Customer Driven Cold Storage Devices

- Market Demands
  - Cloud service customers want to keep their content forever
- Regulatory requirements
  - Health care records, e-Discovery, Financial data, Government data
- Storage is inexpensive and data management is complex and takes too much time
- Enables new cloud services for CSPs to offer…
Key Requirements
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• Lowest $/GB
• Highest Capacity
• Most efficient Energy Consumption Profile
• Suitable in High Density Storage Environment
Key Requirements - Solutions

• Lowest $/GB

• Highest Capacity

• Most efficient Energy Consumption Profile

• Suitable in High Density Storage Environment
How do we lower $/GB?

Increase Capacity

Best option
- Near term?

SMR: Shingled Magnetic Recording
- Today’s most cost effective way to increase capacity
What is SMR?
Why SMR?

Conventional, Non-SMR Writes

- Conventional writer width defines TPI
- Conventional reader is much narrower than writer
SMR squeezes tracks, enabling more TB

SMR Writes

- Data is written wide and the write to the next adjacent track trims the previous track
  - Data is written in progressing track order
  - The last track of a band is not trimmed
  - No random in-place writes

- Readable tracks are narrower than originally written track
What about Random Writes?

* New Data is in Buffer

* Preserve neighboring data (read) before writing New Data
What About Random Writes?

* New Data is written
* Neighboring data is destroyed
Grouping tracks into Bands

Band n

“Wide” Track

Band n+1

“Wide” Track
What other strategies do we have to handle random performance?
SMR Architectures

New Communication Method
Standard progressing in T10 (SAS) & T13 (SATA)

New rules for writing

**Host Aware SMR**
- Host can optimize write behavior
- What if new write rules are not 100% followed?
  - Drive Managed performance
  - Backward Compatible

**Restricted SMR**
- Host must optimize write behavior
- What if new write rules are not 100% followed?
  - Device rejects the request
  - Not backward compatible – new device type

Drive Managed SMR HDD

No Standard required
Drive manages all requests
Fully backward compatible

Engineering Workshop
Power Management
Power Management

- Enables storage devices to operate in lower power states with faster recovery latencies

- Firmware Features enable hosts to manage or control power states
  - Automated Power Management (APM)
  - PowerChoice™
Drive Heath Management …

- In-Field Drive Diagnostics (IDD)
What is In-Field Drive Diagnostics (IDD)?

- Drives conduct self diagnostics in-situ – No Drive Removal!
  - Firmware Feature
  - Host initiates IDD

Goal

Reduce operating cost

by reducing unnecessary, costly, and time-consuming drive removal
In-Drive Diagnostics Details

in-situ self diagnostics, in-situ error detection, & in-situ repair

The host determines and invokes when the feature is run

extension of existing firmware features
  • accessed through ATA SMART commands
Value to Customers

IDD

1) Reduces TCO for large scale-out data centers
2) Aligns with hyper-scale data center automation philosophy and architecture
3) Reduces costs associated with drive maintenance – HDD checks, HDD pulls and replacement, HDD returns, and human errors related to drive maintenance
4) Improves operational efficiencies – load balancing, minimizes data migration and resources needed for migrating data
Call to Action for Cold Storage Devices

Engage with your HDD provider on SMR
- Participate in changes to standards and file systems
- T10 (SAS) & T13 (SATA)

Lower the operational costs of Cold Storage
- Lower energy consumption → Power Management features
- Better operational efficiency → In-Drive-Diagnostics for drive health
Thank You
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