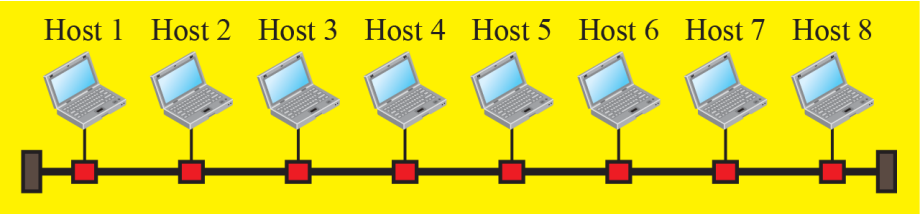
Tutorial 1 Solutions

Instructions

1. Form ad-hoc groups of 2 to 3 students to solve this week's exercise.
2. Each group must answer the following review Q's and problems
3. Each group will use shared google docs to work with all group members and tutor. The document must include the group member's names and the tutorial sheet number.

Review Questions

1. Q1-1. Is transmission in a LAN with a common cable (Figure 1.1a) an example of broadcast (one to many) transmission? Explain.



a. LAN with a common cable (past)

Answer: In this case, when a station sends a message to another station, the message is received by all stations. All stations except the intended recipient need to drop the message. This is an example of broadcast transmission (one to many).

2. Q1-3. How many point-to-point WANs are needed to connect n LANs if each LAN should be able to directly communicate with any other LAN?

Answer: Each LAN should be connected to (n-1) LANs. This means that we have n x (n-1) connections. However, if each connection can be used in both directions, we need only [n x (n-1)] / 2 connections.

3. Q1-5. When a resident uses a dial-up or DLS service to connect to the Internet, what is the role of the telephone company?

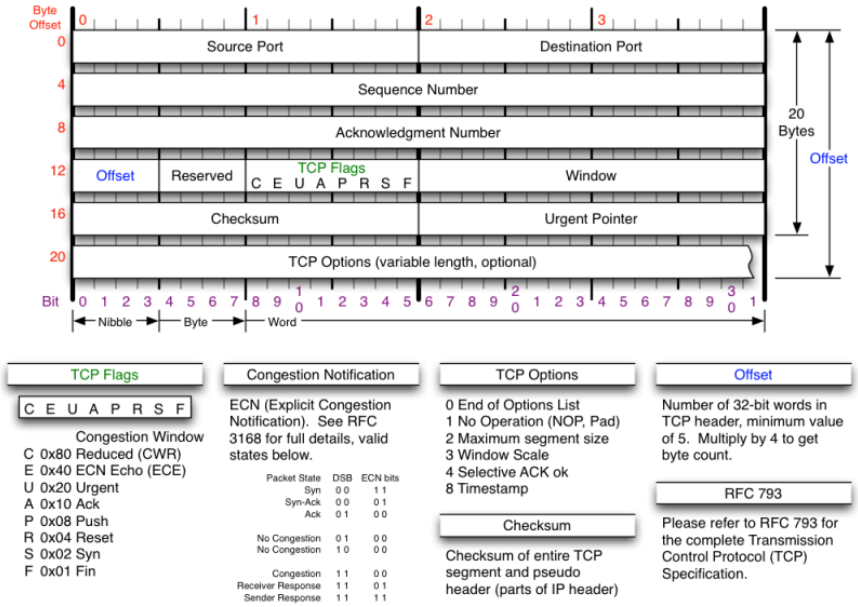
Answer: The telephone company acts as an ISP. The connection from the resident to the telephone company is a point-to-point access WAN that connects the premises to the Internet. At the same time, the telephone company needs to provide the necessary services such as e-mail.

4. Q1-7. Which layers of the TCPIIP protocol suite are involved in a link-layer switch?

Answer: The link-layer switch is normally involved in the first two layers of the TCP/ IP protocol suite: the physical layer and the data-link layer.

5. Q1-15. If a port number is 16 bits (2 bytes), what is the minimum header size at the transport layer of the TCP/IP protocol suite?

   Answer: The transport-layer packet needs to include two port numbers: source and destination port numbers. The transport-layer header needs to be at least 32 bits (four bytes) long, but we will see in Chapter 3(transport layer) that the header size is normally much longer because we need to include other pieces of information.



6. Q1-16. What are the types of addresses (identifiers) used in each of the following layers?

   a. application layer
   b. network layer
   c. data-link layer

   Answer: Application layer address: Domain name address; Network layer address: IPv4 (32-bit) or IPv6 address (128-bit); data-link address is 46-bit MAC address/Physical address/Hardware NIC address.

7. Q 1-17. When we say that the transport layer multiplexes and demultiplexes application layer messages, do we mean that a transport-layer protocol can combine several messages from the application layer in one packet? Explain.

   Answer: The answer is no. Multiplexing/demultiplexing at the transport layer does not mean combining several upper-layer packets (from the same or different applications) into one transport-layer packet. It only means that each of the transport-layer protocols (such as TCP or UDP) can carry a packet from any application-layer protocol that needs its service. However, a transport-layer packet can carry one, and only one, packet from an application-layer protocol. For example, UDP can carry a message from FTP in one user datagram and a message from HTTP in another user datagram.

8. Q1-19. Assume we want to connect two isolated hosts together to let each host communicate with the other. Do we need a link-layer switch between the two? Explain.

Answer: We do not need a link-layer switch because the communication in this case is automatically one-to-one. A link-layer switch is needed when we need to change a one-to-many communication to a one-to-one.

9. P1-5. Assume we have created a packet-switched internet. Using the TCP/IP protocol suite, we need to transfer a huge file. What is the advantage and disadvantage of sending large packets?

   Answer: The advantage of using large packets is less overhead. When using large packets, the number of packets to be sent for a huge file becomes small. Since we are adding three headers to each packet, we are sending fewer extra bytes than in the case in which the number of packets is large. The disadvantage manifests itself when a packet is lost or corrupted during the transmission; we need to resend a large amount of data, and another disadvantage is not providing equitable and fair access to other devices in the network.

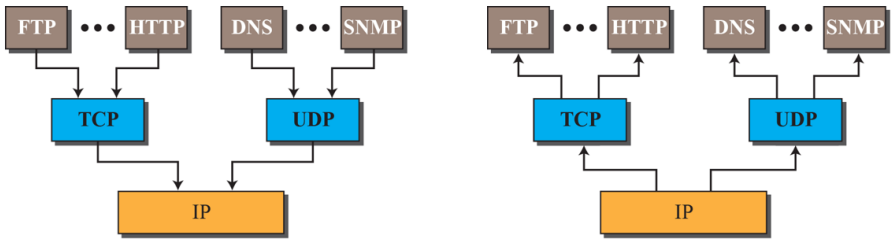
10. P1-7. Match the following to one or more layers of the TCP/IP protocol suite:

    a. creating user datagrams
    Ans:-User datagrams are created at the transport layer.

    b. responsibility for handling frames between adjacent nodes
    Ans: The data-link layer is responsible for handling frames between adjacent nodes.

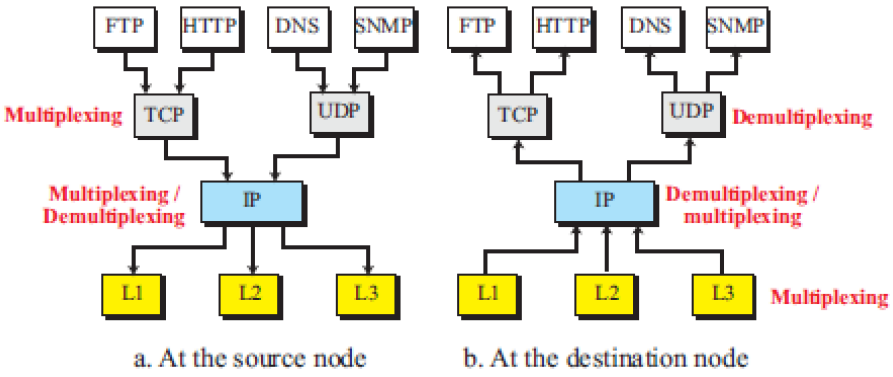
    c. transforming bits to electromagnetic signals
    Ans: The physical layer is responsible for transforming bits to electromagnetic signals.

11. P1-9. Assume a private internet uses three different protocols at the data-link layer (Ll, L2, and L3). Redraw Figure 1.18 with this assumption. Can we say that, in the data-link layer, we have demultiplexing at the source node and multiplexing at the destination node?



a. Multiplexing at source b. Demultiplexing at destination

Answer: The following shows the situation. If we think about multiplexing as many-to- one and demultiplexing as one-to-many, we have demultiplexing at the source node and multiplexing at the destination node in the data-link layer. However, some purists call these two inverse multiplexing and inverse demultiplexing.



12. P1-15. Assume that an application-layer protocol is written to use the services of UDP. Can the application-layer protocol uses the services of TCP without change?

    Answer: The reason for having several protocols in a layer is to provide different services to the upper-layer protocols. The services provided by UDP are different from the services provided by TCP. When we write an application program, we need to first define which transport-layer protocol is supposed to give services to this application program. The whole program is written based on the availability of these services. Note that this does not violate the principle of layer independence. The independency of a layer means that we can change a protocol in a layer as long as the new one gives the same services as the old one. This does not mean that we can replace UDP by TCP, because they provide different services.

13. What is a protocol? What is a protocol data unit (PDU)?

    Solution: A protocol is the set of rules or conventions governing the way in which two entities cooperate to exchange data. A PDU is the combination of data from the next higher communications layer and control information.

14. What is a protocol architecture? What are some advantages to layering as seen in the TCP/IP architecture?

    Solution: The software structure that implements the communications function. Typically, the protocol architecture consists of a layered set of protocols, with one or more protocols at each layer. Layering decomposes the overall communications problem into a number of more manageable sub-problems.

15. List the major disadvantages with the layered approach to protocols.

    Solution: Perhaps the major disadvantage is the processing and data overhead. There is processing overhead because as many as seven modules (OSI model) are invoked to move data from the application through the communications software. There is data overhead because of the appending of multiple headers to the data. Another possible disadvantage is that there must be at least one protocol standard per layer. With so many layers, it takes a long time to develop and promulgate the standards.