TUTORIAL 1 (EKT 332)

1. Can a connection-oriented, reliable message transfer service be provided across a connectionless packet network? Explain.

Solution:

Yes. To provide a connection-oriented service, the transport layer can establish a logical connection across the connectionless packet network by setting up state information (for example, packet sequence number) at the end systems. During the connection setup, the message is broken into separate packets, and each packet is assigned a sequence number.

Using the sequence numbers, the end-system transport-layer entities can acknowledge received packets, determine and retransmit lost packets, delete duplicate packets, and rearrange out-of order packets. The original message is reassembled as packets arrive at the receiving end.

For example, TCP provides a connection-oriented reliable transfer service over IP, a connectionless packet transfer service.

2. Suppose all laptops in a large city are to communicate using radio transmissions from a high antenna tower. Is the data link layer or network layer more appropriate for this situation?

Solution:

The data link layer is concerned with the transfer of frames of information across a single hop. The network layer involves the transfer of information across a network using multiple hops per path in general. The connection from a radio antenna to the laptops is direct, and thus a data link layer protocol is more suitable for this situation.

3. Suppose an application layer entity wants to send an L-byte message to its peer process, using an existing TCP connection. The TCP segment consists of the message plus 20 bytes of header. The segment is encapsulated into an IP packet that has an additional 20 bytes of header. The IP packet in turn goes inside an Ethernet frame that has 18 bytes of header and trailer. What percentage of the transmitted bits in the physical layer correspond to message information, if L = 100 bytes, 500 bytes, 1000 bytes?

Solution:

TCP/IP over Ethernet allows data frames with a payload size up to 1460 bytes. Therefore, L = 100, 500 and 1000 bytes are within this limit.

The message overhead includes:

• TCP: 20 bytes of header

• IP: 20 bytes of header

• Ethernet: total 18 bytes of header and trailer.

Therefore

L = 100 bytes, 100/158 = 63% efficiency.

L = 500 bytes, 500/558 = 90% efficiency.

L = 1000 bytes, 1000/1058 = 95% efficiency.

4. Suppose that the TCP entity receives a 1.5 megabyte file from the application layer and that the IP layer is willing to carry blocks of maximum size 1500 bytes. Calculate the amount of overhead incurred from segmenting the file into packet-sized units.

Solution:

1500 - 20 -20 = 1460 bytes

1.5 Mbyte / 1460 byte = 1027.4, therefore 1028 blocks are needed to transfer the file.

Overhead = ((1028 x 1500 - 1.5M)/1.5M) x 100 = 2.8%

5. Suppose a user has two browser applications active at the same time, and suppose that the two applications are accessing the same server to retrieve HTTP documents at the same time. How does the server tell the difference between the two applications?

Solution:

A client application generates an ephemeral port number for every TCP connection it sets up. An HTTP request connection is uniquely specified by the five parameters: (TCP, client IP address, ephemeral port #, server IP address, 80). The two applications in the above situations will have different ephemeral port #s and will thus be distinguishable to the server.

6. What is the difference between a physical address, a network address, and a domain name?

Solution:

The physical address is the unique hardware address that identifies an interface of a machine on a physical network such as a LAN. Physical addresses are used in the data link layer.

A network address is a machine's logical address on a network. The network address is used in the network layer. The network address used on the Internet is the IP address.

Domain names are used as an aid to identify hosts and networks in the Internet, since names are easier to remember than numbers. The DNS system is used to translate between domain names and IP addresses. The domain name for the network address 128.100.132.30 is toronto.edu.

7. What is wrong with the following methods of assigning host id addresses?

(a) Copy the address from the machine in the next office.

(b) Modify the address from the machine in the next office

(c) Use an example from the vendor's brochure.

Solution:

(a) Copy the address from the machine in the next office.

There is an address conflict. The host id must be unique to each machine.

(b) Modify the address from the machine in the next office.

The resulting address may be an existing address and result in address conflict, or the

address may not be recognizable by the routers.

(c) Use an example from the vendor's brochure.

The address has different network and subnetwork ids, and is not recognized by the routers.

8. Suppose a computer is moved from one department to another. Does the physical address need to change? Does the IP address need to change? Does it make a difference if the computer is a laptop?

Solution:

The physical address does not change. It is globally unique to the computer's NIC card.

The IP address may need to be changed to reflect a new subnetwork id and host id.

The situation is the same for laptops.