Data Communication

Problem list

Chapter 8

P8-1. A path in a digital circuit-switched network has a data rate of 1 Mbps. The exchange of 1000 bits is required for the setup and teardown phases. The distance between two parties is 5000 km. Answer the following questions if the propagation speed is 2×10^8 m:

a. What is the total delay if 1000 bits of data are exchanged during the data-transfer phase?

b. What is the total delay if 100,000 bits of data are exchanged during the data-transfer phase?

c. What is the total delay if 1,000,000 bits of data are exchanged during the data-transfer phase?

d. Find the delay per 1000 bits of data for each of the above cases and compare them. What can you infer?

P8-2. Five equal-size datagrams belonging to the same message leave for the destination one after another. However, they travel through different paths as shown in Table 8.1.

Table 8.1 *P8-2*

Datagram	*Path Length*	*Visited Switches*
1	3200 km	1, 3, 5
2	11,700 km	1, 2, 5
3	12,200 km	1, 2, 3, 5
4	10,200 km	1, 4, 5
5	10,700 km	1, 4, 3, 5

We assume that the delay for each switch (including waiting and processing) is 3, 10, 20, 7, and 20 ms respectively. Assuming that the propagation speed is 2×10^8 m, find the order the datagrams arrive at the destination and the delay for each. Ignore any other delays in transmission.

P8-3. Transmission of information in any network involves end-to-end addressing and sometimes local addressing (such as VCI). Table 8.2 shows the types of networks and the addressing mechanism used in each of them.

Table 8.2 *P8-3*

Network	*Setup*	*Data Transfer*	*Teardown*
Circuit-switched	End-to-end		End-to-end
Datagram		End-to-end	
Virtual-circuit	End-to-end	Local	End-to-end

Answer the following questions:

a. Why does a circuit-switched network need end-to-end addressing during the setup and teardown phases? Why are no addresses needed during the data transfer phase for this type of network?

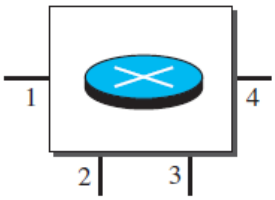
b. Why does a datagram network need only end-to-end addressing during the data transfer phase, but no addressing during the setup and teardown phases?

c. Why does a virtual-circuit network need addresses during all three phases?

P8-7. Figure 8.27 shows a switch (router) in a datagram network.

Figure 8.27 *Problem P8-7*

Destination address	Output port
1233	3
1456	2
3255	1
4470	4
7176	2
8766	3
9144	2



Find the output port for packets with the following destination addresses:

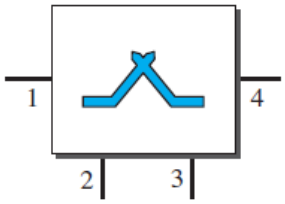
a. Packet 1: 7176 **b.** Packet 2: 1233

c. Packet 3: 8766 **d.** Packet 4: 9144

P8-8. Figure 8.28 shows a switch in a virtual-circuit network.

Figure 8.28 *Problem P8-8*

Incoming		Outgoing	
Port	VCI	Port	VCI
1	14	3	22
2	71	4	41
2	92	1	45
3	58	2	43
3	78	2	70
4	56	3	11



Find the output port and the output VCI for packets with the following input port and input VCI addresses:

a. Packet 1: 3, 78
b. Packet 2: 2, 92
c. Packet 3: 4, 56
d. Packet 4: 2, 71

P8-13. Repeat Problem 8-12 if we use 6 crossbars at the middle stage.

P8-12. We need a three-stage space-division switch with $N = 100$. We use 10 crossbars at the first and third stages and 4 crossbars at the middle stage.

a. Draw the configuration diagram.
b. Calculate the total number of crosspoints.
c. Find the possible number of simultaneous connections.
d. Find the possible number of simultaneous connections if we use a single crossbar (100×100).
e. Find the blocking factor, the ratio of the number of connections in part c and in part d.

Chapter 9

P9-6. Assume Alice is travelling from 2020 Main Street in Los Angeles to 1432 American Boulevard in Chicago. If she is travelling by air from Los Angeles Airport to Chicago Airport,

a. find the end-to-end addresses in this scenario.
b. find the link-layer addresses in this scenario.

P9-7. In the previous problem, assume Alice cannot find a direct flight from the Los Angeles to the Chicago. If she needs to change flights in Denver,

a. find the end-to-end addresses in this scenario.

b. find the link-layer addresses in this scenario.

P9-6. Assume Alice is travelling from 2020 Main Street in Los Angeles to 1432 American Boulevard in Chicago. If she is travelling by air from Los Angeles Airport to Chicago Airport,

a. find the end-to-end addresses in this scenario.

b. find the link-layer addresses in this scenario.

P9-15. Figure 9.7 shows a system as either a host or a router. What would be the actual entity (host or router) of system A and B in each of the following cases:

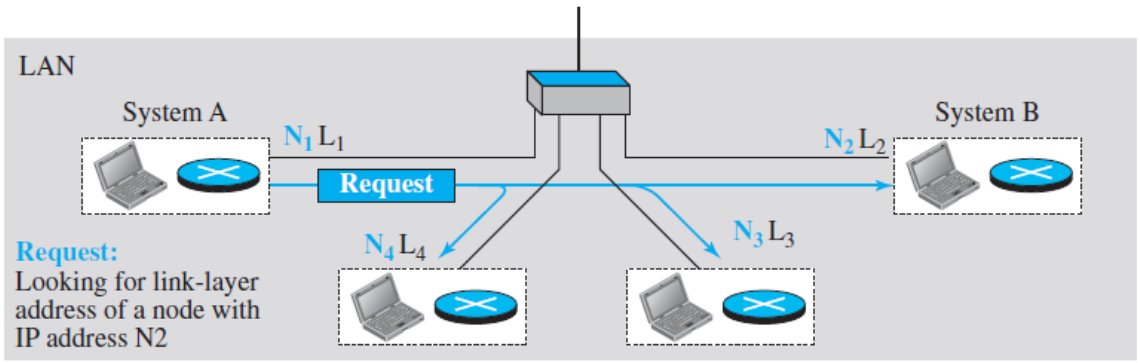
a. If the link is the first one in the path?

b. If the link is the middle one in the path?

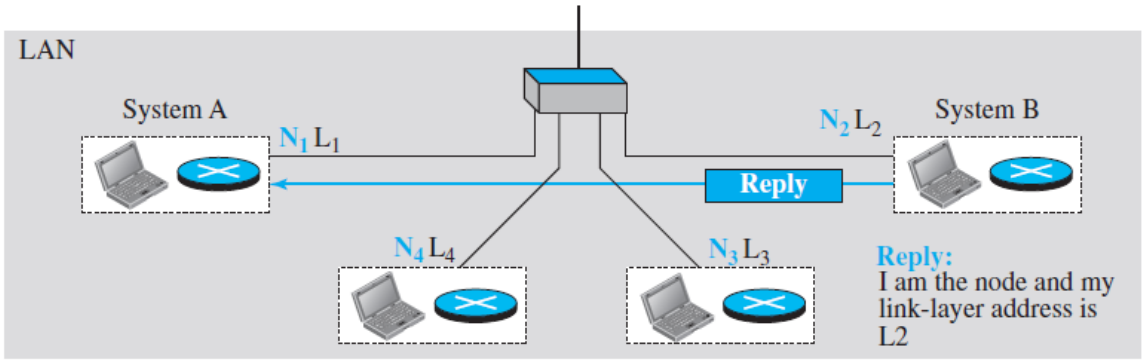
c. If the link is the last one in the path?

d. If there is only one link in the path (local communication)?

Figure 9.7 *ARP operation*



a. ARP request is broadcast



b. ARP reply is unicast

Chapter 11

P11-7. Redraw Figure 11.12 using the following scenario:

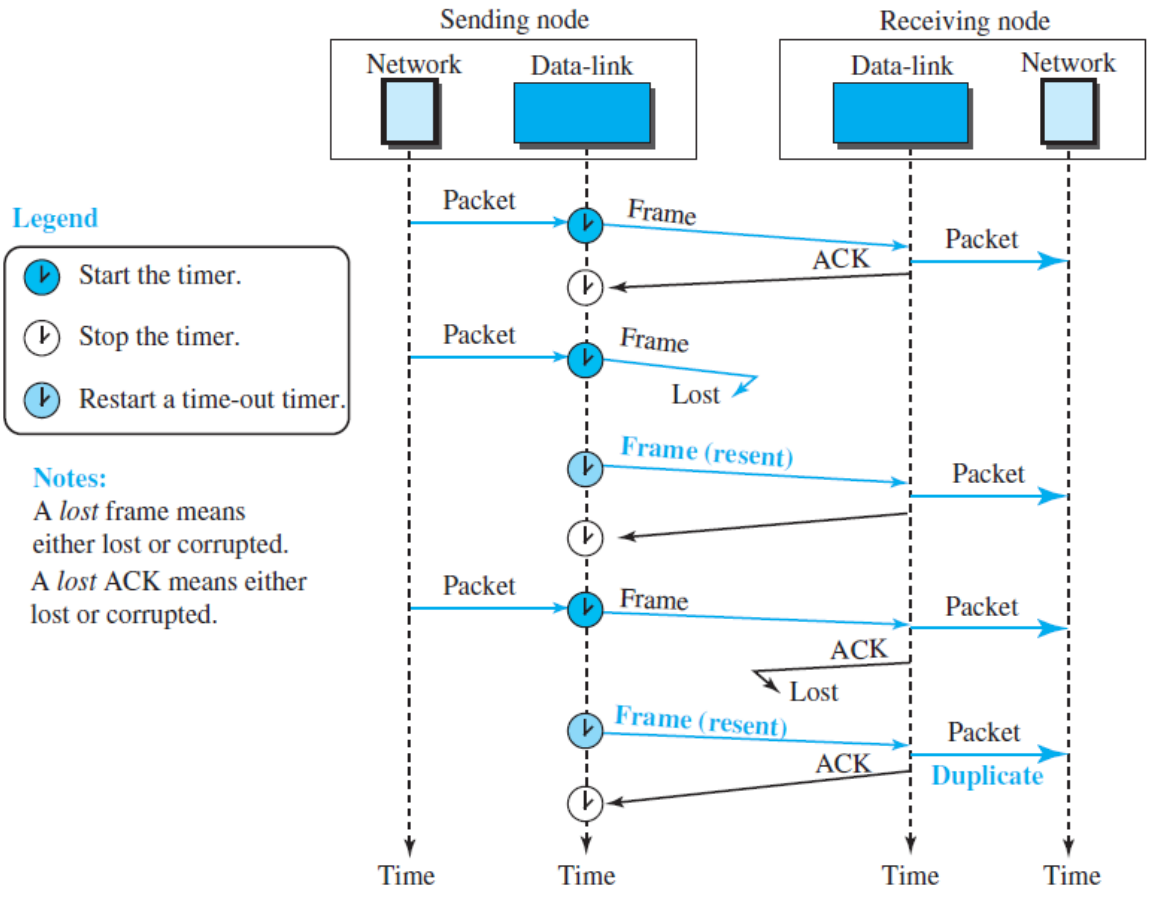
a. The first frame is sent and acknowledged.

b. The second frame is sent and acknowledged, but the acknowledgment is lost.

c. The second frame is resent, but it is timed-out.

d. The second frame is resent and acknowledged.

Figure 11.12 *Flow diagram for Example 11.3*



P11-8. Redraw Figure 11.2 using the following scenario:

a. Frame 0 is sent, but lost.

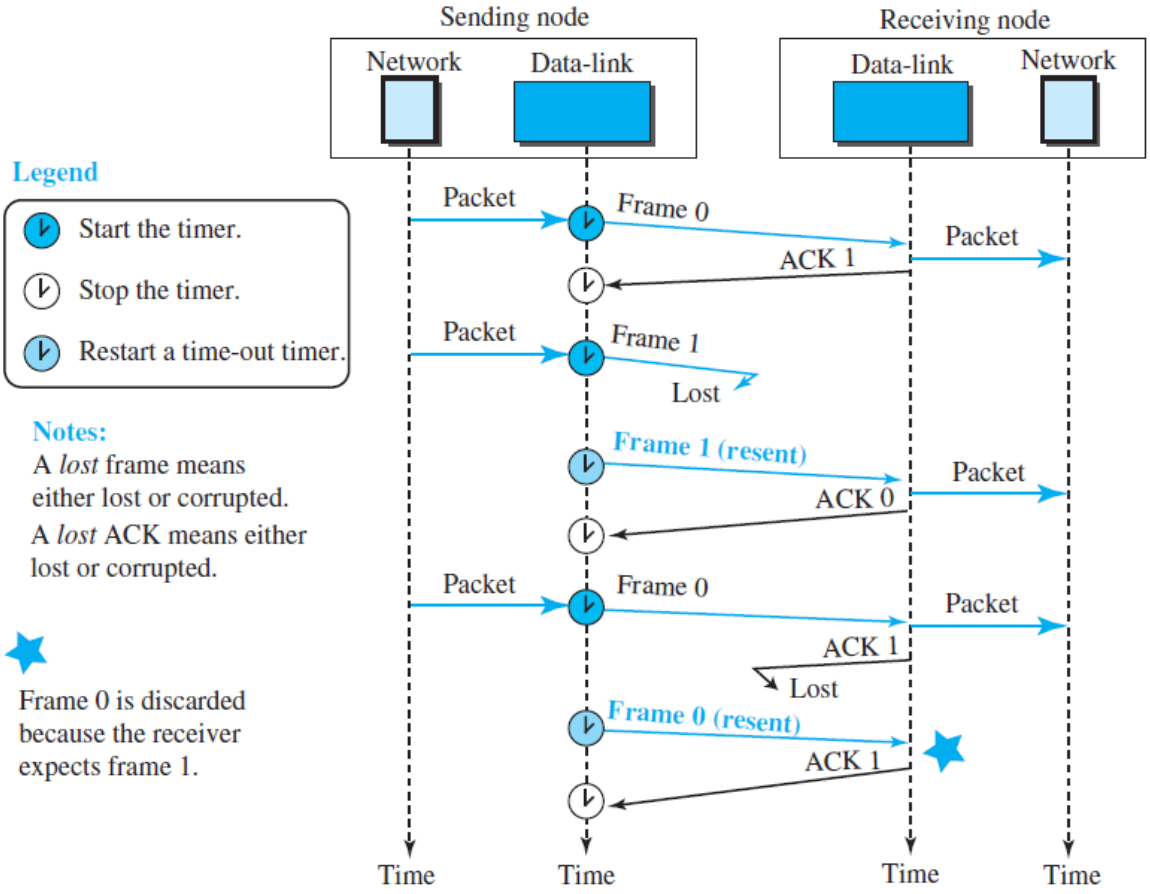
b. Frame 0 is resent and acknowledged.

c. Frame 1 is sent and acknowledged, but the acknowledgment is lost.

d. Frame 1 is resent and acknowledged.

- 문제 수정 : Redraw Figure 11.2 ➔ Redraw Figure 11.13

Figure 11.13 *Flow diagram for Example 11.4*



P11-10. In Figure 11.11, show what happens in each of the following cases:

a. The receiver is in the ready state and a packet comes from the network layer.

b. The receiver is in the ready state and a corrupted frame arrives.

c. The receiver is in the ready state and an acknowledgment arrives.

Figure 11.11 *FSM for the Stop-and-Wait protocol*