



Program : **B.Tech**

Subject Name: **Computer Graphics & Multimedia**

Subject Code: **IT-601**

Semester: **6<sup>th</sup>**



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Subject Name: Computer Graphics and Multimedia

Subject Code: IT 601

Unit IV Syllabus:

Introduction to multimedia components applications, Multimedia System Architecture, Evolving technologies for Multimedia, Defining objects for Multimedia systems, Multimedia Data interface standards, Multimedia Databases, Multimedia Hardware, SCSI, IDE, MCI, Multimedia Tools, presentation tools, Authoring tools.

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**Unit-IV****Introduction to multimedia components & applications**

The term multimedia constituents of two words, multi and medium, multi refer to many i.e. at least two. Media is the plural of medium. Medium refers to storage, transmission, communication, representation, presentation, input interaction and perception, meaning that it can refer to different level of abstraction. It also refers to a basic information type like text, graphics, images, audio, animation, video etc. Therefore multimedia is as an integration of many types of media (i.e. text, graphics, images, audio, animation, video etc) on a single medium in the same information unit.

**Components of Multimedia**

There are five components of multimedia i.e. text, sound, images, animation and video. These are explained in detail as under.

- **Text** - Text or written language is the most common way of communicating information. It is one of the basic components of multimedia. It was originally defined by printed media such as books and newspapers that used various typefaces to display the alphabet, numbers, and special characters.
- **Image** - Images are an important component of multimedia. These are generated by the computer in two ways, as bitmap or raster images and as vector images.
  - Raster or Bitmap Images: Bitmap is a simple matrix of the tiny dots called pixel that forms a raster or bitmap image. Each pixel consists of two or more colours. The colour depth is determined by how much data, in bits is used to determine the number of colours. Depending on the hardware capabilities, each point can display from two to millions of colours. Comprehensive image means that an image looks as much as possible like the real word or original product. This means that the proportion, size, colour, and texture must be as accurate as possible. Bitmap formats are Windows Bitmap (BMP), Device Independent Bitmap (DIB), and Windows Run Length Encoded.
  - Vector Images: Vector images base on drawing elements or objects such as lines, rectangles, circles and so forth to create an image. The advantage of vector image is the relatively small amount of data required to represent the image and therefore, it does not requires a lot of memory to store. The image consists of a set of commands that are drawn when needed.
- **Animation** - Animation consists of still images displayed so quickly that they give the impression of continuous movement. The screen object is a vector image in animation. The movement of that image along paths is calculated using numerical transformations applied to their defining coordinates.
- **Sound** - Sound is probably the most sensuous element of multimedia. It is meaningful speech in any language, from a whisper to a scream. It can provide the listening pleasure of music, the startling accent of special effects, or the ambience of a mood setting background. It can promote an artist, add interest to a text site by humanizing the author, or to teach pronouncing words in another language. Sound pressure level (volume) is measured in decibels, which is actually the ratio between a chosen reference point on a logarithmic scale and the level that is actually experienced.
- **Video** - Video is defined as the display of recorded real events on a television type screen. The embedding of video in multimedia applications is a powerful way to convey information. It can incorporate a personal element, which other media lack.

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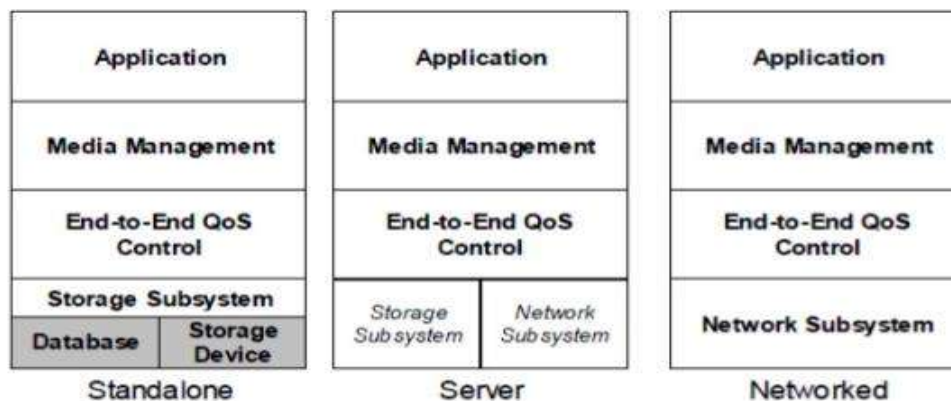
### Applications of Multimedia

Multimedia can be seen at each and every aspect of our daily life in different forms. However, entertainment and education are the fields where multimedia has its dominance. A brief introduction of multimedia applications in different fields can be as follows.

- Medicine
- Entertainment and fine arts
- Business
  - Showing what things look like, how they move and how they change.
- Education
  - Recorded or broadcast lectures.
  - Recording students' performances to enable feedback and promote reflection.
  - Bringing in an expert speaker from a distant location.
- Mathematical and Scientific Research
  - Recorded or broadcast conference presentations and discussions.
  - Demonstrating new techniques to colleagues.
  - Publicizing and promoting research outcomes to related professionals and to the general public.
  - Capturing data - such as focus groups, interviews, behavioral observations.

### Multimedia System Architecture

The architecture of multimedia system may be described as a four-level hierarchy. In line with concepts developed in conventional layered systems such as the OSI and Internet each layer performs a specific function and supports the function performed in the layer above. The four-layers (lowest (bottom) layer first) of the architecture, known as the RT architecture (Real-time information handling), are:



**Figure 4.1: Real Time Multimedia Architecture**

- Network Subsystem (Layer 1) - This layer takes care of the functionalities up layer 3 in the OSI model. Network specific functions depend on the technology used in this layer. Essentially this level provides a possible connection through a network with a specified bandwidth and error probability as supported by the underlying technology.
- End-to-End QoS Control (Layer 2) - This layer maintains the connection between the source and destination and can be conceptually viewed as a single connection -- even though there may be physically many more. Each connection is managed to ensure that a given Quality of Service (Qos) is maintained.
- Media Management (layer 3) - This layer provides generic services to applications so far as media management is concerned. A primary functions is synchronization across the media.
- Application (Layer 4) - The direct interface with the user. The application will also interface with the operating system, if required, for example calls to storage media or specific library functions (subroutines).

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### Evolving Technologies for Multimedia Systems

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

- **Hypermedia documents** - Hypermedia documents are documents which have text, embedded or linked multimedia objects such as image, audio, hologram, or full-motion video.
- **Hypertext** - Hypertext systems allow authors to link information together; create information paths through a large volume of related text in documents. It also allows annotating existing text, and appending notes. It allows fast and easy searching and reading of selected excerpts.
- **Hypermedia** - It is an extension of hypertext. In that, we can include texts, any kind of information that can be stored in electronic storage, such as audio, animated video, graphics or full-motion video. Hypermedia documents used for electronic mail and work flow applications provide a rich functionality for exchanging a variety of information types. The hypermedia document is a definition of a document and a set of pointers to help locate the various elements of the document on the network.
- **Hyper Speech** - Multimedia stimulated the development of general-purpose speech interfaces. Speech synthesis and speech recognition are fundamental requirement for hyper speech systems. Speech recognition is nothing but converting the analog speech into a computer action and into ASCII text. Speech-recognition systems cannot segment a stream of sounds without breaks into meaningful units. The user must speak in a stilted fashion. He should make sure to interpose silence between each word.
- **3D Technologies and Holography** - Three-dimensional technologies are concerned with two areas: pointing devices and displays. 3-D pointing devices are essential to manipulate object in a 3-D display system. 3-D displays are achieved using holography techniques. The techniques developed for holography have been adapted for direct computer use.
- **Fuzzy Logic** - Fuzzy logic is logic which is used for low-level process controllers. Use of fuzzy logic in multimedia chips is the key to the emerging graphical interfaces of the future. It is expected to become an integral part of multimedia hardware. Fuzzy logic has mathematical principles. Hence, the application of multimedia can benefit those principles.

### Defining objects for Multimedia systems

The basic data types of object using in multimedia include text, image, audio, holograms and full-motion video.

#### Text

It is the simplest of data types and requires the least amount of storage. Text is the base element of a relational database. It is also the basic building of a document. The major attributes of text include paragraph styling, character styling, font families and sizes, and relative location in a document.

#### Hypertext

It is an application of indexing text to provide a rapid search of specific text strings in one or more documents. It is an integral component of hypermedia documents. A hypermedia document is the basic complex object of which text is a sub object. Sub-objects include images, sound and full motion video. A hypermedia document always has text and has one or more other types of sub-objects.

#### Images

Image object is an object that is represented in graphics or encoded form. Image object is a subobject of the hypermedia document object. In this object, there is no direct relationship between successive representations in time. The image object includes all data types that are not coded text. It do not have a temporal property associated with them. The data types such as document images, facsimile systems, fractals, bitmaps, meta files, and still pictures or still video frames are grouped together.

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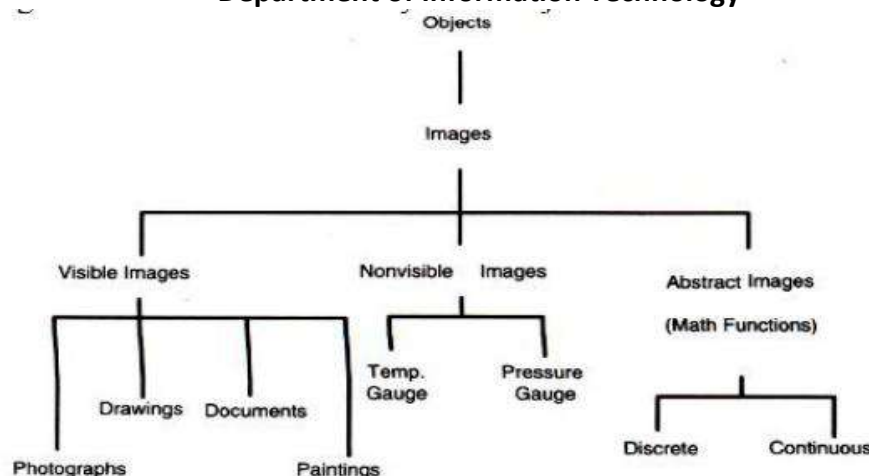


Figure 4.2: A hierarchy of the object classes

**Non-Visible:** This type of images are not stored as images. But they are displayed as images. Example: Pressure gauges, and temperature gauges.

**Abstract:** Abstract images are computer-generated images based on some arithmetic calculations. They are really not images that ever existed as real-world objects. Example of these images is fractals.

### Audio and Voice

Stored-Audio and Video objects contain compressed audio information. This can consist of music, speech, telephone conversation and voice commands. An Audio object needs to store information about the sound clip. Information here means length of the sound clip, its compression algorithm, playback characteristics, and any annotations associated with the original clip.

### Full Motion and Live Video

Full motion video refers to pre-stored video clips. Live video refers to live and it must be processed while it is being captured by the camera. From a storage perspective, we should have the information about the coding algorithm used for compression. It needs decoding also. From a processing perspective, video should be presented to user with smooth and there should not be any unexpected breaks. Hence, video object and its associated audio object must be transferred over the network to the decompression unit. It should be then played at the fixed rate specified for it. For successful playback of compressed video, there are number of technologies. They are database storage, network media and protocols, decompression engines and display engines.

### Multimedia Data interface standards

File Formats for Multimedia Systems:

**Device-independent Bitmap (DIB):** This file format contains bit map, color, and color palette information.

**RIFF device Independent Bitmap (RDIB):** Resource Interchange File Format (RIFF) is the standard file format defined for Microsoft Windows and OS/2. It allows a more complex set of bit maps than can be handled by DIB.

**Musical Instrument Digital interface (MIDI):** This is the interface standard for file transfer between a computer and a musical instrument such as a digital piano. It is also, used for full-motion video and voice-mail messaging systems. It has the advantage of ready availability of MIDI device controller boards for personal computers.

### RIFF Musical Instrument Digital Interface

A MIDI format within a RIFF envelope provides a more complex interface.

**Palette File Format (PAL)** An interface that allows defining a palette of 1 to 256 colours in a representation as RGB values.

**Rich Text Format (RTF)** This file format allows embedding graphics and other file formats within a document. This format is used by products such as Lotus Notus. This format is also the basis for the use of OLE.



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**Waveform Audio File Format (WAVE)** A digital file representation of digital audio.

**Windows Metafile Format (WMF)** This is a vector graphic format used by Microsoft Windows as an interchange format.

**Apple's Audio Interchange File Format** Apple's standard files format for compressed audio and voice data.

**SDTS GIS Standard** The Spatial Data Transfer Standard (SDTS) is designed to provide a common storage format for geographic and cartographic data.

### Video Processing Standards

INTELS DVI

**DVI** is an acronym of Digital Video Interface.

DVI standard is to provide a processor independent specification for a video interface. That video interface should accommodate most compression algorithms for fast multimedia displays. An example of custom-designed chip which supports DVI is Intel's i750 B. This chip is designed for enhancing low-end, software based PC video.

### Advantages of the DVI Chip

(i) It can operate software video processing real time. (ii) It can share the processing with the host CPU. (iii) It can handle additional vector-quantization-type algorithms in conjunction with host processing. DVI silicon chip relies on a programmable video processor. It gives potential to DVI chips to run a range of compression algorithms.

### Apple Quick Time

Quick Time standard is developed by Apple Computer. It is designed to Support multimedia applications. It is integrated with the operating system. Quick time refers to both the extensions to the Mac Operating system and to the compression/decompression functionality of the environment. Quick Time is designed to be the graphics standard for time based graphic data types.

Quick Time's definition has been extended to include (i) System Software, (ii) File Formats, (iii) Compression decompression algorithms, (iv) Human Interface Standards.

Quick Time adjusts automatically to the hardware being used by the user. MPEG is another competing standard which is comparatively higher-end, hardware-assisted standard. It can produce better resolutions at faster rates.

### Microsoft AVI

AVI is an acronym for Audio Video Interleave Standard. It is similar to Apple's Quick Time. It offers low-cost, low-resolution video processing for the average desktop user. It is a layered product. AVI is scalable. It allows users to set parameter such as window size, frame rate, quality and compression algorithm through a number of dialog boxes. AVI-compatible hardware allows enhancing performance through hardware-accelerated compression algorithms such as DVI and MPEG.

### Multimedia Databases

Multimedia data typically means digital images, audio, video, animation and graphics together with text data. The acquisition, generation, storage and processing of multimedia data in computers and transmission over networks have grown tremendously in the recent past.

Multimedia data are blessed with a number of exciting features. They can provide more effective dissemination of information in science, engineering, medicine, modern biology, and social sciences. It also facilitates the development of new paradigms in distance learning, and interactive personal and group entertainment.

The huge amount of data in different multimedia-related applications warranted to have databases as databases provide consistency, concurrency, integrity, security and availability of data. From an user perspective, databases provide functionalities for the easy manipulation, query and retrieval of highly relevant information from huge collections of stored data.

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Multimedia Databases (MMDBs) have to cope up with the increased usage of a large volume of multimedia data being used in various software applications. The applications include digital libraries, manufacturing and retailing, art and entertainment, journalism and so on. Some inherent qualities of multimedia data have both direct and indirect influence on the design and development of a multimedia database. MMDBs are supposed to provide almost all the functionalities, a traditional database provides. Apart from those, a MMDB has to provide some new and enhanced functionalities and features. MMDBs are required to provide unified frameworks for storing, processing, retrieving, transmitting and presenting a variety of media data types in a wide variety of formats. At the same time, they must adhere to numerical constraints that are normally not found in traditional databases.

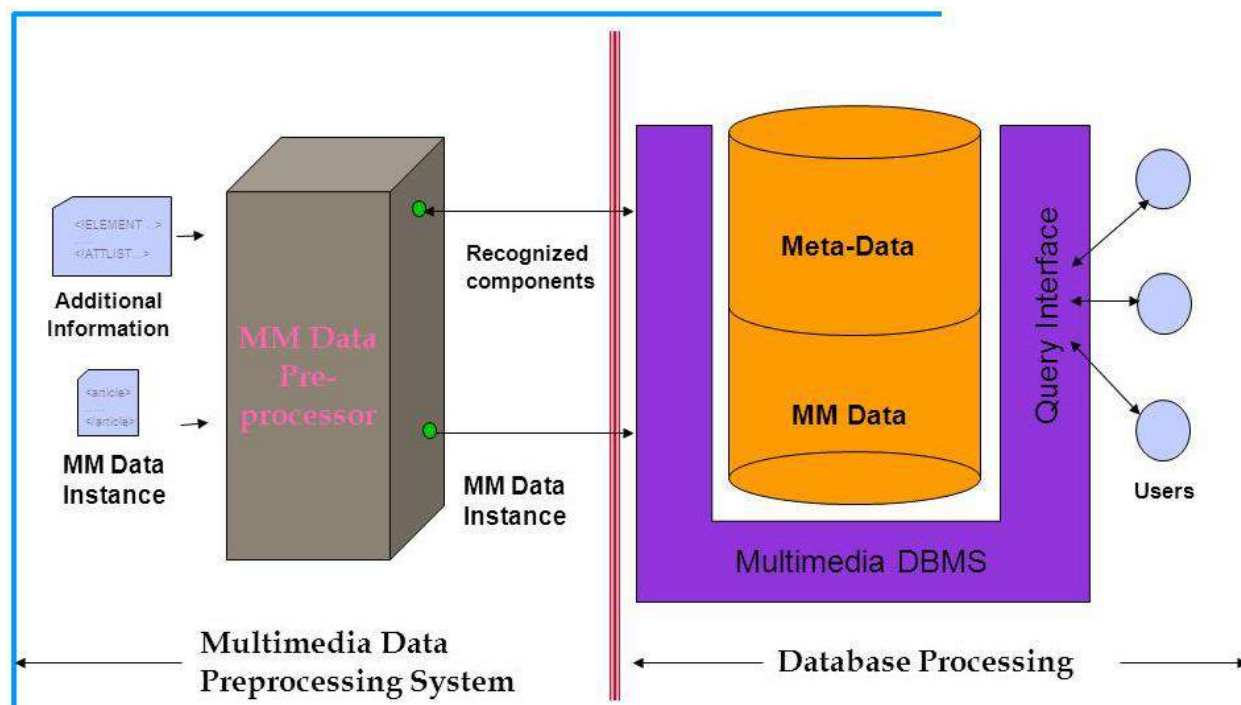


Figure 4.3: Multimedia Database Architecture

### Contents of MMDB

An MMDB needs to manage several different types of information pertaining to the actual multimedia data. They are:

- **Media data** - This is the actual data representing images, audio, video that is captured, digitized, processes, compressed and stored.
- **Media format data** - This contains information pertaining to the format of the media data after it goes through the acquisition, processing, and encoding phases. For instance, this consists of information such as the sampling rate, resolution, frame rate, encoding scheme etc.
- **Media keyword data** - This contains the keyword descriptions, usually relating to the generation of the media data. For example, for a video, this might include the date, time, and place of recording, the person who recorded, the scene that is recorded, etc This is also called as content descriptive data.
- **Media feature data** - This contains the features derived from the media data. A feature characterizes the media contents. For example, this could contain information about the distribution of colors, the kinds of textures and the different shapes present in an image. This is also referred to as content dependent data.

The last three types are called meta-data as they describe several different aspects of the media data. The media keyword data and media feature data are used as indices for searching purpose. The media format data is used to present the retrieved information.

### Multimedia Hardware

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- Fast processor e.g. Pentium
- Large RAM (Random Access memory)
  - Memory space that the computer uses when performing work.
  - More RAMs means computer works quicker and more efficient.
- Storage
  - Large Hard Disk
    - Capable of supporting fast data transfer rate.
  - Removable large-capacity storage devices. E.g. rewritable CD-Rom, Pen drive.
- A good CD-ROM burner & good CD-R software to complement it.
  - Easy CD Creature Deluxe
- High resolution and a large monitor
  - Minimum 17 inch monitor
  - A dot-pitch value of .28 or smaller
  - Dot-pitch: distance in millimeters between each of the red, green and blue dots etched into the phosphor of the inside of the screen.
  - The smaller the dot-pitch value, the finer the image.
  - Multisync monitor: allow the change in screen resolutions without having to reset the system.
- Good video display card
  - preferable capable of displaying 24 bit colours
- Good video capture cards
  - Allow you to capture video from a tape or camcorder
- A good quality digital camera
  - At least support 640 x 480 pixels images
  - Has display panel
  - Use disk or card to store the images before being uploaded to the computer.
- Input devices
  - Keyboard, mouse, track ball, touch screen, graphic tablet
- A good flatbed scanner
  - 24 bit colour depth and 300-dpi resolution
- Colour Printer
- Colour projector

### SCSI, IDE, MCI

#### SCSI-(Small Computer System Interface)

SCSI is a set of standards for physically connecting and transferring data between computers and peripheral devices. The SCSI standards define commands, protocols and electrical and optical interfaces. SCSI is most commonly used for hard disks and tape drives, but it can connect a wide range of other devices, including scanners and CD drives, although not all controllers can handle all devices. The SCSI standard defines command sets for specific peripheral device types.

SCSI is an intelligent, peripheral, buffered, peer to peer interface. It hides the complexity of physical format. Every device attaches to the SCSI bus in a similar manner. Up to 8 or 16 devices can be attached to a single bus. There can be any number of hosts and peripheral devices but there should be at least one host.

#### IDE-(Integrated Drive Electronics)

Integrated Drive Electronics also known as Advanced Technology Electronics (ATA) connections. They are typically only internal, and they connect hard disks, CD-ROM drives and other peripherals inside the computer. A PC motherboard can have two IDE controllers and each of them can support two devices one of which is master and the other slave. We can install a combination of four hard disks, CD-ROM drives, or other devices in our PC, with IDE.



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### Types of IDE

- Plain IDE, transfers data at 2.5 mb/sec.
- EIDE (Enhanced IDE), transfers data at 16.6 mb/sec.
- Ultra IDE, transfers data at 33 mb/sec.

### Multimedia MCI

MCI control enables a program to interact with any multimedia device connected to the computer that supports Media Control Interface (MCI)- which is a standard for controlling multimedia devices. Example of these devices: MIDI sequences, CD-Rom devices, audio players, video disk players. MCI control is an ActiveX component you should add it to your project before using it. The control provides a series of buttons that corresponds to typical buttons on a multimedia device such as a CD player or a VCR.

### Multimedia Tools -Presentation tools

Presentation tool (sometimes called "presentation graphics") is a category of application program used to create sequences of words and pictures that tell a story or help support a speech or public presentation of information. Presentation software can be divided into business presentation software and more general multimedia authoring tools, with some products having characteristics of both. Business presentation software emphasizes ease- and quickness-of-learning and use. Multimedia authoring software enables you to create a more sophisticated presentation that includes audio and video sequences. Business presentation software usually enables you to include images and sometimes audio and video developed with other tools. Some very popular presentation software, such as Microsoft's Powerpoint and Lotus's Freelance Graphics, are sold stand-alone or can come as part of office-oriented suites or packages of software. Other popular products include Adobe Persuasion, Astound, Asymetrix Compel, Corel Presentations, and Harvard Graphics. Among the most popular multimedia authoring tools are Macromedia Director and Asymetrix's Multimedia Toolbook. These authoring tools also include presentation capability as well. Most if not all of these products come in both PC and Mac versions.

Recently, a new presentation tool has arrived: your Web browser and the tools for creating Web pages, such as Microsoft's FrontPage and Adobe's PageMill. The ubiquity of these tools and the browser as a playback device make this a popular approach, especially when a presentation can combine HTML pages on the hard disk with links to outside sites (if you have a live Internet connection).

### Authoring tools

Multimedia Authoring Tools are also known as Author ware. It is a program that helps the author [user/programmer] write hyper text (or) multimedia application. Authoring tools usually enable a user to create a final application merely linking together. Objects such as paragraph of text, illustration (or) song can be embedded in a web page with the help of authoring tools. Multimedia authoring tools provide the frame work for organizing and editing the elements of multimedia projects. Authoring software provides an integrated element for combining the content and the functions of the project. It enables the developer to combine text, graphics, audio, video and animation into an interactive presentation. Authoring system includes editing tools to create, edit and convert multimedia elements such as animation and video clips. The process for multimedia involves story boarding and flow chart development. Visual flow chart (or) over viewing facility illustrates project structure at a macro level. In macro media flash, flash is used for delivering rich multimedia content to the web. It allows the creation simple; static HTML pages with the flash player Plug-in.

### Features of Authoring Tools

- Basic features
- Editing and organizing features
- Programming features
- Interactivity features
- Performance timing and playback features

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- Cross-platform and internet features

### Types of Authoring Tools

There are 3 types of authoring tools and they are as follows:

- Card and page based tools
- Icon based- event driven tools
- Time based tools

#### Card and page based tools:

This tool provides a simple and easily understandable metaphor for organizing multimedia elements. It contains media objects such as buttons, text files and graphic objects. It provides facilities for linking objects to pages (or) cards. The software required is Hyper card and Linked card tool box.

Advantages:

- Easy to understand
- Easy to use
- Easy to link metaphor1=screen1=card1= page1
- It consumes very less time for developing an application.

Disadvantages:

- Few applications run only on one platform.
- Card and page tools are not powerful as unique stand alone.

#### Icon based- event driven tools:

Icons (or) object based tools are the simplest event driven authoring object. Its provision of simple branching has the ability to go to another section of multimedia production. Multimedia elements and interaction are organized in the flowchart. A flow chart can be build by dragging appropriate icons from a library and then dropping them in the required field finally adding multimedia elements to it. The software required is Icon Author and Author ware.

Advantages:

- It has a clear structure [appropriately designed flow charts].
- Easy to edit and update the elements.

Disadvantages:

- Learning process is very difficult.
- Very expensive in nature.

#### Time based tools:

Time based tools are best suited for a message with a beginning and an end so that a message can be passed within a stipulated time period. Few time based tools facilitate navigation and interactive control. It has the branching technique so that different loops can be formed for different multimedia applications and time period can be set for these individual applications. The software required is Adobe's Directors.

Advantages:

- These tools are good for creating animation.
- Branching, user control interactivity.

Disadvantages:

- Steep learning curve for advance features.
- Music and sound files embedded in Flash movies increases the file size and increases the download time.
- Very expensive.

Multimedia data base contains still images, sound files, text, shapes, scripts, movies and other director's files. Course is the sequence for displaying and animating cast and crew members. Lingo is the object oriented scripting language that enables interactivity and programmed control.



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