TAIBAH UNIVERSITY

College of Computer Science and Engineering

Computer Engineering Department

COE332
Computer Networks
Student's Lab Manual
V7

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Lab01

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Section: C8C **Group:**

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Lab-1: Networking Fundamentals

Objectives

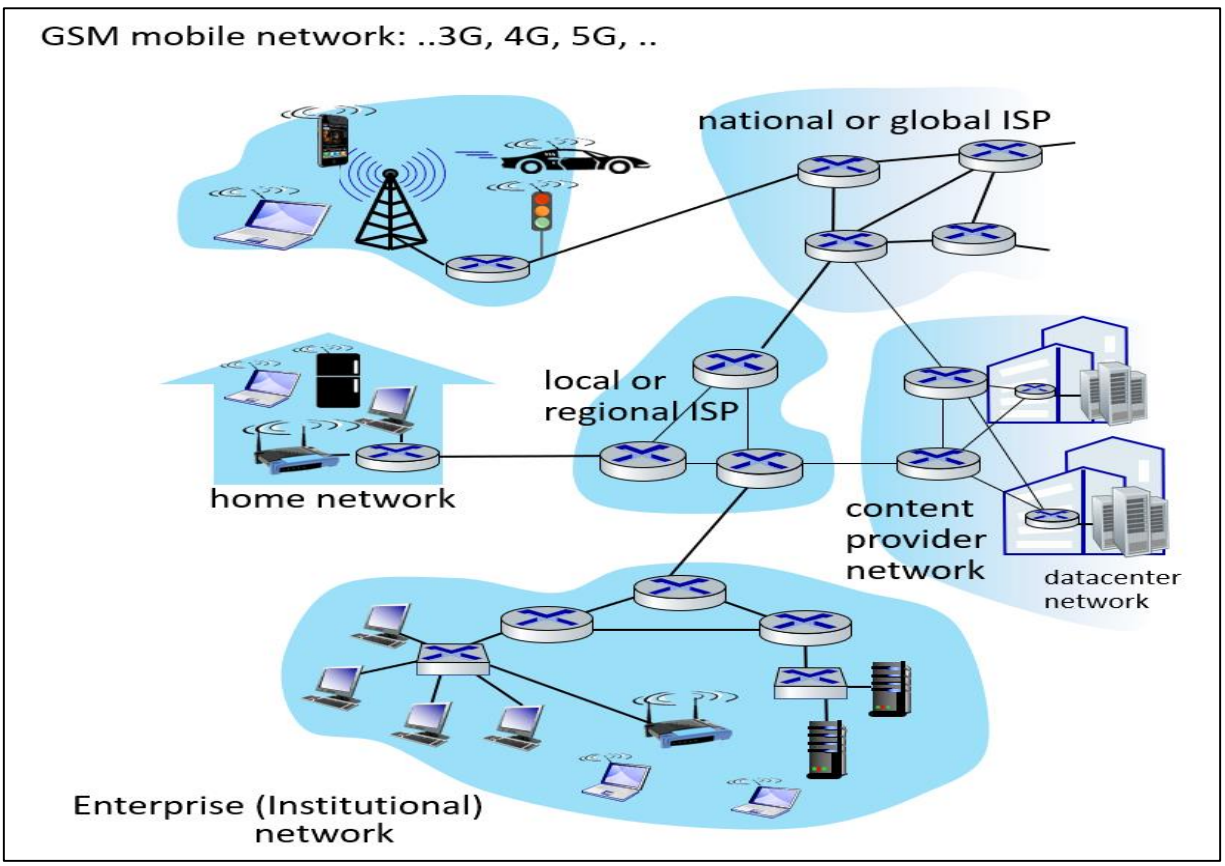
- To familiarize students with types of networks & networks topologies
- To introduce students with different cables types used in networking.
- To make students familiar with various networking components such as hub, switch, router and firewall
-

Requirements

- Different network cables (UTP, Coaxial, Fiber).
- Hub
- Switch
- Router

What is a Network?

• A network refers to two or more connected computers that can share resources such as data, a printer, an Internet connection, applications, or a combination of these resources.



Types of Networks

1) Local Area Network (LAN)

LAN networks connect computers together over relatively small distances, such as within a single building or within a small group of buildings.

2) Backbone Networks (BN)

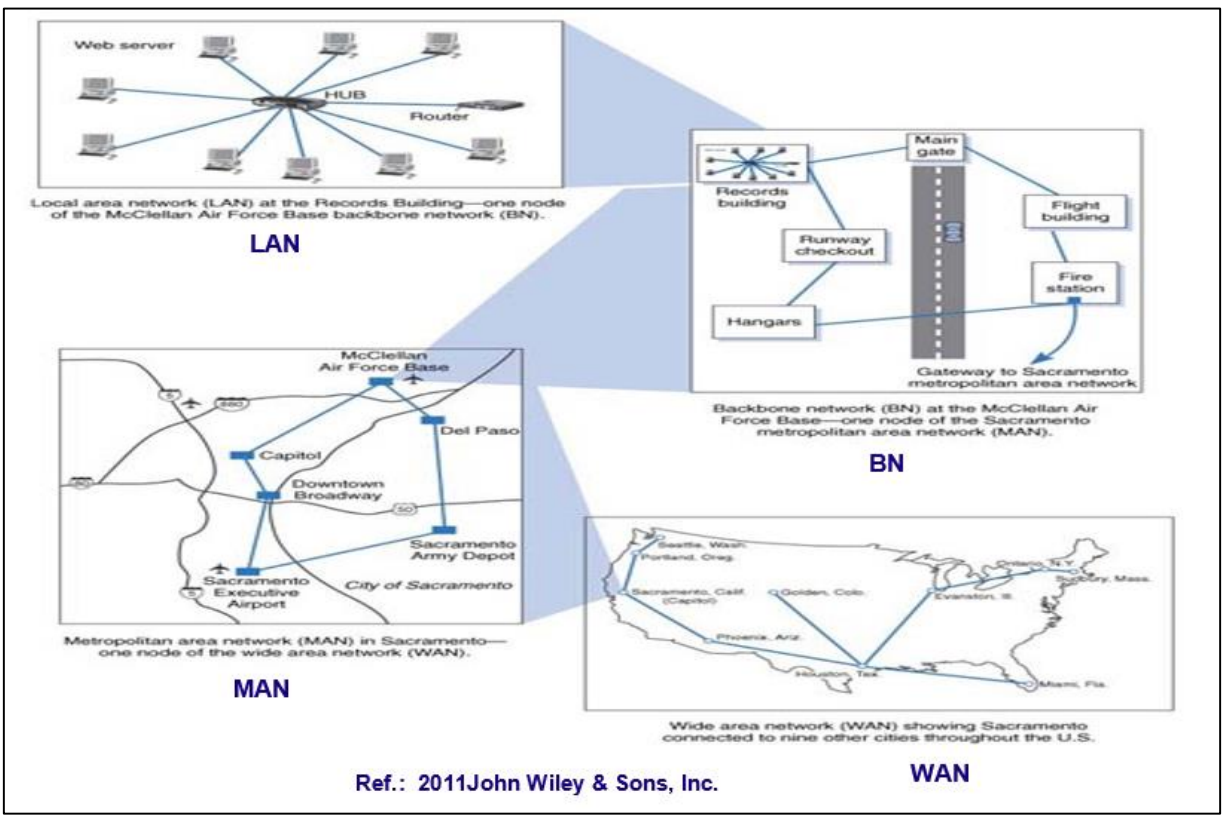
a high-speed backbone linking together organizational LANs at various locations.

3) Wide Area Network (WAN)

WAN networks connect computers together over large physical distances, remotely connecting them over one huge network and allowing them to communicate even when far apart.

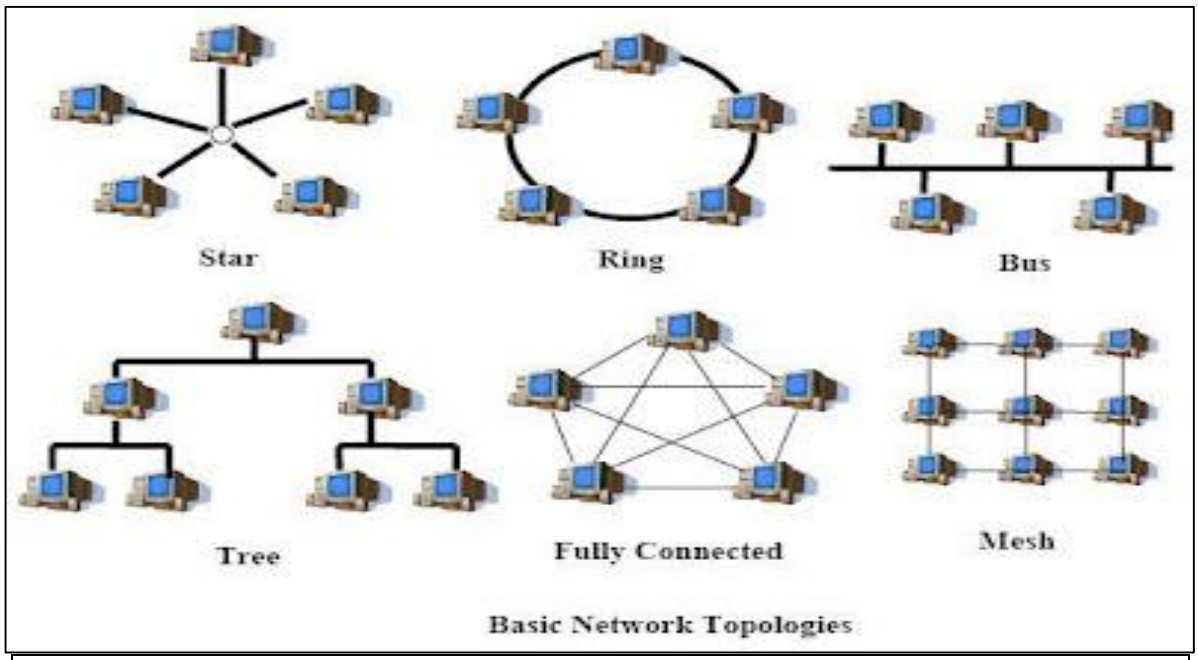
4) Metropolitan Area Network (MAN)

This is a network which is larger than a LAN but smaller than a WAN, and incorporates elements of both. It typically spans a town or city and is owned by a single person or company, such as a local council or a large company.



Network Topologies:

Network topology refers to the physical or logical layout of a network. It defines the way different nodes are placed and interconnected with each other. Alternately, network topology may describe how the data is transferred between these nodes. The following are the main network topologies.



http://3.bp.blogspot.com/_fg5Ns8EgpAY/SRmnQny9HRI/AAAAAAAAACU/8moCUmVpLFI/s400/net+topology.jpg

Network Components

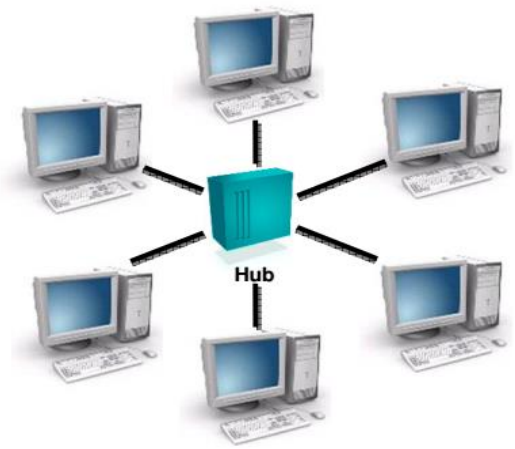
This section presents some of the components used in networks.

- ## Network Interface Card

A network interface controller (NIC, also known as a network interface card, network adapter, LAN adapter or physical network interface) is a computer hardware component that connects a computer to a computer network.

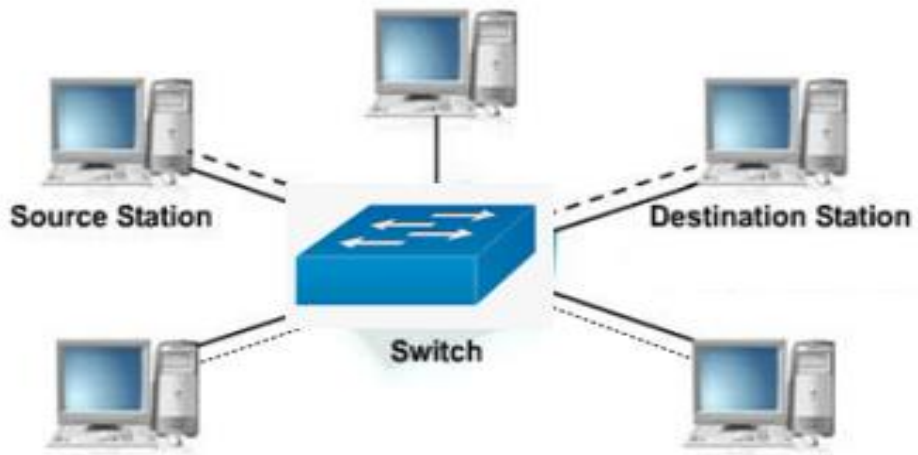
- **Hub**

A hub (concentrator) is a device that repeats the signals it receives on one port to all other ports. It is a central connection point for several network devices.



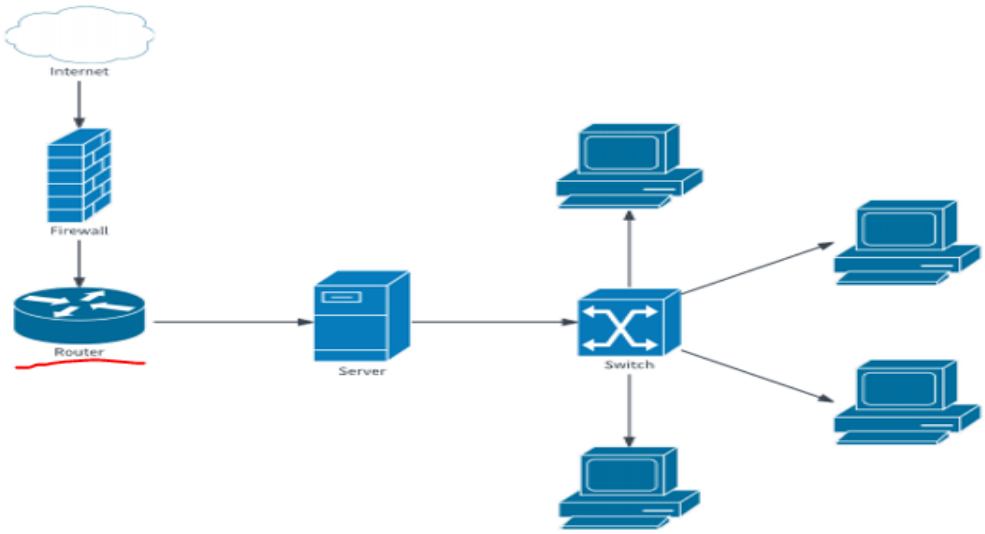
- **Switch**

When a switch receives data the switch examines the data link header for the MAC address of the destination station and forwards it to the correct port. This opens a path between ports that can use the full bandwidth of the topology.



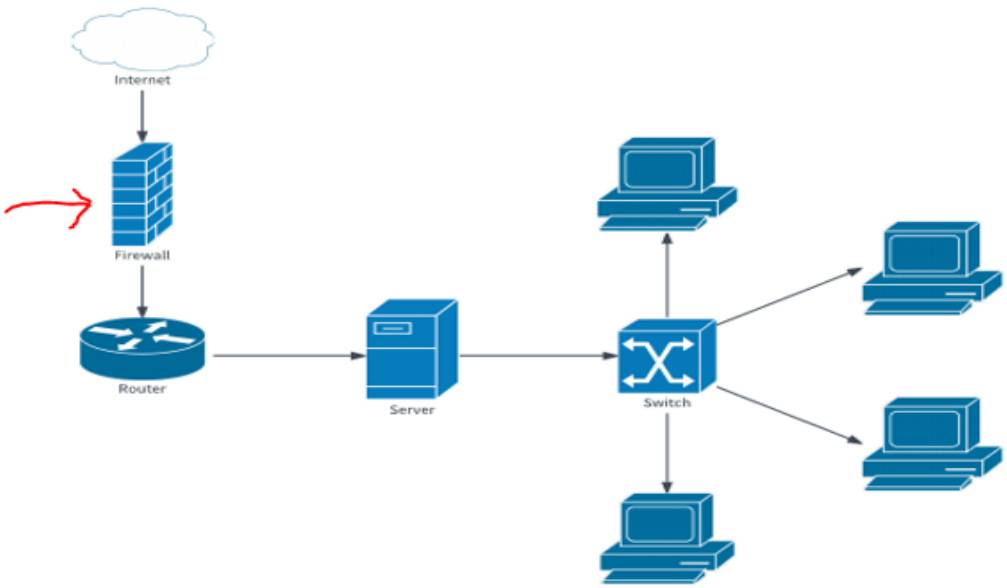
- **Router (Gateway)**

A gateway is a combination of hardware and software that connects dissimilar network environments.



- **Firewall**

A firewall is a system or group of systems that manages access between two or more networks



Physical Media Types

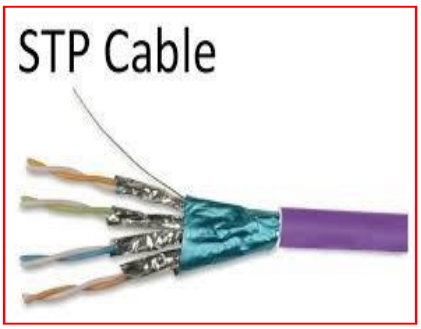
Network media is the actual path over which an electrical signal travels as it moves from one component to another.

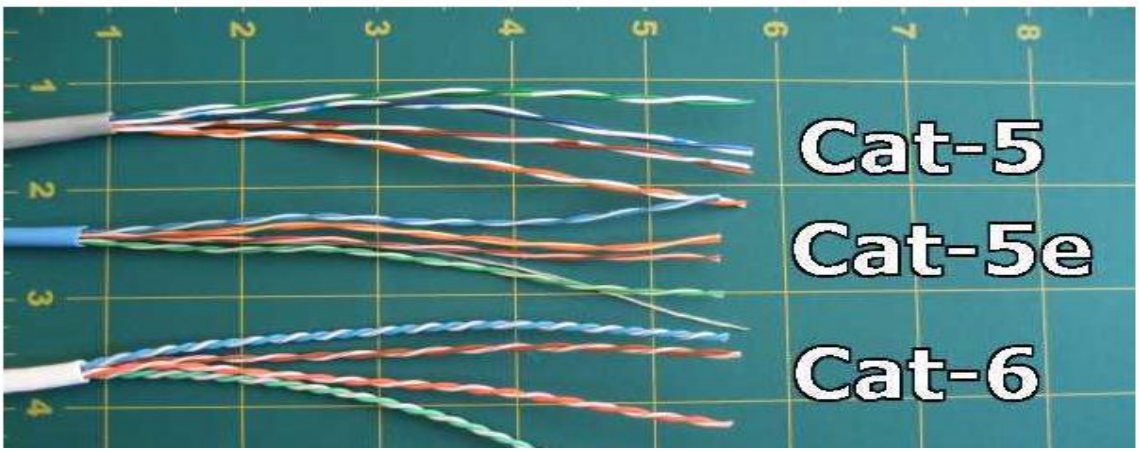
1) Twisted Pair (TP)

****Twisted Pair (TP) Wires**

- Commonly used for telephones and LANs
- Reduced electromagnetic interference
  - Via twisting two wires together
    (Usually several twists per inch)
- TP cables have a number of pairs of wires
  - Telephone lines:
    - two pairs (4 wires, usually only one pair is used by the telephone).
  - LAN cables:
    - 4 pairs (8 wires)
    - Cat 5, cat 6, cat 7
- TP: STP and UTP
  - STP: Shielded twisted pair also exists, but is more expensive
  - UTP: Un -shielded twisted pair
- TP Also used in telephone trunk lines (up to several thousand pairs)

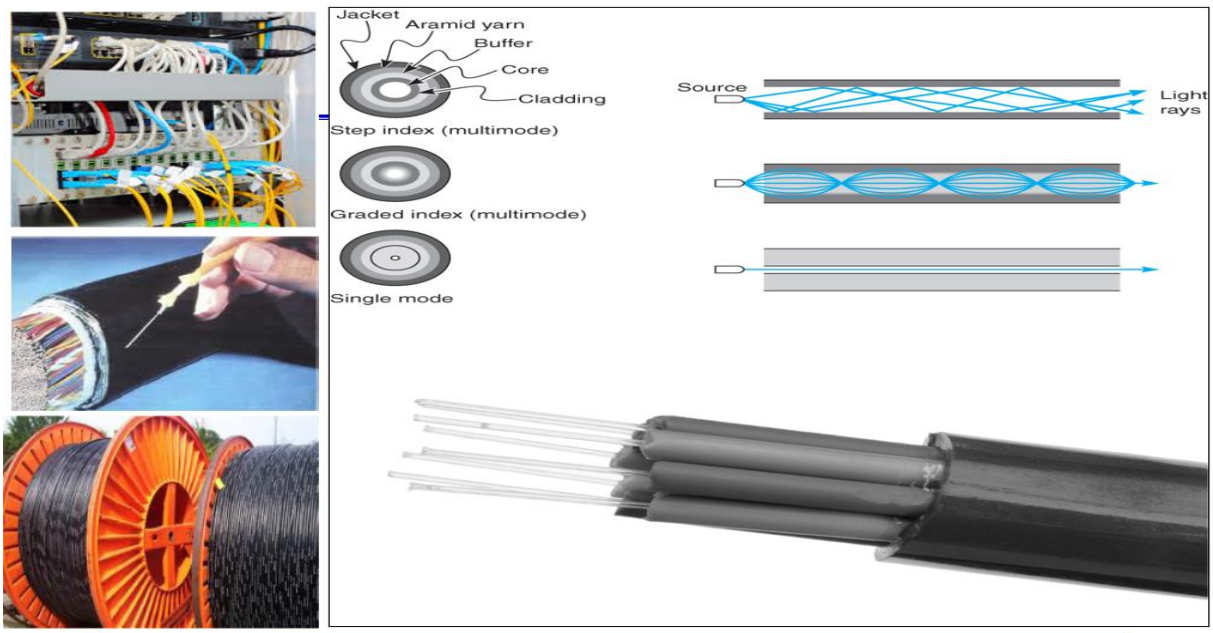
UTP Cable





2) Coaxial

3) Fiber optics



4) Wireless

a. Examples: WIFI, Satellites, Bluetooth, GSM: 3G, 4G, 5G, …), Infra-Red (IR), TV, Radio, …

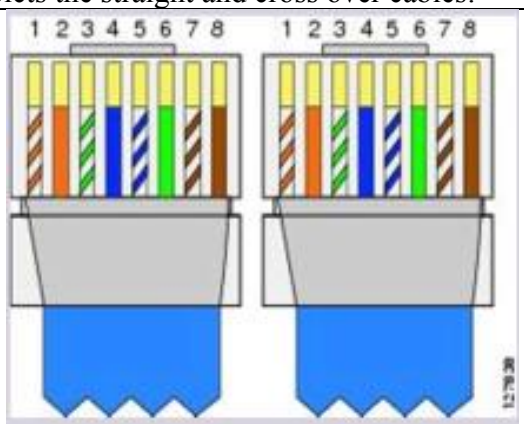
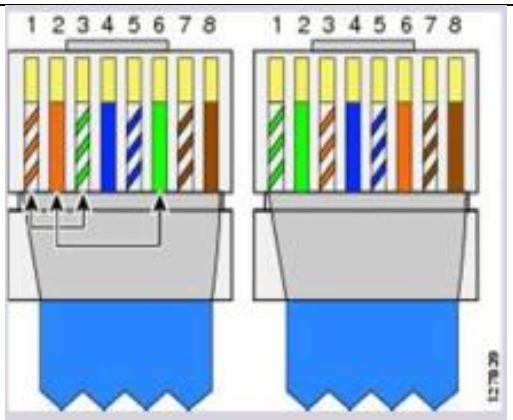
Physical Media Comparison

	Twisted Pair (TP)	Coaxial	Fiber Optic	Wireless LAN (WIFI)	Other Media
Transmission Rate (~ Bandwidth)	**Up to 1 Gbps**	**10–100 Mbps**	**Up to 10 Gbps or higher**	**Up to 54 Mbps**	**?**
Distance	**Up to 100 m**	**Up to 500 m**	**Up to 60 km**	**Up to 100 m**	**?**
Price	**Least expensive**	**Inexpensive**	**expensive Most**	**Moderate**	**?**

Ethernet Interface

Types

Also called the LAN interface. Types: Straight or Cross Over Cable. Straight Cable is used for communication between different devices (e.g., switch and workstation). Cross Over cable is used to connect similar devices (e.g., routers and workstation or two workstations). The following depicts the straight and cross over cables:

	
Straight cable	**Cross-over Cable**

Which Cable Do I Need?

The table below helps you determine which type of cable you need for your setu

	Hub	Switch	Router	Workstation
Hub	Crossover	Crossover	Straight	Straight
Switch	Crossover	Crossover	Straight	Straight
Router	Straight	Straight	Crossover	Crossover
Workstation	Straight	Straight	Crossover	Crossover

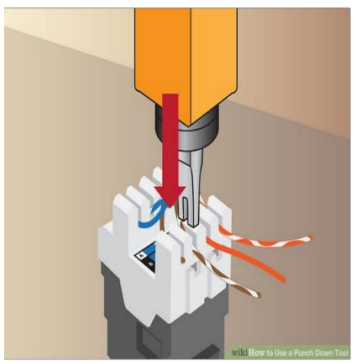
Network Cabling: 1) Twisted Pair (TP)

- **Cabling Kit (Tools) or Networking Kit (Tools)**

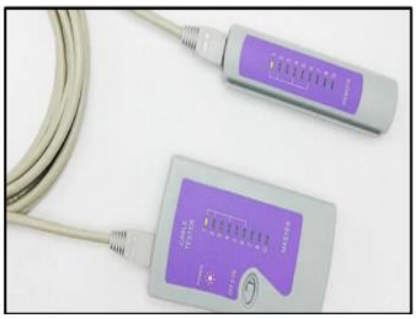
1. **Wire Cable Crimper المكبس (الكباس، الضغاط)**

2. **Wire Stripper السلاخة (العراية)**

3. **Punch Down Tool كباس ومثبت للأسفل**



4. **Cable Tester جهاز فحص سلامة الكيبل**

- **Video Demos on Twisted Pair (TP) Cabling**
  1. **https://www.youtube.com/watch?v=5bUpKRko4nY&t=36s**
  2. **https://www.youtube.com/watch?v=Q7mqbxHXTlo**
  3. **https://www.youtube.com/watch?v=xIq3SY4jqfo**

Network Cabling: 2) Fiber Optics

- **Video Demos on Fiber Optic Cabling**
  1. **https://www.youtube.com/watch?v=yfrPgzXKdQo&t=22s**
  2. **https://www.youtube.com/watch?v=Lic3gCS_bKo**
  3. **https://www.youtube.com/watch?v=tCeD4LUHWiM**

Reflection Question : ==➔ Next Page

Reflection Question

1. What is the most common topology used in LANs?

   The Star topology

2. Which of the following media has higher bandwidth UTP or fiber optics?

   Fiber optics

3. Which network's type can be used for implementing a university campus network?

   - Bachbone (BN): For single campus
   - Metropolitan Area Network (MAN): For university campuses in the same city
   - wide Area Network (WAN): For university branches in different cities.

4. What is difference between a hub and a switch?

   Hub and Swich are both network connecting devices. Hub works at physical layer and is responsible to transmit the signal to port to respond where the signal was recived whereas Switch works in data link layer. it is enable connection setting and terminating based on need.

5. What is the difference between routers and switches?

   The main objective of router is to connect various networks simulatneusly and it is works in network layer, whereas the main objective of switch is to connect various devices simultaneously and it works in data link layer.

6. What is a firewall?

   System or group of systems that manges access between two or more networks.

7. List 4 cabling tools with pictures. ➔

   Next Page

ALL INCLUSIVE NETWORK TOOLKIT

NETWORK CABLE TESTER

For RJ-11, RJ-12, RJ-45, CAT5, CAT5e, 10/100BaseT, TIA-568A/568B, AT T 258-A; 1, 2, 3, 4, 5, 6, 7

UNIVERSAL STRIPPER

Strips a range of different types and sizes of cable

2x SLOTTED AND PHILLIPS SCREWDRIVERS

Most popular sizes used for disassembling desktop computers, CPU fans, printers and other equipment casing

MINI WIRE CUTTER/STRIPPER

Small and portable cutter, stripper, and punchdown tools.

CO-AXIAL STRIPPER (100MM)

For stripping and crimping coaxial cables

PUNCH DOWN KRONE INSERTION TOOL

Terminates wire and cuts off excess

6 x 8P MODULAR PLUGS

Commonly used for Ethernet CAbles and other networking applications

19 PIECE

6 x 6P MODULAR PLUGS

Telephone Lines and more

CRIMPING/ CUTTING / STRIPPING TOOL (200MM)

For RJ-45, RJ-11 RJ-12 connectors, and suitable for Cat5 and Cat5e cables with 8P8C, 6P6C and 4P4C plugs

PROFESSIONAL TOOLS

TESTER REMOTE

Test network cables in place

TESTER BODY

Judges wrong connections, short circuits and open circuit

FLATHEAD SCREWDRIVER

Quickly adjust screws or move wires

UNIVERSAL SCISSORS

Automatically trims excess wire fom terminal when pushed down

CABLE HOOK

Hook onto and remove wires from terminals

INSERTION BLADE

Strips a range of different types and sizes of cable