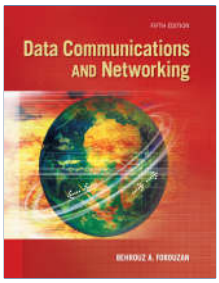


Computer Networks

Lecturer: Dr. A.O. Aldhaibani

Lecture 1

2

Data Communication

– **Data communications** are the **exchange** of **data** between two **devices** via some form of transmission **medium** such as a wire cable, fiber optic, or wireless.

Copper Wire

Fiber Optic

Wireless

3

Data Communication cont.

Data communications system depends on four fundamental characteristics:

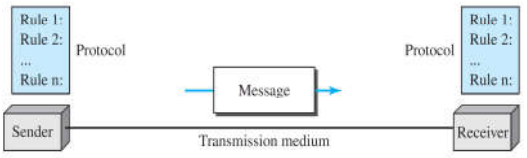
– Delivery:
  The system must deliver data to the correct destination.
– Accuracy:
  The system must deliver the data accurately.
– Timeline:الجدول الزمني
  The system must deliver data in a timely manner. وقت مناسب
– Jitter:
  Jitter refers to the variation in the packet arrival time.

4

Data Communication cont.

Data communications system has **five** components:

Five components of data communication



Source Distination

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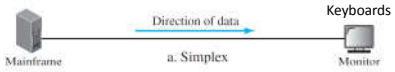
Data Communication cont.

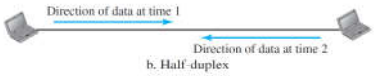
Data Flow

Data flow (simplex, half-duplex, and full-duplex)

Data Flow in one direction ONLY



Data Flow in one direction in each time.



Data Flow in two directions at the same time.

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Networks

A **network** is the **interconnection** of a set of **devices** capable of communication.

Router

A **network** a connecting at least **two devices** in order to transfer **data** and share **resources**.

Switch

The device can be a **host** (or an *end system*), a **router** , or a **switch**.

Host

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Network Criteria معايير

– **Performance** can be measured in many ways, including transit time and response time.

– **Reliability** is measured by the frequency of failure.

– **Security** issues include protecting data from unauthorized access, protecting data from damage and change.

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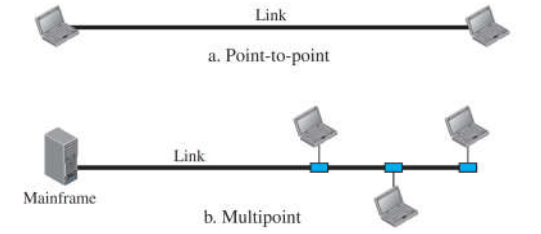
Network Physical Structures

Type of Connection

Types of connections: point-to-point and multipoint



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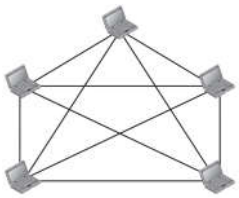
Network Physical Structures cont.

Physical Topologies:
1- Mesh Topology



If the links are unidirectional
No. of links = N*(N-1)

If the links are bidirectional
No. of links = N*(N-1)/2

Advantages:
1-Each connection can carry its own data load
2-Mesh topology is robust
3-Privacy or security
4-Fault identification and fault isolation easy

Disadvantages:
1-Installation and reconnection are difficult
2-Wiring can be greater than the available space
3-link (I/O ports and cable) can be expensive.

Usage
1-Backbone connecting servers.
2-Connection of telephone regional offices

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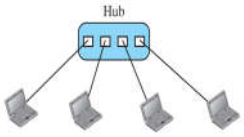
Network Physical Structures cont.

Physical Topologies:
2- Star Topology



Advantages:
1-easy to install and reconfigure
2-Less expensive than mesh topology.
3-easy fault identification and fault isolation.

Disadvantages:
The dependency of the whole topology on one single point.

Usage:
is used in local-area networks (LANs)

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Network Physical Structures cont.

Physical Topologies:
3- Bus Topology:

Advantages:
1-Easy to install
2-Uses less cabling than mesh or star topologies.

Usage:
is used early in local area networks and not popular now.

Disadvantages:
1-Difficult reconnection and fault isolation
2-Signal reflection at the taps can cause degradation in quality
3-Adding new devices may therefore require modification or replacement of the backbone
4-A fault or break in the bus cable stops all transmission

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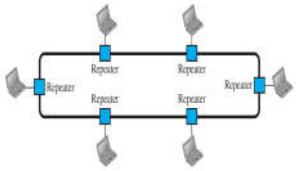
Network Physical Structures cont.

Physical Topologies:

4- Ring Topology:



Advantages:
1-A ring is relatively easy to install and reconfigure
2-In addition, fault isolation is simplified.

Disadvantages:

Usage:
is used early in local area networks and not popular now.

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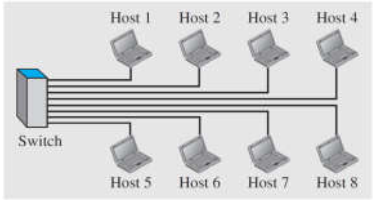
Network Types

– **Local Area Network**

- is usually **privately owned** and connects some hosts in a single **office**, **building**, or **campus**.



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Network Types

– **Wide Area Network**

- has a **wider geographical** span, spanning a **town**, a **state**, a **country**, or even the **world**.
- WAN is normally **created** and **run** by communication **companies** and **leased** by an **organization** that uses it.

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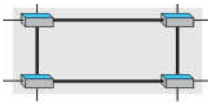
Types of WAN

– **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.



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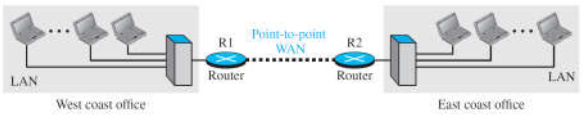
Types of WAN

- **Internetwork**
  - Is a combination of LAN and WAN.



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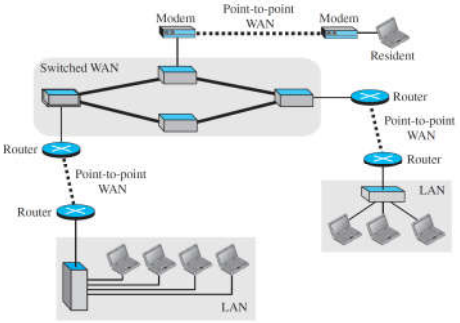
A heterogeneous Network (WAN+LAN)



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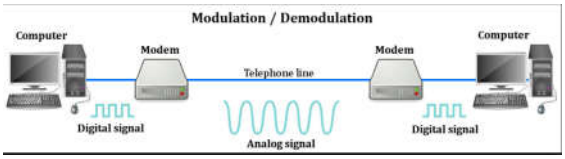
Modem

Modem: is a device that **transforms analog** signals to **digital** signals and vice versa.



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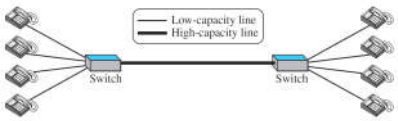
Switching

– **Circuit-Switched Network**
  - A **dedicated**مخصصة connection, called a **circuit**, is always available between the **two** end systems.
  - **Circuit** switching was very **common** in **telephone** networks



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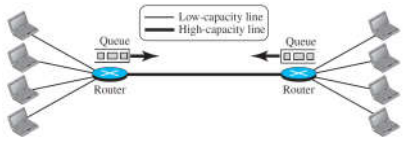
Switching

– **Packet-Switched Network**
  • The communication between the two ends is done in blocks of data called **packets.**

– In this type of switching **packets** may **encounter** some **delays** and **loss**.



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Network Models

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Protocol Layering

– A **protocol** is a **set** of **rules** and formats that **controls** data **communications**.

– It **represents** an **agreement** between the communicating **devices**.

– **Without** a protocol, two **devices** may be **connected** but **not** communicating,

– Protocol **layering** enables us to **divide** a **complex** task into several **smaller** and **simpler** tasks.

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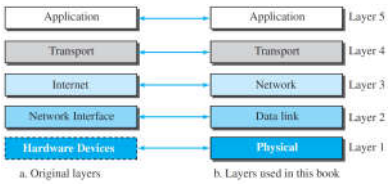
TCP/IP PROTOCOL SUITE

– **TCP/IP** (Transmission Control Protocol/Internet Protocol):
  • TCP/IP is a **protocol suite** (a set of protocols **organized** in different **layers**) used in the **Internet today.**



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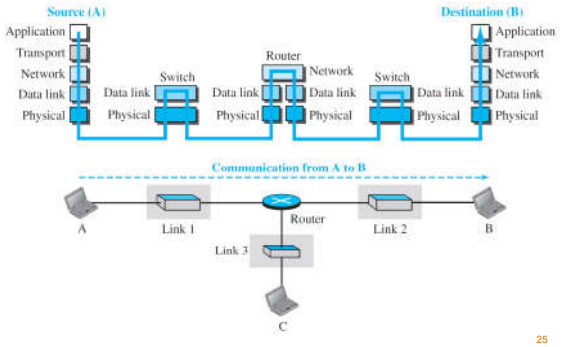
Communication through an internet



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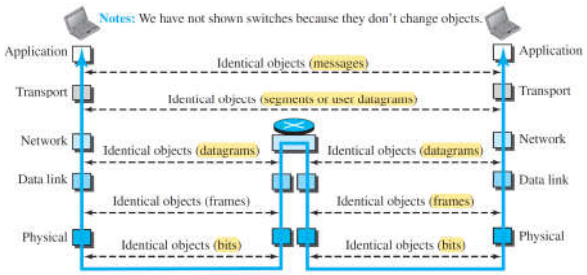
Identical objects in the TCP/IP protocol suite



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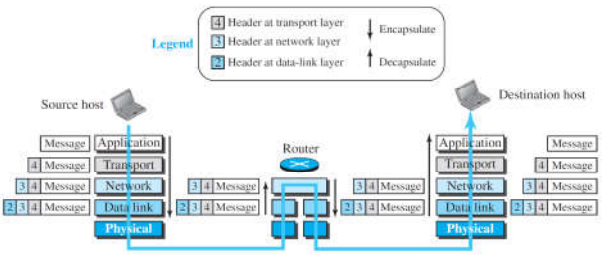
Encapsulation and De-capsulation



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Addressing

- Any **communication** between two **devices needs two** addresses: **source** address and **destination** address.
- **Each** source or destination **address** can be in **four types**.
- **Name:**
  - to **define** the **site** that provides **services**; **such** as www.google.com
- **Port** Number:
  - **local** addresses that **distinguish** between several **programs** running **at the same time**.

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Addressing

– **Logical** Address or A **network-layer** address:
  • **uniquely defines** the connection of a device to the Internet.

– The **link-layer** addresses, sometimes called **MAC** addresses:
  • Are **locally** defined addresses, each MAC **defines** a specific **host** or **router** in a network.

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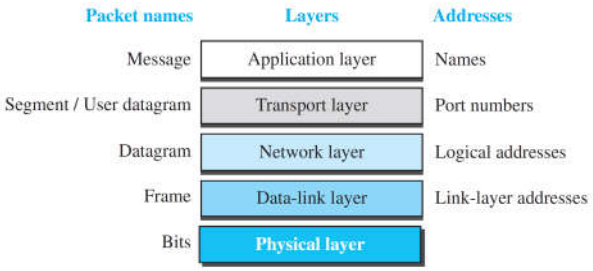
Addressing



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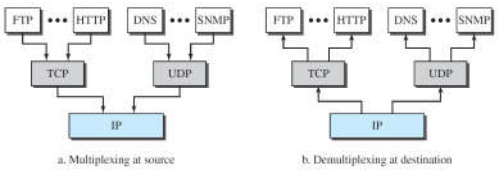
Multiplexing and Demultiplexing



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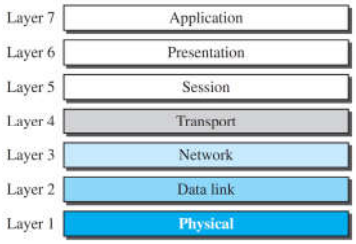
OSI Model



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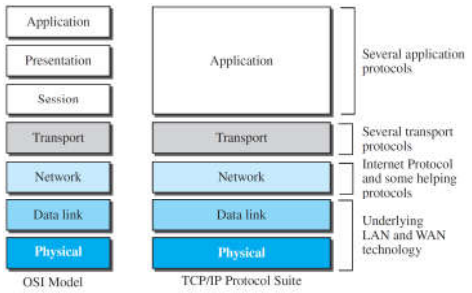
OSI versus TCP/IP



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Discussion

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