Fujitsu Storage Days 2017

Gegenwart und Zukunft – Storage im Wandel – Wir bauen Brücken!
Storage im Wandel – Wir bauen Brücken!

Storage Days 2017

Michael Marticke

Fahren auf der Überholspur mit ETERNUS Onlinespeicher.
Disk drives, a 61 year old technology...
The Flash rumors...

**Pro HDD arguments**
- HDDs are more reliable
- HDDs can write forever
- HDDs are a proven technology
- Data is safer on HDDs

**Pro Flash arguments**
- Flash is expensive
- Flash is slowing down over time
- Flash is not mature enough
- Flash is only for specific environments

- Flash is fast
- Flash is more reliable
- Flash is green
- Flash is affordable
- Flash is for saving money
Flash technology – a closer look
SSD vs. HDD

**Enterprise SSD**
Can write the full capacity 30-1x per day over lifetime

**Client/Laptop SSD**
Can write the full capacity 0.1x per day over lifetime

**HDD**
No write limitation
SLC, MLC, eMLC, and TLC

- **SLC** (Single Level Cell)
  - (1 or 0)

- **MLC** (Multi Level Cell)
  - (11, 10, 01 or 00)

- **TLC** (Triple Level Cell)
  - (000, 001, 010, 011, 100, 101, 110, 111)

- **Readout Voltage ~ Charge Level**
  - Level 0 (.1)
  - Level 1 (.0)
  - Level 2 (.10)
  - Level 3 (.00)
  - Level 4 (.11)

- **Readout Voltage**
  - (.11)
  - (.10)
  - (.01)
  - (.00)

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Endurance: THE Criteria for SSD

- **TBW ("Total Byte Written")**
  - Total amount of data writable into SSD
  - Depending on capacity: Large capacity = higher TBW
  - Difficult to compare

- **DWPD ("Disk Write per Day")**
  - How often the entire capacity of the disk can be written
    - per day
    - over warranty lifetime
  - More complicated, but better to compare and classify
  
  \[
  \text{TBW [TB]} = \text{DWPD} \times \text{Capacity [TB]} \times 365 \text{ Days} \times 3(5) \text{ Years}
  \]

  \[
  \text{DWPD} = \frac{\text{TBW [TB]}}{\text{Capacity [TB]} \times 365 \text{ Days} \times 3(5) \text{ Years}}
  \]
Endurance: THE Criteria for SSD
# Endurance: THE Criteria for SSD

## Drives Table

<table>
<thead>
<tr>
<th>Enclosure</th>
<th>Slot No.</th>
<th>Status</th>
<th>Capacity</th>
<th>Speed</th>
<th>Type</th>
<th>Usage</th>
<th>RAID Group</th>
<th>Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE</td>
<td>0</td>
<td>Available</td>
<td>400.00 GB</td>
<td>-</td>
<td>2.5&quot; SSD-M</td>
<td>Data</td>
<td>0 : Dedup Pool 0</td>
<td>100 %</td>
</tr>
<tr>
<td>CE</td>
<td>1</td>
<td>Available</td>
<td>400.00 GB</td>
<td>-</td>
<td>2.5&quot; SSD-M</td>
<td>Data</td>
<td>0 : Dedup Pool 0</td>
<td>100 %</td>
</tr>
<tr>
<td>CE</td>
<td>2</td>
<td>Available</td>
<td>400.00 GB</td>
<td>-</td>
<td>2.5&quot; SSD-M</td>
<td>Data</td>
<td>0 : Dedup Pool 0</td>
<td>100 %</td>
</tr>
<tr>
<td>CE</td>
<td>3</td>
<td>Available</td>
<td>400.00 GB</td>
<td>-</td>
<td>2.5&quot; SSD-M</td>
<td>Data</td>
<td>0 : Dedup Pool 0</td>
<td>100 %</td>
</tr>
<tr>
<td>CE</td>
<td>4</td>
<td>Available</td>
<td>400.00 GB</td>
<td>-</td>
<td>2.5&quot; SSD-M</td>
<td>Data</td>
<td>1 : Dedup Pool 1</td>
<td>100 %</td>
</tr>
<tr>
<td>CE</td>
<td>5</td>
<td>Available</td>
<td>400.00 GB</td>
<td>-</td>
<td>2.5&quot; SSD-M</td>
<td>Data</td>
<td>1 : Dedup Pool 1</td>
<td>100 %</td>
</tr>
<tr>
<td>CE</td>
<td>6</td>
<td>Available</td>
<td>400.00 GB</td>
<td>-</td>
<td>2.5&quot; SSD-M</td>
<td>Data</td>
<td>1 : Dedup Pool 1</td>
<td>100 %</td>
</tr>
<tr>
<td>CE</td>
<td>7</td>
<td>Available</td>
<td>400.00 GB</td>
<td>-</td>
<td>2.5&quot; SSD-M</td>
<td>Data</td>
<td>1 : Dedup Pool 1</td>
<td>100 %</td>
</tr>
<tr>
<td>CE</td>
<td>8</td>
<td>Available</td>
<td>400.00 GB</td>
<td>-</td>
<td>2.5&quot; SSD-M</td>
<td>Data</td>
<td>2 : FTSP_NAME#0</td>
<td>100 %</td>
</tr>
<tr>
<td>CE</td>
<td>9</td>
<td>Available</td>
<td>400.00 GB</td>
<td>-</td>
<td>2.5&quot; SSD-M</td>
<td>Data</td>
<td>2 : FTSP_NAME#0</td>
<td>100 %</td>
</tr>
</tbody>
</table>
ETERNUS DX/AF media at a glance…

<table>
<thead>
<tr>
<th>Write-intensive</th>
<th>Balanced</th>
<th>Read-intensive*</th>
<th>SAS 7k/10k/15k</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 GB</td>
<td>950 GB</td>
<td>- 6 TB</td>
<td>- 1TB 2,5“</td>
</tr>
<tr>
<td>- 800 GB</td>
<td>- 1,6 TB</td>
<td>- 12 TB</td>
<td>- 2TB 2,5“</td>
</tr>
<tr>
<td>eMLC</td>
<td>eMLC</td>
<td>- 23,94 TB</td>
<td>- 4 TB 3,5“</td>
</tr>
<tr>
<td>10 DWPD</td>
<td>1-3 DWPD</td>
<td>3,84 TB</td>
<td>- 6 TB 3,5“</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8,94 TB</td>
<td>- 8 TB 3,5“</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*currently planned for Q1/2017</td>
</tr>
</tbody>
</table>

SAS 3.0 12 Gbit/s connected – SSDs available in 3,5“ and in SED version as well.

*currently planned for Q1/2017

Fujitsu always calculates DWPD for 5 years!
Intel’s Xpoint™ – a look into the (storage)future
3D XPoint™ TECHNOLOGY

Breaks The Memory Storage Barrier

 STORAGE = Optane PCIe/NVMe

 SRAM
Latency: 1X
Size of Data: 1X

 DRAM
Latency: ~10X
Size of Data: ~100X

 3D XPoint™
Latency: ~100X
Size of Data: ~1,000X

 NAND SSD
Latency: ~100,000X
Size of Data: ~1,000X

 MEMORY

 HDD
Latency: ~10 MillionX
Size of Data: ~10,000X

Technology claims are based on comparisons of latency, density and write cycling metrics amongst memory technologies recorded on published specifications of in-market memory products against internal Intel specifications.
Intel 3D Xpoint™ In the Memory/Storage Hierarchy

- Better Price Point than DRAM
  - Higher capacity at lower cost
  - Better $/write IOPS

- High Bandwidth
  - DDR4 CPU interface

- Lower Latency than Flash
  - Much more IOPS

- Disruptive storage access
  - Not longer block I/O instead load/store operation
Quick introduction to Fujitsu Storage

- More than 47 years of storage heritage
- Manufacture of high quality HDD until 2009
- Strong customer and analyst feedback on performance, quality and price
  - Gartner: “…customers who value stability and investment protection should consider Fujitsu storage…” MQ2015
ETERNUS Storage Family

ETERNUS AF All-Flash Arrays
- AF250
- AF650

ETERNUS SF Storage Management

ETERNUS DX Hybrid Storage Arrays
- DX60 S3
- DX100 S3
- DX200 S3
- DX500 S3
- DX600 S3
- DX8700 S3
- DX8900 S3
"Fujitsu is boringly reliable, and as a technical person I will take that every time. I don’t want exciting or unpredictable; I want it to do the same thing every time."

John Herd,
University Campus Suffolk
100% data insurance

Take out the risk with ETERNUS Storage Cluster

Mirroring of business critical data

Storage Cluster between
All Flash to All Flash
All Flash to Disk

Non-Stop operations
Transparent Failover
Automated/Manual
In case of a primary storage or site failure, the secondary storage takes over identities (IDs)

- Failover can be executed in both directions and between different (multiple) ETERNUS DX & AF S3 models
- Automatic or manual failover
Inline Deduplication/Compression (Dedup/Comp)

Efficient use of SSD capacity in the server virtualization environment or the VDI environment

- source data is critical – not everything can and should be deduped
- maximal performance and latency with DeDupe is not possible
- DeDupe/Compression is selectable on an application base
- Compression only is on the roadmap (Q2-2017)

(1) Data written from the server is divided in the system memory
(2) Duplicated data in the divided data is deleted
(3) Deduplicated data is compressed
(4) Data minimized in the system memory is written into the volume registered in the pool

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Supports Various Vendors’ Products

Connectable to various servers

- HP ProLiant, HP Integrity
- IBM Power Systems
- IBM System x
- DELL PowerEdge
- PRIMERGY, PRIMEQUEST
- SPARC M10

Supports various OS

- Windows Server, Oracle Solaris
- Red Hat Enterprise Linux, SUSE Linux
- AIX, HP-UX, VMware...

Supports various Middleware

- Microsoft
  - Exchange Server, SQL Server
  - SharePoint Server
  - Windows Server Failover Cluster

- ORACLE
  - Oracle Database / RAC
  - Oracle Solaris Cluster

- Symantec
  - VERITAS Storage Foundation

- SAP
  - SAP solutions (CRM, ERP...)

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# ETERNUS AF series

<table>
<thead>
<tr>
<th>Overview</th>
<th>AF250</th>
<th>AF650</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>184 TB (48x3.84TB – 1 DWPD) 368 TB (48x7.68TB – 1 DWPD)</td>
<td>740 TB (192x3.84TB – 1 DWPD) 1.48PB (192x7.68TB – 1 DWPD)</td>
</tr>
<tr>
<td>IO/s – MB/s</td>
<td>300.000 IO/s (SPC-1) – 11.000 MB/s (SPC-2)</td>
<td>600.000 IO/s (SPC-1) – 22.000 MB/s (SPC-2)</td>
</tr>
<tr>
<td>Features</td>
<td>Dedup, Compression, Mirroring, Transparent Failover (to Hybrid as well), nearly all ETERNUS DX S3 hybrid features</td>
<td>Dedup, Compression, Mirroring, Transparent Failover (to Hybrid as well), nearly all ETERNUS DX S3 hybrid features</td>
</tr>
</tbody>
</table>
A clever combination

Flexible configuration is a must
- Switch it on volumes for capacity optimization
- Keep it off for performance SLAs

Auto Quality of Service
- Guarantees response time to every application
- Keeps the noisy neighbor under control

Balances performance & cost

Auto QoS ensures business priorities
- Guaranteed Response time

Dedup & Compression reduces capacity

Pool #1 Pool #2 Pool #3
ETERNUS AF – Time to flash

--leading response time
-Management integration with disk storage
-Data mirroring, replication
-Deep integration in relevant use cases
-Transparent system failover
-Selective use of deduplication
-Automated quality of service management

VDI
DATABASE
MIXED WORKLOADS
ENTERPRISE VIRTUALIZATION
TRADING
ANALYTICS
COLLABORATION
E-COMMERCE

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**Summing up …**

**Flash now**

**Boost**
- Accelerate the business
- Increase productivity
- Create competitive edge

**Trust**
- Eliminate business risks
- Provide constant access
- Preserve reputation/trust

**Optimize**
- Automate administration
- Enable green IT
- Maximize TCO results
ETERNUS DX & AF Family

Features and Enhancements 2017
Hard- & Software Enhancements

- Storage Cluster for iSCSI
- Online data migration
- All inclusive software bundle AF series

Roadmap
- Selective Compression only
- New SSDs with 7,68TB
- New 10 TB NL-SAS HDDs
- New ???
The REC path now supports Automatic Failover for iSCSI connections as well
Online Migration Advantage

- Traditional offline migration

  ![Diagram showing traditional offline migration with downtime]

- Downtime is reduced because data gets copied in the background

  ![Diagram showing online storage migration with reduced downtime]
Gegenwart und Zukunft – Storage im Wandel – Wir bauen Brücken!