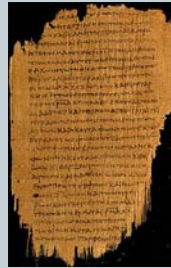


# Digital Preservation: An Historical Perspective and Overview



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## What is digital preservation?



**Digital preservation is the management of digital  
assets over time to ensure their continued  
accessibility.**

## Historical Perspective

- **Rock**
  - Cave paintings, stone carvings, clay tablets
- **Paper**
  - Papyrus, parchment/vellum (not paper, but), rag, wood
  - “Brittle book” problem
  - Standards developed to ensure longevity
- **Microfilm**
  - Early film quality spotty
  - Standards developed to ensure quality
- **Despite problems, all remain readable**

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## Digital Content is Fragile

- **Media and storage devices degrade and/or become obsolete quickly.**
  - Replacement costs...
  - Current appeal for old hardware/software at CoOL (Stanford)
- **Software, file formats, and operating systems become obsolete.**
  - New versions may not be backwards compatible
- **Proprietary encoding schema disappear.**
- **Files are deleted...**
  - Early working group on DP listserv archived and lost at Yale .
- **Web links ‘break.’**

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## Digital Preservation Strategies

- **Refreshing**
  - involves periodically moving a file from one physical storage medium to another to avoid the physical decay or the obsolescence of that medium.
- **Migration**
  - involves periodically moving files from one file encoding format to another that is useable in the current computing environment.
- **Emulation**
  - mimics obsolete applications software to run in the current computing environment.
  - Common with video/arcade games

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## Planning for Digital Preservation

- **Develop a plan for managing each file format in a digital archive.**
  - May include specific strategies based upon data format risk assessments.
    - ✦ How likely support software/hardware is to disappear
  - Establish Digital Preservation policies
    - ✦ Involve bibliographers, catalogers, and faculty to determine selection criteria for assets to be preserved.
    - ✦ Incorporate DP into existing collection development policies and workflows.
      - ✦ Directory structure and naming conventions
    - ✦ Policies must address Intellectual Property rights and access.
    - ✦ Document best practices.
    - ✦ Develop preservation metadata guidelines .

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## Digital Preservation Plan

- Subject to regular review/revision.
- May be built into application to varying degrees.
- Should be a collaborative effort between departments or among organizations.
- **Requires resources and organizational commitment.**
  - Raise awareness of DP among library staff and university community.
  - Encourage/require good habits and standardization
    - ✦ File naming conventions
    - ✦ Directory structure

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## Preservation Storage Requirements

- Standard back-up practices are insufficient for long-term preservation. Preservation requirements include:
  - **Standards:** OAIS, ensures accessibility and compatibility
  - **Audit/reporting.** Ability to run reports on data integrity for ingested digital objects.
  - **Automated back-up.** Regular back-ups to multiple physical locations at defined time intervals.
  - **Automated technical/preservation metadata capture.**
  - **Data integrity.** Any means of ensuring that data is whole, complete, or authentic. The term “fixity” is also used.
  - Continued...

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## Preservation Storage Requirements

- **Preservation requirements, cont:**

- **File versioning.** Saves “snapshot” of file at the point it is amended, thereby helping to ensure data integrity.
- **Migration tools.** Convert data from one type of storage material to another to ensure continued access to the information as the material becomes obsolete or degrades over time.
- **Object verification.** Checks a submission for schema errors, file format problems, and ingest parameter inconsistencies that might affect its suitability for preservation.
- **Continued...**

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## Preservation Storage Requirements

- **Preservation requirements, cont:**

- **Security.** Tools and behaviors to ensure write access only to authenticated users.
- **Self-healing.** In information technology, self-healing describes any device or system that has the ability to perceive that it is not operating correctly and, without human intervention, make the necessary adjustments to restore itself to normal operation.
- **Virus check.** At the point of ingest and at regular intervals.

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## Trusted Digital Repository (TDR)

- Accept responsibility for the long-term maintenance of digital resources on behalf of its depositors and for the benefit of current and future users;
- Have an organizational system that supports not only long-term viability of the repository, but also the digital information for which it has responsibility;
- Demonstrate fiscal responsibility and sustainability;
- Design its system(s) in accordance with commonly accepted conventions and standards to ensure the ongoing management, access, and security of materials deposited within it;
- Establish methodologies for system evaluation that meet community expectations of trustworthiness;
- Be depended upon to carry out its long-term responsibilities to depositors and users openly and explicitly;
- Have policies, practices, and performance that can be audited and measured; and
- Understand and act on requirements keeping in mind:
  - the scope of collections;
  - preservation and lifecycle management;
  - the wide range of stakeholders;
  - ownership of material and other legal issues; and
  - cost implications.

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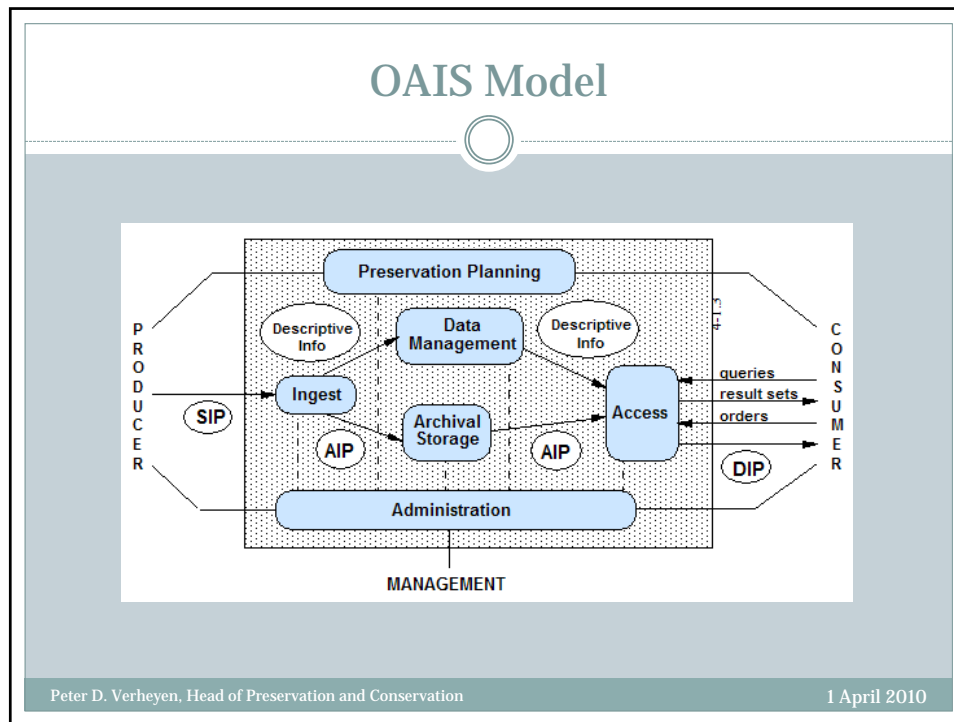
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## OAIS Requirements

- Negotiate for and accept appropriate information from information producers.
- Obtain sufficient control of the information provided to the level needed to ensure long term preservation.
- Determine, either by itself or in conjunction with other parties, which communities should become the *designated community* and, therefore, should be able to understand the information provided.
- Ensure that the information to be preserved is *independently understandable* to the designated community. In other words, the community should be able to understand the information without needing the assistance of the experts who produced the information.
- Follow documented policies and procedures which ensure that the information is preserved against all reasonable contingencies, and which enable the information to be disseminated as authenticated copies of the original, or as traceable to the original.
- Make the preserved information available to the designated community.

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- ## Examples of DP Initiatives and Tools
- Co-operative Projects**
    - LOCKSS & CLOCKSS
    - Portico
  - Tools**
    - Fedora Commons
    - D-Space
  - Hosted Options**
    - Digital Archive @ OCLC
    - Digital Commons @ BePress
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## Examples of DP Initiatives and Tools

### Co-operative Projects

- **LOCKSS & CLOCKSS (Lots of Copies Keep Stuff Safe):** “Grass roots” international community initiative for open access and publishers.
  - Content mirrored on servers world-wide.
  - OAIS-compliant; the software migrates content forward in time; and the bits and bytes are continually audited and repaired. Files are preserved as originally published (PDF, HTML, ...) and migrated on access.

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## Examples of DP Initiatives and Tools

### Co-operative Projects

- **Portico:** Preserves scholarly literature published in electronic form. Working closely with publishers, Portico creates a dark archive from source files that have been converted to a standard format. The archive is migrated forward en-masse as formats change. A standardized format. Similar mission as CLOCKSS but focused on non-open access publications.

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## When are Files Released?

Files are released when a “trigger event” occurs.

A “trigger event” is when publisher ceases operations or its delivery platform fails. Release of a title can via LOCKSS/CLOCKSS or Portico can be temporary or long term depending on circumstance.

## Tools: Fedora Commons

- **F**lexible **E**xtensible **D**igital **O**bject **R**epository **A**rchitecture
- Divided into four areas – repository services; preservation services; semantic services; enterprise services. Provides structure to facilitate long-term digital preservation
  - Can form the core of a trusted, preservation-enabled repository
    - × Metadata
    - × Versioning
    - × ...

## Tools: DSpace

- **Repository**
  - Secure managed storage of a wide variety of standard file formats
  - Automated monitoring and workflows
  - Open source
  - Can form the core of a trusted, preservation-enabled repository
    - × **Metadata**
    - × **Versioning**
    - × ...

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## Tools: OCLC Digital Archive

- **Provides foundation for preservation of digital collections:**
  - Secure managed storage
  - Automated monitoring and workflows
  - Works seamlessly with CONTENTdm
  - Hosted, i.e. ideal for those without infrastructure

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## Tools: CONTENTdm

- **Repository**
  - Secure managed storage of a wide variety of standard file formats
  - Can form the core of a trusted, preservation-enabled repository
    - ✦ **Metadata**
    - ✦ **Master images/files**

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## Tools: The Cloud

- **Hosted repositories such as BePress's Digital Commons.**
  - "Turn-key" solution
  - Hosted means no infrastructure/programming required
  - Vendor responsible for backups...
    - ✦ **Can provide to contracting organization with backup copies of content and metadata at regular intervals**
  - Manage forms for metadata and content submission to ensure cross collection interoperability...
  - But, ...

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## What Can We Do – Easy Steps

- Know what you have
  - Content
  - Media types
- Organize and maintain directory structure
- Limit “archival” formats to stable/established types
- Migrate forward (or backward) as formats change
  - Lowest common denominator
- Make use of metadata
- Keep control (intellectual & physical) of content
  - Keep your head out of “the cloud” except for access
- Keep and maintain obsolete hardware as needed... you just might
- Find partners to share resources and costs

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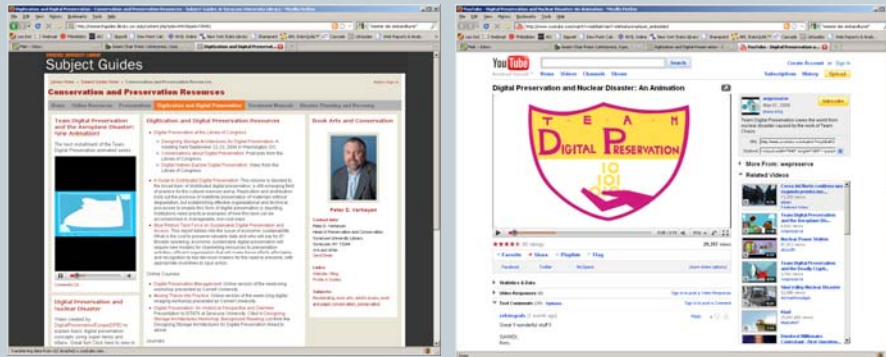
## Past is Prolog



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## Further Readings



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## Further Readings

- For a vivid statement of the problem, see <http://www.popularmechanics.com/technology/industry/4201645.html>
- *Preserving Digital Information: Final Report and Recommendations* published by the commission of the Commission on Preservation and Access: <http://worldcat.org/arcviewer/1/OCC/2007/08/08/0000070519/viewer/file2456.html>
- Cornell's excellent online tutorial on digital preservation: [http://www.icpsr.umich.edu/dpm/dpm-eng/eng\\_index.html](http://www.icpsr.umich.edu/dpm/dpm-eng/eng_index.html)
- Digital preservation at the Library of Congress: <http://www.digitalpreservation.gov/>
- For more on attributes of Trusted Digital Repositories, see <http://www.oclc.org/programs/ourwork/past/trustedrep/default.htm>
- For examples of collaborative digital preservation efforts, see <http://www.hathitrust.org/> and <http://www.lockss.org/lockss/Home>
- For examples of digital preservation tools, see <http://www.fedora.info/about/> and <http://www.dspace.org/>

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