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Electronic Records Preservation Educational Module

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PROPERTY RECORDS INDUSTRY ASSOCIATION

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For

PRIA Completed Work Product

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This PRIA Educational Module on **Electronic Records Preservation** combines multiple PRIA publications into one document circumventing the need to search the PRIA Resource Library for all related papers around electronic records preservation.

Preserving land records forever needs to be understood. The resources in this educational module address the past, the present and the future of permanent public records. Much of the material may present new ideas and information for recorders and is imperative to the functioning of the recorder's office. It is not the responsibility of information technology to preserve public records forever but they do have a role to play in an increasingly electronic world.

This paper helps you identify your preservation needs, explains what you need to know and why, how to create a partnership with your IT team, and how to include this information in your RFP.

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Approved by the PRIA Board of Directors on August 28, 2017

Introduction

To understand more thoroughly the concept of preserving land records, it is important to have an understanding of the history of the media used. This PRIA paper describes the primary media used in the preservation of land records; paper, Photostats, microfilm, and electronic images.

Paper

In the beginning, there was paper. Actually, in the beginning there were stone tablets, parchment[1] and vellum[2], but, for the purposes of this paper, they won't be discussed as they weren't made from plant fiber. Papyrus is, also, not considered paper as it is made by laminating strips of sliced grass rather than creating a mulch.

The roots of what we know as paper can be traced to China in AD 105.[3] From there, various papermaking techniques spread slowly westward. The earliest mention of paper made from cotton or linen in Europe was in the 12th century but it wasn't until the advent of printing in the mid-15th century that the demand for paper began to rise.[4]

The paper used for recording real property transactions in the United States was originally manufactured in England, the source of many of our land records traditions. It commonly was called "rag paper" as it was primarily made from recycled and cleaned linen or cotton rags. It took until 1690 for the first U.S. paper mill to be built near Philadelphia.[5]

By this time, the strength and durability of this paper was well known and state archivists recommended or required its use for permanent records. It wasn't until the mid-19th century that wood pulp was introduced into the paper-making process. This change was the result of a shortage of rags and the availability of wood from the vast forests that covered North America.

Processing wood pulp, however, required different manufacturing processes that affected the long-term stability of the paper. Two of the primary destabilizing components were lignin (a natural component of wood) and the acids that were used to breakdown wood fibers into pulp. The result was a product that became discolored and brittle over a relatively short period of time. It wasn't until the mid-1990s that production processes changed and paper made from wood pulp became preservation quality.

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[1] https://en.wikipedia.org/wiki/Parchment
[2] https://en.wikipedia.org/wiki/Vellum
[3] http://users.stlcc.edu/nfuller/paper/
[4] http://users.stlcc.edu/nfuller/paper/
[5] http://www.conservatree.org/learn/Essential%20Issues/ElPaperContent.shtml

Photostats

In the early 1920s, typewriting gradually replaced the handwriting of property ownership details. Although a significant step forward in efficiency and legibility, it still required the recorder to transcribe the submitters' recording information. Also during the early 20th century, a process emerged that could produce a photographic image (copy) of a document. It was a projection photocopier developed by the Commercial Camera Company, which later became the Photostat Corporation.[6] During the 1940s, this machine found its way into recorders' offices but, when it did, it changed many things both for better and worse.

Improved efficiency became the primary appeal for adopting this technology even though little was known about the longevity of Photostats. The days of tedious, hand-cramping transcription were replaced by the click of a shutter followed by a handful of chemical baths.

Maintaining the knowledge base needed to capture reliably the diverse content of a recordable document proved to be challenging. The euphoria of convenience ultimately became the image quality nightmare that makes these records a challenge to manage.

[6] https://en.wikipedia.org/wiki/Photostat_machine

Microfilm

Microfilm was patented by René Dagron in the 1859[7] and was used in the Franco-Prussian war to transport messages across German lines via carrier pigeon. It wasn't until the 1920s that George McCarthy was issued a patent for his Checkograph, a camera that was used to microfilm bank records. In 1928, Eastman Kodak purchased his invention and marketed it under its Recordak Division.[8]

Two significant events in 1938 hastened the use of microfilm for archival preservation in American libraries and educational institutions. The rapid deterioration of the newsprint originals and the numerous difficulties in storage and use of newspapers prompted Harvard University Library to begin its "Foreign Newspaper Project." Today, this project continues and the microform masters are stored at the Center for Research Studies in Chicago. The same year also saw the founding of University Microfilms, Inc. (UMI) by Eugene Power. He had previously microfilmed foreign and rare books, but in 1938 his work became a commercial enterprise as he expanded into microfilming doctoral dissertations.[9]

The adoption of microfilm by recorders began in the mid-1900s. As with Photostats, convenience and efficiency were the primary drivers. Reduced storage space and rapidly improving retrieval technology were compelling reasons for using microfilm rather than creating paper-based books. Another important argument for microfilm that was known but not fully appreciated was the development of standards by the National Micrographics Association and the American National Standards Institute (ANSI).

The academic community whose interests reached beyond convenience to embracing long-term information preservation saw standards as necessary and beneficial. By following well-researched and published standards, the possibility of achieving long-term information existence and court admissibility were greatly enhanced.

In the land recording community, adoption of these standards by recorders was limited. Much of the microfilm in the care and custody of recorders was created by untrained staff and/or indifferent vendors. These factors produced film with poor to average image quality containing undocumented splices (placing court admissibility in jeopardy). The film was often kept in poor storage conditions, which threatened the film's longevity. Add to these negative factors the plethora of formats that were used over the years and the results are that the history of U.S. land recordings is deteriorating, the film is difficult and expensive to migrate to modern formats, and, apparently, not worth saving by those who should fund its rescue.

[7] https://en.wikipedia.org/wiki/Ren%C3%A9_Dagron
[8] http://www.srlf.ucla.edu/exhibit/text/BriefHistory.htm
[9] http://www.srlf.ucla.edu/exhibit/text/BriefHistory.htm

Electronic Images

In the early 1960s, the National Aeronautics and Space Administration (NASA) introduced electronic imaging to the world at large. The need to transmit pictures from spacecraft required the use of a digital camera, a direct precursor to the cameras and smart phones available today.

One of the first business applications to embrace electronic imaging technology was the facsimile machine. For fax machines to be widely accepted, a standard image format and data compression scheme was necessary. The Tagged Image File Format (TIFF) and the Consultative Committee for International Telephony (CCITT), now known as International Telecommunications Union, or "ITU," were adopted as the image format and compression schemes that were to be compatible with every fax machine sold.[10]

By the early 1990s, network technology was evolving to meet the bandwidth needs of rapidly developing scanning and storage systems. In marketing parlance, electronic imaging was starting to sizzle and vendors were more than ready to "sell the sizzle." A big obstacle to early sales success was the proprietary data formats that manufacturers created to: 1) make the technology reliable; and 2) lock customers into their product.

Among the best candidates for this scanning and storage technology were heavy microfilm users, putting county recorders in the cross hairs of industry marketing efforts. Most recorders resisted the temptation to be early adopters based on concerns over embracing proprietary technology.

It was not until the late 1990s that sluggish sales and improving system reliability made the marketplace realize that a standard data exchange format would be the key to jumpstart sales. The timely success of the fax machine made the TIFF ITU Group 4 (TIFF Group 4) an obvious choice for a broader imaging standard. By the end of the 1990s, TIFF G4 had become the "de facto" image and compression standard and recorders across the country began to adopt this new format.

The cumulative impact that electronic imaging and internet access have had on the use of microfilm, both for viewing and preservation, is devastating. Traditional microfilm companies push back, but the promises of improved image quality, streamlined workflow, and instant access make microfilm seem primitive and undesirable.

In 1995, Eastman Kodak Company, recognizing the displacement of film for records retrieval, introduced the Kodak Archive Writer as a way to incorporate the preservation benefits of microfilm into the workflow of a scanning and storage system. Archive Writers attached to a Land Records Management System (LRMS) network and use light-emitting diodes (LEDs) to record images on microfilm. Archive Writers have been successfully integrated into many LRMS products and, when their use complies with PRIA's best practice *Recording Electronic Images on Roll Microfilm*[11], the microfilm produced by these systems is customized for preservation and efficient document recovery.

Beginning around the turn of the 21st Century, electronic imaging technology has profoundly changed the land records management industry. PRIA has been a key player in this evolution by pioneering the policies and procedures to exchange real property records through the process known as "electronic recording." But without the image and index data that the LRMS manages, all of the technology and workflow improvements

[10] http://netpbm.sourceforge.net/doc/faxformat.html
[11] https://ww.pria.us/i4a/pages/index.cfm?pageID=3308

are meaningless.

The strategic value of electronic records has been under-appreciated and now is the time to turn our focus to assuring their authenticity and long-term existence. PRIA's microfilming best practice is just one layer of insurance in what needs to become a multilayered approach to preserve records. The time to develop a strategy to preserve electronic records in their native form has come.

Electronic Records Preservation

Approved by the PRIA Board of Directors on December 19, 2018

Introduction

The increasing use of electronic records since the late 1990s has provided unlimited access and unparalleled retrieval speeds along with new risks and liabilities. Those same electronic records may be the most challenging format of record that recording jurisdictions have been tasked with preserving permanently, i.e., forever. History has shown that preserving recorded documents is a low priority. Preserving electronic records is complex and requires a greater commitment and effort than previous formats and media. This paper addresses the complexity of the issues surrounding preservation of electronic records.

An effective electronic records preservation program should include four vital components:

1. The ability at any time to confirm the existence of a record,
2. The ability to authenticate the record,
3. The ability to maintain file uniformity or track acceptable file formats, and
4. The ability to recover the authentic record if it has been lost or corrupted.

This Property Records Industry Association (PRIA) work product describes key characteristics of these four components and identifies various strategic layers of insurance that should be considered in an electronic records preservation program.

Although this document is prepared by PRIA for stakeholders in that industry, the information contained in this work product is applicable to stakeholders in other industries interested in electronic records preservation.

The History and Evolution of Records Preservation

Paper

In the beginning, there was paper. The paper used for recording real property transactions in the United States was originally manufactured in England beginning in the 15th century. The strength and durability were well known, and state archivists recommended or required its use for permanent records. As a convenient organizational tool, the papers were placed in books.

Photostats

In the early 1920s, typewriting gradually replaced the handwriting of property ownership details. Also, in the early 20th century, a photographic process emerged that could produce an image (copy) of a document. In the 1940s the photostat machine found its way into county recorder offices. Improved efficiency was the primary appeal to adopting this new technology, but little was known about the longevity of photostats. The images were also placed in books.

Microfilm

The adoption of microfilm by county recorders began in the mid-1950s. As with photostats, convenience and efficiency were the primary drivers. Reduced storage space and rapidly improving retrieval technology were compelling reasons for using microfilm rather than creating books.

Although microfilm standards were developed, adoption of these standards by recorders was limited. Much of the film was created with limited quality assurance and oversight of staff and vendor personnel. This practice produced film with poor to average image quality that was often kept in poor storage conditions. As a result, the media containing the history of U.S. land recordings is deteriorating. When microfilm has degraded, it becomes more difficult and costly to migrate its contents to modern formats. The cost to preserve or migrate the contents can be significant and is often treated by those who should provide funding as though the records are not a priority.

Electronic Images

By the early 1990s, network technology was rapidly evolving to support the bandwidth needs of developing scanning and storage systems. By the mid- to late-1990s, TIFF Group 4 had become the de facto file format and compression standard for electronic images.

The cumulative impact that imaging and Internet access had on the use of microfilm, both for viewing and for preservation, was devastating. Traditional microfilm companies tried to buck the trend but the promise of improved image quality, streamlined workflow, and instant access made microfilm seem primitive and undesirable.

In 1995, Eastman Kodak Company, recognizing the displacement of film, introduced the Kodak Archive Writer as a way of incorporating the preservation benefits of film into the workflow of an electronic system. Archive Writers could be attached to a Land Records Management System (LRMS) network and use Light Emitting

Diodes (LEDs) to record images on microfilm. Archive Writers have been integrated successfully into many LRMS products and, when their use complies with PRIA's recommendations for committing electronic images to microfilm[12], the film is optimized for preservation and efficient document recovery.

Preservation Expectations

Recorded real property documents are regarded by recorders as "permanent records[13]." Permanent records are documents that retain legal, historical, and administrative value without any timeframe limitations. A frequently cited assumption is that permanent equals 500 years into the future; however, 500 years is not forever. The need to migrate image and index data has always been a necessary component of a permanent records preservation strategy.

Achieving 100 percent document existence and authenticity forever is undeniably ambitious and even more so with the multiple media formats used today to preserve permanent records. The difficulty in attaining this goal was underestimated in the analog world of paper and microfilm, and the consequences of inattention and deferred maintenance are now understood. Permanently preserving books, microfilm, and electronic data/images is a big burden especially if done in such a way as to be certain that all of the records are being securely maintained and no changes are occurring. It takes great commitment on the part of the recording jurisdiction to establish the necessary and appropriate business processes to achieve and maintain such a high standard of preservation.

The virtual nature of electronic data, along with the evolving hardware and software that surrounds it, creates a more challenging preservation environment. To be successful, seemingly redundant practices need to be implemented. These practices should be periodically reviewed for their availability and effectiveness over the lifetime of the records' existence. Together, these practices create layers of insurance to safeguard the health and preservation of electronic records.

There is industry-wide agreement that preservation begins at image capture, which usually takes place within hours of recording. Capturing the best version of the document is time sensitive and critical for authenticity. The importance of capture cannot be underestimated. The people doing the image capture should be focused, well-trained and suited for this particular job. Frequently the people handling image capture do not meet these criteria, which has become evident in historical document collections across the country.

Local or state laws and regulations set policies and expectations for permanent retention. These laws and regulations are often slow to be changed. For example, some jurisdictions are still required to keep paper copies of the recorded document, while most of the jurisdictions are permitted to rely upon microfilm; only a handful are permitted to rely upon electronic images. Potential local disasters (fires, snow, floods, and hurricanes) are seldom addressed when describing acceptable permanent retention options.

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[12] See PRIA's July 2007 Recording Electronic Images on Roll Microfilm

[13] See PRIA's State Chart on Permanent Records

Layers of Insurance

Preservation is best accomplished using a diverse mixture of retention strategies to ensure the long-term existence of the records. Funding these "layers of insurance" may appear redundant or even wasteful but multiple layers and methods help create a robust preservation and recovery program. Diverse practices create confidence in the recovery process.

The first step in establishing a robust recovery and preservation program is to communicate the responsibilities of a recorder to preserve and maintain forever the existence and integrity of the land records to all of the stakeholders. Stakeholders include Information Technology (IT) staff, funding agencies, elected officials/CEO, title professionals, the staff in the recorder's office, as well as the public.

Preservation Roadmap

For preservation layers to be effective, whether a single layer or multiple layers are utilized, business processes need to be established. The business processes become the roadmap that describes in depth how the preservation of the records will be accomplished. In a typical recording preservation environment, this roadmap should include periodic assessment of books and microfilm and routine auditing of electronic records to ensure that the layers are intact and meeting data recovery expectations, and that there have been no unexpected changes. The roadmap should also contain an accurate description of the various media and what periods of time they cover. Finally, the roadmap describes the order in which the various media will be accessed in order to recover missing data/images.

Paper

For centuries, paper was the only medium for recording, accessing and preserving records. High quality paper was the best medium available because of its proven longevity. A few states that still require recorders to print out their recorded documents onto paper and put them into bound books. This requirement results in growing storage space issues but bound books are a form of analog backup. As long as there is not a fire, flood, insect infestation or other disaster that can destroy the paper, then paper is a useful preservation medium and layer of insurance[14].

Microfilm

Recorders also use microfilm as a preservation medium that has been an industry standard requiring simple equipment for future access to records. It is important that the conversion to microfilm takes place before any corruption of the electronic images occurs. This form of preservation medium is another analog version that can be viewed by either a microfilm reader or other magnifying device. While basic microfilm readers are getting harder to find, newer readers are available that scan the film to a computer for display. Today's electronic technology has improved microfilm's usefulness by presenting a better-quality image in a more organized manner. This benefit occurs when the image is first electronic and then placed on microfilm or when an image is retrieved from existing microfilm. Microfilm can last for hundreds of years if film processing

[14] See Appendix 1 – Evolution of Paper

and storage standards are met. If these standards and preservation practices are not met, microfilm is vulnerable to vinegar syndrome, redox, and mold.[15]

Optical Media

Optical media include the wide variety of CDs and DVDs that became available during the 1980s. These media were used in some recording jurisdictions to store electronic images and data. Optical media are less expensive than creating microfilm and take up less space than paper bound books and microfilm. However, the quality of the media varies widely, especially considering the timeframe during which it was manufactured. Most optical media were expected only to have a lifespan of up to 10 years, which does not meet the "forever" expectation for land records. Where and how the media were stored also impact the length of time that the contents might remain unchanged. An additional caution is that optical media are susceptible to scratches and fingerprints, making reliable information extraction a challenge. Finally, the equipment and software to read the media may not be available long term. These optical media might well disappear much as VHS tapes did. If a recording jurisdiction has optical media, the media may provide yet another layer of insurance in a land records preservation business process as long as its limitations are well understood.

Electronic Systems

With the rise of electronic systems, access to index data and images has significantly improved. The trend toward managing records in a computer system introduced a set of under-appreciated risks that support the need for a "layers of insurance" data recovery practice.

Some of these risks include:

- Computer system failures, including hardware and software, resulting in a loss of data and images.
- Reliance on software that fails to detect corruption or lacks quality control to identify missing images.
- Data or image loss when migrating between systems, performing software updates, or doing general maintenance.
- Inadequate ability to recover corrupted or lost data and images.
- Malicious or innocent alterations and procedural failures from internal or external sources.
- Procedural failures because of lack of compliance or inadvertent destruction.

In the relatively short time that these electronic systems have been in place, there have already been instances where information has been lost and only recovered by rescanning these records from bound books or preservation microfilm. If these analog media had not existed or if they had been discarded, the lost data and images could not have been recovered without relying on private sector business partners like title plants. It must be noted that not every state allows title plants to operate. Recovering data from a private sector source should only be considered as a last resort.

One benefit of electronic records is that backup copies are made as a standard practice. Although these backup copies serve as an additional layer of insurance, they do not, on a standalone basis, meet all the technical criteria to provide electronic records preservation. This issue is discussed later in the paper.

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[15] See Appendix 2 – Technical References

Additional questions to consider are:

- In an increasingly electronic recording environment, who is responsible for the existence and authenticity of recorded information?
- Will electronic information and formats survive as well as their analog predecessors?
- Who governs the security of the database?
- Who is responsible for the security to prevent tampering with or corruption of these documents by hackers?

Electronic records preservation should involve the use of a variety of layers of insurance to protect the existence and integrity of electronic data and images. Records custodians must analyze potential risks of loss and develop a plan that addresses each potential loss. Always consider technology obsolescence. Forms of redundancy should be developed to protect against any eventuality. All these issues must be discussed, and answers documented, with vendors and computer department staff.

Offsite Preservation Strategies

Storing electronic data and images is relatively easy and can be cost-effective but must be carefully planned and executed. The preservation of electronic data and images involves more than the typical IT process of making backup copies. Backup copies are just one component of a preservation strategy. A thoughtfully designed strategy, that ensures that data and images do not change, is a crucial consideration.

Offsite storage is an essential strategy for records preservation. It should be included in the permanent records preservation plan, as well as for disaster recovery.

Whether across town, in another part of the state, or across the country, storing a copy of the records away from the location of daily operation is a mission critical part of a preservation strategy. When selecting the location and distance to the offsite storage facility, it is important to consider the types of disruptions or disasters common to the geographical location.

Offsite storage can be challenging with all media types. There are important environmental storage conditions that need to be maintained for the successful long-term preservation of all records. The cost can be a challenge but jurisdictions must find funding for this investment.

Generally, a private sector organization provides and manages an offsite facility. When there is a disaster, quick and easy access is needed. During research for offsite preservation locations, consider ease of access and security of the records. The security considerations include those of the storage facility itself (both physical and environmental), as well as the protocols for secure access by jurisdiction personnel. A memo of understanding, or a more detailed contractual agreement, is an important part of storing records in an offsite facility.

In this age of technological innovation, the use of “the cloud” could be a viable off-site storage solution for electronic records if it was constructed in a secure, trustworthy, and regionally diverse environment. The use of off-site preservation strategies, including a qualified cloud solution, are part of an overall electronic preservation strategy that will be addressed in the next section.

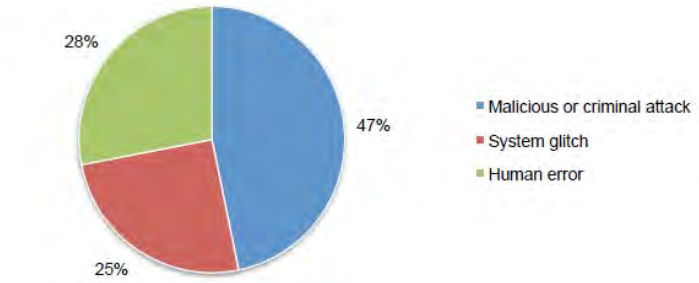
Electronic Preservation

As jurisdictions reduce their reliance on paper records and microfilm, the electronic data and images become the primary source for daily use and preservation. However, the efforts and concerns about using them for preservation have just begun to be addressed.

Preservation of electronic data and images may encompass a series of strategies and processes involving multiple devices and media.

Causes of Data Loss

Data loss probably will occur at some point. Each jurisdiction needs to formulate strategies to eliminate (or at least minimize) the potential loss. Here are industry-recognized categories for data losses.



Source: "2017 Cost of Data Breach Study," Ponemon Institute, June 2017

Malicious or Criminal Attack (47 percent)

- Computer virus – a malicious software program that results in data loss or modification over time and use
- Unauthorized access – loss or modification of data without proper authority, e.g., data mining, data manipulation

System Glitch (25 percent)

- Hardware malfunction – any failure of the hardware that results in data loss over time and use
- Software corruption – any change in the software that results in data loss or modification over time and use
- Natural disaster – any uncontrollable eventuality that results in data loss or modification
- Bit rot – eventual degradation of storage media that can result in data loss over time and use

Human Error (28 percent)

- Any accidental or inadvertent action by a person, or persons, that results in loss or modification of data

A key role of electronic records preservation is to address recovery strategies for these and any other unforeseen data loss, all in an effort to protect the existence and integrity of the original record.

Preservation Versus Backup

Backup, as performed by information technology staff or vendors, is primarily intended for disaster recovery and not preservation. A disaster recovery process may not recover 100 percent of lost information while a preservation strategy does.

A traditional electronic backup process captures the data on the system as it exists at that point in time and is intended to recover information after a disaster. To assess its viability as a preservation layer, the following questions need to be addressed:

- How frequently are backups created?
- How many of these backups are sequential?
- What is the backup scheduling strategy (e.g., quarterly backup that is superseded by an annual backup)?
- Is the policy to overwrite backup media in subsequent backup sessions?
- What is the recovery strategy if there is a failure between backups?
- How long will it take to restore operations if a recovery from backup is needed?

These questions are important to answer so that missing, corrupt, or altered data on the LRMS server can be reliably recovered from backup media. Awareness of the backup frequency and retention period of backup media before they are recycled is essential to determining preservation potential of a backup process. Unless a proactive approach is taken, discovering the inadequacies of the backup strategy will likely take years or more to discover.

Additional concerns include the change of servers and/or the change of operating systems on both servers and computers. Here are other considerations:

- Will the backups from two years ago still be accessible or useable with the current operating system?
- Is the current version of software compatible with backups from several years ago?
- Did the tape drive or other form of backup capture all data and images and can both be imported back into the system three to ten years later?
- Has the integrity of the data been compromised due to the passage of time?

Traditional business continuity is based on two fundamental objectives:

- Recovery Point Objective (RPO) – the maximum targeted period during which data and images might be lost because of a service interruption or major incident. Should computer operations suddenly be interrupted or cease, what is the maximum possible time where data and images might be lost? Is this acceptable? If not, what would be acceptable?
- Recovery Time Objective (RTO) – the maximum targeted period before operations return to a state of normalcy after a service interruption or major incident. If there is a service interruption, how long will it take for IT to restore operations? This recovery period will vary based on the type of service interruption. How much recovery time is acceptable?

In summary, to understand the requirements for the preservation of electronic documents, establish the distinction between backup and preservation with all stakeholders. Some IT personnel believe that periodic backups of electronic data constitute a preservation strategy. IT may presume that backup and preservation are accomplished with the same functionality, but that is not the case.

The concepts of recovery, retention, and preservation are separate actions. The objectives and practices of traditional IT business continuity plans do not adequately encompass the concept of preservation. RPO and RTO relate to business continuity, but alone they do not guarantee the long-term existence of data. Thus, although computer backup copies may serve as a records preservation layer, such copies do not meet all the essential criteria of an electronic preservation strategy.

Electronic Preservation Strategy

An electronic preservation strategy must address all the following requirements:

- Authenticity
  Stored data and images are vulnerable to accidental or malicious change. Steps should be taken to ensure that these files cannot be overwritten or changed while in the custody of the recorder. Write Once Read Many (WORM) recording would be an example of this type of protection.
- File Integrity
  Land records are legal documents and, as such, their integrity is essential. An electronic identification process must create a unique "fingerprint" (a hash "mathematical" algorithm) of each image as soon as possible after recording. This fingerprint information must be maintained in a safe but accessible location to be used as a baseline value for future comparison to ensure the veracity of the image. The hashing calculation should be strong enough that duplicates are not possible.
- Archival Auditing
  Run the electronic fingerprinting process (described above) periodically against every stored image. Compare the results from each run to the file's baseline value to assure its integrity and authenticity.
- Data Existence
  With or without warning, hardware or software malfunction can render stored data irretrievable. If the auditing process discovers a difference between the baseline fingerprint value of a file and its current value, the system must report the discrepancy to the responsible parties. The system should be self-auditing and self-reporting.
- Recoverability
  A process must be in place to restore lost data and images to their original, authentic condition. A credible restoration process ensures that lost or corrupted files can be recovered. The system should be self-correcting.
- Versioning
  When stored data and images are legitimately corrected, those corrections should be tracked through a versioning process that documents the file's history of modification. Versioning should meet audit guidelines applicable to the jurisdiction.

- File Uniformity
    - Awareness of the file types being stored, along with the contents (e.g., compression, header data and associated metadata), is important to ensuring long-term preservation and is critical for a complete and reliable data migration.
    - Various electronic image formats have been adopted and used over the years during which electronic images have been created. As of March 2017, PRIA recommends the use of PDF/A-2A as a standard for preservation of electronic images.[16] Other preservation format standards for property records may evolve.
    - Computer systems and software continue to evolve at a rapid pace. Expecting new systems to maintain backward compatibility with historical media and data formats has already proven to be problematic. Insisting on backward compatibility would eventually limit the technological progress. When information access, migration, or preservation are at stake, it is incumbent on the person(s) with custodial responsibility for that information to recognize upcoming hardware and/or software obsolescence and make the necessary changes to avoid orphaning image and/or index data.
- Life Expectancy (LE)

  LE refers to the timeframe during which information can be retrieved without significant loss of data and image integrity. Implied in an LE rating is both existence and access. For example, information written on polyester base microfilm, processed correctly, and stored at 21˚C and 50 percent relative humidity has an LE of 500 years. Thus, the information the microfilm holds is expected to be retrievable for 500 years after processing. At this time, there is no LE rating associated with electronic storage media or the data it holds.
- Data Migration

  Whether technology obsolescence or improved performance is the reason to migrate, changing storage media or data format is inevitable during the lifetime of a permanent record collection. For a migration program to reliably move information, it needs to recognize every data format in the source file (see File Uniformity above). Even when this is done, files can become corrupted during the transfer process so comparing the migrated file with the original is a necessary audit procedure to ensure that the migration was successful.

[16] See PRIA March 2017 TIFF-PDF/A White Paper.

Conclusion

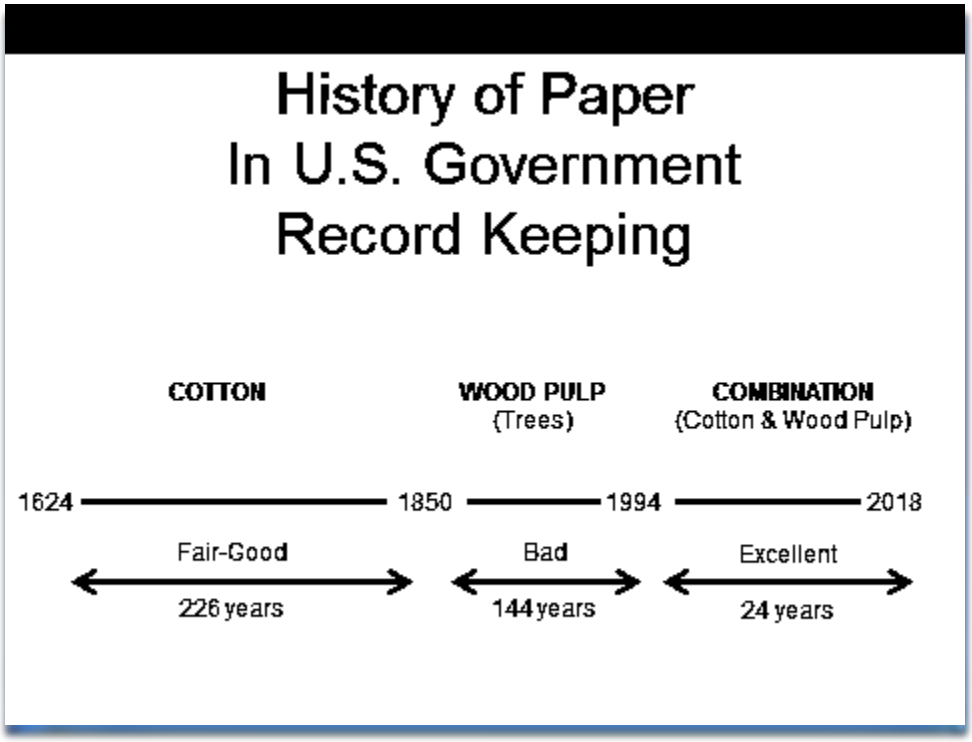
Preserving electronic records is a complex undertaking. It requires vigilance and a greater commitment and effort than was practiced with previous preservation formats and media. This paper addresses these electronic records preservation issues and offers the following conclusions:

- Land Records are permanent (forever) in all United States jurisdictions. Permanent records are documents that retain legal, historical, and administrative value without any timeframe limitations. Responsibility for permanency rests on the shoulders of the current records custodians and their successors.
- Those responsible for both public and private land records repositories must develop an understanding of, and strategy for, electronic records preservation.[17] The difficulty in attaining permanency of land records through various storage methods has been underestimated and may be again with electronic records. The goal should be to prevent the loss of even one record.
- The on-going existence and authenticity of land records as captured require continuous attention for effective preservation.
- Laws and regulations, which set records management policies, are often slow to change while new technology options advance rapidly.
- Preservation of electronic records requires funding. In the past, adequately funding a preservation program has not been a high priority for recording jurisdictions, local governments, and private businesses.
- Creating a plan for electronic records preservation is essential. The plan should include viewpoints and expertise of a variety of people with different skill sets and expectations. The principles of preservation need to be considered and incorporated into the plan. Preservation is not computer system backup.
- For possible emergency options for recovery, incorporate previous preservation media (e.g., paper, microfilm, and optical media). These prior media are considered layers of insurance. As older layers of insurance become obsolete, new layers need to be added.
- The preservation plan must be regularly reviewed for effectiveness over a record's lifetime.

[17] See Appendix 3 – Sample Electronic Records Policies (I added as it wasn't referenced anywhere else in paper)

Appendix 1 – Evolution of Paper

PRIA previously issued A Brief History of Records Preservation with more detail on paper records. The graphic below provides a timeline for the evolution of paper



Courtesy of Kofile Technologies

Appendix 2 - Technical References

LEGAL ADMISSIBILITY

ANSI/AIIM TR31/4-1994 (R1999): Performance Guidelines for Admissibility of Records Produced by Information Technology Systems as Evidence - Part IV: Model Act and Rule

ISO/TR 12036:2000: Micrographics - Expungement, deletion, correction or amendment of records on microforms

ANSI/AIIM TR31-2004: Legal Acceptance of Records Produced by Information Technology Systems

ISO/TR 12037:1998: Electronic imaging - Recommendations for the expungement of information recorded on write-once optical media

ISO/TR 12654:1997: Electronic imaging - Recommendations for the management of electronic recording systems for the recording of documents that may be required as evidence, on WORM optical disk

ISO/TR 15801:2009: Electronic imaging - Information stored electronically - Recommendations for trustworthiness and reliability

MEDIA MANUFACTURING

ISO 18901:2010: Imaging materials - Processed silver-gelatin-type black-and-white films -- Specifications for stability

ISO 18902:2013: Imaging materials - Processed imaging materials -- Albums, framing and storage materials

ISO 18902:2007/Cor 1:2009: Imaging materials - Processed imaging materials - Albums, framing and storage materials

QUALITY ASSURANCE - RECOMMENDED PRACTICES

ANSI/AIIM TR15-1997: Planning Considerations, Addressing Preparation of Documents for Image Capture

ANSI/AIIM MS44-1988 (R1993): Recommended practice for quality control of image scanners

ISO 10550:1994: Micrographics - Planetary camera systems - Test target for checking performance

ISO 6200:1999: Micrographics - First generation silver-gelatin microforms of source documents -- Density specifications and method of measurement

ISO 12650:1999: Document imaging applications - Microfilming of achromatic maps on 35 mm microfilm

ANSI/AIIM MS48-1999: Recommended practices for filming public records on silver halide microfilm.

MEDIA AND ENCLOSURE TESTING

ISO 18917:1999: Photography - Determination of residual thiosulfate and other related chemicals in processed photographic materials - Methods using iodine-amylose, methylene blue and silver sulfide

ISO 18915:2000: Imaging materials - Methods for the evaluation of the effectiveness of chemical conversion of silver images against oxidation

ISO 18916:2007: Photography - Processed photographic materials - Photographic activity test for enclosure materials

MEDIA INSPECTION

ISO/TR 12031:2000: Micrographics - Inspection of silver-gelatin microforms for evidence of deterioration

ENVIRONMENTAL CONDITIONS

ISO/TR 18931:2001: Imaging materials - Recommendations for humidity measurement and control

ISO 18911:2010: Imaging materials - Processed safety photographic films - Storage practices

ISO 18934:2011: Imaging materials - Multiple media archives - Storage environment

TRUSTED SYSTEM ARCHITECTURE

AIIM ARP1-2007: Analysis, Selection, and Implementation of Electronic Document Management Systems (EDMS)

ISO 14641-1:2012: Electronic archiving - Part 1: Specifications concerning the design and the operation of an information system for electronic information preservation

Appendix 3 – Sample Electronic Records Policies

Some national and state electronic records policies and recommended practices:

- AIIM ARP-1-2009 - Analysis, Selection, and Implementation of Electronic Document Management Systems (EDMS)
  - https://www.aiim.org/Resources/Standards/AIIM_ARP-1-2009
- California Trusted System Specification
  - https://admin.cdn.sos.ca.gov/regulations/tech/electronic-docs/docs/20120709-final-approved-text.pdf.
- Florida Electronic Records Policy
  - Rule 1B-26.003 Florida Administrative Code
  - Electronic Records and Records Management Practices (November 2010)
- ISO/TR 15801:2017(en) - Document Management - Electronically Stored Information – Recommendations for Trustworthiness and Reliability
  - https://www.iso.org/obp/ui/#iso:std:iso:tr:15801:ed-3:v1:en
- Washington State Electronic Records Policy
  - http://apps.leg.wa.gov/wac/default.aspx?cite=434-662&full=true

Sample RFP Wording for Electronic Preservation Strategy

NOTE TO PREPARER OF RFP: It is probably the case that, as of 2019, many LRMS cannot meet all nine of these requirements. Consider how strongly you want each component and how long you are willing to wait. However, unless your jurisdiction makes it clear that your goal is to establish an electronic records preservation system encompassing these requirements, no LRMS vendor is going to develop or routinely provide them. If you don't ask, you won't get!

Wording may need adjustment based on how your jurisdiction writes an RFP; the important thing is to incorporate and expect a specific response to each requirement.

Electronic Preservation Strategy RFP Components

We are creating (*Don't say "want to"- imply that process has already begun.*) an electronic preservation strategy for our land records. The strategy must address all nine of the following requirements.

In your response to this RFP, please indicate if and how the proposed LRMS system would enable us to implement an electronic preservation strategy encompassing these nine requirements.

If you do not currently provide the means to meet a requirement, please explain if, and when, this requirement fits into your product roadmap, and at what additional cost.

If you do not currently provide or expect to provide the means to meet a requirement, please recommend an ancillary product, compatible with your LRMS, to meet this requirement.

- Authenticity

  Stored data and images are vulnerable to accidental or malicious change. Steps should be taken to ensure that these files cannot be overwritten or changed while in the custody of the recorder. Write Once Read Many (WORM) storage would be an example of this type of protection. **What procedures do you have in place to ensure authenticity?**
- File Integrity

  Land records are legal documents and, as such, their integrity is essential. An electronic identification process must create a unique "fingerprint" (hash algorithm) of each image as soon as possible after recording. This fingerprint information must be maintained in a safe but accessible location to be used as a baseline value for future comparison to ensure the veracity of the image. The hashing calculation should be strong enough that duplicates (collisions) are not possible**. What hashing process is in place and when does it occur?**
- Archival auditing

  The electronic fingerprinting process (hash algorithm) must be continuously run against every stored image over its lifetime. The resulting value from each run must be compared to the file's original value to assure its existence and authenticity. **Does your system do this?**
- Data existence

  With or without warning, hardware or software malfunction can render stored data irretrievable. If the auditing process discovers a difference between the hash value of a file and its current value, the system should automatically report the discrepancy to a designated custodian. The system should be self-auditing, and self-reporting. **What self-auditing and self-reporting mechanisms does your system have in place?**

- Recoverability

  A process must be in place to restore lost data and images to their original, authentic condition. A credible restoration process ensures that lost or corrupted files can be recovered. **The system should be self-healing. What self-healing processes does your system have in place?**

- Versioning

  When stored data and images are legitimately corrected, those corrections should be tracked through a versioning process that documents the file's history of modification. A jurisdiction expects a versioning process to be in place, which will audits every change made to data and images over the life of the record. **What versioning processes does your system have in place to meet this expectation?**

- File uniformity
  - Awareness of the file types being stored, along with the contents (e.g., compression, header data and associated metadata), is important to ensuring their long-term preservation and is critical for a complete and reliable data migration.
  - Various electronic image formats have been adopted and used over the years during which electronic images have been created. As of March 2017, PRIA recommends the use of PDF/A-2A as a standard for preservation of electronic images. Other preservation format standards for property records may evolve.
  - Computer systems and software continue to evolve at a rapid pace. Expecting new systems to maintain backward compatibility with historical media and data formats has already proven to be problematic. Insisting on backward compatibility would eventually limit the technological progress that we have come to expect. When information access, migration, and/or preservation are at stake, it is incumbent on the person(s) with custodial responsibility of that information to recognize upcoming hardware and/or software obsolescence and make the necessary changes to avoid orphaning image and/or index data.

  What recommendations do you have for standardizing, replicating, and migrating index and image data to protect against hardware or software obsolescence and orphaning image or index data?

- Life Expectancy (LE)

  In the microfilm world, LE refers to the timeframe during which information can be retrieved without significant loss of data and image integrity. Implied in an LE rating is both existence and access. For example, information written on polyester base microfilm, processed correctly, and stored at 21˚C and ~~50~~ 35 percent relative humidity has an LE of 500 years. This LE means that the information the microfilm holds is expected to be retrievable for 500 years after processing. In the digital world, the goal is to maintain the integrity of the original data or image without any loss. As of 2019, there is no LE rating associated with electronic storage media or the data it holds.

  Describe your experience with testing for longevity of electronic data and images.

- Data migration

  Whether technology obsolescence or improved performance is the impetus to migrate, changing storage media or data format is inevitable during the lifetime of a permanent record collection. For a migration program to reliably move information, it needs to recognize every data format in the source file (see File Uniformity). Even when this is done, files can become corrupted during the transfer process so comparing the migrated file with the original is a necessary audit procedure to ensure that the migration was successful. **Address how data migration will be handled and what audit procedures will be used.**

Sample Meeting Agenda

Preservation of Electronic Records Meeting

(Read *Electronic Records Preservation* before scheduling this meeting)

Jurisdiction Recorder and IT Director

Purpose of meeting:

- Discuss and define roles of two different entities: IT and Recorder
- Seek first to understand then to be understood (Stephen R. Covey)
- Clarify expectations/obligations of each
- Define terms
- Identify ways to work together to accomplish and pay for those roles

Role of IT: Computer system backup for recovery after a service disruption or disaster

Backup Discussion

- Historically back up has been IT's responsibility and is primarily used for business continuity
- If we were to lose records, what processes do you have in place to recover those records?
- How do your specific IT backups work? How often? How deep? At what cost?
- What are the potential vulnerabilities?
- What is your Recovery Point Objective (RPO)?
  - Time intervals between backups?
  - What if there is a system failure?
  - At what cost?
- What is your Recovery Time Objective (RTO)?
  - How long to recover from an electrical outage?
  - How long to recover from a total loss of computer systems?
  - At what cost?
- Can you recover any version? Why or why not?
  - Backups restore what is on the backup copy
  - They don't monitor, protect or correct problems
  - Backups could perpetuate an error over and over
  - Records could be accidently overwritten

Role of Recorder: Preservation of recorded documents ensuring existence and authenticity permanently (forever)

Preservation Discussion

- Preservation is the recorder's responsibility; must protect and prove existence and authenticity of recorded documents
  - Existence and authenticity includes file integrity, archival auditing, recoverability, versioning, file format uniformity, data migration, and life expectancy
  - How do I prove that our copy is the authentic (real) version if someone produces a copy different from ours?
  - What checks are in place to make sure no one can tamper with our images?
  - If something is lost and the loss is not discovered for a long interval (more than 6 months, more than 1 year), can it be recovered? How?
- Preservation starts at image capture

    - Fingerprint the original image through a strong hash algorithm
- Aids to ensuring preservation
    - Need layers of protection: backup is one layer; multiple media types is another; offsite storage is another component (cloud, offsite backup copy, offsite microfilm copy)
    - WORM to prove existence
    - Hashing to prove authenticity
    - Monitoring current hash against baseline to provide file auditing
    - Records reconstruction software to help with file repair or the use of multiple data sites
    - A formal notification system is needed for when (not if) something goes awry
- Preservation requires a comprehensive plan, which is reviewed regularly (as often as annually)
    - Need to understand the process and the technologies, including new ones as they come into acceptance
    - Have to determine if there is ever an acceptable level of loss
    - As elected official, have to take concrete steps to meet this requirement
    - Have to make preservation a priority
        - Might want a separate system to self-audit and self-correct
        - Perhaps partner with other public and private organizations
        - Consider costs and justify expenditures
        - Secure ongoing funding
        - Pay attention

Date for next meeting(s) and agreeing to next step(s)

Electronic Records Preservation Highlights

1. What do I need?
   - An Electronic Preservation Strategy that works as well or better than paper or film, and that includes a good IT backup process
   - A solution that self-audits and self-corrects to be proactive vs. reactive
   - A commitment that preservation starts at data and image capture (in LRMS)
   - Up-to-date hardware, software and data recovery structure to track, validate and protect
   - A process to maintain other existing layers for protection

2. Why do I need it?
   - To avoid media obsolescence, e.g., microfilm, optical media
   - To protect against data and/or image loss, which can be accidental or malicious, e.g., incompatible file types or versions, data migration, bit rot, mistakenly doing test in live vs. test mode, malicious tampering
   - To ensure security and file uniformity
   - To prove existence, authenticity and legality which includes proof of the chain of custody
   - To protect the costly investment of creating electronic indexes and converting microfilm to images
   - To protect a public asset that has under-appreciated value to the industry at large

3. How do I communicate those needs to my IT professionals?
   - Begin by understanding that IT may not understand your records management responsibilities and you may not understand IT's role in managing your systems
   - Make clear that preservation, paper or electronic, is your statutory responsibility
   - Define terms so you are all talking about the same thing
   - Discuss backups vs. digital preservation. See resources below
   - Point out backups may perpetuate an error by overwriting the good with the bad
   - Discuss and determine your Recovery Point Objective (RPO) and Recovery Time Objective (RTO)
   - Discuss the value of WORM (Write Once Read Many) to support authenticity
   - Discuss fingerprinting (aka hashing or applying a mathematical algorithm) to prove file integrity
   - Discuss comparing baseline file values and repair, if needed, to assure existence, integrity and authenticity in the archival auditing process
   - Discuss a formal notification system to report problems, and corrections for assuring data existence
   - Discuss file repair and alternate recovery sites for recoverability
   - Discuss tracking corrections to prove a file history of modification by utilizing versioning
   - Review, annually at minimum, any plan implemented

4. Resources
   - Check with your state or local archives
   - Council of State Archivists (CoSA). Why You Need More Than Backups to Preserve Records

Webinar Resources

Electronic Records Preservation – What Recorders Should Know (PDF)
Webinar Recording
January 17, 2019

Electronic Records Preservation – What IT Should Know (PDF)
Webinar Recording
January 31, 2019