Video On Demand Technologies and Demonstrations

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Topics

- **Project review: presentation by Marek Podgorny**
  - Detailed status report
  - Technology update for VOD architectures: Integrated Network Services, RSVP, RTP
- **Adaptive motion compensation algorithms: presentation by Miguel del Rosario**
- **Design of a continuous media file system for adaptive video servers: presentation by Avneesh Pant**
- **Demonstrations: server monitoring, SGI video client, H.263-based client-server**

Tasks 1 - 3: Extension of project scope to low bit rate codecs and new network architectures

- **Rapid technology changes call for the project scope readjustment**
  - We will wrap up the current implementation work for the MPEG1-based system.
  - Upon project completion we intend to deliver a functional software suite supporting high quality video on demand over NYNET from NPAC to RL, including database, server monitoring, and multiple platform support for both server and client side.
  - However, the technology trends call for project scope adjustment to include the new elements:
    - ***RTP and multicast***
    - ***low bit rate codecs***
    - ***RSVP/Integrated Network Services***
    - ***application adaptivity***

Task 1: Hardware and Software Requirements for VOD Server - Progress to Date (1)

- **Select a set of capture and digitization solutions**
  - Reported as "completed" during the last review meeting. However, new external developments and a fast pace in the implementation of other system components prompted us to include support for the low bit rate video and Indeo standard.
  - Started design work for the H.263 encoding setup
    - **OpenDVE used for handling video hardware**
    - **Encoder based on the Telenor H.263 implementation**
    - **Status: 0%, but all prerequisites in place**
  - Completed AVI encoding setup
    - **Hardware encoding board, VCR control setup**
    - **Status: Completed**

Task 1: Hardware and Software Requirements for VOD Server - Progress to Date (2)

- **Compression: multiple compression methods should be supported**
  - Reported as completed; revisited for low bit rate coders. The reason: new RTP-based architecture.
  - H.263 codec now supported by the video server
  - The server has ability to concurrently serve MPEG1 and H.263 streams
  - Corresponding audio delivery synchronization implementation in progress. The system will use RTP for low bit rate streams
  - Status: 60%
  - AVI support
    - **Will be implemented before the next quarterly meeting**
    - **Does not require RTP**

Task 1: Hardware and Software Requirements for VOD Server - Progress to Date (3)

- **Storage issues**
  - We have decided to implement the notion of "adaptivity" in the video server architecture:
    - **The goal: integration of the video server architectures ("prerecorded contents") with the collaboratory environments**
    - **Video server treated as a video database backend for the collaboratory**
    - **"Adaptivity" will support viewers with varying available bandwidth capabilities without having to store multiple copies of the video contents with different encoding.**
    - **"Adaptivity" will be supported end-to-end, i.e. not only from the NIC on but also for the storage access**
  - Started design of the corresponding file system
    - **The design will be discussed in a separate presentation**
  - This is a basic research issue, but we will deliver a working implementation.

Task 2: Hardware and Software Requirements for Video Network Service - Progress to Date

- **Networking protocols versus VOD applications**
  - Our earlier plans to develop a dedicated video protocol has been pre-empted by the recent developments sponsored by the IETF: the RTP protocol offers an "umbrella" solution for synchronous delivery of multiple media streams.
  - New implementation of the video server:
    - **scalable solution: limited number of threads for unlimited number of media streams**
    - **optional support for RTP**
      - ***audio/video sent using independent streams, synchronization on the client side***
      - ***support for multicast***
      - ***support for multiple video codecs and video stream formats***
      - ***implemented via "session bus" a la vic/vat***

Task 2: Hardware and Software Requirements for Video Network Service - Progress to Date(2)

- **Networking protocols versus VOD applications**
  - Current focus: RTP provides an application level framework for implementing synchronous media delivery. Within RTP/RSVP framework one can design adaptive media streams
  - Challenge: design a structure of media stream that is:
    - **robust (fault tolerant)**
    - **adapts to available bandwidth**
    - **supports quality of service setup (RSVP-aware)**
  - Status: 10%
  - Prospect: no robust implementation expected before current contract expiration

Task 2: Hardware and Software Requirements for Video Network Service - Progress to Date(3)

- **Distribution network**
  - a missing element: LAN Emulation
    - **Problem: current routing scheme on NYNET works but imposes performance limitations**
    - **LANE installed on the NT server but not tested**
    - **An attempt to upgrade the ATM infrastructure**
  - Hardware and software upgrade on the LAX-20 access switches
    - **Fruitless effort so far. In spite of the vendor assurances no combination of HW/SW supports LANE**
    - **Even worse, the new software versions cease supporting basic routing and bridging functionality**
    - **A real danger of losing the investment made in the Living Schoolbook ATM infrastructure**

Task 3: Parallel, Distributed, and Heterogenous Architectures for VOD Apps: Progress to Date

- **In addition to the current distributed, multiserver architecture we started designing a truly distributed video server**
  - the design of the continuous video file system allows striping over disks subsystems across multiple machines
  - as video pump must be local to the disk, this implies a distributed, collective server
    - **note the difference with respect to nCUBE Media Server**
    - **this is radically new architecture with presumably high scalability but based on off the shelve components**
    - **main challenge: tight time synchronization - we study and plan to use the Network Time Protocol (NTP)**
- **Status: 0% implementation, significant conceptual work**

Task 3: Parallel, Distributed, and Heterogenous Architectures for VOD Apps: Progress to Date

- **Video client implementation work**
  - Continued work on the SGI client. The DML-based client completed although not deemed satisfactory.
    - **no hope for improvement without radically new version of DML which is not forthcoming**
    - **current attempt at high-performance MPEG1 software based decoder: NVR software**
      - ***NVR suggested that the MPEG1 decoder source is made available to NPAC in return for NPAC implementing the GUI and porting the code to Windows NT.***
  - PC client: effort suspended, will be resumed by end of April
    - **OpenDVE/H.263 client**
    - **Indeo software client**
    - **MPEG1 software client assuming deal with NVR goes through**

Task 4: User Interface

- **End user interfaces**
  - the only work in this period was related to the SGI client GUI
  - trained two new students to resume the work on the final GUI and database design
- **Administrator server interface**
  - design work of the server monitor interface well advanced

Task 5: Demonstration Upgrade

- **Few new elements are demonstrable and will be show later today**
  - new SGI video client
  - new version of the multi-codec scalable server for Windows NT
  - H.263 software client
- **An entirely revamped set of demonstrations expected by end of May for the "Dual Use" conference in Syracuse**
- **Parallel work on the speech recognition as an alternative indexing methodology**

Task 6: Prototype Testbed Implementation and Evaluation - Progress to Date

- **No effort during the reporting period on the part of VoD team.**
  - technical difficulty: lack of the efficient MPEG1 software video client. HW based decoder too expensive for educational use. To remedy, we will provide AVI support by mid-May. Low bit rate codecs should be available at the same time.
- **Technology use in the CNN and Reuters projects - no recent progress although no technological obstacles exist.**
- **Prospect: unclear. No human resources available in VoD team, prospective partners still in bureaucratic maze.**

Status of the Main Tasks

Task #	%completed	Continuation work
Task 1	90%	1. Continue integrating high and low bit rate codecs in the server. 2. Continue CFS work. 3. Implement H.263 encoding station.
Task 2	90%	1. Low bit rate stream structure. 2. LANE. 3. Support for RTP on both server and client side for low bit rate codecs
Task 3	80%	1. Continue scalable server implementation. 2. Continue distributed server design and trial impleementaation. 3. Video clients supporting AVI and H.263.
Task 4	70%	1. Redisign of the video database usert interface. 2. Design state-of-the-art News-on-Demand interface
Task 5	80%	1. Ongoing effort with amajor milestone in early June
Task 6	50%	1. Organize logistic of the technology transfer!

Technology Review: Integrated Network Services/RSVP/RTP

- **The remainder of the presentation will deal with the emerging model for the network multimedia delivery**
- **The following issues will be briefly discussed:**
  - Integrated services model
  - Reservation Protocol and its impactions
  - Real-Time Transport Protocol
  - OpenDVE/Live Media