LTO Tapes at WGBH

and the American Archive of Public Broadcasting

The Project

- American Archive of Public Broadcasting (AAPB) – 40,000 hours of a/v content from around the country
- Partnership between WGBH and the Library of Congress to work with stations to deliver material, with Crawford Media Services as vendor
- At WGBH, 300 TB of digital a/v material (11,561 files) identified for inclusion in the American Archive

The Data Transition

- WGBH backup data stored on LTO 4
- Administered through a SAMFS/QFS storage management system
- Metadata in Artesia Digital Asset Management system

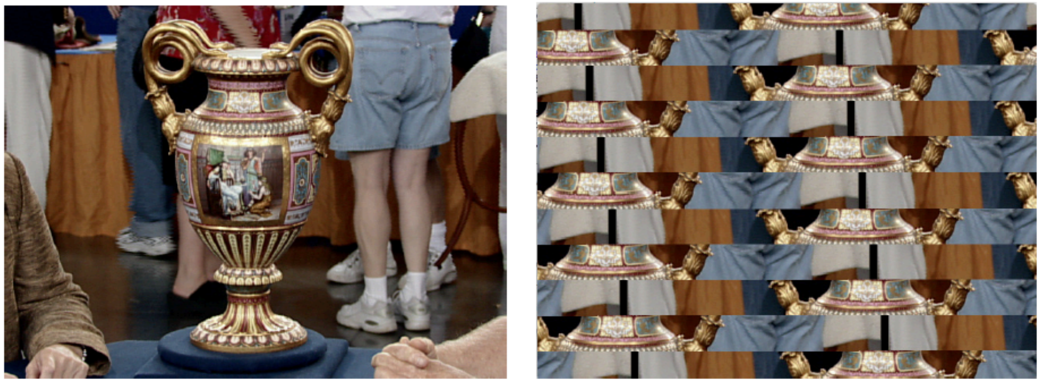
Use of Artesia DAM being discontinued at WGBH – opportunity to pull media and data out of Artesia-SAMFS/QFS system & store it locally on the archive’s dedicated LTO-6 tapes

The Data Transition

- List of files characterized as media reported by Artesia
- SAMFS/QFS queried to generate report on which LTO-4 tapes those files were stored on
- Files organized into ‘batches’ for download to local storage based on reported storage location
- Files transferred remotely from LTO-4 via ssh and downloaded onto external hard drives
- Drives shipped to Crawford Media Services for transcode and upload to Archival Management System

Initial Problems

- 57% of files in first large batch of video (2069 files) sent to Crawford proved to be incomplete or unreadable
- Several types of failure: 0-byte files, files that failed analysis by standard tools such as ffmpeg and mediainfo, files that could be analyzed but failed QC

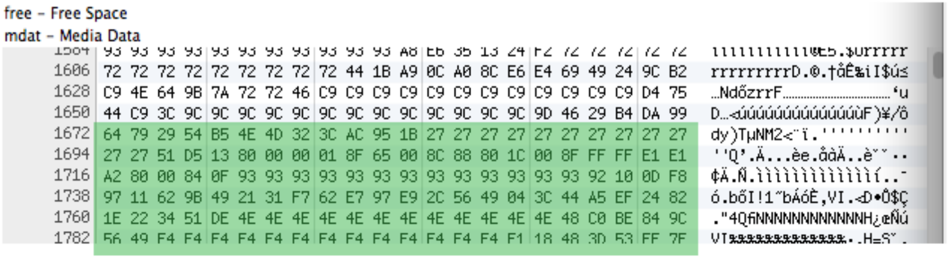


QC Failure: File reads as normal when tested, but content is replaced with repeated glitching image or green screen a portion of the way through the video

Deeper Analysis

- Most failed files transferred a certain amount of data successfully, then eventually cut out and replaced with nonsense ‘filler’ data

Media data for uncorrupted file



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mdat – Media Data
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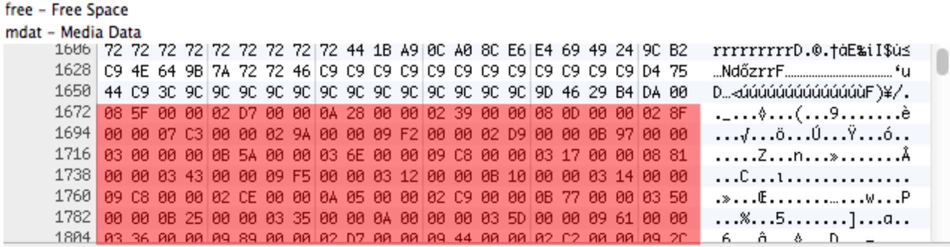
Media data at point of corruption



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Process Evolution

- Each ‘batch’ of files was analyzed by ffmpeg immediately after download to determine which files failed
- Many files that initially failed could be successfully downloaded on a second or third try
- Other failed files (QC failure) were not detected until re-analysis after the drives returned to WGBH
- Final tally: 9957 out of 13492 were successfully re-ingested at WGBH -- 74% of files overall

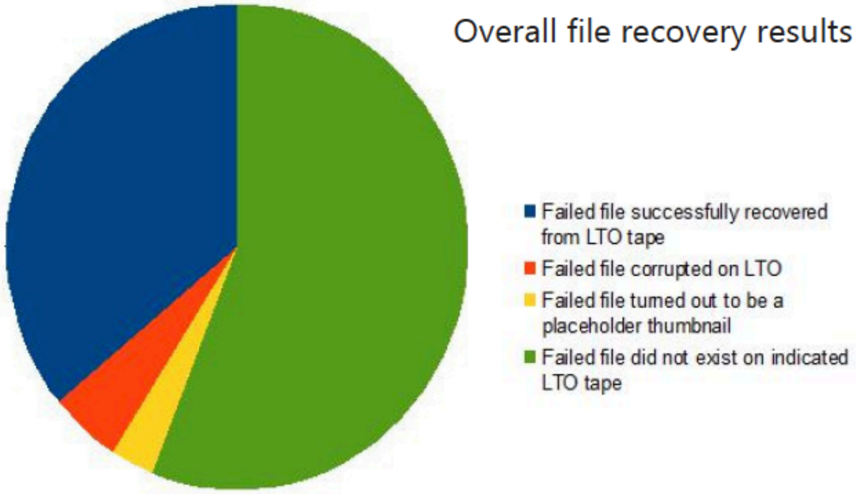
LTO Investigation

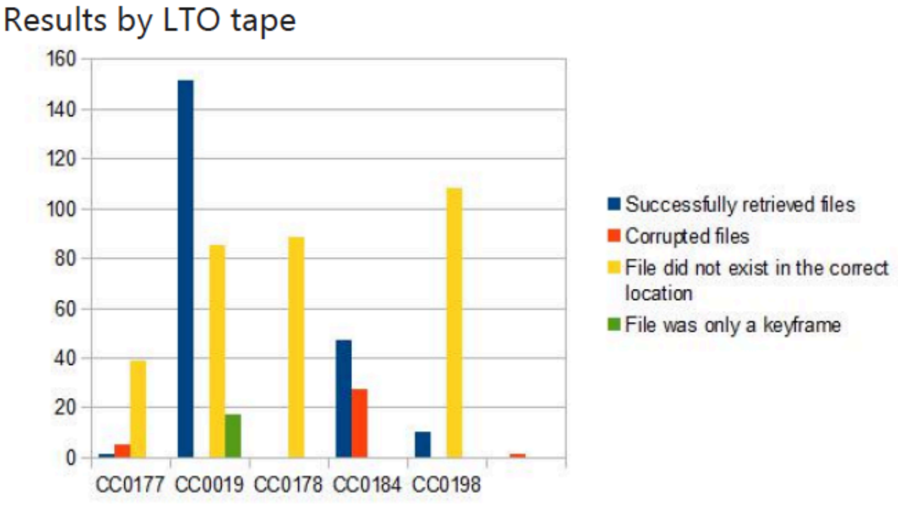
- Ran checksums on all the files that had existing checksums recorded – 1005 failed files passed checksum analysis when checked in storage, 20 checksums could not be generated

- Generated analysis of failed files by LTO-4 storage tape and identified tapes with greatest number of failures, then requested then from IT

- Used MLA LTO-6 decks to do a direct data dump with dd of all the tar files written to the LTO-4 tapes

LTO File Recovery Results





Inconclusive Conclusions

- Most files are still good on tape
- Some of the failures may be due to corruption on the LTO tapes themselves, but only a small percentage
- Processing problems may have been caused by inaccurate reporting from SAMFS/QFS

Next Steps

- Re-ingesting successful files onto local LTO-6 through direct connection
- Tracking location in XML files entered into local Filemaker-based DAM system
- Re-attempting networked transfer of the other 26% and analyzing results

Ideas or discussion welcome!

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