X is(from a), packet from Z will be transmitted to X through B3, B2, B1. These Bridges (B3, B2, B1) will learn where Z is.
As bridges know where X is, Y network interface won't see this packet.

c) If Y sends to X, it will go through B2, B1(learnt from a). Bridges B2 and B1 will learn where Y is.

d) When W sends to Y, B3 does not know where Y is. So it will be retransmitted to all nodes. So, Z interface will see this packet. As, B2 knows where Y is, it will transmit to Y. Both B2 and B3 will learn where W is.