PASIG – Disk Trends
Oracle Storage Technology 101 Session
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Tape gets its capacity by having 1000X the recording surface area comparing a 1/2 inch cartridge to a 3 1/2 inch disk.
Tape & Disk Data Storage Price Trends

Technology Price per GB History & Predictions

- Disk
- Tape

$/GB

Year

Possible New Disk Technologies

- Discrete Track Recording (DTR) (~2 Tb/inch²)
- Bit Patterned Media (BPMR) (~5 Tb/inch²)
- Heat Assisted Magnetic Recording (HAMR) (~5 Tb/inch²)
- Microwave Assisted Magnetic Recording (MAMR) (~5 Tb/inch²)
- Shingled Recording (SWR) (~5 Tb/inch²)
- 2-D Recording (TDMR)

- HAMR + BPMR -> 10 Tb/inch²

Shingled Recording Concept

Wide tracks are partially overwritten to get narrower tracks
Technologies Likely to be Introduced

- Helium Drives (2013, WD)\(^1\)
  - 40% capacity increase 4 platters -> 6 or 7 platters
- Shingled Drives (2013, WD, Seagate)\(^1\)
  - 20-25% areal density increase
- Heat Assisted Drives (2014, Seagate)\(^1\)
  - 60% areal density increase
- Bit Patterned Media (end of the decade, WD)\(^2\)
  - 100% areal density increase

At the same time, disk performance does not significantly increases

1. [http://www.theregister.co.uk/2013/02/12/seagate_hamr/](http://www.theregister.co.uk/2013/02/12/seagate_hamr/)
Disk Drive Manufacturers Family Tree

IBM

Hitachi

Western Digital

Quantum

Maxtor

Seagate

Conner

Samsung

Toshiba

Fujitsu

Micropolis

HP

1995


Western Digital (50%*)

Seagate (40%*)

Toshiba (10%*)

* Source IDC

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Data Protection and Archiving Requirements

The Increasing Importance of Some Key Storage Attributes

- Long-Term Retention of Data
- Energy Efficiency for Storage
- Proven & Open Formats
- Dual Technology Scheme
- Low Storage Costs
- 99.999% Reliability of Storage
Increasing pressure from legal and governmental organizations and rules

- Use case for archive storage is becoming distinct from primary or backup use case
- Tape is established as primary storage tier for long-term archive retention
Tiered Storage

More than ever a necessity

• Tiered storage architectures ensure data is on the *right storage at the right time at the right cost*

• Drives IT Infrastructure Efficiency and Economies
Oracle Storage is Engineered for Archiving

Industry Leading Performance and Scalability

**ZFS Storage Appliance**
- **Scalability**: Up to 3.5PB in a single system
- **Performance**: Up to 120Gb/s Ethernet bandwidth connectivity

**Pillar Axiom**
- **Scalability**: 3 TB to 1.66 PB in a single system
- **Performance**: Up to 128 Gb/Sec Fibre Channel connectivity

**StorageTek Tape Solutions**
- **Scalability**: Up to 33.8EB* of storage, behind a single point of control
- **Performance**: Up to 18.6PB / hour native throughput, behind a single point of control

* Assumes 2:1 compression
Oracle’s new **ZS3** Series

**ZFS Storage Operating System**
Most powerful storage software suite
Engineered Integration with Oracle software

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### ZS3-2
- Single or Dual Controllers
- 512GB or 1TB DRAM
- 8 PCIe Slots
- 16 Drive Enclosures
- 12TB Read Flash
- 4TB Write Flash
- Up to 1.5PB scalability

### ZS3-4
- Single or Dual Controllers
- 2TB DRAM
- 14 PCIe Slots
- 36 Disk Enclosures
- 12TB Read Flash
- 10TB Write Flash
- Up to 3.5PB scalability

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**2x Faster**

**3x More Scalable**

**OS8 Storage OS Support**
**Engineered for Extreme Performance**

### Most Horsepower Possible

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>2TB DRAM</td>
<td>-</td>
</tr>
<tr>
<td>80 Cores Processing Power</td>
<td>-</td>
</tr>
<tr>
<td>12.8TB Read Flash</td>
<td>-</td>
</tr>
<tr>
<td>10.5TB Write Flash</td>
<td>-</td>
</tr>
</tbody>
</table>

### Hybrid Storage Pools

- **Adaptive Throttle Algorithm** Determines Pipe Size
- **Automated, real-time data migration from DRAM to multi-class flash, to multi-class disk storage**
- **Software specifically engineered for multi-level flash and disk storage**

![Diagram of Hybrid Storage Pools](image-url)