

Lectures series in

# CCNA Routing & Switching I

2nd Year 2nd Semister

By

*Dr. Eng. Ehab Helmy Mohamed El Shazly*

## Course Outline is as follows:

The course is broken down into modules:

Module 0: Introduction to networks

Module 1: Network strategies.

Module 2: OSI model and TCP/IP.

Module 3: Application layer, presentation layer and session layer.

Module 4: Transport layer.

Module 5: Network Layer.

Module 6: IP Subnetting.

Module 7: Data Link Layer

Module 8: Physical layer

## **LO1 Understand the principals to build simple LAN.**

Determine the network components

Explore the ways of transmitting data

Identify the types of networks

Differentiate between internet, intranet and extranet

Explain network strategies

Identify the ways of message delivery

## **LO2 Understand the functions of application layer and transport layer.**

Explore the layers of OSI and TCP/IP models

Explain the function of application layer, presentation layer, session layer, and transport layer.

Differentiate between well-known application layer protocols and services

Differentiate between transport layer protocols

Explain the operation of transport layer protocols and the applications that use them.

## **LO3 Understand the functions of network layer and addressing schemes.**

Explain the function of network layer

Define the IP address classes and subnets

Design an IP addressing scheme to provide network connectivity for a small to medium-sized business network using the subnetting.

## **LO4 Understand the functions of data link layer and physical layer.**

Define MAC address and Ethernet protocol.

Explain function of data link layer and physical layer

Differentiate between switch forwarding methods

Explain physical layer characteristics

Identify the network media types

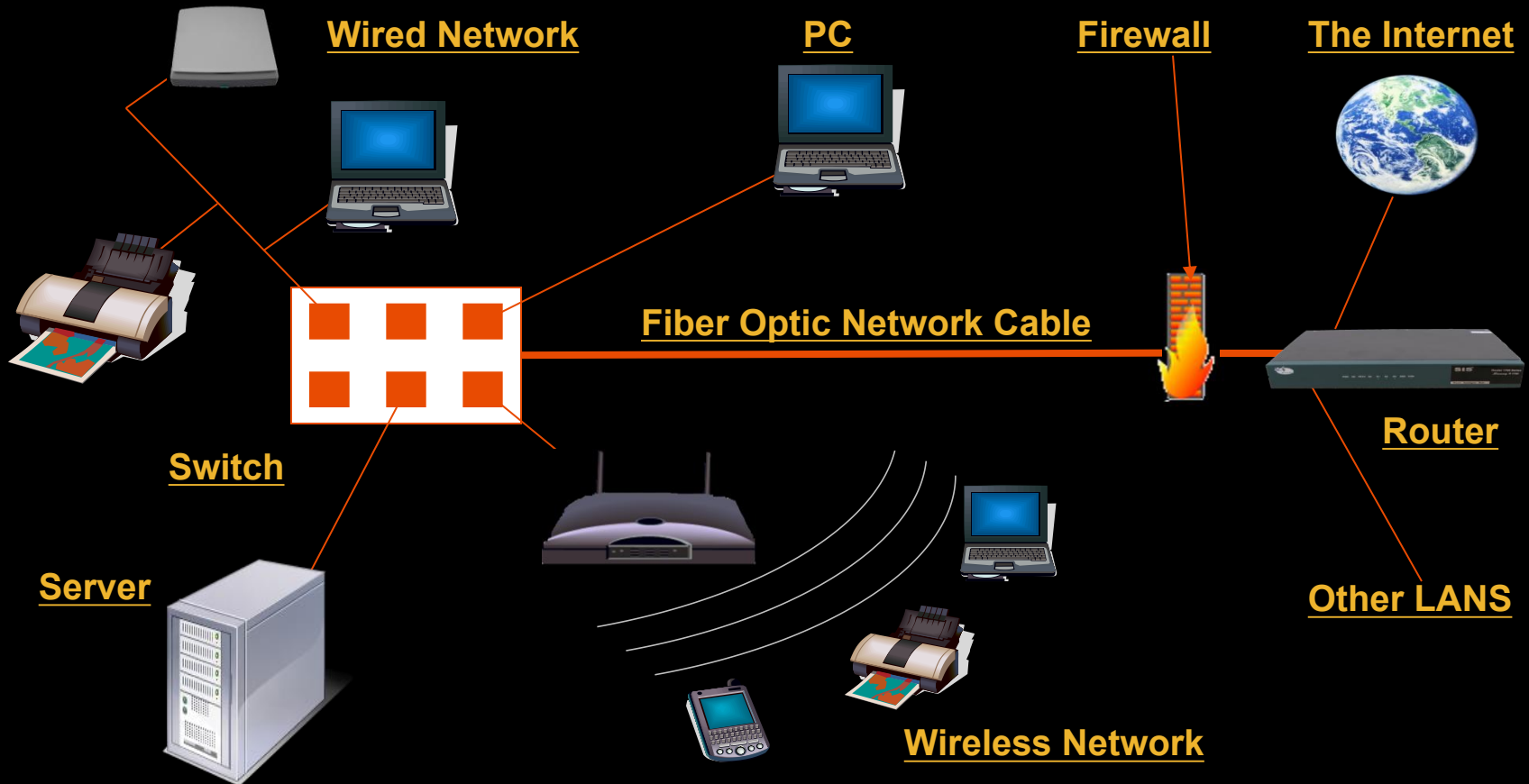
Illustrate the media access control method

# The Computer Network

- A **computer network** is a group of computers/devices(**Nodes**) that use a set of common communication **protocols** over digital **interconnections** for the purpose of sharing resources located on or provided by the network nodes.
- The **nodes** of a computer network may include personal computers, servers, networking hardware, or other specialised or general-purpose hosts.
- The **interconnections** between **nodes** are formed from a broad spectrum of telecommunication network technologies, based on physically wired, optical, and wireless technologies.
- A **communication protocol** is a set of rules for exchanging information over a network.

# The Network Diagram

(Click on the Words Below and Learn More About Each Component)



# The Advantages/Uses of Network

## Simultaneous Access

- There are moments in any business when several workers may need to use the same data at the same time.

## Shared Peripheral Devices

## Personal Communications

- Videoconferencing
- Voice over Internet Protocol (VoIP):-VoIP transmits the sound of voice over a computer network using the Internet Protocol (IP ) rather than sending the signal over traditional phone wires

## Easier Data Backup



# **The Networking Devices(Nodes)**

1. NIC Card
2. Repeater
3. Hub
4. Switch
5. Bridge
6. Router
7. Gateway
8. Firewall

# 1. Network Interface Card

- NIC is used to physically connect host devices to the network media.
- A NIC is a printed circuit board that fits into the expansion slot of a bus on a computer motherboard.
- It can also be a peripheral device. NICs are sometimes called network adapters.
- Each NIC is identified by a unique code called a Media Access Control (MAC) address.
- This address is used to control data communication for the host on the network.



## 2. Repeaters

- A repeater is a network device used to regenerate a signal.
- Repeaters regenerate analog or digital signals that are distorted by transmission loss due to attenuation.
- A repeater does not make an intelligent decision concerning forwarding packets



# 3. Hubs

- Hubs concentrate on connections.
- In other words, they take a group of hosts and allow the network to see them as a single unit. This is done passively, without any other effect on the data transmission.
- Active hubs concentrate hosts and also regenerate signals.

100BaseT Hub

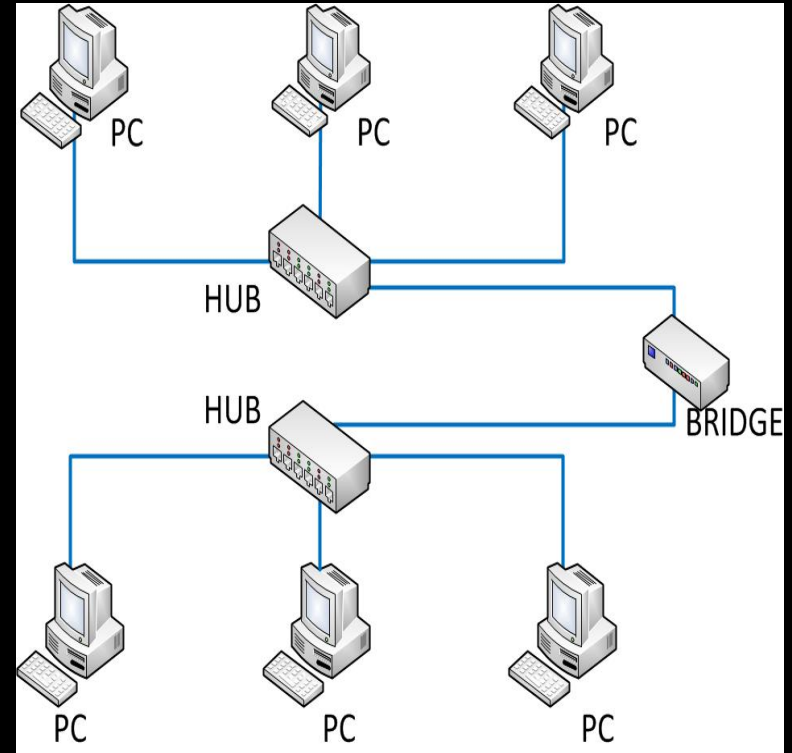


10BaseT Hub



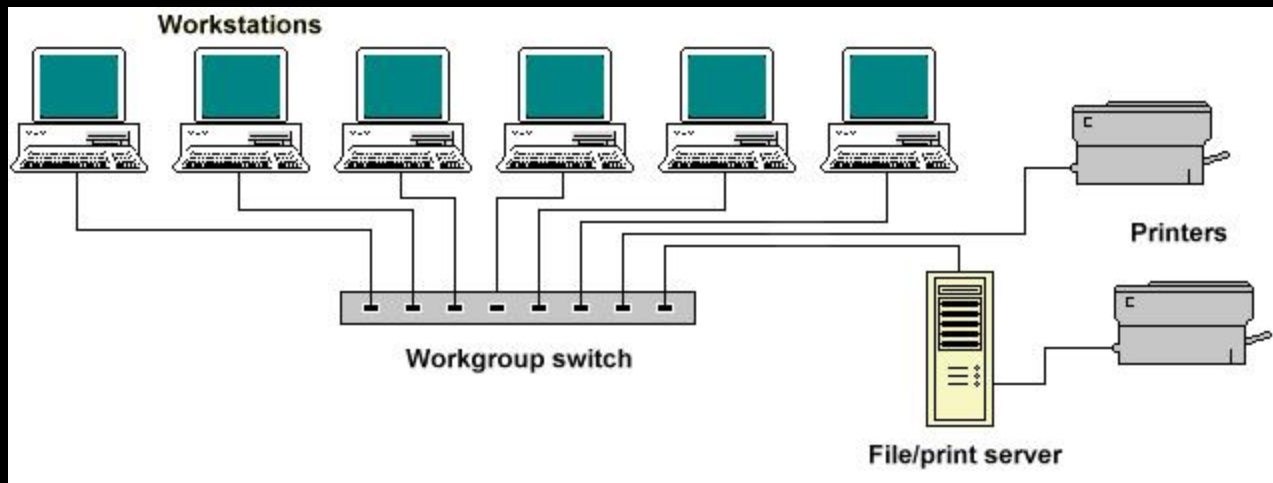
# 4. Bridges

- Bridges convert network data formats and perform basic data transmission management.
- Bridges provide connections between LANs.
- They also check data to determine if it should cross the bridge. This makes each part of the network more efficient



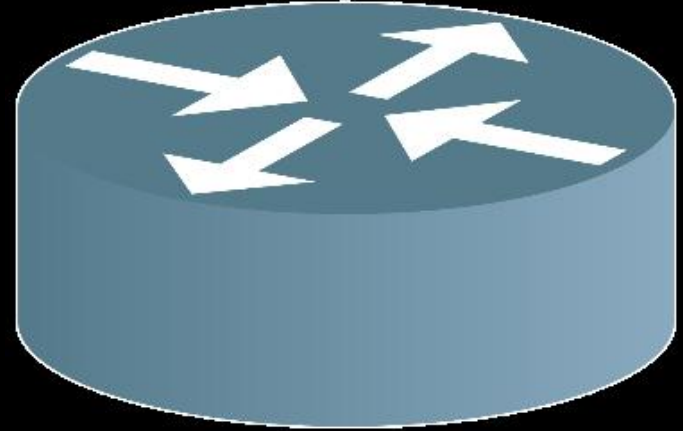
# 5. Switches

- Switches add more intelligence to data transfer management.
- They can determine if data should remain on a LAN and transfer data only to the connection that needs it.
- Another difference between a bridge and switch is that a switch does not convert data transmission formats



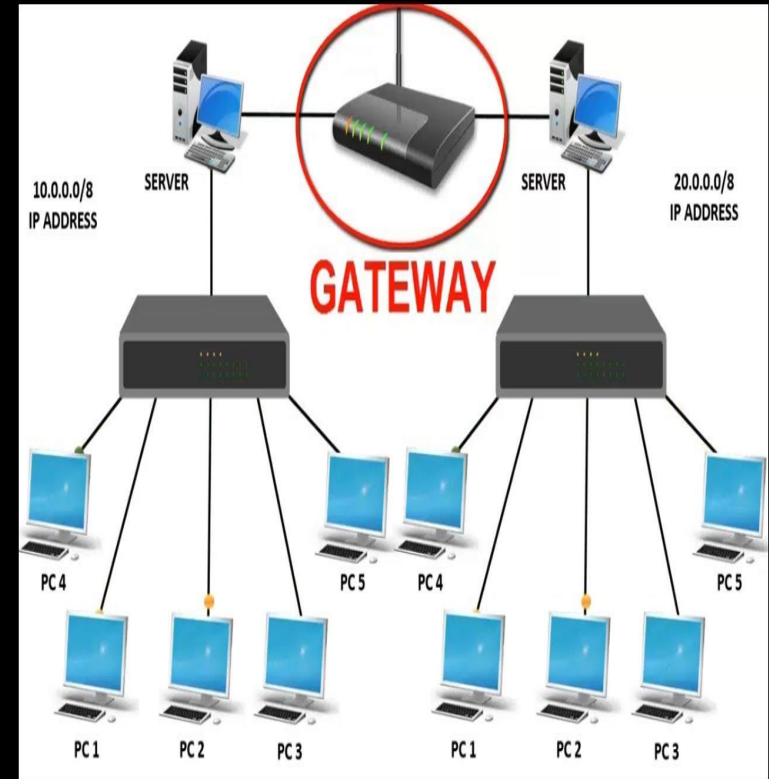
## 6. Routers

- Routers have all the capabilities listed above.
- Routers can regenerate signals, concentrate multiple connections, convert data transmission formats, and manage data transfers.
- They can also connect to a WAN, which allows them to connect LANs that are separated by great distances.



# 7. Gateway

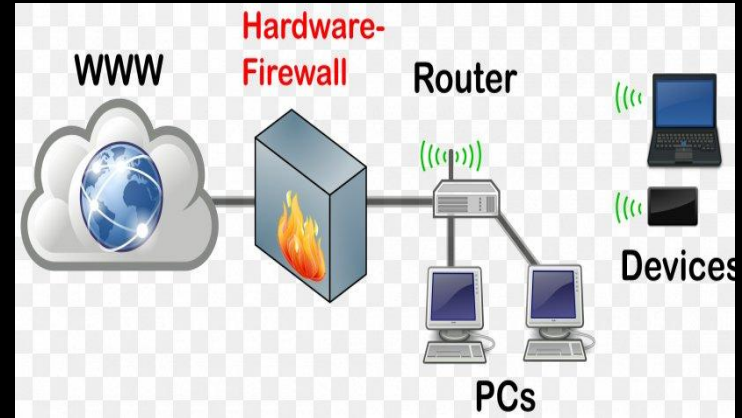
- A **gateway** is a piece of networking hardware used in telecommunications for telecommunications networks that allows data to flow from one discrete network to another.
- Gateways are distinct from routers or switches in that they communicate using more than one protocol to connect a bunch of networks





## 8. Firewall

- A firewall is a network device or software for controlling network security and access rules.
- Firewalls are inserted in connections between secure internal networks and potentially insecure external networks such as the Internet.
- Firewalls are typically configured to reject access requests from unrecognized sources while allowing actions from recognized ones.
- The vital role firewalls play in network security grows in parallel with the constant increase in cyber attacks.



# Network Media

The function of the media is to carry a flow of information through a LAN.

A. Wired Media:- widely adopted *family* that uses copper and fiber media in local area network (LAN) technology are collectively known as Ethernet

1. Copper Cable

- a. Coaxial Cables
- b. Shielded Twisted Pair(STP)
- c. Unshielded Twisted Pair

2. Fibre Optic Cable

B. Wireless Media:- use the atmosphere, or space, as the medium.

# 1. Copper Cable

- The most common, easiest, quickest, and cheapest form of network media to install.
- The disadvantage of sending data over copper wire is that the further the signal travels, the weaker it becomes.

10BASE5 - "Thicknet"



10BASE2 - "Thinnet"

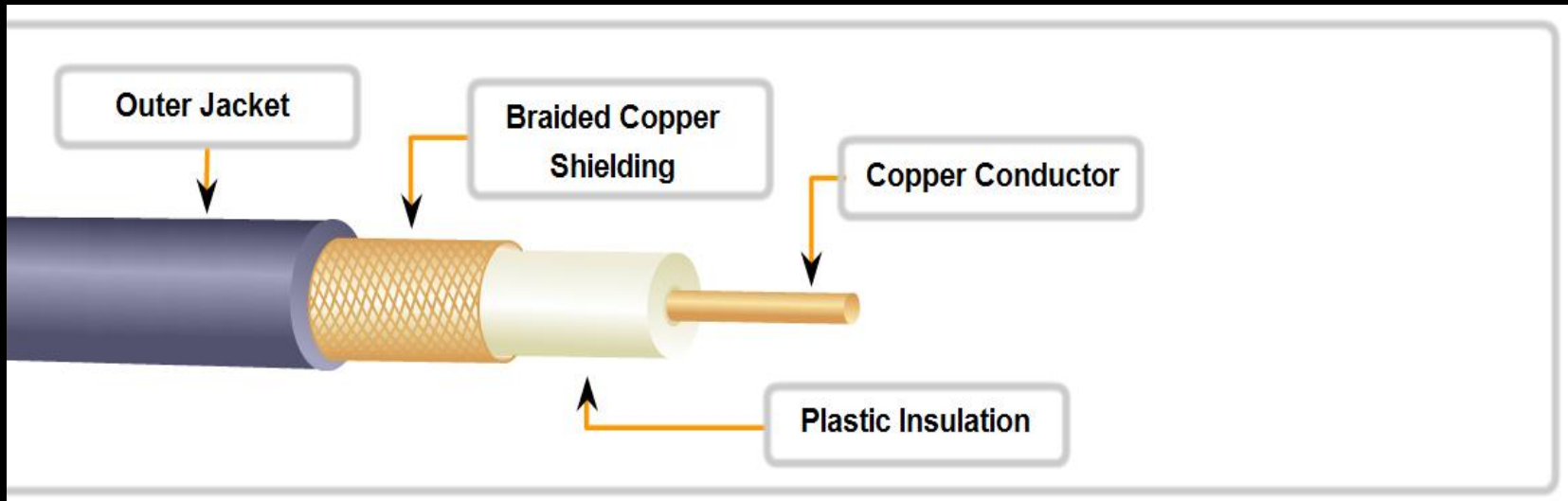


10BASE-T



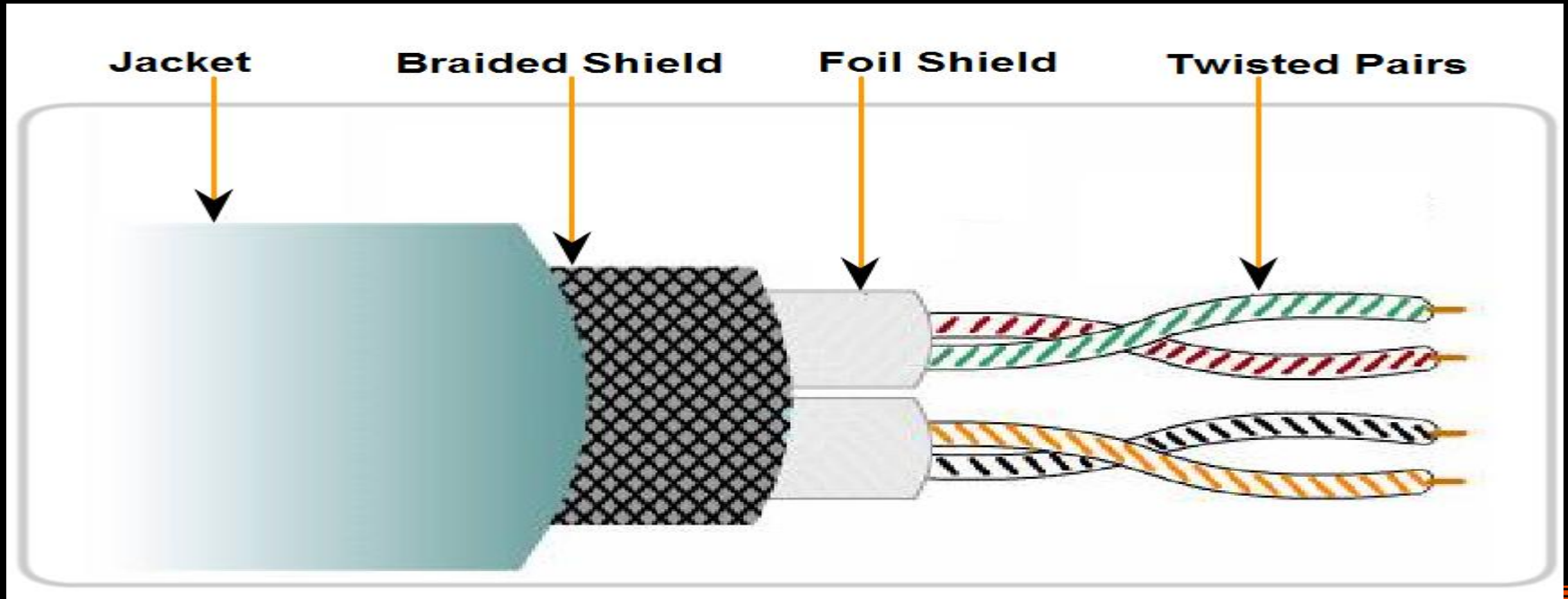
## a. Coaxial Cable

- It can be run longer distances than Twisted pair Cables.
- Speed: 10-100Mbps
- Cost: Inexpensive
- Media and connector size: Medium
- Maximum cable length: 500m



## b. Shielded Twisted Pair(STP)

- Speed: 0-100Mbps
- Cost: Moderate
- Media and connector size: Medium to large
- Maximum cable length: 100m



## c. Unshielded Twisted Pair

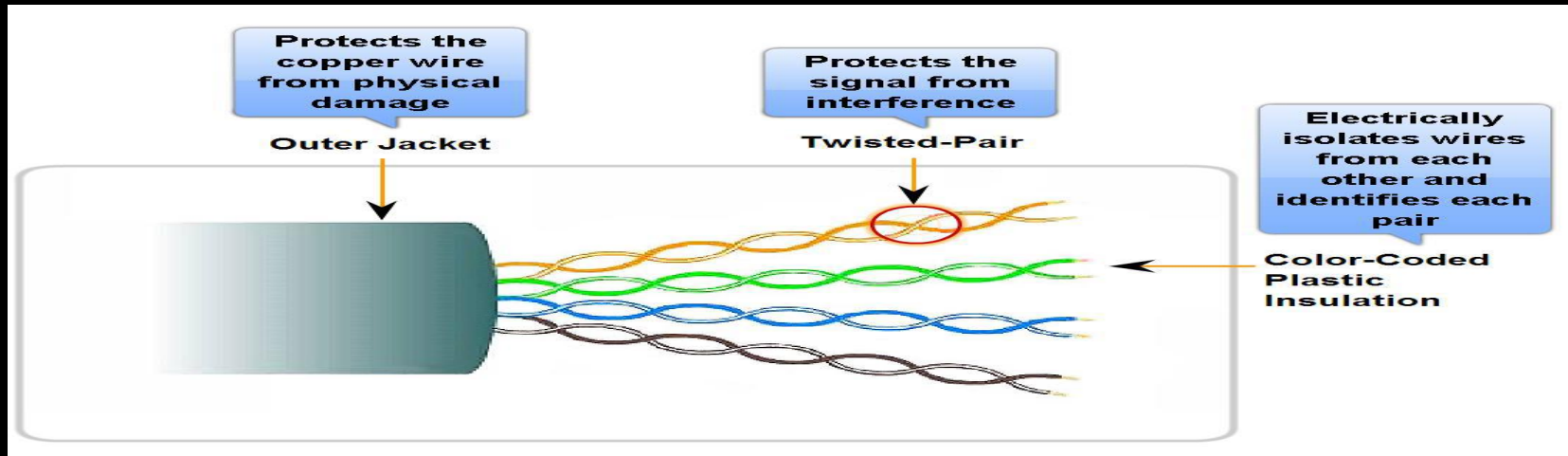
- UTP is a four-pair wire medium used in a variety of networks.
- Each of the eight copper wires in the UTP cable is covered by insulating material

Speed: 10-100-1000 Mbps\*

Cost: Least Expensive

Media and connector size: Small

Maximum cable length: 100m \* (Depending on the quality/category of cable)



# UTP Implementation

- EIA/TIA specifies an RJ-45 connector for UTP cable.
- The letters RJ stand for registered jack.



# Fiber Optic Cable

- Glass fiber carrying light pulses, each pulse a bit.
- Based on the Total Internal Reflection of Light.
- High-speed point-to-point transmission 10-100's Gbps
- low error rate:
  - repeaters spaced far apart
  - immune to electromagnetic noise

