CMR Institute of Technology
Department of ECE
17EC741/15EC741 – Multimedia Communication
Scheme and Solution – 5th IAT Feb 2022

USN

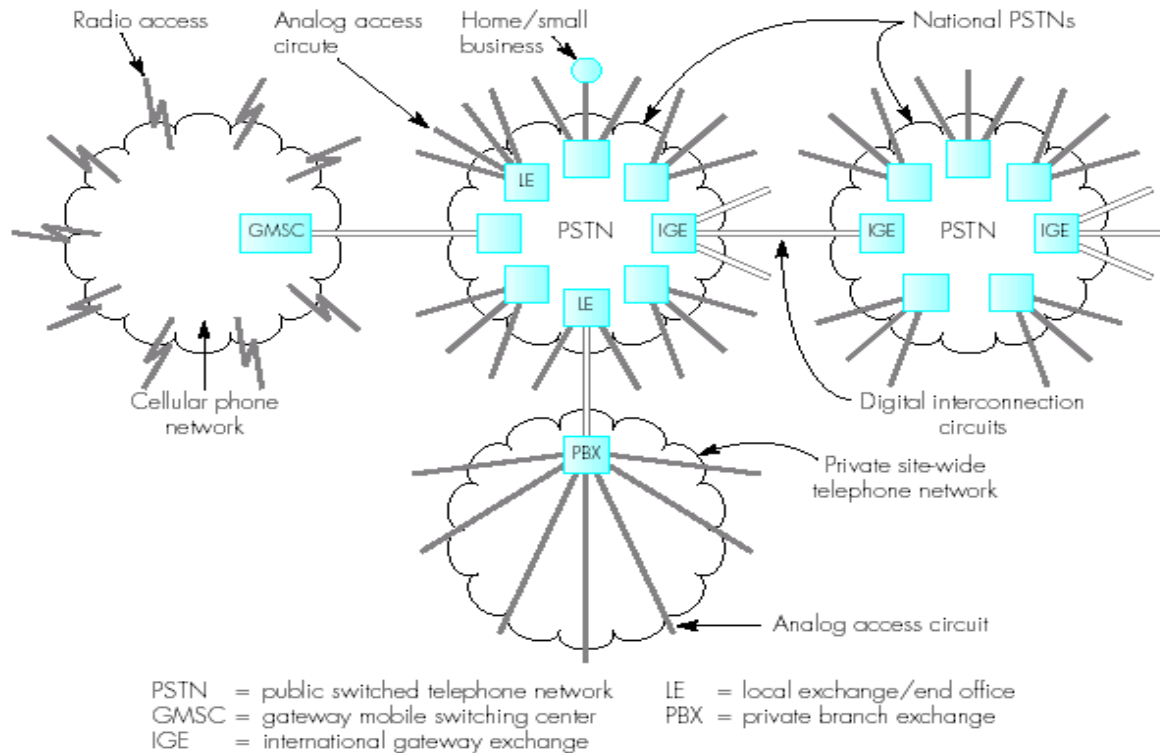### Internal Assessment Test 5 – February 2022

Sub:	Multimedia Communication					Sub Code:	15EC741/ 17EC741		Branch:	ECE/TCE	
Date:	08/02/2022	Duration:	90 min's	Max Marks:	50	Sem / Sec:		VII E		OBE	

|	Answer any FIVE FULL Questions	MARKS	CO	RBT
1.	Explain with a neat diagram, the following multimedia networks: (i)Telephone Networks (ii) Broadcast Television Networks	[10]	CO1	L2
2.	(a) Explain the communication modes available to transfer the information stream	[05]	CO1	L1
	(b) The webpage size is 100 Mbits. Calculate the minimum time to transmit the file using (i) PSTN and 28.8Kbps Modem (ii) ISDN at 64 Kbps (iii) Cable Modem at 27 Mbps	[05]	CO1	L3
3.	Explain with a neat diagram the principle of raster scanning	[10]	CO1	L2
4.	Discuss the concept of Audio Synthesizer with a neat block diagram	[10]	CO4	L1
5.	(a) Explain briefly about SIF and QCIF HDTV Formats	[06]	CO4	L2
	(b) Assuming the CD-DA standard is being used, compute the time to transmit a 30 second portion of the title using a transmission channel of bit rate (i) 64 Kbps (ii) 1.5 Mbps	[04]	CO4	L3
6.	Discuss briefly about entertainment applications of Multimedia	[10]	CO1	L1

1. (i) Telephone Networks

- Public switched telephone networks (PSTNs) – initially designed to provide speech services. However, due to the advances in Digital Signal Processing (DSP) hardware and software now can support multimedia applications


```
PSTN  = public switched telephone network    LE  = local exchange/end office
GMSC = gateway mobile switching center        PBX = private branch exchange
IGE   = international gateway exchange
```

- 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 Centers (**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
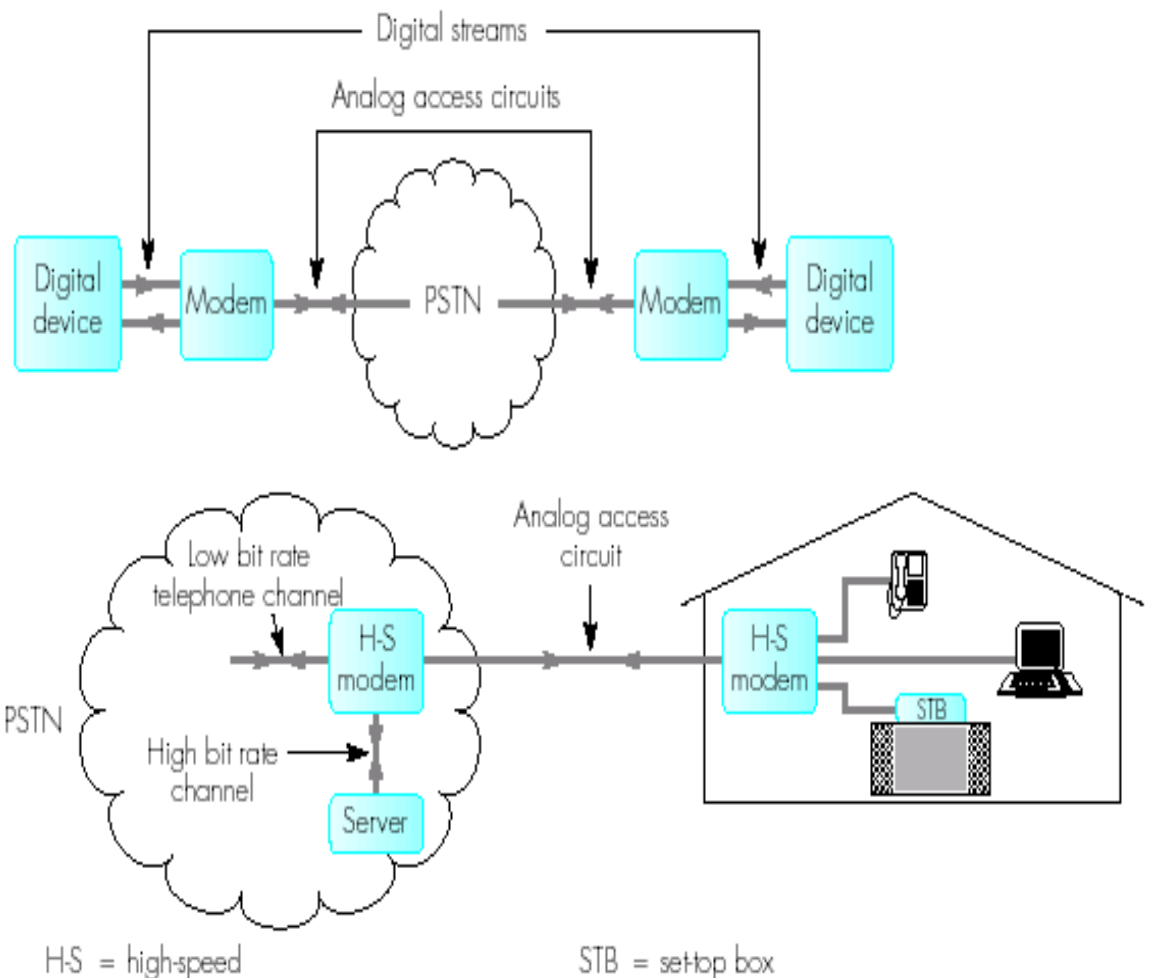

- Today with *high bit-rate channels* in addition to the voice using the same access networks high resolution audio and video can be downloaded from a range of entertainment related servers

(ii) Broadcast Television Networks
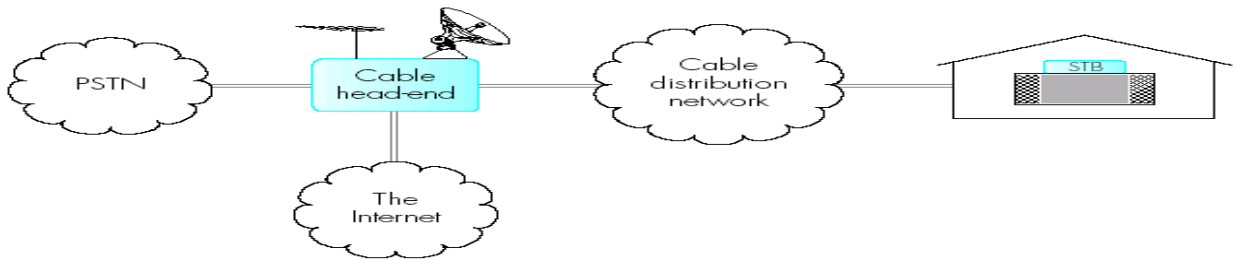
- Broadcast television networks support the diffusion of analogue television programs to a wider geographical area via a **cable distribution network, a satellite network**
- A cable modem integrated into the STB (set-top-box) provides both a low bit rate channel (connects the subscriber to the PSTN) and a high bit rate channel (connects to the Internet) from the subscriber back to the cable head-end
- A **set-top box** is a device that enables a television set to become a **user interface** to the Internet and also enables a television set to receive and decode digital television (DTV) broadcasts. DTV set-top boxes are sometimes called **receivers**.

**Satellite/terrestrial broadcast network**
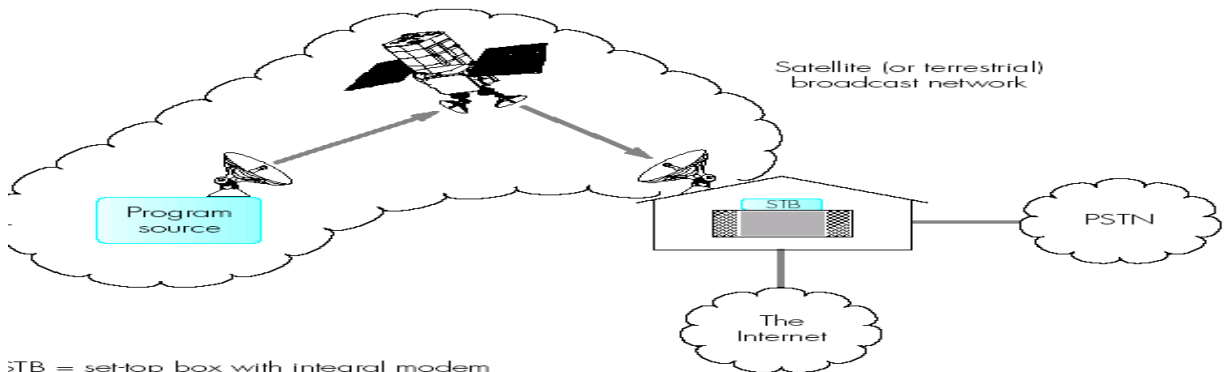
- In Satellite and broadcast networks by integrating an H-S modem into the STB a range of interactive services can be supported. This is the origin of the term "**interactive television**"

2. (a) Communication Modes

Communications channel

(a)

Simplex:

Half-duplex: Time
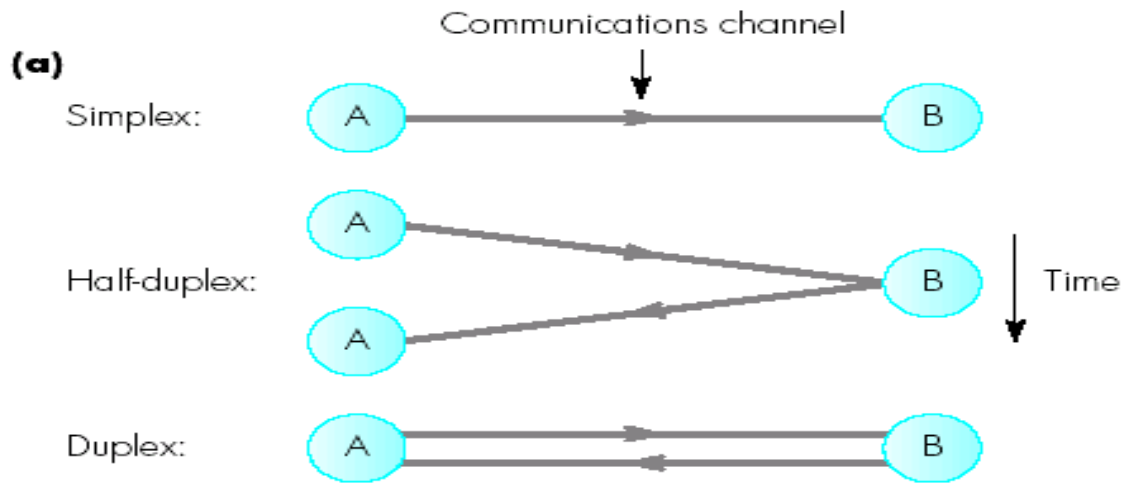
Duplex:

- **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:

Multicast:

B, D and F are members of the same multicast group
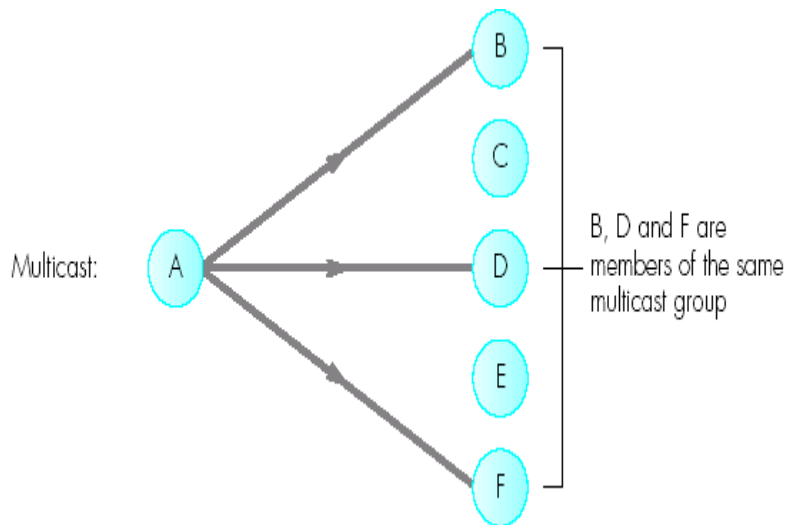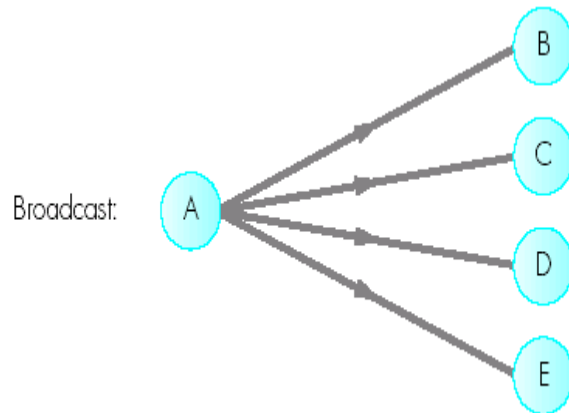
- Broadcast: The information output by a single node is received by all the other nodes connected to the same network
- Multicast: The information output by the source is received by only a specific subset of the nodes (Latter form known as **multicast group**)
- In half-duplex and duplex communications, the bit rate associated with the flow of information in each direction can be equal (symmetric) or different (asymmetric).
- Video Telephony – Symmetric duplex communication
- Web browsing – Asymmetric half-duplex mode (as different bit rates for downloading and uploading)

2. (b) Webpage size is 100 Mbits

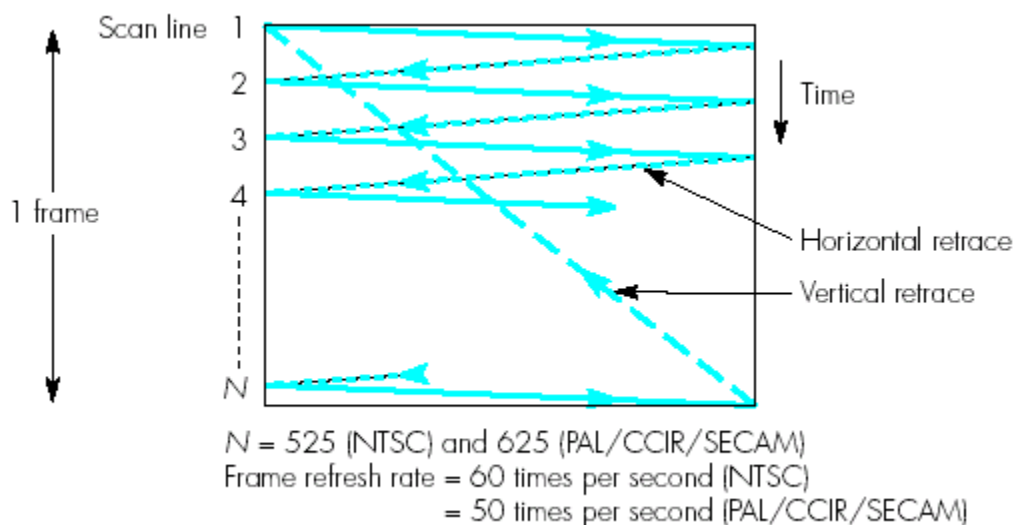Time to transmit using PSTN and 28.8Kbps Modem

100 Mbits / 28.8 Kbps = 3472.2 Sec

Time to transmit using ISDN at 64 Kbps

100 Mbits/64 Kbps = 1562.5 Sec

Time to Transmit using cable Modem at 27 Mbps

100Mbits / 27 Mbps = 3.7 Sec

3. Raster Scanning

N = 525 (NTSC) and 625 (PAL/CCIR/SECAM)
Frame refresh rate = 60 times per second (NTSC)
= 50 times per second (PAL/CCIR/SECAM)

- *Progressive scanning* is performed by repeating the scanning operation that starts at the top left corner of the screen and ends at the bottom right corner follows by the beam being *deflected back* again to the top left corner
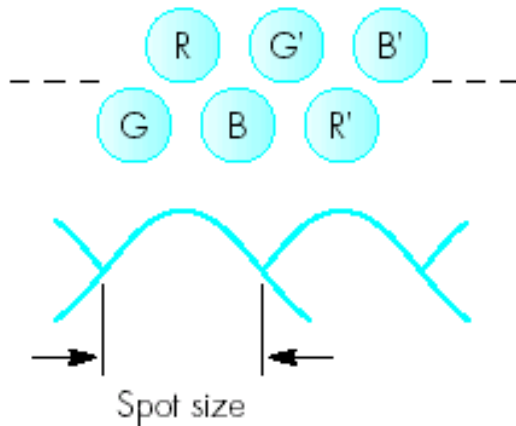
R, G, B/R', G', B' = phosphor triads

- The set of three related colour-sensitive phospors associated with each pixel is called a **phospor triad** and the typical arrangement of the triads on each scan line is shown.

- *Frame:* Each complete set of horizontal scan lines (either 525 for North & South America and most of Asia, or 625 for Europe and other countries)

- *Flicker*: Caused by the previous image fading from the eye retina before the following image is displayed, after a low refresh rate (to avoid this a refresh rate of 50 times per second is required)

- *Pixel depth*: Number of bits per pixel that determines the range of different colours that can be produced

- *Colour Look-up Table* **(CLUT):** Table that stores the selected colours in the subsets as an address to a location reducing the amount of memory required to store an image

- Each complete set of horizontal scan is called a frame

- The number of bits per pixel is known as the *pixel depth* and determines the range of different colors.

- Aspect ratio

- Both the number of pixels per scanned line and the number of lines per frame

- The ratio of the screen width to the screen height

- National Television Standards Committee (NTSC), PAL(UK), CCIR(Germany), SECAM (France)

4. Audio Synthesizer
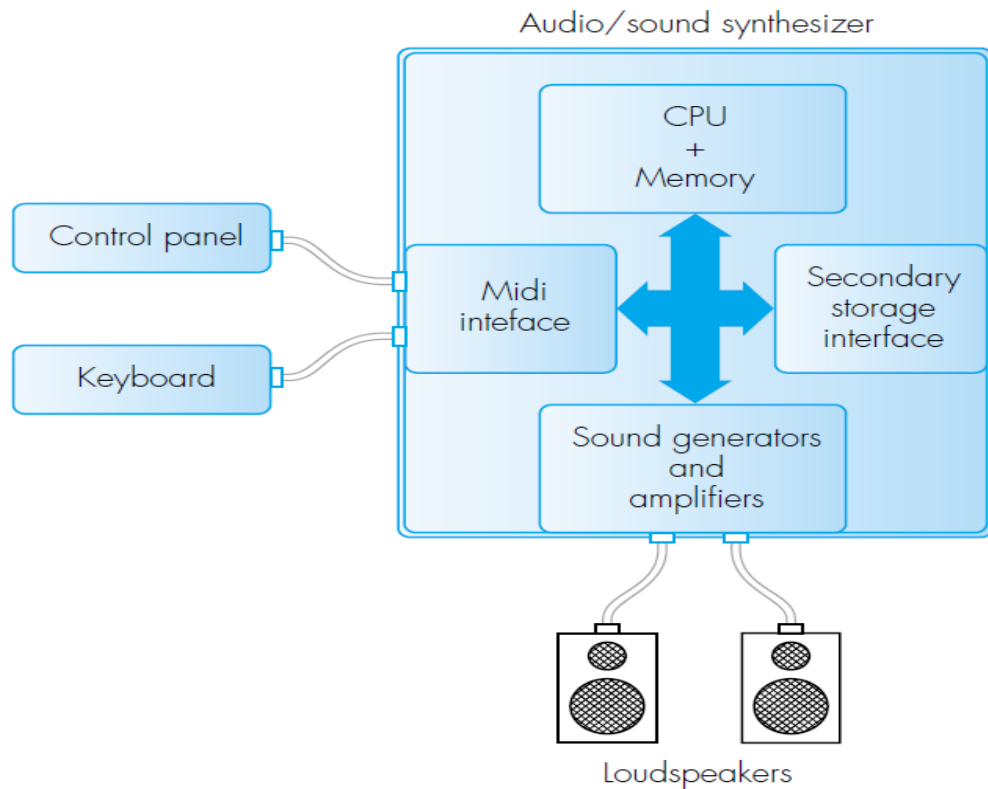
CD- QUALITY AUDIO
STANDARD FOR CD PLAYERS AND CDROMS –CD-DA STANDARD
SYNTHESIZED AUDIO:
Synthesized audio uses less memory. It is easier to edit synthesized audio. Mix several passages together.
Three components are- computer, keyboard, sound generators
Keyboard sends commands to computer which is sent to sound generators which produces Sound waveform via DAC to drive speakers
For each key different codeword known as the message with a synthesizer keyboard is generated and read by the computer program
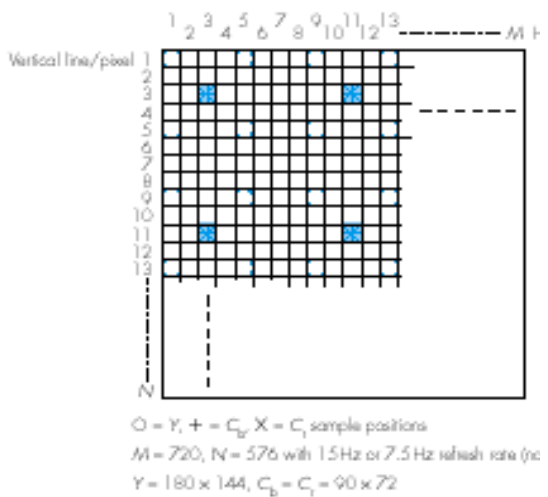The control panel has switches and sliders which indicate the volume and sound effects for the program
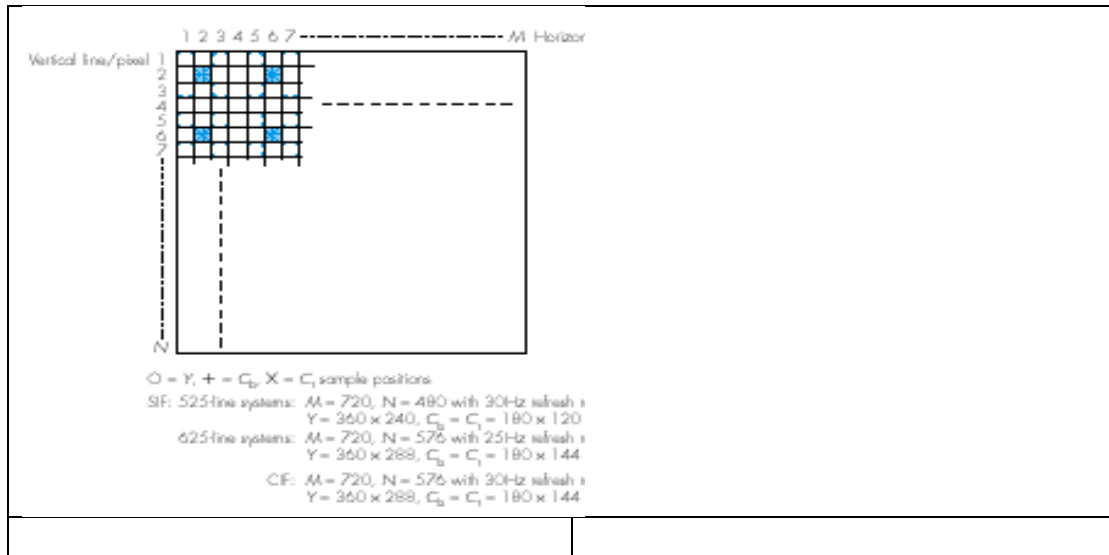Secondary interface stores audio in secondary Storage devices. There are programs to allow the users to edit a previously entered passage or mix several stored passages together. There is a range of other inputs from instruments.
To discriminate between inputs from different possible sources a standard messages are defined for corresponding sound generators

These are defined in a standard – music instrument digital interface-MIDI
It defines format of standardized set of messages used by synthesizer, types of
connectors, cables and electrical signals.

5. (a) SIF and QCIF HDTV formats

SIF(4:1:1)	Q-CIF
525 Line System Y= 360 x 240 Cb=Cr= 180 x 120 30 Hz Non-Interlaced(Progressive) Storage $6.75 \times 10^6 \times 8 + 2(1.6875 \times 10^6 \times 8)= 81$ Mbps	Y= 180 x 144 Cb=Cr=90 x 72 15 or 7.5 Hz Non-Interlaced(Progresive) Video Telephony $3.375 \times 10^6 \times 8 + 2(0.84375 \times 10^6 \times 8)= 40.5$ Mbps
Half the spatial resolution in both horizontal and vertical directions as that of 4:2:0 format.-Subsampling. Half the refresh rate-Temporal resolution.	Derived from CIF and uses half the Spatial resolution of CIF in both horizontal and Vertical directions and the temporal resolution is divided by either 2 or 4.
625 Line System Y= 360 x 288 Cb=Cr= 180 x 144 25 Hz Non-Interlaced(Progresive) Storage $6.75 \times 10^6 \times 8 + 2(1.6875 \times 10^6 \times 8)= 81$ Mbps	

O = Y, + = C_b, X = C_r sample positions
SIF: 525-line systems: M = 720, N = 480 with 30Hz refresh
Y = 360 × 240, C_b = C_r = 180 × 120
625-line systems: M = 720, N = 576 with 25Hz refresh
Y = 360 × 288, C_b = C_r = 180 × 144
CIF: M = 720, N = 576 with 30Hz refresh
Y = 360 × 288, C_b = C_r = 180 × 144

(b)

Assuming the CD-DA standard is being used, derive:

(i) the storage capacity of a CD-ROM to store a 60 minute multimedia title,

(ii) the time to transmit a 30 second portion of the title using a transmission channel of bit rate:

■ 64 kbps
■ 1.5 Mbps.

Answer:

(i) The CD-DA digitization procedure yields a bit rate of 1.411 Mbps. Hence storage capacity for 60 minutes

$$= 1.411 \times 60 \times 60 \text{ Mbits}$$
$$= 5079.6 \text{ Mbits or } 634.95 \text{ Mbytes}$$

(ii) One 30 second portion of the title $= 1.411 \times 30 = 42.33$ Mbits
Hence time to transmit this data:

At 64 kbps $= \dfrac{42.33 \times 10^6}{64 \times 10^3} = 661.4 \text{ s}$ (about 11 minutes)

At 1.5 Mbps $= \dfrac{42.33 \times 10^6}{1.5 \times 10^6} = 28.22 \text{ s}$
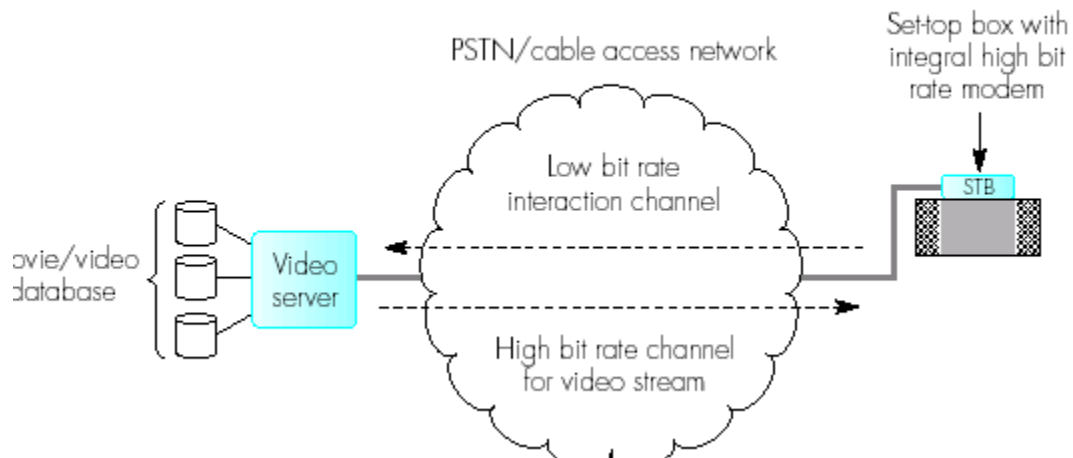
6. Entertainment Applications of Multimedia
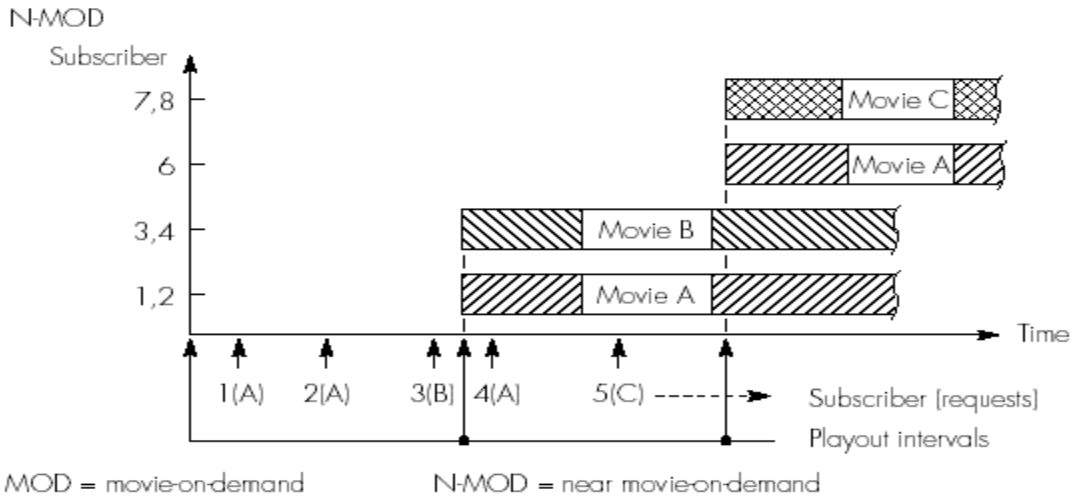Entertainment applications are classified into:
- Movie/video-on-demand

- Interactive television

Movie/video-on-demand

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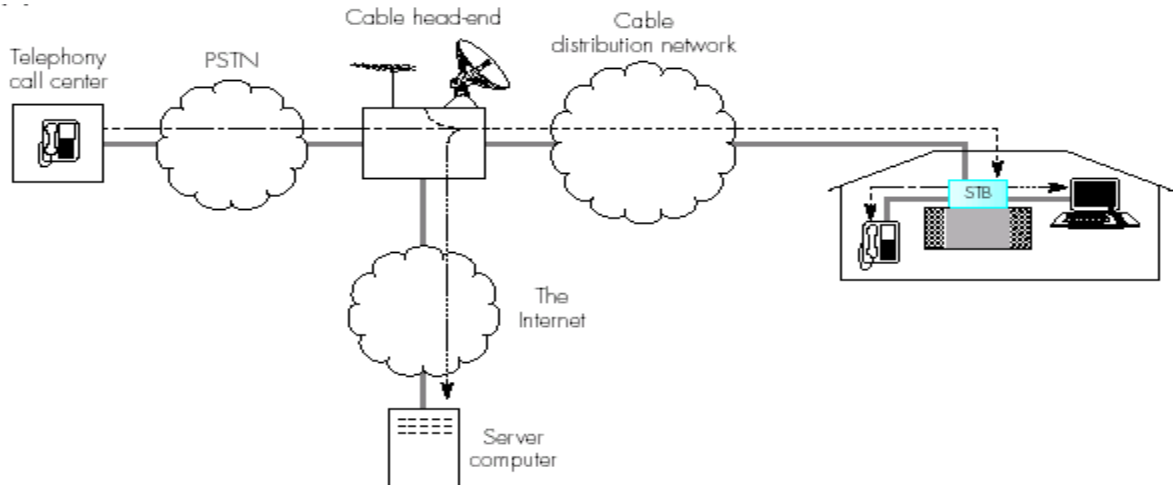

- Normally the subscriber terminal comprises television with a selection device for interaction purposes
- The user interactions are relayed to the server through a set-top-box (STB) which contains a high speed modem
- By means of the menu the user can browse through the movies/videos and initiate the showing of a selected movie. This is known as Movie-on-demand or Video-on-demand.
- *Key features of MOD*
- - Subscriber can initiate 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.

N-MOD

Subscriber

7,8 — Movie C

6 — Movie A

3,4 — Movie B

1,2 — Movie A

Time

1(A) 2(A) 3(B) 4(A) 5(C) ------► Subscriber [requests]

Playout intervals

MOD = movie-on-demand   N-MOD = near movie-on-demand

- This mode of operation is known as the **near movie-on-demand (N-MOD)**

Interactive television (Cable network)

Telephony call center   PSTN   Cable head-end   Cable distribution network

STB

The Internet

Server computer

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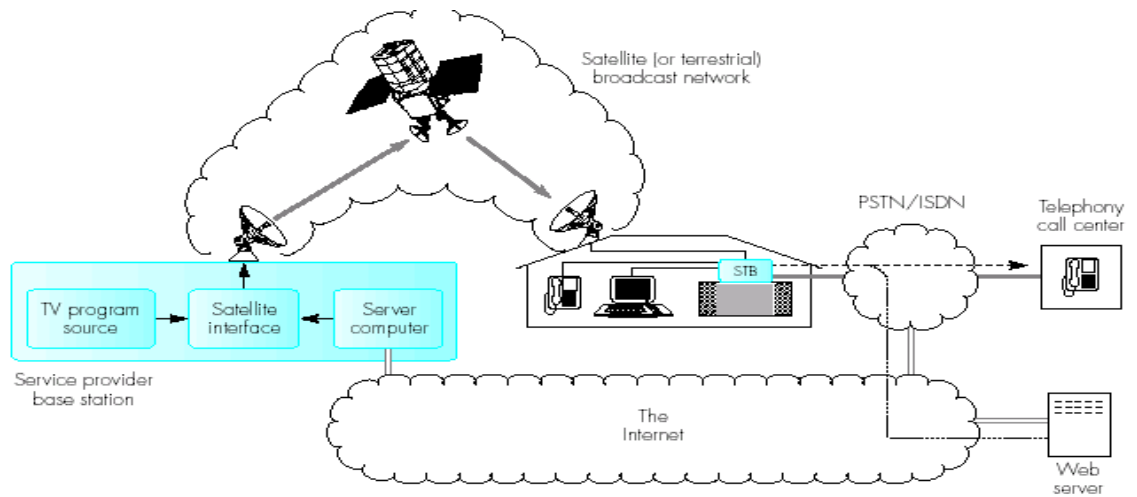
- The STB associated requires a high speed modem to provide the connections to the PSTN and the Internet