

Media Requirements in Telemedicine

Application	Media Requirements	Remote Control
Teleradiology	Large Images	None
Telepathology	Still Images	Microscope, camera
Teledermatology	High-quality video or Still Images	Camera
Telecardiology	High-quality video	None
Tele-endoscopy	High-quality video	None
Telepsychiatry	Teleconferencing video	Camera

Networking Requirements of Multimedia Streams

Multimedia Streams	Description	Real-time	Range of bitrates
System	Session connection/disconnection mouse/pointer control synchronization	No	Negligible
Audio conferencing	Full Duplex, G.72x audio	Yes	10 - 128 kb/s
Diagnostic audio	One-way, CD-quality, stereo audio	Yes	32 - 768 kb/s
Video conferencing	Two-way, H.261 video	Yes	64 kb/s - 1.92 Mb/s
Diagnostic video	One-way, MPEG-2 video	Yes	3 - 15 Mb/s
Image transfer	Image transmission for consultation	No	7 Mb/s

Multimedia Networking in Medicine

- The KANS-A-N network for Telemedicine:
 - Kansas State wide network
 - Connects various divisions of Kansas University Medical Center (Departments of Oncology, Neurology, and Pediatric Cardiology) for outreach medical services throughout the state
 - Uses two-way interactive video systems
- The Georgia Interactive Network for Medical Information (GaIN):
 - To provide on-line delivery of medical information and educational services to rural areas that are underserved and has a shortage of primary care physicians.
- The West Virginia CONSULT network:
 - To provide access to biomedical information to rural areas and hospitals with inadequate local resources, and to health professionals with limited computer literacy.

Multimedia Networking in Medicine

- HEALTHCOM of New York State Department of Health:
 - Connects all of the 272 New York State hospitals, 635 nursing homes, and 59 county health clinics.
 - Services: Data collection for epidemiological, and regulatory studies, hospital reimbursement program, and training programs for counties.
- The Wisconsin Health Information Network (WHIN):
 - Connects eleven hospitals and a large number of physicians to provide medical information.
- United States Military Telemedicine Project:
 - To support a 40 bed inpatient facility in Croatia to support United Nations medical operations

Digital Libraries

<i>The Second</i>	<i>Inter- national</i>	D	I	G
I	T	A	L	<i>Conference on the</i>
<i>Theory & Practice</i>	L	I	B	<i>of Digital Libraries</i>
R	A	R	<i>Austin Texas</i>	I
E	S	<i>June 11-13 1995</i>	9	5

- Paper available online at <http://www.csdl.tamu.edu/DL95>
- For R & D information see <http://www.dlib.org/dlib.html>

Digital Libraries Initiative

- Carnegie Mellon University - Informedia Project
- Stanford University Digital Libraries Project
- UC Berkeley Environmental Library Project
- UC Santa Barbara - Alexandria
- University of Illinois at Urbana-Champaign - Digital Library Initiative Project
- University of Michigan Digital Library Project (UMDL)
- Many more

Informedia Project

- **On-line multimedia digital library**
 - contain over a thousand hours of digital video, and audio, images, text and other related materials.
- **Automatic population mechanisms**
 - automatically encoding, segmenting and indexing data.
 - Image understanding techniques are employed for segmenting, or video paragraphing, video sequences by automatically locating boundaries for shots, scenes, and conversations.
- **Knowledge-based Search**
 - Conceptual queries.
- **Speech Queries Interface**

<http://www.informedia.cs.cmu.edu>

Informedia: User Perspective

Speech query

“I’ve got to put something together on culture and satellites. What are they?”

The screenshot displays the Informedia web interface. At the top, a search bar contains the text "Do you have information about cultural changes and communications satellites?". Below the search bar, a list of search results is shown, each with a small thumbnail image and a text label:

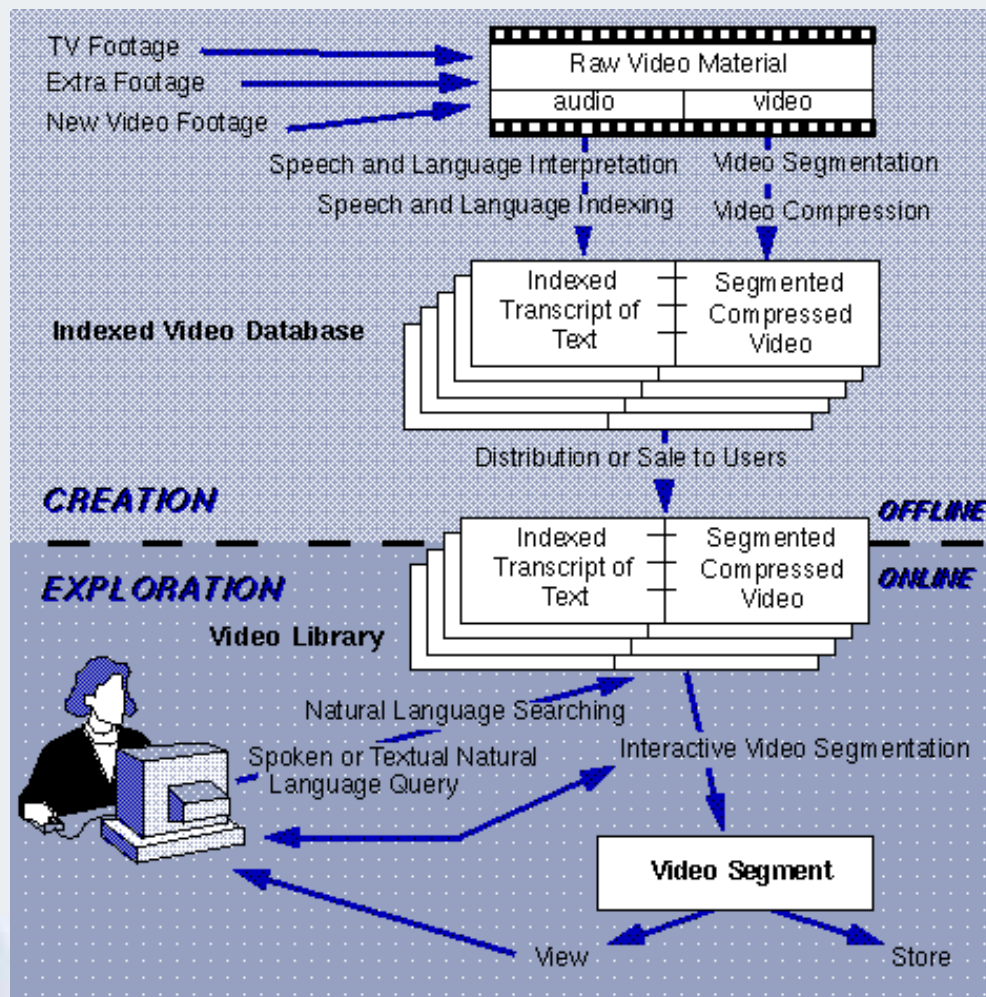
- Global communications (with a globe and satellite dish icon)
- Inventor of Communication Satellites, Arthur C. Clark (with a portrait of Arthur C. Clark)
- Satellite dishes in the third world (with a satellite dish icon)
- The Westar satellite (with a satellite icon)

A video player window is open, showing a close-up of Arthur C. Clark speaking. The video player has a progress bar and a timestamp of "TCR 01:07:28.09". The Informedia logo and "© CMU, 1999" are visible in the top right corner of the interface.

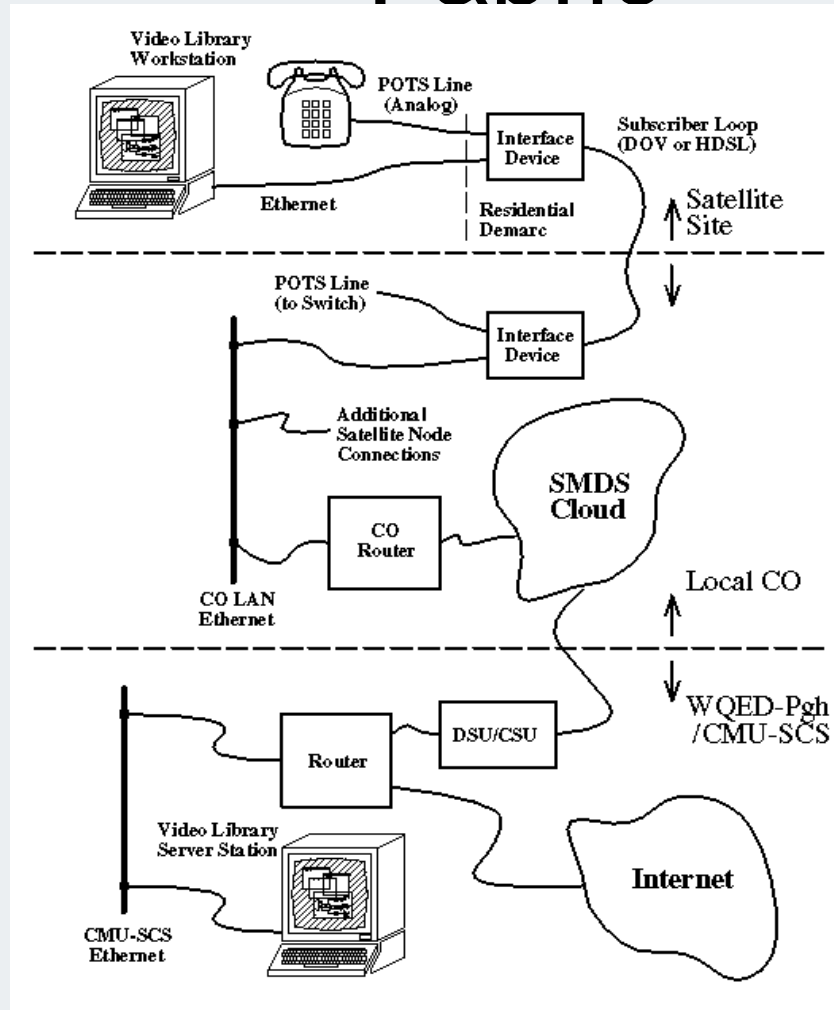
Research Areas defined in the Informedia Project

- Speech recognition
- Image processing
- Natural language processing
- Human computer interaction
- Network accounting of copyright usage

Informedia Digital Video Library System Overview



Informedia Communication Fabric



Stanford Digital Libraries Project

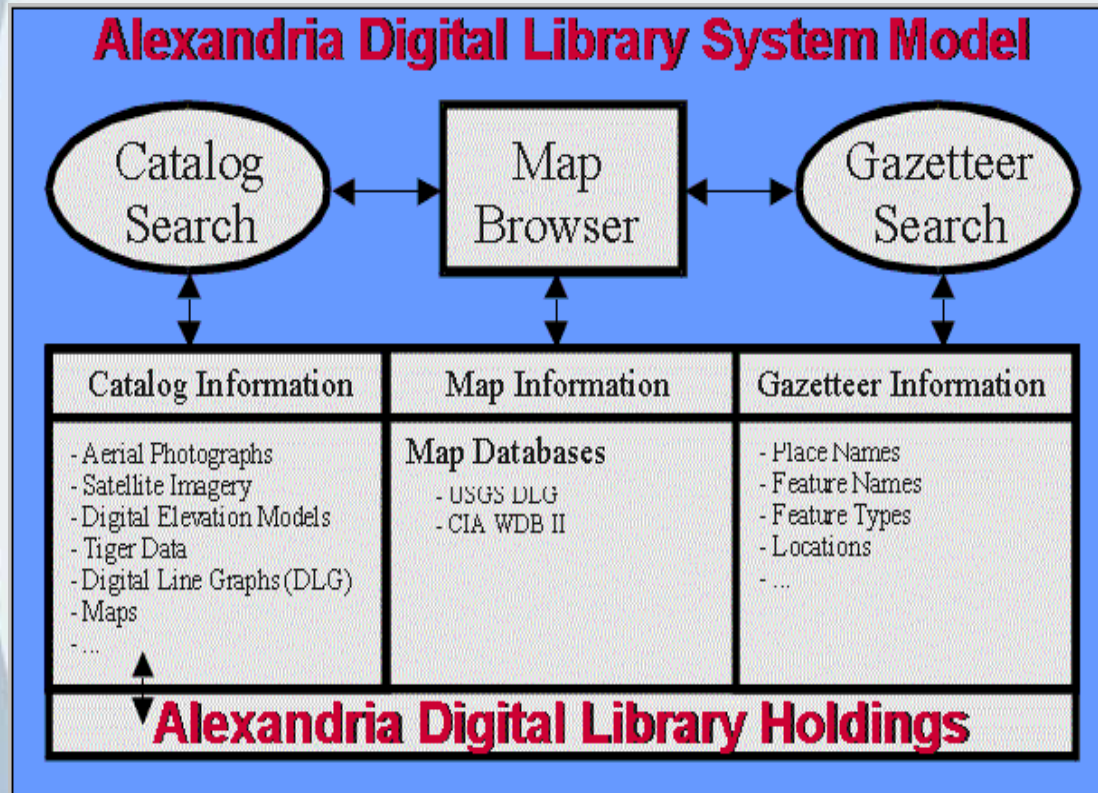
- \$24 million Digital Library Initiative, started in 1994
- Projects
 - information finding
 - user interfaces
 - legal and economic issues
 - the testbed or agents
- <http://www-diglib.stanford.edu/diglib>

UC Berkeley Digital Library Project

- Document collection
- The “multivalent document” model
- titlebars access
- full-text searching
- <http://elib.cs.berkeley.edu>

The Alexandria Project

Distributed digital library for geographically-referenced information

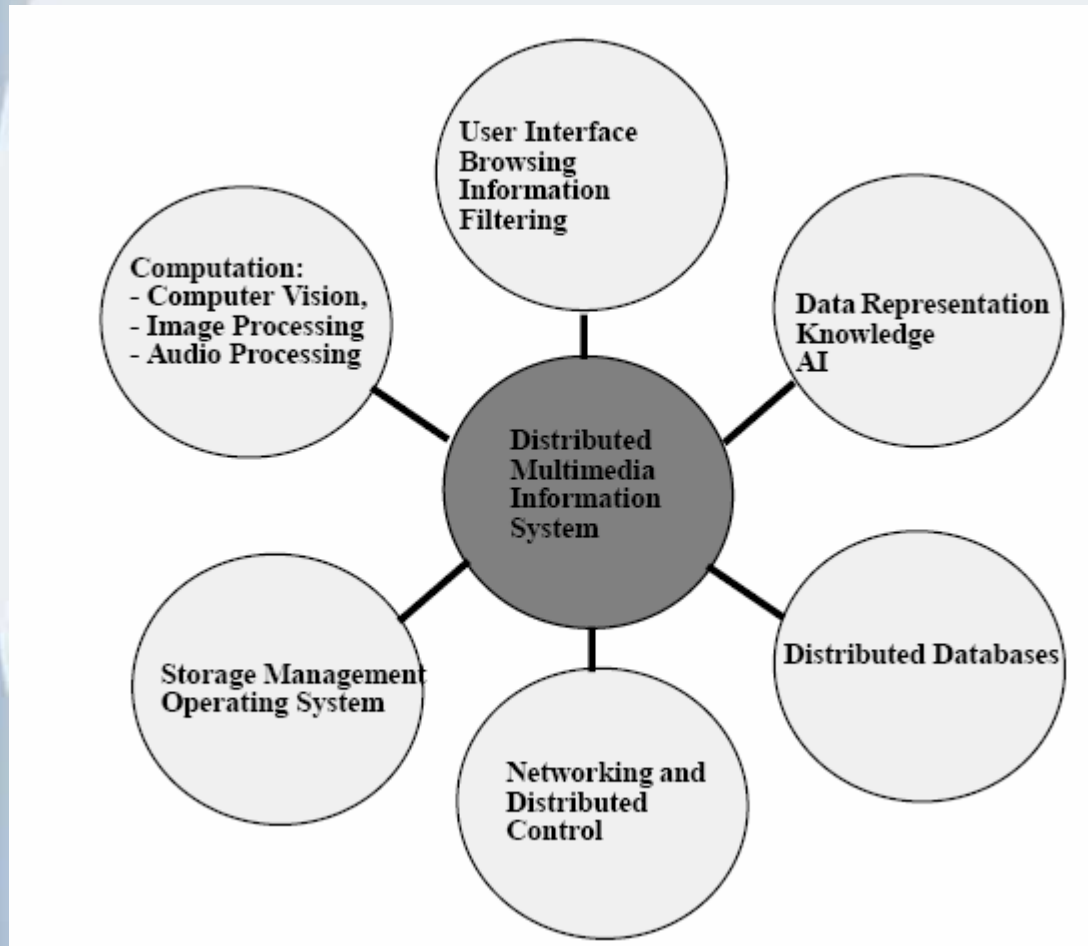


<http://alexandria.sdc.ucsb.edu>

UIUC Digital Library Initiative Project Goals

- Semantic Federation (research)
of
- Distributed Repositories (internet)
of
- Scientific Literature (testbed)
- evaluate large testbed
- perform technology research
- <http://www.grainger.uiuc.edu/dli>

Interdisciplinary Technologies



Requirement Specifications for a Multimedia DBMS

Why do we need a multimedia DBMS?

- Dealing with more than text
- Archival data
- Searching, sharing
- Multiple presentations
- Data exchange

Differences Between Conventional and Multimedia Data

Conventional Data	Multimedia Data
Types known to programming languages (character, integer, real)	Not generally known
Relatively small size	Large size (memory & bandwidth)
Fixed size atomic units	Variable size atomic units
Not highly interactive	Highly interactive
No special spatio/temporal requirements	Spatio-temporal synchronization requirements exist
No special interface is needed for querying and presentation	Special interfaces are needed for querying and play-out
Frequent updating	Mostly archival

Characteristics of Multimedia Data

- Text and formatted data (static data)
- Audio and music data (transient data)
- Images and pictures data (static data)
- Full-motion video data (transient data)

Requirement Specifications for Multimedia DBMS

- Semantic modeling of multimedia information
 - Identification of contents, objects, features, events, etc.
 - Formal specification of contents, objects, features, events, etc.
 - Grouping and linking of information based on semantics, association or referencing
- Indexing and Data Representation
 - Feature-based representation and indexing
 - Segmentation and partitioning, eg., B-trees, Quad-trees, Video scenes and shots, VSDG model, etc.
 - Management of indices for events, contents, features etc.

Requirement Specifications for Multimedia DBMS

- Media Synchronization
 - Spatio-temporal synchronization models
 - Logical structuring
- Schema Management (semantics, synchronization, representations)
 - Relational vs. object-oriented models
 - Quality management information
 - Heterogeneity of schema
 - Data exchange capabilities
 - Mono-media processing requirements
 - Inter-operatability of shemas for mono-media and composed multimedia data.

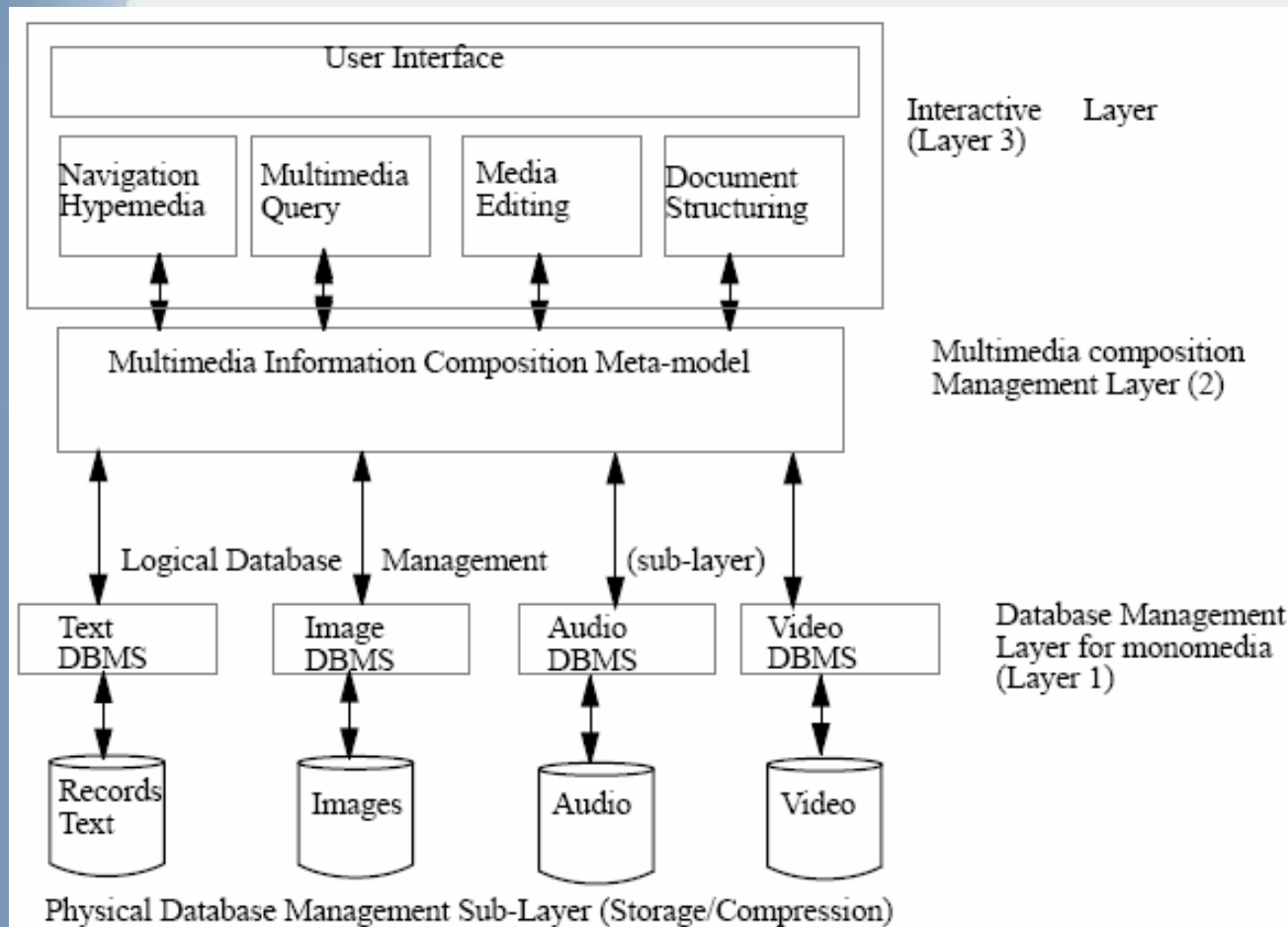
Requirement Specifications for Multimedia DBMS

- Multimedia querying
 - Modes of querying (formal language, By-examples, natural language)
 - Query processing facility and retrieval algorithms. Real-time considerations.
- User Interface
 - Browsing and navigation tools
 - Interactive functionality
 - Presentation layouts
 - Media editing facilities

Requirement Specifications for Multimedia DBMS

- Storage management
 - Data placement strategies
 - Data loading and input facilities
 - Compression/Decompression techniques
 - Scalability

Software Architecture for a Multimedia DBMS



Indexing of Multimedia Data (Layer 1)

- Approaches:
 - Automated vs. Manual
- Consideration:
 - Cost vs. Complexity and Robustness
- Driving force:
 - The volume of data requiring inspection and indexing can be very large.
- Content Representation and Image/Video Database

Image Databases

- Indexing Content-based features
- Querying the exact vs Similar matches

Images Databases

- Requirements:
 - Image Processing Capability
 - Image understanding Capability (knowledge-based)
- Image Representation
 - Local Features:
 - Pixels
 - Edges
 - Shape
 - Texture
 - Colors
 - Global Features:
 - Histograms
 - FFT
 - Hough Transform
 - Eigenvalues

Different features are useful for different types of queries.