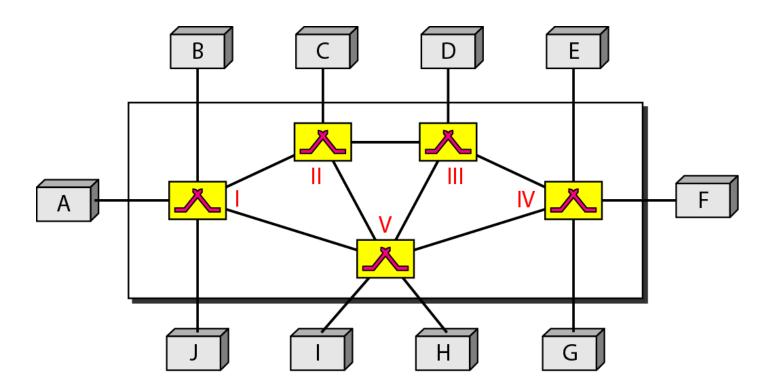
Data Communications and Networking Fourth Edition

Forouzan

Switching

Figure 8.1 Switched network

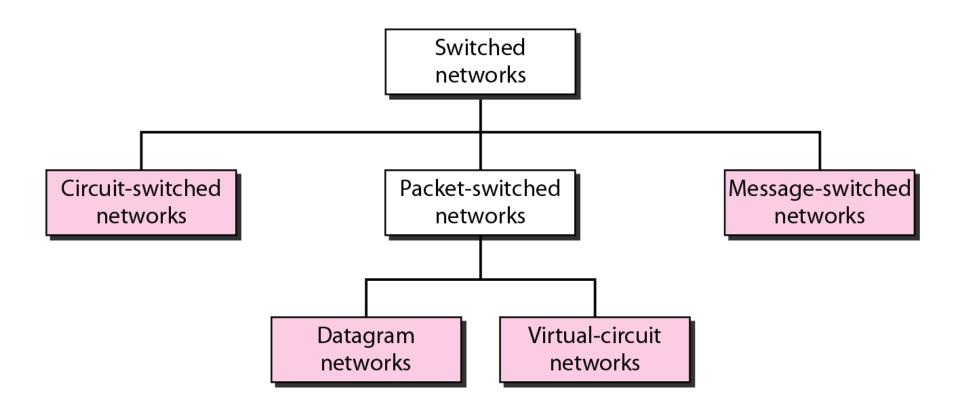


Switches are devices capable of creating temporary connections between two or more devices linked to the switch.

6:05 AM

8.2

Figure 8.2 Taxonomy of switched networks

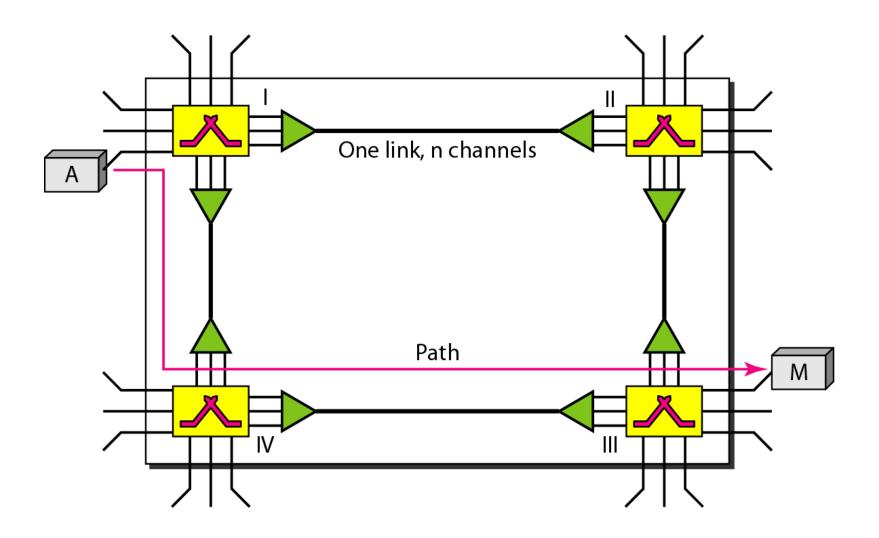


8-1 CIRCUIT-SWITCHED NETWORKS



A circuit-switched network is made of a set of switches connected by physical links, in which each link is divided into *n* channels by using FDM or TDM.

Figure 8.3 A trivial circuit-switched network





Note

In circuit switching, the resources need to be reserved during the setup phase; the resources remain dedicated for the entire duration of data transfer until the teardown phase.



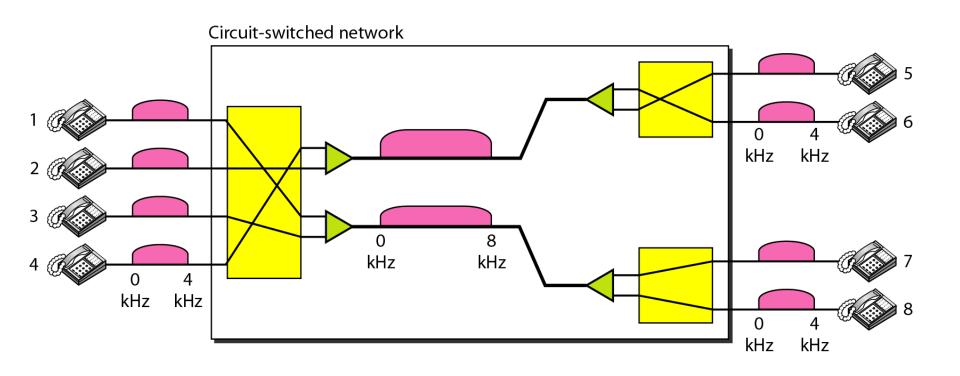
Circuit switching takes place at the physical layer.

Example 8.1

Figure 8.4 shows the situation. Telephone 1 is connected to telephone 7; 2 to 5; 3 to 8; and 4 to 6.

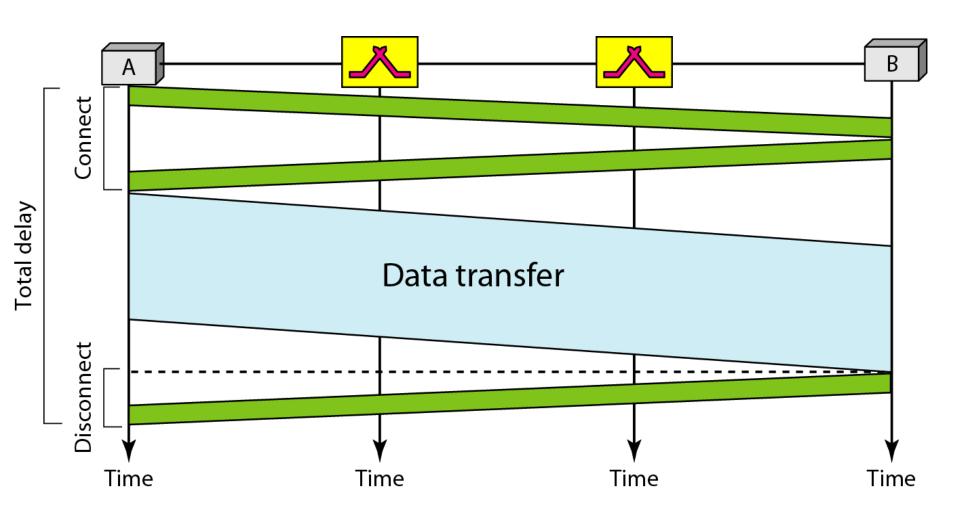
Of course the situation may change when new connections are made. The switch controls the connections.

Figure 8.4 Circuit-switched network used in Example 8.1

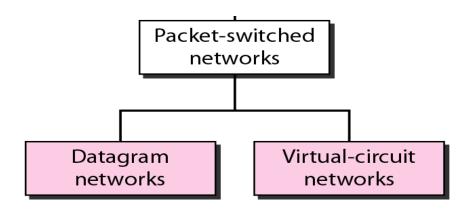


1 is connected to 7; 2 to 5; 3 to 8; and 4 to 6.

Figure 8.6 Delay in a circuit-switched network



8-2 DATAGRAM NETWORKS

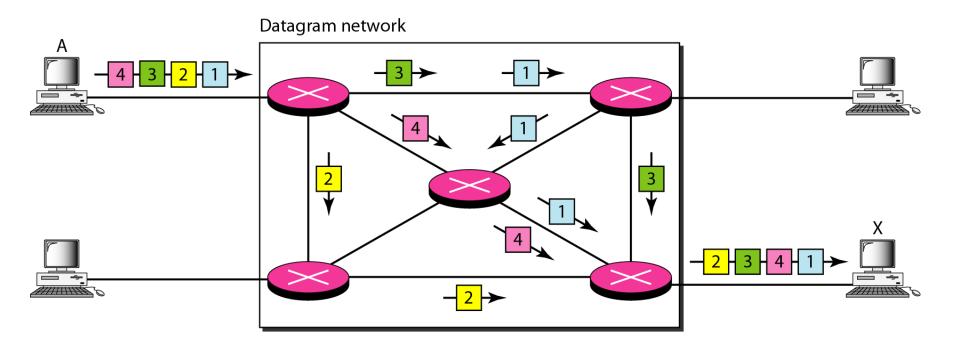


In data communications, we need to send messages from one end system to another. If the message is going to pass through a packet-switched network, it needs to be divided into packets of fixed or variable size. The size of the packet is determined by the network and the governing protocol.



In a packet-switched network, there is no resource reservation; resources are allocated on demand.

Figure 8.7 A datagram network with four switches (routers)



Note:

- In a datagram network, each packet is **treated independently** of all others. Even if a packet is part of a multi-packet transmission.
- Datagram switching is normally done at the **network layer**.
- There are **no setup or teardown** phases.

Figure 8.8 Routing table in a datagram network

	stination address	Out po	put ort
	1232 4150 :	1	2
	9130	3	3
1			4

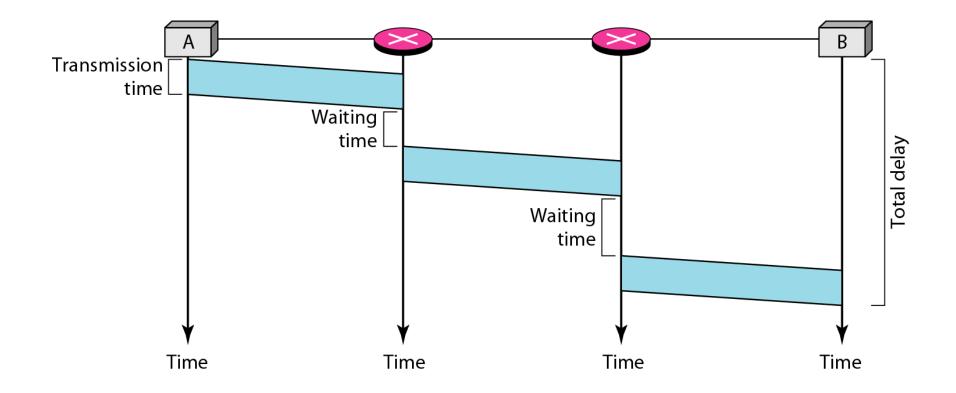


A switch in a datagram network uses a routing table that is based on the destination address.



The destination address in the header of a packet in a datagram network remains the same during the entire journey of the packet.

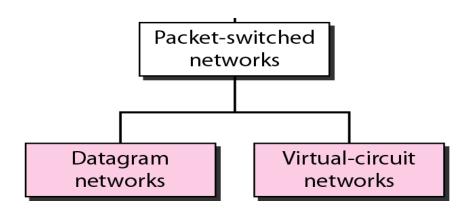
Figure 8.9 Delay in a datagram network





Switching in the Internet is done by using the datagram approach to packet switching at the network layer.

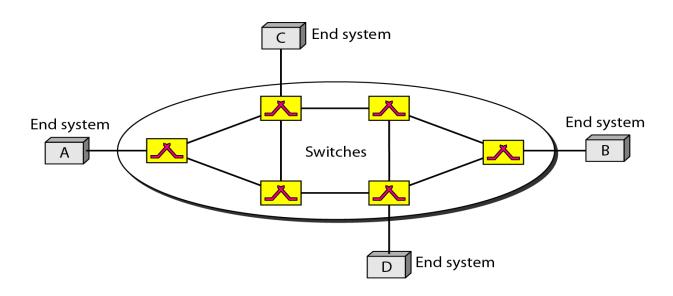
8-3 VIRTUAL-CIRCUIT NETWORKS



A virtual-circuit network is a cross between a circuitswitched network and a datagram network. It has some characteristics of both.

8.19

Figure 8.10 Virtual-circuit network



- There are setup and teardown phases.
- Data are packetized and each packet carries an address in the header defines the next switch.
- All packets follow the same path.
- Implemented in the data link layer.

Figure 8.10 Addressing in Virtual-circuit network

- Two types of addressing are involved: global and local
 - ✓ Global Address

That can be unique in the scope of the network or internationally if the network is part of an international network. It used only to create a virtual-circuit identifier.

✓ Local Address (Virtual-Circuit Identifier)

It is used by a frame between two switches. When a frame arrives at a switch, it has a VCI; when it leaves, it has a different VCI.

• The global address is used only to create a virtual-circuit identifier.

Figure 8.11 Virtual-circuit identifier

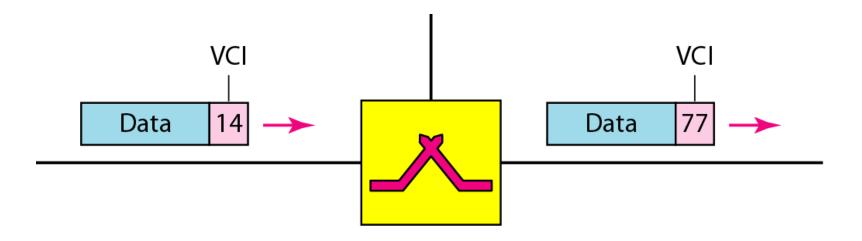


Figure 8.12 Switch and tables in a virtual-circuit network

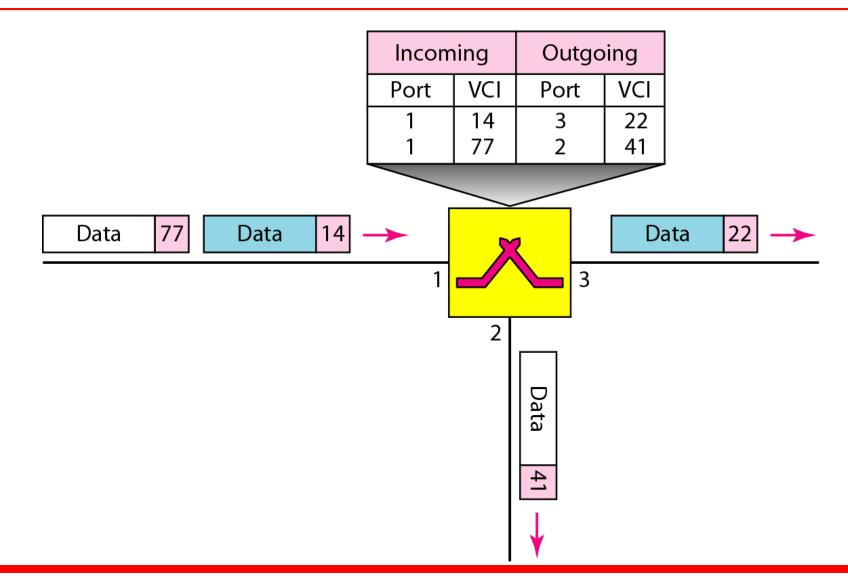
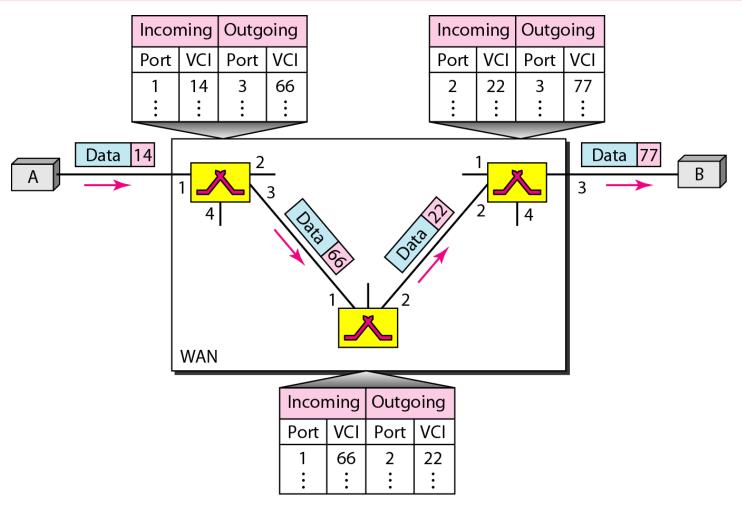
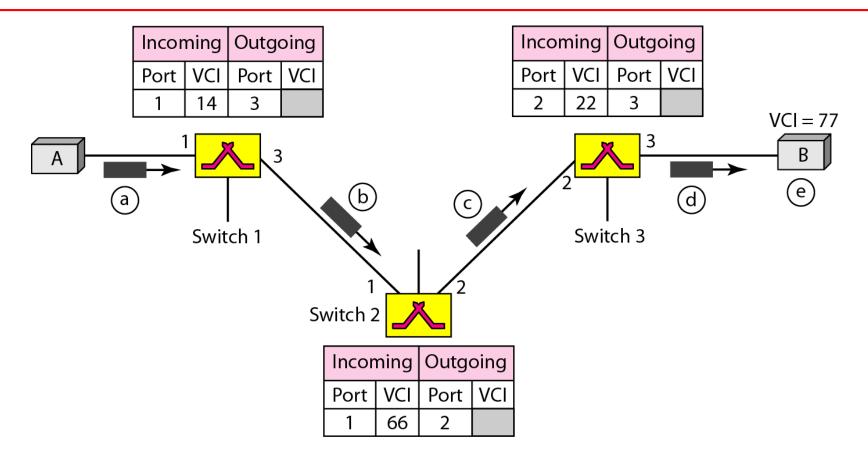


Figure 8.13 Source-to-destination data transfer in a virtual-circuit network



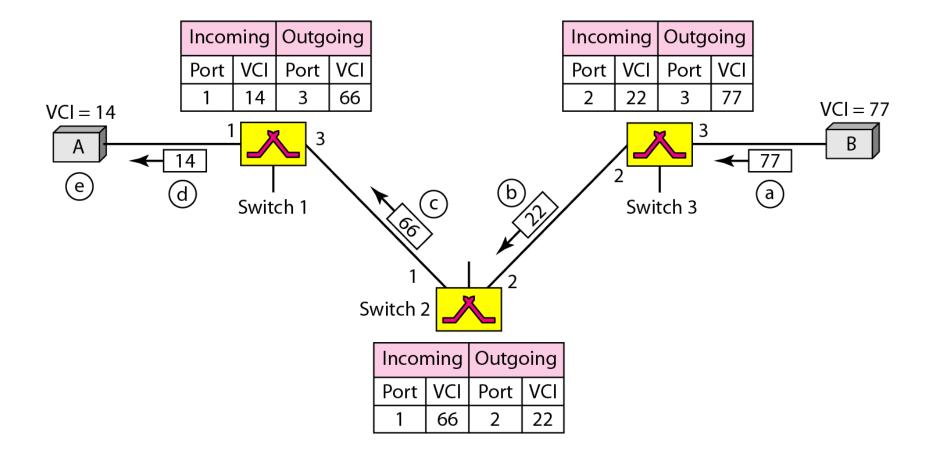
Note: As in a circuit-switched network, a source and destination need to go through three phases in a virtual-circuit network: **setup, data transfer, and teardown**.

Figure 8.14 Setup request in a virtual-circuit network



Note: In the setup phase, a switch creates an entry for a virtual circuit and it requires two steps: the **setup request** and the **acknowledgment**.

Figure 8.15 Setup acknowledgment in a virtual-circuit network

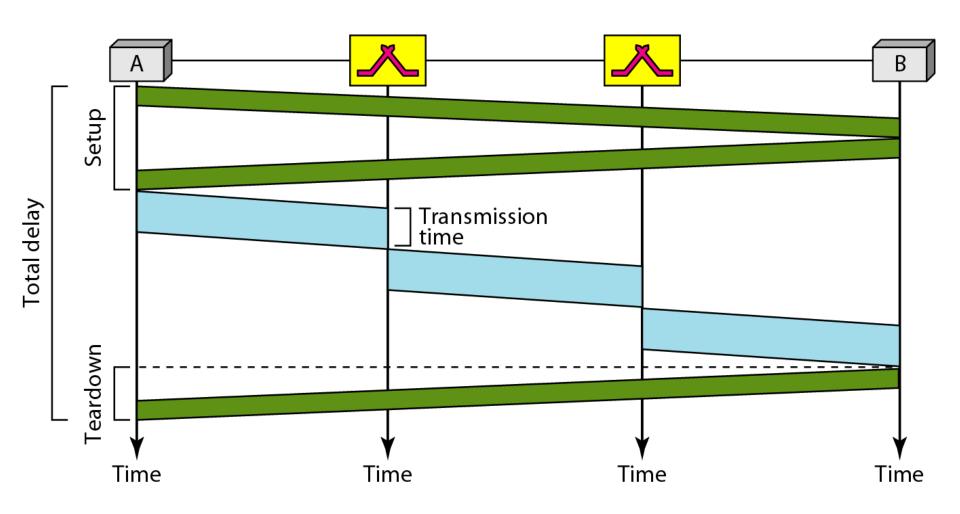


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Note

In virtual-circuit switching, all packets belonging to the same source and destination travel the same path; but the packets may arrive at the destination with different delays if resource allocation is on demand.

Figure 8.16 Delay in a virtual-circuit network







Switching at the data link layer in a switched WAN is normally implemented by using virtual-circuit techniques.

8- Review Questions & Exercises

Answer all the Review Questions & Exercises in the end of this chapter.

The end of chapter 8