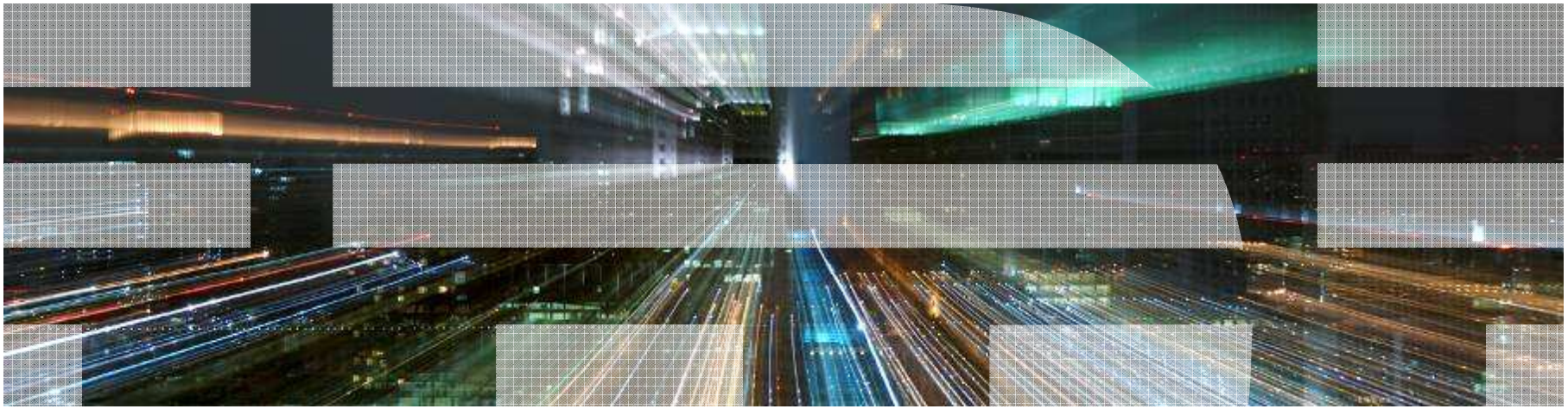
IBM System Storage and IBM System z Together

Information Infrastructure for the World's Most Demanding Customers



Thomas Frey
High-End Storage Sales Leader
thfrey@de.ibm.com

Agenda

- **IBM Information Infrastructure**
- **High-end and enterprise disk systems**
  - DS8000
- **Enterprise tape**
  - Virtualization engine
- **Storage virtualization**
  - SAN Volume Controller
  - XIV
- **Summary**

Smarter Planet …..

The world is changing, enabling organizations to make faster, better-informed decisions as their systems can be made

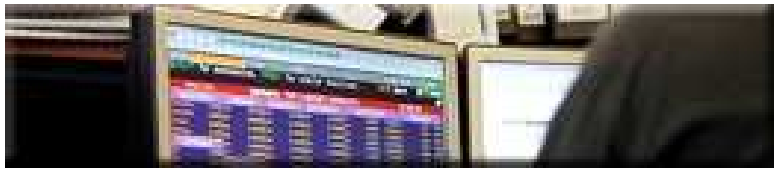
Our world is becoming
INSTRUMENTED

By 2010, 30 billion RFID tags will be embedded into our world and across entire ecosystems

Our world is becoming
INTERCONNECTED

An estimated 2 billion people will be on the Web by 2011 …. and a trillion connected objects – cars, appliances, camera, roadways, pipelines – comprising the "Internet of Things"

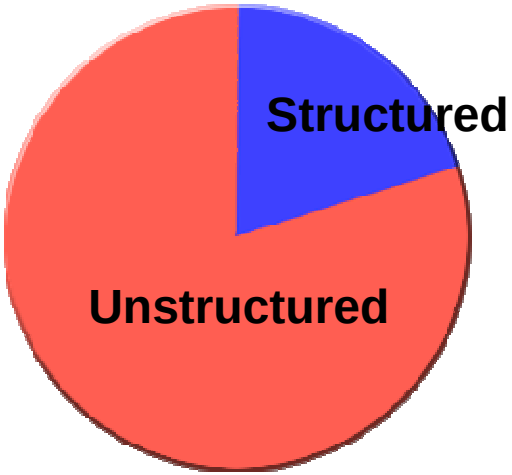
All things becoming
INTELLIGENT



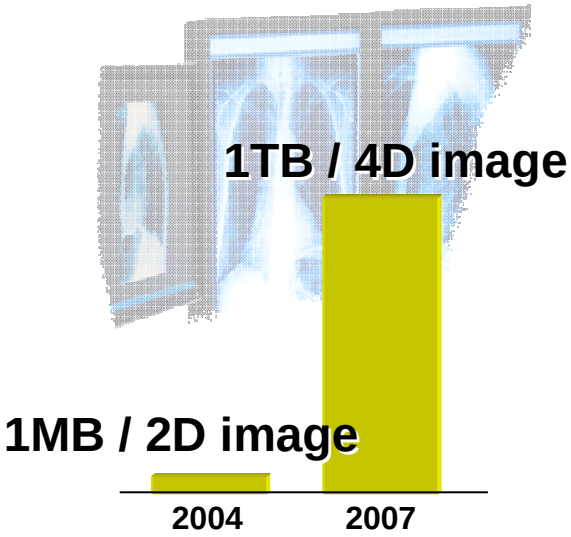
Every day, 15 petabytes of new information are being generated. This is 8x more than the information in all U.S. libraries

The Information Explosion

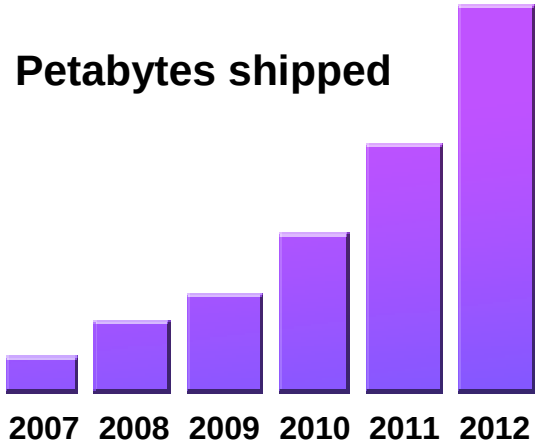
Data Types



Data Value



Data Growth



Today

80% unstructured data

By 2010...

> 1000x storage per image

Through 2012...

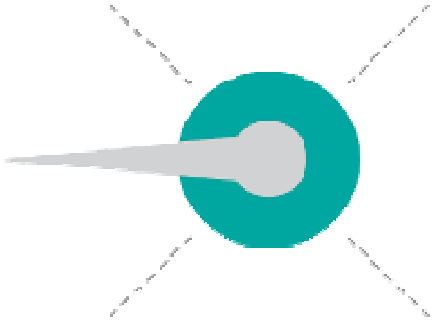
54% annual storage growth

Ihr Anspruch an Information ebenfalls…

Relevant und Realtime

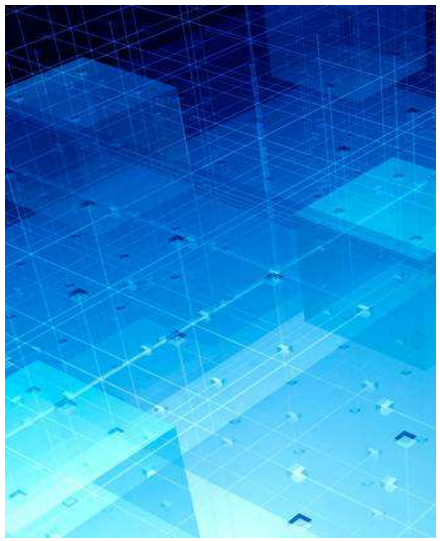
Echtzeitanalysen statt “XLS”-Sheets

Verfügbar



Downtime kostet Existenzen!

Übergreiffend und Sicher



Informations-Inseln schränken ein

Datensicherheit wird wichtig

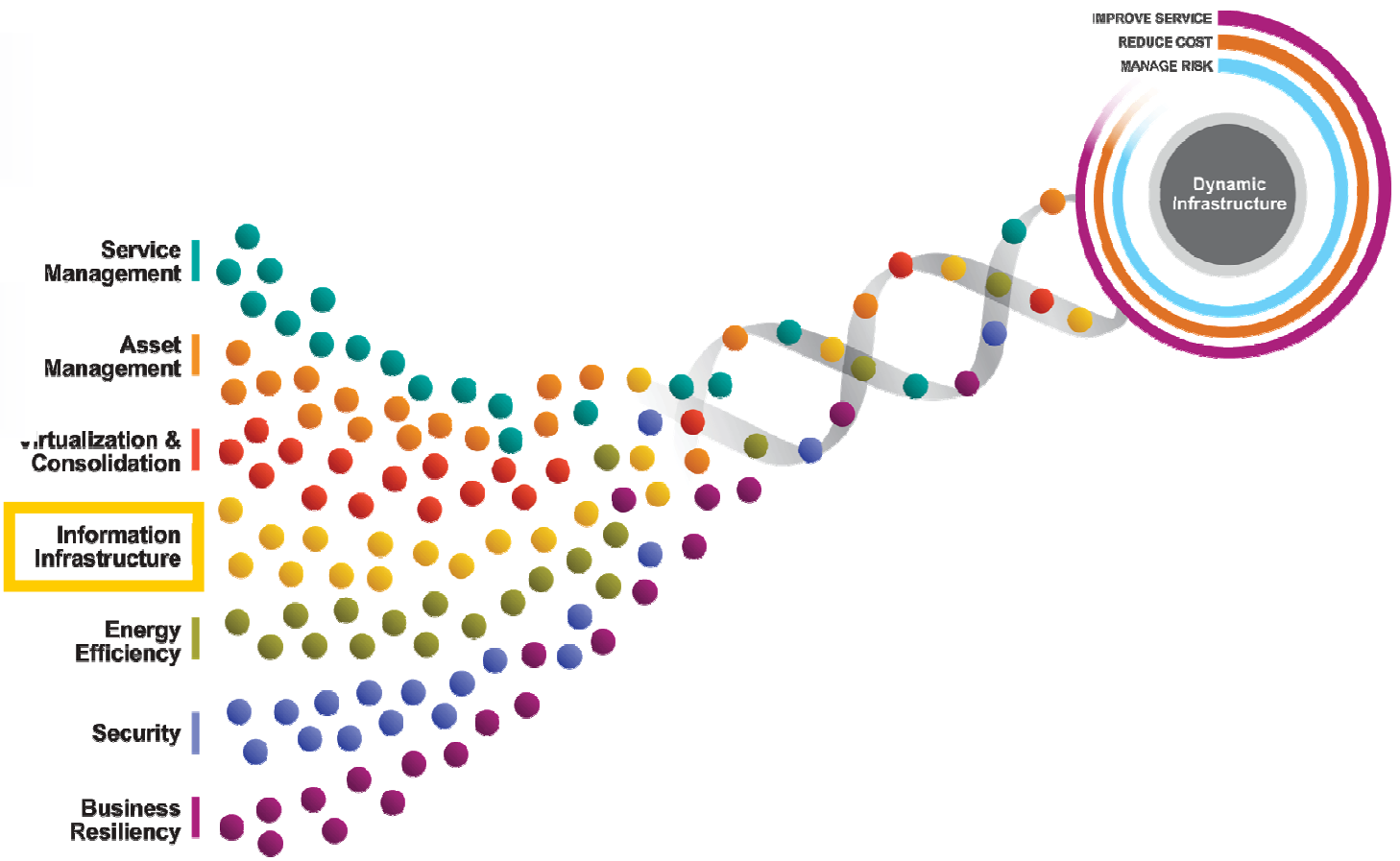
Building the infrastructure for a Smarter Planet

Compliance
Reduce reputation risks and audit deficiencies

Availability
Deliver continuous and reliable access to information

Retention
Support your information retention policies

Security
Protect and enable secure sharing of information



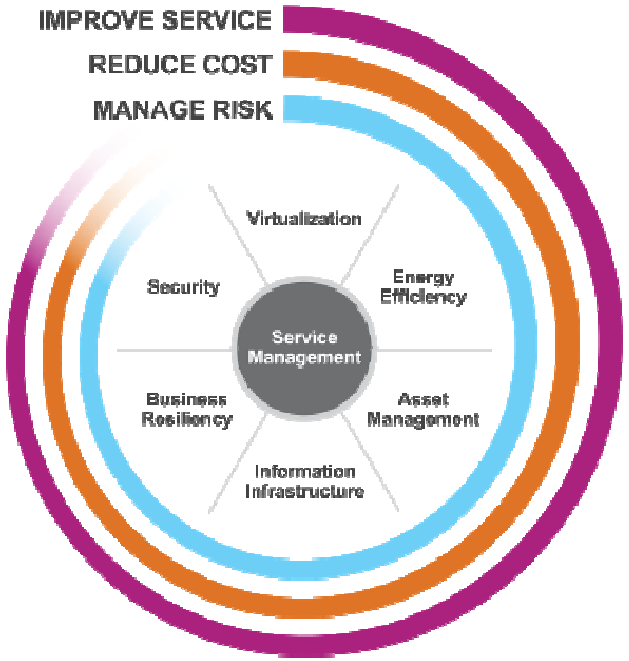
Wir addressieren damit:

Kosten reduzieren

Weniger, effizienterern Storage = Weniger Ausgaben
Weniger Daten = Einfacheres Management
Bessere Utilisierung und ideales ILM

Service verbessern

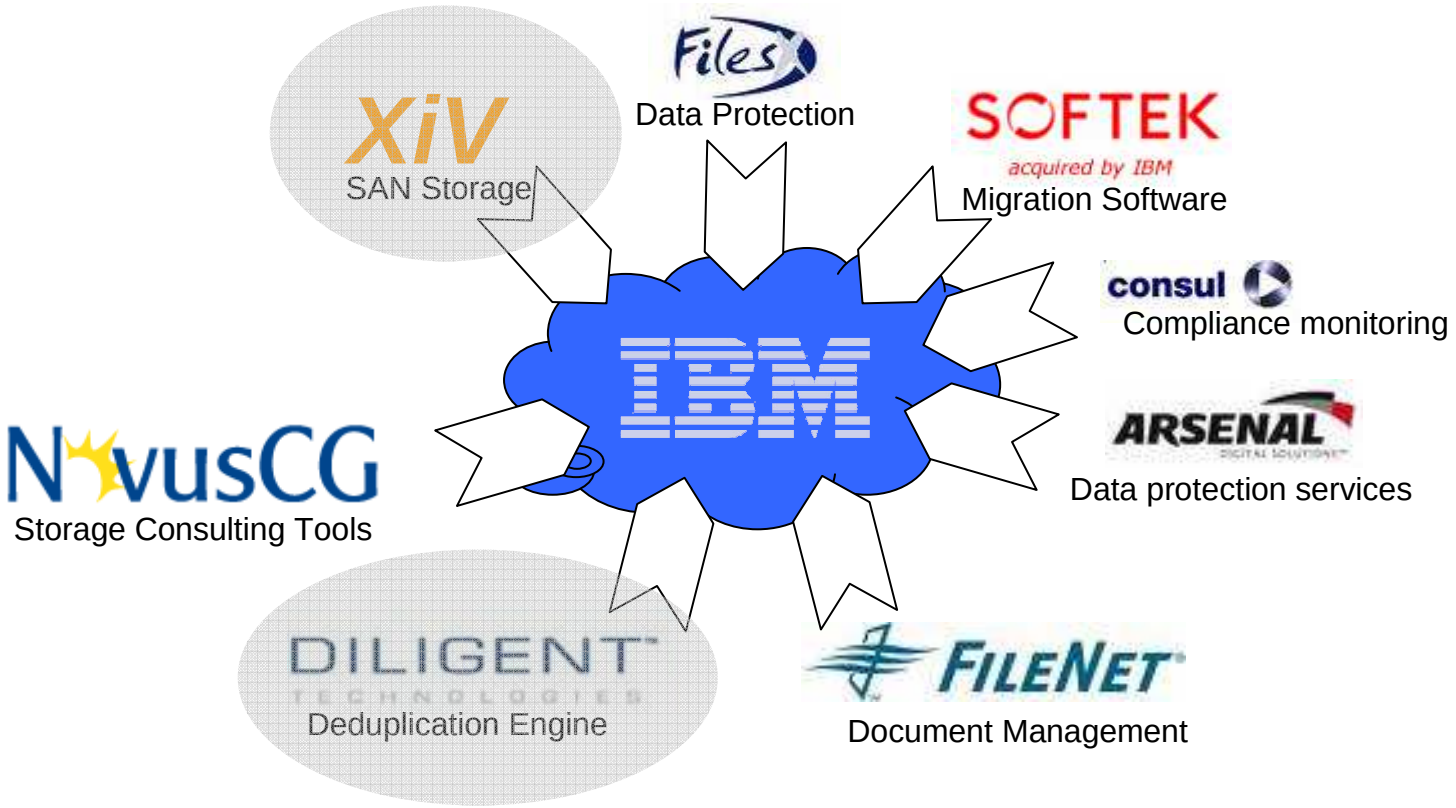
Weniger Downtime =
Höhere Verfügbarkeit und Produktivität
Verbesserte Wettbewerbschancen und
Kundenzufriedenheit



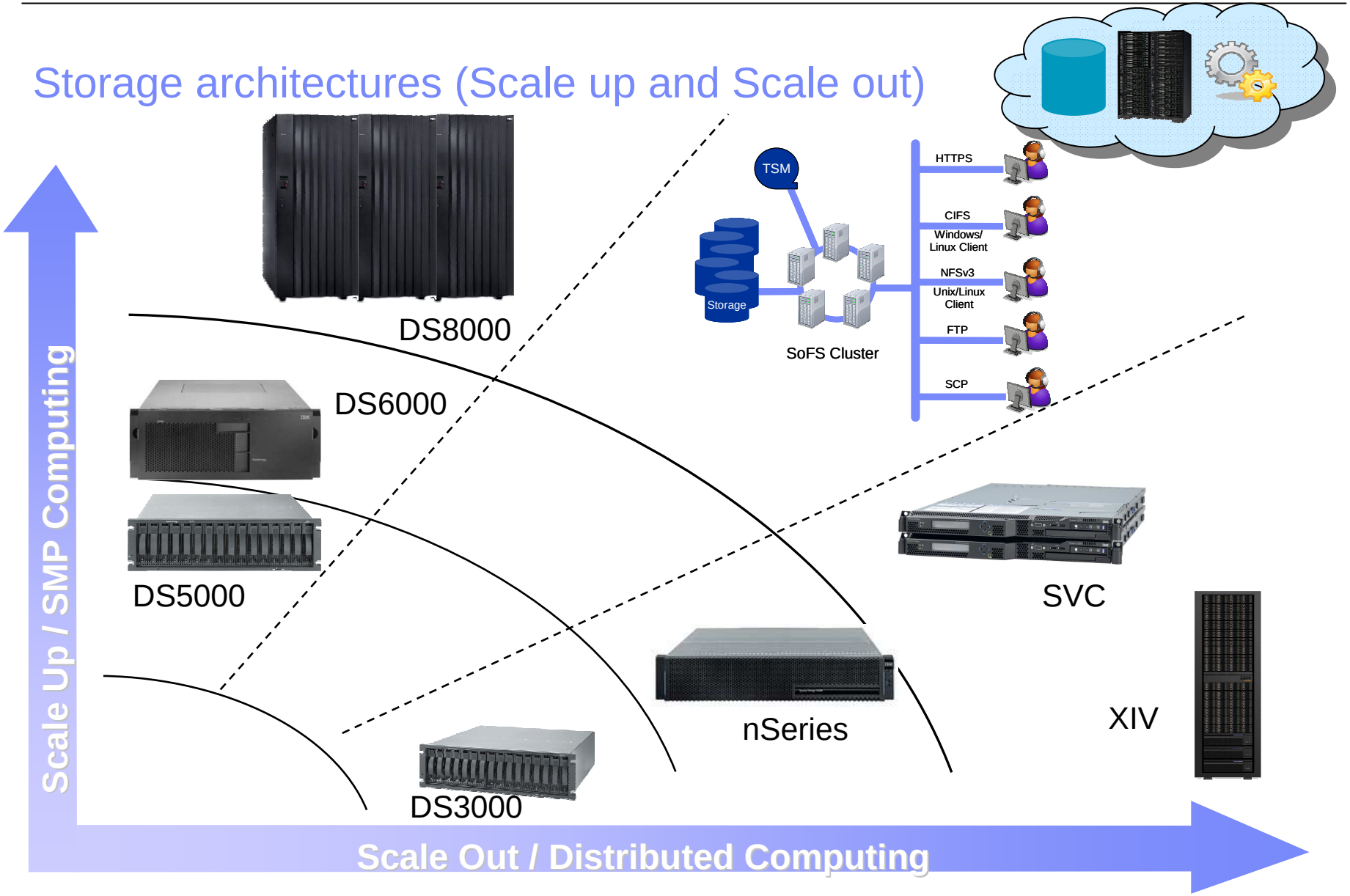
Risiko minimieren

Kein Data lost
Schnellere Reaktion auf “legal” Anforderungen

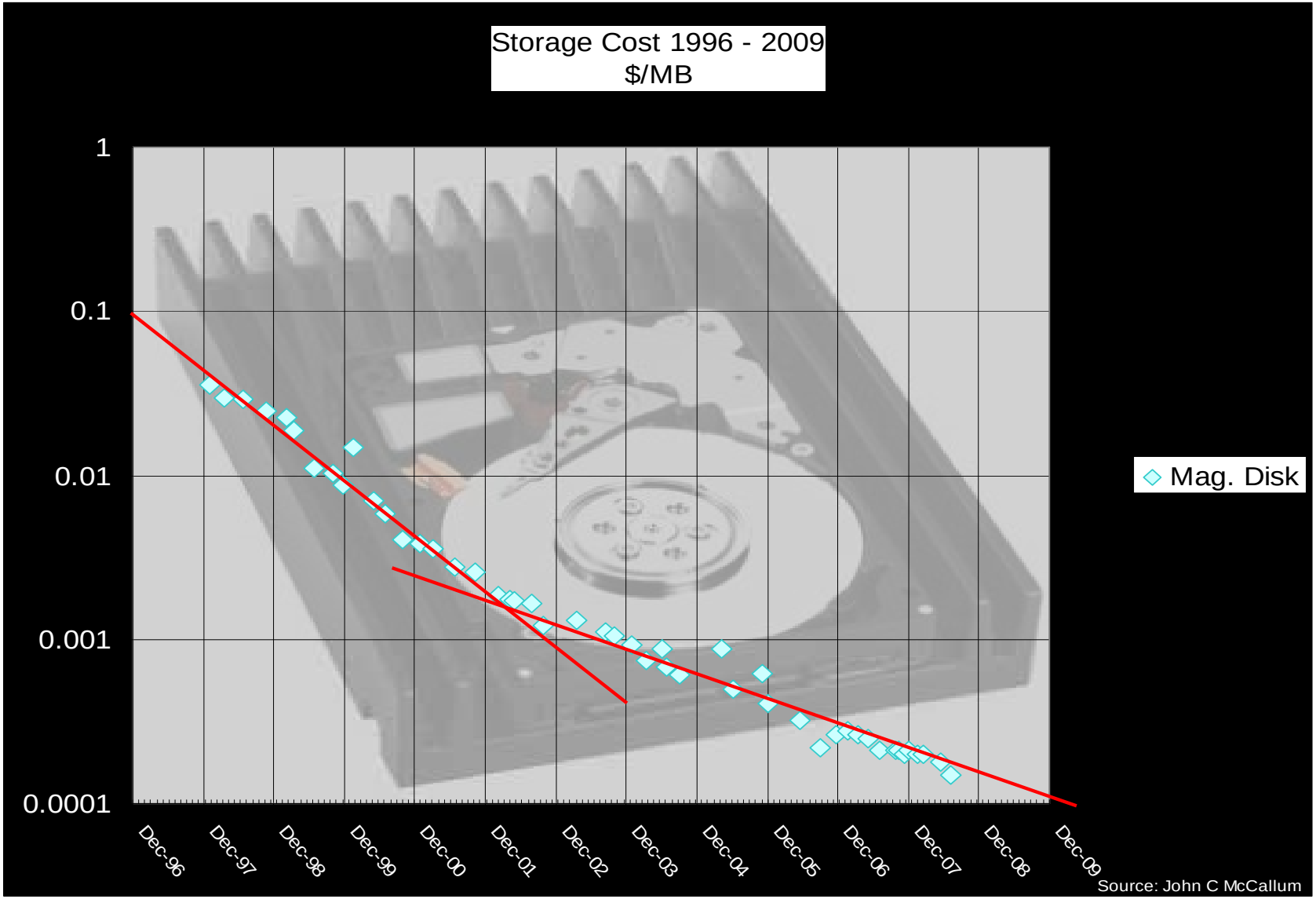
Important STG Acquisitions in Recent Years



Storage architectures (Scale up and Scale out)

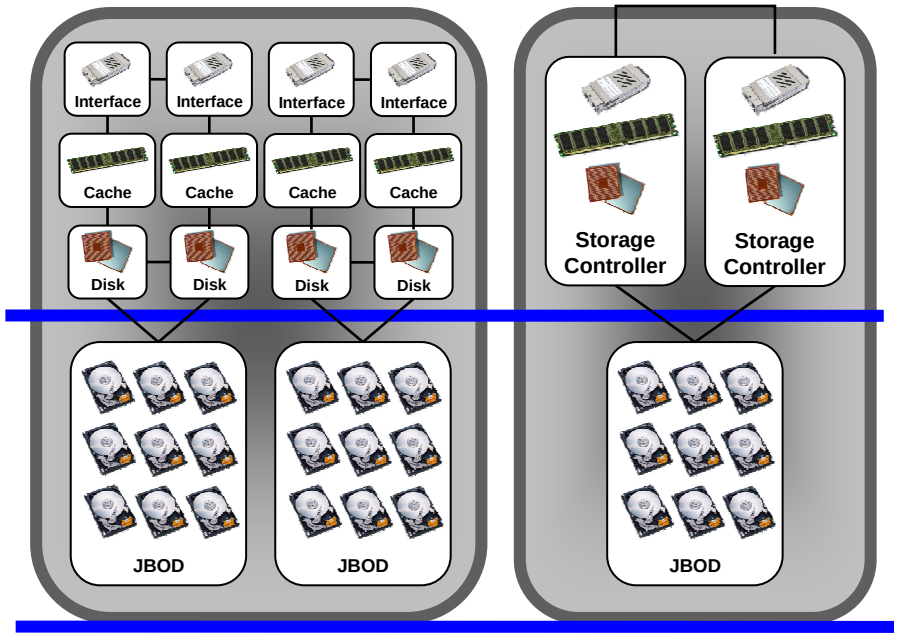


…[end of] The Golden Age of storage…?

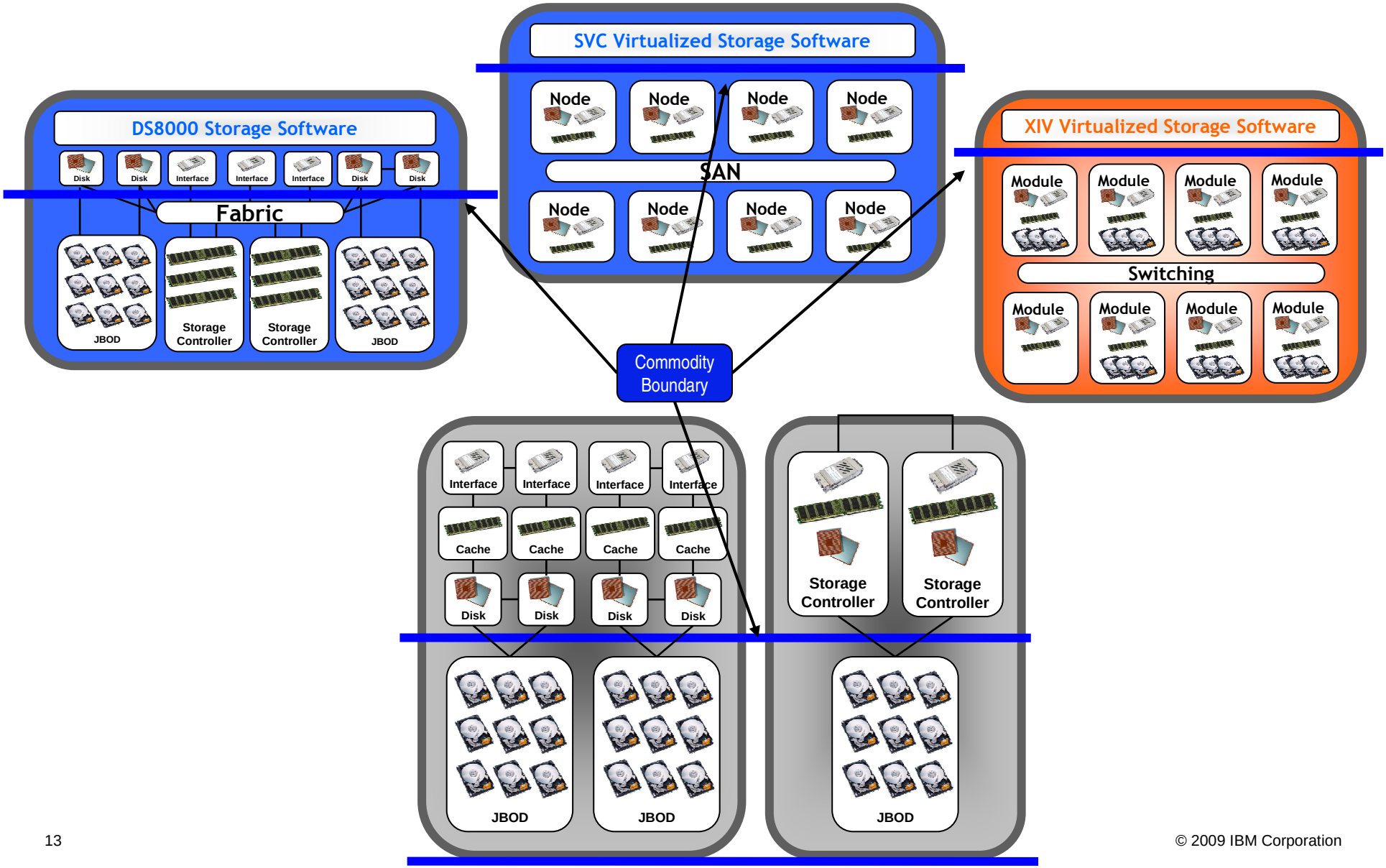


Power (dissipation) – cooling elephants…and mice

Using “commodity” components in Storage Systems



Using “commodity” components in Storage Systems



Agenda

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IBM System Storage DS8000 Series

Enterprise Disk for the World's Most Demanding Clients

Built on 50+ Years of Enterprise Class Innovation

- IBM's Flagship Enterprise Storage Device for Tier 1
- Strong Synergy with IBM Servers (z, i, p)

Over 11,000+ DS8K systems sold worldwide!!!

Over 23,000+ Legacy Systems Active

Performance, Resiliency, and Flexibility to Satisfy the World's Most Demanding Clients

- ***Performance*** – Architected for highest total throughput
- ***Availability*** – Designed for 24X7 Environments
- ***Resiliency*** – Outstanding Copy and Mirroring Capability
- ***Virtualization for Simplification*** – Storage System LPARs
- ***Flexibility*** – High Performance, Online & High Capacity, Nearline Disk options to satisfy tiered storage objectives
- ***Scalability*** – Scalable 2 TB to 1 PB
- ***Heterogeneous Server Support*** - *IBM z/OS, z/VM, OS/400, i5/OS, AIX, Linux, HP-UX, Sun SOLARIS, Novell, KVM, VMware and Microsoft, among others*
- ***Security –*** *Self-encrypting Disk Drives*
- ***Long-Term Cost Advantage*** – Enterprise Choice Warranty, Model-to-Model Upgradeability

5 Key Attributes for Enterprise Storage

Performance

•Superior and consistent performance under all conditions; advanced capabilities to eliminate hotspots and deliver consistent high performance

Reliability

•Business data is more critical than ever; no tolerance for disruption or downtime of service; greater than 5 9's is the new standard

Functionality

•Tier1 functions for replication, thin provisioning, point in time copy etc that are robust, scalable and minimise application performance impact

Manageability

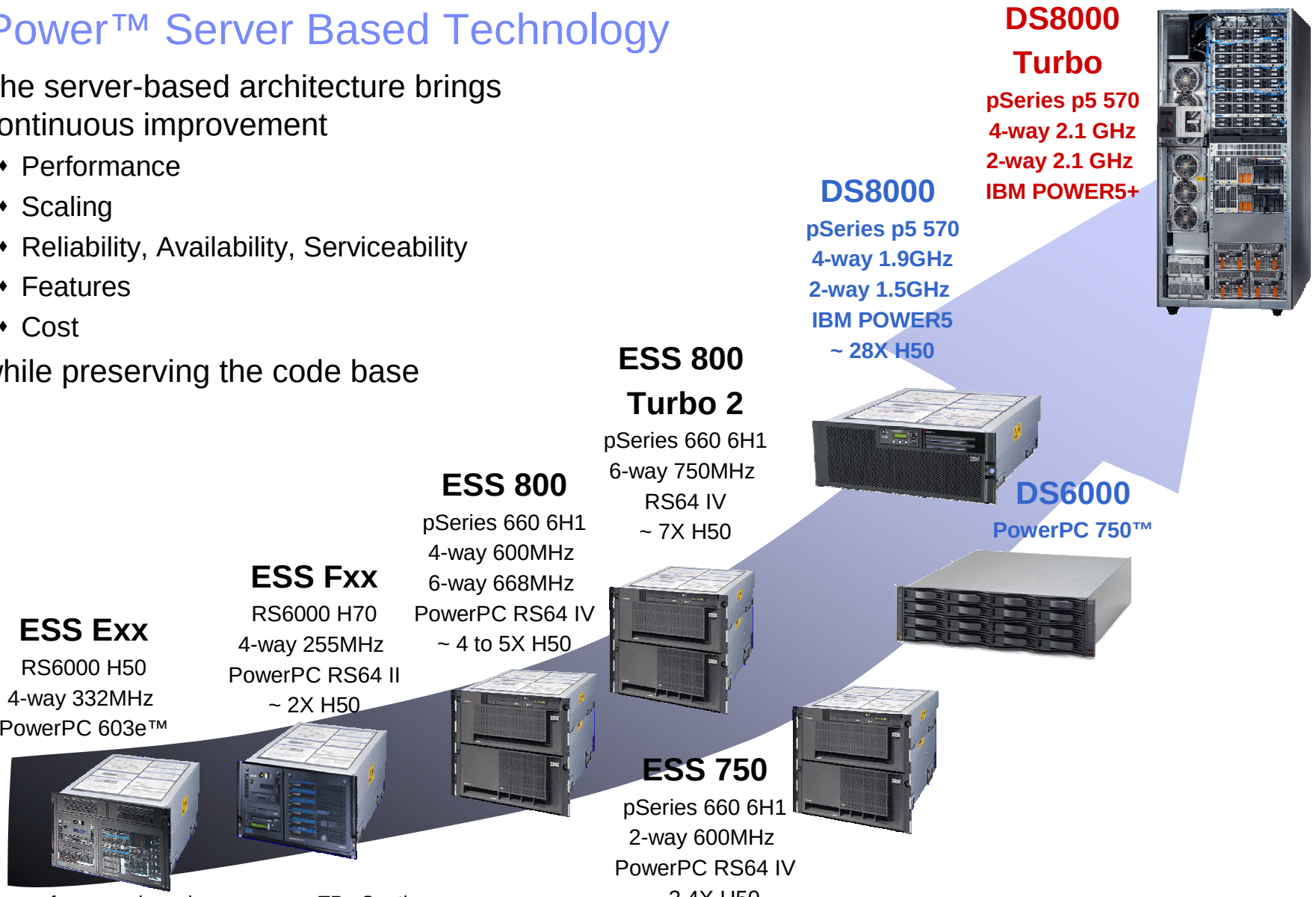
•Virtualised systems delivering superior ease of use and management capabilities

Cost

•Superior cost containment and control; best in class TCO and reduced ongoing management costs

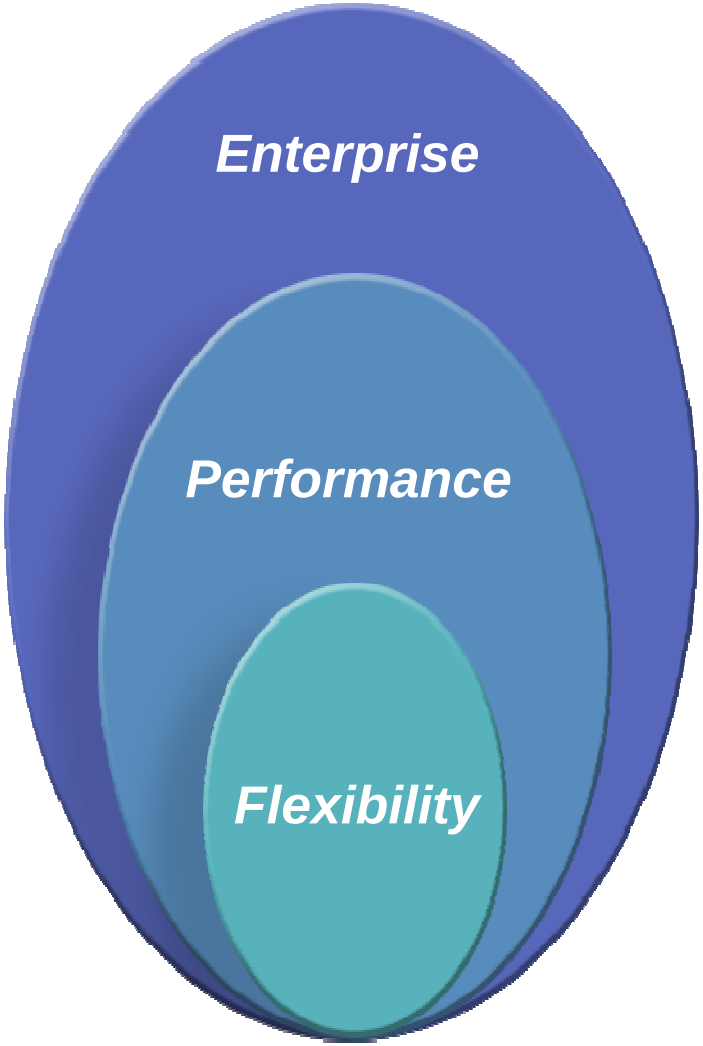
Power™ Server Based Technology

- The server-based architecture brings continuous improvement
  - Performance
  - Scaling
  - Reliability, Availability, Serviceability
  - Features
  - Cost
- while preserving the code base



Relative performance based on processor TPmC ratings

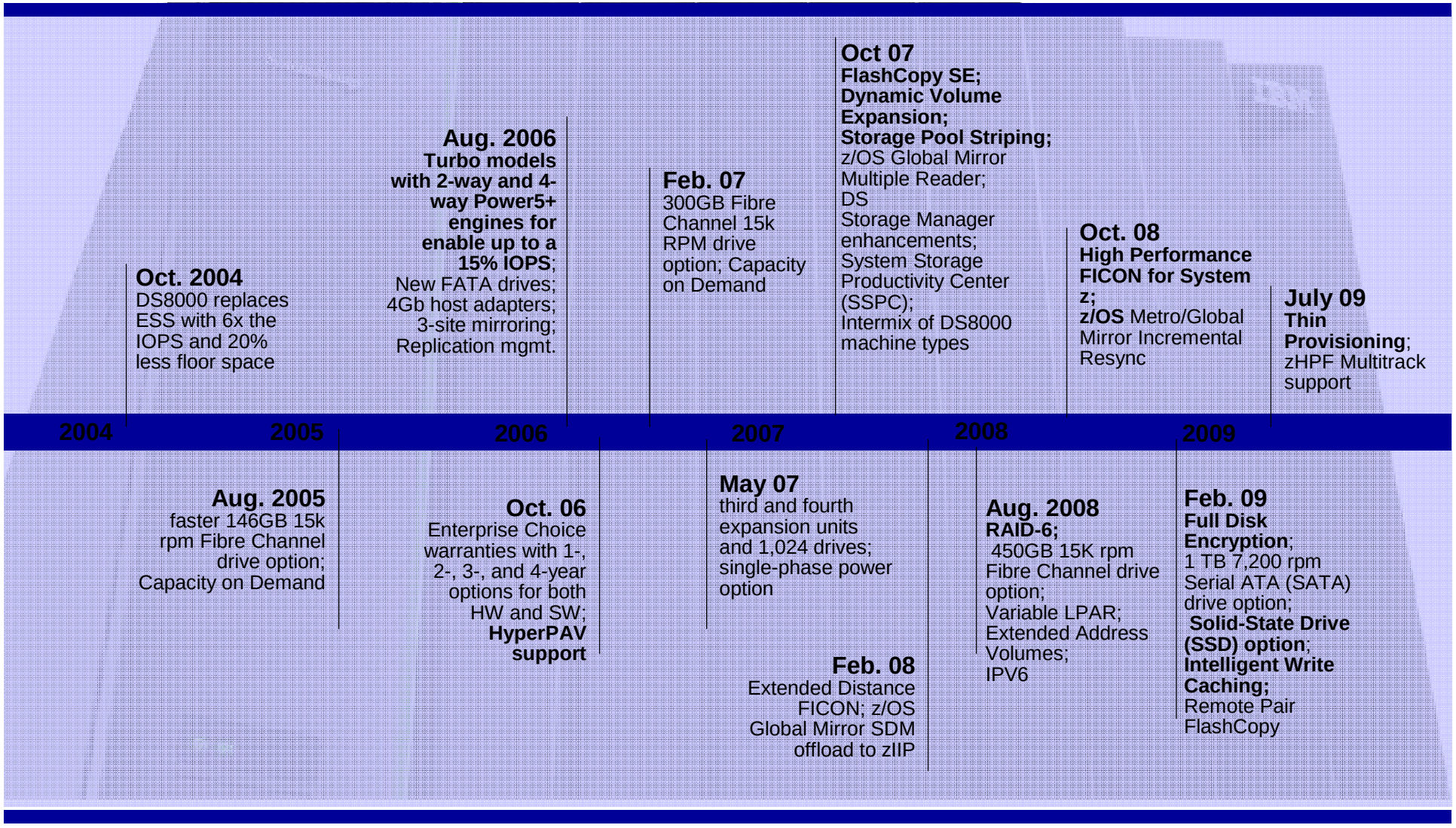
DS8000 Core Strategy



- *Enterprise Features*
  - **Highest Availability**
  - **Advanced data recovery features**
  - **Advanced E2E data checking**
  - **Disaster Recovery Feature**
- *Performance*
  - **Best of Breed: Transactional Workloads**
  - **Copy Service Performance Leader**
  - **Leadership Position in Flash Enablement: Hot-spot Workload Analysis and Optimization**
- *Flexibility*
  - **Satisfy Different Workloads: Performance and Capacity Workloads**
  - **Scalable from 2 TB to 1 PB**
  - **Optimized for Hybrid media and technologies**

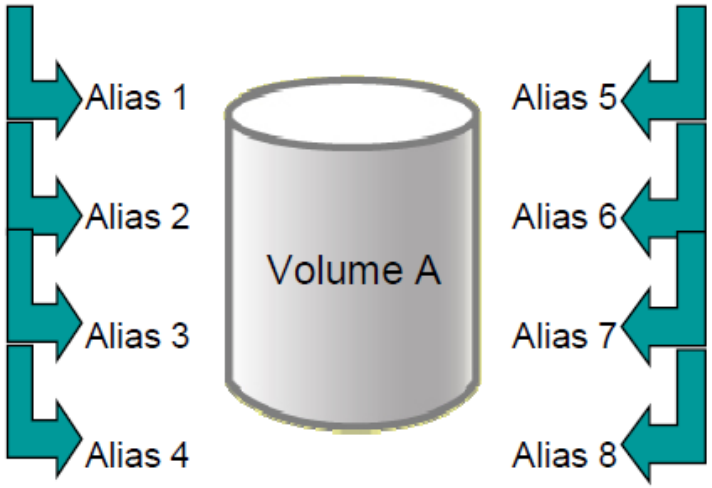
DS8000 Major Releases & Functions

2004 – July.2009



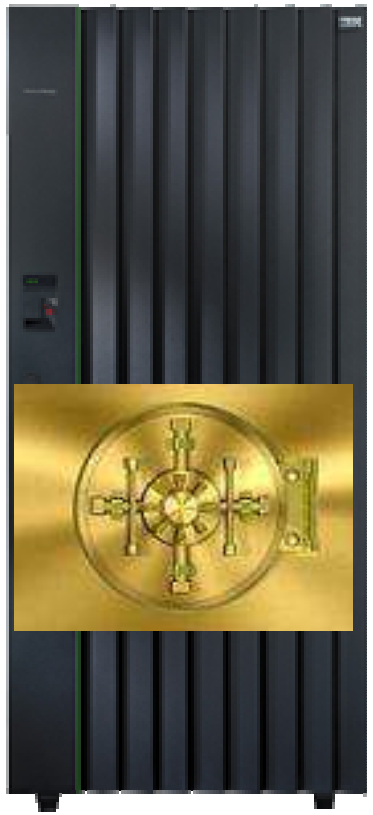
z/VSE V4.2 Enhancement: Parallel Access Volume (PAV)

- Allows a z/VSE V4.2 host to access a single ECKD disk volume with multiple concurrent requests
  - multiple addresses (alias) to a single logical device
  - enables more than one I/O operation to a single logical device
  - may reduce device queue delays
  - volume sharing – not file sharing
- PAV is an optional, licensed feature of IBM DS8000 and DS6000
  - no changes needed for application programs
- Examples of PAV candidates
  - VSAM catalogs, shared clusters, libraries
  - spool files, work files, log files
- Potential benefits include possibility of improved performance/throughput
  - multiple jobs, multiple partitions, CICS
  - gains are *highly dependent on workload*



Full Disk Encryption on DS8000

- Encrypted data on DS8000 series storage controller
  - Capability to install encrypted 146 GB, 300 GB, and 450 GB 15,000 rpm Fibre Channel drives
  - Full Disk Encryption drive sets are optional to DS8000 series
  - Available only as plant order
  - Transparent to applications
  - Can be used by z/VSE V3.1 or later
- Helps to mitigate the threat of
  - Theft
  - Mis-management
  - Loss of critical data



The System z and System Storage encryption solution:

Delivers integrated security

- z/OS encryption controlled via Data Policy (SMS) and user Policy (JCL)
- Open systems encryption controlled via data source, VolSer or drive
- Storage Encryption of Tape and DS8000 managed by IBM Tivoli Key Lifecycle Manager (TKLM) for z/OS V1.0

DS8700- New IBM Power 6-based Controller

DS8k R5

Upgrade der Controller HW, Interconnection und HW auf:

- 4.7 Ghz Prozessor
- PCI-E statt RIO-G
- Arrowhead GX

Nutzen

- 2x höhere Performance
- Perfektes Backend für SSD
- Höhere und bessere Konsolidierungsplatform mit genügend Reserven für Datenspiegelung und FlashCopy
- Schnellerer µCode Load verbessert Service
- 36% weniger Energieverbrauch pro I/O als p5 Modelle
- Update des Daten Analyse Tools um passende Daten auf passende Tierstufen abzuspeichern.
- Optimiert den Einsatz von SSD

GA 6.11 geplant Neu GA: 23.10

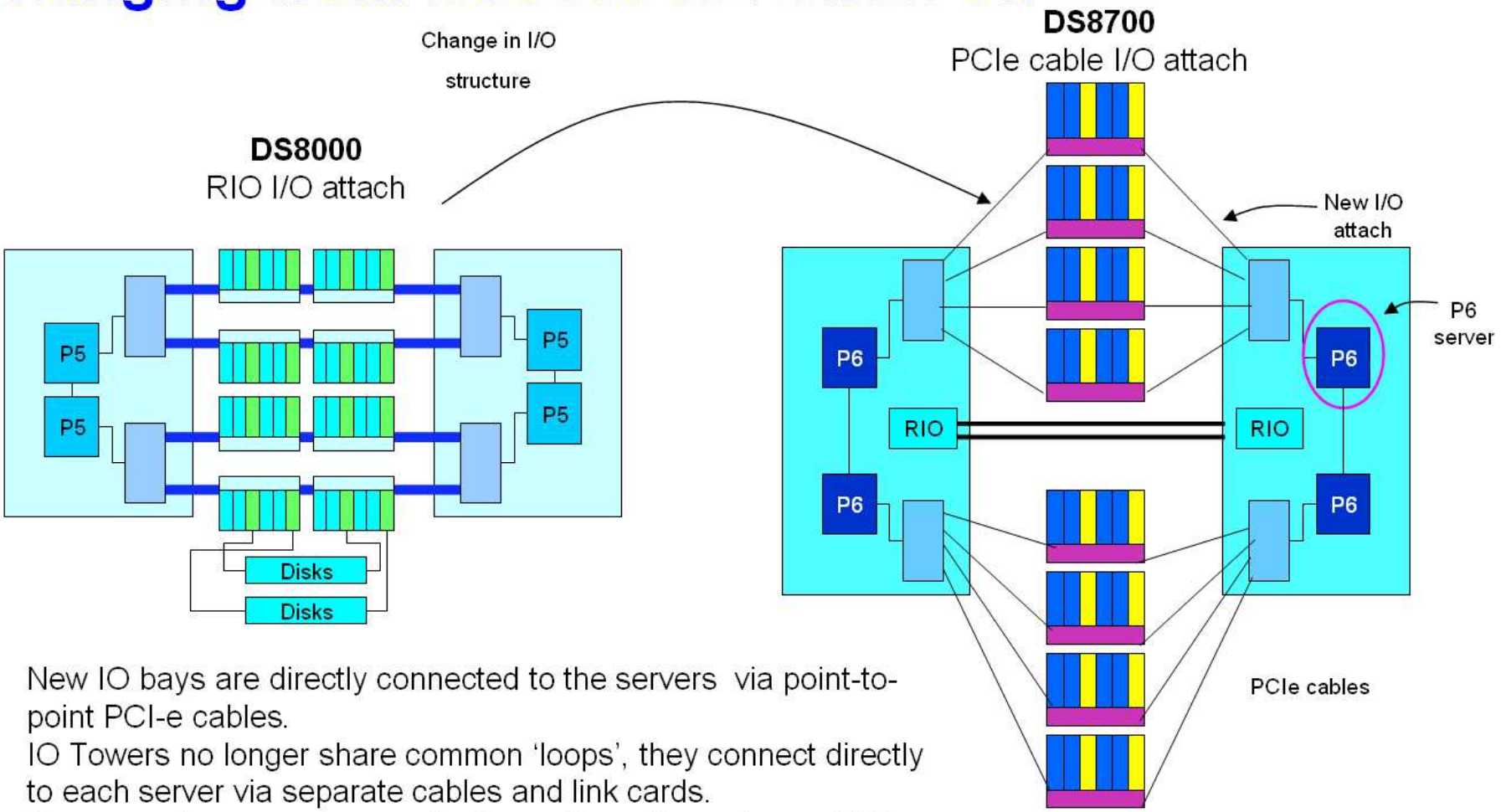
Introducing the New DS8700

The Next Chapter in IBM's Flagship Disk Platform

What's New

- **Performance**
  - Up to over 150% performance boost with new IBM POWER6-based controller
  - New, faster PCI Express (PCI-E) internal fabric enables much higher performance and scalability
  - Almost 70% faster ASIC on the device adapters
- **Availability**
  - Single model, scalable via concurrent upgrade of all components
  - Shorter service windows with faster concurrent microcode updates
- **Management**
  - Simplified management, data protection now provides application-aware FlashCopy
- **Security**
  - Full Disk Encryption enhancements address PCI-DSS compliance

Changing from DS8000 to Follow on



- New IO bays are directly connected to the servers via point-to-point PCI-e cables.
- IO Towers no longer share common 'loops', they connect directly to each server via separate cables and link cards.
- The server to server communication path continues to use RIO, but is now isolated from IO traffic.

- 4.7 Ghz P6 570 CECs
- Cache 32GB to 384GB
- 4Gb/s FC / FICON

Performance Projections

			DS8700 R5 vs DS8300	
	units		P6	
Rd Seq	GB/s		**2X**	
Wr Seq	GB/s		**2.3X**	
DBz	K IO/s		**1.4X**	
DB open	K IO/s		**1.6X**	
Power consumption	Watt/IOs		**0.64X**	

DS8700 Performance Matrix (System z workloads)*

Higher Performance for Every Benchmark!

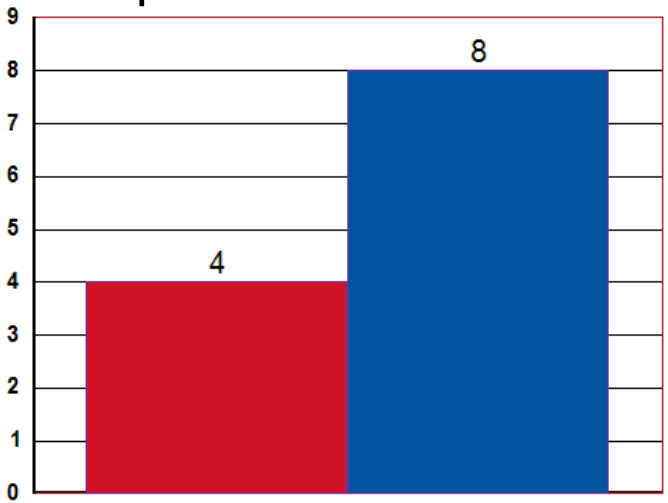
DS8K Metric	DS8700 Result	DS8300 Equivalent	Change
FICON 4K Read Hit (IOs/sec)	364K	232K	56%
FICON 4K Write Hit (IOs/sec)	145K	120K	20%
zHPF 4K Read Hit (IOs/sec)	420K	344K	22%
zHPF 4K Write Hit (IOs/sec)	162K	124K	30%
FICON DB zOS (IO/sec)	181K	124K	45%
FICON Cache Hostile (IO/sec)	142K	89K	59%
FICON Cache Friendly (IO/sec)	206K	142K	45%
zHPF DB zOS (IO/sec)	201K	165K	21%
zHPF Cache Hostile (IO/sec)	156K	109K	43%
zHPF Cache Friendly (IO/sec)	227K	189K	20%
FICON 4K Read Miss (IOs/sec)	129K	64K	101%
FICON 4K Read-Write Miss (IOs/sec)	89K	62K	43%
zHPF 4K Read Miss (IOs/sec)	128K	86K	48%
zHPF 4K Read-Write Miss (IOs/sec)	90K	63K	42%
Sequential Read BW (GB/sec)	9.3	3.7	151%
Sequential Write BW (GB/sec)	5.3	2.0	165%

*Note: For almost all these maximum throughput benchmarks, all 32 Host Adapters must be utilized.

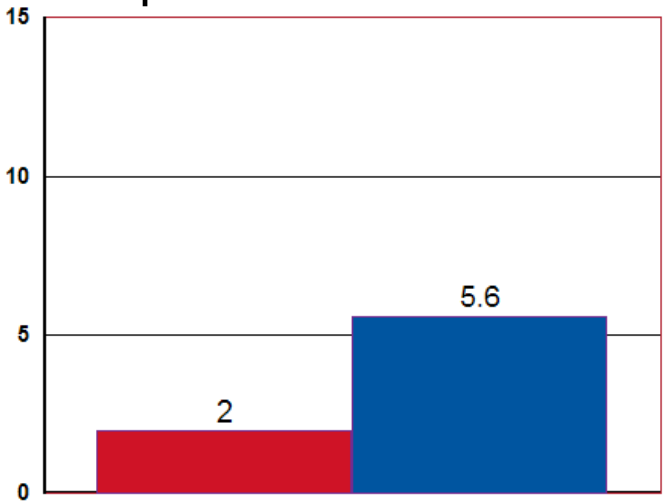
*** Preliminary Pre-GA benchmarks**

DS8000 POWER6 Estimated Performance

Sequential Reads – GB/s



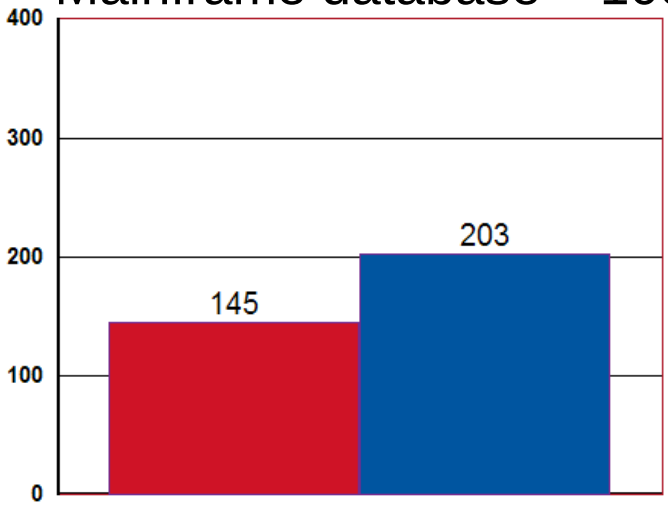
Sequential Writes – GB/s



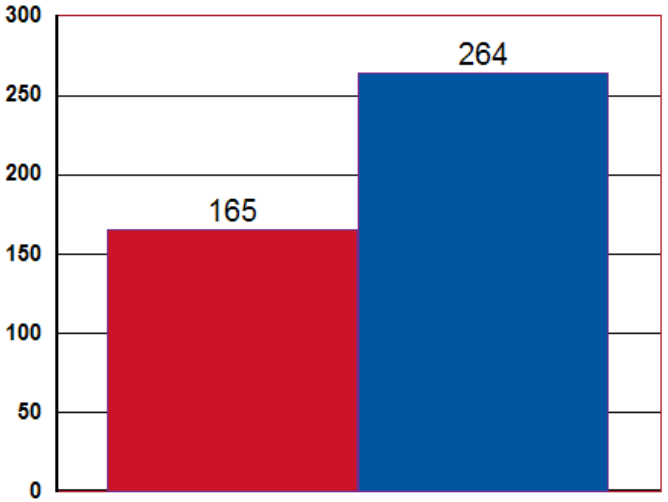
P5+

P6

Mainframe database – 1000 IO/s

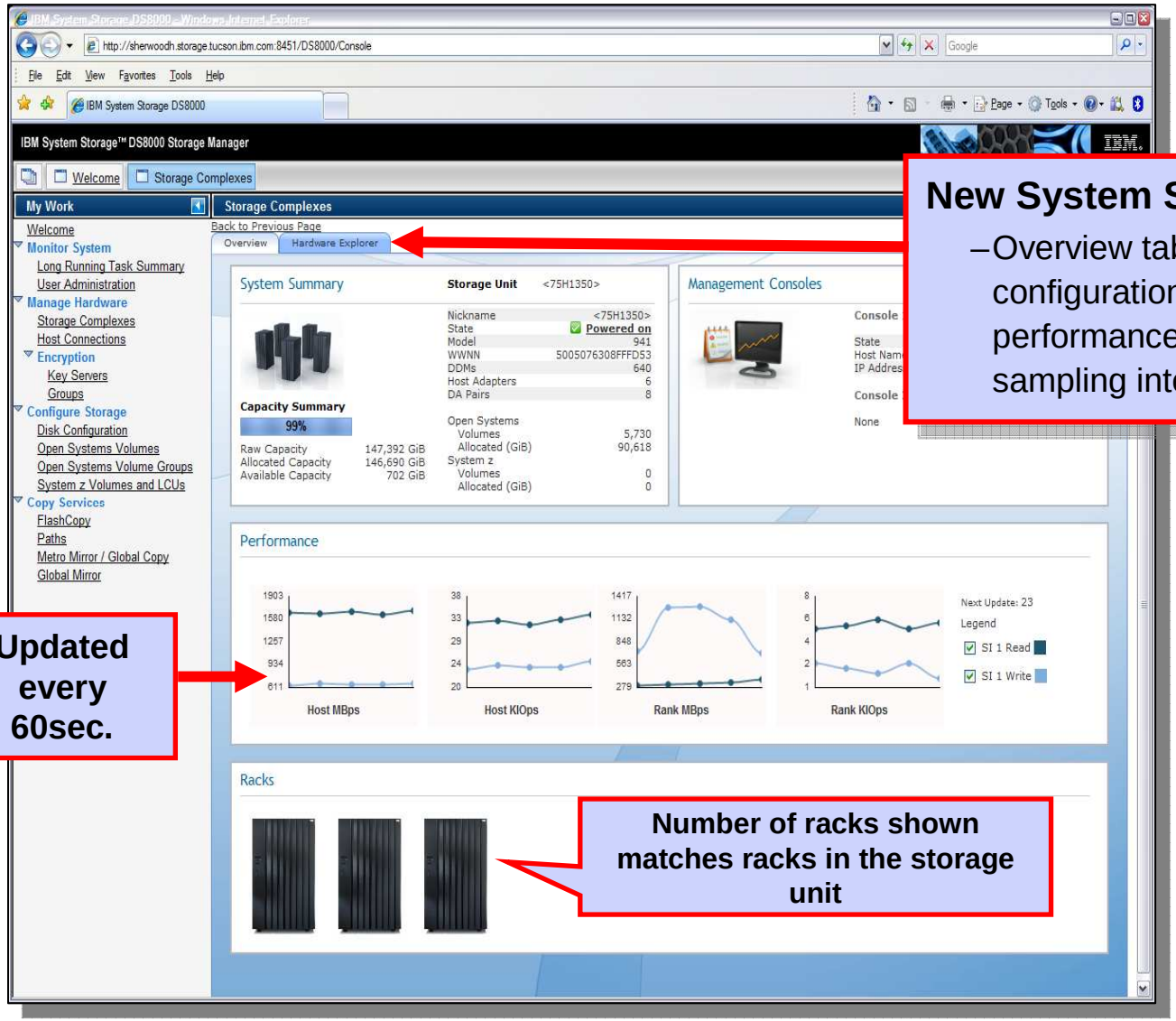


Distributed database – 1000 IO/s



Improved and Simplified Management

GUI enhancements



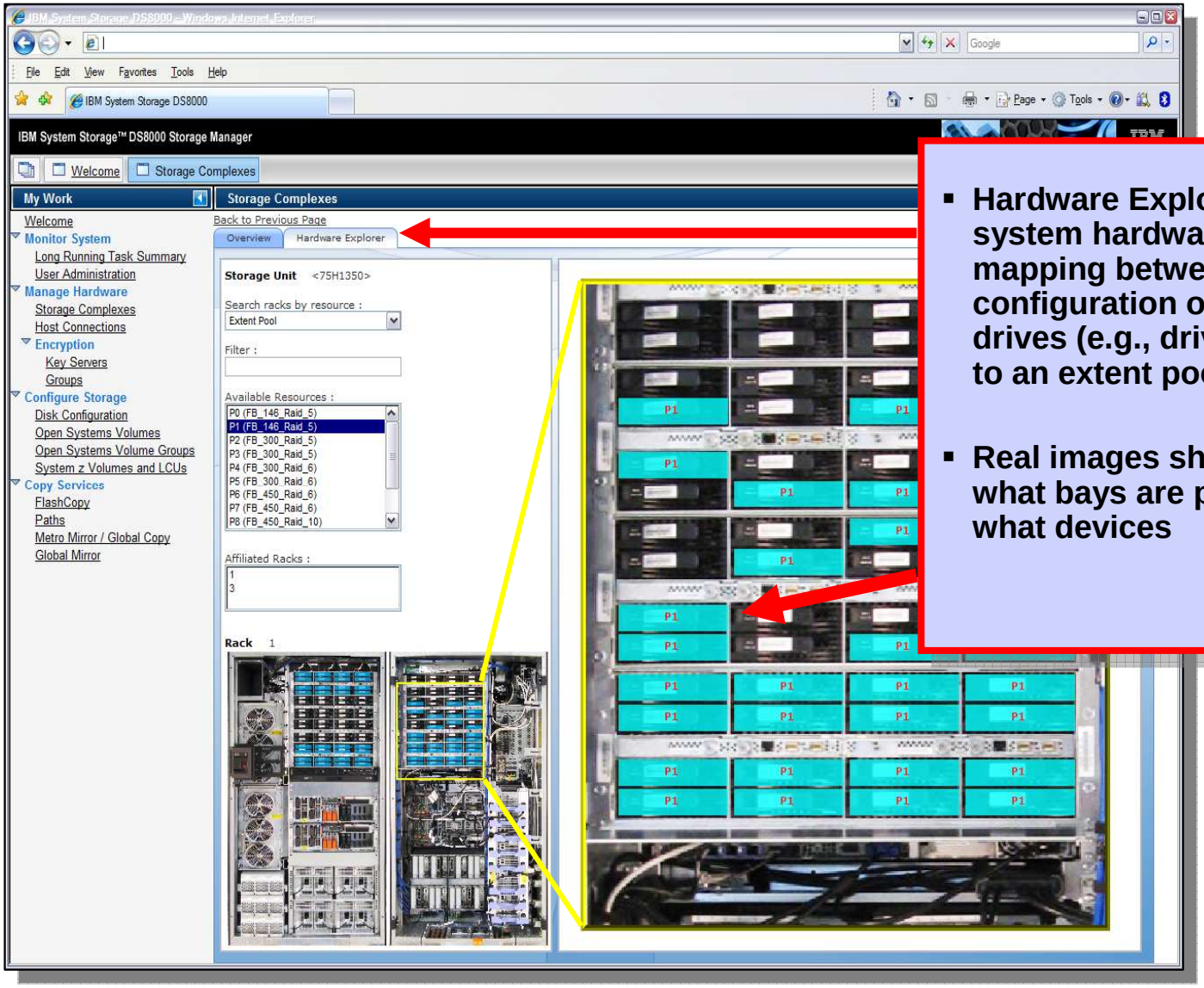
New System Summary Panel

- Overview tab displays system configuration and real-time performance data for a 5 minute sampling interval

Updated every 60sec.

Number of racks shown matches racks in the storage unit

System Summary Panel – Overview Tab



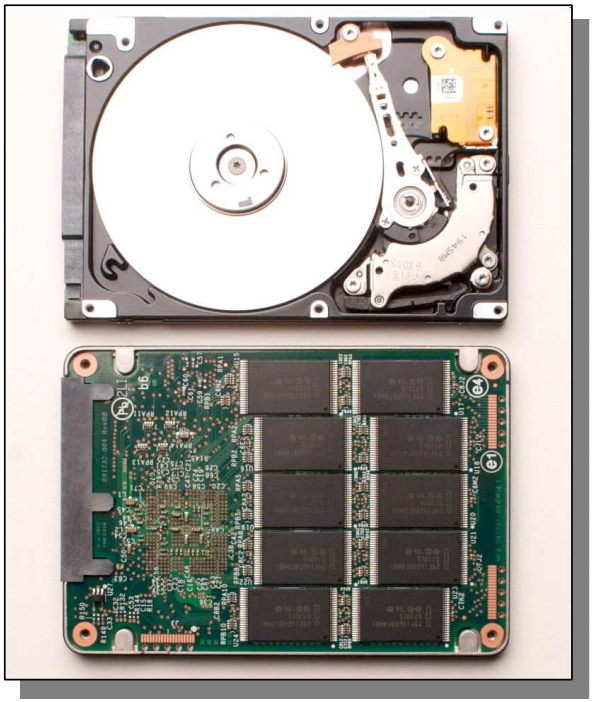
- **Hardware Explorer tab shows system hardware and a mapping between logical configuration objects and drives (e.g., drives belonging to an extent pool or array)**
- **Real images show exactly what bays are populated with what devices**

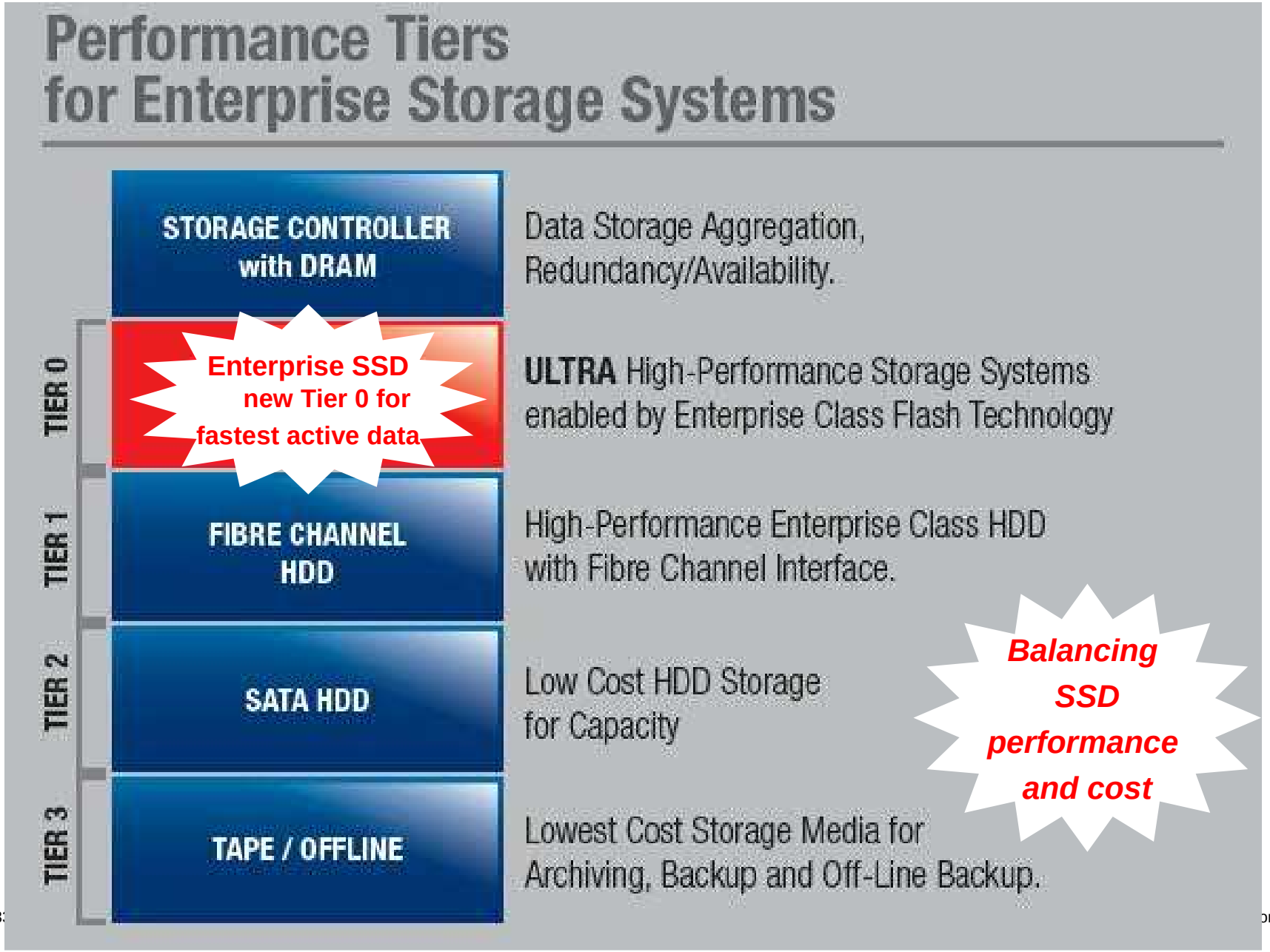
SSD

DS8000 Solid-State Drive Option

New Tier-0 drives for high priority, time-sensitive applications

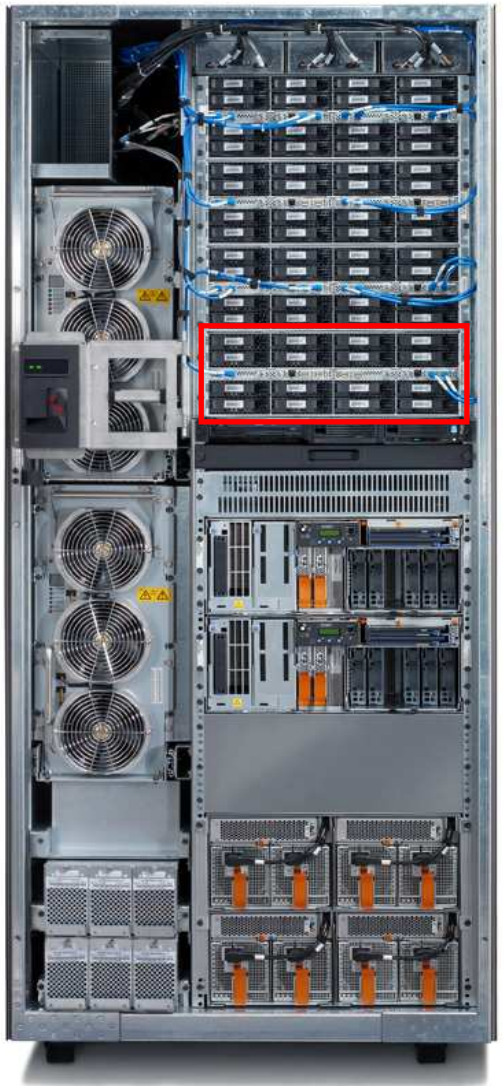
- What are solid-state drives?
  - **Semiconductor (NAND flash)**
  - **No mechanical read/write interface**
  - **No rotating parts**
  - **Electronically erasable medium**
  - **Random access storage**
- Client Value
  - **Increased performance for transactional applications**
    - **Online Banking / ATM / Currency Trading**
    - **Point-of-Sale Transactions / Processing**
    - **Real-time data mining**
  - **Faster data replication and recovery from outages**
  - **Historically used for military applications that needed to withstand extreme temperatures, shock, vibration, and dust**
- Market view
  - **Cost is very expensive compared to spinning disks**
  - **Industry expecting breakthrough in capacity (currently available in 73GB and 146GB)**
  - **Analysts foresee rapidly closing gap in pricing**
  - **Cost may be reduced by lowering cache size**




Performance Tiers
for Enterprise Storage Systems
STORAGE CONTROLLER with DRAM
Data Storage Aggregation, Redundancy/Availability.
TIER 0
Enterprise SSD new Tier 0 for fastest active data
ULTRA High-Performance Storage Systems enabled by Enterprise Class Flash Technology
TIER 1
FIBRE CHANNEL HDD
High-Performance Enterprise Class HDD with Fibre Channel Interface.
TIER 2
SATA HDD
Low Cost HDD Storage for Capacity
TIER 3
TAPE / OFFLINE
Lowest Cost Storage Media for Archiving, Backup and Off-Line Backup.
Balancing SSD performance and cost

DS8000 R4.2 SSD Release – 1Q2009

- SSD types available
  - **73 GB – 16 drives**
  - **146 GB – 16 drives**
- Maximum 16 SSD drives for each DA pair
- RAID-5 only
- Copy services support



MARKET ANALYSIS

Worldwide Solid State Drive 2009–2013 Forecast and Analysis

- In the enterprise, IDC continues to believe that SSDs complement HDDs for certain applications. The desire for increased performance, better utilization, faster access times, and lower power consumption is providing an increasing opportunity for SSD-based solutions in the datacenter where there is a premium on high performance.

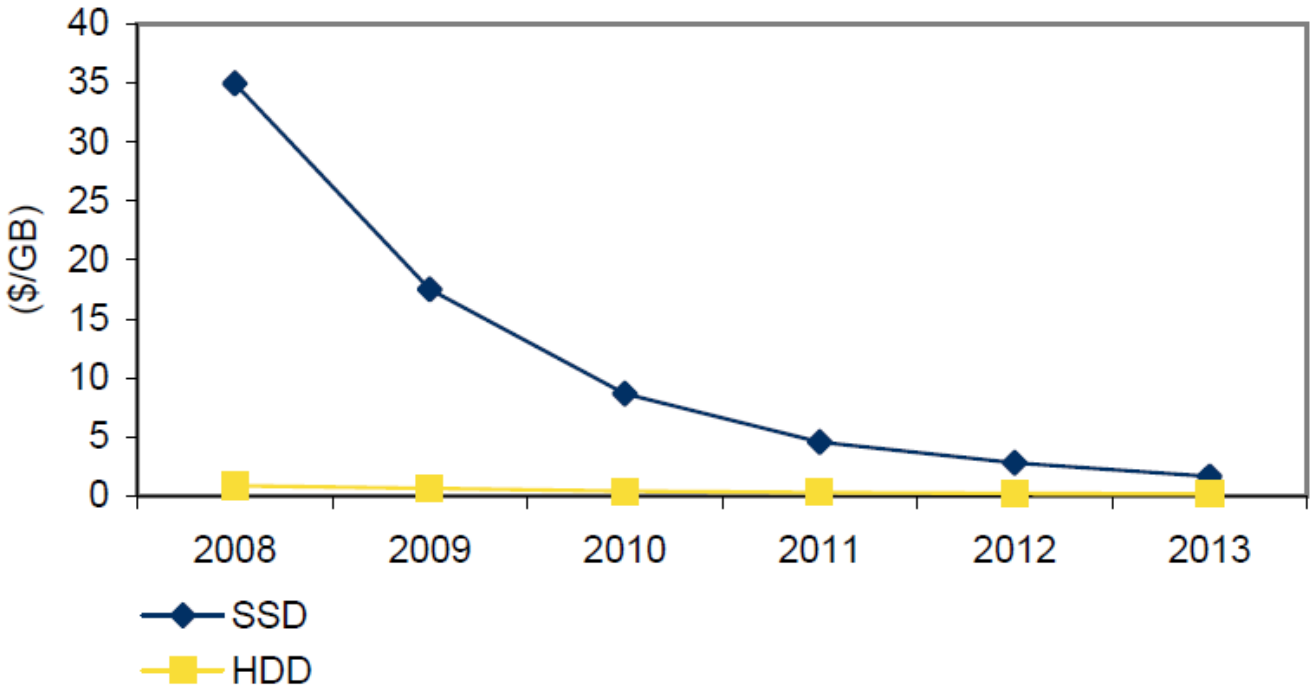
- **Higher performance.** SSDs can achieve multiple gigabytes (GB) per second of random data throughput. SSDs offer high input/outputs per second (IOPs) performance and more consistent I/O response time due to its low access time and high bandwidth.

- **Greater energy efficiency.** With no mass to move, SSDs offer lower power consumption. This also translates into less heat generation, which in turn lowers cooling costs at the system level.

- **Higher reliability.** While yet to be validated in the market with years of historical experience, SSDs have no moving or mechanical parts to fail. Early specifications indicate that SSDs provide a high mean time between failure (MTBF) and have a low probability of mechanisms causing an entire SSD to fail.

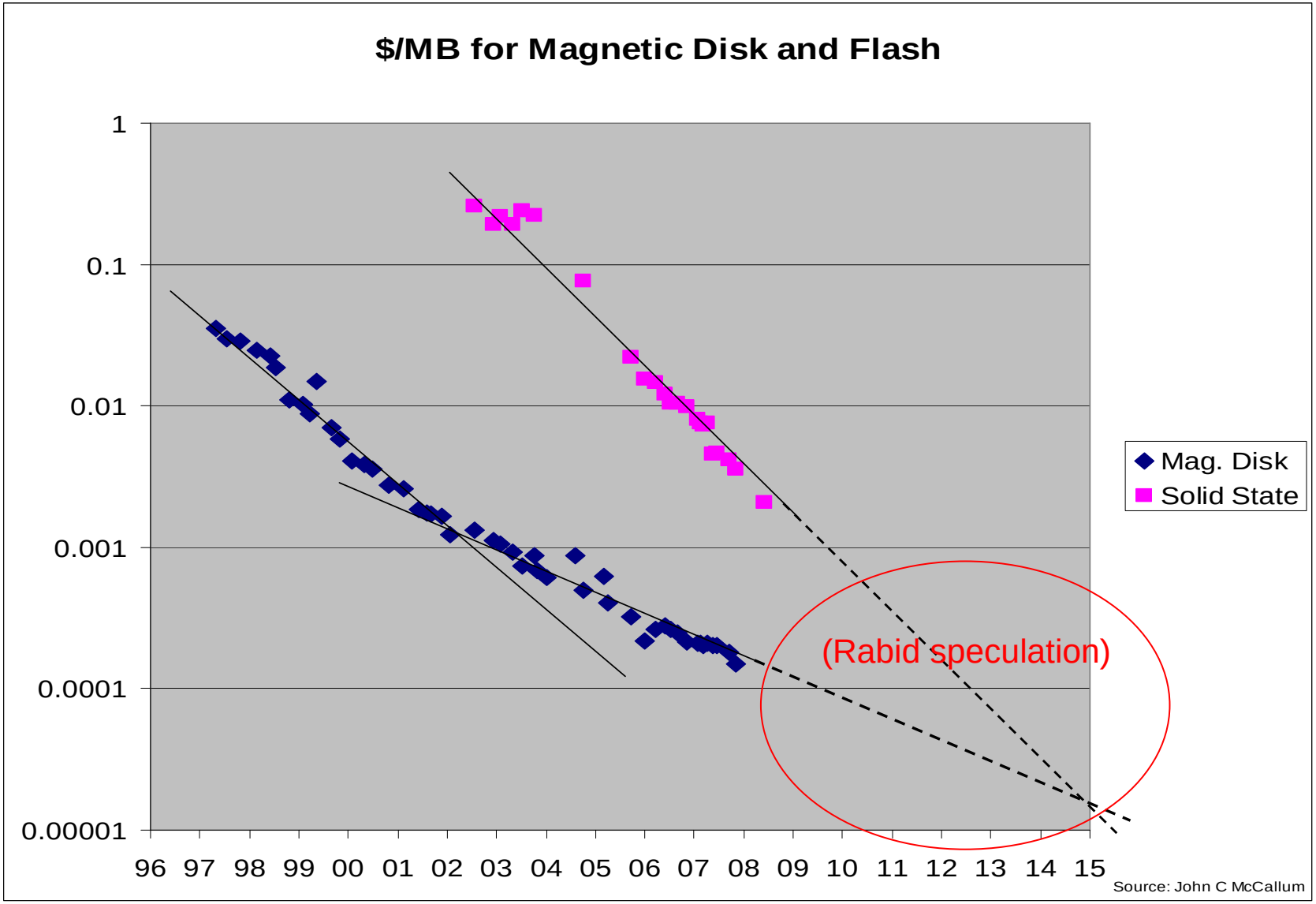
Worldwide Solid State Drive 2009–2013 Forecast and Analysis

Worldwide Enterprise Average Price per Gigabyte Enterprise Flash SSD and Enterprise HDD Comparison, 2008–2013



Source: IDC, 2009

SSD vs. HDD cost



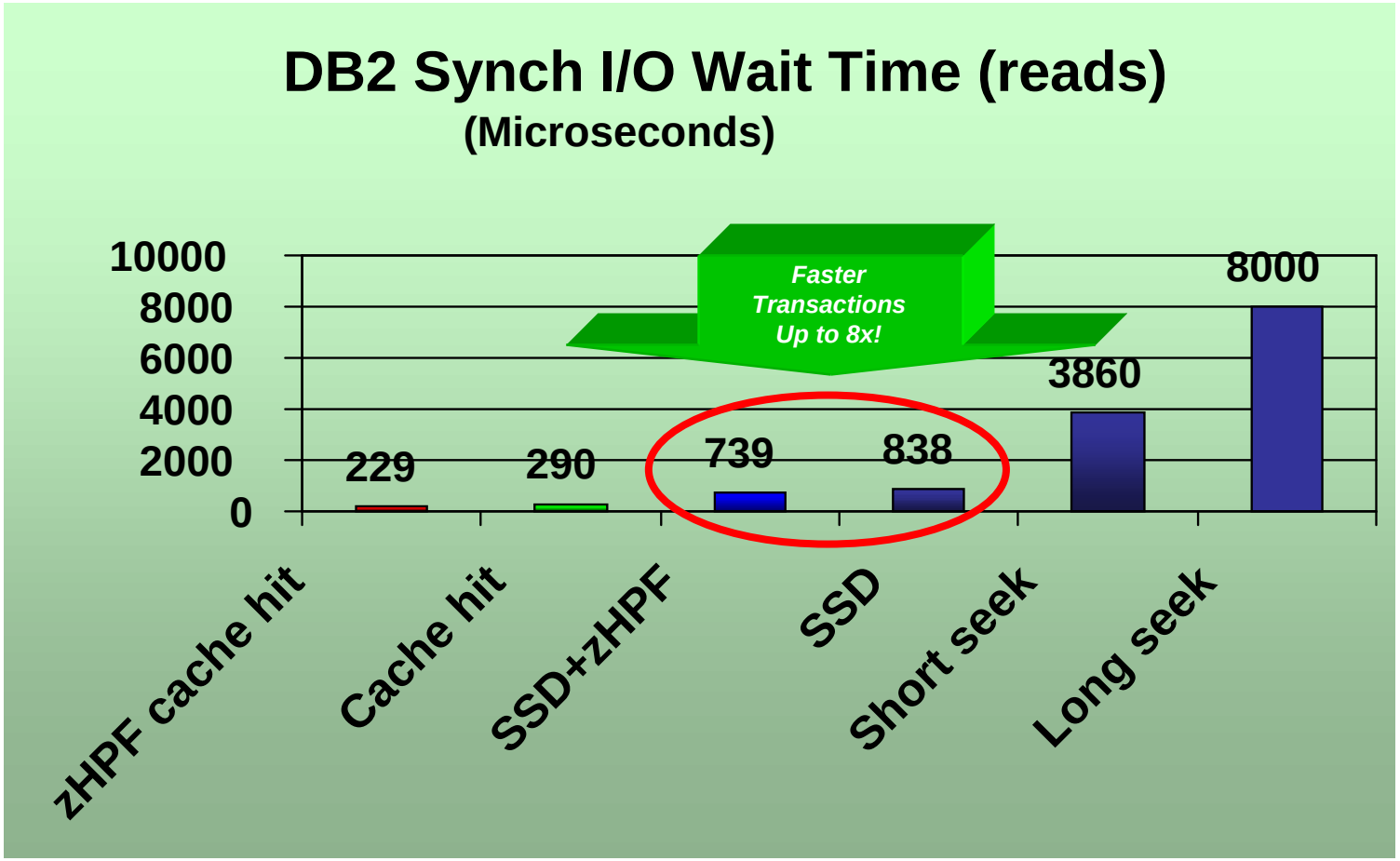
Worldwide Solid State Drive 2009–2013 Forecast and Analysis

Worldwide Enterprise SSD Shipments, Revenue, ASP, and Capacity Shipped, 2008–2013

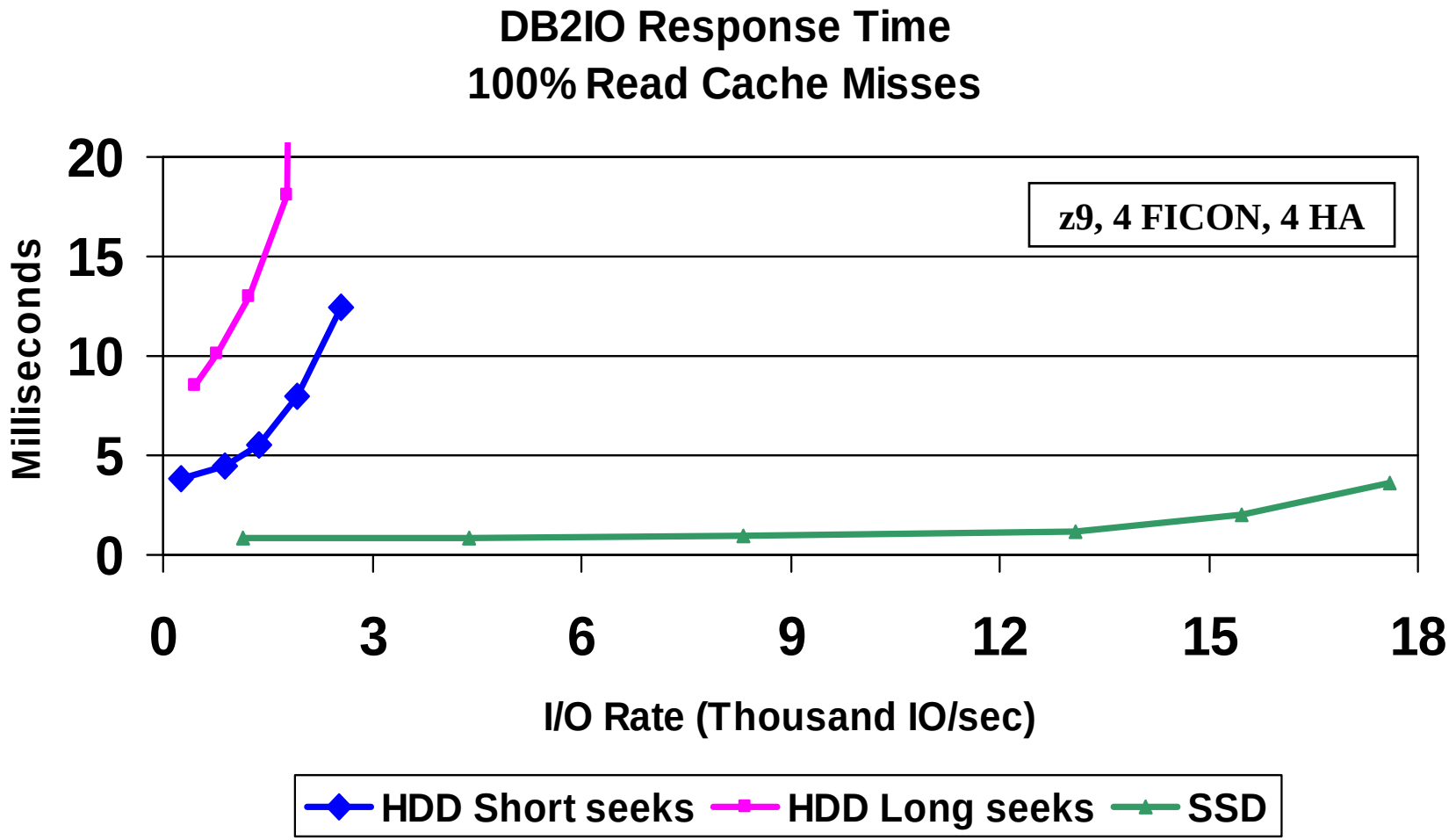
	2008	2009	2010	2011	2012	2013	2008–2013 CAGR (%)
Shipments (000)							
Enterprise DRAM	0.6	0.8	0.9	1.0	1.1	1.3	15.2
Enterprise NAND IO intensive	11.7	56.5	290.1	776.1	1,618.3	3,160.0	206.7
Enterprise NAND	29.2	87.9	204.7	607.4	955.3	1,248.1	111.9
Total	41.5	145.2	495.6	1,384.5	2,574.8	4,409.4	154.3

DS8000 SSD Performance

DB2 Sync I/Os Running on z/OS



HDD vs SSD Response Time on DS8000
DB2IO Workload, one RAID-5 rank



IBM SAP International Competence Center

ISICC

... combining our strengths

IBM

IBM System z and IBM DS8000 for SAP Environments - a winning combination -

Maik Gasterstaedt

Technical Sales enablement for

IBM System Storage and SAP

SAP and IBM

Improved performance with zHPF and SSD's (Solid State Drives)

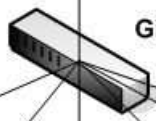
Database Storage
- IBM System Storage DS8300 Turbo dual frame
- 1 frame with 32 SSD's and 32 HDD's
- 1 frame with 64 SSD's and 64 HDD's
- capacity of each drive 146 GB
- usable capacity of 11 TB for each SSD's and HDD's
- 128 GB memory
- Host connection via 16 long wave FICON Express4 connections

Active Logs Storage
- IBM System Storage DS8300 Turbo
- 128 FC HDD's with 146 GB capacity each
- usable capacity 13 TB
- 128 GB memory
- Host connection via 8 long wave FICON Express4 connections

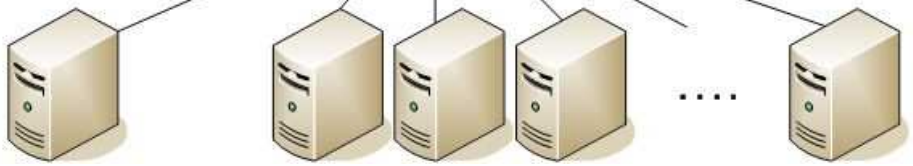
SAP database server
- IBM System z10 Enterprise Class server
- 2 z/OS LPARS
- each with 16 dedicated CP's
- each with 16 GB central memory

- 2 internal Coupling Facilities
- each with 8 GB memory

Software Environment
- z/OS release 01/09/00
- DB2 for z/OS 9.1 level dated 11/02/2008
- AIX® 5.3 release level 06
- SAP NetWeaver 2004s, kernel release 7.10, patch no 95
- SAP Deposits Management software



Gigabit Ethernet Switch



1 Presentation Server
- IBM System p 620
- 4 600 MHz processors
- 4 GB memory

33 Application Servers
- IBM System p 5-550
- each with 4 2.1 Ghz processor cores
- each with 32 GB memory

SAP and IBM - Core Banking Day Posting Workload

Improved performance with zHPF and SSD's (Solid State Drives)

SSD Measured results	Baseline HDD only	HDD + SSD	% Improvement	HDD + SSD + zHPF	% Improvement
Throughput	**14.3M postings/hour**	**18.0M postings/hour**	26%	**18.7M postings/hour**	31%
DB request time	**1.13 sec**	**0.682 sec**	40%	**0.605 sec**	41%
DASD response time	**5.18 ms**	**3.35 ms**	35%	**2.85 ms**	45%

Feature	Benefits
SSD (Solid-State Drive)	• **Increased data throughput** • **Improved Database response time** • **Improved data center environmental results, (e.g., reduced electrical energy needs, facility space, emissions, etc.)**
zHPF (High Performance FICON for System z)	• **Exploits a new channel protocol especially designed for more efficient I/O operations** • **Designed to satisfy the performance requirements of bandwidth-hungry applications**

SSDs for DS8000 in SAP Distributed Environments

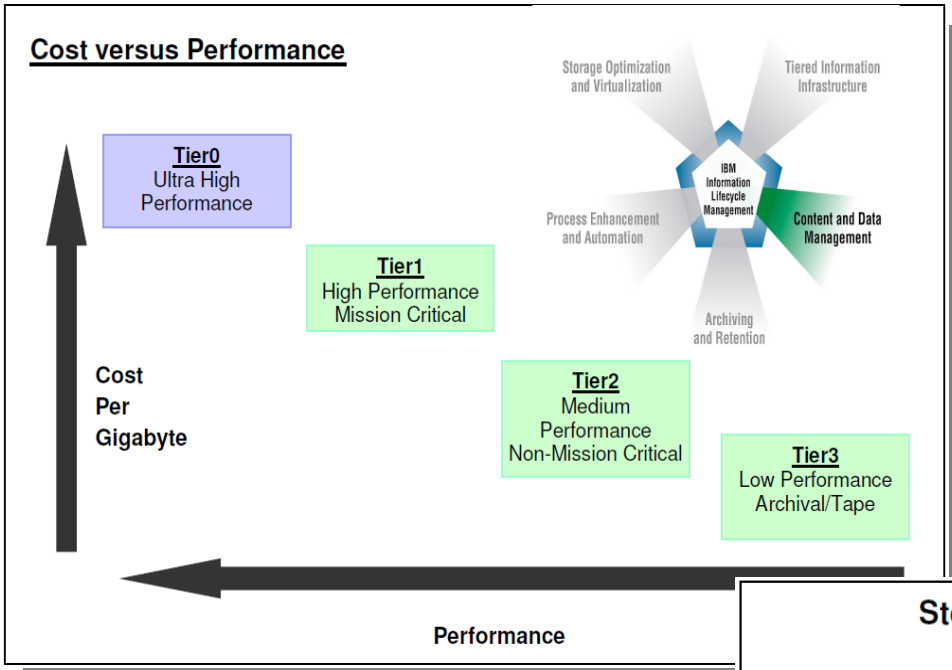
Optimize Disk infrastructure with mix of SDD/HDD

(Sample Workload OLTP / DB*)

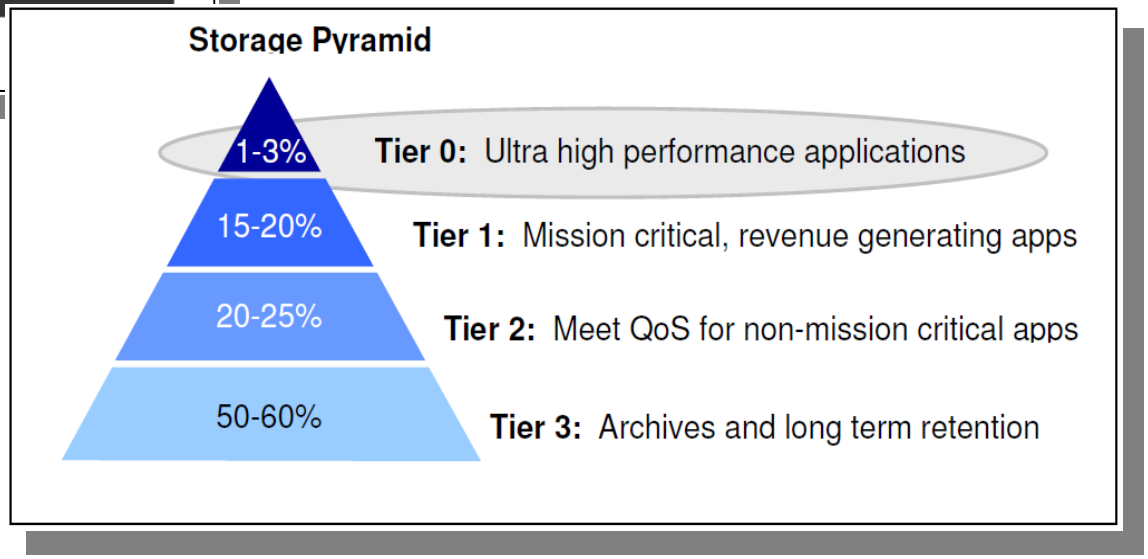
- **SSDs or "flash drives" offer a new way of running your system to boost I/O Ultra high speed I/O can**
  - **Improve your system performance**
  - **Save space in your computer room**
  - **Lower your electrical/cooling costs**
  - **Fewer drives improves overall hardware reliability**

All HDD (Hard Disk Drives)	800 HDD
Optimized Mix: SSD + HDD	36 SSD + 80 HDD
Total transactions	1.65x more
Average drive throughput – I/O per second (HDD + SDD)	10.8x more (SSD does 97% work)
SSD average I/O response time	3.1x better Reads
Fewer total drives	86% reduction
Energy for I/O	90% reduction

SSD positioning for SAP application data



- Examples of SAP data categories:
- Tier 0
  - DB-hotspots, SAP system tables, active transactional data, buffer areas
- Tier 1
  - SAP master data
- Tier 2:
  - Non-production systems, persistency layers
- Tier 4:
  - SAP archives



- **Hot data may be only 10-20% capacity, but represent 80-90% activity**

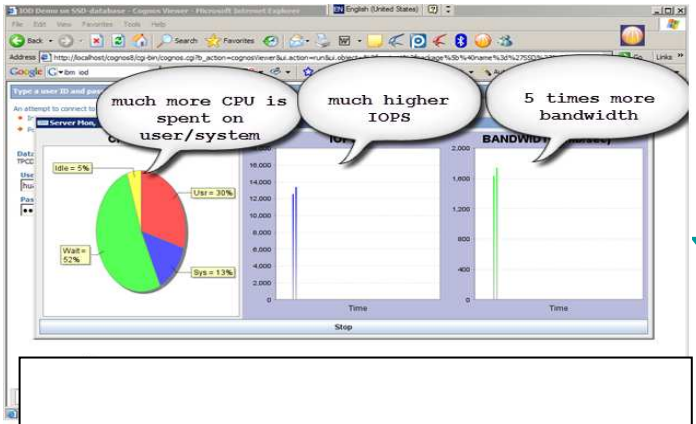
DB2 Data Warehouse Configurations

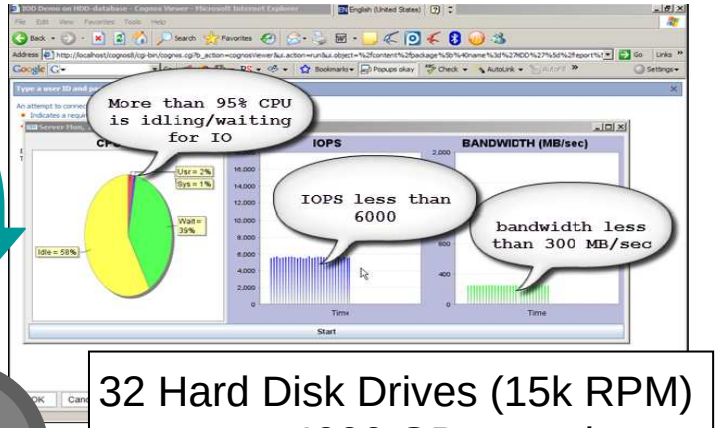
DB2 9.5

Linux (SUSE 10)

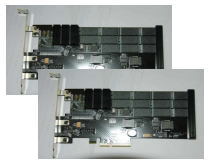
Cognos 8

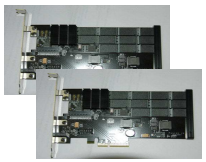
IBM System x3850
16GB RAM





4 FusionIO® Solid State Drives
400GB capacity
SVC/SSD prototype

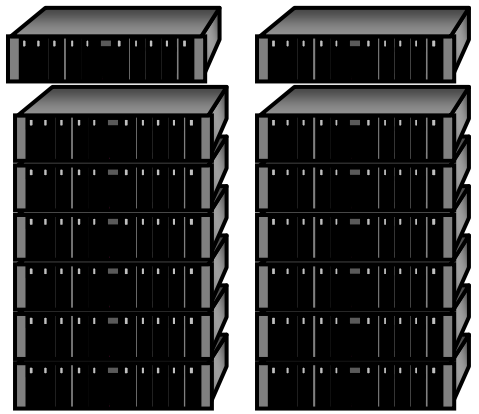




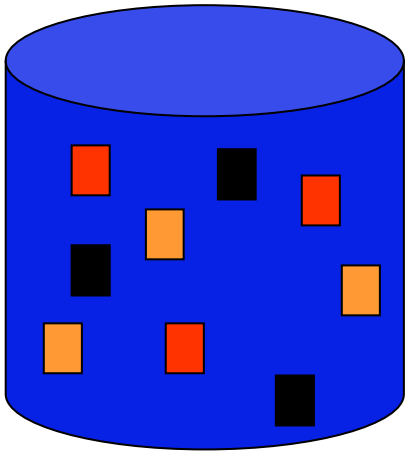
B E N E F I T S

- **5x improvement in elapsed time for business queries**
- **4x additional improvement with SSD awareness in DB2**
- **Used *1/4th* number of spinning disks (75% space reduction)**
- **Used *1/9th* amount of power at disk level (89% power reduction)**

32 Hard Disk Drives (15k RPM)
4000 GB capacity



Sub-LUN Optimization



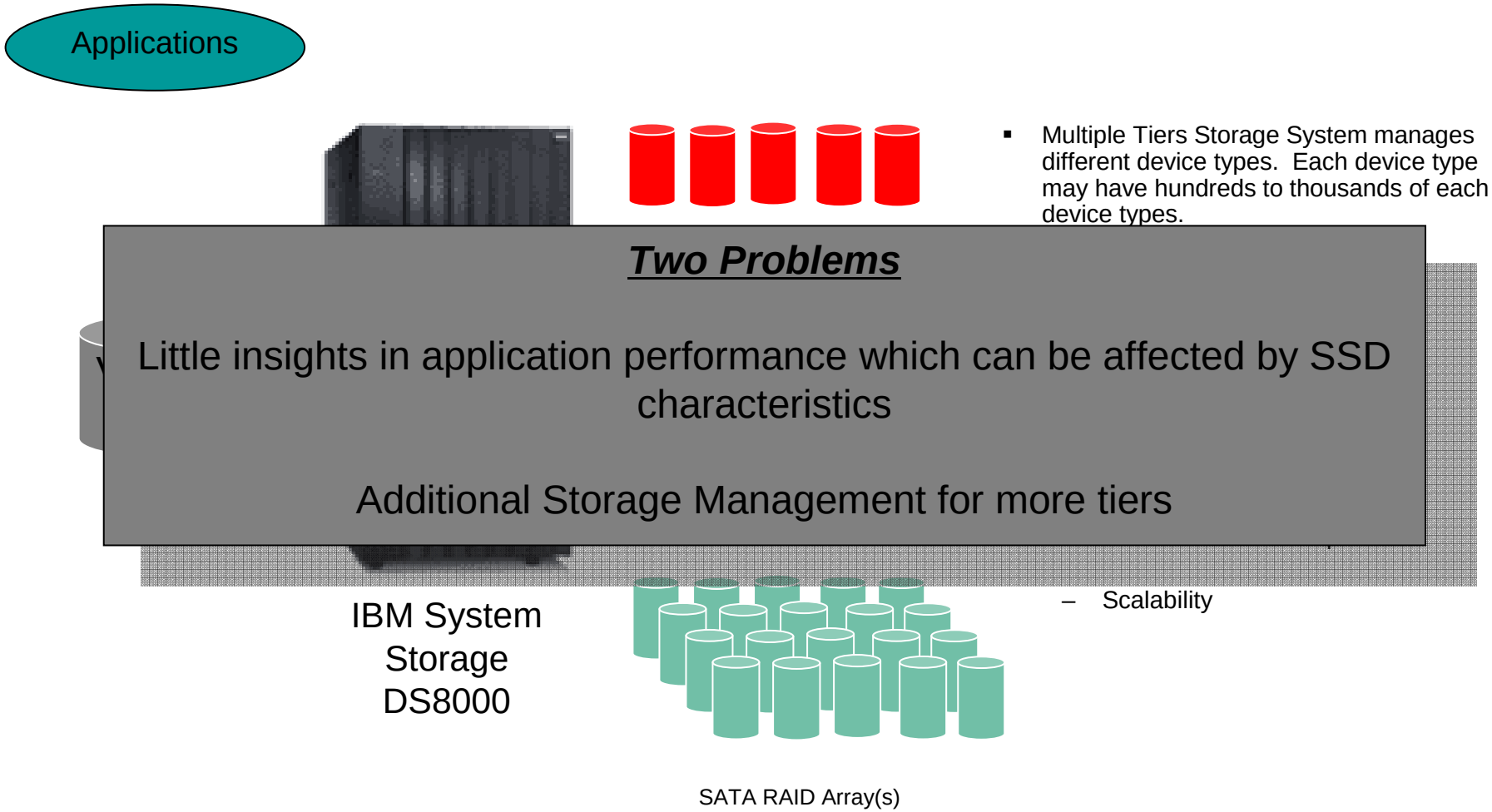
	“hot” extent
	Medium use
	Low use

SSD

Fibre Channel/SAS

SATA

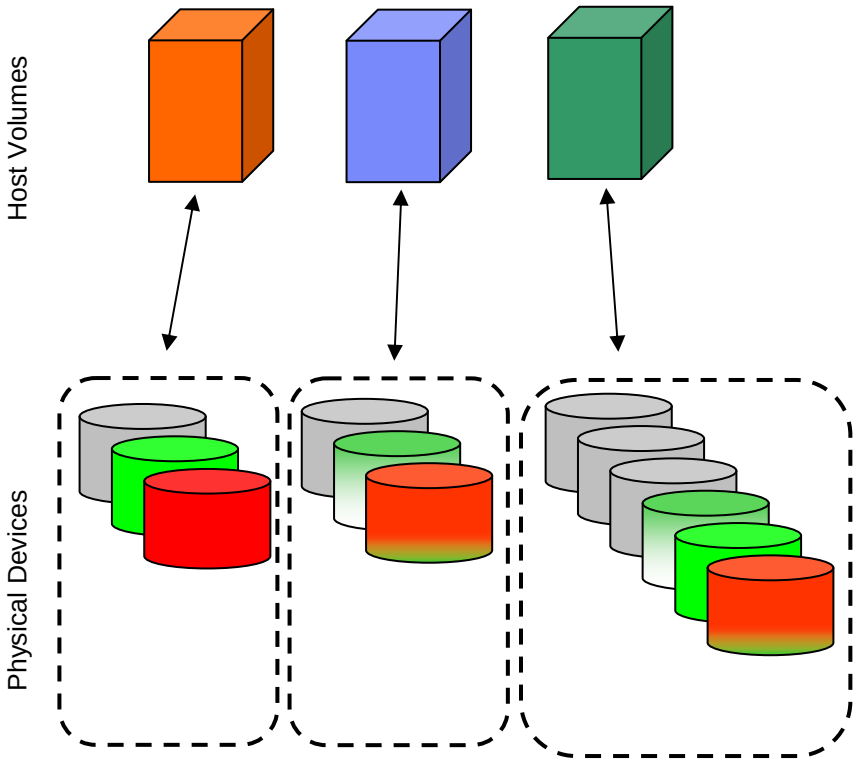
Multiple Tiers Storage System Naturally Embraces SSD Tier



- Multiple Tiers Storage System manages different device types. Each device type may have hundreds to thousands of each device types.
  - Scalability

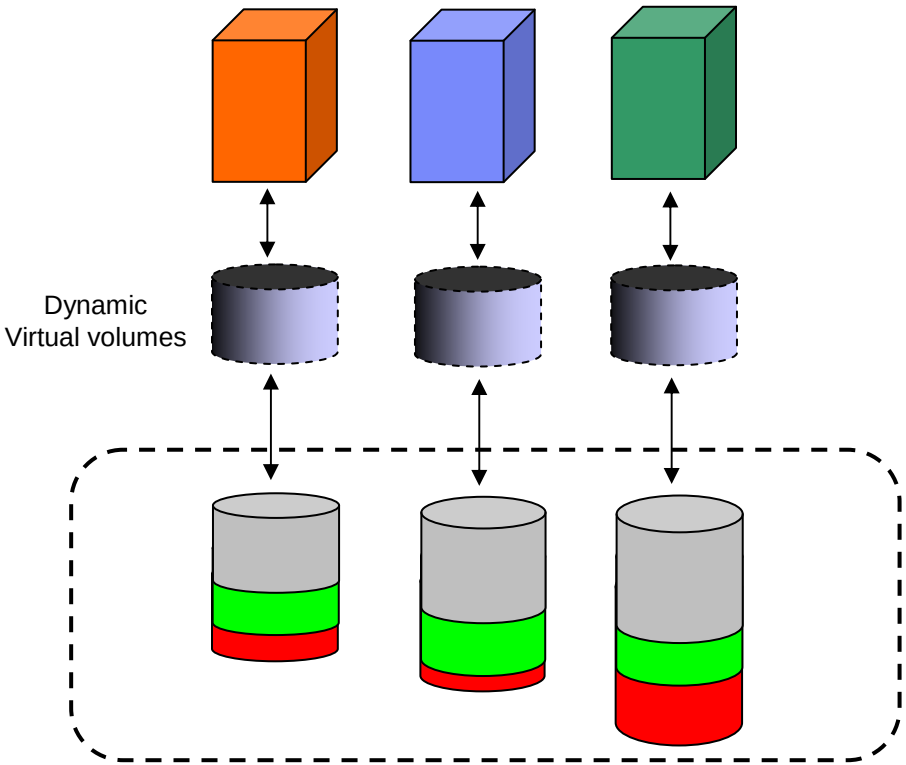
Traditional Disk Mapping vs. *Dynamic Virtual* Storage Mapping

Traditional disk mapping



Volumes have different characteristics. Applications need to place them on correct tiers of storage based on usage.

Dynamic Virtual Storage mapping

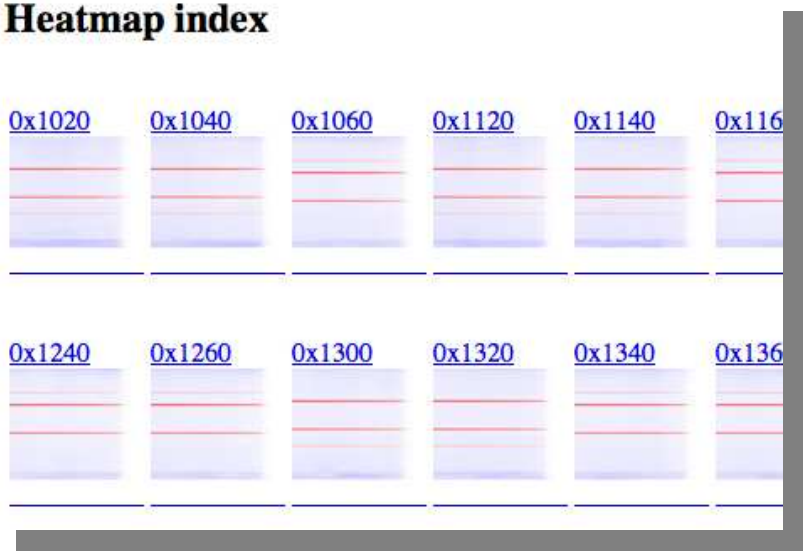


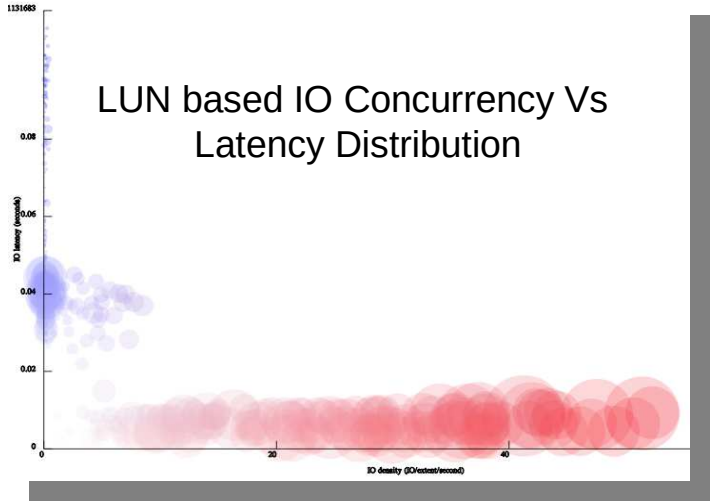
All volumes appear to be “logically” homogenous to apps. But data is placed at the right tier of storage based on its usage through smart data placement and migration.

Detailed Report Shows Application Performance Issues

	IO density (			
LUN	**mean**	**std dev**	**max**	**99%**
0x1020	1.148	5.379	63.93	33.1
0x1040	1.13	5.301	55.97	31.9
0x1060	0.9824	4.997	58.5	30.6
0x1120	1.138	5.303	59.79	33.4
0x1140	1.146	5.332	54.89	32.5
0x1160	0.9803	4.959	60.26	31.0
0x1200	1.151	5.413	60.36	33.1
0x1220	1.149	5.356	59.01	32.9
0x1240	0.969	4.893	58.93	30.2
0x1260	0.9923	4.994	55.82	31.2
0x1300	1.149	5.353	62.48	33.4
0x1320	1.158	5.406	57.27	33.1
0x1340	0.9811	4.935	58.54	31.0
0x1360	0.9685	4.882	55.15	31.3
All	1.068	5.168	63.93	32.3

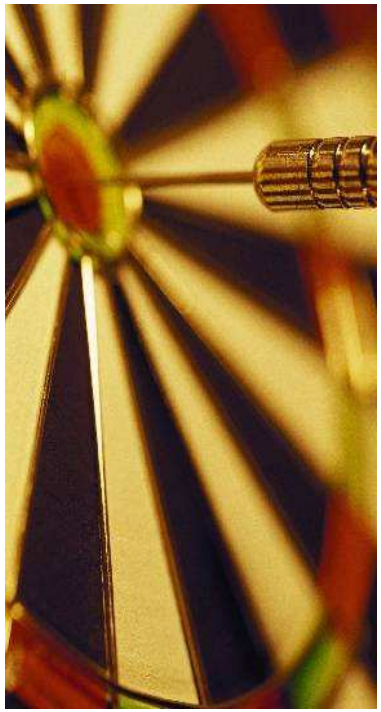
Heatmap index





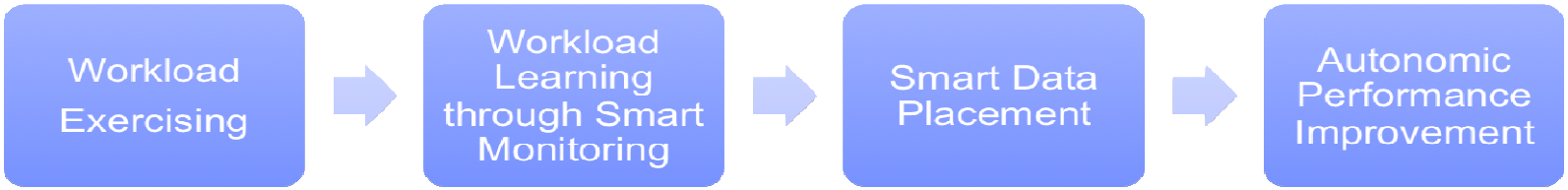
Smart Tools for Optimizing Tiered Storage

Smart data migration tools



- **Upcoming D8000 automated data relocation function** to dynamically move hot and cold extents across drive tiers
- **DB2 Online Reorg** function for migrating DB2 table spaces to appropriate drive tier
- **z/OS DFSMS** to migrate data to the right tier via HSM policies
- **Tivoli Storage Productivity Center Storage Optimizer** to identify opportunities for tiered storage exploitation and enable plans to place data on the right tier
- **Softek Data Mobility Console for z/OS** for real time data analysis and data movement without disrupting applications
- **Softek Data Migration Services** can migrate mainframe and open data non-disruptively

Relocating only 10% of existing data to SSDs, can result in increased system throughput by 300% *

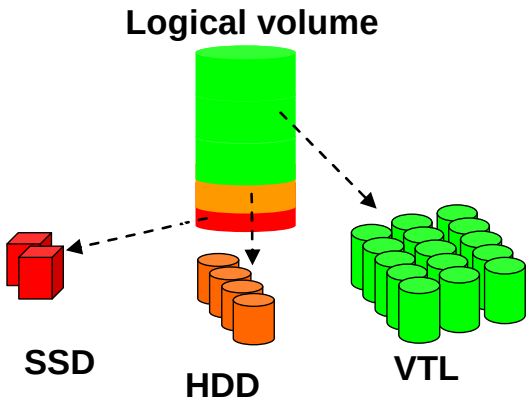


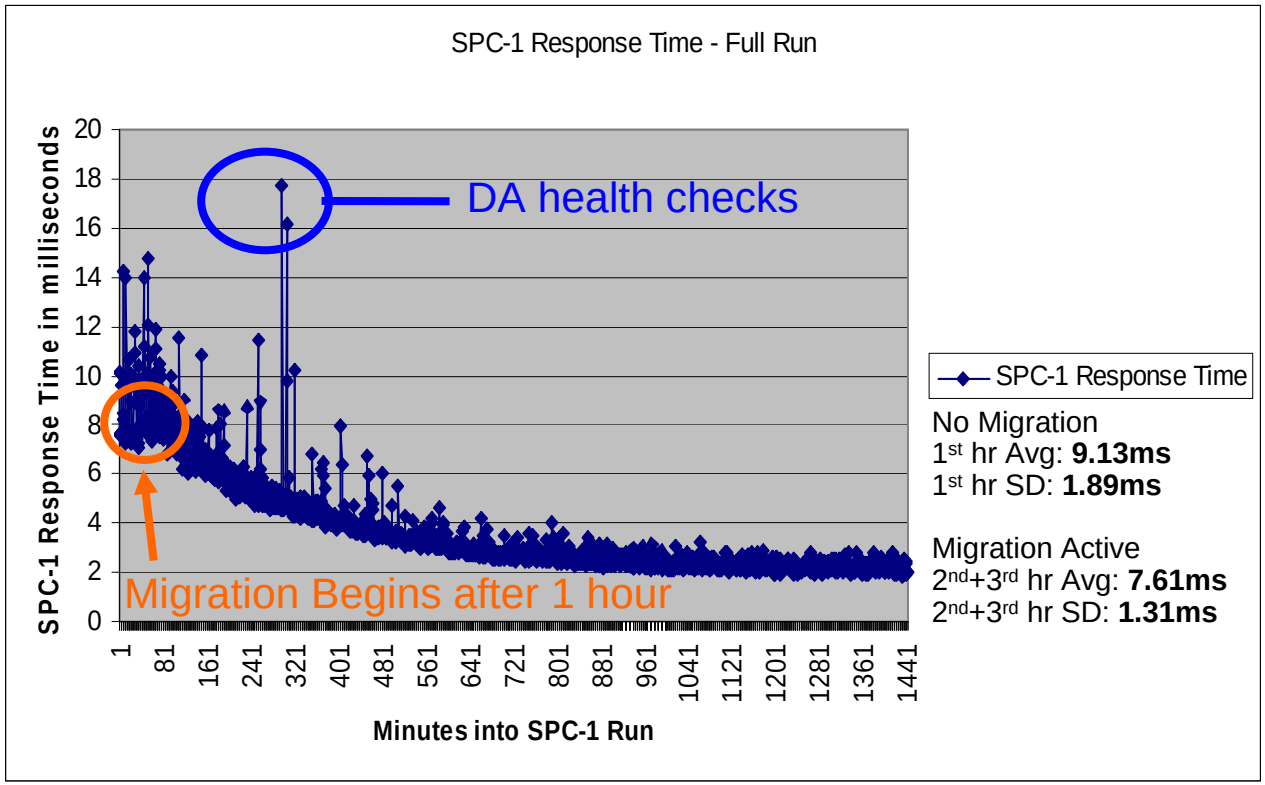
* Internal IBM Performance benchmark run with TPC-E-like workload

Technology Directions – Smart Placement

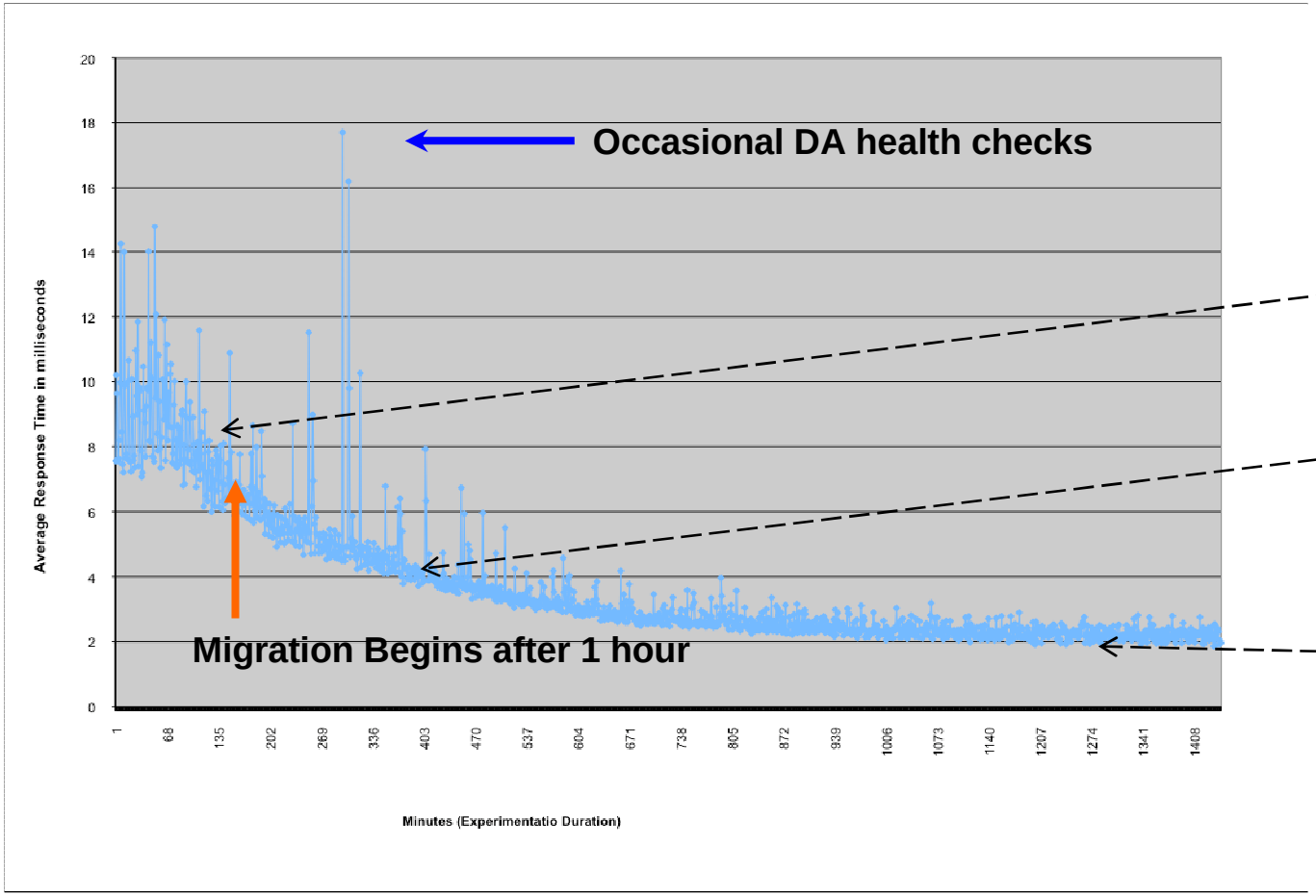
- SPC-1 Benchmark with smart placement technique May, 2009
- For Brokerage benchmark, 5% data moved for >50% response time improvement
- Most customer workloads have non-uniformities which will lead to performance gains with smart placement.
- Positive customer response on value

Smart placement moved just 5% of the data from HDDs to SSDs, yet reduced response time from 9ms to 2ms!!!



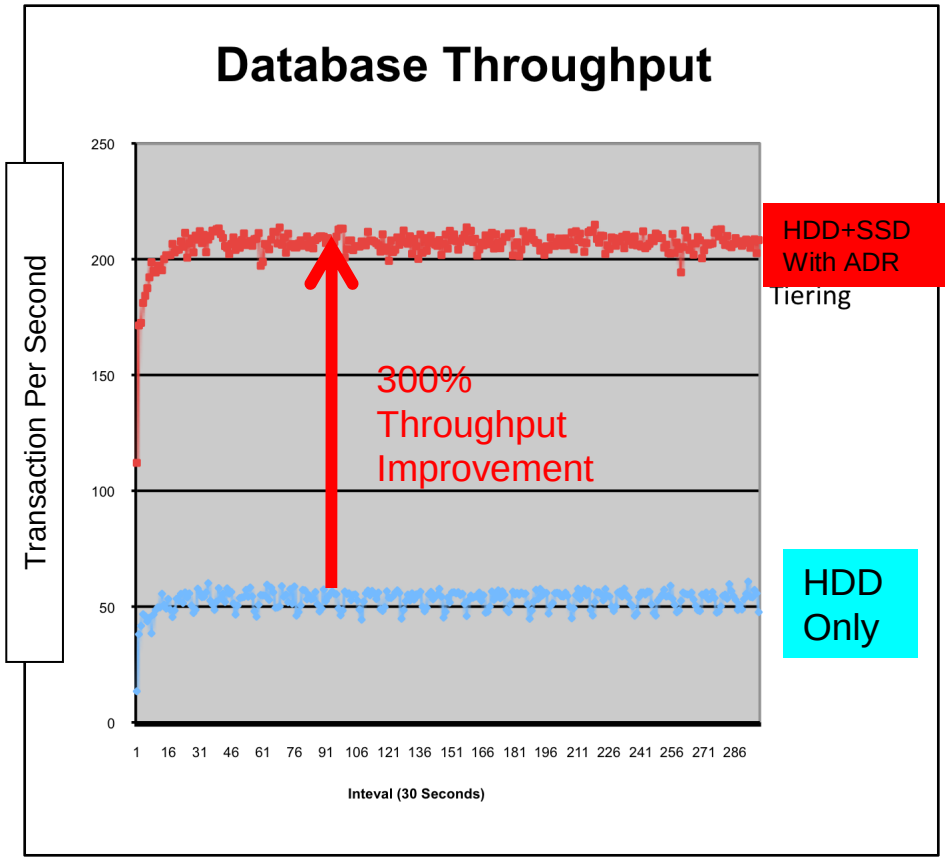


Significant Improvement on Average Application Response Time Concurrently with Live Workload

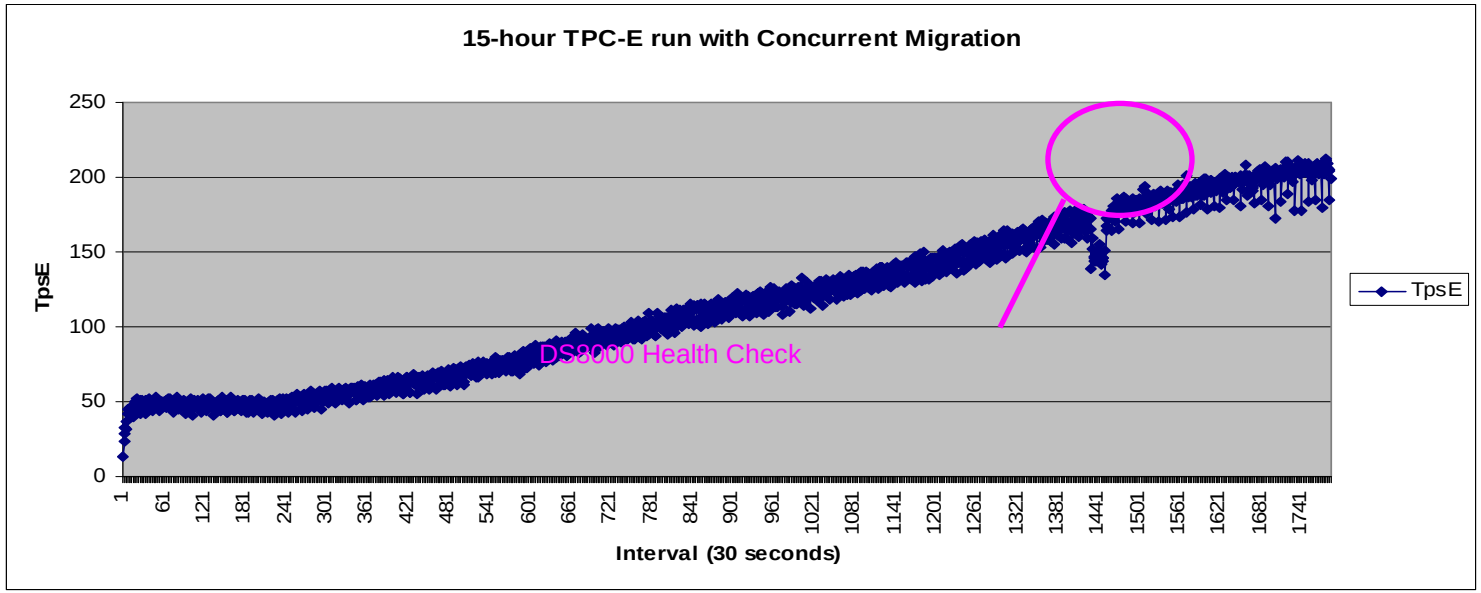


Brokerage Workload using DB2 with ADR

- Scalable Throughput
  - 300% throughput improvement.
- Identify hot “database objects” and smartly placed in the right tier.
- Substantial IO Bound Transaction Response time Improvement
  - 45%-75% response time improvement.

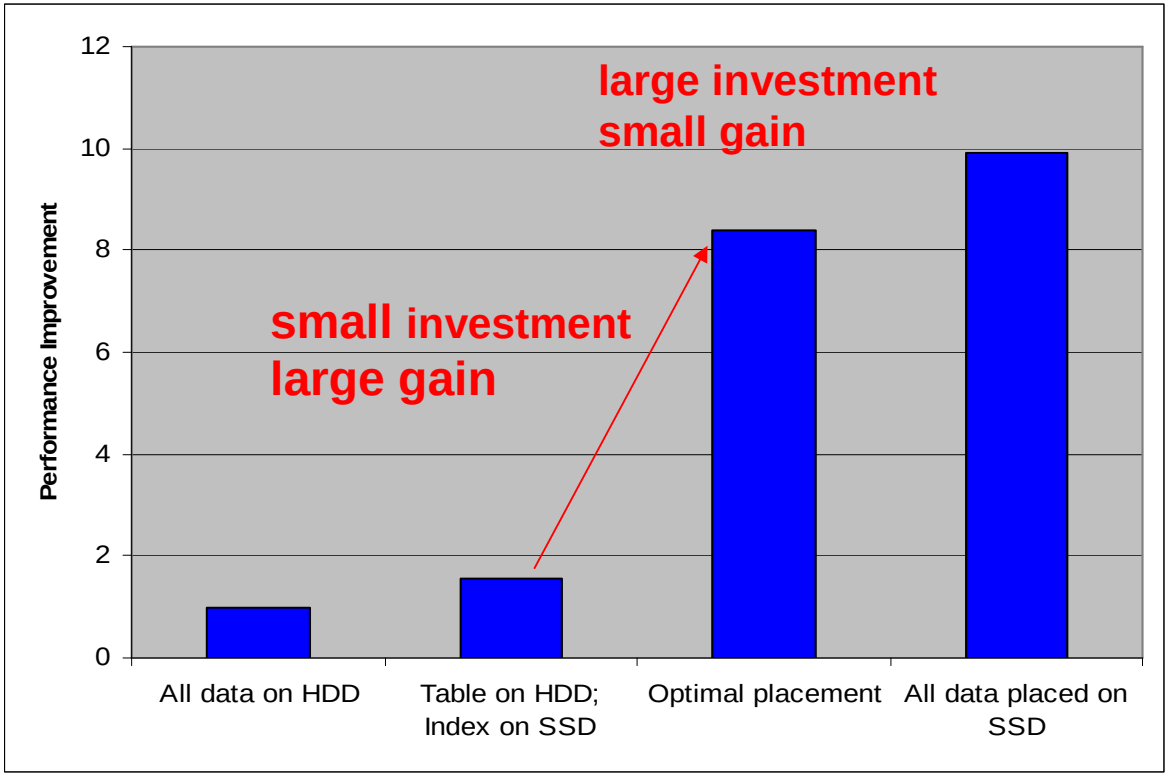


300% Increase (4x) in Application Throughput (transaction per second) with Concurrent Migration



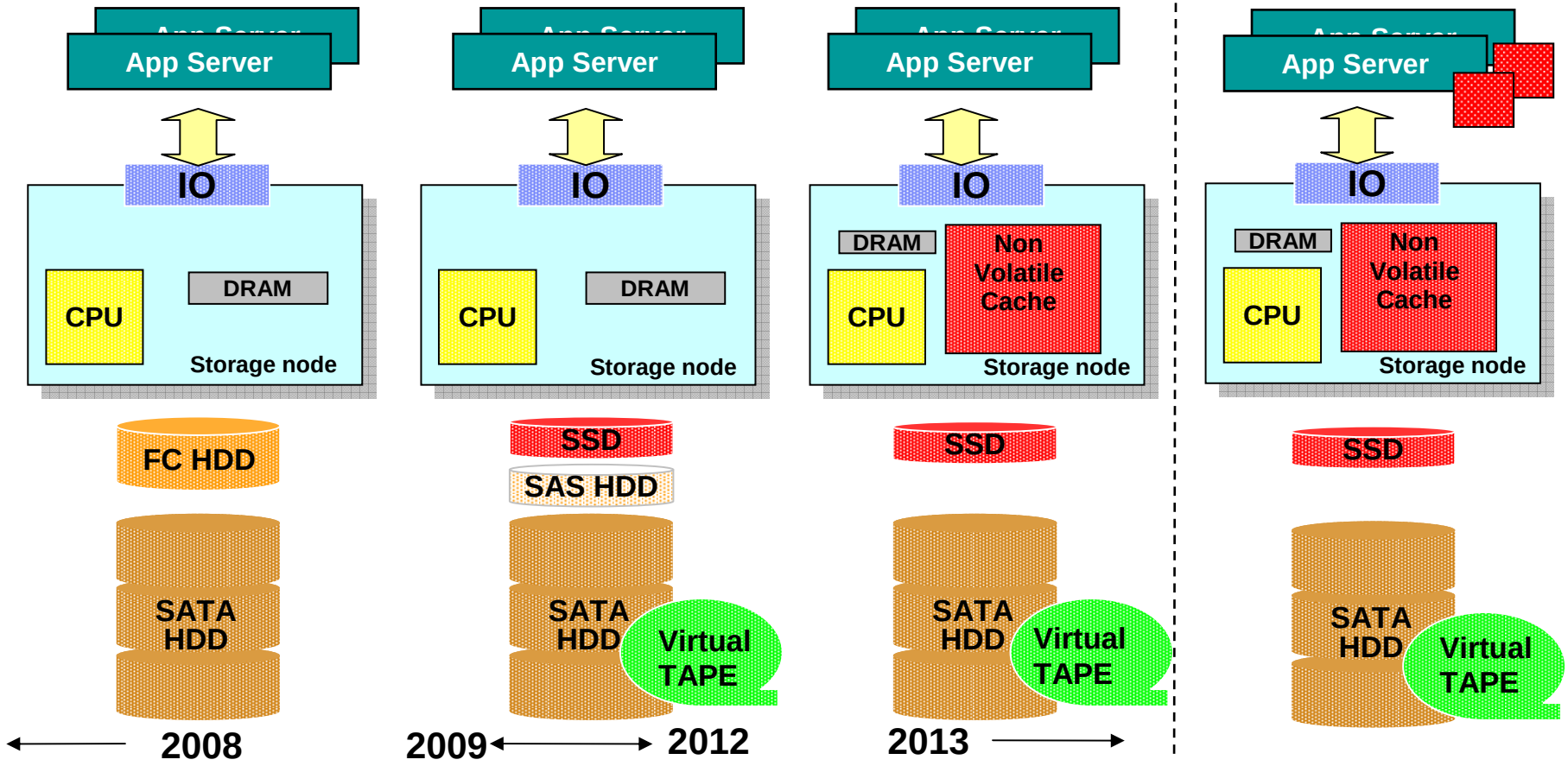
- 65% of accessed extents were moved from HDD to SSD
  - 2 GB moved every 5 minutes, 6.8 MB/s
- Host CPU utilization increased from 17% to 73%
  - Idle changed from 48% to 5%, wait changed from 35% to 22%
- Host IOPS increased from 9040 to 39,600
- Host bandwidth increased from 38 MB/s to 160 MB/s

Get the Most Benefit from Solid State Technology



Blind placement of database objects on SSDs result in less value

Storage System Evolution with Flash Technology



- **Step one - start with NAND flash SSDs, emulate HDD and embed within disk arrays**
- **Step two - use as an extension of subsystem Cache**
  - Keep Flash based SSDs as devices under the cache?
- **An additional model – server integration**

Agenda

- **IBM Information Infrastructure**
- **High-end and enterprise disk systems**
  - DS8000
- **Enterprise tape**
  - Virtualization engine
- **Storage virtualization**
  - SAN Volume Controller
  - XIV
- **Summary**

Agenda

- **IBM Information Infrastructure**
- **High-end and enterprise disk systems**
  - DS8000
- **Enterprise tape**
  - Virtualization engine
- **Storage virtualization**
  - SAN Volume Controller
  - XIV
- **Summary**

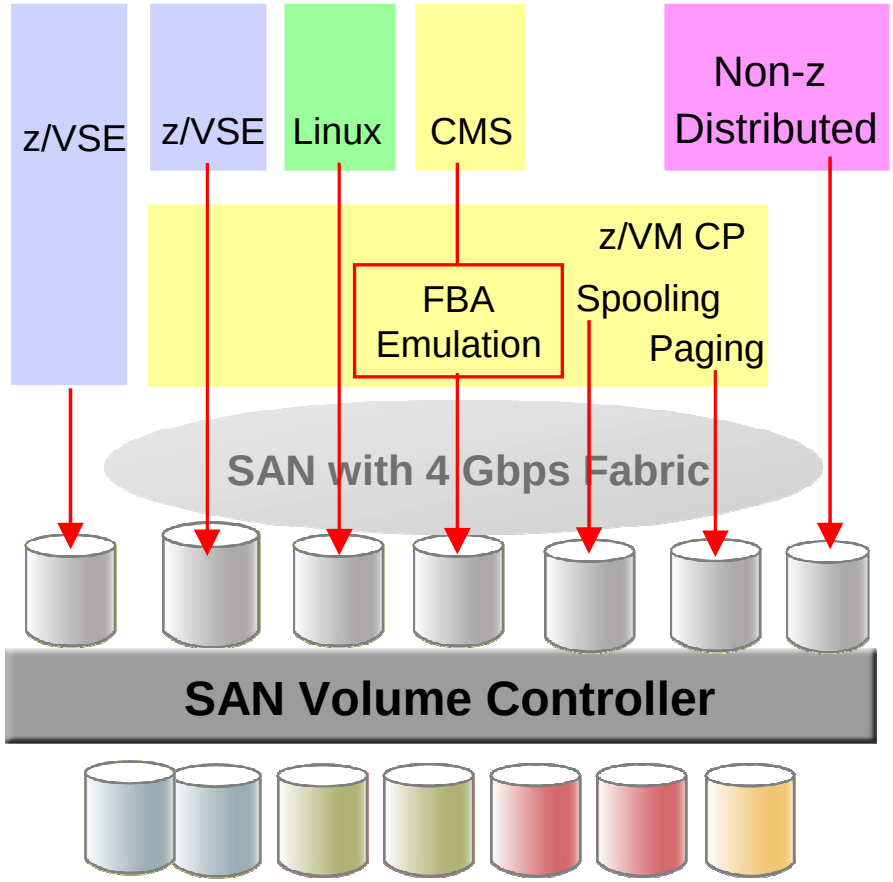
IBM Information Infrastructure for Storage Virtualization
IBM System Storage SAN Volume Controller

- **Client Value**
  - Improves storage utilization and reduces storage growth
  - Reduces power and cooling requirements helping make data centers more “green”
  - Boosts performance and simplifies storage management for IBM and non-IBM disk
    - Improve storage administration productivity by up to 2x
  - Redundant architecture supports enterprise-class availability
    - Non-disruptive upgrades of both hardware and software
  - Supports non-disruptive data movement

- **Powerful data management capabilities**
  - Space-Efficient Virtual Disks support on demand provisioning
  - Space-Efficient FlashCopy dramatically reduces storage needed for backup copies by as much as 75% or more
  - Virtual Disk Mirroring helps improve availability for critical applications

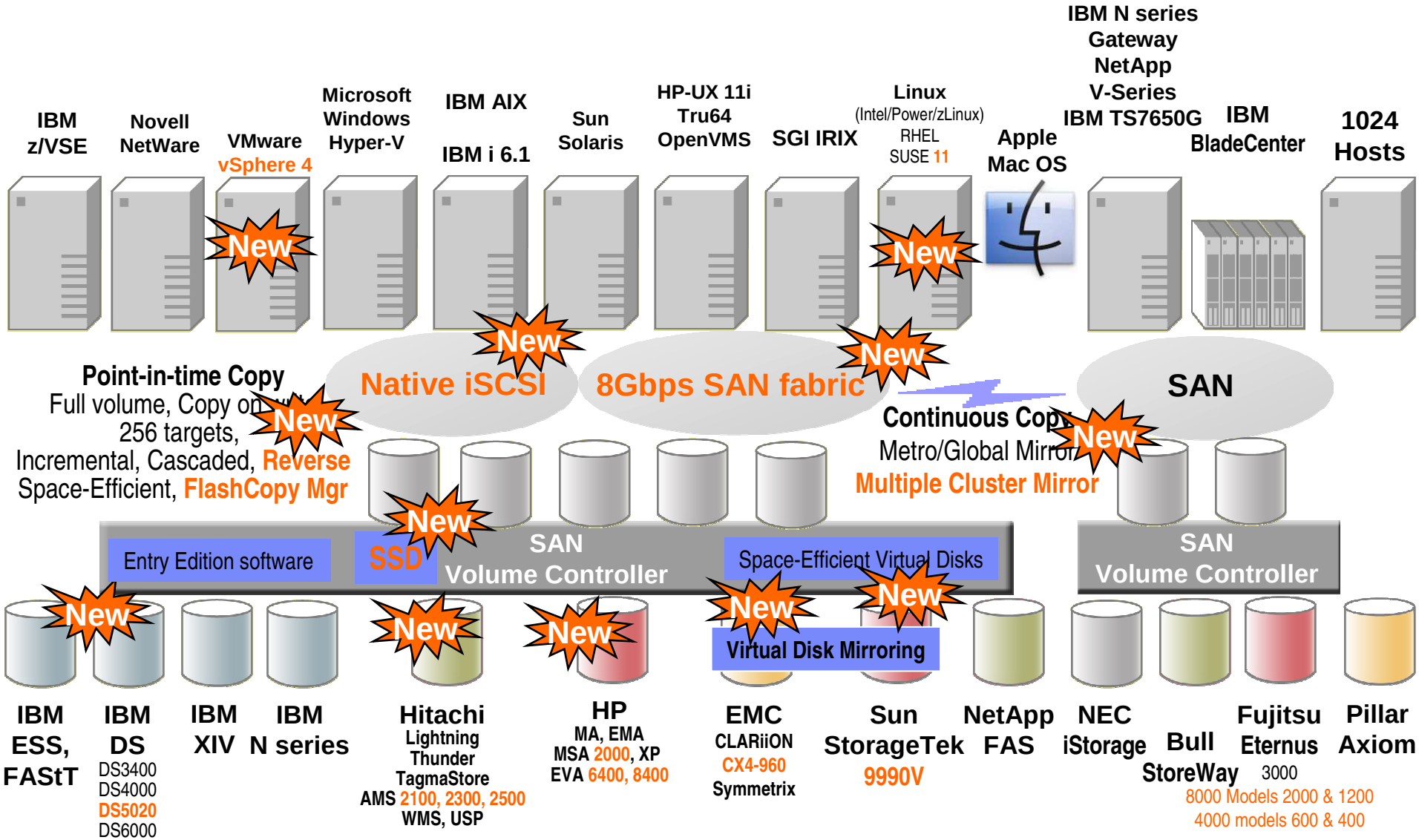
z/VSE V4.2 Enhancement: SAN Volume Controller (SVC)

- SAN Volume Controller (SVC) creates a single pool of SCSI disk capacity
- Disk storage options include IBM DS8000, DS6000, ESS, DS4000, etc. plus qualified systems from various non-IBM vendors
- SVC *platform* includes both hardware and software components:
  - SVC 'nodes' provide redundant components plus cache
  - Systems Storage Productivity Center (SSPC) software provides administrative and copy services
- Also supported in z/VM V5.3 and later, as well as Linux on System z



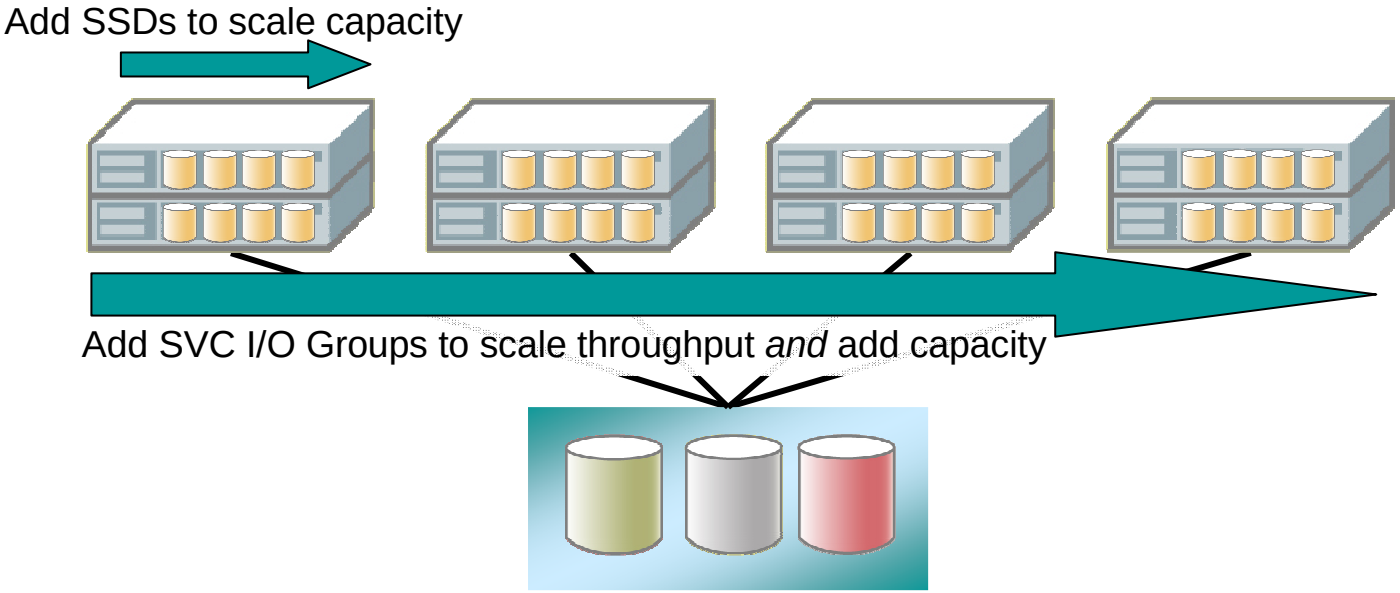
Learn more at: **ibm.com**/storage/support/2145

Asset Utilization: Virtualizing Existing IT with SVC



For the most current, and more detailed, information please visit **ibm.com**/storage/svc and click on “Interoperability”.

Scalability: Scale-Out SVC SSD Implementation



- Add SSDs to SVC engines for more capacity
  - SSDs may be added without disruption to engines
- Add SVC engines for more capacity and throughput
  - Additional engines provide more processing power, more bandwidth, more SAN attachments
  - SVC designed to deliver maximum I/O capability of SSDs
  - Up to 50,000 read IOPS per SSD
  - Up to 200,000 read IOPS per SVC I/O Group
  - Up to 800,000 read IOPS per SVC cluster

IBM Storage Systems and System z Together