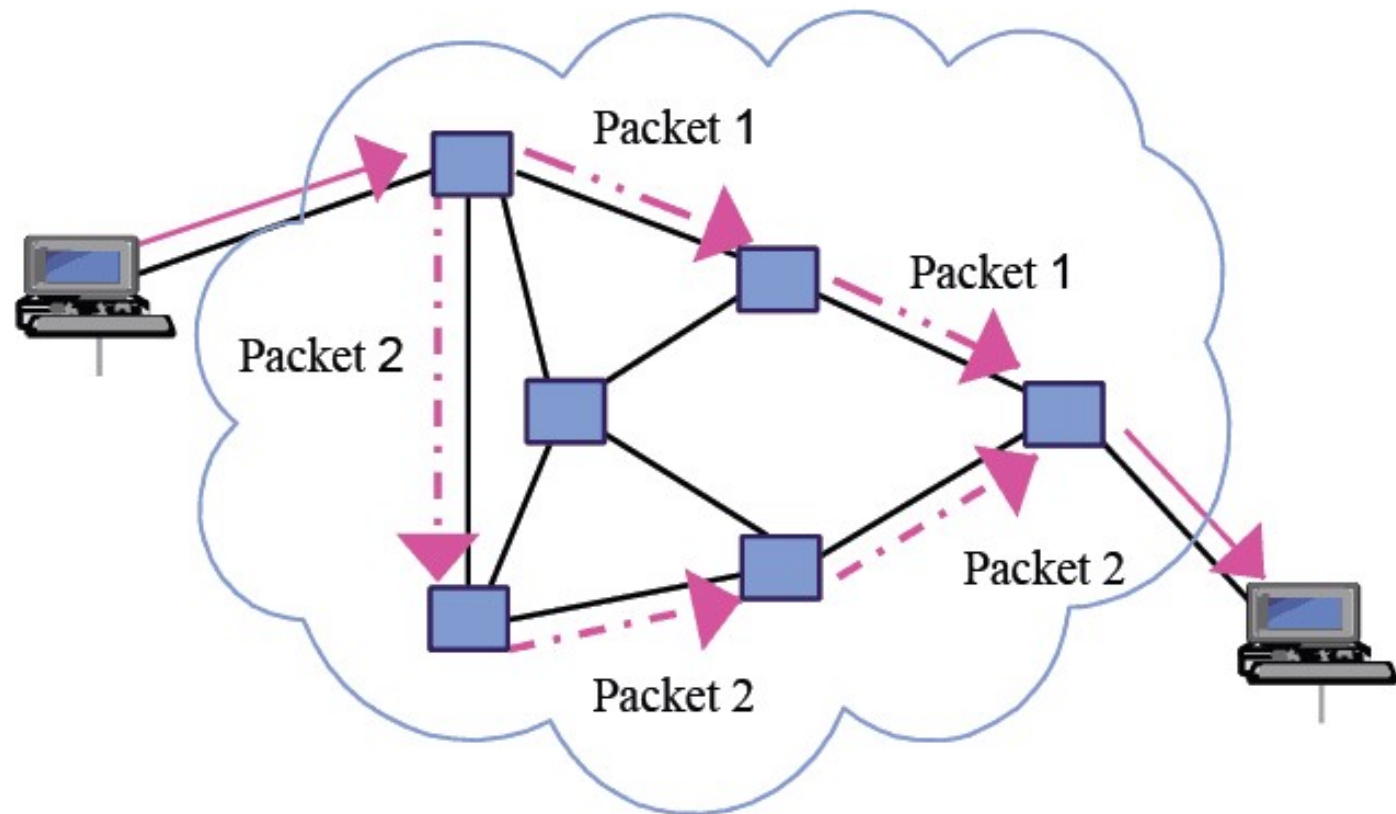


Chapter 8

Switching



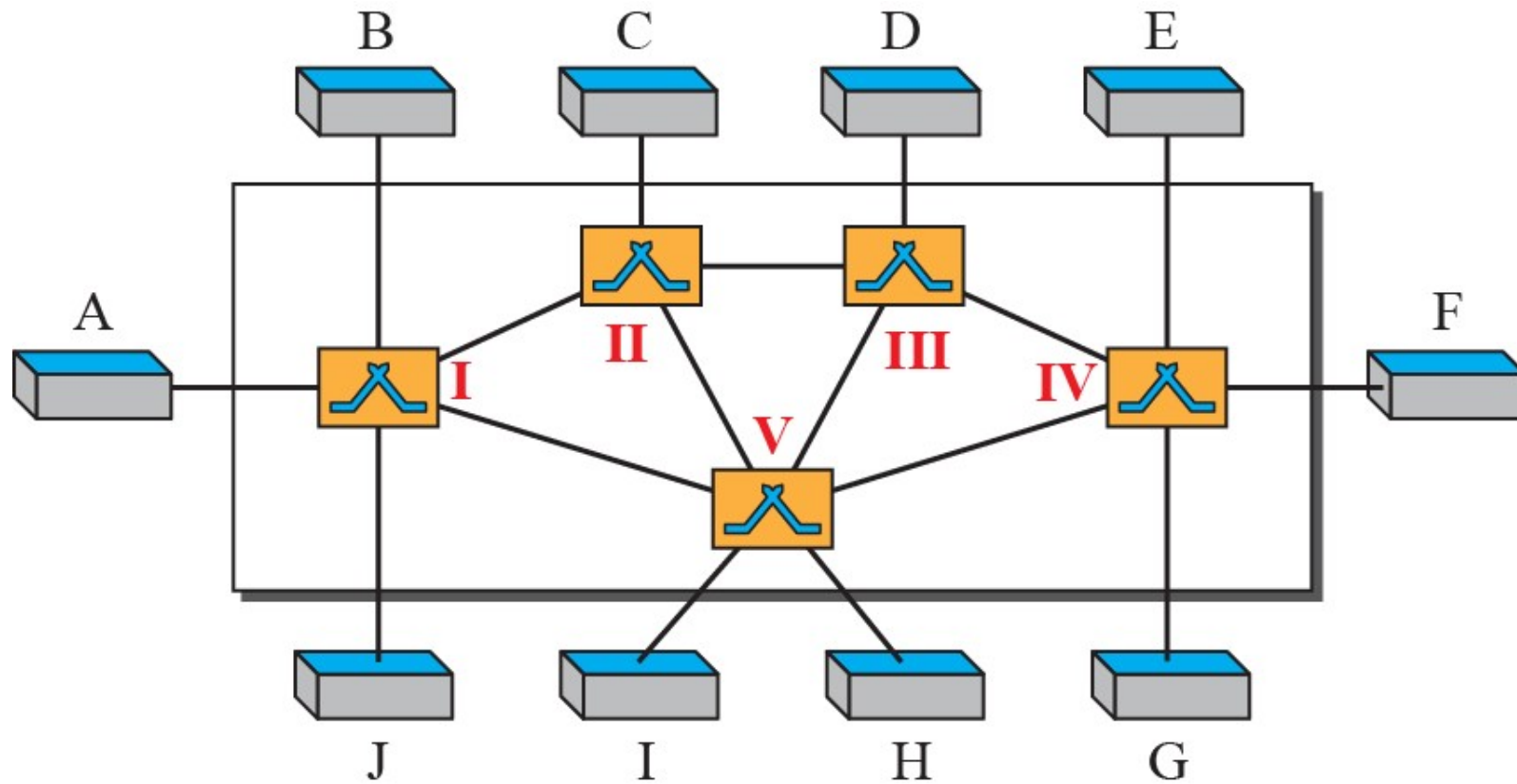
Objective

- Switching: circuit switching, packet switching, and message switching.
- Circuit-switched networks. It defines three phases in these types of networks.
- Packet-switched networks. It describes datagram networks and virtual circuit networks.
- Structure of a circuit switch and a packet switch.

INTRODUCTION

- A network is a set of connected devices. Whenever we have multiple devices, we have the problem of how to connect them to make one-to-one communication possible.
- The solution is switching. A switched network consists of a series of interlinked nodes, called switches.





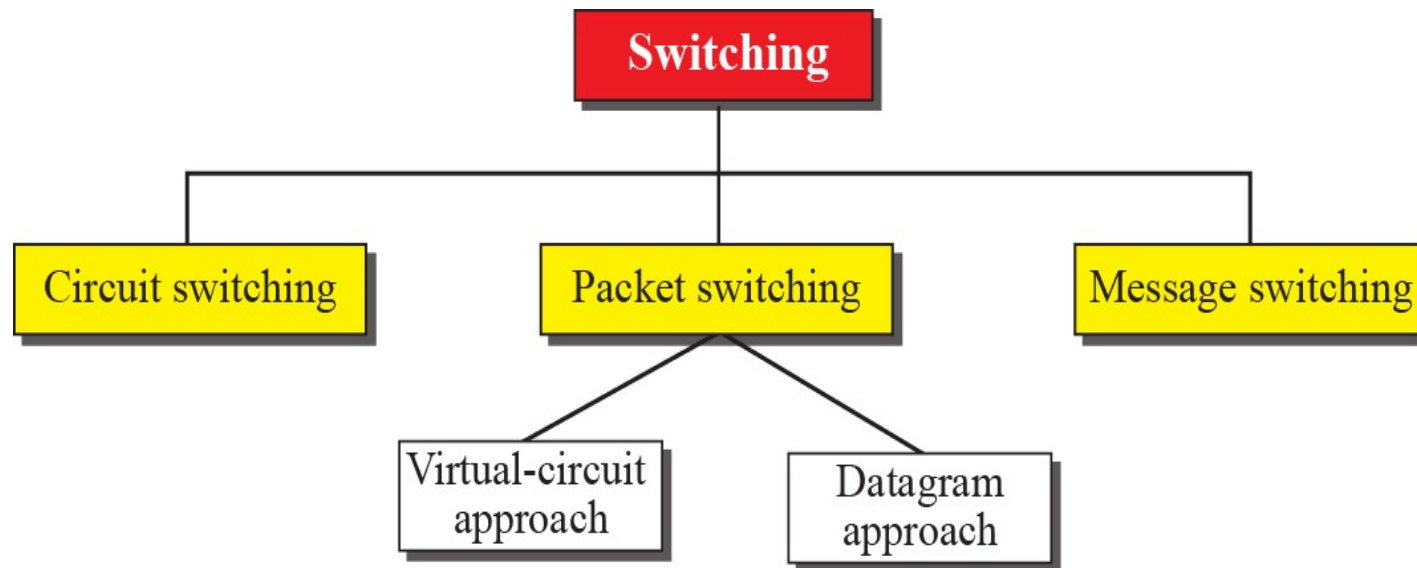
Switched network

Three Methods of Switching

- Traditionally, three methods of switching have been discussed: **circuit switching, packet switching, and message switching.**
- The first two are commonly used today. The third has been phased out in general communications but still has applications.
- Packet switching can further be divided into two subcategories, **virtual-circuit approach and datagram approach.**

Switching and TCP/IP Layers

- Switching can happen at several layers of the TCP/IP protocol suite: at the physical layer, at the data-link layer, and at the network layer.



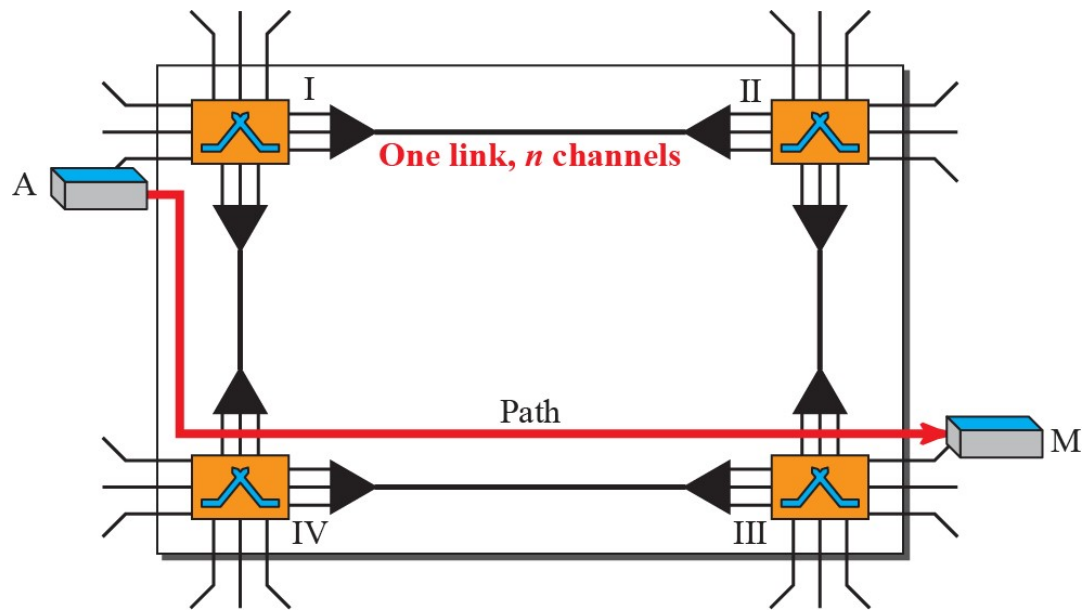
Taxonomy of switched networks

CIRCUIT-SWITCHED NETWORKS

- A **circuit-switched network** consists of a set of switches connected by physical links.
- A connection between two stations is a **dedicated path** made of one or more links.
- However, each connection uses only one dedicated channel on each link. Each link is normally divided into n channels by using FDM or TDM.

Three Phases

- The actual communication in a circuit-switched network requires three phases: **connection setup**, **data transfer**, and **connection teardown**.



A trivial circuit-switched network

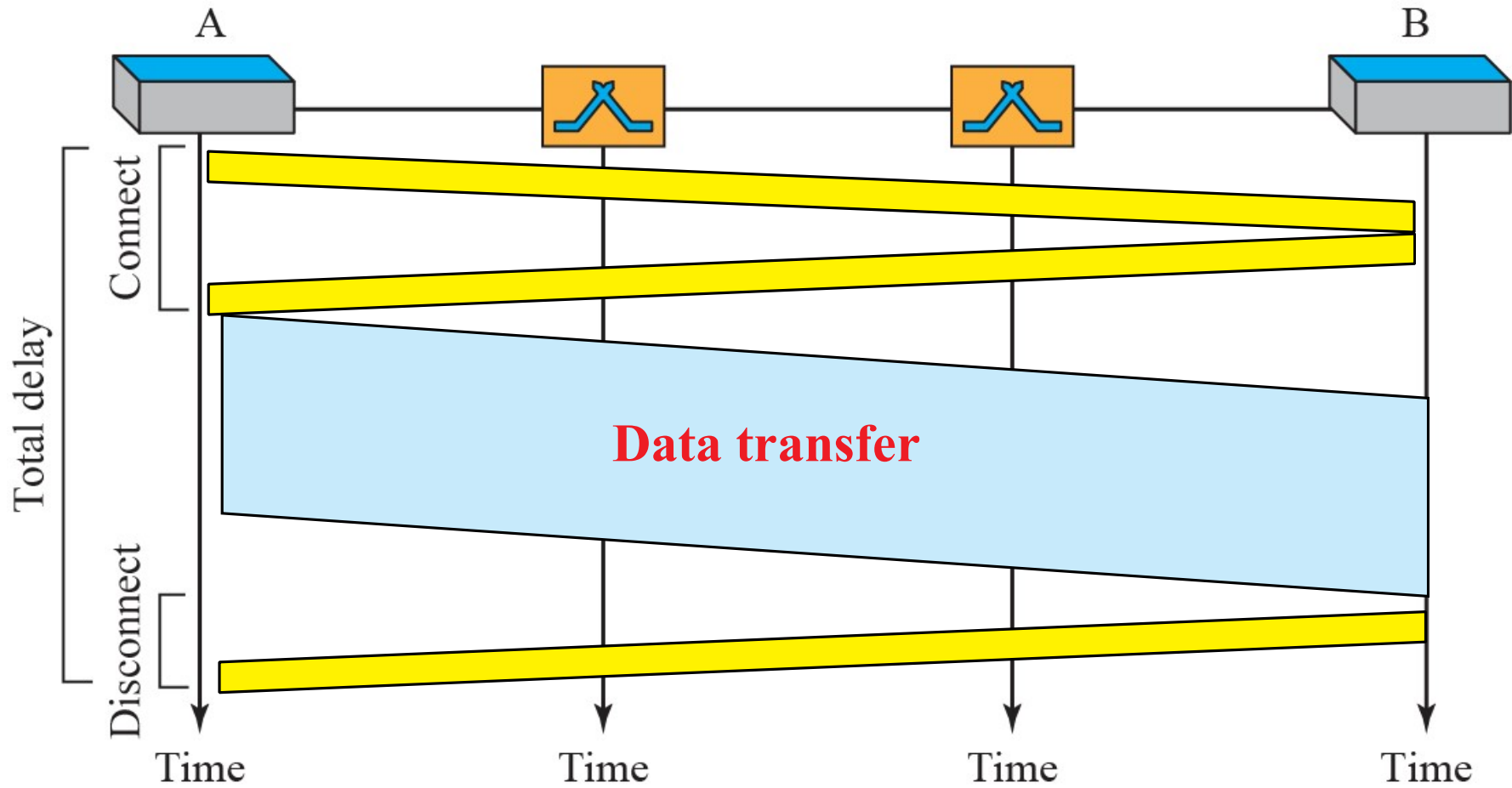
Efficiency

- It can be argued that circuit-switched networks are not as efficient as the other two types of networks because resources are allocated during the entire duration of the connection.
- These resources are unavailable to other connections.
- In a telephone network, people normally terminate the communication when they have finished their conversation.

Delay



- Although a circuit-switched network normally has low efficiency, the delay in this type of network is minimal.
- During data transfer the data are not delayed at each switch; the resources are allocated for the duration of the connection.
- Next figure shows the idea of delay in a circuit-switched network when only two switches are involved.



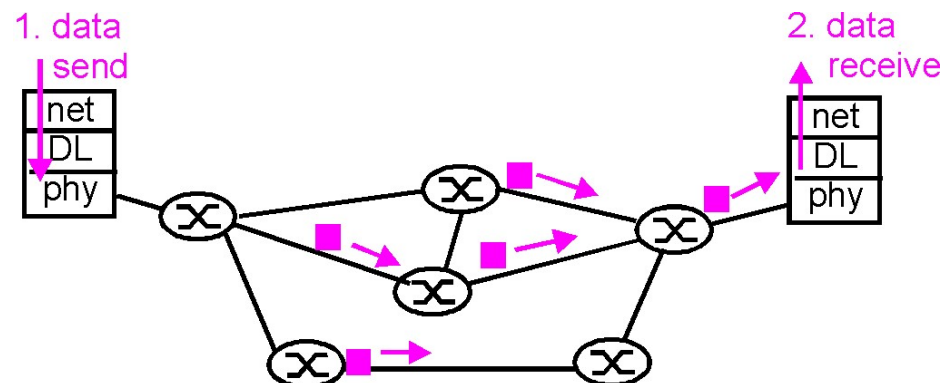
Delay in a circuit-switched network

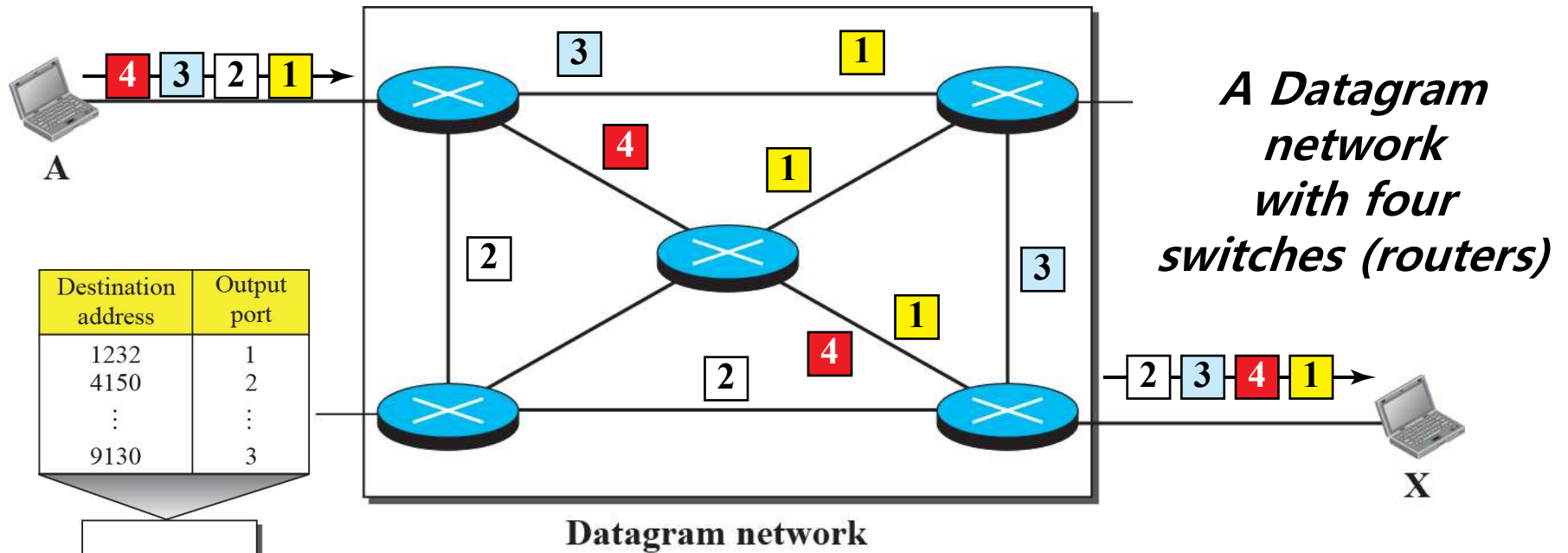
PACKET SWITCHING

- 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.

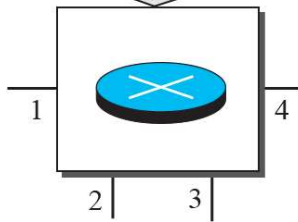
Datagram Networks

- In a datagram network, each packet is treated independently of all others.
- Even if a packet is part of a multipacket transmission, the network treats it as though it existed alone.
- Packets in this approach are referred to as datagrams.

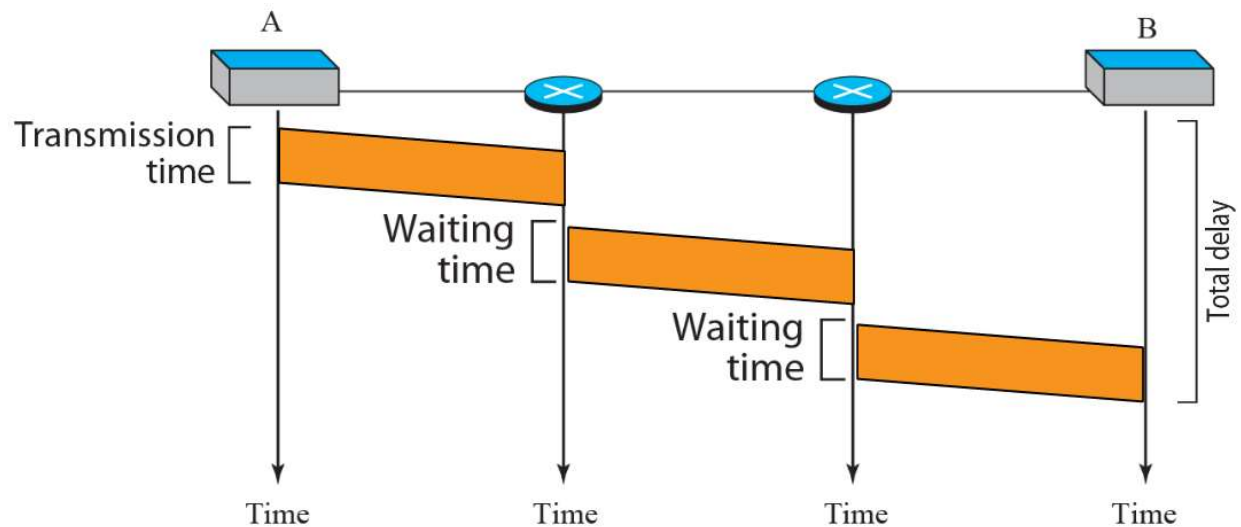




Destination address	Output port
1232	1
4150	2
⋮	⋮
9130	3

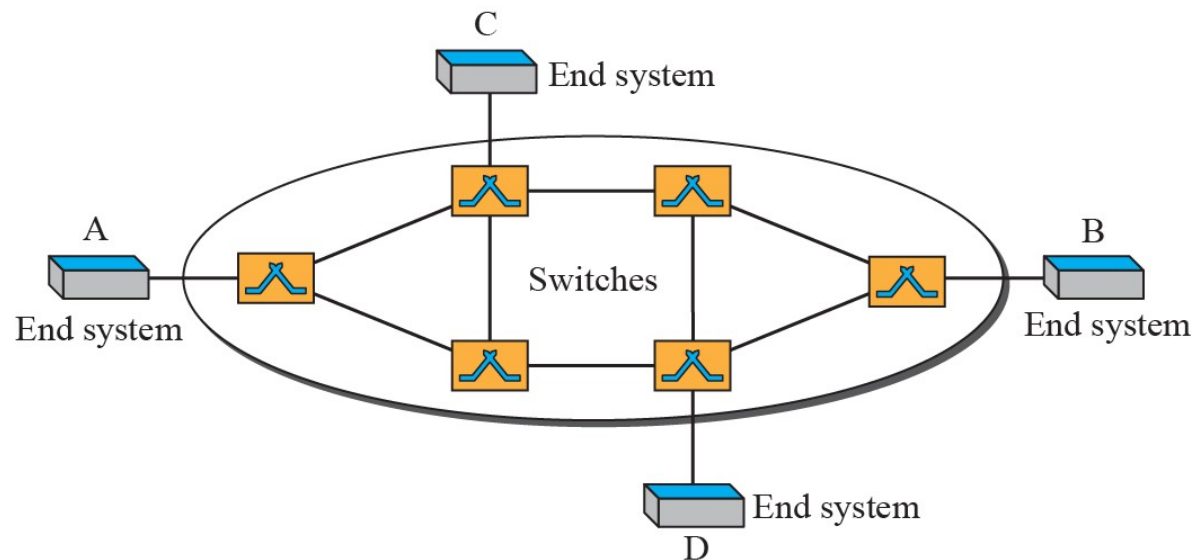


Routing table in a datagram network

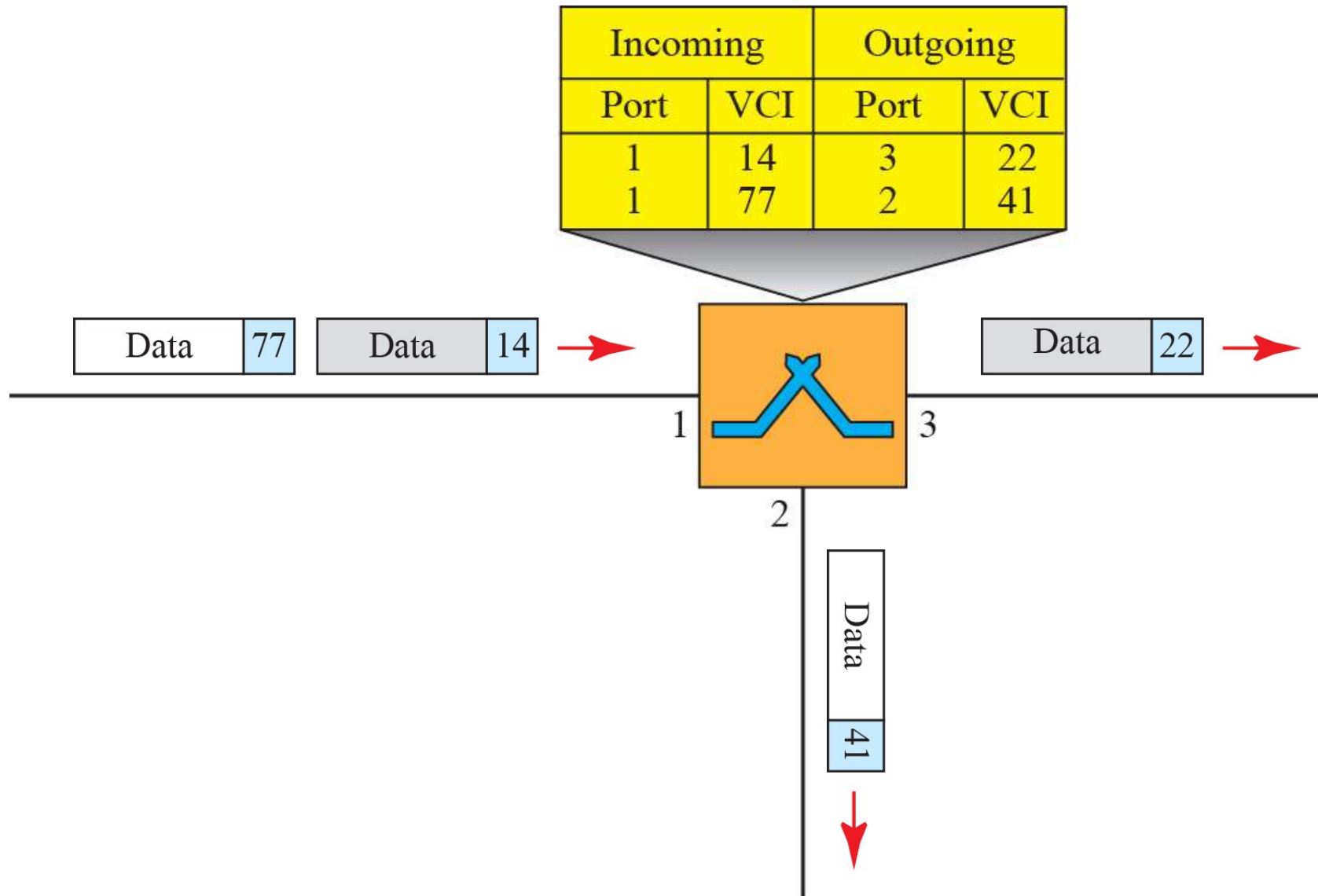


Virtual-Circuit Networks

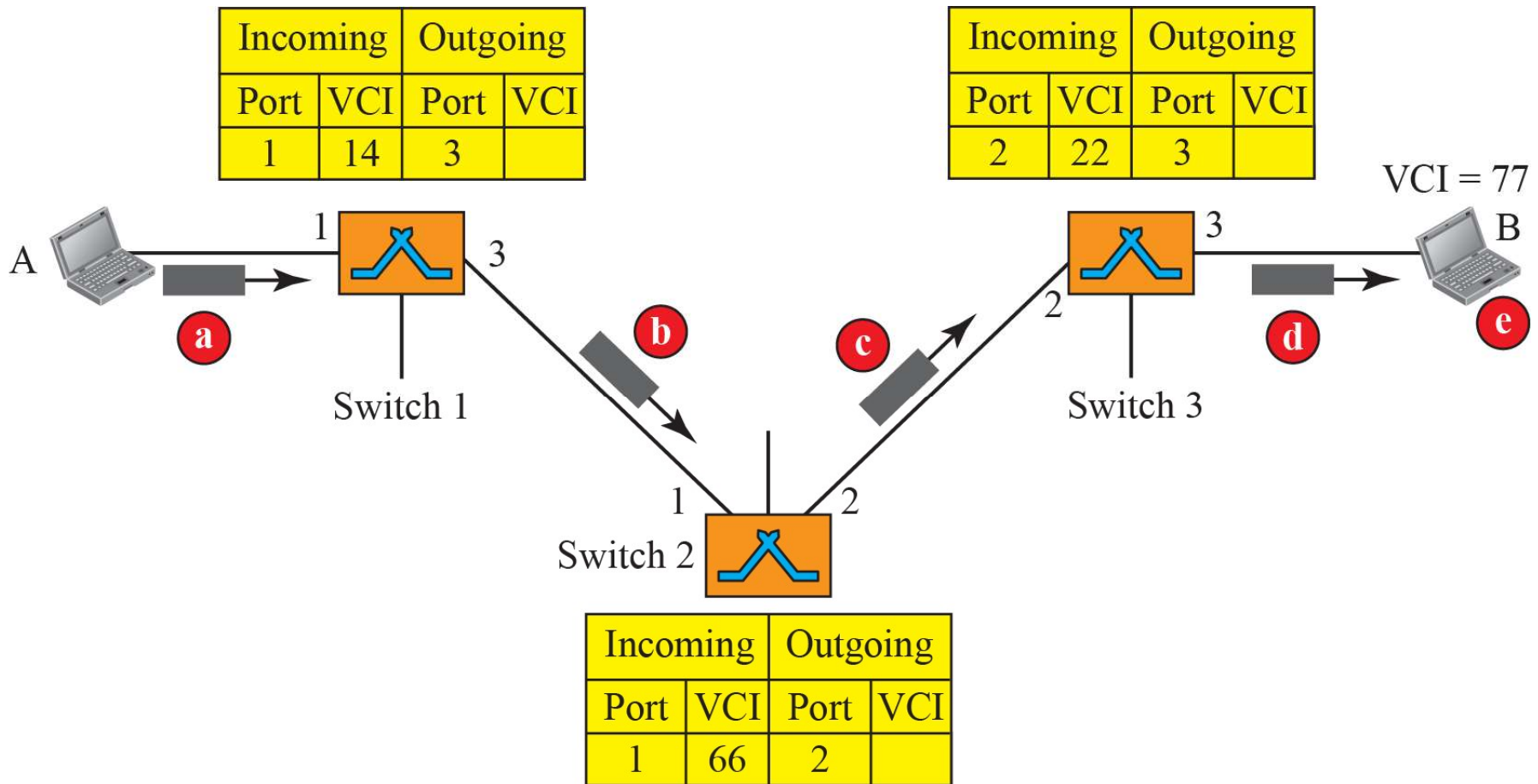
- A virtual-circuit network is a cross between a circuit-switched network and a datagram network. It has some characteristics of both.



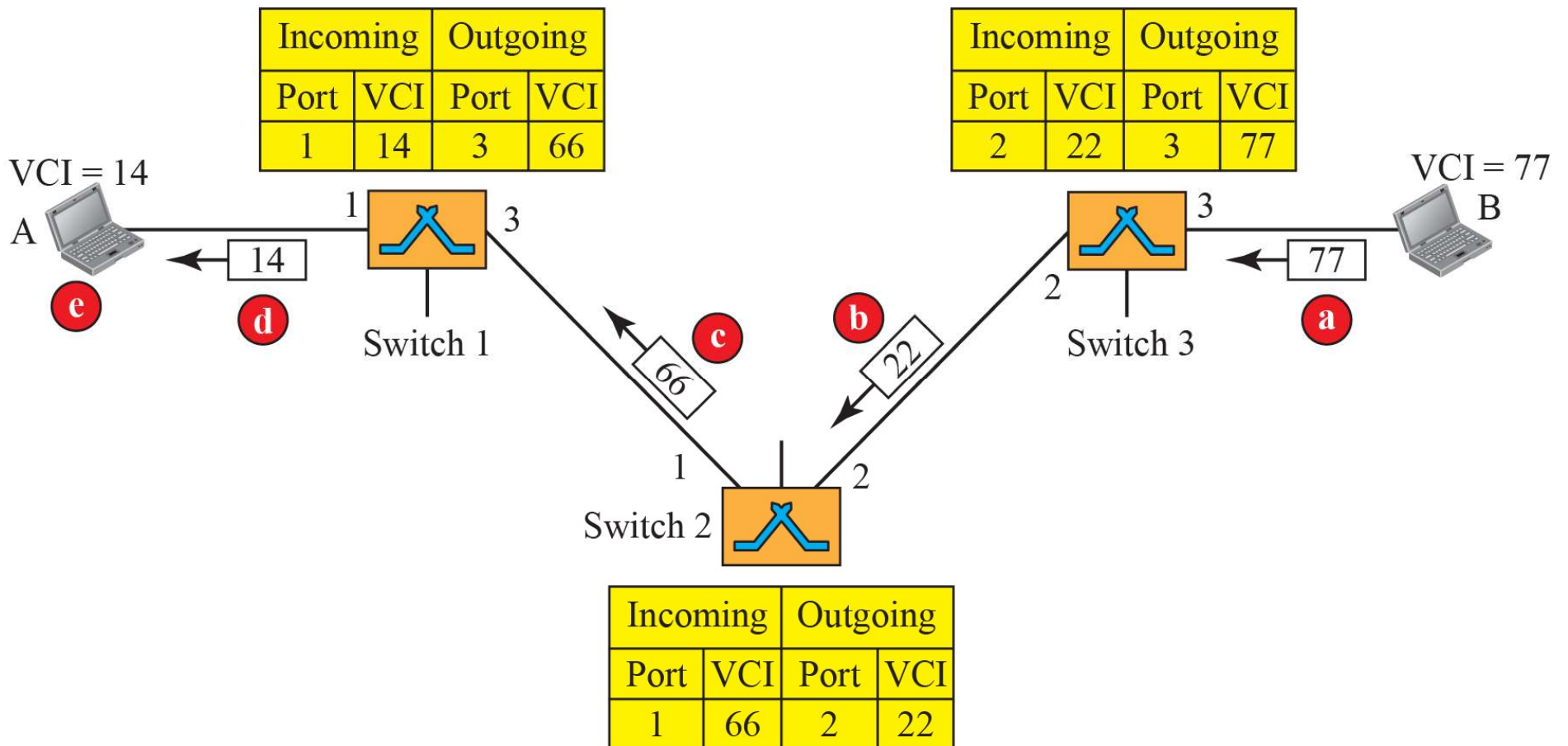
Virtual-circuit network



Switch and table for a virtual-circuit network



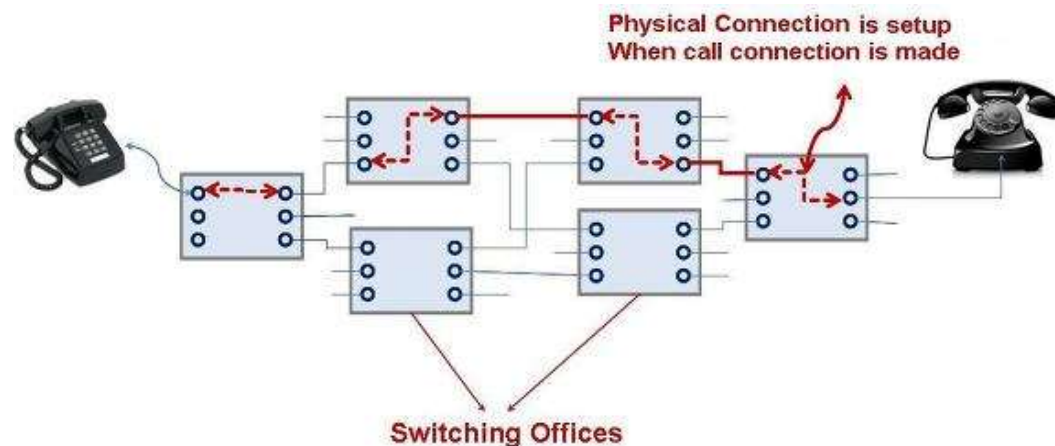
Setup request in a virtual-circuit network

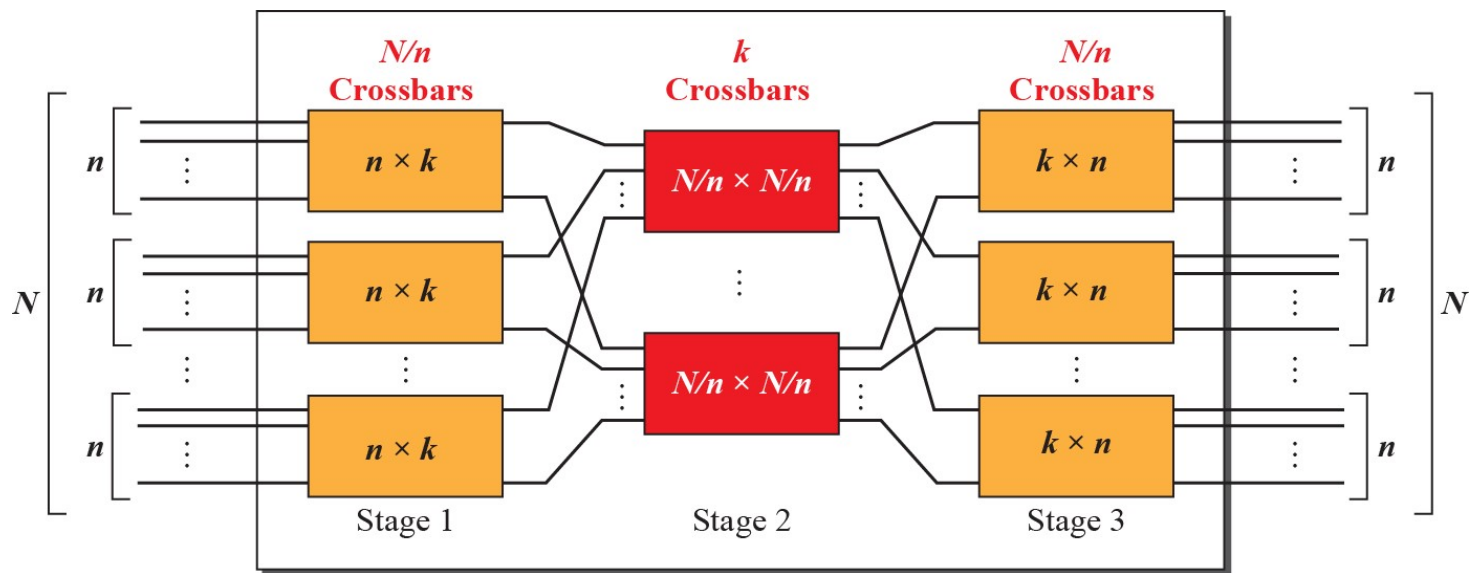
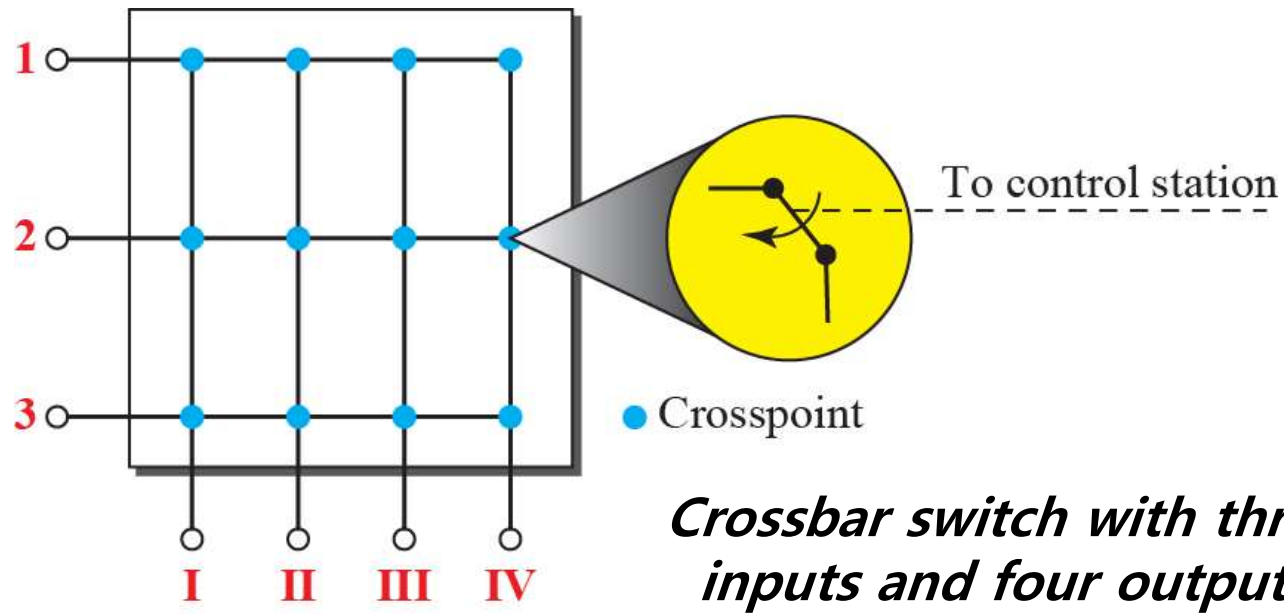


Setup acknowledgment in a virtual-circuit network

STRUCTURE OF A SWITCH

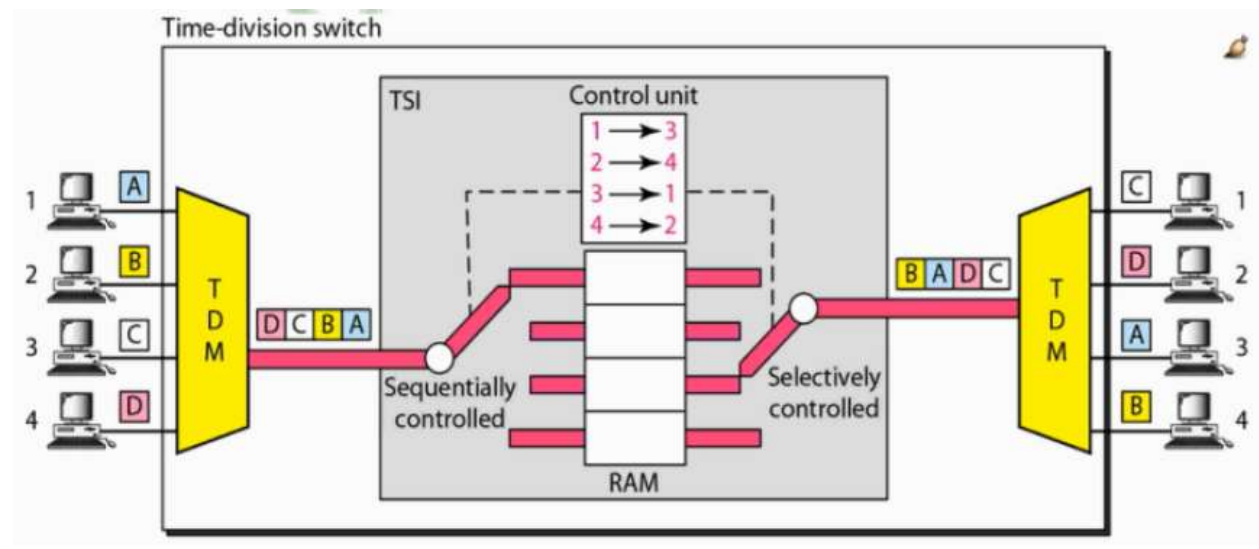
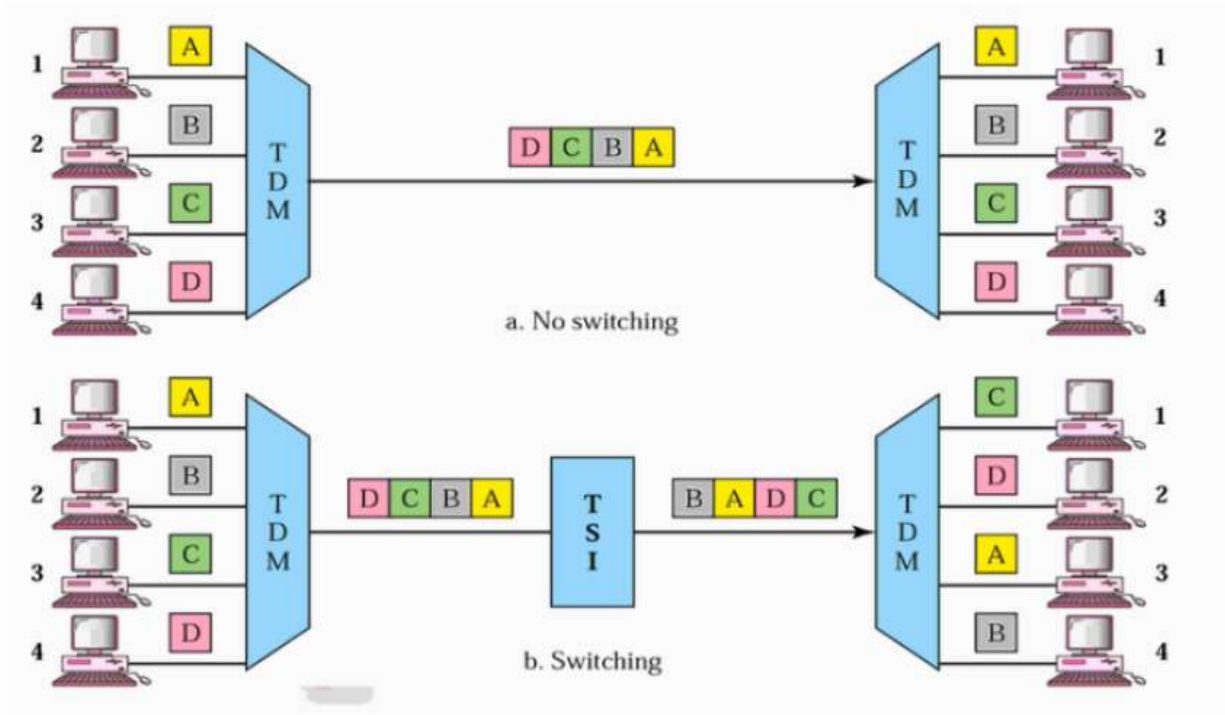
- We use switches in circuit-switched and packet-switched networks. We discuss the structures of the switches used in each type of network.
- Circuit switching today can use either of two technologies: the space-division switch or the time-division switch.





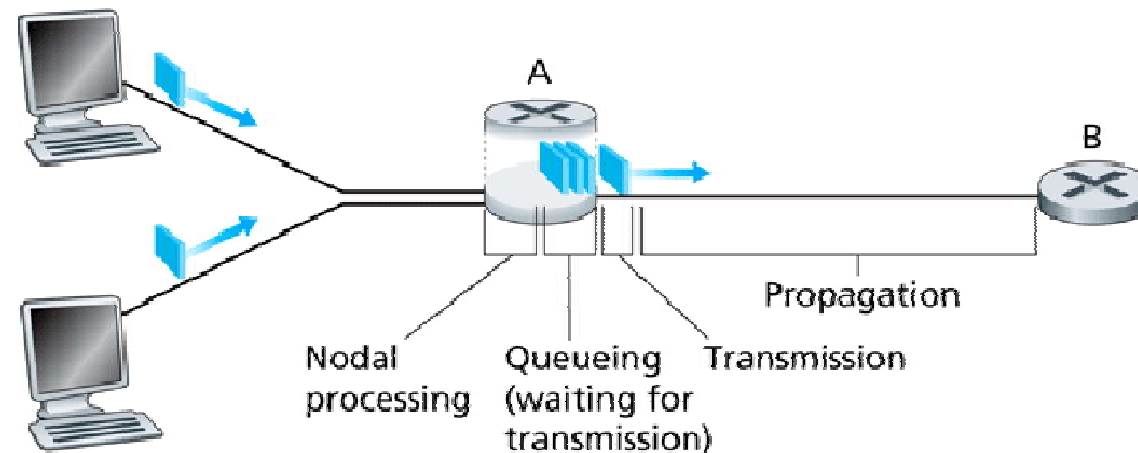
Multistage switch

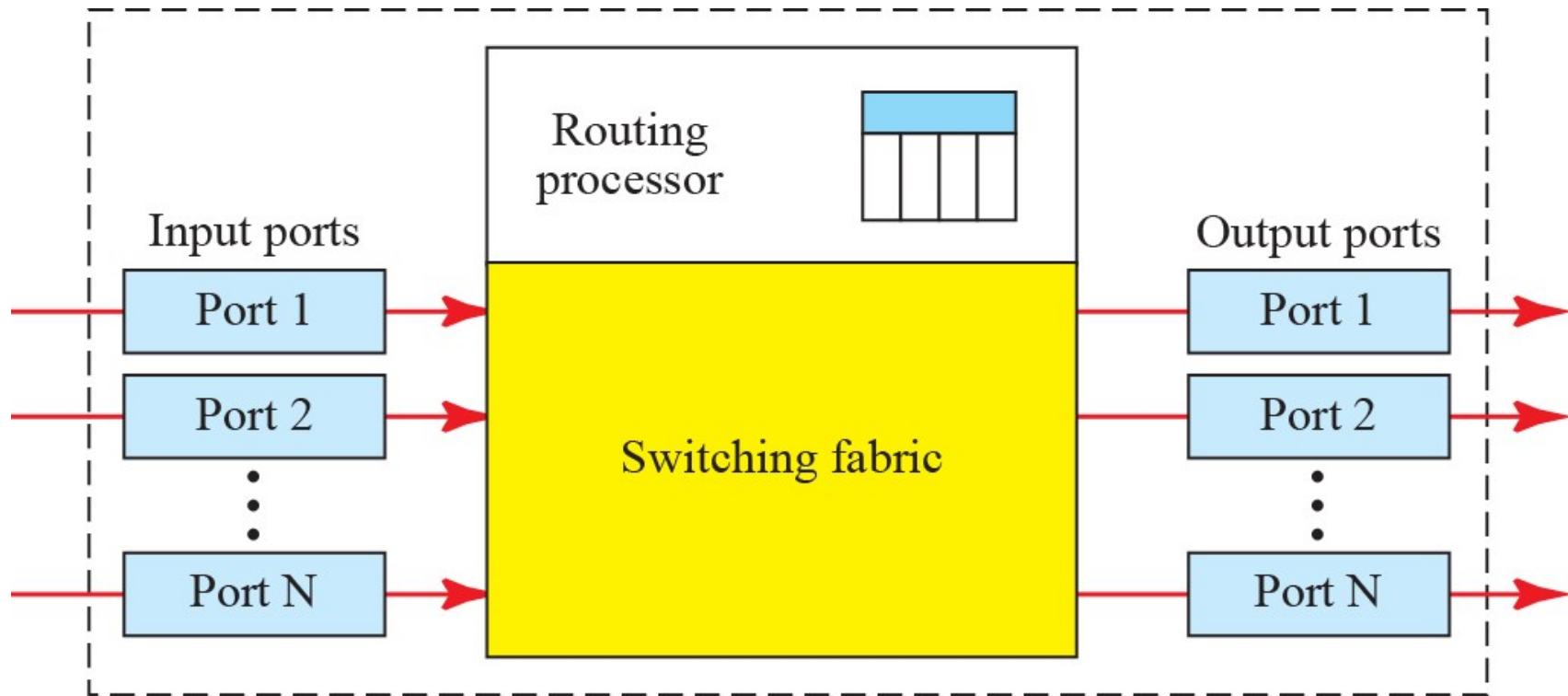
time-division switch



Structure of Packet Switches

- A switch used in a packet-switched network has a different structure from a switch used in a circuit-switched network.
- We can say that a packet switch has four components: input ports, output ports, the routing processor, and the switching fabric.





Packet switch components