姚熙源 3190300677 计算机网络作业 1

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.

   Answer : Assume that the time between me and dog is t, then we have

$$3 * 7 \, GB \; = \; 150 \, 000 \, 000 \, b \; * \; t \; - - - (1)$$

$$\frac{18km}{3600s} * t = s - - - (2)$$

So , $s = \frac{21 * 10^9 * 18 * 8}{3600 * 150000000} = \; 5.6KM, t = 1120s$

   (i)   If Bernie's speed is doubled, s will also be doubled, s = 11.2KM
   (ii)   If each tape capacity is doubled, s will also be doubled, s = 11.2KM
   (iii)   If the data rate of the transmission line is doubled, s will be half of itself, s = 2.8KM

2. What are two reasons for using layered protocols? What is one possible disadvantage of using layered protocols?
   Answer :
   - It can be divided into smaller packets/pieces. Layered means that protocols can be changed and do not affect other layers.
   - One of the possible disadvantage of layered system : it is difficult to implement and manage to let all of us to follow the protocol.

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.
   Answer : Assume that after k-1 times, exactly the kth time success and we denote it as P-$_k$,probability of the first k-1 attempts fail p^{k-1}. For each time, the probability of success is 1-p and p for fail.

$$P_k = p^{k-1}(1-p)$$

$$P = \sum_{k=1}^{\infty} kP_k = (1-p) \sum_{k=1}^{\infty} kp^{k-1} = (1-p) * \left(\frac{1}{1-p}\right)^2 = \frac{1}{1-p}$$

4. What is the main difference between TCP and UDP?
   Answer : TCP is connection oriented service, while UDP is 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.
   Answer :

   $$v = 3 * 10^8 * \frac{2}{3} = 2 * 10\verb|^|8$$
   $$t = \frac{1 bit}{10 * 10^6 bit/s} = 1 * 10^{-7}$$

   So, a bit in the original 802.3 standard is $s = v * t = 20 \ (meters)$

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

   Advantage :
   - Everyone can talk to each other easily no matter the person is located at or how far is the person at, as long as the protocol is supported.

   Disadvantage :
   - The standards are not easy to be changed and updated.

7. Which layers are common in the OSI model and TCP/IP model?
   Answer : Internet(Network) layer, Transport layer, Application layer.