1. Imagine that you have trained your St. Bernard, Bernie, to carry a box of three 8-mm tapes instead of a flask of brandy. (When your disk fills up, you consider that an emergency.) These tapes each contain 7 gigabytes. The dog can travel to your side, wherever you may be, at 18 km/hour. For what range of distances does Bernie have a higher data rate than a transmission line whose data rate (excluding overhead) is 150 Mbps? How does your answer change if (i) Bernie's speed is doubled; (ii) each tape capacity is doubled; (iii) the data rate of the transmission line is doubled.

Solution:

Assume distance equals to x, then we obtain:

$$\frac{x}{18*1000/3600} < 3 * 7 * \frac{1024^3*8}{150*10\text{^}6}$$

Then x < 6013 m

(i) x double

(ii) x double

(iii) x half

2. What are two reasons for using layered protocols? What is one possible disadvantage of using layered protocols?

Solution:

Among other reasons for using layered protocols, using them leads to breaking up the design problem into smaller, more manageable pieces, and layering means that protocols can be changed without affecting higher or lower ones. One possible disadvantage is the performance of a layered system is likely to be worse than the performance of a monolithic system, although it is extremely difficult to implement and manage a monolithic system.

3. In some networks, the data link layer handles transmission errors by requesting that damaged frames be retransmitted. 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.

Solution:

The probability , Pk, of a frame requiring exactly k transmissions is the probability of the first k−1 attempts failing, P^{k-1}, times the probability of the k-th transmission succeeding, (1−p). The mean number of transmission is then just

$$\sum_{k=1}^{\infty} k(1-p)p^{k-1} = \frac{1}{1-p}$$

4. What is the main difference between TCP and UDP?

Solution:

TCP is connection oriented, whereas UDP is a connectionless service.

5. How long was a bit in the original 802.3 standard in meters? Use a transmission speed of 10 Mbps and assume the propagation speed in coax is 2/3 the speed of light in vacuum.

Solution:

Time to transmit a bit = 1bit/10Mbps = 0.1us

Meters of a bit = 0.1*10^-6s * 2/3 * 3*10^8m/s = 20m

6. List one advantage and one disadvantage of having international standards for network protocols.

Solution:

One advantage is that if everyone uses the standard, everyone can talk to everyone. Another advantage is that widespread use of any standard will give it economies of scale, as with VLSI chips. A disadvantage is that the political compromises necessary to achieve standardization frequently lead to poor standards. Another disadvantage is that once a standard has been widely adopted, it is difficult to change, even if new and better techniques or methods are discovered. Also, by the time it has been accepted, it may be obsolete.

7. Which layers are common in the OSI model and TCP/IP model?

Solution:

Application layer, transport layer, network(internet) layer