1. Connectionless communication has each packet being transmitted independently while connection oriented communication involves the setup of a dedicated connection before data transmission, ensuring reliability and ordering of data packets.

1. Connection oriented commuunication has three phases. In the establishment phase a request is made to set up a connection. Only after this phase has been successfully completed can the data transfer phase be started and data transported. Then comes the release phase. Connectionless communication does not have these phases. It just sends the data.

SC2008-CE3005-CZ3006 (Computer Network)

Part I: Tutorial – 4

1. What is the principal difference between connectionless communication and connection-oriented communication?

2. Packet switched networks route each packet as a separate unit, independent of all others. Virtual-circuit networks do not have to do this, since each data packet follows a predetermined route. Does this observation mean that virtual-circuit networks do not need the capability to route isolated packets from an arbitrary source to an arbitrary destination? Explain your answer.

3. Consider a packet switched network. Two nodes, node S and node D, are connected through an intermediate node I. A message of size 1000 bytes is transmitted from node S to node D. The message is fragmented into four packets each with a 50-byte header. All links run the same data rate. If propagation delay is negligible, determine the minimum data rate of the links to achieve 100ms of total transmission delay. (Hint: *pipeline effect*)

4. A factor in the delay of a store-and-forward packet switched network is how long it takes to store and forward a packet through a switch. If switching time is 10 μsec, is this likely to be a major factor in the response of a client-server system where the client is in New York and the server is in California? Assume the propagation speed in copper and fiber to be 2/3 the speed of light in vacuum.

5. Compare the delay in sending an x-bit message over a k-hop path in a circuit switched network and in a (lightly loaded) packet switched network. The circuit set up time is s seconds, the propagation delay is d seconds per hop, the packet size is p bits, and the data rate is b bps. Under what conditions does the packet switched network have a lower delay?

2. Routing of isolated packets only occurs in connectionless communication. Virtual circuits establishes a logical connection between the sender and receiver before any data transmission occurs. Once established, all data packets belonging to that connection follow the same path through the network and are delivered in the order they were sent.

2. Virtual circuits subnets most certainly need this capacbility in order to route connection setup packets from an arbitrary source to an arbitrary destination.

3. Tx. Delay = [Total data+ (One header * # of packets) + (# of hops -1)* (Packet length including header)]/link rate
= (1000 + (50*4) + (1*(1000/4)+50))/link rate= 100*10^-3s
Link rate = 15000bytes/s
Transmission time,Tf = 250+50 = 300bytes. Last bit send at time 4Tf. Last packet retransmitted by intermediate router. Total delay is 5Tf. Since T<100ms, 5Tf <100ms. Tf = 300*8/d. Thus, d>120kbps

4. 2/3 speed of light in vacuum is 199,861,638m/s. Distance from New York and California is around 4500km. Propagation time = 0.0225s. Thus, the switching time will not be a major factor in the response of a client server system since it is minuscule compared to the propagation time.

5. Circuit Switching: x/b + kd = Tx delay + propagation delay

Virtual Circuit: s + [x+(k-1)*p]/b

Total delay with packet switching is smaller if (k-1)p/b < s

A packet switched network will have a lower delay when there is bursty data due to resource sharing. The excessive congestion will cause packet delay and loss to occur.