



# BRAINWARE UNIVERSITY

BNCSC201

CLASS NOTES

Computer Networks

## What are network devices?

Network devices are physical devices that allow hardware on a computer network to interact and communicate with one another.

## Types of Network Devices

- Hub
- Switch
- Router
- Bridge
- Gateway
- Modem
- Repeater
- Access Point

## NIC

A network interface card (NIC) is a hardware component without which a computer cannot be connected over a network. It is a circuit board installed in a computer that provides a dedicated network connection to the computer. It is also called network interface controller, network adapter or LAN adapter.



## Types of Network Interface Card:

**Wireless:** These are NICs that use an antenna to provide wireless reception through radio frequency waves.

**Wired:** These are NICs that have input jacks made for cables.

**USB:** These are NICs that provide network connections through a device plugged into the USB port.

**1000Base-T:** 1000BASE-T is Gigabit Ethernet -- 1 gigabit is 1,000 megabits per second (Mbps) on copper cables, using four pairs of Category 5 (Cat5) unshielded twisted pair (UTP) to achieve



# BRAINWARE UNIVERSITY

BNCSC201

CLASS NOTES

Computer Networks

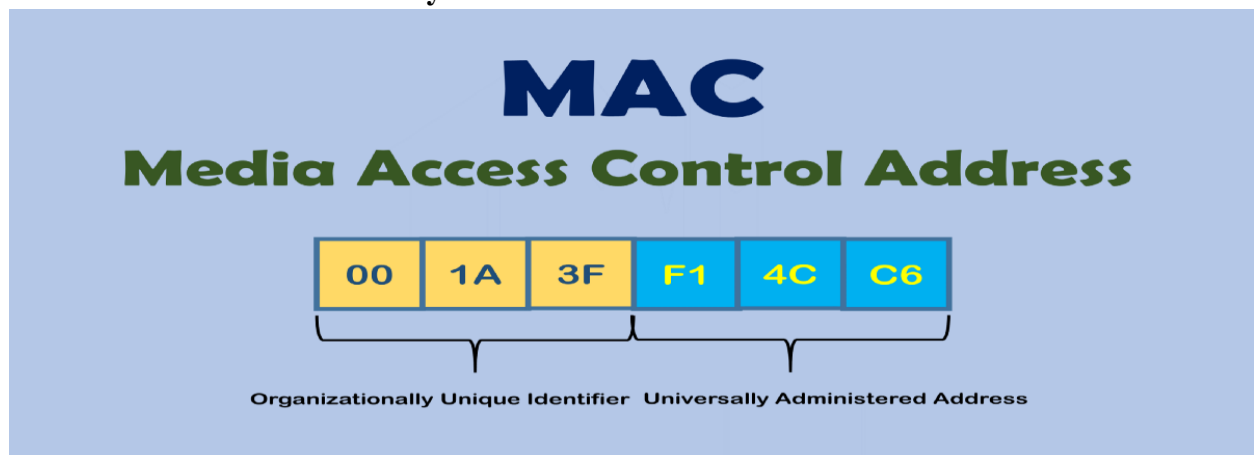
the gigabit data rate. 1000BASE-T can be used in data centers for server interconnects or network switch uplinks or be used directly with the desktop.

**Fiber Optic NIC:** card use 32/64-bit PCI bus network interface card, the establishment of the PC or the connection between the server and the switch, to solve the bottleneck problem of the Intranet server NIC mode fiber optic transmission media interface, 32/64bit/66MHz's



## MAC Address

MAC Addresses are unique **48-bits** hardware number of a computer, which is embedded into a network card (known as a **Network Interface Card**) during the time of manufacturing. MAC Address is also known as the **Physical Address** of a network device.













# BRAINWARE UNIVERSITY

BNCSC201

CLASS NOTES

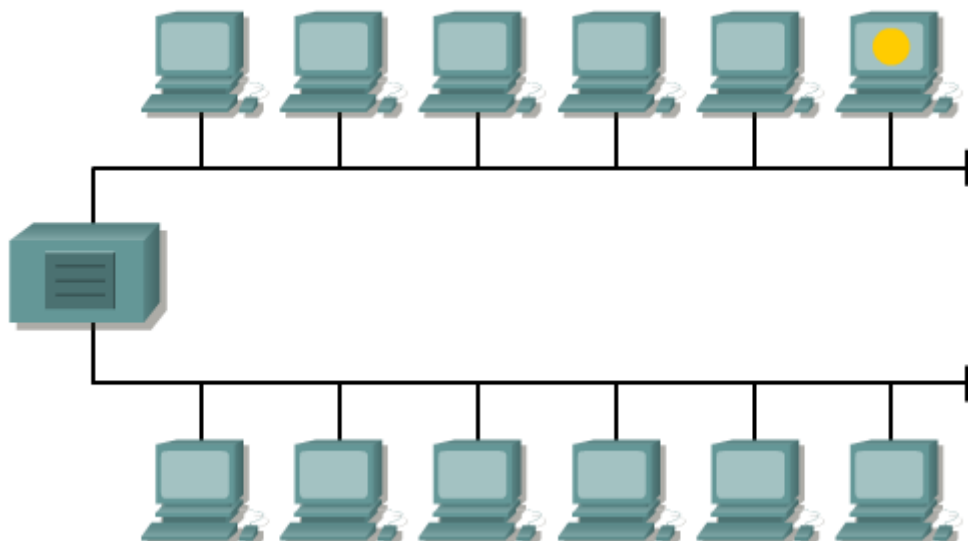
Computer Networks

## Network Device Icons

Network Devices	
Repeater 	Bridge 
10BASE-T Hub 	Workgroup Switch 
100BASE-T Hub 	Router 
Hub 	Network Cloud 

### Repeater

A repeater is a network device used to regenerate a signal. Repeaters regenerate analog or digital signals distorted by transmission loss due to attenuation. A repeater does not perform intelligent routing.





# BRAINWARE UNIVERSITY

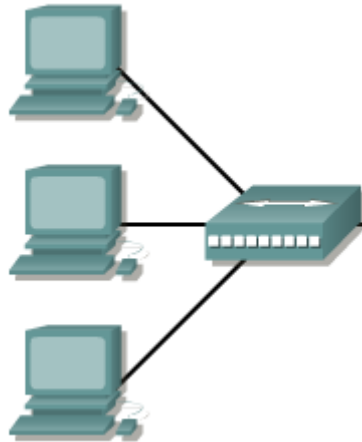
BNCSC201

CLASS NOTES

Computer Networks

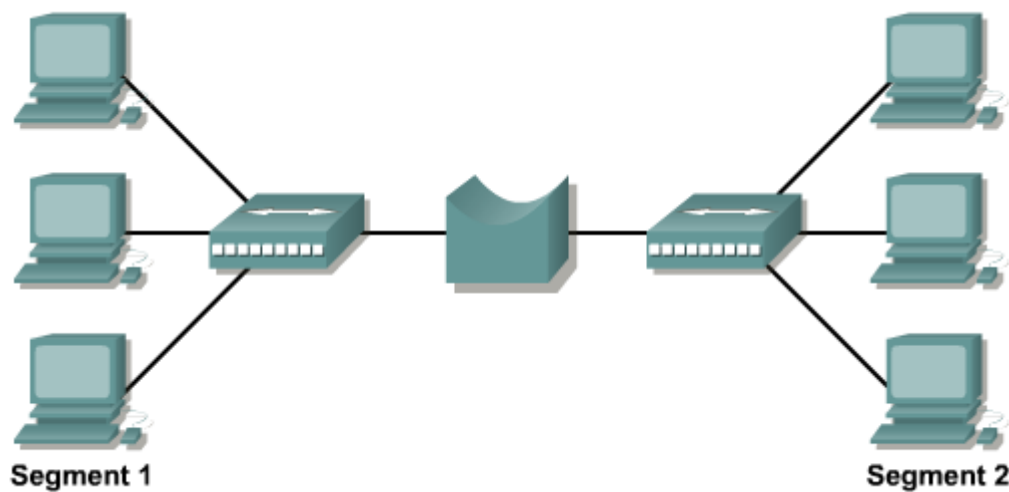
## Hub

Hubs concentrate connections. In other words, they take a group of hosts and allow the network to see them as a single unit. This is done passively, without any other effect on the data transmission. Active hubs not only concentrate hosts, but they also regenerate signals.



## Bridge

Bridges convert network transmission data formats as well as perform basic data transmission management. Bridges, as the name implies, provide connections between LANs. Not only do bridges connect LANs, but they also perform a check on the data to determine whether it should cross the bridge or not. This makes each part of the network more efficient.



## Switch

**Switches are Data Link layer devices.** Each Switch port has a unique MAC address. Connected host MAC addresses are learned and stored on a MAC address table.

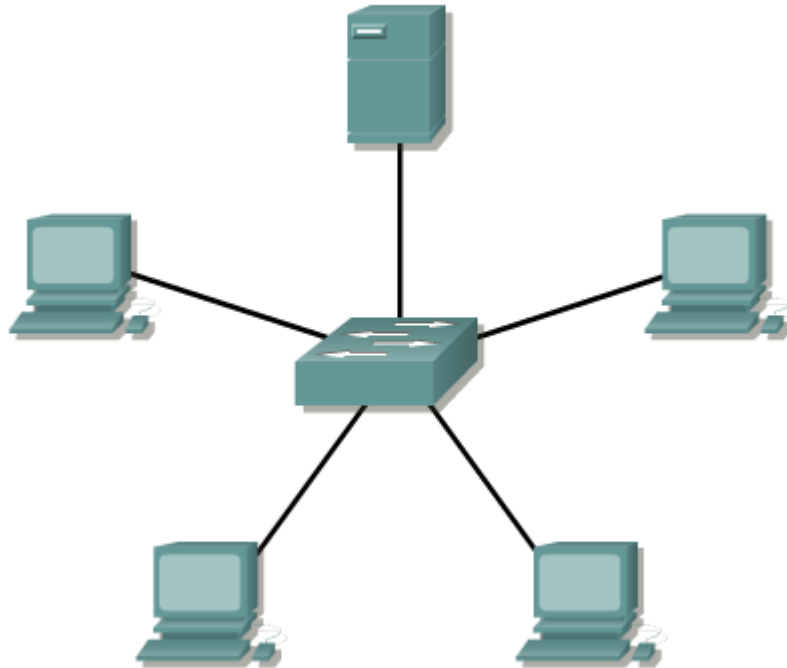


# BRAINWARE UNIVERSITY

BNCSC201

CLASS NOTES

Computer Networks



## Workgroup Switch

Workgroup switches add more intelligence to data transfer management. Switches can determine whether data should remain on a LAN or not, and they can transfer the data to the connection that needs that data.

Types of Switch:

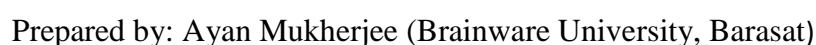
- KVM Switch.
- Managed Switch.
- Unmanaged Switch.
- Smart Switch.
- PoE Switch

## KVM Switch

A KVM switch is an ideal interface for a single user that needs to control the functions of multiple computers from a single console. These devices can often be programmed with keyboard hotkeys that let you easily switch between PCs. With the addition of a KVM extender, the reach of the switch can be extended several hundred feet by transmitting DVI, VGA or HDMI video signals. This configuration allows for local and remote access to the machines. A complete KVM solution lets you easily centralize server maintenance and management.



Computer Networks





# BRAINWARE UNIVERSITY

BNCSC201

CLASS NOTES

Computer Networks

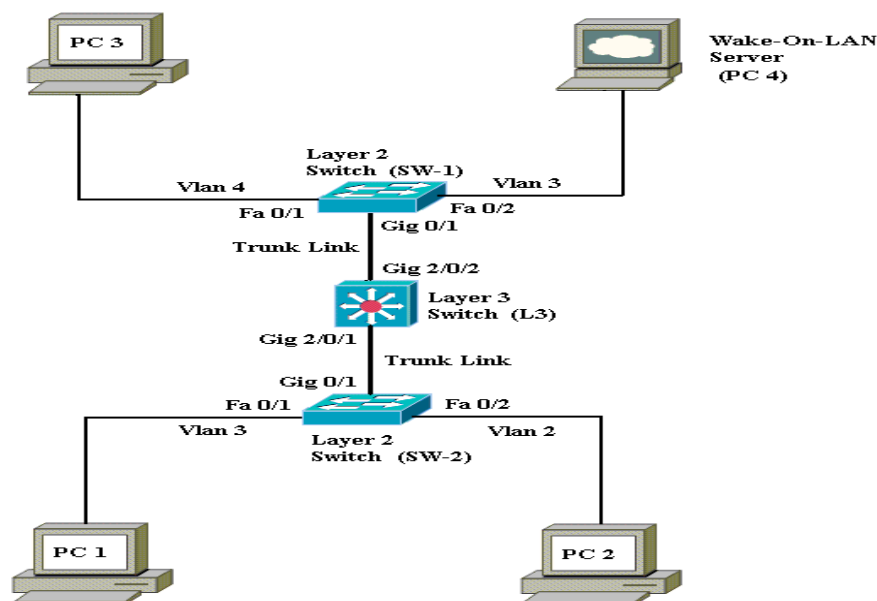


## Working of a Switch

A network switch works at the data link Layer 2 of the architecture of Open Systems Interconnection (OSI). It accepts packets from access points linked to physical ports and then sends them only via the ports going to a destination device. These could also function where routing occurs at the network Layer 3.

Connecting to Ethernet Segment:

Layer 2 Ethernet ports on Cisco switches support simultaneous, parallel connections between Layer 2 Ethernet segments. Switched connections between Ethernet segments last only for the duration of the packet. New connections can be made between different segments for the next packet. Cisco switches that support Layer 2 Ethernet ports solve congestion problems caused by high-bandwidth devices and by a large number of users by assigning each device (for example, a server) to its own 10-, 100-, or 1000-Mbps collision domain. Because each LAN port connects to a separate Ethernet collision domain, servers in a properly configured switched environment achieve full access to the bandwidth.





# BRAINWARE UNIVERSITY

BNCSC201

CLASS NOTES

Computer Networks

## Multi-Speed Switch

Multi-gigabit Ethernet paves the way for high-speed Wi-Fi 5 and Wi-Fi 6 access points, as well as IoT devices, by delivering blazing fast performance and PoE support over existing cabling. Using existing CAT5e and CAT6 twisted pair wiring, multi-gigabit Ethernet saves the expense and reduces the complexity of a new cabling infrastructure.



## Introduction to Routers

A router is a special type of computer. It has the same basic components as a standard desktop PC. However, routers are designed to perform some very specific functions. Just as computers need operating systems to run software applications, routers need the Internetwork Operating System software (IOS) to run configuration files. These configuration files contain the instructions and parameters that control the flow of traffic in and out of the routers. The many parts of a router are shown below:



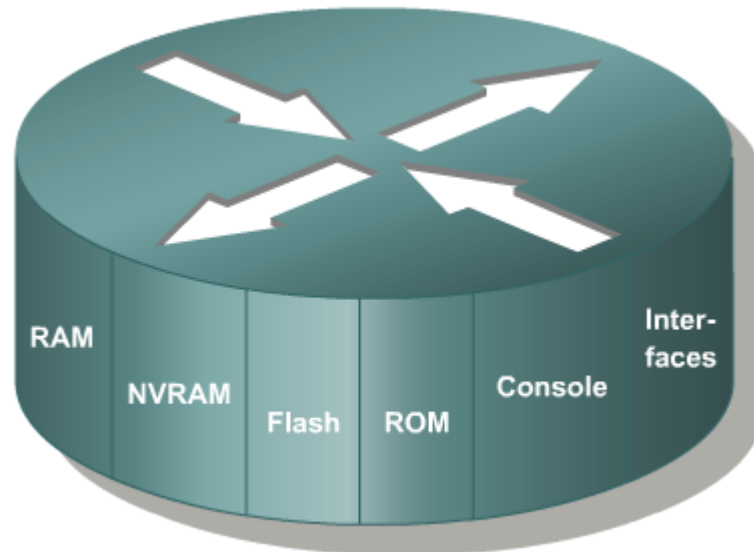


# BRAINWARE UNIVERSITY

BNCSC201

CLASS NOTES

Computer Networks



## Features of Router

- A router is a layer 3 or network layer device.
- It connects different networks together and sends data packets from one network to another.
- A router can be used both in LANs (Local Area Networks) and WANs (Wide Area Networks).
- It transfers data in the form of IP packets. In order to transmit data, it uses IP address mentioned in the destination field of the IP packet.
- Routers have a routing table in it that is refreshed periodically according to the changes in the network. In order to transmit data packets, it consults the table and uses a routing protocol.
- In order to prepare or refresh the routing table, routers share information among each other.
- Routers provide protection against broadcast storms.
- Routers are more expensive than other networking devices like hubs, bridges and switches.
- Routers are manufactured by some popular companies like –
  - ✓ Cisco
  - ✓ D-Link
  - ✓ HP
  - ✓ 3Com
  - ✓ Juniper
  - ✓ Nortel

## Gateway

A computer that sits between different networks or applications. The gateway converts information, data or other communications from one protocol or format to another. A router may perform some of the functions of a gateway.

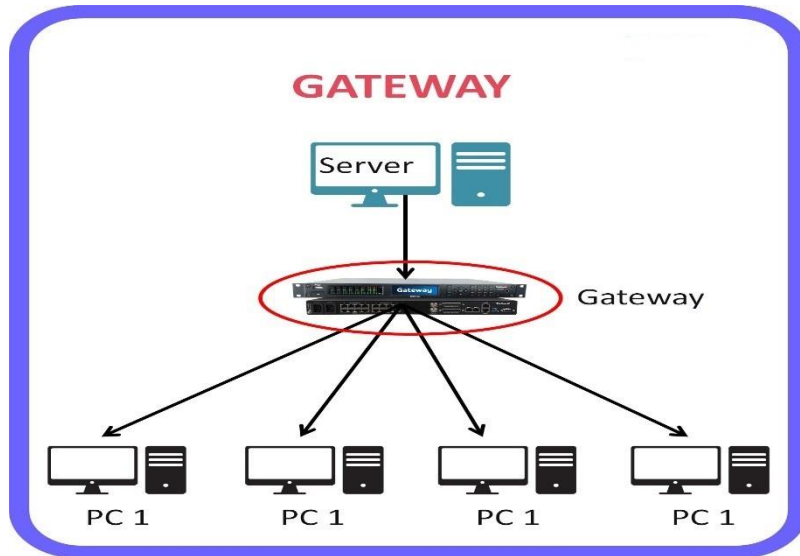


# BRAINWARE UNIVERSITY

BNCSC201

CLASS NOTES

Computer Networks



## Modem

Modem stands for Modulation Demodulation. A modem converts the digital data signals into analogue data signals. They can be installed within the computer in a development slot applicable for it.

There are frequently two types of Modems that are as follows –

### Standard Modem

The standard modems use generic device drivers, and they can be internal and external ones. The internal modems do not need much physical structure. They can be installed into a compatible development slot. The external modem is connected through one of the COM port to the computer through a cable called a null-modem cable.

### Window Modem

A window modem is a private plug and plays tool. It requires a particular device driver supported by the window operating framework to function correctly.

### Features of Modems

The main features of modems are as follows –

- They have high uploading and communication rates. An X2 modem provides an uploading bandwidth between 28.8 to 56 Kbps.
- They are upgradeable through a software patch to meet almost any universal standard.
- They enable high-speed downstream data transfers by digitally encoding all downstream data while upstream runs at conventional rates of 33.6 kbps.
- Some modems incorporate dual simultaneous voice and Data (DSVD), i.e., they can carry both analog voices and computer data.



# BRAINWARE UNIVERSITY

BNCSC201

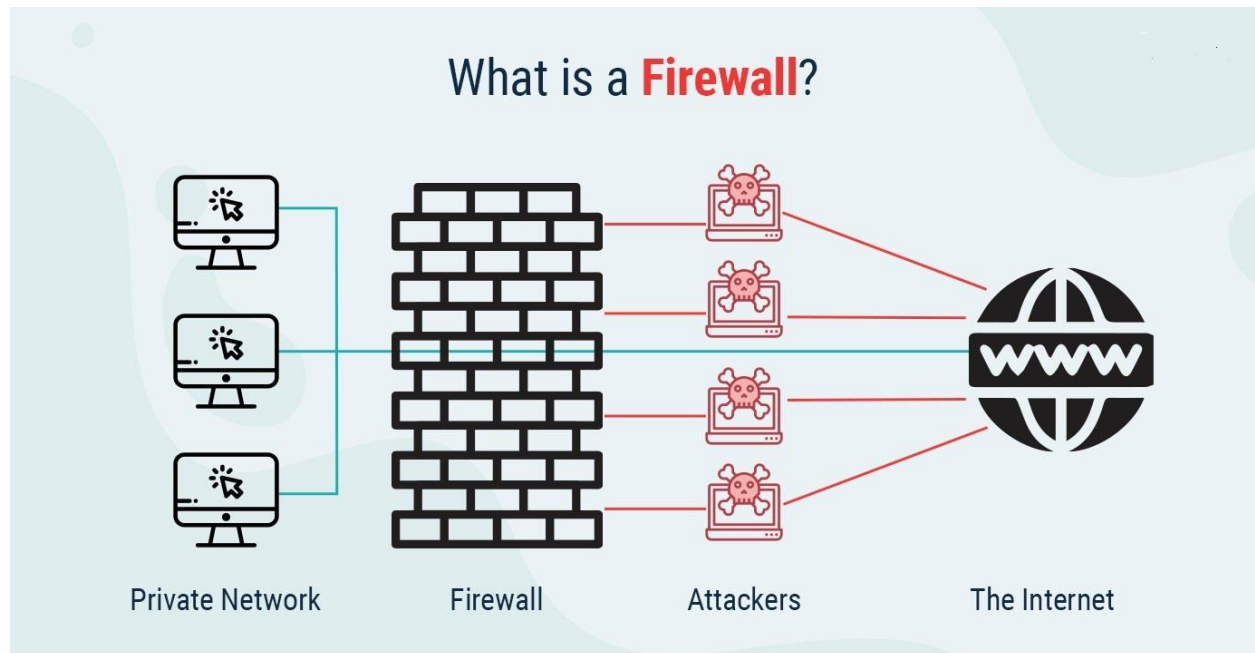
CLASS NOTES

Computer Networks

- They can detect callers originating telephone number, and thus they can serve as caller ID.
- Some modems provide advanced voice mail features, and those modems serve as intelligent, answering machines or digital information systems.

## Firewall

A Firewall is a network security device that monitors and filters incoming and outgoing network traffic based on an organization's previously established security policies. At its most basic, a firewall is essentially the barrier that sits between a private internal network and the public Internet. A firewall's main purpose is to allow non-threatening traffic in and to keep dangerous traffic out.



## Access Point

An access point (AP) is a term used for a network device that bridges wired and wireless networks. Consumer APs are often called a "wireless routers" because they typically also serve as both internet routers and firewalls. Commercial and industrial APs tend towards minimal network routing capabilities and rarely have firewalls.

Most APs connect wireless networks using the Wi-Fi standard; however, modern commercial and industrial APs increasingly offer support for the Bluetooth and Thread wireless standards, as well. This allows commercial and industrial APs to support both human-centric and Internet of Things (IoT) devices.

The differences between consumer APs and commercial or industrial APs is easily explained by network scale. A consumer AP is typically designed to be the only piece of network infrastructure in a



# BRAINWARE UNIVERSITY

BNCSC201

CLASS NOTES

Computer Networks

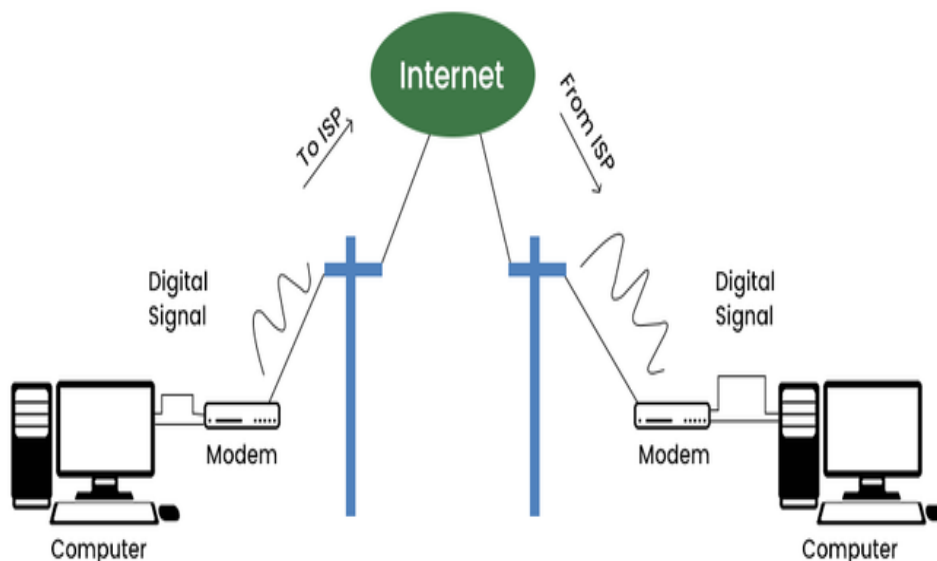
home. It must connect the home network to the internet, provide basic information security defenses, and support perhaps a dozen networking devices.

Baseband Frequency:

**Baseband** is the transmission of a signal in its original, unmodulated form. A baseband signal can be analog (e.g., originating from a telephone) or digital (e.g., originating from a computer). It is a signal at a very narrow frequency range on which data or information is superimposed and then transmitted. It is also called a lowpass signal since it can include near-zero frequencies. In this sense, a sound waveform is considered as a baseband while radio signals often rated in the megahertz levels are not considered baseband.

## Broadband

Broadband refers to various high-capacity transmission technologies that transmit data, voice, and video across long distances and at high speeds. Common mediums of transmission include coaxial cables, fiber optic cables, and radio waves.



## Leased Line

A leased line is a dedicated data connection with a fixed bandwidth. It enables small, medium, and large businesses to connect to the internet in a secure, reliable, and highly efficient manner, with maximum download capacity, resilience, and uptime.

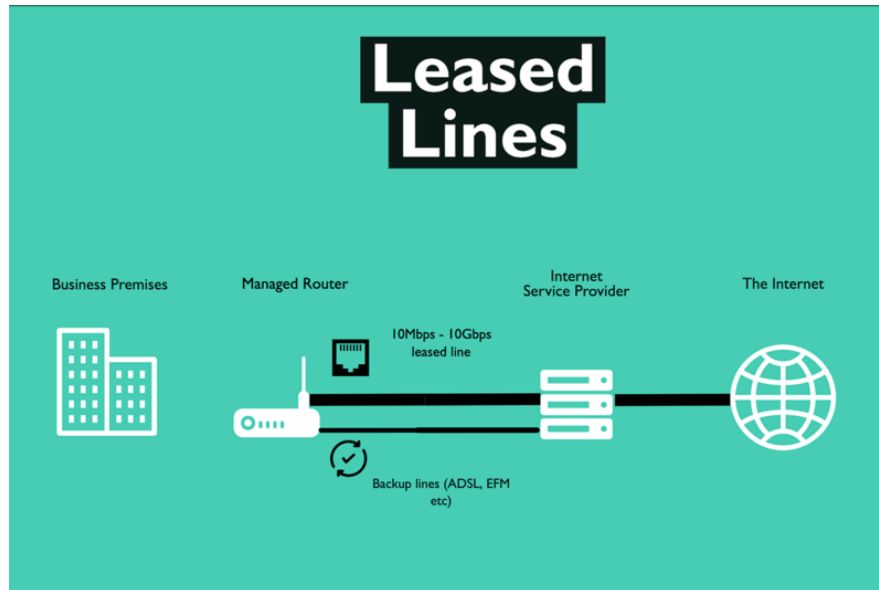


# BRAINWARE UNIVERSITY

BNCSC201

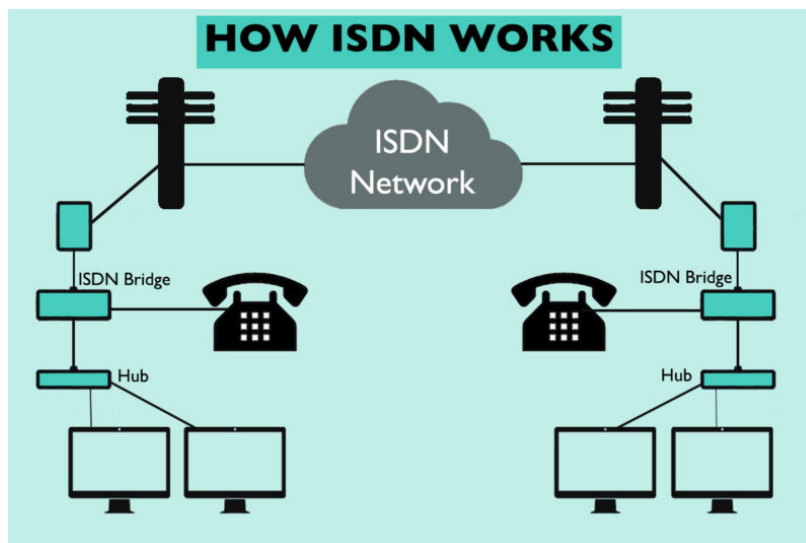
CLASS NOTES

Computer Networks



## ISDN

ISDN or Integrated Services Digital Network is a **circuit-switched telephone network system that transmits both data and voice over a digital line**. You can also think of it as a set of communication standards to transmit data, voice, and signaling. These digital lines could be copper lines.



## DSL

DSL utilizes old copper telephone lines to transfer digital data, including internet downloads and uploads and VoIP calls, together with conventional phone signals. It runs at different frequencies than phone signals, but dial-up internet inhibits phone signals from utilizing the connection.

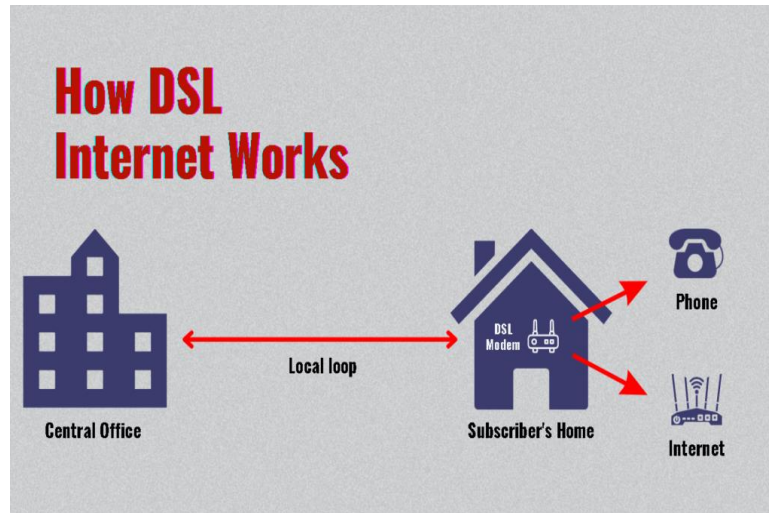


# BRAINWARE UNIVERSITY

BNCSC201

CLASS NOTES

Computer Networks



## ADSL

ADSL is a popular, older type of broadband, with the term standing for Asymmetric Digital Subscriber Line. It is a broadband connection that works through the copper wires of existing phone lines and is mainly used for home broadband and within small businesses. To set-up an ADSL broadband connection, an existing phone system is connected to the BT line through copper wires. During installation, a DSL (Digital Subscriber Line) filter, or splitter, isolates frequency bands allowing a single line to be used for both telephone calls and ADSL broadband.

