

Pathways to Preservation: Digital Curation Strategies in North Carolina State Government

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ABSTRACT

This paper discusses the impact of digital publishing, e-mail, and electronic records management on the North Carolina State Archives and the State Library of North Carolina, the entities responsible for gathering, providing access to, and permanently storing state agency electronic publications and records in North Carolina. In addition to outlining the current state of digital government information in North Carolina, as evidenced by recent survey data, this article touches on future plans and collaborative efforts, both within state government and with other states, as well as some of the challenges to successful implementation that the State Archives and State Library must overcome.

Categories and Subject Descriptors

H.3.6 [Library Automation]: Large text archives; I.7.4 [Electronic Publishing]; H.2.8 [Database Applications]: Spatial databases and GIS; H.4.3 [Communications Applications]: Electronic mail; H.3.7 [Digital Libraries]; H.3.5 [Online Information Services]: Data sharing; H.3.5 [Online Information Services]: Web-based services; K.5.2 [Governmental Issues]: Regulation; K.6.4 [System Management]: Centralization/decentralization.

General Terms

Management, Documentation, Measurement

Keywords

Digital curation, state government information, collaboration, e-mail, digital publishing, geospatial data, state publications, geographic information systems, digital preservation, electronic records.

1. INTRODUCTION

The State Library of North Carolina and the North Carolina State Archives are the official repositories for publications and records, regardless of format, produced by all state government agencies. For years, the acquisition, management, access, and preservation of paper publications and records has been systematically approached — albeit not without challenges and shortcomings — through such programs as the State Publications Clearinghouse of the State Library [1] and the Government Records Management Program of the State Archives [2]. Like many states, North Carolina has a decentralized government structure, but in the world of paper, publications were typically produced and

distributed through the office of the agency chief information officer (CIO), making the acquisition by the State Library somewhat less challenging than contacting every author at every agency and division throughout the state. Likewise, records were transferred to the State Archives according to records retention schedules through an established workflow and authorization process.

With the coming of digital publishing, e-mail, and electronic record keeping, the world changed dramatically for producers of information dispersed throughout North Carolina state government, the CIOs, and the State Library and State Archives programs responsible for their curation. An already decentralized government became even more so as publications went from formal documents with formal publishing policies to digital files that could be produced quickly, with little intervention from designers, editors, or agency officials. Paper records that were once relatively stable and “easy” to store became electronic files that could be modified, were poorly named or indexed, or disappeared as quickly as they were created. To this day, if and where many of these files reside remains a mystery. For the State Library and State Archives, the divisions of the N.C. Department of Cultural Resources (DCR) with the legally-mandated responsibility for the long-term maintenance of publications and records, and for the citizens of North Carolina, who demand an open and transparent democracy, this is not just a problem to ponder, but one that requires an absolute answer.¹

¹ The issues North Carolina and other states face in addressing this problem are well documented. Several reports offering some background and context for these issues can be found at <http://www.ctg.albany.edu/themes/pubs?chapter=records>.

2. CURRENT AGENCY PRACTICE

2.1 Publications

In 2003 and again in 2008, the State Library surveyed state agency staff to attempt to identify what was being produced, how, and where electronic files were being stored. The goal of the 2003 survey was to establish a need for a program within the State Library that would be responsible for investigating the challenges of long-term preservation of agency publications and implementing solutions as they became available [3]. That goal was reached in 2006 through permanent funding of the Digital Information Management Program (DIMP) and the continuation of a Statewide Leadership grant called the *Access to State Information Initiative*, now in its fourth year. The 2008 survey followed up with questions regarding current publishing practices and continuing participation in the State Publications Clearinghouse program to help inform the DIMP's current and future plans for a digital repository [4].

The findings of these surveys have been telling. In general, agencies have not begun cooperative efforts (although some are working intra-departmentally) to ensure long-term management of digital files of any sort, and the trend continues towards distribution, rather than centralization, of digital assets. Currently, 95.5% of agencies publish mainly to their website(s), and have used over 20 different formats to do so in the past three years. Forty-two percent of respondents to the 2008 survey stated that publications remain on publicly accessible sites for only a limited period of time. Over 56% of respondents said that the public is not notified when data is moved or removed from, or updated on agency sites. Once removed, data is often stored in locations not accessible by the public, including agency servers (39% of respondents) and personal computers (32%).

The State Library's answer to the surveys is a centrally-managed, digital repository of born-digital state publications. Ingest occurs in two ways, either the "push" system or the "pull" system. Many agencies "push" their digital publications to the State Library (over 73% of respondents are currently complying with the law) through email or other submission methods. Or, the State Library proactively "pulls," or acquires, publications by harvesting them from Agency websites using Archive-It software, contacting agency staff via telephone or email to request specific publications, or obtaining the publication through other manual methods. However they are acquired, all publications are made accessible via several web interfaces and databases, including the Internet Archive and a CONTENTdm database. Work to provide access to these publications through a single portal is ongoing. Preservation of these files is, likewise, ongoing, however, archival copies are currently monitored and maintained in several locations.²

² Other states are also working to provide long-term access to publications using various tools and approaches. For instance, the Arizona State Library and Archives is leading a multi-state effort to build an automated, integrated, curatorial workflow combined with existing LOCKSS (Lots Of Copies Keeps Stuff Safe) technology through the PeDALS (Persistent Digital Archives and Library Systems) project (<http://rpm.lib.az.us/pedals/index.asp>). Similarly, the Minnesota State Archives is leading another multi-state initiative to

2.2 Geospatial Data

The world of cartography has changed from the use of a compass, brushes and parchment paper to create a map to the modern Geographic Information System (GIS), reliant on complex relational databases that integrate digital graphical data collected by satellites and GPS units with tabular attribute information such as street addresses, environmental observations or demographic data. As the tools used to create the map have grown more complicated, the challenge of preserving this information about "places" has become much more difficult. Instead of just preserving the paper map, archivists must now be concerned with capturing the digital data sources, databases, processes and decisions used to generate a map in the current digital GIS era. As the government entity with curatorial responsibility for these files and through the participation in two federally funded grants, the State Archives has begun to understand how these files are created in the office and how they might transfer and be appropriately managed.³ Through a Library of Congress National Digital Information Infrastructure Preservation Program (NDIIPP) grant called the *Geospatial Multistate Archive and Preservation Partnership*, GeoMAPP [5], the State Archives has begun to understand the creation and movement of geospatial content on both the local and state agency level in North Carolina. In the summer of 2008, the State Archives surveyed creators of geographic information systems (GIS) data about current creation and data archiving practices throughout the state. The introduction to the survey clearly delineated the difference between routine backups and data archival practices in an attempt to focus the responses on data that are being preserved for long-term use and analysis [6]. Of the respondents to the state agency survey, approximately half stated that they currently capture or retain snapshots of superseded geospatial data for archival or historical purposes. The other half either responded that they did not retain snapshots or were unsure. Slightly less than half of the respondents named records retention schedules and historic mapping as the primary purpose for retaining their data.

The North Carolina Center for Geographic Information and Analysis (CGIA) conducted a similar survey for local and municipal governments in the summer of 2008 [7]. This survey was a follow up to a survey conducted in 2006 as part of another NDIIPP grant, awarded to North Carolina State University Libraries, called the *North Carolina Geospatial Data Archiving Project*. The local surveys were aimed primarily at documenting current production of GIS data at the county and municipality level. Responses from the 64 participating counties in the second survey confirmed results from the first: almost 50% of local

develop *A Model Technological and Social Architecture for the Preservation of State Government Digital Information* (<http://www.mnhs.org/preserve/records/legislativerecords/>).

This initiative will focus on identifying extensible methods to provide enhanced online access to digital materials by drawing on existing tools already in use by participating state partners.

³ For a broader view of the challenges of preserving and accessing GIS data, see <http://www.lib.ncsu.edu/ncgdap/>, <http://www.nla.gov.au/padi/topics/432.html>, <http://www.maine.gov/sos/arc/GeoArchives/geoarch.html>, <http://www.ngda.org/index.php>.

government GIS coordinators are taking archival snapshots of at least one type of geospatial data annually. In addition, approximately 58 counties publish their GIS data to the viewer and acquisition portal developed by the state of North Carolina called “NC OneMap” [8].

2.3 E-mail

While publications and geospatial data present preservation challenges, e-mail presents its own challenges. No less important than their paper counterparts (memos, letters), but so much more complicated, these files are large in nature and have unique dependencies regarding relationships and attachments that place them in context. During the spring of 2008, the status of e-mail as a public record was affirmed in the findings of the E-mail Records Review Panel created by Governor Mike Easley [9]. This panel included members of state agencies, the public, and the press, as well as university and city representatives. The State Archives, on two occasions, has accessioned e-mail per the records retention schedule: from the office of former governor Jim Hunt, and from former Superintendent of Public Instruction Michael Ward. Practices in North Carolina state government agencies, prior to the panel’s findings, were to simply delete e-mail belonging to employees who left or retired. In the case of the Hunt administration, the State Archives received the entire e-mail server at the end of the governor’s term. The State Archives received Dr. Ward’s e-mail on DVDs that contained his e-mail account in his original folder structure that reflected his categorization of information. In both instances, information technology staff in the office burned the files to disc and transferred it to the State Archives. The other records in analog format were transferred at the same time.⁴

3. COLLABORATIVE DIGITAL CURATION EFFORTS OF THE STATE ARCHIVES AND STATE LIBRARY

As previously stated, the State Library and the State Archives are legally mandated by general statute to manage and preserve different state government information — the Library is responsible for “publications,” while the Archives is responsible for “records.” In an analog world, these information formats were more clearly delineated, and as such, each institutional division established its own programs to collect, process, preserve, and provide access to the information for which it was responsible [10]. Because these curatorial programs did not support the systematic collection, preservation, and access to state information in digital formats, valuable state information was at risk of being lost. In recent years, especially as the transition to digital creation has accelerated and the lines between the information formats has blurred (e.g., is a website a publication or a record?), the two divisions have realized the value and necessity of pooling resources, staffing, and funding to initiate collaborative

⁴ For more information on email management and preservation, please see www.records.ncdcr.gov/emailpreservation,

<http://www.siarchives.si.edu/ceip/ceipindex.htm>,

<http://www.nla.gov.au/padi/topics/47.html>,

<http://www.digitaleduurzaamheid.nl/index.cfm?paginakeuze=215&categorie=2>,

curatorial efforts focused on digital content. As a result, the State Archives and the State Library now collaborate not only with one another, but also with other North Carolina state agencies and similar institutions in other states to identify curatorial solutions that will work across state government.

3.1 Collecting and Processing

3.1.1 Websites

One area in which the State Archives and the State Library have been collaborating is on the harvesting of state agency websites. Retention and preservation of State Agency web sites is the responsibility of the Department of Cultural Resources.⁵ In 2002, the State Archives did a test of a “manual” transfer of its own website to be accessioned into the Archives. The process became tedious, time-consuming, and was not accurate and true in the information it collected. The webmaster included all the files on the web site in addition to any files he may have created and not used on the site. In 2005, during a pilot testing of new technology, it became clear that centralized web harvesting through the State Library and State Archives is more economical, efficient, and effective than asking each agency to identify its own solution. Starting in 2005 with the Internet Archive’s Archive-It [11] harvesting service pilot, North Carolina has archived over 25 million files comprising approximately 2.5 terabytes of storage in the form of web pages, publications, reports, videos, and other important state government information that might otherwise be permanently lost. Former Governor Jim Hunt was the first Governor in North Carolina to have a website. Although repeated attempts were made to obtain a copy of the site, the state Archives never received one. However, during the Archive-it pilot, the State Archives captured the site. Soon after, the site was taken down from the live web and the Web Site Archives is the only instance of this historic web site. The State Library’s State Publications Clearinghouse has taken advantage of this service to locate copies of many electronic state publications not submitted through the standard “push” methods. Likewise, the State Archives is able to ensure that regular snapshots of electronic records posted on the web are captured. In addition, this single solution has produced a single search interface across all harvested North Carolina state government web content.

3.1.2 Publications

The State Library currently employs a combination of hosted vendor tools that together answer several, specific needs. These systems are neither interoperable (although work on at least some of them is promising in this area) nor does the entire set answer *all* of the Library’s current digital curation needs. Consequently, the State Library will collaborate with the Washington State Archives as part of the Multi-State Preservation Consortium to test the functionality of the Washington State Digital Archive with respect to electronic publications and certain record series [13]. Testing this Microsoft products-based system is of great interest to North Carolina because the NC Office of Information Technology Services (ITS) has existing purchasing contracts with

⁵ For citation of the retention schedule item for Web sites, please see

http://www.records.ncdcr.gov/schedules/GS_Amendments2006.pdf.

Microsoft, making replication of the Washington State system a greater possibility. The hope is that the Washington State Digital Archives tool will offer a seamless, end-to-end digital information management solution (acquisition/ingest, management, access, preservation) that meets the needs of both the State Library and the State Archives so that resources can be pooled to jointly manage the system in house.

Under the auspices of a National Historical Publications and Records Commission (NHPRC) grant to the Data Intensive Cyber Environments (DICE) group, the State Archives and the State Library are also working with local universities via the North Carolina-based Renaissance Computing Center (RENCI) to evaluate iRODS™ (Integrated Rule Oriented Data Systems)⁶ as another potential preservation environment [14]. Currently, iRODS does not offer a preservation mechanism that will allow for the rendering of data over the “long term,” but the developers are looking at incorporating one of two preservation mechanisms in testing.⁷ And because iRODS is infrastructure independent, it can be used in conjunction with any of the other solutions the State Library and State Archives are investigating [15].

3.1.3 Geospatial Data

The State Archives does not currently collect or accession geospatial data. One component of the GeoMAPP grant is to determine the feasibility of collecting this data and building the capacity to provide access to it. This is a collaborative effort with CGIA; Kentucky's Department for Libraries and Archives (KDLA) and Commonwealth Office of Technology's Division of Geographic Information; and Utah's Division of Archives and Automated Geographic Reference Center. A second GIS grant based in Raleigh (the *North Carolina Geospatial Data Archiving Project* at North Carolina State University [16]) has provided the State Archives with greater insight into the skills, knowledge, and resources required to institute an archiving program of this magnitude.

Since there is no single entity designated or processes established for collecting GIS data in North Carolina, it remains dispersed throughout the state. Some attempts have been made to create access points; namely, NC OneMap, the North Carolina GIS portal. NC OneMap provides discovery and access to North Carolina's geospatial data resources from 70 of North Carolina's 100 counties. The level of county participation differs: in some instances NC OneMap contains an individual county's GIS data, while in others, it simply acts as a portal to data located on county servers. GIS data from participating counties can be downloaded via FTP from the NC OneMap web site, or transferred on a portable hard drives upon request.

GIS file formats for distribution, access, and preservation vary from county to county and there are no defined packaging

⁶ iRODS is a trademark of the DICE group.

⁷ In the meantime, the iRODS toolset allows administrators to acquire and manage electronic data using traditional archival practices, and store materials in a grid computing system. The administrative system — for data management and patron access — is infrastructure- and operating system-independent. For more detailed information about iRODS, see <https://www.irods.org/index.php/Publications>.

standards. Shape files are the de facto file format for distribution. However, in order for the data to render logically and “live in coordinate space”, five files are required for distribution. If any of the five is missing, the data must be “massaged” or manipulated in order for it to be understood.

3.1.4 E-mail

The State Archives first began accessioning e-mail in 2001 after Governor James Hunt left office. At the end of his term, the State Archives received over 6 gigabytes of e-mail. Much of this had not been culled and State Archives staff had to appraise the e-mail message by message. Eventually, it was reduced to approximately 2 gigabytes of archival records.

Realizing that the volume of e-mail would continue to increase and seeking to find a tool that would help in the timely transfer of e-mail to the State Archives, staff applied for and received a grant from NHPRC. Through this grant, the *Preservation of Electronic Mail Collaboration Initiative*, the State Archives, in conjunction with the staff of Pennsylvania Historical and Museum Commission, Bureau of Archives and History and the KDLA, developed and tested an e-mail collection and preservation tool called EMCAP [17]. The concept for the tool was developed, in part, from requests for an easier way to transfer e-mail records to the Archives. The State Archives is testing the tool with the Office of Community and Citizen Affairs in the Governor's office, the Corporations Division in the Secretary of State's office, and director-level positions in the State Emergency Management Office within the Department of Crime Control and Public Safety. Each agency utilizes a different e-mail system — Microsoft Exchange, Novell GroupWise, and IBM Lotus Notes. In the EMCAP scenario, the user determines which e-mail messages are records of archival value per his or her agency's records retention schedule, and, using their email client, deposits those e-mails by “dragging and dropping” them into an EMCAP folder. The EMCAP e-mail account and the folders (created by the user) within that account physically reside on a server located at the State Archives rather than on an agency machine or a machine at ITS. An original copy of each e-mail is saved and the e-mail header information and text is converted to XML. Depending on the size of the attachment, it is either kept with the message itself or is de-coupled and a relative link back to it is added to the message. To date, the pilot has ensured the retention of over 38,000 e-mail messages at the State Archives.

3.2 Providing Access (Short and Long-Term)

3.2.1 Websites

The State Library and the State Archives jointly developed and manage a web interface for accessing the web pages harvested with Archive-It. Because the service allows for only minimal metadata entry (and only at a high level), keyword searches are drawn from indexes based on the text found on websites or other objects. And while the State Library and State Archives do not currently have preservation tools to ensure long-term access to all of the harvested material, the files are stored in preservation-friendly ARC and WARC files and the Internet Archive manages and stores this content on their servers in California, Amsterdam, and Paris. The State Archives also annually purchases hard drives of the content and stores them locally.

3.2.2 Publications

The State Library has developed a separate web access tool — utilizing CONTENTdm — for its digital repository of publications. As part of a pilot training program offered to state agency staff in 2008 and increased outreach efforts by State Library staff, state agency personnel responsible for publishing or managing agency-created publications have been informed about the new repository service and encouraged to submit their publications as a starting point to answer both their short-term access and long-term storage needs. State Library staff is hopeful that this educational effort will increase agency participation in the use of the repository, in terms of both submissions and access. Access to information within the repository is fairly straightforward as CONTENTdm allows for two levels of search: item-level metadata records and full-text. And, while “true” preservation management tools are not currently in place, the State Library is storing digital masters and access copies locally on a departmental storage area network (SAN), and duplicates are stored off-site at OCLC’s Digital Archive in Dublin, Ohio, where multiple copies of the files are created, managed, and stored [18].

Driven by the desire to offer a single point of access to all of the State Library’s digital content, the State Library subscribes to WebFeat’s federated search tool. Presently, WebFeat searches the library’s catalog, digital repository, and all of the library’s electronic journal subscriptions [19]. The State Library is investigating the feasibility of adding harvested web content from Archive-It to the digital repository, thus making that data searchable through WebFeat, as well.

3.2.3 Geospatial Data

Access to North Carolina geospatial data is typically provided by either its county of origin or via CGIA’s NC OneMap. “Archival” programs are not as well established; the fact that GIS data exists in many different places — held by creators, various users who have downloaded or requested it, and as part of CGIA’s NC OneMap — means that its chances for long-term survival are increased. However, sustainable access is an issue that must be addressed. One goal of the State Archive’s GeoMAPP initiative is to build the infrastructure and knowledge base regarding how to provide long-term access to the geospatial content that the State Archives will collect. Using funding from NDIIPP, the State Archives will purchase storage to begin collecting geospatial data. A mirror site for CGIA is also being considered. And, instead of building another access tool, the GeoMAPP partners are hoping to leverage NC OneMap to access this data.

3.2.4 E-mail

The goal of the EMCAP grant was to develop and test a tool for the collection and preservation of e-mail. To that end, the State Archives has been successful. The EMCAP development team has presented at a number of conferences on the project. A recurring question raised is about how individual files are accessed (short answer: a file-by-file browse). The State Archives recognizes that the next, important step is to provide public, real-time access through full-text searching of archived e-mail. Limited funding and staffing resources prevents the State Archives from developing an interface on its own, however. Fortunately, a number of institutions from around the United States have expressed interest in collaborating to build a

search/access module on top of the current EMCAP tool, and the State Archives is working with them to develop a grant. It is hoped that through these collaborative efforts the State Archives will be able to build on the success of EMCAP to not only preserve but also provide access to North Carolina government archived e-mail.⁸

4. CHALLENGES TO SUSTAINABILITY

As mentioned previously, state government in North Carolina is, for the most part, decentralized. This means that state agencies have the authority to make decisions about how to address publication, curation, and records management issues independently. This autonomy is advantageous in that it allows an agency the flexibility to determine the right solution for the specific circumstances facing it. However, autonomy can (and does) also lead to silos. This occurs when agencies focus on solving a problem they are facing without thinking about the bigger picture, including whether other agencies might be struggling with the same issues. This happens with respect to digital information management when agencies either have not realized that they are losing electronic information, or, in a short-term effort to provide wider access to electronic information on the web, have not considered the long-term implications of removal of files, restructuring of directories, or versioning controls. It may also be that they recognize a need to store information for the long term, but have not considered all that “long-term maintenance” implies. Until agencies understand these complicated (and expensive) issues, and prioritize the storage and management of certain information to ensure usability down the road, there is little hope of creating a sustainable program.

The State Library and State Archives offer that “big picture” perspective to agencies through education programs. These programs educate agency staff about the various issues involved in hosting their own digital information management environments, as well as encouraging them to partner with the State Library and State Archives to address their agency’s issues on a broader, more collaborative, scale. However, because state government is vast and staff is constantly changing, reaching all of the right people (and then maintaining that contact) is often a monumental task.

As in so many other environments in the public and private sectors, agency staff indicate that they feel overworked and do not have time to incorporate new and complex actions into their existing workflows. This is another challenge to implementation and sustainability of digital information management programs. The State Library and State Archives must ensure that the actions necessary to participate are not burdensome on any one individual, can easily be incorporated into existing workflows, and will produce a reportable benefit that management will appreciate and encourage. While the first two of these requirements are difficult to achieve, the third seems nearly impossible in the short term. However, as technology continues to advance and stored digital information becomes obsolete or disappears altogether, the value will become obvious.

⁸ Until such an access system is developed, patron requests are filled by burning a CD of the e-mail account in its original file format. It is incumbent upon the researcher to have the tools to read the messages.

Some attempts to consolidate data management have been made by ITS, the central service point for network and application support for many (but not all) state agencies. But push-back from agencies has been strong as ITS is seen as taking on too many initiatives without sufficient staffing, resources, or a fundamental understanding of all the issues required to succeed. However, the North Carolina state legislature has recently encouraged ITS' involvement and allocated funding for new projects. In the summer of 2008, the legislature passed, through HB 2436, S.L. 2008-107, appropriations to develop a detailed plan to implement the recommendations contained in the Geographic Information System Study, including a cost study to centralize the management of all GIS resources, projects, and – ideally – long-term preservation of the products of this undertaking by NC ITS [section 6.13]. Similar plans are in the works for e-mail [section 6.14].

The challenges are great — while the investigation of long-term maintenance needs for all data continues, and forging inter-agency partnerships is daunting, some progress has been made. NC OneMap, the State Library's Digital Publications Repository, the State Archives' e-mail preservation tool, and the State Library and State Archives' web harvesting efforts are all practical examples of how consolidation *can* work. Continued participation in grants that allow testing and research of newly-developed tools that ease the burdens of digital curation across the spectrum of state government agencies are sure to build upon these successes in the near future.

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