

Solid State Storage is Everywhere – Where Does it Work Best?

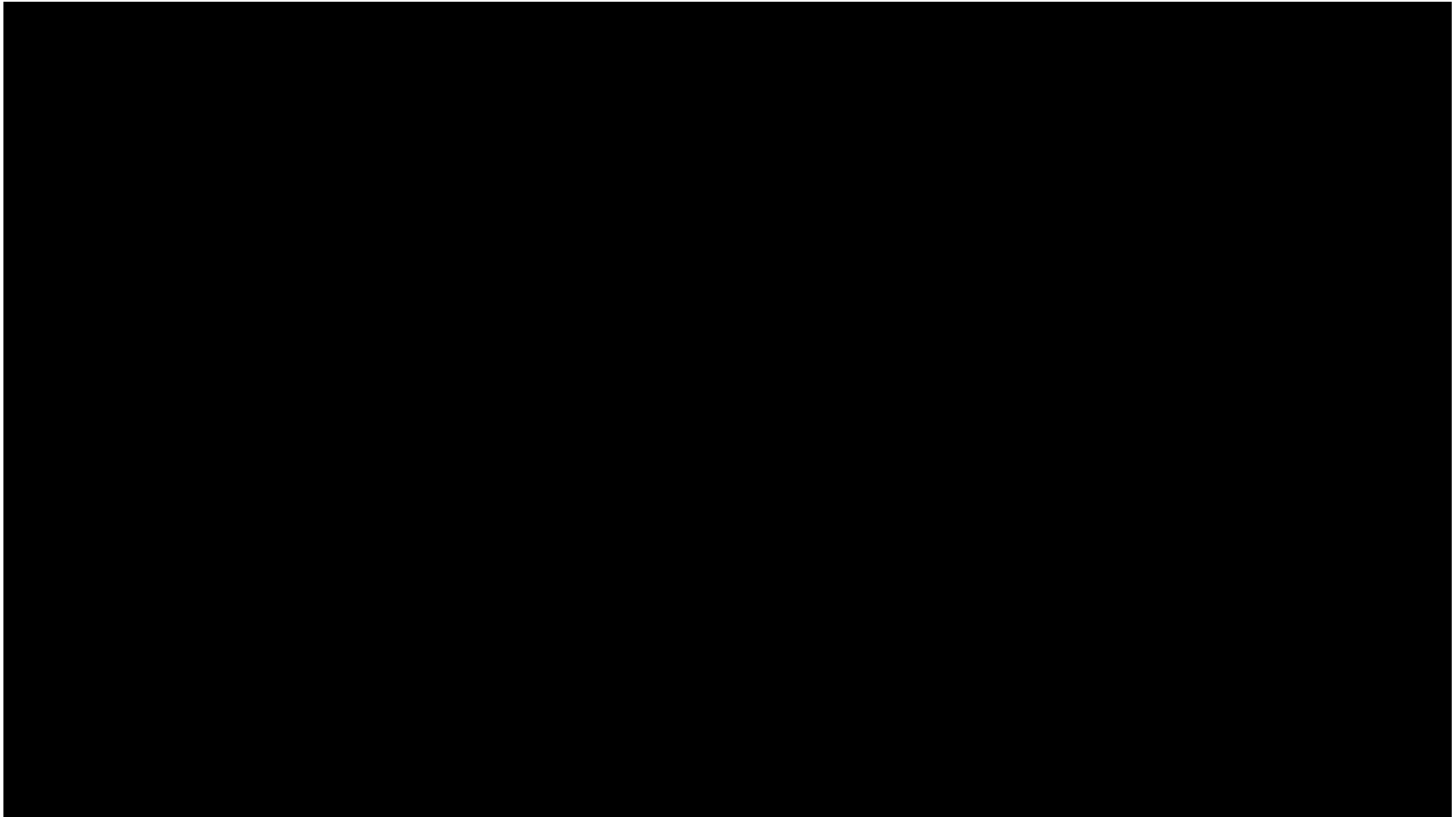
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Agenda

- Demartek – About Us
- Solid-state storage overview
- Different places to deploy SSD technology
- How to evaluate SSD technology
- Future SSD Deployment Strategies
- References

About Demartek Video



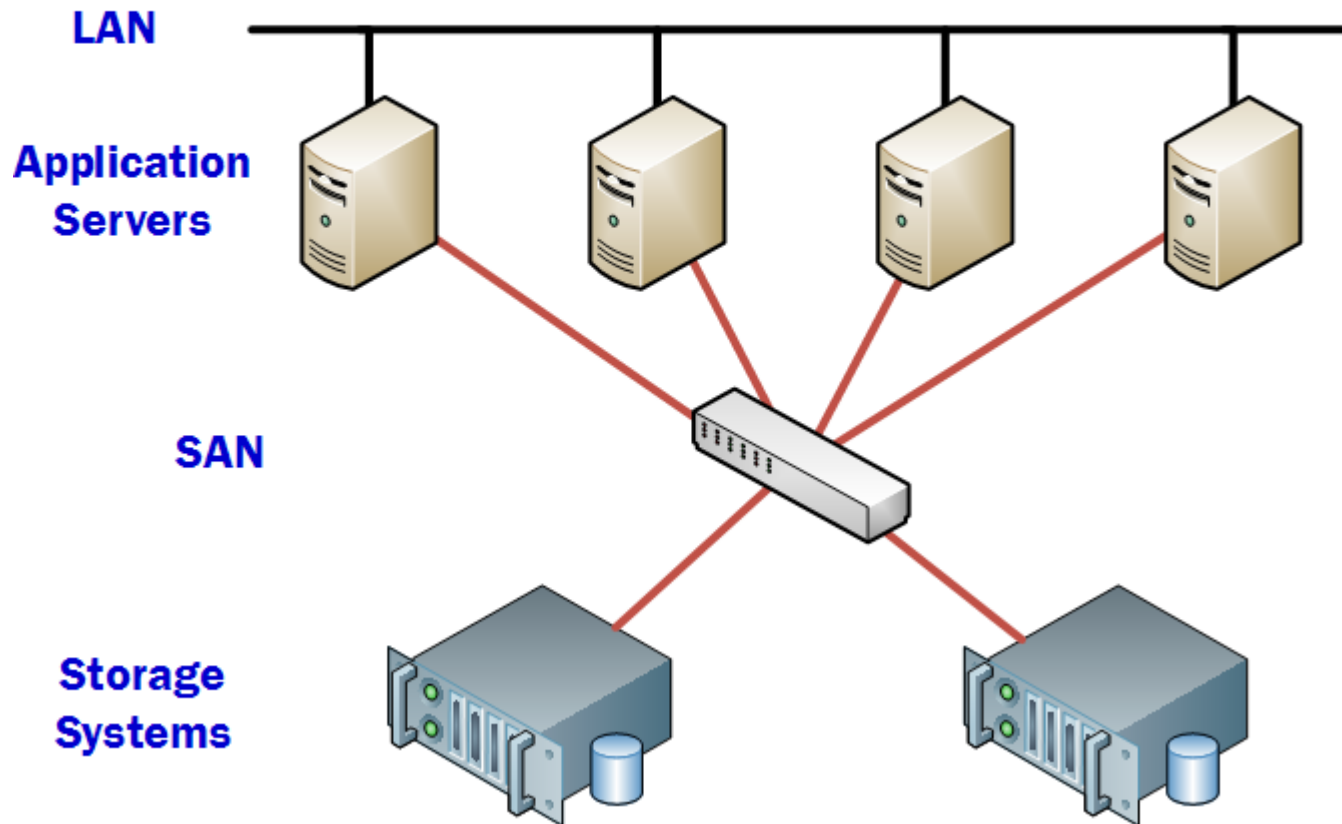
Demartek About Us video – <http://www.youtube.com/demartek>

Solid State Technology Overview

- Presents memory technology, such as DRAM or NAND flash, as storage media and appears as a disk drive to the operating system in most cases
 - Some motherboards allow dedicated SSD to act as a cache or other functions
- Very fast, no moving parts (no “seek time”)
- Variety of form factors
- Prices dropping
- Some SSDs use DRAM and NAND flash together
- Capacities doubling almost yearly

Typical I.T. Infrastructure

Example I.T. Infrastructure



SSDs in the Infrastructure

- SSDs as primary storage
 - Data is stored permanently on the SSDs
 - Could be part of a tiering solution
 - Only the applications whose data is stored on the SSDs are accelerated
- SSDs as a cache
 - Data (a **copy**) is stored temporarily on the SSDs
 - Accelerates reads (usually) and writes (sometimes)
 - Can potentially accelerate multiple applications at the same time
- Consider the possibility of both primary storage and caching (for different data types or applications)

Server-side SSD

- Advantages
 - Closest to CPU and applications
- Disadvantages
 - Difficult to share across servers, such as clusters, etc.
- Device types
 - Motherboard cache device
 - Caching storage/RAID controller
 - Installed SSD drives
 - Installed PCIe cards



SSD in the Network

- Advantages
 - No changes to servers or applications
 - Can be shared across servers (clusters) or applications
- Disadvantages
 - Possibly new equipment added to the network
 - Possibly change target names for NAS or SAN targets from servers
 - Shared cache HBAs require installation into servers
- Device Types
 - NAS accelerator appliances – file workloads
 - SAN accelerator appliances – block workloads
 - FC HBA with shared cache across SAN fabric

SSD in the Storage

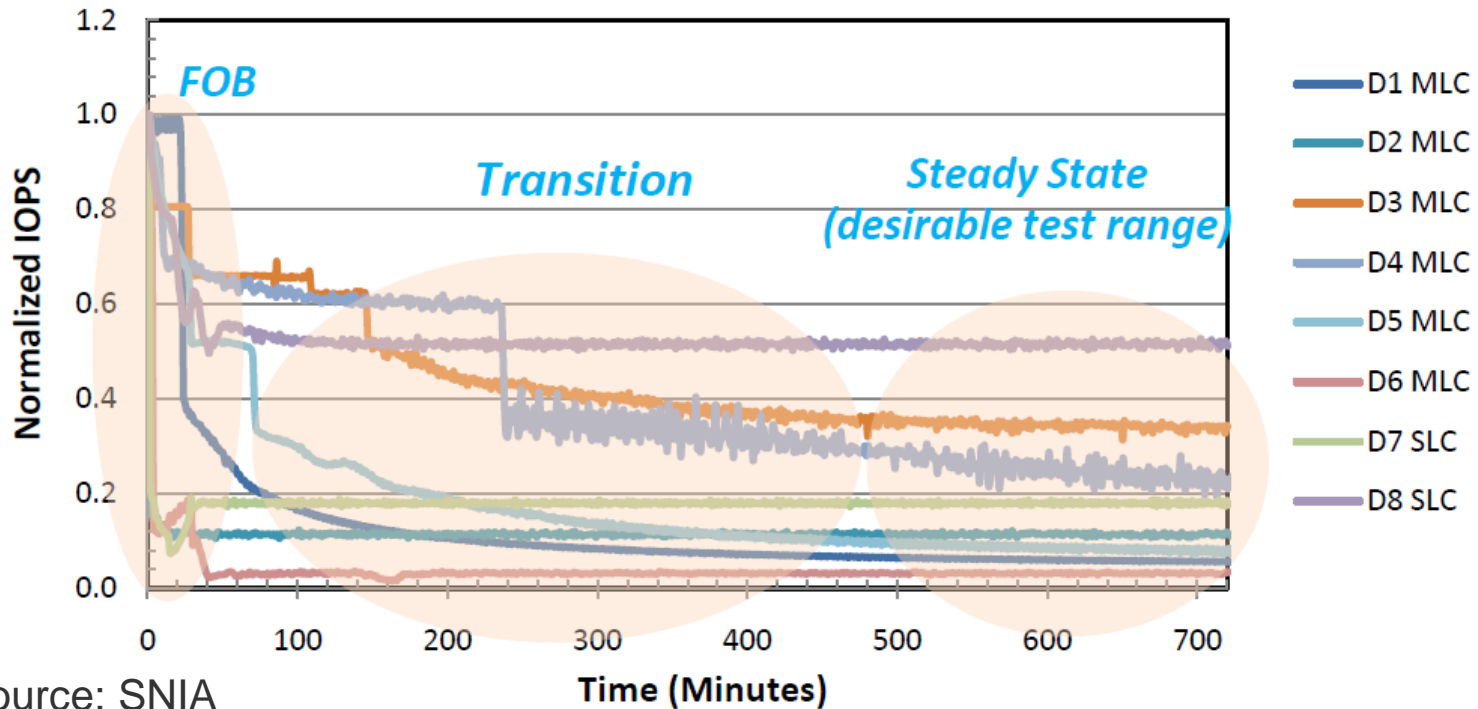
- Advantages
 - Does not require changes to server
 - Cache implementations require no changes to application
 - SSD technology can be shared across servers and apps
- Disadvantages
 - Primary storage or tiers may require application changes to storage locations
- Device Types
 - SSD drives acting as a cache in the storage subsystem
 - SSD drives acting as primary storage, a storage tier
 - PCIe SSD cards acting as cache in controller

Evaluating Solid State Technology

- Pre-conditioning for NAND flash devices
- Know your requirements and workloads
- Scenarios to test
- Side-effects of SSD technology

Pre-conditioning

- SSDs “fresh out of box” (FOB) perform better than normal for a short while before any normal use garbage collection has occurred. SSDs need to reach steady-state before any application performance testing is performed.



Source: SNIA

Pre-conditioning Testing

- The Storage Networking Industry Association (SNIA) has created the ***Solid State Storage (SSS) Performance Test Specification (PTS) – Enterprise***
 - Describes the need for pre-conditioning
 - Describes workload independent pre-conditioning runs that should be run before application performance tests are run
 - http://www.snia.org/tech_activities/standards/curr_standards/pts

Know Your Requirements and Workloads

- What applications are you running?
 - What are the block sizes of your I/Os?
 - Random or sequential?
- What operating environments are you running?
 - Physical servers vs. VM environments
- What are your requirements (how much is enough) for:
 - IOPS
 - Bandwidth (throughput)
 - Latency
- Are you currently saturating any of your storage devices or storage interfaces?

Good Workloads for SSDs

- In our testing, most workloads show improved performance with the addition of SSD technology
 - Some workloads, such as databases, do quite well with SSDs, but remember that real applications are not always waiting for I/O and do a fair amount of work that requires CPU and memory.
 - Mission-critical database environments often deploy large amounts of RAM in order to reduce the number of I/Os issued. These environments may not fully utilize the maximum performance of some SSDs. We sometimes artificially constrain RAM in order to force more I/Os and stress test the SSDs.

Scenarios to Test

- Application workloads
 - Single application workloads
 - Multiple large workloads from VM environments
- Capacity tests
 - 80% or 90% full with active workloads
- Hazard testing
 - Path failures
 - Drive failures
 - Reboot controllers while running
 - Perform firmware upgrades while running

Side Effects of SSD Technology

- SSDs can have unexpected side-effects. In some of our testing:
 - We found that with use of SSD technology, the 1GbE network became the bottleneck in some cases.
 - We found that with heavy use of SSDs, CPU utilization goes up, because significantly more work is performed (often in less time). In one test scenario, CPU averaged about 10% utilization with HDDs, but same test with SSDs the CPU averaged 50% utilization.
- SSDs and high speed networks (10GbE, 8GFC, 16GFC) were made for each other.

Future SSD Deployment Strategies

- SSD technology has three basic dimensions of interest:
 - Performance
 - Endurance
 - Capacity
- With high performance an assumed characteristic, future SSD technology products will divide into two product groups, each group focusing on one of these:
 - Endurance
 - Capacity

Demartek References

- Demartek SSD Zone
 - www.demartek.com/SSD
- Demartek SSD Deployment Guide
 - www.demartek.com/Demartek_SSD_Deployment_Guide.html
- Demartek Commentary – Horses, Buggies & SSDs
 - www.demartek.com/Demartek_Horses_Buggies_SSDs_Commentary.html
- Demartek Free Monthly Newsletter
 - www.demartek.com/Newsletter



Thank You!

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To learn more about Demartek:

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*also on the back of Dennis' business card

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