

CT 1502

Planning and Design of Communication Networks

Chapter 1,2

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Sharing in deferent kinds of networks

Networks	Shared resource	Ways to share
Transportation networks	roads	transportation
Electricity networks	energy	wires
Water networks	water	water pipes
Computer networks	data (images, text, voice, etc)	computer systems, sending and receiving devices and channels

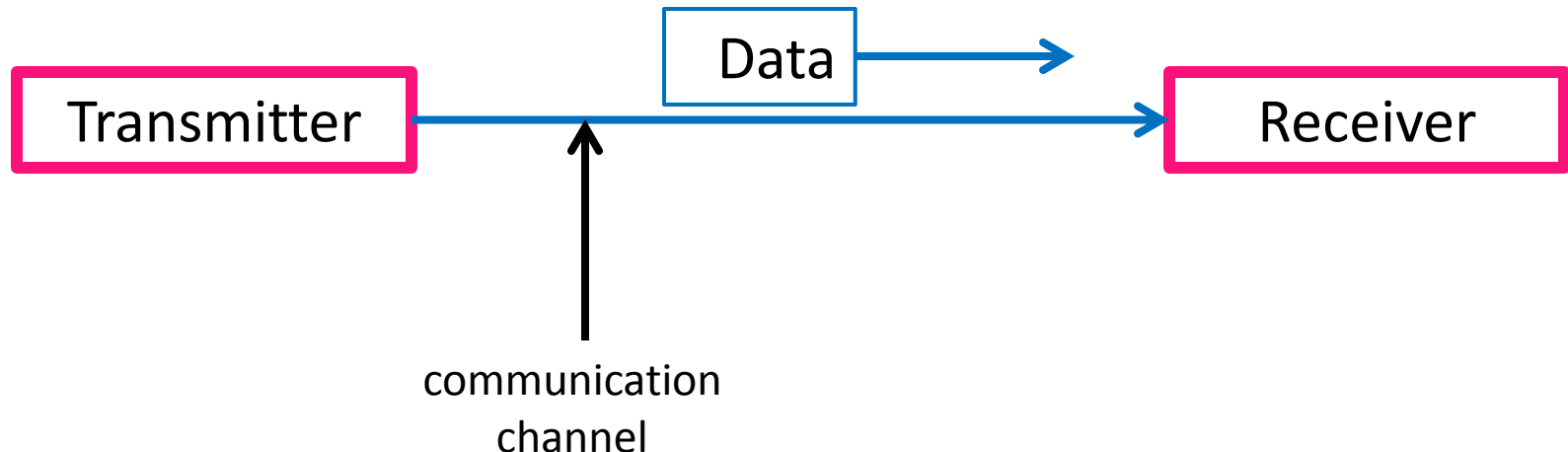
Networks benefits

- **Efficiency:** rapid of procedure completion, (save time), reduce movement, save paper, save room, etc.
- **Quality:** accuracy(الدقة), Integration(التكامل) and homogeneity(التجانس), Reliability(الوثوقية) and security(الأمن), etc.
- **New development opportunities:** expand information resources, support making decision, Provide unprecedented possibilities that opens new horizons for new busniss.

Fundamentals of communication networks

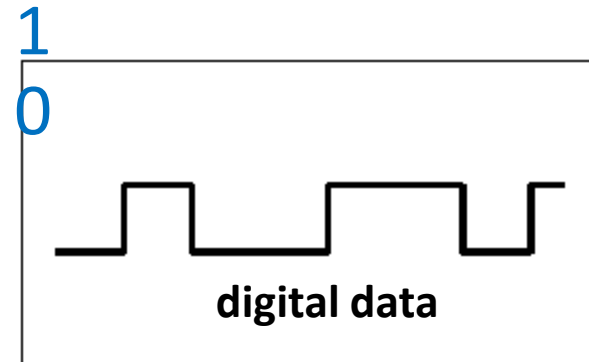
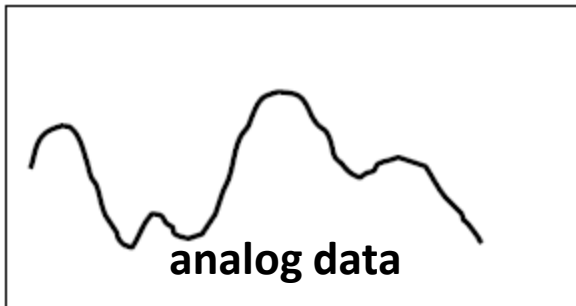
Main Components of Communication Systems

- **Communications:** is the act of exchanging information between two or more users in form of letters, words, message, images, voice, etc.



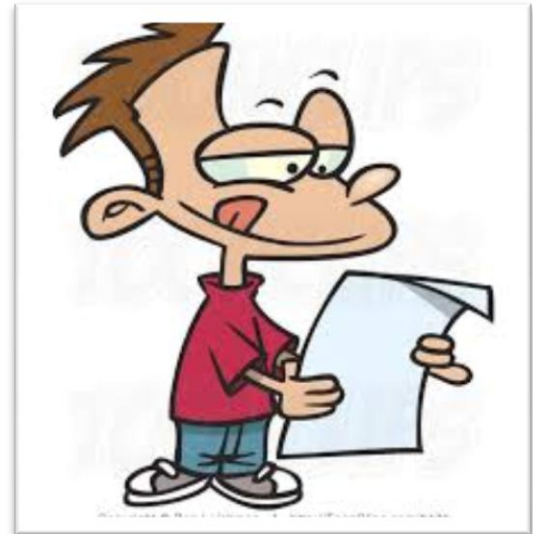
Main Components of Communication Systems

- **Data:**
 - **Analog Data:** data represented in a continuous form, similar to its original structure (voice, video, etc).
 - **Digital Data:** data that are electromagnetically stored in the form of discrete digits (zeros and ones).



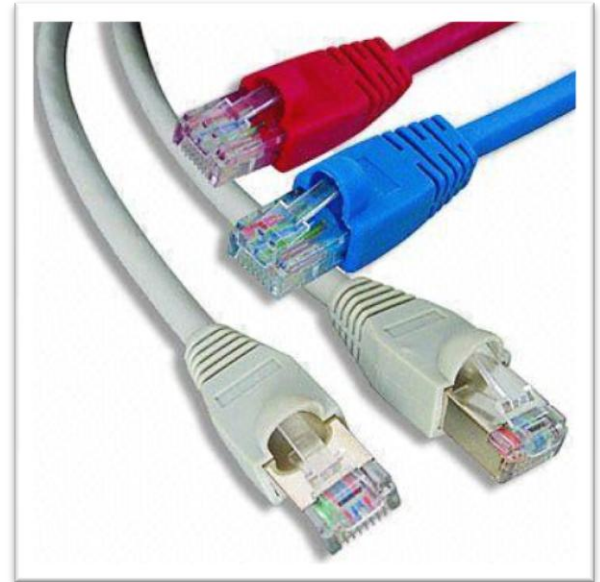
Main Components of Communication Systems

- **Transmitter and Receiver:**
 - **Transmitter:** send data in electrical form (signals) across communication channel.
 - **Receiver:** receive the signals across the channel and restores the data from that signals.



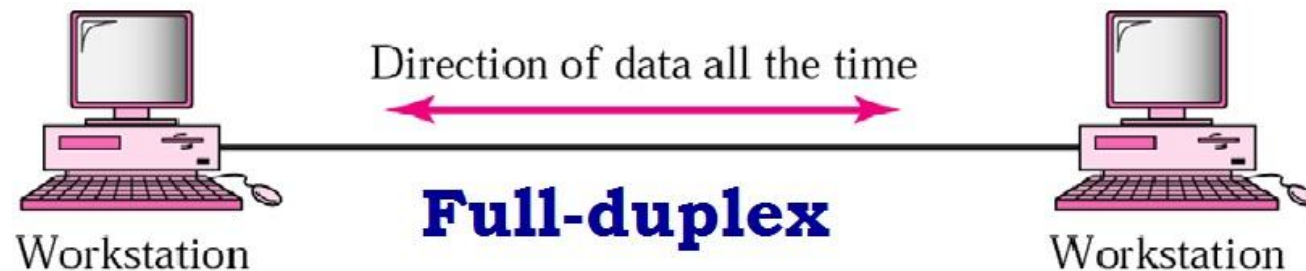
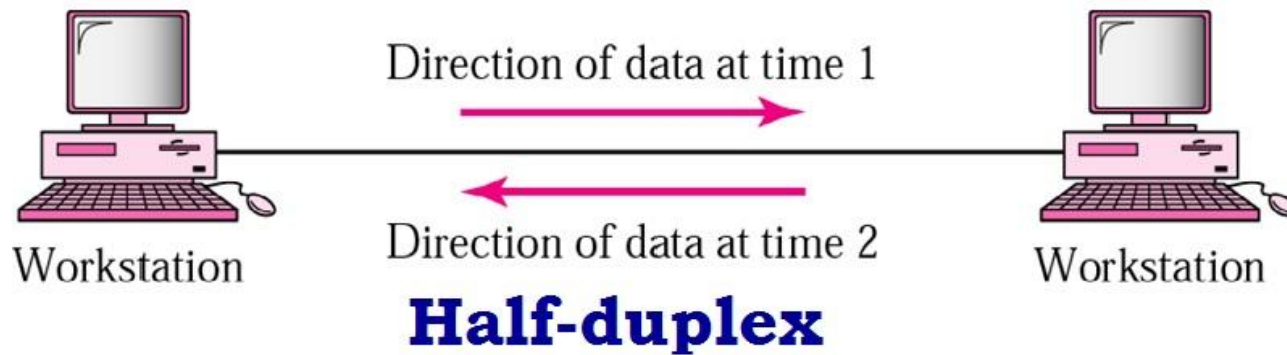
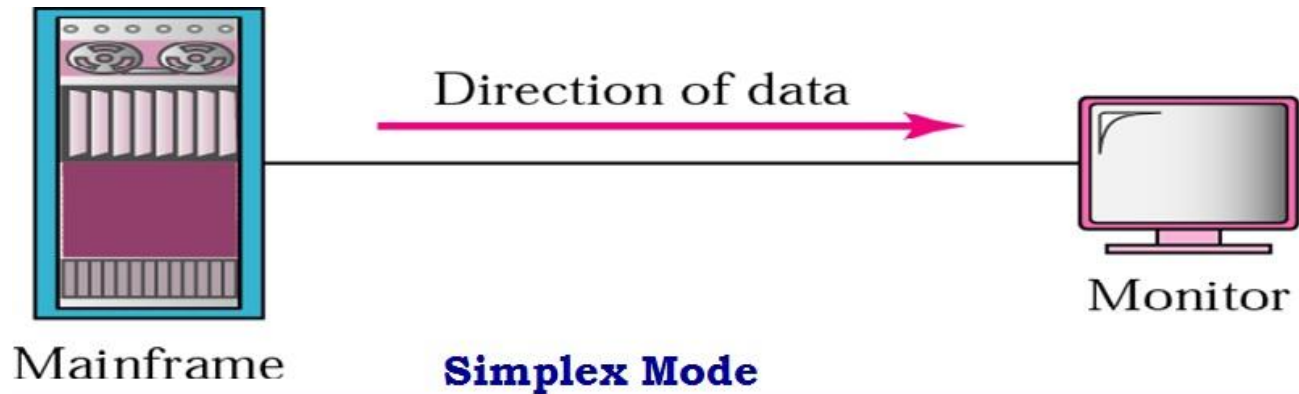
Main Components of Communication Systems

- **Communication Channels:** the medium that data travel through between transmitter and receiver.
 - **Wires and Cables:** communication channels that links network components using cables (twisted pair, coaxial cable, fiber optic)
 - **Wireless:** communication channels that links component using electromagnetic waves to transmit data through atmosphere (microwave, radio, satellite)



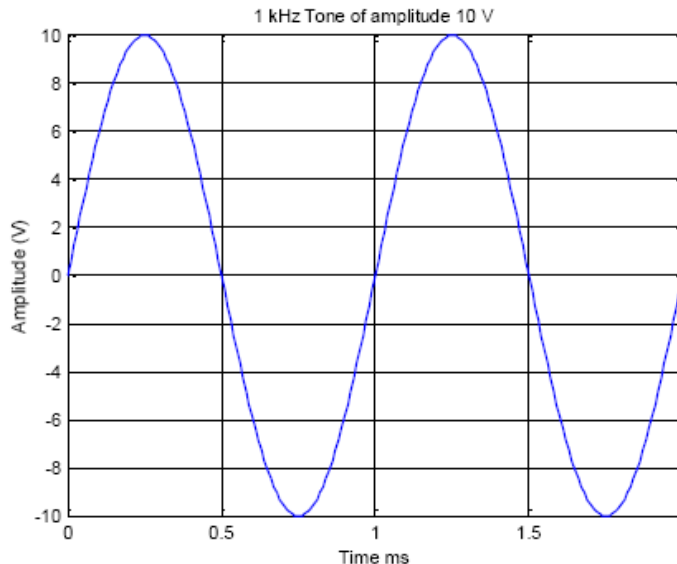
Main Components of Communication Systems

- **Transmission Protocol:**
 - **Simplex:** data transmission in only one direction (radio broadcasting, TV cable).
 - **Half duplex:** data transmission in one direction at a time (walky-talky).
 - **Full duplex:** data transmission in both directions simultaneously (في نفس الوقت) (telephone).



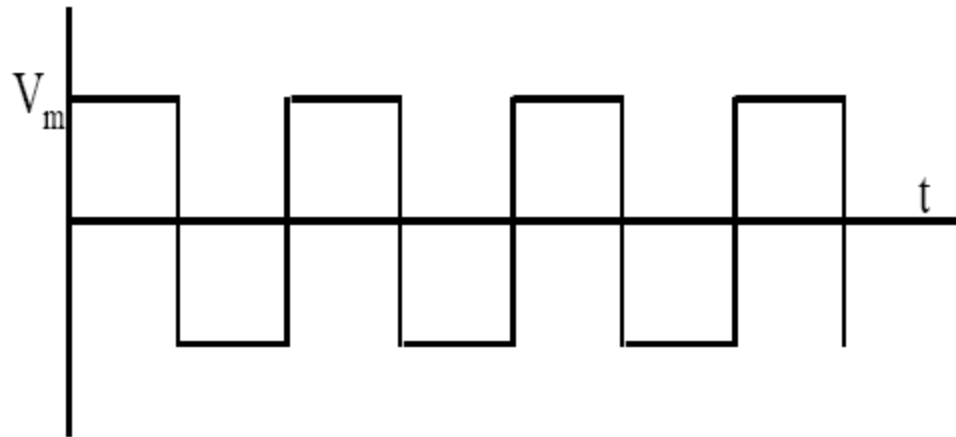
Main Components of Communication Systems

- **Signals Concept:** to transmit data from one station to another it has to be modulated to (signals) that can be transmitted through channels.
- **Analog Signals:** represent data with continuously varying electromagnetic waves



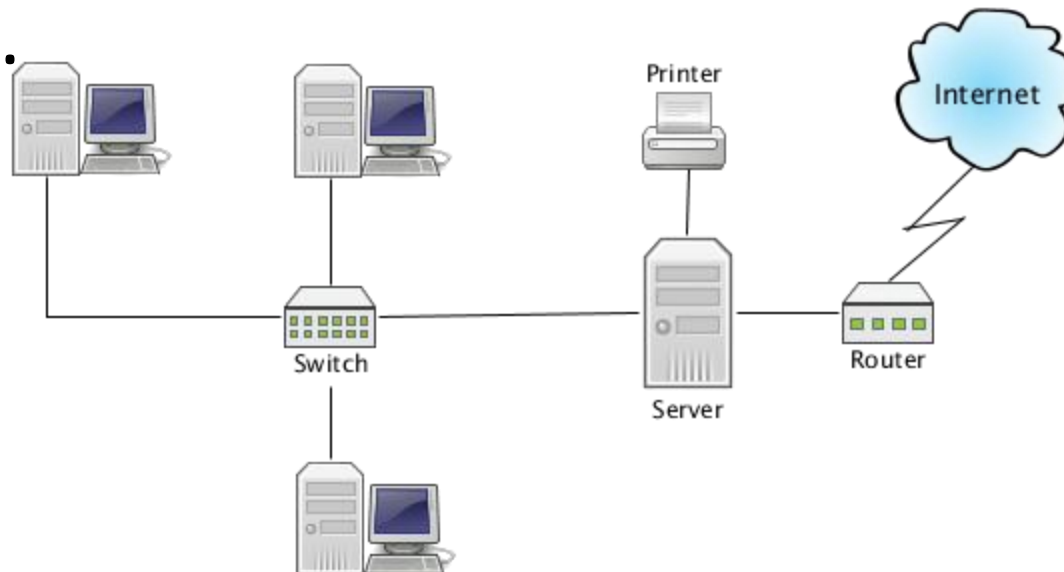
Main Components of Communication Systems

- **Digital Signals:** represent data with sequence of voltage pulses.



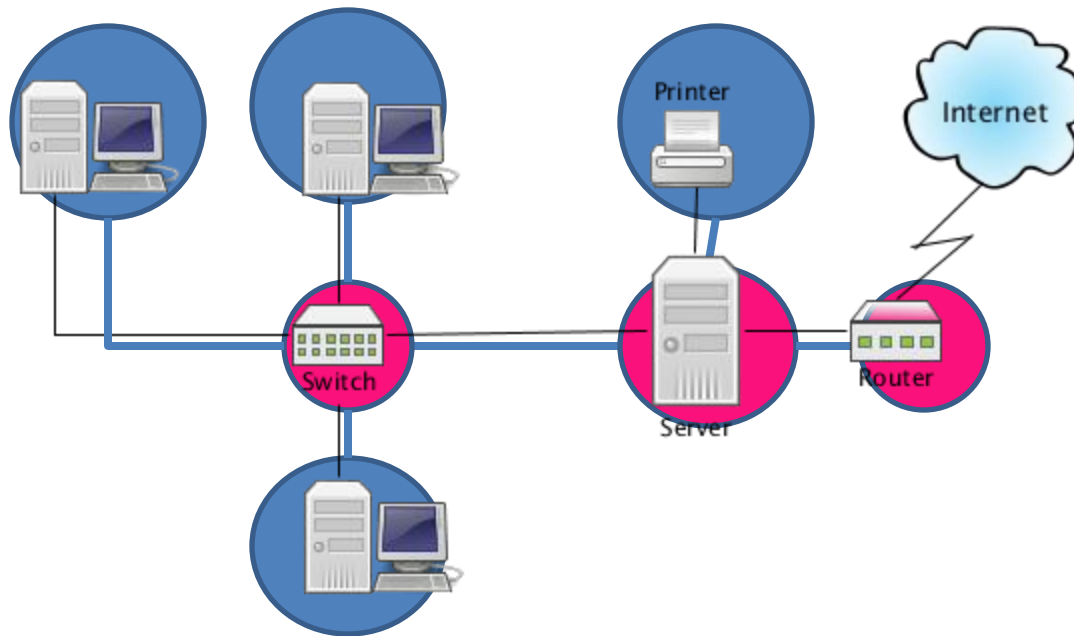
Understanding Communication Networks

- **Network:** is a set of devices (often referred as a node) connected by communication links.
- A node can be: any device can send or receive data computer, printer, router, or any other device.



Understanding Communication Networks

- Nodes:
 - **Terminal Node**: generate data, use data.
 - **Communications Node**: transmit data, doesn't use it

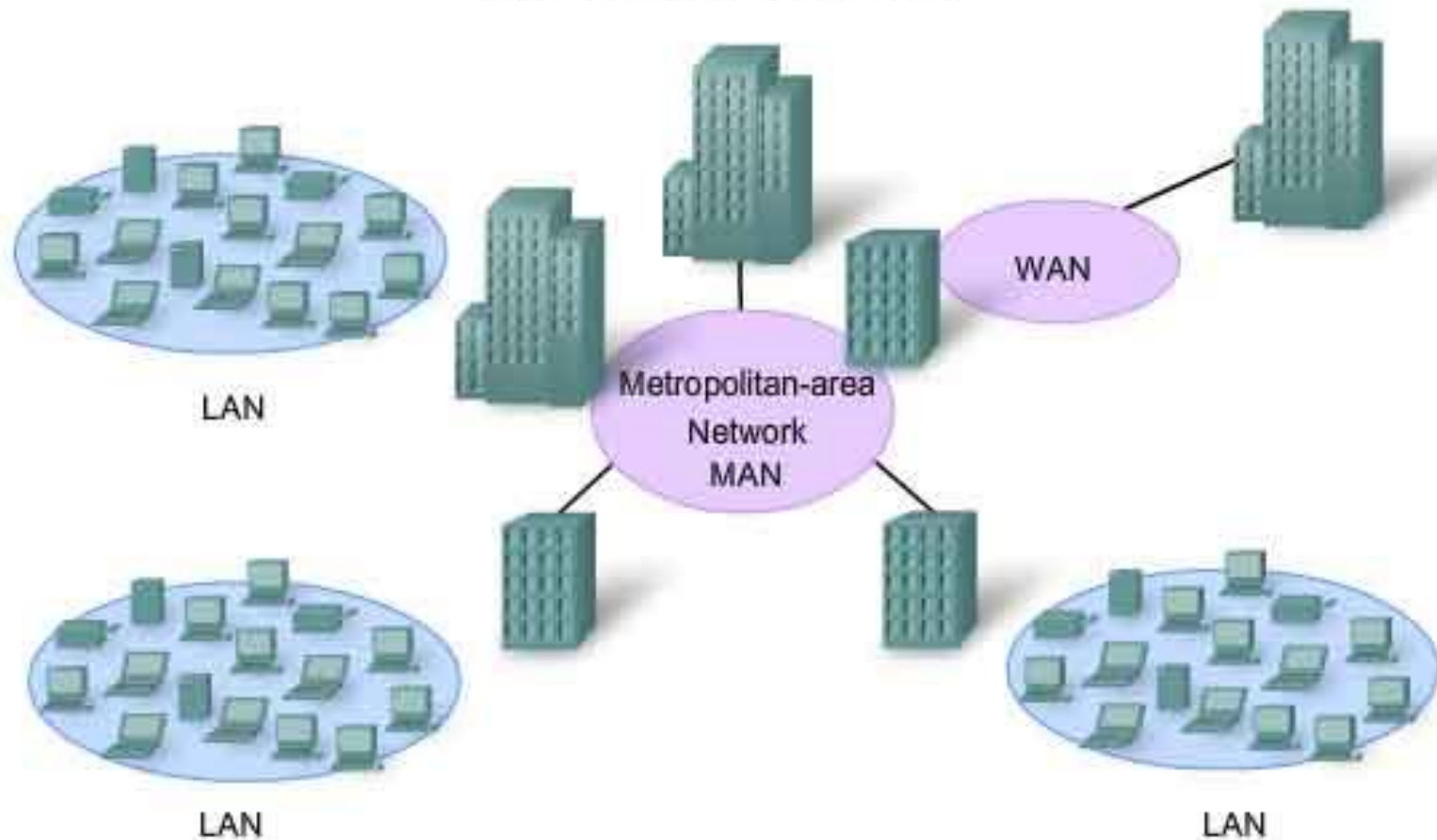


Categories of networks

- **Local Area Network(LAN):** private owned and links the devices in a single office, building or campus.
- **Wide Area Network(WAN):** provides long-distance transmission of data over large geographic area (country, continent, the whole world)
- **Metropolitan Area Network(MAN):** a network between the size of a LAN and a WAN.

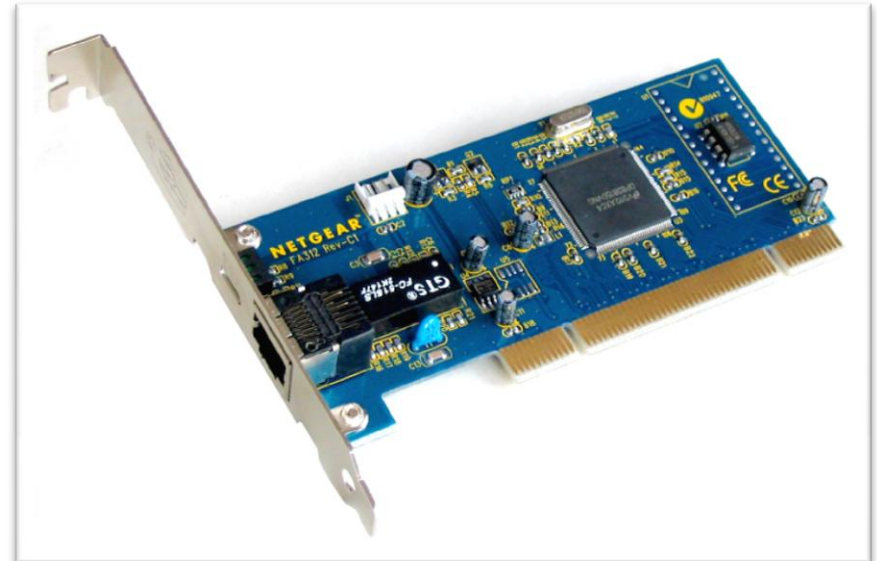
Gigabit Ethernet

Gigabit Ethernet technology is applied beyond the enterprise LAN to MAN and WAN-based networks.



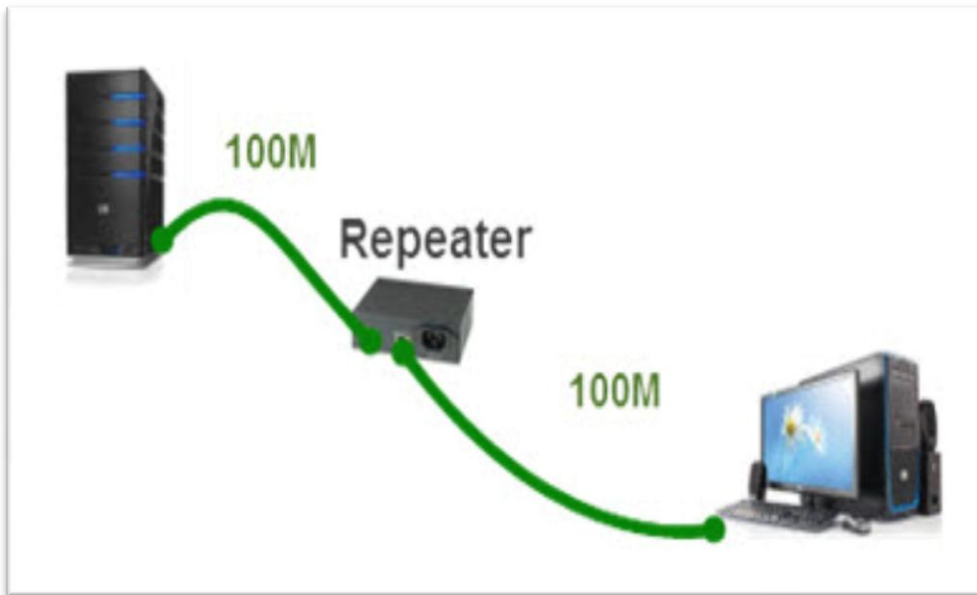
Hardware Components

- **Transmission Media:** the medium that data travel through between transmitter and receiver.
- **Access Device:**
 - prepare and transform data into electrical pulses that can transmit through transmission media.
 - send and receive data.
 - control data flow.
 - ex: Network Interface Card (NIC).



Hardware Components

- **Repeaters:** receive a network signal and regenerate and retransmit the signal as it is in its original strength.

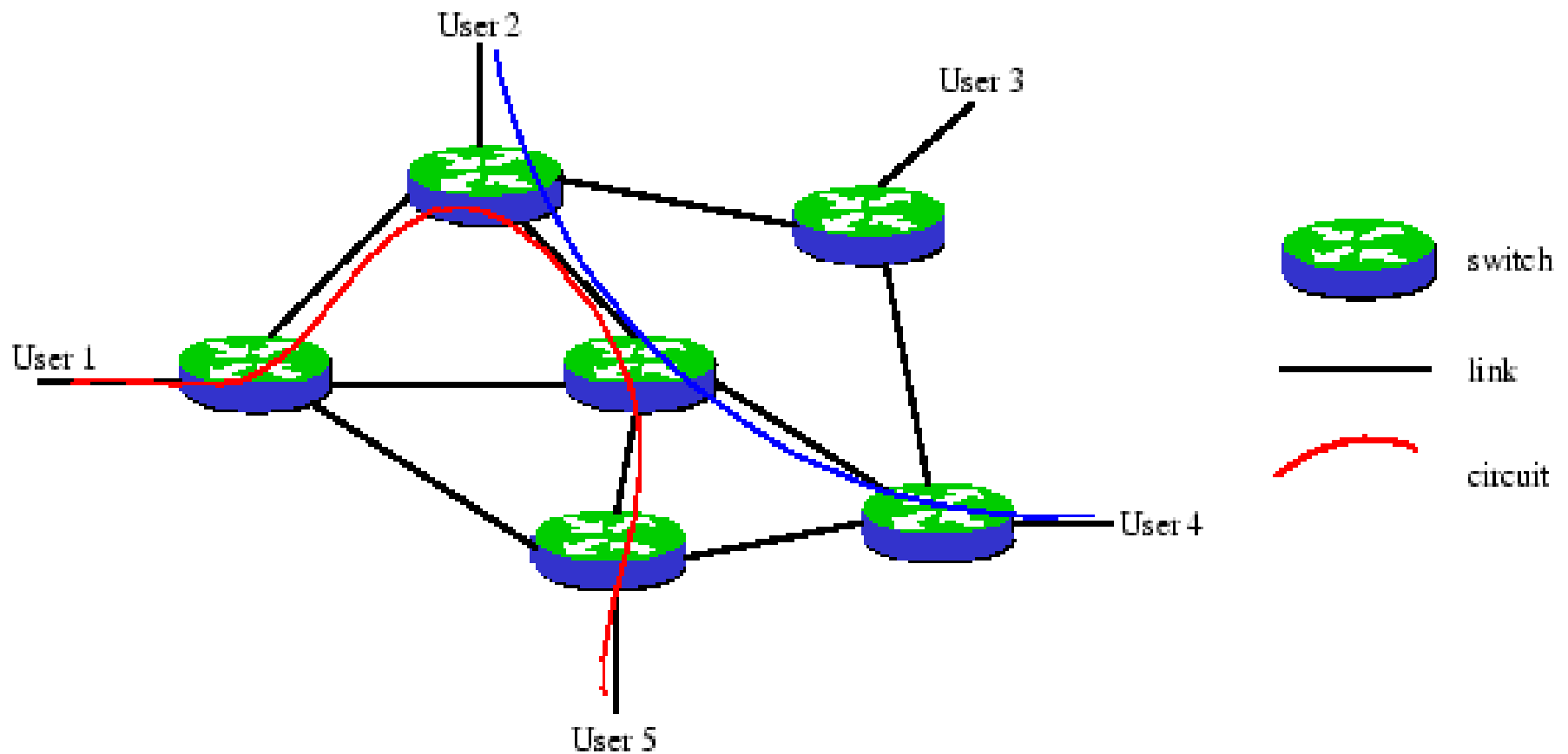


Software Components

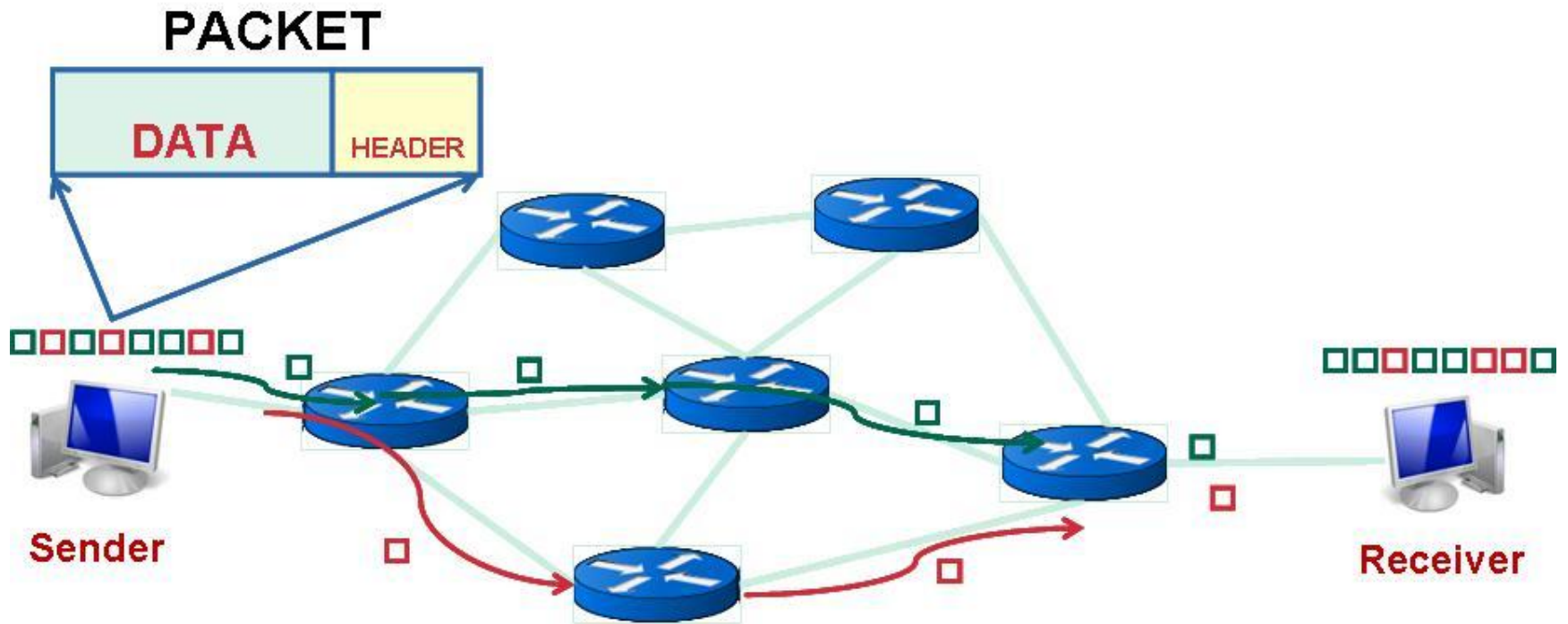
- **Protocols:** is a system of digital rules for message exchange within or between network devices.
- **Network Operating System:** software allow the connection between network and devices enable users to connect each other, share resources, in addition of manage and control the network components.
 - Ex: Microsoft windows, Unix

Network Functions

1. **Switching:** receive data from any source connected to it and dispatch that data to the appropriate destination through multiple channels.
 - **Circuit switching technique:** consists of set of switches connected by physical links.
 - **Packet switching technique:** message is broken into a number of parts which are sent independently, and reassembled at the destination.



Circuit switching



Packet switching

Network Functions

2. **Routing:** selecting best paths in a network the data travel through from transmitter to receiver.
3. **Addressing:**
 - IP address for each device
4. **Multiplexing:** integrates multiple signals into a signal transmitted over a shared medium.

Network Functions

5. Network Management:

- Configuration Management
- Performance Management
- Fault Management
- Accounting Management
- Security Management

Network Functions

6. Other Network Functions

- Error Detecting and Correction
- Flow Control
- Congestion Control

The End