



WHAT WE DO  
**BEHIND**  
**THE SCENES**

# Creating the ultimate digital insurance

## ENSURING FUTURE ACCESS

Digital preservation is about ensuring future access to digital material.

When long-term access is needed, frequent obsolescence of the storage media, software, hardware and file formats complicates the preservation process. Consequently, data migration to newer technological platforms every three to five years is common. Considering that from now until 2020, the digital universe will double every two years, the amount of data to migrate will increase enormously.

It is well known that data migrations involve a risk of data loss, corruption or even unwarranted manipulation. According to Mozy Online Backup, every week 140,000 hard drives crash in USA. Other analysts, such as Boston Computing Network reports that 77% of the companies in USA that rely on magnetic tapes for long term storage have found backup failures when retrieving data. These challenges have been accepted by the IT community as normal risks in digital storage technology. This is usually compensated for by scheduled redundancy backups and continuous hardware migrations. The IT community is aware of the increasing migration cost involving hardware, people and time but this cost is seldom quantified.

## RESHAPING DIGITAL PRESERVATION

We want to make sure data owners' valuable digital data is safe and accessible, irrespective of future financial capabilities and technological developments. Piql Preservation Services uses an OAIS<sup>1</sup> (Open Archival Information system) compliant turnkey solution to provide data owners with a secure, accessible and migration-free solution for digital preservation. This new digital storage technology has been developed by combining the well-documented preservation qualities of photosensitive film with the accessibility of being a seamless element within a standard IT infrastructure.



The storage medium is the key element; film is a photosensitive, chemically stable and secure medium with proven longevity of hundreds of years<sup>2</sup>. Furthermore, film is unalterable; once the data is written it cannot be edited. The data is stored offline and will not be affected in case of an electricity shortage or if exposed to electromagnetic pulses. For extra security against digital obsolescence, the storage medium has been designed to be a self-contained medium where instructions is written in human readable text onto the film explaining how to recover the information.

Lacing film in the piqlWriter



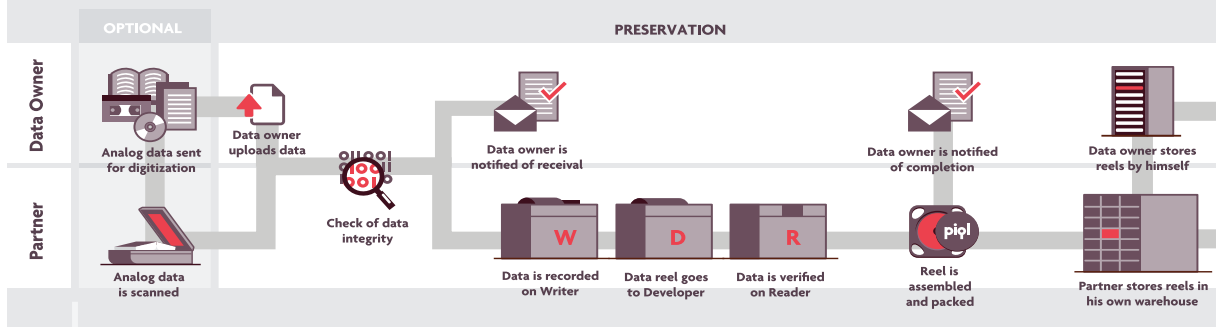
#### **HOW DIGITAL PRESERVATION IS ACHIEVED**

Piql Preservation Services is offered as a managed service through a certified network of partners. Workflows have been designed so data owners can easily use the services. They simply upload files and request files when needed, the rest is automatically done. Let's have a look at what is happening behind the scenes.

<sup>1</sup> OAIS reference Model (Open Archival Information System) described in ISO 14721:2003. <http://public.ccsds.org/publications/archive/650x0m2.pdf>

<sup>2</sup> Longevity testing of the materials (piqlFilm and piqlBox) has been done by Norner AS, (Independent Industrial Polymer Institute, Norway) and IPI (Image Permanence Institute, Rochester Institute of Technology, USA) following the ISO standards ISO 18911, ISO 18924 and ISO 18936.

# piql PRESERVATION SERVICES JOURNEY



## WORKFLOW FOR PRESERVATION

This is the main workflow for preservation; writing the data onto the film. It consists of the following steps:

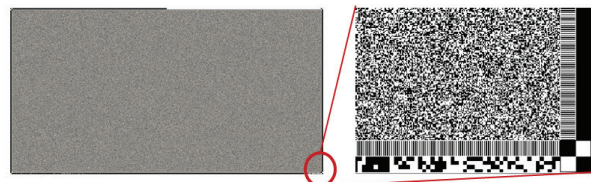
### Transferring the data

Data owners upload their digital data through their own document management solution or directly to a secure file-sharing document platform. The Piql solution supports different protocols (FTS, SFTP, HTTP, file share and web services) for control and data communication, allowing integration with any document management system. Piql will integrate with solutions like Archivemata<sup>3</sup>, a digital preservation system that allows to process digital files before recording on film in compliance with the ISO 14721:2003 certified OAIS reference model. Archivemata uses best practice preservation metadata standards and simplifies file format normalization (to proper archival file formats).

### Data integrity

The quality-check of the data integrity aims at preventing unintentional changes to information and ensures the data is recorded and retrieved exactly as intended. Before printing the data, Forward Error Correction (FEC) techniques and checksums are used to make sure the accuracy and authenticity of the data is kept during the entire preservation process.

After the file is received, checked for virus and normalized to a preservation file format, a checksum is generated for the file, sent back to the data owner for verification and saved in the Piql database for future verification. Then the file is decoded and split into small

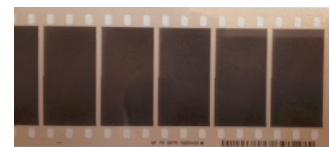


*Digital data frame. Magnified section to the right.*

elements of information (binary form) that fits into a frame on the film reel. For each frame to be recorded another checksum is generated and added to the data frame, then sent to the data recorder. Before recording, each frame checksum is verified to assure data integrity during transmission.

### Data writing

When the reel has been virtually created as a set of recordable images (frames), the reel is written onto film by the piqlWriter.



*Frames of data on a film reel.*

PiqlWriter is a high-speed industrial grade data recorder writing at 40 MB/s. When the operator has loaded film and closed the cover, the writing starts automatically. The solution uses piql-Film, a high-resolution photosensitive film specially designed for longevity and high density digital writing. After the reel has been written, the operator puts the film in a developer cartridge ready for processing. PiqlWriter requires dark-room conditions only during loading and unloading of film.

*piqlFilm and piqlBox*



*piqlWriter and piqlReader*



### **Film processing**

The recorded film reel is mounted on the piqlProcessor and developed under qualified processing standards. After being developed the film is placed directly into the piqlBox, the final cartridge. The piqlBox is labelled and sent to verification, for final quality assurance. The piqlFilm, the piqlBox and the label have been tested together to ensure a longevity of at least 500 years when stored under ISO<sup>4</sup> conditions.

### **Data verification**

After the film has been developed, the written information has to be verified to ensure integrity and accessibility in the future. This verification process is performed by the piqlReader. PiqlReader is an industrial grade data scanner with two main functions. Firstly, it reads all frames in the reel. Secondly, it decodes every frame and restores the original files. During that process it ver-

ifies each file checksum against the one stored in the database. After this quality assurance, the film is packed into the piqlBox and sent to final storage

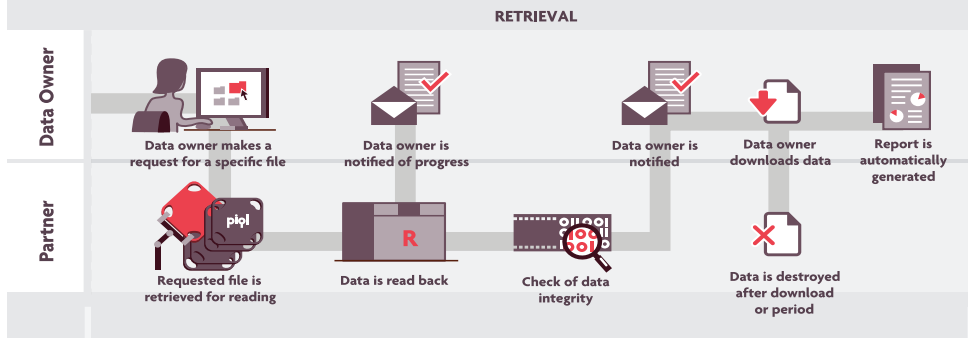
### **Film storage**

The Piql system can be integrated with any warehouse management system (WMS). The WMS keeps track of each reel's position in the warehouse. The label on the piqlBox is used for identifying the reel using a standard barcode scanner. When the reel is safely stored, the original uploaded file is deleted from the system and the Data Owner is notified. The WMS supports manual, semi-automatic and automatic solutions.

<sup>3</sup><https://www.archivematica.org/>

<sup>4</sup>ISO 18936 and 18901

# piql PRESERVATION SERVICES JOURNEY



## WORKFLOW FOR RETRIEVAL

The workflow for retrieval is the next main process; it allows data owners to search for and access files in only a few minutes. The data owner requests a specific file; this can be done through their own integrated document management system or directly through the Piql client interface. The system communicates to the WMS to identify the location of the reel in the warehouse and retrieve it. The reel is placed in the piqlReader and the film is forwarded to the exact position of the requested file. Then the file is restored and quality-checked as explained earlier during the data verification stage. Finally, the file is made available for download and the reel is returned to the warehouse. As soon as the data owner downloads the file, the recovered file is deleted.

## FUTURE ACCESSIBILITY

It is of uttermost importance to us that all information needed to decode the data is available to those that might need it sometime in the future. The source code

for the retrieval software is stored on the film at the beginning of the reel in both human readable and digital form. File format specifications for preservation formats will be also written on the film in both human readable and digital form. In this way, only a camera/scanner and a computer of the future will be needed to restore the information in the future.

## THE ULTIMATE DIGITAL INSURANCE

Piql Preservation Services allow data owners to feel confident about the future accessibility of their most valuable digital data. We convert digital files into a physical copy that can be stored as the ultimate digital insurance. By storing digital data in archival file formats on photosensitive film, repetitive data migrations are no longer needed. Data owners avoid the risk of migration-related data loss, saving time and leading to a more predictable long-term cost.





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