Six Strategies for Sustainable Preservation of Born Digital Public Television

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Abstract

This paper is based on a report entitled, Strategies for Sustainable Preservation of Born Digital Public Television*, published in February 2010 by the Preserving Digital Public Television Project (PDPTV) [1], part of the National Digital Information Infrastructure and Preservation Program (NDIIPP) of the Library of Congress. In that comprehensive report, which is aimed at a US public broadcasting audience, we present the technical, operational, and economic requirements for digital preservation to a large, diverse, and fragmented system that is generally unaccustomed to including preservation in its mandate. The report is largely framed around the guidelines established by the Reference Model for an Open Archival Information System (OAIS) and Trustworthy Repositories Audit and Certification: Criteria and Checklist (TRAC), and argues that there is an urgent need for a dedicated digital preservation repository, or system of repositories. It discusses some economic and business models that such a repository might employ in order to sustain its operations. The report also presents a case study of the costs related to the development of the prototype preservation repository developed at New York University for the PDPTV Project. In this paper, we present some of the key findings of that report, and argue that sustainable preservation of public broadcasting requires the continual presence of six key factors: alignment of stakeholders, the integration of archival-friendly practices in the digital production workflow, following OAIS and TRAC guidelines, clear communication of value, the application of appropriate business models, and an ongoing re-evaluation of preservation needs and users expectations.*

Introduction

There is no easy answer to the question of how to sustain preservation of and access to born-digital public television content. It is not simply a matter of funds: even if unlimited monies were potentially available, long-term preservation still cannot take place if the wrong decisions are made at the point of creation, or if no one takes on the responsibility to preserve. It is also not solely a question of storage: one can save all the bits in public broadcasting, but if those bits are not discoverable, understandable, and playable, there is no point to investing in a field of servers.

Instead, we argue here that sustainable preservation requires a number of interoperating factors that must be constantly at play throughout the life cycle of digital public broadcasting content. These factors are cyclical, and must be continually revisited as new content is created, new technologies are utilized, and user expectations evolve. The six strategies discussed here are not unique to the public broadcasting context; they are applicable to a broad range of content, disciplines, and organizational scenarios. In this paper, we will address how these strategies can be used to introduce digital preservation to the public broadcasting system and how they can provide a foundation for the first system-wide archiving effort.

The Preserving Digital Public Television Project

In 2004, public television stations Thirteen/WNET in New York and WGBH in Boston, in partnership with the Public Broadcasting Service (PBS) and New York University, organized Preserving Digital Public Television (PDPTV) as a collaboration to introduce digital preservation issues and practices to the public television system [2]. The project was funded by the Library of Congress through the National Digital Information Infrastructure and Preservation Program (NDIIPP) [3]. PDPTV, which concluded in March 2010, focused on addressing challenges related to the preservation of born-digital program files, and was not engaged in the digitization of analog materials.

The goals of the PDPTV project were to:

- Design and build a prototype preservation repository for born-digital public television content;
- Develop a set of standards for metadata, file and encoding formats, and production workflow practices;
- Recommend selection criteria for long-term retention;
- And examine issues of long-term content accessibility and methods for sustaining digital preservation of public television materials.

This paper explores the outcomes of content and repository sustainability research. It incorporates some of the lessons learned by the project partners through the process of developing a preservation repository at NYU, analyzing metadata and file formats, implementing workflows, and watching the public broadcasting system change over 5 years. We address some of the unique challenges US public broadcasting faces in its quest for content longevity. As system-wide preservation efforts are still in their infancy, we hope the sustainability strategies recommended in this report provide helpful food for thought, though we acknowledge they will need to be revisited and revised as new outcomes and conclusions are reached.

Public Broadcasting in the US

US Public Broadcasting is quite different from most other public broadcasting systems around the world. The system is decentralized (in contrast to the UK or Australia, for example), and not government operated, though stations do receive some government funds. There are 700+ radio and 300+ television stations, and very different governance and license statuses amongst them. Some operate under state authorities, such as Louisiana Public Broadcasting, others operate under the auspices of a university, such as Illinois Public Media at the University of Illinois, and still others are licensed to independent community-based not-for-profit organizations, such as WGBH in Boston. In terms of public television, many people are familiar with the Public Broadcasting Service (PBS), but even within the US most people don't realize that PBS is just a distributor for national programs, and that they don't actually produce any content themselves. PBS is not the only distributor in the system: there are other national distributors such as American Public Television

(APT) and Native American Public Telecommunications, as well as distribution of local programming by the producing stations themselves.

The stakeholders in the US public broadcasting system can generally be characterized as fiercely independent. Although they share much in common – including how they are funded, which is generally a combination of grants from the Corporation for Public Broadcasting (CPB) and other public agencies, private philanthropic foundations, underwriters, and contributions from local "viewers like you" – they have numerous differences. Despite the fact that in the Public Broadcasting Act of 1967 Congress authorized the Corporation for Public Broadcasting (CPB) to "establish and maintain, or contribute to, a library and archives of noncommercial educational and cultural radio and television programs and related materials," this has not yet been done. [4] Occasionally a local station or other entity will donate its holdings to a library or archive (which then effectively becomes another stakeholder in the system if public broadcasting preservation). But with the exception of a few larger stations that have created in-house archives, preservation of public television materials has largely been the result of ad hoc efforts or benign neglect.

Six Strategies for Sustainable Preservation of Born-Digital Public Television

1. Define and Align Stakeholder Roles and Responsibilities

Over the course of a typical production, many clips are acquired and others are shot. Sound and still images are also gathered. And various edits of the materials are generated – some as part of the internal assembly process, and some as final program alternatives designed for distribution to different audiences. At the end of a production, a broadcast producer might hold on to her tapes (some tapes are labeled, some are not), perhaps puts them in a box, and then put the box under her desk or in a closet with other similar boxes of half-labeled tapes before moving onto the next production. Although the producer and the station have an interest in keeping those materials around, their role is to create content and put it on air or online. The station does not explicitly have a mission to preserve that content. Similarly, a distributor like PBS, which receives and disseminates lower resolution versions of finished programs, does not prioritize preservation of those programs; its mission is distribution, not preservation. PBS keeps tapes (and now digital files) of broadcast versions of the programs it distributes nationally. But because they do not even receive local programming, they don't play any role in collecting or preserving it.

In the analog era, and indeed in the early digital era as well, roles and responsibilities amongst stakeholders around preservation have been loosely defined, if at all. Today, this scenario severely jeopardizes audiovisual content. Traditional stewardship organizations (such as libraries or archives) only collect a fraction of the public broadcasting material produced, and those stewardship organizations have difficulty providing access (both because they are not granted all the rights they need in order to make the material available, and because they have difficulty in handling audiovisual material). And the primary concern of the handful of public television stations and distributors that have implemented extensive in-house archives still lies in creating and disseminating content rather than in providing preservation services.

The US public broadcasting system is in desperate need of a system-wide preservation repository service, and indeed, it is on its way to creating one, The American Archive. Before such a repository can be built for US public broadcasting, the preservation roles and responsibilities of all stakeholders involved in the creation, dissemination, and consumption of public media must be articulated.

Producers, broadcasters, distributors, educators, journalists, rights holders, cultural memory organizations, and the public (who in large part fund public television creation and broadcast) are just a few of the stakeholders who have a vested interest in ensuring that content survives and can be accessed in the future. However, they all have very different reasons for wanting to access public media now and many years from now, and they have very different, but important, roles to play in the lifecycle of these digital objects. As technologies and business models for preservation and long-term access are developed, public broadcasting will need to carefully think through questions of stakeholder roles: Who has the incentive to preserve? Who can take on the role of preservation? At what point in the lifecycle of the digital work do handoffs take place? Who decides what is preserved (given the enormous amount of material created for each production)? Who is responsible for providing descriptive metadata? Who can use the materials, and under what conditions?

Conversations around these questions and many more will help clarify the responsibility of each stakeholder in the preservation process, and will help ensure that stewardship of digital public media takes places in a manner that each group can agree on and effectively achieve. Without such an alignment of stakeholder roles in the preservation process, born-digital public media is not likely to be adequately managed over the long term, and will end up falling through the cracks in the busy production and broadcast cycle.

2. Integrate Archival-Friendly Practices into the Production Workflow

Public media producers have an obvious role to play in the longevity of the works they create. Digital preservation decisions, whether conscious or not, are made at, or even before, the point of creation. Choices of file formats, codecs, metadata creation and collection, video resolution, and the processing of digital media can have long-term preservation consequences that the production unit is probably completely unaware of.

When the prototype repository at NYU began collecting content from the public broadcasting partners in 2007, the PDPTV team understood that preservation and other valuable metadata should be captured early in the lifecycle of digital programs as possible. The project examined production workflows to identify points where key metadata are created, and layed out a vision of a more ideal world where metadata gathering could be "pushed upstream" into the production process. [5] However, streamlining metadata collection turned out to be problematic because when the project began, production workflows were largely manual and the production technology and digital asset management tools necessary to manage file-based workflows were not in place.

Because standards for file formats and metadata were not yet implemented for the production process, the quality of video and metadata received by the repository reflected this situation. Repository staff had to spend a significant amount of time and resources mapping myriad metadata exports to the PBCore

standard and developing tools to automate metadata extraction and conversion. Additionally, because production masters (received from the producing stations, either WNET or WGBH) and broadcast versions (received from PBS) of programs were not normalized to a common format at NYU, the repository had to find ways to deal with the organization, retrieval, and playback of a wide range of file formats.

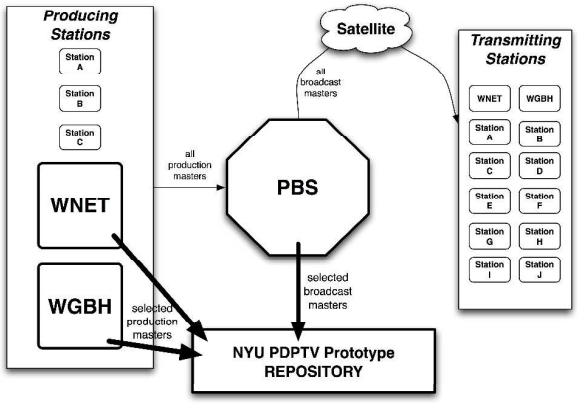

Figure 1. Public broadcasting submission and transmission workflow for programming nationally broadcast through PBS. For the PDPTV project, WNET and WGBH send selected production master versions to the NYU repository, and PBS sent the corresponding broadcast version (lower resolution, with PBS logo, underwriting credits, etc).

In the first phase of the project, 8 different video file formats were collected, with metadata exports from 4 different databases, none of which conformed to any standard schema. Collecting, analyzing, and aggregating inconsistent metadata was challenging and labor intensive. The team concluded that the time and effort required to create manageable Archival Information Packages (AIPs) and Dissemination Information Packages (DIPs) from the Submission Information Packages (SIPs) received from the public media entities was not scalable to a system-wide repository. Standards for file and encoding formats, metadata, and quality would have to be introduced into the production workflow in order to allow automated large-scale ingest into a repository if long-term preservation of public television content were to succeed.

In 2008, WNET launched WorldFocus [6], a daily half-hour international news program. The show was produced entirely in digital form, with file-based recording and editing from end-to-end. WNET management, together with the PDPTV team, decided that archival-friendly practices would be introduced into the production workflow from the very beginning of the program's creation. The approach included mandating sustainable file formats and standardized metadata collection and creation. The production unit wasn't told that certain procedures were being implemented for archival purposes – they were simply informed that these practices would be necessary to make the digital workflow efficient and cost effective. In fact, both explanations are true, and the experiment was successful on both fronts.

WNET hired a digital archivist who worked with the technologists, the WNET archives, and the PDPTV team at NYU to develop standards and procedures for acquisition, production, broadcast and archiving workflows. These included:

- File and folder naming conventions for producers working in the field
- Specifications for: video codec (DVCProHD aka DV100), frame size (1280 x 1080 or 1080i), aspect ratio (16:9), frame rate (29.97 fps), and data rate (1 GB/minute of video)
- No transcoding of the video content throughout the entire workflow. The video codec remained DV100 from the shoot through delivery for broadcast, despite many actions performed on the content, including re-wrapping files from the original MXF wrappers to Quicktime wrappers for editing. Thus no generation loss was introduced during the creation process.
- Creation of PBCore records in-house using the station archive's metadata collection tool, which included extracted technical metadata from files.
- Export of preservation-ready packages to the NYU PDPTV repository.

On the repository's side, these changes resulted in drastically simplified ingest processing (see Figures 2 and 3), demonstrating the benefits of introducing standards and archival-friendly practices into the production workflow [7]. This experiment was successful largely because preservation practices were introduced while the program was being conceived, and coincided with the station's transition to end-to-end file-based workflows.

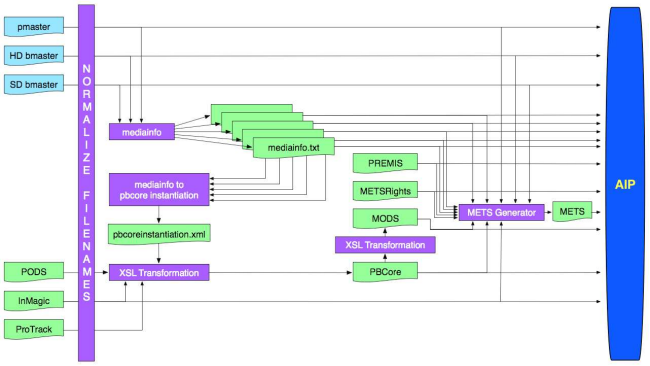

Figure 2. Sample NYU PDPTV preservation repository processing workflow for Phase 1 content. Diagram by Joseph Pawletko (NYU) for the report "Repository Design Report with Attached Metadata Plan." [7]

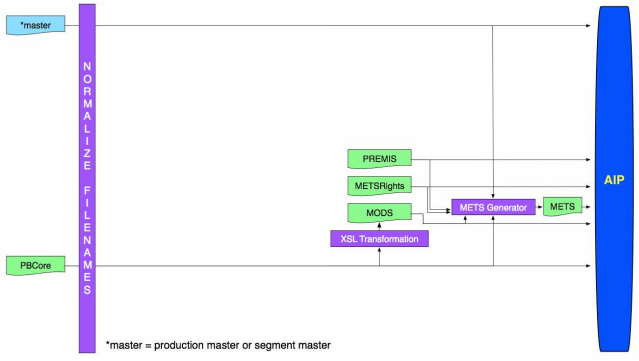

Figure 3. Sample NYU PDPTV preservation repository processing workflow for Phase 2 (WorldFocus) content. Diagram by Joseph Pawletko (NYU) for the report "Repository Design Report with Attached Metadata Plan." [7]

At a minimum, archival-friendly practices and standards, similar to those used for WorldFocus, should be implemented across production units. Better yet, these practices should be incorporated into the station-level workflows. This will facilitate long-term access to the content and make in-house digital asset management (DAM) systems more effective.

It is our hope that guidelines around standardizing file formats, codecs, and metadata will be developed by the upcoming American Archive for the entire public broadcasting system, which will make submission and long-term management of content in a system-wide repository cost-effective, and will also increase efficiency for digital production and archiving in-house at stations. Educating production staff about how decisions made early in the creative process can impact the preservability of that content should also be part of this strategy. However, given the high-pressure and frenzied pace of the production process (and the fact that completion of production is the *raison d'etre* for all public television activities), preservation related outreach should be approached carefully, with a clear articulation of the benefits for immediate production needs, in addition to the long-term implications.

3. Follow OAIS and TRAC Guidelines for Digital Preservation

The repository, or network of repository services, developed to preserve public broadcasting content should align with digital preservation activities in other domains to leverage existing and emerging technologies and best practices.

Though still evolving, best practices for digital preservation have surfaced that can be applied to all types of digital data, regardless of domain. Digital preservation professionals caring for content ranging from social science data, to electronic journals, to audiovisual media utilize the framework offered by the Reference Model for an Open Archival Information System (OAIS) [8] to structure preservation services and roles within and/or between institutions. More specific guidelines relating to the implementation of the OAIS Reference Model are available from initiatives such as Trustworthy Repositories Audit and Certification: Criteria and Checklist (TRAC) [9] and the Digital Repository Audit Method Based on Risk Assessment (DRAMBORA) toolkit [10]. These guidelines are all centered around three overarching digital preservation requirements categories:

1. **Bit Preservation**: Ensuring the 0s and 1s that make up the digital files remain uncorrupted through a stable and secure technical infrastructure, ongoing file verification, and regular backup procedures.
2. **Content Accessibility**: Ensuring that digital files can be identified and located in a storage system, interpreted, read or played back, and delivered to users.
3. **Organizational Infrastructure**: Ensuring that the digital conservation process is continuous through appropriate institutional policies, staffing, and funding.

These three categories and the criteria defined by each are not mutually exclusive. Even with the richest metadata and latest web-based video players, the content will not be accessible without good bit-level preservation. These practices will never be established and upheld if there are no resources and skilled staff to do so. This is one way that digital preservation differs from digital asset management: DAMs are simply tools (or toolsets) that facilitate content accessibility, while preservation requires long-term maintenance practices. Furthermore, sustainable digital preservation is not simply a monetary issue, however important funding is to the overall undertaking.

Although these categories are fundamental for sustainable digital preservation – it is unlikely that digital content will survive very long into the future without a sound technical infrastructure, good descriptive metadata, well articulated policies, and a mission statement supporting that content – we feel strongly that these elemental aspects must be supported by the other five strategies recommended here if the effort is to be sustainable.

4. Identify and apply appropriate organizational & business models

In the analog age, audiovisual archives in the US typically funded preservation efforts – generally involving the reformatting from one content carrier to another (as in the case of video and audio) or making new preservation film print masters – with grant money. The grant would be used to pay for the reformatting or transfer of a single film or perhaps a collection of videos identified as having value to the institution and its users. The institution would cover the costs of storing the new archival masters in its vaults (lumped in with electricity and building maintenance costs), and staff salaries would cover cataloging of the material. Since access was often rather uncomplicated – researchers would come onsite to view access copies, or film prints were loaned for exhibition – there were no large additional costs associated with providing screening or listening uses. And preservation required no regular interventions or maintenance, other than keeping the storage space cool and dry. Archives always had a backlog of materials to process and catalog, but the system worked well enough.

Audiovisual archives have continued to follow this model as they've moved from the analog to digital preservation scenarios, without thinking through either the different needs of preserving digital objects versus analog, or the new potential that digital technology has to reach a wider user base. Archives are using grant money to digitize collections, but are finding themselves without the funds to store the resultant digital objects, to create the kind of detailed metadata records that can greatly increase the value of the content, nor the infrastructure and tools to manage digital content or make it available on the web. For born-digital objects, these sorts of concerns emerge at the beginning of their lifecycle. Grant money alone can no longer be relied upon to "preserve" the content in the analog sense. New business models and income streams are urgently needed to ensure that digital audiovisual materials, which are much more complex in their storage and metadata needs than digital text documents or images, will survive into the future in a way that keeps them relevant to users' expectations. Grants will still likely figure into the picture, but more likely as a means to develop tools and processes to support preservation, not as a means to fund ongoing preservation management.

The good news is that the digital era brings new opportunities to increase access to archival collections, create new value, and enable people to find new uses for content. This translates into a potential for broad access to increase awareness of audiovisual holdings, which can directly or indirectly channel funds into preservation in ways that were previously unimaginable.

The first step for US public broadcasting will be to identify the economic and organizational models that will govern preservation and access activities. An economic model provides a framework for understanding the relationships between economic stakeholders and establishes cause and effect relationships.

An economic model for digital preservation should provide a simple, abstracted view of the digital preservation process that can be used to identify the interests, motivations, and roles of stakeholders involved, and how they are related to each other. An economic model for preserving digital public television would, for example, help to predict how an entity, such as a program producer or a repository, might choose to allocate its resources under given economic constraints, and indicate what actions are required by other entities, such as users or public funders, to ensure that preservation occurs. This knowledge allows us to then devise business models to shape the given economic reality to achieve preservation ends. Economic modeling is an important precursor to business planning.

Determining appropriate economic models for a public broadcasting repository is directly linked to the organizational model of a new repository. Because of the nature of digital content and networked environments, the division of labor and responsibility within a repository can be allocated in many different ways, from a single centralized repository to a decentralized network of repositories shared among public television entities, administered by a third party. Careful and thorough discussions with public broadcasters will be necessary to find which models might both serves their needs and effectively manages costs through economies of scale and scope.

Once these are determined, appropriate business models can be identified and tested. In their 2009 study *Sustaining Digital Resources: An On-the-Ground View of Projects Today*, Ithaka Strategy and Research concluded that, "A sustainable project covers its operating costs through a combination of revenue sources and cost-management strategies and continues to enhance its value based on the needs of the user community." [11] This is an important lesson for all digital archives, especially an emergent one entering a landscape that is already saturated with video content, and where the users' expectations change at alarming rates. The willingness to experiment with revenue models, combine business approaches, and ability to be flexible will figure critically into a sustainable approach to preservation. Public broadcasting is experienced with diversifying its revenue sources, which will benefit the system's preservation business planning.

Seemingly endless questions arise when approaching the business model question: What type of user can and should pay for access or access services? Can a tiered access model, one that balances open access to certain classes of content or uses with charging for other classes or uses, sustain access services? Can access revenues contribute to preservation? Will stations and producers willingly contribute to the preservation effort? Is a subscription model for certain classes of users appropriate? What about advertising?

Successful business models abound in the marketplace that can influence a digital preservation business plan. The "Free" and "Long Tail" models articulated by Wired Magazine editor-in-chief Chris Anderson certainly should be considered, as well as the "Open Business Model," which enables organizations to leverage solutions developed by other institutions and individuals, so as to not reinvent the wheel and instead focus on creating value for users. [12]

5. Clearly Communicate Value of Preservation and Ongoing Access to Stakeholders

It is not easy to fund a project on the basis of "preservation for preservation's sake". Someone must clearly state use cases and value propositions to attract the amount of investment, infrastructure development, and staffing that will need to go into an effort to preserve the enormous amount of digital content generated by the public broadcasting system.

In their final report, *Sustainable Economics for a Digital Planet*, the Blue Ribbon Task Force (BRTF) on Sustainable Digital Preservation and Access argues, "To make the case for preservation, make the case for use." [13] After all, they emphasize, preservation is a "derived demand – an activity that people undertake in the service of something else they value. In the case of digital information, people care about the possibility of future access and use, and preservation creates that potential." [14]

All stakeholders in the public broadcasting system can express a use case for archival content. Producers can potentially reuse materials for new productions; distributors can reach new audiences and markets; a university professor teaching a course on human rights can show footage of actual events to spark student interest; and the public often likes to re-watch old favorite programs. Identifying these uses is not the hard part. Getting useful content to the users in meaningful, cost-effective, and appropriate ways is. Finding ways to incentivize stakeholders to support preservation for long-term access will be a challenge – though not one that can't be overcome with careful planning.

At the outset, it will be necessary to communicate the value of submitting content to a repository to creators and broadcasters. Without wide buy-in and large scale participation from the public broadcasting system, the repository will not be able to grow to a scale that will allow it to provide cost effective preservation services, and provide access to varied user communities.

Users will want to be able to access content of suitable quality, with sufficient metadata, and through diverse outputs that meet their various needs. The public will not likely need the high quality version with detailed technical metadata information that an editor will. Likewise, an editor isn't likely to be concerned with attaching public comments to a video clip. Different modes of access for different users will be an important part of creating value for users and, most importantly, to keep them from going elsewhere to get their video content.

This last point is important when thinking about a long-term sustainability strategy. These days, it is a significant challenge to compete for, and then keep the public's online attention. Likewise, if a repository does not provide an easy-to-use platform with a broad range of material to meet producers' needs, the producer will either shoot new footage, or go to a commercial stock footage house to find the material they need. As for teachers, they need content tailored to their curriculum, which requires completely different packaging and context. To remain relevant and compete in the market place, a public media repository will have to create value not just in the content it houses, but also in how it provides access and contextualizes that content for these and many other user demands.

6. Continually re-evaluate workflows, preservation requirements, and user needs

In conclusion, the sustainable preservation of born-digital public broadcasting content will most certainly depend on a keen understanding of how to best serve the public media system's wide-ranging needs, especially as those needs change over time. Extensive discussions with different communities must take place at start-up, and should continue regularly.

While always keeping in mind the unknown needs of future users, it will be useful to start by engaging user groups about their access needs: What type of material do they want access to? What

different uses can they think of? What quality and format of video and audio is needed? What metadata is most important? For the PDPTV model repository, NYU asked its public broadcasting partners to pretend that they were users, and asked them similar questions. The partners then pretended that they were content submitters, and thought through how the type and quality of the content submitted would ultimately affect what could be disseminated later. This process allowed the repository to frame its services on the life cycle needs of public broadcasters (the only real user group thesfar). These conversations, conducted in Fall 2008, also revealed some of the partners' expectations for a future, system-wide repository [15].

The creation of a sustainable preservation and access repository of public media content will require revisiting these questions as new technologies, tools, and workflows emerge. Re-evaluating the six strategies presented here, changing them as needed, and developing new tactics will also be important. We don't see these strategies as necessary solely at the beginning of a plan for a system-wide repository, though we certainly present here examples of what should be considered now. The landscape of creation, dissemination, and archiving will never stop changing. A sustainable repository of public broadcasting will have to change with it by revisiting these strategies periodically and refreshing the operations accordingly.

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Author Biography

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