October 15-17, 2013

COMPUTERWORLD SNIA

SNW

Intelligent Architecture for the Data-Driven Business

Solid State Performance Comparisons: *SSD Cache Performance*

Dennis Martin, President, Demartek

Demartek®

This presentation is available at http://www.demartek.com/Demartek_Presenting_SNWUSA_2013-10.html

Agenda

- Demartek – About Us
- Solid-state Technology Overview
- SSD: Primary Storage vs. Caching
- Locations for SSD Caching
- Cache-friendly workloads
- SSD Performance Results – Demartek Lab
- References

[View the Demartek Video Library]

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
- Some SSDs use DRAM and NAND flash together
- Very fast, no moving parts (no “seek time”)
- Variety of form factors
- Prices dropping
- Capacities doubling almost yearly

SSD: Primary Storage vs. Caching

- 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
- Both can be used (for different data)

SSD Caching Basics – 1

- Caching controller or software identifies any frequently accessed data ("hot data") and automatically moves ***a copy*** of the hot data to the solid-state media
- SSD impact
  - Multiple applications can benefit from the SSD cache simultaneously
  - Performance improves over time, as cache is populated with data, known as cache "warm-up" or "ramp-up"

SSD Caching Basics – 2

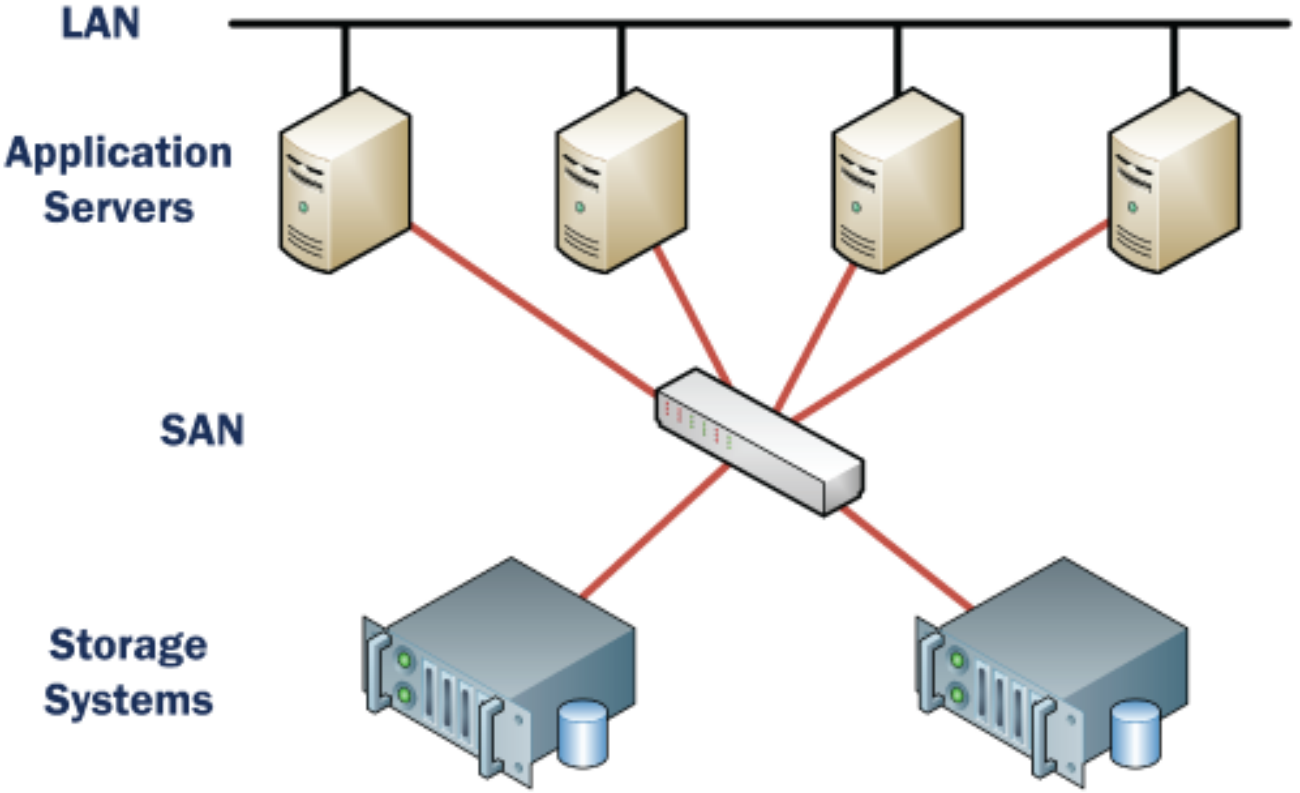
- Data that can be cached:
  - Reads only ("write-through" cache)
  - Reads and writes ("write-back" cache)
    - Write-back cache takes more work to guarantee cache coherency
- Overall HDD I/O load is reduced – Fewer I/O requests are seen by the back-end HDDs

SSD Caching Components

- Hardware
  - PCIe NAND flash cards
  - Drive form-factor SSDs (SATA or SAS interface)
  - DIMM socket NAND flash solutions
  - NAND flash mounted on motherboard
- Software
  - Provided by independent software groups
  - Provided by the hardware vendor

Demartek

Example I.T. Infrastructure



SSD Caching Architecture

- SSD caching can be deployed:
  - Server-side
  - In the network
  - In the storage system
- We have seen increased performance benefits by combining server-side with the others, in many cases

SSD Caching Workloads

- Caching Algorithms
  - Prefer random I/O, small to moderate block sizes
  - Some allow adjustments to cache block sizes, etc.
- Cache Friendly Workloads
  - Hot spots with repeated access
  - OLTP databases
  - Database indexes
  - File system table of contents (MFT, inodes, etc.)

- Cache Un-friendly Workloads
  - Data that is accessed approximately evenly and is larger than the cache

Server-side SSD

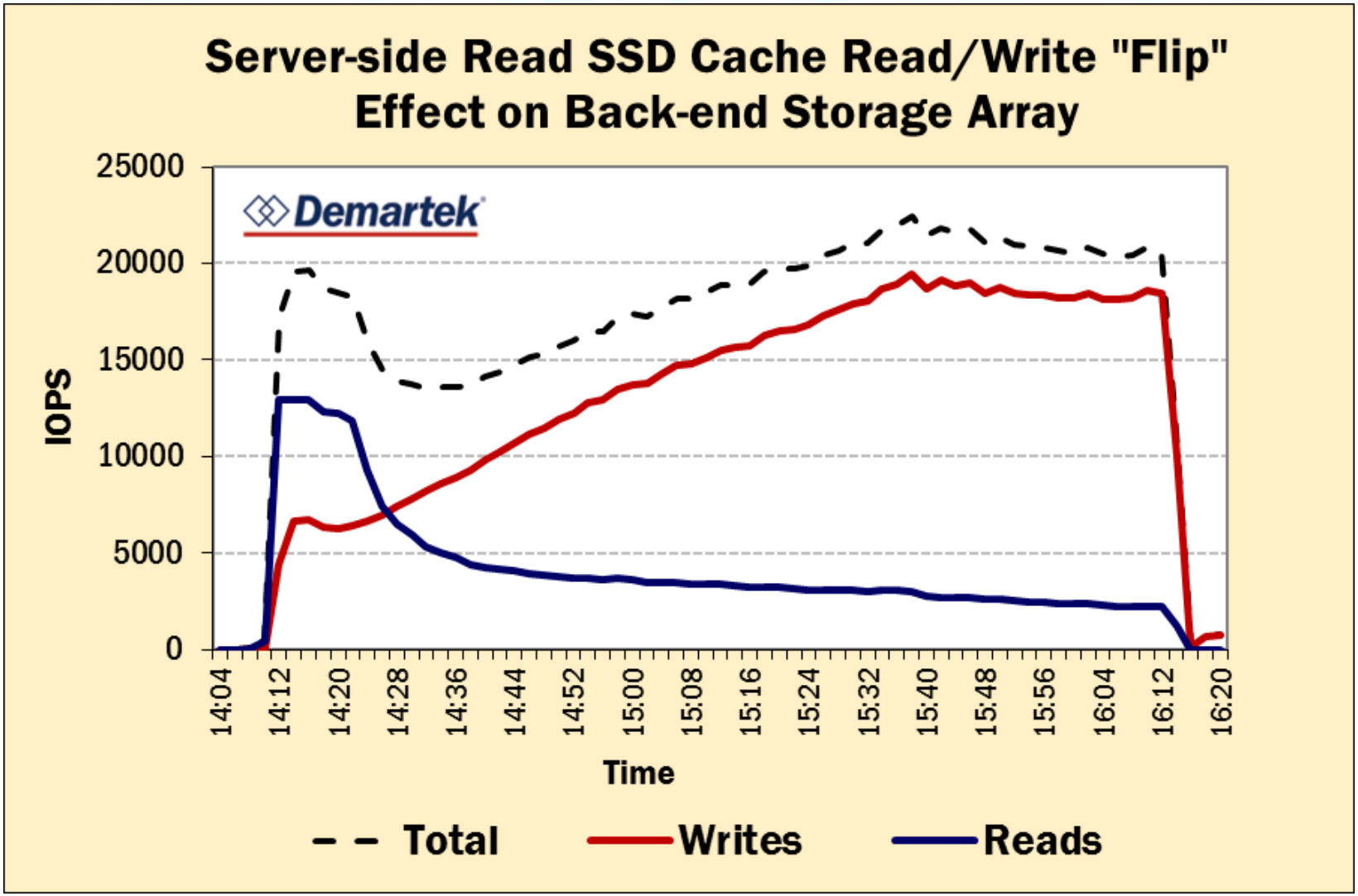
- Advantages
  - Closest to host CPU and applications
- Disadvantages
  - Difficult to share across servers, such as clusters, but this is changing
- Device types
  - Motherboard cache device
  - Caching storage/RAID controller
  - Installed SSD drives
  - Installed PCIe cards
  - DIMM socket NAND flash solutions

SSD In the Network

- Advantages
  - Little or no change 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 System

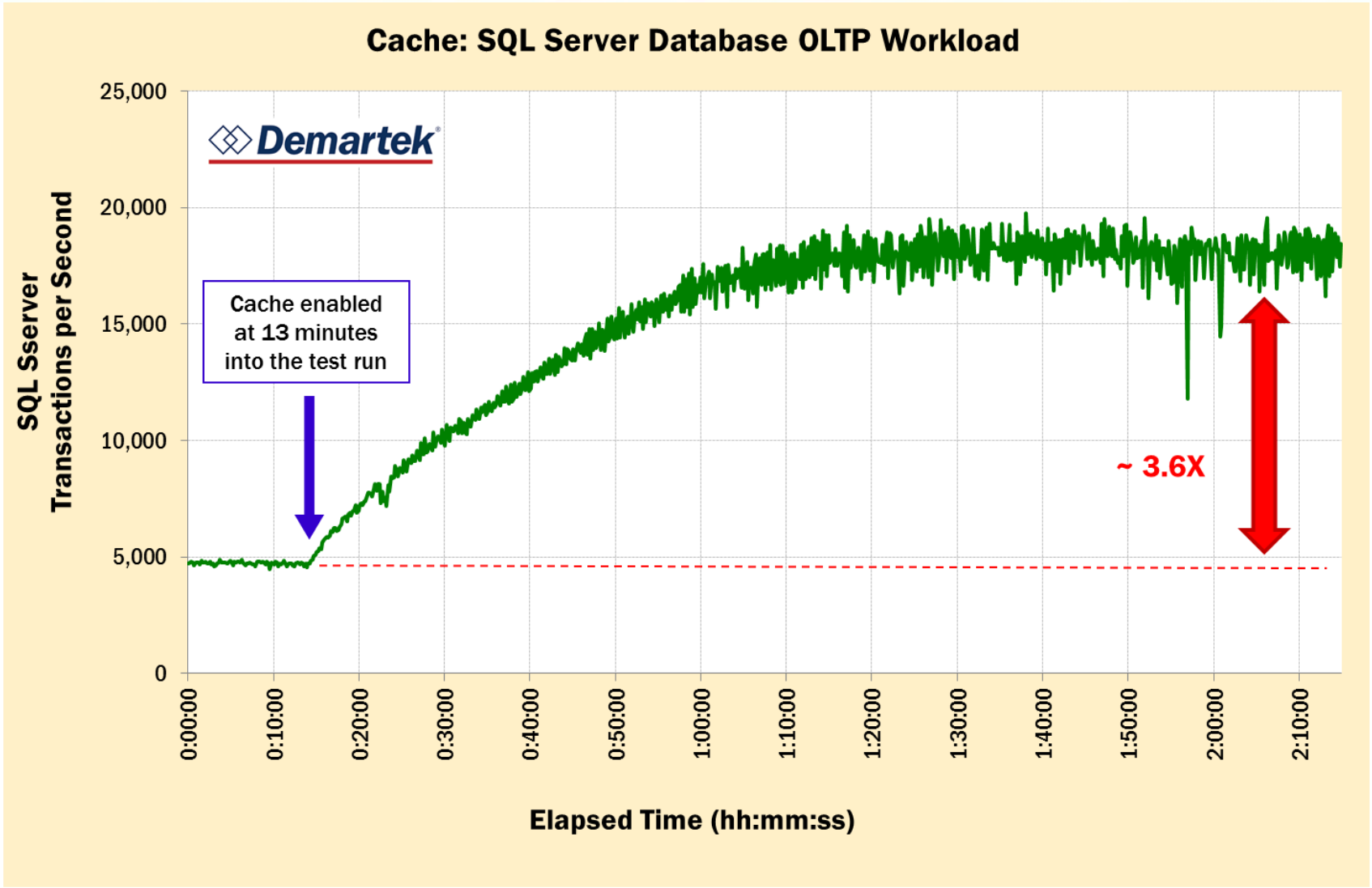
- Advantages
  - Cache implementations require no changes to application
  - SSD cache can be shared across servers and apps
- Disadvantages
  - Some storage system SSD caches only accelerate reads
- Device Types
  - SSD drives acting as a cache in the storage subsystem
  - PCIe SSD cards acting as cache in controller



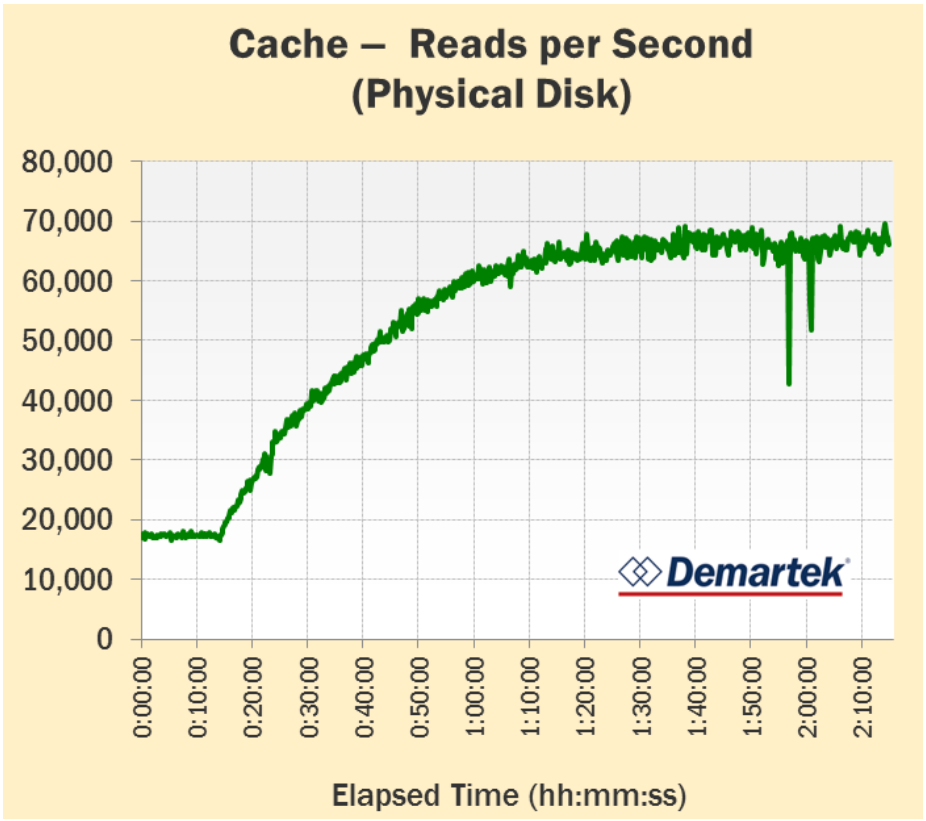
Read/Write “Flip” effect of server-side SSD read cache on back-end storage array

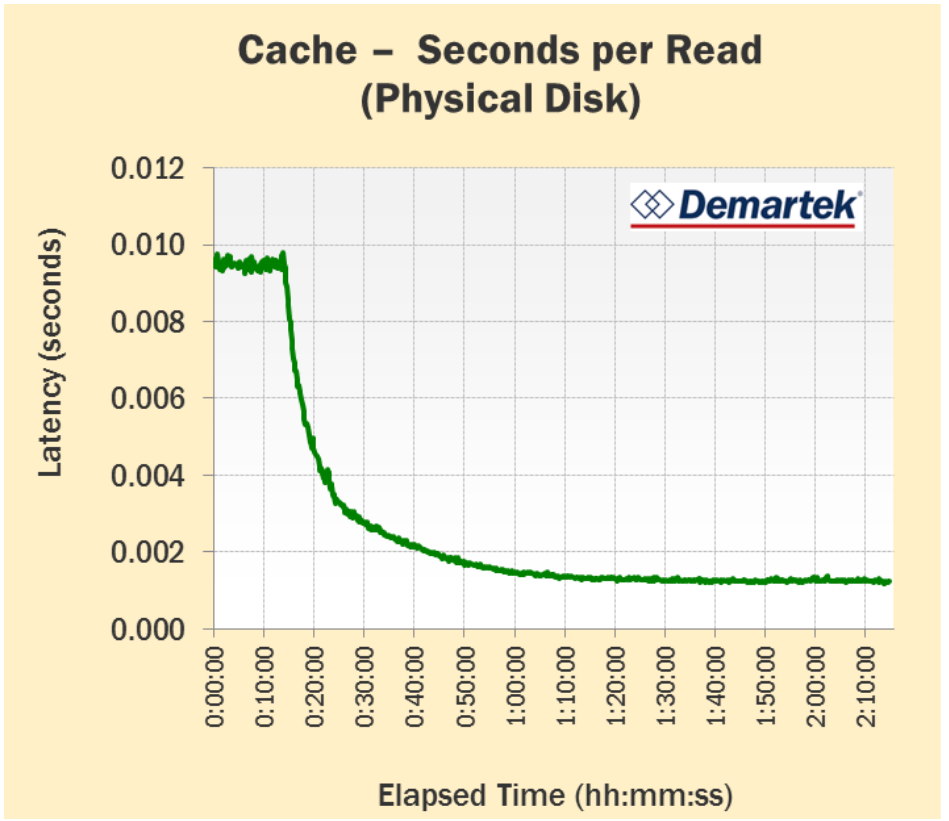
SSD Cache Performance Examples

Reports available in the Demartek SSD Zone

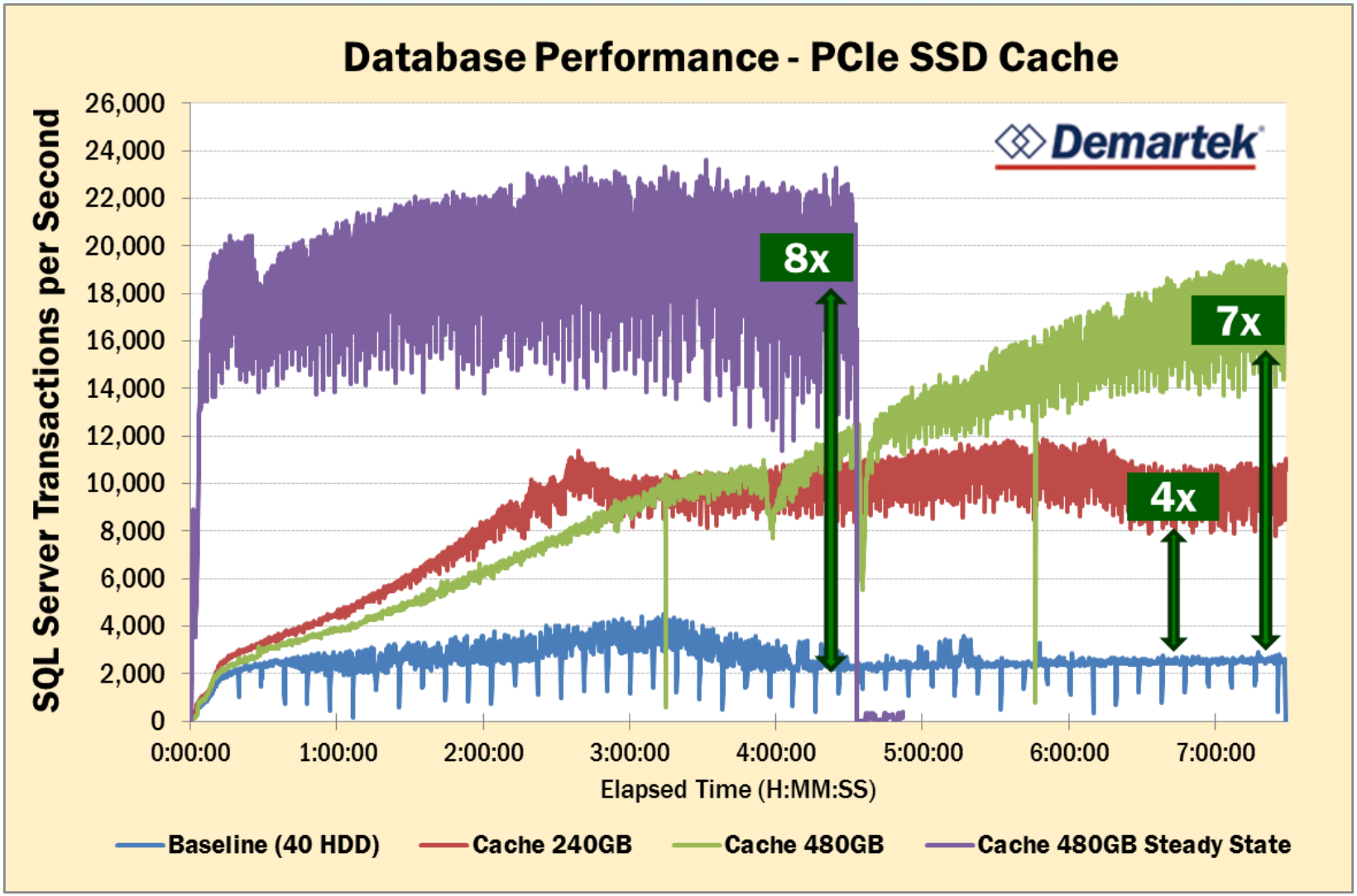


Example 1: Server-side PCIe SSD cache connected to large FC SAN storage array



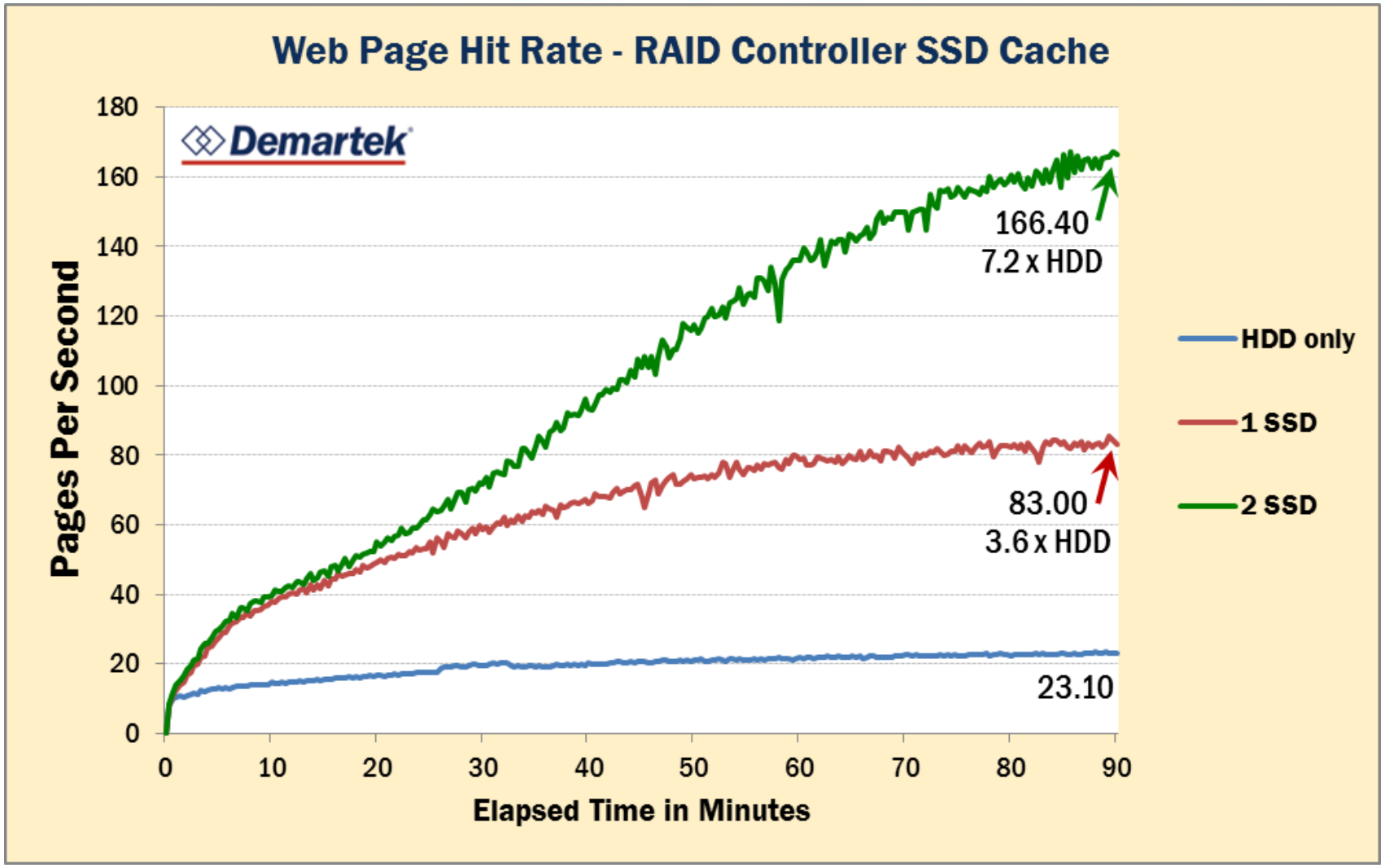


Example 1: Server-side PCIe SSD cache connected to large FC SAN storage array



Example 2: Server-side PCIe SSD cache connected to medium FC SAN storage array

Database size: 1TB Server: 2x Intel Xeon E5-2690, 2.9 GHz



Example 3: Internal RAID Controller with SSD cache and HDDs in a JBOD

Web server data size: 40GB SSD: 32GB Server: 2x Intel Xeon E5345, 2.33 GHz

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 Storage Interface Comparison**
  - www.demartek.com/Demartek_Interface_Comparison.html
- **Demartek Free Monthly Newsletter**
  - www.demartek.com/Newsletter

Thank You!

Dennis Martin, President
dennis@demartek.com
www.linkedin.com/in/dennismartin

Demartek

(303) 940-7575
www.demartek.com
http://twitter.com/Demartek
www.youtube.com/Demartek
Skype: Demartek

To learn more about Demartek:

- Download the Aurasma App (Android/iPhone)
- Search and follow "Demartek"
- View image below with viewfinder.

*also on the back of Dennis' business card

Powered by: AURASMA