Embedded Systems Interfacing

Lecture one

Digital Input Output Part 1

ESP8266 WIFI Module

The ESP8266 is the name of a micro controller designed by Espressif Systems. The module can even be programmed to act as a standalone WiFi or it can be used as a WiFi module suitable for adding WiFi functionality to an existing microcontroller project via a UART serial connection.

The ESP8266 WiFi module and the microcontroller can be interface through UART and with the help of a wide range of AT Commands, the Microcontroller can control the ESP Module.

The AT Commands of the ESP8266 WiFi Module are responsible for controlling all the operations of the module like restart, connect to WiFi, change mode of operation and so forth. So, it is important to understand the ESP8266 AT Commands, at least a few important ones if not all. We will focus on the ones used to make esp as client.
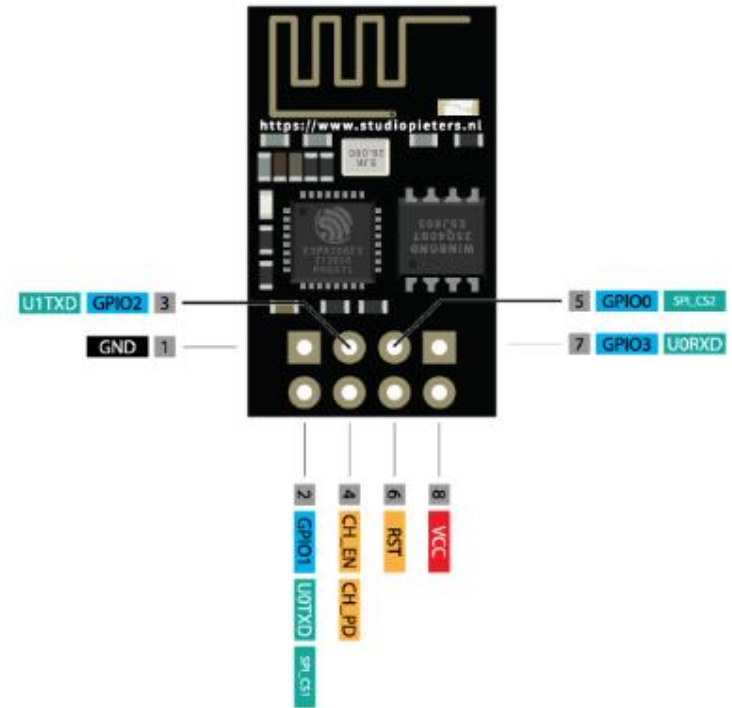
Simply, network is a connection between two or more devices. When two computers need to communicate, you have to link them, either physically or wirelessly.

Such a network is not limited to two computers. You can connect as many computers as you wish. But it gets complicated quickly. If you are trying to connect, say, ten computers, you need 45 cables, with nine plugs per computer!
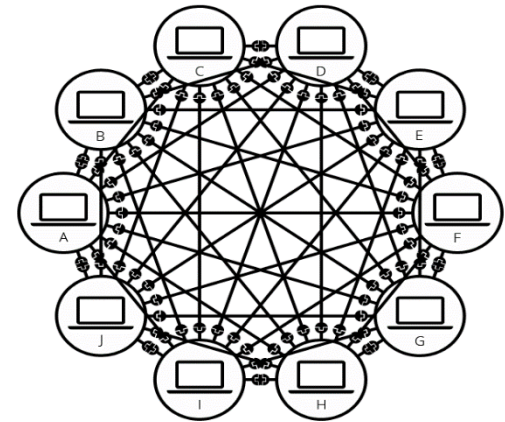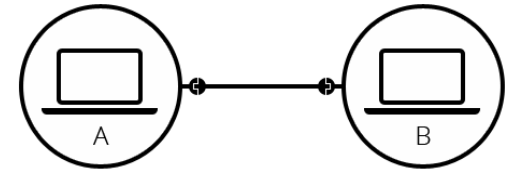
To solve this problem, each computer on a network is connected to a special tiny computer called a router

This router has only one job; it makes sure that a message sent from a given computer arrives at the right destination computer. To send a message to computer B, computer A must send the message to the router, which in turn forwards the message to computer B and makes sure the message is not delivered to computer C. Once we add a router to the system, our network of 10 computers only requires 10 cables: a single plug for each computer and a router with 10 plugs. This is called Local Area Network (LAN).
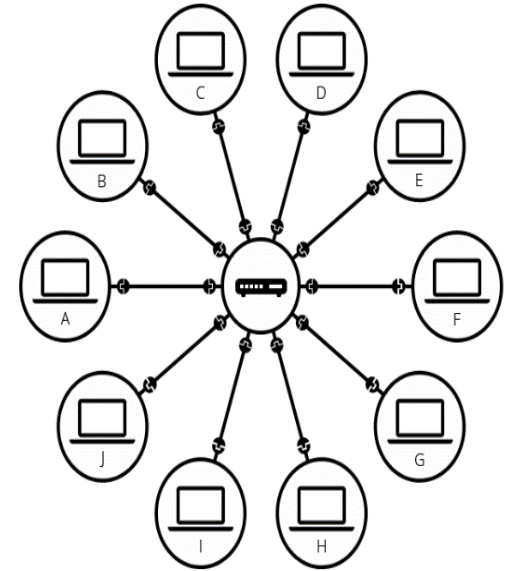
What about connecting hundreds, thousands, billions of computers? Of course a single router can't scale that far. By connecting computers to routers, then routers to routers, we are able to scale infinitely.
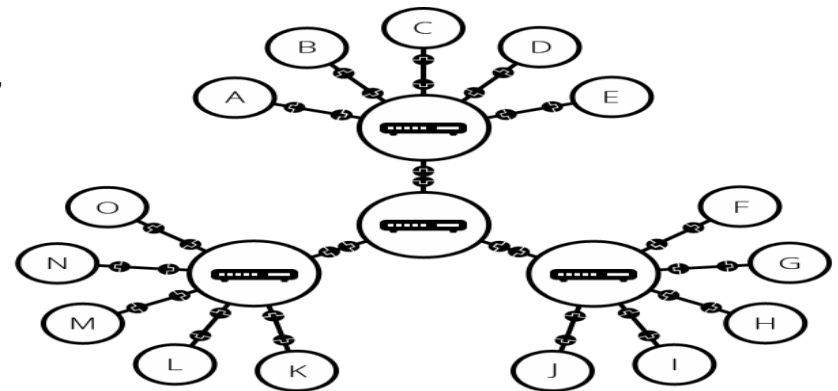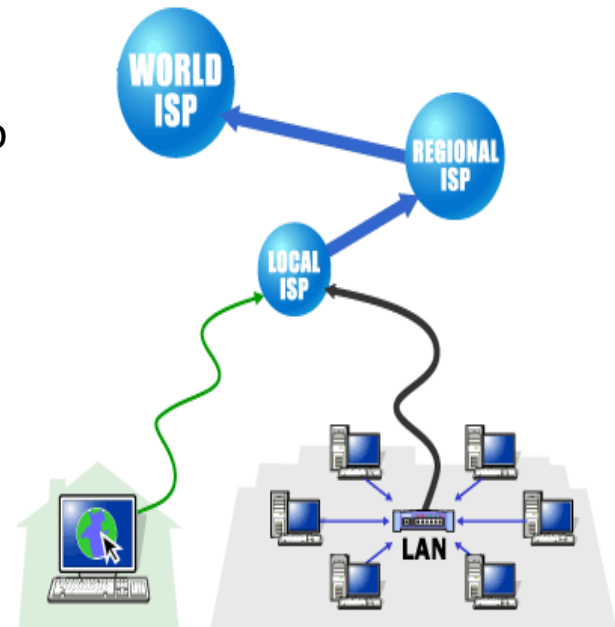
Internet

Internet is a network of networks that consists of private, public, academic, business, and government networks of local to global scope, linked by a broad array of electronic, wireless, and optical networking technologies. The Internet carries a vast range of information resources and services, such as the inter-linked hypertext documents and applications of the World Wide Web (WWW), electronic mail, telephony, and file sharing.

For a device to be connected to internet it need a *modem.* The modem is a device that converts data into a format suitable for a transmission medium. It may be wired or wireless and used to connect to an *Internet Service Provider* (ISP) and become part of their network.

Another option for a device to connect to the Internet is to have a **Network Interface Controller (NIC)** that is used to connect to a router. The router itself has its own modem that is connected to ISP.

The ISP assigns to each modem a unique address called *Internet Protocol address (IP address)*.

In case a router is used, the router gets only one IP from the ISP and use it to transmit and receive data between its local network and the external world.

Each device on the LAN has a local IP assigned by the router.

IP is four bytes, which allows 4,294,967,296 different IPs.

Client Server

A server is a computer that provides data to other computers called clients. Client can communicate to a server in different ways (Protocols) according to the type of data. One communication technique is using web browsers over the Hypertext Transfer Protocol (HTTP). When you click a link on a web page, submit a form, or run a search, the browser sends an HTTP Request to the server.

This request includes:

- An address for the server. Like any device connected to the Internet, the server has a unique IP.
- A method that defines the required action (for example, to get a file or to save or update some data).

The most common used methods are:

- **GET**: Get a specific resource (e.g. an HTML file containing information about a product, or a list of products).

- **POST**: Create a new resource (e.g. add a new article to a wiki, add a new contact to a database).

Uniform Resource Locator :-

In order for a device to get data from a server, it shouts its IP address. However, it would be very hard to remember the IP addresses for all servers you use. For that reason, a technique is implemented to give each server a meaningful name so that it could be user friendly. An example for that is www.google.com. This name is called uniform resource locator (URL).

The Domain Name System (DNS) is the phonebook of the Internet. DNS translates URL to IP addresses so browsers can load Internet resources. The process of DNS resolution involves converting a hostname (such as www.example.com) into a computer-friendly IP address (such as 192.168.1.1). When a user wants to load a webpage, a translation must occur between what a user types into their web browser (example.com) and the machine-friendly address necessary to locate the example.com webpage.

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