EXPERIMENT-1

Study of Network devices in detail and connect the computers in Local Area Network

STUDY OF NETWORK DEVICES IN DETAIL AND CONNECT THE COMPUTRS IN LOCAL AREA NETWORK

Aim: Study of following Network Devices in Detail

- Repeater
- Hub
- Switch
- Bridge
- Router
- Gateway

Introduction to Computer Networks

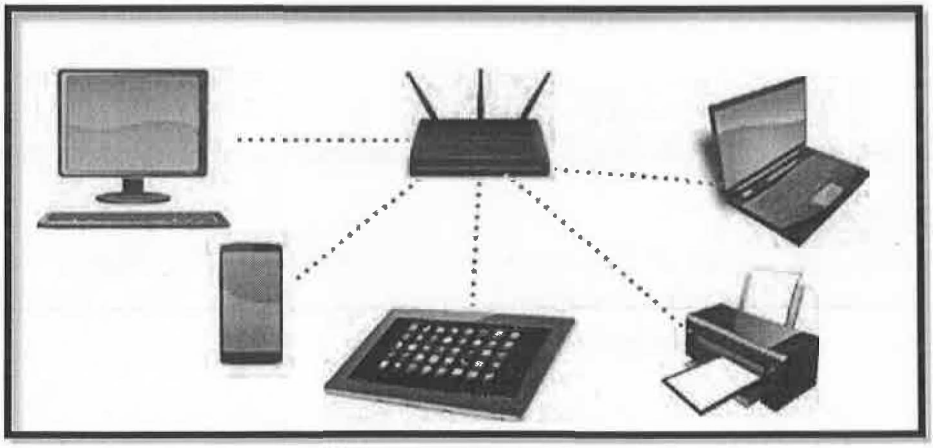
We are living in a connected world. Information is being produced, exchanged, and traced across the globe in real time. It's possible as almost everyone and everything in the digital world is interconnected through one way or the other.

A group of two or more similar things or people interconnected with each other is called network. Some of the examples of network in our everyday life include:

- ❖ Social network
- ❖ Mobile network
- ❖ Network of computers
- ❖ Airlines, railway, banks, hospitals networks

A computer network is an interconnection among two or more computers or computing devices. Such interconnection allows computers to share data and resources among each other. A basic network may connect a few computers placed in a room.

The network size may vary from small to large depending on the number of computers it connects. A computer network can include different types of hosts (also called nodes) like server, desktop, laptop, cellular phones.



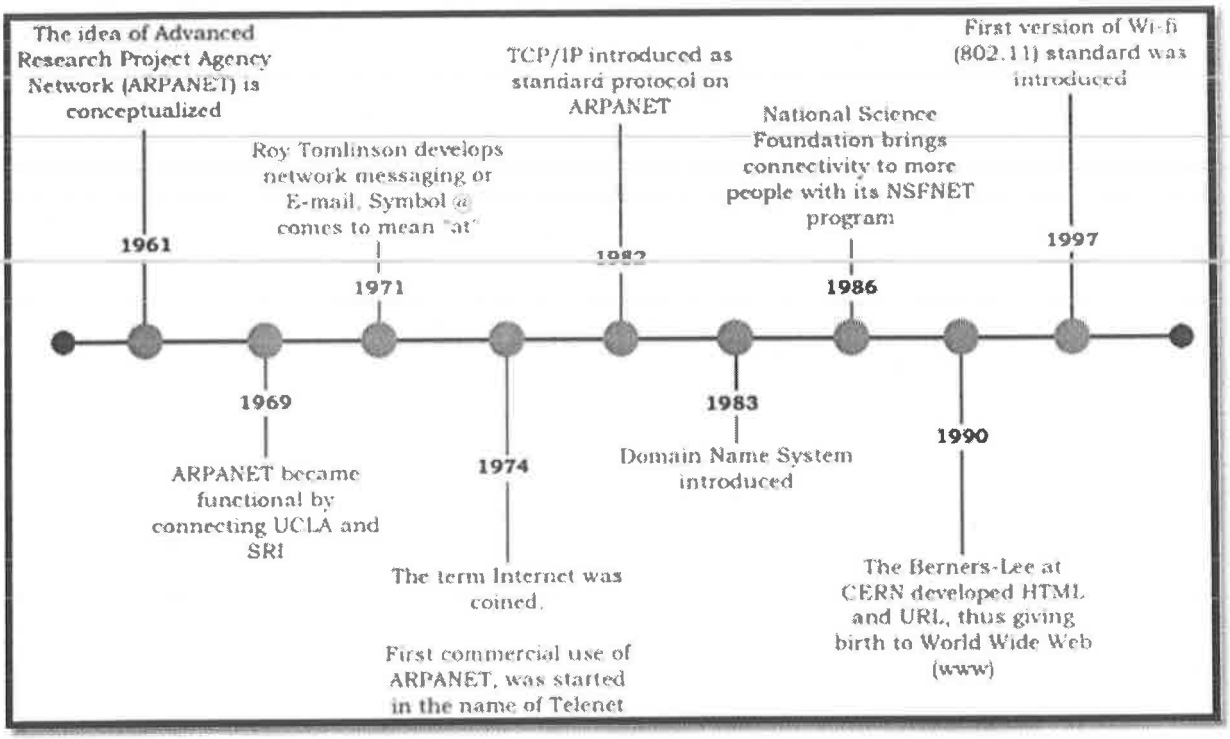
Apart from computers, networks include networking devices like switch, router, modem, etc. Networking devices are used to connect multiple computers in different settings. For communication, data in a network is divided into smaller chunks called packets. These packets are then carried over a network. Devices in a network can be connected either through wired media like cables or wireless media like air.

In a communication network, each device that is a part of a network and that can receive, create, store or send data to different network routes is called a node. In the context of data communication, a node can be a device such as a modem, hub, bridge, switch, router, digital telephone handset, a printer, a computer or a server.

Interconnectivity of computing devices in a network allows us to exchange information simultaneously with many parties through email, websites, audio/video calls, etc. Network allows sharing of resources. For example, a printer can be made available to multiple computers through a network; a networked storage can be accessed by multiple computers. People often connect their devices through hotspot, thus forming a small personal network.

Evolution of Networking

In the 1960s a research project was commissioned by Advanced Research Projects Agency Network (ARPANET) in the U.S. Department of Defence to connect the academic and research institutions located at different places for scientific collaborations. The first message was communicated between the University of California, Los Angeles (UCLA) and Stanford Research Institute (SRI). Slowly but gradually, more and more organisations joined the ARPANET, and many independent smaller networks were formed. Few of the milestones in the magnificent journey of evolution of computer networks is depicted in the timeline.

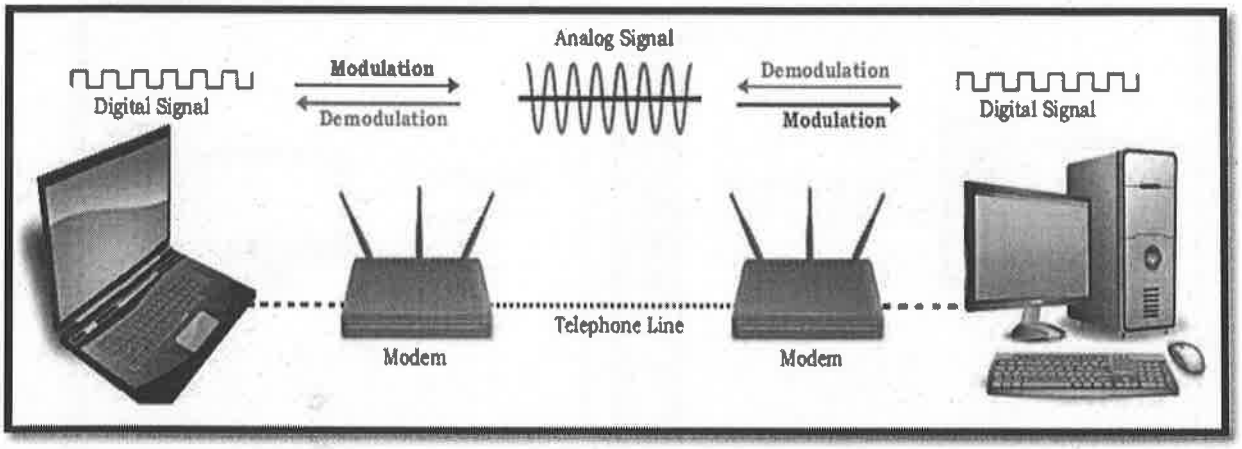


Network Devices

To communicate data through different transmission media and to configure networks with different functionality, we require different devices like Modem, Hub, Switch, Repeater, Router, Gateway, etc. Let us explore them in detail.

Modem

Modem stands for 'MOdulator DEModulator'. It refers to a device used for conversion between analog signals and digital bits. We know computers store and process data in terms of **0's** and **1's**. However, to transmit data from a sender to a receiver, or while browsing the internet, digital data are converted to an analog signal and the medium (be it free-space or a physical media) carries the signal to the receiver. There are modems connected to both the source and destination nodes. The modem at the sender's end acts as a modulator that converts the digital data into analog signals. The modem at the receiver's end acts as a demodulator that converts the analog signals into digital data for the destination node to



understand. Figure shows connectivity using a modem.

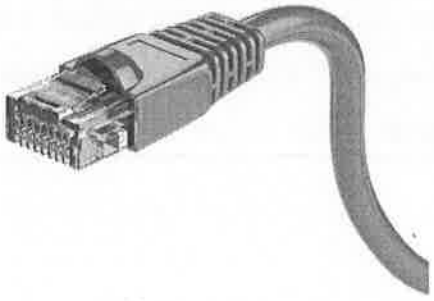
Ethernet Card

Ethernet card, also known as Network Interface Card (NIC card in short) is a network adapter used to set up a wired network. It acts as an interface between computer and the network. It is a circuit board mounted on the motherboard of a computer as shown in Figure. The Ethernet cable connects the computer to the network through NIC. Ethernet cards can support data transfer between 10 Mbps and 1 Gbps (1000 Mbps). Each NIC has a MAC address, which helps in uniquely identifying the computer on the network.

RJ45

RJ 45 or Registered Jack-45 is an eight-pin connector that is used exclusively with Ethernet cables for networking. It is a standard networking interface that can be seen at the end of all network cables. Basically, it is a small plastic plug that fits into RJ-45 jacks of the Ethernet cards present in various computing devices.

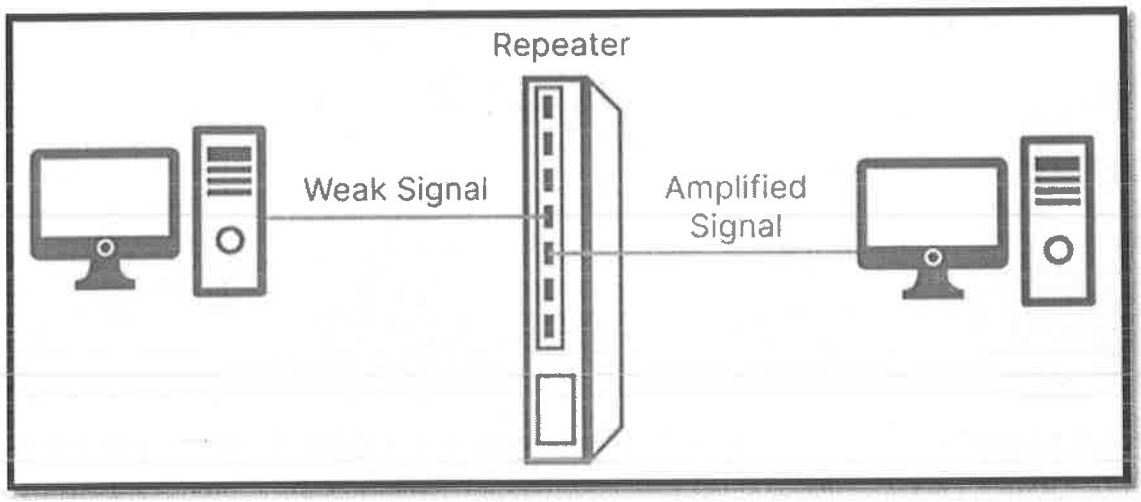
RJ45 Connector



Repeater

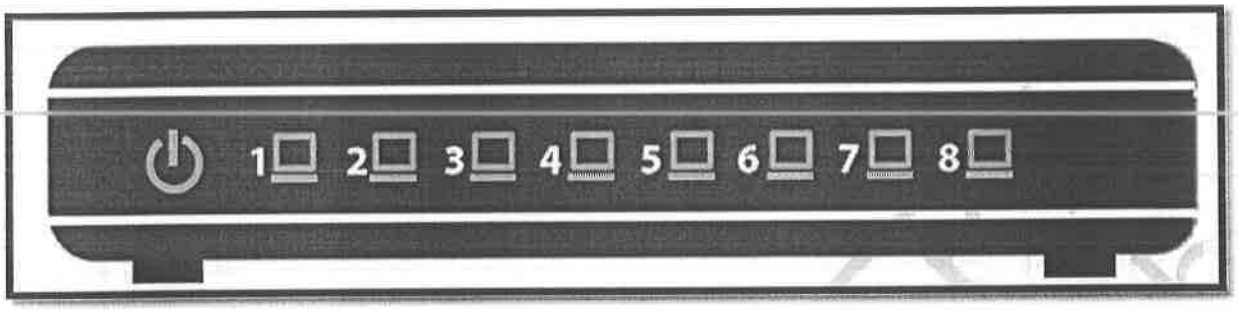
Data are carried in the form of signals over the cable. These signals can travel a specified distance (usually about 100 m). Signals lose their strength beyond this limit and become weak. In such conditions, original signals need to be regenerated.

A repeater is an analog device that works with signals on the cables to which it is connected. The weakened signal appearing on the cable is regenerated and put back on the cable by a repeater.



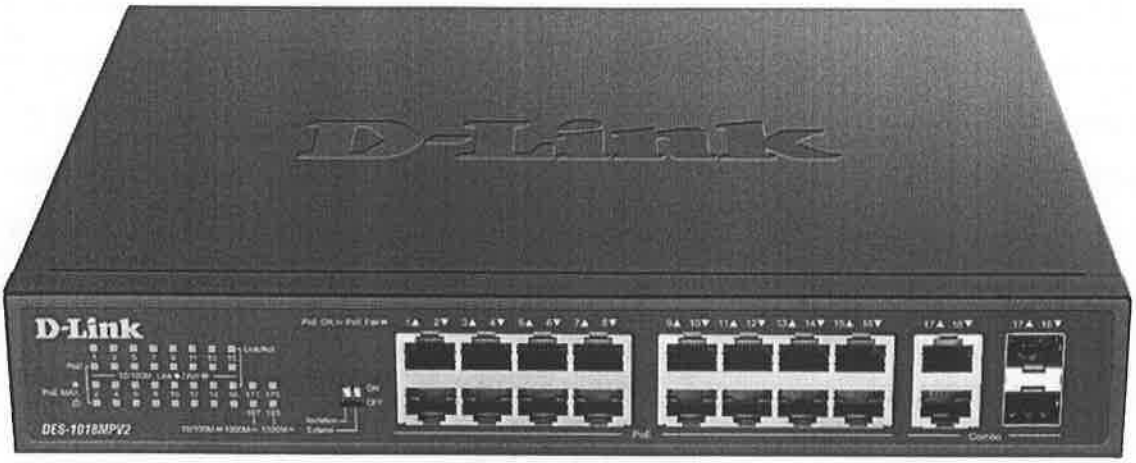
Hub

An Ethernet hub is a network device used to connect different devices through wires. Data arriving on any of the lines are sent out on all the others. The limitation of Hub is that if data from two devices come at the same time, they will collide.



Switch

A switch is a networking device that plays a central role in a Local Area Network (LAN). Like a hub, a network switch is used to connect multiple computers or communicating devices. When data arrives, the switch extracts the destination address from the data packet and looks it up in a table to see where to send the packet. Thus, it sends signals to only selected devices instead of sending to all. It can forward multiple packets at the same time. A switch does not forward the signals which are noisy or corrupted. It drops such signals and asks the sender to resend it.



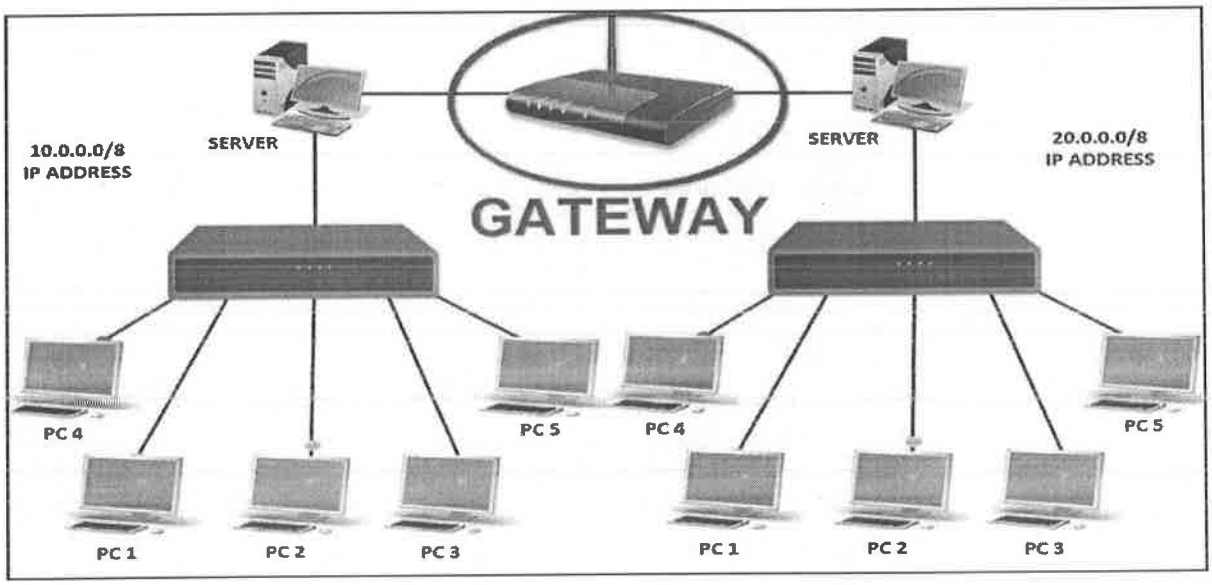
Router

A router is a network device that can receive the data, analyse it and transmit it to other networks. A router connects a local area network to the internet. Compared to a hub or a switch, a router has advanced capabilities as it can analyse the data being carried over a network, decide/alter how it is packaged, and send it to another network of a different type. For example, data has been divided into packets of a certain size. Suppose these packets are to be carried over a different type of network which cannot handle bigger packets. In such a case, the data is to be repackaged as smaller packets and then sent over the network by a router.

A router can be wired or wireless. A wireless router can provide Wi-Fi access to smartphones and other devices. Usually, such routers also contain some ports to provide wired Internet access. These days, home Wi-Fi routers perform the dual task of a router and a modem/ switch. These routers connect to incoming broadband lines, from ISP (Internet Service Provider), and convert them to digital data for computing devices to process.

Gateway

As the term "**Gateway**" suggests, it is a key access point that acts as a "**gate**" between an organisation's network and the outside world of the Internet. Gateway serves as the entry and exit point of a network, as all data coming in or going out of a network must first pass through the gateway in order to use routing paths. Besides routing data packets, gateways also maintain information about the host network's internal connection paths and the identified paths of other remote networks. If a node from one network wants to communicate with a node of a foreign network, it will pass the data packet to the gateway, which then routes it to the destination using the best possible route.

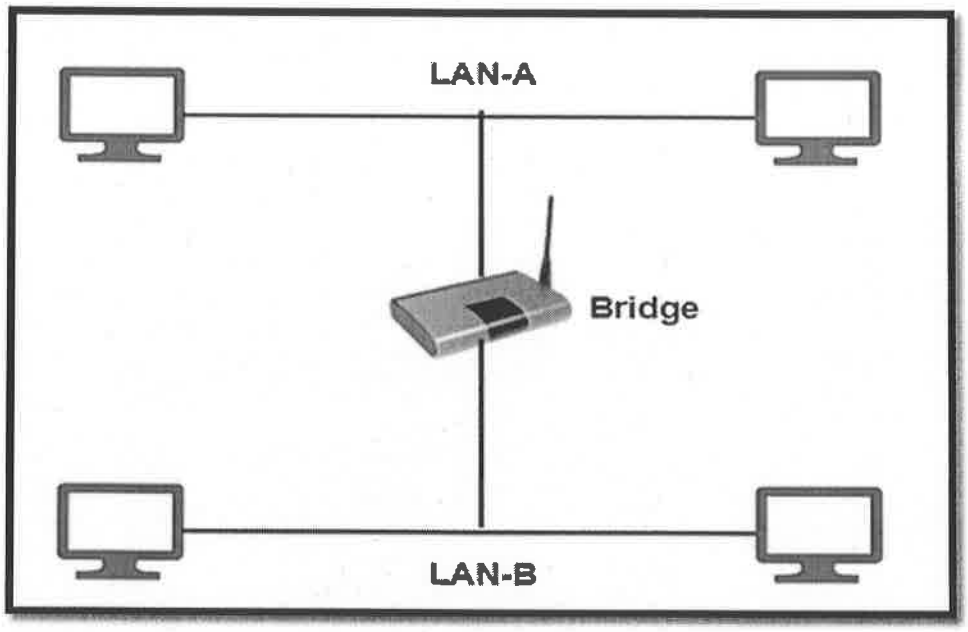


For simple Internet connectivity at homes, the gateway is usually the Internet Service Provider that provides access to the entire Internet. Generally, a router is configured to work as a gateway device in computer networks. But a gateway can be implemented completely in software, hardware, or a combination of both. Because a network gateway is placed at the edge of a network, the firewall is usually integrated with it.

Bridge

A bridge in a computer network is a device used to connect multiple LANs together with a larger Local Area Network (LAN). The mechanism of network aggregation is known as bridging. The bridge is a physical or hardware device but operates at the OSI model's data link layer and is also known as a layer of two switches.

The primary responsibility of a switch is to examine the incoming traffic and determine whether to filter or forward it. Basically, a bridge in computer networks is used to divide network connections into sections, now each section has a separate bandwidth and a separate collision domain. Here bridge is used to improve network performance.


LAN-A
Bridge
LAN-B