Architecting Next Generation Enterprise Network Storage

Anil Vasudeva
IMEX Research

(408) 268-0800
vasudeva@imexresearch.com
Market Drivers

- Data Explosion (Driven by Connectivity…)
- Regulatory Compliance (HIPAA/SARBOX…)
- Standardization (Volume Servers/SATA/SAS…)
- Emergent Applications (Content/eCommerce/HPC…)
- Virtualization/Externalization (Pools of Storage…)
Data Explosion

*Realtime Data, VoIP, HPC, Grids, WebServices/XML
Market Segmentation by Data

- By Application Requirements
- By Data Types
  - Dynamic Data (Online Data – Addressable Fast)
  - Reference Data (Content Addressable Streaming)
  - Backup (Nearline Buffered Data)
  - Archive (Offline Vaulted Recoverable)
- By Record Size, Amount of Data & Frequency of Access
Data Segmentation by Application

*I/Os per second for a required response time (ms)

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Rich Data Applications

- High Performance Computing
  - 100+ Teraflops
  - Throughput $= 100 \text{ GB/s}$

- Commercial Visualization
  - Rendering (Texture & Polygons)
  - Throughput $= 1.2 \text{ GB/s}$

- Bioinformatics
  - Data rate & capacity

- Decision Support Systems
  - Throughput: DSL/Cable

- Entertainment
  - Audio/Video On Demand

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Corporate Data Usage

Corporate Data Usage
I/O Access Frequency vs. Percent of Data

% of Corporate Data
% of I/O Accesses

Cache
- Logs
- Journals
- Temp Tables

Disk Arrays
- Hot Tables
- Indices
- Data

Nearline Storage

Tape Libraries
- Back Up Data
- Archived Data

SSD
<table>
<thead>
<tr>
<th></th>
<th>Online</th>
<th>Midline</th>
<th>Nearline</th>
<th>Offline/Vaulted</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dynamic Data</strong></td>
<td>Current Business Critical Active data</td>
<td>Aged, Reference data - Images, records, BU emails</td>
<td>Centralized backup - Disk-to-Disk-to-Tape Staging to tape</td>
<td>Archived for BC/DR - Local, - Remote</td>
</tr>
<tr>
<td><strong>Reference Data</strong></td>
<td>Hi-transaction data</td>
<td>- Images, records, BU emails Unalterable - regulatory</td>
<td>- Disk-to-Disk-to-Tape Staging to tape</td>
<td>- Local, - Remote</td>
</tr>
<tr>
<td><strong>Buffered Data</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Recoverable Data</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Price</strong></td>
<td>High $/GB</td>
<td>Moderate $/GB</td>
<td>Moderate to Low $/GB</td>
<td>Low $/GB</td>
</tr>
<tr>
<td><strong>Response Time</strong></td>
<td>Milliseconds</td>
<td>10ths of sec to seconds</td>
<td>Minutes to hours</td>
<td>Hours to days</td>
</tr>
<tr>
<td><strong>% On Disk</strong></td>
<td>50%</td>
<td>35%</td>
<td>15%</td>
<td>Tape</td>
</tr>
</tbody>
</table>

Source: Maxtor
Storage System Segments

Product Topologies

- **DAS**
  (Bus Based - ATA, SATA)

- **NAS**
  (NetBased File Level Access – NFS, CIFS)

- **SAN**
  (NetBased Block Level Access – SCSI, FC...)

- **Internal**
  (ATA, SATA) vs.

- **External**
  (SCSI, FC, iSCSI, IB, SAS)
High Performance Computing
Blades Servers - Infrastructure

- Processor Blades (6-24 typically)
- Midplane W/Connectors To Blades & Back Modules
- Management Modules Remote Mgmt+KVM over IP
- Networking: Gbit Ethernet Switches
- Storage: IP NAS or FC SAN Switch
- Cooling N+1Fans/Cooling Modules
- Power: N+1Power Supplies

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Industry Std. Blocks for Open System Platform

I/O Adapters

Midplane

3U Chassis

I/O Adapters

SATA

NVRAM

FC Target

Midplane

3U Chassis

Baseboard

SATA

NVRAM

To 12GB DIMM

Dual Xeon™/Opteron™ Processor-Capable

Integrated Dual GbE

6 High-BW PCI-X Slots

Platform Management

CPU

CPU

BMC

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Tiered Storage by Price/Performance

- Desktop PC
  - Entry NAS
  - Workstations

- Servers
  - Midline Storage
  - Mainstream NAS/SAN

- Large Enterprise
  - SAN & NAS

Drive Interface
- PC Chipset
- SAS HBA
- SATA
- SAS
- SAS HBA/RAID
- FC RAID

Drive Types
- SATA Drive
  - 5400 RPM
  - 7200 RPM
- SAS Drive
  - 10K RPM
  - 15K RPM
- FC Drive

Source: Maxtor

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Enterprise Market – HDD FF Transitions

- 3.5" 10K
- 3.5" 15K
- 2.5" 10K
- 2.5" 15K

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Emerging Opportunities/Key Requirements

- **Compliance Data Protection** (Nearline Storage)
  - Low Cost Vaulting

- **Reference Data Search Engines** (Nearline Storage)
  - Corporate & Service Providers (Google, MS Longhorn +)

- **Storage Externalization/Ease of Use**
  - User Driven Scalability (Cost)
  - Backward Compatibility (Investment Protection)

- **Lower TCO**
  - Standardization/Interchangeability (Mix & Match, Virtualize)
  - Autonomics (Lights Out Management)
    
    *(Self Discover/Self Configure/Self Scale/Self Migrate/Self Healing © IMEX..)*
Major Players in Infrastructure Convergence

- Networks
  - Ericsson
  - Nortel Networks
  - Alcatel
  - 3Com
  - Motorola
  - NTT
  - Cisco Systems
  - Juniper Networks
  - Hitachi
  - Fujitsu
  - NEC
  - IBM
  - Sun Microsystems
  - HP
  - Lucent Technologies

- Storage
  - EMC
  - Veritas
  - StorageTek
  - LSI Logic
  - Hitachi Data Systems
  - McData
  - NetworkAppliance

- Servers
  - Intel
  - Dell
  - Compaq
  - Oracle
  - NCR
  - SGI
  - Unisys
  - Microsoft
For latest, full set of slides - go to

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IMEX Research
(408) 268-0800
vpmarketing@imexresearch.com