Avalon Media System Community Development

A proposal to the Andrew W. Mellon Foundation by
Indiana University and Northwestern University

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Project Summary

The Indiana University Libraries, in partnership with Northwestern University Library, request $749,754 from the Andrew W. Mellon Foundation to support additional software development and community building activities for the Avalon Media System software product. These activities are proposed to take place over a two year period from January 1, 2015 through December 31, 2016 and will also be supported with a 1:1 matching contribution of staff time from Indiana University (IU) Libraries and Northwestern University (NU) Library.

Members of the academic community, and particularly the humanities community, are making increasing use of audio and video collections and resources in research, teaching, and learning. Driven by this demand, as well as by the specter of obsolescence of physical audio visual formats and decreases in costs for storage and network bandwidth, many institutions have embarked on efforts to inventory their audiovisual collections and to digitize them for purposes of preservation and improved access. IU's $15 million internally-supported Media Digitization and Preservation Initiative is a leading example of such efforts. However, both libraries and academic media consumers are finding that current tools for management and delivery of audio and video on the web, which have primarily been developed with commercial or teaching-focused use cases in mind, are insufficient for both long-term management of and scholarly use of media collections.

Based on these needs and this identified solution gap, IU Libraries and NU Library embarked on a collaborative project in 2011 to develop the Avalon Media System, aimed at making it easier for libraries and archives to provide long-term online access to audio and video collections for use by a primarily academic audience. With funding from a three-year grant from the Institute of Museum and Library Services, and advice and support from ten additional partner institutions, IU and NU have successfully collaborated to release three major versions of Avalon since the development project began in October 2011.

The Avalon software, which is based on the Hydra digital repository framework and Fedora digital repository system, has been made available by IU and NU as open source under an Apache license, and interest and uptake by the community has been strong. Avalon software installers have been downloaded over 1900 times since 2013, and in addition to production implementations at NU and IU, at least six other production implementations are currently underway.

In order to build on the momentum of Avalon's successful development collaboration and strong community interest, IU and NU propose to: 1) develop additional features and functionality for Avalon to better meet needs of collection managers and users; 2) conduct studies of use of audio and video collections by researchers in humanities disciplines to help ensure future support for scholarly use; 3) integrate Stanford University's Spotlight exhibit tool with Avalon to allow librarians, archivists, and scholars to showcase and provide additional context for media items and collections; 4) develop and implement a community-funded business and governance model to sustain ongoing support and development for Avalon; and 5) deploy Avalon in a hosted software-as-a-service model for use by institutions that need the functionality of Avalon but would prefer to utilize a cloud-based software-as-a-service option rather than support a locally hosted instance.

Through this set of activities, IU and NU expect to place Avalon on a solid technical, functional, financial, and organizational footing to ensure its continued growth and utility as key infrastructure in the research and higher education community for audio and video media collections management, access, and use.

Project Overview

Existing online access tools for digital audio and video fall short on many needs specific to academic and cultural institutions, particularly in effectively supporting long-term access to library and archival media collections. Yet the quantity of media and demand for its use in research, teaching, and learning is experiencing strong growth across many disciplines and functional units within these institutions. Concurrently, faculty and students have increased expectations as to the ubiquity and quality of online access to such collections based on experience with commercial video streaming services such as YouTube and Netflix.

For these reasons, the Indiana University (IU) Libraries, in partnership with Northwestern University (NU) Library, chose to develop the Avalon Media System as an open source software system that enables libraries and archives to more easily provide online access to their audio and video collections in ways that both meet end-user needs and integrate well with content management systems, repositories and backend workflows in libraries and archives. As Avalon development has progressed, the project has seen great interest from a variety of institutions and potential adopters. The University of Virginia Library and Stanford University Library have Avalon running locally and are in the process of connecting it to their existing repository and authentication infrastructures. In addition, the project team is aware of ten institutions that have or are working on pilot implementations of Avalon and another 21 are actively investigating Avalon or plan to do so.

Based on the open source Hydra[1] framework, Blacklight[2] discovery tool, Fedora[3] repository system, and media processing components of the Opencast Matterhorn[4] system, Avalon has been co-developed by IU and NU with support from a three-year $947,963 National Leadership Grant awarded by the Institute of Museum and Library Services (IMLS) from October 1, 2011 – September 30, 2014, along with an earlier $49,504 planning grant from IMLS awarded in 2010. Nine additional institutions, including Stanford University, the University of Virginia, New York University, and WGBH/Boston, have participated in the Avalon project as partners, providing feedback on requirements and setting up local Avalon pilots in order to provide feedback to inform product development.

IU and NU are both implementing Avalon in production in 2014 in order to support access to local digital media collections for teaching, learning, and research.

After more than a full year of testing, including testing by university faculty and students in select courses starting in June 2013, NU's first production instance of Avalon went live on July 25, 2014. Named the Northwestern Audio + Video Repository,[5] the system is connected to NU's new Canvas course management system and existing campus Adobe Media Server. Both Canvas and the Adobe Media Server are supported by central campus information technology (NUIT). Starting in fall 2014, the team of production and services staff in the University Library's Digital Collections department will exclusively use Avalon to fulfill all new course-based audio and video streaming requests. The Digital Collections staff are also preparing a schedule to import previously digitized audio and video materials into Avalon. Metadata for these assets, stored in a rudimentary home-grown database

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[1] http://projecthydra.org/
[2] http://projectblacklight.org/
[3] http://fedora-commons.org/
[4] http://opencast.org/matterhorn/
[5] http://media.northwestern.edu/

system, will also be imported. The planned timeline for this retirement is summer 2015, and Avalon's batch import features will be utilized to carry out the bulk of the migration.

In addition, NU will use its Avalon-based Audio + Video Repository to make accessible, for the first time, digitized materials from NU's special libraries, including selections from the Music Library, the Melville J. Herskovits Library of African Studies, University Archives, and Special Collections. For copyright reasons, until features to support links with custom passwords have been added to Avalon, some collections may only be accessible on-site or only to curatorial staff, but bringing them into Avalon will still be a significant improvement in access. When link features have been added, remote access will be offered to researchers not affiliated with Northwestern.

IU is currently in the process of bringing up its production instance of Avalon, to be completed by October 2014. The IU Libraries have been running Avalon in pilot since early 2013[6] to host multiple projects, including digitized audio recordings of senate hearings on juvenile justice from IU's Political Papers Collection, movies being used by a class in film music taught in IU's Jacobs School of Music, and films digitized by the IU Libraries Moving Image Archive (IULMIA) in response to remote researcher requests. In addition, over 100 World War II propaganda films from the IULMIA are hosted in Avalon as part of an online exhibit[7] created using the Omeka tool developed by George Mason University. The IU Libraries have also partnered with the Institute of Juvenile Court and Corrections Research[8] to host a separate instance of Avalon for a newly acquired collection of videos of juvenile justice procedures and facilities for use by researchers, instructors, and students. All pilot and production installations run on virtual machines and storage in IU's Bloomington data center and make use of IU's central Adobe Media Server-based media streaming infrastructure.

IU is planning to utilize Avalon as a key component of the access strategy for its Media Digitization and Preservation Initiative (MDPI), a $15 million project funded by IU's administration to digitize and preserve over 300,000 rare and unique audio and video assets from across the university. IU anticipates beginning to make MDPI materials available through Avalon in early 2015.

Relationship to HydraDAM2 and IU-WGBH Collaboration

In the context of MDPI, IU is currently planning to use Avalon as an access tool alongside a preservation repository environment utilizing IU's existing research storage infrastructure. This environment is expected to have a preservation management layer also based on Fedora and Hydra technologies, known as HydraDAM2. IU and WGBH have submitted a proposal to the Preservation and Access Research and Development program of the National Endowment for the Humanities for the development of HydraDAM2, based in part on WGBH's earlier work in creating HydraDAM. This proposal is currently pending, and IU and WGBH expect to learn its outcome in December 2014. If funded, the HydraDAM2 project would begin in January 2015.

If the HydraDAM2 project is not funded, IU will still utilize Avalon to provide access to MDPI content and plans to internally develop a local preservation repository/registry system to track preserved audio and video content in IU's research storage environment.

Existing Solutions

Institutions not using Avalon tend to use media management and delivery solutions that fall short of meeting their full range of needs, particularly in the areas of access control and managing archival versions of media. Much work has been done in the creation of open source systems for

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[6] http://avalon-pilot.dlib.indiana.edu/
[7] http://collections.libraries.iub.edu/IULMIA/exhibits/show/world-war-ii-propaganda-films
[8] http://iurtc.iu.edu/about/ijccr/

content management specifically suited to library and archive materials, including Fedora, Hydra, and Blacklight. However, development and implementation of these technologies has primarily focused on text and images rather than on time-based media such as audio and video. Avalon leverages these technologies and extends them to suit the added challenges of time-based media due to its large storage, processing, and bandwidth requirements, and the unique issues it presents for indexing and access due to its temporal nature.

Other media management and delivery solutions, such as Kaltura, ShareStream, Ensemble Video, and MediaCast only present partial solutions to the needs of libraries and archives. Although Kaltura has evolved a cloud-based option and has attractive basic editing and management tools for students and faculty, it is designed for access and publishing, and does not offer robust features for managing higher-resolution copies or sophisticated metadata. ShareStream, Ensemble Video and MediaCast are likewise only partial solutions primarily focused on short-term access for teaching and learning purposes, and as closed-source systems present higher barriers for institutions that want to leverage their existing repository and content management systems and integrate with preservation solutions to securely manage archival copies of media assets. Therefore, the focus for Avalon planning and development has been to leverage standards such as Learning Tool Interoperability (LTI) as well as the Application Programming Interfaces (APIs) of commercial solutions when available, so that assets and metadata are managed in Avalon but can be published to external services. Work on Kaltura and YouTube integrations is included as part of this funding proposal.

The development of Avalon has advanced sufficiently to support preliminary production use at IU, NU, and several other institutions and to attract the attention of many more. However, Avalon needs to expand functionality in order to address more fully its primary use cases supporting researcher access, analysis, and annotation as well as the teaching and learning use cases. Moreover, in order to address the deployment and management needs of a significantly broader range of institutions, Avalon needs to work well in a cloud-hosted, software-as-a-service model. Finally, the community of Avalon users and developers needs to become a robust, self-funded entity attracting continued investment so it can keep pace with technology changes and emerging use cases.

Experience of the Partners

Indiana University has an extensive history in the creation of digital library collections and infrastructure, in the development and application of open source software, and in the use of digital and Internet technologies for preservation of and access to audio and video media.

IU's Variations project, launched in 1996, was one of the world's first streaming media digital library systems, focused on music teaching and learning. The current version of Variations, developed by 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 and a National Leadership Grant from the Institute of Museum and Library Services in 2005-2009, was released as open source software under a Berkeley Software Distribution (BSD) license in 2009 and is presently in production use at over a dozen colleges and universities beyond IU. IU's experiences with Variations led in part to its current work on development of Avalon.

Beyond Variations and Avalon, the IU Libraries have 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, a joint effort of Indiana University and the University of Michigan, with support from the Andrew W. Mellon Foundation, has developed workflows for scholarly contribution, annotation, and editing of video, along with software tools for video segmentation, annotation, and searching.

The IU Libraries were also a key partner in the Digital Audio Archives Project, an IMLS-supported effort led by Johns Hopkins University that 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. In addition, Sound Directions, a series of NEH-supported projects in partnership with Harvard University, worked to define and execute best practices in the use of digital technologies for audio preservation.

A major survey of media collections on the IU Bloomington campus in 2009[9] 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 or rare. Efforts over the past five years to develop a plan for systematic digitization of these materials for preservation and improved access led to the announcement in October 2013 by IU President Michael A. McRobbie of the IU Media Digitization and Preservation Initiative (MDPI).[10] MDPI is a five-year comprehensive effort to digitally preserve unique and rare audio and video media collections from across the university, supported by $15 million in funding from the IU Office of the President and university administration. The majority of digitization work for MDPI will be carried out by a private contractor that will operate a digitization facility in Bloomington, which is expected to produce as much as 12 terabytes per day in new digital content for archiving and access.

Indiana University has been a leader in the academic open source community, having served as a cofounder of the Sakai learning management system and Kuali administrative application suite projects. The IU Libraries and University Information Technology Services are playing a lead role in the design and development of the Kuali Open Library Environment (OLE) library management system, also funded by Mellon.

Northwestern University Library also has a history of pioneering use of technology to support teaching and learning, and is an increasingly active partner in open source software development. Northwestern was one of the first American research libraries to develop an electronic reserves service, offering digitized course materials starting in 1994. Northwestern's first online video collection, The Video Encyclopedia of the Twentieth Century, was mounted in 1999. In 2001, the University Library actively partnered with School of Music faculty to begin streaming music collections for course use, and added a video electronic reserve service in 2003. A Moving Image and Sound Preservation Specialist position was permanently added in 2014; the Specialist works closely with archivists and special collections librarians to treat and digitally reformat collections documenting Northwestern's history and the rare and unique materials in its special collections. Recent activities have focused on unique recordings of master classes, WNUR radio archives documenting campus unrest in the 1960's and 70's, and selected items from Northwestern's special collections documenting 20th century art movements.

Through the Library's collaboration with campus partners in media delivery and teaching and learning, active conversations are underway to identify a coordinated media management strategy that integrates Avalon with research and teaching systems. This vision for the campus will integrate Avalon with the Canvas course management system, and define a roadmap for additional integration with lecture capture, student portfolio systems, and other specialized media software in use on campus, including mechanisms for archiving outputs from these systems to Avalon and the Fedora repository for long-term preservation.

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[9] Indiana University Bloomington Media Preservation Survey: A Report, 2009.
http://www.indiana.edu/~medpres/documents/iub_media_preservation_survey_FINALwww.pdf
[10] http://mdpi.iu.edu/

Northwestern is also an active participant in open source software development. The Book Workflow Interface software, a Fedora-integrated workflow management and publishing solution for digitized books, was developed in 2009 under the sponsorship of the Andrew W. Mellon Foundation.

IU and NU are both partners in the Hydra Project, a growing collaboration of institutions working to develop repository applications based on a Ruby on Rails framework. In addition to work on the Avalon Media System, Northwestern developed and released the Digital Image Library Hydra application, now in production at Northwestern and used to provide access to 115,000 teaching images, including several unique collections created by Northwestern faculty. IU and NU are also both sponsors of the Fedora repository project through the DuraSpace organization, with representatives from each serving on the Fedora Leadership Group.

Progress to Date

During the IMLS-funded phase of the project (2011-2014), IU and NU have developed a system with a core set of discovery and content creation features, utilizing a system architecture based on the open source Hydra framework, Blacklight discovery tool, Fedora repository system, and media processing components of the Opencast Matterhorn system (see figure 1). The Avalon Media System integrates with many widely deployed authentication systems to support secure login. It can: accept time-based media in a wide variety of formats, either through web browser upload or via single file or batch ingestion from a watched folder on an attached file system; perform server-side conversion to compress for streamed delivery; extract technical metadata through mediainfo and other utilities; collect Metadata Object Description Schema (MODS) descriptive metadata from a batch file or web form; move higher resolution files into secure repository storage, and publish access copies to streaming servers for viewing on desktop and mobile devices. Media player and content viewing enhancements support easy switching between lower and higher quality versions and between sections of a media file.

Avalon also has an array of access control features to set permissions for management and viewing. Content management tools allow implementers to control permissions at both the unit (top level) and at the level of individual collections, and across three levels of staff user type: manager, editor and depositor. Collection managers can set viewing permissions to limit collection content viewing to individual users or to groups, including groups defined in external systems such as directories utilizing the Lightweight Directory Access Protocol (LDAP). A Learning Tools Interoperability (LTI) connector allows Avalon to integrate with any LTI-compliant system, including Blackboard, Canvas and Sakai learning management systems, to provide secure media viewing for courses.

■ Avalon code – consists of Hydrant Rails App and the Rubyhorn gem. Other pieces are leveraged.
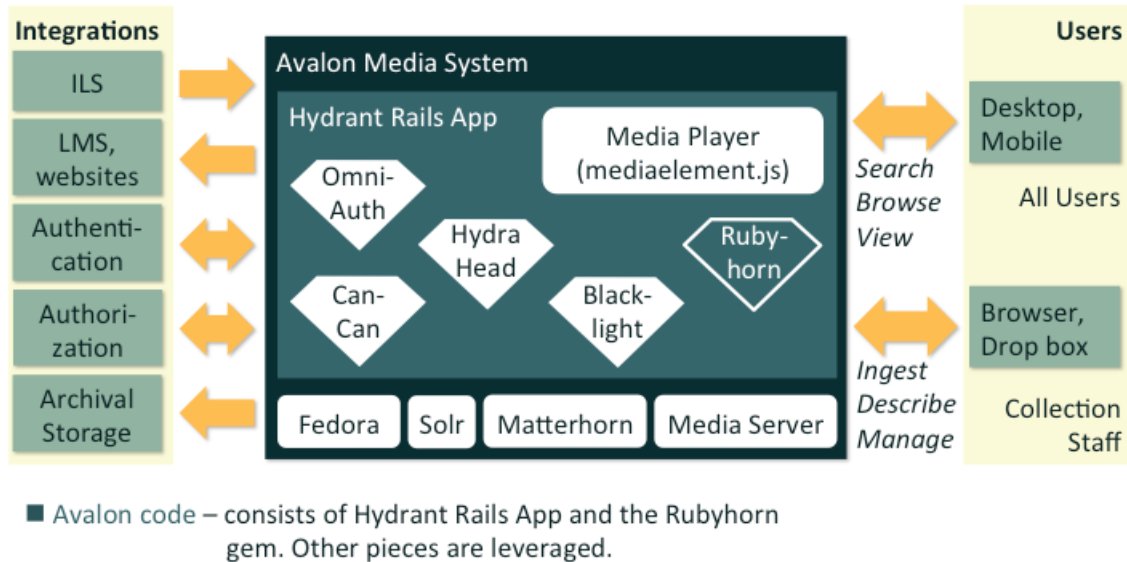
Figure 1. Avalon architecture diagram

Out of the box, Avalon includes the following features:

- Blacklight-based discovery interface for search and simple faceted browse, with additional facets appearing to authenticated users
- Secure media player embedding in external publishing environments such as web content management systems and blogging platforms
- Integration with persistent identifier solutions such as Handles or Persistent Uniform Resource Locators (PURLs)
- Custom selection of still frames for thumbnail display
- Skip-transcode option for items compressed prior to ingestion
- Utilities to support service monitoring and migration from previous versions of the software
- Integration either with a bundled Red5 open source streaming server or an Adobe Media Server. A token-based system has been developed to sit between Avalon and these streaming servers to ensure only an authenticated user with appropriate permissions may access restricted objects.

In addition to development, the IMLS-funded phase of the Avalon project has focused on promotion and outreach for potential implementers of the system. Much attention has been paid to making it easy for other institutions to try out and to install Avalon and its prerequisite software components, including an open test instance hosted by IU, preconfigured virtual machine images, installation scripts, and extensive installation documentation.[11]

Project Scope

The media access services institutions and researchers require can be addressed by the further development of the Avalon software and community. This project proposes to extend Avalon's features based on established needs, to conduct user research to enable better understanding of

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[11] See http://www.avalonmediasystem.org/software

humanities researchers' specific needs, and to invest in development of an engaged Avalon community and a sustainable business model to ensure the future of the project.

Software Development and Integration

With support from IMLS funding, IU and NU have released three major versions of Avalon. The current version, Avalon 3.1, provides the basic feature set (see above) needed for institutional implementation, as exemplified by eight production implementations that have been completed or are currently underway. However, additional features and functionality are required in order to make Avalon fully serve the needs of media collection creators and consumers.

The Avalon team has employed an Agile Scrum software project management methodology to refine and prioritize feature development in a flexible approach that can accommodate both a scheduled set of high-level goals and the ability to make adjustments and refinements as specific needs are uncovered closer to the time that code is actually being written. Using this approach, the project directors, working with the overall project team, establish objectives within the product road map[12] for each six-month period based on the stated goals of the project and feedback on requirements gained from meetings with IMLS grant partners, discussions with prospective adopters, and responses to conference presentations and webinars (see appendix 2 for list). The product owners expand on these higher level goals to write specific scenarios that describe how the software should actually function. Developers and other team members, including metadata specialists and interface designers, then work through these scenarios to build the system. The team works through these tasks on two-week cycles that include testing and feature refinement.

To determine what functionality users of Avalon require and to inform the content and priority of items placed on the product road map, extensive investigations have been conducted by both IU and NU. As part of the original IMLS planning grant for Avalon in 2010, librarians and staff from participating institutions were asked to submit detailed usage scenarios.[13] Some of these scenarios pertain to instructional use, but others describe researcher needs. For example, a scenario from New York University describes details about cross-institutional collaborative research use, surfacing needs such as authentication, open APIs, playlists, and annotation of video. A scenario from Stanford describes time-limited remote researcher access to digitized rare videotape. A WGBH scenario describes the need for referencing and annotating a particular segment of or location in a video.

Beyond this scenario-based approach, Avalon product owners at both IU and NU have met with library staff and researchers to investigate unmet needs. As an example of an item surfaced through these discussions, a history professor at NU is planning an oral history project and noted the need for transcripts and structural metadata editing. In large measure, the end-user functionality planned to be implemented in the course of this project is not discipline-specific but represents features that are important across disciplines and media genres. Researchers regularly ask the team for certain tools and features such as clip-making, playlists and annotations.

The Avalon project team has also continued to take feedback from librarians and staff at conferences and at a meeting of Avalon IMLS grant partners and advisors held in Bloomington in October 2013. These discussions have exposed needs for development work to keep Avalon in line with current expectations from users, library staff, and IT staff. Standards and expectations exist for such features as accessibility, captioning, synchronized transcripts, annotation, and structural metadata. Keeping up with technology is essential to both maintain reliable service and to take

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[12] https://wiki.dlib.indiana.edu/display/VarVideo/Avalon+Release+Road+Map
[13] https://wiki.dlib.indiana.edu/display/VOV/User+Needs+Analysis

advantage of new opportunities to improve the product experience and potential. For example, dynamic adaptive bitrate streaming is an expected experience from our users and will greatly improve playback experience. Features such as APIs are asked for by campus partners in IT at NU and elsewhere or are necessitated by large ingest projects such as the IU MDPI. Project team members regularly talk with current and potential Avalon adopters, as well as those who decide not to use Avalon, in order to understand the expectations of the various stakeholder groups in institutions.

Finally, for Avalon to be appealing as a hosted solution to potential hosting providers, its dependencies have to be simplified so that it is easier to maintain, and its technology base has to be kept up to date. APIs will provide a more flexible means for hosted solutions to offer value to a range of customers beyond the kinds of institutions most closely involved in the creation of Avalon.

The following new sets of functionality will be implemented during the two year timeframe of this grant, listed in planned order of release (see Project Timeline on page 21 for release details) along with estimates of effort for completion.[14] IU and NU plan to continue to work with Avalon implementers and the project's advisory board to refine and adjust development priorities as feedback arises through implementation and use of the system.

Application Programming Interfaces (30 developer weeks)
Avalon implementations are anticipated to encompass many large collections. Although some of these collections may be built up slowly as a result of many small ingests, most of the content is likely to be ingested and managed in large batches. Avalon already has a batch ingest process appropriate for use with dozens or even hundreds of items, but it doesn't scale to thousands of items. Institutions will often want to build customized workflows for content ingest and management to optimize use of network and computing resources. To do this in a maintainable manner, APIs are needed for content ingest, metadata ingest, updating of existing content and metadata, and management of large collections of content. The large ingests enabled by APIs will provide a much larger corpus of media for researcher use.

APIs are also strategically important for the sustainability and success of Avalon. APIs provide a standard and easy way for institutions to integrate Avalon into existing workflows and to build connections with other systems. Avalon needs to develop a community not only of adopters, but contributors who can extend Avalon for their needs and who can make contributions available to others. APIs will also allow hosting providers opportunity to provide value to a wider range of customers.

Dependency Simplification (24 developer weeks)
Avalon currently uses Opencast Matterhorn for its media processing pipeline. As Matterhorn is not a Ruby on Rails application, using Matterhorn therefore adds complexity to the installation and maintenance of an Avalon implementation, requiring a large set of additional technology dependencies. Replacing Matterhorn with a Ruby on Rails solution will remove a barrier to adoption and allow easier customization of media processing in the future. The current plan is to use the Ruby Resque library.

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[14] Estimates are given in "developer weeks," the unit of work achievable by one member of the development team in a work week. A developer week is loaded to include overhead such as vacation, sick time, meetings and other ancillary responsibilities. The estimates for implementation of functionality include time for investigation, design (user interface, metadata, code), coding, testing, debugging, documentation, and refinement.

Access Control Enhancements (20 developer weeks)
To support a fuller range of use cases, the access control features in Avalon will be enhanced to include support for IP restrictions, start and end dates for access controls, and custom URLs with password or access-count features. In addition, support for management of custom access group membership by collection managers will replace the current global group management model.

Structural Metadata Support (40 developer weeks)
Although most content in Avalon repositories will likely be added through batch and automated process, it is important to provide an interactive editor for structural metadata. This editor will allow library and archives staff to correct or add metadata associated with particular time offsets within media files. With these metadata in place, users can navigate media by clicking on tracks, chapters, or other labeled segments.

Playlists and Clip Making (50 developer weeks)
Playlists provide researchers the means of creating a personalized list of media or media clips (excerpts) for study, embedding in online scholarly communication venues, or for other forms of presentation such as conference talks. Clips within a playlist can also be accompanied by user-supplied descriptive text. Playlists can be saved in a user's account and shared selectively using the Avalon access control system.

Annotation (40 developer weeks)
Annotations allow researchers to make contextual comments within media for precise reference, analysis, and explanation. Annotations can be kept private to the user who created them or the annotated version of a video or audio recording can be shared selectively using the Avalon access control system. Annotations will be exportable in a standard reusable format (Open Annotation Specification).

Spotlight Integration Support (24 developer weeks)
Spotlight[15] is a plugin developed by Stanford University for the Blacklight discovery system used by Avalon that supports the creation of custom curated collections of digital items to be presented with additional context and description. Integration of Spotlight with Avalon will allow individuals without programming knowledge to easily create and maintain online exhibits and will allow collection owners to highlight groupings of material and enhance the researcher's experience by adding narrative and context. Although some of the Spotlight integration work will be carried out by a consultant (see Organizational Structure section, below), the IU and NU project team expects to have to provide substantial design, integration, testing, and documentation support to the consultants to ensure a successful outcome.

Synchronized Transcripts (42 developer weeks)
Transcripts for audio and video address important research needs for content-based discovery and rapid navigation in addition to supporting content accessibility. Transcripts can automatically follow the playback or can be disconnected and used for reading ahead (or behind) and jumping to a new location in the media. Discovery is supported both across items (by keyword-indexing with the transcript material) or within an item (searching for the occurrence of a string within a single transcript). Where licensing allows, transcript files should be exportable to a text file for further analysis and study. The project will also investigate whether existing tools designed for transcript synchronization, such as the University of Kentucky's Oral History Metadata Synchronizer (OHMS) could be supported through Avalon APIs or other extensions.

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[15] http://library.stanford.edu/projects/spotlight

Accessible Navigation (42 developer weeks)
Beyond captioning and transcripts, accessibility needs include effective page navigation and use with screen readers. This work will ensure that Avalon is accessible according to the standards of the World Wide Web Consortium and other applicable standards.

Captioning (30 developer weeks)
DVD-based video can contain up to 32 subtitle tracks. The information in these tracks can be captions, but it can also include translations or commentary. Even VHS tapes can support closed captions. Avalon needs to be able to accept caption files, index them for searching, and provide the ability for researchers to optionally display those captions or export captioned content in a text file format for further analysis and study.

Publishing Out to External Media Sites (32 developer weeks)
Some content stored in Avalon will also need to be available in other systems for easier, broader access such as popular internet video hosting sites such as YouTube or institutionally maintained video access systems such as Kaltura. Avalon will offer a configurable publishing interface such that collection owners can easily click and publish media to other media hosting sites.

Additional Embedding Functionality (42 developer weeks)
Current Avalon player embedding relies on use of iframe technology. Not all Web environments of interest to researchers support iframe embedding. Avalon needs to expand to cover a broader range of embedding types.

Dynamic Adaptive Streaming (40 developer weeks)
Avalon currently provides several quality choices that a user manually selects among (high, medium and low for video, high and medium for audio). A player with dynamic adaptive streaming allows users to experience more reliable and consistent playback by detecting the download speed of the user's network connection and automatically delivering an appropriate streaming file, adapting during playback as needed. This not only allows users with lower bandwidth connections better access but also ensures that users with higher bandwidths are experiencing the best quality streaming available for their connection.

Release Planning
The Avalon team works together to plan upcoming releases by grouping together new features into major and point releases. Major releases go through a rigorous process that includes testing, bug fixing, documentation, updating installers and upgrade paths and finally releasing the code via GitHub. Once this is completed the team makes public announcements, offers demonstrations of new work, and participates in providing support for adopters as they upgrade or install Avalon.

Minor (or point) releases have a more lightweight process that allows new features to be released more quickly. Minor and major releases are grouped based on many factors including; feedback from partners and faculty, features that make sense to develop together or in sequence, and features that might necessitate a major technical change in the application.

The team approaches release plans in an agile manner, allowing for a solid path forward but also leaving room to respond to community and user feedback in a timely manner.

Assessment of Scholarly Needs
One of the major motivations for the Avalon project has been to support the needs of humanities researchers for access to and use of time-based media from library and archive collections. Even in the early pilot phases of Avalon, the system was used to provide remote researcher access to restricted media content digitized from the IU Moving Image Archive. However, much of the user research underlying Avalon system development has focused on instructional use cases rather than

research use cases.[16] Instructional use cases often drive initial adoption of a media content management system, but research use cases naturally emerge. Thus one important goal of this project is to fill out the Avalon requirements and implementation such that the system offers robust support for humanities scholarship. As detailed in the previous section, the team already has sufficient information from researchers and the librarians and archivists who support them to identify many of the features required. However, it is not sufficient to know "what" to build; it is also necessary to know "how" the features need to work and how they should be integrated with other systems and features. Thirty years of interactive software development have shown that the best way to develop useful software is to develop with users, not just for users.

Much of the research work on time-based media has concentrated on computer science methods and objectives: automatic generation of segmentation or diagrammatic representations, computational analysis of media (music, speech, moving image), or information storage and retrieval based on such automated analyses of content (e.g., query by humming). These approaches are sometimes of interest to humanists but represent more of an exercise in what computers are good at rather than providing computational support to the sorts of description and analysis humanists have traditionally undertaken with time-based media.

Indiana University, which will take the lead on the user needs investigation, has a substantial history investigating the needs of scholars working with media. The Variations2 project,[17] supported by an NSF/NEH Digital Libraries Initiative grant in the early 1990s, produced, as part of its tool suite, the Variations Audio Timeliner, which allows point-and-click, researcher-authored visualization and annotation of recorded sound (see figure 2 below). The design for the Timeliner grew out of investigations into the traditional, paper-based representations drawn and annotated by music scholars. Diagrams produced by the Timeliner have appeared in research articles.[18]
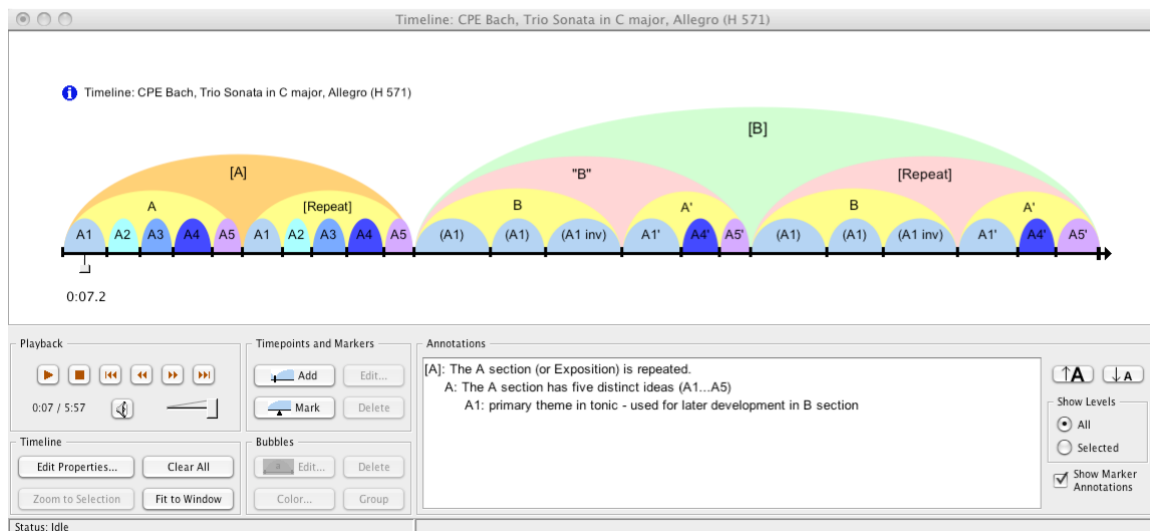

Figure 2. An annotated visualization of recorded sound using the Variations Audio Timeliner

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[16] https://wiki.dlib.indiana.edu/download/attachments/511779322/VoVtechnicalreport-VideoUX.pdf

[17] http://variations.indiana.edu/research

[18] See, for example, http://dl.acm.org/citation.cfm?id=2026263

With respect to video, the Mellon-funded EVIA Digital Archive project, carried out at IU in collaboration with the University of Michigan, worked with ethnomusicology scholars to build tools and processes suited to their research needs, including segmentation and annotation of field recordings and peer review of video annotations. A screen shot of the EVIA Annotator's Workbench is shown in figure 3.
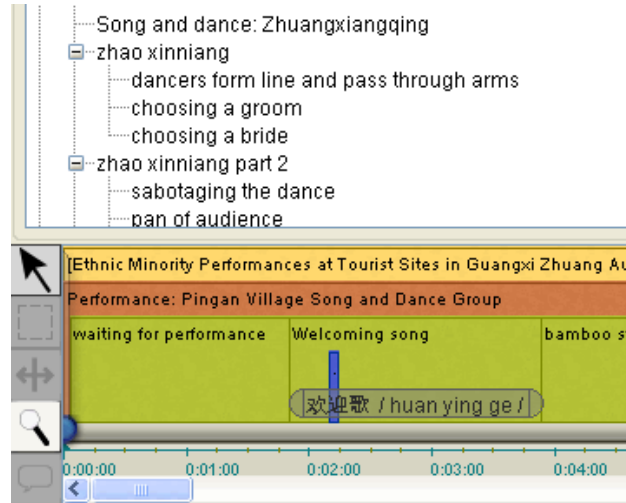

Figure 3. Detail from the *Annotator's Workbench* software application

The user research that contributed to the Variations and EVIA projects is now over a decade old. New technologies, emerging modes of scholarly communication, and new humanities research directions necessitate a refreshed understanding of the needs of humanist scholars working with time-based media.

The proposed user research will be multi-method, though primarily ethnographic in character. Initially the project team will identify at least two disciplines for focus, such as music theory, ethnomusicology, or film studies. Disciplines for focus will be selected based on conversations with library and archives media staff at IU and NU, who will identify researchers who make heavy use of audio or video analysis in their research. Conversations with these researchers will enable us to select a set of researchers for focus who represent a wide range of media research use cases and are willing to work with us during the grant. Project staff will conduct a content analysis of published research in those disciplines to examine emerging practices for referencing, analyzing, describing, and presenting time-based media in scholarly communication. Staff will also conduct contextual interviews (*in situ* observations accompanied by interviews) with researchers in those disciplines to understand the goals, opportunities, and current barriers to scholarly use that could be effectively removed by the Avalon features specified in this proposal or others. Feedback from these researchers as well as from the library and archives staff who support them will help ensure the successful implementation of the features in this proposal as well as the effective planning of new features to be developed beyond this project.

Results of the user research will support the objectives of the grant as follows:

1. User research will help us ensure that the way new features described in the previous section are implemented fits well with scholars' needs. User research will include putting new Avalon functionality from this grant period in front of researchers who will then provide suggestions for refining or expanding on those new capabilities. That feedback will then be analyzed for further improvement opportunities, either within the grant period or

subsequently. Refinements (changes to the way features are implemented or the addition of small features such as an additional button or option) can be addressed within the grant period, as the time estimates for feature development include time for the iteration and refinement necessary to all effective software development. However, as it is usual for user research to generate a broad range of findings, some of which may be too large to fit within the scope of the proposed work (for example, integration with newly emerging annotation tools from a specific discipline), there will almost certainly be discoveries of new opportunities that will have to be addressed by resources additional to the grant. Regardless of when they are addressed, findings from user research will be documented in a report, both to provide a record of the refinements the need for which was uncovered by the research, and to track requirements for potential future Avalon development work following the grant period. The refinements within the grant period can be carried out as the need for them is discovered rather than the work having to await the writing of the final user research report.

2. The findings will also be helpful in communicating the value of Avalon for research to potential Avalon adopters, distinguishing Avalon from other solutions that do not take into account research use cases.

Business and Sustainability Model Development

One of the primary goals at the end of the two-year project is to have Avalon on a sustainable footing for maintenance and future development. To help ensure this outcome, the project will undertake work in the following areas:

1. *Business model development*: The project team, under the lead of the Project Director and working with an outside consultant, will develop a budget for the resources required to sustain ongoing Avalon software development, maintenance, support, and community engagement, and an outline of revenue sources and amounts required to fund the budget. The consultant will be selected based on experience in working with other open source projects in higher education on issues of sustainability strategy. Members of the project team have engaged in preliminary discussions with staff at Ithaka S+R to help scope this work. An examination of models used by other open source and community source projects, including the recent changes announced by the Kuali Foundation, will be a key component of this work.

2. *Engagement with a community host:* The Avalon project team has already engaged discussions with leadership at DuraSpace and the Apereo Foundation, both of which indicated a willingness to work with Avalon to explore acceptance into their incubation programs for open source products. Based on criteria of 1) fit with the community of current and likely Avalon adopters, 2) cost, and 3) compatibility with approaches being taken by other relevant software communities, e.g., Hydra, the PIs, working with the business planning consultant, will identify and enter into an agreement with an organization to provide financial and other project services to Avalon, potentially in partnership with the Hydra project.

3. *Establishment of a sponsorship/contribution program and governance structure:* At this point, one significant source of revenue is expected to be recurring financial contributions or sponsorships from adopting institutions. Based on the business model developed with the consultant and working closely with a hosting organization, the project team will define sponsorship levels and an accompanying governance structure that ensures engagement of sponsors in appropriate advisory and decision-making roles relative to their investment in the project. A structure for soliciting and supporting in-kind contributions of staff resources will also be an integral part of the Avalon sustainability model.

4. *Development and implementation of a hosted Avalon service offering* to increase the adoption base and help generate revenue to support the project (see below)

Hosted Service Offering

While IU and NU have put a great deal of effort into making Avalon and its prerequisite software components easy to install, not every institution that has need for the features Avalon provides will have the server or IT staff resources to implement and support it. In discussions with potential adopters, even some larger institutions have indicated an interest in being able to subscribe to a cloud-hosted instance of Avalon that could be used to deposit and make content available without having to devote their own system administrator and developer resources to its installation, maintenance, customization, and technical support. This project will create, implement, and pilot test a hosted Avalon software-as-a-service (SaaS) offering that will run either in a commercial cloud solution such as Amazon Web Services or out of IU's Internet2-connected data center.

The project plans to identify at least three institutions to pilot and evaluate the hosted service offering. If the pilot test is deemed successful by the participating institutions and feasible by potential hosting providers, IU will seek to continue offering hosting as an ongoing service to be made available to other institutions either directly by IU or through a third-party partner. Options for paid support offerings for local installations of Avalon will also be explored as part of the discussions with potential third-party partners.

Support Requested

The above tasks can be accomplished through a combination of software development support, user experience resources, consulting assistance, and community development activities. The funding for all of these will enable Avalon to become a sustainable system and community.

The primary partners, IU Libraries and NU Library, have resources in place to direct the work and conduct some of the development and user experience activities. However, current development and user experience resources must be supplemented to accomplish the above tasks. In addition, the transition from a grant-funded to a community-supported model requires the retaining of external business development expertise as well as support for the travel required to grow and support an Avalon community.

To accomplish the goals of this proposal, the project requests funding in six areas, costs of which are further detailed in the Budget Narrative:

- Salary and benefits for software developers to augment base funded resources contributed by IU and NU for development of new features and functionality for Avalon based on the existing Avalon road map
- Salary and benefits for a half-time DevOps Engineer to work with developers and system administrators to engineer and deploy a hosted Avalon service
- Salary and benefits for a half-time Community Manager to maintain engagement with Avalon partners, implementers, and hosted service customers
- Consultants to assist with 1) business planning to outline costs and potential revenue sources, select a community host organization, and develop a sponsorship program; 2) business planning to establish cost and revenue models for an Avalon hosted service; and 3) integration of Avalon with Spotlight
- Stipends for faculty and graduate students to support their participation in contextual studies of scholarly use of media
- Wages for project assistants to assist in project management, faculty needs assessment, marketing, and communications

- Travel to support project meetings and participation in and promotion of Avalon in the open source repository development community, audiovisual archives community, and library community

Project Activities

Through a combination of the resources requested in this proposal and resources committed by IU and NU, we propose to carry out the following activities during the two-year project period:

1. Ensure Avalon's suitability for a wide range of media access use cases, including teaching and learning, research, and archival collections, by developing additional features based on demonstrated needs of Avalon partners and implementers and the existing Avalon product road map.
2. Conduct studies of scholarly use of audio and video collections by researchers in at least two disciplines using contextual inquiry methods; use these results to guide future feature prioritization and communicate the value of Avalon to institutions supporting humanities scholars. Candidate disciplines might include music theory, ethnomusicology, and film studies.
3. Integrate Stanford University's Spotlight exhibit extension for Blacklight with Avalon to allow librarians, archivists, and faculty to showcase and provide context for media items and collections delivered through Avalon.
4. Develop and implement a community-funded business model for sustaining ongoing support and development of Avalon, in alignment with the other key open source components used by Avalon: Hydra, Fedora, Blacklight, and Opencast Matterhorn. As a component of implementing a business model, identify and engage with a nonprofit open/community source foundation to provide and coordinate project services and activities.
5. Deploy Avalon in a software-as-a-service model, to be hosted in the IU data center and/or an external cloud environment such as Amazon Web Services, to be made available to other institutions through a buying channel such as Internet2's Net+ Services program.

Organizational Structure

The project will be managed by the Indiana University Libraries, under the direction of Jon Dunn as project director and co-principal investigator, in partnership with Northwestern University Library. Northwestern University will serve as a subgrantee to IU, with work at NU directed by Sarah Pritchard as co-PI and Julie Rudder as Northwestern project director. The software development and release process will be carried out by a joint IU-NU team through use of the Agile Scrum software development project management methodology, an approach that has proven to be very successful during the IMLS-funded portion of Avalon's development over the past three years. The team makes use of daily standup meetings and biweekly development review and planning meetings conducted via videoconferencing, as well as semiannual in-person meetings to review status and conduct near-term and strategic planning.

IU expects to contract with consultants for work in three areas: 1) business and sustainability planning for ongoing development and support of Avalon; 2) business planning for establishing a hosted software-as-a-service (SaaS) Avalon offering; and 3) integration of Stanford University's Spotlight exhibits tool with Avalon. IU and NU have conducted initial scoping discussions with potential consultants Ithaka S+R to develop a preliminary plan and cost estimate for areas 1 and 2 and Data Curation Experts to develop a cost estimate for area 3. Final selection of consultants and

awarding of contracts will be carried out in accordance with IU's standard procurement practices and the Foundation's *Guidelines for Grants Involving Consultants and/or Subcontractors*.

An advisory board of approximately six members will be established for the two-year duration of the project, with representation drawn from Avalon implementers, the Hydra community, the media archives community, media library community, university IT community, and scholars using media in their research. Potential members who have confirmed their willingness to participate on the advisory board include:

- Howard Besser, Director, Moving Image Archive and Preservation Program, Tisch School of the Arts, New York University
- Karen Cariani, Director, Media Library and Archives, WGBH Educational Foundation
- Tom Cramer, Chief Technology Strategist and Associate Director of Digital Library Systems and Services, Stanford University Libraries
- Scott Spicer, Media Outreach and Learning Spaces Librarian, University of Minnesota

Two additional participants will be identified by the beginning of the grant period: 1) a scholar using media in his or her research, and 2) a senior university IT leader.

An in-person meeting of the advisory board will be conducted in Bloomington during the first six months of the project in order to gain input from participants on project priorities and strategies, and quarterly meetings will be held by telephone or video conference to update board members on progress and seek additional feedback.

Existing Staff

Jon Dunn, Director of Library Technologies at Indiana University, will serve as Principal Investigator and 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 Principal Investigator, Project Director, or Project Manager on numerous grant projects funded by IMLS, NSF, NEH, and the Andrew W. Mellon Foundation, including the IMLS-funded Variations on Video / Avalon Media System planning and implementation grants and the Variations3 project (both as Principal Investigator), NSF/NEH-funded Variations2 project (Project Manager), and Mellon-funded Integrating Licensed Library Resources with Sakai project (Principal Investigator). He also served as Lead Technical Investigator for the Mellon-funded Ethnomusicological Video for Instructional Analysis Digital Archive project.

Julie Bobay, Associate Dean for Collection Development and Scholarly Communication at Indiana University, will serve as Principal Investigator and will contribute to the business model and community development activities, with a focus on engaging additional sponsors, and will serve as liaison to IU's Media Digitization and Preservation Initiative, for which she serves as Director of Library Operations.

Sarah Pritchard, Dean of Libraries and Charles Deering McCormick University Librarian at Northwestern University, will serve as Principal Investigator, providing overall institutional support and direction, and will contribute to the business model and sustainability activities. She will also champion the project within NU and serve as senior liaison to partner organizations at NU, including Northwestern University Information Technology, on repository and media services planning.

Julie Rudder, Digital Initiatives Project Manager at Northwestern University, will serve as Northwestern Project Director and Product Owner, responsible for coordinating functional requirements for the project and setting functional priorities for development. She will oversee

project direction and priority setting, in collaboration with Dunn, and will oversee financial management of NU's work on the project. She will coordinate the team of technical staff managing the production deployment of Avalon at Northwestern, and will be the key liaison to central IT staff managing Canvas and other campus media systems. She will be the key Northwestern contact for activities around assessing scholarly needs. She has served as co-Product Owner for the IMLS-funded phase of Avalon and formerly managed all aspects of public services in the Digital Collections department.

D.J. Hoek, Acting Associate University Librarian for Special Libraries and Head, Music Library at Northwestern will serve as a special advisor to the project. The Music Library and Digital Collections departments at Northwestern have been key partners in providing streaming music and opera video services to the campus, and Music Library staff are core Avalon Media System users. In his role as Head of the Music Library, D.J. will be able to commit additional staff resources to the project for testing, outreach for recruiting faculty users, and feature design conversations.

Mark Notess, Head of User Experience and Digital Media Services in the IU Libraries, will serve as IU 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 serve as IU's Product Owner (as defined by the Agile Scrum software development methodology) responsible for coordinating functional requirements for the project and setting functional priorities for development. Notess served as Project Manager for both the NSF/NEH-funded Variations2 and IMLS-funded Variations3 digital music library projects and as Product Owner for the Avalon Media System IMLS project.

Michael Klein, Senior Software Developer (NU), will serve as development lead for Northwestern, and primary technical liaison to the devops and system administration staff for Northwestern's production implementation. Klein has been a member of the Avalon development team for the past two and a half years, and is an active participant in the Hydra committers group. Klein previously worked on a number of Hydra development projects at Stanford University, including the Argo workflow management system.

Brian Keese, Multimedia Application Developer (IU), is a full-time programmer/analyst assigned to the Avalon project. Brian joined the Avalon team in April 2014, bringing twelve years of web and application development experience from industry and higher education. Prior to joining the Avalon team, Brian had previously worked on digital library projects, including development of data provider tools for the IMLS-funded IU/UCLA Sheet Music Consortium project and technical leadership for IU's VIVO pilot implementation.

Leah Lee, Digital Media Services Programmer/Analyst (IU), develops and supports media-related applications for the IU Libraries. Her primary assignment is on the Avalon team, where she contributes to software development and is the primary technical support contact. She is also responsible for maintenance and technical support on the Variations digital music library. Leah joined the Avalon team in July 2013, with previous programming experience at IU and in industry.

Cynthia Ramlo, User Experience Designer (IU), conducts user research and designs user interfaces for the IU Libraries. She joined the IU Libraries in 2013 and has been an active member of the Avalon team in addition to supporting other projects. Cynthia brings broad experiences in web design, usability, interaction design and instructional design. She meets regularly with researchers and other users to understand their requirements and ensure that system design addresses real needs.

Stefan Elnabli, Moving Image and Sound Preservation Specialist (NU), will serve as Service Owner for Avalon at Northwestern. Stefan oversees all of the film, audio and video collections digitization projects at Northwestern, and will be the key liaison between the project team and curators, archivists, and production staff. He will also coordinate testing and lead compression and codec selection and will assist with metadata requirements and specifications gathering. He is also responsible for storage forecasting and planning for Northwestern's audiovisual digitization program.

Carolyn Caizzi, Acting Head of Digital Collections (NU), will contribute service and design support to the project. Caizzi supervises all of the production and public services staff who are the primary users of the system, and will assist Rudder and Elnabli in providing timely feedback on usability of existing and emerging features. She will also assist Rudder in identifying NU faculty to participate in scholarly needs assessment. Caizzi also supervises and directs the work of three digital project librarians, including Elnabli, and serves as product owner for Northwestern's other Hydra development project, the Digital Image Library. Prior to her arrival at Northwestern in 2012 as the Assistant Head of Digital Collections, Caizzi served as Digital Initiatives Librarian at Yale University.

Julie Hardesty, Metadata Analyst (IU), will contribute to metadata decisions and design in system implementation.

Brian Wheeler, Lead Systems Engineer (IU), will contribute to design and implementation of the hosted service offering.

Karen Miller, Metadata Specialist (NU) will contribute to metadata decisions and design in system implementation.

Jim Bottino, DevOps Engineer (NU) will to contribute to design and implementation of the hosted service offering. Before he came to Northwestern, Jim worked as a Senior Cloud DevOps Engineer for Ex Libris. Prior to that he worked for 12 years at Motorola Labs where he maintained a complex variety of Unix and Linux systems.

Dan Zellner, Multimedia Services Specialist (NU) supervises the Digital Collections production staff and operations. He will lead Avalon testing activities at Northwestern.

Grant-Funded Staff

Chris Colvard, Programmer/Analyst (IU), will serve as the IU development lead and technical architect on the project. Chris has been involved in Avalon from its inception, supported with funding from the IMLS grant, and previously worked on the Variations digital music library, having joined the IU Libraries in 2006.

Two **Senior Programmer/Analysts** (IU, NU) will carry out feature design, development and testing for Avalon.

The **DevOps Engineer** (IU) will bridge the gap between developers and IT operations staff both at Avalon-implementing institutions and in the project's implementation of the hosted Avalon service in IU or commercial cloud provider infrastructure, to ensure that Avalon is implementable, supportable, and maintainable at scale across a variety of implementation models. The engineer will ensure appropriate uses of automation to enable rapid deployment and robust change management.

The **Community Manager** (NU) will be responsible for working with partners and other potential Avalon adopters at other institutions. The Community Manager will have virtual and in-person meetings with these organizations, channeling feedback and feature requests to product owners

and project directors. He or she will work closely with the Consultant and the PIs to develop the business model, and will direct project outreach and marketing activities, host webinars, and contribute significantly to documentation and to product information on the Avalon web site.

Project Timeline

<u>January-June 2015</u>
1. Hire and appoint project staff: Senior Programmer/Analyst, DevOps Engineer, Community Manager, Project Assistants (Dunn, Notess, Rudder)
2. Select and contract with business planning consultant (Dunn, Rudder)
3. Convene project advisory board meeting in Bloomington (Dunn, Bobay, Pritchard, Rudder)
4. Engage in discussions with prospective project hosting organizations (Dunn, Rudder, Business Planning Consultant)
5. Develop technical implementation plan for hosted Avalon pilot (DevOps Engineer, Wheeler, Bottino)
6. Develop, test, and release Avalon version 5 with new functionality (IU and NU team)
   a. APIs
   b. Dependency Simplification
   c. Access Control Enhancements
   d. Structural Metadata Editing
7. Implement Avalon for MDPI at IU (Dunn, Notess, Lee, DevOps Engineer, Wheeler)
8. Identify faculty and graduate students for needs assessment (Notess, Rudder, Hourly Project Assistants)
9. Present Avalon at conferences and participate in Hydra community meetings (IU and NU team)

<u>July-December 2015</u>
1. Conduct project team meeting in Bloomington (IU and NU team)
2. Develop cost model (Dunn, Rudder, Pritchard, Business Planning Consultant)
3. Enter into agreement with project hosting organization (Dunn, Rudder, Pritchard)
4. Implement technical environment for hosted Avalon service offering pilot (DevOps Engineer)
5. Solicit pilot participants for hosted Avalon service offering (Dunn, Rudder, Notess)
6. Contract with consultant for Spotlight integration and carry out development work (Dunn, Notess, Rudder)
7. Develop, test, and release Avalon version 6 with new functionality (IU and NU team)
   a. Playlists and Clip Making
   b. Annotation
   c. Spotlight Integration Support
8. Conduct researcher needs assessment (Notess, Hourly Project Assistants)
9. Present Avalon at conferences and participate in Hydra community meetings (IU and NU team)

<u>January-June 2016</u>
1. Develop sponsorship program and begin inviting founding sponsors (soft launch) (Dunn, Bobay, Pritchard, Rudder, Business Planning Consultant)
2. Formally announce sponsorship program (Dunn, Bobay, Pritchard, Rudder)
3. Conduct pilots of hosted Avalon service offering and write report on results and recommendations for moving forward (Notess, Rudder, DevOps Engineer)
4. Develop, test, and release Avalon version 7 with new functionality (IU and NU team)
   a. Synchronized Transcripts

          b.   Accessible Navigation
          c.   Captioning
5. Analyze and supplement needs assessment, creating and prioritizing new Avalon requirements (Notess, Rudder, Hourly Project Assistants)
6. Write report on researcher needs assessment (Notess)
7. Present Avalon at conferences and participate in Hydra community meetings (IU and NU team)

<u>July-December 2016</u>
1. Conduct project team meeting in Evanston (IU and NU team)
2. Continue marketing sponsorship program and soliciting sponsors (Dunn, Bobay, Pritchard, Rudder)
3. Transition hosted service offering from pilot to production service (Dunn, Notess, Rudder, DevOps Engineer)
4. Develop, test, and release Avalon version 8 with new functionality (IU and NU team)
          a.   Publishing Out to External Media Sites
          b.   Additional Embedding Functionality
          c.   Dynamic Adaptive Streaming
5. Present Avalon at conferences and participate in Hydra community meetings (IU and NU team)

Expected Outcomes and Benefits

The Avalon Media System is a critical component of the media preservation and access strategies at both the Indiana and Northwestern University Libraries and other Avalon partner libraries. Media collections must enjoy the same curation and preservation services universities and cultural heritage institutions are putting in place for printed works, research outputs, and other content of enduring value. Avalon is the open source, standards-based solution that brings together best practices in sustainable repository management with a suite of discovery, description, security and teaching and research tools designed for time-based media. This project will support a crucial set of activities to ensure Avalon's future by creating a governance model to better integrate community needs and community support and a business model to support ongoing development of core features.

The software development will result in four new major Avalon software releases, one every six months over the two years of the project. These releases will deliver additional functionality in the areas of APIs, access control, structural metadata, annotation, online exhibits, transcripts, accessibility, captioning, publishing to external sites, embedding, and dynamic adaptive streaming. Further details are included in the Project Scope and Project Timeline sections above. A report will be produced that summarizes the results of the researcher needs assessment activities, with a detailed and prioritized list of features for future development.

This project will also support implementation of a hosted Avalon service, expanding the community of potential adopters to include organizations choosing not to run the software on local infrastructure.

Intellectual Property

The Avalon Media System has been developed as open source software, released under version 2.0 of the Apache License, which allows for open use, reuse, and adaptation of the code for both commercial and non-commercial purposes. The Apache 2.0 license was selected because of its use by the Hydra community and the fact that it has been widely adopted and is widely understood

within the open source world. Similar permissive licenses are used by the Fedora repository (Apache 2.0) and Opencast Matterhorn (Educational Community License 2.0) systems on which Avalon currently depends.

The Avalon project team is aware of the Kuali Foundation's recently announced shift to the GNU Affero General Public License (AGPL), which requires anyone who redistributes a modified version of the software or uses a modified version of the software as part of a hosted software-as-a-service (SaaS) offering to make their modifications available under the same license. This has the potential to either increase sharing of enhancements by commercial partners with the broader community or to decrease interest by prospective commercial partners due to additional restrictions on reuse.

Initial releases of Avalon during this project will continue to be covered under the Apache 2.0 license. The project team will explore licensing options as part of its discussions with its advisory board, potential community project hosts, SaaS providers, implementers, and the Hydra community during the course of the first year of the project, and the PIs reserve the right to move future releases to AGPL if that change is deemed beneficial to the project, subject to the terms of the intellectual property agreement between the Foundation and IU.

Development will take place in an open Git repository on GitHub.com and distributions of source code, executables, and installers will also be made available via the project website.[19]

Sustainability

Indiana University Libraries and Northwestern University Library have both made long-term commitments to support of Avalon that are independent of grant funding. At IU, this is demonstrated by an ongoing base commitment of 2.20 FTE to Avalon support and development and a strategic commitment to use Avalon as a component of its Media Digitization and Preservation Initiative. At Northwestern, Avalon is the primary media service solution for time-based media. In addition to ongoing infrastructure and baseline Avalon staff support commitments, continued funding support will be maintained for development, system administration, media preservation and metadata analysis.

As noted above, the source code for Avalon will continue to be released as open source and developed in an open GitHub repository.

The strength of current interest and adoption of Avalon beyond IU and NU and the activities of the project focused on developing a long term business model, governance structure, hosted service offering, and organizational home for Avalon will contribute significantly to Avalon's likelihood for continued adoption, investment, and sustainability as a software platform and community.

Reporting

Indiana University, working with Northwestern University, will provide the Mellon Foundation with interim and final reports according to the schedule specified in the award letter received from the Foundation. PI and Project Director Jon Dunn will have responsibility for ensuring completion of these reports, in collaboration with Indiana University's Office of Research Administration, which will take the lead on the financial portion of the reporting. Narrative reports will comment on and provide context for the financial reporting.

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[19] http://avalonmediasystem.org/

In these reports, project progress will be assessed in relation to the project timeline outlined in this proposal. Project success will be evaluated based on completion of project goals and deliverables and also on the following metrics: 1) number of institutions evaluating Avalon; 2) number of institutions adopting Avalon; 3) quantity of audio and video content hosted and served by Avalon instances; 4) number of institutions and individuals contributing code, testing, documentation, or other services to the Avalon project; 5) number of institutions contributing financial resources for Avalon development and support; 6) amount of financial resources contributed; and 7) number of faculty and students using Avalon for scholarly and teaching applications.