Course: Computer Networks I

Assignment #4: MAC & LAN

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1. Let *G* be the total rate at which frames are transmitted in a slotted ALOHA system. What proportion of slots goes empty in this system? What proportion of slots go empty when the system is operating at its maximum throughput? Can observations about channel activity be used to determine when stations should transmit?

2. A wireless LAN uses polling to provide communications between *M* workstations and a central base station. The system uses a channel operating at 25 Mbps. Assume that all stations are 100 meters from the base station and that polling messages are 64 bytes long. Assume that frames are of constant length of 1250 bytes. Assume that stations indicate that they have no frames to transmit with a 64-byte message. What is the maximum possible arrival rate that can be supported if stations are allowed to transmit an unlimited number of frames/poll?

    1. What is the maximum possible arrival rate that can be supported if stations are allowed to transmit *N* frames/poll?
    2. Repeat parts (a) and (b) if the transmission speed is 2.5 Gbps.

3. Suppose that a group of 32 stations is serviced by a token-ring LAN. For the following cases calculate the time it takes to transfer a frame using the three token reinsertion strategies: after completion of transmission; after return of token; after return of frame.

    a) 1000 bit frame; 10 Mbps speed; 2.5-bit latency per adapter; 50 meters between stations.
    b) Same as part (a) except 100 Mbps speed and 8-bit latency/adapter.
    c) Same as part (a) except 1 km distance between stations.

4. A group of *N* stations share a 56-kbps pure ALOHA channel. Each station outputs a 1000-bit frame on an average of 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*?

5. Ten thousand airline reservation stations are competing for the use of a single slotted ALOHA channel. The average station makes 18 requests/hour. A slot is 125 μsec. What is the approximate total channel load?

6. A 1-km-long, 10-Mbps CSMA/CD LAN (not 802.3) has a propagation speed of 200 m/μsec. Repeaters are not allowed in this system. Data frames are 256 bits long, including 32 bits of header, checksum, and other overhead. The first bit slot after a successful transmission is reserved for the receiver to capture the channel in order to send a 32-bit acknowledgement frame. What is the effective data rate, excluding overhead, assuming that there are no collisions?

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

8. A CDMA receiver gets the following chips: (-1 +1 -3 +1 -1 -3 +1 +1). Assuming the chip sequences defined in figure 1, which stations transmitted, and which bits did each one send?

A: (−1 −1 −1 +1 +1 −1 +1 +1)
B: (−1 −1 +1 −1 +1 +1 +1 −1)
C: (−1 +1 −1 +1 +1 +1 −1 −1)
D: (−1 +1 −1 −1 −1 −1 +1 −1)

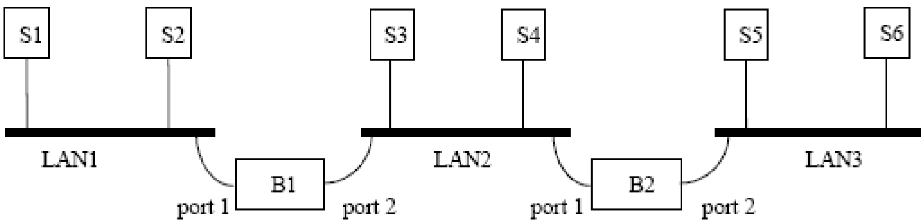
Figure 1

9. Suppose that A , B , and C are simultaneously transmitting 0 bits, using a CDMA system with the chip sequences of figure 2. What is the resulting chip sequence?

A: (−1 −1 −1 +1 +1 −1 +1 +1)
B: (−1 −1 +1 −1 +1 +1 +1 −1)
C: (−1 +1 −1 +1 +1 +1 −1 −1)
D: (−1 +1 −1 −1 −1 −1 +1 −1)

Figure 2

10. Six stations (S1-S6) are connected to an extended LAN through transparent bridges (B1 and B2), as shown in the figure below. Initially, the forwarding tables are empty. Suppose the following stations transmit frames: S2 transmits to S1, S5 transmits to S4, S3 transmits to S5, S1 transmits to S2, and S6 transmits to S5. Fill in the forwarding tables with appropriate entries after the frames have been completely transmitted.



Station	Port

Station	Port