Lecture1:

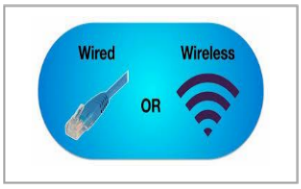
Introduction to Computer Networking

1- Computer Networking Concepts

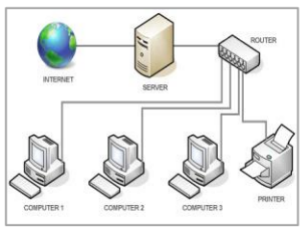
A computer network is a group of connected devices that can communicate with each other to share information and resources. The first computer network created in the late 1960s. Computer network forms the global infrastructure to interconnects devices throughout the world, the network connection between devices can be wired or wireless, to offers network services that can provide user applications services, these applications include:

E-mail, web surfing, social networks, instant messaging, video streaming, distributed games, file sharing.

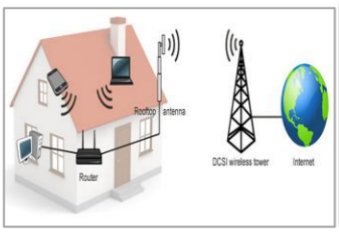
There are many ways to connect devices, these devices have different hardware structure, and each device has a range of connection speeds, for example:



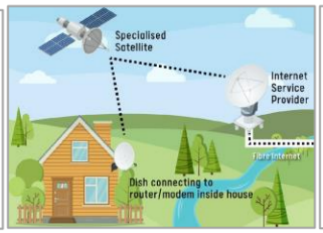
1. Dial-Up: connects to the Internet by dialing a phone number.
2. Wired: provides an internet connection through a cable and all the computers must be connected to a router.
3. Wireless: or WiFi, uses radio frequency.
4. Satellite: accesses the internet via a satellite in Earth's orbit
5. Cellular: provides wireless Internet access through cell phones. Example the 3rd generation cellular network 3G and 4G



Wired



Wireless



Satellite

Cellular

- **Internet**: The Internet is a global system of interconnected computer network that communicate using a protocol. The history of the Internet started in the 1960s by the US department of defense as a way to connect computers and share information between researchers and scientists. January 1983 is considered the official birthday of the Internet, using a standard rule to communicate with each other.

- **The Internet Protocol (IP)** provides mechanisms that enable different systems to connect to each other to transfer data with an IP address. IP use set of rules, for routing and addressing data on the connected computer networks, the unit of transmitted data is called IP packet. The protocol also manages the problems and errors that may occur when data is sent or received, such as resending data or cannot and network overload.

- **IP address:** is a unique identifier that enables devices to communicate over the internet. Each device has a 32-bit IP address written as four 8-bit numbers (0-255). All devices that connect to the internet, such as computers, phones, tablets, printers, and any internet of things (IOT) devices have an IP address. The IP address works like a digital address. When a user sends or request information online, information can reach his device by the IP address.

  For example, when you search for a particular website, request from your device's IP address, travels via the network to the website's server to get the website's IP address then send the information (you requested) to your device.

  The full IP addressing range goes from 0.0.0.0 to 255.255.255.255.

Example: Find out your local IP address:

-First, click on your **Start Menu**, type **cmd** in the search box and press enter.

-The terminal will open, then **type (ipconfig) to** find the IP address of your computer

As example the result will be:

192.158.100.38

```
ipconfig
```

You'll then see a snippet of information. Your IP address is next to **IPv4 Address**:

```
 Wireless LAN adapter Wi-Fi:
Connection-specific DNS Suffix .: lan.ourhost.net
IPv6 Address.....................: fd21:9d17:c305:5:c
Temporary IPv6 Address..........: fd21:9d17:c305:5:4
Link-
local IPv6 Address.........: fe80::cld3:ca36:flc:bd6
IPv4 Address.....................: 192.176.2.143
Subnet Mask.....................: 255.355.455.0
Default Gateway.................: 192.176.2.1
```

- **Client and server model**

A **server** is a computer or software system that provide services or data to other computers programs known as the clients. One of the main communication models is the client-server model. The Clients and servers communicate with requests and responses steps. A client (host) computer requests data or services from the central computer (server), which provides the data or services.

- **Web:** also referred to *World Wide Web* (www) is a collection of information that is accessed via the Internet. The web is an application that uses the Internet's infrastructure which enables packets of information to be sent between Internet hosts, the Web content is viewed through web **browsers**.

- **Web Browsers**

A web browser is a software application or program to (explore) displaying, and traversing information resources on the World Wide Web. It provides an interface between the server and the client and it requests to the server for web documents and services.

- **Web page:** It a single document or page that contains information hosted on a web server, the web page is displayed using web browsers such as, Google Chrome. The web pages composed using a markup language like HTML so that web browsers can

read it, the main feature of web page, is the hyperlink, which is a pointer to another resource (e.g. another Web page). Webpages have URLs so people can access them directly. ***The webpage is an independent page of a website***.

- **Website:** A website is a collection of webpages grouped together, often handled by a person or an organization, which can be accessed via the internet. One website will have several webpages like Home, About Us, Services, Products, all of these pages together make up a website. The website can be static or dynamic.

  - The static pages: the page is stored on the server and ca not be changed. All the client gets the same copy from the server.
  - The dynamic page: the information is changed frequently, the server can run executable code and return the output to the client, for example, weather information web page.

The primary protocol used for information transmission on the internet, is HTTP (Hypertext Transfer Protocol), which is a set of commands between networked devices, specifically web servers and client browsers.

- **URL**: A URL (Uniform Resource Locator) is a complete web address, the server needs the address to access a web site and send the correct page to the browser. The address contains information about the location of the webpage. Each web page has its own **URL** address composed of two parts, the **main** and the **optional**. When a you write the URL address in the browser, an HTTP command is sent to the server and fetches the requested web page.

Examples:
The **Main** URL address:
https://www.example.com
Another Example with **Options**:
https://www.example.com: 80/category/webpage.html/
Another example with more **options** and **Parameters**
https://www.example.com: 80/category/webpage.html/?key1=value

URL includes several components:

- **Scheme**: **http://** (protocol)
- **Domain**: **www.example.com** (full domain name)
- **Port**: is is a "gate" used to access the resources on the web server (***option***)

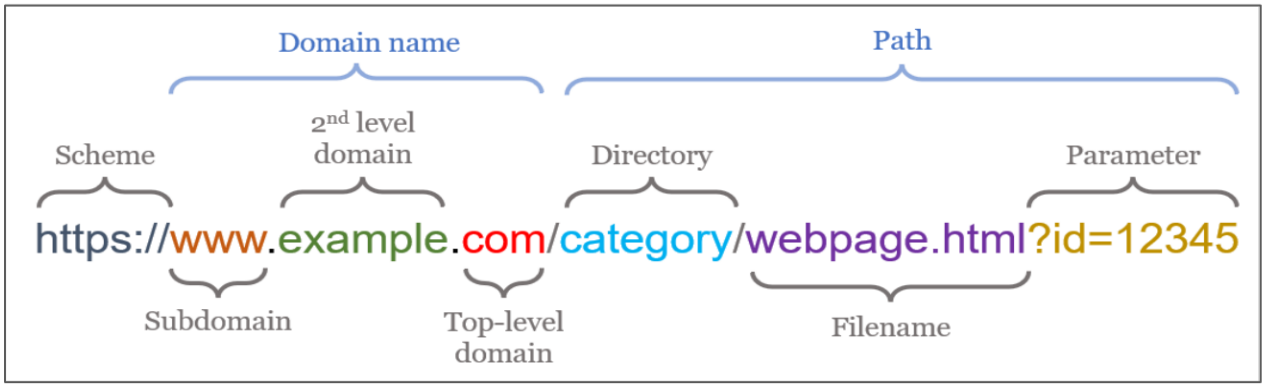
  :80 Note: (80 for HTTP)
- Path: is the path to the file location it separated by the **forward-slash sign (/)**,it may also include the folder name that contain the file (*option*) example:

  category/**webpage**.**html**/
- **Parameters**. Also called query parameters used for more information such as a filter. A question mark (?) indicates a parameter, follow a key-value.

  /?key1=value , Another example /products?category=books&sort=price

- **Domain name:** is a human-readable address consist of a series of characters (letters and numbers) used to identify a location on the internet.
  A domain name is associated with a physical IP address on the Internet, the domain name, is the name after the @ sign in (email addresses), and after **www.** in web addresses.
  Examples: www.Firstclaa@gmail.com, www.example.com
  The domain name (example.com) can be translated to the physical address such as 198.102.434.8. Example of full domain name is:
  www.example.com → 198.102.434.8.
  The domain name can be classified as:
  - Subdomain: **www** as in www.example.com
  - Second-Level Domain (SLD): as **example** in example.com
  - Domain or Top-Level Domain (TLD): **.com**, .org, .net

    Domains are structured in levels, separated by dots such as: **(.com, .org. .net, .gov, .edu, .int, .mil).**



The main seven TLDs of the Domain Name System (DNS) are:

- .com: Intended for commercial entities
- .org: Designed for non-profit organizations
- .net: Created for network-related entities
- .gov: Reserved for government agencies in the United States
- .mil: Designated for the United States military
- .edu: Established for educational institutions
- .int: Available for international treaty-based entities

Domain extensions can also include names related to the web page subject, example, **.tech**: for technology company, **.pro**: for professionals (people or institution).

To get page site the user must type a long URL address to access a document. The hyperlinks solved this by using the links.