Aligning National Approaches to Digital Preservation

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Economic Sustainability and Economic Alignment: Examples from North America

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Abstract

Much of the literature on digital preservation focuses on technical solutions. However, recent experience from North America suggests that questions of governance and economic sustainability are equally if not more important than technical issues. This paper examines how three community-owned and community-governed digital preservation networks in North America have crafted policies aimed at achieving long-term economic sustainability and discusses their relevance for digital preservation initiatives in other countries.

Introduction

Digital preservation is the corollary to digital collection building. Like many things having to do with infrastructure, it's invisible, unglamorous, and absolutely necessary. Although precise figures are hard to come by, it is generally recognized that most of the world's information is currently being produced in digital form, not as print documents or analogue artifacts. This poses a serious challenge to libraries, archives, museums, and other cultural memory organizations, as well as government agencies. Unlike their analogue counterparts, digital files are inherently susceptible to decay, destruction, and disappearance. Given the vulnerability of digital content to fires, floods, tornadoes, hurricanes, power blackouts, cyber-attacks, and a variety of hardware and software failures, cultural heritage organizations need to start incorporating long-term digital preservation services for locally owned and created digital content into their routine operations, or risk losing that content irrevocably.

A number of countries have recognized the challenge and embarked on ambitious digital preservation programs at the national level. In the United States, the Library of Congress initiated the National Digital Information Infrastructure and Preservation Program (NDIIPP) almost ten years ago, and recently

launched the National Digital Stewardship Alliance (NDSA). In the United Kingdom, the Digital Curation Centre of the Joint Information Systems Committee (JISC) provides a national focus for digital preservation issues. Similar initiatives are underway in Canada, New Zealand, France, Germany, Italy, the Netherlands, and other European countries.

Several lessons have already emerged from these initiatives. One of them concerns the importance of collaboration among institutions, states, and even countries. In digital preservation, as in many other endeavors, there is strength in numbers. With numbers comes complexity, however, and comprehensive digital preservation programs inevitably raise difficult technical, administrative, financial, and even legal questions. That said, these questions are not unsolvable. Indeed, they are being solved, or successfully addressed, by a number of preservation programs in the United States, Canada, and other countries. There is a growing body of empirical experience that shows that it is possible to build technically and administratively robust digital preservation networks across institutional and geographical borders without compromising those networks' long-term viability through excessive complexity and cost.

Economic Sustainability: One Approach

The authors of the final report of the Blue Ribbon Task Force on Sustainable Digital Preservation and Access (2010) have written that "economically sustainable preservation—ensuring the ongoing and efficient allocation of resources to digital preservation—is an urgent societal problem" (p. 9). Proceeding from that assertion, they posited five conditions for economic sustainability:

1. Recognition of the benefits of preservation by decision makers;
2. A process for selecting digital materials with long-term value;
3. Incentives for decision makers to preserve in the public interest;
4. Appropriate organization and governance of digital preservation activities; and
5. Mechanisms to secure an ongoing, efficient allocation of resources to digital preservation activities. (p. 12)

Fortunately, digital preservation solutions that satisfy most or all of those five conditions have started to emerge in the past several years. One especially promising approach combines Distributed Digital Preservation (DDP) with LOCKSS ("Lots Of Copies Keep Stuff Safe") peer-to-peer software in so-called Private LOCKSS Networks (PLNs). As its name implies, DDP is based on the idea of distributing copies of digital files to server computers at geographically dispersed locations in order to maximize their chances of surviving a natural or man-made disaster, power failure, or other disruption. DDP networks consist of multiple preservation sites, selected with the following principles in mind:

- Sites preserving the same content should not be within a 75-125-mile radius of one another;
- Preservation sites should be distributed beyond the typical pathways of natural disasters, such as hurricanes, typhoons, and tornadoes;
- Preservation sites should be distributed across different power grids;
- Preservation sites should be under the control of different systems administrators;
- Content preserved in disparate sites should be on live media and should be checked on a regular basis for bit-rot and other issues; and
- Content should be replicated at least three times in accordance with the principles detailed above. (Skinner, 2010, pp. 12-13)

LOCKSS was developed and is currently maintained at the Stanford University Libraries. It is ideally suited for use in DDP networks. Originally designed to harvest, cache, and preserve digital copies of journals for academic libraries, LOCKSS is also effective at harvesting, caching, and preserving multiple copies of locally created digital content for cultural memory organizations in general. LOCKSS servers (also called LOCKSS boxes, LOCKSS caches, and LOCKSS nodes) typically perform the following functions:

- They collect content from target Web sites using a Web crawler similar to those used by search engines;

- They continually compare the content they have collected with the same content collected by other LOCKSS boxes, and repair any differences;
- They act as a Web proxy or cache, providing browsers in the library's community with access to the publisher's content or the preserved content as appropriate; and
- They provide a Web-based administrative interface that allows the library staff to target new content for preservation, monitor the state of the content being preserved, and control access to the preserved content.

LOCKSS is open-source software and therefore theoretically available for further development by the open-source community. In practice, however, its design and development have been confined to the LOCKSS team at Stanford.

Although there are LOCKSS-based digital preservation networks in Europe (e.g. the UK LOCKSS Alliance and LuKII), most of the Private LOCKSS networks are currently based in North America.[1] Auburn University, a large land-grant university in east-central Alabama, is a founding member of two of them: the MetaArchive Cooperative, an international preservation network which began in 2004 with support from the Library of Congress' NDIIPP Program; and the Alabama Digital Preservation Network (ADPNet), a statewide preservation network which began in 2006 with a two-year grant from the Institute of Museum and Library Services (IMLS), a federal funding agency. ADPNet also served as the model for a third LOCKSS-based network in North America: the Council of Prairie and Pacific University Libraries (COPPUL) PLN in western Canada.

The MetaArchive Cooperative is an independent, international membership association administered by the Educopia Institute, which is based in Atlanta, Georgia. The Cooperative's purpose is to support, promote, and extend the MetaArchive approach to distributed digital preservation practices. The Cooperative is responsible for preserving member organizations' content in a decentralized, distributed preservation network consisting of subject- and genre-based archives (e.g.

[1] Private LOCKSS Networks listing: http://www.lockss.org/lockss/Private_LOCKSS_Networks (last accessed 03-05-2012). This may be changing, as seen through emerging PLNs in Italy and Belgium.

Southern Digital Culture, Electronic Theses and Dissertations, etc.), as well as maintaining and extending its methodology and approach to distributed digital preservation. MetaArchive is growing quickly and currently preserves content for more than fifty member institutions in the United States, the United Kingdom, Brazil, and Spain. MetaArchive is also engaged in exploratory work with several statewide digitization efforts to build a new preservation network and infrastructure that is based on the model of a "preservation hub." The network currently has 16 terabytes of storage at each of the member institutions and has harvested over 900 archival units totaling over six terabytes.

The Alabama Digital Preservation Network (ADPNet) is a statewide digital preservation network that serves cultural heritage organizations in Alabama. ADPNet currently has nine members: the Alabama Department of Archives & History in Montgomery, Auburn University, the Birmingham Public Library, the Huntsville-Madison County Public Library, Spring Hill College in Mobile, Troy University in Troy, the University of Alabama in Tuscaloosa, the University of Alabama in Birmingham, and the University of North Alabama in Florence. Inspired in large part by Auburn University's experience with the MetaArchive Cooperative, the Alabama network began in 2006 with a two-year National Leadership Grant from the Institute of Museum and Library Services (IMLS). The grant provided support for equipment and associated expenses to the seven founding institutions; crucially, it also covered those institutions' annual membership fees in the LOCKSS Alliance for the same period. For their part, the participating institutions split the equipment costs with the IMLS and contributed staff time and other in-house resources to the project. A LOCKSS staff member was assigned to the project to provide technical support and guidance. The IMLS grant ended in September 2008, and ADPNet is now a self-sustaining, member-owned DDP network operating under the auspices of the Network of Alabama Academic Libraries (NAAL), a department of the Alabama Commission on Higher Education in Montgomery. All of the original member institutions have contributed content to the network, which currently contains over 400 archival units totaling over four terabytes. The network plans to harvest several terabytes of new content in 2012, including content from the public libraries in Birmingham and Huntsville.

The COPPUL PLN is a digital preservation network that operates under the auspices of the Council of Prairie and Pacific

University Libraries, a consortium of twenty-two academic libraries in western Canada. The COPPUL PLN began work in 2006 as a two-year pilot initiative among eight member institutions: Athabasca University, Simon Fraser University, and the universities of Alberta, British Columbia, Calgary, Manitoba, Saskatchewan, and Winnipeg (a ninth institution, the University of Victoria, joined the network in late 2010). The pilot initiative was approved by the COPPUL consortium in 2008; and the network has been financially self-supporting since 2010. The COPPUL PLN focuses its preservation efforts on digital collections of local or regional interest that would not be preserved elsewhere. These include: locally hosted open-access journals, especially those that use Open Journal Systems (OJS), an open-source journal management and publishing system developed and managed by the Public Knowledge Project (PKP) at the University of British Columbia and Simon Fraser University; locally digitized collections; small university press publications; digitized journals with a regional focus; and Web sites and online resources from the member institutions' local collections.[2] The COPPUL PLN based its governance policy and administrative structure on ADPNet's, and the two networks have discussed swapping LOCKSS servers to increase geographic dispersion and improve the preserved content's survivability in the event of a major mishap. The COPPUL PLN has harvested over 500 archival units (mostly articles from Open Journal Systems) and 100 gigabytes of content to date. Plans are in place to begin harvesting digital objects from DSpace, CONTENTdm, and other digital content-management systems.[3]

Why Alabama?

ADPNet is the first working statewide PLN in the United States. Alabama was an attractive candidate for a geographically distributed digital preservation network for several reasons. The first is the frequency of hurricanes, tornadoes, flooding, and other natural disasters, especially on and around Alabama's Gulf coast. In the past ten years, Alabama has been hit by at least four major hurricanes and many more tropical storms. In 2005, Hurricane Katrina devastated the coastal communities of Bayou la Batre and

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[2] Personal communication from Andrew Waller, University of Calgary, March 11, 2011.

[3] Personal communication from Mark Jordan, Simon Fraser University, March 20, 2012.

Coden and flooded downtown Mobile. The coastal communities are not the only parts of the state that have suffered from natural disasters, however. The interior of the state is vulnerable to tornadoes. In March 2007 a tornado swept through Enterprise, Alabama, destroying a high school and causing nine deaths.[4] In April 2011, a string of powerful tornadoes hit the cities of Tuscaloosa, Birmingham, and Cullman, destroying entire neighborhoods and killing over 250 people.[5]

The second factor is Alabama's economic status and financial situation. An historically poor state, Alabama ranked 47th out of 51 states and territories in median household income in 2010.[6] The lack of state and institutional resources in Alabama means that technical solutions have to be simple, robust, and above all inexpensive to implement and maintain.

Finally, despite its economic challenges, Alabama is home to a rich and growing array of digital collections at libraries, archives, and museums. Many of these collections can be found in AlabamaMosaic, a statewide repository of digital materials on all aspects of Alabama's history, geography, and cultures.[7] AlabamaMosaic currently contains over 40,000 digital objects from more than twenty institutions around the state, and the number continues to grow. This combination of circumstances—extreme weather, meager state financial resources, and rich digital collections—made Alabama an ideal test case for a simple, inexpensive, but effective digital-preservation solution like LOCKSS.

Although ADPNet was originally inspired by and has some similarities with the MetaArchive Cooperative, there are important differences between the two initiatives. First and most importantly, the Alabama network is a single-state solution. This has simplified governance and allowed the network to be absorbed into an existing legal and administrative entity, one with bylaws and a

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[4] For more about the 2007 tornado in Enterprise, Alabama, please see: http://en.wikipedia.org/wiki/Enterprise,_Alabama (last accessed 03-05-2012).

[5] For more about the "2011 Super Outbreak" http://en.wikipedia.org/wiki/April_25-28,_2011_tornado_outbreak (last accessed 03-05-2012).

[6] U.S. Census Bureau (2010), "Table R1901: Median Household Income (In 2008 Inflation-Adjusted Dollars)," available at http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_10_1YR_R1901.US01PRF&prodType=table (last accessed 03-06-2012).

[7] AlabamaMosaic repository: http://www.alabamamosaic.org/ (last accessed 03-06-2012).

committee structure already in place. Second, the Alabama network was designed to be a practical solution to a pressing statewide problem, not a research-and-development project (although the network has worked with the LOCKSS technical team on ingesting large archival units and other technical issues). In order to attract participants, ADPNet had to be simple, robust, and above all inexpensive. This, and the fact that only one or two institutions in Alabama had had any prior experience with LOCKSS, meant that the members opted for the simplest, least expensive hardware and software solutions available, in the hope that these would be easier to deploy and manage and more attractive to other institutions in the state. Finally, unlike the MetaArchive Cooperative, ADPNet is not a service organization with a separate administrative office. Rather, the preservation network was intended to be sustained primarily by in-kind contributions from its participating institutions. In other words, ADPNet was designed from its inception to run on relatively small expenditures and "sweat equity." To some degree these differences reflect Alabama's expense-averse institutional culture. They also reflect a preference for simplicity, self-sufficiency, and informality where administrative arrangements are concerned.

Economic Sustainability: Practical Issues

Auburn University's experience with the MetaArchive Cooperative and especially with ADPNet suggests that LOCKSS-based distributed digital preservation networks are a relatively simple and affordable way to preserve locally created digital content, regardless of the type of institution or the nature of the content to be preserved. If a group of institutions in one of the poorest states in the United States can set up and sustain a robust digital preservation network, then presumably other institutions in other states and countries can do it too.

This raises a practical question: How does a group of institutions go about setting up a LOCKSS-based preservation network? A good first step would be to download and read a copy of the *Guide to Distributed Digital Preservation*, the MetaArchive Cooperative's first book—it was published in 2010 by the Educopia Institute, and it is the first comprehensive guide to the

subject. The *Guide* is available for free as a PDF file from the MetaArchive Web site.[8]

The first requirement for a PLN is a quorum of at least six institutions that have locally created digital content they would like to preserve and that have agreed to work together to create the network and to allocate sufficient resources to sustain it over the long term. A PLN may have more than six members—MetaArchive, COPPUL, and ADPNet all do—but six is the recommended minimum to ensure network robustness in the event that one or two nodes experience a simultaneous failure.

The second requirement is a policy or governance document. This document contains the rules for running the network and spells out the rights and responsibilities of the network members. When the MetaArchive Cooperative began its work in 2004-2005, there were no governance documents for collaborative digital preservation networks to use as models, so the members had to draft their own from scratch, with some help from legal counsel at one of the member institutions and *pro bono* contributions from a private law firm in Atlanta. Thanks to MetaArchive's work and work by other preservation initiatives in North America, there are now at least three publicly available governance documents that nascent preservation networks can copy or adapt to their purposes: the MetaArchive Cooperative Charter, the ADPNet Governance Policy, and the COPPUL PLN Governance Policy. All of these documents are publicly available on the Web sites of the three PLNs.[9] Other institutions are encouraged to use them as models.

Finally, setting up a distributed digital preservation network requires money, either in kind or in cash. Distributed digital preservation is less expensive than re-creating damaged or destroyed collections, but it is not without cost. In general, the costs can be divided into four categories: hardware, staff time, communication, and membership fees.

Hardware first. Every preservation site in a PLN needs a dedicated LOCKSS server computer, or LOCKSS box. LOCKSS

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[8] The Guide to Distributed Digital Preservation: http://www.metaarchive.org/GDDP (last accessed 03-06-2012).

[9] These governance policies are publicly available at the following locations: http://adpn.org/resources.html; http://coppullockssgroup.pbworks.com/w/page/11478105/FrontPage#GovernancePolicy; http://www.metaarchive.org/documentation (all last accessed 03-06-2012).

will run on inexpensive, even surplus or superannuated equipment, but we have found that it runs best on up-to-date servers with at least several terabytes of expandable storage capacity. Although prices are falling, these servers typically cost between USD$2,000-USD$4,000. Remember too that as a digital preservation network grows, additional storage space needs to be purchased and that hardware must be refreshed at regular intervals.

Staff time is needed is manage the LOCKSS equipment and to write the documentation and instruction sets (manifest pages and plugins) that LOCKSS uses to identify available content and harvest it into the network. The total commitment in staff time is not very large—typically the equivalent of one quarter-time staff person or even less—but it is an expense and needs to be considered at the outset. Communication costs are negligible, at least in our experience. The MetaArchive Cooperative conducts weekly conference calls and holds an annual meeting of the cooperative's Steering Committee. ADPNet conducts monthly conference calls and holds an annual meeting of the network's Steering Committee. COPPUL conducts "mostly monthly" Skype calls. All three networks have listservs, and most routine business is conducted by e-mail.

This brings us to membership fees, the single most expensive item on the list. There are two types of membership fees in PLNs: the annual LOCKSS Alliance fee, which is usually required but may be waived at the discretion of the LOCKSS administration, and network membership fees, which are optional. The LOCKSS Alliance fee is based on the Carnegie Classification system for colleges and universities in the United States and currently ranges from USD$1,080 per year for small, two-year institutions to USD$10,800 per year for large research universities. Obviously, this is a substantial expense, and it has put LOCKSS-based digital preservation beyond the reach of smaller, poorly resourced institutions—that is, precisely those institutions whose digital collections are most vulnerable to loss.

In an attempt to eliminate this obstacle to membership, the Alabama network worked out an agreement with LOCKSS that will permit institutions to join the network for a graduated annual membership fee without also having to join the LOCKSS Alliance, as long as the network delivers an previously agreed-upon amount for the year to LOCKSS to pay for continued software development and technical support. The product of negotiations between the LOCKSS administration and Thomas C. Wilson,

Associate Dean for Library Technology at the University of Alabama, the new ADPNet membership system consists of four membership categories with progressive annual membership fees, base storage allocations in the network and fees for increasing that allocation, different levels of technical and administrative responsibility, and different levels of representation on the ADPNet governance bodies. Specifically, the four ADPNet membership categories are: Anchor (base annual membership fee: USD$5,000; base local data allotment: 1.5TB); Host (base annual membership fee: USD$2,400; base local data allotment: 500GB); Participant (Large) (base annual membership fee: USD$800; base local data allotment: 1.5GB); and Participant (Small) (base annual membership fee: USD$300; base local data allotment: 500MB).[10]

The new four-tiered ADPNet membership system was designed to address three issues. First, by divorcing membership in ADPNet from membership in the LOCKSS Alliance, it was designed to make participation in the network possible for smaller, poorly resourced institutions that cannot afford the LOCKSS Alliance membership fees. Second, it was designed to enforce the principle of "use more, pay more" by making membership fees commensurate with usage of the network. Third, and in that connection, it was designed to address the "free rider" problem that was identified by the authors of the Blue Ribbon Task Force on Sustainable Digital Preservation and Access Final Report and which they defined this way:

> **free-rider problem:** a situation arising when goods are nonrival in consumption, when benefits accrue to those who don't pay for them. For example, the costs of preserving digital assets may be borne by one organization, but the benefits accrue to many. (p. 107)

The new ADPNet membership system ensures that all the members pay something in order to belong to the network. At the same time, the less-expensive membership categories were designed to persuade institutions that might otherwise opt out to participate. Evidence to date suggests that the system is working as intended. Two public libraries—the Birmingham Public Library and the Huntsville-Madison County Public Library—joined the network at the end of 2011, the first at the Host level, the second at the Participant (Small) level. The network now consists of a state

[10] For details on the different levels of membership, see the "ADPNet Membership Model" at http://adpn.org/resources.html (last accessed 03-06-2012).

agency, five large or medium-sized research universities, a small liberal-arts college, and two public libraries—a fairly diverse membership. This early evidence suggests that the system of graduated membership fees will be successful; we hope that it can serve as a model for other digital preservation networks that are facing the same problem.

The MetaArchive Cooperative has been grappling with some of the same issues. The Cooperative encourages but does not require members to pay the LOCKSS Alliance membership fee. In addition, it charges an annual membership fee of USD$5,500 (for Sustaining Members—the highest level of membership) or USD$3,000 (for Preservation Members—a lower level of membership). These fees are used to support the Cooperative's administrative, collaborative, and software-development activities. The Cooperative recently added a Collaborative Member category that has enabled consortia of institutions to join the network through a lead institution for USD$2,500 per year, with nominal annual fees—typically USD$100 per year—for each of the consortium member institutions.[11] It is hoped that this will broaden participation in MetaArchive.

It is important to repeat that membership fees are not required for LOCKSS-based networks. For example, the COPPUL PLN in western Canada does not charge a separate membership fee. Instead, every member pays the annual LOCKSS Alliance membership fee (the same arrangement that ADPNet used to have).

Economic Sustainability: Some Guiding Principles

Auburn University's experience as a founding member of two digital preservation networks and the model for a third has enabled it to identify a number of principles that contribute to economic sustainability. Briefly, the main ones are as follows:

- Whenever possible, use open-source solutions (e.g. LOCKSS)—not necessarily because they cost less than commercial solutions, although generally they do, but because they can be managed and modified locally. This is an

[11] Please see: http://www.metaarchive.org/how-to-join (last accessed 03-05-2012). Starting in 2012, the membership fee for the Collaborative category is calculated on a case-by-case basis in accordance with the number of member institutions in each consortium: see http://www.metaarchive.org/costs (last accessed 03-05-2012).

important consideration if one believes that cultural heritage organizations should retain control of and access to the digital content they want to preserve while minimizing their dependence on third-party solutions.

- Whenever possible, take advantage of existing administrative infrastructure. There is a corollary here: whenever possible, avoid creating new administrative infrastructure. As was mentioned above, ADPNet is part of the Network of Alabama Academic Libraries (NAAL), an existing state agency. The COPPUL PLN is part of the Council of Prairie and Pacific University Libraries, an existing consortium of academic libraries in western Canada. For various reasons, the MetaArchive Cooperative decided to create a new administrative entity (the Educopia Institute in Atlanta, Georgia) to manage that network, but that decision was necessitated by the network's geographic dispersion across a number of states and the absence of a satisfactory existing administrative home. In the MetaArchive event, this arrangement does not seem to have impeded the network's growth. On the contrary, basing the administration of the network with a neutral agency seems to have allayed concerns about institutional favoritism (and fluctuations in institutional commitment) and increased the network's attractiveness to potential members.

- Aim for a lightweight administrative structure. Like any other form of administration, administering a digital preservation network costs time and money, and it is therefore advisable to keep the administrative structure as simple as possible. ADPNet and the COPPUL PLN each have just two committees: a steering committee for policy questions and a technical committee for hardware and software issues. The MetaArchive Cooperative has a similar administrative structure. The networks have different communication schedules: due to its size and relative complexity, MetaArchive holds weekly conference calls, the COPPUL PLN meets via Skype every other week, and ADPNet has monthly conference calls. A lot of business in all three networks is conducted by e-mail. The idea is to make digital preservation a routine, low-maintenance, and integral part of an institution's information-management activities.

- Delegate as much decision-making power as possible to the individual member institutions. They know their digital collections best, and are best able to set preservation priorities.
- Broaden "ownership" of the network by involving all the network members in management and administration. The chair of the ADPNet Steering Committee—the network's policy-making body—rotates among the participating institutions every year or two. This helps to ensure a flow of fresh ideas and approaches and gives all of the members a stake in the network's success. The same arrangement obtains in the COPPUL PLN. Management of the MetaArchive Cooperative tends to be concentrated in the central office that was created for that purpose, but the member institutions are represented on the network's steering committee.
- Finally, a perhaps-controversial and counterintuitive principle: resist spending a lot of time working on "business models" or devising detailed financial justifications for digital preservation. Such activities may be necessary at the national level or for very large and complex organizations (e.g. national libraries and archives), but they are less useful at the local level. The very fact that institutions have invested substantial resources in creating digital collections and have a professional and fiduciary interest in protecting that investment by preserving those collections is reason enough to institute a digital preservation program. Doing so will require planning and the apportionment of responsibilities, but it should not require elaborate and time-consuming justifications. If it does, that itself may be a sign that long-term institutional commitment is lacking.

Whichever preservation model one chooses, it is advisable to keep it as simple and cheap as possible. Simplicity contributes to economic sustainability; complexity undermines it. This maxim rings true across a whole spectrum of activity, especially since anecdotal evidence suggests that digital preservation can be a tough sell precisely because of its perceived complexity and cost.

Robert Fox (2011) of the University of Notre Dame has identified a number of "key advantages" of peer-to-peer digital preservation networks, including "garner[ing] support from like-minded institutions and rais[ing] the awareness level regarding the preservation of key digital assets"; "the potential to increase the knowledge base required to maintain the preservation systems

being used"; and "increas[ing] the opportunity for validity checking, especially in systems that use 'voting' as a mechanism for checking file integrity" (p. 268). In addition to those benefits, distributed digital preservation networks also offer excellent opportunities for international collaboration. Geographic separation of LOCKSS nodes is one of the core principles of DDP, and the more far-flung the LOCKSS servers are, the more survivable the network will be. It is hoped that the points raised in this paper will help to persuade other institutions that distributed digital preservation is an affordable option for their digital collections. The members of the MetaArchive Cooperative, ADPNet, or the COPPUL PLN would be happy to help interested institutions—in the United States, Canada, or other countries—get started on setting up their own DDP networks.

Conclusion: Toward Economic Alignment?

Digital preservation is widely perceived to be a complex and expensive undertaking, requiring years of planning and large infusions of money and other resources. As Fox (2011) put it, the issues surrounding long-term digital preservation "are daunting not only owing to the complexity of the topic, but also the time commitment that would be required to implement very robust preservation systems" (p. 271). This perception may be true in some cases, but it need not be. The experience of the LOCKSS-based DDP networks in North America suggests that it is possible to build robust, scalable, and economically sustainable preservation solutions with relatively modest resources. Moreover, it is possible to extend this solution across different kinds of institutions in different states, provinces, and countries. The MetaArchive Cooperative is a truly international preservation network, with institutional members in Brazil, Spain, and the United Kingdom. The ADPNet-COPPUL relationship is an example of two self-sustaining DDP networks that are collaborating fruitfully across national borders. Taken together, these initiatives represent working examples of economic alignment and offer proof that it is possible to create affordable and sustainable preservation networks internationally.

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