姚熙源 3190300677 计算机网络作业 4

1. A group of N stations share a 56-kbps pure ALOHA channel. Each station outputs a 1000-bit frame on average once every 100 sec, even if the previous one has not yet been sent (e.g., the stations can buffer outgoing frames). What is the maximum value of N?

Answer : The maximum throughput in pure Aloha mechanism can get 18.4%. For 56kbps Pure ALOHA Channel , the data rate is 0.184 * 56kbps = 10304bps. One station outputs 1000bits in every 100 sec so one station will output 1000/100 = 10bits per second. For N station in 1 second, the total output data rate is 10 * N bits, this should be equal to the channel capacity in pure ALOHA, N * 10 = 10304, so N = 1030, which is the maximum number of station.

2. Consider the delay of pure ALOHA versus slotted ALOHA at low load. Which one is less? Explain your answer.

Answer : When the load is low, collisions will be lesser and there are more chances to transmit a frame successfully. In pure ALOHA, a station will transmite a frame whenever it is in ready, but in case of slotted ALOHA, even if the load is low a station has to wait for the start of next time slot to transmit its frame(even if the frame is ready). So, delay in pure ALOHA will be lesser than slotted ALOHA.

3. Sixteen stations, numbered 1 through 16, are contending for the use of a shared channel by using the adaptive tree walk protocol. If all the stations whose addresses are prime numbers suddenly become ready at once, how many bit slots are needed to resolve the contention?

Answer : Prime numbers for 1-16 are 2,3,5,7,11 and 13. So stations are 2,3,5,7,11,13. Then,

Slot1 : 2,3,5,7,11,13

Slot2 : 2,3,5,7

Slot3 : 2,3

Slot4 : 2

Slot5 : 3

Slot6 : 5,7

Slot7 : 5

Slot8 : 7

Slot9 : 11,13

Slot10 : 11

Slot11 : 13

Total 11 bit slows are needed to resolve the contention

4.Six stations, A through F, communicate using the MACA protocol. Is it possible for two transmissions to take place simultaneously? Explain your answer.

Answer : Yes. Since they are in a straight line and each station can only reach its nearest neighbours, A can only reach B, B can reach A and C. Therefore, in a case that A can send to B, while E is sending to F.

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

Answer : For a 1km cable, the propagation time for one way is 1km / 200000km/sec = 5 * 10^-6 = 5μsec, so for both ways would be 2 * 5μsec = 10μsec(at least). To let CSMA/CD works, it must be impossible to transmit an entire frame in this interval. At 1Gbps, all frames shorter than 10000bits can be completely transmitted in under 10μsec, so the minimum frame is 10000bits or 1250 bytes. 10^9 bps * 10 * 10^-6 sec = 10^4 bits / 1250bytes.

6. Please show the differences between

(a) The Ethernet CSMA/CD protocol and the 802.11 CSMA/CA protocol

(b) The MACA protocol and the 802.11 CSMA/CA protocol

Answer :

(a) CSMA/CD needs to listen to the medium when a station is transmitting, will terminate the transmission immediately if a collision is detected, and retransmit after a random period of time. The CSMA/CA has to listen to whether the medium is in use before sending the frame, if it is in use then it will wait until it is idle

(b) RTS/CTS frames in CSMA/CA solves hidden terminal problem found in CSMA/CD. Exposed terminal problem cannot be solved by RTS/CTS frames in CSMA/CA while MACA protocol uses RTS and CTS to solve hidden and exposed terminal problem.

7. An unscrupulous host, A, connected to an 802.3 (Ethernet) network biases their implementation of the binary exponential backoff algorithm so they always choose from {0,1} after a collision, in any situation. Another host, B, is trying to send a frame at the same time as A. Assuming A and B collide exactly three times before one of their transmissions succeeds, what are the odds that B sends its frame before A(as opposed to A sending before B)?

Answer : After i^{th} time collision, A always choose to wait {0,1} time slots and B waits {0, 2^i - 1} time slots, so after three times of collision, A has 2 choices and B has 8 choices. According to multiplication principle, there are 16 cases in total, in which there are two conflicting cases which are (0,0) and (1,1), so there are 14 non-conflicting cases. If B transmit first, then (x,y) should satisfy y<x, when x = 0, y is always impossible to satisfy, when x = 1 if and only if y = 0, so only (1,0) satisfy the condition. The probability is 1/14.

8. Consider the following wireless network, where the circles are showing transmission ranges, and the presence of a host (letter) in a particular circle indicates it can hear that transmitter. If hosts A and C are both trying to send to host B will they encounter the hidden or exposed station problems? Does the MACA protocol help in this situation?

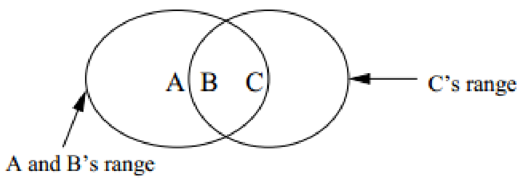

Figure 1: MACA Network showing transmission ranges for Question 8.

Answer : They will encounter the hidden station problem, because when A and C are transmitting to B at the same time, C does not know that A has sent a frame too, so C will continue to send then a collision will occur at B. MACA protocol can solve this problem. The problem is when A wants to transmit data to B, it will send RTS(request to send) to B, at the same time C listen the RTS so C needs to wait, then B will return CTS to A as a reply. A can start to transmit data to B completely. When A complete the transmission then C will only start to send RTS to B for data transmission.

9. Consider the extended LAN connected using bridges B1 and B2 in Fig. 4-41(b). Suppose the hash tables in the two bridges are empty. List all ports on which a packet will be forwarded for the following sequence of data transmissions:

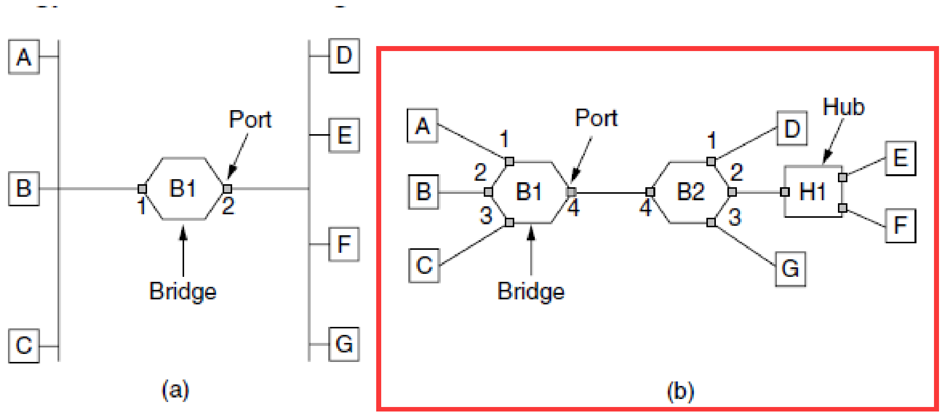

Figure 4-41. (a) Bridge connecting two multidrop LANs. (b) Bridges (and a hub) connecting seven point-to-point stations.

(a) A sends a packet to C.

(b) E sends a packet to F.

(c) F sends a packet to E.

(d) G sends a packet to E.

(e) D sends a packet to A.

(f) B sends a packet to F.

Answer :

(a) B1: 2,3,4	B2: 1,2,3
(b) B1: 1,2,3	B2: 1,2,3
(c) B1: null	B2: null
(d) B1: null	B2: 2
(e) B1: 1	B2: 4
(f) B1: 1,3,4	B2: 2