



AXF

The Archive eXchange Format

Transporting, Storing and Preserving the World's Most
Valuable File Based Assets Now and Into the Future

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Where Did We Come From?



- Proprietary storage systems and formats are rampant in M&E
 - Data formats, interface protocols
 - Risk of orphaned archives
- User requirements:
 - Simplified movement of material between systems
 - Flexibility in changing storage vendors or technology
 - Limitless scale (number of files and size)
 - Ability to span across media
 - Universally accessible leveraging stand alone utilities
 - Support for all media types – now and into the future
 - Highly resilient with in-built redundancy
 - Standardized approach!!!



Storage and Preservation



- We must take steps to ensure long term accessibility to valuable file-based assets stored in digital archives in all industries
- Key objectives:
 - Ensure long term accessibility
 - Self-describing assets and self-describing media
 - Wrapped (encapsulated) to maintain metadata/file relationships
 - Scalability for any number of elements of any size and type
 - Standardized regardless of storage media technology
 - Enable transportability between systems
 - Include preservation features such as fixity, provenance, etc.
 - Streaming support to enable on-the-fly processing
- What choices are there today?

What About LTFS?



- The Linear Tape File System (LTFS) is a simple file system for linear data tape which makes tapes appear as “removable storage”
- There are no standards bodies which currently endorse LTFS although often incorrectly referred to as a “*standard*”
- LTFS is a great transport tool but has some significant limitations in storage and preservation applications
 - Relies on simple folder hierarchies to maintain asset relationships (no encapsulation)
 - No support for spanning (limited scalability)
 - Only applicable to modern data tape technologies
 - No preservation characteristics
 - Application specific in terms of implementation
- Cross vendor compatibility issues have been plaguing early adopters caused by vendor specific implementations and no centralized control

What About AXF?



- AXF is a universal format for the wrapping (encapsulation), storage, transport and preservation of any type of file assets
- AXF is like an advanced ZIP which encapsulates any number of files of any type, metadata and a universal file system – an “object store” model
- AXF is IT-centric and applies to all types and generations of storage technologies
- The first open format targeted at the storage, preservation and transport of file assets
- AXF fully defines (and constrains) implementations for increased interoperability
- AXF includes all of the functionality of LTFS, overcomes all of its limitations and adds significant features and benefits

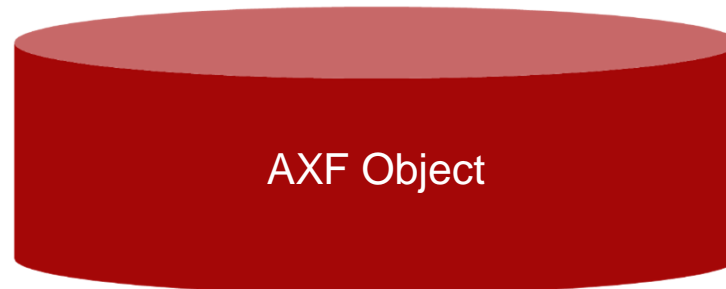
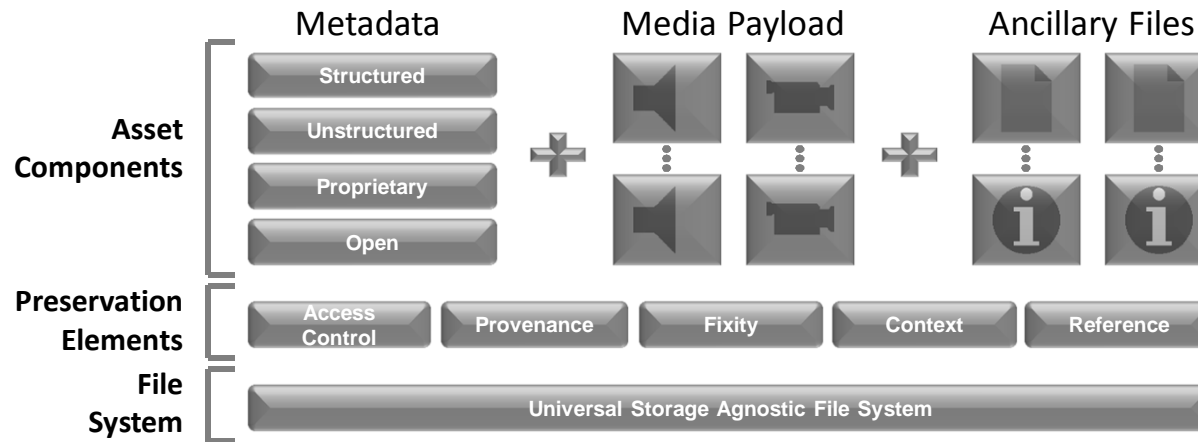


AXF and LTFS Key Features

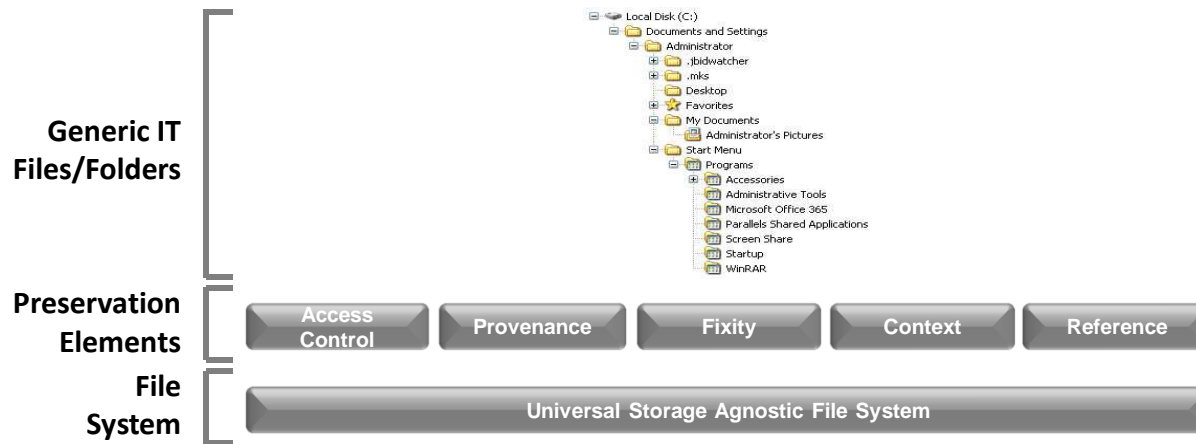
Key Features	AXF	LTFS
IT-centric design applicable to M&E as well as enterprise	✓	✓
Applicable to cloud-based transfers and storage	✓	
Encapsulates (wraps) files and metadata to protect key asset relationships	✓	
Scales to store any number of files of any size and of any type	✓	
Key support for spanning across media (data tape spanning, etc.)	✓	
Universal format regardless of storage technology (disk, flash, data tape, etc.)	✓	
Includes key preservation qualities (provenance, fixity, access control, etc.)	✓	
Self-Describing Media: Maintains on-media index of all stored objects	✓	✓
Self-Describing Objects: Maintains in-object index of all stored files	✓	
Each object and file is individually indexed for enhanced recoverability	✓	✓
Supports any generation of data tape technology (LTO-X, IBM TS11XX, Oracle T10000X, etc.)	✓	
Includes advanced resiliency features allowing media catalogs, objects and files to be recovered	✓	



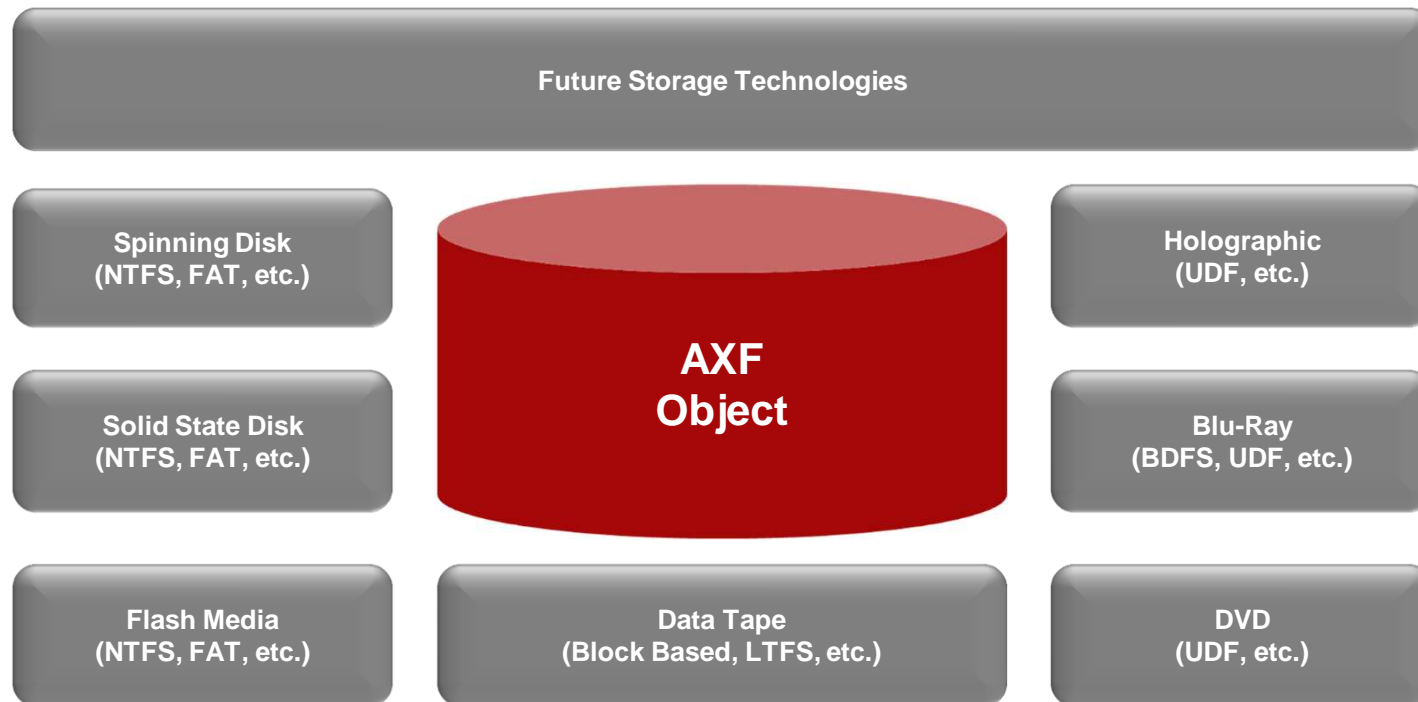
Archive eXchange Format – M&E



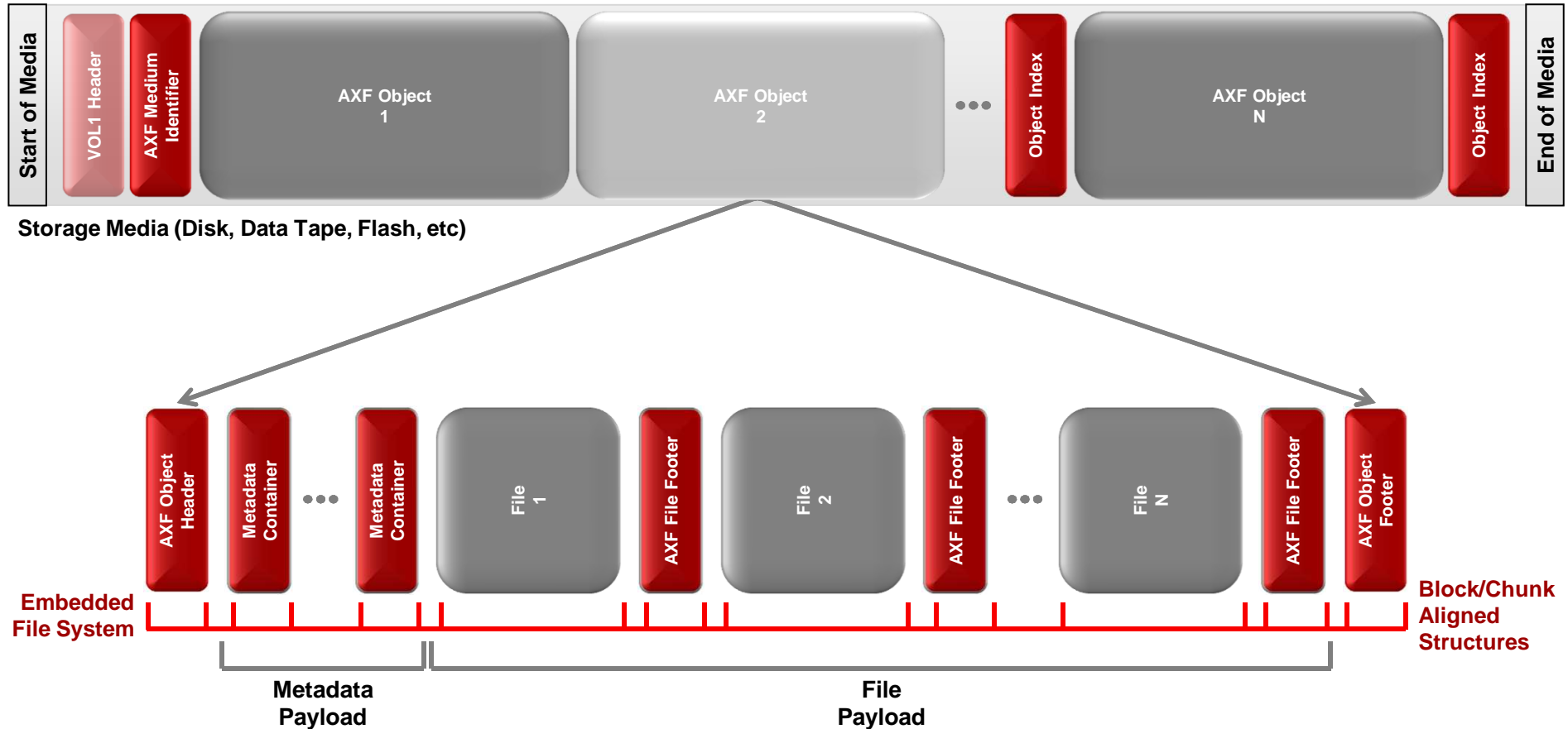
Archive eXchange Format – Generic IT



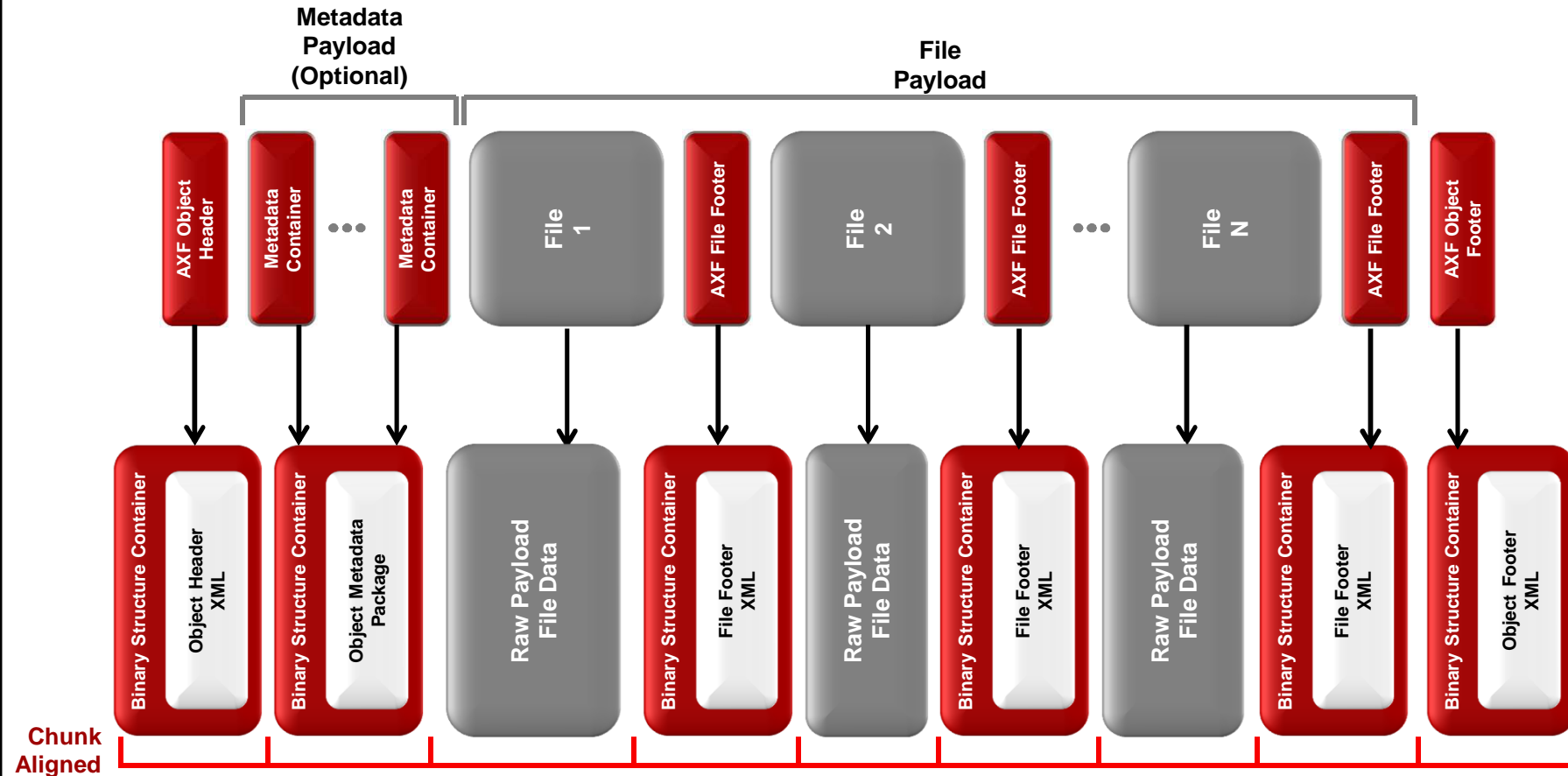
AXF is a Universal Format



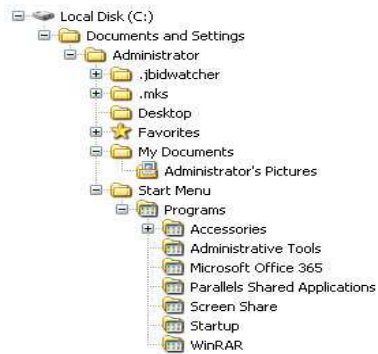
AXF Structural Overview



Inside an AXF Object



Constructing an AXF Object



File Collection



Metadata

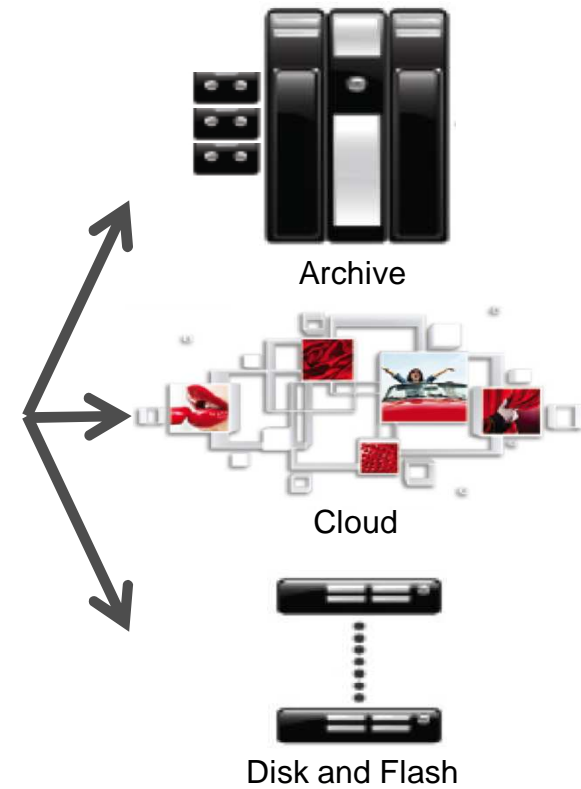


Source Information

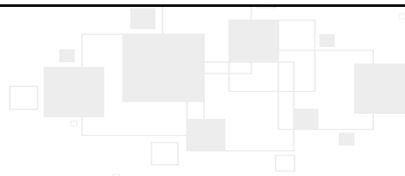
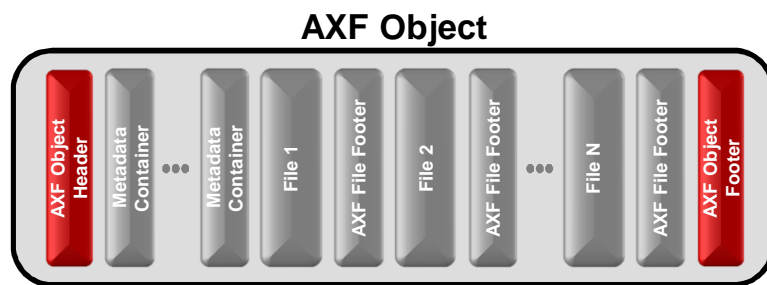


**AXF Aware
Application**

AXF Object



Handling an AXF Object



Archive



Cloud



Disk and Flash

Features and Benefits

- Block aligned for increased resiliency
- Provenance tracks the **entire** lifecycle of object forever
- Stream based transport and checksum verification on all files and structures
- Spanning across media for limitless scale
- Random access to all metadata and files
- Self-describing objects and media allow quick exchange between systems



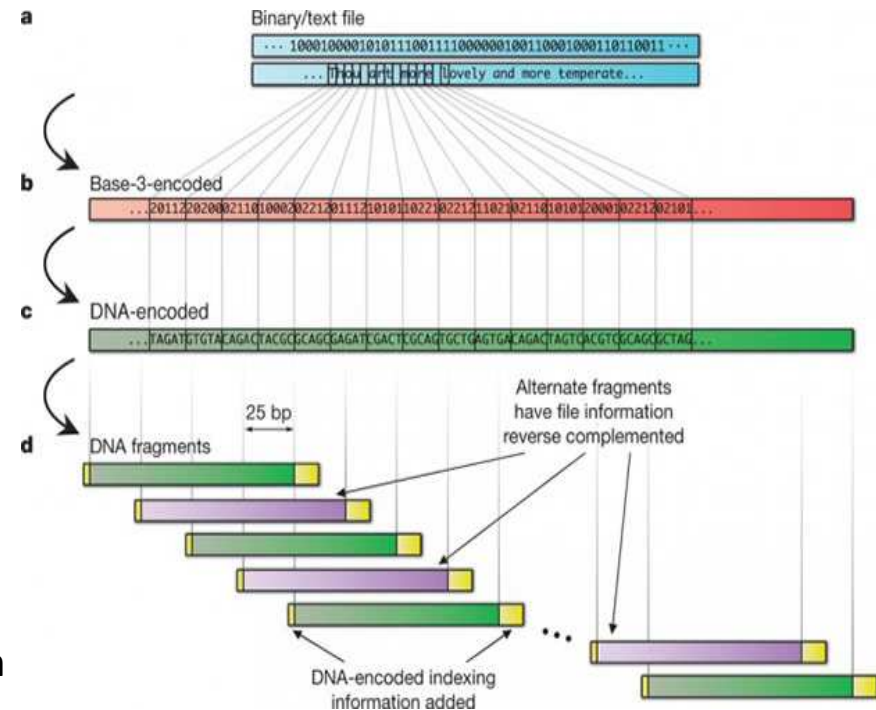
AXF Key Features

- Unlimited File and Size Scalability
- Resilience to Media Damage and Corruption
- Support for All Media Types
- Support for Any File System or Operating System
- Self Describing Objects and Self Describing Media
- Object Versioning and Collection Support
- Support for All File Types – Not Just Media Files
- Streaming and File Based Asset Transport and Delivery



On the Horizon – DNA Based Storage

- Ground breaking research by Nick Goldman and Ewan Birney at the European Bioinformatics Institute
- Data encoded using DNA's four bases (A, T, C and G)
- Projected shelf life in the 10,000+ year range
- 2PB of data storage per gram of DNA material
- First trials were able to independently encode and decode a payload which included:
 - MP3 recordings of Martin Luther King's speeches
 - Shakespeare's 154 Sonnets of Time, Love, Beauty and Mortality
- Although likely more than a decade away from commercial availability we could immediately leverage the benefits of AXF!



AXF Today



- Products are available today which fully support AXF!
- Universal access and exchange tools are available (such as “AXF Explorer”)
- AXF is also the basis for cloud-based asset transport, archive and preservation services offered today – AXF is not just for storage!
- The SMPTE AXF committee was founded by proactive manufacturers because of industry demand and limitations in legacy approaches
- AXF is currently in the “balloting” phase in SMPTE with more than 90% approval rating at this point – balloting ends Dec 6th
- AXF is the only transport, storage and preservation approach formally endorsed by any standards body



OpenAXF.org



- OpenAXF.org is the community portal for the AXF initiative
- The website includes news, documentation, videos and whitepapers providing additional technical details on AXF
- This is the focal point for the AXF community – sign up now!
- Information and material refresh is pending so please check back often
- SMPTE is always looking for active participants (users, manufacturers, etc.) to help bring other perspectives to AXF
- Please visit smpte.org for more information



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THANK YOU!

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