

# Multimedia Technical Briefs - Set Two

by

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# Table of Contents

## Chapters

- 1. Topic One: Compression 1**
  - Introduction 1
  - What is Compression? 1
  - Why is Compression Essential? 1
  - How is Compression Accomplished? 2
  - References 4
  
- 2. Topic Two: Multimedia Authoring Metaphors 5**
  - Introduction 5
  - Authoring Metaphors and Multimedia Tools 5
  - Summary 7
  - References 8
  
- 3. Topic Three: Quality of Service 9**
  - Introduction 9
  - QOS 9
  - Role of QOS in Distributed Multimedia 9
  - Summary 11
  - References 11

## Chapter 1

### Technical Briefs Set Two - Topic One:

#### Compression

Multimedia presentations consist of combinations of image, sound, and video files. The size of these data files may be substantial. Color bit-mapped images of a moderately sized graphic typically require a million bytes of data storage (Tannenbaum, 1998). Sound and video files are often larger. The storage and data transmission limitations imposed by available technology requires the use of data compression for the successful production and distribution of megabyte-sized multimedia presentations. In the following sections, this brief discusses what multimedia data compression is, why it is essential, and how it is accomplished.

#### **What is Compression?**

Data compression is the process of encoding data to use less storage space. Data is compressed by finding repeating patterns of binary 0s and 1s. The greater the number of patterns that can be identified, the more the data can be compressed. It is normal for text to compress to about 40 percent of its original size (Rabinowitz, 2000). Graphic files compress in the range of 20 to 90 percent. The amount that a file compresses depends on the type of file and the compression algorithm employed.

#### **Why is Compression Essential?**

The compression of multimedia files is essential for two reasons. The first is the excessive storage required for uncompressed files. For example, each image in a presentation typically requires at least one megabyte of storage space and the amount of

space available on a CD-ROM is only 650 megabytes. A presentation that includes multiple images along with sound and video easily exceeds a CD's capacity. The second reason that compression is essential is that current networks and storage devices are unable to present the information in real time without the use of data compression. They are just not fast enough.

### **How is Compression Accomplished?**

Data files are compressed in two ways (Tannenbaum, 1998). In the first method, the coding of the data is altered to a more efficient code. The nature of the information being encoded is not relevant in this method. One example would be when data inefficiently encoded with an 8-bit code is recoded using a 5-bit code and the overall file size drops. This is an example of a lossless compression. When text or financial data are compressed, lossless compression is employed. Accuracy of the information demands that the decompressed data be an exact copy of the original. The Lempel-Ziv-Welch (LZW) compression method is one of the major lossless compression technologies (Rabinowitz, 2000).

The second method of data compression is the application of a compression algorithm that is dependant on the nature of the information being compressed. This lossy compression is commonly employed when the information is in the form of images, audio, or video. Lossy compression algorithms are able to compress audio and video to five percent of their original size. As the name implies, some of the data is lost, however the loss is not perceptible by the human eye and ear. The Huffman coding method is one of the major lossy compression technologies. Examples of lossy compression algorithms in widespread use today are JPEG, MPEG, and MP3.

### *JPEG*

The JPEG (Joint Photographic Experts Group) standard is used to compress still images. It has become very popular due to its ability to compress with ratios up to 100:1 and greater. Ratios of 10:1 to 20:1 produce little noticeable loss. Compression is accomplished by dividing an image into small pixel blocks that are halved repeatedly until the desired compression ratio is achieved. JPEG file extensions are .JPG and .JFF.

### *MPEG*

The MPEG (Moving Pictures Experts Group) standard is used to compress video images (Chiariglione, 1999, June 15). It is a variation of JPEG and is lossy. MPEG-1 is used in CD-ROMs and Video CDs. It provides a resolution of 352 x 288 at 30 frames per second with 24-bit color and CD-quality sound. MPEG-2 is used with a variety of audio and video formats. These include legacy TV, HDTV, and five channel surround sound. It provides the 720 x 480 resolution used in DVD movies.

MPEG-4 is the next-generation of MPEG. Instead of encoding the data as a continuous stream, MPEG-4 deals with audio/video objects (AVOs) that are manipulated independently (Puri & Eleftheriadis, 1998, June). This allows for interaction with the coded data and provides more flexibility during editing.

### *MP3*

MP3 (MPEG Audio Layer 3) is a lossy compression technology that is part of the MPEG-1 and MPEG-2 specifications. MP3 is able to compress CD-quality sound by a factor of 12 and has made it possible to download high quality audio very quickly over the Internet.

## References

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## Chapter 2

### Technical Briefs Set Two - Topic Two:

#### Multimedia Authoring Metaphors

Washington Township, Michigan has commissioned the creation of a multimedia production to provide visitors with an imaginary travelogue of the community. As detailed by the city leaders, the travelogue will offer a virtual tour of points of historical interest along with an interactive method of obtaining a map and directions to a particular place within the township. Several authoring metaphors and multimedia authoring programs are available to accomplish this task. In the following sections, this brief describes the available authoring metaphors and multimedia authoring tools. In addition, a discussion of which is the most appropriate to the travelogue is included.

#### **Authoring Metaphors and Multimedia Tools**

The authoring metaphor used to create a multimedia production is the methodology by which the authoring tool accomplishes the task. Authoring metaphors available to create the Washington Township travelogue include card/page-based, time-based, icon/flow-based, frame-based, and object-based.

#### *Card/Page-based*

Card/page-based authoring metaphors and authoring systems organize elements as pages of a book or a stack of cards (Kenez, 1995). The method is best used when the multimedia content consists of elements that should be viewed individually. A card/paged-based authoring system links the pages or cards into organized sequences and is well suited for hypertext applications. Examples of authoring tools that employ this

metaphor are Apple - HyperCard, Allegiant - Supercard, Microsoft - FrontPage, and Asymetrix - Multimedia Toolbook.

The card/page-based authoring metaphor would be an effective means of presenting and organizing the "points of interest" section of the Washington Township travelogue. Hypertext pages with navigation buttons and linked descriptions would allow visitors to effectively select and view items of interest.

#### *Time-based*

Time-based authoring metaphors organize multimedia elements and events along a timeline (Kozel, 1997, July). In addition, time-based authoring tools use a score as the primary metaphor. Synchronous elements are shown in horizontal tracks with simultaneity indicated in vertical columns. This authoring metaphor is best suited for animation-intensive and synchronized multimedia applications. Examples of this type of authoring tool are Macromedia - Director 8 and Adobe - Premiere.

The time-based authoring metaphor and Director 8 would be appropriate to use for the introduction and conclusion of the Washington Township travelogue. A scripted, cast, and time-based animation intensive introduction is necessary to peak visitor interest in the rest of the presentation.

#### *Icon/flow-based*

The icon/flow-based authoring metaphor provides the multimedia developer with a visual programming technique for sequencing multimedia events (Lopuck, 1996). The icons used represent graphics, audio files, animations, and text. Icon-based authoring systems provide the fastest development method. They are best suited for rapid prototyping and rush projects. The icon palette is the core of the paradigm. Examples of

this class of authoring tool are Macromedia - Authorware, Aimtech - IconAuthor, and HSC - InterActive.

An icon/flow-based authoring metaphor and development tool such as Authorware would be an excellent choice to develop a prototype of the Washington Township travelogue. This prototype would be used to solicit approval for the overall look, feel, and direction of the finished presentation.

#### *Frame-based*

The Frame-based metaphor is similar to the icon/flow-based metaphor since it employs an icon palette. However the links between icons are conceptual and do not necessarily represent actual program flow. This metaphor is also a fast development system. Examples of the type of authoring tool include Allen - Quest and Apple - Media Tool.

#### *Object-based*

The object-based authoring metaphor is visually represented by embedded objects and iconic properties. These media objects are mini multimedia applications that can be tied together in various ways. Examples of authoring tools employing this metaphor are mTropolis and Kaleida - ScriptX.

### **Summary**

The most appropriate authoring metaphor to use during the prototype phase of the travelogue project is the icon/flow-based metaphor. Next, the time-based authoring metaphor is best suited for the introduction and conclusion of the finished presentation. Finally, the points of interest and interactive mapping sections would be most effectively authored using the card/page-based hypertext metaphor.

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## Chapter 3

### Technical Brief Set Two - Topic 3:

#### Quality of Service

Quality of Service (QoS) is the ability of a network element (e.g. multimedia application, host, or router) to have a level of assurance that its traffic and service requirements will be met (Vogel, Kerherve, Von Bochmann, & Gecsei, 1995). For example, ATM networks specify levels of service that ensure optimum performance for traffic such as real-time voice and video. QoS is a major issue on the Internet and in enterprise networks. This is because voice and video increasingly travel over IP-based data networks. In the following sections, this brief will describe QoS types and the role of QoS in distributed multimedia.

#### **QoS Types**

There are two types of QoS currently available: resource reservation and prioritization. Resource reservation QoS apportions network resources according to an application's QoS request and the network's bandwidth management policy. Prioritization QoS apportions network resources according to a set bandwidth management policy. This policy gives preferential treatment to applications identified as having more demanding transmission requirements.

These two QoS types are complementary and not competitive or mutually exclusive. They are designed to be used together to accommodate the operational requirements of different networks.

#### **Role of QoS in Distributed Multimedia**

QoS represents the quantitative and qualitative characteristics of a distributed multimedia system required to satisfy the functionality of an application. An application's functionality includes general user satisfaction and the presentation of multimedia data to the user. Different multimedia applications on the same distributed system often have different QoS parameters. In addition, it is difficult to separate the QoS parameters in a distributed multimedia system from other system parameters. However, QoS parameters differentiate themselves because they are subject to negotiation between system components.

There are five categories of distributed multimedia QoS parameters. Those parameters are:

- Performance-oriented: End-to-end delay and bit rate
- Format-oriented: Video resolution, frame rate, and storage format
- Synchronization-oriented: Skew between the beginning of sequences
- Cost-oriented: Connection and data transmission charges and fees
- User-oriented: Subjective image and sound quality

Depending on the type of multimedia application to be distributed, each of the above parameters is of greater or lesser significance. For example, end-to-end delay is less important for presentational applications than it is for conversational (i.e. interactive) ones.

Several related activities are involved in processing QoS parameters in a distributed multimedia system. These include:

1. Assessing QoS requirements in relation to users' satisfaction with the quality of the application

2. Mapping assessment results to QoS parameters
3. Negotiating between system components to ensure that all components are able to consistently meet requirements

When negotiation ends with agreement on requirements, the multimedia application can then be launched.

QoS processing is further complicated with the consideration of additional issues. For example, QoS requirements that change during a session or negotiated parameters that cannot be maintained due to network overload.

### **Summary**

QoS is the ability of a network element to have a level of assurance that its traffic and service requirements will be met. QoS parameters in a distributed multimedia system will vary over time. This is the result of changing system loads. Therefore, distributed multimedia systems must continuously monitor actual QoS levels and block lower priority tasks when it becomes necessary. In this context, maintaining QoS is a complicated control problem.

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