

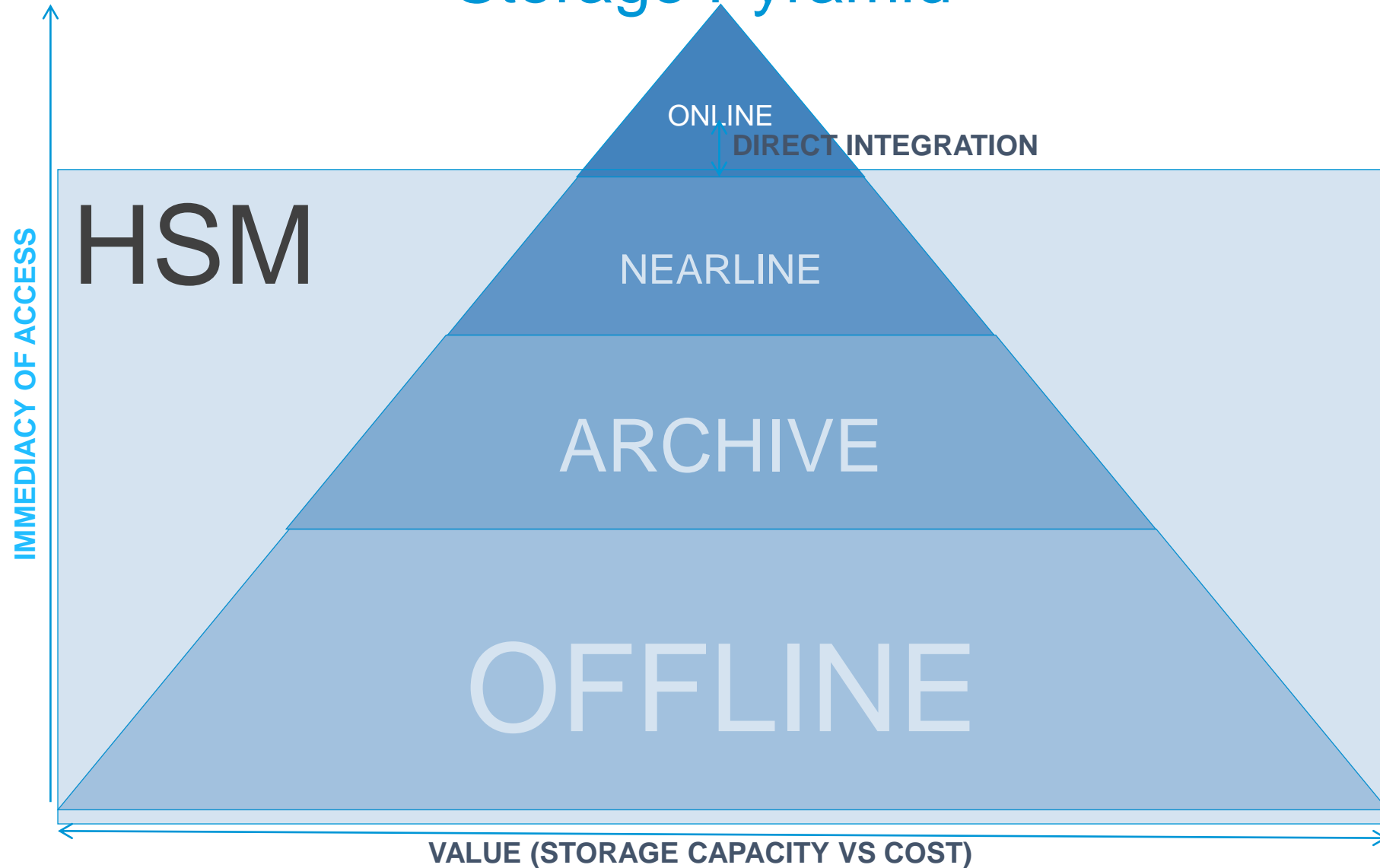
Building Media in the Cloud



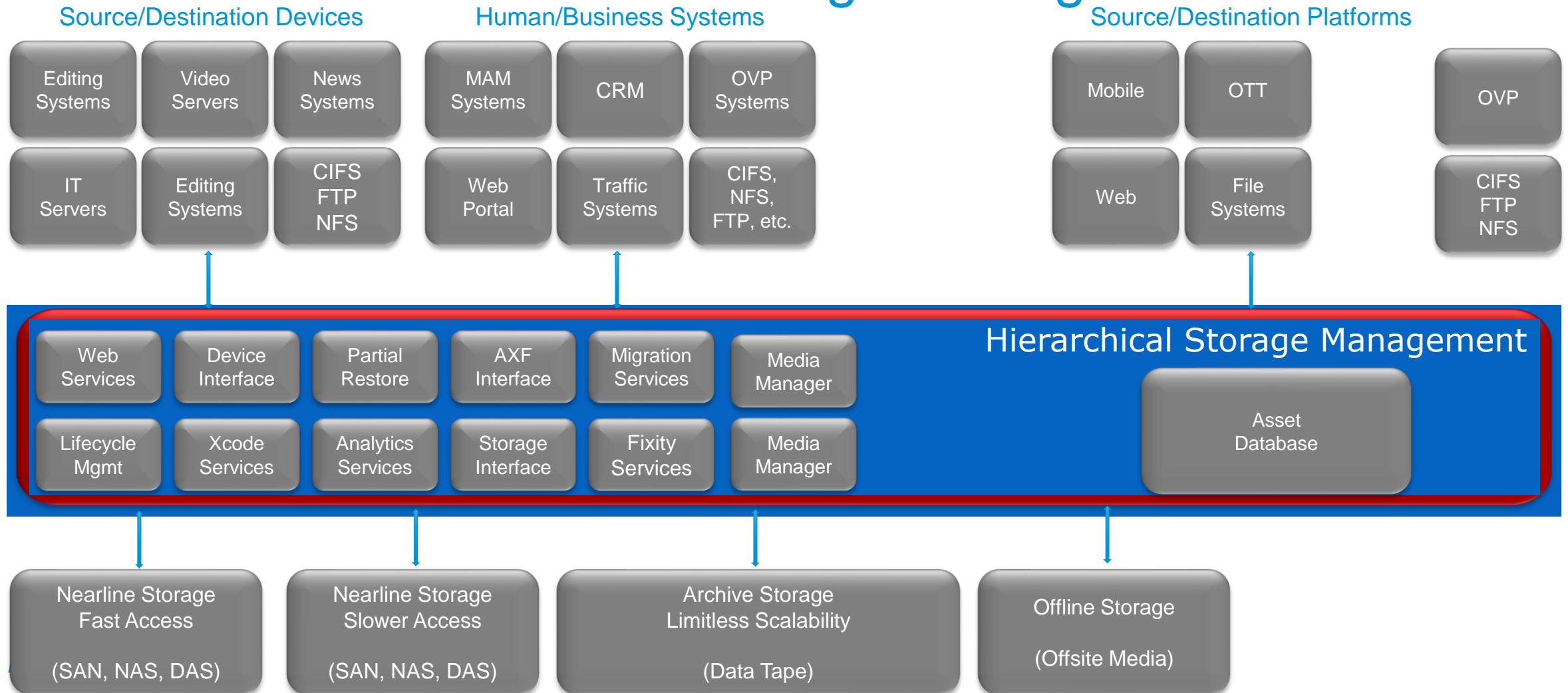
Hierarchical Storage Management (HSM)

- Etere HSM is a object aware, intelligent archive management solution
- HSM is the middleware which resides between any devices which produce or consume file-based content and commodity storage
- HSM is VERY different than disk migration solutions (SAMFS, StorNext, TSM, etc.) which do not handle content as “objects”
- Etere HSM in media applications offer “content aware” features such as transcoding, timecode partial restore, asset analytics, etc. but also extend to non-media applications as well!
- HSM offer direct integration with business systems to fundamentally link processes, resources and metadata with the content repository

Storage Pyramid



Hierarchical Storage Management



Storage Technology and Trends



Global Storage Trends

Over the next five years the media and entertainment industry will see a ~10X increase in required digital storage capacity

Currently 93% of the total storage capacity is used for content archiving and long term preservation

This number is expected to grow to ~96% by 2015 due to more efficient conversion services, lower overall storage costs and a greater ROI on long tail content

Media Type Trends	2010	2015
Data Tape	86%	83%
Hard Drive	10%	14%
Optical	4%	2%
Flash	0.2%	0.6%

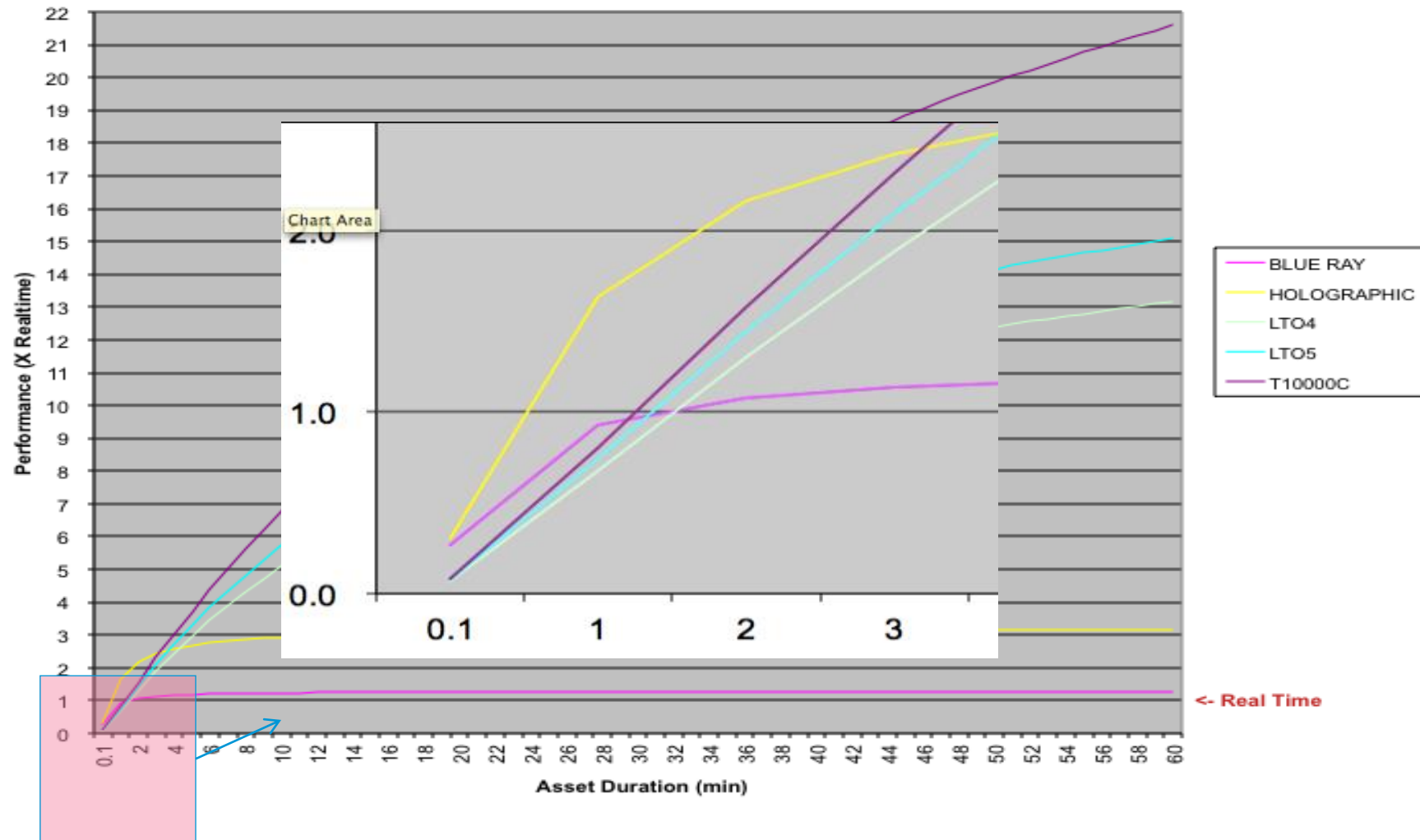
Storage Format Choices

	Hard Disk Storage	Flash Storage	Optical Storage	Data Tape Storage
Pros	<ul style="list-style-type: none"> • Fast transfer speeds • Good storage density • Random access media • Fast mechanical times • Multiple R/W streams 	<ul style="list-style-type: none"> • Random access • Persistent storage • Low energy costs • Acquisition format • Fast access • Rugged 	<ul style="list-style-type: none"> • Random access • No contact read/write • Acquisition format • Emerging holographic • Low replication costs 	<ul style="list-style-type: none"> • Fast transfer speeds • Storage density • Rugged media • Cost per TB • Extremely portable • Expansion costs • Low replication costs
Cons	<ul style="list-style-type: none"> • Tied to host chassis • Not portable • Cost per TB • Cost of ownership • Highly mechanical • Expansion costs • High replication costs 	<ul style="list-style-type: none"> • Limited read/write • Cost per TB • Proprietary formats • Low transfer speeds • Low storage density 	<ul style="list-style-type: none"> • Low storage density • Low transfer speeds • Questionable shelf life • Portability • Single R/W stream 	<ul style="list-style-type: none"> • Sequential data access • Head and tape wear • Slower access • Single R/W stream

Storage Technology Summary

	Type	Media Capacity (GB)	Media Capacity 50Mbps (Hours)	Drive Cost	Street Price (\$/TB)	Drive Speed (MB/s)
BLU RAY	Optical	50	2	\$\$	\$600	14
HOLOGRAPHIC	Optical	300	13	\$\$\$	\$600	20
SOLID STATE (SSD, P2,...)	Flash	16-256	1 - 10	HIGH	\$2,000	~250
SAIT2	Tape	800	35	\$\$\$	\$200	45
LTO4	Tape	800	35	\$\$	\$25	120
LTO5	Tape	1500	65	\$\$\$	\$55	140
TS1140	Tape	4000	175	\$\$\$\$	\$90	240
T10000C	Tape	5000	220	\$\$\$\$	\$70	240

Real World Performance (50Mbps)



Storage Technology Migration

- Data tape “shelf life” need not be a problem once assets have been digitized and placed under HSM control
- HSM systems automatically manage migration to newer storage technologies as a background process at much faster than real time rates
- Each storage generation brings better performance and higher storage density
- Checksums are used during all migration operations to ensure exact byte-for-byte copies are made

Data Tape is the Only Solution

- Unmatched storage density and value
- High performance media ensures no bottlenecks
- TCO is low as data tapes consume no power or cooling
- Low media costs allow automatic offsite asset replication
- Checksums confirm all subsequent file operations
- Automatic migration to new formats ensures longevity
- Initial capital costs are high but flatten out very quickly



What about the Cloud?



What about the Cloud?

Amazon, Microsoft and many others offer scalable cloud based storage “services”

All claim reduced capital costs and high availability via globally distributed data centres

Unfortunately these solutions are not tuned for “big data”

Amazon Simple Storage Service (S3) cloud storage costs:

- \$0.125/GB per month to store data
- No charge for archive transfers (uploads)
- \$0.10/GB for restore transfers (downloads)

Let's take a look at a real world Amazon S3 example...

What about the Cloud?

<u>Assumption</u> 10TB/Month Growth Over Five Years	Annualized WAN Fees	Annualized Cloud Storage Fees	Repository Size at the End of Each Year	Total Annualized Cloud Storage Cost
Year 1	\$30,000	\$97,500	120TB	\$127,500
Year 2	\$30,000	\$277,500	240TB	\$307,500
Year 3	\$30,000	\$457,500	360TB	\$487,500
Year 4	\$30,000	\$637,500	480TB	\$667,500
Year 5	\$30,000	\$817,500	600TB	\$847,500
Amazon S3 Five Year Total Cost				~ \$2.5M

Pricing based on Amazon S3 cloud services in \$USD

Results in an average cost of more than \$4,000/TB over five years

Annual storage fee of \$900,000 continues forever!!!

Can Cloud Storage Work?

- Commodity IT-centric cloud solutions such as Amazon cannot work in “big data” environments like those typical in the media industry
- However HSM-based solutions “in the cloud” are now available and do make real economic sense
- These solutions offer cost-effective “big data” storage as well as the content-centric features of “HSM as a service”
- How do different cloud services topologies fit and can the transition be handled in a staged manner?

Offsite Media Storage

PROS

Cost effective content protection

Data tapes can be shipped daily offering rapid protection

“FedEx” offers fast transfers!

Scale to any size with little additional investment

Capital costs are minimal

Workflows are very well known...

CONS

Workflows are human intensive

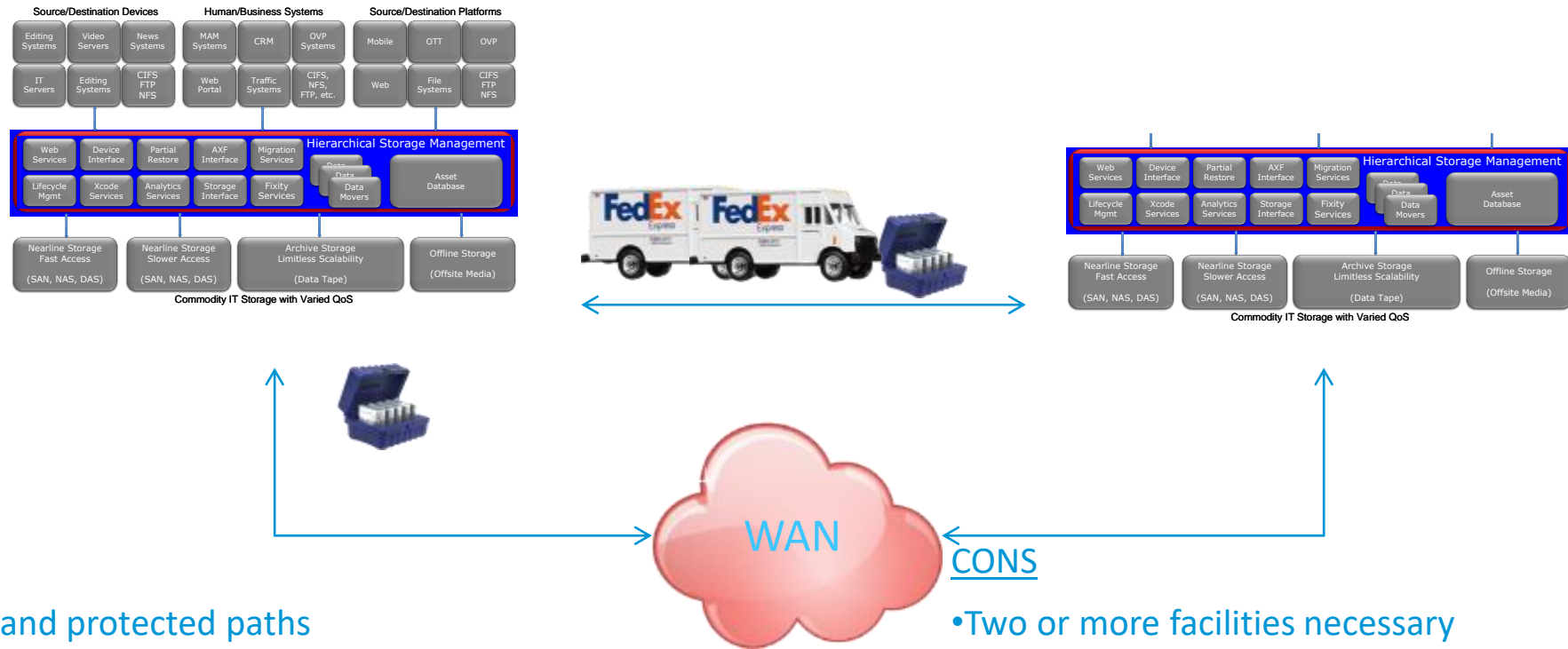
Recall times can be excessive

Tapes on the shelf are not “active” and must be managed over time

Does not offer any redundancy to the main facility

Main facility disaster can take a significant amount of time to recover from

The Private Cloud



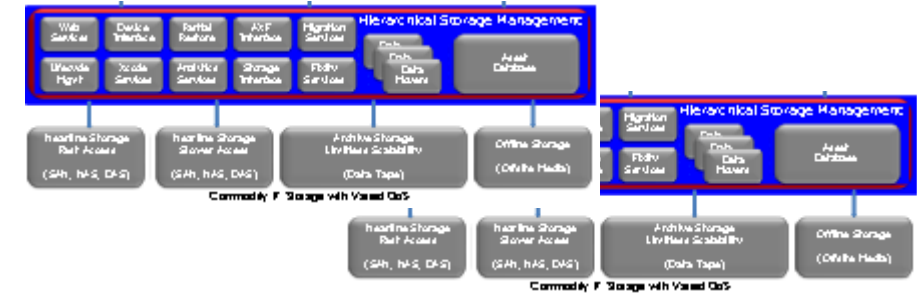
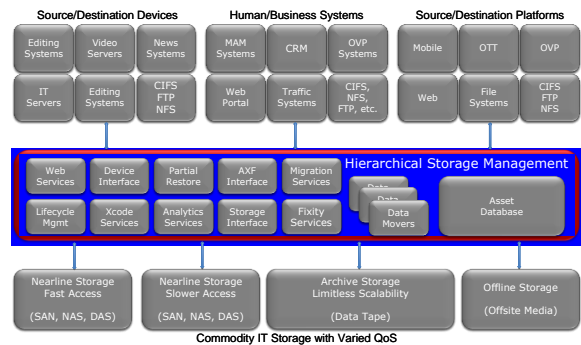
PROS

- Private, secure and protected paths
- Controlled and fairly predictable workflows
- Business continuance possible
- Shipping of high density data tape media is FAST and INEXPENSIVE

CONS

- Two or more facilities necessary
- Infrastructure, capital and staffing costs are simple multiples
- Technical challenges are multiplied by the number of facilities
- Heavy capital and operations costs

The Hybrid Cloud



HSM Cloud Service Provider

WAN

PROS

- Protected and encrypted paths
- Controlled and predictable managed workflows
- Business continuance as a service possible
- Shipping of high density data tape media is FAST & INEXPENSIVE
- Services can be “tuned” on demand

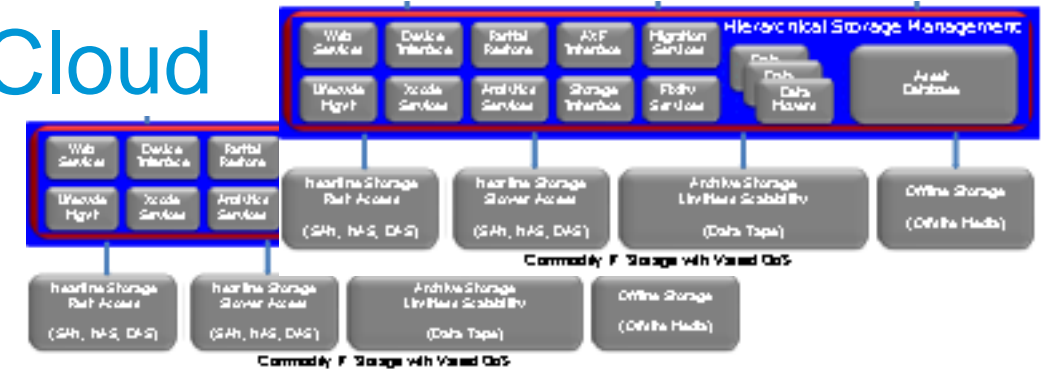
CONS

- Content must be stored in a “hosted” environment
- Security is a key concern which must be carefully managed

HSM in the Cloud



Customer Facilities



Cloud Service Facilities



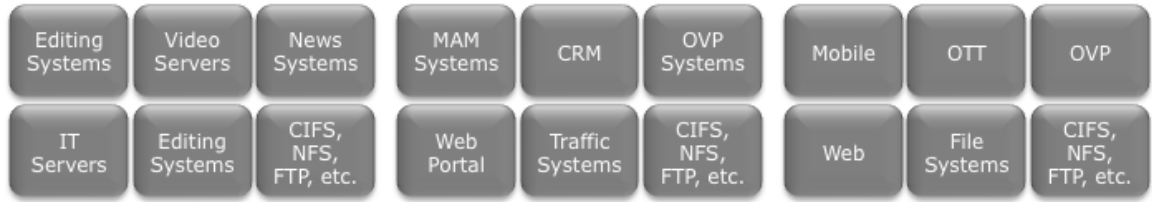
PROS

- HSM as a service
- Protected and encrypted paths
- Controlled and predictable managed workflows
- a as a service
- Services can be tuned on demand
- Global distribution and diversity
- Perfect for “elastic” applications

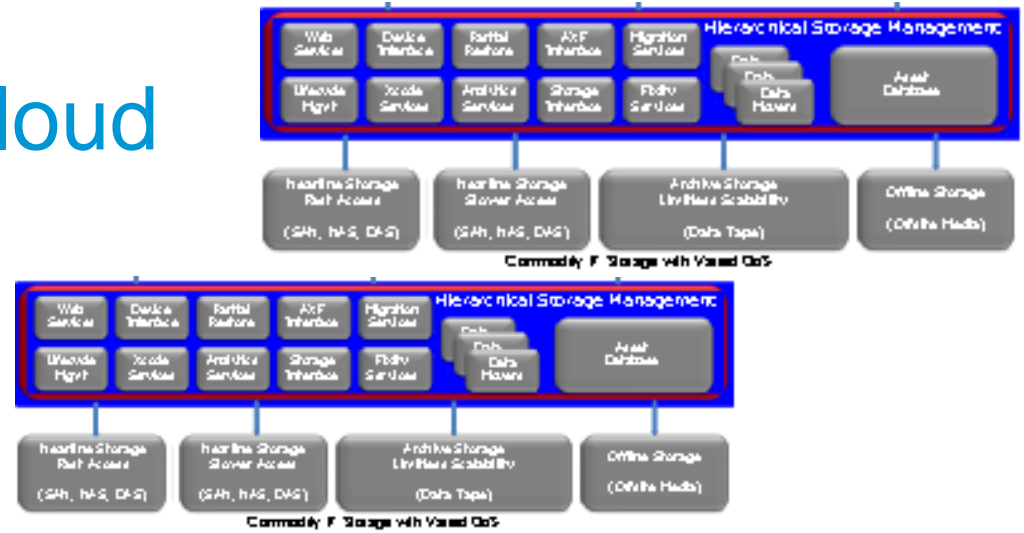
CONS

- Content stored in a “hosted” environment
- Network costs can be prohibitive
- High availability WAN must be part of the solution
- Local “caching” may be necessary to ensure rapid local access

HSM in the Cloud



Customer Facilities



Cloud Service Facilities



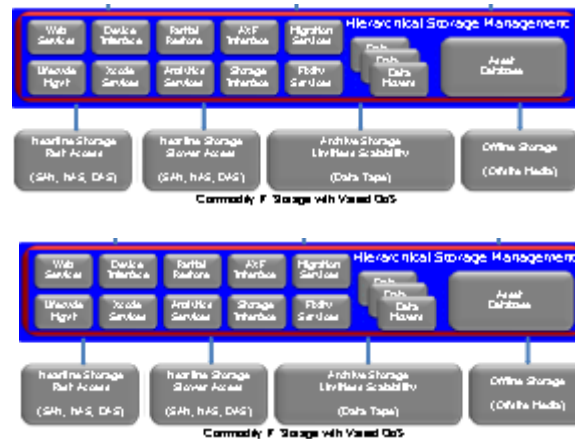
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Cloud Services Evolution



Content Distribution Services

The Connected Enterprise

Business Continuity as a Service

Online Video Publishing as a Service

Elastic Transcoding Farm

Elastic Facility Services

Storage Migration Services

Global Media Asset Management (MAM)

Metadata Mining as a Service

Hub and Spoke Distributed Facility

How are my Valuable
Assets Actually
Stored?



How Are My Valuable Assets Stored?

We must take steps to ensure long term accessibility to valuable file-based assets

Key goals of the “ideal storage format” include:

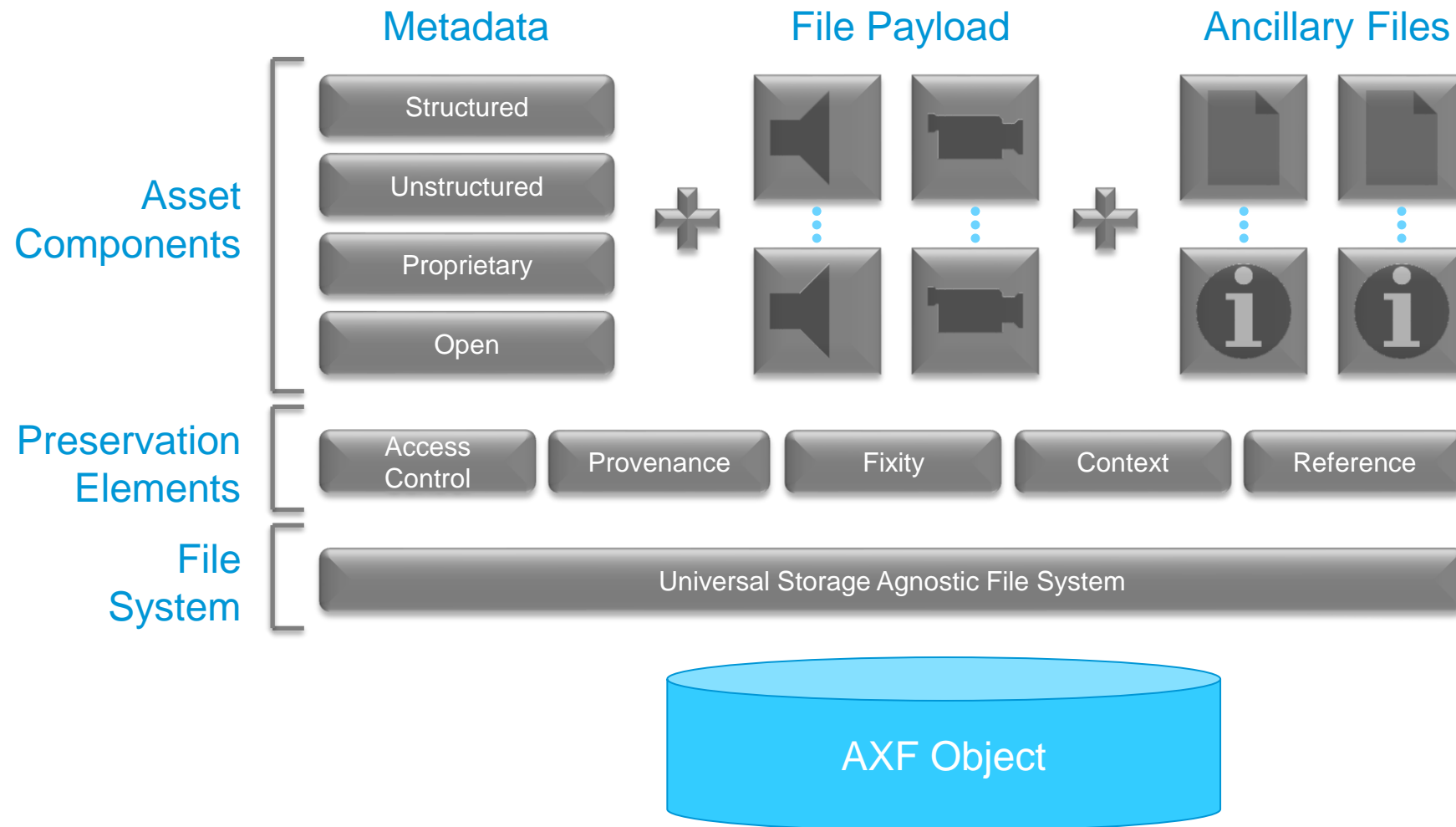
- Ensure long term accessibility
- Self descriptive assets and self descriptive storage media
- Preservation (OAIS) features such as fixity, provenance, etc.
- File encapsulation to wrap related metadata and files
- Scalability for any number of elements of any size and type
- Standardized regardless of storage media technology
- Transportability and compatibility between systems

What choices are there?

Archive eXchange Format (AXF)

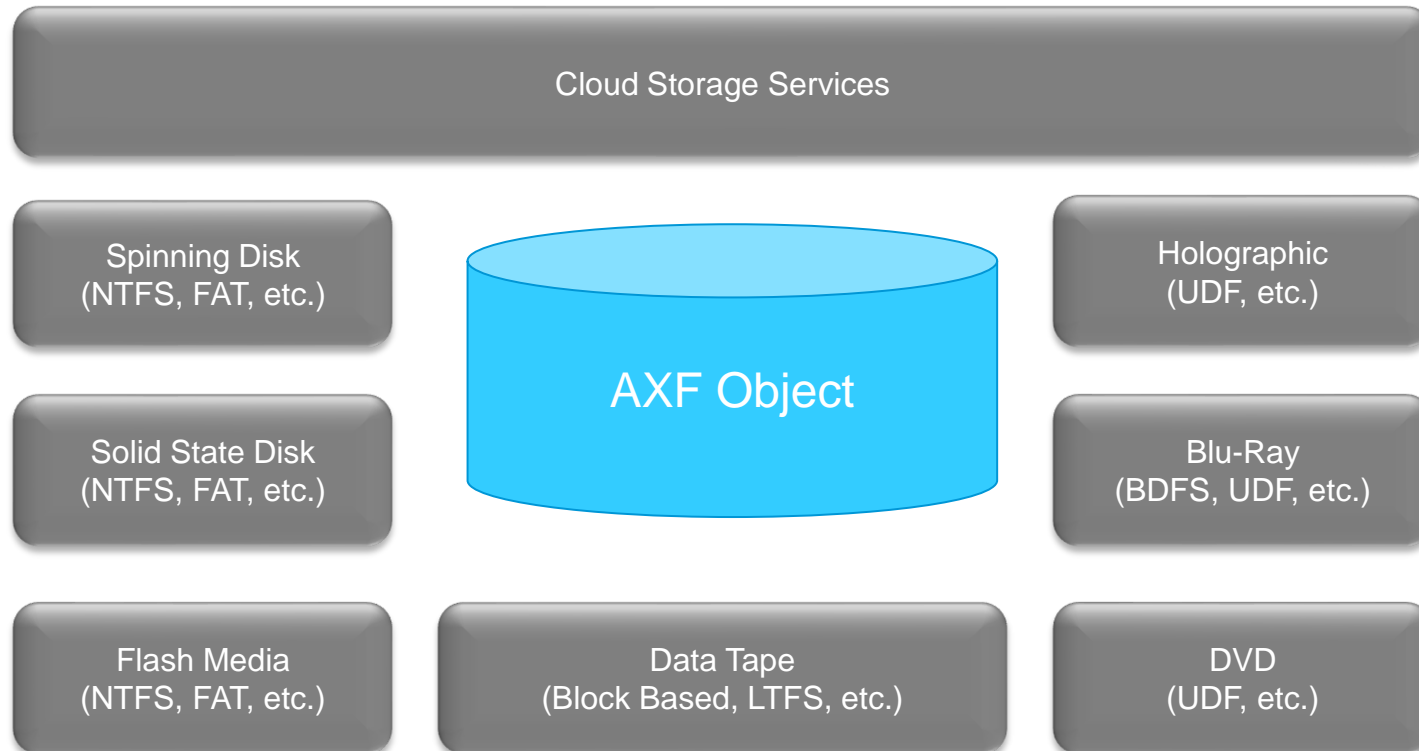
- AXF was in the final process of standardization by SMPTE
- AXF is a fully self-contained, self-describing file storage "container" – think of it as advanced "ZIP"
- AXF is IT-centric and not tied to media applications only!
- AXF is based on an innovative "file system per object" approach
- AXF fully supports all storage technologies – now and into the future!

What is AXF?



AXF and Storage

AXF is storage technology, operating system and file system agnostic



AXF Benefits

- AXF Objects can scale to any size and encapsulate any number of files with full support for media spanning
- No need to upgrade existing storage infrastructures
- AXF guarantees long term compatibility and resiliency with self-describing features for both AXF Objects and AXF Media
- AXF overcomes all the technical, operational and functional limitations of other options such as TAR and LTFS
- AXF is an IT-centric implementation and is not limited to media files alone (documents, imaging data, etc.)
- Visit OpenAXF.org for more information

www.etere.com

Thank you

