Visions for Ethernet Connected Drives

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Visions for Ethernet Connected Drives

Today’s Agenda

- Introductions
- Market Statistics
- Viewpoints—Audiences Interviewed
- Status of Ethernet Connected Drive Trend
- Potential Benefits/Use Cases and Challenges of Ethernet Drives
- System-level Architectural Changes to Support Ethernet Drives
- Open Discussion and Q&A
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Market Statistics – For Overall Market

• **Storage Systems**
  - all HDD and SSD’s included

• **HDD**
  - all drives
  - enterprise drives

• **Cloud Computing**
  - servers in cloud versus enterprise

• **White Box Storage**
  - total storage market
Visions for Ethernet Connected Drives Storage Systems Revenues & Capacity
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Worldwide HDD Revenues

Sources: HDD suppliers plus DG estimates
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Enterprise HDD Shipments and Capacity

14% of 2014 HDD units were Enterprise

HDD Shipments (Millions – bars)

Capacity Shipped (Exabytes – line)

Sources: HDD suppliers plus DG estimates
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Server Market Adoption

Percent of Server Shipments (Bars)

Enterprises

Cloud and SP


0% 25% 50% 75% 100%
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Unstructured Data Growing Fast

Market Status:

- Data explosion – store everything, unstructured, growing very fast
- IT budgets flat
- Server pricing stable
- HDD price erosion stabilizing
- HDD density improving, but not like in prior years
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What is This Type of Drive?

Conventional

HDD’s

Storage-oriented Server

Ethernet Connected Drive System

eHDD’s with embedded server/memory/Ethernet Interface

The economic argument:

\[ n_{eHDD} \times eHDD_{px} < n_{HDD} \times HDD_{px} + n_{server} \times Server_{px} \]
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Viewpoints

—we surveyed suppliers in the following industries:
- HDD
- SSD
- Hardware/Server System
- Semiconductor
- Software

…as well as some enterprises
Ethernet Connected Drives trend is in its infancy – very early to make predictions

One HDD vendor began early shipments

Handfuls of customers are trialing the technology

Cost models have been estimated by various players

Abundance of start-ups (not all related to this trend, but lots of new ideas)

Killer applications still being considered

...But, it looks exciting and the served market is huge...
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Object Storage and Ethernet Drives

- Two trends potentially coming together...
- HDD prices, IT spending trends, cloud computing phenomenon converging
- Potential benefits of adopting Ethernet Connected Drives
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Object Storage & Ethernet Connected Drives

*Applications discussed during surveys: cold storage, archival, near-line/mid-range
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Potential Benefits

Ethernet Connected Drives is an innovation that may reduce capital and operating costs by:

- Reducing software stack (File System, Volume Manager, RAID system) and corresponding server infrastructure
- Reducing connectivity costs and complexity

Costs vary by:
- Application (e.g. cold storage, archiving, etc.)
- Cost of additional components on each HDD (CPU, memory, interface)
Use Case #1 – Object-Based Cluster:

- Vendor-supplied TCO Cost/Tb shows nearly 40% TCO savings for a 500 PB deployment.
- We reviewed the material and understand that the main difference between conventional and Ethernet Connected Drive-based system is that Object Servers are eliminated.
- The estimated capex saving is 26% and estimated annual power expense saving is 61%.
Use Case #2 – Archiving:

- 1 PB economy file storage (large file archiving)
- Comparing Ethernet Connected Drive architecture to conventional architecture
  - Ratio of server node CPU / drive is higher
  - Drive density in chassis is higher
- TCO saving is 36%, due to lower hardware and power/cooling savings
Use Case #3 – Online Backup Service:

- Well-known cloud-based backup service company for SMB & enterprise customers claims
  - Is testing Ethernet Connected Drives in an object storage environment using SWIFT interface, working to prove that it can scale to 1 PB using only two proxy servers
  - The company estimates the two proxy servers would manage several racks of drives with need for traditional storage servers and direct attached drives
  - Estimated TCO savings 33.5%
Use Case #4 – Analytics:

- With processor/memory on each HDD, as data is stored, it can be pre-processed, leaving metadata that can be easily searched.
- Applications can leverage this metadata to provide very rapid query responses when compared to centrally processed responses.
- Each HDD CPU/Memory system can search contents quicker, and parallel-computing oriented applications can leverage this as a benefit.
Use Case #5 – Nearline Storage:

- While this viewpoint is in the minority, we understand that some suppliers expect Ethernet Connected Drives may compete in environments such as nearline storage, which could be interpreted as moving to higher-performance implementations. No cost justifications were provided, but we chose to share the viewpoint because it is interesting!
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Challenges

Dissenting views point out the following:

- Ethernet drives concept around for past 15 years
- No single technical approach in the market – some offer “Key Value” approach, others allow an O/S to be installed on the drive
- Many use cases presented are cost-sensitive, and dissenting views say OEMs and SPs won’t pay a premium for HDDs
- Ethernet drive means hundreds of CPUs to manage
- Each drive would be unaware of contents of other drives

Flash not currently part of this Ethernet Connected Drive vision. External flash capacity growing 100% Y/Y

New use cases / applications likely to drive this trend – is it Object Storage?
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Storage Value Chain Evolution

<table>
<thead>
<tr>
<th>Year</th>
<th>Operating System</th>
<th>HDD</th>
<th>Flash</th>
<th>Hardware and Processor</th>
<th>Commodity &amp; Intel</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>EMC, NetApp, HP, IBM, HDS</td>
<td>WDC, HGST, Seagate, Toshiba</td>
<td></td>
<td>Commodity &amp; Intel</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>EMC, NetApp, HP, IBM, HDS</td>
<td>WDC, Seagate, Toshiba</td>
<td>SanDisk, Micron, Samsung</td>
<td>Commodity &amp; Intel</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>EMC, NetApp, HP, IBM, HDS, Microsoft, Nexenta, RedHat, Corinfa, Scality...</td>
<td>WDC, Seagate, Toshiba</td>
<td>SanDisk, Micron, Samsung</td>
<td>Commodity &amp; Intel/?</td>
<td></td>
</tr>
</tbody>
</table>
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Architectural Discussion

- Software Defined Storage and White Box / Stripped Box impact
- Difference between traditional systems and potential Ethernet Connected Drive systems
- What about Flash and NVMe systems?
- Value chain discussion
- Discussion of cloud versus enterprise architecture evolution
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Traditional Storage Architecture
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Evolving Ethernet Drive-based Architecture

*Each HDD equipped with CPU, memory, Ethernet connection

*The ratio of HDD to Server varies for each application/use case
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Potential Evolution of Object Storage*

*Those surveyed had represented this trend in many ways – we chose a simple block diagram approach
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Summary of Survey Findings

Based on our interviews:

➢ There is no consensus, but some common themes:
  • Ethernet Connected Drives will likely cost more
  • Parallel/local processing of data at each HDD is when benefits occur
  • Apps likely need to be re-written – new apps being written for new use cases
  • If Ethernet drives are used, number of storage-oriented servers could be reduced
After This Webcast

- This webcast and a PDF of the slides will be posted to the SNIA Ethernet Storage Forum (ESF) website and available on-demand
  - [http://www.snia.org/forums/esf/knowledge/webcasts](http://www.snia.org/forums/esf/knowledge/webcasts)

- A full Q&A from this webcast, including answers to questions we couldn't get to today, will be posted to the SNIA-ESF blog
  - [http://sniaesfblog.org/](http://sniaesfblog.org/)

- Follow us on Twitter @ SNIAESF
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Open Discussion

—we invite your questions...

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Thank You