Designing Storage Architectures for Preservation Collections

Designing for Large Scale

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26 September 2011
Storage Technology

The Good News

• Disk drives have progressed from 1TB to 4TB in 3 years.
• SATA Bus transfer rates have gone from 300MB/s to 600MB/s.
• SATA drives still operate within the 10W range.

The Bad News

• Average building block sizes are still 12 to 24 drives in a server.
• Motherboards capable of high speed data service are in the 400W-600W range.
Building Block Size

If each building block is efficient will the system be efficient?

• Let’s move 60 people from point A to point B using Smart Cars
• If each car gets 40M/G the resultant motorcade gets 0.67M/G
• A better choice is a bus even if it gets less than 10M/G

Let’s build a storage system with 1200 disk drives

• We can use 50 servers with 24 drives each
  • We need 30kW just for the motherboards without considering power supply efficiency
  • The drives consume 12kW so the total is 42kW

A better choice is a bigger building block

• A dedicated dual control system running efficient state machine code can control the entire access with less than 500W added for switching
  • The total is 12kW + 1.2KW + 500W = 13.7KW
Architect for the Use Case

The 50 Server System
- Data service at 100GB/s peak 50GB/s with data recovery.
- CPU to storage ratio allows for map reduce applications.
- Distributed management and external switching.

The Dedicated Data Service Module
- Data service at 40GB/s.
- High degree of efficiency since internal data channels are less than 2W each.
- High level of consistency due to aggregation.
- Highly simplified and centralized management.
- Increased MTBF.
- 50% reduction in space requirements.
- Dynamically manageable power conservation control.
- Centralized service channels allowing on the fly data reduction.
Summary

Build with “right-sized” blocks.

• Balancing the requirements of availability, capacity, and bandwidth with the constraints of space, power, and cooling is non-trivial.

• The decision of CPU utilization per storage unit is crucial in considering a power budget.

• Select storage elements based upon usage;
  • Solid state storage for metadata and indexing
  • High speed rotating media for data mining and processing
  • Lower speed rotating media for general service

The system size and use should dictate the scale and flexibility of the incremental module.
Thank You

Questions?