

EMC Tech Talk: Enterprise Flash Drives

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EMC Storage Division*

June 25, 2008

Forward-Looking Statements and GAAP Reconciliation



This presentation contains “forward-looking statements” as defined under the Federal Securities Laws. Actual results could differ materially from those projected in the forward-looking statements as a result of certain risk factors, including but not limited to: (i) adverse changes in general economic or market conditions; (ii) delays or reductions in information technology spending; (iii) our ability to protect our proprietary technology; (iv) risks associated with managing the growth of our business, including risks associated with acquisitions and investments and the challenges and costs of integration, restructuring and achieving anticipated synergies; (v) fluctuations in VMware, Inc.’s operating results and risks associated with trading of VMware stock; (vi) competitive factors, including but not limited to pricing pressures and new product introductions; (vii) the relative and varying rates of product price and component cost declines and the volume and mixture of product and services revenues; (viii) component and product quality and availability; (ix) the transition to new products, the uncertainty of customer acceptance of new product offerings and rapid technological and market change; (x) insufficient, excess or obsolete inventory; (xi) war or acts of terrorism; (xii) the ability to attract and retain highly qualified employees; (xiii) fluctuating currency exchange rates; and (xiv) other one-time events and other important factors disclosed previously and from time to time in EMC’s filings with the U.S. Securities and Exchange Commission. EMC disclaims any obligation to update any such forward-looking statements after the date of this release.

**On January 14, 2008
EMC Changed Everything You Knew
About Information Storage**

Again.

“Most likely this will create a giant gap against IBM & Hitachi.”
-- ESG Analyst Steve Duplessie
Wall Street Journal, 14 January 2008

EMC Seeks Edge With Large Flash-Memory Drives

“EMC Lands a Haymaker... shocked the storage world and ushered in a new era .”

-- Nicholas Allen
Wikibon

“EMC ushers in new era...adds 'tier 0' storage to Symmetrix”

-- Simon Robinson
the 451 Group

“Today the enterprise disk drive market changed forever.”

-- Techworld
14 January 2008



Enterprise Flash Drives Deliver Ultra Performance

- New Enterprise Flash Drive (EFD) technology
 - Architected for Performance, Reliability and Data Integrity
- DMX-4 is First and Only High End Array to support EFDs
 - Fully integrated with Symmetrix management and functionality
- Ideal for Low Latency Workloads
 - Accelerate Response Times, Shorten Batch Windows

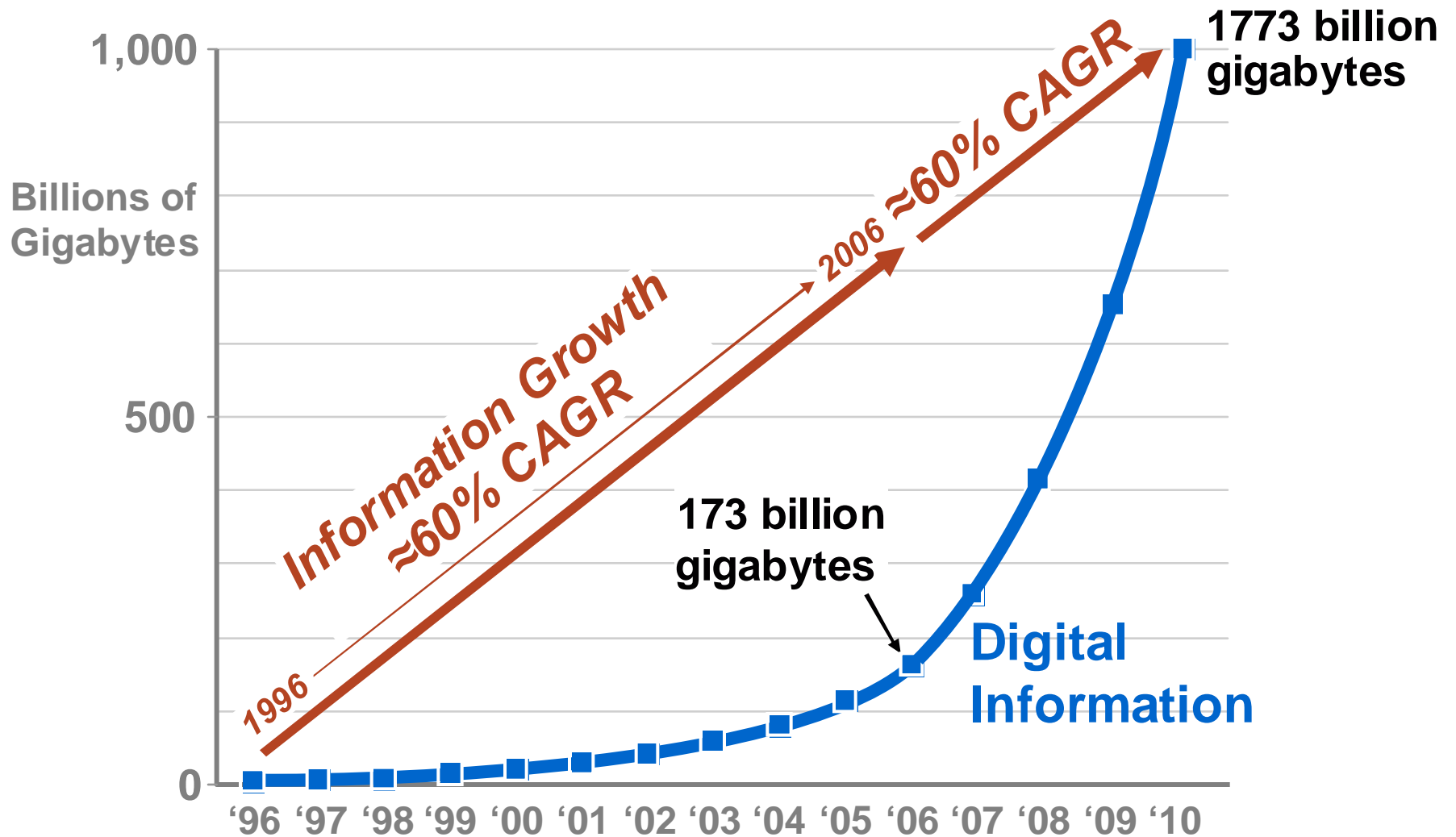


Available for New
and Existing
Symmetrix DMX-4

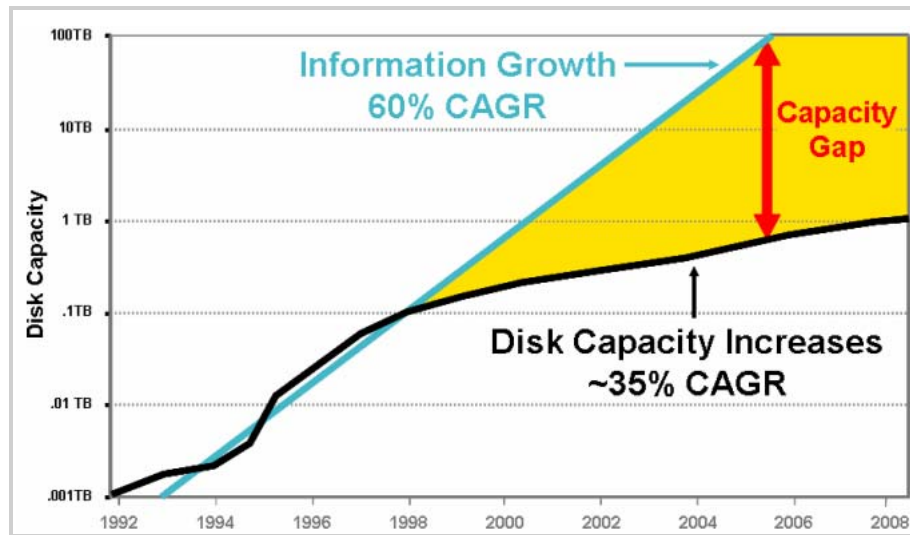
Flash drives are redefining storage performance and energy efficiency

Information Continues to Expand Rapidly

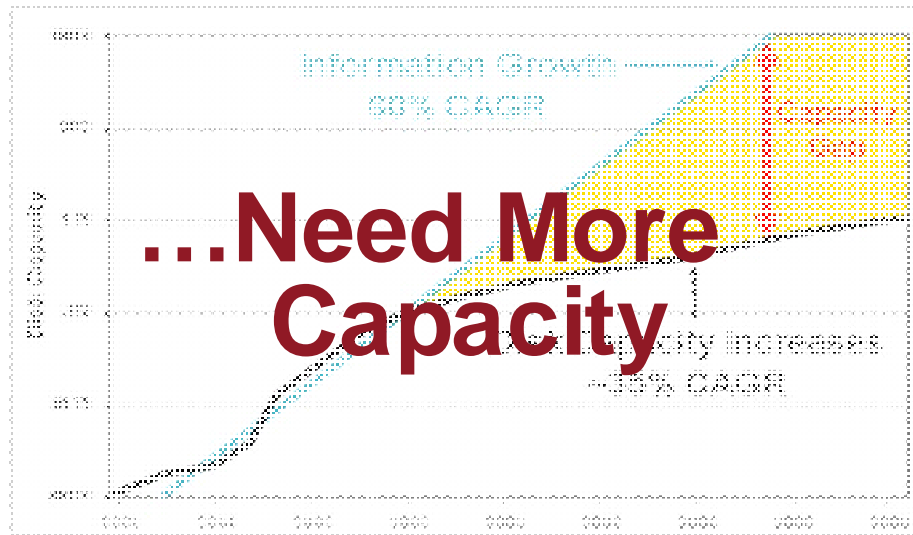
Amount of Digital Information Created and Replicated Each Year



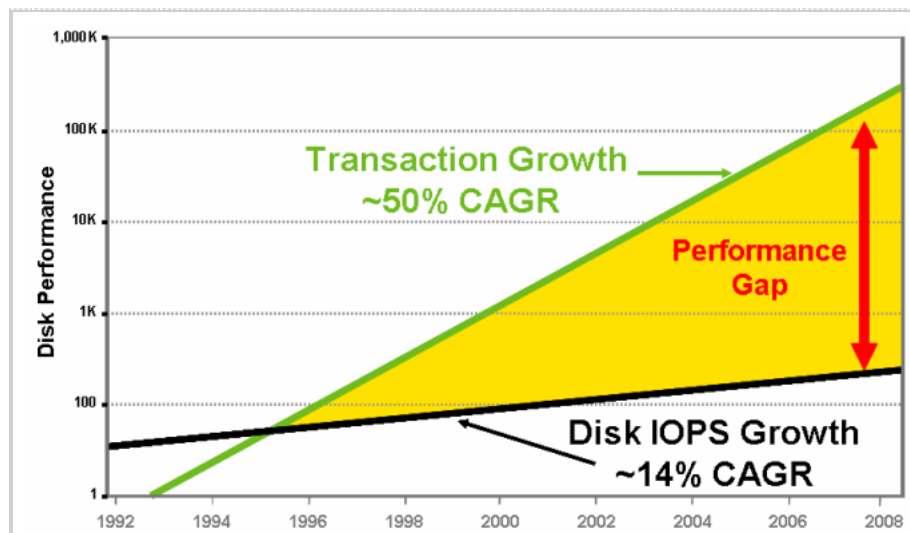
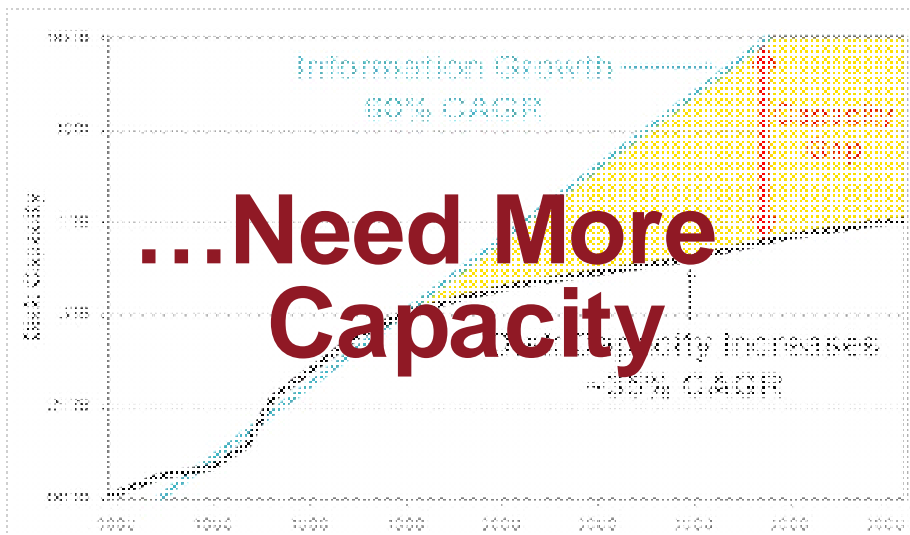
Storage Technology Has Not Kept Up With Customer Demands



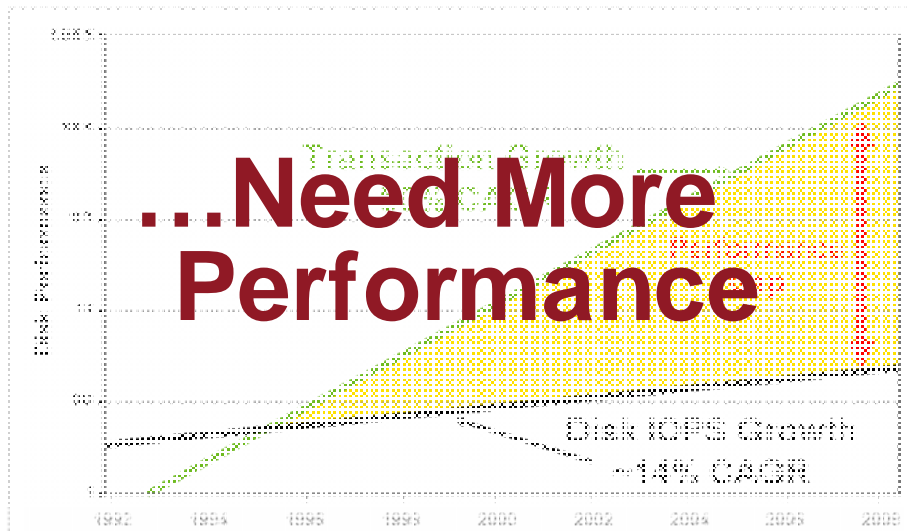
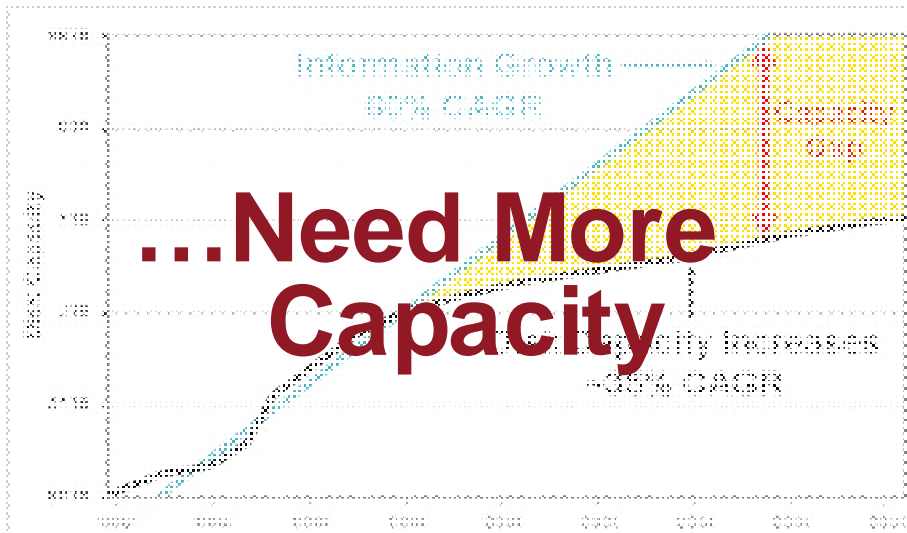
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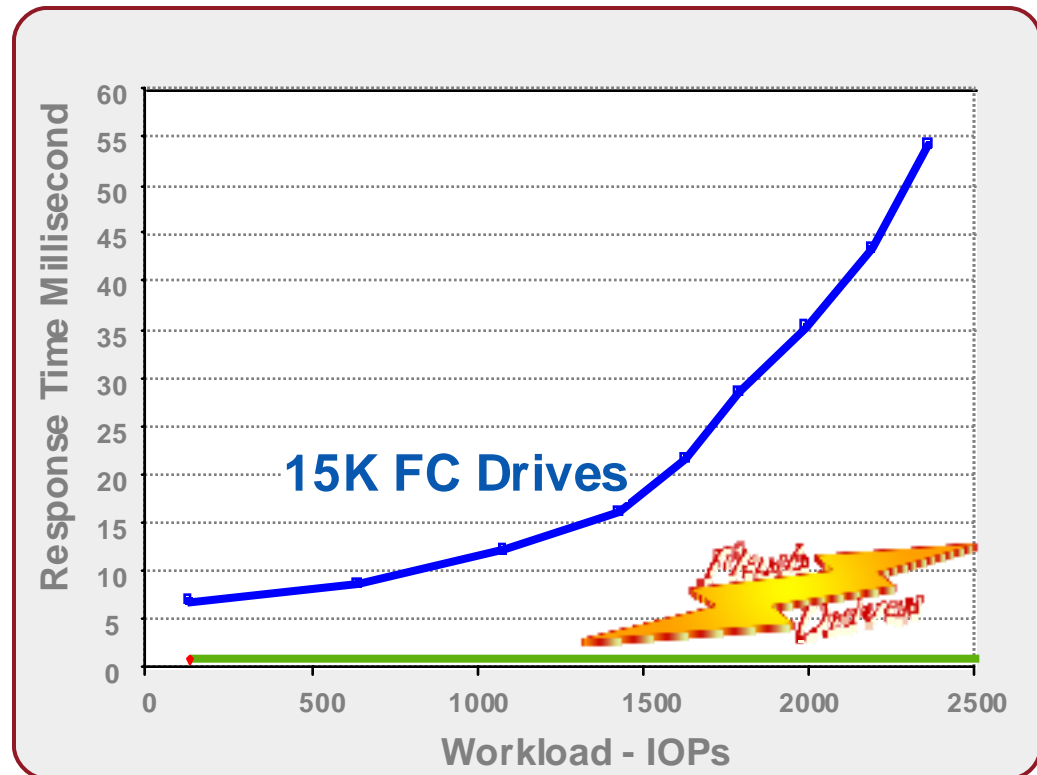


Symmetrix DMX-4 Shatters Performance Barriers

Flash Drives Deliver Unprecedented Application Performance

- 30x IOPS improvement
- 10x faster response time
- 32% less power per drive
- 98% less power per IO
- No moving parts for high reliability

Flash is the new foundation for high performance applications



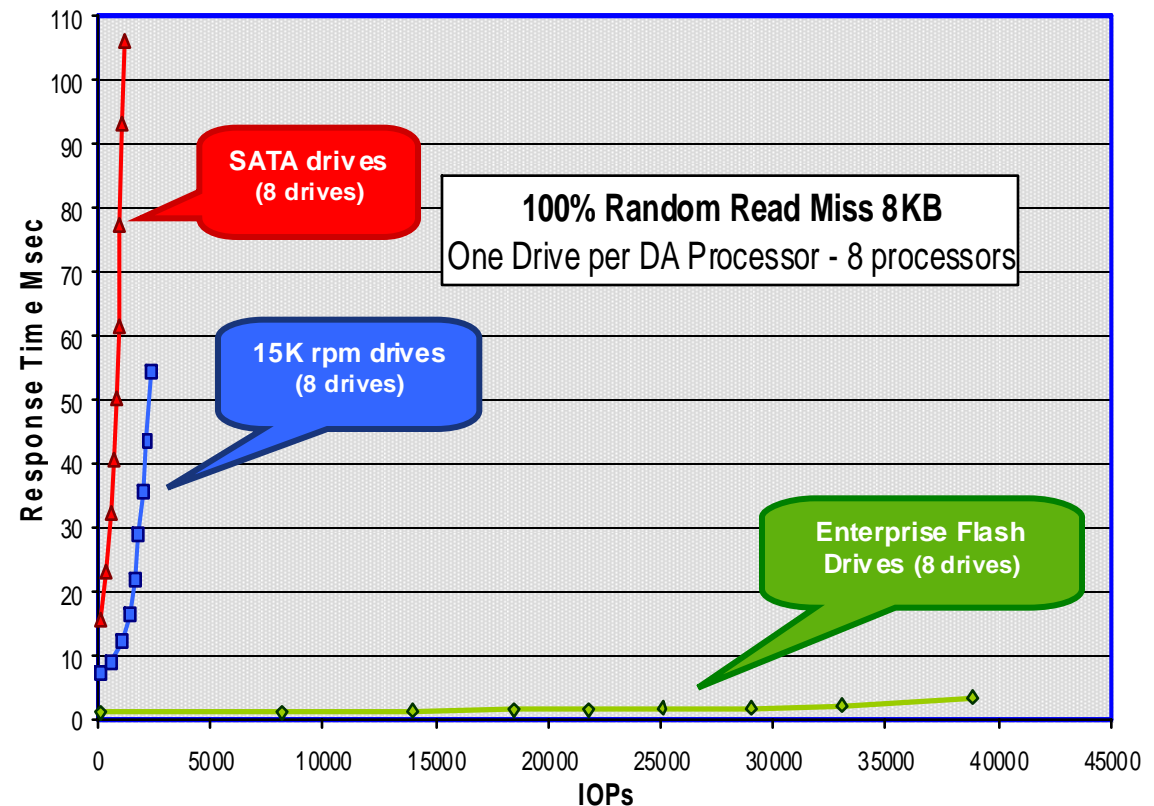
Enterprise Flash Drives deliver ~1 millisecond Read Miss Response Time!

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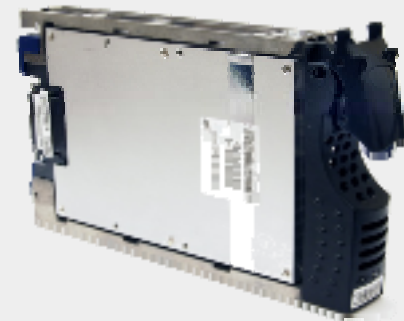
Example Use Cases

- High transaction OLTP
 - Billing, reservations, MRP, etc.
 - Electronic trading, retail banking, market data feeds
- Data Warehouse / Data Modeling
 - Trend analysis, Retail inventory mgt, data correlation
- Sales Automation
 - Order processing, eCommerce, CRM, scheduling, etc.
- Crime prevention
 - Credit Card fraud detection
 - Facial recognition, fingerprint/DNA matching, etc.

Large Scale Microsoft Exchange

Symmetrix Enterprise Flash Drives: Offering Overview

- Designed for the Enterprise
 - Highest availability
 - Extended endurance
 - Unmatched performance
- Available for All DMX-4 Arrays
 - Standard 3.5" drive form factor, 2Gb/s FC
 - 73 GB & 146 GB usable capacities
 - Supports Mainframe & Open Systems
- Tightly integrated with Symmetrix DMX-4
 - Optimized for in-the-box tiered storage
 - Integrated with Symmetrix QoS
 - Supported by all Symmetrix functionality (TimeFinder, SRDF, etc.)



**Architected
to Support
at least
5 years of
Continuous
Writes
*24 x 7 x 365***

Tiered Storage Optimization – Flash Drives

Enterprise Flash Drives:

- Much faster than consumer flash
 - Better transfer rates
 - More I/Os per second
 - Shorter response times
- More reliable than consumer flash
 - SLC NAND inherently more durable than MLC
 - Comprehensive write leveling
 - Automatic bad-block remapping
- Built for HA applications
 - Dual-ported drive interface
 - Massive internal parallelism
 - End-to-end error detection & recovery

Purpose Built for Enterprise Class Performance and Durability

Enterprise Flash Drives



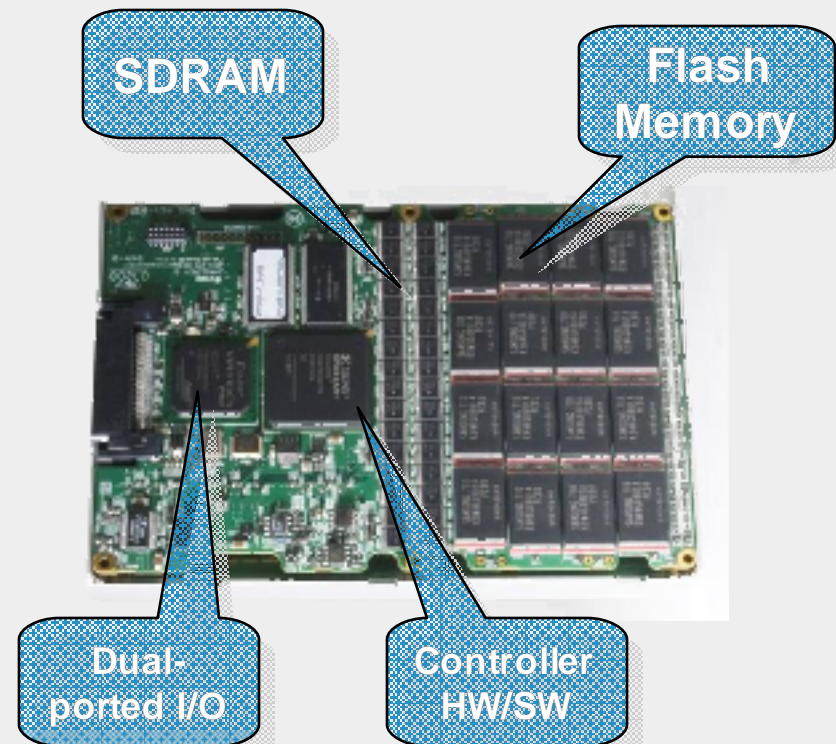
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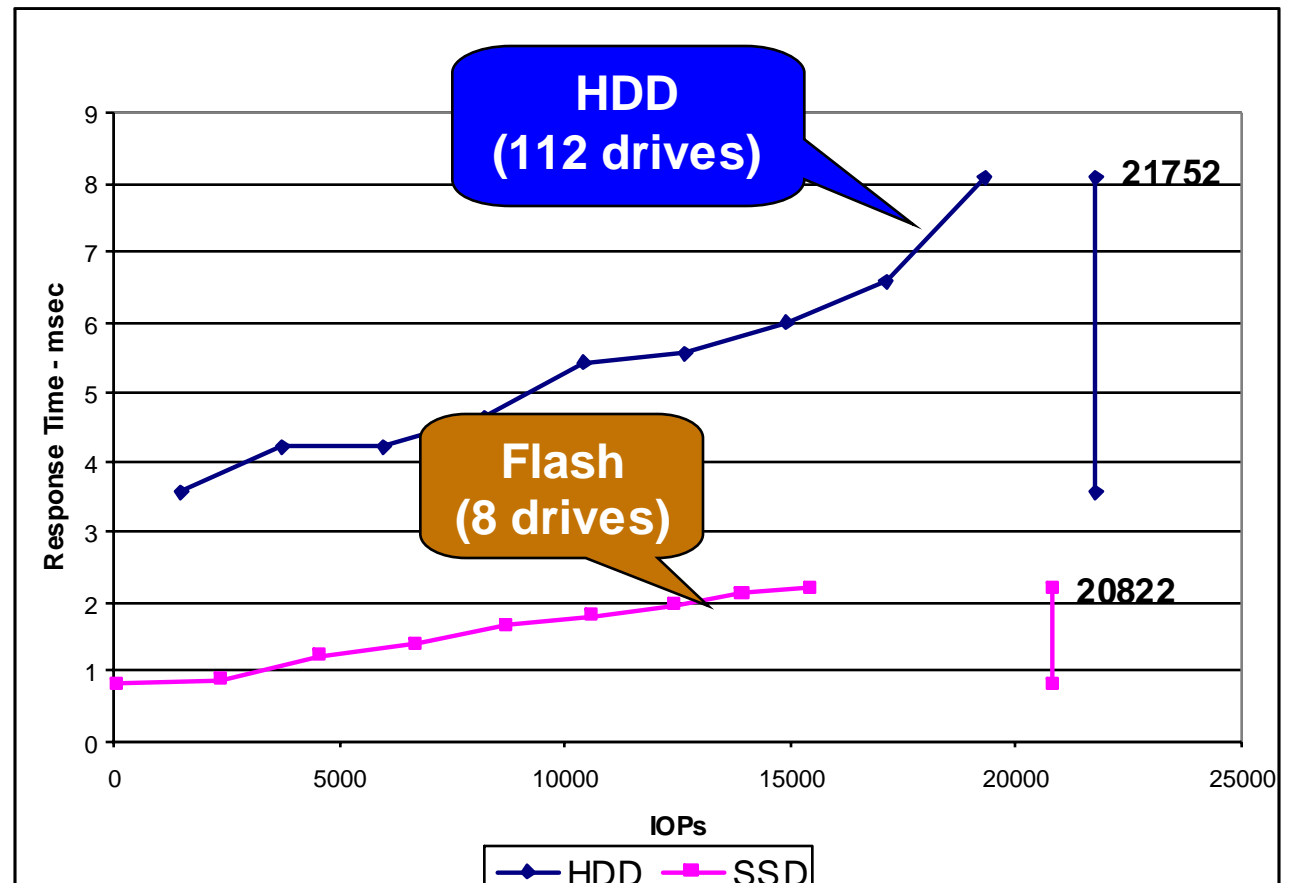


Tiered Storage Optimization – Flash Drives

Flash – A Distinctly Faster New Tier of Storage

- Fewer Drives
- Less Energy
- Less Space
- Less Weight

Oracle / Exchange-Like Workload



Real World Response Time Benefit (The Math)

A very Common workload: 90% Read Hit and 10% Read Miss

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- HDD response time **Cache Read Miss is 6 msec** (15K rpm drive):
 - $90\% \times 0.5\text{msec} (0.45\text{ms}) + 10\% \times 6\text{msec} (.6\text{ms}) =$

1.05 msec Average Response Time with HDD drives

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- EFD response time **Cache Read Miss is 1 msec**:
 - $90\% \times 0.5\text{msec} (0.45\text{ms}) + 10\% \times 1\text{msec} (0.1\text{ms}) =$

0.55 msec Average Response Time with EFD drives

Real World Response Time Benefit (The Math)

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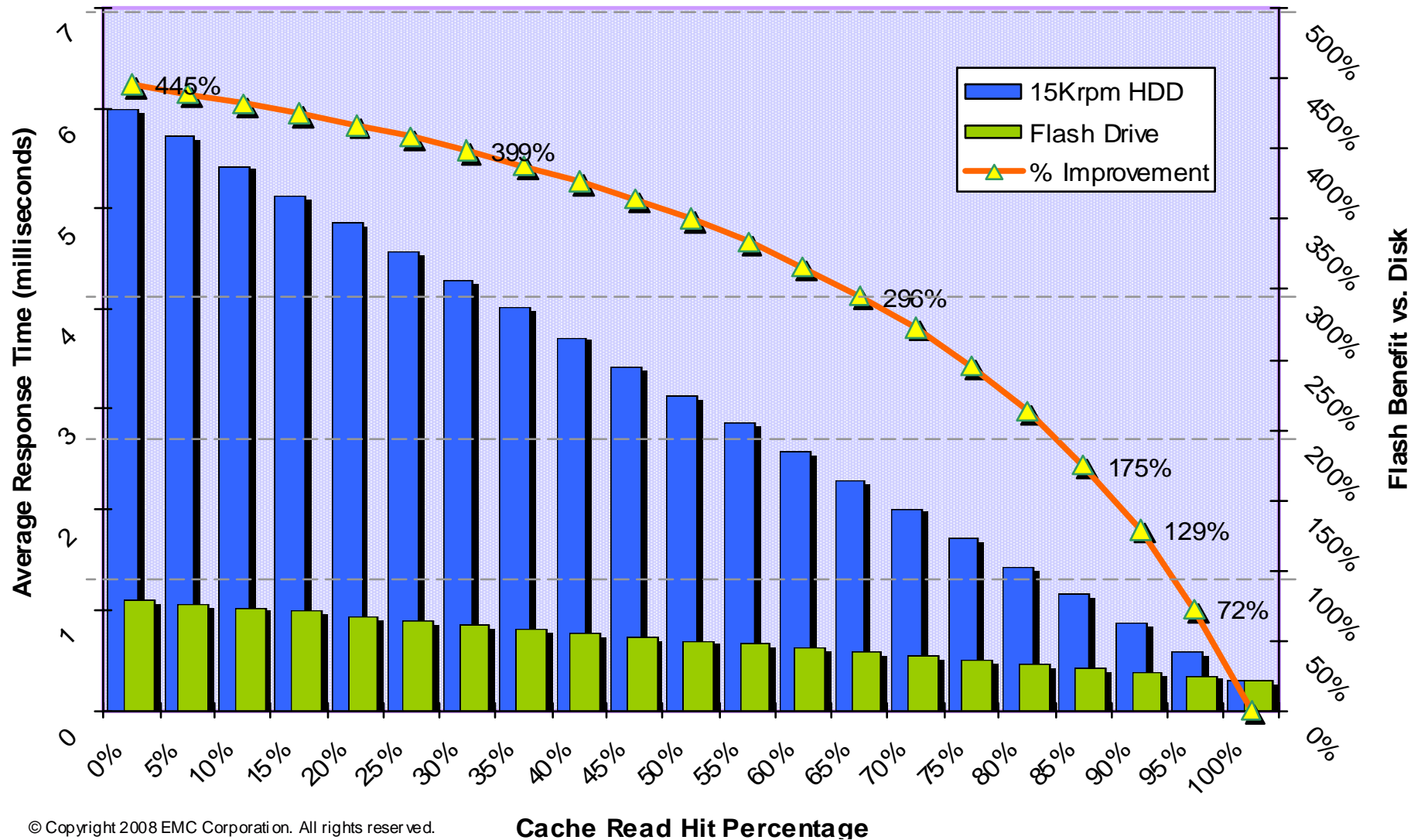
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0.55 msec Average Response Time with EFD drives

***Even when the Read Hit ratio is 90%
Flash Drives Cut Average Response Time in HALF!***

EFD Delivers Significant Response Time Benefits

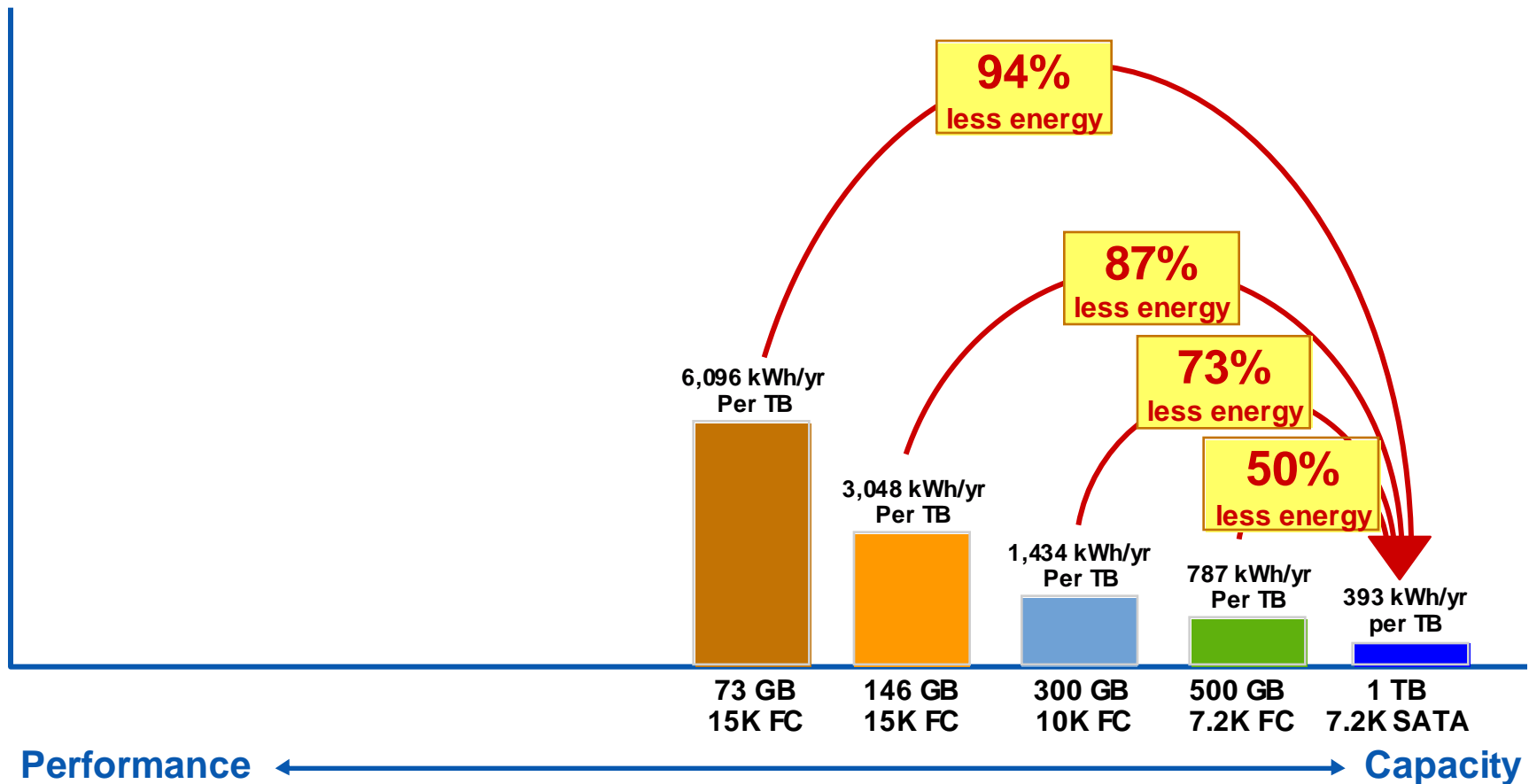
Measurable Improvements Even In High Read Hit Scenarios



Enterprise Flash Drives Are Very Energy-Efficient

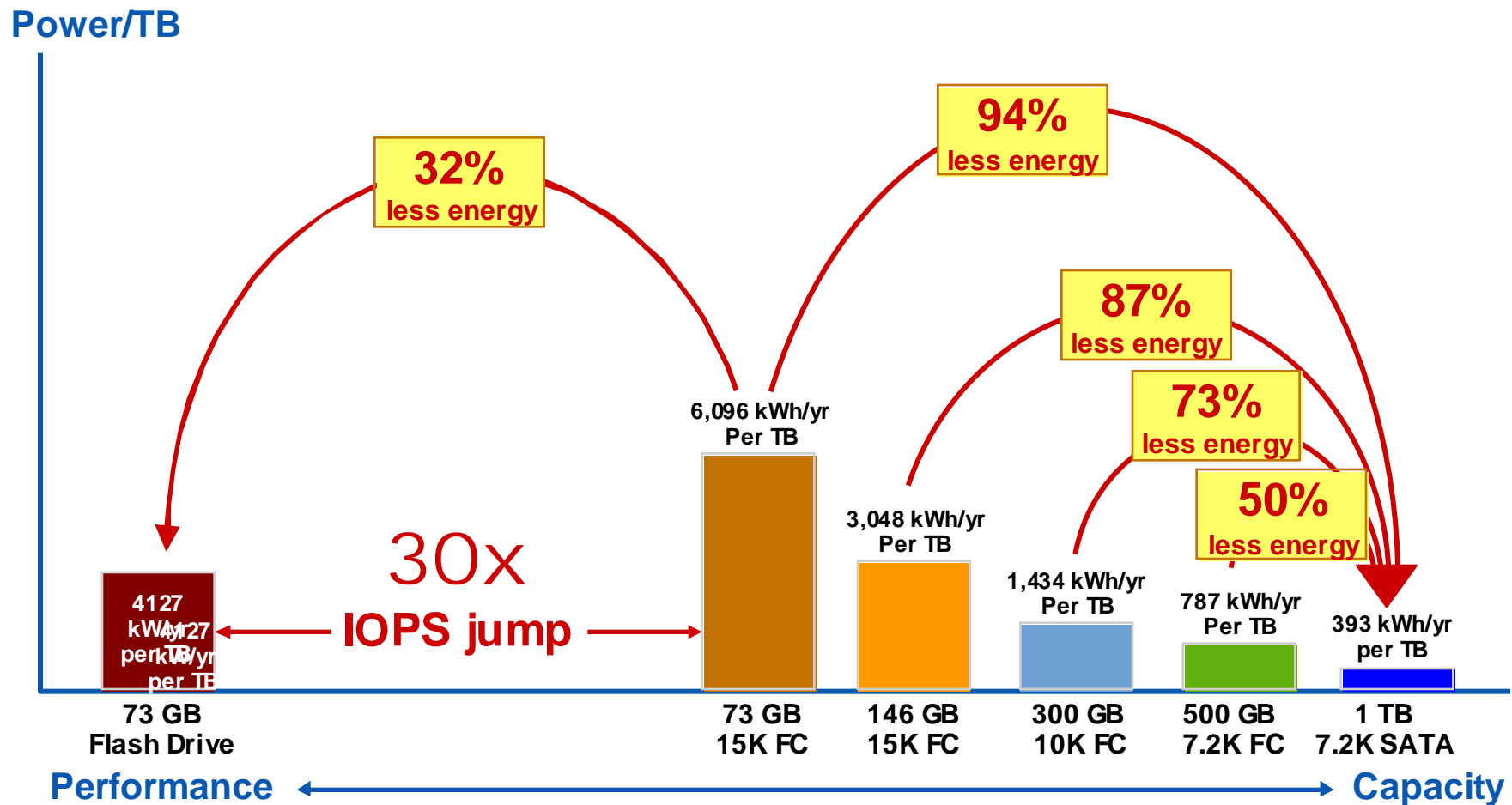
Power / GB – Energy To Store 1TB of Information*

Power/TB



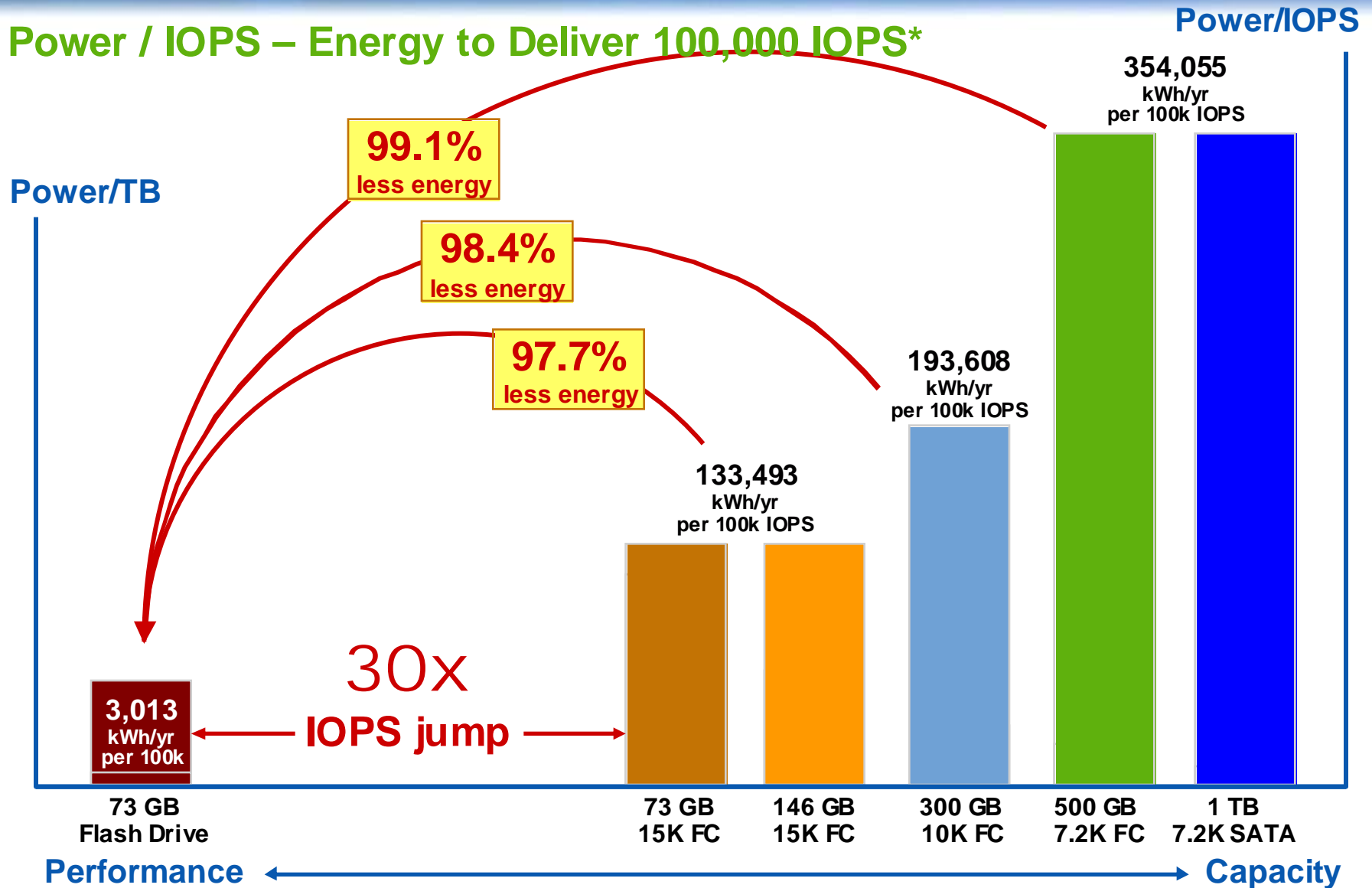
Enterprise Flash Drives Are Very Energy-Efficient

Power / GB – Energy To Store 1TB of Information*



Enterprise Flash Drives Are Very Energy-Efficient

Power / IOPS – Energy to Deliver 100,000 IOPS*



EMC Symmetrix DMX-4 Series

World's Most Trusted Storage Platform

Symmetrix DMX-4: World's Largest High-end Storage Array



- 96–2,400 FC, SATA & Flash drives
- Two to 12 Channel Directors*
- Two to eight disk directors*
- FC, iSCSI, Gigabit Ethernet, FICON, ESCON connectivity
- Up to 256GBu Global Memory

DMX-4 950: New High-end Entry Point



- 32–360 FC, SATA & Flash drives
- Two or four front-end/back-end directors
- FC, iSCSI, FICON, Gigabit Ethernet connectivity
- Up to 64GBu Global Memory

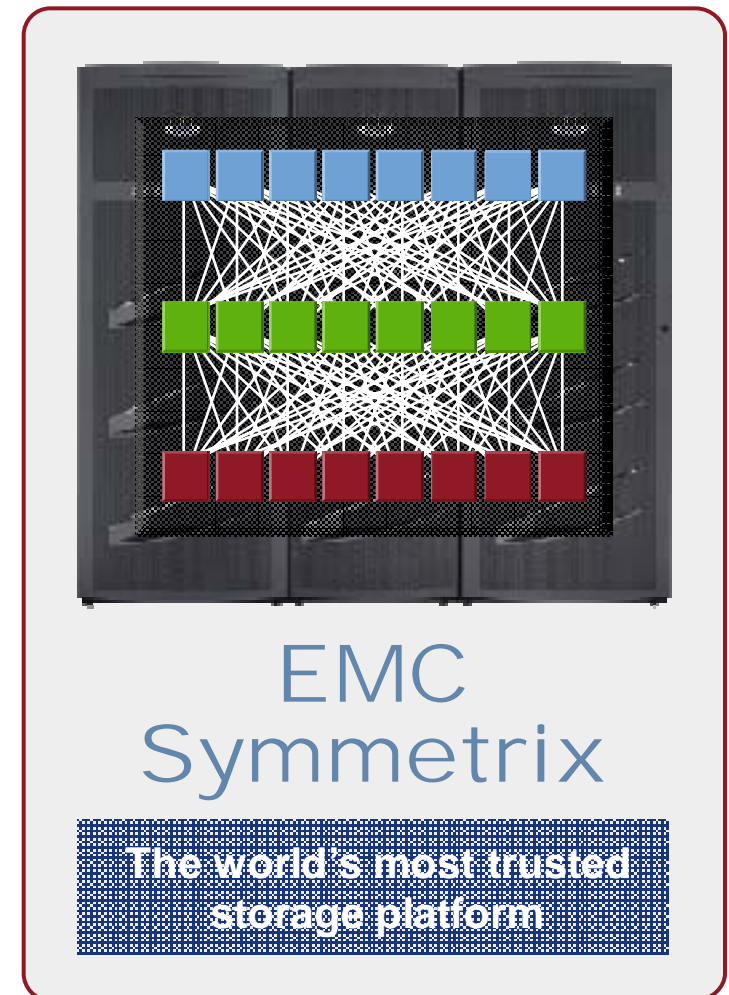
CAPACITY AND PERFORMANCE SCALABILITY

**Combinations may be limited based on configuration*

Symmetrix DMX

#1 in High-End External RAID (IDC, Q1 2008*)

- Information availability
 - Most advanced and widely deployed business continuity platform
- Tiered-storage optimization
 - Advanced Quality of Service, Mobility, and Management capabilities to consolidate application tiers, including Tier 0
- Simplified management and operations
 - Simplified storage allocation, resource management and tiering
- Information-centric security, built in
 - Advanced security and integrated RSA technology
- Energy efficiency
 - Best green data center solutions for today's IT requirements



* EMC analysis based on IDC product-line estimates

Any Questions



The image features the EMC logo and tagline centered on a blue background with a sunburst effect. The logo consists of the letters 'EMC' in a large, bold, blue serif font, with a superscript '2' to the right of the 'C'. A registered trademark symbol (®) is located at the bottom right of the 'C'. Below the logo, the tagline 'where information lives' is written in a smaller, bold, black sans-serif font, also followed by a registered trademark symbol (®).

EMC²
®

where information lives[®]