Question 1:

Suppose the size of an uncompressed text file is 1 megabyte

1. How long does it take to download the file over a 32 kilobit/second modem?

**Solution:**

Size text file = 1 x 1024 x 1024 x 8 (bit)

Speed = 32 x 1000 (bit / second)

=> T (32k) = (1 x 1024 x 1024 x 8) / (32 x 1000) = 262.144 (seconds)

b. How long does it take to take to download the file over a 1 megabit/second

modem?

**Solution:**

Size text file = 1 x 1024 x 1024 x 8 (bit)

Speed = 1 x 1000 x 1000 (bit / second)

=> T (1M) = (1 x 1024 x 1024 x 8) / (1 x 1000 x 1000) = 8.38 (seconds)

c.Suppose data compression is applied to the text file. How much do the transmission times in parts (a) and (b) change?

**Solution:**

=> T (32k) = (1 x 1024 x 1024 x 8) / (32 x 1000 x 6) = 43.69 (seconds)

=> T (1M) = (1 x 1024 x 1024 x 8) / (1 x 1000 x 1000 x 6) = 1.4 (seconds)

Question 2: Suppose HDLC is used over a 1.5 Mbps geostationary satellite link. Suppose that 250-byte frames are used in the data link control. What is the maximum rate at which information can be transmitted over the link?

**Solution:**

R = 1.5 Mbps, and nf =250 bytes or 2000 bits (250 x 8). The distance that the information must travel is the earth-to-satellite distance, or d ≈ 36,000 km.

The speed of light c is 3 x 108.

We can calculate the propagation delay and processing rate as follows:

Tprop = = = 120 ms

Tf =

We can use either Go-Back-N or Selective Repeat ARQ. The default window size is N = 7 (with a 3bit sequence number). 0 1 2 3 4 5 6 7 …  
The maximum information rate is achieved with no error, and hence, no retransmission.

Tcycle = minimum time to transmit a group of N packets = Tf + 2tprop = 1.33 + 2x120 = 241.33 ms

n = no. of bits transmitted in a cycle = N x nf = 7x2000 = 14,000 bits

Rmax = = = 58 kbps

If the extended sequence numbering option (7-bit) is used, the maximum send window size would be N = 27 – 1 = 127, and hence, the maximum information rate is:

Rmax = = = 1.052 Mbps.

Question 3:

Consider the transfer of a single real-time telephone voice signal across a packet network. Suppose that each voice sample should not be delayed by more than 20 ms.

1. Discuss which of the following adaptation functions are relevant to meeting the requirements of this transfer: handling of arbitrary message size; reliability and sequencing; pacing and flow control; timing; addressing; and privacy, integrity and authentication.

**Solution:**

Message size is important because in real-time signals of voice it is necessary to transfer a fixed packet size of that holds no more than 20 ms of the speech signal. The handling of arbitrary message size is not as important as long as the desired packet size for voice can be handled.

Sequencing is essential because each packet needs to arrive in the same sequence that it was generated. Reliability is moderately important since voice transmission can tolerate a certain level of loss and error.

Pacing and flow control are not as important because the synchronous nature of the voice signal implies that the end systems will be matched in speed.

Timing, for real-time voice transfer, is important because this adaptation function helps to control the jitter in the delivered signal.

Addressing is only during the connection setup phase if we assume some form of virtual circuit packet switching method.

Privacy, integrity, and authentication have traditionally not been as important as the other issues discussed above.

1. Compare a hop-by-hop approach to an end-to-end approach to meeting the requirements of the voice signal.

**Solution:**

If the underlying network is reliable then the end-to-end approach is better because the probability of error is very low so processing at the edge suffices to provide acceptable performance.

If the underlying network is unreliable then the hop-by-hop approach may be required. For example, if the probability of error is very high, as in a wireless channel, then error recovery at each hop may be necessary to make effective communication possible.

Question 4:

The ability to work with IPv4 subnets and determine network and host information based on a given IP address and subnet mask is critical to understanding how IPv4 networks operate. The first part is designed to reinforce how to compute network IP address information from a given

IP address and subnet mask. When given an IP address and subnet mask, you will be able to determine other information about the subnet.

Fill out the tables below with appropriate answers given the IPv4 address, original subnet mask, and new subnet mask.

|  |  |  |  |
| --- | --- | --- | --- |
| **Given:** | | |  |
| **Host IP Address:** | 192.135.250.180 | |  |
| **Original Subnet Mask** | 255.255.255.0 | |  |
| **New Subnet Mask:** | 255.255.255.248 | |  |
| **Find:**  **Solution:** | | | |
| **Number of Subnet Bits** | | *5* | |
| **Number of Subnets Created** | | *32* | |
| **Number of Host Bits per Subnet** | | *3* | |
| **Number of Hosts per Subnet** | | *6* | |
| **Network Address of this Subnet** | | *192.135.250.176* | |
| **IPv4 Address of First Host on this Subnet** | | *192.135.250.177* | |
| **IPv4 Address of Last Host on this Subnet** | | *192.135.250.182* | |
| **IPv4 Broadcast Address on this Subnet** | | *192.135.250.183* | |

Question 5:

a. How many host addresses are needed in the largest required subnet?

**Solution :** No of host addresses required = 2^6-2 = 62

b. What is the minimum number of subnets required?

**Solution :** According to the question , two subnet are required for LAN-A and LAN-B and two subnets are needed to be left for future use Therefor the total number of subnets are 4 .

c. The network that you are tasked to subnet is 192.168.12.0/24. What is the /24 subnet mask in binary?

**Solution :** Subnet mask for any network is obtained by changing the net id bits to 1's and host id bits to 0's. Since the given network is a Class C network so the number of netid bits are 24 and the number of host id bits are 8 and there are two bits reserved for subnet id bits . Therefore the subnet mask for network is 11111111.11111111.11111111.11000000 in binary.

d. The subnet mask is made up of two portions, the network portion, and the host portion. This is represented in the binary by the ones and the zeros in the subnet mask?

e. When you have determined which subnet mask meets all of the stated network requirements, derive each of the subnets. List the subnets from first to last in the table. Remember that the first subnet is 192.168.12.0 with the chosen subnet mask.

**Solution:**

|  |  |  |
| --- | --- | --- |
| **Subnet Address** | **Prefix** | **Subnet Mask** |
| **192.168.12.0** | **/26** | **255.255.255.192** |
| **192.168.12.64** | **/26** | **255.255.255.192** |
| **192.168.12.128** | **/26** | **255.255.255.192** |
| **192.168.12.192** | **/26** | **255.255.255.192** |