Developing a Born-Digital Preservation Workflow

Jack Kearney & Bill Donovan

Audiovisual Archives Assistant
John J. Burns Library

Digital Imaging & Curation Manager
Thomas P. O’Neill, Jr. Library

Boston College Libraries

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Goals

1. Develop a systematic approach to digital preservation (DP) of born-digital collections.

2. Gain experience with various DP hardware and software and figure out practical protocols --- how does this all stuff work?

3. Use a real-life example, the electronic records of the Mary O’Hara papers. (MOH)
Who is Mary O’Hara?

An Irish soprano and harpist of international renown, Mary O'Hara has appeared on many of the world's major stages, including Royal Albert Hall, New York’s Carnegie Hall, Sydney Opera House, and Toronto's Roy Thompson Hall.

The Mary O'Hara (MOH) papers include promotional materials, business correspondence, recordings, sheet music, books, ..., and a hard drive used to transfer files from her personal computer.
Institutional Context

MOH hard drive donated to the Burns Library Irish Music Center at Boston College.

Since the Mary O’Hara papers were already being processed, also begin evaluating the electronic records on the hard drive.

Digital preservation much discussed at meetings attended by BC staff from Digital Libraries, Archives, and the Irish Music Center.

We anticipated needing to manage many more born-digital collections.

Opportunity for collaborative project involving all 3 groups.

Focus: digital preservation of MOH electronic records.
Chain of Custody

August 2009:
• Mary O'Hara's electronic files were copied to a 750 GB Seagate FreeAgent Pro external hard drive at her home in England
• The hard drive was shipped to the Burns Library at Boston College, where the files were copied for backup
• The hard drive itself was then stored in a secure, climate-controlled location within the Burns Library

January 2014:
• The hard drive was transported to the O'Neill Library DigLab to use as a test-case in developing a born-digital preservation workflow
Where does forensics come in?

“Digital forensics focuses on the use of hardware and software tools to collect, analyze, interpret, and present information from digital sources, and ensuring that the collected information has not been altered in the process.”

How to not alter the information

Used a forensic “write-blocker.”
Permits reading but not writing.
Prevents changes to the files on the hard drive.

USB USB

DP Workstation (offline)
Is the information virus-free?

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<th>Details</th>
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**Event Type**: Quarantine Failed

**Detection Name**: Clam.Joke.Mona

**File Path**: E:\System Volume Information\_restore\{98B18669-0908-4363-8098-8694D3CC2B82}\RP733\A0162061.EXE

**Date**: 1/29/2014 11:47:27 AM

Decision: Delete 33 infected files from the hard drive (after first creating a comprehensive inventory of all files on the drive)
What’s on the MOH hard drive?

Inventory taken with this Unix command:

```
find directory-name -type f -exec ls -l {} ; >c:\data\MOH\inventory.txt
```

21,988 files that are on the hard drive, for a total of 104.3 GB

If this were a “working” drive there may also be additional information besides these files, e.g. deleted files that have not been overwritten

Decision: In this case we decided that we will just transfer the files to our DP workstation, rather than creating a disk image of the entire hard drive
20 most frequent file types, plus other

- .doc: 43%
- .jpg: 26%
20 file types with most number of bytes, plus other

- mpg
- wma
- jpg
- m4a
- wav
- doc
- exe
- pdf
- wmv
- pub
- tif
- ra
- zip
- mp3
- ppt
- psd
- bmp
- chk
- chm
- rtf
- other

86% .mpg
Transfer of files

MOH hard drive with original files

DP Workstation’s internal hard drive: “Original files”

DP Workstation’s internal hard drive: “Working files”
Discovered duplicate files

There is already a file with the same name in this location. Click the file you want to keep.

- **Copy and Replace**
  Replace the file in the destination folder with the file you are copying:
  - ASSPIN-1.DOC
    - (E:\MaryO'Hara\Desktop\Rudai\Africa_Backup\TZ\Pat\UK\Pri
    - Size: 120 KB
    - Date modified: 11/3/1995 6:48 AM

- **Don’t copy**
  No files will be changed. Leave this file in the destination folder:
  - Asspinal 2.doc
    - (C:\DATA\OHara-Mary\original-files\MaryO'Hara\Desktop\Rt
    - Size: 120 KB
    - Date modified: 11/3/1995 6:48 AM

- **Copy, but keep both files**
  The file you are copying will be renamed “Asspinal 2 (2).doc”

“8.3” constraint

Also, employ de-duping software

Decision: keep only the copy with the more complete filename
Computed initial checksums

What is a “checksum” (aka hash)?

We computed initial checksums for each set of files.

We compared checksums to verify original files and copies identical.

For long-term fixity-checking, use automated app “Fixity”
Idiosyncratic folder names on the external hard drive. Had to “escape” problematic characters in folder name when issuing Unix commands.

Local conventions regarding naming files and folders:

- Use letters of the English alphabet and the numerals 0 thru 9.
- Avoid punctuation marks other than underscores or hyphens.
- Do not use spaces.
- Limit file/folder names to 31 characters, including the 3 digit file extension – strive for shorter names.

**Decision:** We may choose to remediate folder and file names, **but only for the working copies**.
Any files off-limits or expendable?

- Confidential information
  - Social security numbers
  - Financial information
- Files that have nothing to do with MOH per se
  - System Files
- Files that have no value
  - Thumbs.db
Personally Identifiable Information (PII)

Policy decisions to be made:
- Based upon the PII findings, which files will eventually made open to the public, or not?
Any proprietary file formats?

Normalize using Xena?

For RealAudio files, normalize with dBpoweramp?

Policy decision: Which files to normalize, and which formats to preserve?
File formats --- identify, validate, and extract metadata --- using FITS
Output of FITS --- identification

...
Output of FITS --- file information

...<size toolname="Jhove" toolversion="1.5">1795770</size>
<creatingApplicationName toolname="Jhove" toolversion="1.5">Omniscan 11.12 SR2 Build13</creatingApplicationName>
<lastmodified toolname="Exiftool" toolversion="9.06" status="SINGLE_RESULT">2013:08:14 14:15:38-04:00</lastmodified>
/filepath toolname="OIS File Information" toolversion="0.1" status="SINGLE_RESULT">C:\DATA\FITS_test_folder\fits_test_imagefile.tif</filepath>
/filepath toolname="OIS File Information" toolversion="0.1" status="SINGLE_RESULT">C:\DATA\FITS_test_folder\fits_test_imagefile.tif</filepath>
<filename toolname="OIS File Information" toolversion="0.1" status="SINGLE_RESULT">C:\DATA\FITS_test_folder\fits_test_imagefile.tif</filename>
<md5checksum toolname="OIS File Information" toolversion="0.1" status="SINGLE_RESULT">ccfca47fb4f2597c04e299c99f4043ce</md5checksum>
<fslastmodified toolname="OIS File Information" toolversion="0.1" status="SINGLE_RESULT">1376504138000</fslastmodified>
...

Output of FITS --- file status

```
<filestatus>
  <well-formed toolname="J hove" toolversion="1.5"
status="SINGLE_RESULT">true</well-formed>

  <valid toolname="J hove" toolversion="1.5" status="SINGLE_RESULT">true</valid>
</filestatus>
```


A digital object is **well-formed** if it meets the purely syntactic requirements for its format.

An object is **valid** if it is well-formed and it meets additional semantic-level requirements.
Output of FITS --- metadata

...<compressionScheme toolname="Jhove" toolversion="1.5">Uncompressed</compressionScheme>
<imageWidth toolname="Jhove" toolversion="1.5">1598</imageWidth>
<imageHeight toolname="Jhove" toolversion="1.5">373</imageHeight>
<colorSpace toolname="Jhove" toolversion="1.5">RGB</colorSpace>
<referenceBlackWhite toolname="Jhove" toolversion="1.5" status="SINGLE_RESULT">0.0 255.0 0.0 255.0 0.0 255.0</referenceBlackWhite>
<iccProfileName toolname="Exiftool" toolversion="9.06" status="SINGLE_RESULT">sRGB IEC61966-2.1</iccProfileName>
<orientation toolname="Jhove" toolversion="1.5">normal*</orientation>
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<samplingFrequencyUnit toolname="Exiftool" toolversion="9.06" status="CONFLICT">inches</samplingFrequencyUnit>
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<samplesPerPixel toolname="Jhove" toolversion="1.5">3</samplesPerPixel>
<imageProducer toolname="Jhove" toolversion="1.5" status="SINGLE_RESULT">Zeutschel Omniscan 11</imageProducer>
<scanningSoftwareName toolname="Jhove" toolversion="1.5">Omniscan 11.12 SR2 Build13</scanningSoftwareName>
...

Local Archival Copies

Copy remediated files to DP file server.
Compute checksums for new copies.
Verify checksums match. (using “diff” command?)
Local long-term fixity-checking

Key: make it simple and automated

Using “Fixity” (available for free)
- Verifies checksums on a schedule
- Per “project” monitor up to 7 folders, recursively
- Looks for...
  - Confirmed Files
  - Moved or Renamed Files
  - New Files
  - Changed Files
  - Removed Files
- Sends emails to notify up to 7 stakeholders
Fixity

http://www.avpreserve.com/news/fixity-v0-3-released/
Distributed Digital Preservation

LOCKSS-based MetaArchive Cooperative

- At least 6 copies, geographically dispersed
- Fixity-checking (not just back-ups)

Queue up ingest into MetaArchive Cooperative or equivalent
What if file(s) corrupted?

If checksum discrepancies are discovered…

Or the checksums themselves are corrupted…

From multiple back-up copies, including multiple sets of checksums,
replace corrupted files with pristine copies
Keep track of DP actions

- File migrations
  - Obsolete file formats
  - Proprietary file formats

- Metadata changes
Future Plans

Additional electronic records from the Mary O’Hara Papers (e.g. data DVDs or CDs)

Replicate DP system but portable

DP in a box

Beyond preservation…

- Hand off to our archivists (policy questions)
- Provide access to the MOH electronic records
- Create links within the MOH finding Aid
Additional Resources

ASERL Webinars re: Digital Preservation (Spring 2013)
http://www.aserl.org/intro-dp-2013/

OCLC Research “Demystifying Born Digital” Reports (2012-13)
http://www.oclc.org/research/publications/library/2012/2012-06r.html

BitCurator Project White Paper: “Bitstreams to Heritage: Putting Digital Forensics into Practice in Collecting Institutions” (September 2013)
http://www.bitcurator.net/docs/bitstreams-to-heritage.pdf

ARL SPEC Kit 329: Managing Born-Digital Special Collections and Archival Materials (August 2012)
Q & A

Bill Donovan  bill.donovan@bc.edu

Jack Kearney  kearneyj@bc.edu
Archival policy questions

- Preserve just the digital files or the entire disk image?
- Delete the virus-infected files?
- Save the duplicate 8.3 files?
- Delete extraneous files? (And, define extraneous)
- Decide fate of PII files:
  - Credit cards
  - Bank accounts
  - Social Security
- Normalize file formats?
- Which files to preserve?
  - External hard drive
  - As-is copies of original files
  - Remediated copies (And, define remediated)
- What sorts of documentation to preserve and how?
DP Workstation

hardware:
• PC desktop computer with 64-bit Windows 7
• 4 GB RAM and a 465 GB internal hard drive
• UltraKit III + FireWire Write-Blocker

software:
• Cygwin 64 Terminal (md5sum)
• Immunet 3 powered by ClamAV
• Identity Finder
• FITS
• Fixity
• Access Data FTK Imager
• dBpoweramp Music Converter
• HxD Hex Editor

security measures:
• authorized personnel only room
• security cable for workstation
• need-to-know only username/password
## De-duping software

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