CHAPTER 1

PRACTICE SET

Questions

Q1-1. 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).

Q1-3. Each LAN should be connected to $(n - 1)$ LANs. This means that we have $n \times (n - 1)$ connections. However, if each connection can be used in both directions, we need only $[n \times (n - 1)]/2$ connections.

Q1-5. 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.

Q1-7. 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.

Q1-9. The identical objects are the two messages: one sent and one received.

Q1-11. A frame is a link-layer data unit. It encapsulates a data unit coming from the network layer. In this case, the data unit is a datagram.

Q1-13. The data unit should belong to layer 4. In this case, it is a user datagram.

Q1-15. 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 that the header size is normally much longer because we need to include other pieces of information.

Q1-17. 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.

Q1-19. 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.

Q1-21. An Internet draft is a working document with no official status and a six-month lifetime; an Internet draft may become a proposed standard after six months if it has received enough attention in the Internet community.

Q1-23. The IETF is responsible for identifying operational problems and recommending solutions; the IRTF focuses on long-term research topics.

Problems

P1-1. The services provided in part a and part b are the opposite of each other.

a. Layer 1 takes the ciphertext from layer 2, inserts (encapsulates) it in an envelope and sends it.

b. Layer 1 receives the mail, removes (decapsulates) the ciphertext from the envelope and delivers it to layer 2.

P1-3. In 10 years, the number of hosts becomes about six times ($1.20^{10} \approx 6.19$) the number in 2010. This means the number of hosts connected to the Internet is more than three billion.

P1-5. 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.

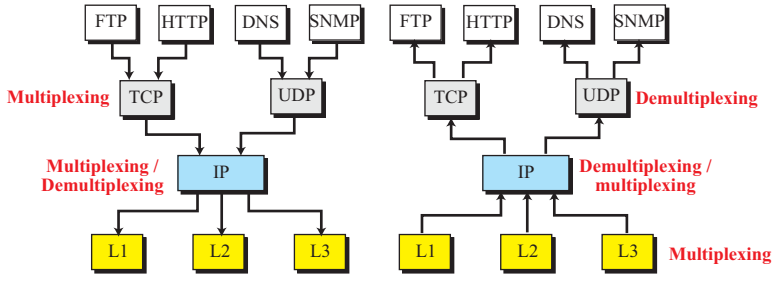
P1-7.

a. User datagrams are created at the transport layer.

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

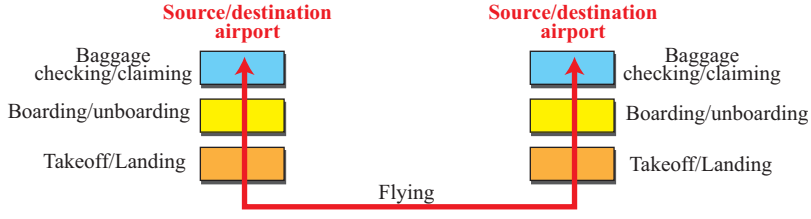
c. The physical layer is responsible for transforming bits to electromagnetic signals.

P1-9. 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*.

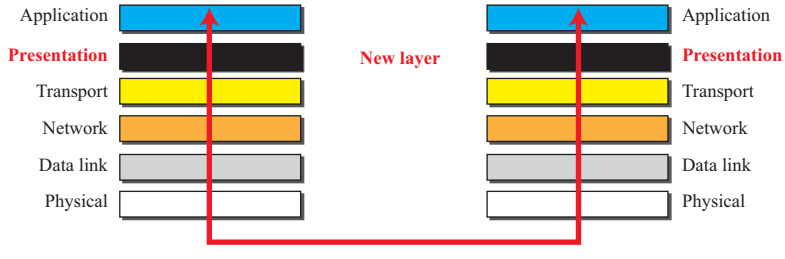


a. At the source node b. At the destination node

P1-11. The following shows the layers. Note that we have not shown the security checking that you need to pass through because it does not have the counterpart when you arrive. It must be included in baggage/checking layer.



P1-13. The following shows the position of the presentation layer. The new layer is at the same position as the presentation layer in the OSI model if we ignore the session layer.



P1-15. 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.