CMPSCI 754 Multimedia Systems **Spring 2001**

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1.1 Introduction to Multimedia Systems

This course will deal with the kinds of system support required for Multimedia applications such as real time audio/video streaming, interactive multi-player games etc.

Traditional systems are typically text-based.

However, multimedia systems access, process and communicate different kinds of information (text, audio, video) that have different formats, encoding methods, sizes etc.

Also, conventional operating systems are best-effort in nature, while multimedia systems provide soft real-time guarantees.

1.1.1 Technology Trends

Advances in technology have led to the availability of cheap multimedia workstations to end users. This has been possible due to tremendous improvements in CPU processing power and development of special-purpose compression techniques for different data types such as images, audio, video etc.

There have also been increase in capacities of storage devices (availability of large magnetic disks, large optical storage servers) and transmission bandwidth (100-200 Mbps, prototype gigabit networks, DSL, Cable etc).

Moore's Law
CPU speed doubles every 18 months.

It has been observed that network bandwidth (doubles every 6 months), storage capacity and disk bandwidth also obey a similar law.

1.1.2 Service Vision and Applications

Developments in multimedia systems technology have paved the way for the following services:

- *Residential Services:* such as video-on-demand, video conferencing, distance education, video advertisements and shopping (e.g., multimedia catalogs etc.)
- *Business Services:* such as corporate education, desktop multimedia conferencing and multimedia e-mail.
- *Education:* such as multimedia repositories of available classes, videos, books and access to such repositories over high speed networks.

- *Science and technology:* Multimedia systems are being used to support computational prototyping and scientific visualization. They also allow for efficient access to a large number of satellite images (e.g., NASA has a library of satellite images) for astronomy and environmental science studies.
- *Medicine:* Diagnosis and treatment - support queries that allows one to detect and locate tumors and study therapeutic response of patients to treatment.

1.1.3 Hierarchy of Distributed Applications

- *Class 1 - Information Retrieval:* Distance learning (allows for download/retrieve and play).
- *Class 2 - Information Retrieval and Processing:* Digital library of satellite imagery, subsurface modeling (allows for retrieval and processing of such data).
- *Class 3 - Interactive Systems:* Education and training for fire-fighters, command and control (involves real-time constraints).

1.1.4 Design Difficulties

Multimedia applications

- have real-time performance requirements.
- involve huge data sizes (see class slides for examples).

1.1.5 Snapshot of Research Horizons

- Compression techniques: Data is typically stored in compressed formats to alleviate the manageability of data (100's of GBs of data may be stored in 10's of GBs of disk space).
- Storage models and structures: for organization of multimedia data.
- Digital audio and video networking and communication architectures: for efficient transmission of multimedia data over networks.
- Media Synchronization: for synchronizing multiple feeds (e.g., audio lip-synchronized with video).
- Methodologies, tools and software architectures for multimedia collaborative applications: e.g., adobe photoshop, video conferencing etc.
- Multimedia document architectures: logical grouping of related data.
- Multimedia database management, content-based retrieval techniques: Techniques required for retrieval are different than those used in relational/object-oriented database management systems. e.g., retrieving all images with roses.