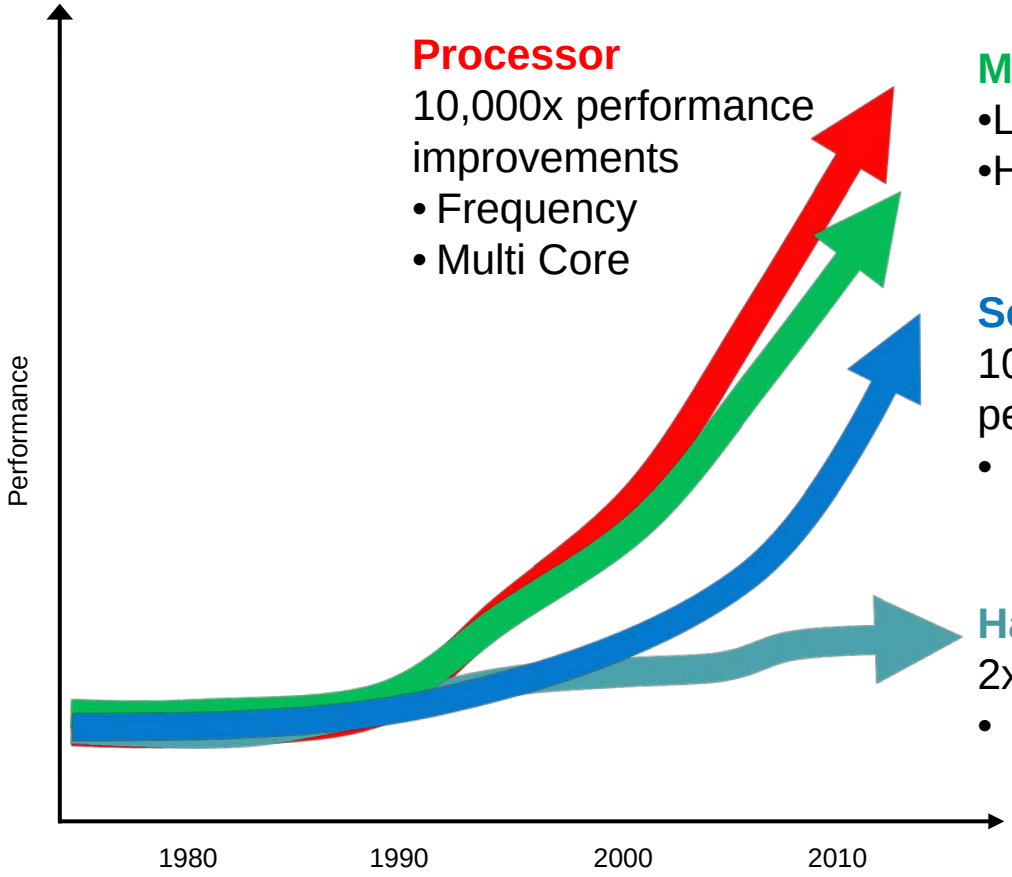
Optimizing Tier-1 Enterprise Storage for Solid State Memory

Ivan Iannaccone

HP 3PAR Lead Product Manager

What is driving the need for Solid State Storage?



Processor
10,000x performance improvements
- Frequency
- Multi Core

Memory
- Larger Footprint
- Higher Bandwidth

Flash fills the gap!

Solid State Storage
100 to 10,000 greater performance
- Better $/IOP than Hard Disk

Hard Disk Storage
2x Performance improvements
- Cheaper $/GB, not faster

Wikibon Definition of Tier1 Storage

- 1. Has the time-tested ability, through whatever array resources are required, to make the critical application perform at the highest possible levels required for the business.
- 2. Has a complete and fire-tested set of high availability remote replication functionality allowing large-scale consistent replication to multiple locations.
- 3. Has a set of well-established performance and availability services that understands both the technology and how to integrate and project manage that technology to meet the specific organization and industry imperatives, and prove those requirements have been met.

“Tier1” Definition

- Tier1 storage is something that people nod sagely about, and they know what it is when they are confronted by it. But, when asked for a definition, things get somewhat hazier.

- Is there a set of core Tier1 storage system attributes?

- Below is a list of attributes we have drafted after many conversations with customers, colleagues and competition :

  - **Quality**
  - **Availability**
  - **Serviceability**
  - **Performances**
  - **Replication**
  - **Monitoring and Reporting (Ease of Use)**
  - **Encryption**
  - **Scalability**
  - **Storage Virtualization**

Tier-1 attributes with Flash

Quality

- Day one architectural decisions that make the most of Flash by providing greater than 6 nines availability while assuring longevity of the media
- Ability to source the highest possible quality of flash

Availability

- ARR of SSD/Flash is lower when compared to HDD
- Rebuild times are faster
- MTBF are greater

Performance

- Predictable performance
- Low Latency
- High level of IOPS/BW for workload consolidations

Transactional Cost

- Storage QoS
- Rack Density
- Lower Power and Cooling
- Ease of Use

Architectural Optimizations for Flash

- Faster multi-core processors in controllers
- Faster Caching Algorithms
- Latency Optimizations in every level of the stack
- Coalescing of writes to reduce write amplification
- Data Reduction technologies
- Optimized Flash Overprovisioning techniques
- System Wide striping for optimal wear levelling
- Failure Handling
- Storage Quality of Service to enable consolidation

Why use flash in a Tier 1 environment?

Increase Revenue

Quicker Decisions

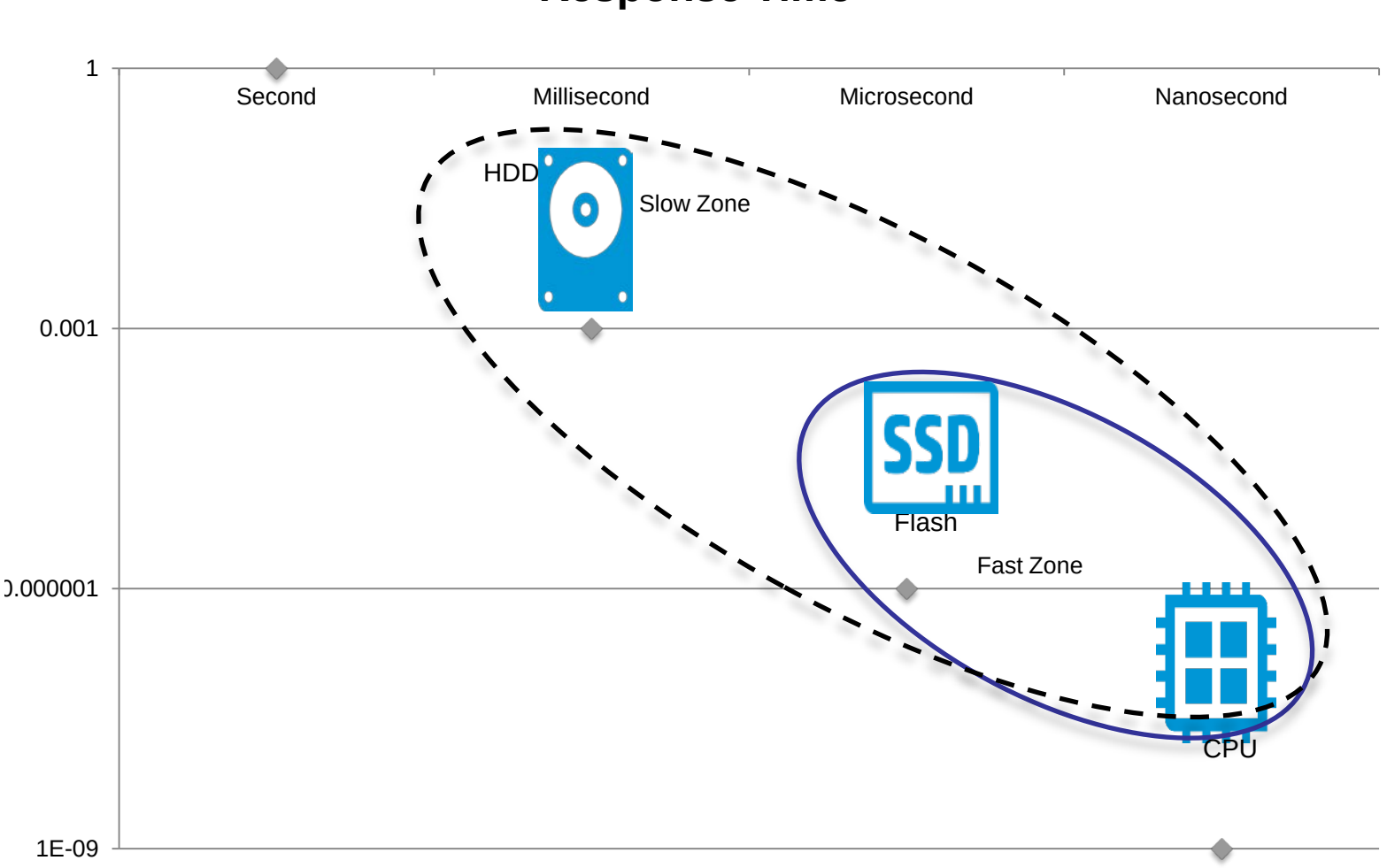
Licensing Cost

Footprint Cost

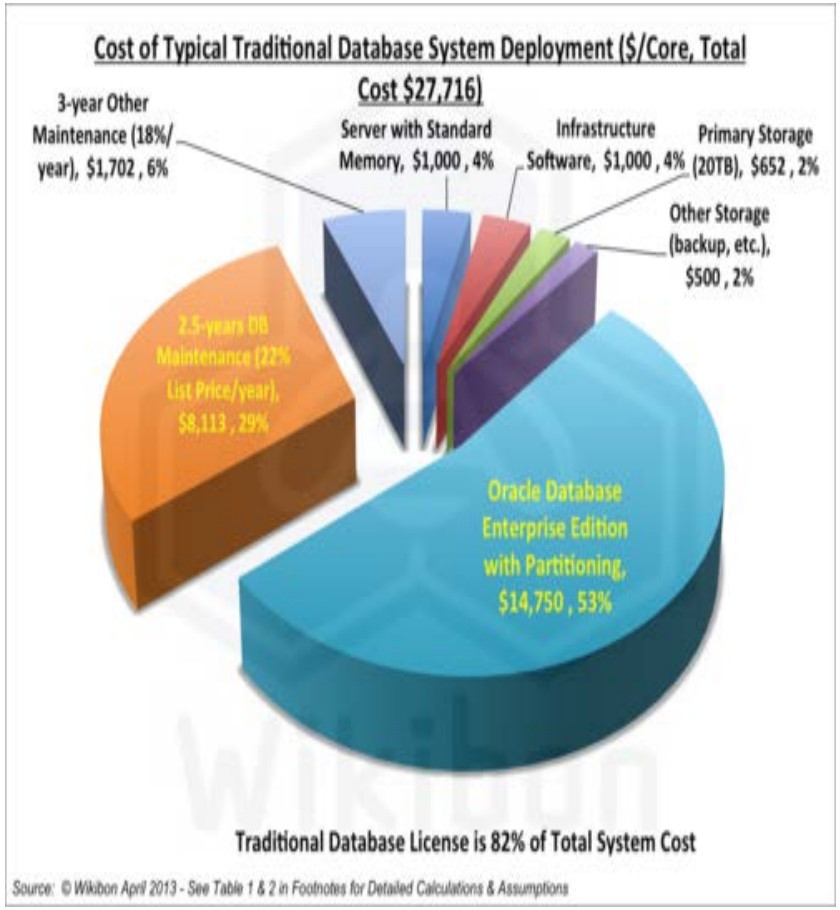
Power and Cooling Cost

Flash accelerates applications

So customers are not left waiting, or queueing, or giving up



All Flash Arrays to help reduce Oracle licensing costs

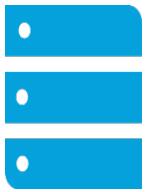
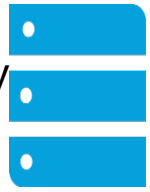


- Optimize Servers: add more memory, increase speed, reduce # cores
- Leverage flash storage to improve response times and reduce latency
- Optimize storage infrastructure.

Source: Reproduced from http://wikibon.org/wiki/v/Oracle_Negotiation_Tips:_Focus_on_Reducing_License_and_Maintenance_Costs

Flash deployment locations

LOW — Infrastructure disruptiveness — HIGH

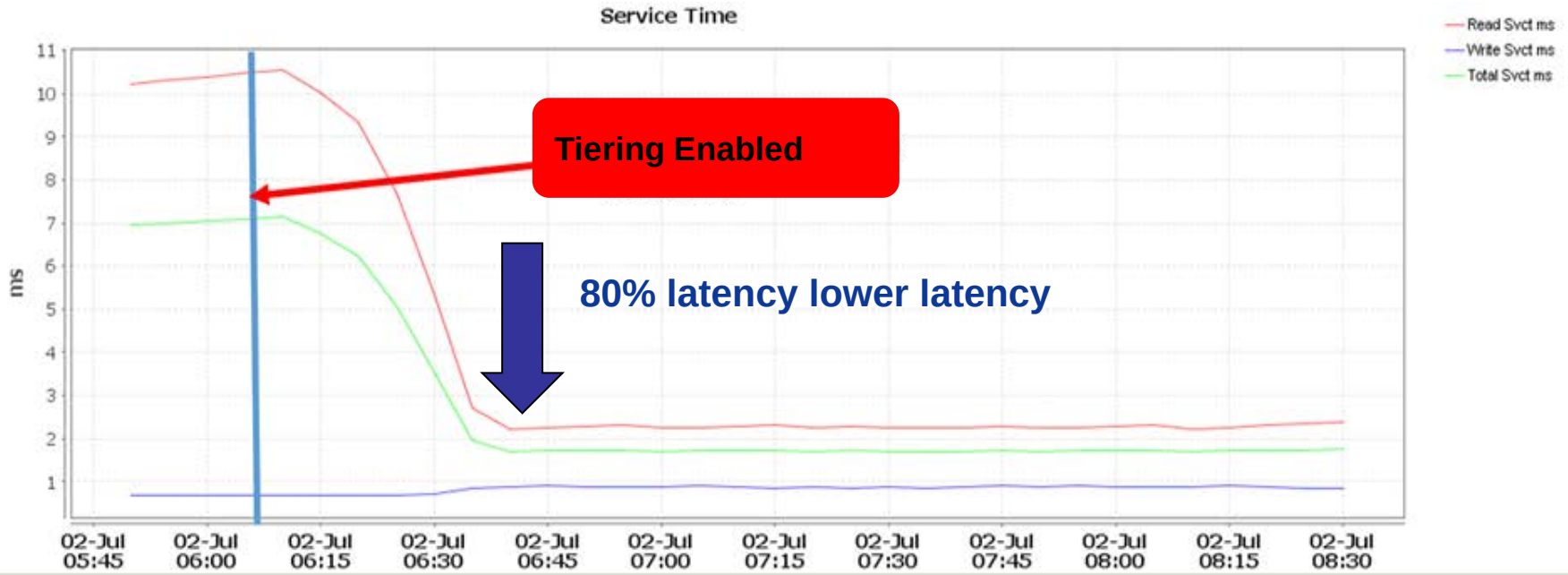
Highly shared, blended capacity and targeted performance	Less specific, semi-shared high performance	Very targeted application specific performance boost
✓ General workloads ✓ Integrates easily into existing infrastructure ✓ Less performance boost ✓ Subtiering technologies	✓ Dedicated workloads ✓ Some added complexity ✓ High and variable workloads ✓ All-Flash	✓ Application specific workloads ✓ Disruptive to infrastructure ✓ Workload mobility issues ✓ Server Based Caching
Hybrid Array 	All Flash Array 	Server Cache / Server Storage 

But which workloads are suitable / suited for flash?

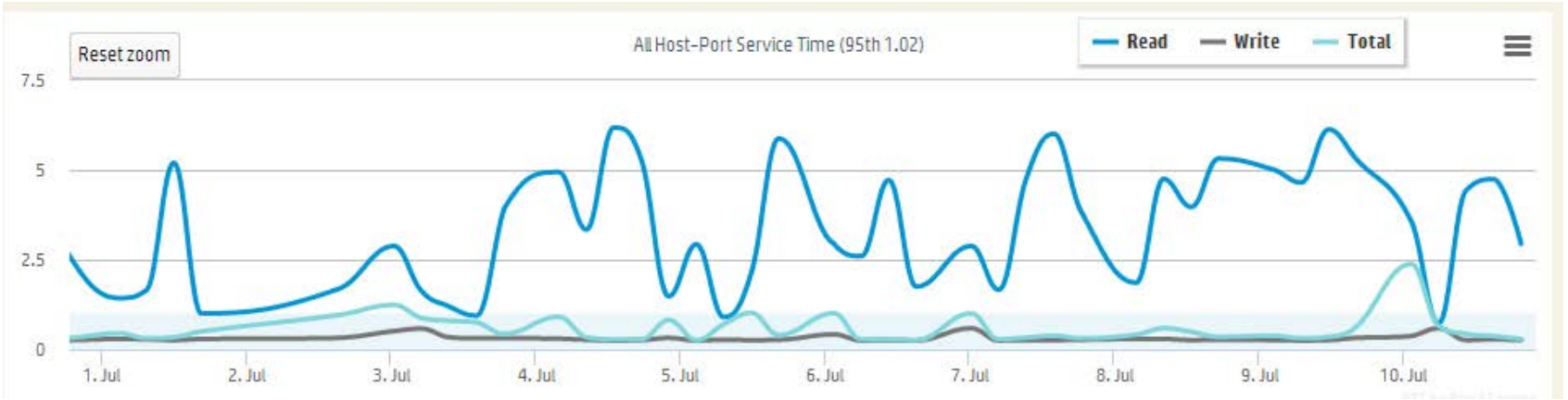
Understanding the I/O fingerprint is key

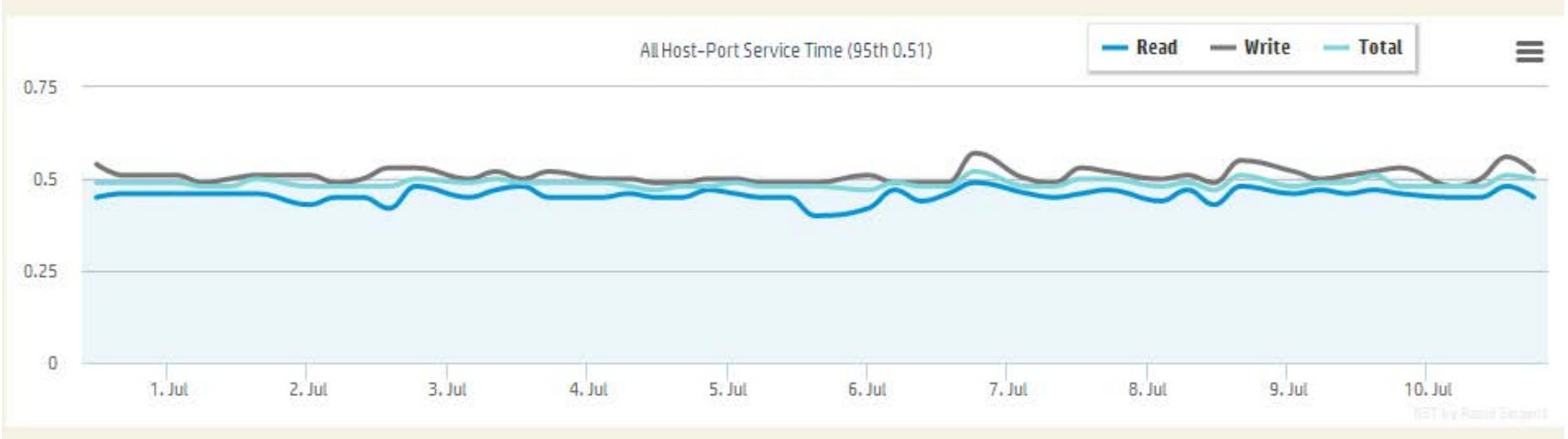
Source: SNIA SSSI

Flash as Tier of Storage for Hybrid Deployments



What is predictable latency?





Flash enable new possibilities – but breaks old architectures

What could a business do if it could process 500% more transactions per second on 90% fewer disks?

"Solid-state drive devices can deliver data at phenomenal speeds…But can your data center's network handle the data equivalent of switching from a water bubbler to a fire hose?"
Dennis Martin, Founder and President of Demartek

Summary

Solid State Storage and non-volatile memory technologies disrupting the industry today

Close collaboration between servers and storage will improve application landscape 10X

Key differentiation will be in rich data services – software and ability to offer high availability

Solid State as tier will continue to exist in servers and storage. Sub-lun tiering will continue to play a key role

Spinning media will still have a place in this world.

Flash is just a starting point. Next generation flash technologies already in development