

Definition of Computer Networks

- A **Computer network** to mean a collection of *autonomous computers interconnected by a single technology*.
- *Two computers* are said to be *interconnected* if they are able to *exchange information*.
- The *connection need not* be via a *copper wire*; *fiber optics*, *microwaves*, *infrared*, and *communication satellites* can also be used.
- The computers are autonomous, which are not forcibly started or controlled by other one.

Note: *A system with one control unit and many slaves is not a computer network.*

- A computer network consists of *end systems (or) nodes* which are capable of transmitting of information.
- The *transit system* is also called an *interconnection subsystem* or simply a *subnetwork*.
- The old model of a single computer serving all of the organization's computational needs has been replaced by one in which a large number of separate but interconnected computers do the job. These systems are called *computer networks*.

Definition of Networking

Data Communication: When we communicate, we are *sharing information*.

- *This sharing can be local or remote.*
- Between individuals, local communication usually occurs face to face, while remote communication takes place over distance.
- A **network** is a set of devices (often referred to as nodes) connected by *communication links*.
- *A node can be a computer, printer, or any other device capable of sending and/or receiving data generated by other nodes on the network.*

Network Criteria:

A network must be able to meet a certain number of criteria. The most important of these are *performance, reliability, and security*.

- *Performance*: It can be measured in many ways, including *transit time* and *response time*.
 - *Transit time* is the amount of time required for a message to travel from one device to another.
 - *Response time* is the elapsed time between an inquiry and a response.

Note: Performance is often evaluated by two networking metrics: *throughput* and *delay*.

Reliability:

- *Network reliability is measured by the frequency of failure.*
- The time it takes a link to recover from a failure, and the network's robustness in a catastrophe.

Security:

- *Network security issues include protecting data from unauthorized access.*
- Protecting data from damage and development, and implementing policies and procedures for recovery from breaches and data losses.

Network Speed

A network's speed can be summed up with two values: *Bit Rate* and *Latency*

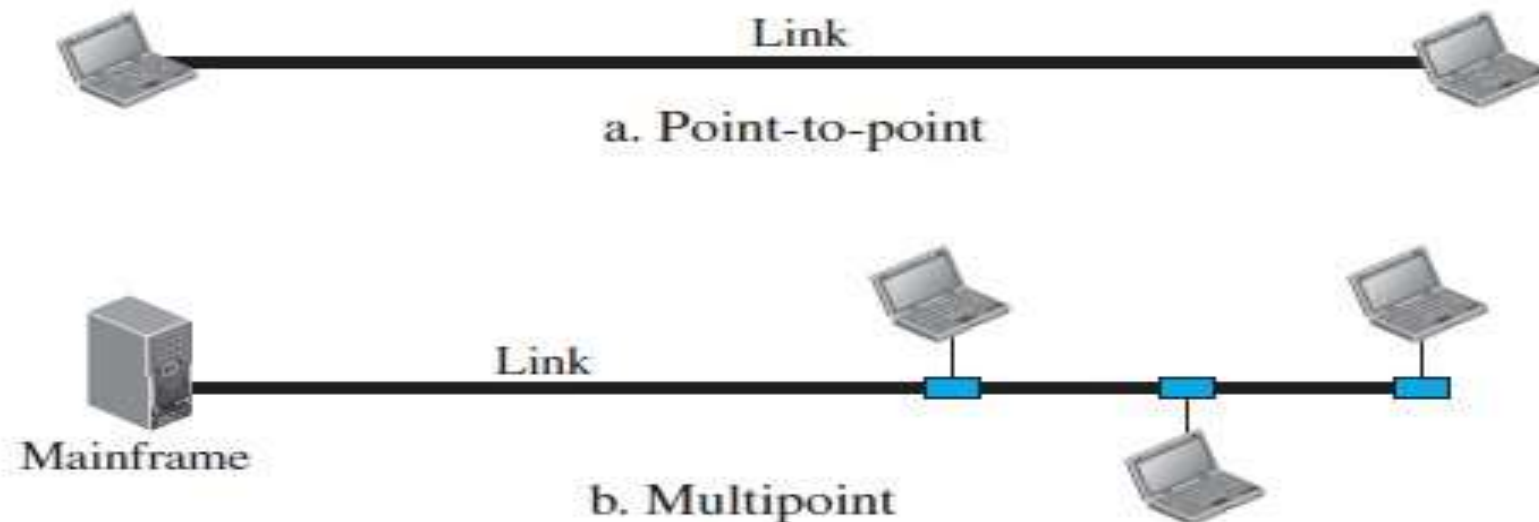
- *Bit Rate:*
 - *How many bits can be placed on the network in a given time interval* (e.g. 1 second)?
 - *This is often called bandwidth*, but this is a misnomer since bandwidth has to do with the range of frequencies to be used.
 - *Bit rate becomes the dominant factor when sending many packets* (e.g. a large file)

- *Latency:*
 - *How long does it take a bit to be received by the destination node?*
 - Latency becomes the dominant factor *when sending individual packets*, or alternating sending/receiving

Type of Connection

- *A network is two or more devices connected through links.* A link is a communications pathway that transfers data from one device to another.
- There are two possible types of connections: *point-to-point* and *multipoint*.

Figure 1.3 Types of connections: point-to-point and multipoint



Point-to-Point:

- A ***point-to-point connection*** provides a dedicated link between two devices. The entire capacity of the link is reserved for transmission between those two devices.

Multipoint:

- A ***multipoint*** (also called ***multidrop***) **connection** is one in which more than two specific devices share a single link.
- In a multipoint environment, the capacity of the channel is shared, either spatially or temporally.
- If several devices can use the link simultaneously, it is a ***spatially shared*** connection. If users must take turns, it is a ***timeshared*** connection.

Data Communication Components



A data communications system has five components.

1. **Message.** The message is the information (data) to be communicated.
2. **Sender.** The sender is the device that sends the data message.
3. **Receiver.** The receiver is the device that receives the message.
4. **Transmission medium.** The transmission medium is the physical path by which a message travels from sender to receiver.
5. **Protocol.** A protocol is a set of rules that govern data communications.

Network Types

- One network can be distinguished from another network based on few criteria such as size, Geographical area, and ownership.
- There are 2 basic types of Networks : *Local Area Networks (LAN)* and *Wide Area Networks (WAN)*.

Local Area Network (LAN):

- LAN's, are *privately-owned networks* within a single building or campus of up to a few *kilometers in size*.
- They are widely used to *connect personal computers and workstations* in company offices and factories to share resources (e.g., printers) and exchange information.

LANs are distinguished from other kinds of networks by *three characteristics*:

1) *Their size*

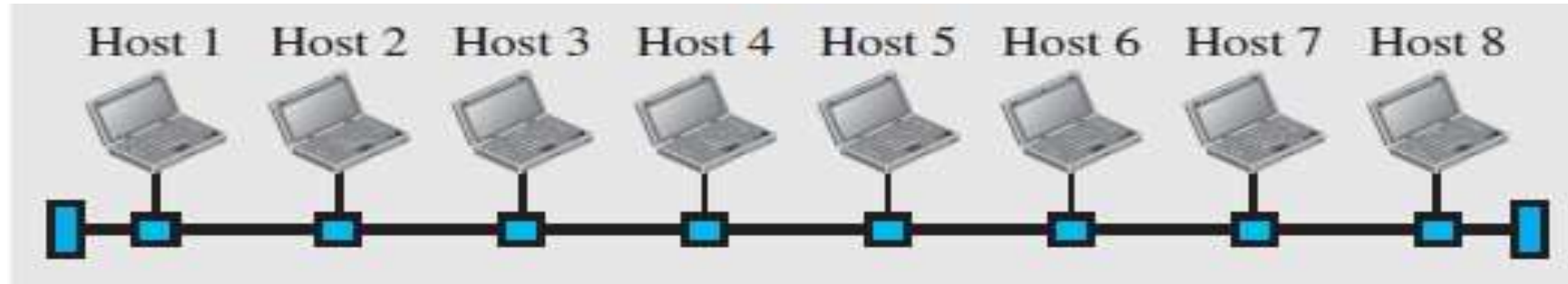
2) *Their transmission technology, and*

3) *Their topology.*

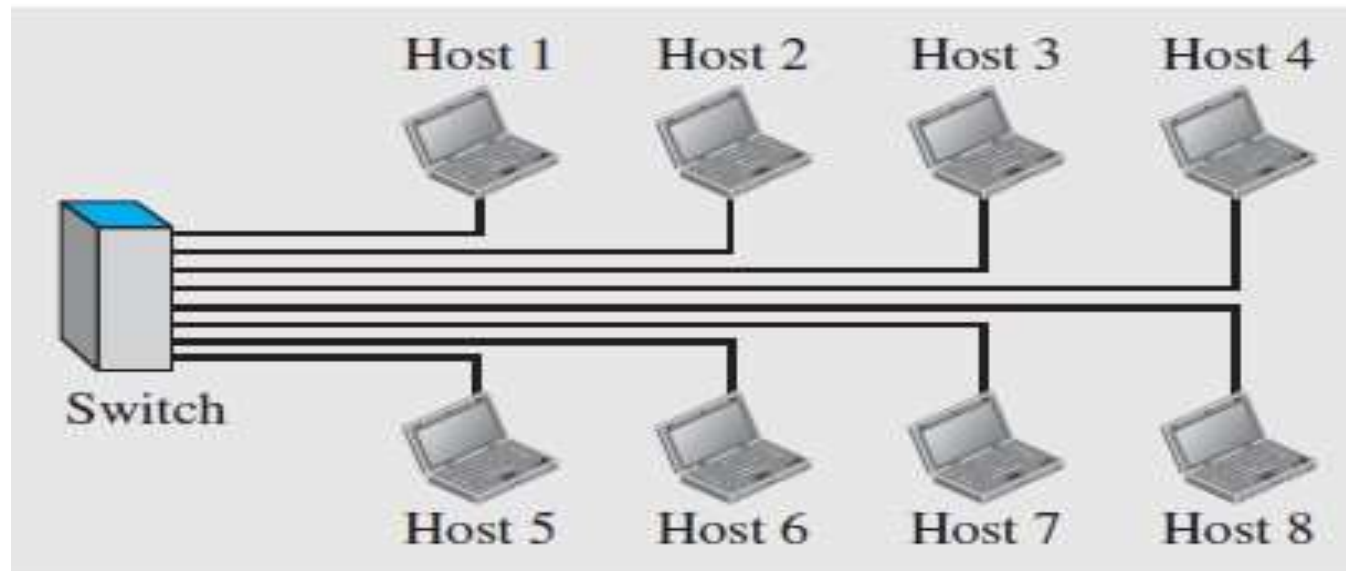
I. Size: LANs are restricted in size, which means that the worst-case transmission time is bounded and known in advance.

II. Transmission technology: LANs consisting of a cable to which all the machines are attached. Traditional LANs run at speeds of 10 Mbps to 100 Mbps.

Topology: Various topologies are possible for broadcast LANs. Ex: Bus and Ring.

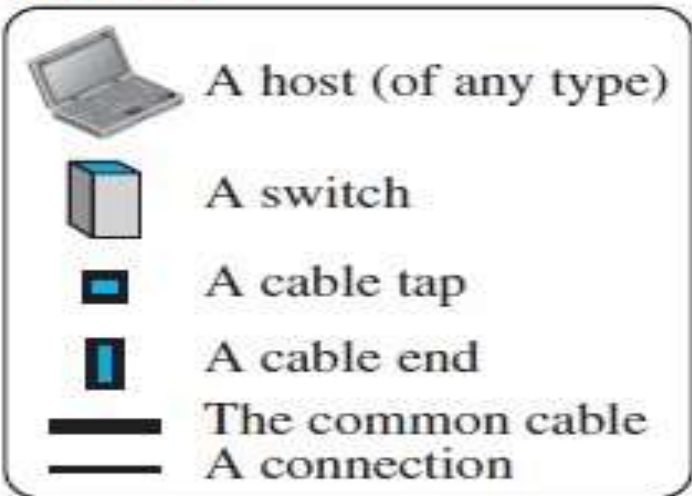


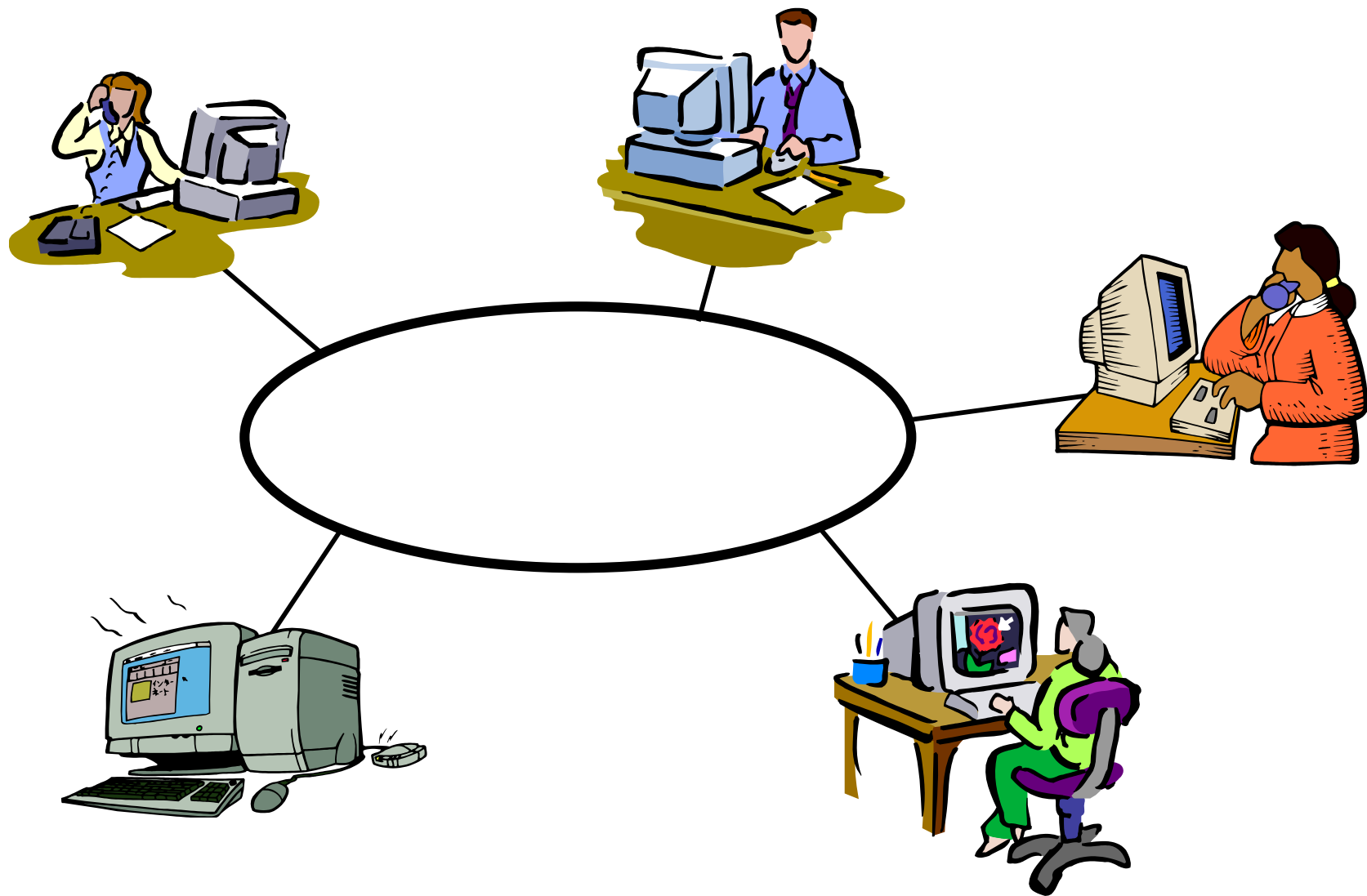
a. LAN with a common cable (past)

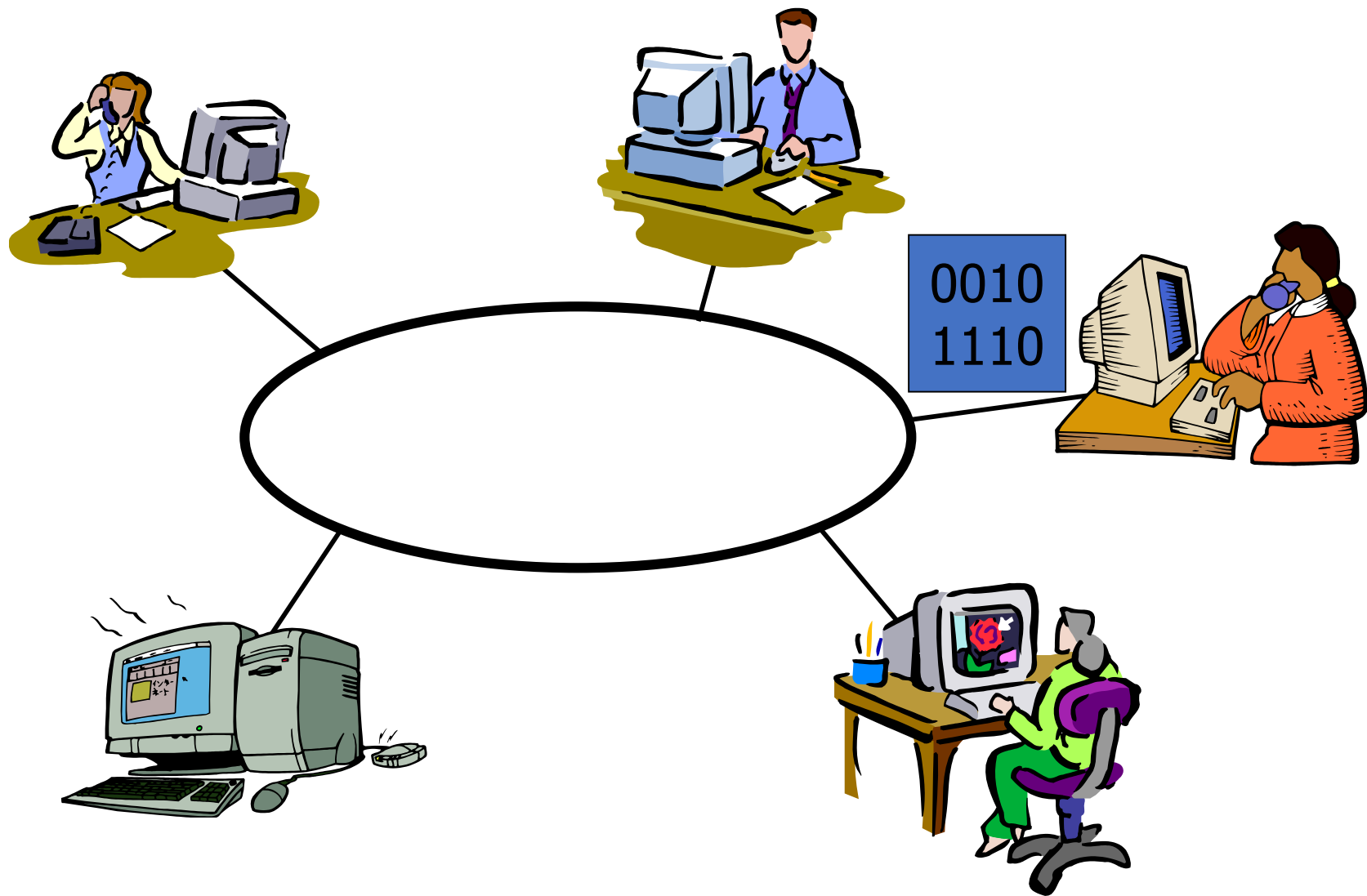


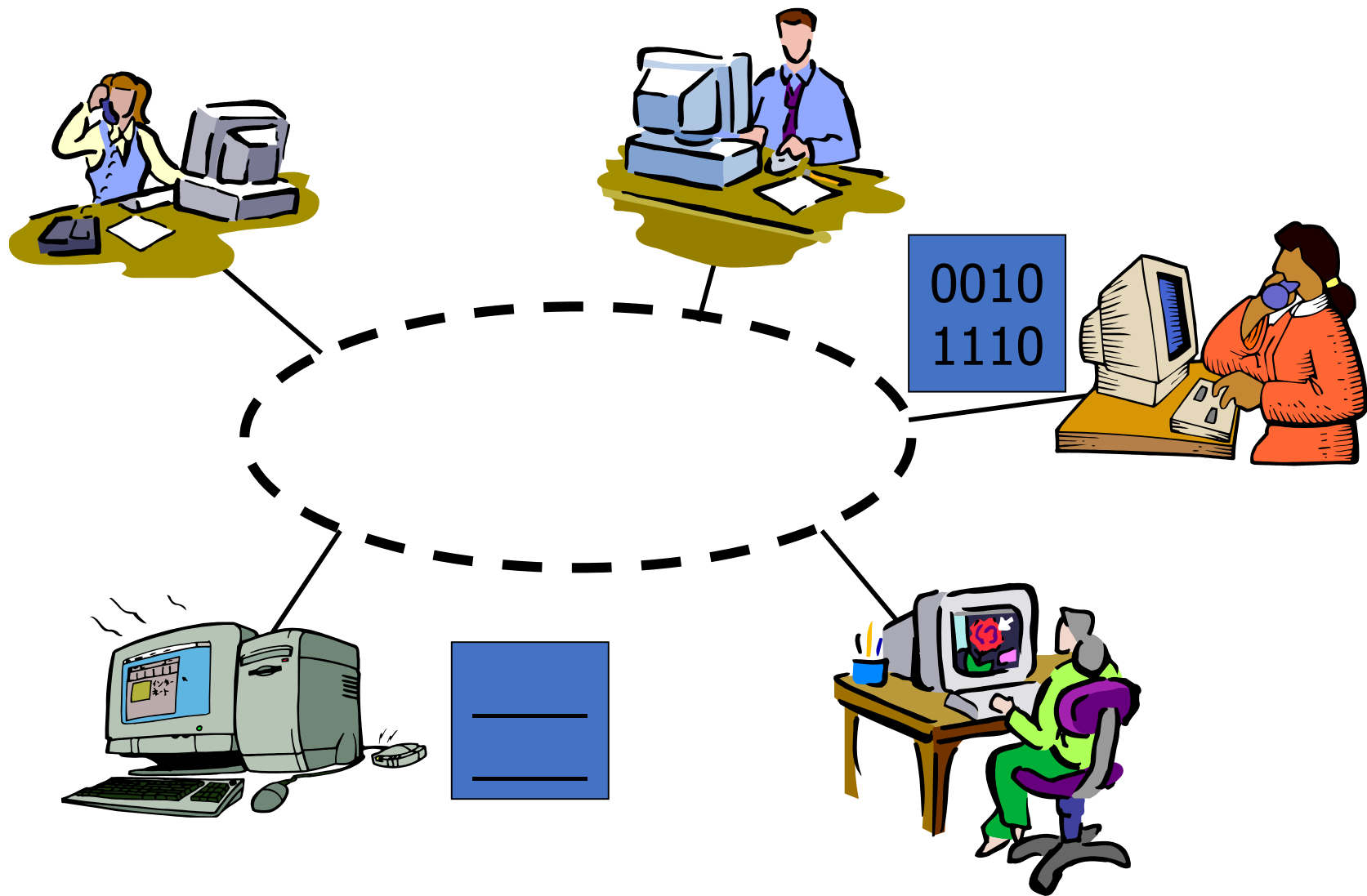
b. LAN with a switch (today)

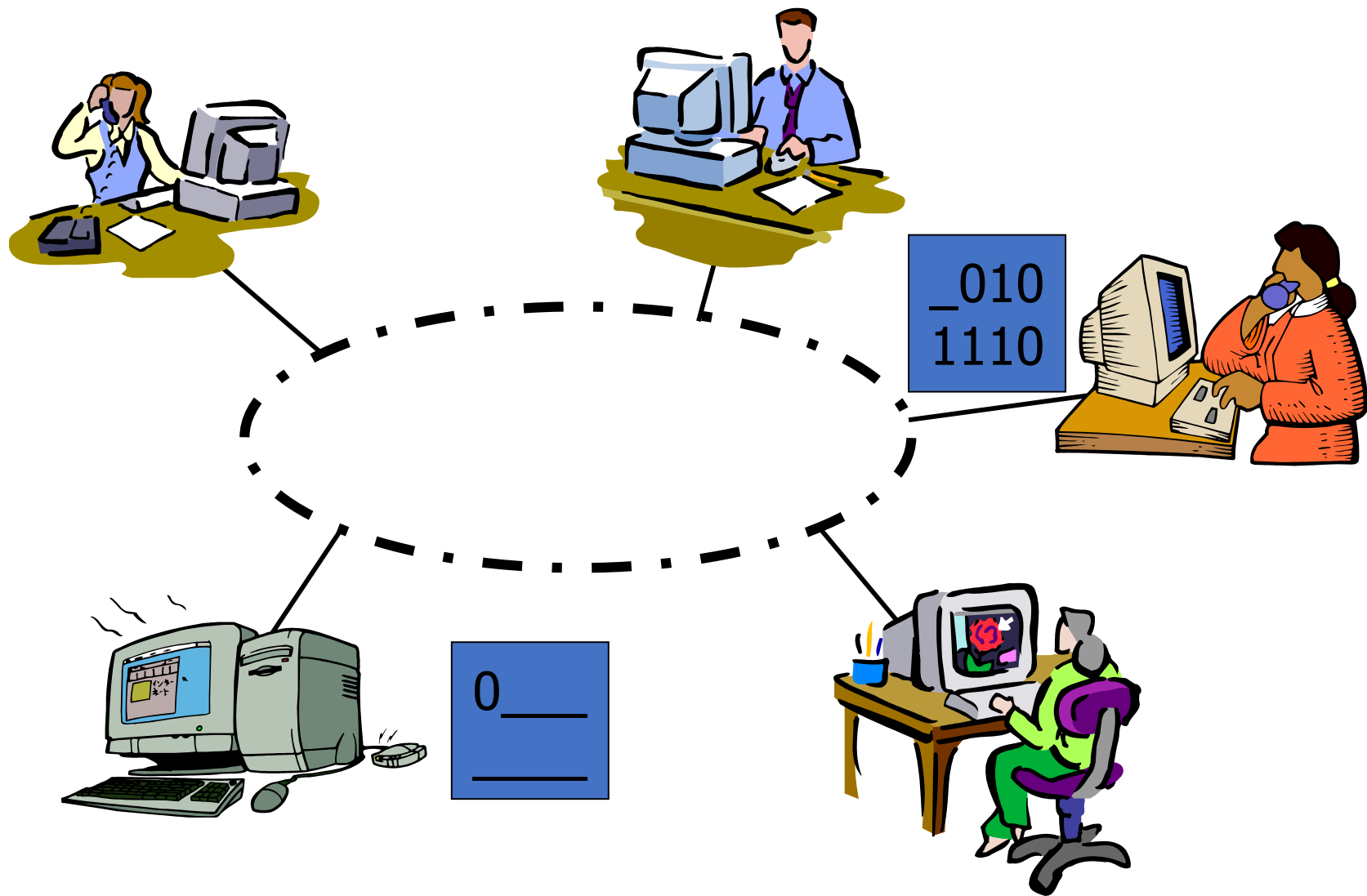
Legend

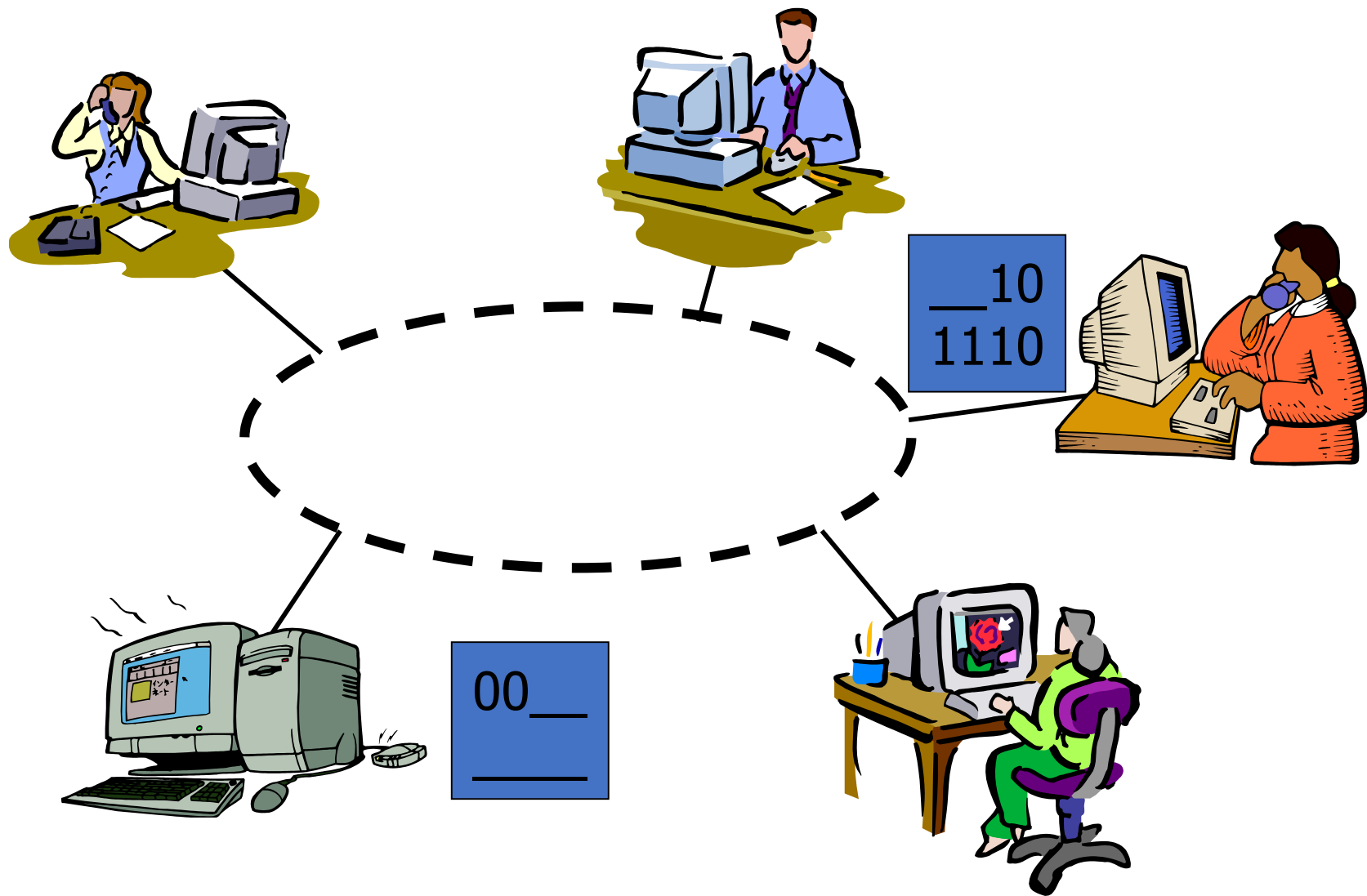


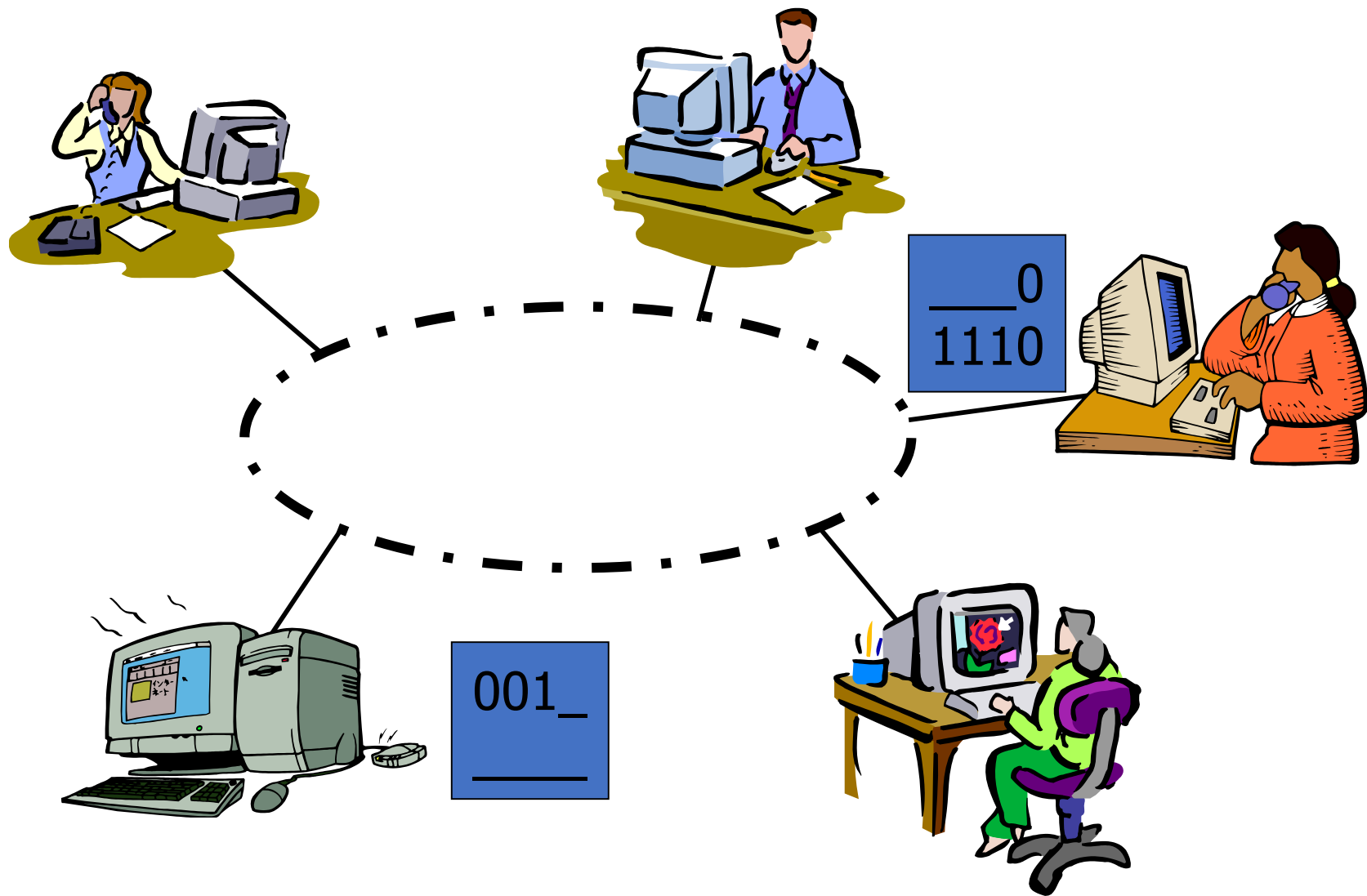


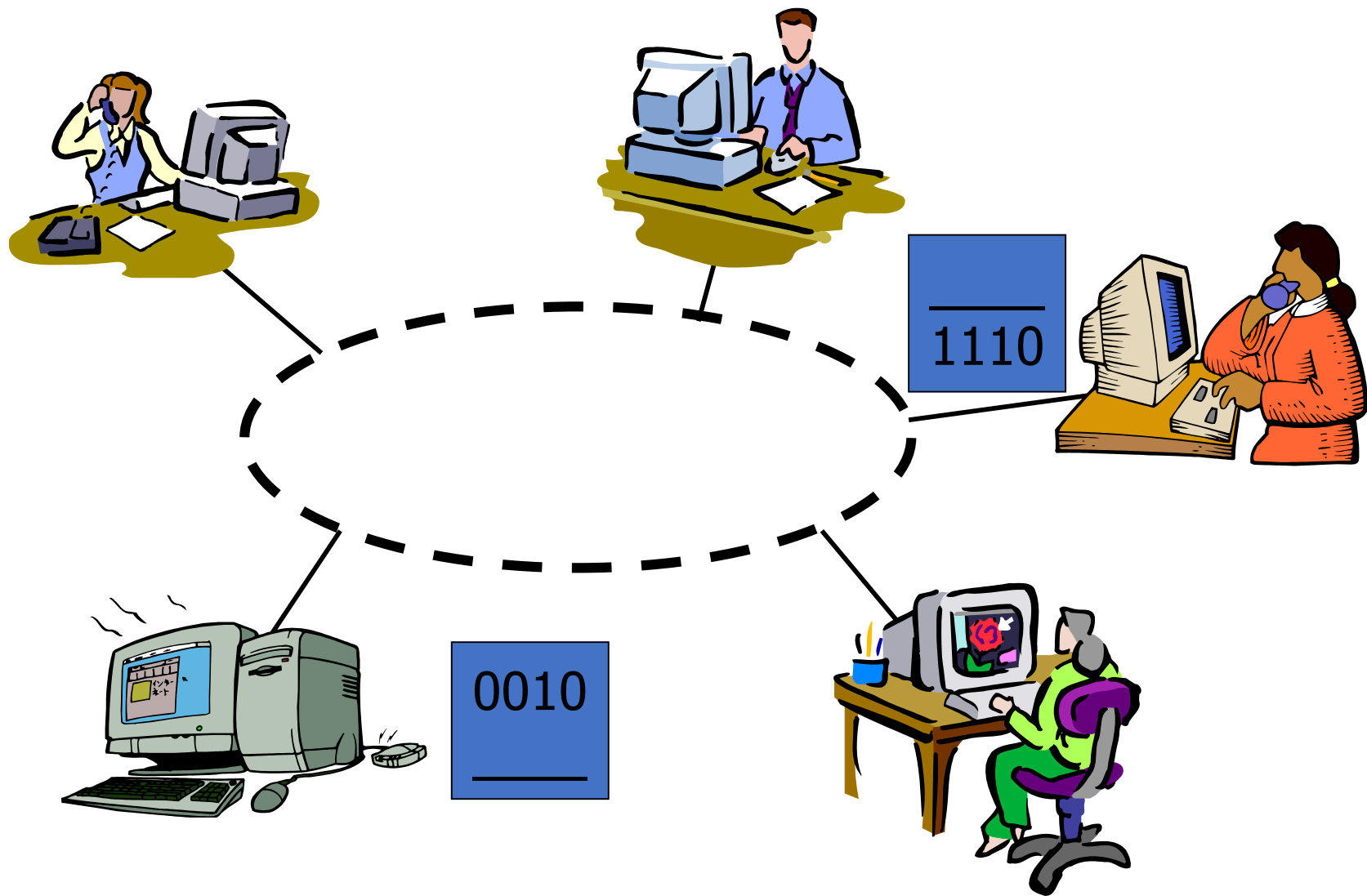


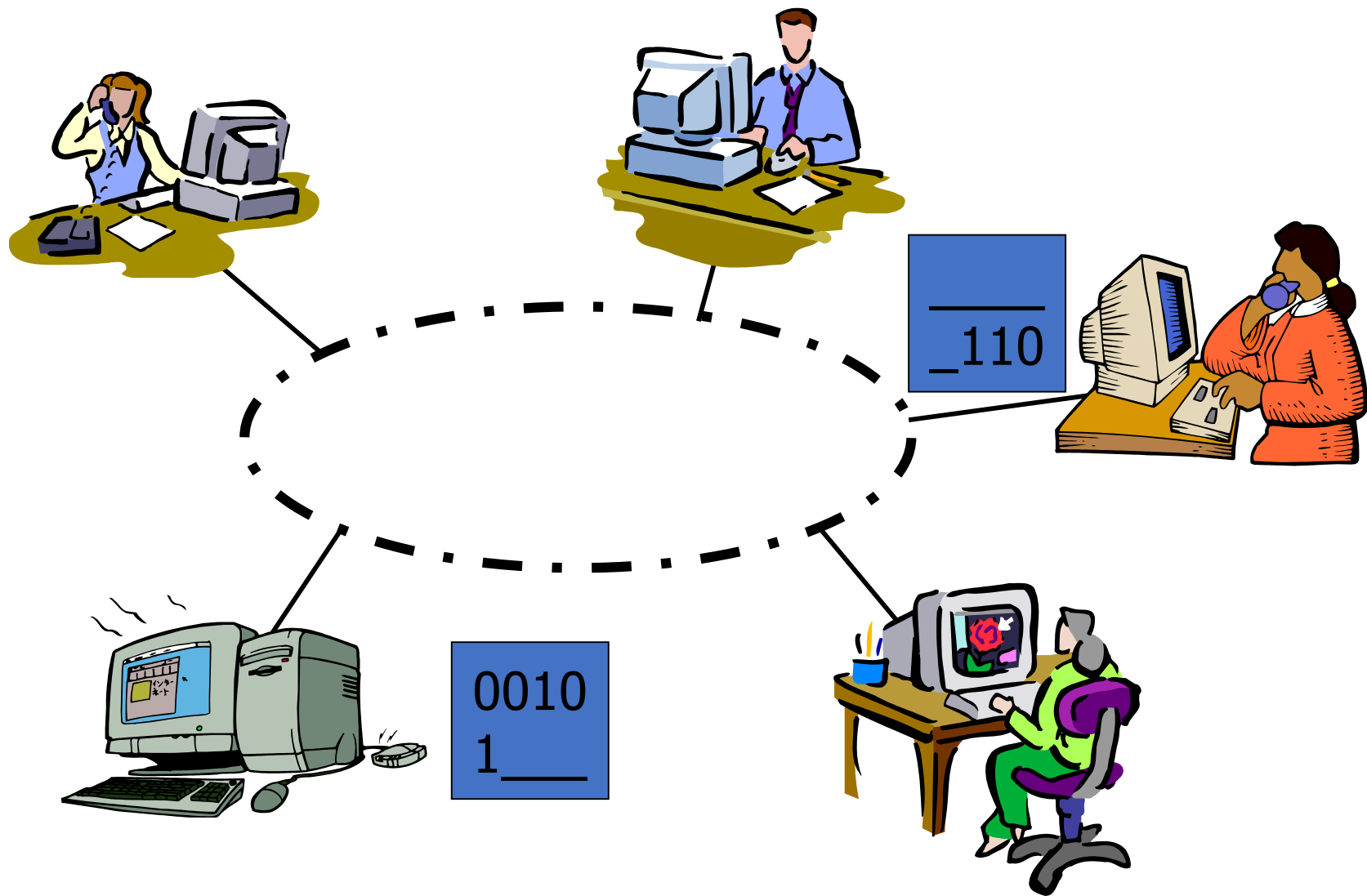


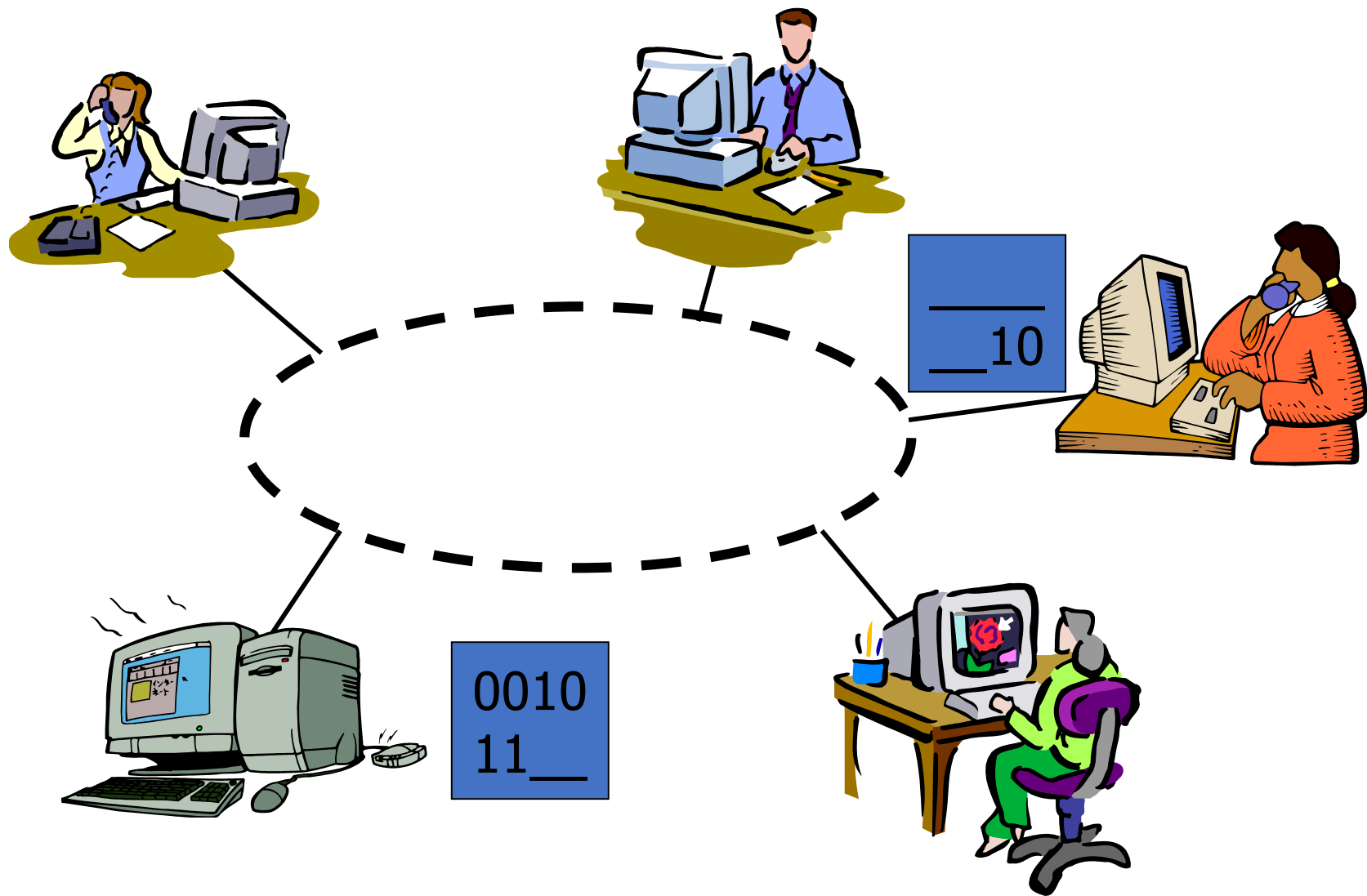


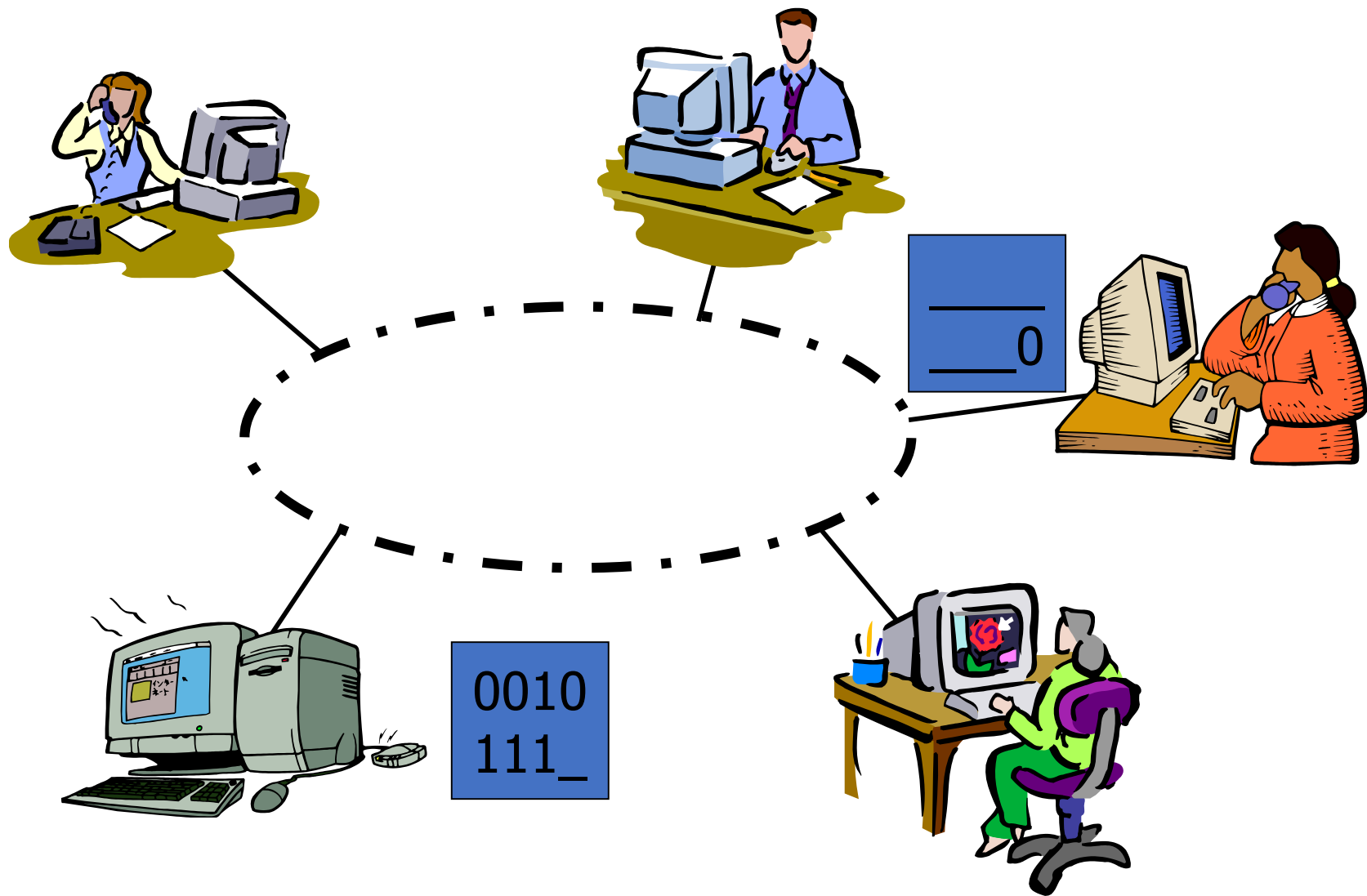


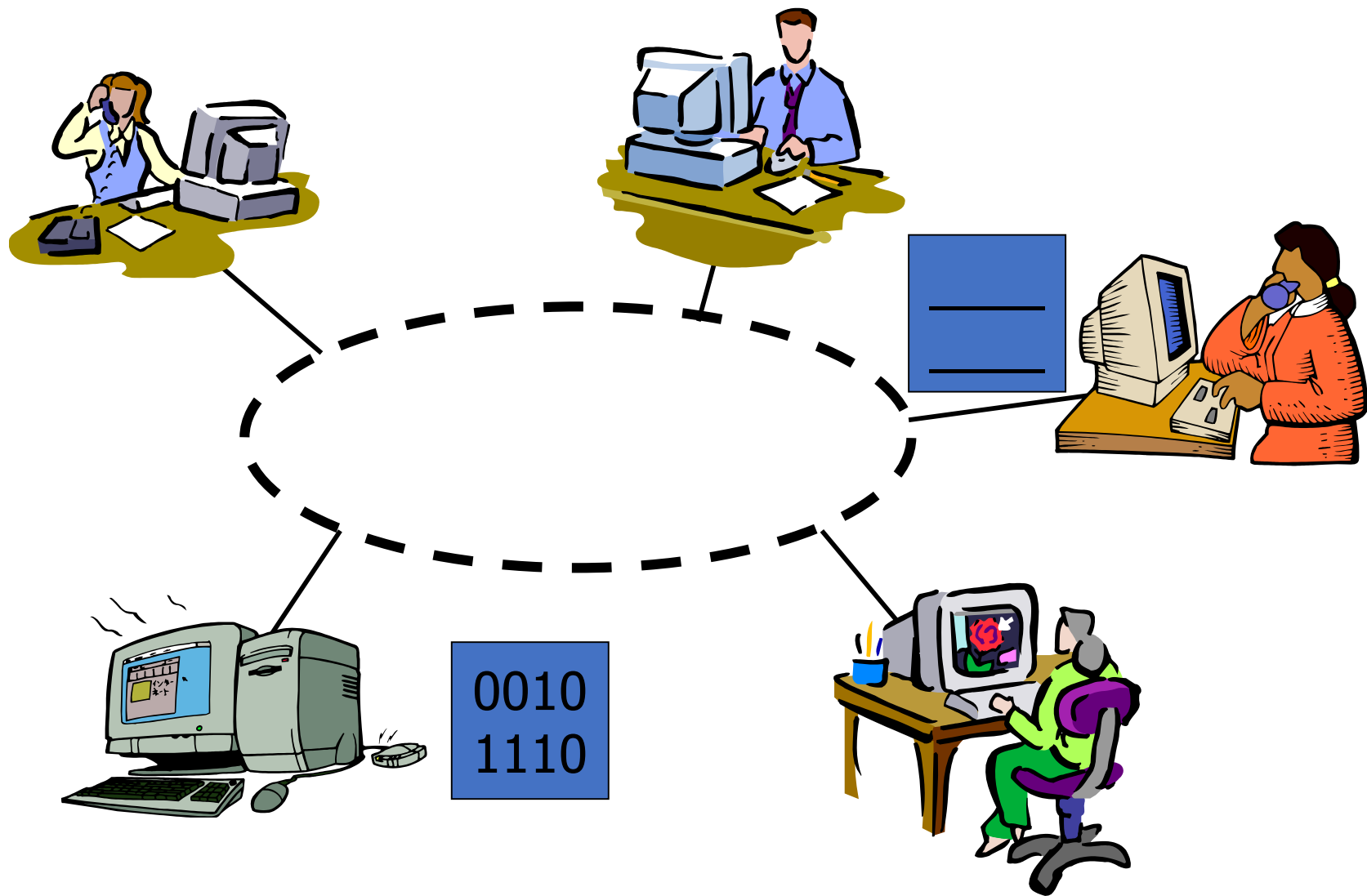


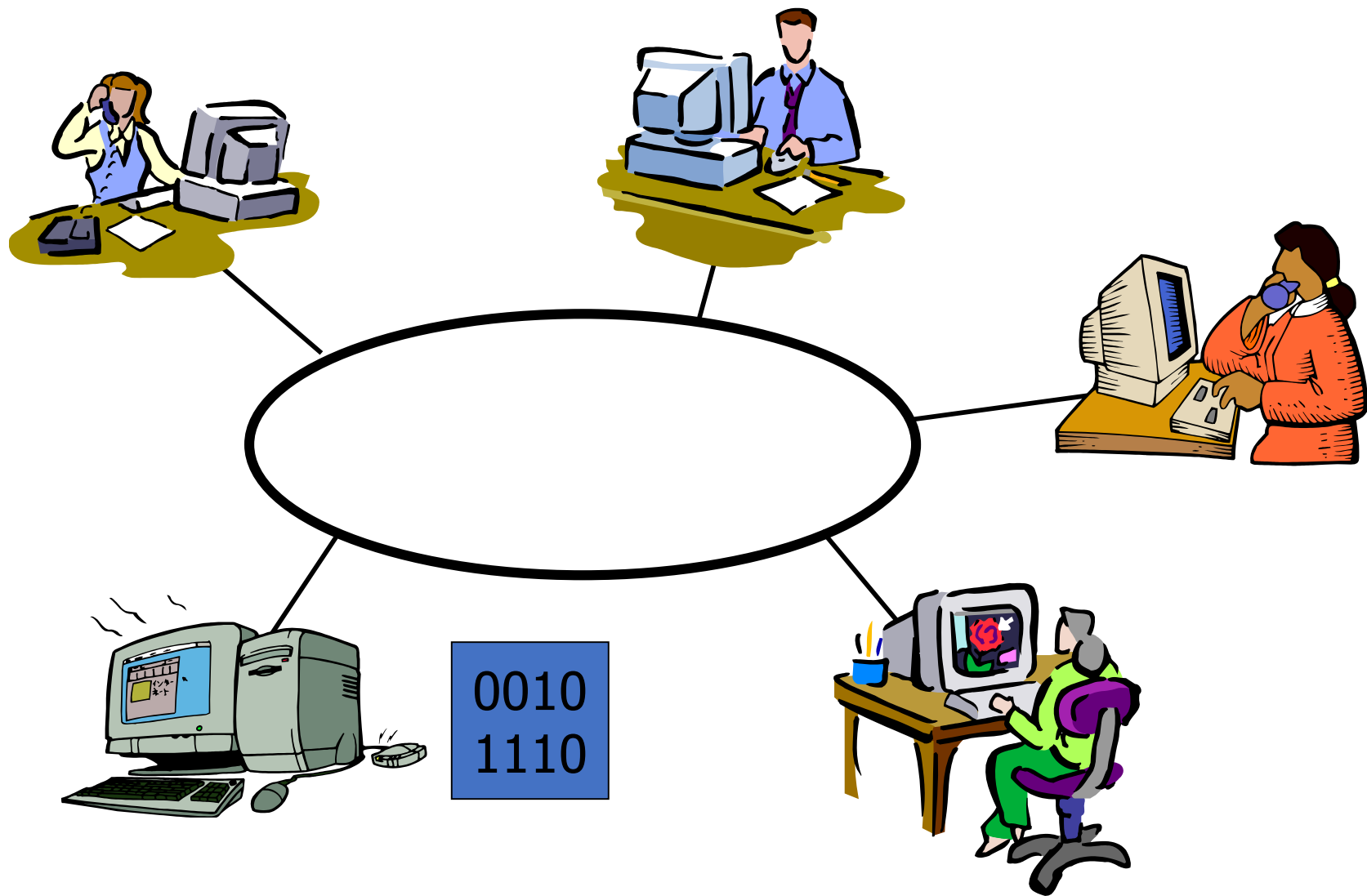












Wide Area Network:

- A **Wide Area Network (WAN)** is also an *interconnection* of devices capable of communication.
- A wide area network, or WAN, spans a large geographical area, often a country or continent.

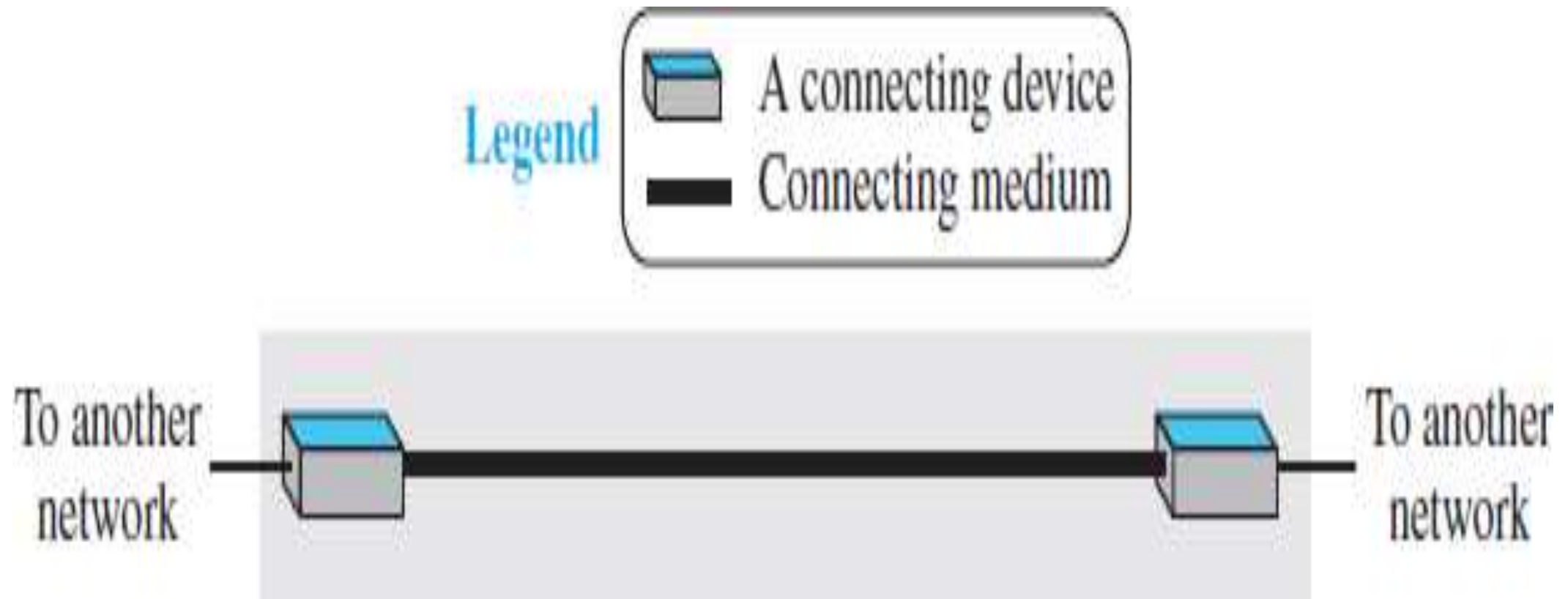
It contains a collection of machines intended for running user (i.e., application) programs.

- A WAN interconnects connecting devices such as switches, routers, or modems.
- A WAN is normally created and run by communication companies and leased by an organization that uses it.

Ex: point-to-point WANs and switched WANs.

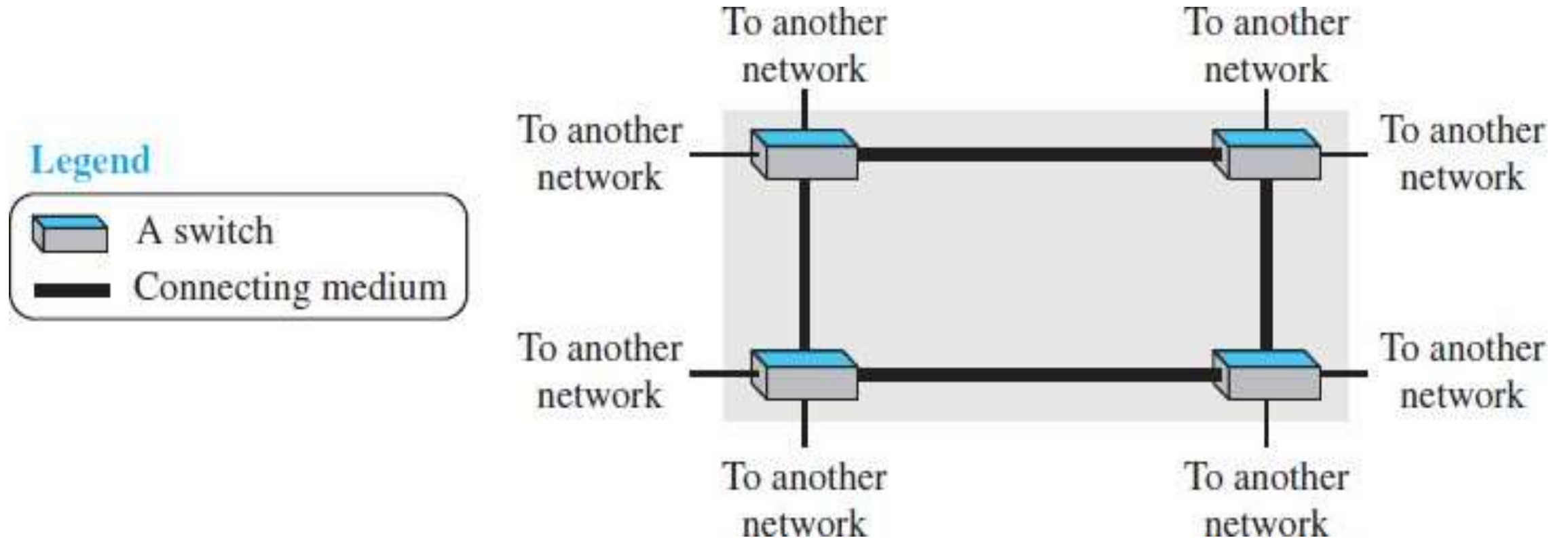
Point-to-Point WAN:

A point-to-point WAN is a network that connects two communicating devices through a transmission media (cable or air).



Switched WAN:

A switched WAN is a network with more than two ends. Switched WAN is a combination of several point- to-point WANs that are connected by switches



- An internet is a **switched network** in which a switch connects at least two links together.
- The two most common types of switched networks are **circuit-switched** and **packet-switched networks**.

Circuit-Switched Network

In a **circuit-switched network**, a dedicated connection, called a circuit, is always available between the two end systems; the switch can only make it active or inactive.

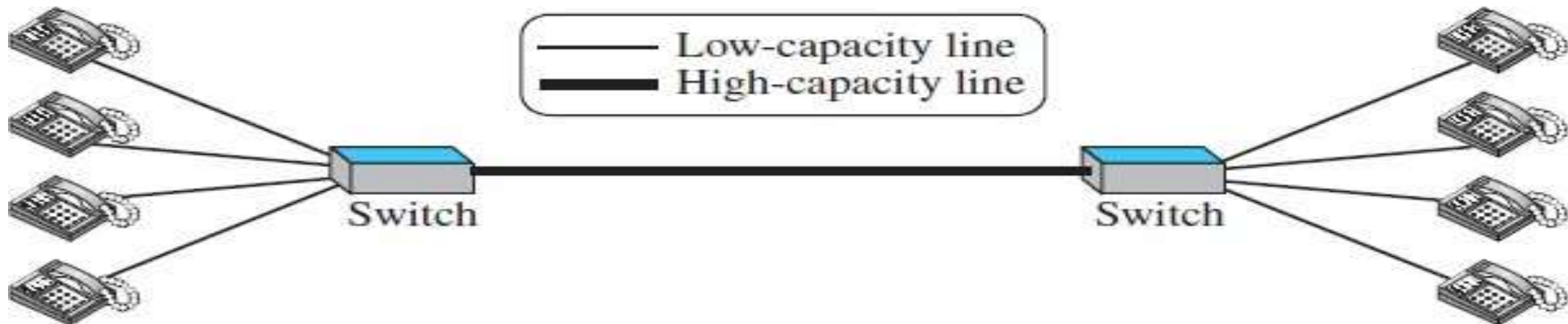


Fig: A circuit-switched network

Packet-Switched Network:

- In a computer network, the communication between the two ends is done in blocks of data called **packets**.

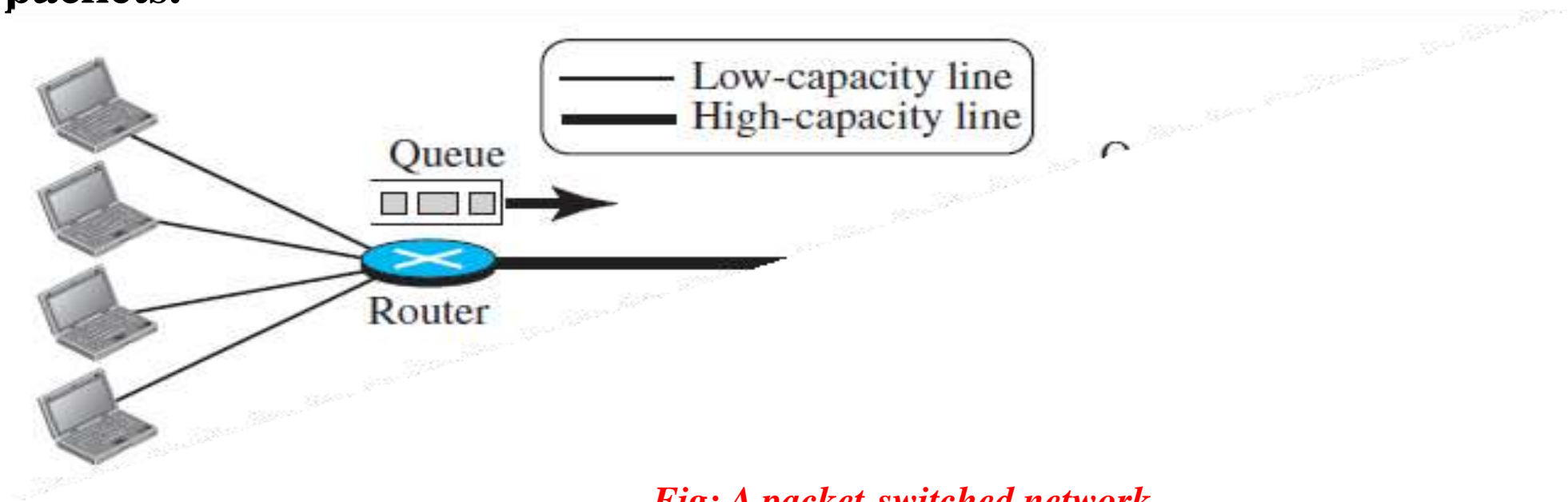


Fig: A packet-switched network

Note: Packet-switched network is more efficient than a circuit switched network, but the packets may encounter some delays

THANK YOU