Variations on Video:
Building the Next Generation Library Media Management System

1. Assessment of Need

Digital audio and video are becoming increasingly important to institutions of higher education, and the management of media collections is becoming an important function for academic libraries and archives. Digital media are being generated at a growing rate through a diverse set of activities, including digitization of collections, licensing of third-party digital audio and video materials, born-digital capture of university performances and events, classroom capture, student projects, and university public relations efforts. At the same time, faculty and student expectations for digital media are rising based on experience with online services such as YouTube and iTunes and with personal video capture devices such as solid-state video cameras.

Academic libraries, archives, and their host institutions have needs for distributing audio and video through a variety of different venues, depending on the nature of the users and use. Downloadable podcasts and commercial services such as YouTube and iTunes U are appropriate for video that may be made available for open access and use. However, access to a large percentage of institutions' digital media holdings must be restricted for compliance with copyright law, third-party license restrictions, or ethical considerations. These restrictions may be based on campus location, status of the user's affiliation with the university, course enrollment, and various other factors. In addition, user needs for working with digital media vary depending on the nature of the content (e.g. music, theater performance, classroom capture, educational programs, feature films), the discipline (e.g. anthropology, musicology, film studies), and the nature of the use (e.g. close study vs. classroom presentation).

Commercial services—including media streaming and delivery servers, digital asset management systems, and cloud-based online video environments—have emerged to support various subsets of the digital video distribution functionality required by colleges and universities, but they generally have not been flexible enough to support the full set of online media management and delivery needs of libraries and archives, much less for the whole institution. A few open source and community source projects have emerged to support portions of the digital media production workflow, such as the Mellon-funded Opencast Matterhorn[1] project, which focuses on classroom lecture capture and production. However, no open tool exists that truly serves the needs of academic libraries, archives, and the higher education enterprise for managing access to streamed video and audio collections and enabling their use by students and faculty. Support for deep description in the form of structural or time-based metadata, robust authentication and authorization, and integration with repositories providing services for long-term preservation are key areas where these tools most often fall short.

Variations

The *Variations* digital music library and learning system was developed by Indiana University (IU) with support from a Digital Libraries Initiative – Phase 2 grant from the National Science Foundation and National Endowment for the Humanities in 2000-2005[2] and a National Leadership Grant from the Institute of Museum and Library Services in 2005-2009.[3] Building on IU's past experience in creating the original *VARIATIONS,*[4] one of the world's first music and streaming media digital library systems, the current Variations system—available since February 2009 as free open source software[5] under a BSD license—offers a complete environment in which students and faculty can

[1] http://www.opencastproject.org/
[2] http://variations2.indiana.edu/research/
[3] http://www.dlib.indiana.edu/projects/variations3/
[4] http://www.dlib.indiana.edu/variations/
[5] http://variations.sourceforge.net/

discover, listen to, view, annotate, and interact with music in both streaming audio and scanned score formats. Variations supports a flexible access control system that is adaptable to local policies, as well as end-user tools useful in teaching, learning, and research.

Variations is currently in production use at ten college and university libraries in addition to IU, and the Variations team is aware of at least eight other institutions currently evaluating or piloting Variations, including Northwestern University. While Variations has been adopted outside of IU, one theme that has emerged repeatedly in our discussions with implementers and potential implementers is that academic library and IT administrators are often looking for solutions to music media delivery in conjunction with the needs of other areas. Consequently, two of the most frequent questions that the Variations team has received have been 1) whether Variations can support video collections in the same way that it supports audio and 2) whether the system can be scaled to support multiple audio and video collections across a library system or larger institution. University-based libraries and archives are increasingly involved in digital video and video digitization efforts and are looking for a way to more easily manage this content and the workflows used to generate it and to provide useful integration of library-based video collections into teaching, learning and research activities.

Indiana University

Beyond Variations, the IU Digital Library Program (DLP) has been involved in a wide variety of efforts both within and outside the university related to digital audio and video. The EVIA Digital Archive Project,[6] in which the DLP has been a partner, is a joint effort of Indiana University and the University of Michigan, with support from the Andrew W. Mellon Foundation. EVIA has developed workflows for scholarly contribution, annotation, and editing of video, along with software tools for video segmentation, annotation, and searching. The DLP was also a key partner in the Digital Audio Archives Project—an IMLS-supported effort led by Johns Hopkins University, which worked on developing efficient workflows for preservation-level digitization of audio collections and established a preservation audio digitization lab within the Cook Music Library at IU—and on Sound Directions,[7] a series of NEH-supported projects in partnership with Harvard University working to define best practices in the use of digital technologies for audio preservation.

A major survey of media collections on the IU Bloomington campus in 2009[8] identified over 80 campus units with collections of over 560,000 audio and video recordings and film reels or cores, 41% of which are either unique (one-of-a-kind) or rare. Efforts are currently underway to develop a plan for systematic digitization of these materials for preservation and improved access. IU's new strategic plan for information technology[9] also identifies media collection digitization and delivery services as a key area of need and recommended action.

Northwestern University

Northwestern University (NU) has been providing audio and video digitization and delivery services to its community since the late 1990's. A substantial majority of these were prepared in response to specific faculty requests and are delivered by means of links from the campus course management system. Scholars from disciplines as diverse as Dance, Religion, Law, Education, and Industrial Engineering integrate video in their classes. Segments of feature films, recordings of Shakespeare and opera performances, and documentary works have all been employed in widely diverse ways by Northwestern scholars.

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[6] http://www.eviada.org/
[7] http://www.dlib.indiana.edu/projects/sounddirections/
[8] http://research.iub.edu/communications/media_preservation/
[9] *Empowering People: Indiana University's Strategic Plan for Information Technology*, 2009, pp. 27-28. http://ep.iu.edu/

Like many other college and university libraries, Northwestern is experiencing an explosion of demand for increasingly sophisticated digital video services from its faculty. Among the needs that have been articulated are the desire to integrate locally digitized content with commercially licensed content, ability to create and share playlists, to create and export segments as portable files for presentation and other offline use, and desire for a full range of annotation, custom grouping and presentation tools.

In 2009, with support from the Andrew W. Mellon Foundation, Northwestern completed a "Mounting Books" project[10] to develop a workflow management and publishing system for digitized books that incorporates an engine to manage requests and digitization jobs, move page image files through the digitization and post-processing phases, and publish digitized books via a Fedora repository. Northwestern is in the process of extending these workflow management and publishing systems to include the 75,000 images in the campus Digital Image Library. Experience gained with these two projects will enhance Northwestern's contributions to the Variations project, and will bring, in particular, a focus on workflow management, event monitoring and messaging, and server- based conversion services.

IU and NU propose to leverage our combined experience in digital audio and video services, alongside input from additional institutions with significant experience in these areas, to build a new software product, currently code-named *Variations on Video (VoV).* This product will serve as a digital media management and delivery system that can meet the needs of other media collections and services within a library system or its larger home institution. The project will also engage with the museum community and will seek to eventually generalize metadata and management tools, and other key features, to serve museum audiovisual collections as well.

Outcomes of Planning Grant

IMLS awarded a six-month planning grant to IU in August 2010,[11] which supported an investigation by IU, NU and other partners into how best to address the audio/video media ingest, management, and access needs of academic libraries. In October 2010, approximately 30 participants met at IU to surface technical and user requirements from their institutions.[12] In addition, the results of a survey of over 150 institutions' video plans and needs, conducted by IU earlier in 2010, were presented.[13] From this meeting, we began to develop a product vision and list of modules.

Further discussions regarding requirements were held at the annual EDUCAUSE conference later in October, as the team continued to refine plans and conducted classroom observations of video use and instructor interviews. Over the period of the planning grant, the team also conducted technical investigations of numerous technologies related to video and digital content management, and engaged in discussions with a number of the communities supporting these technologies, culminating in the high-level architecture presented later in the proposal.

In early December, a more focused team of potential project participants met at Northwestern to identify potential partners, technologies, and development processes for the present proposal.[14] The group determined that the system should leverage existing technology, such as free and commercial media streaming/delivery servers, where possible. Moreover, we decided it would be essential to take advantage of technology from other collaborative efforts within higher education. Opencast Matterhorn was selected as the likely basis for the media-processing pipeline, and the Fedora digital repository and related Hydra architecture were selected to provide necessary

[10] http://books.northwestern.edu/

[11] This planning grant has been extended through July 2011 to allow for additional dissemination activities, but will conclude before the start of this proposed project in October 2011.

[12] Overview available at: https://wiki.dlib.indiana.edu/display/VOV/Project+Participant+Meeting+Summary

[13] Reports of user needs analysis: https://wiki.dlib.indiana.edu/display/VOV/User+Needs+Analysis

[14] Overview available at: https://wiki.dlib.indiana.edu/display/VOV/Grant+Planning+Meeting+Summary

components for content and metadata storage and user interface development. It was established that staff at IU and NU would form the core of the development team for this new product, and based on the experience of several institutions with agile development processes, we decided to adopt the Scrum development methodology for design, development, integration, test, and delivery of the system.

2. National Impact and Intended Results

This project builds upon several strong foundations: Indiana University's fifteen years of experience developing and deploying the Variations digital music library system; Northwestern University's eleven years of experience with large scale digital audio and video management and delivery; and an active community of developers already engaged on the Fedora, Hydra and Opencast Matterhorn projects. The Variations on Video (VoV) project will build on these previous efforts, with an emphasis on modularity, so that implementing institutions can readily integrate VoV components with their existing systems. The project will also actively seek partnerships with potential hosting partners to ease implementation for consortia and smaller institutions, and will develop a sustainability program to ensure the health of the tools well beyond the initial development phase.

Digital media management systems in use and emerging in the marketplace do not readily support robust, standards-based metadata for description and annotation of time-based media, have limited support for authentication and authorization, and often fail to take into account special requirements for digital media asset preservation and long-term archiving. Although VoV will be built on a specific set of core technologies for metadata and digital object storage and for conversion workflow services, it will rely on open standards to maximize interoperability with a number of different streaming server technologies, integrated library systems, player technologies, and course management systems.

Openness, interoperability and modularity will be guiding principles for the VoV project. Libraries often partner with other organizations, both within their academic institutions and without, for specialized or resource-intensive services. Whether these services include massive storage for high-bitrate digital assets, federated search and link resolution, or highly-customizable player and media manipulation tools, VoV must integrate with, not replace, these important services. Building a powerful but open media management tool is a significant but worthy challenge; particularly in the current economic climate, libraries must have tools that leverage, rather than duplicate, other partnerships and opportunities.

3. Project Design and Evaluation Plan

Project Goals

The goals of this project are as follows:

1. Develop a new digital video and audio management and delivery system, with a focus on the needs of academic libraries and archives.
2. Follow an agile, open source, community development approach, so that the system can be used by a broad community of stakeholders, who in turn will support ongoing development and maintenance.
3. Wherever feasible, leverage existing technologies to minimize the need for new development and maximize the opportunity for integration with a variety of technical infrastructures.
4. Communicate and market the project and product broadly, to increase awareness and grow the size of the community.

Project Activities

Investigation of user needs

A significant outcome of the Variations on Video planning grant was the investigation of user needs, through survey data analysis, analysis of usage scenarios contributed from seven different organizations, and field studies of media use in instruction.[15] These activities have led to an initial set of requirements, but requirements analysis needs to be continuous, as user needs and expectations are continually evolving. Because this project will follow an agile development methodology, a primary means of continuous input on user needs will be from those institutions committed to installing and testing the system, piloting it at their institutions. Test partner sites will provide a stream of feedback to inform requirements for multiple classes of users: IT specialists, librarians, curators, archivists, instructors, students, and researchers. Data from these activities will be continuously analyzed and folded into the agile development process so the most important needs can be addressed in subsequent development cycles.

During the planning grant, the needs of instructors were the primary ones investigated. Moving forward, three categories of user are particularly of interest for further data collection: library staff, researchers, and students. To that end, the project will continue to schedule and conduct observational and interview studies of media management and use, with a focus on video. Some of this data collection will be conducted beyond IU and NU through remote interviewing. Data from these activities will be analyzed and fed into the user story pipeline by the product owner (see development process description below).

Development

The development process for VoV will be managed with a Scrum agile framework using the three standard roles, Scrum Master (facilitates process), Product Owner (defines product features) and Scrum team (cross-functional). The Scrum agile process has a value driven focus, and assumes that requirements will evolve over time; work is scheduled instead of estimated and feedback is integrated throughout the project instead of happening at the end. The IU and NU team members, though located in two separate locations, will function as a single Scrum team.

VoV will be built upon three major open source technologies. These technologies offer features important for media management, and offer an excellent starting point for development. The first is the Fedora (Flexible Extensible Digital Object Repository Architecture) repository, which will be used as the backend preservation and metadata storage component. Another is Opencast Matterhorn, from which components will help with video transcoding and preparation and possibly the end-user player. The third is Hydra, a Ruby-on-Rails framework that provides a development environment for creating user-friendly front-end interfaces to Fedora. The Hydra framework is very promising and supports rapid development; however, it is a relatively new project, and tools will need to be built in order to support more complex media management. A built-in component of Hydra called "Blacklight" is more mature; it is a search tool based on Solr technology, and will be used to provide a basic search and discovery interface for the system. These technologies emphasize our modular approach to the project; rather than a monolithic code base with a "black box" architecture, the VoV system will support more open connectivity between components. This will make it easier for future contributors and users to add or remove parts based on their needs.

During the planning process, several other areas of development were noted that are vital to the project. A default media player will ideally be developed from on an existing code base, but features may need to be developed to support embeddable browser-based playback, mobile device functionality, and navigation based on structural metadata. A flexible authentication and authorization architecture will need to be developed, user roles defined, and

[15]Reports available online at: https://wiki.dlib.indiana.edu/display/VOV/User+Needs+Analysis

metadata and content models will need to be architected for storage into the repository. Bridge services will be created to support communication between systems, including course management systems and library catalogs.

The current product vision is as follows:

- Content focus will be on library/archive-owned or -managed video and audio collections, extending to 3rd-party licensed or other content, as well as museum-owned/managed content over time.
- Access concerns will drive system design, while preservation concerns will also be supported.
- Access to media will be available both through desktop web browsers and mobile devices.
- A flexible access control system will allow institutions to support local authorization policies and integrate with local authentication systems.
- Accessibility, transcripts and captioning will be supported.
- The Media player will provide fine-grained, responsive direct navigation and navigation by chapter/section.
- Standards-based metadata will address areas of identification, navigation, rights, digital provenance, and technical specifications. Various standards (e.g. PBcore, MPEG-7, METS) will be explored.
- A basic search and discovery interface will be provided, but the system will also integrate with existing discovery systems and descriptive metadata standards (e.g. MARC, EAD).
- The media player will be embeddable in other contexts, such as a course management system or blog.
- The system must be extensible and modular, to support integration with existing institutional infrastructure and the development and integration of tools focused on the needs of particular disciplines, content, and users.

Marketing and community building

One of the most critical lessons learned from the Variations3 project is the need to actively and continuously market and promote the work of the project to key stakeholder communities and engage those communities in providing feedback to guide the project's activities. This important area of work is described in section 5, below.

Participants and Advisors

Primary software development will occur at Indiana University and Northwestern University, with potential contributions from several of our test and implementation sites. We also plan to engage members of the Opencast Matterhorn and Hydra communities, through consulting arrangements and participation in community meetings and online discussions.

An advisory board representing key communities, possible future users, and related efforts will serve to provide more structured guidance around possible development directions and to assist with visioning and developing a product sustainability plan.

Seven institutions—Stanford University, the University of Virginia, University of Connecticut, New York University, University of Miami, University of York (UK), and the Rock and Roll Hall of Fame Library and Archives—have committed to providing feedback on requirements, installing and testing the software developed by the project, and participating on a project advisory board via telephone and in-person meetings. In addition, we have commitments from representatives of WGBH/Boston, the Hydra Project, the Opencast Matterhorn project, and Harvard University to serve on the project's advisory board to provide additional guidance.

We will also work with the current community of Variations digital music library users to develop a plan to adapt the current Variations tools to utilize VoV as a backend.

Relationship to Other Projects

The VoV project is basing its development and sustainability strategies in part around affiliation with and use of several existing open source software projects. VoV project staff will work with these project communities to ensure that product planning and development work are in alignment with the communities' roadmaps and can be integrated into the primary codebase. The two communities where the VoV project will be most active are Hydra and Opencast:.

- The *Hydra Project*[16] is a collaboration between the Universities of Hull, Stanford and Virginia, working in partnership with DuraSpace. The project is building a set of repository workflow tools to control management, indexing, discovery, retrieval, and preservation of digital content in the Fedora digital repository. The core repository framework of VoV will be based on Hydrangea, a Hydra application. The VoV development team will be actively engaging the Hydra community to architect, evaluate and test the VoV system. One of the VoV project goals is to develop and contribute a new "Hydra head" for audio, video, and other time-based content.
- The *Opencast Community*[17] is a collaboration of individuals, higher education institutions and organizations working together to explore, develop, define and document best practices and technologies for management of audiovisual content in academia. Opencast Matterhorn is a free, open-source software platform to support the management of educational audio and video content. The processing, encoding and delivery services in Matterhorn are ideally suited for integration into the VoV system. VoV developers will work with the Matterhorn community to enhance existing tools and potentially develop new components.

In addition, we will engage in discussions with other current and past IMLS-funded audio and video projects to explore options for integration, including the Open Video Digital Library Toolkit,[18] which provides an easy means of cataloging and publishing small, open online video collections.

Evaluation Plan

There are two levels of evaluation planned for this project. One is formative evaluation at the *product* level, consisting primarily of usability and accessibility evaluation. Usability tests will be performed for product installation and usage, with usage covering both ingest and end-user activities. The other level of evaluation is summative evaluation at the *project* level. Project level evaluation will be accomplished with the following metrics:

- Number of institutions committing to product adoption within the grant period (goal: 10)
- Number of institutions planning to adopt within the next year after the grant (goal: 10)
- Total amount of ongoing development and support resources committed by adopting institutions (goal: 2 FTE/year minimum)

4. Project Resources

Project Management

The project, which will from October 1, 2011 through September 30, 2014, will be managed by the Indiana University Digital Library Program (DLP), under the direction of Jon Dunn. The Digital Library Program is a partnership between the IU Libraries and University Information Technology Services, and is able to leverage the resources and expertise of both of these organizations to support the work of this project. The Digital Library Program has a long history of successful grant projects, including five prior IMLS NLG project grants as lead institution and two as a major partner.

[16] https://wiki.duraspace.org/display/hydra/
[17] http://www.opencastproject.org/
[18] http://www.open-video-toolkit.org/

The project will be carried out in close collaboration with staff from the Northwestern University Libraries, with Stu Baker of Northwestern serving as Project Director for Northwestern. Northwestern's digital library program is collaboratively led by the Digital Collections department and the Library Technology Division, with close ties to the staff in the Academic & Research Technologies unit of Northwestern's central IT organization, NUIT.

Teams at IU and NU will communicate regularly via e-mail and weekly or biweekly teleconferences. During development phases, developers at both institutions will meet together daily via videoconferencing for a Scrum "daily standup" meeting. In-person meetings of the IU and NU project teams will be held twice in year one, and once in each of years two and three. In addition, project advisory meetings will be held in years one and two, and will involve the IU and NU teams, plus external advisors (see Advisors and Test Sites, below).

Personnel

Existing Indiana University and Northwestern University staff will play a major part in the project:

Jon Dunn, Director of Library Technologies and Digital Libraries at Indiana University, will serve as Project Director, responsible for overall project direction and financial management of the project, as well as overseeing the involvement of the project's advisory group. He has served as Project Director or Project Manager for numerous grant projects funded by IMLS, NSF, NEH, and the Andrew W. Mellon Foundation, including the IMLS-funded *Variations on Video* planning grant and *Variations3* project (both as Project Director), NSF/NEH-funded *Variations2* project (Project Manager), and Mellon-funded *Integrating Licensed Library Resources with Sakai* project (Project Director). He also served as Lead Technical Investigator for the Mellon-funded *Ethnomusicological Video for Instructional Analysis Digital Archive* project.

Stu Baker, Associate University Librarian for Library Technologies at Northwestern University, will serve as Project Director for Northwestern's work on the project and will collaborate with Dunn on overall project direction and priority setting. He will also serve as primary liaison to NUIT. He has broad responsibility for development and implementation of technology services at the libraries, including the library management system, federated search and open URL resolvers, interlibrary loan and reserve services, all web services, staff and public computing, and digital repository implementation.

M. Claire Stewart, Head of Digital Collections in the NU Library, will serve as the Product Manager (as defined by the Scrum agile software development methodology) responsible for coordinating functional requirements for the project and setting functional priorities for development. She will also take the lead on engaging the media library community in the project through presentations and other outreach activities. Stewart managed the IMLS-funded *Winterton Collection of East African Photographs, 1860 – 1960* project, as well as the Mellon-funded *Mounting Books* project. She is administratively responsible for the team of library staff providing media production and delivery services, training, and support, and for management of all special library digitization projects.

Mark Notess, Manager of Teaching and Learning Systems Development in the IU Digital Library Program, will serve as Project Manager, managing the development team at IU and consultant relationships, and overseeing user needs analysis, communication with project advisors, and marketing activities. He will also serve as backup Scrum Product Manager. Notess served as Development Manager for both the Variations2 and Variations3 projects.

Chris Colvard, Programmer/Analyst at IU, will serve as a developer and technical architecture lead on the project. He has worked as a developer on the Variations project since 2006 and has led the technical investigation and architecture work for the Variations on Video planning grant. He will also serve Scrum Master for IU.

Steve DiDomenico, Head of Enterprise Systems in the NU Library, will serve as Software Development Manager for the project (specifically, "Scrum Master" within the Scrum agile software development methodology). He serves as technical lead on the Library's overall Fedora repository implementation, on the Mounting Books and security architecture projects. **Bill Parod**, Repository Architect Engineer at NU, will serve as the lead repository architect and developer for Northwestern on the project. He has been a leader in the FEDORA development community since its inception. Bill was the primary developer on the IMLS-funded *Winterton Collection of East African Photographs, 1860 – 1960* project and previously worked in Academic & Research Technologies at Northwestern. **Mike Stroming**, Senior Software Developer at NU, will serve as a developer and analyst on the project. He previously worked as a software developer for Country Insurance and Walgreens doing web development for walgreenshealth.com and walgreens.com

Phil Ponella, Director of the Cook Music Library at IU, will participate in the requirements process and will take a lead role in engaging the music library community. In addition, though not committed as formal cost share, **Monique Threatt**, Media Librarian at IU, will work with Claire Stewart to engage with the media library community, and **Rachael Stoeltje**, Film Archivist at IU, will represent the needs of film archives and users of digitized films.

Budget

The overall budget for the project will be managed by IU, with NU serving as a subcontractor. Participation by existing permanent staff from IU and Northwestern will be cost shared, as will one full-time programmer/analyst at IU and half of the cost of a full-time programmer/analyst at NU.

IMLS funding is requested to address three areas of need:

1. *Staffing:* IMLS funding will be used to fund the other half of the full-time programmer/analyst at NU and to hire an additional temporary full-time programmer/analyst at IU to carry out the system design and development work proposed. Student hourly project assistants at each institution will assist in quality assurance testing, usability testing, project administration, and marketing activities.
2. *Travel:* We are also requesting funding from IMLS to support travel for project meetings, project advisory board meetings, attendance by project staff at relevant technical meetings, and presentations by project staff at conferences to support promotion of the project and product and dissemination of project results.
3. *Consulting:* IMLS funding will be used to engage external consultants/partners in four critical areas: 1) branding, web site, and visual design; 2) Scrum and agile development training; 3) Hydra integration; and 4)
4. Opencast Matterhorn integration.

Full details of the budget are supplied in the attached Budget Justification.

5. Communication and Dissemination Plan

Active discussions with the broader library community about requirements and use cases will be a crucial component of the Variations on Video project. Testers and potential users will be engaged frequently, and requirements continuously refined throughout the agile development process. The project team will conduct regular online software demonstrations as components are completed, to be promoted via appropriate mailing lists and other online venues, and use the demonstrations to gather feedback for development cycles.

A project web site, including all of the existing survey data and other user needs documents gathered in the planning grant,[19] will be actively maintained throughout the project period. As needed, the project web site can form special sub-sections as communities of practice coalesce around specific requirements and modules. Source code developed for Variations on Video will be managed through a Git or Subversion code repository with open read access. Requirements and system documentation will be developed on a public Confluence Wiki at IU. Releases of system components will be made available for download via the project web site and deployed for testing via web access.

Project staff will maintain an active presence at in-person and virtual events attended by a wide range of potential users and collaborators. Target constituencies include librarians, archivists, and museum curators working with audiovisual materials; library technologists; academic technology specialists; digital media specialists; and administrators and decision makers in these institutions within both libraries and central IT organizations. We will also engage in outreach to adjacent communities, such as museum professionals dealing with audiovisual materials. Variations on Video participants will seek to present project updates or software demonstrations, and/or host Birds of a Feather or other informal gatherings around key conferences including: American Library Association meetings, Open Repositories, Museums and the Web, New Media Consortium, Sakai Conference, National Media Market, Music Library Association Annual Meeting, EDUCAUSE regional and national meetings, IMLS WebWise, HydraCamp, Digital Library Federation Forum, Coalition for Networked Information task force, Association of Moving Image Archivists (AMIA), and Association for Recorded Sound Collections conferences.

The project team will continue to share updates and solicit participation in virtual or in-person meetings through the Variations on Video mailing list, and will widely cross-post invitations on key community mailing lists. Canned video demos, print brochures, Facebook, and Twitter postings, and advance tester bonuses will all be developed to reach as many audiences as possible.

6. Sustainability

Indiana University has made a commitment to providing ongoing baseline support for digital library services through its Digital Library Program. This includes support from University Information Technology Services and the IU Libraries for equipment and personnel to sustain Variations as an ongoing production service at IU. NU Library staff jointly support streaming media delivery support to faculty and graduate students with the Library Technology Division and staff in Academic & Research Technologies who are also actively involved in the Opencast, Duraspace and Fedora Commons communities

The *Variations on Video* software will be released as open source software, and will be maintained and supported by the Indiana University Digital Library Program, Northwestern University Libraries, and by other members of its user community. As part of this project, we plan to engage in discussions with organizations hosting other higher education open source and community source software products, including the Sakai Foundation, Jasig, the Opencast Community, and Duraspace, to explore the possibility that one of them may be a viable home to provide some support services to assist with ongoing sustainability. Our choice to leverage and engage with existing successful open source projects such as Opencast Matterhorn, Hydra, and Fedora Commons will also help to ensure the sustainability of our product.

However, the real key to sustainability is to create something so valued that people insist on sustaining it. Broad community engagement and adoption are the most important means of ensuring the ongoing availability and maintenance of any open source system. We believe that the partners we have engaged on this project and the marketing efforts outlined earlier in this proposal will be critical to achieving this goal.

[19] http://www.dlib.indiana.edu/projects/vov/