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Preparing to Preserve: Three Essential Steps to Building Experience with Long-Term Digital Preservation

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Abstract:

Many organizations face complex questions of how to implement affordable and sustainable digital preservation practices. One strategic priority at the University Libraries at the University of Nevada-Las Vegas, United States, is increased focus toward preservation of unique digital assets, whether digitized from physical originals or born digital. A team comprised of experts from multiple functional library departments (including the special collections/archives area and the technology area) was established to help address this priority, and efforts are beginning to translate into operational practice. This work outlines a three-step approach: Partnership, Policy, Pilot taken by one academic research library to strategically build experience utilizing a collaborative team approach. Our experience included the formation of a team, education of all members, and a foundational attitude that decisions would be undertaken as partners rather than competing departments or units. The team's work included the development of an initial digital preservation policy, helping to distill the organizational priority and values associated with digital preservation. Several pilot projects were initiated and completed, which provided realistic, first-person experience with digital preservation activities, surfaced questions, and set the stage for developing and refining sustainable workflows. This work will highlight key activities in our journey to date, with the hope that experience gained through this effort could be applicable, in whole or part, to other organizations regardless of their size or capacity.

Keywords: digital preservation, partnerships, policy, archives, technology

Introduction

Responsibly managing valuable cultural heritage collections includes responsibly managing digital assets. Guaranteeing the long-term preservation and ongoing access to digital content has become a critical component of many institutional missions. Just as we transform collections through digitization, we must transform our libraries through preservation strategies that can ensure global access to cultural heritage. At a fundamental level, digital preservation aims to ensure a level of permanence and ongoing access. As defined by the Association for Library Collections and Technical Services, digital preservation combines "policies, strategies and actions to ensure access to reformatted and born digital content regardless of the challenges of media failure and technological change. The goal of digital preservation is the accurate rendering of authenticated content over time." Unfortunately, regardless of an entity's size, staffing, budget, or expertise, digital preservation isn't easy. As the most recent National Digital Stewardship Alliance (NDSA) *National Agenda for Digital Stewardship* acknowledges,

> *Despite continued preservation mandates and over ten years of work and progress in building a comprehensive practice around digital preservation, the community still struggles with advocating for resources, adequate staffing, and articulating the shared responsibility for stewardship. Underlying all of these challenges is a lack of prioritization of digital preservation programs. Integrating digital stewardship practice and thinking across an entire organization is a core challenge, especially in a time of restricted resources* (National Digital Stewardship Alliance Coordinating Committee & NDSA Working Group Co-Chairs, 5).

Despite this, digital preservation, at some scale, is not impossible. Any action in digital preservation is preferable to risking *no* action. But how do we prepare to preserve? Is there a path forward that combines idealistic best practices and expert theory with the practical reality and ongoing costs of preservation? This paper will outline a three-component approach: *Partnership, Policy, Pilot* adopted by the University of Nevada-Las Vegas to advocate strategically building digital preservation experience by utilizing a collaborative team approach, and setting attainable goals with the recognition that digital preservation, above all, is an ongoing *process* and not a finite project.

Our journey on the road to digital preservation has embraced central themes consistently present in our Libraries' values: inclusive collaboration, broad institutional awareness, administrative support, and staff empowerment through opportunities such as education and pilot projects. There is no "perfect" or "universal" solution to digital preservation; progress is made through incremental steps grounded in supported institutional mission goals. Small steps today can lead to availability and use of important digital assets for generations to come.

Background & Early Program Notes

Following are brief notes on the setting and evolution of the digital collections program at the Libraries. The University of Nevada-Las Vegas (UNLV), established in 1957, serves an urban student population of 23,500 in the American Southwest. The university's library system initiated early digitization projects beginning around 2001. In time, the position of digital projects librarian was established, followed by formalization of a Digital Collections department in 2011. Today, the department has a full-time staff of five and employs additional externally funded grant project staff. Work focuses on digitization of culturally significant materials, descriptive metadata creation, online discovery and presentation, and innovative experimentation. Situated in the Special Collections and Archives Division, Digital Collections works in conjunction with other library units, including Special Collections Technical Services and Library Technologies, as well as with outside contracted vendors, to address the practicalities of acquisition, accession, metadata creation, and online worldwide discovery and access for reformatted collections and born digital materials. Digital preservation at the UNLV Libraries as a critical,

fundamental goal is a more recent priority in the intentional, gradual evolution of the program, though incremental efforts began over a decade ago.

Figure 1: Timeline of Digital Asset Management Activities as Related to Digital Preservation and Components of Partnerships, Policy or Pilots [items in **bold** represent activities newly initiated during that time period]

Year	Digital Asset Management Activities	Preservation Partnerships?	Preservation Policy?	Preservation Pilots?
2001 - 2005	• **Data backups** (multiple copies; geographically distributed)	no	no	no
2006-2010	• Data backups • **Locally authored white paper on digitization** • **Organizational forums/surveys** • **Digitization Advisory Committee** • **Preservation metadata work** • **External/grant funding including digital preservation commitments** • **Outsourced media reformatting** • **Formation of Nevada Digital Advisory Committee (with three subgroups, including one focused on digital preservation)**	Across departments Within region	no	no
2011 - 2014	• Data backups • Preservation metadata work • External/grant funding including digital preservation commitments • Outsourcing media reformatting • **Reference to preservation in Libraries' local strategic plan** • **Creation of Libraries Digital Asset Management (DAMS) Task Force** • **Administrative support (via new hires)**	Across organization Within region	no	Research into commercial preservation platforms; planning for future pilots
2015-2018 +	• Data backups • Preservation metadata • External/grant funding • Outsourcing media reformatting • Reference in strategic plan • Digital Asset Management Task Force	Across organization Within region Within	yes	Two DP platform pilots Amazon Glacier pilot

	• **Digital preservation workshop training** • **Pilots of two commercial preservation systems focused on cultural heritage communities** • **Born Digital workstation installed and workflows developed** • **Amazon pilot (secure cloud based storage of digital assets)** • **Fedora repository pilot** • **Digital Preservation Policy drafted and approved** • **New Metadata Application Profile** • **Persistent Identifier pilot for online assets** • **DAMS Task Force becomes DAMS Implementation Team** • **Digital Asset audit pilot begins**	development community		Fedora repository pilot Asset Auditing pilot

2001-2005

Early preservation efforts for our organization focused on data backups and operational practices safeguarding these backups. These included restricted access, read-only daily backups (including preservation master TIFFs, PDFs, and various audiovisual file formats), and multiple copies of those backups stored locally and offsite at two geographically separate locations. As noted by the *Blue Ribbon Task Force on Sustainable Digital Preservation and Access*, "A solid disaster strategy requires that even these [local] backups be mirrored in separate locations. This is the thinking behind the Lots of Copies Keep Stuff Safe (LOCKSS) program" (105). Asset backup is an important component of digital preservation but by no means a complete solution. This was acknowledged by staff at the time, but then-current institutional capacity provided limited ability to go beyond this. Digital Collections staff worked in partnership with Library Systems (information technology), but in an operational way; no formal digital preservation partnership or policy was in place.

2006-2010

An early important organizational goal was to broaden awareness of the Libraries' digital collections program and to determine priorities through participatory decision making. Exemplary of this were two forums the authors led in 2007 and 2008, attracting attendees from across the Libraries and, for the initial workshop, attendees from across the state of Nevada. This first forum served as "[an] intimate chance to talk about the technical and philosophical aspects of a digitization program," and overall served as a "momentum-building opportunity for the digitization program" (Lampert & Vaughan, 121). An internal survey to help gather data and opinions about the Libraries' priorities preceded the second forum. One survey question asked which factors were important in determining whether to proceed with a new digitization project. Of eight possible answer choices, "the collection includes items for which there is a preservation concern or to make fragile items more accessible to the public," was chosen more than any other response save "the collection includes unique items" (ibid.).

This early work helped inform several actions including the formation of a Digitization Advisory Committee to identify at-risk collections, administrative support for outsourcing high priority collections for digitization, a new emphasis on grants and external funding, and UNLV Libraries' adoption of a

regional metadata application profile to guide metadata creation. Apart from actions initiated at UNLV, the Nevada State Library and Archives in the state capital initiated a Nevada Statewide Digital Advisory Committee. The authors of this paper were extensively involved in this statewide group (including leadership roles), which focused on digital collections and collaborative infrastructure issues of capacity, policies, best practices, and priorities of cultural heritage institutions throughout the state. Digital preservation was one of the topics that surfaced within the group's work, which noted funding challenges for both infrastructure and staff expertise. This statewide group established three subgroups, including one focused on digital preservation, and several members participated in digital preservation educational opportunities and developed the framework for an initial digital preservation policy at the state level. The group's work unfortunately coincided with the global financial crisis that manifested beginning in 2008, and the repercussions in America were especially acute in Nevada (e.g. among other things, some participants in the group lost their job as their organizations were downsized).

2011 - 2014

In the 2011-2014 time period, two events led to a higher prioritization of digital preservation: the allocation of new positions for staff well-versed in digital preservation for archives and born digital materials, and references in the Libraries' strategic plan highlighting the need to preserve digital assets. Responding to limitations of current digital asset management systems, especially in regard to digital preservation, a Digital Asset Management Task Force was formed, which included a Digital Preservation subgroup (led by one of the authors). To cross pollinate and support synergy between new staff, support strategic priorities, and foster future technology evaluations, a cross-divisional day-long education session was offered where staff worked together to adopt a shared vocabulary and understanding of high-level conceptual models related to digital preservation. There was also time focused on discussing technology and organizational readiness.

2015-2018+

As the Libraries' program matured, and as administrative support grew, the stage was set to initiate a more thorough investigation into standards-based digital preservation via the Digital Asset Management Task Force (*Partnership)*, specific investigations into digital preservation tools and workflows *(Pilots)*, and the development of a digital preservation document to share across the organization *(Policy)*. This time period resulted in some of the most substantial progress to date. The presence of all three components illustrate a useful pathway that other organizations, regardless of size or resource-level, may want to consider to enhance their local digital preservation planning as detailed in the remainder of this paper.

Partnerships

Like many organizations, UNLV Libraries is divided into multiple divisions, and each division has individual sets of goals and priorities, informed by and feeding into the overarching organizational strategic plan. The addition of digital preservation language in the strategic plan was an important first step to acknowledge this important priority, but it only became truly effective with the formation of several interwoven partnerships of key faculty and staff.

Inception

As Verheul notes in her research related to fifteen European libraries, "cooperation between units or departments is often formalized within library working groups involving staff from all departments. These cross-divisional working groups focus on practical aspects of digital preservation or on strategic issues" (30). Noted above, in 2014, with the approval of Library Administration, a cross divisional Digital Asset

Management Task Force was created, noting "The Task Force will evaluate systems and make recommendations for sustainable solutions including platforms and technology solutions to address acquisition, digitization, metadata creation, file management, digital preservation, and delivery of these [unique] assets (including born-digital assets)," (University Libraries, 1), with one of the group's roles to evaluate systems against a list of functional requirements and criteria (including digital preservation). The ambitious nature of the group's charge was both challenging and rewarding, as each member related to different focus areas. An unanticipated benefit of the Task Force was that digital preservation, which began as merely one evaluative factor for the systems, emerged via group consensus as a priority. This aligned with the realities of growth of our unique digital assets and associated stewardship expectations.

Perspectives

The Task Force was intentionally comprised of a broad array of stakeholders from three library divisions, including several managers (two division directors and five department heads), with the charge noting, "Special Collections and Library Technologies staff will be key decision-makers and technical experts essential to this evaluation" (University Libraries, 1). From Special Collections and Archives, the group included staff from both Digital Collections and the Special Collections and Archives' Technical Services department, a relatively new department whose responsibilities include accessioning of born digital materials and web archiving. The Task Force also included several staff from two departments in Library Technologies, responsible for information technology and web and application development (including the present day development of a local Fedora based repository to host our unique assets). The group also included a department head from the Collections, Access, and Discovery Division, whose departmental responsibility included oversight of the Libraries' institutional repository, containing important scholarly output from the institution.

As Ravenwood, Muir, and Matthews note, "the influence of senior managers is important in providing a mandate and encouraging shared working and networks of expertise" (83). The membership of this group was intentional, with managers who support and advocate for human and financial resources sitting alongside technical experts and staff whose roles would be most affected. This created efficiencies in decision-making and stemmed lag time for information to rise through organizational hierarchies, and also reinforced collaboration and shared ownership of goals. Ravenwood et al note, "relationships between practitioners, information technology staff, and sources of material are found to be crucial" (83). They continue, "IT personnel are seen as having very different views of the material and of appropriate processes and procedures. It is here that the potential for the positive influence of senior managers can be seen, in providing not only a mandate for preservation but also a requirement for different areas of the institution to work together" (98) and "it is important for managers to create harmonious relationships, building trust and a shared understanding to reduce anxiety and encourage effective cooperation" (101). In reviewing the years leading up to the creation of this group, it was a shift in administration, leadership, and staff roles that acted as a catalyst for change. While there had always been "bottom-up" expressions of digital preservation priorities, it was only when several managers forged a partnership that progress accelerated. Ravenwood et al note that "without [senior management] support and 'championing' for digital preservation it seems less likely to happen or to be made more difficult" (95). Twenty-one percent of responses to a 2014 Bishoff Group survey noted a lack of administrative support as one barrier to digital preservation (Bishoff & Smith, 22).

Interdependencies

The group was expected to make decisions by consensus, which can be both a pro and a con of partnerships. Each of the functional areas represented had a broad stake in a new digital asset management system, and in particular for digital preservation goals, with each area envisioned to have an eventual ongoing role. This mirrors Verheul's finding among 15 European libraries that "none of the libraries have

placed all activities of digital preservation strictly within one unit" and that "in practice, digital preservation is a subject for all units and falls under the responsibility of the library as a whole. Moreover, it will have to be embedded in the normal workflow activities of the library in the future" (29). The scale and variety of digital assets managed across our Libraries reflected this as a reality and encouraged the group to think outside of departmental silos to address the issue.

Reflecting on their home institution Rinehart, Prud'homme, and Hout write, "it is possible that organizational structures are inhibiting DP, particularly if the digital collections are maintained by separate departments that have different reporting lines . . . this creates confusion regarding who has ownership of DP" (33). The UNLV Libraries were committed to overcoming these roadblocks, yet thinking needed to evolve from considering digital asset management *after* digital assets were created to an acceptance that digital preservation responsibilities and workflows needed to be collectively understood and clearly explicated *prior to* digital reformatting, metadata creation, and web development. As noted by Lavoie, "organizational issues [highlight] complicated patterns of preservation interests and obligations on the part of multiple stakeholders associated with a particular set of digital materials. Who [is] responsible for digital preservation over the course of the digital life cycle . . . digital preservation often involves a wide variety of stakeholders, each of whom bring different sets of motivations, objectives and incentives to the table" (3-5). There was some initial concern with prioritizing digital preservation over other functional requirements, but eventually a new partnership-based philosophy emerged, advocating collective responsibility for digital assets as a shared foundation for the future.

Influencing Change

By charging a cross-divisional group comprised of management and support staff, it was hoped that increased education would ignite evolution through additional areas of the organization. Rinehart et al note, "three of [their library's] eleven departments are already staunch DP advocates. Another five departments have some stake in DP and need assistance in understanding how DP affects them" (35). The drive to create more advocates became a focus of our group as deliberations progressed. Ensuring baseline knowledge relating to digital preservation became a priority for both the partnership and future pilots. As Ravenwood et al note, "despite the need for librarians, archivists, and curators to share responsibility with IT staff, it seems that a lack of common understanding can lead to a lack of ability to work together, which could jeopardize organizational efforts to preserve digital material" (90). One way to help mitigate this is through common shared understanding and education. Supporting this, an onsite daylong seminar was held which included the Task Force, several others in the Libraries, and external participants. The course, "Preserving Digital Archives," provided a fundamentals overview of digital preservation, including reference models and sample policies. Education continued through subsequent webinars and by spearheading two pilot projects of commercial preservation systems. Task Force members, regardless of functional background, were encouraged to participate in all learning experiences. Ravenwood et al continue, "encouragement from senior managers for cooperative working and participation in events or training which include both IT staff and curatorial staff would help to improve understanding [between these two communities]" (98).

But how much education is enough to make decisions? *From Theory to Action: 'Good Enough' Digital Preservation Solutions for Under-Resourced Cultural Heritage Institutions*, encompasses the Digital POWRR (Preserving Digital Objects with Restricted Resources) white paper and associated website produced by a working group comprised of five separate academic institutions in the American state of Illinois, focused on advancing their level of digital preservation despite shared challenges of funding and general resources. They evaluated a range of products associated with digital preservation, both open source and commercial, and provided details of how each handled various preservation components as described in the OAIS Reference Model, one of the foundational (and aspirational) models related to

digital preservation best practices. They note that "small staff sizes, a lack of specialized expertise, dated technical infrastructures, and/or limited budgets create unique barriers for the professional tasked with stewarding digital content. When combined, these factors can create a seemingly insurmountable obstacle" (Schumacher, Thomas, VandeCreek, Erdman, Hancks, Haykal, Miner, Prud'homme, & Spalenka, 3). Despite these barriers, the Illinois working group had an epiphany,

> *"We discovered a fundamental misconception preventing many cultural heritage professionals from making meaningful progress towards the development of an effective program. We assumed that digital preservation is an either/or proposition; either an institution has implemented successful digital curation and preservation measures or it has not. We came to realize that the opposite is true. Digital preservation is best thought of as an incremental, ongoing, and ever-shifting set of actions, reactions, workflows, and policies. An iterative approach means that practitioners don't have to start by creating or selecting a comprehensive solution and making hard and fast technology choices to be used for the next 20 years. They can start by taking small steps to prioritize and triage digital collections, while working to build awareness and advocate for resources. It is appropriate to focus efforts on the activities that we can perform in the next six to twenty-four months to steward our digital content, rather than wait a decade for a potential perfect solution" (ibid., 4-5).*

This thinking was mirrored in the aforementioned *Blue Ribbon Task Force* report, which noted, "digital preservation is indeed a significant commitment, but to present that commitment as a once-and-for-all, all-or-nothing decision may exaggerate the economic challenge of initiating and sustaining digital preservation services . . . another misleading perception about digital preservation investments is that the technical and curatorial choices are binary: either we implement intensive preservation and curatorial techniques such as format migration or emulation immediately and forever; or we do nothing" (99). It notes that minimalist preservation strategies are an option, and that such a strategy still allows one the option to implement a more extensive future strategy; the report notes that looking at economics / resource needs could be viewed in a shorter time span, perhaps more realistic given that preservation costs over time are hard to predict (ibid.). One of the report's conclusions states, "commitments made today are not commitments for all time. But actions must be taken today to ensure flexibility in the future" (81).

While the UNLV Libraries have not fully determined every role for various operational steps related to an eventual digital preservation workflow, having multiple stakeholders and decision makers mutually involved at the start has fostered increased communication, shared learning, and deeper appreciation for the myriad digital preservation actions that are necessary for success. A summary of tips for forming an initial digital preservation partnership include:

- prioritize bringing together numerous individuals with diverse perspectives, even if this results in longer deliberations on ultimate decisions
- jointly suggest and subsequently review a list of ground rules to help guide interpersonal behavior expectations of the diverse membership. Collegiality yields ongoing dividends
- provide educational opportunities to get everyone "speaking the same language" and responding to the same concepts; assumptions can cause misunderstanding and result in lost trust
- target administrators, managers, technical experts, and influencers for the group; each has an important role to play in allocating resources, evaluating technologies, and shifting energy
- accept that digital preservation is a moving target and then identify concrete actions despite this; even small steps can build momentum
- break larger concepts, challenges, or questions into experiments, projects, and research activities that can create a pilot project pipeline

Policy

The Space Between

The formation of partnerships was instrumental in gathering perspectives, building common ground, and understanding dependencies and impacts of digital preservation activities. But the next step was to find a way to focus the work on more practical concerns and navigate the space between theory and practice. The literature (Trujillo, Bergin, Jessup, Radding, & McGowan, 119) shows that after forming working groups, many organizations then take the next step of focusing on a particular toolset for testing. As technology evaluation and testing began, our group realized there was a large amount of minute detail to consider when configuring systems and determining workflows. One need was to better understand our content. Without understanding more about *what* we might be preserving, it was difficult to make choices on *how* to preserve it, let alone speculate on how we might *use* the content through time. Many choices were challenging, due not to specific formats, but because they pointed to the need for human intervention to guide and select from a set of actions that are then executed through technology. Systems are designed to carry out routine functions, but not all content fit preselected functions, nor did it all warrant the same investment in storage. Criteria were needed to determine appropriate management and technical actions depending on content characteristics.

Focus on Content

Sandy and Corrado propose a three-part model that reflects the challenge we discovered and suggests that one way to fill the gap between high-level understanding and specific technology is to focus on the nature of the human interventions in digital preservation as expressed through policy. They state, "policies are high-level documents that provide a framework for ensuring trust. Policies can cover aspects relating to management, technology, or content, but are considered here in their overarching and governing role or providing direction as a management tool. Along with policies, documented plans and instructions for day-to-day procedures can also be consulted in the future when one wants to know why, what, or how decisions were made and what actions were taken" (6).

By discussing specific use cases and scenarios, we sought practical solutions that favored flexibility over rigidity and defined practices that weren't governed by unrealistic theory or which fixated on specific technology limitations. Instead, we asked *what needs to be done to establish trust in stewarding these materials*, and a pattern emerged that suggested more specific types of preservation actions. We soon began roughly sorting content into categories, with discussions focused on uniqueness of material, commercial value, organizational mandates, preservation risk level, and other factors.

This led to several in the group suggesting the drafting of a "spectrum-based" digital preservation policy that could codify a flexible approach to managing the organization's assets. Members of the group drafted a local digital preservation policy to:

- serve as a clear statement of organizational commitment to digital preservation
- outline a definition of digital preservation as inclusive of policies, strategies and actions
- define parameters for sorting content into different preservation treatment tiers

The document contains guiding principles and addressed mandates, and defines four levels of commitment from highest to lowest priority. The policy provides criteria for human intervention and decision making about assets, while also serving as a public commitment and advocacy tool for the organization. The policy also provides curators and administrators with a useful reference document when engaging donors or external stakeholders about born digital acquisitions, collaborative digitization agreements, and university mandates for records.

Details and Delegation

Once the preservation tiers were finalized for the policy, a clearer pathway emerged to evaluate the use cases for particular materials that arose during the group's pilot projects, described below. The *Blue Ribbon Task Force* notes a "need for clear allocation of responsibilities . . . each organization that creates data should have clear policies that specify roles, responsibilities, and procedures" (78). The group debated level of specificity for the preservation policy, and rather than become stymied in details, the group tried to pause and consider whether the topic was policy-level or practice-level, deciding to address some questions in subsequent additional documentation:

- What is automated versus a manual action?
- What procedures should be explicated and how do they relate to the policy?
- What are the key roles in the organization currently; and for the future?
- Who will do unassigned tasks?

The group decided to keep the core digital preservation policy language separate from more detailed procedures, technical guidelines, and job descriptions, consciously moving these questions into additional documentation projects. Procedures and documents can change, while language in the core policy could endure. Discussing who will take on new work is always an uncomfortable conversation; we have not resolved all such questions, but with a clear policy in place and managers working collaboratively in partnership, we are optimistic such questions will be addressed.

Pilots

Library as Laboratory and the Value of Hands-On Experience

In many new initiatives, the daily practice of librarianship must be adjusted to allow space to use the library as a laboratory. As digital preservation is technology dependent, the group acknowledged that time and resources would be needed for testing and experimentation, and management would build this into staff priorities. The UNLV Libraries are strong advocates of pilot projects. Using the label "pilot" connotes an opportunity to learn, take risks, and become more knowledgeable at the end. Regardless of outcome, we view any pilot as impossible to "fail." As noted in the *2015 National Agenda for Digital Stewardship*, "Genuine interest and motivation to learn about a subject cannot be taught in a workshop or training session; similarly, knowledge about standards and practices in an evolving field is best gained through direct, practical experience" (24), and this is precisely what our local pilots provided –low-risk learning opportunities with positive knowledge gained.

Piloting and experimentation occurred through every stage of the Task Force. We performed several direct, months-long evaluations of two commercial systems – ArchivesDirect and Preservica. Both support many digital preservation components of the OAIS model and seemed to meet the needs of our use cases. The two digital preservation platform evaluation pilots emerged from:

- Reviewing the landscape for products
- Formulating a question to explore (i.e. how well will the system handle this use case?)
- Predicting expected results. To what degree does the system follow standards, is easy to use, reasonably efficient, provide automated tools, has good documentation, etc.
- Using the system from ingest to deliverable, to experience the workflow and take notes
- Assessing and analyzing the results

Working in conjunction with the product vendors, Library Technologies helped set up the software and access. For one product there was a more formal preparation process, while the other was more a pre-set

configuration. Both vendors provided training, though this varied in length and format. Once adept at basic functions, several staff took responsibility for unique use cases and worked through the steps suggested by OAIS model best practices as accommodated within each system. We worked collaboratively in the Task Force to communicate progress, ask questions, and troubleshoot minor issues before seeking support from the vendor. At the conclusion of the pilots, the Task Force drafted a report recommending not to continue long-term with either product, as neither fully matched the goals or anticipated workflows we'd envisioned. Interestingly, this was less a "decision" than an acknowledgement that other preservation steps could be more immediately addressed which weren't specifically dependent on either of these products.

Current Approach

Stakeholders calculated existing and future estimated data sizes for preservation needs, which IT staff used to help model cost estimates across several commercial storage / preservation services, and across multiple timeframes. This generalized cost modeling included six systems – ArchivesDirect, Preservica, DuraSpace, Chronopolis, Amazon S3, and Amazon Glacier. Amazon is the largest cloud storage provider in America and is often a component of cultural heritage institution digital preservation platforms, providing a level of digital preservation services against stored assets. Like Preservica and ArchivesDirect, DuraSpace and Chronopolis provide front end interface and tools more directly tailored to cultural heritage institutions' preservation-related functions. Commonalities across all six services is that each are cloud-based, and all meet the best practice of geographically dispersed, offsite data copies, and, to varying degrees, support for additional digital preservation activities, such as data fixity checks. A comparison grid of many of these services can be found at the POWRR website. For the UNLV Libraries at present, it was decided to secure funding and initiate a storage subscription to Amazon, which would allow staff to leverage both S3 and Glacier. This option was unanimously chosen by stakeholders, since:

- The Amazon option would meet several (though not all) digital preservation goals, providing additional significant safeguards to our digital assets
- The option was significantly cheaper than the others, in terms of both start-up and ongoing annualized costs
- Many of the other services actually use Amazon for their back-end storage infrastructure, which provided additional confidence in directly selecting Amazon
- The Libraries' institutional repository, BePress, had an easy to configure, already developed feature which syncs content hosted in the IR to an instance of Amazon S3
- The Libraries had local IT staffing capacity to interact with data stored in Glacier, if needed. Compared to the other services, interacting with Glacier-stored data is less real-time and utilizes a command line interface
- A pathway existed to integrate the Amazon cloud infrastructure with a potential locally developed DAMS system utilizing Fedora as a backend repository

Given that several digital preservation best practices such as periodic fixity checking and multiple duplicate copies are components with both S3 and Glacier, we chose to use Glacier for the majority of our assets, given its cheaper cost and the fact that we intended to continue to keep multiple local copies of our digital assets (currently around 30 TB), mitigating the need for real-time or recurring access to the copies stored in the Amazon infrastructure. The Libraries are at an early stage of piloting Amazon, with the development of sustainable workflows the next step. At present, Amazon is one component of an evolving strategy that will continue to investigate additional automated management tools and software that offers user-friendly dashboards, and, ideally, highly configurable workflows. If continued, the Amazon component cost of our digital preservation strategy will be defined as a core infrastructure cost, one of several strategies mentioned in the *Blue Ribbon Task Force* report (83). At present, members of

the original Task Force have shifted from the original exploratory charge to additional focused pilot projects, and continue practical implementation discussions with the intent of developing sustainable digital preservation workflows. Digital preservation for us has moved from a "project to investigate" into a key programmatic component of digital asset management. While there is no singular answer to the myriad questions associated with digital preservation, the authors see success in the fact that digital preservation is now unquestionably better integrated across the organization, with a shared commitment to sustainability.

Conclusion

Archives are being transformed through digitization, research is being transformed through digital publication, and learning itself relies on digital dissemination and access. We must transform our libraries through development of preservation strategies that can ensure global access to cultural heritage. Despite the complexities of the work, initial investments can be made on a small scale which reap high impact. Lessons can be learned by sharing our reflections of a variety of preservation planning processes. Our experience at UNLV highlights the benefits of a cooperative partnership to frame the work; commitment to experimental pilot projects to actively learn, research, and revise workflows; and the development of a preservation policy to aid the mediation aspects of the work. This approach has been productive in terms of meaningful action, while also empowering all those involved. Digital preservation is within reach for all of us - and the world's information future depends upon our choice to transform our thinking and embrace the challenge.

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