

The Video Development Initiative

MPEG-4 Working Group

Request for Information on MPEG-4
Technology Development

Solicitation of Interest in Cooperative
MPEG-4 Application Development

January 8, 2001

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Section 1: Executive Summary

The goals of this combined *Request for Information on MPEG-4 Technology Development and Solicitation of Interest in Cooperative MPEG-4 Application Development* are:

1. To identify industry partners interested in collaborative MPEG-4 application development, and pursuit of joint funding;
2. To ascertain the state-of-the-art of MPEG-4 technology development;
3. To establish a base for and promote the adoption of MPEG-4 technologies in higher education;
4. To promote awareness of MPEG-4 beyond the academic community.

The Video Development Initiative MPEG-4 Working Group is a subcommittee of The Video Development Initiative (ViDe), an international, multi-institutional effort founded in 1998 to promote the deployment of digital video in higher education (Appendix A: *The Video Development Initiative*). ViDe has gained recognition within the Internet2 and the higher educational IT community for its success in advancing the deployment of emerging digital video technologies, both video-on-demand and video conferencing technologies. The ViDe MPEG-4 Working Group is comprised of affiliates from The Georgia Institute of Technology, Indiana University, The University of Tennessee, and the Australian National University. This group represents and extends the outcomes of its activities to the entire ViDe membership, to ViDe collaborators and partners, and to the Internet2 Digital Video Initiative, of which ViDe is a founding member.

The ViDe MPEG-4 Working Group believes MPEG-4 has the potential to greatly enhance online learning, collaboration and resource sharing. While MPEG-4 technology and application development is in its infancy, we are seeking opportunities to engage industry in partnerships that will result in the creation of model MPEG-4 applications. Early MPEG-4 deployments in the higher educational domain, especially when realized through private sector participation, will facilitate technology transfer and replication beyond that domain, and thus will accelerate the widespread adoption of the standard.

MPEG-4 applications in the e-learning, e-medicine and telemedicine, and virtual reality domains are of particular, but not exclusive, interest to this working group. Our specific interest is in the potential of MPEG-4 to enhance data mining and content management, rights and access management, annotation, metadata, audiovisual object interaction and manipulation, audiovisual objects in 3-D virtual reality environments, and scalable multimedia delivery, both realtime and on-demand. We are also interested in exploiting the capabilities of MPEG-4 to improve accessibility for end-users with disabilities. Our application and development interests are outlined in detail in section four of this document.

The ViDe MPEG-4 Working Group brings to this endeavor our collective experience, expertise, and resources. Working group members have backgrounds and expertise in a variety of fields, including electrical engineering, information sciences, advanced

networking, digital multimedia, Internet2 application development, and H.323 Videoconferencing over IP (Appendix B: The *ViDe MPEG-4 Working Group*). Serving the academic and research activities at our respective institutions, we have access to an environment fertile in application opportunities, and to granting agencies that support both innovative IT development and applications of IT that advance science and engineering and the higher educational research agenda in the U.S.

The intent of this combined RFI and Solicitation of Interest (SoI) is to explore the state of MPEG-4 product development, and solicit interest in cooperative MPEG-4 application development from the development community. This RFI/SoI is not being released as an expression of intent to purchase or establish cooperative purchasing agreements. Respondents may choose to respond only to the RFI, if cooperative application development is not of interest.

After reviewing the responses to the RFI, the ViDe MPEG-4 WG will develop:

- A directory of MPEG-4 players, technologies and developments;
- An overview of the state-of-the-art of MPEG-4 development.

Both the directory and overview will be published online in May '01, and will be publicized in the Internet2 and international advanced research networking communities, and in the U.S. and Australian higher educational communities, and beyond.

Since its inception in 1998, ViDe has demonstrated successes in developing authoritative and widely read sources on emerging digital video technologies. The ViDe *Video Conferencing Cookbook* (<http://www.vide.gatech.edu/cookbook2.0/>), now in its second edition, has gained international recognition as an effective educational tool, and for the promotion of the H.323 standard for videoconferencing. The ViDe white paper on digital video, *Digital Video for the Next Millenium* (<http://sunsite.utk.edu/video/index.html>) is similarly viewed as an authoritative source on its topic, and has an international readership. ViDe affiliates have presented on these publications at national and international conferences, including Net'99, the EDUCAUSE Annual Conference, Internet2, Telecon West, the Southeastern Universities Research Association Digital Video annual workshops, and the Coalition for Networked Information.

Responses submitted to the ViDe *RFI concerning Video Conferencing over IP and/or Video-on-Demand Server Technologies*, which was released to the vendor community in September 1998, were included in both the *Video Conferencing Cookbook* and the white paper on video-on-demand. Respondents to the first ViDe RFI subsequently developed collaborations and partnerships with ViDe member institutions, and leveraged such partnerships to develop relationships with other institutions in the Southeast and nationally.

In addition to the online publications, the ViDe MPEG-4 WG will establish an MPEG-4 discussion list to disseminate information on MPEG-4 and promote the adoption of the standard within the higher educational community. After reviewing responses to the Solicitation of Interest, we will proceed with selection of partners to jointly pursue funding opportunities.

Respondents to both the RFI and SoI will be invited to attend the annual ViDe Digital Video workshop, sponsored by the Southeastern Universities Research Association

(SURA), a consortium of 53 universities and colleges in 15 southern states and the District of Columbia. This workshop typically has a large attendance of IT and networking representatives from both the SURA region and beyond, and will be held on March 20 and 21, in Atlanta.

Section 2: Instructions for Respondents

2.1 Schedule

The schedule for the RFI/SoI process is as follows:

January 8, '01	Release of RFI/SoI.
February 5, '01	Responses to RFI and SoI due.
February 12/13 '01	ViDe MPEG-4 WG meet to review responses.
March 20,21 '01	Selected industry participants invited to annual ViDe workshop in Atlanta for more discussion, and also for product demonstration or participation in workshop session.
March – May '01	RFI deliverables developed from RFI responses.
March 21 '01	Selection of industry partners to collaborate on development and pursuit of funding opportunities.

2.2. Responding to the RFI/SoI

All respondents should complete the RFI portion of this RFI/SoI. Respondents seeking to explore research and development activities, and pursuit of cooperative funding in conjunction with the ViDe MPEG-4 Working Group should also complete the SoI.

Responses to both the RFI and SoI should be emailed as attachments to mpeg4-rfi@vide.net on or before February 5, 2001. If the respondent wishes to also submit collateral material, mailing addresses for the ViDe MPEG-4 WG affiliates are included in the biographies in Appendix B of this document.

Any requests for clarification or questions may also be emailed to the mpeg4-rfi@vide.net address.

2.3 Trade Secrets

It is understood that a Responding Vendor may be sharing products and services under development that the Responding Vendor may consider to be a trade secret. Any such information must be clearly labeled "TRADE SECRET." The ViDe MPEG-4 WG will maintain the confidentiality of such trade secrets to the extent provided by law.

If the Responding Vendor wishes to provide a Non-Disclosure Agreement, for signature by a representative or by each member of the ViDe MPEG-4 WG, the vendor should provide a copy of this agreement as soon as possible.

The ViDe MPEG-4 WG will make every effort, as a group and individually as members, to sign and abide by the provisions of any Non-Disclosure Agreements that reflect established industry practices. The ViDe MPEG-4 WG reserves the right to reject or re-negotiate terms for Non-Disclosure Agreements that, in our judgment, do not reflect established industry practices.

Section 3: Request for Information

Please address each of the questions below regarding your product and MPEG4 functionalities and profiles. Use a separate form for each product.

For each question please address:

- Whether the feature is available in currently released product or is in development;
- If the product is in development, what phase? i.e. design, alpha, beta or early release;
- If the product is in development, what is the expected release date?
- Additional information as appropriate.

This questionnaire is largely structured on the ISO MPEG-4 Overview document, v.16 – La Baule version. Clarification on terminology in this questionnaire can be gained by referring to the MPEG4-Overview document at <http://www.cselt.it/mpeg/standards/mpeg-4/mpeg-4.htm>.

1. Product name:
2. Technical contact phone and email address:
3. Sales contact phone and email address:

4. MPEG 4 Version 1 Functionalities

4.1. System

- 4.1.1. DMIF
- 4.1.2. FlexMux
- 4.1.3. BIFS (please elaborate on capabilities supported)
- 4.1.4. Elementary Streams and Object Descriptors
- 4.1.5. Interactivity, including
 - 4.1.5.1. Client and server-based interaction
 - 4.1.5.2. Event model for triggering events or routing user actions
 - 4.1.5.3. Event handling and routing between scene objects based on user or triggered actions
- 4.1.6. MP4 file format support
- 4.1.7. MPEG-J
- 4.1.8. Transport layer independence
- 4.1.9. Text display with international language support
- 4.1.10. Text display with font controls
- 4.1.11. Text display with timing and synchronization
- 4.1.12. Intellectual Property Management and Protection
- 4.1.13. Other relevant functionality

4.2. Audio

- 4.2.1. Codecs supported - list
- 4.2.2. Low bit rate speech coding
- 4.2.3. Variable Bit Rate (VBR) speech coding
- 4.2.4. Range of general audio bitrates - list

- 4.2.5. Support for mono to many channels
- 4.2.6. Synthesized audio - Structured Audio Decoder
- 4.2.7. Bounded-complexity Synthetic Audio (wavetable support)
- 4.2.8. Audio speed change
- 4.2.9. Audio pitch change
- 4.2.10. Bitrate scalability
- 4.2.11. Bandwidth scalability
- 4.2.12. Encoder complexity scalability
- 4.2.13. Decoder complexity scalability
- 4.2.14. Audio effects (i.e. mixing, reverb, spatialization etc)
- 4.2.15. Other relevant functionality

4.3. Audio-Speech synthesis

- 4.3.1. Text to speech coders
- 4.3.2. Speech synthesis using the prosody of the original speech
- 4.3.3. Lip synchronization with phoneme information
- 4.3.4. Pause, resume, jump control
- 4.3.5. Language and dialect support
- 4.3.6. International symbol support for phonemes
- 4.3.7. Specifying age, gender, speech rate
- 4.3.8. Facial animation parameter bookmarks
- 4.3.9. Other relevant functionality

4.4. Visual

- 4.4.1. Codecs supported - list
- 4.4.2. Bitrates - list
- 4.4.3. Progressive format video
- 4.4.4. Interlaced video
- 4.4.5. Video resolutions - list
- 4.4.6. Compression ratios - list
- 4.4.7. Can compression be applied to textures?
- 4.4.8. Random access of video; functions including pause, fast forward and fast reverse
- 4.4.9. Content based coding of images and video - decoding and reconstruction of arbitrary shaped objects
- 4.4.10. Random access of content in video sequences; functions including pause, fast forward and fast reverse of stored video objects
- 4.4.11. Extended manipulation of content in video sequences - warping, mapping, overlaying, etc
- 4.4.12. Complexity scalability in the encoder
- 4.4.13. Complexity scalability in the decoder
- 4.4.14. Spatial Scalability
- 4.4.15. Temporal Scalability
- 4.4.16. Quality scalability
- 4.4.17. Shape Coding
- 4.4.18. Gray Scale or alpha shape coding
- 4.4.19. Error resilience
- 4.4.20. Face Animation
- 4.4.21. Coding of 2-D meshes with implicit structures
- 4.4.22. Other relevant functionality

5. MPEG 4 Version 2 Functionalities

5.1. Systems

- 5.1.1. Extended BIFS
- 5.1.2. MPEG-J
- 5.1.3. MPEG-4 File Format
- 5.1.4. Other relevant functionality

5.2. Visual

- 5.2.1. Improved object-based scalable coding
- 5.2.2. Improved coding efficiency
- 5.2.3. Improved temporal resolution stability with low buffering delay
- 5.2.4. Improved error robustness
- 5.2.5. Coding of multiple views
- 5.2.6. Body Animation
- 5.2.7. Coding of 3-D Polygonal meshes
- 5.2.8. Other relevant functionality

5.3. Audio

- 5.3.1. Increased error robustness
- 5.3.2. Audio coding that couples high quality to low delay
- 5.3.3. Fine grain scalability (down to 1 kbit/s per channel)
- 5.3.4. Parametric Audio Coding
- 5.3.5. CELP silence compression
- 5.3.6. Error resilient parametric speech coding
- 5.3.7. Environmental spatialization - using perceptual and/or physical modeling
- 5.3.8. Back channel
- 5.3.9. Low overhead, MPEG-4 audio specific transport mechanism
- 5.3.10. Other relevant functionality

5.4. DMIF

- 5.4.1. Support to mobile networks
- 5.4.2. QoS monitoring
- 5.4.3. User Commands with ACK
- 5.4.4. Management of MPEG 4 Sync Layer Information
- 5.4.5. DAI syntax in C language
- 5.4.6. Other relevant functionality

6. Extensions to MPEG-4 Functionality beyond Version 2

6.1. Visual

- 6.1.1. Fine Grain Scalability
- 6.1.2. Simple Studio Profile
- 6.1.3. Core Studio Profile
- 6.1.4. Digital Cinema

6.2. Systems

- 6.2.1. Advanced BIFS
- 6.2.2. XMT
- 6.2.3. FlexTime

6.3. 2-D and 3-D Animation

7. Profile Support

7.1. Visual Profiles – Version 1

- 7.1.1. Simple Visual Profile
- 7.1.2. Simple Scalable Visual Profile

- 7.1.3. Core Visual Profile
- 7.1.4. Main Visual Profile
- 7.1.5. N-Bit Visual Profile
- 7.1.6. Simple Facial Animation Visual Profile
- 7.1.7. Scalable Texture Visual Profile
- 7.1.8. Basic Animated 2-D Texture Visual Profile
- 7.1.9. Hybrid Visual Profile

7.2. Visual Profiles – Version 2

- 7.2.1. Advanced Real-Time Simple Profile
- 7.2.2. Core Scalable Profile
- 7.2.3. Advanced Coding Efficiency Profile
- 7.2.4. Advanced Scalable Texture Profile
- 7.2.5. Advanced Core Profile
- 7.2.6. Simple Face and Body Animation Profile

7.3. Audio Profiles – Version 1

- 7.3.1. Speech Profile
- 7.3.2. Synthesis Profile
- 7.3.3. Scalable Profile
- 7.3.4. Main Profile

7.4. Audio Profiles – Version 2

- 7.4.1. High Quality Audio Profile
- 7.4.2. Low Delay Audio Profile
- 7.4.3. Natural Audio Profile
- 7.4.4. Mobile Audio Internetworking Profile

7.5. Graphics Profiles

- 7.5.1. Simple 2-D Graphics Profile
- 7.5.2. Complete 2-D Graphics Profile
- 7.5.3. Complete Graphics Profile

7.6. Scene Description Profiles

- 7.6.1. Audio Scene Graph Profile
- 7.6.2. Simple 2-D Scene Graph Profile
- 7.6.3. Complete 2-D Scene Graph Profile
- 7.6.4. Complete Scene Graph Profile

7.7. MPEG-J Profiles

- 7.7.1. Personal Profile
- 7.7.2. Main Profile

7.8. Object Descriptor Profile

- 7.8.1. Object Descriptor Tool
- 7.8.2. Sync Layer Tool
- 7.8.3. Object Content Information Tool
- 7.8.4. Intellectual Property Management and Protection tool

8. Additional Questions

- 8.1. Please provide a detailed product description. Describe the product functionality and targeted market segment (e.g. mobile, Internet streaming, broadcast) and provide a URL if available.

- 8.2. Describe any deviation from or incomplete implementation of the MPEG-4 standard.
- 8.3. Describe the product's current customer base, including total sites, and breakdown percentages according to industry, academic and other customers.
- 8.4. Describe areas of R&D your firm is working on with MPEG-4.
- 8.5. What transports/hardware do you use or plan to use for your products?
- 8.6. Optional references.
- 8.7. Do you participate in MPEG-4 standards development?
- 8.8. Is your company represented on the MPEG-4, MPEG-7, or MPEG-21 international standard committees?
- 8.9. Do you have any development partners or collaborators, particularly in the academic community (specifically, the post-secondary educational community)?
- 8.10. Which end device manufacturers, network service/access providers, streaming servers, codecs, decoder cards, digital asset management systems, content development tools, metadata and database standards, operating systems, etc., does your product interoperate with?
- 8.11. Do you have plans to develop MPEG-4 based videoconferencing products? Will MPEG-4's capability to draw multiple objects from multiple sources be used for continuous presence display of multiple parties in conference?
- 8.12. Describe in detail your product's intellectual property rights and access management features.
- 8.13. Discuss backward compatibility with existing servers, etc.
- 8.14. Is there a migration path for existing customers?

Section 4: Solicitation of Interest

MPEG-4, the latest standard to emerge from the Moving Picture Experts Group, has the capability to transform online content delivery - not just video and audio, but text, still images, and metadata. In addition to multiple information streams, MPEG-4's object-oriented encoding, with synchronization and interactivity features across two and three dimensions, will greatly enhance information sharing in such diverse fields as e-learning, and e-medicine, and enable equitable access for disabled users.

The ViDe MPEG-4 Working Group has identified the following application areas to be of particular import in the higher educational environment today and in the future:

4.1 E-learning

E-learning will benefit from MPEG-4's increased interactivity within information sources. MPEG-4 provides for multiple content layers, which can be used to enhance the base information layer as bandwidth increases, thus providing incremental information at higher bandwidths. Multiple content layers can also offer alternate forms of content depending on actions taken by the information user. Particularly in MPEG-4-v2, as MPEG-J (MPEG-enabled Java) is integrated with content, alternate information streams can allow for streaming an array of alternate results as real-time feedback for complex simulations, examinations, or experiments.

The 2-D and 3-D planes capable of carrying separate media streams will allow engineering students, for example, to build machines without requiring a CAD/CAM workstation, chemistry students to model complex chemical bonds and interactions, and meteorology students to track hurricane and tornado paths. Students in any discipline will be able to evaluate the real-time alternatives resulting from their choices in an overall information package that is bandwidth friendly and requires only an MPEG-4 plug-in for display.

MPEG-4 e-learning features include support for synchronized text and metadata as well as the ability to capture, integrate and edit information objects in two- and three-dimensional fields. Instructors will use MPEG-4 editors to add bookmarks, contextual annotations and metadata to video course lectures, as well as adding images, text, and contextual "mini-examinations" within a multimedia "lecture." Added information streams for course content (e.g. scores and librettos synchronized to music performances), will provide highly integrated and interactive content in any discipline. Students will edit MPEG-4 objects at point-of-use by highlighting and annotating the relevant objects directly. Students will be able to take examinations, perform simulations, and otherwise interact richly with information at every stage of the learning process.

MPEG-4's variable bandwidth will drive interactivity deeply into the classroom, the library and the field as students interact with MPEG-4 streams on laptops and mobile PDAs. Architectural students will be able to capture building details using digital cameras on PDAs and encode them on MPEG-4 streams during field trips, for example. Those same building details and architectural features will be edited into building objects in an MPEG-4 content stream either onsite or back in the classroom.

MPEG-4 will enable electronic lab notebooks in which notes are synchronized with experiment observations captured in digital video and audio, while experiment milestones can be annotated with still images to document changes. Written annotations by multiple participants might be distinguished by color or font, or tied to digital certificates for authentication and data integrity. Audio streams can capture student comments as well as experiment results. A robust lab notebook standard might therefore very well emerge as a specialized MPEG-4 implementation.

Contextual metadata - either Dublin Core to ensure interoperability with legacy data in other formats, or MPEG-7 for advanced multimedia indexing on a contextual metadata track, or both - will enable advanced data mining and discovery down to the base object level (e.g. a specific precipitant in chemistry experiments, a cellular abnormality in a biological experiment, or a variation in a musical score). This data mining will pull together relevant objects in varied formats, e.g. a score and a performance for a musical work, a VR simulation and a blueprint for an equipment or building assembly.

4.2 E-Medicine

E-medicine will benefit from the interactivity, synchronization and flexible bandwidth capabilities of MPEG-4 in much the same manner as e-learning. Telemedicine—the sharing of medical knowledge and resources across distances—has already transformed the medical field, enabling consultations between medical schools and rural hospitals, for example, as well as the sharing of information such as MRIs and CT scans across distances. However, MPEG-4 will not only greatly expand the reach of telemedicine, but has the potential to transform the practice of medicine and the instruction of medical students in significant ways.

Telemedicine frequently requires a level and quality of detail for electronic information that until now could only be satisfied by MPEG-2. MPEG-4 addresses high-bandwidth requirements in several ways: MPEG-4 is designed to support QoS bandwidth reservation, and also supports variable bandwidth at the object level, so that for an MRI or X-Ray, high bandwidth can be reserved for objects of interest such as tumors, shadows, or breaks, while other objects of lesser or no interest are allowed to “fall away.” In addition, alternate content layers for the objects of interest can be provided in alternate information streams, allowing the receiving physician to examine the tumor in context, and then in progressive enlargements. Lab results of tumor resections, blood work, relevant articles or abstracts, etc. can be transmitted in the same MPEG-4 content package, providing the receiving physician with multiple information streams for diagnosis and treatment.

E-medicine, a broader application area, involves the use of electronic information in every area of medical practice. MPEG-4 will allow students to practice “virtual surgery” in 3-D simulations and to evaluate symptoms, make diagnoses and receive feedback in virtual examinations.

In the practice of e-medicine, the bandwidth scalability of MPEG-4 will allow attending physicians to examine patients and capture vital signs monitoring video, audio and still image information streams which reside in MPEG-4 “patient charts.” These charts can be updated by nurses and physicians on duty, and updated information can be automatically forwarded to the attending physician’s home or office for remote case management. Similar to MPEG-4 lab notebooks, these patient charts can be annotated, linked via metadata to articles, updated with MRIs, lab

work, diagnostic interviews, prescriptions and treatments, and searchable via MPEG-7 and other contextual metadata, to provide granular patient management, but also to aid in diagnosis and treatment of related cases. MPEG-4v2 security and encryption features will protect patient privacy even as patient case studies are used to advance medical knowledge and diagnosis.

4.3 Equitable Access

As web-based information becomes increasingly multimedia-based, there is concern that certain classes of disabled users may become increasingly disenfranchised. Hearing-impaired users require captioning, and in some cases signing objects enlarged with increased object-level bandwidth, so that hand signs are completely intelligible at lower Internet1 bandwidths. Sight-impaired users may need to choose between alternate content streams to enlarge certain objects in an MPEG-4 content stream. Future integration with MPEG-7 in an MPEG-4 content stream may allow advanced non-textual indexing and access, including speech recognition indexing, of great benefit not just to sight impaired, but those with mobility impairments.

4.4 ViDe MPEG-4 Development Priorities

ViDe MPEG-4 Working Group members represent universities with large, diverse student bodies and research interests. These universities (The Georgia Institute of Technology, Indiana University, The University of Tennessee, and the Australian National University) include medical and veterinary schools, engineering and science programs and liberal arts departments with particularly strong music programs. They are leading research centers in digital video, advanced networking, multimedia asset management, and videoconferencing over IP.

ViDe MPEG-4 Working Group members are leaders in these areas at their institutions and have been actively involved in telemedicine, advanced metadata and non-textual indexing, large-scale digital library initiatives, and access equity for hearing disabled users, among other research activities and interests. The Working Group is very interested in helping to shape the capabilities of MPEG-4 to meet e-learning, e-medicine and equitable access needs. One participant has already begun MPEG-4 audio testing. Working Group members have been principal or key participating investigators in several recent grant-funded multimedia and videoconferencing initiatives. Additional information about the research interests and multimedia expertise for Working Group participants is appended to this document.

Particular Research interests of the Working Group, to be explored in joint funding opportunities with the most appropriate vendor(s) are (not in hierarchical order):

1. *Testing of MPEG-4 encoders, decoders, and editing tools:* Testing MPEG-4 streams and object-based variable bandwidth encoding on multiple platforms (desktop, PDA, cave, powerwall) at multiple access bandwidths (Internet1 and Internet2, wireless and VR simulation environments).
2. *Standards-based annotations and bookmarking:* Implementing dynamic Dublin Core metadata fields, by both the content provider and the end user, will insure bookmarks and annotations that are standardized across a user base, allowing different commercial systems to recognize annotations and bookmarks for sharing among users and interoperability across platforms. Standards-based bookmarking will also allow the creation of component objects that can be

shared, maintained and managed with rights metadata to form durable information objects from separate MPEG-4 objects and streams.

3. *Robust use of MPEG-4 text tracks*: Addition of synchronized and alternate content such as alternate languages, captions for hearing-disabled students, music notation, and scores and librettos to audio streams.
4. *Rights and access management*: Using digital certificates and differential access, for individual MPEG-4 content streams, and utilizing XRM in a synchronized metadata track. Of particular interest is encryption of data streams to support e-medicine patient confidentiality requirements. Another security interest is granular authentication of individual objects and streams to enable data integrity for collaborations in a highly editable multiple-stream environment. The use of watermarking in MPEG-4 is also of particular interest.
5. *Interoperability with videoconferencing technologies*: E-learning and e-medicine often depend on videoconferencing for information sharing. ViDe working group members have been actively involved in large-scale videoconferencing deployments utilizing H.323, MPEG-2 and Mbone multicast technologies. The MPEG-4 Working Group is very interested in exploring transcoding of H.323 streams in MPEG-4 implementations, where synchronized participant media streams can be used to recreate the session, the rights management component of MPEG-4v2 can maintain participant privacy, and other tracks can provide annotations or shared collaborative work.
6. *Collaborative data management*: The Working Group is interested in developing collaborative data management and storage standards utilizing MPEG-4 and MPEG7. Advanced networking infrastructures such as Access Grid forum activities involve multiple parallel information streams. The Working Group is interested in exploring how MPEG-4, particularly in conjunction with the forthcoming multimedia content description standard MPEG-7, with its ability to define synchronized, consecutive and hierarchical information objects, can be used to capture, describe and manage networked collaborations.

The opportunities for MPEG-4 research and development are many. The ViDe MPEG-4 Working Group is very interested in collaborating with vendors to develop robust, standards-based MPEG-4 implementations that can transform education, medicine and other research areas. The above areas of interest are not exclusive, however. This statement of interest is intended to stimulate a dialogue between the ViDe MPEG-4 Working Group and interested parties on the development of mutually beneficial collaborative activities, while MPEG-4 is in its earliest development stages. Vendors are encouraged to share their MPEG-4 development interests below, and to indicate their degree of interest in any of the six collaborative activities proposed above.

1. Vendor's MPEG-4 Development Priorities

2. Interest in ViDe MPEG-4 WG development priorities:

- 2.1 Testing of MPEG-4 encoders, decoders, and editing tools:

- 2.2 Standards-based annotations and book-marking:
- 2.3 Robust use of MPEG-4 text tracks:
- 2.4 Rights and access management:
- 2.5 Interoperability with videoconferencing technologies:
- 2.6 Collaborative Data Management:

Appendices

Appendix A: The Video Development Initiative (<http://www.videnet.net>)

The goal of The Video Development Initiative (ViDe) is to promote the deployment of digital video in higher education by leveraging collective resources and expertise towards addressing challenges to deployment - poor interoperability, volatile standards and high cost. A multi-institutional effort, ViDe was founded by four educational institutions: The Georgia Institute of Technology, North Carolina State University, The University of North Carolina at Chapel Hill, and The University of Tennessee, Knoxville. NYSERNet (New York State, Educational and Research Network) became a working partner with ViDe in its efforts shortly thereafter.

In May 1999, ViDe expanded its membership to include nine additional institutions: University of Alabama at Birmingham, CANARIE, George Washington University, NYSERNet (New York State, Educational, and Research Network), Ohio State University, The University of Hawaii, Indiana University, The University of South Carolina, Vanderbilt University, The College of William and Mary, and Yale University. The Australian National University joined ViDe in December 2000.

ViDe Phase I (August 1, 1998 - April 1, 1999) was funded by the Southeastern Universities Research Association (SURA), and focused on the specification of optimum video-on-demand and videoconferencing systems, the establishment of relationships with vendors willing to refine their products to meet those specifications, and the preparation and release of recommended practices and standards for video systems to SURA member institutions. In September 1998, an RFI Concerning Video Conferencing over IP and/or Video-on-Demand Server Technologies was released to video system vendors nationally. The responses to the RFI contributed to the creation of two deliverables for the SURA and NYSERNet communities: a *Videoconferencing Cookbook* and a white paper on video-on-demand, *Digital Video for the Next Millennium*, both of which are available online at <http://www.videnet.net>. Version 2.0 of *The Videoconferencing Cookbook* was released in June 2000.

ViDe Phase II foci included the SURA-funded "*Large Scale Video Network Prototype*," a distributed H.323 testbed to explore issues critical to the deployment of seamless networked video between institutions and regions; ViDeNet, a testbed and model network in which to develop and promote ViDe's goals for highly scalable and robust networked video technologies, and to create a seamless global environment for teleconferencing and collaboration.

In the recently initiated Phase III (June 2000), ViDe has established two new working groups - the Video Access Working Group and the MPEG4 Working Group - to focus on testing, standards development and industry partnerships in the video-on-demand arena, and to accelerate the adoption of metadata for digital video assets. The Video Access working group is currently developing a draft extension of Dublin Core for digital video. Members of the MPEG-4 working group are also active in other ViDe working groups, including the Video Access Working Group, and H.323 Videoconferencing.

Appendix B: The ViDe MPEG-4 Working Group

1. Georgia Institute of Technology: Grace Agnew

Grace Agnew

Georgia Tech Library
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Grace Agnew is the Assistant Director for Systems & Technical Services at the Georgia Tech Library and Information Center. Her areas of expertise include digital video, information management, and digital archives management & design. She is the author/co-author of two books, two CD-ROMs, two web pages, a white paper on digital video, a book chapter and six articles. She has delivered numerous presentations on digital video and information management. Grace Agnew is Chair of the ViDe Video Access Working Group which is currently designing a Dublin Core record in XML and a database structure for digital video metadata. She has managed two digital archives grants and is currently designing a federated catalog gateway for moving image collections in the United States and Canada for the Association of Moving Image Archivists.

Relevant publications and presentations include:

G. Agnew and J. Hudgins. Digital Video Metadata. Presentation for the SURA Networked Video Conference, Atlanta, Georgia, April 2000.

G. Agnew. Scalable, Durable Metadata: A Tutorial. Presentation to the Asian Pacific Advanced Network, Tsukuba, Japan, February, 2000.

J. Hudgins, G. Agnew and E. Brown. *Getting Mileage out of Metadata: Practical Applications for the Library*. Chicago, IL.: ALA, 1999.

G. Agnew. Metadata Overview. Presentation to the Asian Pacific Advanced Network, Canberra, Australia, October, 1999.

G. Agnew. *Digital Video for the Next Millennium*. ViDe White Paper.
<http://sunsite.utk.edu/video/1.shtml>

"Overview of Metadata Technologies." CANARIE, Inc.
Canada's Advanced Internet Development Organization, Toronto, Canada,
November, 1999.

"Video on Demand Client/Server Systems: Overview and State of the Art." SURA Networked Video Workshop, Atlanta, GA. April, 1999.
http://vide.utk.edu/conference/Grace_files/v3_document.htm

"Using Metadata in Real Time," Coalition for Networked Information Spring 1998 meeting, Washington, D.C. Co-presenter: Miriam Drake

N. Nelson and G. Agnew. "Opening the Door to the Future: The Selected Archives at Georgia Tech and Emory (SAGE) Project," *Microform & Imaging Review*. Summer 1999, pp. 83-90.

"Nailing Water to the Wall: Digital Video before 2000," Digital Archival Directions Workshop, sponsored by the National Archives and Records Administration. College Park, MD. March, 1997.

G. Agnew, W. Meneely and L. Thaxton. "Faculty Audiovisual Materials Use and Collection Planning at Georgia State University," *Collection Management*. Vol. 11, no. ½, 1989, pp. 151-174

2. Australian National University: Marcus Buchhorn

Markus Buchhorn

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Australia.

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markus@acsys.anu.edu.au

Current Positions:

Lecturer, Computer Networks, Australian National University, 2001-
Network Manager, Australia-Japan Network Link, 1997-
Network Manager, ACSys Broadband Network, 1998-
Director, User Community Area, Asia Pacific Advanced Network (APAN), 1998-
IT Manager, Faculty of Engineering and IT, Australian National University,
2000-

Research Interests:

- Network Technologies
- Audio/Video transport technologies
- Audio/Video storage technologies
- Videoconferencing
- Collaborative Virtual Environments
- Large-scale data management technologies

3. The University of Tennessee: Mairéad Martin

Ms. Mairéad Martin

Director, Advanced Internet Technologies
Office of Research & Information Technology
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Experience

April 2000 – present Director, Advanced Internet Technologies
Sept. 1999 – April 2000 Manager, Emerging Technologies
Sept. 1997 – Sept. 1999 Network Information Consultant

Current Projects

- Chair, Video Development Initiative MPEG-4 Working Group. The Video Development Initiative is an international, multi-institutional effort dedicated to the promotion of digital video in higher education (<http://www.vide.net>).
- Member, Video Development Initiative VideoAccess Working Group. The goal of the VideoAccess WG is the expansion of access to digital video resources, and the promotion, preservation and management of digital video resources through the use of shared, standards-based video metadata and search and retrieval technologies.
- Member of Internet2 H.323 Videoconferencing Service Implementation Task Force. Established in October 2000 to design and implement a H.323 videoconferencing service for the Internet2 community.
- Member, Internet2 Digital Video Steering Committee.
- Member, Internet2 ResearchChannel Working Group, dedicated to collaborative experimentation of high-quality and high-bandwidth streaming, on-demand and multicast video-over-IP.
- Co-author, Video Development Initiative *Videoconferencing Cookbook Version 2.0*. Responsible for the *Models for Campus Deployment* section.
- Chair, Video Development Initiative 1998 – 99.

Selected Grant Writing Experience

- Co-authored *SURA ViDe/BBN Large Scale Video Network Prototype*; submitted to SURA. \$179,128 awarded April 1999.
- Co-authored *CHIPS: Computers for Homebound and Isolated Persons*; submitted to the Department of Commerce TIIAP Program. \$524,838 awarded September 1998.

- Co-authored: *SURA Video Initiative: Video-on-Demand and Video Conferencing over IP*; submitted to SURA. \$54,000 awarded July 1998.

Recent Presentations

- *H.323 Videoconferencing in Veterinary Medical Education*; EDUCAUSE, October 2000.
- *High Quality Internet Video Conferencing is Here Now!*: joint presentation at EDUCAUSE, October 2000.
- *What is H.323 Videoconferencing?*: presentation to meeting on collaborative technologies at the UT College of Veterinary Medicine, April 2000.

An Internet2 H.323 Videoconferencing Service?: presentation at Internet2 Members' Meeting, Washington, DC, March 28, 2000.

Education

Master of Science in Information Sciences
The University of Tennessee, Knoxville, 1997.

Bachelor of Arts (Honors) in English and Classical Civilization
University College Dublin, Ireland, 1984.

4. Indiana University: Doug Pearson

Doug Pearson

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Doug Pearson is manager of Digital Media Network Services (DMNS) at Indiana University (IU), responsible for the development and management of infrastructure and services supporting video conferencing, media streaming and collaboration for the eight-campus IU system. His information technologies background is centered on twenty years experience in network management and engineering. Prior to his recent undertaking in the formation of the DMNS unit, Doug served as executive investigator on the NSF-sponsored TransPAC High Performance International Internet Services network that provides linkage of the Asia-Pacific Advanced Network to U.S. and global high performance research and education networks. Doug continues to serve as an investigator on the TransPAC project, as an investigator on the NSF-sponsored IU Digital Music Library project and is chair of the Committee on Institutional Cooperation (CIC, an academic consortium of the Big Ten universities) Digital Video Working Group.

Experience

Strategy development and oversight - national and international projects including TransPAC and the Internet2 Abilene Network Operations Center; institutional infrastructure and services for digital videoconferencing, media streaming and collaboration; digital library; IU interests in relation to the State of Indiana next-generation network backbone; and advanced telecommunications infrastructure for the City of Bloomington, Indiana.

Management - manager, IU Digital Media Network Services; TransPAC executive investigator; manager, IU-Bloomington Network Operations; led the design, implementation and operational establishment of a 22-site digital video conferencing network for IU; managed the design and implementation of an ATM-based voice/data/video wide area network for IU.

Analysis, design and implementation - twenty years of experience, beginning with the SNA networks of a data processing service bureau and insurance company, followed by two years as an independent network and applications consultant, followed by Indiana University's large multi-protocol campus, integrated services wide area and video conferencing networks; international high performance research and education networks and most recently, audiovisual digital media and collaboration systems.

Selected Relevant Publications and Presentations

D. Pearson. Video Services for iGrid2000 Projects. Presentation to the Internet2 Member Meeting, Washington DC, March 2000.

D. Pearson. Digital Video Activities in Internet2. Presentation to the combined Internet Workshop 2000 and Asia-Pacific Advanced Network conferences, Tsukuba, Japan, February 2000.

D. Pearson, R. Robel, S. Wallace. ATM WANs: Cornering the Market on Wide Area Data. Feature article in *Network Computing* magazine, April 19, 1999.

D.F. McMullen, M. McRobbie, K. Adams, D. Pearson, T. DeFanti, M. Brown. D. Plepys, A. Verlo, S. Goldstein. The iGrid Project: Enabling International Research and Education Collaborations through High Performance Networking. Paper and presentation to the combined Internet Workshop 1999 and Asia-Pacific Advanced Network conferences, Osaka, Japan, February 1999.

D. Pearson and R.A. Robel. Policy-Based Routing and Differentiated Services in TransPAC. Presentation to KRNET'98, Seoul, Korea, July 1998.

D. Pearson, et. al. TransPAC – A High Performance Network Connection for Research and Education between the vBNS and the Asia-Pacific Advanced Network (APAN). Presentation to Internet Workshop 1998, Tsukuba, Japan, March 1998.

5. Georgia Institute of Technology: Edward Price

W. Edward Price

Research Director
Interactive Media Technology Center
Georgia Institute of Technology
Atlanta, Georgia 30332-0130

Appointments

Georgia Institute of Technology

Research Director
Assistant Director
Research Engineer I & II
Research Assistant

Five Selected Projects

E. Hornor, E. Price, T. O'Quinn, P. Rodewald, *Odyssey Online: a object based social science learning site for K-12 students*, 1997-2000.

H. Mitchell, E. Price, C. Evans, N. Jayant, J. Copeland, J. Limb, R. Trebino, *IDEAL: Innovative, Dynamic Educational Applications for Learning, innovative tools and technologies for k-16 learning environments*, 2000.

G. Agnew, E. Price, M. Clements, P. Cardillo, *SAGE: Selected Archives of Georgia Tech and Emory- Wordspotting, using wordspotting to search archived media information*, 1998-2000.

R. Schafer, E. Price, K. Beck, S. Shamp, R. Welke, *Digital Telepresence: using digital content processing and data communication to create more realistic and effective communication environments for human interaction*, 2000.

E. Price, A. Quay, J. Peifer, A. Hopper, M. Burrow, B. Sudduth, S. Panchal, and J. Searle, *Patent #5987519: Telemedicine system using voice, video, and data encapsulation and de-encapsulation for communicating medical information between central monitoring stations and remote patient monitoring stations*, 1995-1999.

Five Synergistic Activities

Chair, SURA (Southeastern Universities Research Association) Video Development Initiative, 1999-2000

Member, Internet 2 Digital Video Steering Committee, 1999-2000

Chair and Organizer, 1999 and 2000 SURA Networked Video Workshop

Co-Author, SURA Video Conferencing Cookbook, 1999-2000

Member, Educational Advisory Council, Georgia Tech/Emory Center for the Engineering of Living Tissues

6. The University of Tennessee: Chris D. Hodge

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