Chapter 1

Introduction

Networks

Network
- *the interconnection of a set of devices capable of communication.*

Device
- *can be a host such as a large computer, desktop, laptop, workstation, cellular phone, or security system.*
- *can also be a connecting device such as a router a switch, a modem that changes the form of data, and so on.*

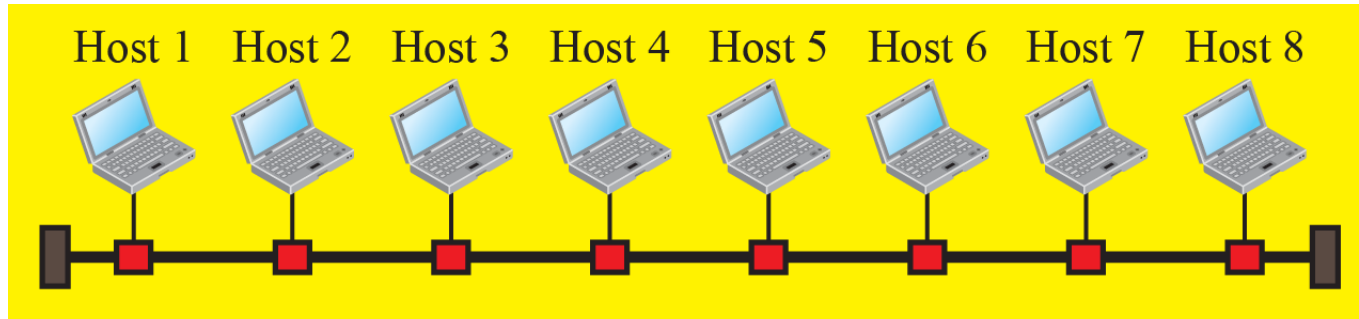# *Networks (Continued)*

❑ *Local Area Networks*

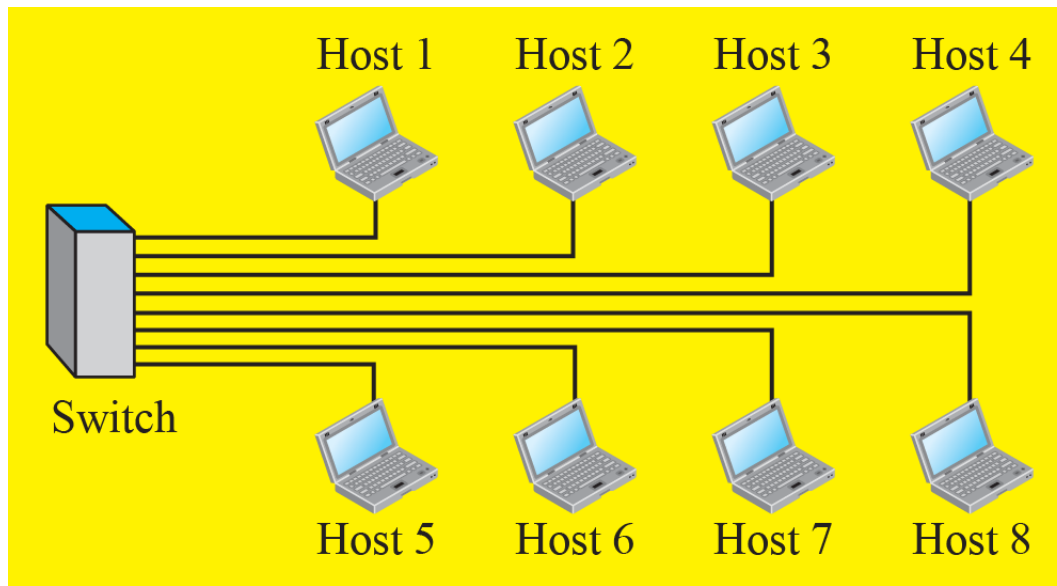❑ *Wide Area Networks*

❖ *Point-to-Point WANs*

❖ *Switched WANs*

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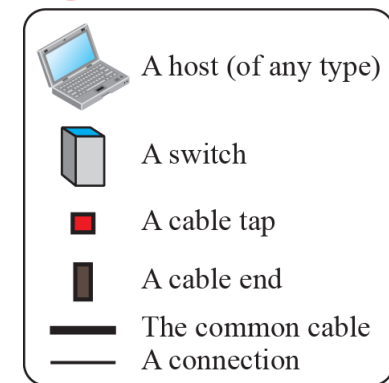
An Isolated LAN in the past and today

a. LAN with a common cable (past)

b. LAN with a switch (today)
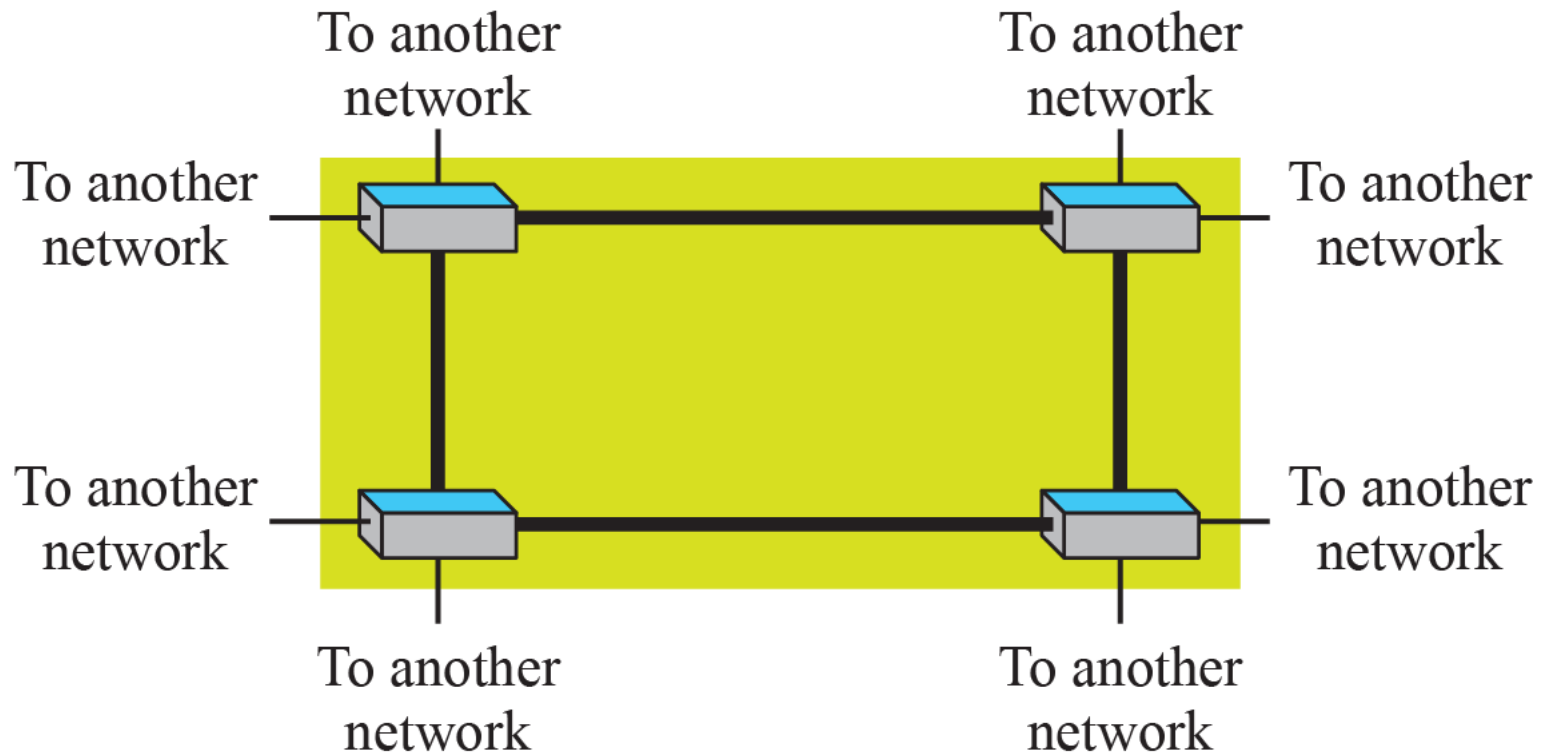
Legend

- A host (of any type)
- A switch
- A cable tap
- A cable end
- The common cable
- A connection

A Point-to-Point WAN

To another network

To another network

Legend

A connecting device

Connecting medium

A Switched WAN

To another network

To another network

To another network

To another network

To another network

To another network

To another network

To another network

Legend

A switch

Connecting medium
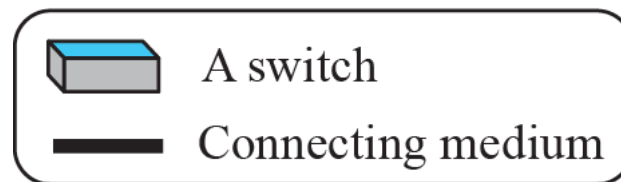
An internetwork made of two LANs and one WAN
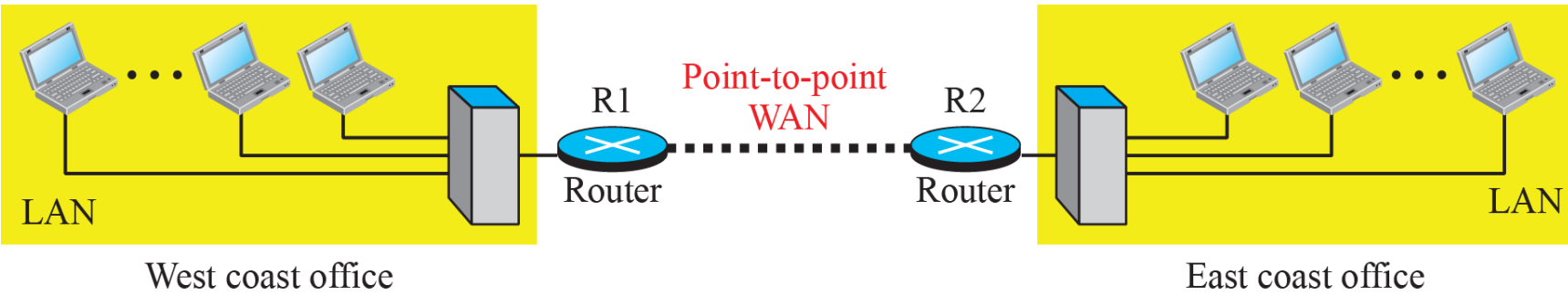
A heterogeneous network made of WANs and LANs

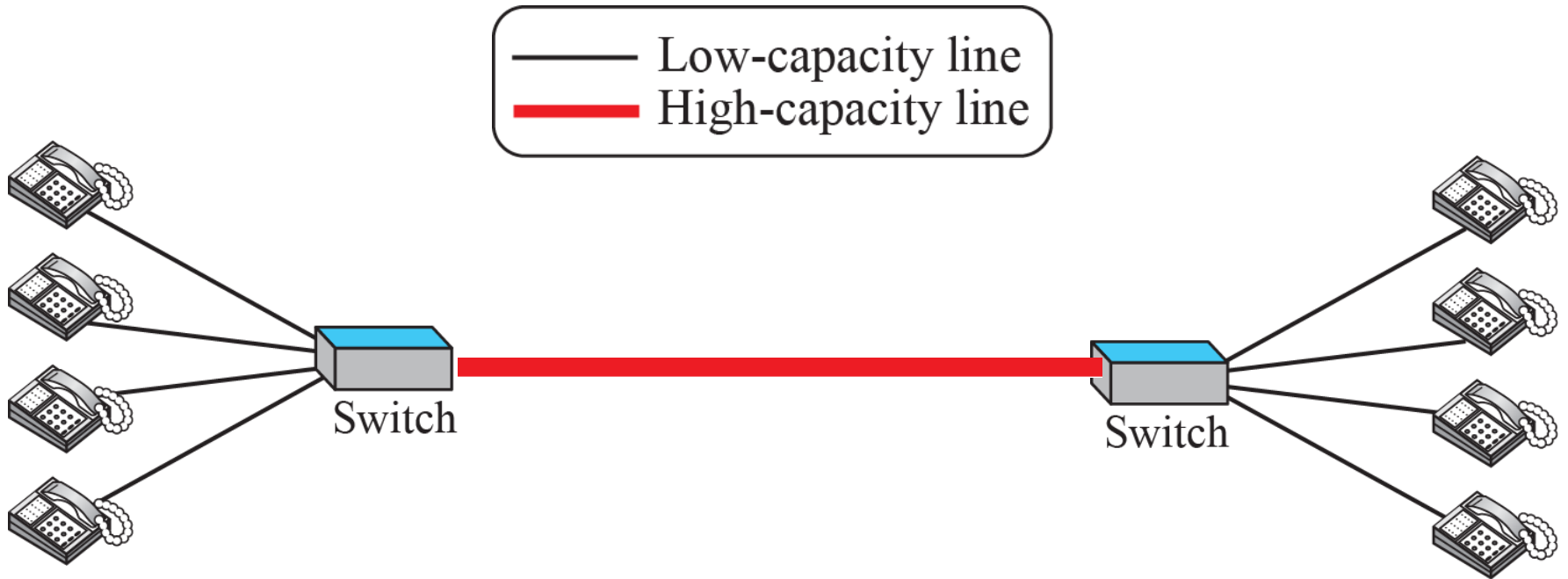s, Inc. Permission required for reproduction or display.
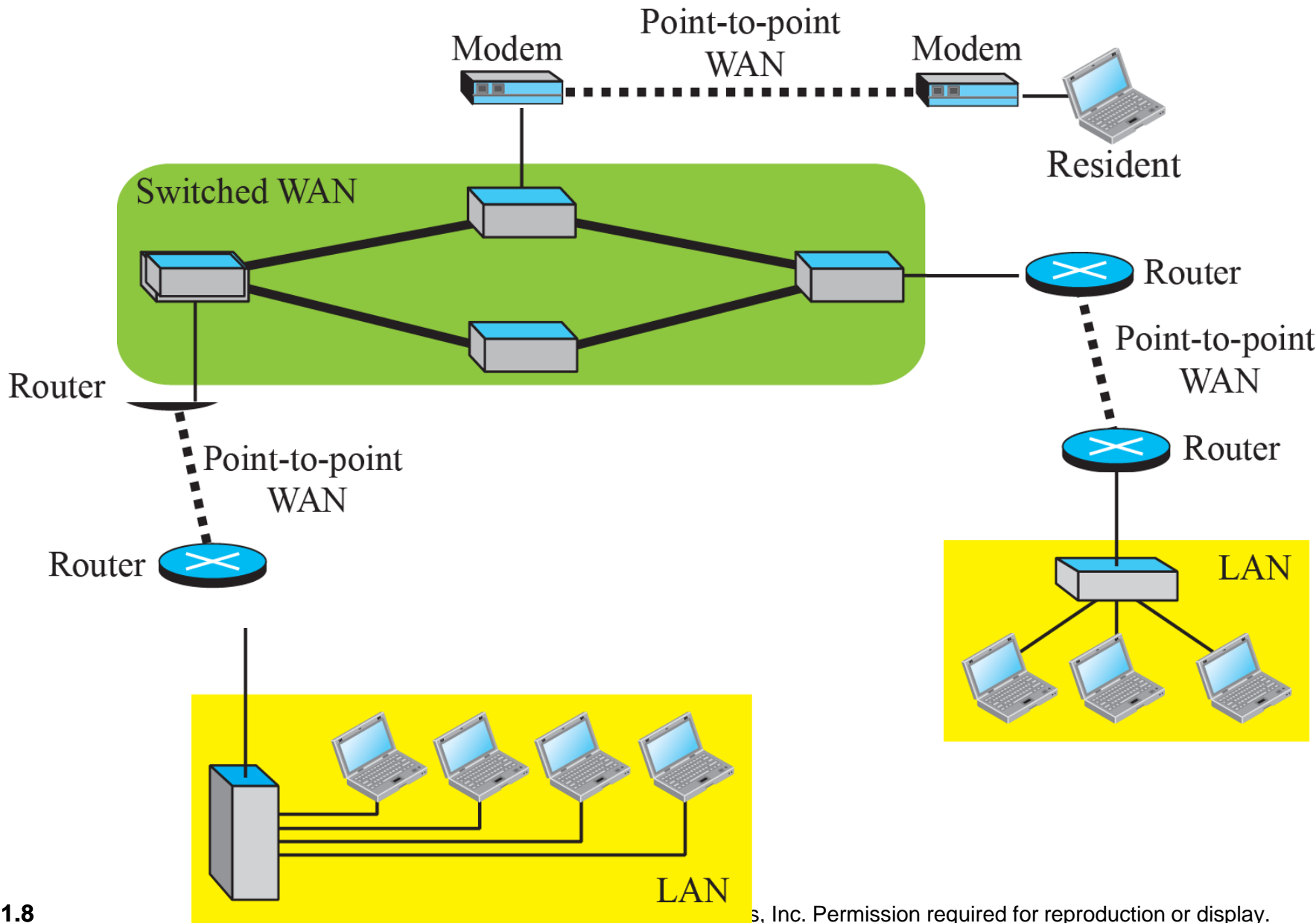
Switching

- connects at least two links together.

- needs to forward data from a link to another link
when required.

❑ *Circuit-Switched Network*

❑ *Packet-Switched Network*

A circuit-switched network

Low-capacity line

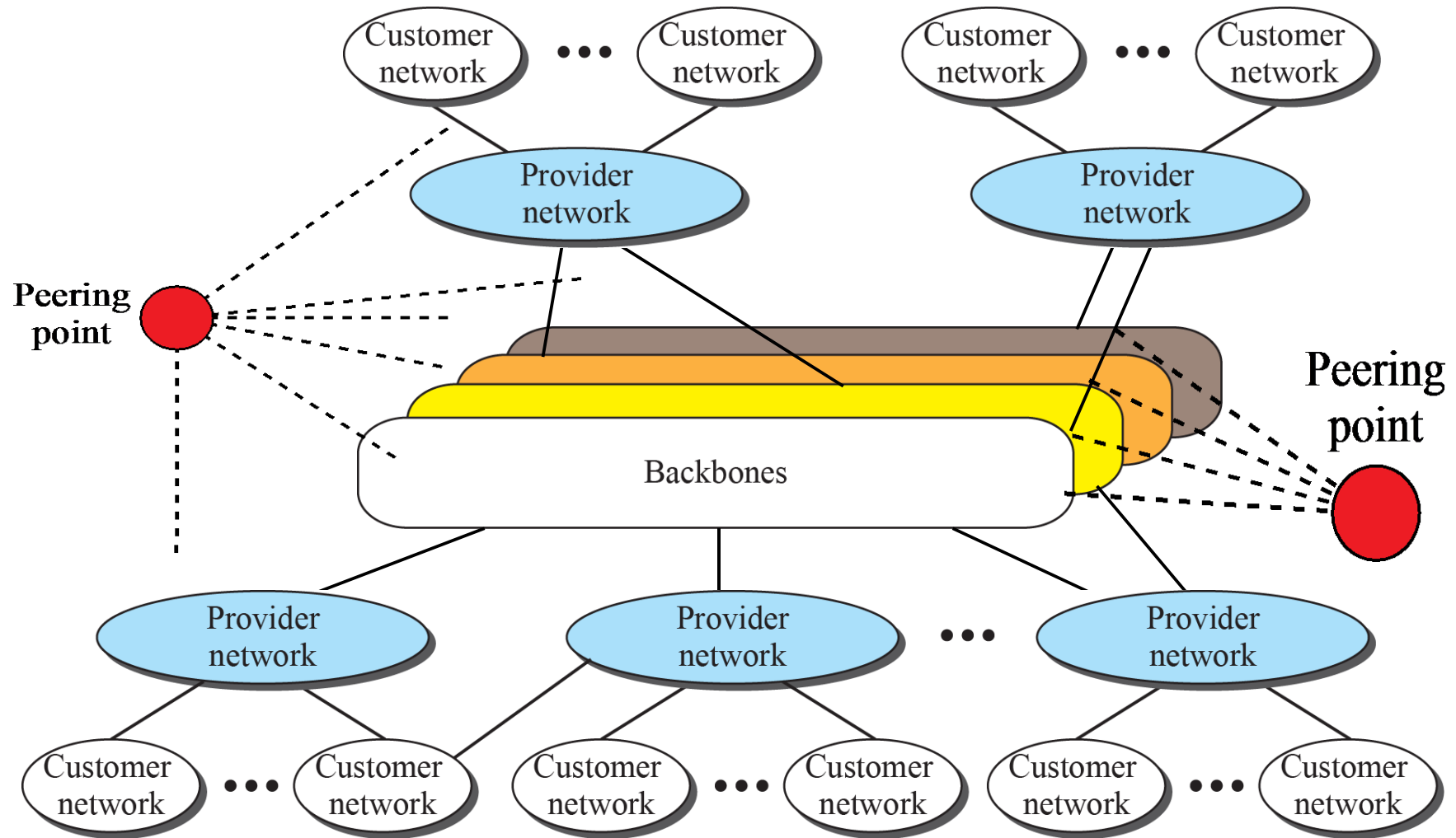High-capacity line

Switch

Switch

A packet-switched network
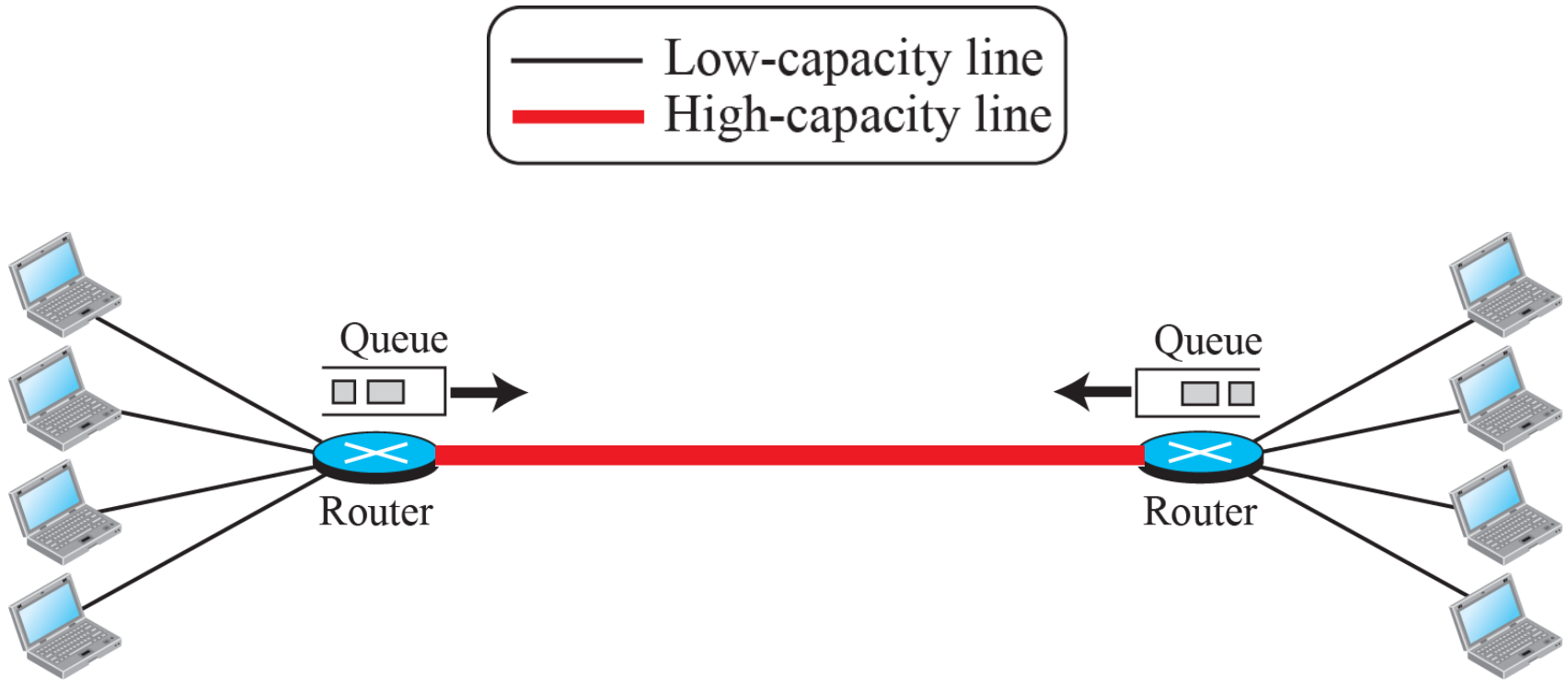
The Internet

- The most notable internet

- is composed of thousands of inter-connected networks.

The Internet today

PROTOCOL LAYERING

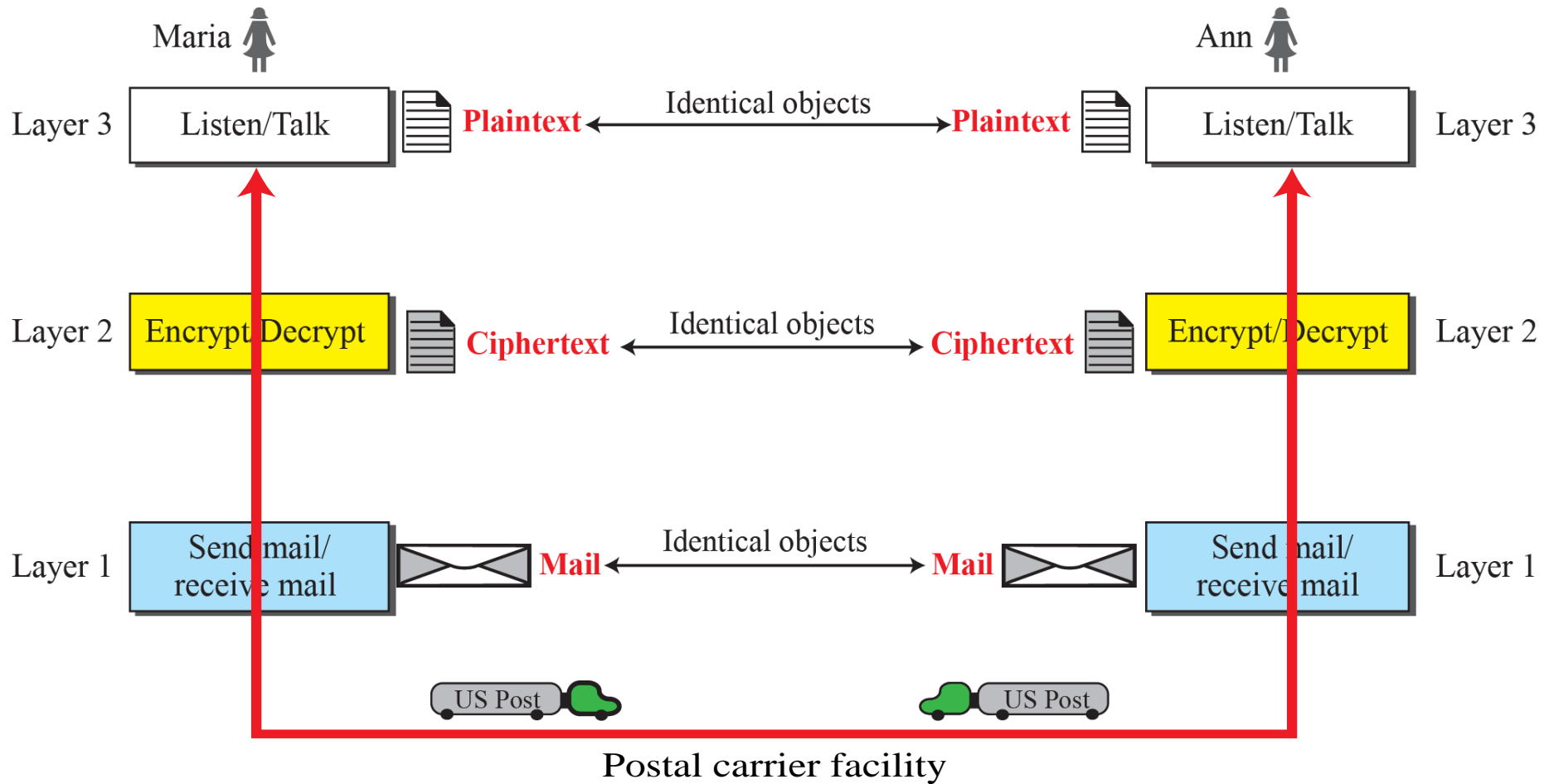- *A protocol defines the rules that both the sender and receiver and all intermediate devices need to follow to be able to communicate effectively.*

- *When communication is simple, we may need only one simple protocol*

- *when the communication is complex, we need a protocol at each layer, or protocol layering.*

A single-layer protocol
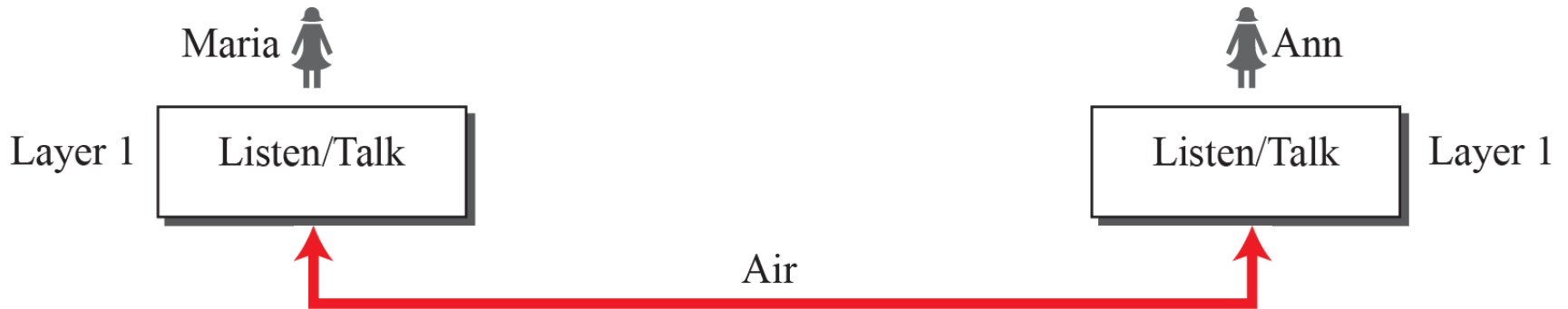
A three-layer protocol

Logical connection between peer layers
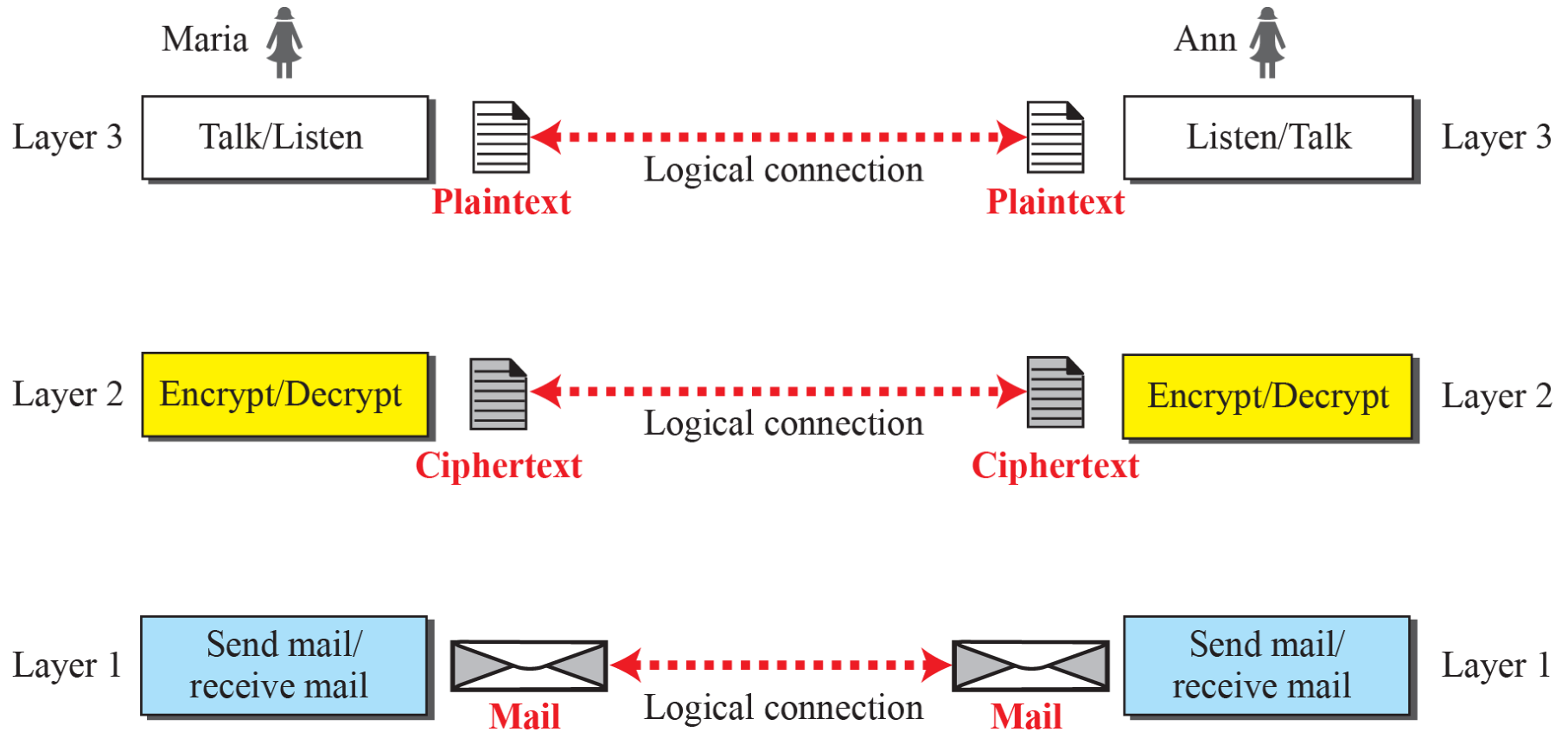
TCP/IP Protocol Suite

- *used in the Internet today*

- *It is a hierarchical protocol made up of interactive modules, each of which provides a specific functionality*

- *The term hierarchical means that each upper level protocol is supported by the services provided by one or more lower level protocols*

- *is thought of as a five-layer model*

TCP/IP Protocol Suite (continued)

❑ *Layered Architecture*

❑ *Layered in the Suite*

❑ *Description of Each Layer*

❖ *Application Layer*

❖ *Transport Layer*

❖ *Network Layer*

❖ *Data-link Layer*

❖ *Physical Layer*

TCP/IP Protocol Suite (continued)

❑ *Encapsulation and Decapsulation*

    ❖ *Encapsulation at the Source Host*

    ❖ *Decapsulation and Encapsulation at Router*

    ❖ *Decapsulation at the Destination Host*

❑ *Addressing*

❑ *Multiplexing and Demultiplexing*

Communication through an internet

Source (A) — Destination (B)

Communication from A to B

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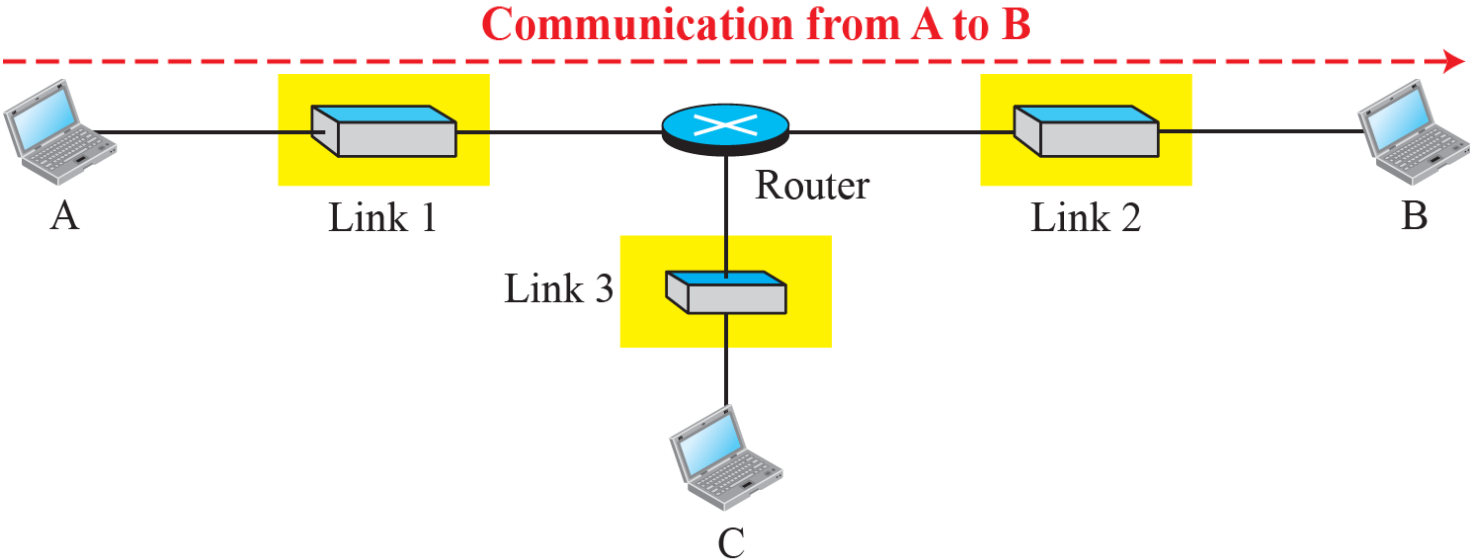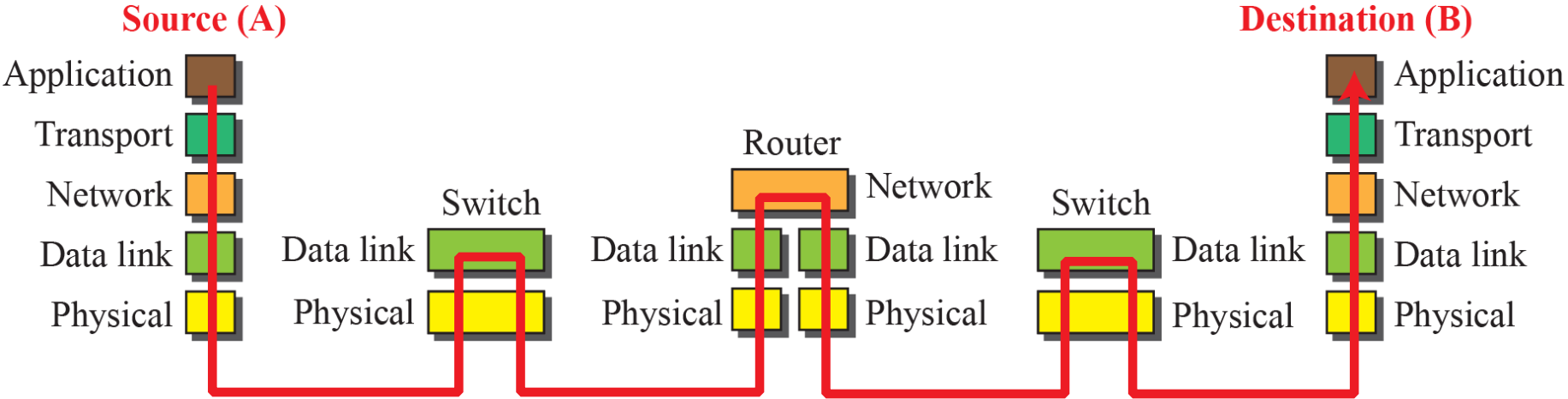
Logical connections between layers in TCP/IP

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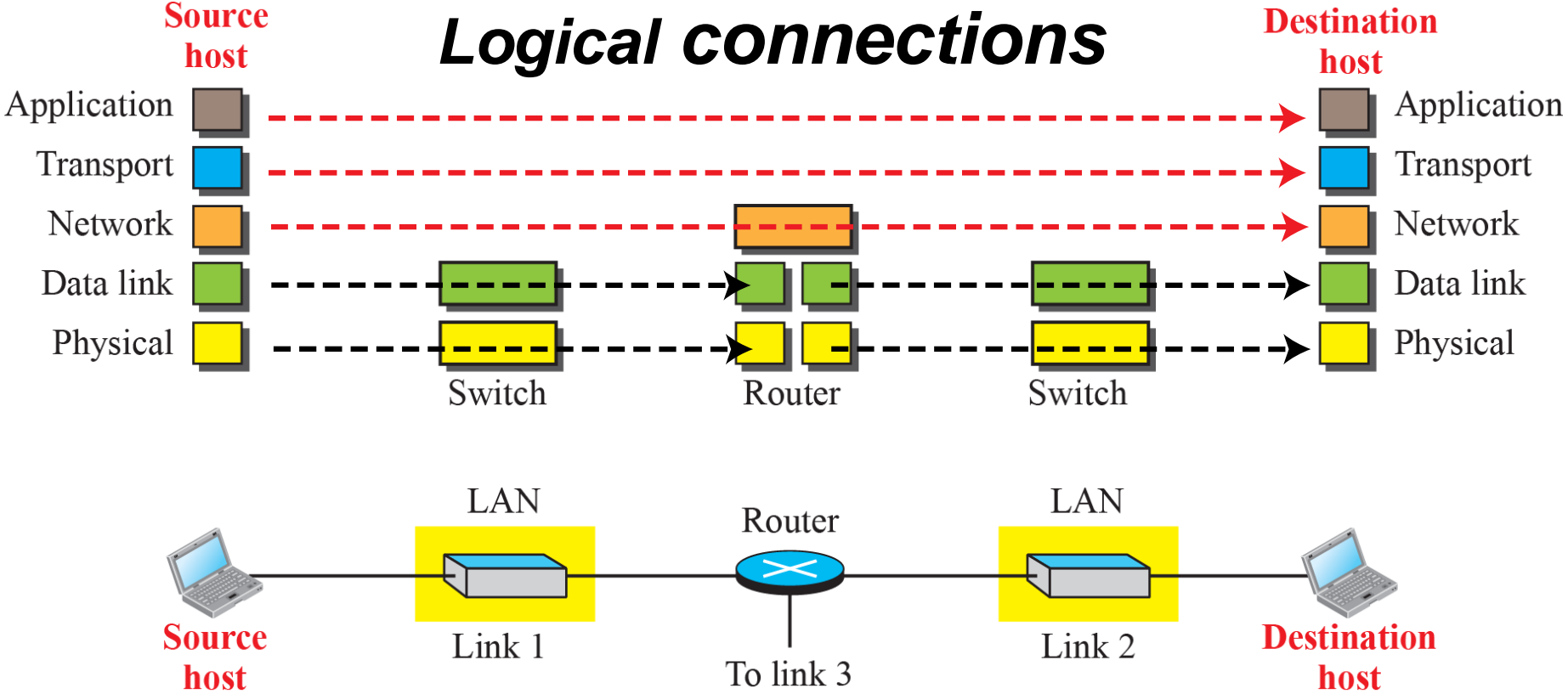
Identical objects in the TCP/IP protocol suite

Notes: We have not shown switches because they don't change objects.

Identical objects (messages)

Application

Identical objects (segment or user datagram)

Transport

Identical objects (datagram)   **Identical objects (datagram)**

Network

Identical objects (frame)   **Identical objects (frame)**

Data link

Identical objects (bits)   **Identical objects (bits)**

Physical
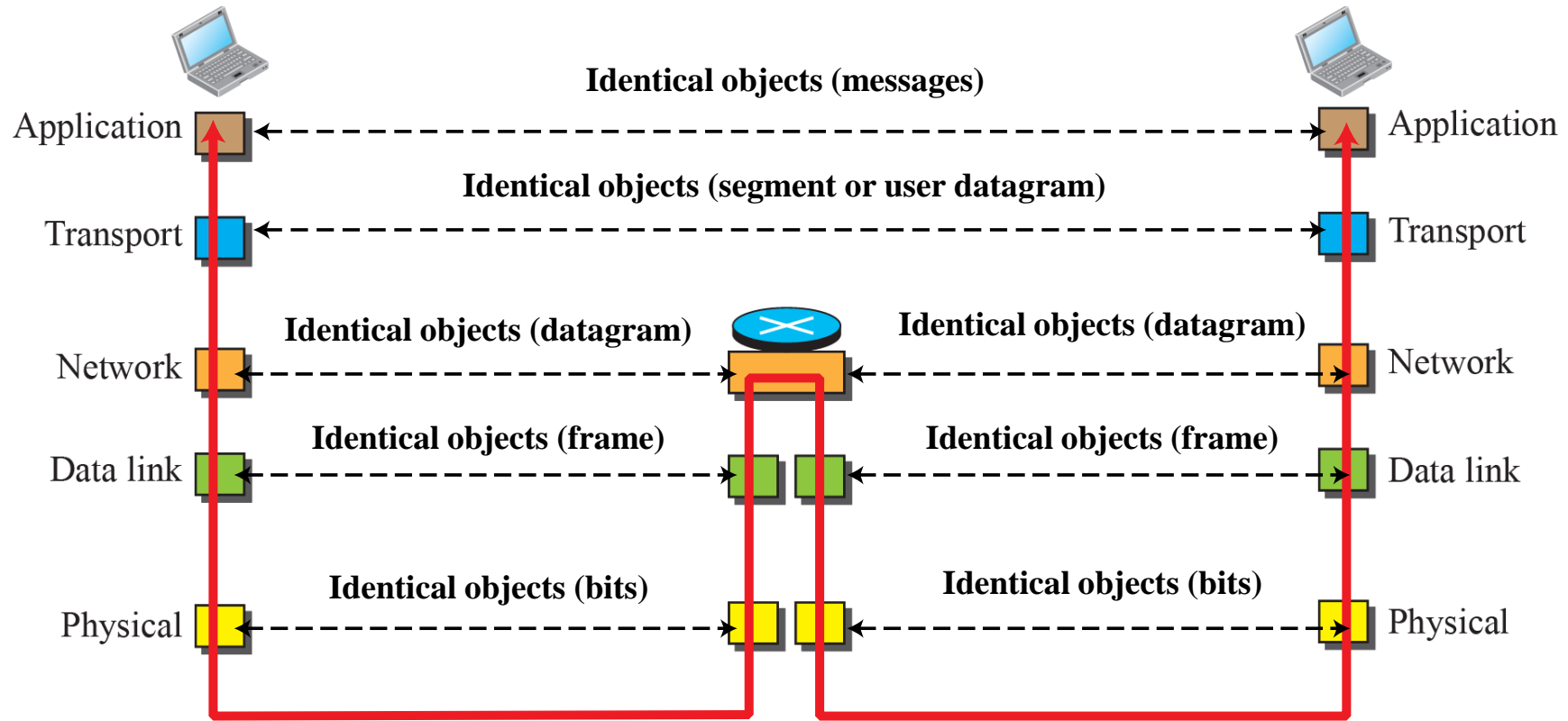
Encapsulation / Decapsulation
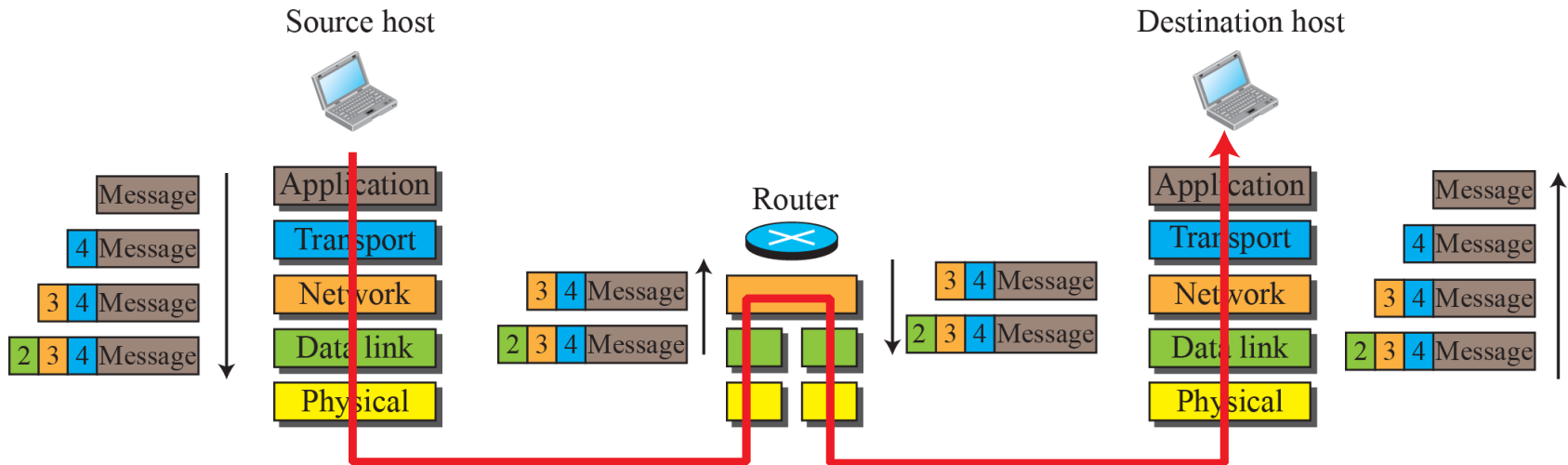
Addressing in the TCP/IP protocol suite

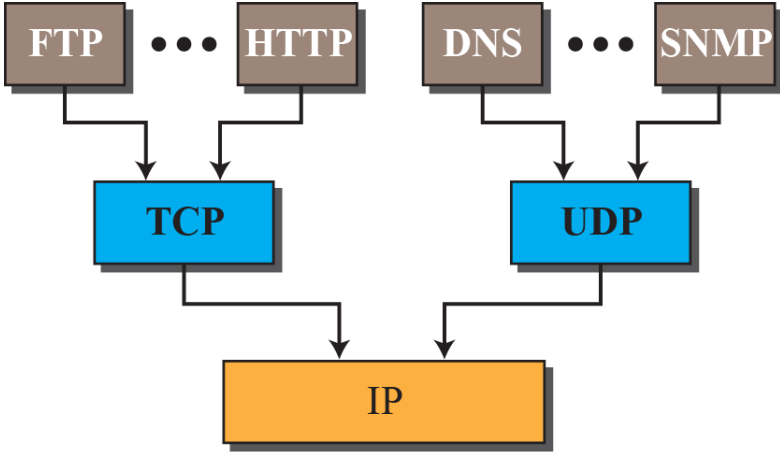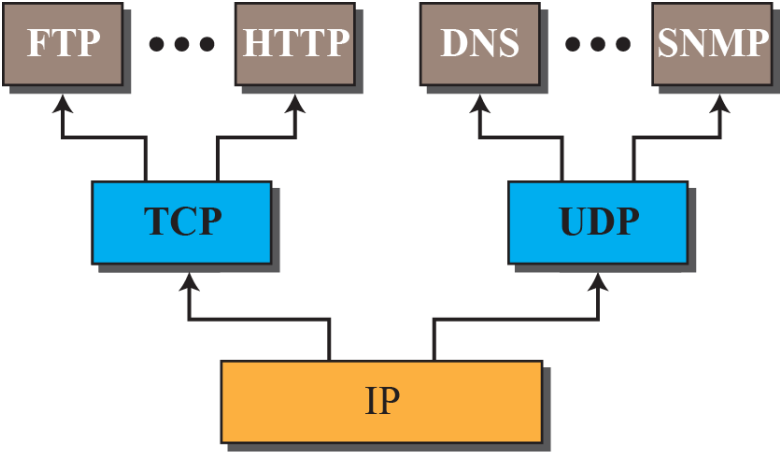| Packet names	Layers	Addresses
Message	Application layer	Names
Segment / User datagram	Transport layer	Port numbers
Datagram	Network layer	Logical addresses
Frame	Data-link layer	Link-layer addresses
Bits	Physical layer	

Multiplexing and demultiplexing

a. Multiplexing at source
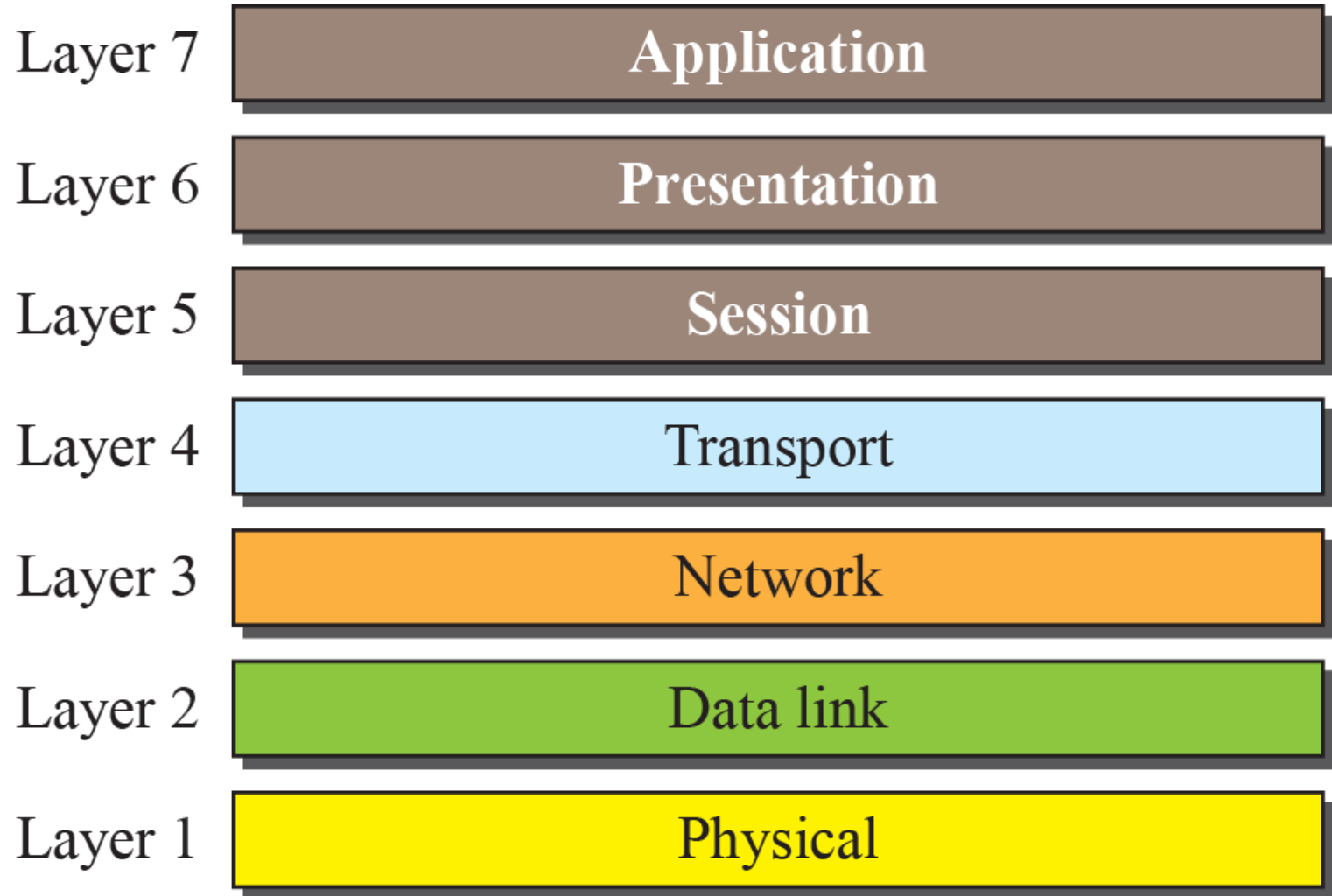
b. Demultiplexing at destination

The OSI Model

- *An ISO standard that covers all aspects of network communications*

- *It was first introduced in the late 1970s*

❑ *OSI versus TCP/IP*

❑ *Lack of OSI Model's Success*

The OSI model

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TCP/IP and OSI model

OSI Model	TCP/IP Protocol Suite	
Application	Application	Several application protocols
Presentation		
Session		
Transport	Transport	Several transport protocols
Network	Network	Internet Protocol and some helping protocols
Data link	Data link	Underlying LAN and WAN technology
Physical	Physical	

OSI Model   TCP/IP Protocol Suite