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Flash Multiprotocol Storage

and the End of Hard Drives in Primary Storage

Market Forecast

Enterprise solid state shipments will double to 762,400 units and $800 million in 2011, **growing to $2.5 billion by 2014**.

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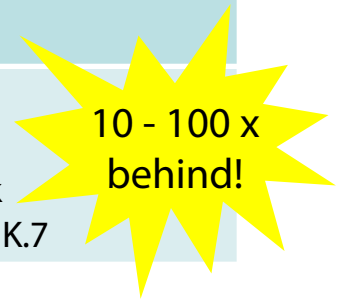
The Problem

	2000	2005	2010
CPU speed	**1 x** Pentium 4 1.5 GHz	**5 x** Pentium D 2.6 GHz	**15 x** Nehalem Quad 2.6 GHz
DRAM speed	**1 x** 2.1 GB/s DDR1 PC-2100	**4 x** 8.4 GB/s DDR2 PC2-4200	**12 x** 25.6 GB/s DDR3 PC3-8500
Network speed	**1 x** 100Mb Ethernet	**10 x** Gigabit Ethernet	**100 x** 10 Gigabit Ethernet
Bus speed	**1 x** 133 MB/s PCI 32/33 MHz	**15 x** 2000 MB/s PCIe G1 x8	**30 x** 4000 MB/s PCIe G2 x8
Disk speed	**1 x** 3.8 ms seek Cheetah 15K.2	**1.2 x** 3.6 ms seek Cheetah 15K.4	**1.2 x** 3.6 ms seek Cheetah 15K.7



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Unacceptable Alternatives

- **Option #1: More spindles**
  - Does not address latency, increases failure risk, and multiplies power, cooling, and datacenter rackspace costs
- **Option #2: Short-stroke hard drives**
  - Wastes 70% of storage capacity for limited speed gains
- **Option #3: Caching**
  - Caches are 1000:1 oversubscribed, offering inconsistent results
- **Option #4: Tiering**
  - Adds complexity, more hardware, does not improve performance

NAND Flash as 15K Disk Replacement

- **Huge Performance and Reliability Gains**

	15K HDD	NAND Flash	Improvement
Performance (IOps)	350	30,000	**86x greater**
Latency (ms)	10 ms	0.3 ms	**30x faster**
Reliability (MTBF)	1.2 M	2.0 M	**67% greater**
Rebuild Times	10-20 hrs	20-30 min	**40x faster**

NAND Flash as 15K Disk Replacement

- **Significant Efficiency and Economic Gains**

	15K HDD	NAND Flash	Improvement
Power (W / TB)	30	5	**83% lower**
Efficiency (IO / W)	15	6,500	**433x higher**
Density (TB / U)	3	5	**67% higher**

The Solution

- **Nimbus S-Class**
  - 100% NAND flash memory
  - 10 - 50x faster than disk arrays
  - 80% lower power usage
  - 70% greater rack density
  - Superior availability

- **Game-changing Technology**
  - Purpose-built hardware + smart software
  - Comparable acquisition cost to aging 15K rpm disk arrays
  - Significantly lower OpEx, enabling green datacenters
  - Unparalleled performance to increase QoS and slash TCO

System Architecture

- **Nimbus Data Details**
  - Modular 2.5, 5.0, and 10.0 TB rackmount systems
  - On-demand scalability to 250 TB via stacking
  - Up to 800,000 IOps and 8 GBps throughput
  - 1 Gb/10Gb Ethernet, 8 Gb Fibre Channel, and 40 Gb Infiniband
  - SAN and NAS
- **Enterprise Flash Modules**
  - 24 hot-swap modules/shelf
  - 80% better MTBF than HDD
  - 10x more durable EMLC silicon
  - 28% additional reserve flash
  - TRIM and dynamic wear-leveling

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Questions?

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