

Indiana University Digital Library Program

Variations3: An Integrated Digital Library and Learning System for the Music Community

Abstract

The Indiana University Digital Library Program proposes to create a digital music library and learning system that can be easily deployed at a wide range of college and university libraries with minimal technical support and minimal cost to the institutions. By offering a complete environment in which students and faculty can discover, listen to, view, annotate, and interact with music, this system will integrate access to online recordings and scores into teaching, learning, and research activities. The project builds on Indiana University's successful history in digital music library development and responds to the keen desire of music libraries large and small to operate similar systems.

Specifically, we seek funding from the Institute of Museum and Library Services to take the successful experimental *Variations2* system developed at Indiana University with research grant funding from the National Science Foundation, and use it to create and evaluate a turnkey digital music library system, *Variations3*, that will serve to transfer the knowledge we have gained to the nationwide library community. By identifying and working with four institutions as test sites, who will implement and test the system locally, we will determine how this digital music library system can offer the maximum benefit to music libraries and the varied constituents they serve. When the project is complete, music libraries around the country will be able to offer their patrons opportunities to easily search for and locate musical works, listen to online music recordings, view scanned scores, view and play back encoded scores, segment and play back specific parts of the music, and create annotations in the form of a visual timeline that corresponds to the music. Because flexibility is a key component of the system, institutions will be able to integrate online music from licensed subscription services with music they digitize themselves.

This “digital music library in a box” will respond to the teaching and learning needs of large academic libraries, small colleges, and music conservatories, many of which have expressed enthusiastic support for the digital music library now in place at Indiana University. With the results of this IMLS-funded project, such institutions nationwide will be able to introduce, expand, or upgrade their current digital music offerings in a way that provides new benefits to their users. For example, students now able to merely listen to digitized music in their library will—with the nationwide release of IU's system—be able to see the score of that music on their own computers, annotate it, and use an online visualization tool to compare one performance to another. The system will serve undergraduate students (music majors and non-majors alike); music researchers, including faculty and graduate students; music librarians; authors of learning materials; lifelong learners; and teachers.

The system will rely heavily on metadata for its operation, therefore streamlining the metadata creation process is essential to the system's widespread adoption by the nation's music libraries, who already spend a great deal of time and money creating descriptive metadata in MARC format. The system now in place at Indiana, despite the benefits it offers, will not be sustainable in a production environment if manual “re-cataloging” is required for all items loaded into the system. Consequently, streamlining metadata creation is a paramount objective of this project, and we will investigate methods for collaborative metadata creation and automatically locating and importing metadata from outside sources.

As a previous recipient of IMLS National Leadership Grants, Indiana University is well qualified to execute this project, which advances the IMLS goals to support the creation, use, preservation, and presentation of significant digital resources as well as the development of tools to manage digital assets. As defined in the Building Digital Resources funding category, this project will 1) “help individuals and organizations manage, present and/or use digital assets through authoring, annotation, personalization, or other tools;” and 2) “test, or develop and test, service models for sustaining digital assets.”

Variations3: An Integrated Digital Library and Learning System for the Music Community

1. Assessment of Need

Over the past several decades, information technology has become an essential part of how libraries with music collections deliver services and collections to their users. Online catalogs allow users to search and browse information about music collections in an electronic environment. Electronic reserves systems allow students to view course readings from any place at any time. Special collections digitization projects provide access to valuable historical collections of musical scores and recordings. Online sound recording reserves services offered by an increasing number of libraries allow students to complete listening assignments more easily and study for exams without waits and hassles. And, subscription music services offer rights-cleared access for libraries to a growing number of sound recordings and supplemental materials.

To a great degree, however, all of these systems merely translate existing modes of access (search the card catalog, then listen to or view the item) into electronic form, albeit with the greater convenience of online networked delivery. Similarly, virtually all of the new consumer-oriented commercial online music services such as iTunes, Rhapsody, and Napster2.0 target entertainment, not pedagogy, and are generally lacking in classical repertoire. None of these systems takes advantage of the full power of technology to go beyond mere access to information and offer new capabilities for teaching, learning, and research. Even with these technological advances, music students and faculty have not been able to transform routine listening assignments that traditionally involve studying a printed score while listening to a recording. While library reserves and recording desks have increasingly launched streaming audio reserves services, most projects are limited to a small subset of sound recordings, with no mechanism for viewing scores with recordings. Furthermore, the extent of access to these services varies across institutions due to uncertainty over the bounds of fair use and other copyright exceptions and a lack of practical licensing mechanisms for educational use of music.

These sound recording reserve services typically rely on a streaming server containing excerpts of sound recordings digitized by library staff, with basic web pages or a simple database for access. In some cases, a commercial electronic reserves system (such as Docutek E-Res) or the reserves module of a library management system is used as the front end. In a 2002 study, Richard Griscom discovered that the audio streaming format used by music library staff engaged in digital audio projects varied between RealAudio (67 percent), QuickTime (18 percent), Layer II or III of MPEG-1 (11 percent), Windows Media Audio (2 percent), and Shockwave Audio (2 percent).¹ Since that time, internet-based subscription services, such as the commercial Naxos Music Library² and Classical Music Library,³ and the non-profit Database of Recorded American Music⁴ from New York University and New World Records have emerged as viable alternatives to local collections of digital content, suitable for some but not all libraries because of their limited repertoire.

These subscription services provide basic access to a set of online recordings, and in some cases offer value-added capabilities such as bookmarking of content. However, it is unlikely that any one of these services can offer all of the sound recordings necessary for a given course, let alone for an entire music program. Thus librarians still must integrate content from their own local collections with these multiple services in order to provide access to reserve sound recordings. Such work is labor intensive for library staff, and forces faculty, students, and library staff to contend with multiple inconsistent user interfaces and functionalities to complete or create even simple listening assignments.

¹ Richard Griscom, "Distant Music: Delivering Audio Over the Internet," *Notes* 59.3 (2003): 521-541.

² <http://www.naxosmusiclibrary.com/>

³ <http://www.classical.com/>

⁴ <http://dram.nyu.edu/>

Variations2

Over the past four years, with funding from a Digital Libraries Initiative – Phase 2 grant from the National Science Foundation and the National Endowment for the Humanities, Indiana University has developed an experimental digital music library system known as *Variations2*.⁵ Building on IU's past experience in creating the original *Variations*,⁶ one of the world's first digital music library systems, *Variations2* provides a complete environment in which students and faculty can discover, listen to, view, annotate, and interact with music. The *Variations2* system offers the following functionality:

- A user interface for searching and browsing a database of information on musical composers, performers, compositions, recordings and scores (both images and music notation).
- Tools for playing back sound recordings and viewing scores from the library and creating bookmarks to points of interest in each
- Tools for creating and saving visual annotations to scores and creating audio annotations in the form of a visual timeline.
- Tools for students or instructors to create customized lists of musical excerpts for study or in-class presentation, in the form of playlists.
- Tools for students or instructors to create listening quizzes using excerpts in playlists.
- The ability to link to recordings, scores, bookmarks, playlists, timelines, and score annotations from web pages or a web-based course management system.

The current *Variations2* system has been developed as a Java client-server application. The system uses MPEG-1 layer 3 (MP3) and MPEG-4 AAC audio formats, delivered using Apple's QuickTime for Java and open source Darwin Streaming Server. The DjVu format is used for compression of musical score images. The IBM DB2 relational database system, running on Linux or IBM AIX, stores and indexes metadata.

Together with the development of the *Variations2* system, we have carried out a program of research work in metadata and have developed a music-specific metadata model using entity-relationship analysis, based on similar principles to those developed in the Functional Requirements for Bibliographic Records (FRBR) report⁷ from the International Federation of Library Associations and Institutions (IFLA). This model supports dramatically improved functionality for searching and browsing of digital music collections over that of traditional Online Public Access Catalogs (OPACs) that offer searching of bibliographic records in the MARC format, and provides for linking of multiple representations of the same musical work at a structural level. Using these structural links, scores and recordings can be synchronized upon playback, and two recordings or two scores could be analyzed side-by-side to enable detailed comparison. We make use of some information imported from existing MARC bibliographic and authority records to create and populate metadata records in *Variations2*, but significant manual cataloging is required in the current system.

The *Variations2* system was developed primarily to support digital library research in a number of areas, including music pedagogy, intellectual property, metadata, and human computer interaction. However, while *Variations2* was developed as an experimental system, we are currently adapting it so that it can be placed into production at IU in May 2005. Even then, it will require a fair amount of hands-on management that is currently only possible at Indiana, where the system's developers reside.

It is clear from the consistent communication we receive that many libraries, of all sizes, public as well as academic, are interested in implementing a system like *Variations2* for their clientele. However, the current *Variations2* system is tied to the technical and service environment of Indiana University, and additional work is required to turn it into a system that can be distributed to and used by others.

⁵ <http://variations2.indiana.edu/>

⁶ <http://www.dlib.indiana.edu/variations/>

⁷ <http://www.ifla.org/VII/s13/wgfrbr/finalreport.htm>

Summary of Needs

The needs this project proposes to address can be summarized as follows:

- Libraries need an easy way to provide digitized music content to their patrons. Current methods are generally a clumsy patchwork of minimal tools, yielding an environment that is hard to use and in many cases difficult to maintain.
- Library patrons need a simple, consistent way to discover and listen to digitized audio from a variety of sources, including library collections and subscription services. Current methods are inconsistent, not integrated, and poorly suited to music content.
- Students need annotation and visualization tools to help them learn with digital music content. Current digital tools provide access only.

2. National Impact and Intended Results

This project builds upon a national exemplar system, *Variations2*, that has evolved over the past decade at Indiana University and makes it easy for other libraries to replicate and participate in the successful large-scale delivery of music content online. The project will reduce the cost of deploying a high-quality digital music library while increasing the ease and usefulness of access. The resultant turnkey system can then be inexpensively and effectively deployed by other institutions.

The existing *Variations2* software already provides analytical and annotation tools for use with both library content and personal recordings or scores stored on users' own computers. Virtually all music students and teachers who see these tools demonstrated immediately ask about how they can get them. This project extends the benefit of those tools to a much larger number of institutions and individuals by supporting the market research and business planning necessary to provide for their long-term support and maintenance.

The system's scalability will offer needed flexibility to a very broad range of institutions. Large music libraries with adequate resources may choose to invest in creating rich cataloging data to support improved discovery of music content, sharing the metadata with other institutions. Other libraries may simply use the system to provide streaming audio in a simple, secure, pedagogically useful environment, integrating a small amount of their own holdings with material from one or more subscription services, providing access through their existing OPAC. This system will scale to meet the needs of educational and cultural institutions both large and small.

The complex and difficult issue of intellectual property keeps some institutions from granting online access to locally digitized music content although most do provide some level of access, according to their interpretation of current copyright law. With its flexible access control mechanisms, this system will let institutions operate at their own comfort levels. For example, some institutions may feel comfortable allowing students to access course reserves from off campus providing they are registered for a given course. Other institutions may need to restrict access to on-site patrons. Yet other institutions may have material in the public domain for which they wish to provide open access. This system will support any of these access control models and will not require institutions to switch to new software when their policy changes.

This project will seed a community of user institutions who can share best practices, drive requirements for future versions, and creatively collaborate to improve the system in a way that a single institution, however inventive, cannot hope to achieve.

3. Project Design and Evaluation Plan

Project Goals

The goals of this project are:

1. To develop a turnkey digital music library system, known as *Variations3*, based on the basic technology platform of *Variations2*, that integrates access to local and licensed music content and provides tools for use of music in research, teaching and learning
2. To implement and evaluate a work-based metadata model, as part of the system, that supports improved access to musical information for users
3. To implement this system at Indiana University and at four test sites of varying characteristics
4. To establish a model for distribution, support, and continued development of the system.

Project Activities

To achieve these goals, we plan to engage in activities in a number of areas:

System Development

Through conversations with music librarians, information technology staff, and others at institutions outside of IU during the course of the *Variations2* project, we have identified four major requirements for making *Variations3* an attractive digital delivery solution for a wide range of music libraries. We plan to focus our software development on four requirements:

1. ***Variations3 must fit into institutions' existing technology environments.*** We will adapt *Variations2* to run on a wider variety of server operating system and database platforms. As noted earlier, the *Variations2* server is written in Java and currently runs on Linux and IBM AIX servers with the IBM DB2 relational database system. We plan to focus on adapting it to a free open-source database platform such as MySQL and to run on the Windows and Mac OS X operating systems. We will also migrate more of the client functionality from a Java desktop application to a web browser-based interface, to ease support and installation issues. In addition, we must ensure that it is easy to link to resources in *Variations3* from within other evolving technology environments used in teaching and learning, including course management systems⁸ and electronic portfolio systems.
2. ***Variations3 must be reliable and require a minimum of IT staff time to implement and maintain.*** Currently at Indiana University, the system is supported by its developers, but for deployment beyond IU, we must create improved administration, logging, statistics, diagnostic, and repair/recovery tools, as well as documentation for administrators to help them install, configure, manage, and troubleshoot the system.
3. ***It must be easy for music libraries to make their locally digitized content available through Variations3.*** Tools for “ingestion” of sound recordings and metadata into the system must be easy to use and require a minimum amount of time and effort on the part of library staff. In addition, the search interface in *Variations2* should be improved in *Variations3* to allow searching across both traditional MARC and *Variations3* metadata (see Metadata section below), so that institutions may selectively enhance portions of their metadata for improved search and browse capabilities, while not requiring extensive staff time for metadata creation as a prerequisite to taking advantage of many of the other features of *Variations3*.
4. ***Music libraries must be able to provide access to content from subscription music services alongside local content through a common interface.*** We have an agreement with New York University and New World Records, the creators of the Database of Recorded American Music (DRAM), to engage in mutual work to integrate access to DRAM through *Variations3*, and we have had preliminary contacts with commercial subscription music services aimed at libraries, including Naxos Music Library and Classical Music Library, about the need to offer a consistent interface across such services.

In the course of the project, we will work towards meeting all of these requirements, engaging in discussions with the test sites to determine development priorities. As with any software development effort, there will be many more requirements and suggestions than we can address within the resource constraints of this project. It will

⁸ Such as Sakai: <http://www.sakaiproject.org/>

therefore be essential to follow a rigorous but open prioritization process. This process will involve test sites in successive refinements of development priorities and will require continual progress reports. We plan to release three versions of the software over the course of the three-year project. Year One will focus on increasing the flexibility, reliability, and manageability of the system and on implementing support for an updated metadata model. Year Two will focus on integrating access to one or more subscription services and on building new tools to support more efficient metadata creation. In Year Three, we will implement additional features throughout the system based on test site feedback from use during Year Two, and we will work on implementing access to additional subscription services.

Systems development work will follow the same user-centered design approach taken by the *Variations2* project, basing requirements and design on observed user behavior, and validating designs and implementations through lab-based testing, field studies of actual use, and usage log analysis. A multiple-method approach to user-centered design provides a rich picture of user needs. From this data, we develop an overall vision and set of use scenarios that guide design decisions for all areas of systems development, including the end-user interface, metadata tools, and the administration interface.

Metadata

Today's music library users typically access collections, both digital and physical, through OPACs using the MARC record format. However, searching for musical materials in OPACs can be problematic, due to both OPAC design and the structure and contents of the MARC bibliographic record itself. As part of our research on the *Variations2* project, we have developed a music metadata model, and a corresponding user interface for access, that allows musicians to search for musical scores and recordings using terms and concepts familiar to them, to easily view all of the scores and recordings of a given musical work available in the system, to easily navigate through the sections of a score or recording, and to play and page through a recording and score of the same work in sync with each other.

While we have demonstrated that the *Variations2* metadata model provides improved discovery capabilities for users,⁹ we have been able during the course of the project to create only a limited amount of metadata in the *Variations2* format, as its creation has proven to be extremely resource-intensive. Long-term success of the *Variations2* metadata model depends on the ability for libraries to create metadata records with a minimal amount of human effort and on developing workflows to allow *Variations2* metadata creation to occur together with existing cataloging and digitization processes.

We have identified two major areas of work necessary for *Variations3* to be able to continue to offer the enhanced discovery capabilities achieved in *Variations2*, while simultaneously improving the ability of libraries implementing the system to achieve these benefits with minimal effort. These areas are:

Align the Variations2 descriptive metadata model more closely with the IFLA FRBR model: Sustainability of the metadata model will require closer integration with standard descriptive practices in libraries. During the initial months of the project, we will make recommendations for changes to the *Variations2* model in order to better align it with the model developed in the Functional Requirements for Bibliographic Records (FRBR) report of the International Federation of Library Associations and Institutions, based on final *Variations2* project documentation, and on comments from music catalogers and FRBR experts.

Further streamline the process for creating records: Metadata creation workflows must be more seamlessly integrated with existing cataloging and digitization activities. In *Variations3*, we will investigate several approaches to streamlining the descriptive and structural metadata creation process and allowing further integration with a MARC cataloging workflow:

⁹ <http://variations2.indiana.edu/pdf/V2SearchUsabilityReport12-03.pdf>; <http://mypage.iu.edu/~mnotess/ECDL/ecdl-04-reprint.pdf>

1. **Maximize automated mapping of data from MARC Bibliographic and Authority records into Variations3 records.** This mapping has been a challenge in the *Variations2* project due to conflicts between the work-centered nature of the data model and the centrality of the bibliographic item in MARC cataloging. However, recently developed “FRBR-izers,” algorithms converting MARC records describing bibliographic items to FRBR records describing both abstract and concrete entities,¹⁰ could improve MARC to *Variations3* mappings and thus allow us to make better use of existing library-created metadata. We will also expand current mappings to make better use information in MARC contents notes and in records created using pre-AACR2 cataloging practices and obsolete MARC fields.
2. **Implement a cooperative cataloging workflow.** Sharing metadata records among multiple institutions would create a critical mass of records for core works, thus significantly reducing the time it takes to add a new recording or score of a given work into the *Variations3* system. A phased cataloging approach could be developed whereby certain institutions create core records with only minimal fields completed, and other institutions build on these to create enriched records. To support cooperative cataloging, we will need to develop either a centralized database of records, modeled after bibliographic utilities such as OCLC or RLIN, or a completely distributed model of sharing records between institutions. In addition, we will explore the potential of making records available in an XML format via the Internet to other interested parties for research purposes.
3. **Experiment with import of metadata from non-library sources.** Structural metadata, while essential to enabling user navigation in *Variations3* or other digital library systems, is largely missing in machine-processable form in MARC records. We plan to investigate methods for automatically locating and importing structural metadata not generally available in library metadata records from outside noncommercial and commercial sources, such as MusicBrainz¹¹ and GraceNote CDDB.¹²
4. **Experiment with allowing end-users to enrich basic metadata with their own contributions.** All metadata in the *Variations2* project was created by project staff, most of whom are metadata specialists. While each record type in the data model has a core set of required fields, there are many other fields in the model that exist to enhance the research value of the system but are of lesser value for discovery. Staff expert in both music and metadata should continue to generate this core metadata to provide the minimal-level record required for appropriate discovery of the work and its container. The uniformity of description this expertise provides, however, may not be necessary for other parts of the metadata model. In *Variations3*, we will experiment with user-contributed metadata for certain elements of the data model (e.g., date of composition, measure-level linking of a score to a recording), possibly along the lines of a Wiki.¹³ Models varying the level of expert vetting of this user-enriched metadata could be compared to find an optimal balance between quality of metadata and the cost of its creation.

In addition to work on improving our model and processes for creation of descriptive and structural metadata, we plan to work on improving the system’s ability to automatically create technical metadata (for tracking characteristics of digital objects for long-term maintenance) and administrative metadata (allowing more complete reporting functionality).

Deployment and Evaluation at Test Sites

We plan to solicit four test sites, representing a variety of institution types from small colleges to conservatories to large research universities, to participate with us in this project. To date, we have commitments from two sites: the

¹⁰ The two FRBR-izers currently available are the FRBR display tool from the Library of Congress <<http://www.loc.gov/marc/marc-functional-analysis/tool.html>> and the FRBR work-set algorithm <<http://www.oclc.org/research/projects/frbr/algorithm.htm>> from OCLC’s Office of Research.

¹¹ <http://www.musicbrainz.org/>

¹² http://www.gracenote.com/gn_products/cddb.html

¹³ See, for example, the Wikipedia: <http://www.wikipedia.org/>

Tri-College Consortium in the Philadelphia area (Haverford, Bryn Mawr, and Swarthmore Colleges) and Ohio State University. At the time of proposal submission, we are in discussion with a number of other sites regarding potential participation. (Please see attached letters of support.)

IU staff will assist in the installation of the *Variations3* system at each of the four sites, providing training to library and IT staff as well as ongoing technical support and advice, and assistance in upgrading to new versions as they are released. Each test site library has committed to loading and making available to its patrons a sufficient amount of digitized sound and/or score content to evaluate the system from both a staff and user perspective. A site may choose to load content that has already been digitized or to digitize new content for this project, but funding for digitization is outside the scope of this proposal.

Test sites will also receive training, documentation, and ongoing consultation from IU on the use of the metadata model implemented in the *Variations3* system. Each site will create *Variations3* descriptive and structural metadata records for a portion of the scores and recordings that they load into the system, to be shared with IU and the other participants, and provide feedback on their experiences in order to help us evaluate the *Variations3* data model and metadata tools.

Through experience gained with the test sites, we will gain a broader perspective on the needs of both administrators and users of the system, and will use the input gained to help us prioritize new features and changes to existing features that are necessary for the system to be successfully used at a wide variety of institutions.

Sustainability of Variations3

Throughout the course of the project, we will engage in discussions with our test site institutions and with others in the library community to explore models for sustaining development of *Variations3* past the time span of IMLS funding. We will solicit input from stakeholders using a variety of different means, including focus groups, contacts with relevant professional communities (including the Music Library Association), e-mail/web surveys, or telephone interviews, and will use this data to help us evaluate, select, and implement an option for continued development and support of the *Variations3* software platform.

These options include an open source or community source development model such as those being established for the Sakai course management environment and DSpace institutional repository system, a consortial model, or a membership/subscription model such as that used by the University of Michigan for its DLXS digital library software.

Relationship to Other Projects

This project will serve to complement the growing number of projects focused on the digitization of musical score and sound recording collections by developing a system that can serve as an effective delivery mechanism for the integration of such collections into the teaching, learning, and research environment. Such related projects include: the Johns Hopkins University Digital Audio Archives Project, focused on researching efficient procedures for high quality audio capture; the McGill Audio Preservation Project, focused on developing an efficient workflow for the digitization and delivery of phonograph records; the Database of Recorded American Music, a partnership between New York University and New World Records to digitize and make available New World's extensive catalog of recordings of American music; and the Chopin Early Editions project at the University of Chicago, which has digitized a collection of over 400 first and early printed editions of works by Frédéric Chopin.

This project also complements and enhances the benefits of commercial efforts, such as Naxos Music Library and the Classical Music Library service offered by Alexander Street Press, by seeking to provide a common interface across such services that allows music libraries to easily integrate multiple subscription services with local content into a seamless environment for their users.

Metadata in *Variations3* will be similar in many ways to other emerging entity-relationship models for bibliographic information. The IFLA FRBR report has emerged over the last few years as a catalyst for re-thinking traditional

bibliographic data, with the goal of improving end-user discovery of library materials. The next version of the Anglo-American Cataloging Rules, scheduled for publication in 2007,¹⁴ will use FRBR terminology, further establishing entity-relationship modeling as the core of bibliographic description in libraries. In addition to the existing *Variations2* metadata model, entity-relationship models for music materials also exist at the Cité de la Musique in Paris and at the British Library Sound Archive. Such models are now developing to a point where it is reasonable to begin thinking about how best to bring them together.

Evaluation Plan

As noted earlier, the goals of this project center on the development of a digital music library and learning system and metadata model that can be deployed at a wide range of institutions and have a sustainable life past the time span of this grant.

We plan to evaluate our success towards meeting these goals using a variety of techniques: First, we will measure our success in developing a system that provides the functionality described in this proposal. Secondly, we will look at the level of adoption by the test sites, measured in terms of metrics such as number of scores and sound recordings made available, number of metadata records created, and the number of students, faculty, and staff who are using the system. Thirdly, we will use surveys and other tools to evaluate user satisfaction on the part of faculty, students, librarians, and IT staff at the test sites. Finally, we will look at the intent of the institutions participating as test sites to continue use of the system past the period funded by this grant, as well as interest by other institutions who wish to implement the system.

We will evaluate the benefits to end-users of the *Variations3* metadata model by performing user studies analyzing discovery of music materials in the *Variations3* system in comparison to discovery in traditional MARC catalogs. We will measure the time it takes to create the various types of metadata in *Variations3* format and seek feedback from test site staff creating metadata in the system to determine if the actions taken to improve the speed of metadata creation are sufficient for the metadata model to be sustainable in production environments.

Several members of the project team have attended IMLS training in Outcome-Based Evaluation. Additional members of the project team will be funded to attend this training. We will use the methods we learned there to develop measurable indicators of the project's success and impact.

4. Project Resources

The project will be managed by the Indiana University Digital Library Program, with additional participation from staff in IU's Cook Music Library. The Digital Library Program is a partnership between the IU Libraries and University Information Technology Services, and is able to leverage the resources 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 the past IMLS-supported Hoagy Carmichael Collection and Charles W. Cushman Photograph Collection digitization projects, and the current IMLS-funded IN Harmony sheet music digitization project and Digital Audio Archives Project (the latter under subcontract to Johns Hopkins University).

Personnel

Existing Indiana University staff will play a major part in the project, and are contributed as cost share:

Jon Dunn, Associate Director for Technology in the IU Digital Library Program and Senior Technology Advisor to the Dean of University Libraries, will serve as Project Director, responsible for overall project direction and financial management of the project. He has worked with digital music libraries at IU since 1994, first in the Music Library, and since 1997, in the Digital Library Program. He currently serves as Lead Technical Investigator and Executive Investigator / Project Manager for the NSF-funded *Variations2* digital music library research project, as

¹⁴ <http://www.collectionscanada.ca/jsc/current.html>

Project Manager for the IU portion of the IMLS-funded Digital Audio Archives Project, and as Technical Manager for the IMLS-funded IN Harmony sheet music digitization project.

Phil Ponella, Director of the IU Cook Music Library, will serve as Co-Project Director, providing leadership in setting functional priorities for development of the system and coordinating the engagement of test sites and others in the music library community. Prior to his arrival at IU in August 2004, he led Academic Technology Services at the University of Rochester. There he led the units who assisted faculty and students with the integration of new technologies into teaching and learning. He led programs in the area of intellectual property and copyright as part of the first implementation of Napster2.0 at a private university, and taught classes in the Eastman School of Music's Institute for Music Leadership. He will continue to work with faculty in their use of the pedagogical tools and with intellectual property and copyright experts regarding this project.

Mark Notess, Software Development Manager in the IU Digital Library Program, will serve as Development Manager for this project, overseeing requirements gathering, specification, design, and development of the *Variations3* system, and supervising the development staff hired on this grant. Mr. Notess will also contribute to work on market research and evaluation of options for sustainability of the *Variations3* system. He has served as Development Manager for the NSF-funded *Variations2* project at IU for the past two years, and prior to that has worked in development management and usability roles at Hewlett-Packard, Agilent Technologies, and UNext, an online education company.

Jenn Riley, Metadata Librarian in the IU Digital Library Program, will oversee metadata-related research and development work on the project, focusing particularly on continuing to develop the *Variations3* data model to meet user and library needs, including the development of automated means of reusing metadata from existing data sources. She will supervise the Metadata Graduate Assistant and an additional student employee. She serves on the Metadata team on the *Variations2* project, and holds a B.M. and an M.A. in music in addition to an M.L.S.

Harriette Hemmasi, Executive Associate Dean in the IU Libraries, will serve as a consultant in the area of metadata; she is currently a project investigator in metadata on the NSF-funded *Variations2* project. **Kristine Brancolini**, Director of the IU Digital Library Program, will serve as a consultant in intellectual property matters and will assist with overall project management. **Suzanne Thorin**, Ruth Lilly University Dean of University Libraries, will assist with development of test site relationships and evaluation of sustainability models and will assist with promotion of project activities and results within the broader library community. The Digital Library Program's System Administrator (position currently vacant) will provide server administration support for development servers at IU and will assist test sites with setup of their *Variations3* servers. **Emma Dederick**, Electronic Resources Librarian in the Cook Music Library, and **Kara Alexander**, Digital Media Specialist in the IU DLP, will both work to assist test sites with use of the system and in developing digitization specifications and procedures for loading existing digitized content into the *Variations3* system

Budget

Existing IU staff from the Digital Library Program and Music Library contributing to the project will be cost shared, along with additional funding for equipment and hourly student assistance.

Two programmer/analysts will be hired with IMLS funding to carry out the system design and development work proposed, one position focusing primarily on front-end user interface issues and the other on back-end server issues. One graduate assistant will assist the development team with usability and user interface design, and one graduate assistant will assist with metadata research and development work. We are also requesting funding from IMLS to support travel to and from test sites and to conferences for dissemination of project results, and for consultants to provide expert review and input on our metadata model, market research approach, and sustainability models. Additional details are available in the budget narrative.

Test Sites

Staff at the four project test sites will contribute by providing input on functional and technical requirements for deployment and use of the *Variations3* system at their institutions, and by installing and using the *Variations3* system in a pilot test mode, placing audio and score content in the system and creating and contributing metadata records to be shared with IU and other participants.

IU project staff will communicate with librarians, IT staff, and faculty and student users at the test institutions via e-mail, telephone, and in person. IU staff will conduct one visit to each test site during the first three months of the project and another set of visits at the end of the first year to install the system. Thereafter, additional visits to and from test sites will be conducted as necessary to support the use of the system and gather additional feedback on system and user requirements and user satisfaction, and to evaluate options for sustainability.

Participating test sites will benefit by having early access to the *Variations3* software, direct technical support from the system developers, input into system requirements and development priorities, and by receiving server hardware on which to deploy the system. IU will benefit by obtaining valuable information on the requirements for use of *Variations3* at other institutions, so that we may develop the system in a way that allows it to be adopted by many other libraries nationally.

A fifth institution, New York University, will work with IU development staff on the integration of access to the Database of Recorded American Music service, which includes the catalogs of New World Records and several additional labels, into the *Variations3* system.

5. Dissemination

A project web site will be created to provide a program description and portfolio of documents and related materials. All programmatic and evaluative activities of the project will be posted there throughout the duration of the project, including a final evaluation report at the conclusion of the project.

Findings will be presented at appropriate scholarly and professional conferences and published in relevant journals. Investigators and staff of the NSF-funded *Variations2* grant have published and presented frequently.¹⁵ At the conclusion of the project we will provide access to *Variations3* software through a model to be determined by the sustainability investigation.

6. Sustainability

Indiana University has made a commitment to providing ongoing baseline support for digital library services through its Digital Library Program, as one of ten major priorities in the University's Information Technology Strategic Plan. 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.

The *Variations3* software will be maintained and supported by the Indiana University Digital Library Program unless an outcome of this project is the creation of a separate consortium or other organization tasked with development, maintenance, and support. Depending on the outcome of the market research portion of this grant, the software may also be "open sourced" so that it is freely available to anyone who wishes to examine or use it.

The key to sustainability is to create something so valued that people insist on sustaining it. The market research and business planning work described in section 3 of this proposal are the most important means of ensuring the ongoing availability of the system for broad use.

¹⁵ A complete listing of publications, conference papers, and presentations associated with the *Variations2* project may be found at: <http://variations2.indiana.edu/papers.html>