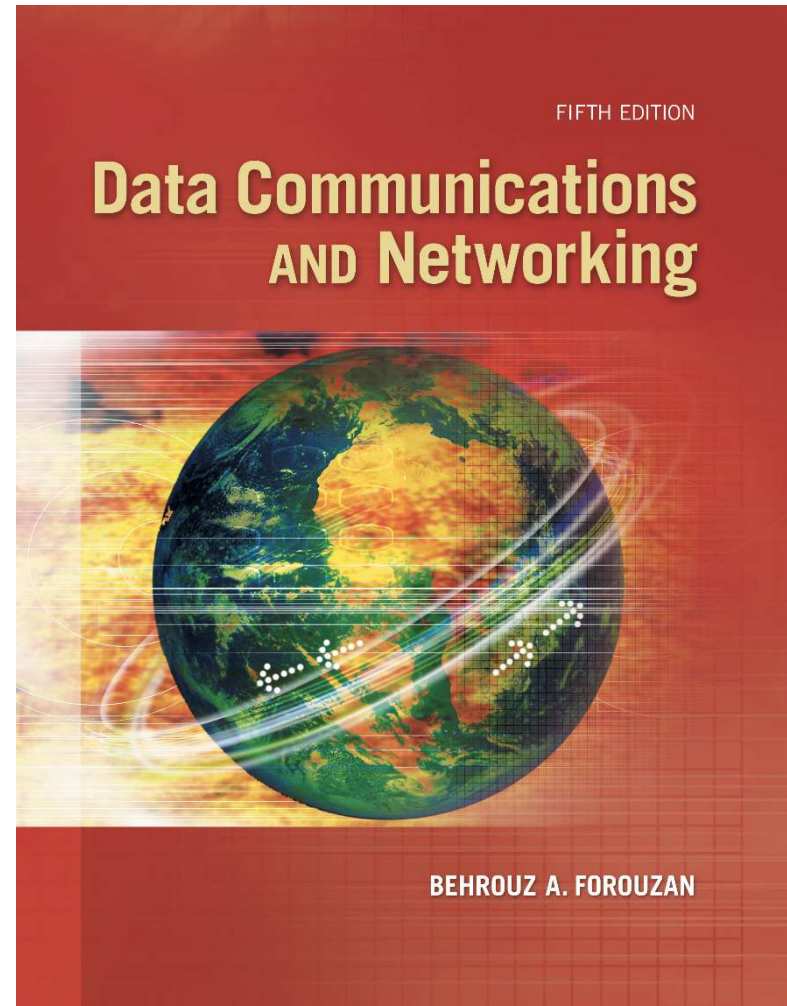


# Chapter I

## Introduction



# Introduction

*I would ask for understanding on one point.*

*Even though this class is English class, almost students are Korean, and they do not well English.*

*1) For Korean students, I will summarize the lecture content in Korean language at the end of every lecture. I hope you understand.*

*2) For foreign students, I will give you a preferential treatment for your final grade. To put it simply, I guarantee fairness in class.*

# Chapter 1: Objective

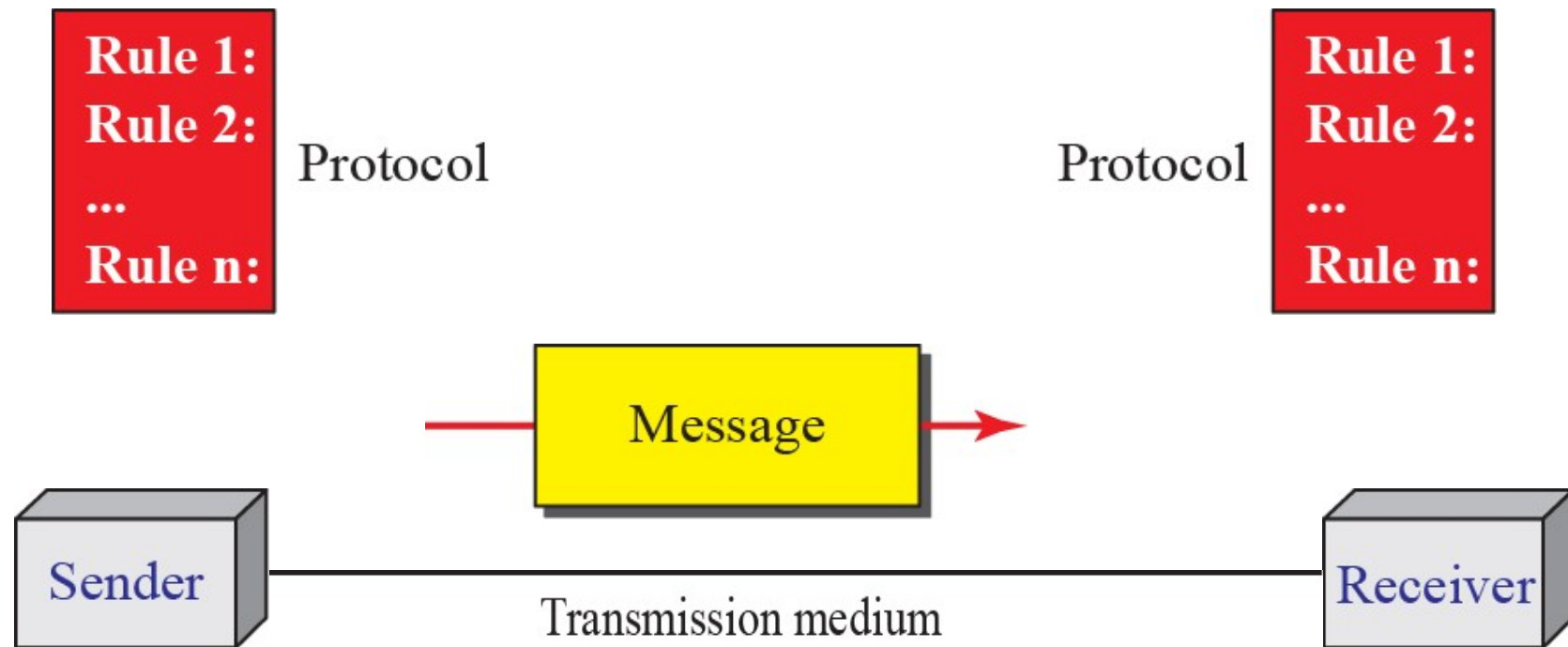
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- **Components and the types** of data exchanged; how different types of data are represented and how data is flowed through the network.
- **Criteria and structures;** four different network topologies
- **LANs, WANs, and internetworks (internets), and the Internet; switching** to show how small networks can be combined to create larger ones.

# DATA COMMUNICATIONS

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- When we communicate, we are sharing information. This sharing can be local or remote.
- The term telecommunication, which includes telephony, telegraph, and television, means communication at a distance.
- Data communications are the exchange of data between two devices via some form of transmission media.
- A data communications system has five components



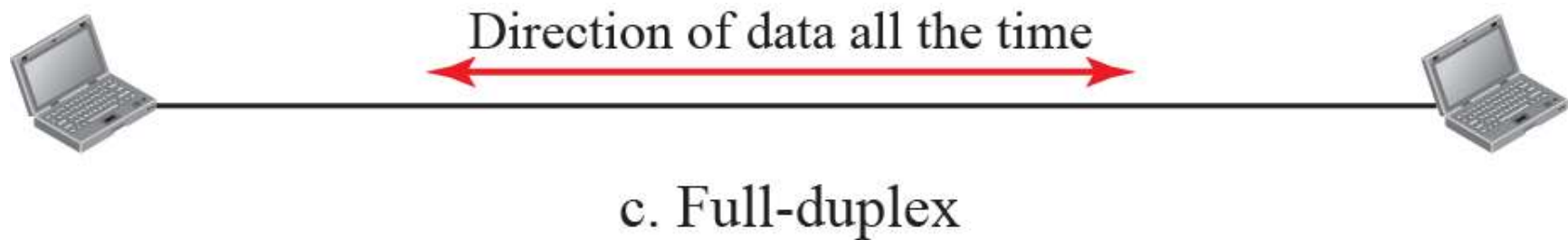
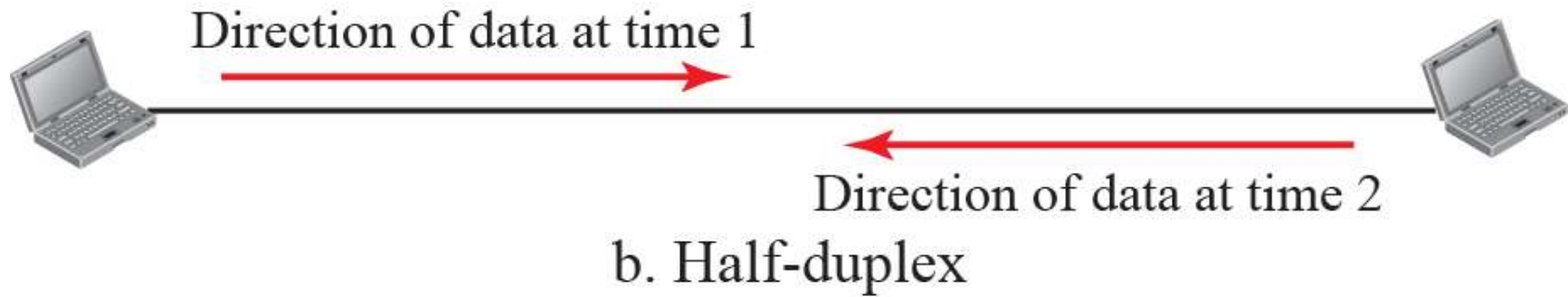
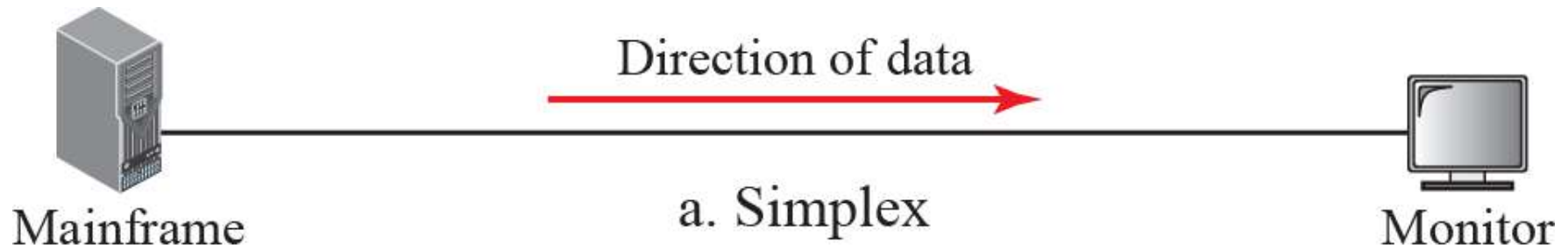
*Five components of data communication*

# Data Representation & Flow

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- Information today comes in different forms such as text, numbers, images, audio, and video.
- Communication between two devices can be **simplex, half-duplex, or full-duplex**





*Data flow*

# NETWORKS

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- A network is the interconnection of a set of devices capable of communication.
- In this definition, a device can be a host such as a large computer, desktop, laptop, workstation, cellular phone, or security system.
- A device in this definition can also be a connecting device such as a router, a switch, a modem that changes the form of data, and so on.



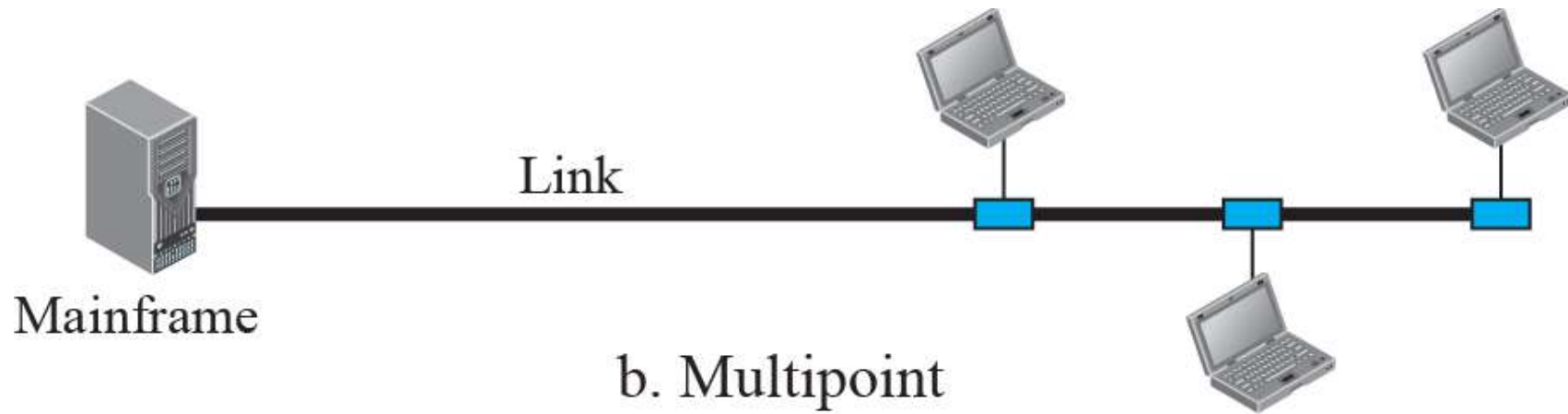
# Network Criteria

- A network must be able to meet a certain number of criteria. The most important of these are **performance, reliability, and security.**
- Before discussing networks, we need to define some network attributes.





a. Point-to-point

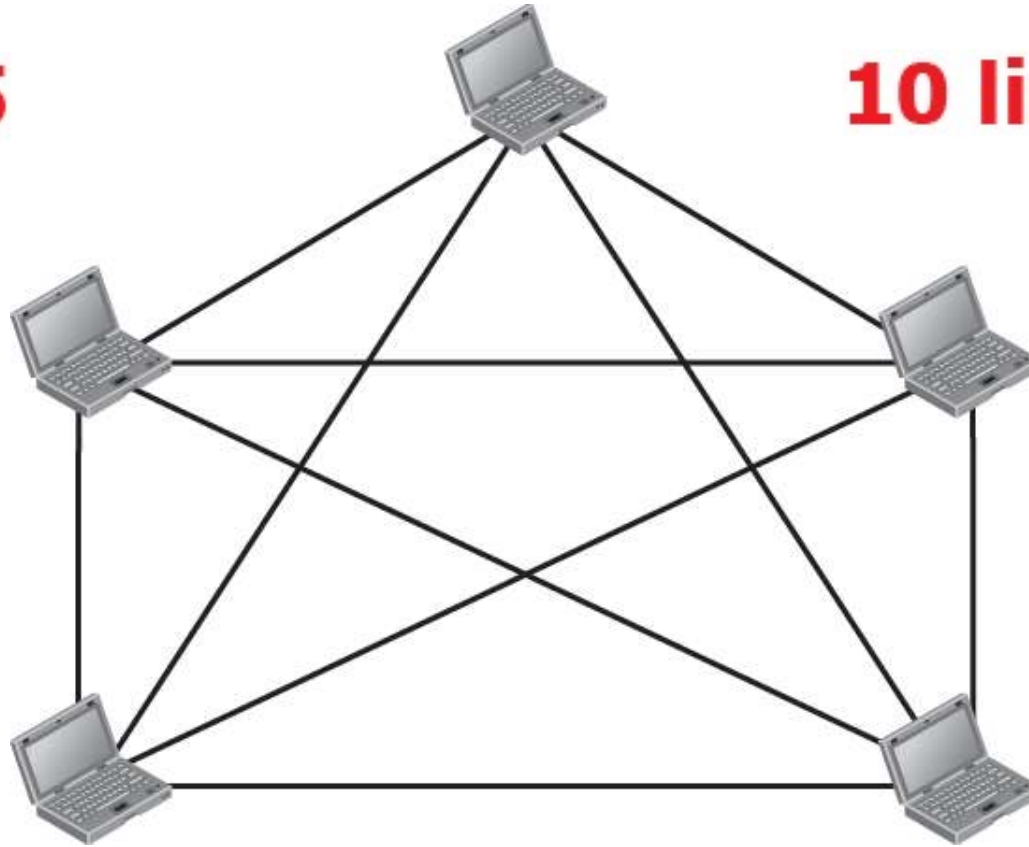


b. Multipoint

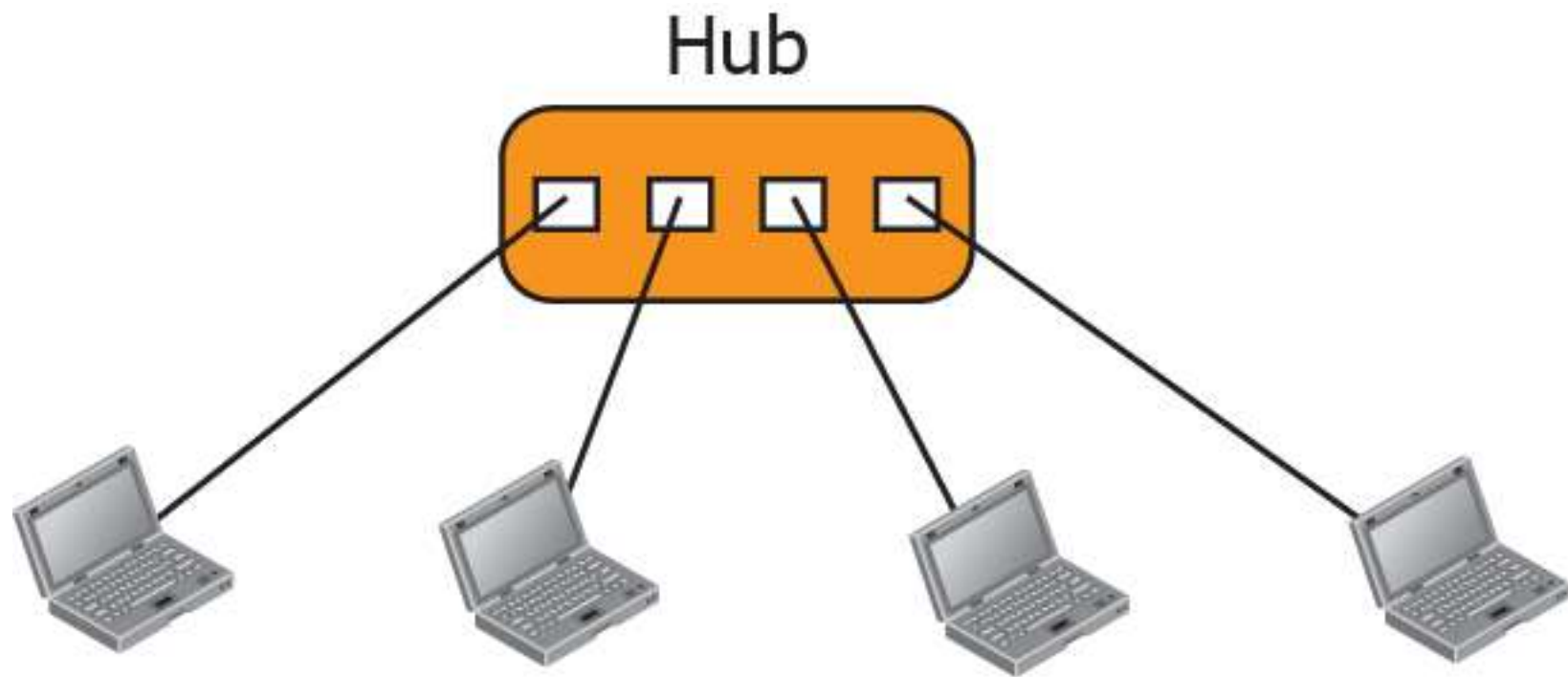
*Types of connection*

**n = 5**

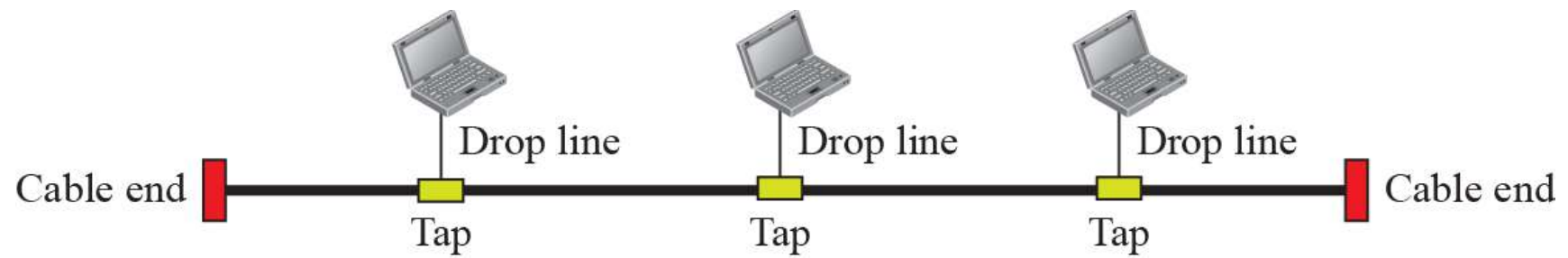
**10 links**



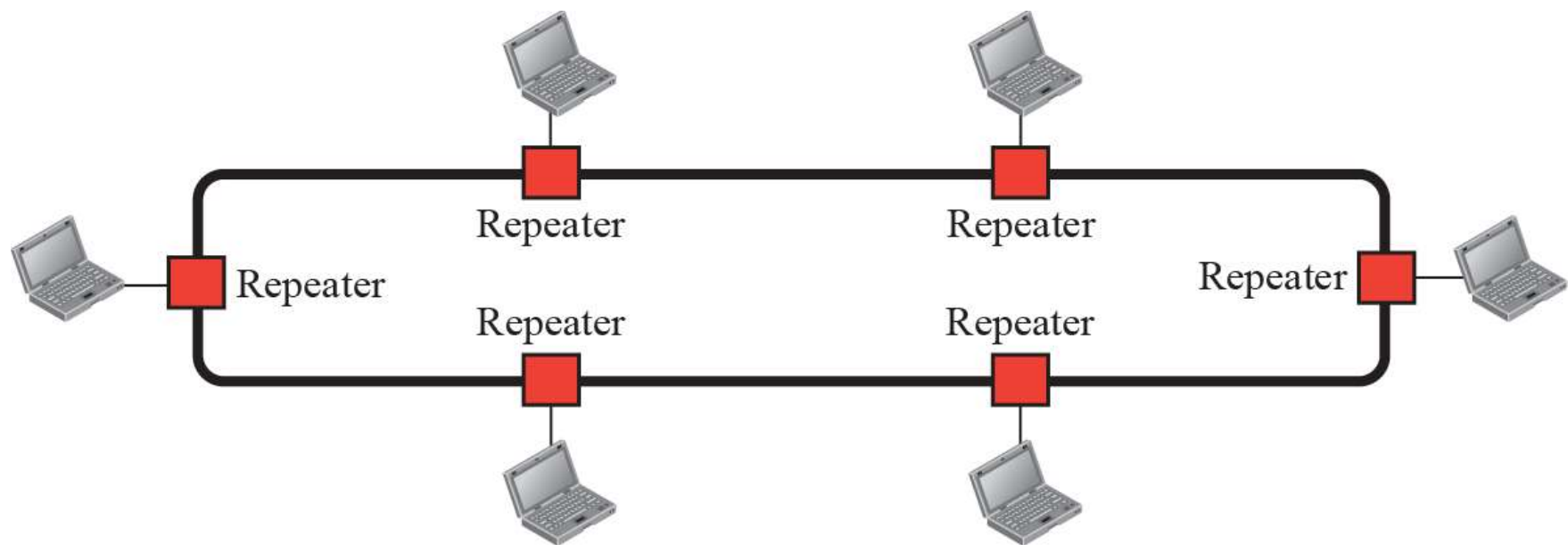
*fully-connected mesh topology*



*A star topology*



*A bus topology*



*A ring topology*

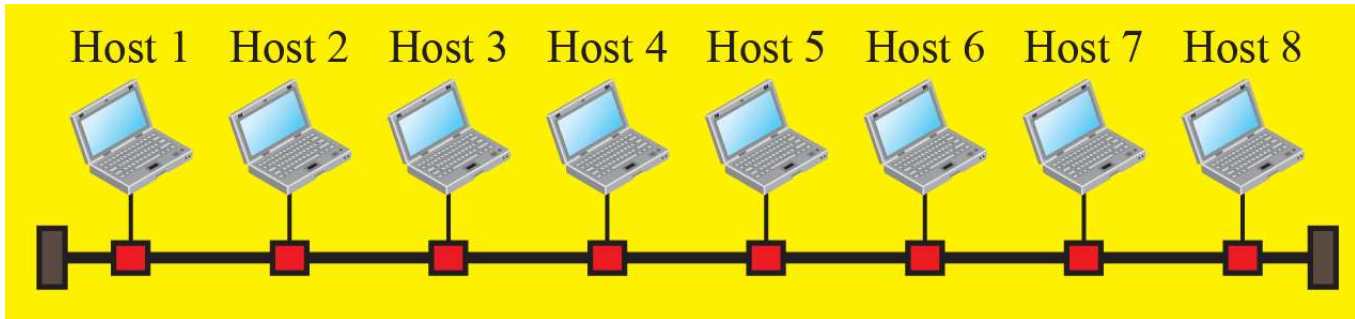
# NETWORKS TYPES

- After defining networks in the previous section and discussing their physical structures, we need to discuss **different types of networks** we encounter in the world today.
- The criteria of distinguishing one type of network from another is difficult and sometimes confusing.
- We use a few criteria such as size, geographical coverage, and ownership to make this distinction.

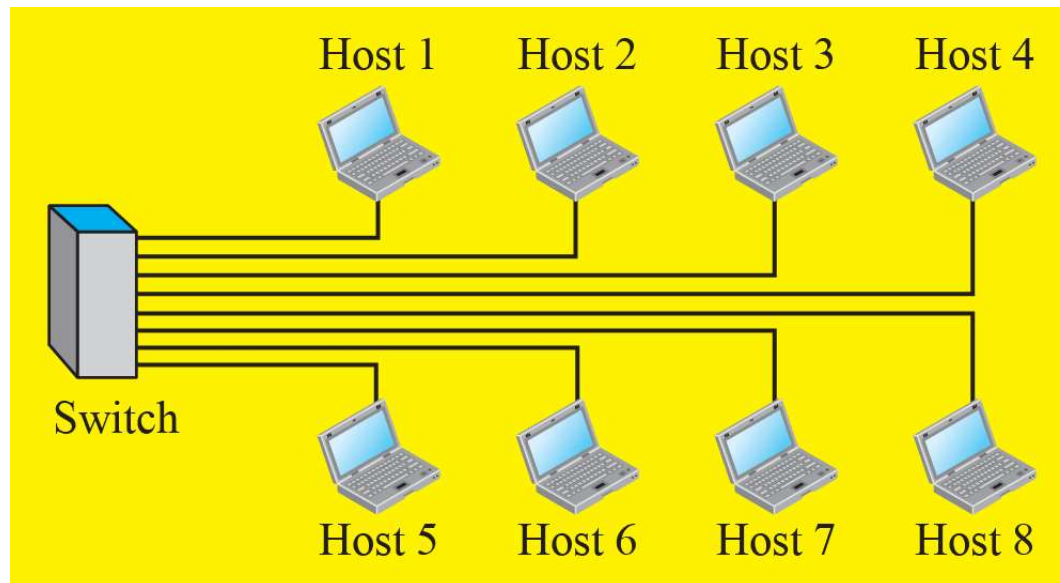
# Local Area Network

- A local area network (LAN) is usually privately owned and connects some hosts in a 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.

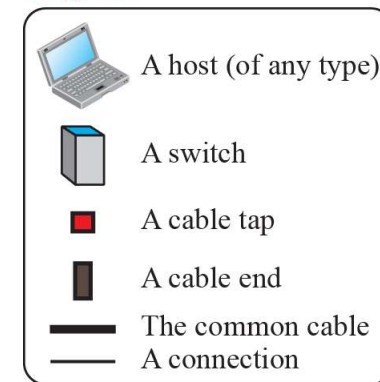




a. LAN with a common cable (past)



**Legend**



b. LAN with a switch (today)

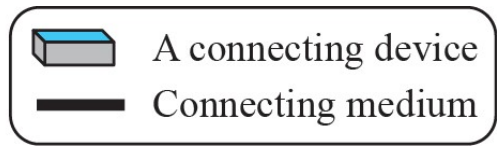
***An Isolated LAN in the past and today***

# Wide Area Network

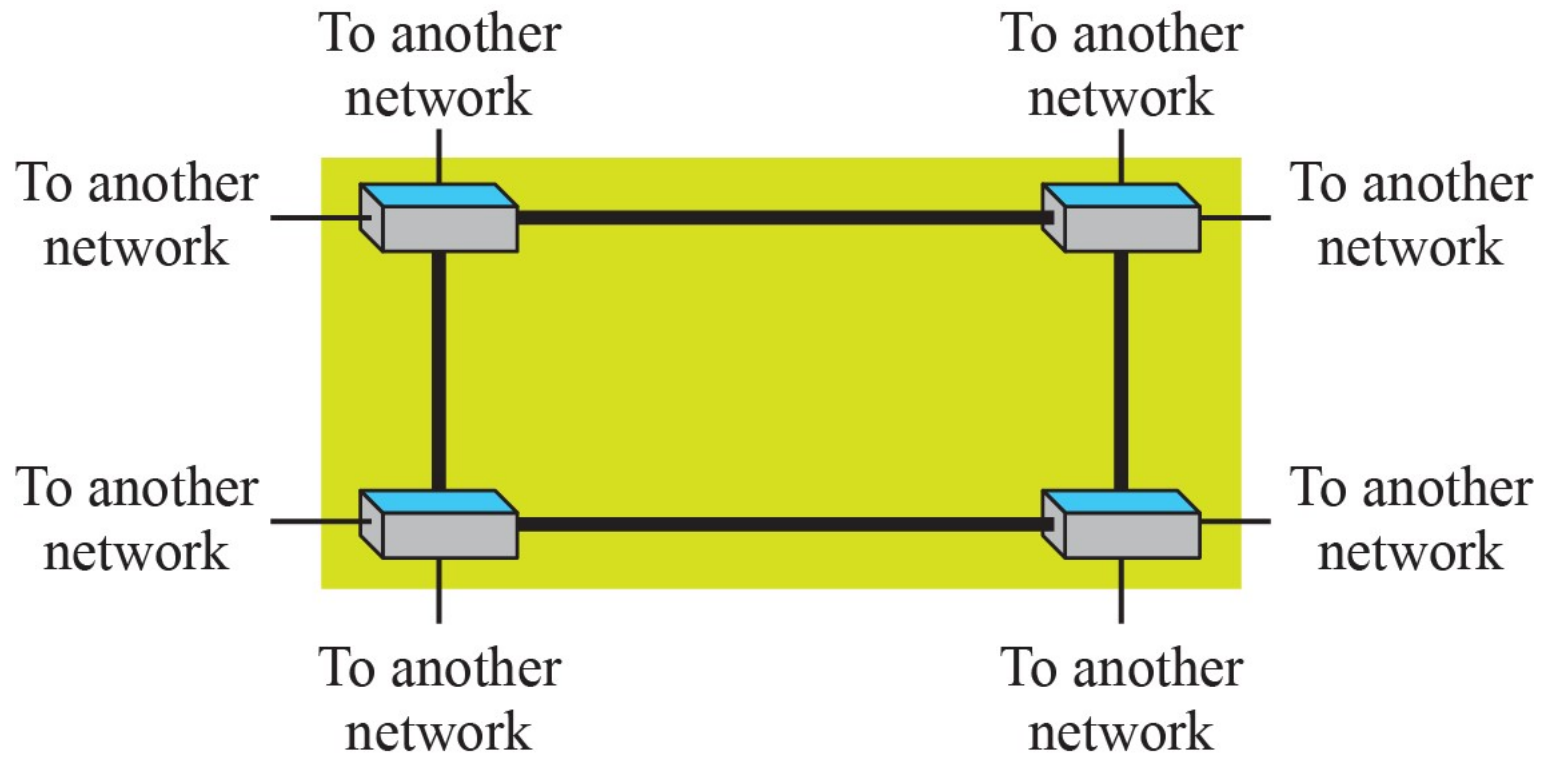
- A **wide area network (WAN)** is also an connection of devices capable of communication. However, there are some differences between a LAN and a WAN.
- A LAN is normally limited in size; a WAN has a wider geographical span, spanning a town, a state, a country, or even the world. A LAN interconnects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



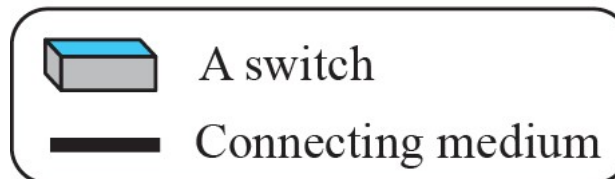
**Legend**



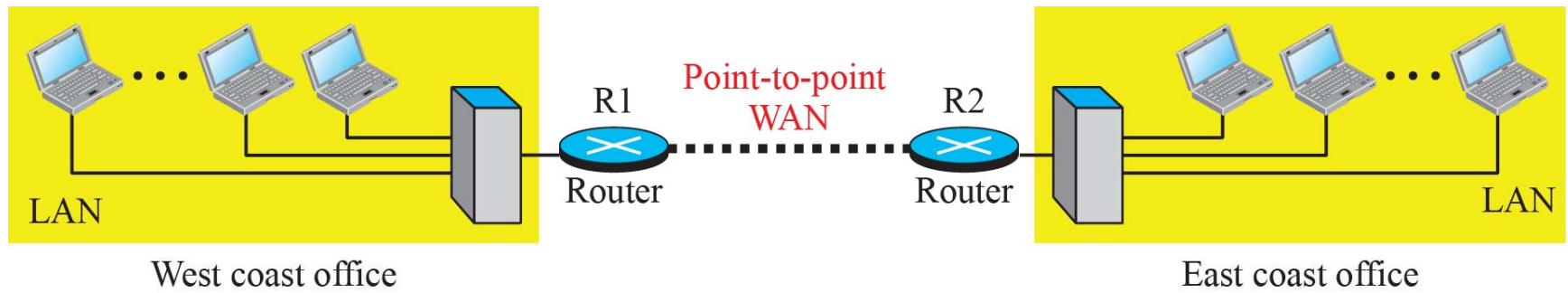
***A Point-to-Point WAN***



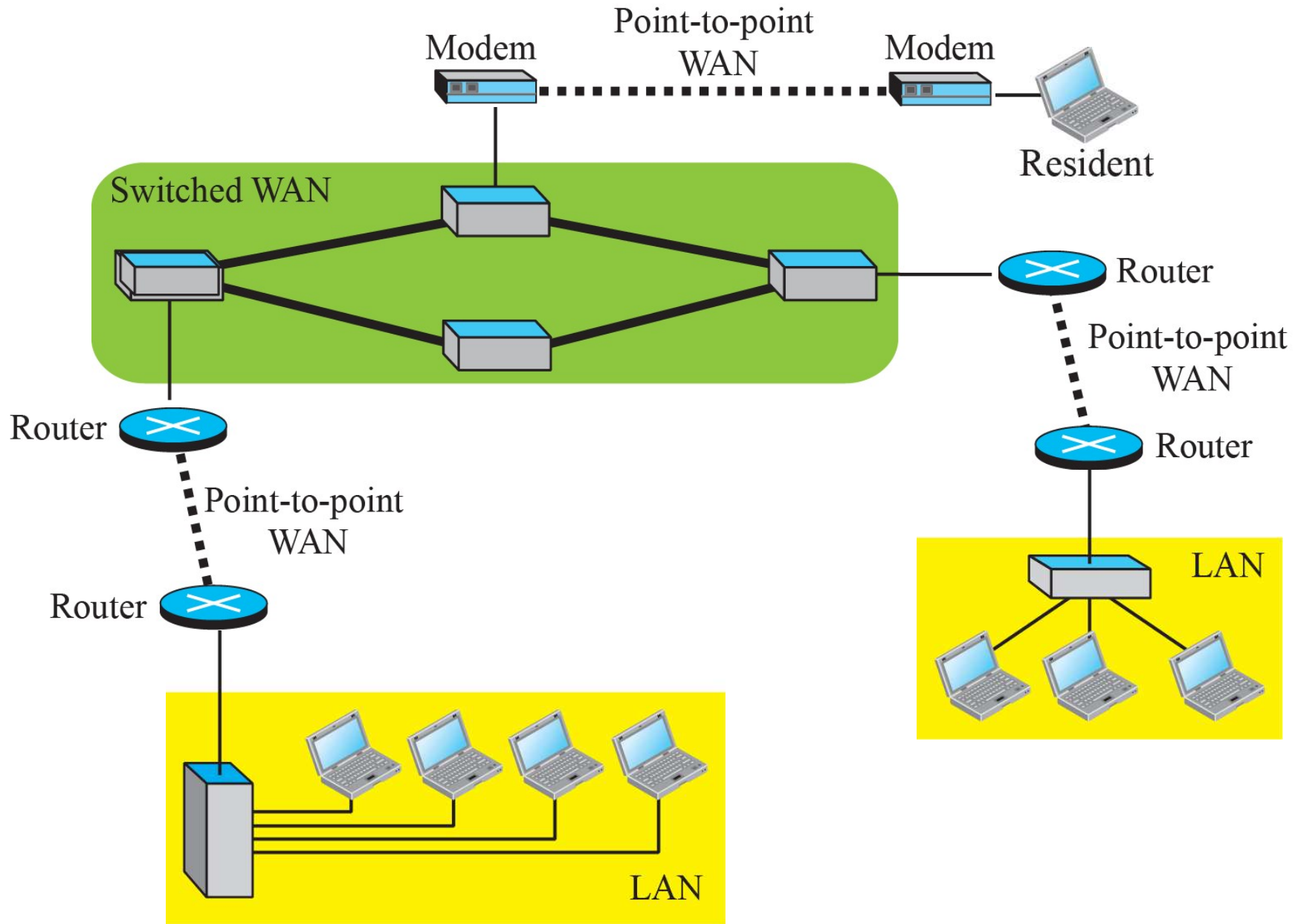
### Legend



### *A Switched WAN*



***An internetwork made of two LANs and one WAN***

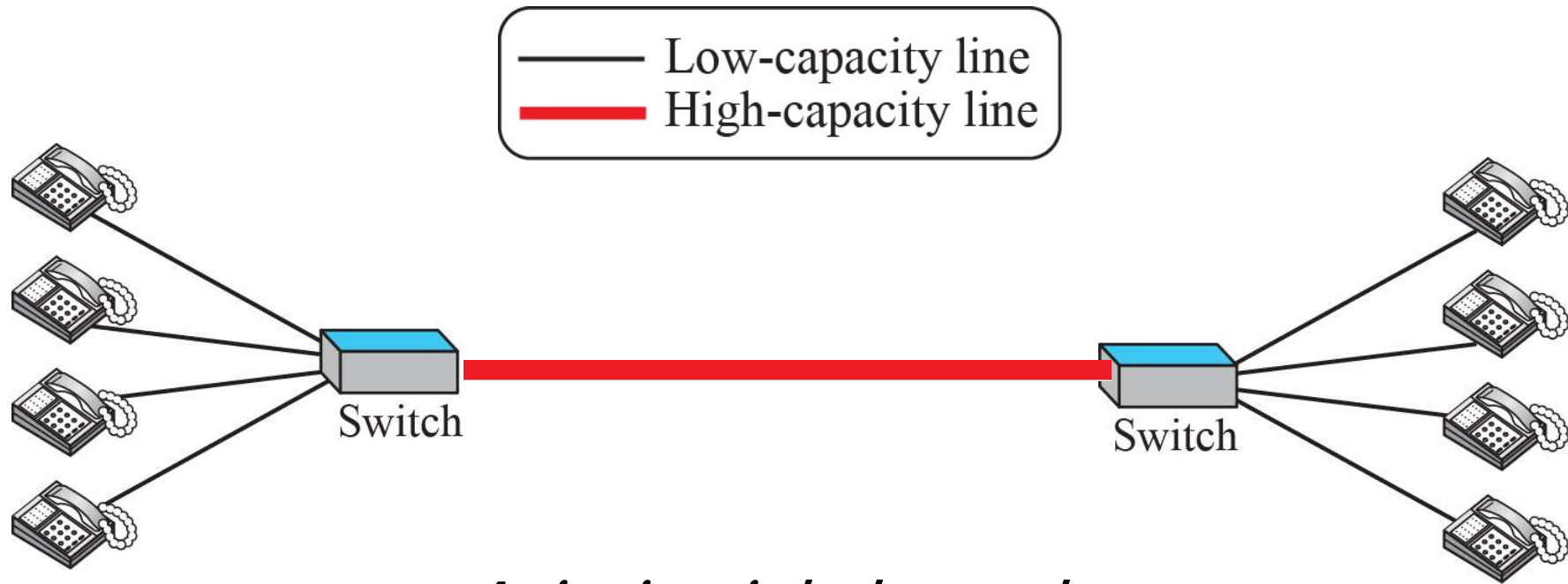


*A heterogeneous network made of WANs and LANs*

# Switching

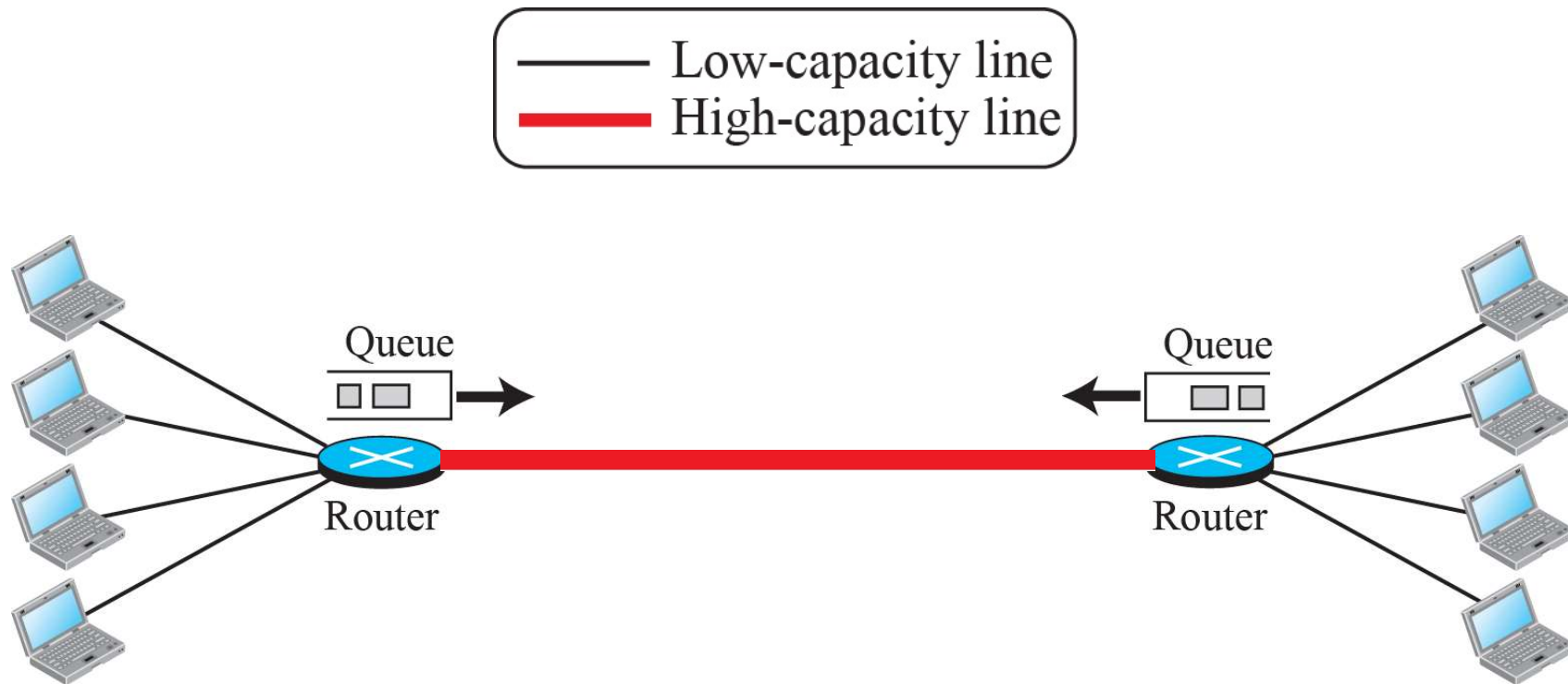
- An internet is a switched network in which a switch connects at least two links together.
- A switch needs to forward data from a network to another network when required.
- The two most common types of switched networks are circuit-switched and packet-switched networks.





*A circuit-switched network*



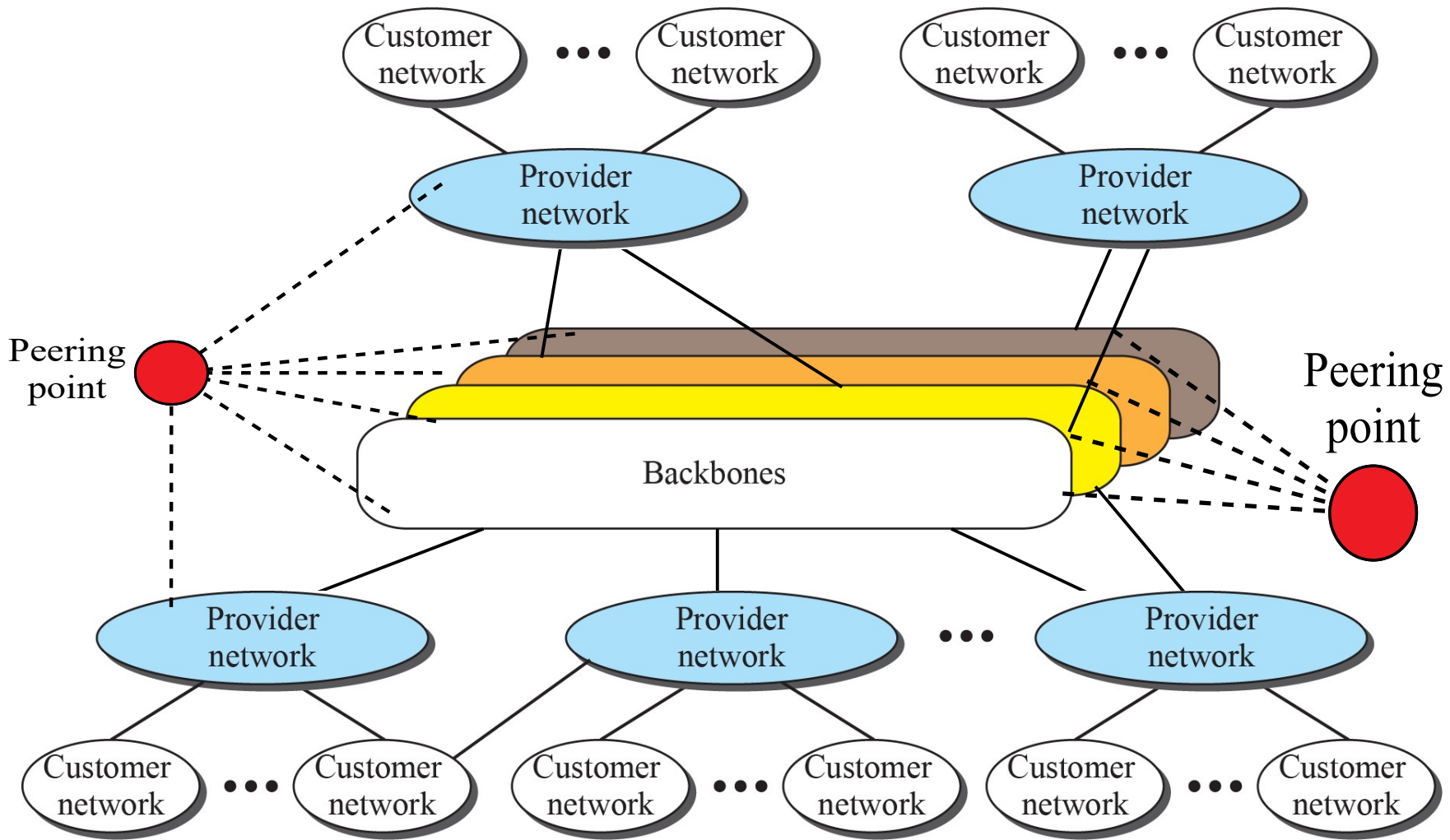


*A packet-switched network*

# The Internet

- As we discussed before, 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 today*

# Accessing the Internet

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- The Internet today is an internetwork that allows any user to become part of it. The user needs to be physically connected to an **ISP**.
- The physical connection is normally done through a point-to-point WAN.
- In this section, we briefly describe how this can happen, but we postpone the technical details of the connection until Chapters 14 and 16.



# Early History

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- There were some communication networks, such as telegraph and telephone networks, before 1960.
- These networks were suitable for constant-rate communication at that time, which means that after a connection was made between two users, the encoded message (telegraphy) or voice (telephony) could be exchanged.
- A computer network, on the other hand, should be able to handle bursty data, which means data received at variable rates at different times. The world needed to wait for the **packet-switched network** to be invented.

# Birth of the Internet

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- In 1972, Vint Cerf and Bob Kahn, both of whom were part of the core ARPANET group, collaborated on what they called the Internetworking Project.
- They wanted to link dissimilar networks so that a host on one network could communicate with a host on another. There were many problems to overcome: diverse packet sizes, diverse interfaces, and diverse transmission rates, as well as differing reliability requirements.
- Cerf and Kahn devised the idea of a device called a gateway to serve as the intermediary hardware to transfer data from one network to another.

# Internet Today

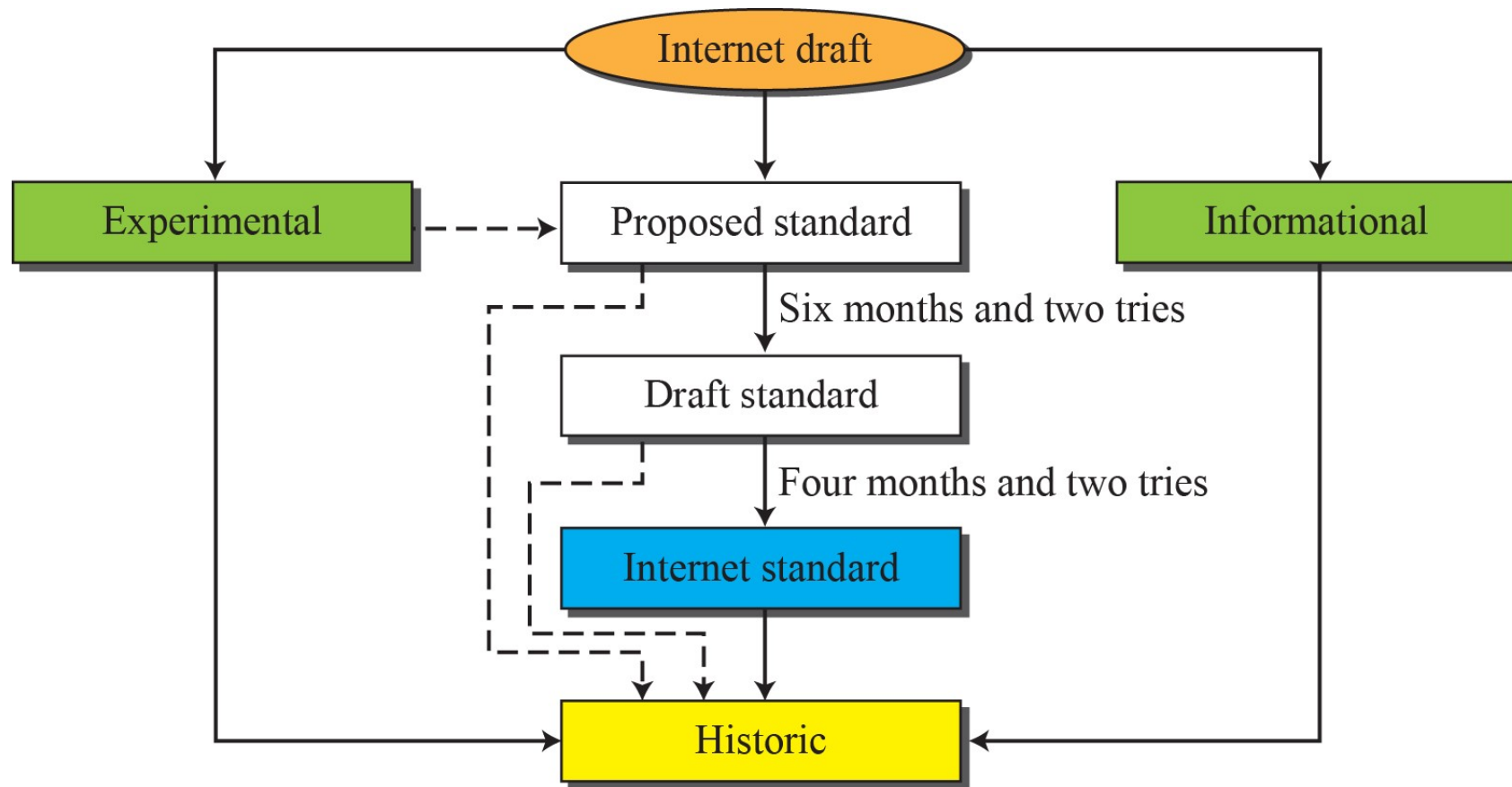
- Today, we witness a rapid growth both in the infrastructure and new applications.
- The Internet today is a set of peer networks that provide services to the whole world.
- What has made the Internet so popular is the invention of **new applications**.





# Internet Standards

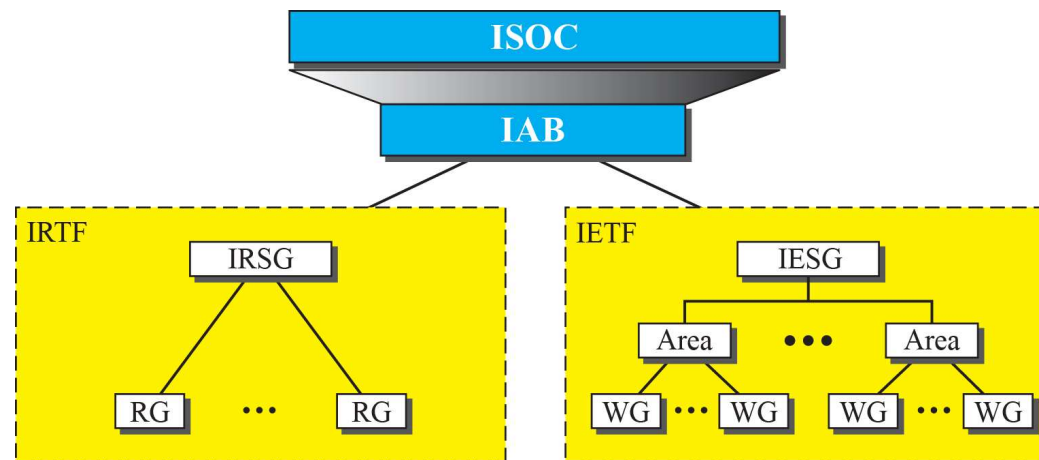
- An **Internet standard** is a thoroughly tested specification that is useful to and adhered to by those who work with the Internet.
- It is a **formalized regulation** that must be followed. There is a strict procedure by which a specification attains Internet standard status.
- A specification begins as an **Internet draft**. An Internet draft is a working document (a work in progress) with no official status and a six-month lifetime.



***Maturity levels of an RFC***

# Internet Administration

- The Internet, with its roots primarily in the research domain, has evolved and gained a broader user base with significant commercial activity.
- Various groups that coordinate Internet issues have guided this growth and development.



*Internet administration*