Beyond Capacity

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For 7 minutes, reflect about our mission of what we can build together.
We All Joined The Engineering Tribe of High Tech at Some Point

My story begins at 17 years of age in Seattle at a CDC offshoot that wanted to start an ARPanet.

Since that time, I have been an EE, Computer Engineer, Software Manager, P&L Owner and loved all of it. …but I have also been a husband, a father and saw that technology was more than a job. Without asking, I know that almost all of you understand that we are creating more than business cases or setting new tech standards. We are crafting the building blocks of our children’s future.
Just like my children, our technology has grown

Fast forward 12 years
My Daughter in 2016

Remind us of what we know
What does 20x the data find us?
My Daughter in 2016

Remind us of what we know
Which detail would I want to forget?
Our Ultimate Goal

So here at Seagate, we want you to think about what life might be like if we could

**remove one thing**
Our story is a story of having more resources.

and not “or”
Remind Us of What We Know

Exabytes of Data Shipped

~10x Gap (Cost & EB)
Hyperscale/Hyperconverged/SDS/Virtualization To Save The Day

Legacy:
The Story of “Or”

Hyperscale/Hyperconverged
The Story of “And”
Today

220°

The Law of Diminishing Returns

SSD

HDD

32°

HDD performance bottlenecks virtually unchanged for years

70°

Desired Temperature
Tomorrow

Let this happen naturally

SSD

HDD

220°

32°

70° Desired Temperature

2x 64°

Fix the bottleneck
What Are Our Challenges to Preserve Our Memories?

- Keep the gap of cost, and therefore EB growth at 10x (or greater)

- Look to challenge a long established bottleneck on the HDD, and innovate to preserve the most retention of our memories at the greatest efficiency.
Innovation: Density

Capacity Growth:

Step 1:
Zone Block Devices
Software development at OCP underway to control dataflow and data warmth

Step 2:
HAMR
Core technological achievement to keep pace with Industry Exabyte demand

Growing Exabyte Demand
Enable Storage Density
Store Multiple Copies

HDD TECHNOLOGIES

Areal Density
Technology: HAMR
Focus: 20TB by 2020
Innovation: The Technology

Capacity growth starts at the media

SEAGATE has created production media up to 2Tbpsi

SEAGATE has created media in research up to 10Tbpsi

9 YEARS of 30% CAGR demonstrated with HAMR
Innovation: The Technology

Investment in precision manufacturing, optics, mechanical/electrical/chemical engineering

Energy assisted technology is needed to continue this amazing growth in the Hyperscale world.
Performance Enablement

- Cost, Size, Performance matter in the data center!
- Logistics has known this model for years
- All are required for customer experience
Innovation: Performance

IOPS Growth:

Step 1: Latency Bounded IO – ICC – Banding
- Command priority, queues, locality optimization
- Unfortunately latency boundaries become encountered

Step 2: Dual Actuator
- Enable 1 drive slot to perform like 2 drives
- Significantly less power than 2 drives, avoid slot tax!
Innovation: Performance

1 Slot in the Datacenter ➔ Performance of 2X ➔ Enable TCO

Up to 2018

3.5” NL Performance History
- Spindle Speed
- Disk Size
- Actuator Mass

*Random Read performance has been flat*

Ingest:
Open the pipe from the SSDs to allow software defined storage to scale

Read IOPS:
- We can’t predict what users will read…yet ;)
- Need to give analytics access to the data lakes with efficient model

2019 and beyond
Beyond Capacity:

Latency is critical to data center growth

Software solutions to keep IO/TB sufficient in the short term (1-2 years).
Hardware solutions to enable storage economics for the data center longer term.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Dual Actuator</th>
<th>LBIO</th>
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<tbody>
<tr>
<td>Random Read IOPS</td>
<td>160 IOPS in 1st half of 2019</td>
<td>10 IOPS/TB achieved on 10-12-14TB</td>
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<tr>
<td>Power</td>
<td>Significantly less than 2 drives</td>
<td>Optimized for customer use case</td>
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<tr>
<td>TCO</td>
<td>Significantly less than 2 drives</td>
<td></td>
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<tr>
<td>Sequential Fill</td>
<td>~500MB/Sec!</td>
<td>No change to traditional NL Allows writes/reads prioritization</td>
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<td>Compatibility</td>
<td>Seamless integration to all future capacity growth recording techniques. (HAMR)</td>
<td>Works with both SAS &amp; SATA devices</td>
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Ensuring Hard Drives Can Meet Hyperscale Workload Requirements

IOPS/TB calculation based on Random Read Q1 4k IOPS based on Servo-Mechanical capability
The Bottom Line:

1. **Capacity**  
   Improve the Density of the Data Center

2. **Performance**  
   Enable the users to access the data to continue achieving service level agreements

3. **Collaboration**  
   Work closely to ensure software genius fully optimize hardware capability
Our story does not end here, but what we do here sets up what we can give to the future
A World Where History Is More Than a Grainy Shadow

I live in a 100 year old house built by Ruth Comfort Mitchell

1000 questions?

We are asking you to help us create this vision...

Together
Backup