

# ***UNDERSTANDING PAIRED STORAGE***

**David Lin, NVELO, Inc.**

The NVELO logo, consisting of the word "NVELO" in a bold, blue, sans-serif font. The letter "V" is stylized with three horizontal bars.

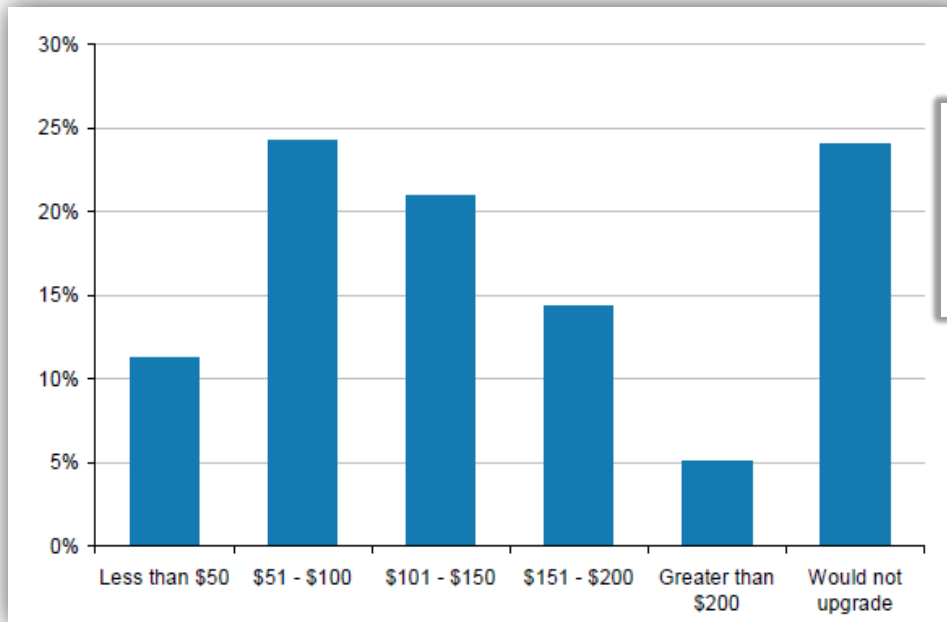
**Flash Memory Summit - August 2011**

# Presentation Goals

- Acknowledge
  - Benefits and challenges of SSD for client computing
- Raise awareness
  - Storage pairing and caching options
- Motivate discussion
  - To characterize end-user value for caching
- Introduce
  - Dataplex™ cache software product from NVELO

# End User Benefits

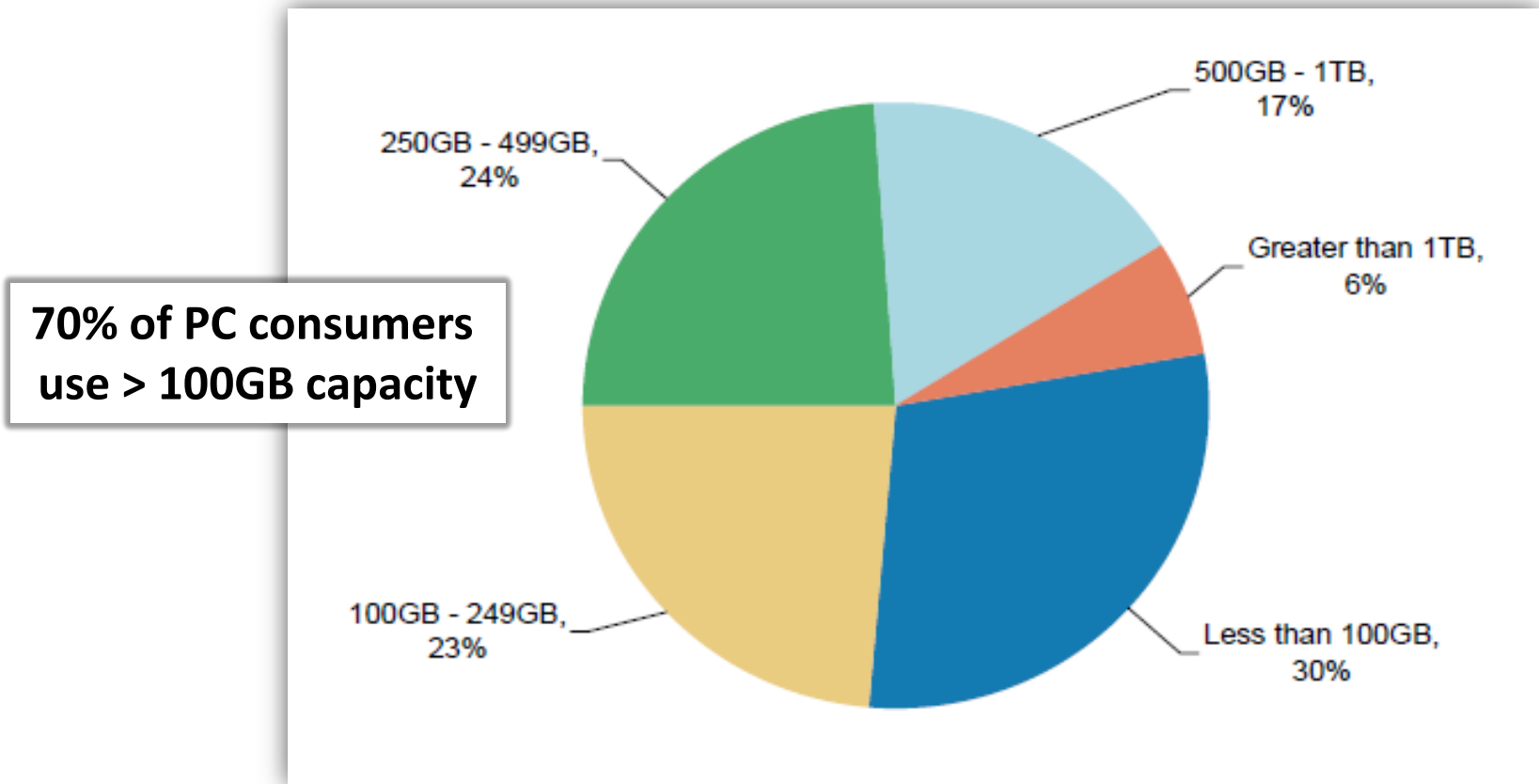
- We know SSD benefits resonate with PC end users ...
  - Instant power on
  - Faster application launch
  - Improved system responsiveness



**Most consumers willing to spend \$\$ to get SSD benefits ... to a point**

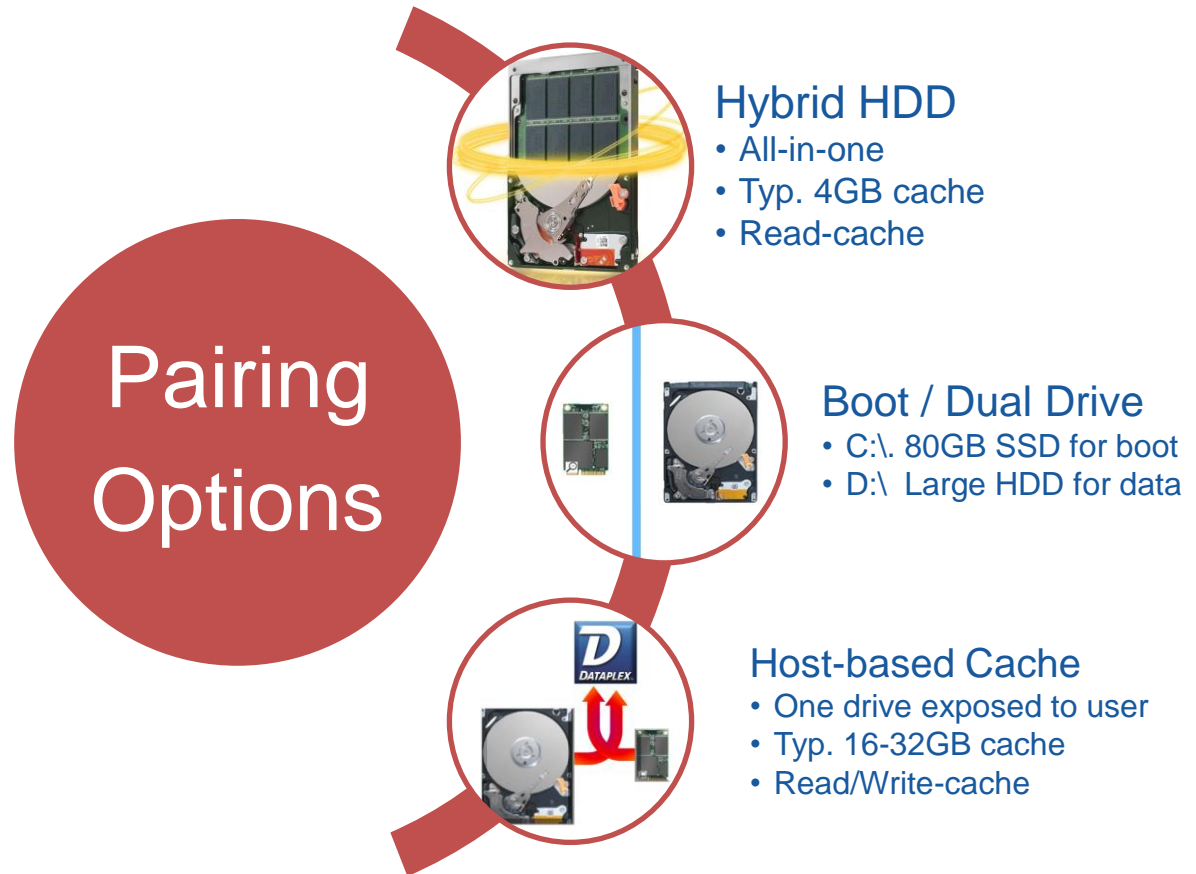
***For \$150, consumers can only afford 64GB SSD ...***

# The Capacity | Price Dilemma

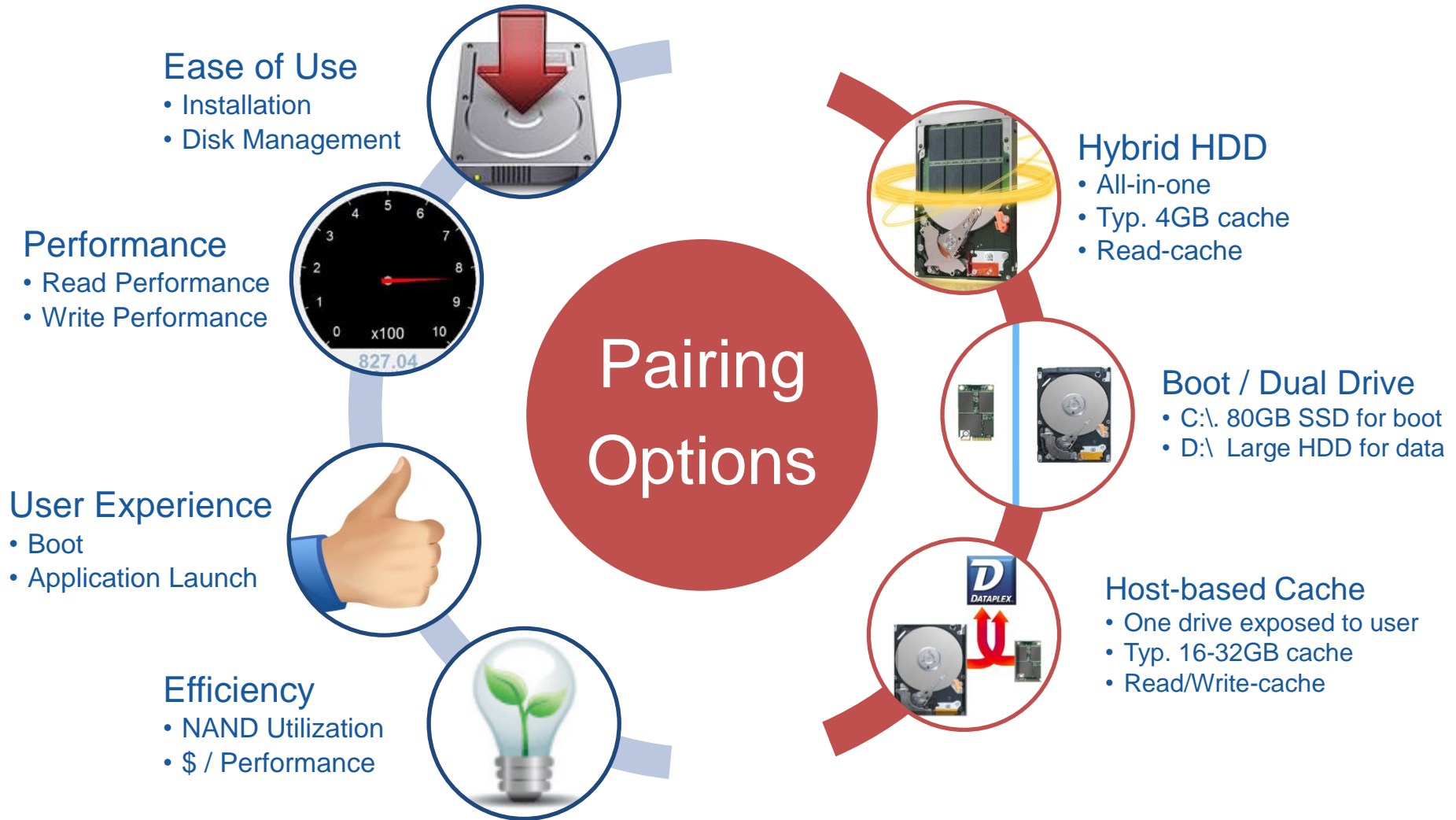


Source: Alphawise, Morgan Stanley Research

# Paired Storage Bridges the Gap



# Evaluation Criteria



# Performance Benchmarks

## ■ Raw Disk Benchmarks

- Sequential & Random Read/Write Performance
- Examples: IOMeter, CrystalMark

## ■ Synthetic Benchmarks

- Special programs to impose specific workloads
- Code fragments to mimic the work performed by real applications
- Useful for isolating the performance of certain parts of the hardware
- Examples: SYSMark, PCMark

## Notes:

- Most benchmarks don't comprehend Paired Storage configurations
- Size of boot drive or cache can dramatically affect results
- Dual-drive results can be artificially good since benchmark workloads are typically small
- For caching solutions, repeatable and best results achieved when SSD and cache are pre-conditioned

# Performance Benchmarks

- **Boot Performance**

- “Clean” vs “Real World System”
- Example: Velocity

- **Application Testing**

- Complete applications that a user typically runs
- Performance results should correlate with user experience
- Highly dependent on user profile and workload



# User Profiles

	Casual User	Professional	Power User	Enthusiasts
Typical Applications				
Workload	<ul style="list-style-type: none"> <li>- Capacity 500GB</li> <li>- Writes 10 GB/day</li> </ul>	<ul style="list-style-type: none"> <li>- Capacity 320GB</li> <li>- Writes 15 GB/day</li> </ul>	<ul style="list-style-type: none"> <li>- Capacity 1TB+</li> <li>- Writes 20 GB/day</li> </ul>	<ul style="list-style-type: none"> <li>- Capacity 2TB+</li> <li>- Writes 20 GB/day</li> </ul>

With the right combination of Capacity and Performance, caching can deliver SSD-level performance

Ideal Cache capacity (not SSD size)	16GB	16 - 32GB	32GB+	64GB
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# EFFICIENCY & COST

- Valuable (expensive) SSD bits actively used for performance and power savings vs occasional speed-improved storage
  - Why store entire OS in valuable SSD bits ?

*Caching is more efficient,  
no matter how you slice it!*

- Cost Effectiveness

	WD HDD	Momentum XT	Dataplex Cache	Agility3 SSD
Price (Amazon / Aug 6, 2010)	\$ 89.21	\$ 89.99	\$ 215.20	\$ 198.99
Capacity (GB)	1000	250	1000 (60)	120
Performance (MB/s, PCMark HDD)	<b>37.62</b>	<b>42.45</b>	<b>134.47</b>	<b>146.37</b>
Price/GB	\$ 0.09	\$ 0.36	\$ 0.22	\$ 1.66
Price-Performance-per-GB	\$ 2.37	\$ 8.48	\$ 1.60	\$ 11.33

# Introducing Dataplex™

- Dataplex is an intelligent, adaptive storage manager
  - Host-based cache policy manager
  - Any Intel or AMD chipset/processor running Windows 7
  - Works with any HDD and any SSD (incl. mSATA, PCIe)
  - All SATA modes supported (IDE, AHCI, RAID)
  - Simple installation, no BIOS integration

***SSD Performance with HDD capacity  
... and NO LIMITS***

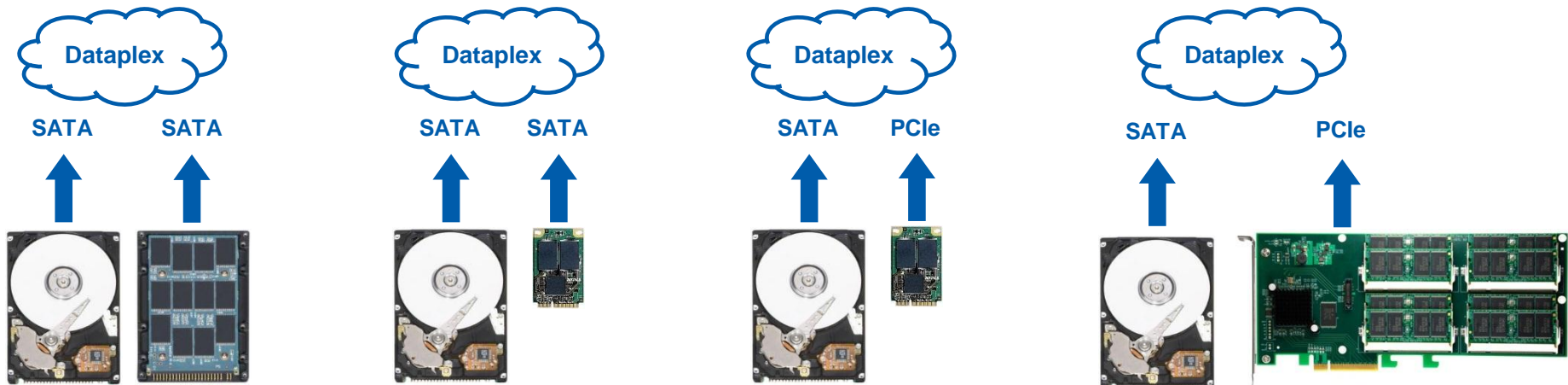


# Cache Form Factors & Interconnects

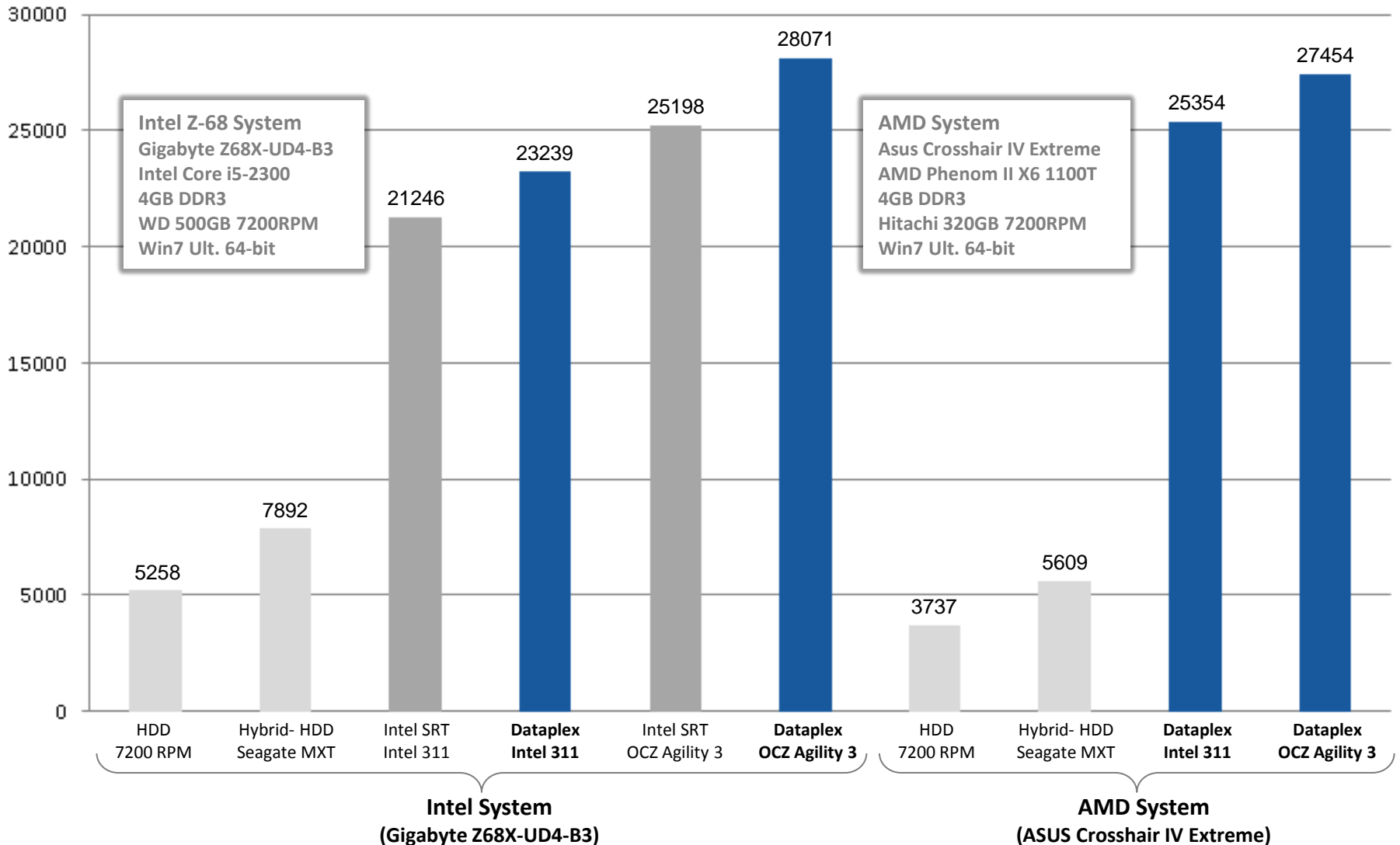
- Dataplex cache software supports the following:

- HDD + Standard 2.5" SSD (SATA)
- HDD + mSATA SSD (SATA)
- HDD + PCIe mini-card SSD (PCIe)
- HDD + full-sized PCIe SSD card (PCIe)

On any Win7 system,  
AMD or Intel chipset



# PCMark Vantage HDD Suite (avg. of iterations 2, 3, 4)



# Summary

- SSD performance is compelling
- Caching is the most efficient use of SSD technology to improve overall PC system (runtime & boot) performance
- Dataplex cache software delivers:
  - Affordable SSD-level Performance,
  - across the entire HDD Capacity,
  - on Any PC platform,
  - with your Choice of SSD and HDD
  - Complete solution, no end-user burden



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**NVELO**