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Internal Assessment Test 1 – September. 2019

Sub:	Multimedia Communication					Sub Code:	15EC741	Branch:	ECE	
Date:	07/09/2019	Duration:	90 min's	Max Marks:	50	Sem / Sec:	VII A,B,C & D		OBE	

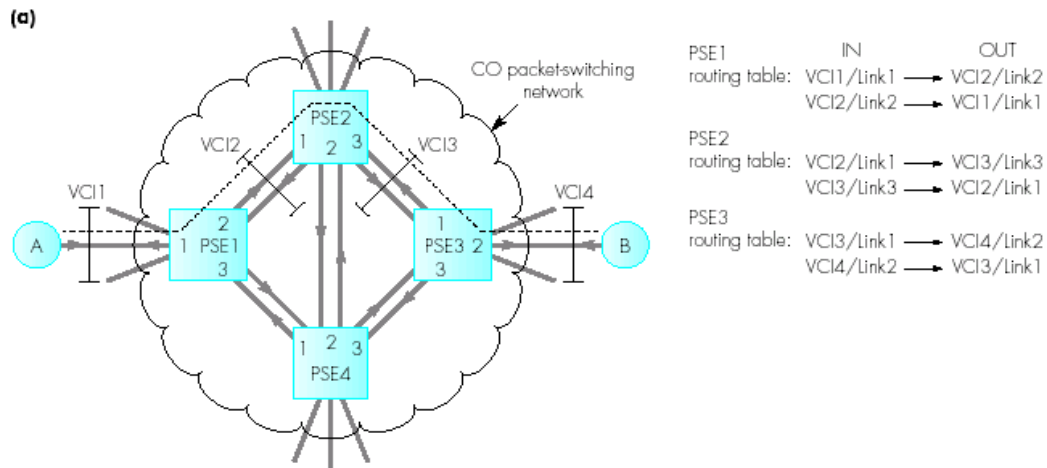| Answer any FIVE FULL Questions	MARKS	CO	RBT
1. Explain the working principle of circuit-mode and packet-mode of operation of multimedia networks with a neat diagram. List out salient features of each type of networks.	[10]	CO1	L1
2. List different types of multimedia networks. Explain with a neat diagram (i)Telephone network (ii)Integrated Services Digital Network	[10]	CO1	L1
3. Explain with a neat sketch how voice mail and teleconferencing is supported in relation To Speech only interpersonal communication.	[10]	CO1	L2
4. (a) Briefly explain the communication modes with a simple sketch.	[04]	CO1	L1
(b)What is multipoint conferencing? Explain the various types with diagrams.	[06]	CO1	L1
5. Explain with neat diagrams the entertainment applications of multimedia.	[10]	CO1	L2
6. (a)Derive the maximum block size that should be used over a channel which has BER Probability of 10^{-4} if the probability of a block containing an error and being discarded is to be 10^{-1}.	[05]	CO1	L3
(b)Explain briefly about the network QoS Parameters.	[05]	CO1	L1
7.Explain with neat diagrams, the Interactive Television application for both cable and satellite network.	[10]	CO1	L1

1.) **Circuit and Packet Switching:**

- **This operates in a *time-dependent* manner and comprises an interconnected set of switching offices/exchanges to which the subscriber terminals/computers are connected**

- **Step1: The source must set up the connection first through the network**

- **Step2: Each subscriber terminal has a unique network wide address and to make a call the source first enters this number of the intended communication partner**

- **Step3: The local switching office uses this number to set up a connection. Depending on the availability of the destination the connection will be established**

- **Step4: Finally at the end of information exchange the call will be terminated by the source or the destination**

- ***Signalling messages* – The messages associated with the setting up and clearing of a connection**

- *Call/Connection setup delay* – **The delay associated with the connection procedures**

- **Examples of Circuit-mode operation – PSTN and ISDN**

- **PSTN – setup delay varies from fraction of a *second* to *few seconds* for international connections**

- **ISDN – setup delay ranges from *tens of milliseconds* through to several *hundred milliseconds***

- **There are two types of packet-mode network**

- **- Connection Oriented (CO)**

- **-Connectionless(CL)**

(a)

CO packet-switching network

VCI2   VCI3

VCI1   VCI4

A   2   1 PSE1   3   PSE3 2   3   B

PSE2   1 2 3

PSE4   1 2 3

PSE1
routing table: VCI1/Link1 ⟶ VCI2/Link2
                 VCI2/Link2 ⟶ VCI1/Link1

PSE2
routing table: VCI2/Link1 ⟶ VCI3/Link3
                 VCI3/Link3 ⟶ VCI2/Link1

PSE3
routing table: VCI3/Link1 ⟶ VCI4/Link2
                 VCI4/Link2 ⟶ VCI3/Link1

IN   OUT

-

- **As the name implies a connection is established prior to information interchange**

- **The connection utilizes only a variable portion of the bandwidth of each link and known as virtual circuit (VC)**

- **To set up a VC the source terminal sends a call request control packet to the local PSE which in addition to the source and destination addresses holds a short identifier known as *virtual circuit identifier* (VCI)**

- **Each PSE maintains a table that specifies the outgoing link to use to reach the network address**

- **On receipt of the call request the PSE uses the destination address within the packet to determine the outgoing link**

- **The next free identifier (VCI) for this link is selected and two entries are made in the *routing table***

(b)

CL packet-switching
network

Router
2

A/B

A/B

Router
1

Router
3

A

B

Router
4
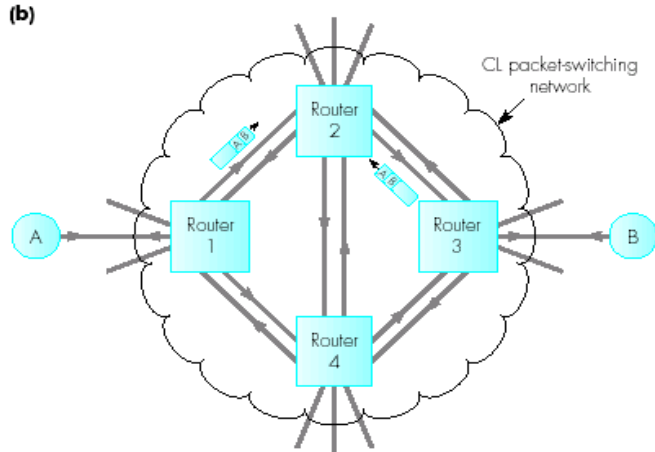
- **In connectionless network, the establishment of a connection is not required and they can exchange information as and when they arrive**

- **Each packet must carry the full source and destination address in its header in order for each PSE to route the packet onto the appropriate outgoing link (router term used rather than PSE)**

- **In both types each packet is stored in a memory buffer and a check is performed to determine if any transmission errors are present in the received message. (i.e 0 instead of a 1 or vice versa)**

- **If an error is detected then the packet is discarded known as best-effort service.**

- **All packets are transmitted at the maximum link bit rate**

- **As packets may need to use the same link to transfer information an operation known as store-and-forward is used.**

2. Five types of Multimedia Networks are:

- Telephone Networks - Telephony
- Data Networks – Data Communications
- Broadcast Television Networks – Broadcast TV
- Integrated services digital Network
- Broadband Multiservice networks
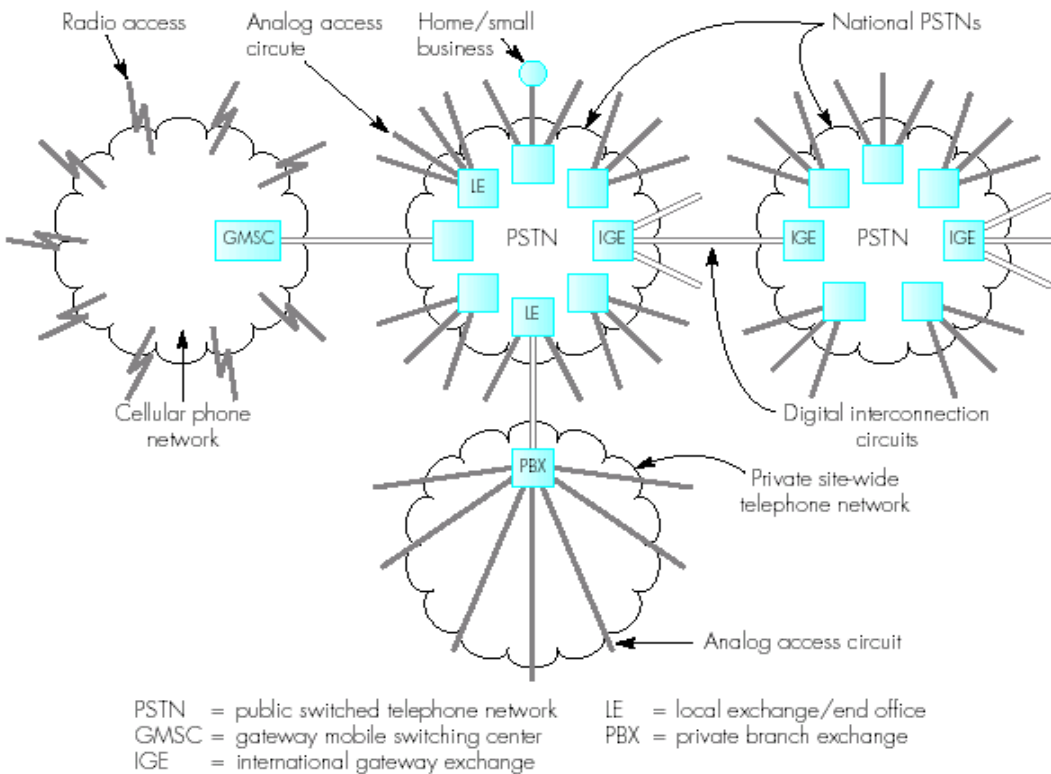
Telephone Networks:

Fig: Telephone Networks

- PSTN – Now known as *Plain Old Telephone Service* (**POTs**)

 The term *switched* means a subscriber can make a call to any other telephone on the 'total' network. PSTN (public switched telephone network) is the world's collection of interconnected voice-oriented public telephone networks, both commercial and government-owned. It's the aggregation of *circuit-switching* telephone networks that has evolved from the days of Alexander Graham Bell. Today, it is almost entirely digital in technology except for the final link from the central (local) telephone office to the user.

Telephones in the home or in a small business are connected directly to their nearest **local exchange/end office.** Telephones in a large office are connected to a private switching office known as **private branch exchange** (**PBX).**PBX provides free service between two telephones that are connected to it.

A PBX is a telephone system within an *enterprise* that switches calls between enterprise users on local lines while allowing all users to share a certain number of external phone lines. The main purpose of a PBX is to save the cost of requiring a line for each user to the telephone company's central office.

PBX is connected to the *local exchange* and this enables phones connected to the PBX to make calls through PSTN too. **Cellular phone networks** – Provides service to mobile subscribers. The switches used in a cellular phone network are known as **Mobile Switching Centres (**MSCs**).**International calls are routed to and switched by **international gateway exchanges** (IGEs).

Circuit mode – Telephone networks operate in this mode in which a separate circuit is set up through the network for each call for the duration of the call.

Access Circuits – Link the telephone handsets to a PSTN or PBX and carry two-way analogue signals associated with a call.
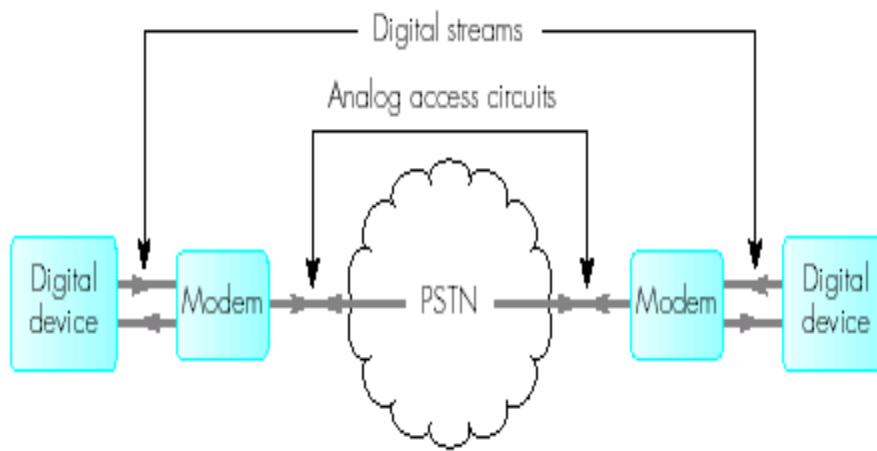
Today with *high bit-rate channels* in addition to the voice using the same access networks high resolution audio and video can be downloaded from a range of entertainment related servers.
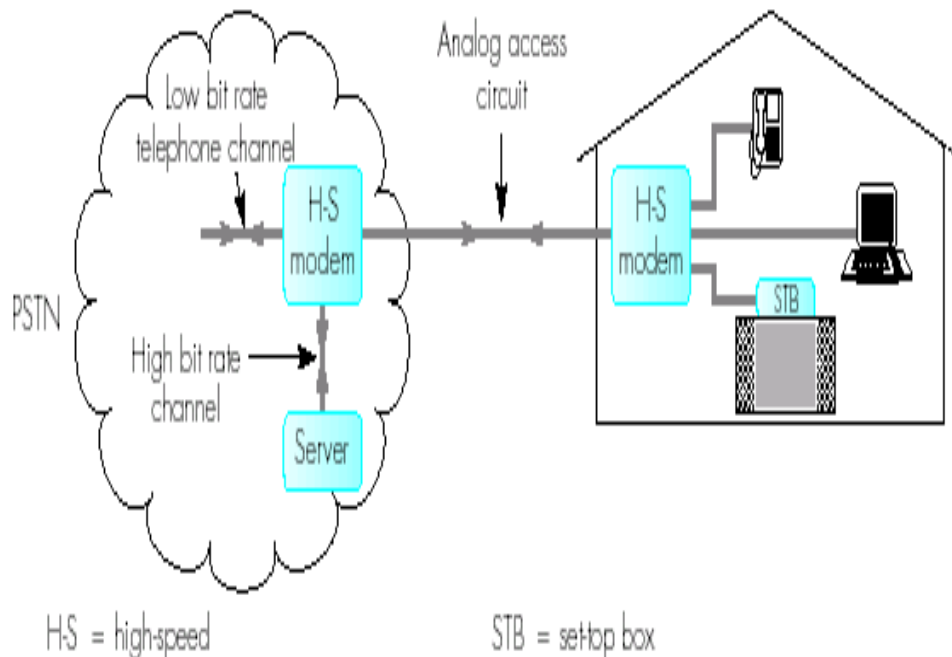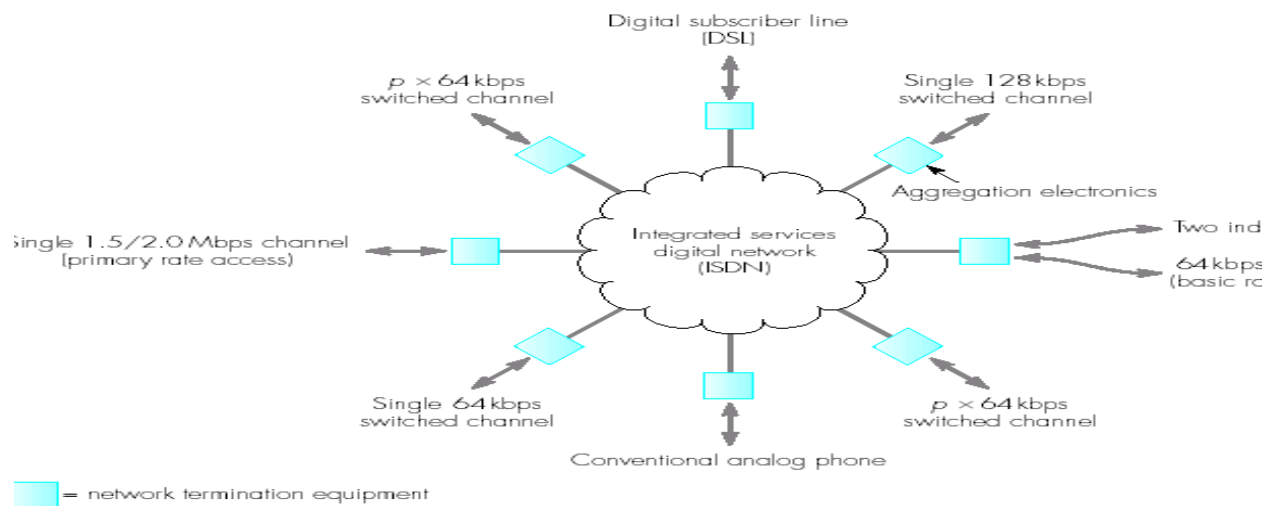
Integrated Services Digital Network:

- Started to develop in the early 1980s to provide PSTN users the capability to have additional services

- *Integrated Services Digital Network (ISDN)* in concept is the integration of both analogue and voice data together with digital data over the same network.

ISDN is a set of ITU standards for digital transmission over ordinary telephone copper wire as well as over other media. Home and business users who install an ISDN adapter (in place of a modem) can see highly-graphic Web pages arriving very quickly (up to 128 Kbps). ISDN requires adapters at both ends of the transmission so your access provider also needs an ISDN adapter. ISDN is generally available from your phone company

- DSL (Digital Subscriber Line) is a technology for bringing high-bandwidth information to homes and small businesses over ordinary copper telephone lines.

- Assuming your home or small business is close enough to a telephone company central office that offers DSL service, you may be able to receive continuous transmission of motion video, audio, and even 3-D effects.

- Typically, individual connections will provide from 1.544 Mbps to 512 Kbps **downstream** and about 128 Kbps **upstream**. A DSL line can carry both data and voice signals and the data part of the line is continuously connected.

- **Access circuit** that allows users either *two different telephone calls simultaneously or a telephone call and a data network*

Digital subscriber line
[DSL]

$p \times 64$ kbps switched channel

Single 128 kbps switched channel

Aggregation electronics

Single 1.5/2.0 Mbps channel
(primary rate access)

Integrated services digital network
(ISDN)

Two ind

64 kbps
(basic rd

Single 64 kbps switched channel

$p \times 64$ kbps switched channel

Conventional analog phone

= network termination equipment

- DSL supports two 64 kbps channels that can be used independently or as a single combined

3. Traditional interpersonal communication involving speech was provided by using telephones connected to either PSTN/ISDN or PBX hub.

Today multimedia PC equipped with a microphone and speakers can be used to make telephone calls. This technology is known as computer telephony integration (CTI)

- The users can create their own private directory of numbers and can initiate a call simply by selecting the desired numbers from the PC screen

- Provides access circuit to the network with more capacity known as the bandwidth

- Integration of the PC based network services with the telephony is possible

- Voice mail: Used in the event of the called party being unavailable. The voice mail is saved in the server mailbox and can be read by the owner next time they contact the server

- Teleconferencing: Involves multiple interconnected telephones/PCs. Each person can talk to all the others involved in the call. This is known as a conference call. A central unit called an audio bridge provides the necessary support to set up the call automatically

- Internet telephony initially supported computer-to-computer communications

- Today the technology is extend so that computer-to-telephony is possible

- To make a PC-to-PC telephone call the standard addresses that identify the PC on the network are used same as in a data transfer application

- However, since the internet operates in a packet mode necessary conversion software and hardware is mandatory in both the PCs. This type of telephony is known as Voice over IP (VoIP)

- To make a call using a PC connected to the Internet to a telephone connected to a PSTN/ISDN an interworking unit known as telephony gateway is necessary.

- Initially the PC user sends a request to make a telephone call to a preallocated gateway using its internet address.

- If the user is registered the gateway will request the phone number to establish the call from the PC

- On receipt of this the source gateway will initiate a call with the gateway nearest to the called party.

- The called gateway then establishes the call to the recipient telephone using its telephone number and the call setup procedures

- If the called party answers then a signal is sent back by the recipient gateway to the PC user via the source gateway
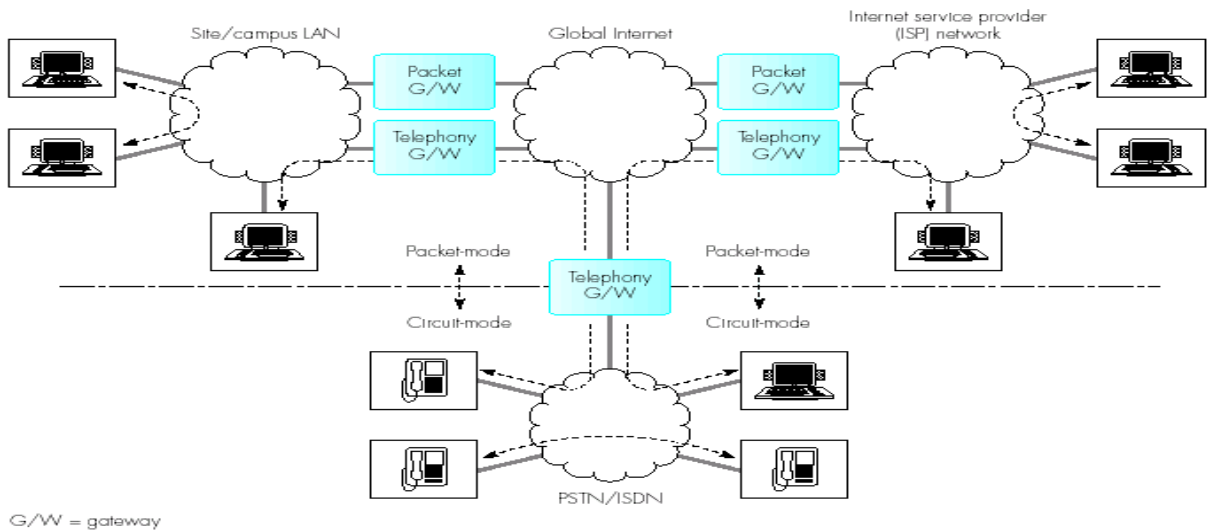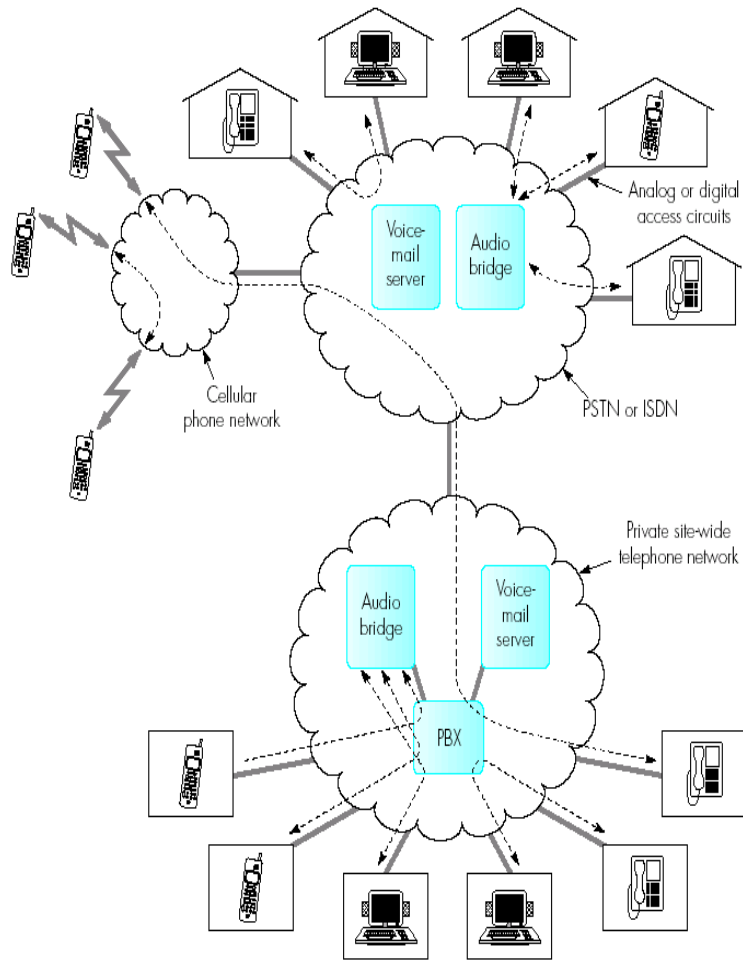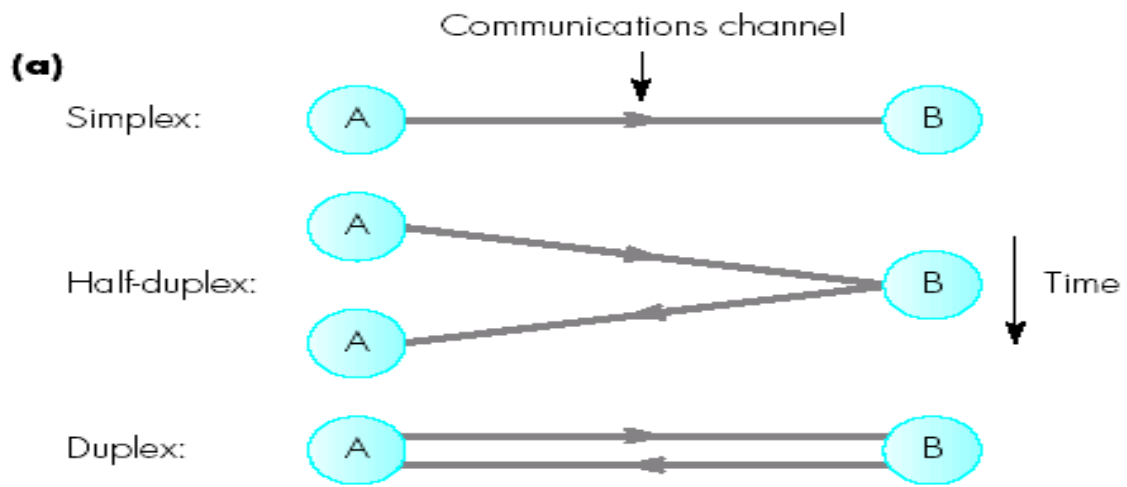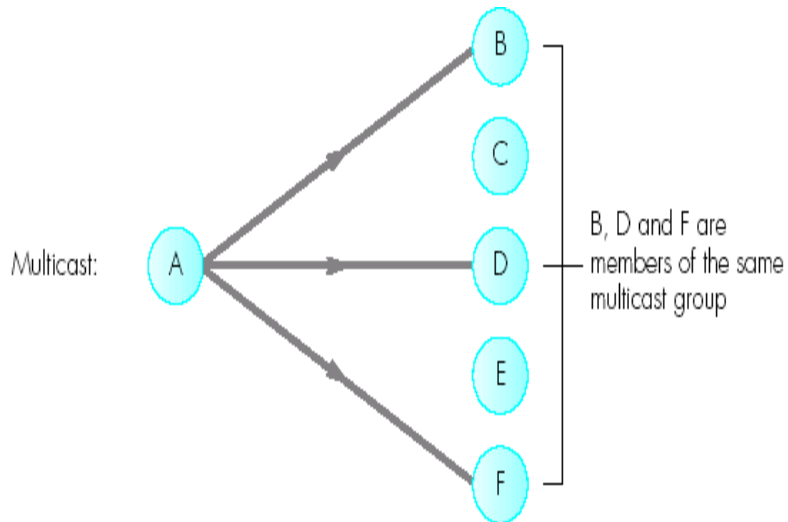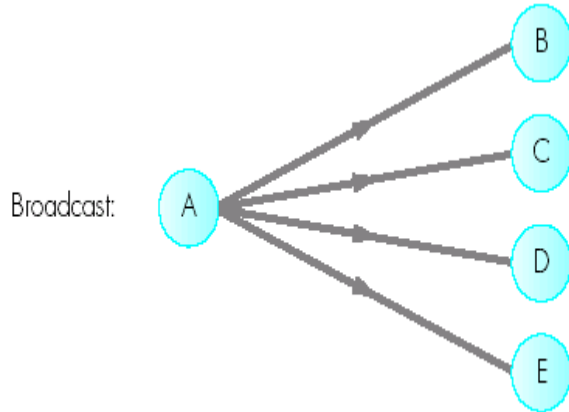
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G/W = gateway

-

PSTN = Public switched telephone network   ISDN = Integrated services digital networrk
PBX = Private branch exchange

-

4. (a) Communication Modes:

- **Simplex: The information associated with the application flows in one direction only.**

- **Half-Duplex: Information flows in both directions but alternatively (two-way alternative).**

- **Duplex: Information flows in both directions simultaneously (Two-way simultaneous).**

Broadcast:

B

C

A

D

E

Multicast:

B

C

A

D

E

F

B, D and F are members of the same multicast group

- **Broadcast: The information output by a single node is received by all the other nodes connected to the same network**

- **Multicast: The information output by the source is received by only a specific subset of the nodes (Latter form known as multicast group)**
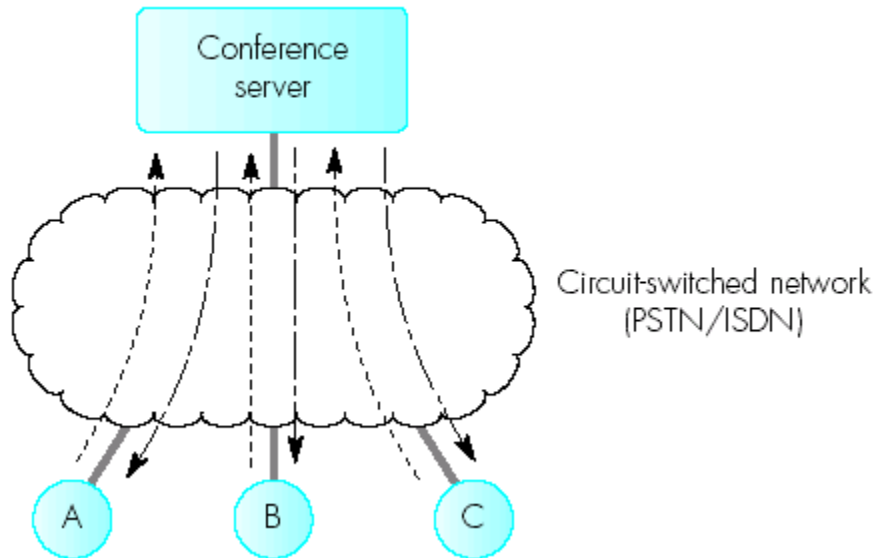
(b) Multipoint Conferencing

- **Multipoint conferencing is implemented in one of two ways**

 *- Centralized mode*

  - Decentralized mode

Centralized mode

**This mode is used with circuit switched networks**

(a)

- **With this mode a central server is used**

- **Prior to sending any information each terminal needs to set up a connection to the server**

- **The terminal then sends the information to the server.**

- **The server then distributes this information to all the other terminals connected in the conference**

- **The decentralized mode is used with packet-switched networks that support multicast communications**

- **E.g – LAN, Intranet, Internet**

(b)
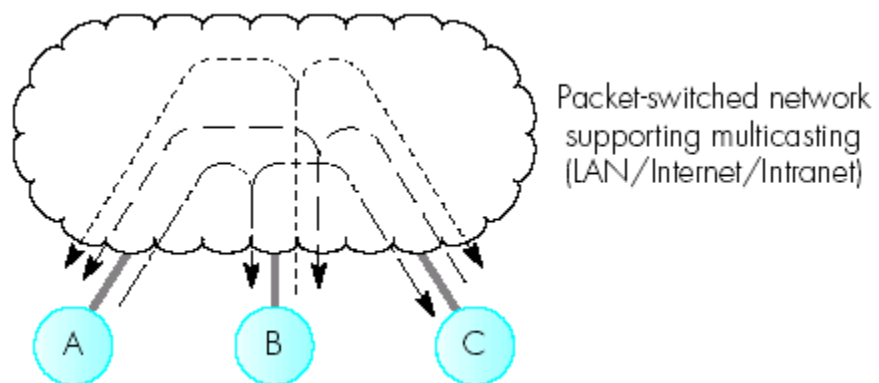
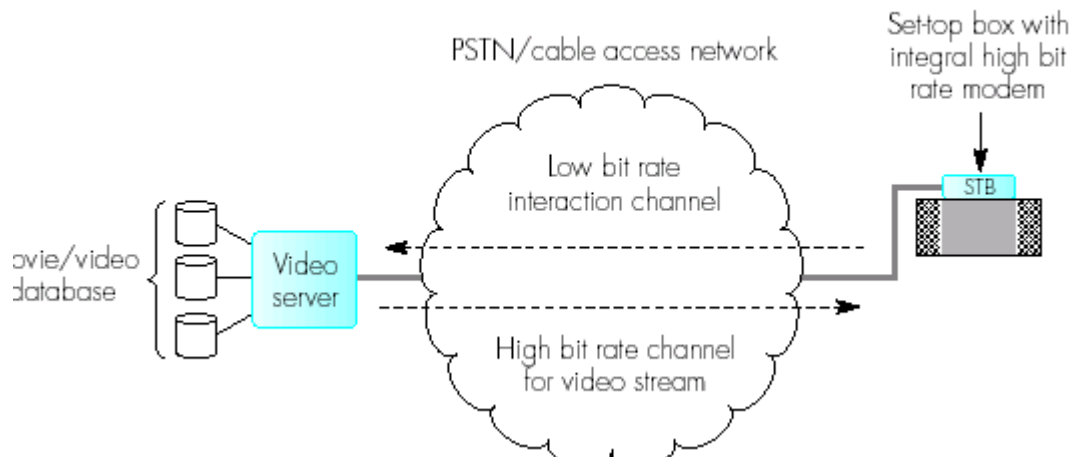- **The output of each terminal is received by all the other members of the conference/multicast group**

- **Hence a conference server is not required and it is the responsibility of each terminal to manage the information streams that they receive from the other members**


Circuit-switched network

Packet-switched network with multicasting

◯ = attached terminal/computer
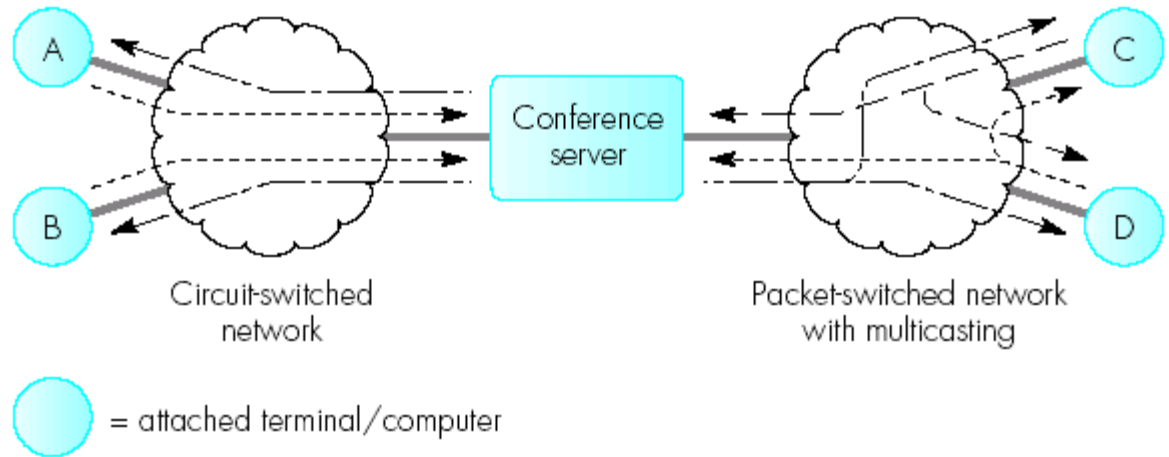
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    This type of mode is used when the terminals are connected to different network types

- **In this mode the server determines the output stream to be sent to each terminal**

5. Entertainment Applications

- *Entertainment applications are classified into:*

- *Movie/video-on-demand*

- *Interactive television*

- **The entertainment applications require higher quality / resolution for video and audio since wide-screen televisions and stereophonic sound are often used**

PSTN/cable access network

Set-top box with integral high bit rate modem

Low bit rate interaction channel

ovie/video database

Video server

High bit rate channel for video stream

STB

- **Normally the subscriber terminal comprises television with a selection device for interaction purposes**

- **The user interactions are relayed to the server through a set-top-box (STB) which contains a high speed modem**

- **By means of the menu the user can browse through the movies/videos and initiate the showing of a selected movie. This is known as Movie-on-demand or Video-on-demand.**

- *Key features of MOD*

- **- Subscriber can initate the showing of a movie from a library of movies at any time of the day or night**

- *Issues associated with MOD*

- **- The server must be capable of playing out simultaneously a large number of video streams equal to the number of subscribers at any one time**

- **- This will require high speed information flow from the server (multi-movies + multi-copies)**

- **In order to avoid the heavy load there is another mode of operation used. In which requests are queued until the start of the next playout time.**
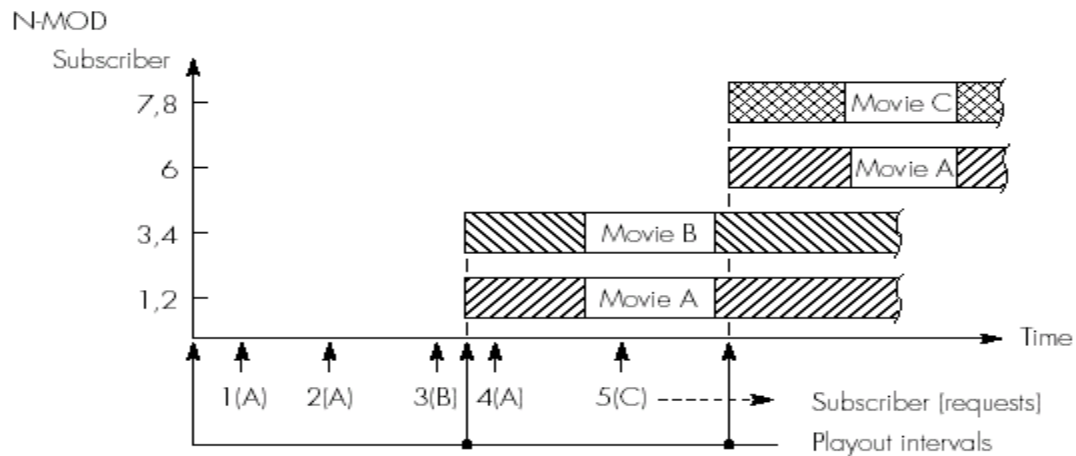
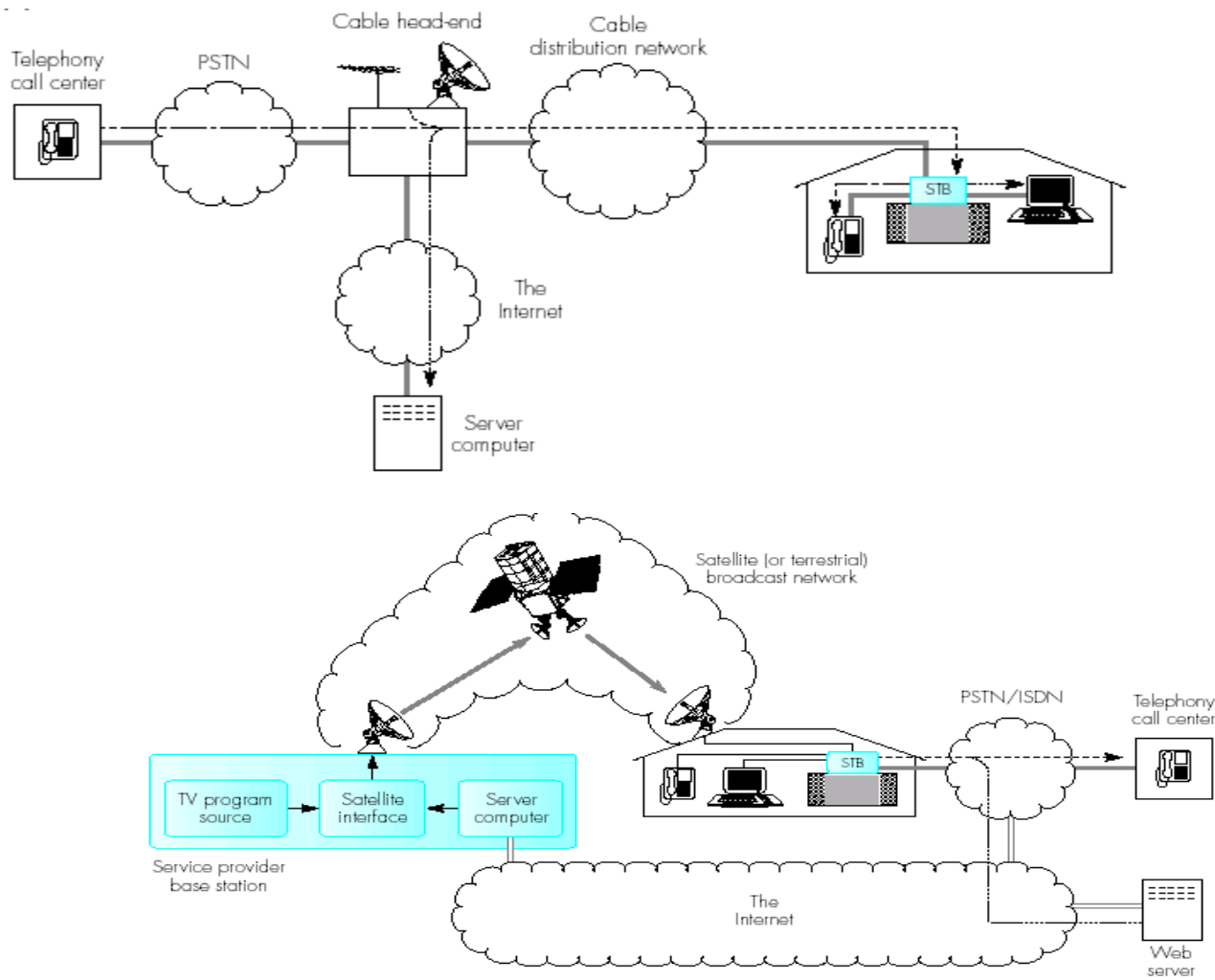**This mode of operation is known as the near movie-on-demand (N-MOD)**

Interactive Television

- **The set-top box (STB) provides both a low bit rate connection to the PSTN and a high bit rate connection to the internet**

- **Through the connection to the PSTN, the subscriber is able to actively respond to the information being broadcast**

Telephony call center
PSTN
Cable head-end
Cable distribution network
STB
The Internet
Server computer

Satellite (or terrestrial) broadcast network
PSTN/ISDN
Telephony call center
STB
TV program source
Satellite interface
Server computer
Service provider base station
The Internet
Web server

- **The STB associated requires a high speed modem to provide the connections to the PSTN and the Internet**

6. (a)

Derive the maximum block size that should be used over a channel which has a mean BER probability of 10^{-4} if the probability of a block containing an error – and hence being discarded – is to be 10^{-1}.

Answer:

$$P_B = 1 - (1 - P)^N$$

Hence $0.1 = 1 - (1 - 10^{-4})^N$ and $N = 950$ bits

Alternatively, $P_B = N \times P$

Hence $0.1 = N \times 10^{-4}$ and $N = 1000$ bits

6. (b)

Network QoS

- **Most networks (circuit and packet switched) provide an unreliable service which is also known as a *best-try* or *best-effort service***

- **If the application accepts only error free blocks then it is necessary for the sending terminal to divide the source information into blocks of a defined maximum size and the destination to detect any missing blocks**

- **When a block is missing then the destination must request for a copy of the block from the source. The service is then called a reliable service.**

Network Quality of Service (QoS) parameters· are the operational parameters associated with a Communications channel through a network, and collectively determine the suitability of the channel in relation to its use for a particular application.

· Circuit-switched network: (CBR network)

· The QoS associated with a CBR channel that is set up through a circuit-switched network include:

· The bit rate
· The mean bit error rate
· The transmission delay

· **The mean bit error rate (BER) of a channel is the probability of a bit being corrupted during its transmission across the channel in a defined time interval.**

Issue of the block size:
· **In practice, most networks provide an unreliable service (best-effort service).· Information is partitioned into blocks during its transmission so as to minimize the propagation of error.**

· **Any blocks containing bit errors will be discarded. A reliable service can be offered by using error detection and block retransmission, which results in high transmission overheads and additional delay.**

· **The choice of the block size is a compromise between the delay and the overhead in this case.**

· **The transmission delay associated with a channel is determined by the bit rate, the codec delay and the propagation delay.**
· **The propagation delay is determined by (i) the physical separation of the 2 communicating devices and (ii) the velocity of propagation of a signal across the transmission medium.**
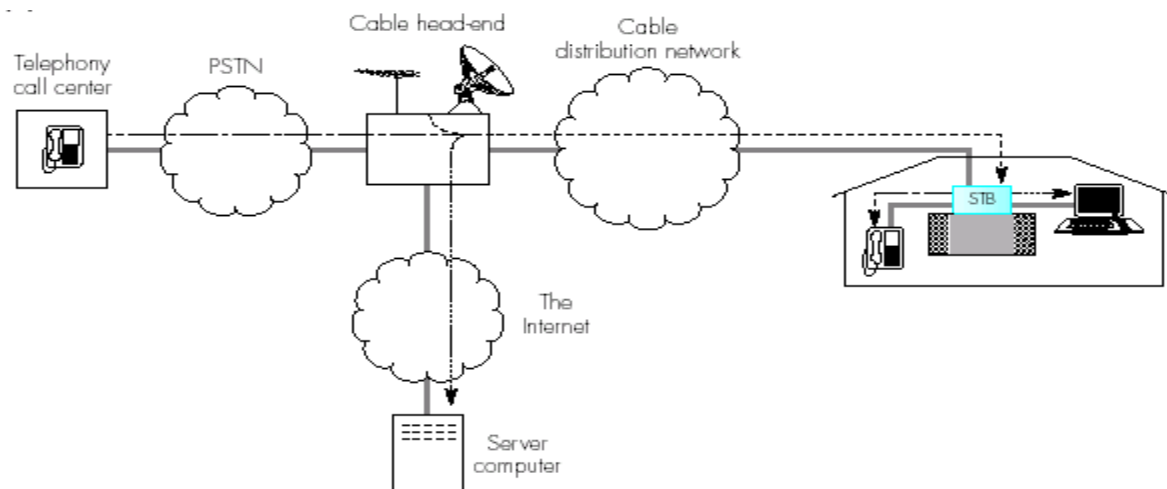
Packet-switched network

· **The QoS parameters associated with a packet-switched network include:**

· **The maximum packet size**
· **The mean packet transfer rate**
· **The mean packet error rate**
· **The mean packet transfer delay**
· **The worst-case jitter**
· **The transmission delay**
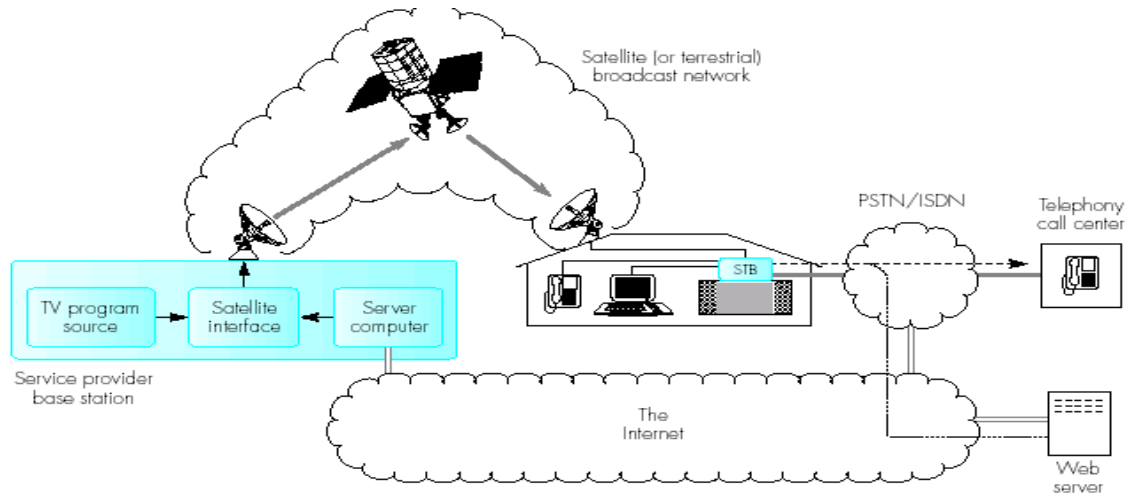
7. Interactive Television

Cable Network

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- **Through the connection to the PSTN, the subscriber is able to actively respond to the information being broadcast**

Satellite Network

Satellite (or terrestrial)
broadcast network

PSTN/ISDN

Telephony
call center

STB

TV program
source

Satellite
interface

Server
computer

Service provider
base station

The
Internet

Web
server

- **The STB associated requires a high speed modem to provide the connections to the PSTN and the Internet**