



Power Saving Architectures Enabled by Smarter Software

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Saving Power with Flash

- Known:
 - > Cheap
 - > Fast
 - > Low power
- Unknown:
 - > How best to put flash to use

slides available here: http://blogs.sun.com/ahl/resource/fms09_leventhal_power.pdf

Storage Technologies

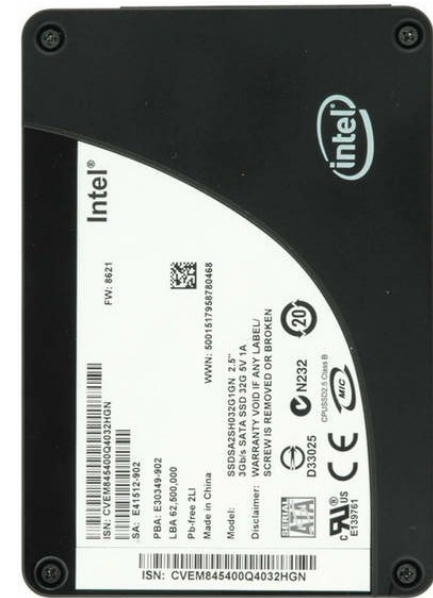
15K RPM HDD



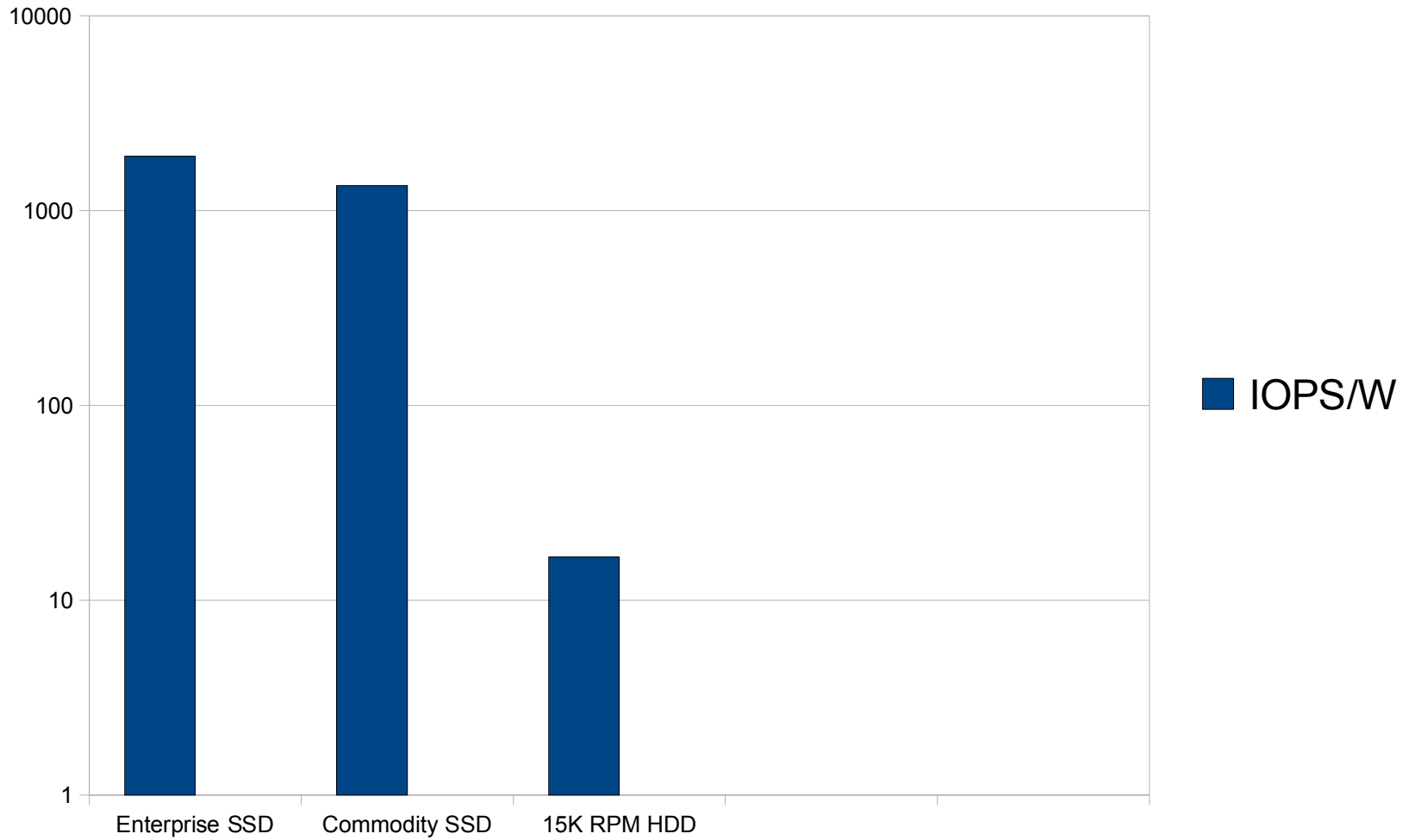
Enterprise SSD



Commodity SSD

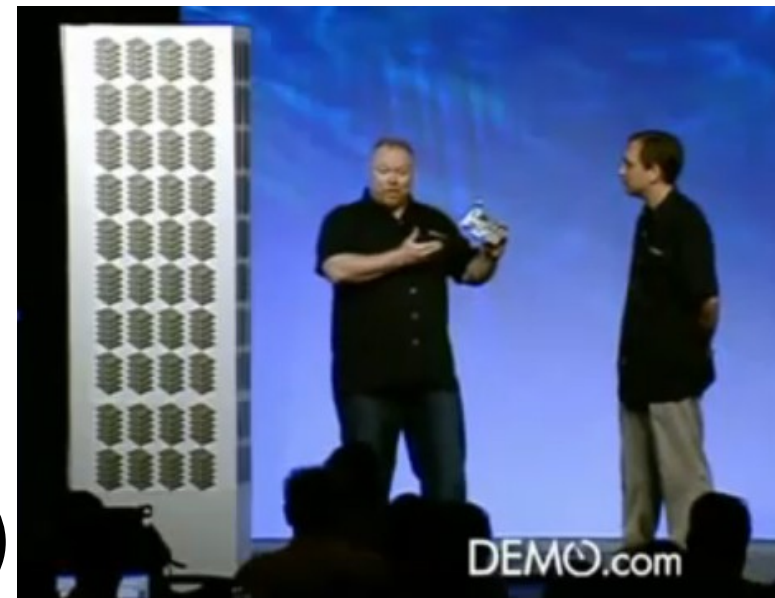


Case for Flash



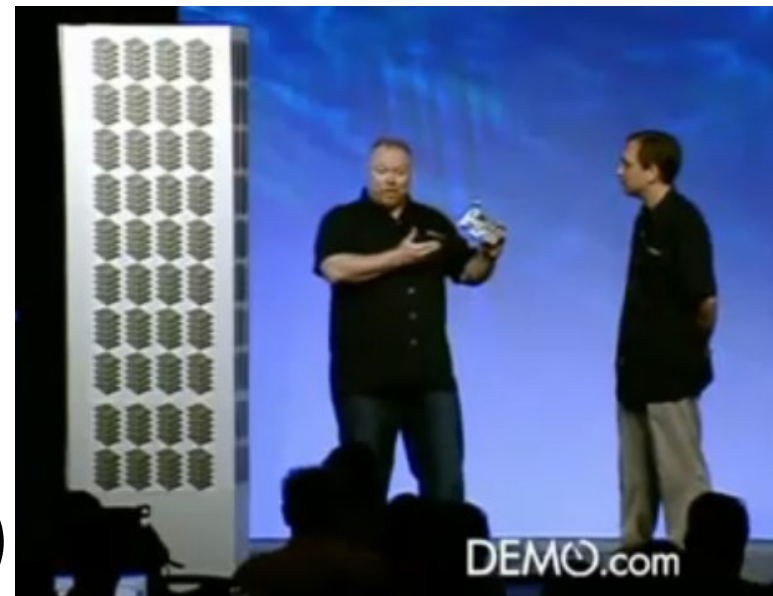
Time to throw out our hard drives!

- “Performance of a SAN in the palm of your hand”
 - Fusion-io
- IDC 2008: 1.3EB NAS
- If that's for performance...
- Reduce power consumption by an **order of magnitude** or more (assuming 15K drives)



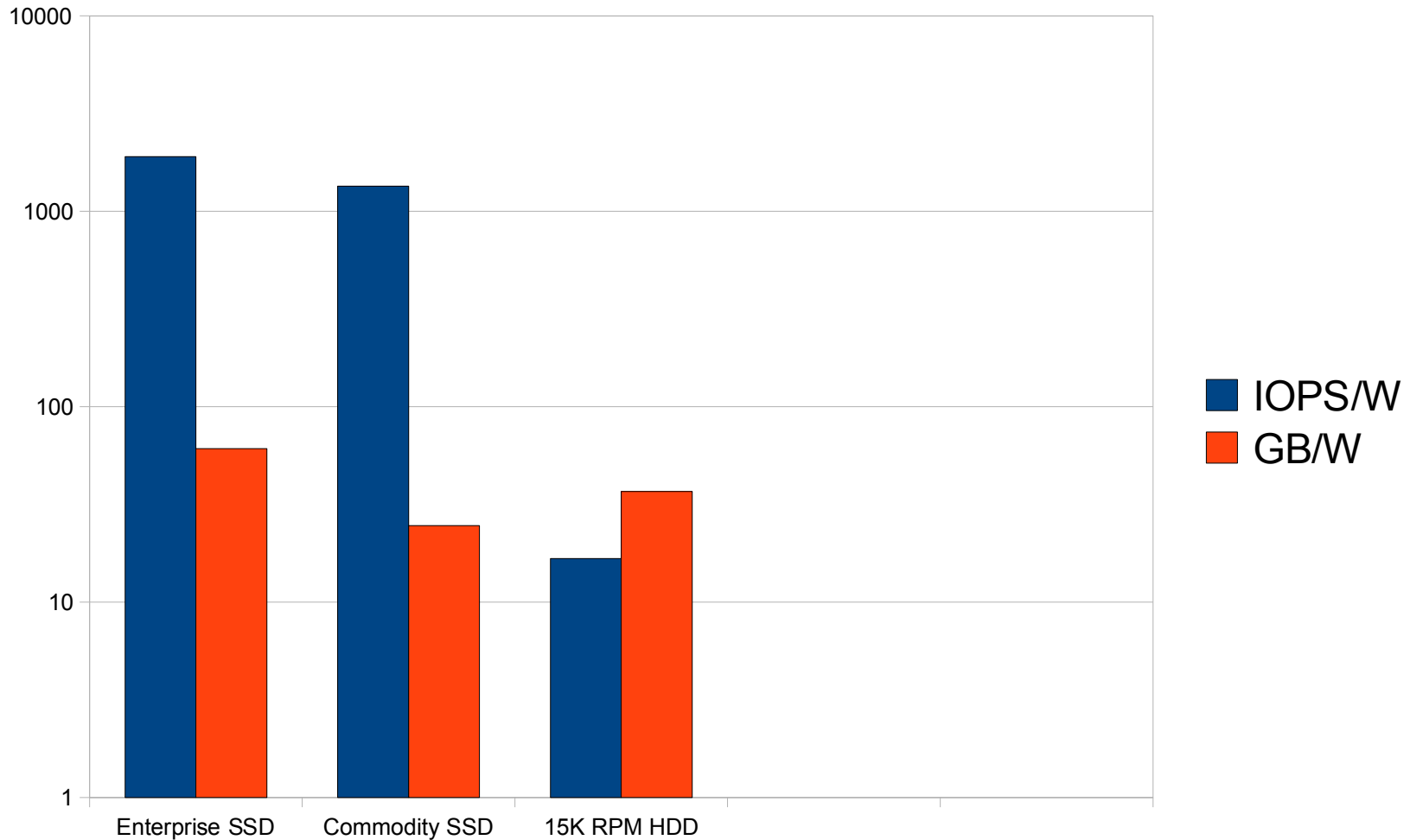
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- ... but wasn't I storing data on those drives?

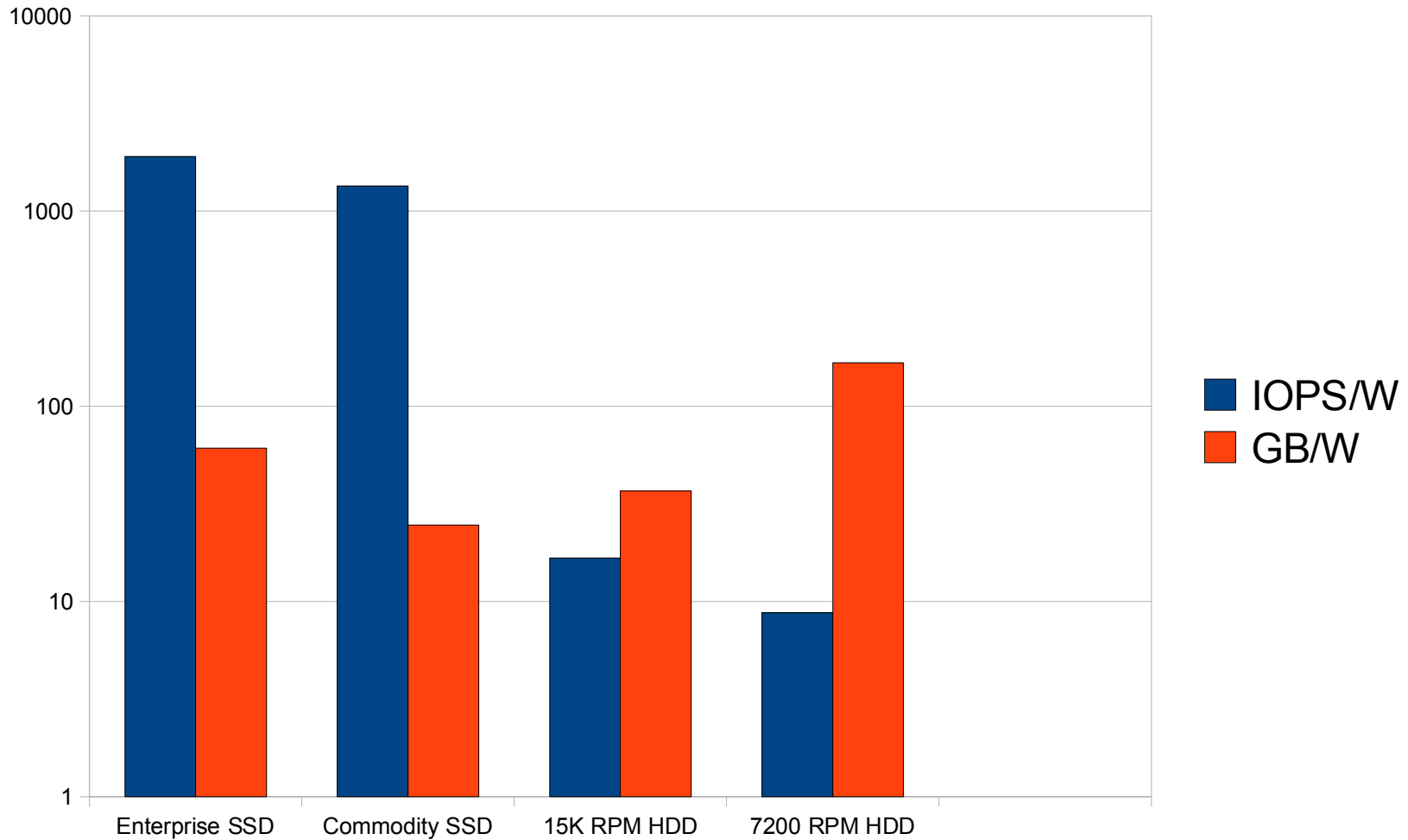
GB/W roughly equivalent



IOPS vs. Capacity

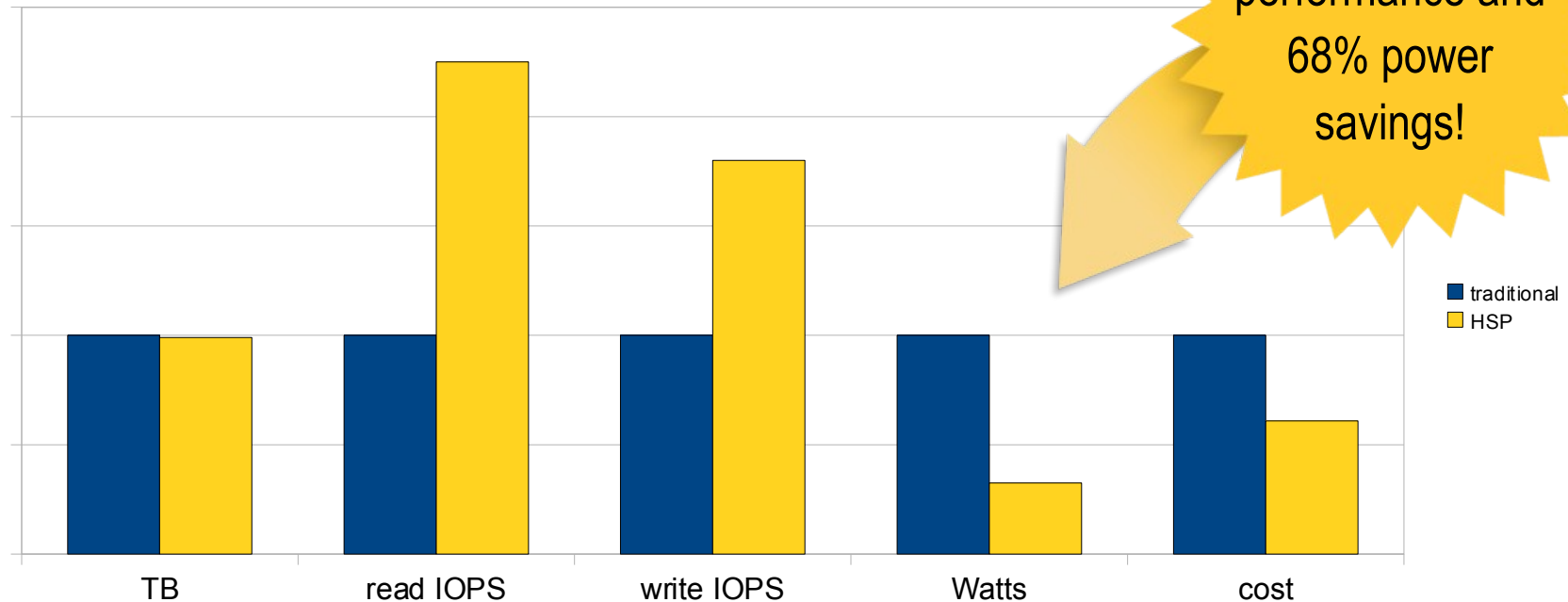
- HDDs for IOPS → flash is a clear win
- HDDs for capacity → flash about the same
- Solution: flash as an augmentation of the storage hierarchy, not an HDD replacement
- HDDs for capacity
- Flash for IOPS

7200 RPM Drives



Hybrid Storage Pool Results

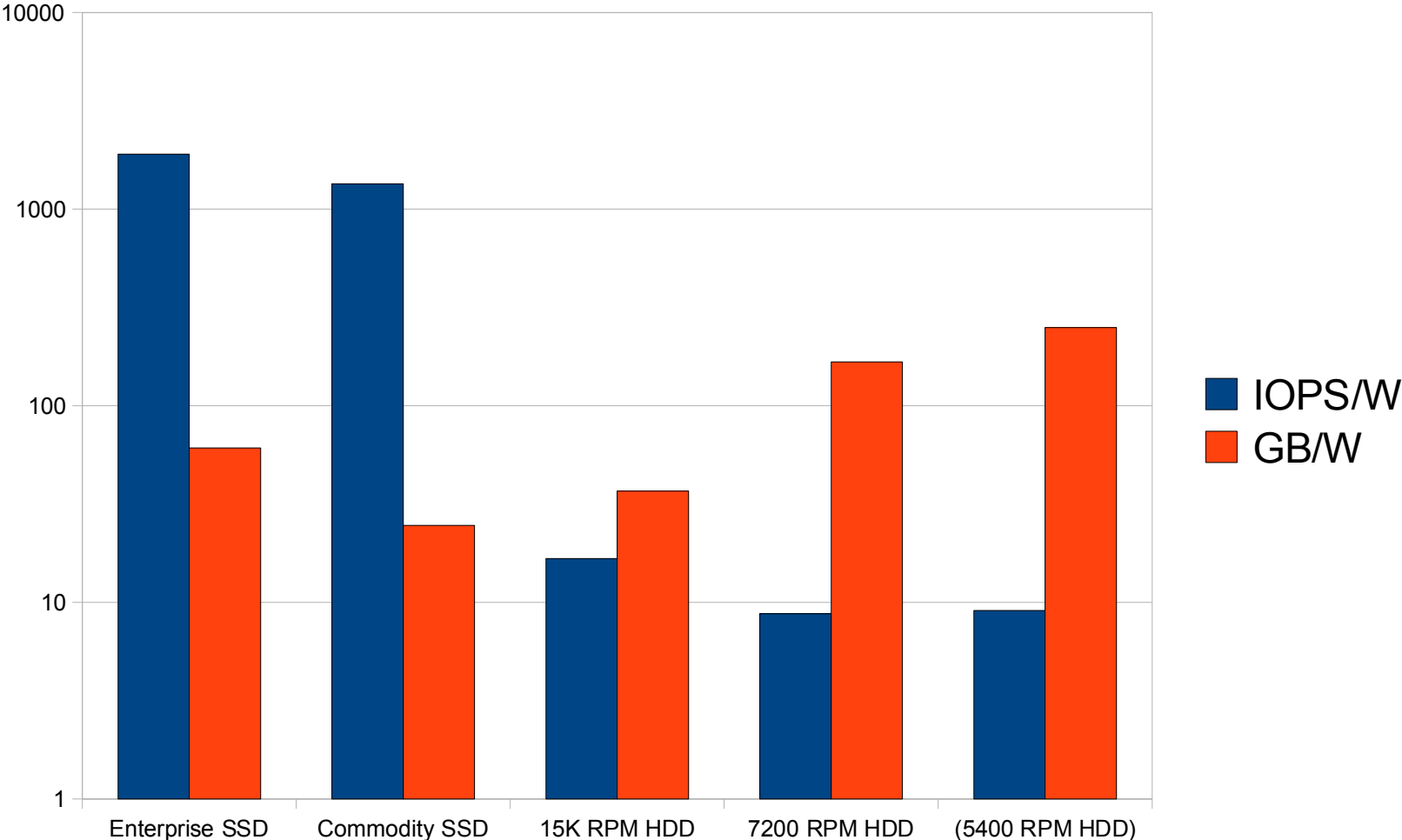
- 216 x 450GB 15K RPM HDD
- 48 x 1TB 7200 RPM HDD
- 6 x read-optimized SSD
- 2 x write-optimized SSD



Hybrid Storage

- Smarter software: Hybrid Storage Pools in ZFS
- Integrates knowledge of specialized components into the filesystem
- Scales to fit application needs
 - > In this case, match capacity/performance; better power
- Unlocks the potential of flash for general purpose storage
- Customize your application or use ZFS to take advantage of flash

What's next?



Flash to Unlock More Power Savings

- Putative 5400RPM drive
 - > Lower power / higher density
 - > Higher GB/watt, (and GB/\$)
- Flash enables a new storage hierarchy
- Software: changing today
- Hardware: slower moving, but needs to react to the new realities created by flash



Questions?

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<http://blogs.sun.com/ahl>

