High-Level Storage and Data Management Trends & Observations

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What We'll Cover

• Need To Know...
  > What's driving the Archive market
  > Industry Acknowledgments and Efforts
  > What is Archive anyway?
• Green Thinking
• Open Storage / Open Archive
Why is Backup & Archive So Important?

... because The History of Data Growth is Exponential!

• 24 Words - Pythagorean Theorem
• 67 Words - Archimedes Principal
• 179 Words - 10 Commandments
• 286 Words - Lincoln's Gettysburg Address
• 1300 Words - US Declaration of independence
• 26911 Words .........

EU REGULATION ON THE SALE OF CABBAGES
Challenge: Manage Data for 75++ Years

- HW typically only backward compatible N-1
- Yearly capacity increases
- Every 2-5 years HW becomes obsolete:
  > Need to migrate current data to newer HW components
  > Replace compute parcels
  > Replace FC Parcel for performance and capacity
  > Replace tape drives and media to current technology
  > Replace SATA parcels for capacity / footprint
- Minimize vulnerability
- HW migration is inevitable; PLAN for it
SNIA Standards and Technology

SNIA XAM Standard Activities

- **The SNIA XAM Initiative** is chartered to drive adoption of XAM specification, and ensure that the specification fulfills market needs for a fixed content data management interface standard.

- **The SNIA Fixed Content Aware Storage Technical Work Group (FCASTWG)** is the center of technical activities related to new application-level interfaces for storage of unchanging data (fixed content) and associated metadata.

- **The SNIA Software Development Kit Technical Working Group (XAM SDK TWG)** is chartered to develop SNIA Software which implements current and future versions of the XAM Specification(s).
XAM is a Data Storage Interface

Resource Domains are a way of classifying services into specific areas that each deal with a different aspect of the problem. An information domain application creates data and associates MetaData with it.

Certain Data Storage Interfaces can accommodate both Data and MetaData (XAM, Filesystems with extended attributes).

MetaData aware Data Services interpret Data System MetaData as the requirements for its lifecycle and implement policies for retention, placement, lifecycle, etc.

Other Data Storage interfaces (based on blocks or objects) provide virtualized Containers for the Data bits and the management of those containers.

Storage services are employed to meet those requirements at this point in the data’s lifecycle, however the storage services are unaware of the data’s requirements.

eXtensible Access Method (XAM) - A new fixed content API
© 2008 Storage Networking Industry Association. All Rights Reserved.
Digital Archiving & Data Protection (Backup)

Fundamentally Different Approaches to Data Availability

<table>
<thead>
<tr>
<th></th>
<th>Data Protection</th>
<th>Active Archive</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>To recover info in the event of loss, corruption, destruction, etc</td>
<td>To retain data for regulatory compliance, e-discovery, corporation best practice</td>
</tr>
<tr>
<td><strong>Data Type</strong></td>
<td>Dynamic data in production</td>
<td>Fixed content with near perpetual business or compliance value</td>
</tr>
<tr>
<td><strong>Access Pattern</strong></td>
<td>Entire volume or directory is restored after outage</td>
<td>Individual files or tables are recalled disparately</td>
</tr>
<tr>
<td><strong>System Activity</strong></td>
<td>Usually block based</td>
<td>Usually file system or object based</td>
</tr>
<tr>
<td><strong>Records Search</strong></td>
<td>Offline volume remounted and manually searched</td>
<td>Online files recalled based on specific criteria; has time stamp, descriptor and a retention parameter</td>
</tr>
</tbody>
</table>

Both are required in today's technology environment
Demands of a New Archive Reality

Is the ratio for archiving solutions changing?

10 / 90

versus

2 / 18 / 80

• Next Generation Archives need to address a new dimension of the massive resting data – How do you search Petabytes of data from the edge?
  > The new ratio has evolved into a Write / Read / Search relationship (2 / 18 / 80)
  > Business semantics need to drive data management not systematic schemas
  > Virtualization and Search become critical to the presentation of the data, something new is needed...
  > Compute and Store need to Converge
How do you build an Archive, sensitive to Access and Presentation, when any asset can be requested at any time?

Tier 1
- Primary storage
  - Enterprise class disk
  - High-performance applications
  - Mission-critical/OLTP and database
  - Mirroring and replication
  - Synchronous and asynchronous (remote)
  - CDP

Tier 2
- Secondary storage
  - SATA disk and virtual tape
  - Fixed content, backup/recovery, reference data
  - Point-in-time, snapshot

Tier 3
- Long-term retention
  - Fixed content
  - Audio, video, medical, government regulations
  - Tape libraries, deep archive
  - Offsite

Average days since creation
- Tier 1: 0 days
- Tier 2: 30+ days
- Tier 3: 90+ days
- Recovery Time Objective (RTO)
- Tier 1: milliseconds
- Tier 2: seconds
- Tier 3: minutes, hours, days

Key components
- Policy engine
- Tiered storage hierarchy

Source: Horison Information Strategies
More Reasons Why...
Power Consumption is Becoming a Big Problem in Storage

Storage is a significant part of datacenter energy usage, and at 20% CAGR, it is the fastest growing segment. (2)

Some customers are being told that they can have no more power!

Source (1): © 2007 Jupiter Media Corporation and The StorageIO Group
Source (2): Report to Congress on Server and Data Energy Efficiency (08/2007)
### 2005 US State Industrial Electricity Costs (¢/KWH)

#### 10 Most Expensive States

<table>
<thead>
<tr>
<th>Rank</th>
<th>State</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HI</td>
<td>15.79</td>
</tr>
<tr>
<td>2</td>
<td>DC</td>
<td>14.13</td>
</tr>
<tr>
<td>3</td>
<td>NH</td>
<td>11.48</td>
</tr>
<tr>
<td>4</td>
<td>RI</td>
<td>10.01</td>
</tr>
<tr>
<td>5</td>
<td>NJ</td>
<td>9.76</td>
</tr>
<tr>
<td>6</td>
<td>CA</td>
<td>9.55</td>
</tr>
<tr>
<td>7</td>
<td>CT</td>
<td>9.40</td>
</tr>
<tr>
<td>8</td>
<td>AK</td>
<td>9.29</td>
</tr>
<tr>
<td>9</td>
<td>MA</td>
<td>9.22</td>
</tr>
<tr>
<td>10</td>
<td>NY</td>
<td>8.23</td>
</tr>
</tbody>
</table>

#### 10 Least Expensive States

<table>
<thead>
<tr>
<th>Rank</th>
<th>State</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td>KY</td>
<td>3.60</td>
</tr>
<tr>
<td>50</td>
<td>WV</td>
<td>3.85</td>
</tr>
<tr>
<td>49</td>
<td>ID</td>
<td>3.91</td>
</tr>
<tr>
<td>48</td>
<td>WY</td>
<td>3.99</td>
</tr>
<tr>
<td>47</td>
<td>UT</td>
<td>4.24</td>
</tr>
<tr>
<td>46</td>
<td>WA</td>
<td>4.27</td>
</tr>
<tr>
<td>45</td>
<td>ND</td>
<td>4.32</td>
</tr>
<tr>
<td>44</td>
<td>IN</td>
<td>4.42</td>
</tr>
<tr>
<td>43</td>
<td>NE</td>
<td>4.43</td>
</tr>
<tr>
<td>42</td>
<td>VA</td>
<td>4.46</td>
</tr>
</tbody>
</table>
More Reasons Why... The Cost of Power and Cooling

Storage Growth 30% annually, Power Cost Growth 28% annually, Electricity Cost Used $.145 per kWh

Energy Costs Racing to Out-Pace Hardware Costs

Source: IDC

- **LTO Tape System** = 191 TB (85% utilization yielding 125 TB), (4) LTO3 Tape Drives, (1) 700 slot LTO library
- **SATA Disk System** = 232 TB (70% utilization yielding 125 TB), (15) Disk Controllers, (105) Expansion Trays

Source: Clipper Group 2007: Tape and Disk Costs – What it Really Costs to Power the Devices
## Advantages of Tape vs. Disk

<table>
<thead>
<tr>
<th>Feature</th>
<th>Tape Advantages</th>
<th>Disk Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-life media</td>
<td>Yes, 15-30 years on all new media.</td>
<td>~5 years for most HDDs</td>
</tr>
<tr>
<td>Portability</td>
<td>Yes, media completely removable and easily transported.</td>
<td>No, disks are difficult to remove and to safely transport.</td>
</tr>
<tr>
<td>Move data to remote location for DR with or without electricity</td>
<td>Yes, can move remotely with or without electricity.</td>
<td>Difficult to move disk data to remote location for DR without electricity.</td>
</tr>
<tr>
<td>Inactive data does not consume energy</td>
<td>Yes – green storage</td>
<td>Rarely, except in the case of MAID.</td>
</tr>
<tr>
<td>Encryption for highest security level</td>
<td>Yes, encryption capability available on essentially all tape drives. Highest demand with mainframe and mission critical tape applications.</td>
<td>Available on selected disk products, mainly PCs.</td>
</tr>
</tbody>
</table>

Source: Horison Information Strategies
# Regulatory Compliance & Litigation - Driving Digital Archive

Regulations and required retention periods for information types

<table>
<thead>
<tr>
<th>Regulation</th>
<th>Information Type</th>
<th>Retention Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIPAA</td>
<td>Personal medical records</td>
<td>Lifetime +2 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEC 17a-4</td>
<td>Trading account records</td>
<td>Account life + 6 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOX</td>
<td>Audit correspondence of publicly traded firms</td>
<td>Audit +4 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 CFR Part 11</td>
<td>Biological product manufacturing</td>
<td>5 years original form</td>
</tr>
<tr>
<td>FERC Part 125</td>
<td>Public utilities general accounting ledgers</td>
<td>10 years</td>
</tr>
<tr>
<td>IRS 26 CFR Part 31</td>
<td>Social Security documents</td>
<td>4 years</td>
</tr>
</tbody>
</table>

**Explanations**

- **HIPAA**: Health Insurance Portability and Accountability Act
- **SEC**: Securities and Exchange Commission
- **SOX**: Sarbanes-Oxley
- **CFR**: Code of Federal Regulations
- **FERC**: Federal Energy Regulatory Commission
- **U.S. Code**: U.S. Code of Laws
What is OpenStorage?

- **Open Architecture**
  general purpose hardware & software implementing storage functions that scale higher at lower TCO than proprietary alternatives

- **Open Software**
  open sourced code and APIs to maximize the developer opportunity

- **Open Interoperability**
  simple, predictable integration in heterogeneous environments (open standard)

Creating a rock solid foundation that will scale and evolve over time while remaining secure, transparent, and flexible.
Open Storage
Converges Compute, Storage and the Network

• Open Storage
  > Non-Proprietary
  > Open Source
  > Production Ready

• Innovative
  > OpenSolaris + ZFS
  > Fishworks

• Scale
  > Capacity
  > Performance

• Breakthrough economics
  > Industry Std Components
  > Features at no extra cost
Sun offers three architectural choices...

1. Servers + Storage Arrays

2. Storage Server (4U self-contained)

3. Servers + JBOD

Multiple Disk Arrays

X4540
“Thumper” / “Thor” Storage Server

Extensible Open Storage/Open Archive

Server

Storage Server

SAN

Expansion

Expansion

Sun Proprietary/Confidential: Internal Use Only
Open Storage Plug-Ins....

- NFS
- CIFS
- FCP
- SAS
- iSCSI
- IB
- VTL
- OSD
- CAS
- XAM
- Web
- DAV

Solaris
- Galaxy servers
- ZFS
- DTrace
- FMA
- Containers
- SAM-O

StorageTek Array Family
- Unified Storage
- SSD
- JBODs

StorageTek Tape Family
- Thumper/Thor Series

Niagara servers
- Replication
- Security
- Mirror/Snap
- Search
- Encryption
- De-duplication
- Migration
- Backup
- Compliance

SPARC servers
- DTrace
- ZFS
- SAM-Q

Unified Storage
- SSD
- JBODs

Containers
- FMA
- DTrace

SPARC servers
- DTrace
- ZFS
- SAM-Q

Unified Storage
- SSD
- JBODs

Containers
- FMA
- DTrace

SPARC servers
- DTrace
- ZFS
- SAM-Q
General Design with Continuous Open Archive

High Availability Infrastructure with Continuous Backup/Data Protection and Archive to Shadow File System(s)

- Meta Data Servers
- Tier #1 Active Data
- Tier #2 Disk Archive
- Tier #3 Tape Archive

DATA IP Connections (GigE)

Customer LAN or WAN

DATA IP Connections (GigE)

Standard IP, NFS and/or CIFS

UNIX
Linux
Windows
...in Summary...

• Open approach, breaks proprietary vendor lock-in

• Exponentially better Scale, Flexibility and TCO

• Simplifies heterogeneous management

• Massive ISV support/integration
Sun’s Enterprise Archive Portfolio

Example Enterprise Archive Solution

Structured Data
- SAP
- Oracle
- Primary Database
- Database Archiver
- 7000 Unified Storage
- SAM-FS (IAS) (Larger)
- NFS

Unstructured Data
- Email
- Video
- Images
- Primary Disk
- Email Archiver
- 7000 Unified Storage
- SAM-FS (IAS)
- SATA/FC Modular Disk
- Open Storage Honeycomb RAIN

Mixed Workgroup

Tape Libraries and Virtual Tape

Off-Site Tape

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Thank You for Your Time and Attention

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