

Solid State Storage for Archival

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Technology**

Cost of Ownership

- Initial acquisition cost ●
 - 4+ bit/cell will help
- Operational costs
 - Power (duty cycle, per access, idle) ●
 - Cooling ●
 - Facility (Sq. ft) ●
 - Maintenance ●
- Retirement
 - Decommissioning ○
 - Migration ●



Temperature Dependence

- Write accuracy, dielectric stress, and electron trapping favor writing at higher temperatures
- Data retention and read disturb favor storage at lower temperatures
- From JEDEC JESD218A endurance specification:
 - Enterprise end of life specifies 13 weeks retention with active temperature of 55° C and power off temp of 40° C
 - If power off temp is 55° C, then retention would only be 2 weeks
 - If power off temp is 25° C, then retention would be 101 weeks
 - If active temp is 25° C and power off temp is 25° C, then retention would be 7 weeks
- Temperature dependency gets worse with smaller geometries
- How to handle scrubbing?
- Challenges facilities and system designs

Interfaces

- Conventional block storage
 - Scalability to large configurations on single nodes important for reduced overhead/power
 - Single server with hundreds of drives (e.g. SAS today)
 - Scrubbing/maintenance problematic in conjunction with temperature dependencies
- Key-Value Ethernet drives
 - Highly scalable, extremely dense
 - Ethernet longevity
 - Eliminates storage server, direct to drive from application API – reduced cost, fewer obsolescence points
 - Reduced power, only drives actively accessing data need be powered up
 - Simplifies scrubbing/data migration/maintenance

New Solid State Media Types

- New technologies (PC, Memristor, RRAM, etc) claim better scalability than flash, but...
- Flash will continue to reduce costs for the foreseeable future
 - 3D structures, more bits/cell
 - Volume driven by consumer markets
- Very difficult for new technologies to gain a foothold and compete on cost until flash no longer acceptable for consumer markets