

***INTRODUCTION TO
MULTIMEDIA***

V SEMESTER

(UG-CCSS-SDE)

OPEN COURSE

***(For candidates with core course other
than BMMC)***

***Candidates who select this Open Course
have to attend a Practical Examination
for 20 marks***

(2011 Admission)



UNIVERSITY OF CALICUT

SCHOOL OF DISTANCE EDUCATION

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STUDY MATERIAL

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INTRODUCTION TO MULTIMEDIA

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UNIT 1

INTRODUCTION TO MULTIMEDIA

Definition

Multimedia is the media that uses multiple forms of information content and information processing (e.g. text, audio, graphics, animation, and video, interactivity) to inform or entertain the user. Multimedia also refers to the use of electronic media to store and experience multimedia content. Multimedia is similar to traditional mixed media in fine art, but with a broader scope. The term "rich media" is synonymous for interactive Multimedia.

Multimedia System

Medium: An intervening substance through which some thing is transmitted or carried on.

Computer System medium:

1. Text
2. Image
3. Sound
4. Video

Representation Dimension of media:

Media are divided into two types in respect to time in their representation space:

1. Time independent (discrete): Information is expressed only in its individual value. E.g.: text, image, etc.
2. Time dependent (continuous): Information is expressed not only it's individual value, but also by the time of its occurrences. E.g.: sound and video.

Multimedia system is defined by computer controlled, integrated production, manipulation, presentation, storage and communication of independent information, which is encoded at least through a continuous and discrete media.

Classification of Media:

1. The perception media
2. The representation Media

3. The Presentation Media
4. The storage media
5. The transmission media
6. The information Exchange media

Perception media: Perception media help human to sense their environment. The central question is how human perceive information in a computer environment. The answer is through seeing and hearing.

Seeing: For the perception of information through seeing the usual such as text, image and video are used.

Hearing: For the perception of information through hearing media such as music noise and speech are used.

Representation media: Representation media are defined by internal computer representation of information. The central question is how the computer information is coded? The answer is that various format are used to represent media information in computer.

- i. Text, character is coded in ASCII code
- ii. Graphics are coded according to CEPT or CAPTAIN video text standard.
- iii. Image can be coded as JPEG format
- iv. Audio video sequence can be coded in different TV standard format(PAL, NTSC,SECAM and stored in the computer in MPEG format)

Presentation Media: Presentation media refer to the tools and devices for the input and output of the information. The central question is, through which the information is delivered by the computer and is introduced to the computer.

Output media: paper, screen and speaker are the output media.

Input Media: Keyboard, mouse, camera, microphone are the input media.

Storage media: Storage Media refer to the data carrier which enables storage of information. The central question is, how will information be stored? The answer is hard disk, CD-ROM, etc.

Transmission media: Transmission Media are the different information carrier that enables continuous data transmission. The central question is, over which information will be transmitted? The answer is co-axial cable, fiber optics as well as free air.

Information exchange media: Information exchange media includes all information carrier for transmission, i.e. all storage and transmission media. The central question is, which information carrier will be used for information exchange between different places? The answer is combine uses of storage and transmission media. E.g. Electronic mailing system.

Multimedia system architecture

Multimedia operating system is the system software that handles multimedia data and multimedia devices.

Important issues in Multimedia System:

1. Appropriate scheduling method should be applied: In contrast to the traditional real time operating system, multimedia operating systems also have to consider task without hard timing restriction under the aspects of fairness.
2. Communication and synchronization between processes must meet the restriction of the real-time requirement and timing relations between different Medias.
3. In multimedia system, memory management has to provide access to data within a guaranteed timing delay and efficient data manipulation function.
4. Data management is a important component in multimedia system, however database management system abstracts the details of storing data on the secondary media storage. Therefore database management should depend on file management services provided by multimedia operating system.

Real-time system:

Real time process is the process which delivers the result of processing in a given time. Main characteristics of real time system are the correctness of computation and fixed response time. Deadline represent the latest acceptable time for the presentation of the processing result. Real time system has both hard and soft deadline.

Soft deadline is the type of deadline which in some cases is missed and may be tolerated as long as.

Hard deadline should never be violated. Hard deadline violation is the system failure.

Characteristics of Real time system:

1. Predictably fast response to time critical event and accurate timing information.
2. High degree of schedulability :

Schedulability refers to the degree of resource utilization at which or below which deadline of each time critical task can be taken into account. Under system overload, processing of the critical task must be done.

3. Management of manufacturing process and control of the military system are the application area of real time system.

Real-time and Multimedia System:

1. A piece of music must be played back at a constant speed.
2. To fulfill the timing requirement of the continuous media, the operating system must use real time scheduling techniques.
3. The real-time requirements of traditional real-time scheduling techniques and control system in application areas such as factory automation, air craft piloting have high demand of security and fault tolerance.
4. The requirement desire from this demand somehow differentiates real time scheduling efforts applied to continuous media.
5. Multimedia system uses the different scenario than traditional real time operating system in real time requirements.

Digital Media

Digital media is a form of electronic media where data are stored in digital form. It can refer to the technical aspect of storage and transmission (e.g. hard disk drives or computer networking) of information or to the "end product", such as digital video, augmented reality, digital signage, digital audio, or digital art. Definition of digital media is "the creative convergence of digital arts, science, technology and business for human expression, communication, social interaction and education". Examples of digital media types include: Windows Media Audio (WMA), Windows Media Video (WMV), MP3, JPEG, and AVI. For information about the digital media types supported by Windows Media Player, see the article "Information about the Multimedia file types that Windows Media Player supports".

Hypermedia

Hypermedia is used as a logical extension of the term hypertext in which graphics, audio, video, plain text and hyperlinks intertwine to create a generally non-linear medium of information. This contrasts with the broader term multimedia, which may be used to describe non-interactive linear presentations as well as hypermedia. It is also related to the field of electronic literature. The term was first used in a 1965 article by Ted Nelson.

The World Wide Web is a classic example of hypermedia, whereas a non-interactive cinema presentation is an example of standard multimedia due to the absence of hyperlinks.

The first hypermedia work was, arguably, the Aspen Movie Map. Atkinson's HyperCard popularized hypermedia writing, while a variety of literary hypertext and hypertext works, fiction and nonfiction, demonstrated the promise of links. Most modern hypermedia is delivered via electronic pages from a variety of systems including media players, web browsers, and stand-alone applications (i. e., software that does not require network access). Audio hypermedia is emerging with voice command devices and voice browsing.

Image Authoring tools

Image Authoring tools is so known as *authorware*, a program that helps you write *hypertext* or *multimedia applications*. Authoring tools usually enable you to create a final application merely by linking together objects, such as a paragraph of text, an illustration, or a song. By defining the objects' relationships to each other, and by sequencing them in an appropriate order, authors (those who use authoring tools) can produce attractive and useful graphics applications. Most authoring systems also support a scripting language for more sophisticated applications. The distinction between authoring tools and programming tools is not clear-cut. Typically, though, authoring tools require less technical knowledge to master and are used exclusively for applications that present a mixture of textual, graphical, and audio data.

Multimedia Authoring Tools

Multimedia authoring tools provide the important framework you need for organizing and editing the elements of multimedia like graphics, sounds, animations and video clips. Authoring tools are used for designing interactivity and the user interface, for presentation your project on screen and assembling multimedia elements into a single cohesive project. Authoring software provides an integrated environment for binding together the content and functions of your project. Authoring systems typically include the ability to create, edit and import specific types of data; assemble raw data into a playback sequence or cue sheet and provide structured method or language for responding to user input.

Types of Authoring Tools

The various authoring tools can be classified in three categories based on the metaphor used for sequencing or organizing multimedia elements and events.

- Card or page based tools
- Icon base, event driven tools
- Time base and presentation tools

Card or page based tools

In these authoring systems, elements are organized as pages of a book or a stack of cards. These tools are best used when the bulk of your content consists of elements that can be viewed individually, like the pages of a book or cards in a card file. The authoring system lets you link these pages or cards into organized sequences. You can jump, on command, to any page you wish in the structured navigation pattern. It allows you to play sound elements and launch animations and digital video.

Icon based, event driven tools Multimedia Systems

In these authoring system, multimedia elements and interactions cues are organized as objects in a structural framework or process. Icon base, event-driven tools simplify the organization of your project and typically display flow diagrams of activities along branching paths. In complicate structures, this charting is particularly useful during development.

Time based tools

In these authoring systems, elements and events are organized along a timeline, with resolutions as high or higher than 1/30 second. Time based tools are best to use when you have a message with a beginning and an end. Sequentially organized graphic frames are played back at a speed that you can set. Other elements are triggered back at a given time or location in the sequence of events. The more powerful time based tools let you program jumps to any location in a sequence, thereby adding navigation and interactive control.

Features of Authoring Tools

Features of multimedia authoring tools are as mention below:

- Editing features
- Organizing features
- Programming features
- Interactive features
- Performance tuning features
- Playback features
- Delivery features
- Cross-Platform features
- Internet Playability

Now let us discuss each of them in detail.

Editing features

The elements of multimedia – image, animation, text, digital audio and MIDI music and video clips – need to be created, edited and converted to standard file formats and the specialized applications provide these capabilities. Editing tools for these elements, particularly text and still images are often included in your authoring system.

Organizing features

The organization, design and production process for multimedia involves storyboarding and flowcharting. Some authoring tools provide a visual flowcharting system or overview facility for illustrating your project's structure at a macro level. Storyboards or navigation diagrams too can help organize a project. Because designing the interactivity and navigation flow of your project often requires a great deal of planning and programming effort, your story board should describe not just graphics of each screen but the interactive elements as well. Features that help organize your material, such as those provided by Super Edit, Authorware, IconAuthor and other authoring systems, are a plus.

Programming features

Authoring tools that offer a very high level language or interpreted scripting environment for navigation control and for enabling user inputs – such as Macromedia Director, Macromedia Flash, HyperCard, MetaCard and ToolBook are more powerful. The more commands and functions provided in the scripting language, the more powerful the authoring system. As with traditional programming tools look for an authoring package with good debugging facilities, robust text editing and online syntax reference. Other scripting augmentation facilities are advantages as well. In complex projects you may need to program custom extensions of the scripting language for direct access to the computer's operating system. Some authoring tools offer direct importing of preformatted text, including facilities, complex text search mechanisms and hyper linkage tools. These authoring systems are useful for development of CD-ROM information products online documentation products, online documentation and help systems and sophisticated multimedia enhanced publications. With script you can perform computational tasks; sense and respond to user input; create character, icon and motion animation; launch other application; and control external multimedia devices.

Interactivity features

Interactivity empowers the end users of your project by letting them control the content and flow of information. Authoring tools should provide one or more levels of interactivity: Simple branching, which offers the ability to go to another section of the multimedia production. Conditional branching, which supports a go-to based on the result of IF-THEN decision or events. A structured language that supports complex programming logic, such as nested IF-THENS, subroutines, event tracking and message passing among objects and elements.

Performance tuning features

Complex multimedia projects require extra synchronization of events. Accomplishing synchronization is difficult because performance varies widely among the different computers used for multimedia development and delivery. Some authoring tools allow you to lock a production's playback speed to specified computer platform, but other provides no ability what so ever to control performance on various systems.

Playback features

When you are developing multimedia project, your will continually assembling elements and testing to see how the assembly looks and performs. Your authoring system should let you build a segment or part of your project and then quickly test it as if the user were actually using it.

Delivery features

Delivering your project may require building a run-time version of the project using the multimedia authoring software. A run-time version allows your project to play back without requiring the full authoring software and all its tools and editors. Many times the run time version does not allow user to access or change the content, structure and programming of the project. If you are going to distribute your project widely, you should distribute it in the run-time version.

Cross-Platform features

It is also increasingly important to use tools that make transfer across platforms easy. For many developers, the Macintosh remains the multimedia authoring platform of choice, but 80% of that developer's target market may be Windows platforms. If you develop on a Macintosh, look for tools that provide a compatible authoring system for Windows or offer a run-time player for the other platform.

Internet Playability

Due to the Web has become a significant delivery medium for multimedia, authoring systems typically provide a means to convert their output so that it can be delivered within the context of HTML or DHTML, either with special plug-in or embedding Java, JavaScript or other code structures in the HTML document.

Image file formats

Image file formats are standardized means of organizing and storing digital images. Image files are composed of digital data in one of these formats that can be rasterized for use on a computer display or printer. An image file format may store data in uncompressed, compressed, or vector formats. Once rasterized, an image becomes a grid of pixels, each of which has a number of bits to designate its color equal to the color depth of the device displaying it.

Image File Size

Generally speaking, in raster images, **Image file size** is positively correlated to the number of pixels in an image and the color depth, or bits per pixel, of the image. Images can be compressed in various ways, however. Compression uses an algorithm that stores an exact representation or an approximation of the original image in a smaller number of bytes that can be expanded back to its uncompressed form with a corresponding decompression algorithm. Considering different compressions, it is common for two images of the same number of pixels and color depth to have a very different compressed file size. Considering exactly the same compression, number of pixels, and color depth for two images, different graphical complexity of the original images may also result in very different file sizes after compression due to the nature of compression algorithms. With some compression formats, images that are less complex may result in smaller compressed file sizes. This characteristic sometimes results in a smaller file size for some lossless formats than lossy formats. For example, graphically simple images (i.e images with large continuous regions like line art or animation sequences) may be losslessly compressed into a GIF or PNG format and result in a smaller file size than a lossy JPEG format.

Vector images, unlike raster images, can be any dimension independent of file size. File size increases only with the addition of more vectors.

Image file compression

There are two types of **image file compression** algorithms: lossless and lossy.

Lossless compression

Lossless compression algorithms reduce file size while preserving a perfect copy of the original uncompressed image. Lossless compression generally, but not exclusively, results in larger files than lossy compression. Lossless compression should be used to avoid accumulating stages of re-compression when editing images.

Lossy compression

Lossy compression algorithms preserve a representation of the original uncompressed image that may appear to be a perfect copy, but it is not a perfect copy. Often lossy compression is able to achieve smaller file sizes than lossless compression. Most lossy compression algorithms allow for variable compression that trades image quality for file size.

Major Graphic File Formats

Including proprietary types, there are hundreds of image file types. The PNG, JPEG, and GIF formats are most often used to display images on the Internet. These graphic formats are listed and briefly described below, separated into the two main families of graphics: raster and vector.

In addition to straight image formats, **Metafile** formats are portable formats which can include both raster and vector information. Examples are application-independent formats such as WMF and EMF. The metafile format is an intermediate format. Most Windows applications open metafiles and then save them in their own native format. **Page description language** refers to formats used to describe the layout of a printed page containing text, objects and images. Examples are PostScript, PDF and PCL.

Raster formats

JPEG/JFIF

JPEG (Joint Photographic Experts Group) is a compression method; JPEG-compressed images are usually stored in the **JFIF** (JPEG File Interchange Format) file format. JPEG compression is (in most cases) lossy compression. The JPEG/JFIF filename extension is **JPG** or **JPEG**. Nearly every digital camera can save images in the JPEG/JFIF format, which supports 8-bit grayscale images and 24-bit color images (8 bits each for red, green, and blue). JPEG applies lossy compression to images, which can result in a significant reduction of the file size. The amount of compression can be specified, and the amount of compression affects the visual quality of the result. When not too great, the compression does not noticeably detract from the image's quality, but JPEG files suffer generational degradation when repeatedly edited and saved. (JPEG also provides lossless image storage, but the lossless version is not widely supported.)

JPEG 2000

JPEG 2000 is a compression standard enabling both lossless and lossy storage. The compression methods used are different from the ones in standard JFIF/JPEG; they improve quality and compression ratios, but also require more computational power to process. JPEG 2000 also adds features that are missing in JPEG. It is not nearly as common as JPEG, but it is used currently in professional movie editing and distribution (some digital cinemas, for example, use JPEG 2000 for individual movie frames).

Exif

The **Exif** (Exchangeable image file format) format is a file standard similar to the JFIF format with TIFF extensions; it is incorporated in the JPEG-writing software used in most cameras. Its purpose is to record and to standardize the exchange of images with image metadata between digital cameras and editing and viewing software. The metadata are recorded for individual images and include such things as camera settings, time and date, shutter speed, exposure, image size, compression, name of camera, color information. When images are viewed or edited by image editing software, all of this image information can be displayed.

The actual Exif metadata as such may be carried within different host formats, e.g. TIFF, JFIF (JPEG) or PNG. IFF-META is another example.

TIFF

The **TIFF** (Tagged Image File Format) format is a flexible format that normally saves 8 bits or 16 bits per color (red, green, blue) for 24-bit and 48-bit totals, respectively, usually using either the **TIFF** or **TIF** filename extension. TIFF's flexibility can be both an advantage and disadvantage, since a reader that reads every type of TIFF file does not exist TIFFs can be lossy and lossless; some offer relatively good lossless compression for bi-level (black&white) images. Some digital cameras can save in TIFF format, using the LZW compression algorithm for lossless storage. TIFF image format is not widely supported by web browsers. TIFF remains widely accepted as a photograph file standard in the printing business. TIFF can handle device-specific color spaces, such as the CMYK defined by a particular set of printing press inks. OCR (Optical Character Recognition) software packages commonly generate some (often monochromatic) form of TIFF image for scanned text pages.

RAW

RAW refers to raw image formats that are available on some digital cameras, rather than to a specific format. These formats usually use a lossless or nearly lossless compression, and produce file sizes smaller than the TIFF formats. Although there is a standard raw image format, (ISO 12234-2, TIFF/EP), the raw formats used by most cameras are not standardized or documented, and differ among camera manufacturers.

Most camera manufacturers have their own software for decoding or developing their raw file format, but there are also many third-party raw file converter applications available that accept raw files from most digital cameras. Some graphic programs and image editors may not accept some or all raw file formats, and some older ones have been effectively orphaned already.

Adobe's Digital Negative (DNG) specification is an attempt at standardizing a raw image format to be used by cameras, or for archival storage of image data converted from undocumented raw image formats, and is used by several niche and minority camera manufacturers including Pentax, Leica, and Samsung. The raw image formats of more than 230 camera models, including those from manufacturers with the largest market shares such as Canon, Nikon, Phase One, Sony, and Olympus, can be converted to DNG.^[1] DNG was based on ISO 12234-2, TIFF/EP, and ISO's revision of TIFF/EP is reported to be adding Adobe's modifications and developments made for DNG into profile 2 of the new version of the standard.

As far as video cameras are concerned, ARRI's Arriflex D-20 and D-21 cameras provide raw 3K-resolution sensor data with Bayer pattern as still images (one per frame) in a proprietary format (.ari file extension). Red Digital Cinema Camera Company, with its

Mysterium sensor family of still and video cameras, uses its proprietary raw format called REDCODE (.R3D extension), which stores still as well as audio+video information in one lossy-compressed file.

GIF

GIF (Graphics Interchange Format) is limited to an 8-bit palette, or 256 colors. This makes the GIF format suitable for storing graphics with relatively few colors such as simple diagrams, shapes, logos and cartoon style images. The GIF format supports animation and is still widely used to provide image animation effects. It also uses a lossless compression that is more effective when large areas have a single color, and ineffective for detailed images or dithered images.

BMP

The **BMP file format** (Windows bitmap) handles graphics files within the Microsoft Windows OS. Typically, BMP files are uncompressed, hence they are large; the advantage is their simplicity and wide acceptance in Windows programs.

PNG

The **PNG** (Portable Network Graphics) file format was created as the free, open-source successor to GIF. The PNG file format supports 8 bit paletted images (with optional transparency for all palette colors) and 24 bit true color (16 million colors) or 48 bit true color with and without alpha channel - while GIF supports only 256 colors and a single transparent color. Compared to JPEG, PNG excels when the image has large, uniformly colored areas. Thus lossless PNG format is best suited for pictures still under edition - and the lossy formats, like JPEG, are best for the final distribution of photographic images, because in this case JPG files are usually smaller than PNG files. The Adam7-interlacing allows an early preview, even when only a small percentage of the image data has been transmitted.

PNG provides a patent-free replacement for GIF and can also replace many common uses of TIFF. Indexed-color, grayscale, and true color images are supported, plus an optional alpha channel.

PNG is designed to work well in online viewing applications like web browsers so it is fully streamable with a progressive display option. PNG is robust, providing both full file integrity checking and simple detection of common transmission errors. Also, PNG can store gamma and chromaticity data for improved color matching on heterogeneous platforms.

Some programs do not handle PNG gamma correctly, which can cause the images to be saved or displayed darker than they should be. Animated formats derived from PNG are MNG and APNG. The latter is supported by Mozilla Firefox and Opera and is backwards compatible with PNG.

PPM, PGM, PBM, PNM and PFM

Netpbm format is a family including the **portable pixmap** file format (PPM), the **portable gray map** file format (PGM) and the **portable bitmap** file format (PBM). These are either pure ASCII files or raw binary files with an ASCII header that provide very basic functionality and serve as a lowest common denominator for converting pixmap, graymap, or bitmap files between different platforms. Several applications refer to them collectively as PNM or PAM format (Portable Any Map). PFM was invented later in order to carry floating-point-based pixel information (as used inHDR).

PAM

A late addition to the PNM family is the PAM format (Portable Arbitrary Format).

WEBP

WebP is a new open image format that uses both lossless and lossy compression. It was designed by Google to reduce image file size to speed up web page loading: its principal purpose is to supersede JPEG as the primary format for photographs on the web. WebP now supports animated images and alpha channel (transparency) in lossy images.

WebP is based on VP8's intra-frame coding and uses a container based on RIFF.

HDR Raster formats

Most typical raster formats cannot store HDR data (32 bit floating point values per pixel component), which is why some relatively old or complex formats are still predominant here, and worth mentioning separately. Newer alternatives are showing up, though.

RGBE (Radiance HDR)

The classical representation format for HDR images, originating from Radiance and also supported by Adobe Photoshop.

IFF-RGFX

IFF-RGFX the native format of SView5 provides a straightforward IFF-style representation of any kind of image data ranging from 1-128 bit (LDR and HDR), including common meta data like ICC profiles, XMP, IPTC or EXIF.

Multimedia Elements

Multimedia means that computer information can be represented through audio, graphics, image, video and animation in addition to traditional media (text and graphics). Hypermedia can be considered as one type of particular multimedia application

Categories of Multimedia

Multimedia may be broadly divided into linear and non-linear categories. Linear active content progresses without any navigation control for the viewer such as a cinema presentation. Non-linear content offers user interactivity to control progress as used with a computer game or used in self-paced computer based training. Non-linear content is also known as hypermedia content. Multimedia presentations can be live or recorded. A recorded presentation may allow interactivity via a navigation system. A live multimedia presentation may allow interactivity via interaction with the presenter or performer.

Features of Multimedia

Multimedia presentations may be viewed in person on stage, projected, transmitted, or played locally with a media player. A broadcast may be a live or recorded multimedia presentation. Broadcasts and recordings can be either analog or digital electronic media technology. Digital online multimedia may be downloaded or streamed. Streaming multimedia may be live or on-demand. Multimedia games and simulations may be used in a physical environment with special effects, with multiple users in an online network, or locally with an offline computer, game system, or simulator. Enhanced levels of interactivity are made possible by combining multiple forms of media content. But depending on what multimedia content you have it may vary. Online multimedia is increasingly becoming object-oriented and data-driven, enabling applications with collaborative end-user innovation and personalization on multiple forms of content over time. Examples of these range from multiple forms of content on web sites like photo galleries with both images (pictures) and title (text) user-updated, to simulations whose co-efficient, events, illustrations, animations or videos are modifiable, allowing the multimedia "experience" to be altered without reprogramming.

Multimedia Applications

Multimedia finds its application in various areas including, but not limited to, advertisements, art, education, entertainment, engineering, medicine, mathematics, business, scientific research and spatial, temporal applications.

A few application areas of multimedia are listed below:

Creative industries

Creative industries use multimedia for a variety of purposes ranging from fine arts, to entertainment, to commercial art, to journalism, to media and software services provided for any of the industries listed below. An individual multimedia designer may cover the spectrum throughout their career. Request for their skills range from technical, to analytical and to creative.

Commercial

Much of the electronic old and new media utilized by commercial artists is multimedia. Exciting presentations are used to grab and keep attention in advertising. Industrial, business to business, and interoffice communications are often developed by creative services firms for advanced multimedia presentations beyond simple slide shows to sell ideas or liven-up training. Commercial multimedia developers may be hired to design for governmental services and nonprofit services applications as well.

Entertainment and Fine Arts

In addition, multimedia is heavily used in the entertainment industry, especially to develop special effects in movies and animations. Multimedia games are a popular pastime and are software programs available either as CD-ROMs or online. Some video games also use multimedia features. Multimedia applications that allow users to actively participate instead of just sitting by as passive recipients of information are called Interactive Multimedia.

Education

In Education, multimedia is used to produce computer-based training courses (popularly called CBTs) and reference books like encyclopaedia and almanacs. A CBT lets the user go through a series of presentations, text about a particular topic, and associated illustrations in various information formats. Edutainment is an informal term used to describe combining education with entertainment, especially multimedia entertainment.

Engineering

Software engineers may use multimedia in Computer Simulations for anything from entertainment to training such as military or industrial training. Multimedia for software interfaces are often done as collaboration between creative professionals and software engineers.

Industry

In the Industrial sector, multimedia is used as a way to help present information to shareholders, superiors and coworkers. Multimedia is also helpful for providing employee training, advertising and selling products all over the world via virtually unlimited web-based technologies.

Mathematical and Scientific Research

In Mathematical and Scientific Research, multimedia is mainly used for modeling and simulation. For example, a scientist can look at a molecular model of a particular substance and manipulate it to arrive at a new substance. Representative research can be found in journals such as the Journal of Multimedia.

Medicine

In Medicine, doctors can get trained by looking at a virtual surgery or they can simulate how the human body is affected by diseases spread by viruses and bacteria and then develop techniques to prevent it.

Convergence of Multimedia (Virtual Reality)

At the convergence of technology and creative invention in multimedia is virtual reality, or VR. Goggles, helmets, special gloves, and bizarre human interfaces attempt to place you “inside” a lifelike experience. Take a step forward, and the view gets closer, turn your head, and the view rotates. Reach out and grab an object; your hand moves in front of you. Maybe the object explodes in a 90-decibel crescendo as you wrap your fingers around it. Or it slips out from your grip, falls to the floor, and hurriedly escapes through a mouse hole at the bottom of the wall. VR requires terrific computing horsepower to be realistic. In VR, your cyberspace is made up of many thousands of geometric objects plotted in three-dimensional space: the more objects and the more points that describe the objects, the higher resolution and the more realistic your view. As the user moves about, each motion or action requires the computer to recalculate the position, angle size, and shape of all the objects that make up your view and many thousands of computations must occur as fast as 30 times per second to seem smooth.

Following are the four basic stages of multimedia project development :

1. **Planning and Costing** : This stage of multimedia application is the first stage which begins with an idea or need. This idea can be further refined by outlining its messages and objectives. Before starting to develop the multimedia project, it is necessary to plan what writing skills, graphic art, music, video and other multimedia expertise will be required. It is also necessary to estimate the time needed to prepare all elements of multimedia and prepare a budget accordingly. After preparing a budget, a prototype or proof of concept can be developed.

2. **Designing and Producing** : The next stage is to execute each of the planned tasks and create a finished product.

3. **Testing** :

Testing a project ensure the product to be free from bugs. Apart from bug elimination another aspect of testing is to ensure that the multimedia application meets the objectives of the project. It is also necessary to test whether the multimedia project works properly on the intended deliver platforms and they meet the needs of the clients.

4. **Delivering** : The final stage of the multimedia application development is to pack the project and deliver the completed project to the end user. This stage has several steps such as implementation, maintenance, shipping and marketing the product.

Multimedia Building Blocks

Any multimedia application consists any or all of the following components :

1. Text : Text and symbols are very important for communication in any medium. With the recent explosion of the Internet and World Wide Web, text has become more the important than ever. Web is HTML (Hyper text Markup language) originally designed to display simple text documents on computer screens, with occasional graphic images thrown in as illustrations.
2. Audio : Sound is perhaps the most element of multimedia. It can provide the listening pleasure of music, the startling accent of special effects or the ambience of a mood-setting background.
3. Images : Images whether represented analog or digital plays a vital role in multimedia. It is expressed in the form of still picture, painting or a photograph taken through a digital camera.
4. Animation : Animation is the rapid display of a sequence of images of 2-D artwork or model positions in order to create an illusion of movement. It is an optical illusion of motion due to the phenomenon of persistence of vision, and can be created and demonstrated in a number of ways.
5. Video : Digital video has supplanted analog video as the method of choice for making video for multimedia use. Video in multimedia are used to portray real time moving pictures in a multimedia project.

Text in Multimedia

Words and symbols in any form, spoken or written, are the most common system of communication. They deliver the most widely understood meaning to the greatest number of people. Most academic related text such as journals, e-magazines are available in the Web Browser readable form.

Fonts and Faces

A typeface is family of graphic characters that usually includes many type sizes and styles. A font is a collection of characters of a single size and style belonging to a particular typeface family. Typical font styles are bold face and italic. Other style attributes such as underlining and outlining of characters, may be added at the users choice. The size of a text is usually measured in points. One point is approximately 1/72 of an inch i.e. 0.0138. The size of a font does not exactly describe the height or width of its characters. This is because the x-height (the height of lower case character x) of two fonts may differ.

Typefaces of fonts can be described in many ways, but the most common characterization of a typeface is serif and sans serif. The serif is the little decoration at the end of a letter stroke. Times, Times New Roman, Bookman are some fonts which comes under

serif category. Arial, Optima, Verdana are some examples of sans serif font. Serif fonts are generally used for body of the text for better readability and sans serif fonts are generally used for headings. The following fonts shows a few categories of serif and sans serif fonts.

Computers and text:

Fonts :

Postscript fonts are a method of describing an image in terms of mathematical constructs (Bezier curves), so it is used not only to describe the individual characters of a font but also to describe illustrations and whole pages of text. Since postscript makes use of mathematical formula, it can be easily scaled bigger or smaller. Apple and Microsoft announced a joint effort to develop a better and faster quadratic curves outline font methodology, called true type In addition to printing smooth characters on printers, TrueType would draw characters to a low resolution (72 dpi or 96 dpi) monitor.

2.6 Character set and alphabets:

ASCII Character set

The American standard code for information interchange (SCII) is the 7 bit character coding system most commonly used by computer systems in the United states and abroad. ASCII assigns a number of value to 128 characters, including both lower and uppercase letters, punctuation marks, Arabic numbers and math symbols. 32 control characters are also included. These control characters are used for device control messages, such as carriage return, line feed, tab and form feed.

The Extended Character set

A byte which consists of 8 bits, is the most commonly used building block for computer processing. ASCII uses only 7 bits to code is 128 characters; the 8th bit of the byte is unused. This extra bit allows another 128 characters to be encoded before the byte is used up, and computer systems today use these extra 128 values for an extended character set. The extended character set is commonly filled with ANSI (American National Standards Institute) standard characters, including frequently used symbols.

Unicode

Unicode makes use of 16-bit architecture for multilingual text and character encoding. Unicode uses about 65,000 characters from all known languages and alphabets in the world. Several languages share a set of symbols that have a historically related derivation, the shared symbols of each language are unified into collections of symbols (Called scripts). A single script can work for tens or even hundreds of languages. Microsoft, Apple, Sun, Netscape, IBM, Xerox and Novell are participating in the development of this standard and Microsoft and Apple have incorporated Unicode into their operating system.

Introduction

Sound is perhaps the most important 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. Sound is the terminology used in the analog form, and the digitized form of sound is called as audio.

Power of Sound

When something vibrates in the air is moving back and forth it creates wave of pressure. These waves spread like ripples from pebble tossed into a still pool and when it reaches the eardrums, the change of pressure or vibration is experienced as sound. Acoustics is the branch of physics that studies sound. Sound pressure levels are measured in decibels (db); a decibel measurement is actually the ratio between a chosen

Multimedia Sound Systems

The multimedia application user can use sound right off the bat on both the Macintosh and on a multimedia PC running Windows because beeps and warning sounds are available as soon as the operating system is installed. On the Macintosh you can choose one of the several sounds for the system alert. In Windows system sounds are WAV files and they reside in the windows\Media subdirectory. There are still more choices of audio if Microsoft Office is installed. Windows makes use of WAV files as the default file format for audio and Macintosh systems use SND as default file format for audio.

Digital Audio

Digital audio is created when a sound wave is converted into numbers – a process referred to as digitizing. It is possible to digitize sound from a microphone, a synthesizer, existing tape recordings, live radio and television broadcasts, and popular CDs. You can digitize sounds from a natural source or prerecorded. Digitized sound is sampled sound. Even the fraction of a second, a sample of sound is taken and stored as digital information in bits and bytes. The quality of this digital recording depends upon how often the samples are taken.

Preparing Digital Audio Files

Preparing digital audio files is fairly straight forward. If you have analog source materials – music or sound effects that you have recorded on analog media such as cassette tapes. The first step is to digitize the analog material and recording it onto a computer readable digital media. It is necessary to focus on two crucial aspects of preparing digital audio files: Balancing the need for sound quality against your available RAM and

Hard disk resources.

Editing Digital Recordings

Once a recording has been made, it will almost certainly need to be edited. The basic sound editing operations that most multimedia procedures needed are described in the paragraphs that follow

1. **Multiple Tasks:** Able to edit and combine multiple tracks and then merge the tracks and export them in a final mix to a single audio file.
2. **Trimming:** Removing dead air or blank space from the front of a recording and an unnecessary extra time off the end is your first sound editing task.
3. **Splicing and Assembly:** Using the same tools mentioned for trimming, you will probably want to remove the extraneous noises that inevitably creep into recording.
4. **Volume Adjustments:** If you are trying to assemble ten different recordings into a single track there is a little chance that all the segments have the same volume.
5. **Format Conversion:** In some cases your digital audio editing software might read a format different from that read by your presentation or authoring program.
6. **Re sampling or down sampling:** If you have recorded and edited your sounds at 16 bit sampling rates but are using lower rates you must resample or down sample the file.
7. **Equalization:** Some programs offer digital equalization capabilities that allow you to modify a recording frequency content so that it sounds brighter or darker.
8. **Digital Signal Processing:** Some programs allow you to process the signal with reverberation, multi tap delay, and other special effects using DSP routines.

Making MIDI Audio

MIDI (Musical Instrument Digital Interface) is a communication standard developed for electronic musical instruments and computers. MIDI files allow music and sound synthesizers from different manufacturers to communicate with each other by sending messages along cables connected to the devices. Creating your own original score can be one of the most creative and rewarding aspects of building a multimedia project, and MIDI (Musical Instrument Digital Interface) is the quickest, easiest and most flexible tool for this task. The process of creating MIDI music is quite different from digitizing existing audio. To make MIDI scores, however you will need sequencer software and a sound synthesizer. The MIDI keyboard is also useful to simplify the creation of musical scores. An advantage of structured data such as MIDI is the ease with which the music director can edit the data.

Audio File Formats

A file format determines the application that is to be used for opening a file.

Following is the list of different file formats and the software that can be used for opening a specific file.

1. *.AIF, *.SDII in Macintosh Systems
2. *.SND for Macintosh Systems
3. *.WAV for Windows Systems
4. MIDI files – used by north Macintosh and Windows
5. *.WMA –windows media player
6. *.MP3 – MP3 audio
7. *.RA – Real Player
8. *.VOC – VOC Sound
9. AIFF sound format for Macintosh sound files
10. *.OGG – Ogg Vorbis

Software used for Audio

Software such as Toast and CD-Creator from Adaptec can translate the digital files of red book Audio format on consumer compact discs directly into a digital sound editing file, or decompress MP3 files into CD-Audio. There are several tools available for recording audio. Following is the list of different software that can be used for recording and editing audio ;

Image

Still images are the important element of a multimedia project or a web site. In order to make a multimedia presentation look elegant and complete, it is necessary to spend ample amount of time to design the graphics and the layouts. Competent, computer literate skills in graphic art and design are vital to the success of a multimedia project.

Digital Image

A digital image is represented by a matrix of numeric values each representing a quantized intensity value. When I is a two-dimensional matrix, then $I(r,c)$ is the intensity value at the position corresponding to row r and column c of the matrix.

The points at which an image is sampled are known as picture elements, commonly abbreviated as pixels. The pixel values of intensity images are called gray scale levels (we encode here the “color” of the image). The intensity at each pixel is represented by an integer and is determined from the continuous image by averaging over a small neighborhood around the pixel location. If there are just two intensity values, for example, black, and white,

they are represented by the numbers 0 and 1; such images are called binary-valued images. If 8-bit integers are used to store each pixel value, the gray levels range from 0 (black) to 255 (white).

Digital Image Format

There are different kinds of image formats in the literature. We shall consider the image format that comes out of an image frame grabber, i.e., the captured image format, and the format when images are stored, i.e., the stored image format. **Captured Image Format** The image format is specified by two main parameters: spatial resolution, which is specified as pixels (eg. 640x480) and color encoding, which is specified by bits per pixel. Both parameter values depend on hardware and software for input/output of images.

Stored Image Format

When we store an image, we are storing a two-dimensional array of values, in which each value represents the data associated with a pixel in the image. For a bitmap, this value is a binary digit.

Bitmaps

A bitmap is a simple information matrix describing the individual dots that are the smallest elements of resolution on a computer screen or other display or printing device. A one-dimensional matrix is required for monochrome (black and white); greater depth (more bits of information) is required to describe more than 16 million colors the picture elements may have, as illustrated in following figure. The state of all the pixels on a computer screen make up the image seen by the viewer, whether in combinations of black and white or colored pixels in a line of text, a photograph-like picture, or a simple background pattern.

Clip Art

A clip art collection may contain a random assortment of images, or it may contain a series of graphics, photographs, sound, and video related to a single topic. For example, Corel, Micrografx, and Fractal Design bundle extensive clip art collection with their image-editing software.

Multiple Monitors

When developing multimedia, it is helpful to have more than one monitor, or a single high-resolution monitor with lots of screen real estate, hooked up to your computer. In this way, you can display the full-screen working area of your project or presentation and still have space to put your tools and other menus. This is particularly important in an authoring system such as Macromedia Director, where the edits and changes you make in one window are immediately visible in the presentation window-provided the presentation window is not obscured by your editing tools.

Making Still Images

Still images may be small or large, or even full screen. Whatever their form, still images are generated by the computer in two ways: as bitmap (or paint graphics) and as vector-drawn (or just plain drawn) graphics. Bitmaps are used for photo-realistic images and for complex drawing requiring fine detail. Vector-drawn objects are used for lines, boxes, circles, polygons, and other graphic shapes that can be mathematically expressed in angles, coordinates, and distances. A drawn object can be filled with color and patterns, and you can select it as a single object. Typically, image files are compressed to save memory and disk space; many image formats already use compression within the file itself – for example, GIF, JPEG, and PNG. Still images may be the most important element of your multimedia project. If you are designing multimedia by yourself, put yourself in the role of graphic artist and layout designer.

Bitmap Software

The abilities and feature of image-editing programs for both the Macintosh and Windows range from simple to complex. The Macintosh does not ship with a painting tool, and Windows provides only the rudimentary Paint (see following figure), so you will need to acquire this very important software separately – often bitmap editing or painting programs come as part of a bundle when you purchase your computer, monitor, or scanner

Capturing and Editing Images

The image that is seen on a computer monitor is digital bitmap stored in video memory, updated about every 1/60 second or faster, depending upon monitor's scan rate. When the images are assembled for multimedia project, it may often be needed to capture and store an image directly from screen. It is possible to use the Prt Scr key available in the keyboard to capture a image.

Scanning Images

After scanning through countless clip art collections, if it is not possible to find the unusual background you want for a screen about gardening. Sometimes when you search for something too hard, you don't realize that it's right in front of your face. Open the scan in an image-editing program and experiment with different filters, the contrast, and various special effects. Be creative, and don't be afraid to try strange combinations – sometimes mistakes yield the most intriguing results.

Vector Drawing

Most multimedia authoring systems provide for use of vector-drawn objects such as lines, rectangles, ovals, polygons, and text. Computer-aided design (CAD) programs have traditionally used vector-drawn object systems for creating the highly complex and geometric rendering needed by architects and engineers. Graphic artists designing for print media use

vector-drawn objects because the same mathematics that put a rectangle on your screen can also place that rectangle on paper without jaggies. This requires the higher resolution of the printer, using a page description language such as PostScript. Programs for 3-D animation also use vector-drawn graphics. For example, the various changes of position, rotation, and shading of light required to spin the extruded.

How Vector Drawing Works

Vector-drawn objects are described and drawn to the computer screen using a fraction of the memory space required to describe and store the same object in bitmap form. A vector is a line that is described by the location of its two endpoints. A simple rectangle, for example, might be defined as follows:

Color

Color is a vital component of multimedia. Management of color is both a subjective and a technical exercise. Picking the right colors and combinations of colors for your project can involve many tries until you feel the result is right.

Understanding Natural Light and Color

The letters of the mnemonic ROY G. BIV, learned by many of us to remember the colors of the rainbow, are the ascending frequencies of the visible light spectrum: red, orange, yellow, green, blue, indigo, and violet. Ultraviolet light, on the other hand, is beyond the higher end of the visible spectrum and can be damaging to humans. The color white is a noisy mixture of all the color frequencies in the visible spectrum. The cornea of the eye acts as a lens to focus light rays onto the retina. The light rays stimulate many thousands of specialized nerves called rods and cones that cover the surface of the retina. The eye can differentiate among millions of colors, or hues, consisting of combination of red, green, and blue.

Additive Color

In additive color model, a color is created by combining colored light sources in three primary colors: red, green and blue (RGB). This is the process used for a TV or computer monitor

Subtractive Color

In subtractive color method, a new color is created by combining colored media such as paints or ink that absorb (or subtract) some parts of the color spectrum of light and reflect the others back to the eye. Subtractive color is the process used to create color in printing. The printed page is made up of tiny halftone dots of three primary colors, cyan, magenta and yellow (CMY).

Image File Formats

There are many file formats used to store bitmaps and vectored drawing. Following is a list of few image file formats.

Format Extension

Microsoft Windows DIB .bmp .dib .rle

Microsoft Palette .pal

Autocad format 2D .dxf

JPEG .jpg

Windows Meta file .wmf

Portable network graphic .png

Compuserve gif .gif

Apple Macintosh .pict .pic .pct

ANIMATION

Introduction

Animation makes static presentations come alive. It is visual change over time and can add great power to our multimedia projects. Carefully planned, well-executed video clips can make a dramatic difference in a multimedia project. Animation is created from drawn pictures and video is created using real time visuals.

Principles of Animation

Animation is the rapid display of a sequence of images of 2-D artwork or model positions in order to create an illusion of movement. It is an optical illusion of motion due to the phenomenon of persistence of vision, and can be created and demonstrated in a number of ways. The most common method of presenting animation is as a motion picture or video program, although several other forms of presenting animation also exist. Animation is possible because of a biological phenomenon known as persistence of vision and a psychological phenomenon called phi. An object seen by the human eye remains chemically mapped on the eye's retina for a brief time after viewing. Combined with the human mind's need to conceptually complete a perceived action, this makes it possible for a series of images that are changed very slightly and very rapidly, one after the other, to seemingly blend together into a visual illusion of movement. The following shows a few cells or frames of a rotating logo. When the images are progressively and rapidly changed, the arrow of the compass is perceived to be spinning. Television video builds entire frames or pictures every

second; the speed with which each frame is replaced by the next one makes the images appear to blend smoothly into movement. To make an object travel across the screen while it changes its shape, just change the shape and also move or translate it a few pixels for each frame.

Animation Techniques

When you create an animation, organize its execution into a series of logical steps. First, gather up in your mind all the activities you wish to provide in the animation; if it is complicated, you may wish to create a written script with a list of activities and required objects. Choose the animation tool best suited for the job. Then build and tweak your sequences; experiment with lighting effects. Allow plenty of time for this phase when you are experimenting and testing. Finally, post-process your animation, doing any special rendering and adding sound effects.

Cel Animation

The term cel derives from the clear celluloid sheets that were used for drawing each frame, which have been replaced today by acetate or plastic. Cels of famous animated cartoons have become sought-after, suitable-for-framing collector's items. Cel animation artwork begins with key frames (the first and last frame of an action). For example, when an animated figure of a man walks across the screen, he balances the weight of his entire body on one foot and then the other in a series of falls and recoveries, with the opposite foot and leg catching up to support the body.

The animation techniques made famous by Disney use a series of progressively different on each frame of movie film which plays at 24 frames per second. A minute of animation may thus require as many as 1,440 separate frames. The term cel derives from the clear celluloid sheets that were used for drawing each frame, which is being replaced today by acetate or plastic. Cel animation artwork begins with key frames.

Computer Animation

Computer animation programs typically employ the same logic and procedural concepts as cel animation, using layer, keyframe, and tweening techniques, and even borrowing from the vocabulary of classic animators. On the computer, paint is most often filled or drawn with tools using features such as gradients and antialiasing. The word links, in computer animation terminology, usually means special methods for computing RGB pixel values, providing edge detection, and layering so that images can blend or otherwise mix their colors to produce special transparencies, inversions, and effects. Computer Animation is same as that of the logic and procedural concepts as cel animation and use the vocabulary of classic cel animation – terms such as layer, Keyframe, and tweening. The primary difference between the animation software program is in how much must be drawn by the animator and how much is automatically generated by the software. In 2D animation the animator creates

an object and describes a path for the object to follow. The software takes over, actually creating the animation on the fly as the program is being viewed by your user. In 3D animation the animator puts his effort in creating the models of individual and designing the characteristic of their shapes and surfaces. Paint is most often filled or drawn with tools using features such as gradients and anti-aliasing.

Kinematics

It is the study of the movement and motion of structures that have joints, such as a walking man. Inverse Kinematics is in high-end 3D programs, it is the process by which you link objects such as hands to arms and define their relationships and limits. Once those relationships are set you can drag these parts around and let the computer calculate the result.

Morphing

Morphing is popular effect in which one image transforms into another. Morphing application and other modeling tools that offer this effect can perform transition not only between still images but often between moving images as well. The morphed images were built at a rate of 8 frames per second, with each transition taking a total of 4 seconds.

Animation File Formats

Some file formats are designed specifically to contain animations and they can be ported among application and platforms with the proper translators.

Director *.dir, *.dcr

AnimationPro *.fli, *.flc

3D Studio Max *.max

SuperCard and Director *.pics

CompuServe *.gif

Flash *.fla, *.swf

Following is the list of few Software used for computerized animation:

3D Studio Max

Flash

AnimationPro

Video

Analog versus Digital

Digital video has supplanted analog video as the method of choice for making video for multimedia use. While broadcast stations and professional production and postproduction houses remain greatly invested in analog video hardware (according to Sony, there are more than 350,000 Betacam SP devices in use today), digital video gear produces excellent finished products at a fraction of the cost of analog. A digital camcorder directly connected to a computer workstation eliminates the image-degrading analog-to-digital conversion step typically performed by expensive video capture cards, and brings the power of nonlinear video editing and production to everyday users.

Broadcast Video Standards

Four broadcast and video standards and recording formats are commonly in use around the world: NTSC, PAL, SECAM, and HDTV. Because these standards and formats are not easily interchangeable, it is important to know where your multimedia project will be used.

PAL

The Phase Alternate Line (PAL) system is used in the United Kingdom, Europe, Australia, and South Africa. PAL is an integrated method of adding color to a black-and-white television signal that paints 625 lines at a frame rate 25 frames per second.

SECAM

The Sequential Color and Memory (SECAM) system is used in France, Russia, and few other countries. Although SECAM is a 625-line, 50 Hz system, it differs greatly from both the NTSC and the PAL color systems in its basic technology and broadcast method.

Shooting and Editing Video

To add full-screen, full-motion video to your multimedia project, you will need to invest in specialized hardware and software or purchase the services of a professional video production studio. In many cases, a professional studio will also provide editing tools and post-production capabilities that you cannot duplicate with your Macintosh or PC.

Video Tips

A useful tool easily implemented in most digital video editing applications is "bluescreen," "Ultimate," or "chromo key" editing. Blue screen is a popular technique for making multimedia titles because expensive sets are not required. Incredible backgrounds can be generated using 3-D modeling and graphic software, and one or more actors, vehicles, or other objects can be neatly layered onto that background. Applications such as Video Shop,

Premiere, Final Cut Pro, and iMovie provide this capability. Recording Formats S-VHS video In S-VHS video, color and luminance information are kept on two separate tracks. The result is a definite improvement in picture quality. This standard is also used in Hi-8. still, if your ultimate goal is to have your project accepted by broadcast stations, this would not be the best choice.

Component (YUV)

In the early 1980s, Sony began to experiment with a new portable professional video format based on Betamax. Panasonic has developed their own standard based on a similar technology, called "MII," Betacam SP has become the industry standard for professional video field recording. This format may soon be eclipsed by a new digital version called "Digital Betacam."

Digital Video

Full integration of motion video on computers eliminates the analog television form of video from the multimedia delivery platform. If a video clip is stored as data on a hard disk, CD-ROM, or other mass-storage device, that clip can be played back on the computer's monitor without overlay boards, videodisk players, or second monitors. This playback of digital video is accomplished using software architecture such as QuickTime or AVI, a multimedia producer or developer; you may need to convert video source material from its still common analog form (videotape) to a digital form manageable by the end user's computer system. So an understanding of analog video and some special hardware must remain in your multimedia toolbox. Analog to digital conversion of video can be accomplished using the video overlay hardware described above, or it can be delivered direct to disk using FireWire cables. To repetitively digitize a full-screen color video image every 1/30 second and store it to disk or RAM severely taxes both Macintosh and PC processing capabilities—special hardware, compression firmware, and massive amounts of digital storage space are required.

Video Compression

To digitize and store a 10-second clip of full-motion video in your computer requires transfer of an enormous amount of data in a very short amount of time. Reproducing just one frame of digital video component video at 24 bits requires almost 1MB of computer data; 30 seconds of video will fill a gigabyte hard disk. Full-size, full-motion video requires that the computer deliver data at about 30MB per second. This overwhelming technological bottleneck is overcome using digital video compression schemes or codecs (coders/decoders). A codec is the algorithm used to compress a video for delivery and then decode it in real-time for fast playback.

Real-time video compression algorithms such as MPEG, P*64, DVI/Indeo, JPEG, Cinepak, Sorenson, ClearVideo, RealVideo, and VDOwave are available to compress digital

video information. Compression schemes use Discrete Cosine Transform (DCT), an encoding algorithm that quantifies the human eye's ability to detect color and image distortion. All of these codecs employ lossy compression algorithms. In addition to compressing video data, streaming technologies are being implemented to provide reasonable quality low-bandwidth video on the Web. Microsoft, RealNetworks, Vxtreme, VDOnet, Xing, Precept, Cubic, Motorola, Viva, Vosaic, and Oracle are actively pursuing the commercialization of streaming technology on the Web. QuickTime, Apple's software-based architecture for seamlessly integrating sound, animation, text, and video (data that changes over time), is often thought of as a compression standard, but it is really much more than that.

MPEG

The MPEG standard has been developed by the Moving Picture Experts Group, a working group convened by the International Standards Organization (ISO) and the International Electro-technical Commission (IEC) to create standards for digital representation of moving pictures and associated audio and other data. MPEG1 and MPEG2 are the current standards. Using MPEG1, you can deliver 1.2 Mbps of video and 250 Kbps of two-channel stereo audio using CD-ROM technology. MPEG2, a completely different system from MPEG1, requires higher data rates (3 to 15 Mbps) but delivers higher image resolution, picture quality, interlaced video formats, multiresolution scalability, and multichannel audio features. DVI/Indeo DVI is a property, programmable compression/decompression technology based on the Intel i750 chip set. This hardware consists of two VLSI (Very Large Scale Integrated) chips to separate the image processing and display functions.

Two levels of compression and decompression are provided by DVI: Production Level Video (PLV) and Real Time Video (RTV). PLV and RTV both use variable compression rates. DVI's algorithms can compress video images at ratios between 80:1 and 160:1. DVI will play back video in full-frame size and in full color at 30 frames per second.

Input devices

Often, input devices are under direct control by a human user, who uses them to communicate commands or other information to be processed by the computer, which may then transmit feedback to the user through an output device. Input and output devices together make up the hardware interface between a computer and the user or external world. Typical examples of input devices include keyboards and mice. However, there are others which provide many more degrees of freedom. In general, any sensor which monitors, scans for and accepts information from the external world can be considered an input device, whether or not the information is under the direct control of a user.

Format	File	Description
AVI	.avi	AVI (Audio Video Interleave) was developed by Microsoft. AVI is supported by all computers running Windows, and by the most popular web browsers. It is a very common format on the Internet, but not always possible to play on non-Windows computers
WMV	.wmv	WMV (Windows Media Video) was developed by Microsoft. WMV is a common format on the Internet, but it cannot be played on non-Windows computer without an extra (free) component installed. Some later WMVs cannot play at all on non-Windows computers because no player is available
MPEG	.mpg .mpeg	The MPEG (Moving Pictures Expert Group) format is the most popular format on the Internet. It is cross-platform, and supported by all major browsers
QuickTime	.mov	QuickTime was developed by Apple. QuickTime is a common format on the Internet, but QuickTime movies cannot be played on a Windows computer without an extra (free) component installed.
RealVideo	.rm .ram	Real Video was developed by Real Media. Real Video allows streaming of video (online video, Internet TV) with low bandwidths. Because of the low bandwidth priority, the quality is often reduced
Flash	.swf .flv	Flash was developed by Macromedia. Flash requires an extra component to play. This component comes preinstalled with all major browsers
MP4	.mp4	Mpeg-4 (MP4) is the new format for the internet. YouTube recommends using MP4. YouTube accepts multiple formats, and then converts them all to .flv or .mp4 for distribution

Format	File	Description
MIDI	.mid .midi	<p>MIDI (Musical Instrument Digital Interface) is a format for electronic music devices like synthesizers and PC sound cards. MIDI files do not contain sound, but digital musical instructions (notes) that can be played by electronics (like your PC's sound card).</p> <p>Since MIDI files only contains instructions; they are extremely small. The example above is only 23K in size, but it plays for nearly 5 minutes. MIDI is supported by many software systems/platforms. MIDI is supported by all the most popular Internet browsers.</p>
MP3	.mp3	<p>MP3 files are actually the sound part of MPEG files. MPEG was originally developed for video by the Moving Pictures Experts Group. MP3 is the most popular format for music. The encoding system combines good compression (small files) with high quality</p>
RealAudio	.rm .ram	<p>RealAudio was developed Real Media. It allows streaming of audio (online music, Internet radio) with low bandwidths. Because of the low bandwidth priority, the quality is often reduced</p>
WAV	.wav	<p>WAVE (more known as WAV) was developed by IBM and Microsoft. WAVs are compatible with Windows, Macintosh, and Linux operating systems</p>
WMA	.wma	<p>WMA (Windows Media Audio), compares in quality to MP3, and is compatible with most players, except the iPod. WMA files can be delivered as a continuous flow of data, which makes it practical for use in Internet radio or on-line music.</p>

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