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Data Communication
Discussion(Chapter 8)

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.

Datagram	Path Length	Visited Switches
1	3,200 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 m s respectively. Assuming that the propagation speed is $2*10^8$ m /s, find the order the datagrams arrive at the destination and the delay for each. Ignore any other delays in transmission.

Solution:

We assume that the transmission time is negligible in this case. This means that we suppose all datagrams start at time 0.

The arrivals timed are calculated as:

Propagation time for datagram itself

Delay for visited switches

Delay for First datagram: $\frac{3200\ Km}{2*10^8\ \ m/s} + (3 + 20 + 20) = 59.0$ ms

Delay for Second datagram: $\frac{11700 Km}{2*10^8\ \ m/s} + (3 + 10 + 20) = 91.5$ ms

Delay for Third datagram: $\frac{12200 Km}{2*10^8\ \ m/s} + (3 + 10 + 20 + 20) = 114.0$ ms

Delay for Fourth datagram: $\frac{10200\ Km}{2*10^8\ \ m/s} + (3 + 7 + 20) = 81.0$ ms

Delay for Fifth datagram: $\frac{10700\ Km}{2*10^8\ \ m/s} + (3 + 7 + 20 + 20) = 103.5$ ms

Reach Firstly

The order of arrival is: $3 \rightarrow 5 \rightarrow 2 \rightarrow 4 \rightarrow 1$

Last

Delay الاسرع يصل اولا, طبعا يكون اقل

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

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?

In a circuit-switched network, end-to-end addressing is needed during the setup and teardown phase to create a connection for the whole data transfer phase. After the connection is made, the data flow travels through the already-reserved resources. The switches remain connected for the entire duration of the data transfer; there is no need for further addressing

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?

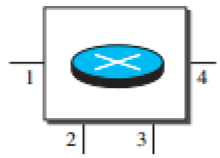
In a datagram network, each packet is independent Even if a packet is part of a multipacket transmission, so the routing of a packet is done for each individual packet. Each packet, therefore, needs to carry an end-to-end address. There are no setup and teardown phases in a datagram network (connectionless transmission). The entries in the routing table are somehow permanent and made by other processes such as routing protocols.

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

In a virtual-circuit network, there is a need for end-to-end addressing during the setup and teardown phases to make the corresponding entry in the switching table. The entry is made for each request for connection. During the data transfer phase, each packet needs to carry a virtual-circuit identifier to show which virtual-circuit that particular packet follows

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

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:

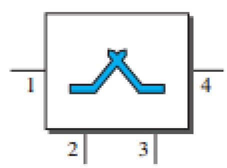
a) Packet 1: 7176 → 2

البكايت رقم واحد رايحة على العنوان رقم 7176 لذلك راح تطلع من البورت رقم 2 حسب Routing table

b) Packet 2: 1233 → 3
c) Packet 3: 8766 → 3
d) Packet 4: 9144 → 2

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

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

الباكيت رقم واحد جاية من البورت رقم 3 ولها (VCI =78) Local address لذلك راح تطلع من البورت رقم 2 والعنوان الجديد VCI=70 حسب الجدول

Packet 1: 2, 70

b) Packet 2: 2, 92

Packet 2: 1, 45

c) Packet 3: 4, 56

Packet 3: 3, 11

d) Packet 4: 2, 71

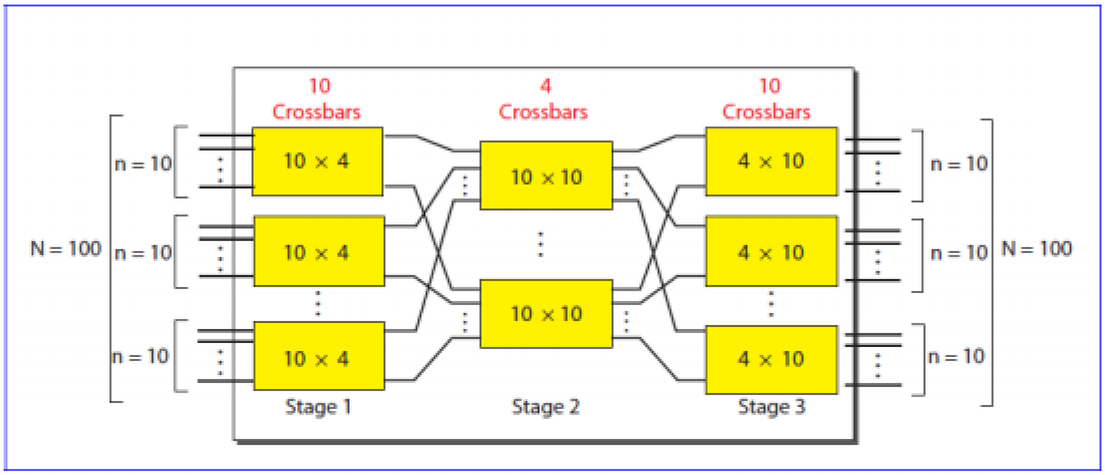
Packet 4: 4, 41

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 cross points.
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.

Solution:

a)



b) The total number of crosspoints = 10 (10 × 4) + 4 (10 × 10) + 10 (4 × 10) = 1200

c) Only four simultaneous connections are possible for each crossbar at the first stage. This means that the total number of simultaneous connections is 4*10= 40

d) If we use one crossbar (100 × 100), all input lines can have a connection at the same time, which means 100 simultaneous connections.

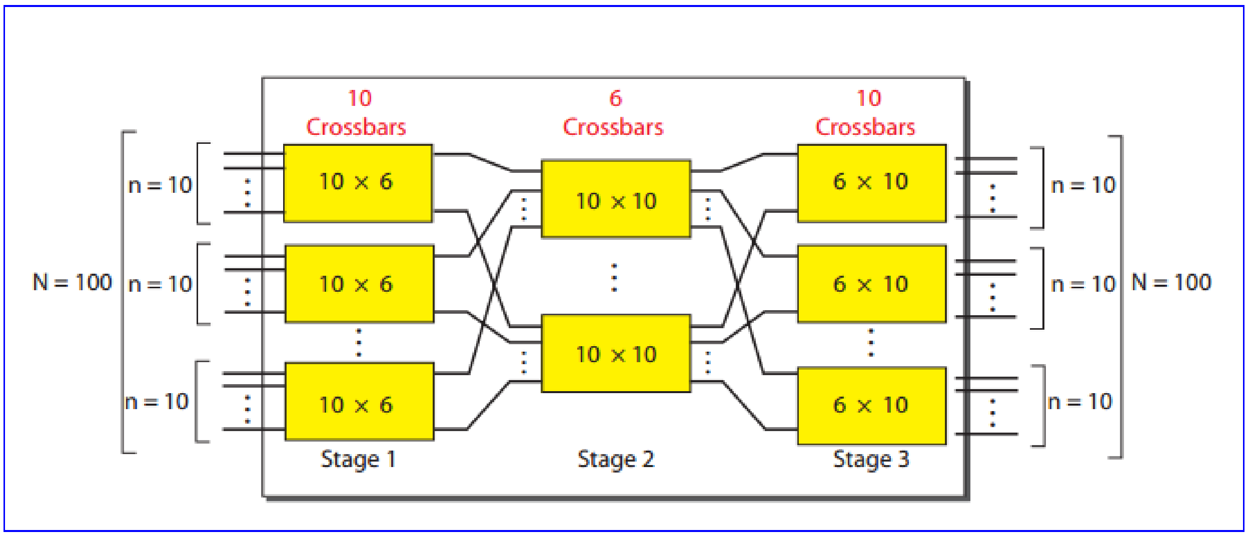
e) The blocking factor is 40/100 or 40 percent.

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

a) Draw the configuration diagram
b) Calculate the total number of cross points.
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.

Solution:

a)



b) The total number of crosspoints = 10 (10 × 6) + 6 (10 × 10) + 10 (6 × 10) = 1800

c) Only four simultaneous connections are possible for each crossbar at the first stage. This means that the total number of simultaneous connections is 6*10 = 60

d) If we use one crossbar (100 × 100), all input lines can have a connection at the same time, which means 100 simultaneous connections.

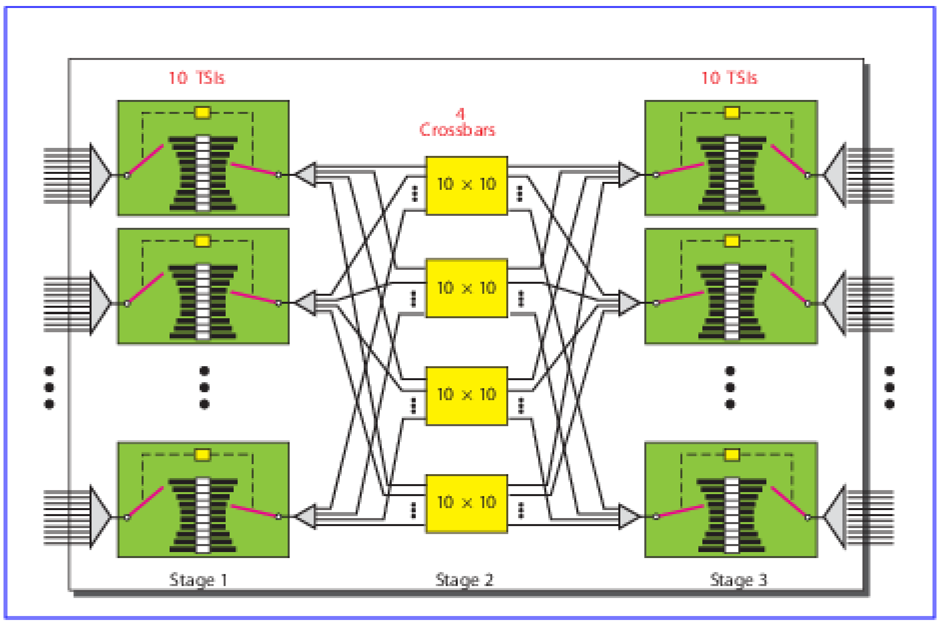
e) The blocking factor is 60/100 or 60 percent.

P8-16 We need a three-stage time-space-time switch with N = 100. We use 10 TSIs 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) Calculate the total number of memory locations we need for the TSIs.

Solution:

a)



b)

The total number of cross points = 4(10 × 10) =400

c)

*Each time slot must be stored by the RAM

In first stage there each TSI has 10 input to multiplexer so the number of slots is 10

Total of slot number in first stage = 10*10=100
Also total of slot number in third stage = 10*10=100

Total number of memory locations we need for the TSIs= 100+100 =200