

Fedora and the Preservation of University Records
Final Narrative Report

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INTRODUCTION

The Digital Collections and Archives (DCA), Tufts University, in conjunction with Manuscripts and Archives (MSSA) of Yale University Library, has completed its National Historical Publications and Records Commission (NHPRC) electronic records research grant project (2004-083). The project combined electronic records preservation research and theory with digital library practice to investigate three primary areas of research: requirements for trustworthy recordkeeping systems and preservation activities, ingesting records into a preservation system, and maintaining records in a preservation system. While the Tufts-Yale Project is aimed at university archivists and focuses primarily on university records, the findings are not university-specific and are easily applicable to the management and preservation of electronic records in many industries.

PROJECT DELIVERABLES

The Tuft-Yale Project team produced twelve reports and one prototype ingest application. All project deliverables are available through the project website at

<<http://dca.tufts.edu/features/nhprc>>.

1.1 Project Overview

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00001>

An introduction to the project and outline of reports

1.2 System Model

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00002>

A description of the components that comprise a recordkeeping system, preservation activities, and the relationship between recordkeeping systems and preservation activities

1.3 Concerns

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00003>

Nine attributes implicit in all requirements of the Requirements for Trustworthy Recordkeeping Systems and the Preservation of Electronic Records in a University Setting, and all the steps in the Ingest Guide and the Maintain Guide

1.4 Glossary

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00004>

Definition of terms used throughout all project reports. Most capitalized words in the project reports are terms defined in the Glossary

1.5 Requirements for Trustworthy Recordkeeping Systems and the Preservation of Electronic Records in a University Setting

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00005>

Requirements for trustworthy recordkeeping systems and requirements for preservation activities

2.1 Ingest Guide

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00006>

A guide defining the necessary steps for a trustworthy Ingest process and a description of the resources needed to operate this process in a semi-automated manner. In addition to the Guide's PDF version, a web version exists at

<<http://dca.tufts.edu/features/nhprc/reports/ingest/index.html>>

2.2 Ingest Projects

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00007>

An examination of three ingest projects undertaken according to the Ingest Guide

2.3 Ingest Tools

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00008>

A description of the Ingest tools examined and developed by project staff, including the Tufts Ingest Prototype System (TIPS), which is available at

<<http://dca.tufts.edu/features/nhprc/reports/tips/index.html>>. TIPS is available as two files: TIPS-alpha1-nolib.tgz which includes source code and documentation without the library dependencies and TIPS-alpha1.tgz which includes source code and documentation with most of the library dependencies

3.1 Maintain Guide

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00009>

A guide defining the necessary steps for a trustworthy maintain process

3.2 Checklist of Fedora's Ability to Support Maintain Activities

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00010>

A description of abstract services needed to support steps described in the Maintain Guide and an analysis of Fedora's ability to support these services

4.1 Analysis of Fedora's Ability to Support Preservation Activities

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00011>

An overview of Fedora's ability to support services needed for preservation activities and Fedora's current and potential role in records preservation

4.2 Conclusions and Future Directions

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00012>

A general discussion of project findings and opportunities for building on the work of this project

Supporting Documents

The following documents concern the Tufts-Yale Project but are not products of the Project:

Project Narrative

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00013>

Revised Plan of Work

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00014>

Interim Narrative Report

January 31, 2005

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00015>

Interim Narrative Report

August 24, 2005

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00016>

Interim Narrative Report

February 27, 2006

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00017>

Final Narrative Report

December 22, 2006

<http://dl.tufts.edu/view_pdf.jsp?urn=tufts:central:dca:UA069:UA069.004.001.00018>

PROJECT DISSEMINATION

All project deliverables are freely available through the project website at

<http://dca.tufts.edu/features/nhprc>. Since September the website has received 1,971 hits.

The project staff gave the following presentations on the project:

- Eliot Wilczek, “Helping Jumbo Remember: Fedora and the Tufts University Institutional Repository,” Institutional Repositories: Models and Approaches, a NELINET Seminar, January 27, 2005. The presentation briefly described the grant project.
- Kevin Glick and Eliot Wilczek, “Fedora and the Preservation of University Records,” ECURE: Preservation and Access for Digital College and University Resources, Arizona State University, March 1, 2005. The presentation focused on Requirements for Trustworthy Recordkeeping and Preservation.
- Kevin Glick, “Fedora and Institutional Repositories,” Meeting of the Information Technology Interest Group and Conservation Interest Group of the ACRL New England Chapter, March 18, 2005. The presentation briefly described the grant project.

- Kevin Glick, Robert Dockins, and Eliot Wilczek, “Researching Fedora’s Ability to Serve as a Preservation System for Electronic University Records,” Fedora Users’ Conference, Rutgers University, May 14, 2005. The presentation focused on Requirements for Trustworthy Recordkeeping and Preservation and the Ingest Guide.
- Eliot Wilczek, brief update on the grant project, Electronic Records Section meeting at the Society of American Archivists conference, New Orleans, August 19, 2005.
- Eliot Wilczek, “Preserving Electronic Records at Tufts University,” International Council on Archives, Section on University and Research Institution Archives Seminar (ICA/SUV), Michigan State University, September 7, 2005. The presentation focused on the grant project’s Requirements for Trustworthy Recordkeeping Preservation and the Ingest Guide.
- Eliot Wilczek, “Institutional Repositories: It’s Not Just the Technology,” New England Archivists Conference, Boston College, March 11, 2006. The presentation reviewed the general findings of the grant project.
- Kevin Glick, Eliot Wilczek, and Robert Dockins, “The Ingest and Maintenance of Electronic Records: Moving from Theory to Practice,” Poster Presentation, Joint Conference on Digital Libraries, Chapel Hill, North Carolina, June 11-15, 2006. The poster summarized the Ingest Guide and the Maintain Guide.
- Kevin Glick, Eliot Wilczek, and Robert Dockins, “The Ingest and Maintenance of Electronic Records: Moving from Theory to Practice,” Poster Presentation, Fedora Users Conference, University of Virginia, June 19-20, 2006. The poster summarized the Ingest Guide and the Maintain Guide.
- Kevin Glick, “Shared Responsibility for Electronic Recordkeeping and Preservation: Yale University,” International Council on Archives, Section on University and Research Institution Archives Seminar (ICA/SUV), Reykjavik, Iceland, September 13-20, 2006. The presentation reviewed the general findings of the grant project.

The project staff published the following article about the project:

- Kevin Glick, Eliot Wilczek, and Robert Dockins, “Fedora and the Preservation of University Records Project,” *RLG DigiNews*, Volume 10, Number 5, October 2006. http://www.rlg.org/en/page.php?Page_ID=20987

The project staff announced the release of the project deliverables in the following venues:

Listservs

- Archives and Archivists
- Records Management
- Electronic Records
- Canadian Archival

- Fedora Users

Publications

- *D-Lib*, Volume 12, Number 10, October 2006, <<http://www.dlib.org/dlib/october06/10inbrief.html#NEWS>>.
- *The Academic Archivist* [College and University Section, Society of American Archivists], Volume 24, Number 1, Fall 2006/Winter 2007, <<http://www.archivists.org/saagroups/cnu/aa-fall2006.pdf>>.
- *Manuscripts Repositories Newsletter* [Manuscripts Repositories Section, Society of American Archivists], Fall 2006, <<http://www.archivists.org/saagroups/mss/fall2006.asp>>

The announcements read as follows:

The Manuscripts and Archives department, Yale University Library, and the Digital Collections and Archives, Tufts University are pleased to announce the completion of the “Fedora and the Preservation of University Records Project.” Funded by the United States National Historical Publications and Records Commission (NHPRC), the project combined electronic records preservation research and theory with digital library practice to investigate three primary areas of research: requirements for trustworthy recordkeeping systems and preservation activities, ingesting records into a preservation system, and maintaining records in a preservation system. While the Tufts-Yale Project is aimed at university archivists and focuses primarily on university records, the findings are not university-specific and are easily applicable to the management and preservation of electronic records in many industries.

The project is releasing twelve reports and an ingest prototype tool. The reports fall into four groups: introduction, ingest, maintain, and findings. All reports and the ingest prototype tool are available in the Reports and Findings section of the project website <<http://dca.tufts.edu/features/nhprc/>>.

During the course of the grant the principal investigators, Kevin Glick and Eliot Wilczek, became members of the Fedora Preservation Working Group <http://www.rlg.org/en/page.php?Page_ID=20987>. Membership in this group enabled Glick and Wilczek to learn more about Fedora, especially its organization of its core and surrounding service frameworks. This experience informed the development of the grant project, especially the Maintain Guide, the Checklist of Fedora’s Ability to Support Maintain Activities, and the Analysis of Fedora’s Ability to Support Preservation Activities. Conversely, the grant project has influenced the work of the Fedora Preservation Work Group. In particular the Checklist of Fedora’s Ability to Support Maintain Activities and the Analysis of Fedora’s Ability to Support

Preservation Activities reports have helped provide the Working Group and the broader Fedora community with a framework for developing Fedora-based preservation services.

Several archivists and records professionals have indicated to Glick and Wilczek that they have made use of the project's findings. In particular, a state university has made considerable use of the final and draft versions of the Requirements for Recordkeeping and Preservation and the Ingest Guide while developing its institutional repository.

PROJECT ASSESSMENT

Original Objectives and Plan of Work

At the beginning of the project the principal investigators outlined the following plan of work

<http://dca.tufts.edu/features/nhprc/reports/0_1_final.html>:

- 1 Articulate functional requirements for active recordkeeping systems that will transfer records to an archival repository.
- 2 Articulate functional requirements for archival repository preservation systems.
- 3 Articulate the Ingest Electronic Records process.
 - 3.1 Develop a step-by-step guide to the interaction between university archives and records producers.
 - 3.2 Develop simple tools to facilitate the transfer of electronic records from producer to archive.
 - 3.3 Undertake six producer-archive projects.
- 4 Articulate the Maintain Electronic Records process.
 - 4.1 Draft a step-by-step guide for the Maintain Electronic Records process.
 - 4.2 Undertake six Maintain Electronic Records projects.
- 2 Report findings / critique Fedora.
- 3 Future work and related grants / implement findings.

This plan of work translated into the following objectives:

- Establish requirements for electronic recordkeeping at Tufts and Yale.
- Establish requirements for records preservation and develop a preservation metadata set for those requirements. Develop a schema for the preservation metadata set and a tool for collecting metadata.

- Develop an ingest process and define procedures to implement ingest within the context of universities like Tufts and Yale.
- Implement a simple version of Fedora and test sample records sets.
- Produce a report on Fedora's ability to serve as an electronic records preservation system and propose future developments to interested parties.
- Institute the first three objectives listed above as university-wide procedures.

Establish Electronic Recordkeeping Requirements at Tufts and Yale

This work centered on project staff developing functional requirements for active recordkeeping systems and archival preservation systems. At the start of the grant project, the principal investigators vastly underestimated the difficulty of this task. Initially, they thought this would be largely a matter of compiling requirements from electronic records projects completed in the past fifteen years and selecting the requirements most appropriate for a university setting. This work ended up being some of the most difficult and complex of the project. Challenges the project team faced included:

- Settling on an appropriate framework for the recordkeeping and preservation requirements
- Setting the two requirement sets within the records life-cycle and records continuum models
- Determining the concerns that cut across all requirements
- Articulating the relationship between the recordkeeping and preservation requirements

The main product of this work is the Requirements for Trustworthy Recordkeeping Systems and the Preservation of Electronic Records in a University Setting report. It contains two sets of requirements: one for trustworthy recordkeeping systems and one for preservation activities. The report is directly supported by the System Model and Concerns reports. The project team engaged Nancy McGovern, formerly of Cornell University and currently of the Inter-University Consortium for Political and Social Research, as a consultant for the project. She provided invaluable help on formulating the structure and configuration of the requirements.

Tufts is currently using the recordkeeping and preservation requirements articulated in Requirements for Trustworthy Recordkeeping and Preservation to establish the policies its needs

for the Tufts Digital Repository. The requirement set essentially gives the Digital Collections and Archives (DCA) a metric for determining the repository's policy gaps. The DCA is also exploring opportunities to use the requirements to guide the development of new recordkeeping systems at Tufts or evaluate existing systems at the University.

Yale University is utilizing the recordkeeping requirements in its selection activities to identify issues with active electronic information systems that may not be able to set aside authentic records that can be preserved by the University Archives. Yale is also using these requirements as they begin to more centrally offer electronic records management services through central IT and the University Archives. Yale is using the preservation requirements as they begin implementation of a central Yale University Library digital repository and implementation of a new collection management system in Manuscripts and Archives, to ensure that digital preservation issues are considered and met.

Establish Preservation Requirements & Develop Preservation Metadata Set

Originally the project team planned on creating separate reports for the recordkeeping requirements and the preservation requirements. The project team ended up producing a single report that included both requirements sets for recordkeeping and preservation, as described above. The requirements for preservation activities provide a framework for implementing a preservation metadata set.

The DCA is exploring options for using a preservation metadata set, including PREMIS. The DCA is also investigating ways to develop or adapt some of the machine-readable resources described in the Ingest Guide. Many of these resources, such as Record Type Records and Producer Records would manifest themselves as metadata schemas. These metadata schemas would be part of a framework of preservation metadata. The DCA's plans for developing a method for capturing preservation metadata in a scaleable manner is tied to its creation or adoption of resources described in the Ingest Guide. Finally, The DCA is using the preservation requirements to determine its policy gaps in the Tufts Digital Repository.

Since March 2006, the Yale University Library has been working to identify digital preservation metadata requirements. YUL established a Preservation Metadata Task Force and has decided to adopt the PREMIS model as the basis for preservation metadata for its digital information assets. Two metadata element sets, a base set and a full set, along with corresponding schemas, have been proposed and accepted. Work on a tool to efficiently collect and or create such metadata has begun.

Develop Trustworthy Ingest Process

The project team produced the Ingest Guide as its step-by-step guide to the interaction between records producers and preservers. It serves as a framework that outlines the steps an archives (or other offices charged with preservation responsibilities) need to undertake to have a trustworthy ingest process. The Guide became a much more detailed and extensive work than the principal investigators originally envisioned.

The project team was pleased enough with the quality of the Ingest Guide to invest grant resources to contract with designers to create a web-based version of the Guide. The project team wrote the Guide as a traditional report, delivering it like the other reports as PDF documents over the web. However, this format has its limits: it does not allow people to easily navigate from sections, to parts, to individual steps in the guide. Moving from steps that listed resources to the descriptions of those resources at the back of the Guide is cumbersome. The web-based version of the Guide facilitates much easier navigation, and the project team hopes it will lead to wider utilization of the Guide. Since September, the Ingest Guide website has received 109 hits.

The DCA is examining the steps it currently takes for accessioning records. It will then use the Ingest Guide as a metric for discovering gaps in its accessioning process. The DCA is also working on implementing the submission agreement as described in the Ingest Guide, first as a human-readable document, then as a machine-readable document. As mentioned above, the DCA is also exploring avenues for developing or adapting tools to implement the machine-readable resources defined by the Ingest Guide.

As a result of the project and its research findings, Yale University Archives has begun a systematic re-analysis of all of its selection and accessioning processes. The University Archives unit has been reorganized under the direction of the Electronic Records Archivist in order to more formally integrate the consideration of electronic records issues. The staff responsibilities have been re-evaluated and more manpower is now assigned to the vital roles of university staff interaction. Before, one professional, supported by one non-professional, handled all interaction with records producers, including appraisal and support of description and preparation for transfer. The remaining two professionals, supported by one non professional, would not intervene until the formal accessioning process was completed. This arrangement did not provide proper protection for electronic records. Electronic records were not appraised for the feasibility of their preservation until after they had already been officially taken in and description was often greatly insufficient. The new unit spends much more time guiding producers through the transfer process. Two professionals, supported by two paraprofessionals, work with producers to facilitate appraisal of electronic records, with a particular emphasis on the feasibility of preservation. Much more time will be spent on conforming accessions to meet the terms and conditions of transfer as defined by more explicit submission agreements. It is the hope of the Electronic Records Archivist that this reengineering will allow the University Archives to better handle a larger number of electronic records; to influence the appraisal and transfer techniques of Yale records producers for the better; to reduce the number of accessions of records taken in that simply can not feasibly be preserved; and finally to ensure the long-term preservation of authentic copies of those records that Yale does take in.

The project team produced the Tufts Ingest Prototype System (TIPS) as its main tool to facilitate the transfer of electronic records from producers to preservers. Archives can use TIPS to execute many of the tasks described in Section B Transfer and Validation of the Ingest Guide. However, this is not a production-ready tool with a polished user interface. It is a developer-oriented tool that can help archives create scalable transfer and validation workflows within an ingest system. TIPS is available for use under the Mozilla Public License Version 1.1. It can be downloaded from <<http://dca.tufts.edu/features/nhprc/reports/tips/index.html>>.

The Yale project team investigated the issues surrounding ingest of email. In particular, the project team sought a solution to the scalability issues created by email stored in thousands of staff workstations using a proprietary software application—Eudora email client application in a POP3 configuration—that stores the email in a proprietary format. The project team developed an email ingest tool that allows archives to copy producer’s pre-determined mailboxes, extract messages, and save them as XML-encoded text files in a recordkeeping or preservation application. The tools were built as a series of scripts, in both Perl and Python, so that they could be easily configured and scheduled to run in an automated fashion. While the development of this email ingest tool was helpful in understanding some of the issues of ingesting into Fedora, there is no user interface to the software. In order to configure or run the scripts a user must be comfortable enough working in the code itself.

Both TIPS and the email ingest tool are described in the Ingest Tools report.

The project team undertook several ingest projects with varying degrees of formality and completeness. These projects were iteratively undertaken to assist the development of the Ingest Guide and especially the ingest tools. The project team formally described three ingest projects in the Ingest Projects report. The team originally planned on reporting on six projects, but felt that adding three projects to the already lengthy (45 pages) Ingest Projects report would have made it unnecessarily long and repetitive.

Develop Trustworthy Maintain Process

The project team articulated the process of maintaining electronic records in a trustworthy manner by producing the Maintain Guide. The Guide describes thirty scheduled and irregular event types that may occur while an archive (or other office with preservation responsibilities) maintains electronic records in a preservation application. The Guide describes each event type, a suggested schedule for the scheduled event types, preconditions for these events occurring, and activities to undertake when an event occurs. The project team envisions that archives could use the Guide as the basis for a service level agreement with an IT office or vendor. In addition, the Checklist of Fedora’s Ability to Support Maintain Activities report describes abstract services needed to support maintain activities.

In the Plan of Work, the project team said it would undertake six maintain electronic records projects. As the project team developed the Maintain Guide it realized that undertaking these maintain projects in a meaningful way would involve a considerable investment in hardware that was well beyond the limits of the grant budget. Although the budget included money for a server to operate an instance of Fedora, this essentially sandbox implementation was not close to a proper environment for testing maintain activities. The project team briefly considered writing six maintain project narratives that would describe scenarios of archives facing various event types and undertaking specific activities to address those events. The team quickly abandoned this option because writing meaningful scenarios would involve articulating a very detailed hardware, storage, and systems environment that would take an effort beyond the scope the grant project. The Checklist of Fedora's Ability to Support Maintain Activities report, which describes at an abstract level the services needed to support maintain activities, stands in as a substitute to the maintain projects. The project team feels that the Checklist is actually more useful for archives than the projects would have been because the report describes abstract services that are not tied to a particular application or systems environment.

Implement Fedora Instance and Text Sample Records Sets

The project team used designated grant funds to purchase a Dell PowerEdge 750 server for running Fedora 1.2 and 2.0 instances. The team employed these instances of Fedora as a sandbox test environment to help with the development of the Ingest Guide and the TIPS tool. The project team used the Fedora instances to ingest the records described in the Ingest Projects reports.

Report on Fedora's Ability to Serve as an Electronic Records Preservation System

Originally, the principal investigators thought testing Fedora as a preservation system would be the central focus of the research project. However, this ended up being a small, although still important, part of the project. The project team changed its focus because it realized that a Fedora instance (or instances) would only be one part of an overall preservation system. Fedora is not an out-of-the box limited repository solution but rather an architecture upon which an institution can implement a variety of services, tools, and policies to build a fully functioning repository. Large portions of ingest and access activities in addition to preservation planning

decisions would occur outside of a Fedora instance. The three main products of the project, Requirements for Trustworthy Recordkeeping and Preservation, the Ingest Guide, and the Maintain Guide, are not Fedora-specific.

The project team realized that its original question: “Can Fedora serve as a trustworthy preservation system” was the wrong question because institutions can implement Fedora in such a wide variety of ways, making the suitability of Fedora as the basis of a preservation system extremely dependent on its implementation. Instead, the project staff should have asked: “Can a Fedora repository, surrounded by the proper preservation policies, tools, and Fedora services, serve as the basis of a trustworthy preservation system?” Or put another way: “Does the use of a Fedora repository necessarily prevent the development of a trustworthy preservation system?” The project team answered yes to the first question and no to the second in its Analysis of Fedora’s Ability to Support Preservation Activities report. The project team also produced an assessment of Fedora’s ability to support maintain activities (Checklist of Fedora’s Ability to Support Maintain Activities) because most of these activities would occur within the Fedora core or service level of a Fedora-based repository.

Institute Electronic Recordkeeping Requirements, Preservation Requirements and Metadata, and Ingest Guide as University-wide Procedures

As mentioned earlier, The Digital Collection and Archives at Tufts and Manuscripts and Archives at Yale are implementing various components of the project deliverables into its regular workflow. The DCA is using the requirements to assess its policy needs for the Tufts Digital Repository. Yale is using the requirements to help ensure that preservation needs are met in the new central Yale University Library digital repository. Both departments envision using the requirement set as the basis for a future assessment tool—probably borrowing from RLG and NARA’s digital repository certification work—of recordkeeping and preservation systems at Yale and Tufts. Both departments are also using the requirement set as a platform for developing an appropriate preservation metadata set. In addition to the project’s own requirement sets, this work is relying heavily on PREMIS. Finally, The DCA and Manuscripts and Archives have begun to use the Ingest Guide to assess and reengineer their ingest workflows and are looking for ways to build and implement the resources described in the Guide as machine-readable tools.

Additional Analysis of Project Work

At the start of the project the principal investigators did not have the proper focus or appropriate understanding of the scale of the project they had set out for themselves. The investigators initial focus on Fedora as a preservation system betrayed an oversimplified view of the repository system. The principal investigators also vastly underestimated the complexity of developing the recordkeeping and preservation requirements. However, the NHPRC gave the project team the flexibility to make the appropriate adjustments to still produce a robust set of deliverables.

The configuration of the project team proved to be a much more important issue than the principal investigators originally considered. Hiring Robert Dockins as the project analyst was critical to the success of this project. His advanced programming skills and advanced understanding of computer science theory was an excellent complement to the principal investigator's archival science backgrounds. In addition, Mr. Dockins' remarkably fast and firm grasp of archival concepts facilitated smooth communication between the project analyst and the principle investigators. The project staff also included several other people—mostly developers—at Yale and Tufts that contributed small percentages of their time to the project. This configuration was difficult to manage and led to less than optimal results. It would have been better to concentrate that contributed time into a single person.

The project benefited greatly from engaging outside people to complete specific tasks. As mentioned earlier, the principle investigators hired Nancy McGovern to provide extensive comments on the Requirements for Trustworthy Recordkeeping and Preservation report. They engaged Thornton Staples of the University of Virginia and Co-Director of the Fedora Project as a consultant to help the project team gain a better understanding of Fedora. They asked Sandy Payette of Cornell University and Co-Director of the Fedora Project to provide technical comments on the Checklist of Fedora's Ability to Support Maintain Activities report. They hired a design firm to produce the web version of the Ingest Guide. Finally, they engaged the services of Patsy Baudoin, an independent digital archivist, to edit several of the project reports. This work done by people outside the project was invaluable. Based on this experience, the principal investigators have concluded that having a small project team that brings in contractors to

complete discrete, well-defined tasks that the core team does not have the time or skills to complete is a good strategy for future grant projects.