

Automation and Magnetic Media Migration in the 21st Century

Media Matters LLC White Paper

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Magnetic tape media requires migration in order for content to survive. The global volume of tapes and their continuous degradation outstrips traditional methods of audiovisual migration. Only through the creation of automated systems can the mission of media preservation be comprehensively fulfilled.

What is the problem with magnetic media?

Magnetic tape media is inexpensive and plentiful, helping it to be one of the most common forms of content storage in the world. These two traits, however, also cause it to be the most difficult form of media to preserve. Videotape manufacturers are not motivated to make tapes that will last a century; tape formats are not guaranteed to last very long. Approximately sixty-five videotape formats were introduced in the last 45 years, with only a handful surviving. The obsolescence of formats causes further problems for media preservation and migration.

Magnetic media can be recorded with ease and in vast quantities. However, it takes significant resources to properly archive and preserve it. Using traditional methods, videotape migration can cost between \$250 and \$400 per media hour¹. Tape migration takes place at specialized facilities, requiring off-site shipment of collections, further raising the cost. Shipping tapes carries its own dangers, including loss, theft, and damage. The few dedicated migration facilities that exist are only able to handle small numbers of tapes – even the largest only can process a maximum of 5,000 tapes per year². This means that even modest-sized collections of videotapes can take many months and hundreds of thousands of dollars to migrate.

The core problem with traditional media migration methods is scalability: tapes must be processed in real-time by professional staffs using specialized equipment. Traditional video migration and restoration facilities do not benefit from economies of scale – they are locked into a limited amount of workflow, unable to scale their operations to meet greater processing demands.

Lessons in Automation

The limitations of the current manual processes endanger the overall preservation of our audiovisual heritage. Traditional methods simply cannot keep up with the amount of magnetic media stored in the world's archives. The costs are too high and the output too low. Without a fundamental change, much of the world's audiovisual heritage on magnetic media will disintegrate before its content can be saved.

Looking closer into the process of manual migration, it's useful to analyze where human resources are spent. In a migration facility, every tape that passes visual inspection is examined thoroughly by a trained engineer. Ideally, however, the process would be oriented to having human experts examine only the *problem* tapes. Instead, human resources are being spent on *every* tape, treating each one as an exception that requires human inspection.

Manufacturing industries can offer archivists many lessons on increased productivity and effective use of both financial and direct labor resources. In order to get the most out of these resources,

archivists should carefully examine how automation technologies and equipment can impact their processes.

Towards an Automated System for Migration

The ideal solution to scalability problems is a robotic handler system, capable of running continuously, with software to support intelligent decisions about tape processing in order to streamline migration. This system would take advantage of economies of scale and drive down costs while improving tape and signal quality. Finally, the process would occur on-site, at the archive, with mobile equipment designed to be installed only for the length of the project and then removed.

Indeed, this idea of a 'factory approach' has been put forth by the European Union's PrestoSpace preservation project as the necessary solution to the problem of scalability.³

A robotic migration system controlled by a custom-designed expert system has numerous advantages over traditional methods. Running 24 hours a day, 7 days a week, a robotic system can process huge quantities of tapes. Sophisticated analysis tools can record valuable metadata about the content being processed. Metadata on individual tapes and across the entire collection gives insight into the health of an archive's tapes that was never available in the past. Real-time analysis based on consistent, objective metrics allows for sorting and removal of fragile or damaged tapes that require extensive restoration work. Instead of treating an entire collection as if it needed extensive work, tapes are segmented into less costly batches that can be automatically migrated and more costly batches requiring human intervention.

Increased productivity can be realized by performing several preservation functions at once. Migration to tape stock, migration to digital media file, and collection of metadata should occur simultaneously in the system. Robotic systems allow for migration on a massive scale and can be customized to the particular needs of individual archives. The ability to do large-scale conversion from magnetic media to digital file "essences" is of great value to archives. Technologies such as Digital Asset Management and the delivery of content via computer networks create whole new avenues of access for archive stakeholders.

The System for the Automated Migration of Media Archives - SAMMA

Media Matters, LLC, has created the first robotic, unattended magnetic media migration system. It is called SAMMA, the System for the Automated Migration of Media Archives. SAMMA incorporates best-of-breed technologies from around the globe to form a unique and comprehensive system to migrate massive quantities of tape media. Through the use of expert systems, proprietary software and hardware, and the distillation of decades of preservation and restoration experience, SAMMA presents a unified solution to the problems of magnetic media.

Created by Jim Lindner, Chief Video Consultant for the Library of Congress, the SAMMA system was designed to preserve as much of the world's audiovisual heritage as possible. After years in the field of preservation and restoration, Lindner developed a "triage" approach to magnetic media, which is the basis for SAMMA: "Save what you can, while you can, at a reasonable cost, within a reasonable timeframe."

Mobile and modular, the SAMMA system is flexible enough for most archives' mixed-media collections. The use of advanced video and audio analysis hardware and software makes quality control possible throughout the process. Each tape is analyzed for its physical and signal health and SAMMA makes dynamic decisions about how to process based on the analysis. Detailed metadata is collected about each tape and can be applied across the collection at large. At any point in the migration process, extensive reports are available to evaluate the condition of a collection. By bringing the SAMMA system to an archive's premises, the uncertainty and risk (not to mention the cost) of shipping collections off-site is eliminated.

Centralized intelligence within SAMMA allows for multiple tasks to be completed in a single pass. Multiple tape copies, as well as digital files, can now be created in the time it used to take to make a single duplication. Digital files present new opportunities for collection access, and increases storage options. Proprietary cleaning equipment and new time base correction and frame synchronizers within SAMMA clean and correct video tape problems while ensuring collection safety and consistency.

SAMMA is standards-based, ensuring long system life. It uses the best, most widely accepted technology standards available, including those from SMPTE and Pro-MPEG.

Finally, Media Matters is setting standards in this sector for a video preservation file format, based on lossless compression and audiovisual metadata standards for the archive community, such as the Library of Congress' METS.

What does the future hold?

Robotic migration systems are key to the immediate survival of our audiovisual heritage. In the near future, these systems will be expanded to include audio and open reel tape. These formats are more fragile and cumbersome and require innovations in equipment and processing techniques to benefit from the existing SAMMA approach.

For large-scale archive projects over 10,000 units, multiple SAMMA systems will operate in concert under a single master control.

Smarter migration strategies yield better results.

SAMMA was created to save as much of the world's audiovisual heritage as possible. By dividing tape collections into those that can be migrated automatically and those that require more specialized attention, SAMMA helps archives maximize their budgets and process more of their collections with fewer resources. The problems of magnetic media - fragility, obsolescence, and sheer quantity – are not going away. The simple fact is that traditional methods of migration will never catch up with the number of tapes in jeopardy. SAMMA attempts to stem the tide of media loss. By migrating collections in a smarter way, archives can meet their mission of preservation at lower costs and with better results.

Summary

- New approaches to migrating magnetic media archives are essential to the preservation of our audiovisual heritage created during the last 50 years.
- Automated migration systems offer advantages over current, manual methods in each area of project management: cost, time, and resources.
- Automated migration systems offer the benefit of consistent and detailed reporting on tape and signal quality, which can be incorporated in to digital file formats along with the media essence.
- Audiovisual archives need to take immediate action to address these issues.
- SAMMA is a key piece to this puzzle, allowing archives to do more with fewer resources and at higher overall quality.

¹ European Project PRESTO Whitepaper.

² Considering a two-person engineering team working 8 hour shifts: 2 x 40 hours x 50 weeks = 4000.

³ PrestoSpace Annex I, September 15, 2003