Ministry of Higher Education and Scientific Research

Al-Mustaqbal University

College Of Engineering & Technology

Computer Techniques Engineering Department

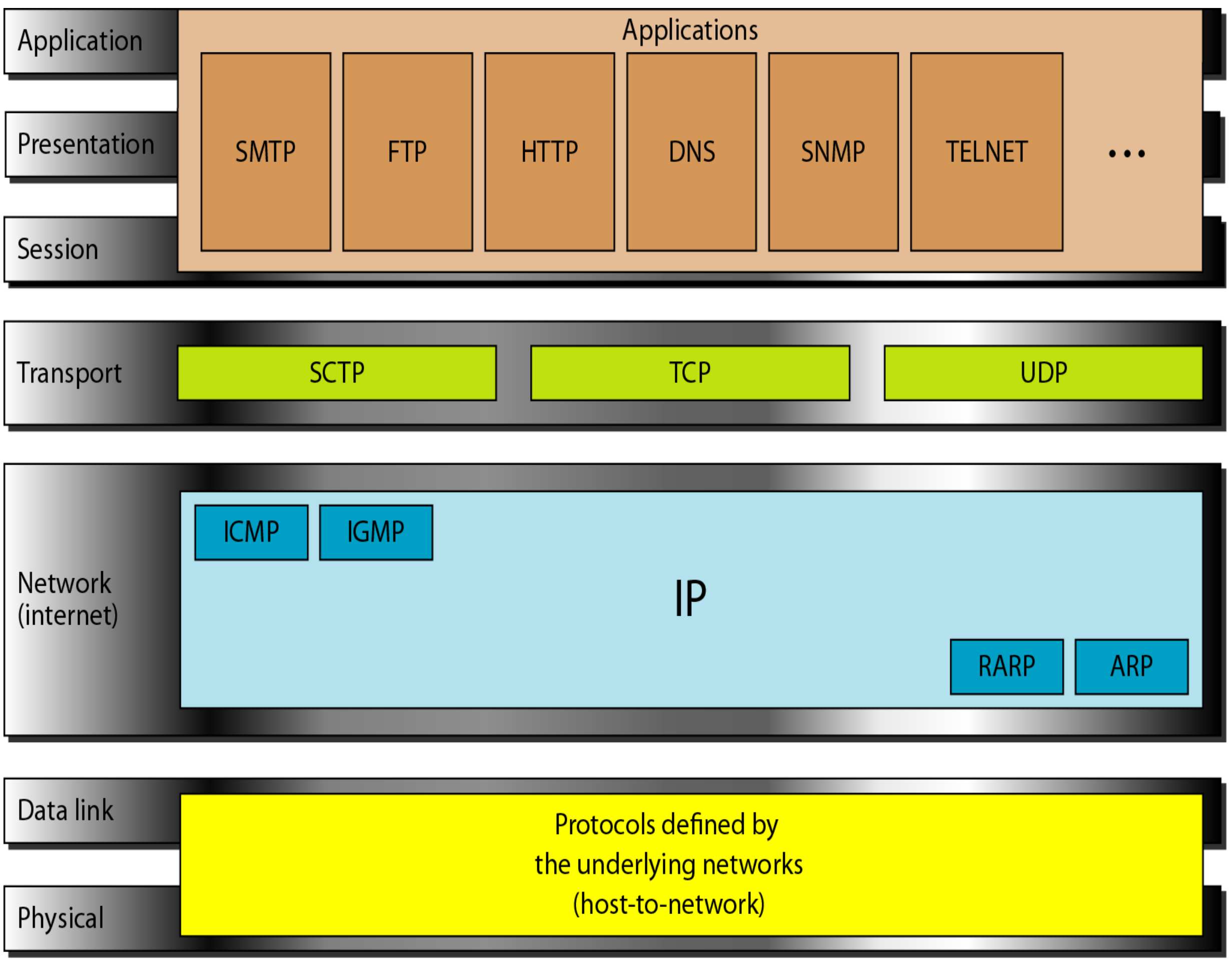
Computer Networks Fundamentals

Lecture 8:

TCP/IP Protocol Suite

8.1- TCP/IP Protocol Suite

The layers in the TCP/IP protocol suite do not exactly match those in the OSI model. The original TCP/IP protocol suite was defined as having **four layers**: *host-to-network*, *internet*, *transport*, and *application*. However, when TCP/IP is compared to OSI, we can say that the TCP/IP protocol suite is made of five layers: physical, data link, network, transport, and application, as shown in figure below.



The TCP/IP protocol stack is the de-facto standard in networking

- ✓ It is an alternative for the OSI 7-layer model, which has never really been implemented in practice.
- ✓ TCP/IP is an open standard and is the protocol used over the Internet.
- ✓ It can be found in most modern day operating systems

The main differences between TCP/IP and the OSI 7-layer model are:

- ➢ Number of layers
  - TCP/IP defines only 4 or 5 layers.
- ➢ TCP/IP protocol model while OSI reference model
- ➢ In TCP/IP application layer equal to application, presentation and session layers in OSI
- ➢ Functions performed at a given layer
  - In the OSI model each layer performs specific functions
  - In TCP/IP different protocols may be defined within a layer, each performing different functions. What is common about a set of protocols at the same layer is that they share the same set of support protocols at the next lower layer.
- ➢ Interface between adjacent layers
  - In the OSI model, a protocol at a given layer may be substituted by a new one without impacting on adjacent layers.
  - In TCP/IP the strict use of all layers is not mandated

8.2- <u>Addressing</u>

Four levels of addresses are used in an internet employing the *TCP/IP* protocols: physical (link) addresses, logical (IP) addresses, port addresses, and specific addresses (see Figure 16).

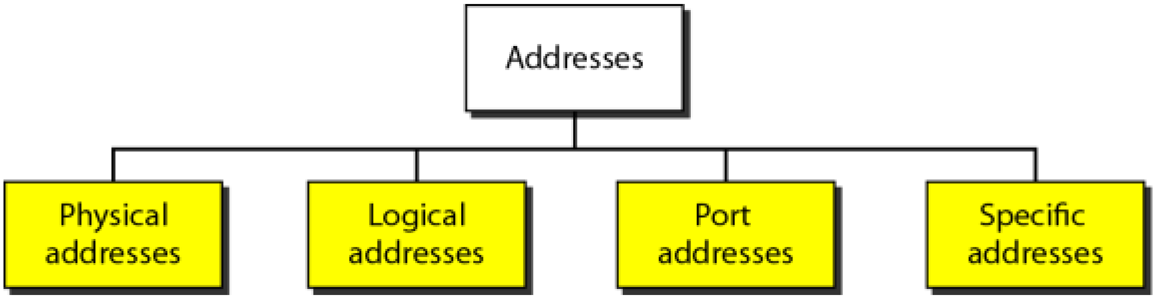
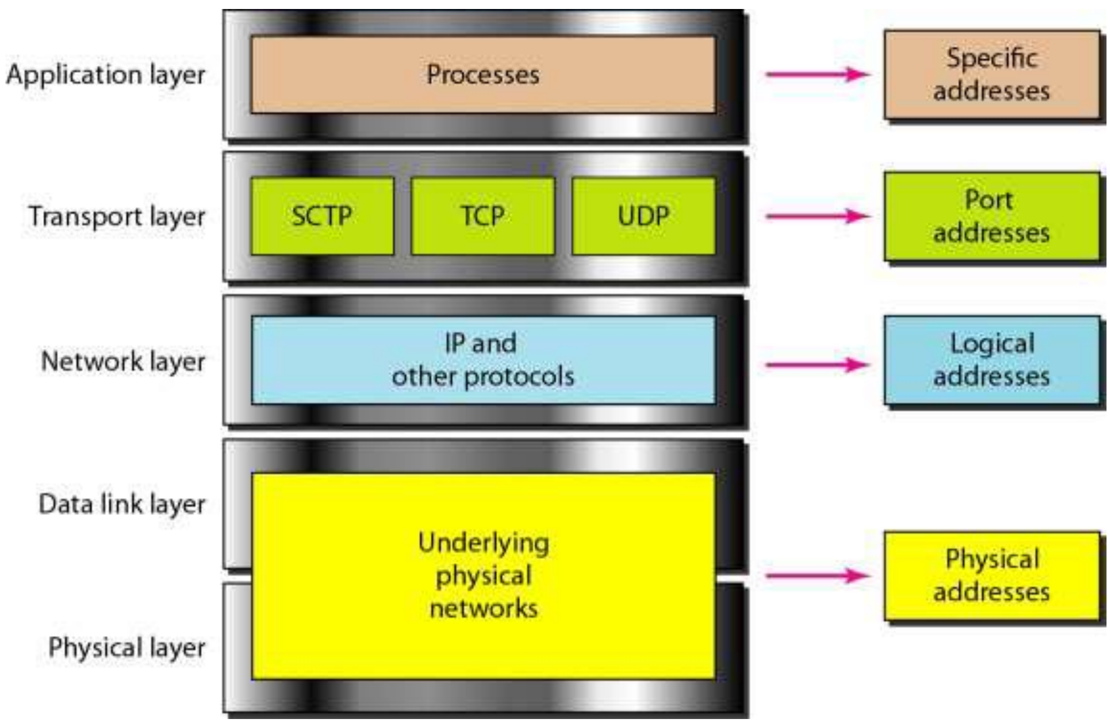


Figure (8.1): Addresses in TCP/IP



Figure(8.2): Relationship of layers and addresses in TCP/IP

8.2.1-Physical Addresses

The physical address, also known as the link address or mac address ,it is the address used in local network it has a 6-byte (48-bit) physical address that is imprinted on the network interface card(NIC) example 07:01:02:01 :2C:4B A 6-byte (12 hexadecimal digits) physical address

8.2.2-Logical Addresses (IP)

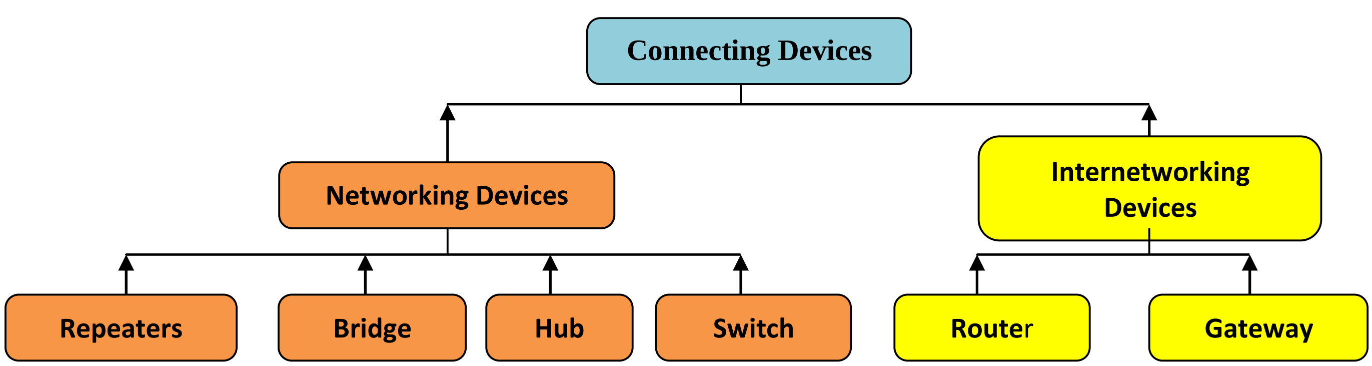
Logical addresses are necessary for network to network communication A logical address in the Internet is currently a 32-bit address that can uniquely define a host connected to the Internet. No two publicly addressed and visible hosts on the Internet can have the same IP address.

8.2.3- Port Addresses

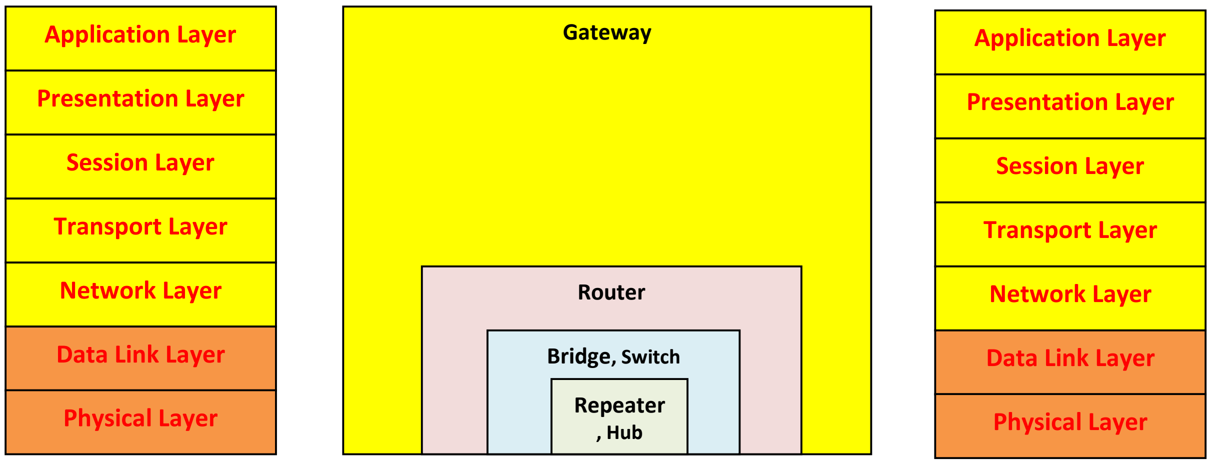
It is implemented in transport layer as process to process delivering

8.3 - Networking and Internetworks

To connect a network or multiple networks together there are different types of connecting devices as illustrated in figure below:

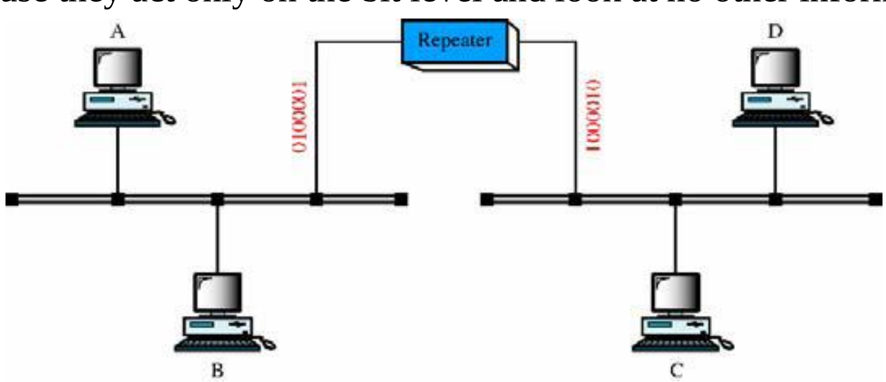


Each of these devices operates at different layer of the OSI model as shown in figure below:



8.3.1- <u>Repeater:</u>

Devices used to extend the network cable length beyond the limit of the specified cable. The purpose of a repeater is to regenerate and retime network signals at the bit level to allow them to travel a longer distance on the media. Repeaters are classified as Layer 1 devices in the OSI model, because they act only on the bit level and look at no other information.

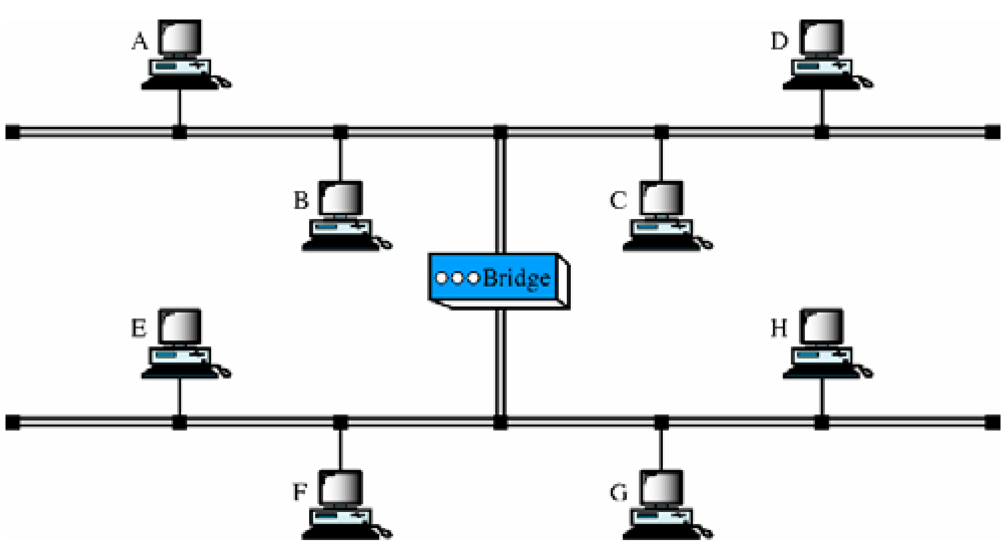


8.3.2- <u>Hubs</u>

The purpose of a hub is to regenerate and retime network signals. This is done at the bit level to a large number of hosts (e.g. 4, 8, or even 24) using a process known as concentration. You will notice that this definition is very similar to the repeaters, which is why a hub is also known as *a multi-port repeater*. The difference is the number of cables that connect to the device. Two reasons for using hubs are to create a central connection point for the wiring media, and increase the reliability of the network. The reliability of the network is increased by allowing any single cable to fail without disrupting the entire network. This differs from the bus topology where having one cable fail will disrupt the entire network. Hubs are considered Layer 1 devices because they only regenerate the signal and broadcast it out all of their ports (network connections).

8.3.3- <u>Bridges</u>

A bridge is a Layer 2 device designed to connect two LAN segments. The purpose of a bridge is to filter traffic on a LAN, to keep local traffic local, yet allow connectivity to other parts (segments) of the LAN for traffic that has been directed there. You may wonder, then, how the bridge knows which traffic is local and which is not. The answer is the same one that the postal service uses when asked how it knows which mail is local. It looks at the local address. Every networking device has a unique MAC address on the NIC, the bridge keeps track of which MAC addresses are on each side of the bridge and makes its decisions based on this MAC address list.



8.3.4 Switches

A switch is a Layer 2 device just as a bridge is. In fact a switch is called a *multi-port bridge*, just like a hub is called a multi-port repeater. The difference between the hub and switch is that switches make decisions based on MAC addresses and hubs don't make decisions at all. Because of the decisions that switches make, they make a LAN much more efficient. They do this by "switching" data only out the port to which the proper host is connected. In contrast, a hub will send the data out all of its ports so that all of the hosts have to see and process (accept or reject) all of the data.

8.3.5- Routers

A router is a Layer 3 device. Working at Layer 3 allows the router to make decisions based on groups of network addresses as opposed to individual Layer 2 MAC addresses. Routers can also connect different Layer 2 technologies, such as Ethernet, Token-ring, and FDDI. However, because of their ability to route packets based on Layer 3 information, routers have become the backbone of the Internet, running the IP protocol. The purpose of a router is to examine incoming packets (Layer 3 data), choose the best path for them through the network, and then switch them to the proper outgoing port. A router is a type of internetworking device that passes data packets between networks, based on Layer 3 addresses. A router has the ability to make intelligent decisions regarding the best path for delivery of data on the network.

8.3.6- Gateway

Gateways are multi-purpose connection devices. They are able to convert the format of data in one computing environment to a format that is usable in another computer environment (for example, AppleTalk and DECnet).

Gateways are devices that link different network types and protocols. For example, gateways translate different electronic mail protocols and convey email across the Internet. Gateways can operate at all layers of the OSI model.

Gateways are available as stand-alone devices or in the form of a network station functioning as a gateway server. In both cases, the gateway requires appropriate network adapters LAN, WAN or both—and appropriate software. It is the software which is responsible for translating the messages from the received format to the format understood by the destination system.