NETWORK TYPES, SWITCHING & INTERNET

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NETWORK TYPES

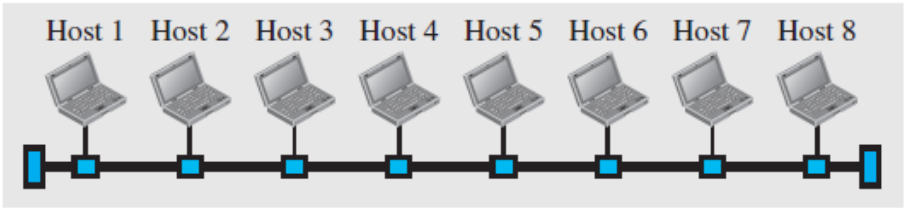
- A few criteria, such as size, geographical coverage, and ownership, are used to distinguish one type of network from another.
- Two types of networks exist:
  - Local Area Network(LAN)
  - Wide Area Network(WAN)

LOCAL AREA NETWORK

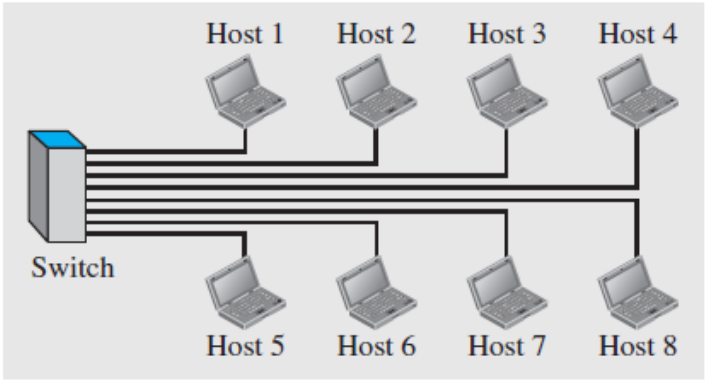
- A local area network (LAN) is usually privately owned and connects some hosts in a single office, building, or campus.
- Depending on the needs of an organization, a LAN can be as simple as two PCs and a printer in someone's home office, or it can extend throughout a company and include audio and video devices.
- Each host in a LAN has an identifier, an address, that uniquely defines the host in the LAN. A packet sent by a host to another host carries both the source host's and the destination host's addresses.

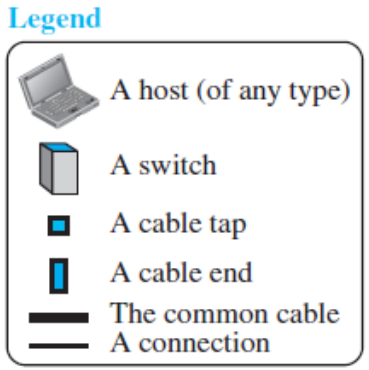
LOCAL AREA NETWORK

Figure 1.8 *An isolated LAN in the past and today*



a. LAN with a common cable (past)





b. LAN with a switch (today)

LOCAL AREA NETWORK

- In the past, all hosts in a network were connected through a common cable, which meant that a packet sent from one host to another was received by all hosts. The intended recipient kept the packet; the others dropped the packet.
- Today, most LANs use a smart connecting switch, which is able to recognize the destination address of the packet and guide the packet to its destination without sending it to all other hosts.
- The switch alleviates the traffic in the LAN and allows more than one pair to communicate with each other at the same time if there is no common source and destination among them.

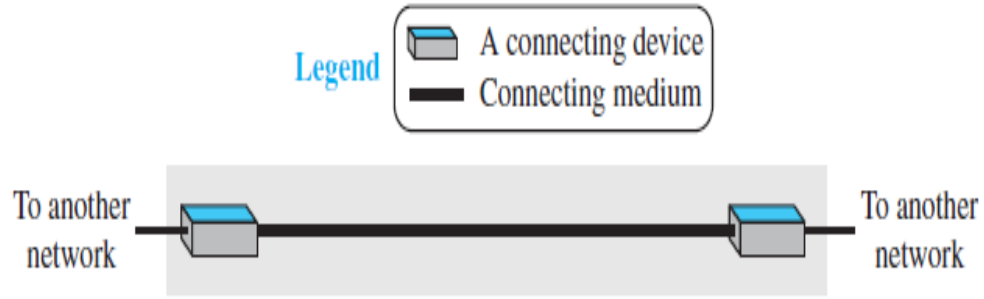
WIDE AREA NETWORK

- A wide area network (WAN) is also an interconnection of devices capable of communication.
- A LAN is normally limited in size, spanning an office, a building, or a campus; a WAN has a wider geographical span, spanning a town, a state, a country, or even the world.
- A LAN interconnects hosts, but a WAN interconnects connecting devices such as switches, routers, or modems.
- LAN is normally privately owned by the organization that uses it, but a WAN is normally created and run by communication companies and leased by an organization that uses it.

POINT-TO-POINT WAN

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

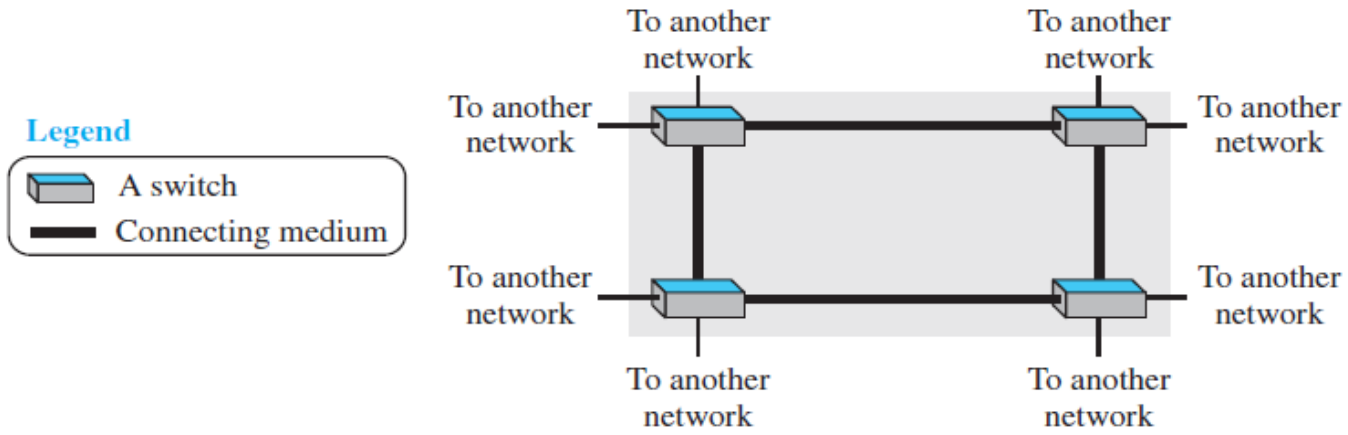
Figure 1.9 *A point-to-point WAN*



SWITCHED WAN

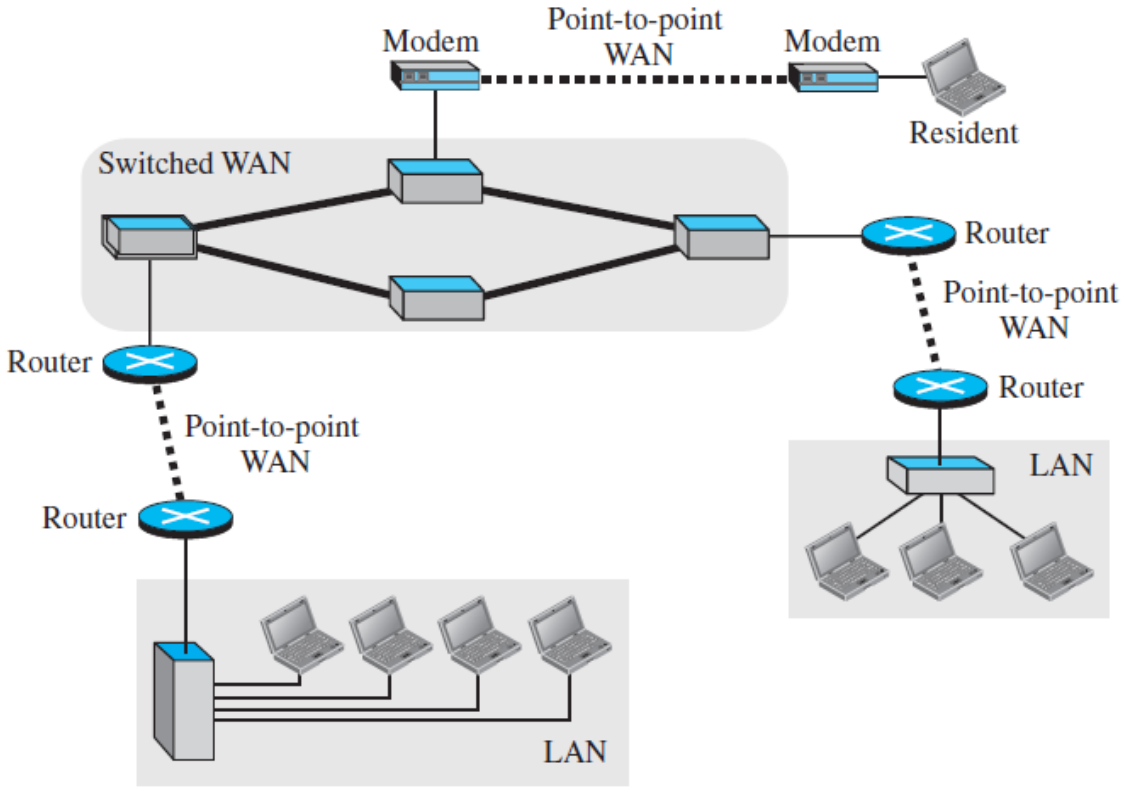
- A switched WAN is a network with more than two ends.
- A switched WAN is used in the backbone of global communication today. We can say that a switched WAN is a combination of several point-to-point WANs that are connected by switches.

Figure 1.10 *A switched WAN*



A HETEROGENEOUS NETWORK

Figure 1.12 *A heterogeneous network made of four WANs and three LANs*



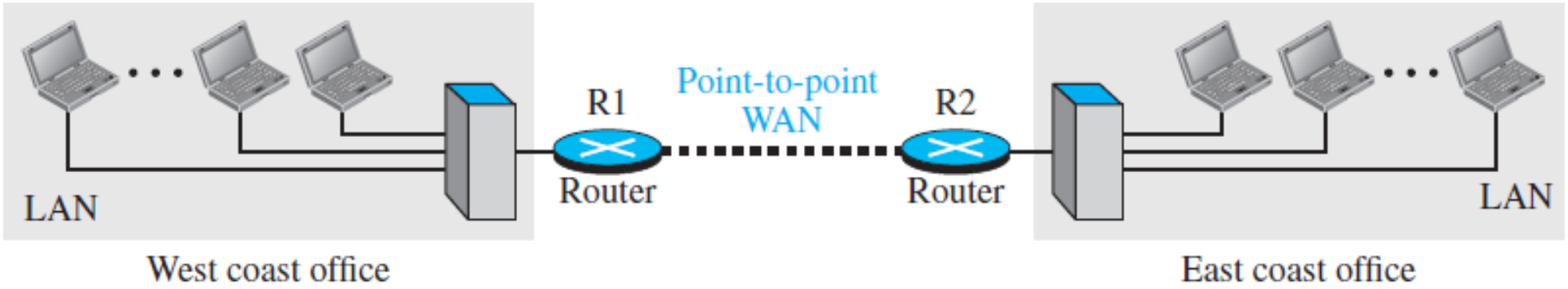
INTERNETWORK

- When two or more networks are connected, they make an internetwork, or internet.
- As an example, assume that an organization has two offices, one on the east coast and the other on the west coast. Each office has a LAN that allows all employees in the office to communicate with each other. To make the communication between employees at different offices possible, the management leases a point-to-point dedicated WAN from a service provider, such as a telephone company, and connects the two LANs. Now the company has an internetwork, or a private internet.

INTERNETWORK

- When a host in the west coast office sends a message to another host in the same office, the router blocks the message, but the switch directs the message to the destination. On the other hand, when a host on the west coast sends a message to a host on the east coast, router R1 routes the packet to router R2, and the packet reaches the destination.

Figure 1.11 *An internetwork made of two LANs and one point-to-point WAN*



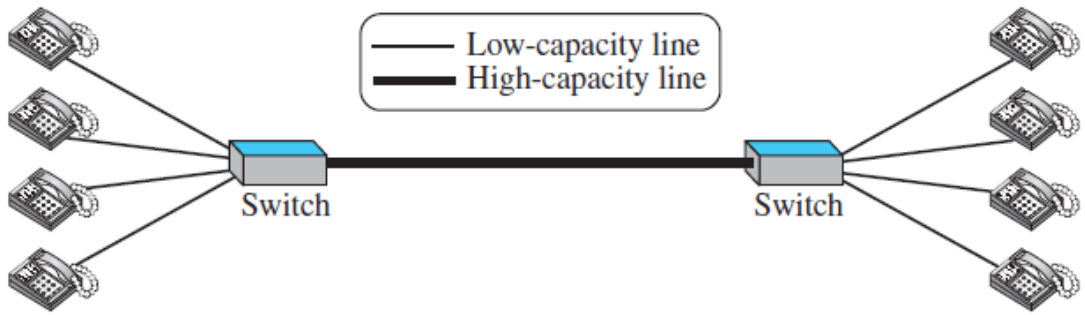
SWITCHING

- An internet is a switched network in which a switch connects at least two links together. A switch needs to forward data from a network to another network when required. 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.
- Circuit switching was very common in telephone networks in the past, although part of the telephone network today is a packet-switched network.

Figure 1.13 *A circuit-switched network*



CIRCUIT-SWITCHED NETWORK

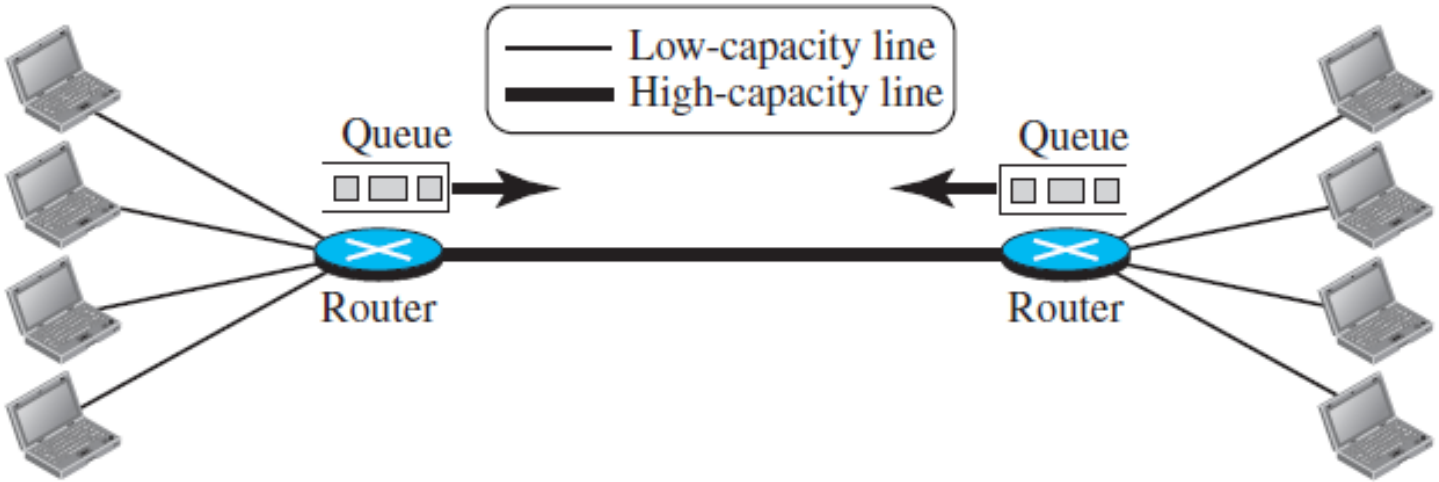
- In Figure 1.13, the four telephones at each side are connected to a switch. The switch connects a telephone set at one side to a telephone set at the other side. The thick line connecting two switches is a high-capacity communication line that can handle four voice communications at the same time; the capacity can be shared between all pairs of telephone sets. The switches used in this example have forwarding tasks but no storing capability.
- This means that a circuit-switched network is efficient only when it is working at its full capacity; most of the time, it is inefficient because it is working at partial capacity.

PACKET-SWITCHED NETWORK

- In a computer network, the communication between the two ends is done in blocks of data called packets.
- In other words, instead of the continuous communication between two telephone sets when they are being used, there is an exchange of individual data packets between the two computers. This allows us to make the switches function for both storing and forwarding because a packet is an independent entity that can be stored and sent later.

PACKET-SWITCHED NETWORK

Figure 1.14 *A packet-switched network*



PACKET-SWITCHED NETWORK

- A router in a packet-switched network has a queue that can store and forward the packet.
- Now assume that the capacity of the thick line is only twice the capacity of the data line connecting the computers to the routers. If only two computers (one at each site) need to communicate with each other, there is no waiting for the packets.
- However, if packets arrive at one router when the thick line is already working at its full capacity, the packets should be stored and forwarded in the order they arrived.

THE INTERNET

- An **internet** (note the lowercase *i*) is two or more networks that can communicate with each other.
- The most notable internet is called the **Internet** (uppercase *I*), and is composed of thousands of interconnected networks. The Internet includes several backbones, provider networks, and customer networks.
- At the top level, the *backbones* are large networks owned by some communication companies such as Sprint, Verizon (MCI), AT&T, and NTT. At the second level, there are smaller networks, called *provider networks*, that use the services of the backbones for a fee. The *customer networks* are networks at the edge of the Internet that actually use the services provided by the Internet. They pay fees to provider networks for receiving services.
- Backbones and provider networks are also called Internet Service Providers (ISPs). The backbones are often referred to as international ISPs; the provider networks are often referred to as national or regional ISPs.

THE INTERNET

Figure 1.15 *The Internet today*