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Multimedia Systems

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***Abstract*—**Throughout the course (O.S) we generally concerned how O.S handled conventional data includes text files, programs, word processing documents, binaries and spread sheets. But O.S may handle other kinds of data as well. A recent trend in technology is the incorporation of Multimedia Data (MD) into computer systems. MD consist of continuous-media data (audio and video)data as well as conventional files. Conventional-media data differ from conventional data in that continuous-media data, such as frames of video, would be delivered (streamed) according to certain time restrictions.

***Keywords*— streaming, multimedia, multicasting,unicasting**

INTRODUCTION

A **Multimedia System** is a system capable of processing multimedia data and applications.

A **Multimedia System** is particularised by the processing, storage, generation, manipulation and rendition of Multimedia information.

Multimedia application are not either audio or video, rather a multimedia application includes a combination of both, for example , a movie may consists of separate audio and video tracks. Nor must multimedia application be delivered only to desktop personal computers. Increasingly , they are being directed toward smaller devices, including personal digital assistance and cellular telephones. For example , a stock trader may be stock quotes delivered in real time to her PDA.

Media Delivery

Multimedia data are stored in the file system just like any other data. The major difference between a regular file and multimedia file is that the multimedia file must be accessed at a specific rate, whereas accessing the regular file requires no special timing . let's use video as an example of what we mean by "rate". Video is represented by a series of images , formally known as **frames** that are displayed in rapid succession. The faster the frames are displayed the smoother the video appears . in general a rate of 24 to 30 frames per second is necessary for video to appear smooth for human eyes(the eyes retain the image of each frame for a short time after it has been presented a characteristics known as persistence of vision, a rate of 24 to 30 frames per second is fast enough to appear continuous). A rate lower than 24 frames per second will result in a choppy-looking presentation. The video file must be accessed from the file system at a rate consistent with the rate at which the video is being displayed. We refer to data with associated rate requirements as a continuous-media data.

Multimedia fata may be delivered to a client either from the local file system or from a remote server. When the data are delivered from the local file system , we refer to the delivery as local playback. Examples include watching a dvd on a laptop computer or listening to an mp3 audio file on a handheld mp3 player, in these cases, the data comprise a regular file that is stored on the local file system and played back(that is, viewed or listened to) from that system.

Multimedia files may also be stored on a remote server and delivered to a client across a network using technique known as streaming. A client may be personal computer or a s smaller device such as handheld computer, PDA, or cellular telephone. Data from live continuous media such as live webcam are also streamed from a server to clients

There are two types of streaming techniques :
Progressive download .
Real-time streaming.

With the progressive download, a media file containing audio or video is downloaded and stored on the clients local file system. As the file is being downloaded, the client is able to play back the media file without having to wait for the file to be downloaded in its entirety. Because the media file is ultimately stored on the client system, progressive download is most useful for relatively small media files, such as short video clips.

Real-time streaming differ from progressive download in that the media files is streams to the client but is only played and not stored by the client. Because the media file is not stored on the client system real time streaming is preferable to progressive download for media files that might too large for storage on the system, such as long video and internet radio and t.v broadcast.

Both progressive download and real time streaming may allow a client to move different points in the stream, just as you can use the FAST FORWARD and remind operation on a VCR controller to move to different points in the VCR tape. For example we could move to the end of our 5 minutes streaming video or replay a certain

section of a movie cli. The ability to move around within the media stream is known as random access.
Two types of streaming are available :
Live streaming
On-demand Streaming

Live streaming is used to deliver an event , such as a concert and lecture live as it is actually occurring.

A radio program broadcast over the internet is an example of a live real time stream. Live real time streaming is also used for applications such as live webcams or a video conferencing. Due to its live delivery this type of real time streaming does not allow client random access to different point in a media stream. In addition live delivery means the client who wishes view a particular live stream already progressed will join the session late thereby missing earlier portions of the stream. The same thing happens with the live TV and radio broadcast.

On-demand streaming is used to deliver media stream such as full length movies and archived lectures. The difference between live and on-demand streaming is that ON-DEMAND streaming does not take place as the event is occurring. Thus , for example, Whereas watching a live stream is like watching a live broadcast on T.V, watching a on-demand stream is like viewing a movie on a DVD player at some Convenient time, there is no motion of arriving late depending on the type of on-demand streaming, a client may or may not have random access to stream .

Characteristics of Multimedia System

the demand of multimedia system are not like the demand of traditional application, we can say the multimedia systems may have the following properties,

1. Mostly, they are quite large i.e a 100 minutes MKV movie requires a space of 1.1 GB of storage space, 70 minutes HD T.V requires approximately 70 GB of storage. A server storing hindered or thousands of video file may require several TB of space.

2. On the other side continuous media may require very high data rates. A digital video frames of colour video having resolution of 800X600. If we use 24 bits to represent each colour then we have 2^24 or thoroughly 16 millions different colours. Then each frame require 800 X 600 X 24 =11.520000.

   If the frames are displayed at the rate of 30 frames/sec bandwidth in access of 345 MB/sec is needed.

3. Multimedia applications are sensitive to time delays during the playback. Once a continuous-media file is delivered to a client delivery must continue at a certain rate during the playback of the media: otherwise the listener or the viewer will be subjected to pause during the presentation

Compression:

Because of the size and rate requirements of multimedia systems, multimedia files or often compressed into smaller forms using in rar extension. Compression is important when the content is being streamed across a network connection . once a file is compressed it must be decompressed (extracted) before it can be accessed. A series of algo's are used to compressed the file effects the later decompression.

MPEG-1 is used for digital video and its associated audio stream. Its resolutions is 352X 240 at 30 frames/s/ with a bit rate of up to 1.5mbps.

MPEG-2 provide better quality the MPEG-1.and it is used to compressing movies and digital T.V. MPEG-2 identifies a number of levels and profile of video compression. Bit rate of MPEG-2 encoded files are 1.5Mbps to 15 Mbps. Its due to high data rates. It's often unsuitable for delivery of video across a network and generally used for local playback

MPEG-3 is the latest standard, used to transmit audio, video and graphics including two dimensional and 3 dimensional layers. It can be delivered on very slow connection such as 56Kbps systems or high speed local networks with several Mbps. By providing a scalable level of quality and service.

MPEG-4 files can be delivered to wireless devices including handheld devices. PDA's and cell phones.

Challenges for Multimedia Systems

The key issues that multimedia systems need to deal with are:

1. How to represent and store temporal information.

2. How to strictly maintain the temporal relationships on play back/retrieval

3. What process are involved in the above.

4. Data has to be represented *digitally* so many initial source of data needs to be *digitised* - translated from analog source to digital representation. This will involve scanning (graphics, still images), sampling (audio/video) although digital cameras now exist for direct scene to digital capture of images and video.

5. The data is ***large*** (several Mb) for audio and video - therefore storage, transfer (bandwidth) and processing overheads are high. Data compression techniques very common.

Given the (mentioned) challenges the following features are desirable (if not a prerequisite) for a Multimedia System:

1. **Very High Processing Power :** needed to deal with large data processing and real time delivery of media. Special hardware commonplace.
2. **Multimedia Capable File System :** needed to deliver real-time media e.g. Video/Audio Streaming. Special Hardware/Software needed e.g. RAID technology.
3. **Data Representations/File Formats that support multimedia :** Data representations/file formats should be easy to handle yet allow for compression/decompression in real-time.
4. **Efficient and High I/O :** input and output to the file subsystem needs to be efficient and fast. Needs to allow for real-time recording as well as playback of data. e.g. Direct to Disk recording systems.

In the following sections, we consider two other approaches for handling the unique requirements of continuous media.

Unicasting and Multicasting

In general there are three methods for delivering content from a server to a client across a network.

Unicasting

The server delivers the content to a single client. If the content is being delivered to more than one client, the server must establish a separate unicast for each client

Broadcasting

the server delivers the content to all clients, regardless of whether they wish to receive the content or not.

Multicasting

The server delivers the content to a group of receivers who indicate they wish to receive the content this method lies somewhere between unicasting and broadcasting

An issue with unicast delivery is that the server must establish a separate unicast session for each client. This seems especially wasteful for live real time streaming., where the server must make several copies of the same content, one for each client. Obviously, broadcasting is not always appropriate, as not all clients may wish to receive the stream.(suffice to say that broadcasting is typically only used across local area networking and is not possible across the public internet).

Multicasting appears to be reasonable compromise, since it allows the server to deliver a single copy of the content to all clients indicating that they wish to receive it. The difficulty with multicasting from a practical stand point is that the clients must be physically close to server or to intermediate routers that relay the content from the originating server. If the route from the server to the client must cross intermediate routers, the routers must also support multicasting . if these conditions are not met, the delays incurred during routing may result in violation of the timing requirements of the continuous media. In the worst case, if a client is connected to an intermediate router that does not support multicasting, the client will be unable to receive the multicast stream at all.

Currently , most streaming media are delivered across unicast channels; however, multicasting is used in various areas where the organization of the server and client is known in advance. For example, a corporation with several sites across a country may be able to ensure that all sites are connected routers. The organization will then be able to deliver a presentation from the chief executive officer using multicasting.

Requirements of multimedia Kernels Multimedia applications often require levels of service from the operating system that differ from the requirements of traditional application , such as word processors, compilers, and spreadsheets. Timing and rate requirements are perhaps the issues of foremost concern, as the playback of audio and video data demands that the data be delivered within a certain deadline and at a continuous, fixed rate. Traditional applications typically do not have such time and rate constrains.

Tasks that request data at constant intervals or periods are known as periodic processes. For example. An MPEG-1 video might require a rate of 30 frames per second during playback. Maintain this rate requires that a frame be delivered approximately every 1/30 or 3.34 hundred's of a second soft.

Rate requirements and deadlines are known as quality of service (QoS)

There are three QoS levels.

1. **Best effort service :** the system makes a best-effort attempt to satisfy the requirements however no gurantees are made.

2. **Soft QoS** :this level treats different types of traffic in different ways, giving certain traffic streams higher priority than other streams, however just as with best-effort service, no guarantees are made
3. **Hard Qos :** the quality of service requirements are guaranteed

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Following are some useful terms used to multimedia systems.

Throughput.

Throughput is the total amount of work done during a certain interval. For multimedia application , throughput is the required data rate

Delay

Delay refers to the elapsed time from where a request is first submitted to when the desired result is produced. For example, the time from when a client requests a media stream to when the stream is delivered is the delay.

Jitter

Jitter is related to delay; but whereas delay refers to the time a client must wait to receive a stream, jitter refers to delays that occur during playback of the stream. Certain multimedia application such as on0deand real time streaming , can tolerate this sort of delay. Jitter is generally considered unacceptable for continuous-media application, however, because it may mean long pauses or lost frames during playback. Clients can often compensate for jitter by buffering a certain amount of data say 5 seconds worth before beginning playback

Reliability

It refers to how errors are handled during transmission and processing of continuous media. Errors may occur due to lost packets in the network or processing delays by the CPU. In these and other scenarios, error connot be corrected , since packets typically arrive too late to be useful

Summary

Multimedia application are in common use in modern computer systems, multimedia files include video and audio files , which may be delivered to system such as desktops computers, personal digital assistants and cell phones. The primary distinction between multimedia data and conventional data is that multimedia data have specific rate and dealing requirements. Because multimedia files have specific timing requirements, the data must often is that multimedia data have specific rata and dealing requirements, the must often he compressed before delivery to a client for playback. Multimedia server across a nerwoek connection using a technique known as streaming.

Conclusion

The timing requirements of multimedia data are known as quality of service requirements, and conventional operating systems often cannot make quality-of-service guarantees. To provide quality of service, multimedia system must provides a form of admission control whereby a system accepts a request only if it can meet the quality of service guarantees requires evaluating how an operating system performs CPU scheduling, disk scheduling and network management a continuous media task as a scheduling criterion. Network management requires the use of protocols that handle delay and jitter caused by network as well as allowing a client to pause or move to different positions in the stream during playback.

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