Homework #5: Due April 15, 2004
5 Points Each

Problem 4.22
An IP packet to be transmitted by Ethernet is 60 bytes long, including all its headers. If LLC is not in use, is padding needed in the Ethernet frame, and if so, how many bytes?

The minimum Ethernet frame is 64 bytes, including both addresses in the Ethernet frame header, the type/length field, and the checksum. Since the header fields occupy 18 bytes and the packet is 60 bytes, the total frame size is 78 bytes, which exceeds the 64-byte minimum. Therefore, no padding is used.

Problem 4.26
How many frames per second can gigabit Ethernet handle? Think carefully and take into account all the relevant cases. Hint: the fact that it is gigabit Ethernet matters.

The smallest Ethernet frame is 512 bits, so at 1 Gbps we get 1,953,125 or almost 2 million frames/sec. However, this only works when frame bursting is operating. Without frame bursting, short frames are padded to 4096 bits, in which case the maximum number is 244,140. For the largest frame (12,144 bits), there can be as many as 82,345 frames/sec.

Problem 4.30
An 802.16 network has a channel width of 20 MHz. How many bits/sec can be sent to a subscriber station?

It depends how far away the subscriber is. If the subscriber is close in, QAM-64 is used for 120 Mbps. For medium distances, QAM-16 is used for 80 Mbps. For distant stations, QPSK is used for 40 Mbps.

Problem 4.32
Give two reasons why networks might use an error-correcting code instead of error detection and retransmission.

One reason is the need for real-time quality of service. If an error is discovered, there is no time to get a retransmission. The show must go on.

Problem #5

Briefly describe the difference between store-and-forward and cut-through switches. What is an advantage of store-and-forward switches over cut-through switches with respect to damaged frames?

A store-and-forward switch stores each incoming frame in its entirety, then examines it and forwards it. A cut-through switch starts to forward incoming frames before they have arrived completely. As soon as the destination address is in, the forwarding can begin.

Forward error correction can be used here. Another reason is that on very low quality lines (e.g., wireless channels), the error rate can be so high that practically all frames would have to be retransmitted, and the retransmission would probably damaged as well. To avoid this, forward error correction is used to increase the fraction of frames that arrive correctly.

Problem #6

What is the baud rate of the standard 10 Mbps Ethernet?

The Ethernet uses Manchester encoding, which means it has two signal periods per bit sent. The data rate of the standard Ethernet is 10 Mbps, so the baud rate is twice that, or 20 megabaud.

What is the baud rate of standard Fast Ethernet?

Several answers. Two are given below.

100Base-T4 – 25 MBaud

100 Mbps/(4 bits/symbol)

100Base-TX – 125 MBaud

125 MHz (4B/5B) = 100 Mbps, where 4B/5B provides for 32 combinations of signal values for each 5 clock cycles only containing 16 bit groups as data (100 Mbps (5B/4B) = 125 MBaud)

List 2 similarities and 2 differences between standard 10 Mbps Ethernet and Fast Ethernet.

Differences: (among others)

Fast Ethernet: Generally does not use Manchester encoding

10 Mbps Ethernet: Uses Manchester encoding

Cabling requirements differ due to roundtrip delay times associated with different data rates (10 Mbps Ethernet vs 100 Mbps for Fast Ethernet)

Similarities: (among others)

Use same frame format

Collision avoidance and detection approaches for 10 Mbps Ethernet and Fast Ethernet are similar.