UNIT-III

MULTIMEDIA SYSTEM DESIGN

3.1 Introduction

Multimedia means a combination of text with document images. Document image is nothing but a facsimile technology. Facsimile provided a means of scanning and converting a document into coded information. The coded information is in the form of pixels as white or black. The information is easily manageable when the number of pixels is low. At 200 dpi (dots per inch), an A-size page contains 1700×2200 data points.

Document image management system supports 400 dpi or higher. For this higher pixels rates. Compression techniques are used to reduce the storage and transmission time.

For compression run length encoding is used, it is called Group3. This is adopted by CCITT as a standard in 1980. This also called Huffman encoding.

Another standard is adopted in 1984 is called Group4. It is used for two dimensional encoding to compression the data.

A gray scale encoding is processed as CCITT Group5.

Compression and decompression is an important role in information component. Video conferencing is one example.

The categories of conferencing includes, text conversation, document conferencing and store and forward video conferencing.

In 1990, the desktop video conferencing was introduced, it allows the user to conference from their own desk.

Compression is also the key to multimedia applications. Video conferencing is one application of multimedia.

The other applications includes

1. Medical applications
2. Real estate on-line video clips
3. Multimedia help and training material
4. Security system for employee identification

3.1.1 Multimedia Element

Multimedia application require dynamic handling of data consisting of text, voice, audio components and image animation. The components of multimedia includes:

a. Facsimile

Facsimile transmission was uses the Group3 compression standards. It is also known as run-length encoding.

The pixel density used for facsimile are in the 100 to 200 dpi range.

b. Document Images

The pixels used for document images are start at 300 dpi. An uncompressed A-size is over 1 MB.

With Group3 compression, the size reduces to very large 300 KB. Using Group4 compression, reduces approximately 75 kbytes.

Gray scaled or color images sizes are larger to accomodate the pixel color information.

Scanning of document images with high resolution requires efficient compression and decompression technologies. 400 dpi is needed to reproduce the image on a laser printer.

c. Photographic Images

Photographic images are used frequently for imaging systems that are used for identification such as badges, fingerprint cards, photo identification system, bank signature cards, and so on.

A resolution of 600 dpi is essential for reproducing a photographic image on a laser printer.

d. Geographic Information Systems Maps (GIS)

Two types of technologies are used for storage and display of geographic maps.

Raster storage allows a map to be displayed on a graphical display system. It consist of road maps and area maps.

Attribute data is assigned and identified by map coordinates. It is stored an object data management system.

Another application combines a raster images that has the basic color map and vector overlays showing the rail roads or highways and other human-made structures.

GIS applications associate attribute data with the man-made structures and relate them to coordinate in a map.

e. Voice Commands

Voice commands are an input voice recognition consideration. It allow hands-free usage of computer applications by allowing command entry via short voice commands rather than a keyboard or pointing device.

Recognition of the command requires specialized techniques and powerful processing capabilities to componstate for differences in pitch, accents and voice modulation of users.

f. Voice Synthesis

Voice synthesis is easier to achieve than voice recognition. This is used for fully stored message or actual voice clip that were string together.

Another approch is to break down the message completely to a canconical form based on phonetics. Digital signal processor used for this application.

g. Audio Messages

Computer equipped with microphones can record an audio message and attach it with an email message.

It require large volume of storage so compression techniques attempt to manage the storage.

The speed of decompression and playback of audio message with proper cadence is crucial for the audio message playback to be comprehensible.

h. Video Message

Similar to audio message, video message can be embedded o attached to email message.

Video message range from a single snapshot to full motion vide clips.

The storage and playback requirements are even more comple for video messages. It is stored in a shared video data server an displayed at the receiver work station.

Audio and video messages require isochronous playbac Isochronous playback is defined as playback at a constant rate.

i. Full-motion stored and live video

CD-ROM technology has provided the basis for the development of full motion video. The application for this technology is in CD-ROM games, courseware training material multimedia on-line manuals and reference material. Video conferencing, multimedia email, video karaoke systems and so on.

An important consideration for full motion video is the need for large bandwidth for communications media, massive storage requirements and high density high performance compression techniques.

The performance bandwidth must be designed not for average load but to address peak load. The NTSC quality acceptable for initial introduction of this technology, will be replaced by HDTV standards and potentially UDTV standards.

Digital HDTV availability places another major demand on the design, that of special effects such as zoom, freeze frame, image merging and image reconstruction.

Standardization efforts are in progress. Intel's Digital Video Interface (DVI) and Indeo definitions and Apple's Quick Time interface are example for such standardization.

An important development is the concept of three-dimensional compression where the third dimension is time.

Rather than store the entire picture for each frame. Only the deltas from one frame to the next are stored and the frames are reproduced on the fly. The entire frame is stored at the resynchronization interval.

j. Holographic Images

Holography is defined as the means of creating a unique photographic image without the use of lens. The photographic recording of the image is called a hologram.

Hologram display will be an unrecognizable pattern of stripes and whorls but which when illuminated by coherent light as by a laser beam, organizes the light into 3D representation of the original object.

In continuous-wave laser holography, a beam of coherent laser light is directed on an object in a darkened room.

The beam is reflected, scattered and diffracted by the physical features of the object and arrives on a photographic plate at the same time that a part of the original beam also arrives at the photographic plate.

The two beams cause interference, which result in a complex pattern of stripes and whorls. The developed plate is called a hologram.

When coherent light passes through the hologram, the hologram acts as a diffraction grating, bending or diffracting some of the light beams to exactly reverse the original condition of the light waves that created the object.

Holography can also be achieved in color.

Using pulse laser holography, a moving object can be made to appear at rest when a hologram is produced with the extremely rapid and high-intensity flash of a ruby laser. This approach is used for aircraft wing design.

Holograph images can also be recorded on all the materials except photographic plate. One application of holograph is, holographs on credit card is used to ensure authentication.

A three-dimensional hologram projected by a special display monitor would allow the designer to get inside a jet engine and view the engine in motion from the inside.

This technology is making rapid progress and can become an important component of multimedia systems used for managing design documents or for manufacturing tasks.

k. Fractals

Fractals are regular objects with a high degree of irregular shape. It is a decompressed images.

Generally image such as maps showing features of the land do not compress well using Group3 or Group4.

In fractal compression, a digitized image is broken into segments. A segment can be a fern or a leaf.

After breaking up the image into segments, the individual segments are checked against a library of fractals.

The library contains a compact set of numbers called iterated function systems codes, which will reproduce the corresponding fractal.

The mathematical processing required to convert an image to a fractal makes compression a very demanding and time consuming task. Once compressed, the algorithm for decompression are part of the stored image.

Fractal compression is based on image content.

As multimedia grows very fast, fractals will become an important component of some specialized integrated applications.

3.2 Multimedia Applications

In variety of multimedia applications, document image management is the first widely used applications that requires storage of large volume of data in document image format.

The fundamental concepts of storage, compression, and decompression and display technologies used for multimedia systems were developed for document image management.

Second important application of multimedia is image processing, also known as image recognition.

Document image management is intended for scanning documents and retaining their images but image processing and image recognition are intended for recognizing objects by analyzing their raster images.

Image processing applications are used for automatic floor inspections and sorting of parts coming out of a manufacturing plant or for guiding robots performing specialized tasks.

The next multimedia applications is, accessible to desktop users in an office environment.

3.2.1 Document Imaging

Organizations such as insurance agencies, law offices, country and state governments and the federal government including the department of defense manage large volumes of documents.

Technologies developed for imaging are an indespensable ingretient in the applications that will evolve to create the efficient combination of text, image, sound and video called multimedia.

Document imaging makes it possible to store, retrieve and manipulate very large volumes of drawings, documents and other graphical representations of data. It also provide electronic interchange of data.

For a document to display on a A-size it need 100 dpi.

One of the application of imaging is medical claims processing, it avoid the reentering information from claims forms into a computer database.

Optical character recognition systems now automatically handle the task of data entry of key fields.

The scanning resolution for images is range from 400 to 600 dpi, then only it is able to print them on high resolution laser printers ranging from 300 to 600 dpi capability.

The images are stored in compressed form and are decompressed to the required resolution at the viewstations for display.

Compression efficiency is defined as the ratio in bytes of an uncompressed image to the same image after compression.

A compression efficiency of over 20:1 is considered highly desirable for document images for most office systems. At this level, an A size page at 300 dpi requires 75 kbytes of storage.

All document image systems are workflows, workflow defines the sequence for scanning images, performing quality checks, performing data entry based on the contents of the images, indexing them and storing them on optical media.

3.2.1.1 Document Image Hardware Requirements

Realtime image decompression and display special demands on image processing hardware.

Image decompression and display hardware support 4 to 8 planes, 4 planes provide 16 colors, 8 planes provide 256 colors.

The image planes are also called bit plane because they are addressed by a bit in a byte. The bit planes may be configured in banks of 4 to 16 bit planes each.

Images must be processed at the rate of tens of hundreds of pixels per nanoseconds.

Gray scale images may requires higher speeds due to the additional grayscale information stored in the image that makes the image size much larger, even in compressed form.

Gray-scale image consist of pixel that have shades of gray ranging from 16 to 256 depending on the implementation.

Similar to gray-scale images, color images feature color hues instead of shades of gray. The number of colors that can be depcited depends on the number of bits used to define the palette.

For complex images with gray-scale and color the storage of pixel information gets even more complex.

3.2.2 Image Processing and Image Recognition

Image processing involves image recognition, image enhancement, image synthesis and image reconstruction.

In document image workflow management system, the original image is not altered but in image processing system may alter the content of image itself.

Examples of image processing systems application include recognition of images, as in factory floor quality assurance systems; image enhancement, as in satellite reconnaissance systems, image synthesis, as in law enforcement suspect identification systems, and image reconstruction, as in plastic surgery design system.

In addition to the compression and decompression techniques, image processing systems employ a wide range of algorithms for object recognition. Comparing images of objects with predefined objects, extrapolating finer detail to view edges more clearly, gray-scale balancing, and gray-scale and color adjustments.

Image synthesis and reconstruction systems may use a combination of bit maps and complex arithmetic algorithms to calculate drawing entitites, including shading and color variations.

Image recognition exist in many form. Optical character recognition (OCR) constraints the general imaging problem to a specific area, recognition of printed characters.

Handwriting recognition is used by the post office for recognition of handwritten zip code for mail string.

3.2.2.1 Image Enhancement

Most of display system uses some levels of image enhancement. Increasing the sensitivity and contrast makes the picture darker by making border line pixels black or increasing the gray scale level of pixels.

The capabilities of image enhancement software includes:

1. *Image calibration* – The overall image density is calibrated, and the image pixels are adjusted is a predefined level.
2. *Real-time alignment* – The image is aligned by real-time for twisting caused by improper feeding of paper.
3. *Gray-scale normalization* – The overall gray level of an image is evaluated to determine if it is skewed in one direction and if it need correction.
4. *RGB hue (color) intensity adjustment* – Too much color makes a picture loud and fuzzy. So automatic color intensity adjustment brings the color intensity within predefined ranges.
5. *Color seperation* – A picture with very little color contrast can be dull and may not bring out the full detail of the picture. The hardware used can detect and adjust the range of color seperation.
6. *Frame averaging* – The intensity level of the frame is averaged to overcome the effects of very dark or very light area by adjusting the middle tones.

3.2.2.2 Image Animation

Images can be displayed sequentially at controlled display speed to provide image animation that simulates real processed.

Image animation is a technology that was developed by Walt Disney and brought into every home in the form of cartoons.

The image animation is used in designing moving parts such as automobile engines. The parts are modelled as images using CAD/CAM system, this images can be set up for automated display in an on-line training or maintenance manual.

This automated display allows the user to clearly visualize the motion of the part and its interaction with neighbouring parts.

3.2.2.3 Image Annotation

It can be performed in two ways: i) as a text file stored along with the image or ii) as a small image stored with the original image.

The annotation is overlayed over the original image for display purpose. It requires tracking multiple image components associated with a single page, decompressing all of them and ensuring correct spatial alignments as they are overlayed.

3.2.2.4 Optical Character Recognition

Data entry work has become more expensive and it require a clerical staff work to enter the data, some times repeated data in different location.

Optical Character Recognition (OCR) technology used for data entry by scanning typed or printed words in a form.

Now a days OCR is available in software with the capability to decipher a large number of printed fonts used in many document image applications.

OCR technology, used as a means of data entry, may be used as a task for reading number of invoice or for capturing entire paragraphs of text. The captured text will be entered as a field in a database or it is in the form of editable documents.

3.2.2.5 Handwriting Recognition

Recently, the motivation for handwriting recognition has been from pen-based systems. Pen based systems are designed to allow the user to write commands on an electronic tablet.

The handwriting recognition system has the ability to recognize writer independent continuous cursive handwriting accurately in real time.

Two important factors for handwriting recognition; the strokes or shapes being entered and the velocity of input or the vectoring that is takes place.

The strokes are parsed and is processed by a shape recognizer, it is compare the stroke with existing shapes.

The stroke is compared with the prototype character set until a match is found.

If there is no match found, a context analysizer may be used to check a collection of characters treated as a word. Then the word may be checked against a dictionary and corrections may be indicated based on the matches.

Comparision with predefine characters can be very processing intensive. There may be more than one set of characters used for cursive styles.

Multimedia systems will use handwriting recognition as another means of user input. Handwritten memos using pen-based machines may be interpreted as read out when they are a complex document

3.2.2.6 Non Textual Image Recognition

In communication the verbal communication is the principal made for exchanging information. In computer, also the transformation of the

human-machine interface that could be achieved by multimedia interface. which allow these inputs in addition to text.

Image recognition has become a major technology componen in the designing, medical and manufacturing fields.

The concept of image recognition architecture; for example, a general image recognition system, it has three processing layer. The first is 512 × 512 array of pixel processor, that extract basic features such as lines and object boundaries.

Data from the pixel array feeds directly into a 1-GByte RAM shared by the next processing layer, it a network of 4000 32-bit Digital Signal Processing chips.

The output from DSP array is fed to another 512-MByte RAM that connect the DSP layer to a processor array. At the highest level, the AI algorithms are used to perform the different task of object and scene recognition.

Chips that perform functions such as the artificial retina are able to perform a major part of image recognition at the instant the image is recorded.

For image recognition, technologies that have a direct application in multimedia are significantly more complex.

Image recognition requires collecting and analyzing a large volume of data and connecting various types of data. The best example is human brain.

The recognition of facial expressions can bring about an important new development in making multimedia applications interactive and more intuitive.

3.2.3 Full Motion Digital Video Applications

Groupware technology as created and evolved by Lotus development corporation is designed to get all members of an organization connected via the corporate network with an ability to exchange messages that may have embedded pictures, images and some complex documents.

There are three major application groups for full-motion video. They are game industries, training and manual and Business world. The figure 3.1 describes this application groups.

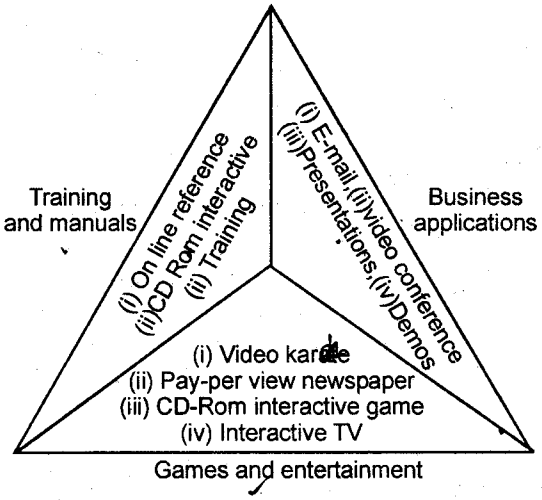

Figure 3.1

Some requirements for all the above application group.

Full motion video clips should be sharable but should have only one sharable copy.

It should be possible to attach full motion video clips to other document such as memos, chapter text, presentation.

Users should be able to take sections of a video clip and combine the sections with sections from other video clips to form their own new video clips.

All the normal features of a VCR metaphor such as rewind, fast-forward, play and search should be available.

Full motion video clip should be indexed, it should be able to search from any point within the video clip.

Users should be able to place their own indexing marks to locate segments in the video clip.

It should be possible to view the same clip in different types of format without storing the format.

It should be possible for users to move and resize the window displaying the video clip.

The users should be able to adjust the contrast and brightness of the video clip and also adjust the volume of the associated sound.

Users should be able to suppress sound or mix sound from other sources.

When video clips are spliced, the sound components are also spliced automatically.

These are some requirements for the above mentioned application groups.

3.2.4 Electronic Messaging

The first-generation mail systems provided a basic text link between users within a department or enterprise.

The second generation of electronic mail systems expanded this capability by providing cross platform and cross network electronic mail with a capability to attach other files.

The availability of other technologies such as audio compression and decompression and full motion video has opened new ways in which electronic mail can be used.

A multimedia-enabled electronic messaging system requires a sophisticated infrastructure consisting of the following to support it,

- Message store and forward facility
- Message transfer agents to route message to their final destination across various nodes in multilevel network.
- Users store the message in repositories as they store it in a filing cabinet.
- Repositories for dense multimedia components such as images, video, frames, audio messages and full-motion video clips.
- Ability for multiple electronic hypermedia messages to share the same multimedia components residing in different networks.
- Dynamic access and transaction managers to allow multiple users to access, edit and print these multimedia messages.
- Local and global directories to locate users and servers across an enterprise network.
- Automatic database synchronization of dynamic electronic messaging database.
- Automatic protocol and data format conversions.
- Administrative tools to manage enterprise-wide networks.

Electronic messaging systems, providing a means for communicating a variety of multimedia components, includes a number of other workgroup type applications.

Due to the preponderance of these applications they are called mail-enabled multimedia applications it have also multimedia capability It is very closed to universal multimedia application.

The universal multimedia applications would require to addressed the following issues.

1. Separation of servers by data type.
2. Compression techniques and decompression techniques.
3. When and where the data is compressed and decompressed
4. When are format conversions require and how they handled
5. How fetching information from servers is handled for display in a manner acceptable to users.

3.2.5 A Universal Multimedia Application

A Universal Multimedia Application means that the application manipulates data types that can be combined in a document, displayed on a screen or printed, with no special manipulations that the user needs to perform.

The document of this type may be a phonebook, a color brochure with pictures and drawings, a memo, a phone message, a video phone message or live teleconferencing.

An important consideration for an universal application is the methodology for disseminators of the information on a network.

The figure 3.2 describes the user screen for a universal multimedia application.

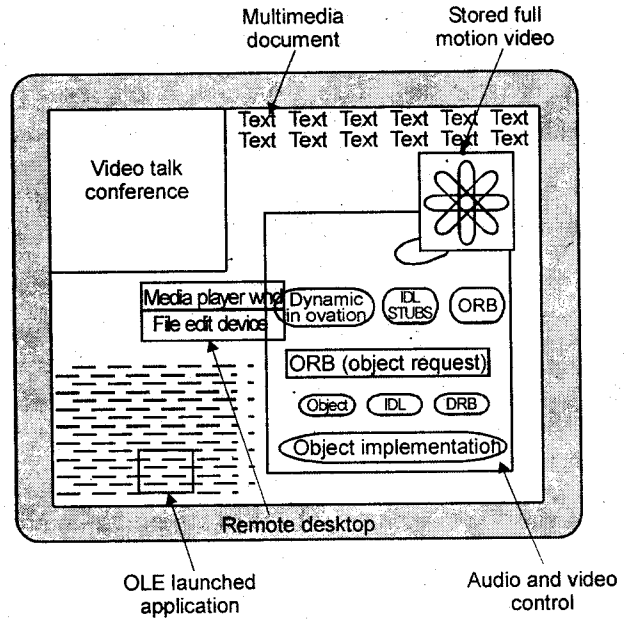

Figure 3.2

In figure 3.2, we see a mix of windows for displaying still video, and document images, a video conference window with live session in progress a remote line desktop being managed by the remote user participating in the video conference, a window for scanned documents, and a couple of other windows for application such as electronic mail and desktop publishing.

3.2.5.1 Full-Motion Video Messages

Electronic mail is an important component of office communications for many products. Email was started with text-only document attachments, then it progressed to textual and non-textual attachment.

The electronic mail capabilities has improved to allow embedding of voice messages and video messages. Video messages may consist of video snapshots or live video with full-motion picture and sound.

The two important factors to implement the full motion video messages are, the storage and transmittal of a very large volume of data at a high rate and decompression of that data to present a continuous playback.

3.2.5.2 Viewer Interactive Live Video

A live camera is used to project the player into the scene. When combined with technologies used to create a sense of virtual reality, viewer interactivity, can became very realistic.

The difference between full motion video and viewer interactive video is given below,

1. Full motion video is playback of stored video clips, while viewer interactive video is live.
2. It is easy to manage decompression and display of full motion video but it is not same in live video.
3. Full motion video is useful for messages and information dissemination, but live video can be used for direct interaction, medical applications manufacturing applications and so on.
4. Technologies used for both are same. Frame grabbers have been used to capture images for live display in a GUI display system, it is used as an image processor to display live video images captured from a camera. It also allow the user to display multiple images at one time and allows a detached comparision of two live video.

3.2.5.3 Audio and Video Indexing

Indexing is mostly used in VCRs. Using index the user can mark a position on tape.

Indexing allows the person viewing the tape to mark the start of a program, a conversation or some scene of interest.

Early desktop video players used a VCR metaphor for controlling a video clip. The metaphor for indexing is more complex.

Some key points used in indexing of stored video clip.

1. Indexing is useful only if the video is stored. Unless live video is stored, indexing information is lost since the video cannot be repeated.
2. When sound and video are decompressed and managed separately; synchronization is very important, synchronization must be achieved before playback.
3. Depending on the application, indexing information must be maintained separately for video and **audio** components of a video clip.

3.3 Multimedia System Architecture

The important aspect of multimedia systems are it encompasses a large variety of technologies and integration of multiple architectures interacting in real time and its capabilities must integrate with standard user interfaces.

The design of the multimedia system is it can operate with the special hardward without changing the application software.

Standardization of multimedia system based on number of hardward interfaces used for video animation and compression boards.

Device-independent application programming interfaces (API), the application is independent from the hardware, and it operate with any hardware or operating environment that support the API. Common file format are used for different hardware architecture and operating environment.

The APIs allow the application to support a large number of drivers, it can work with pheripheral boards, software designed to replace hardware, and network interfaces.

The board level technologies allow a board to adapt a number of different standards using microcode logic.

Software compression and decompression drivers can replace hardware boards and the APIs allows the application developers to develop application that can work with software drivers as well as hardware drivers.

The figure 3.3 describes the architecture of multimedia workstation environment. The left side is non multimedia system and the needed architecture for multimedia system.

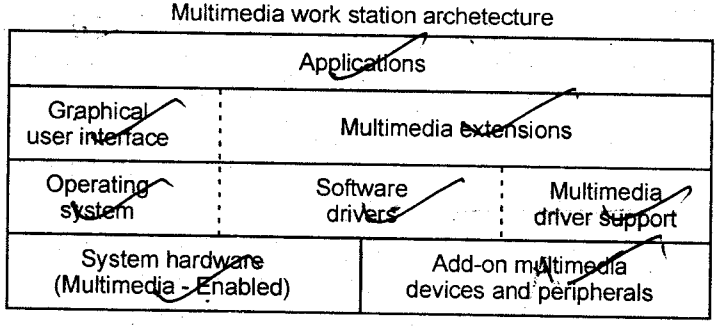

Figure 3.3

The add-on multimedia devices and peripherals include scanners, video camera VCRs and sound equipment along with their corresponding device controller and encoding hardware.

Software drivers is needed to provide the interface between the application and the devices.

GUIs are designed to support windows application.

3.3.1 High Resolution Graphics Display

Graphics standards such as MCA, CGA, EGA, VGA, 8514 and XGA uses high resolution for GUIs.

The function of graphics and imaging have three levels. Provided by three classes of single monitor architecture with different capabilities.

1. **VGA mixing:** In this, the image acquisition memory also serves as the display source memory, there by fixing its position and size on screen.
2. **VGA mixing with scaling:** Use of scalar ICs allows sizing and positioning of images in predefined windows; resizing the window causes the image to be retrived again.
3. **Dual-buffered VGA mixing/scaling:** Dual-buffer schemes maintain the original images in a decompression buffer and the resized image in a display buffer.

In all these schemes, the actual source of the graphics to be merged with a separate board, a motherboard or the combo board itself.

The new generation of MFG (Modular Frame Grabber) boards have a modular memory architecture made up of 1 to 4 Mbytes of image memory, 1 to 2 Mbytes of display memory, 1 Mbytes of overlay and 4 Mbytes of general purpose storage.

Digital Signal Processor (DSP) are used for image processing that integrates graphics through an optional 34020 based daughter board equipped with VGA pass through with double buffering.

3.3.2 IMA Architecture Framework

The Interactive Multimedia Association (IMA) has a task group with a charter to define the architectural framework for multimedia that provide interoperability.

The task group has two area of concentration, i) the desktop (the client) and the server. The desktop defined that interchange format that allow multimedia objects to be displayed on any workstation. The servers defines the class libraries that support distributed multimedia applications for multiple platform.

The IMA architecture is based on defining interfaces to a multimedia interface bus, it is the interface between systems and multimedia sources and it provide I/O services. The figure 3.4 describes the architecture of multimedia based on interface buses.

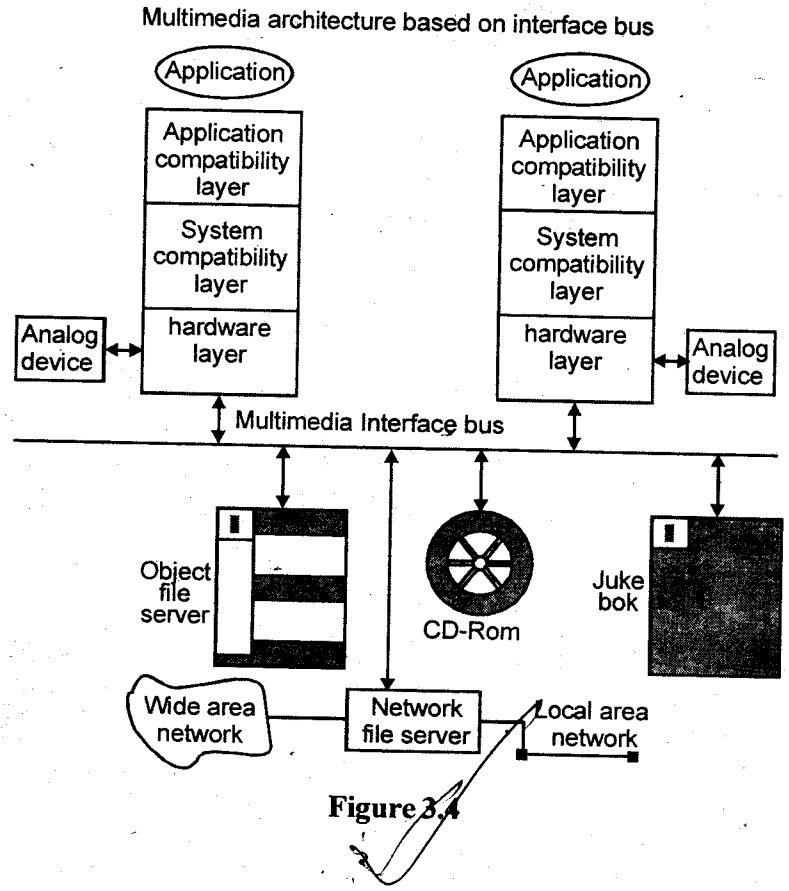

Figure 3.4

3.3.3 Network Architecture for Multimedia Systems

Large volume of images and video messages are being transmitted through LAN as well as WAN using Asynchronous Transfer Mode technology, it is developed by Ungermann Bass and BBN communication.

The increasing use of e-mail and groupware products has placed extensive demands on the networking infra structure of corporations.

In general network congestion can be attributed to a combination of the following leading causes;

1. Number of users accessing the network.
2. Increased computing power and the ability to run multiple applications concurrently.
3. Transmission of large volume of data such as voice, data and video messages.
4. Increased traffic load on existing backbone networks.
5. Use of client/server architecture for a wide range of applications.
6. Graphics intensive applications.
7. Voice and video based multimedia applications that require large volumes of data storage.

a. Task Based Multi-level Networking

The broadcast networks provide a uniform solution for all tasks, but new technologies increased, it is not suitable to satisfy the full demand. Groupware technologies have made the issue of customizing the network to the task more apparant.

The task can be broken down into following types based on their requirements for volume of data, sources of data and transfer speed;

1. Data transfer for text
2. Data transfer for images
3. Data transfer for audio and video clips
4. Data duplications to user workstations
5. Data replication among servers

Transfering text is very simple, lower-cost and less time to take the transmission. But transfer of images is more demanding than text. A page of text may be as large as 2.5 kbytes, but even a black and white image of a page may range from 60 kbytes to 220 kbytes, a gray scale or color image range from 1 Mbyte or more.

Transfer of audio and video clips are more demanding than images or text, because it has the third dimension time.

A video clip contains image and sound. Depending on the technology used, a video-phone quality to full motion video presentation may range from 2 seconds to a frame being displayed to 15 to 30 times a second. One more problem is momentary pause while displaying the video clip.

Higher classes of service require more expensive components in the workstations as well as in the servers supporting the workstation applications. Instead of combining all the services. Classifies the services based on their requirements, this approach is called task based.

Multilevel Networking

Another area of transfer is between servers within the network. The user and the server placed in the same network. For document

imaging networks, a backbone network is used to provide image server, print server and fax server to host links. One or more hosts provides gateway between the backbone based servers and host-based workstations.

In a imaging network, imaging objects are duplicated on host and it is discarded after use. This process is more complex in the network. The next section discuss this issue in server side point view.

b. High Speed Server to Server Links

Duplication is defined as the process of duplicating an object that will remain synchronized with the source object.

Replication is defined as the process of maintaining two or more copies of the same object in a network that periodically resynchronize to use faster and more reliable access to the data.

Every change in a replicated copies of an object is immediately reflected in the master copy and all other replicated copies to ensure that the next user gets a fully updated version. Replication periodically range from one minute to 24 hours.

3.3.4 Networking Standards

Ethernet and token ring are very well known networking standards. Increasing demands in the amount of data transfer and the network structure, new standards have been addressed. That is FDDI is attempt to move the bandwidth out of 100 Mbits/sec or more. ATM attempt to change the topology of the network.

ATM (Asynchronous Transfer Mode)

The Asynchronous Transfer Mode Topology was originally designed for broadband applications in public networks. Its design is applicable to high speed multimedia communications in local area networks.

ATM is a method of multiplexing and relaying 53-byte cell containing either text data packets or compressed images, real-tim audio or video information.

ATM is used for transferring real-time multimedia data in loca networks at speeds higher than 100 Mbits/sec.

When first proposed by CCITT as the technology for the rela method ISDN, ATM was closely linked to the synchronous optica network standard and ATM is adopted as cell-switching standard b ANSI.

ATM has evolved from that to local as well as public switche network that can operate at speeds ranging from 100 to 622 Mbits sec.

ATM provide high capacity, low latency switching fabric for data undependent of protocol and distance and also it provide interfaces f speeds ranging from 1 Mbits/sec to 2.4 Gbit/sec.

Difference between ATM and broadcast media topologies is tha ATM is a switch based, cell relay technology that connects individu nodes over a dedicated bandwidth.

ATM can manage a mix of data types, including text data, voic image and full motion video. The design and functionality direction (ATM is guided by the ATM forum and it is flexible in operations ov 100 Mbits/sec.

FDDI (Fiber Distributed Data Interface)

The capabilities of FDDI Network allow it to be configured in variety of network configurations addressing a range of different need and it act as the network hub in a network configuration tha interconnects different types of LANs.

ANSI group that developed the FDDI standard for fiberoptic networks has been at work since 1984 on a proposed FDDI II and a standard is evolving.

The new standard takes the current realitics into account and is being designed to allow for shielded pair as well as unshielded pair connections in addition to fiber.

The current wiring closet for telephone connections can be used for immediate networking support, and this network can be extended using fiber backbones to link a variety of networks.

The ANSI standard for FDDI allows for single mode fiber supporting upto 40 km between stations, the speed from 100 Mbits/ sec to several gigabits per sec and large distance networking and FDDI is well suited for high performance backbone networks to complement and extend current LANs.

FDDI using fiber technology will also provide the high bandwidth required for workstations, PCs and servers supporting a dedicated workgroup with high data transmission requirements.

ATM vs FDDI II

ATM and FDDI technologies reduce congestion in multimedia networks. The network speed in FDDI is high as 100 Mbits/ sec and in ATM as high as 622 Mbits/sec.

The benefits of shared media networks are ease of installation, lack of common equipment and connectionless operation.

Some difficulties are wiring existing buildings and fault isolation, is addressed by using wiring hubs.

An important disadvantage of FDDI II is that it does not allow a user to connect to the network at the speed required by the user; rather it requires the user to be capable of supporting the network speed.

The hypermedia document is a definition of a document and a set of pointers to help to locate various elements of the documents The users sees a single document, but the locations of the variou components that constitute the document are transparent.

b. Hyperspeech

Recent trends of multimedia and cellular-phone network stimulated the development of general-purpose speech interfaces Speech synthesis is an important component of multimedia systems.

For example, a mail message can be used to generate hyperspeech file that a user can being to navigate on a selective basi Instead of listening the entire message the user can jump from concep to concept. So a user can get a synopsis of a report in a very sho time.

Handling remotely accessible voice mail in a similar manner ma require the additional capabilities of speech recognition to hand hyperspeech searches.

Speech synthesis and speech recognition require, hi performance microprocessors, digital signal processors, code supporting encoding and decoding of sounds.

Speech recognition, converting the analog speech into a compu action, into ANSI text, one important issue of both speech synthe and speech recognition is cadence that is proper continuity of t sequence of highs and lows in the speech.

3.4.2 HDTV and UDTV [High Definition Television, Ultra Definti Television]

The development of computers in one side, parallely t development in electronic world is attempting to raise the resoluti level of commercial television broadcasting.

Some of the television broadcasting standards including NTSC, PAL, SECAM, NHK and so on. These standards range in resolution from 525 lines for NTSC to 819 lines for French standards.

A work is in progress for bringing HDTV as a global broadcasting standards. The Japanese broadcasting services developed a 1125-lines analog MVSE system. US changed the direction from analog to digital.

A 1125 line digital HDTV has been developed and commercialized. NHK of Japan is trying to leapfrog the digital technology to develop Ultra definition television with 300 lines. Figure 3.5 shows the progression of Resolution of Television pictures.

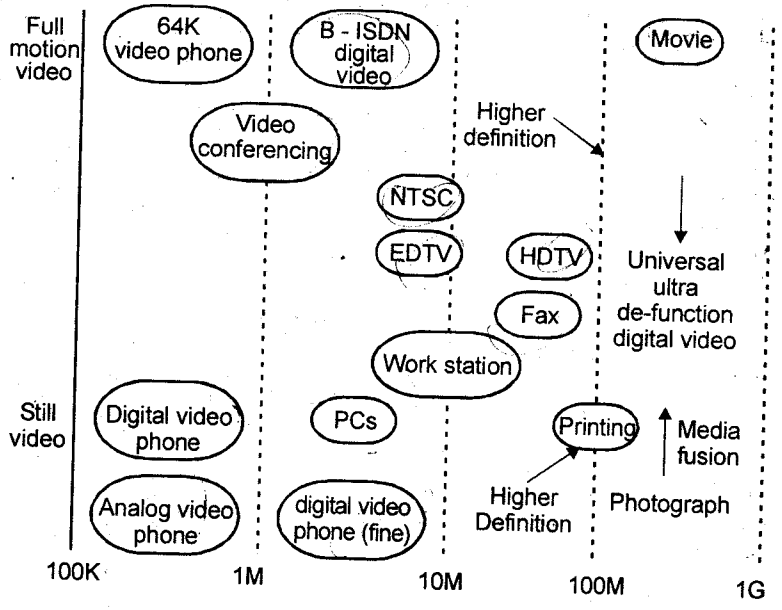

Figure 3.5

The digital HDTV is commercially broadcast by 1997 and the UDTV is broadcast by 2000. There are some technologies necessary to jump from HDTV to UDTV.

It requires the development of ultra resolution displays at a commercially available price, high speed video processing ICs, and ultra broadband communications bandwidth for WAN. The development of digital HDTV and MDTV will also benefit the computer industry for display and communications.

Users in office will be able to experience studio quality UDTV resolution for video messages and full motion video display.

The CAD/CAM and image technology is using resolution of 150 dpi on 20-inch wide display. Use of color monitor at this range will equal digital UDTV quality.

A typical display image with a 2550 × 3300 pixel resolution requires 7.5 Mbits for uncompressed storage. A gray scale or color image of the same size requires 7.5 Mbytes of storage for compressed page. Also transferring 7.5 Mbytes on a 10-Mbits/sec network can take unacceptable duration of several seconds. Time is also an important factor.

3.4.3 3D Technology and Holography

3-D technology are concerned with two areas; **Pointing device and Displays**. Pointing devices are essential to manipulate objects in a 3D display system. It is achieved using holography techniques.

Holography use separate lasers to project the red, blue and green components of light to provide a three-dimensional effect.

The development of 3-D pointing devices and systems is an important component in mutlimedia systems.

The university of Washington's seattle based Human Interface Technology (HIT) Laboratory is in the fore front of development of 3-D pointing devices. For example, wand technology being developed for Digital Equipment Corporation.

The wand can be used to make simple selections with conventional mouse, or to perform mid air trace of **runes**.

The wand, shaped like a small pistol with a button on a top, uses a radio frequency sensor to fed orientation information to the computer to which it is attached.

Other 3-D pointing devices includes three dimensional mice and cordless 3-D track balls that use radio waves to communicate with 3-D software packages.

Three dimensional display are under development. The 2-D display based on technology developed for pilot. One implementation of this consist of a vibrating mirror mounted on a headband that creates a two dimensional image that appears to float in space before the viewer.

These displays are capable of overlaying realtime visual images with some calculated data. The dynamic tracking mechanism synchronizes the image so that, despite head movement, the labels remain next to the correct object no matter where they are in the visual field.

The virtual retina, the result of another ongoing project on HIT lab, writes two scenes, one to each eye, creating illusion of a 3-D display.

In both the technologies the user has to wear some kind of hand gear. The holographic approach overcome this problem.

The omniview three dimensional volumetric display device, developed by Texas Instruments Inc; uses laser of three different colors to project images on a moving surface sweeping a 3-D cylindrical display volume.

Standardized library interfaces such as the Programmer's Hierarchical Interactive Graphics Standard (PHIGS) will assist in application development.

Initially the images display in a 10-cubic foot display, about 3 feet in diameter and 1-1/2 feet high, visible from all sides. The 3-D images are manipulated from Sun Microsystems Inc. workstation.

The display would be used for a variety of applications such as medical imaging for probing or operations, biotechnology and any kind of situational awareness applications as air traffic control. Another example, doctors/ analysts can target the full heart cavity or specific part of a heart such as a value to be displayed in 3-D.

3.4.4 Fuzzy Logic

An interesting development with DSP, is the development of Fuzzy Logic Signal Processor (FLSP). Use of Fuzzy logic in multimedia chip is the key to the emerging graphical interface of the future.

Multimedia is a well-suited application for Fuzzy logic because any application that is computationally intensive can benefit from the mathematical principles behind fuzzy logic.

The computationally intensive areas of multimedia to be addressed by fuzzy logic include graphics rendering, data compression for images voice and video, voice recognition and synthesis as well as signal processing for video, high resolution facsimile and still photographic images.

Graphics rendering involves the painting of three-dimensional objects onto a two-dimensional multimedia display. Instead of full scale calculation, fuzzy logic allows the use of simple intective rule.

The benefits of FLSPs over DSPs are the computational prespective and the calculation result which is better than DSPs.

3.4.5 Digital Signal Processing

The use of Digital Signal Processor chips continues to grow rapidly in the use of ICs. It also used in application such as the European

digital cellular telephone system, digital service in hard disk drives and fax/data modems and also used in video and audio signal processing for office computers.

The main manufacturers includes, Texas instruments, AT & T, Motorola, NEC and Analog Devices, in addition, DSP Group Inc; Shipping DSP chip sets based on functions and algorithm specific ICs called FASICs.

Digital wireless communications, such as Personal Communication networks, wireless local area networks and digital cordless phone are all applications of DSP.

Harddisk drives continue to grow denser and smaller. Digital servo technology is a major contributor to this miniaturization, as DSP permit greater track densities and faster seek times and it is standard in all the new magneto optical disk drives.

a. DSP Architecture and Applications

DSP operating system architecture would contain the following subsystems.

1. Memory Management

DSP architecture provide dynamic allocation of arrays from multiple segments, including RAM, SRAM and DRAM.

2. Hardware-interrupt Handling

It must minimize the interrupt latency to ensure fast response for real-time events.

3. Multitasking DSPs

Multitasking DSPs need real-time kernel that provide preemptive multitasking and user defined and dynamic task prioritization.

ATM on the other hand, it is capable of lower speeds at the workstation, it reduces number of devices, protocol translation require for communication between local and wide area network.

3.4 Evolving Technologies for Multimedia Systems

Multimedia applications use a number of technologies generated for both commercial business applications as well as the video game industries.

The gap between these two area has been narrowing as game become more complex and multimedia applications start making use of interactive video techniques developed originally for game systems. The digital TV will accelerate the integration of business and game system technologies.

3.4.1 Hypermedia Documents

Technical and business documents are increasingly being written in electronic form, they also read in electronic form.

Fast network allowed this hypermedia documents.

Hypermedia documents contains, text, embedded or linked multimedia objects such as images, audio or full-motion video. It has its roots in hypertext.

a. Hypertext

Hypertext implements the organization of non sequential data by natural associations of information rather than hierarchical filling structure as in paper based text documents.

It allows authors to link information together create information path through a large volume of related text in documents, annotate existing text and append notes that direct readers to biblographic information or to other reference material.

Explicit connections or links allow readers to move from one location to another in a document or to other documents much as a reader would browse through references in an encyclopedia.

Hypermedia is an extension of hypertext in that these electronic documents will also include virtually any kind of information that can be stored in electronic storage such as audio, animated video, graphics or full motion video. These documents will encapsulate storage and format conversion information.

The encapsulated information will convert and adapt documents for the user based on where that user is located and what equipment is available as the user's desktop.

Distributed computing networks allow the user to use of hypermedia documents. It is used for electronic mail and workflow applications provide a rich functionality for exchanging a variety of information types.

The hypertext technology was first introduced to move around a text based databases, with hypermedia it is extend upto networks and to support a variety of data formats other than text.

The function OLE has introduced to display video clips in hypermedia documents. Products such as Lotus Notes use these features to provide hypermedia capabilities.

There are many problem when multiple users share the same documents in the network, example, maintaining version control, managing organized access to documents and locating documents and so on.

An important issue in the hypermedia document is storage. In this the embedded components may also be included in other documents, the hypermedia documents needs to store only reference to the documents. These references are resolved before the document is presented to the user.

4. Inter Task Synchronization and Communication

Mechanism for intertask communication include message queues, semaphores, shared memory and quick response event flags.

5. Multiple Timer Service

The ability for the developer to set system check interrupt managed timers to control and synchronize tasks is needed for most real-time applications.

6. Device-Independent I/O

DSP operating system support two form of program interaction- an asynchronous data stream for passing data between program and device and synchronous message passing for passing control message between the device and the program.

Use of DSP has evolved from traditional general purpose DSP to application specific and customizable DSP.

DSP developed to provide functions such as command execution and device interfacing.

DSP architecture were altered to allow designers to take better advantage of the direction in which they were heading. This is the way for development of DSP from pure math engine to general purpose DSP and then to an application specific DSP.

An application specific DSP is designed for one application used by a large number of users a customizable DSP is designed to be used by a large number of similar applications.

Customization can include built-in ROMs and ROMs for specific task, built-in peripheral controllers with specific preprocessing of data, high speed high volume serial ports. Data Acquistion and control processing capabilities with digital analog conversion capabilities bit interface logic and so on.

The development of digital cellular phone is a major application of DSP, portable workstation that can operate from anywhere using a digital cellular phone.

The evolution of more capable digital modem standards will allow transmissions at ISDN speed of 64 Kbits/sec. Specialized DSPs will be used to accomplish the modem's math-intensive calculations such as modulation/demodulation, echo cancellation and controlling the modem data rate and system power consumption.

Alliances such as Mwave bringing together technologies developed by TI, IBM and Intermetrics for multimedia work, will support DSP based multimedia capability.

3.5 Defining Objects for Multimedia System

Multimedia components such as facsimile transmission images, holograms, interactive video, live video, audio and so on are the data types stored in multimedia objects.

These datatypes require different ways of handling the data and have an impact on both encoding of data for compression and processing for storage and retrieval.

The basic types include text, image, audio, holograms and full-motion video.

3.5.1 Text

Text is a simplest data type and require very less storage. Text data type can be fields in a database and can be indexed, searched and sorted. It is a basic elements of relational databases.

Text fields are used for names, addresses, descriptions, definitions and a variety of data attributes.

An electronic mail message consist of some text field such as name and location of recipient, name and location of sender and so on.

The major attribute of text include paragraph styling, font families and sizes.

Hypertext is an application of text to provide a search of specific text strings in one or more documents.

Hypermedia document is the basic complex object of which text is a subobject. Other object include images, sound and full motion video.

3.5.2 Images

Image object is a subobject of hypermedia document object. Image objects will be represented in graphics or encoded form, and no direct relationship between successive representation in time.

It include data types such as document images, facsimile systems, fractals, bitmaps, metafiles and still pictures.

The figure 3.6 describes a hierarchy of the object classes under images.

Image Hierarchy

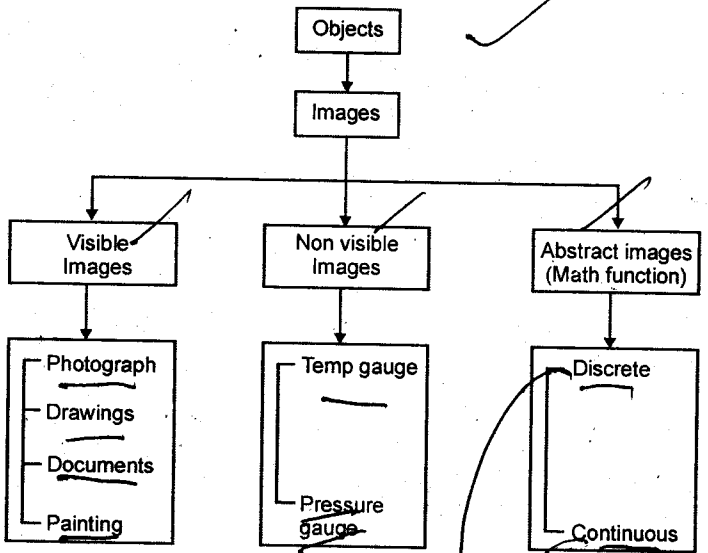

Figure 3.6

a. Visible

The visible images includes drawings, documents, paintings, photographs and still frames captured from a video camera.

In visible images, the images exists for some duration in a bitmap from, is captured by input device. All input devices use scanning methodology to capture the color and intensity of pixels in predefined grid. The grid can range from 340 × 240 to 600 pixels/inch.

In addition to storing the content of image, in a compressed form, the stored information include the type of compression algorithm used, so that the image can decompressed at the target.

There are two ways to handle this; one is all images will be compressed in one specific compressed method, so no need to store that information. This is used in document imaging system.

Another approach used in multimedia system. In this there is no common compression method, it vary depends on the type and source of image. Image scanned from scanner may stored in CCITT Group4 format, image captured from video camera may be stored in JPEG format. So in this system, the information about compression is a part of image file.

b. Nonvisible

Nonvisible images are not stored as images but displayed as images, example pressure gauge, temperature gauge.

c. Abstract

Abstract images are not images that ever existed as real-world objects; they are computer generated images based on some arithmetic calculations.

Fractals are example for abstract images, it is result of some computer generated algorithm which shows some patterns like Kaleidoscope.

The discrete functions result in still images that remain constant on a temporal scale.

The continuous functions are used to show animated images and such operations as an image fading and dissolving into another image.

3.5.3 Audio and Voice

Stored audio and voice objects contain compressed audio information. Audio object similar to video object, have a time dimension with them.

For playing audio, the frequency and pitch is very important, if the audio is faster than the recording speed makes it sound higher pitch and abnormal. So play the audio the speed should be in constant rate.

An audio object needs to store information about the sound clip such as length of the sound clip, its compression algorithm, playback characteristic and any sound annotation associated with the original clip.

3.5.4 Full-Motion and Live Video

Full Motion Video is, it is prestored video clips, live video means, it is live and be processed while it is being captured by the camera.

For full-motion video, it is important to have the information about the coding algorithm used for compression.

For live video it is important that the video as presented to the user is smooth no unanticipated break. This require the video object and its associated audio object be transferred over the network to the decompression unit then it played at the fixed rate.

3.6 Multimedia Data Interface Standards

Multimedia standardization became simpler because the electronic industry and telephony/telegraphy industries has become the basis of computer multimedia standardization.

Standardization of multimedia has been necessary due to its nature that is it require large volumes on user workstation, shared hypermedia documents, a variety of storage platforms and user workstation on the same network shared by multiple users.

The solution for the above problem is standardization will be in some levels. The standards are layered to allow individual layers to provide technology advances without affecting other layers.

For each layer there is a well defined set of interfaces.

3.6.1 File Format for Multimedia Systems

The area of standard file formats and file interchange format is very dynamic. The first standardization of file format is in Microsoft windows and OS/2 Operating System.

The following list gives the file storage format, interchange format and application programming interfaces to multimedia devices.

1. Device - Independent Bitmap (DIB) - This is a file format that contain bitmap, color and color palette information.
2. Resource Device Independent Bitmap (RDIB) - Resources Interchange File Format (RIFF) is the standard file format defined for Microsoft windows and OS/2.
3. Musical Instrument Digital Interface (MIDI) - This interface standard for file transfer between computer and musical instrument.

4. RIFF Musical instrument Digital Interface - A MIDI format within a RIFF envelop provides a more complex interface.
5. Palette File Format - An interface that allows defining a palette of 1 to 256 colors in a representation as RGB values.
6. Waveform Audio File Format (WAVE) - A digital file representation of digital audio.
7. Rich Text Format (RTF) - This format allows embedding graphics and other file formats within a document.
8. Windows Meta File Format (WMF) - This is a vector graphic format used by Microsoft Windows as an interchange format
9. Multimedia Movie Format (MMM) - This format used for digital video animation.
10. Apple's Movie Format - This format defined as a standard for file exchange by QuickTime enabled system.
11. Digital Video Command Set (DVCS) - This is the set of digital video commands simulating VCR controls.
12. Digital Video-Media Control Interface (DV-MCI) - Microsoft is high level control interface for VCR control including play, rewind, record and so on.
13. Apple's Audio Interchange File Format - Apple's standard file format for compressed audio and voice data.
14. Vendor-Independent Messaging (VIM) - Developed by a consortium of vendors providing a standardized format for cross product messages.
15. SDTS GIS Standard-The Spatial Data Transfer Standard is defined to provide a common storage format for geographic and cartographic data.

3.6.2 Video Processing Standards

Apple's Quick Time, Intel's DVI (Digital Video Interface) and Microsoft's AVI standards are the earliest format that were used widely for commercial workstations.

1. Intel's DVI

The Digital Video Interface Standard was defined to provide a processor-independent specification for video interface.

The requirements for displays in varies ranges a dedicated chips and processor designed to support DVI. For example custom designed chip is Intel's i750B.

The chip i750B is designed for enhancing low end, software based PC video and it can be used as a accelerator.

A dedicated DVI chip has the advantage that it can operate software video processing in real time and share the processing with the host CPU. Enhanced by DVI technology, faster central processors can provide better image quality.

Manipulating images, high-resolution graphics, audio and full motion video can take the processing power. Advanced DVI chips and DVI boards will boost power. DVI silicon relies on a programmable video processor, it gives DVI chips the potential to run a range of varies compression algorithms.

3.6.3 Apple's Quick Time

This standard developed by Apple computer, designed to support multimedia applications. Quick time is designed to be a graphic standard for time-based graphic data types. The various components has shown in the figure 3.7.

Components of Quick Time Architecture.

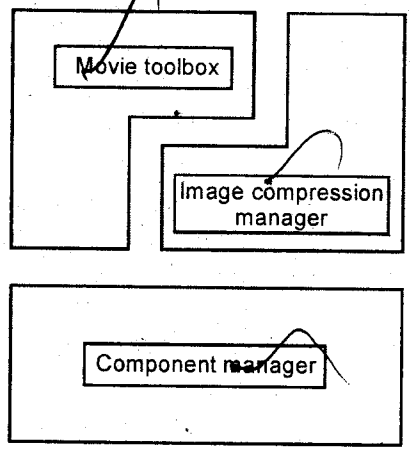

Figure 3.7

The definition of Quick Time has been extended to include the following

- System software
- File Format
- Compression / Decompression algorithm
- Human Interface Standard.

3.6.4 Microsoft's AVI

Microsoft's Audio Video Interface Standard, similar to Apple's Quick Time, offers low-cost low resolution video processing for the average desktop user.

AVI is a layered product, software only solution. This standard play 15 frames/sec of video in a 160 × 120 pixel windows.

AVI is scalable and allows users to set parameters such as window size, frame rate, quality and compression algorithm through a number of dialog boxes. This allows the user to adjust the operating parameter based on other application in use.

AVI compatible hardware allows enhancing performance through hardware-acclerated compression algorithms. Such as DVI and MPEG

3.7 Multimedia Databases

The organization want to add multimedia applications and document management as a fully add on capability to existing systems and applications.

It provide the following benefits,

- Reduce the time and space needed to file, store and retrieve documents in electronic form rather than paper form.
- Increased productivity by elimination lost or missing file conditions using automatically maintained indexing provided by data management system.
- Provide simultaneous access to multiple users.
- Improvement of multidimensional information flow within the organization.
- Reduction of time and money spent on photocopying by reducing the need for distributing multiple paper copies.
- Facilitation of rapid and correct responses to requests for information through stored visual interaction.
- Conversion of paper-based information into a manageable documents.

3.7.1 Multimedia Storage and Retrieval

Multimedia storage is characterized by massive storage volume. Large object sizes, multiple related objects, temporal requirements for retrivel and so on.

a. Massive Data Volumes

Paper records, and films or tapes are difficult to integrate, control, search and access and distribute.

Locating paper documents films and audio or video tapes requires searching through massive storage files, and require major organizational effort to ensure that they are returned in proper sequence to their original storage locations.

Indexing is also more complex than locating.

b. Storage Technologies

Storing of information on paper, film, audio, or video tapes and direct camera input are similar to the storage of data, text and graphics.

Microfiche and Microfilm is a medium of storage of paper documents. But it is very slow and the failure rate is high.

Recovery from failure damages the physical medium of microfilm and it cause loss of information.

Microfiche and microflim it produce a high level of mechanical failure and physical deterioration of microfilm media.

Another factor is it leave is lot of noise and documents, this noise cause compression problem and it disturbing in documents printed from microfiche or microfilm.

There are two mass storage technology for a storage of multimedia documents;

1. Optical storage systems and
2. High speed magnetic storage.

Managing a few optical disk platters is much simpler than managing a much larger magnetic disk farm.

Optical disk storage is an excellent vehicle for off-line archival of old and infrequently reference documents for some period of time.

c. Multimedia Object Storage

A key issue here is random keyed access to various components of a hypermedia document or hypermedia database record.

Optical media require very dense storage. For example, a 12 inch optical disk platter can store 6.5 Gbytes of information..

Full motion video and audio, the third dimensional time it impact on the size of the compressed data. For example 8-bit sound clip requires 50 kbytes/sec. Similarly, a video clip requires 1.5 Mbits/sec.

The speed of retrival is important consideration, it depends on storage latency size of data, transmission media and speed and decompression efficiency. Indexing is essential for fast retrieval of information.

d. Multimedia Document Retrival

Identifying a multimedia document is by storage platter identification and its relative position on the platter. These objects can be grouped using a database in folders or within complex objects representing hypermedia documents.

Accessing objects in a database requires performing the multimedia object directory function.

Another application of sound and full motion video is the ability to clip parts of it and combine them with another set.

3.7.2 Database Management System for Multimedia Systems

The storage of different forms of information including text, graphics and video is the challenge for application developers and database managers.

Most of multimedia applications are based on communications technologies such as electronic mail, the database system must be fully distributed. A number of database storage choices are available. They are

- Extending the existing Relational Database Management System (RDBMS) to support the various objects for multimedia as binary objects.
- Extending RDBMS to provide object programming front ends or C++ support.
- Converting the object-oriented database that support standard SQL language.
- Converting the database and the application to an object oriented database.
- Multimedia applications combine all types of data i.e., textual, nontextual video, audio and soon.
- Key limitation of relational database system for implementing multimedia application stem from two area;
  1. Relational data model
  2. Relational computational models

a. RDBMS Extensions for Multimedia

RDBMS have been designed to manage only tabular alphanumeric form of data. For binary and free form text it use the datatype Binary Large Object (BLOB). It is used for images or other binary data types.

Relational database table include the location information for the BLOBS. The extended relational database provide object oriented environment that support both encapsulation and inheritance.

b. Object-Oriented Database for Multimedia

The main principle of object programming is code reusable, modularity and ease of maintenance.

Once the class is defined, all the objects within it are given attributes of the class. Class definition used for developing and maintaining complex multimedia application in addition to its uses.

Object database capabilities includes, message passing, extensibility and hierarchical structure are important for multimedia systems.

Message Passing allows object to interact by invoking each other methods and the process of handling off data from one component of application to another.

Extensibility means that the set of operations, structures and constraints that are available to operations are not fixed. Developers can develop new operations for their own applications.

Three key concepts of object-oriented software technology that are important for multimedia systems:

1. Encapsulation
2. Association
3. Classification

Class libraries are defined to describe real world entities, it also support function such as data conversions and presentation of data adopted to the user environment.

Encapsulation is one of the advantage of object oriented software it allow the development of open system where one part of the application does not need to know the functioning of another part. It hides the inner functioning of each component.

The **inheritance** mechanism allows building objects rapidly with characteristics similar to the parent. New classes of objects can be created by inheriting the attributes and methods of existing classes.

3.7.3 Database Organization for Multimedia Applications

The following are some key issues of data organization for multimedia system;

1. Data Independence
2. Common Distributed Database Architecture
3. Distributed Database Servers
4. Multimedia Object Management

1. Data Independence

Flexible access by a number of database requires that the data be independent from the application so that the future application can access the data.

Key features of data independent designs are,

- Storage design is independent of specific applications.
- Explicit data definitions are independent of application programs.
- Users need not know the physical storage structure and data format.
- Integrity assurance is independent of application programs.
- Recovery is independent of application program.

2. Common Distributed Database Architecture

The insulation of data from an application and distributed application access present the opportunity to employ common distributed database architecture.

Key features

- Multiple independent data structure in system.
- Uniform distributed access by clients.
- A single point for recovery of each database server.
- Convenient data reorganization to suit requirement.
- Tunability and creation of objects classes.
- Expandability.

3. Distributed Database Servers

Distributed database servers are a dedicated resource on a network accessible to a number of applications.

The database server is built for growth and enhancement and the network provides the opportunity to grow the application and distributed access to the data.

4. Multimedia Object Management

The Object Management system must be capable of indexing, grouping and storing multimedia objects in distributed hierarchical optical storage system, and accessing this objects on keyed basis.

This system will not support the storage of multiple copies.

3.7.4 Transaction Management for Multimedia System

Multimedia transaction is defined as the sequence of events that starts when a user makes request to display, edit or print a hypermedia document.

The transaction is complete when the user releases the hypermedia document and stores back. The edited version and discard the copy in memory.

During the course of transaction the user may add new data elements, including live full motion video using video camera attached to the workstation.

In a general data transaction, it become more complex when data has to be retrieved from multiple data servers.

A hypermedia document cannot be presented successfully to the user until all of its components are available for display and negotiations have been completed with the servers to play out the data at the rate required by the workstation.

Using the concepts of objects, we can find the solution for 3D transactional management system.

ATM on the other hand, it is capable of lower speeds at the workstation, it reduces number of devices, protocol translation require for communication between local and wide area network.

3.4 Evolving Technologies for Multimedia Systems

Multimedia applications use a number of technologies generated for both commercial business applications as well as the video game industries.

The gap between these two area has been narrowing as game become more complex and multimedia applications start making use of interactive video techniques developed originally for game systems. The digital TV will accelerate the integration of business and game system technologies.

3.4.1 Hypermedia Documents

Technical and business documents are increasingly being written in electronic form, they also read in electronic form.

Fast network allowed this hypermedia documents.

Hypermedia documents contains, text, embedded or linked multimedia objects such as images, audio or full-motion video. It has its roots in hypertext.

a. Hypertext

Hypertext implements the organization of non sequential data by natural associations of information rather than hierarchical filling structure as in paper based text documents.

It allows authors to link information together create information path through a large volume of related text in documents, annotate existing text and append notes that direct readers to biblographic information or to other reference material.

Explicit connections or links allow readers to move from one location to another in a document or to other documents much as a reader would browse through references in an encyclopedia.

Hypermedia is an extension of hypertext in that these electronic documents will also include virtually any kind of information that can be stored in electronic storage such as audio, animated video, graphics or full motion video. These documents will encapsulate storage and format conversion information.

The encapsulated information will convert and adapt documents for the user based on where that user is located and what equipment is available as the user's desktop.

Distributed computing networks allow the user to use of hypermedia documents. It is used for electronic mail and workflow applications provide a rich functionality for exchanging a variety of information types.

The hypertext technology was first introduced to move around a text based databases, with hypermedia it is extend upto networks and to support a variety of data formats other than text.

The function OLE has introduced to display video clips in hypermedia documents. Products such as Lotus Notes use these features to provide hypermedia capabilities.

There are many problem when multiple users share the same documents in the network, example, maintaining version control, managing organized access to documents and locating documents and so on.

An important issue in the hypermedia document is storage. In this the embedded components may also be included in other documents, the hypermedia documents needs to store only reference to the documents. These references are resolved before the document is presented to the user.

ATM on the other hand, it is capable of lower speeds at the workstation, it reduces number of devices, protocol translation require for communication between local and wide area network.

3.4 Evolving Technologies for Multimedia Systems

Multimedia applications use a number of technologies generated for both commercial business applications as well as the video game industries.

The gap between these two area has been narrowing as game become more complex and multimedia applications start making use of interactive video techniques developed originally for game systems. The digital TV will accelerate the integration of business and game system technologies.

3.4.1 Hypermedia Documents

Technical and business documents are increasingly being written in electronic form, they also read in electronic form.

Fast network allowed this hypermedia documents.

Hypermedia documents contains, text, embedded or linked multimedia objects such as images, audio or full-motion video. It has its roots in hypertext.

a. Hypertext

Hypertext implements the organization of non sequential data by natural associations of information rather than hierarchical filling structure as in paper based text documents.

It allows authors to link information together create information path through a large volume of related text in documents, annotate existing text and append notes that direct readers to biblographic information or to other reference material.

Explicit connections or links allow readers to move from one location to another in a document or to other documents much as a reader would browse through references in an encyclopedia.

Hypermedia is an extension of hypertext in that these electronic documents will also include virtually any kind of information that can be stored in electronic storage such as audio, animated video, graphics or full motion video. These documents will encapsulate storage and format conversion information.

The encapsulated information will convert and adapt documents for the user based on where that user is located and what equipment is available as the user's desktop.

Distributed computing networks allow the user to use of hypermedia documents. It is used for electronic mail and workflow applications provide a rich functionality for exchanging a variety of information types.

The hypertext technology was first introduced to move around a text based databases, with hypermedia it is extend upto networks and to support a variety of data formats other than text.

The function OLE has introduced to display video clips in hypermedia documents. Products such as Lotus Notes use these features to provide hypermedia capabilities.

There are many problem when multiple users share the same documents in the network, example, maintaining version control, managing organized access to documents and locating documents and so on.

An important issue in the hypermedia document is storage. In this the embedded components may also be included in other documents, the hypermedia documents needs to store only reference to the documents. These references are resolved before the document is presented to the user.