CMPSCI 754: Multimedia Systems

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Overview of Technology, Trends, and Problems

What Are Multimedia Systems?

- Traditional systems - primarily text-based
- Multimedia systems: users access, process, and communicate more than one type of information (e.g., text, images, audio, video, ...)
- Differences in the characteristics (e.g., format, encoding, size, performance requirements, ...) of data types $\Rightarrow$ Need to extend traditional information management techniques in several new dimensions

Technology Trends

- Multimedia workstations with audio and video processing capability
  - Tremendous improvements in CPU processing power
  - Special purpose compression engines for video and audio
- High capacity, high performance storage devices
  - Availability of magnetic disks with several gigabyte capacity, tremendous increase in data transfer rate due to disk array technology
  - Technology for large optical storage servers evolving rapidly
- High speed fiber optic networks and fast packet switching technology
  - Networks with 100-200 Mbit/s already in place, prototype gigabit networks also being deployed
  - Broadband to the home (DSL, cable modem)

Service Vision and Applications

- Residential services:
  - Switched access television, video-on-demand
  - Video phone/conferencing systems
  - Video advertisement and shopping (e.g., multimedia catalogue classified by category, product demonstrations, real estate sales, ...)
  - Self-paced education
- Business services:
  - Corporate education
  - Desktop multimedia conferencing and multimedia e-mail

Service Visions and Applications - Continued

- Education:
  - Multimedia repository of available classes, videos, books, ...
  - Access to digital multimedia library over high speed networks
- Science and technology:
  - Computational prototyping and scientific visualization
  - Astronomy and environmental science studies: efficient access to large number of satellite images
- Medicine:
  - Diagnosis and treatment - support queries like where was the tumor found (i.e., detection and location), what happened to the tumor and assessment of therapeutic response (i.e., temporal analysis), etc.

Hierarchy of Distributed Applications

- Class 1: Information retrieval
  - Distance learning
- Class 2: Information retrieval and processing
  - Digital library of satellite imagery, subsurface modeling
- Class 3: Interactive systems
  - Education and training for fire fighters, command and control

Design Difficulties

- Real-time performance requirements
- Large sizes of information objects

Speech	8000 samples/s	8 KBytes/s
CD Audio	44,100 samples/sec, 2 bytes/sample	176 KBytes/s
Satellite imagery	180x180 km^2, 30 m^2 resolution	600 MB/image (60 MB if compressed)
NTSC video	30 frames/s, 640x480 pixels, 3 bytes/pixel	30 MBytes/s (2-8 Mbits/s if compressed)

Snapshot of Research Horizons

- Compression techniques
- Storage models and structures
- Digital audio and video networking and communication architectures
- Media synchronization
- Methodologies, tools, and software architectures for multimedia collaborative applications
- Multimedia document architectures
- Multimedia database management, content-based retrieval techniques

Course Outline

- Video compression techniques
  - basic concepts, JPEG, MPEG, MPEG-2, MPEG-4
- Multimedia File systems
  - Techniques for video server design: server architecture, placement techniques, fault tolerance, disk scheduling and admission control, buffer space management and caching
  - Integrated multimedia file system design issues
- Multimedia Operating Systems
  - I/O subsystem design
  - Processor scheduling
  - OS structure/architecture
- Multimedia Networks
  - Protocols for video transport
  - Issues in designing integrated services networks
- Multimedia Databases

Course Requirements

- Project (40%)
- Two Exams (40%)
- Two Homeworks (10%)
- Class participation (10%)
  - Scribe duties
  - Class interactions

General Information

- Schedule number: 283566 , Time: TuTh 1:00 - 2:15, CS 140
- Course web page: http://www.cs.umass.edu/~shenoy/courses/spring01
- Office hours: Thursday 2:15 - 3:30, CS 140 or by appointment
- Laboratory facilities: LGRT 222
  - 5 Pentium-II workstations running Linux
  - 1 DEC Alpha Server
- Edlab machines are also available
- Teaching Assistant: TBA