



Department of Cyber Security

LAN Devices,- Lecture (2)

Lecturer Name



جامعة المستقبل
AL MUSTAQBAL UNIVERSITY



قسم الامن
السيبراني
DEPARTMENT OF CYBER SECURITY

SUBJECT:

COMPUTER NETWORKS

CLASS:

THIRD

LECTURER:

DR. SUHA ALHUSSIENY

LECTURE: (2)

LAN DEVICES , TYPES OF NETWORKS

LAN CONNECTING DEVICES

LANs do not normally operate **in** isolation. They are connected to one another or to the Internet. To connect LANs, or segments of LANs, we use connecting devices. Connecting devices can operate **in** different layers of the Internet model. **In** this lecture, we discuss only those that operate **in** the physical and data link layers; we divide connecting devices into five different categories based on the layer in which they operate in a network, as shown **in** Figure 2.1.

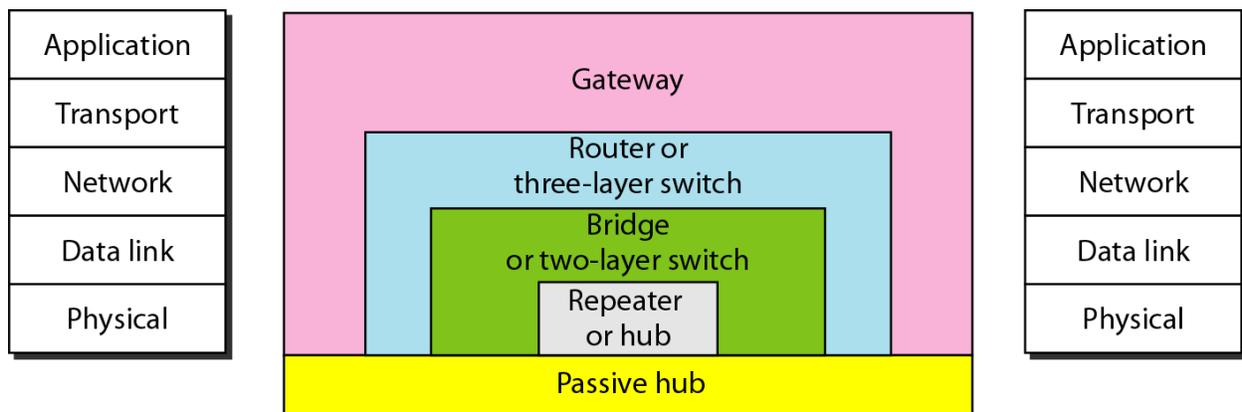
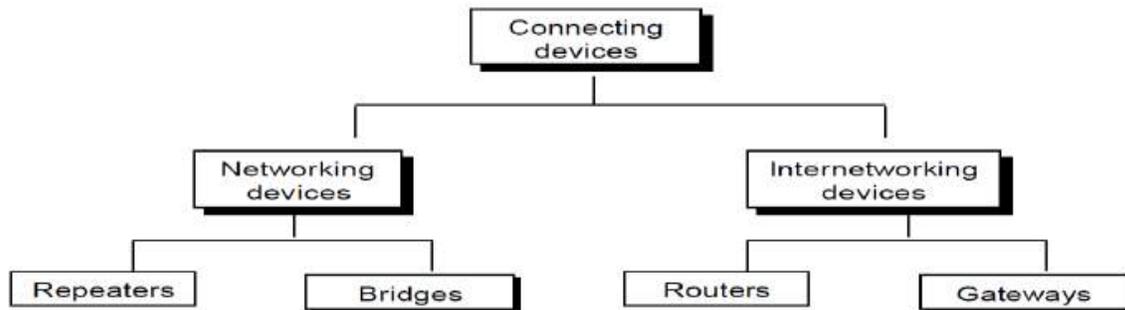


Figure 2.1: Five categories of connecting devices

The five categories contain devices which can be defined as

1. Those which operate below the physical layer such as a passive hub.
2. Those which operate at the physical layer (a repeater or an active hub).
3. Those which operate at the physical and data link layers (a bridge or a two-layer switch).
4. Those which operate at the physical, data link, and network layers (a router or a three-layer switch).
5. Those which can operate at all five layers (a gateway).



1. Passive Hubs

A passive hub is just a connector. It connects the wires coming from different branches. In a star-topology Ethernet LAN, a passive hub is just a point where the signals coming from different stations collide; the hub is the collision point. This type of a hub is part of the media; its location in the Internet model is below the physical layer.

2. Repeaters

A repeater is a device that operates only in the physical layer. Signals that carry information within a network can travel a fixed distance before attenuation endangers the integrity of the data. A repeater receives a signal and, before it becomes too weak or corrupted, regenerates the original bit pattern. The repeater then sends the refreshed signal. A repeater can extend the physical length of a LAN, as shown in Figure 2.2.

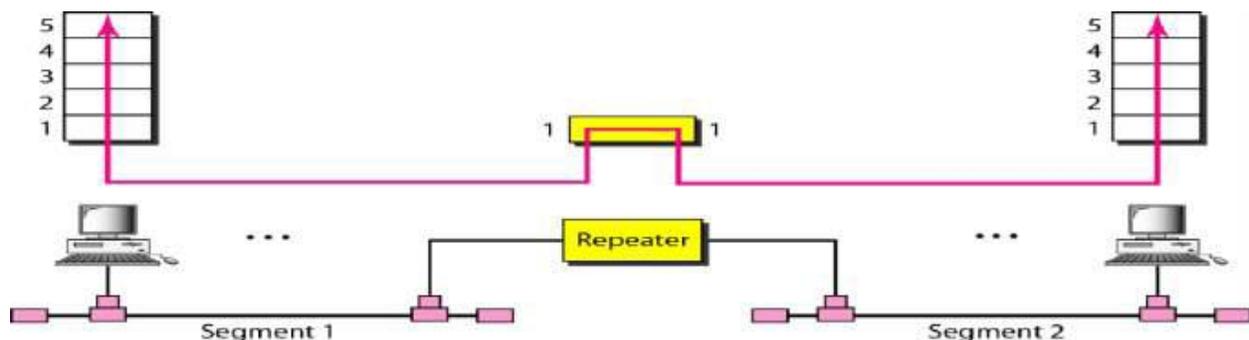


Figure 2.2: A repeater connecting two segments of a LAN

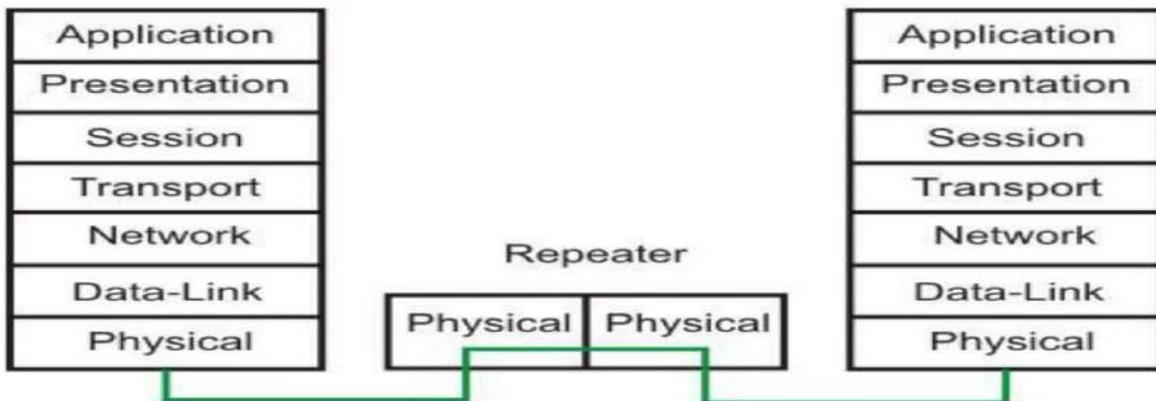


Figure 2.3- operation of a repeater

- A repeater connects different segments of a LAN not different LANS
- A repeater forwards every frame it receives
- A repeater is a regenerator, not an amplifier
- It can be used to create a single extended LAN

3. Active Hubs

An active hub is actually a multipart repeater. It is normally used to create connections between stations in a physical star topology. We have seen examples of hubs in some Ethernet implementations (10Base-T, for example). However, hubs can also be used to create multiple levels of hierarchy, as shown in Figure 15.4. The hierarchical use of hubs removes the length limitation of 10Base-T (100 m).

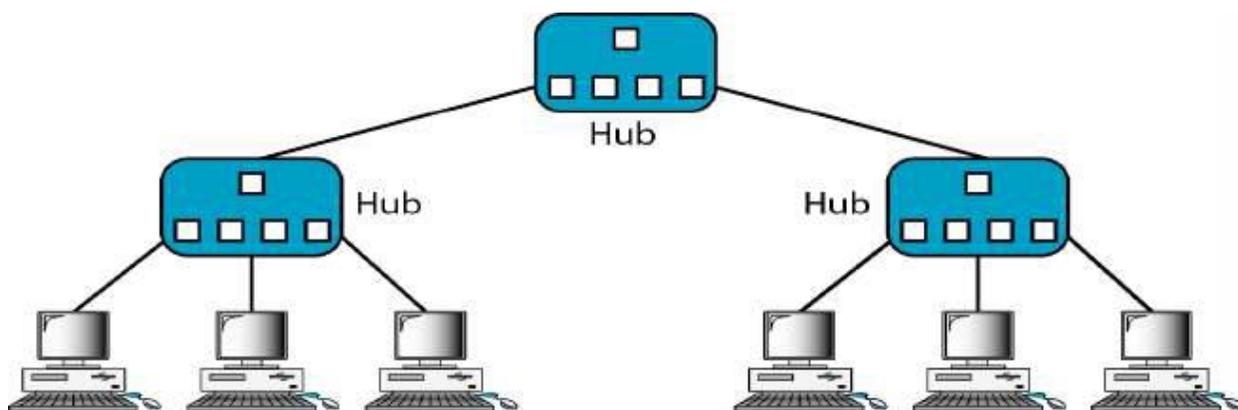


Figure-2.4- A hierarchy of hubs



4. Bridges

A bridge operates in both the physical and the data link layer. As a physical layer device, it regenerates the signal it receives. As a data link layer device, the bridge can check the physical (MAC) addresses (source and destination) contained in the frame.

What is the difference in functionality between a bridge and a repeater?

A bridge has filtering capability. It can check the destination address of a frame and decide if the frame should be forwarded or dropped. If the frame is to be forwarded, the decision must specify the port. A bridge has a table that maps addresses to ports.

5. Two-Layer Switches

When we use the term *switch*, we must be careful because a switch can mean two different things. We must clarify the term by adding the level at which the device operates.

We can have a two-layer switch or a three-layer switch. A **three-layer switch** is used at the network layer; it is a kind of router. The **two-layer switch** performs at the physical and data link layers.

A two-layer switch is a bridge, a bridge with many ports and a design that allows better (faster) performance. A bridge with a few ports can connect a few LANs together. A bridge with many ports may be able to allocate a unique port to each station, with each station on its own independent entity. This means no competing traffic (no collision, as we saw in Ethernet).

A two-layer switch, as a bridge does, makes a filtering decision based on the MAC address of the frame it received. However, a two-layer switch can be more sophisticated.

It can have a buffer to hold the frames for processing. It can have a switching factor that forwards the frames faster. Some new two-layer switches, called *cutthrough* switches, have been designed to forward the frame as soon as they check the MAC addresses in the header of the frame.

6. Routers

A router is a three-layer device that routes packets based on their logical addresses (host-to-host addressing). A router normally connects LANs and WANs in the Internet and has a routing table that is used for making decisions about the route. The routing tables are normally dynamic and are updated using routing protocols. Figure 15.11 shows a part of the Internet that uses routers to connect LANs and WANs.

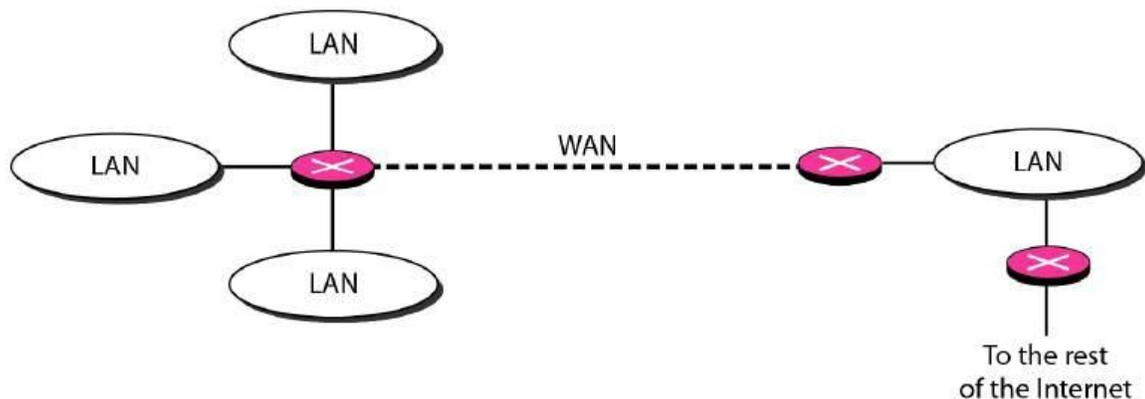


Figure 2.5 : Routers connecting independent LANs and WANs

7. Gateway

A gateway is normally a computer that operates in all five layers of the Internet or seven layers of OSI model. A gateway takes an application message, reads it, and interprets it. This means that it can be used as a connecting device between two internetworks that use different models. For example, a network designed to use the OSI model can be connected to another network using the Internet model. The gateway connecting the two systems can take a frame as it arrives from the first system, move it up to the OSI application layer, and remove the message



Differences between Hub, Switch and Router

Network Hub	Switch	Router
Connects computers together in a network	Connects computers	Connects networks and routes data packets between them
Broadcasts data packets to all connected devices	Doesn't broadcast data packets to all connected devices	
Bandwidth gets split between connected computers	Preferred over Network Hub	

Types of networks

1. Local Area Network (LAN)

A LAN is a local area network that is a small collection of computers in a small geographic area of less than couple of kilometers and is very fast in data transfer. Depending on technology implementation a LAN can be as simple as two PCs and a printer got connected in a small office or it can extend through out an organization and include multimedia (text, voice, video) data transfers.

The LANs may be configured in many ways. The peer-to-peer configuration is the simplest form. In this configuration computers are connected together to share their recourses among themselves. In such configurations it is very difficult impose security features.

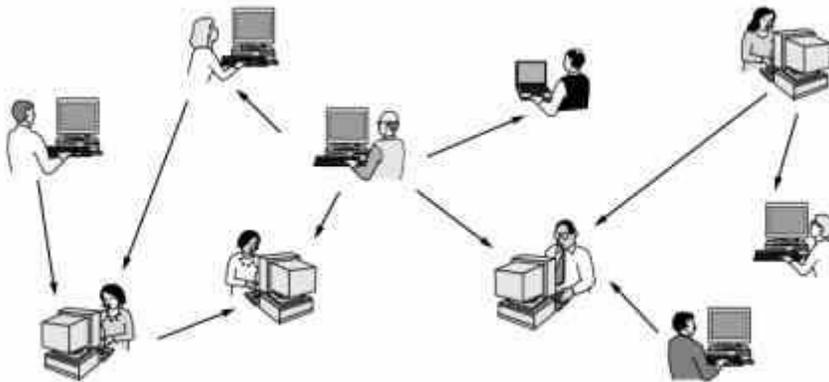
It is also called LAN and designed for small physical areas such as an office, group of buildings or a factory. LANs are used widely as it is easy to design and to troubleshoot. Personal computers and workstations are connected to



each other through LANs. We can use different types of topologies through LAN, these are Star, Ring, Bus, Tree etc.

LAN can be a simple network like connecting two computers, to share files and network among each other while it can also be as complex as interconnecting an entire building.

LAN networks are also widely used to share resources like printers, shared hard-drive etc.



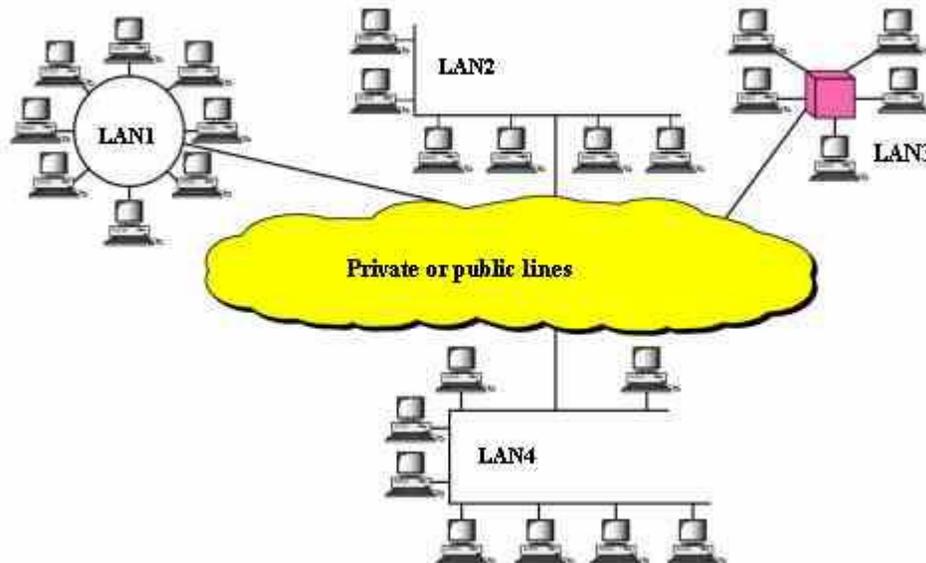
Applications of LAN

- One of the computer in a network can become a server serving all the remaining computers called clients. Software can be stored on the server and it can be used by the remaining clients.
- Connecting Locally all the workstations in a building to let them communicate with each other locally without any internet access.
- Sharing common resources like printers etc are some common applications of LAN.

2. Metropolitan Area Network (MAN)

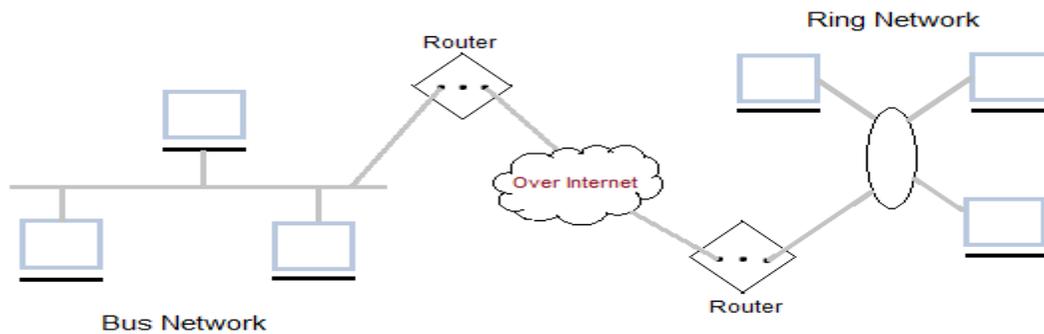
It is basically a bigger version of LAN. It is also called MAN and uses the similar technology as LAN. It is designed to extend over the entire city. It can

be means to connecting a number of LANs into a larger network or it can be a single cable. It is mainly hold and operated by single private company or a public company. For instance a business organization may choose MAN to inter connect all its branch offices within the city.



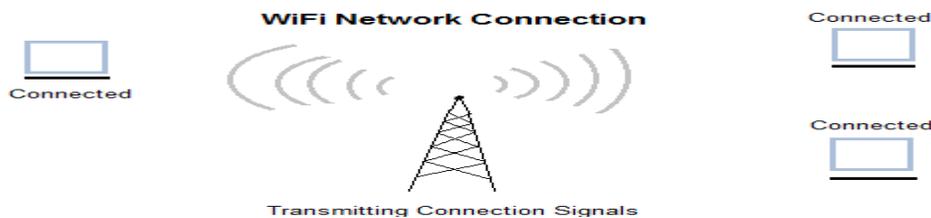
3. Wide Area Network (WAN)

A WAN is a data communications network that covers a relatively broad geographic area, often a country or continent. It contains a collection of machines intended for running user programs. These machines are called hosts. The hosts are connected by subnet. The purpose of subnet is to carry messages from hosts to hosts. The subnet includes transmission facilities, switching elements and routers provided by common agencies, such as telephone companies. Now days, routers with satellite links are also becoming part of the WAN subnet. All these machines provide long distanc transmission of data, voice, image and video information.



4. Wireless Network

It is the fastest growing segment of computer. They are becoming very important in our daily life because wire connections are not possible in cars or aeroplane. We can access Internet at any place avoiding wire related troubles. These can be used also when the telephone systems gets destroyed due to some calamity/disaster. WANs are really important now-a-days.



5. Inter Network(InterNet)

When we connect two or more networks then they are called internetwork or internet. We can join two or more individual networks to form an internetwork through devices like routers gateways or bridges.