Storage Efficielcy 2013

IBM Smarter Storage for Smarter Computing

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Storage Effizienz hat viele Gesichter

- Schnellster „Flash"-Speicher
  - Beschleunigt die Datenverarbeitung
  - Schnellere Business-Entscheidungen
- Compression
  - Mehr Daten pro GB speichern
- Tiering
  - Daten dort halten, wo sie nach Zugriffsverhalten hin gehören
  - Schnelle vs. Hochkapazitiver Speicher
- Virtualisierung
  - Flexibilität
  - Einfaches Management
- Daten-Cloud
  - „Selbstbedienung"
- Datensicherheit
  - Datenspiegelung
  - Backup Verfahren, FlashCopy

FICON
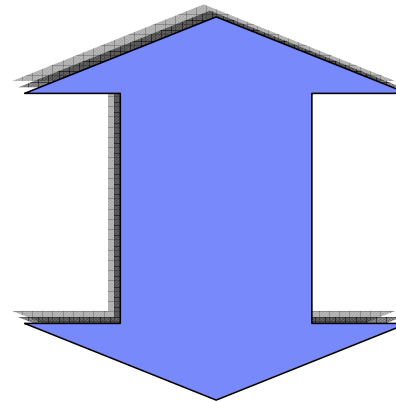
DS8870

mit BC Modell

z/VSE
z/VM
z/Linux

Fibre Channel
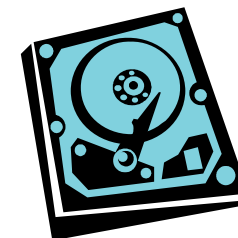
SVC

XIV

V7000 / V3700

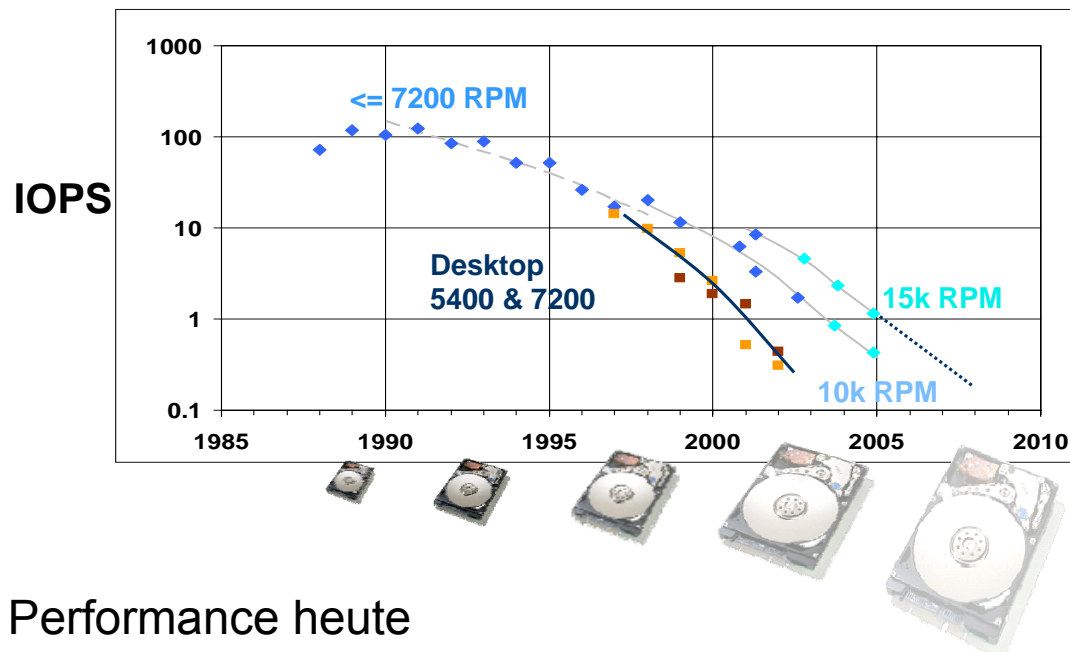**RamSan**

Hard Disk

- Performance Entwicklung

IO Rate per GB und
Hard Disk Drive Generation

Seit 1990 um **Faktor 100**
schlechter

Chart axis labels:

IOPS (vertical axis): 1000, 100, 10, 1, 0.1
Time (horizontal axis): 1985, 1990, 1995, 2000, 2005, 2010

Chart labels: <= 7200 RPM, Desktop 5400 & 7200, 15k RPM, 10k RPM

* 100% Random

- Performance heute

	RPM	Latency (ms)	Seek (ms)	IO/s *
FC/SAS	15000	2	4	167
FC/SAS	10000	3	5	125
SATA/SAS	7200	4.2	9	76

Flash Technologie

**Warten Sie noch auf die
25K RPM Disk?**

**Drehst du noch
oder „blitzt" du schon?**

- Performance-Lücke steigt dramatisch
- Anwendungen werden zunehmend behindert
- SSD als Technologie zur **Performance-Steigerung**

- Bessere Verfahren zur Identifizierung der inaktiven Daten
- SSD als **Technologie zur Kostensenkung**
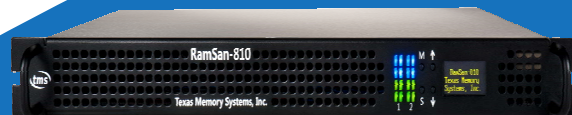
Flash Storage Technologie

Flash Preisentwicklung per GB

Legend:
- Flash
- Disk

2006　2008　2010　2012
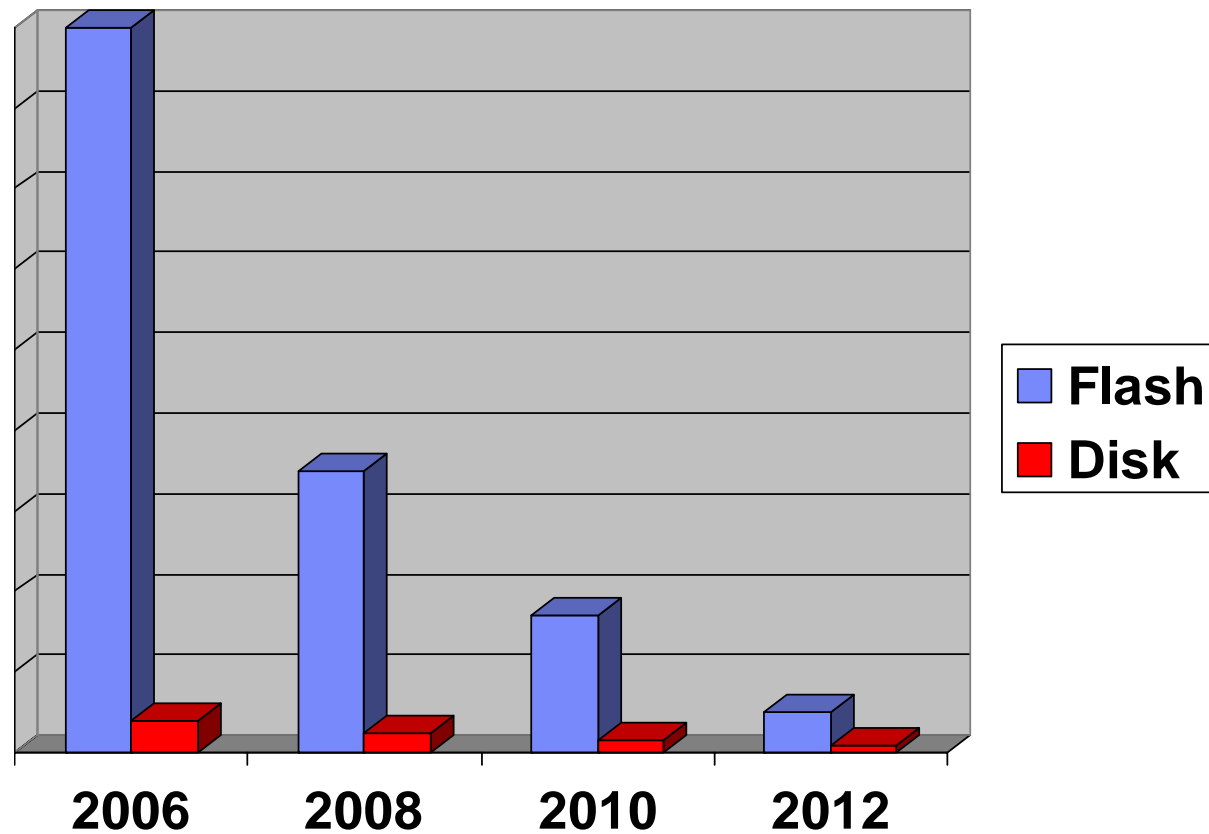
IBM Disk- und Virtualisierungsysteme

Pure-Familie
V7000 ITE

FICON

DS8870

XIV

TMS-RamSan

SVC

V7000
V7000Unified
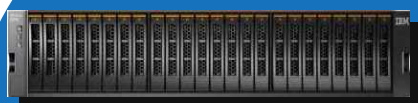
V3700

Alle IBM Storage-Systeme sind „Flash-enabled"!

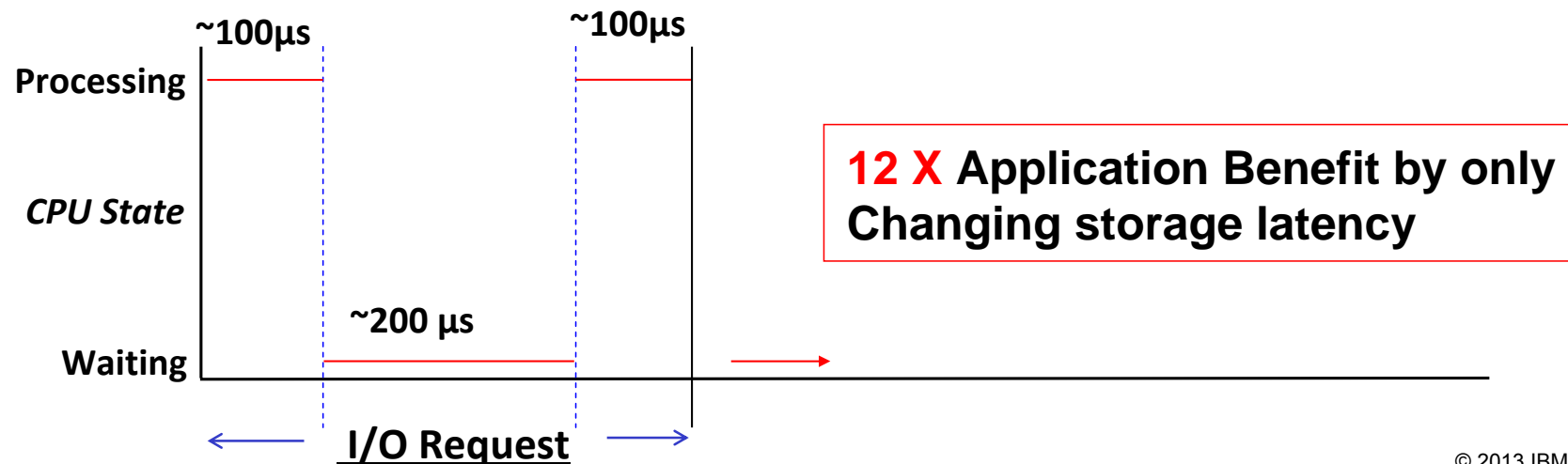# Flash/SSD Benefit

IBM

I/O Serviced by Disk

- I/O request ~ 100 μs, Wait for I/O to be serviced ~ 5,000 μs, Process I/O ~ 100 μs

- CPU Utilization = Processing time / (Wait time+ Processing time) = 200 / 5,200 = <u>~4%</u>

~100μs
~100μs

Processing

CPU State

~5000 μs

Waiting
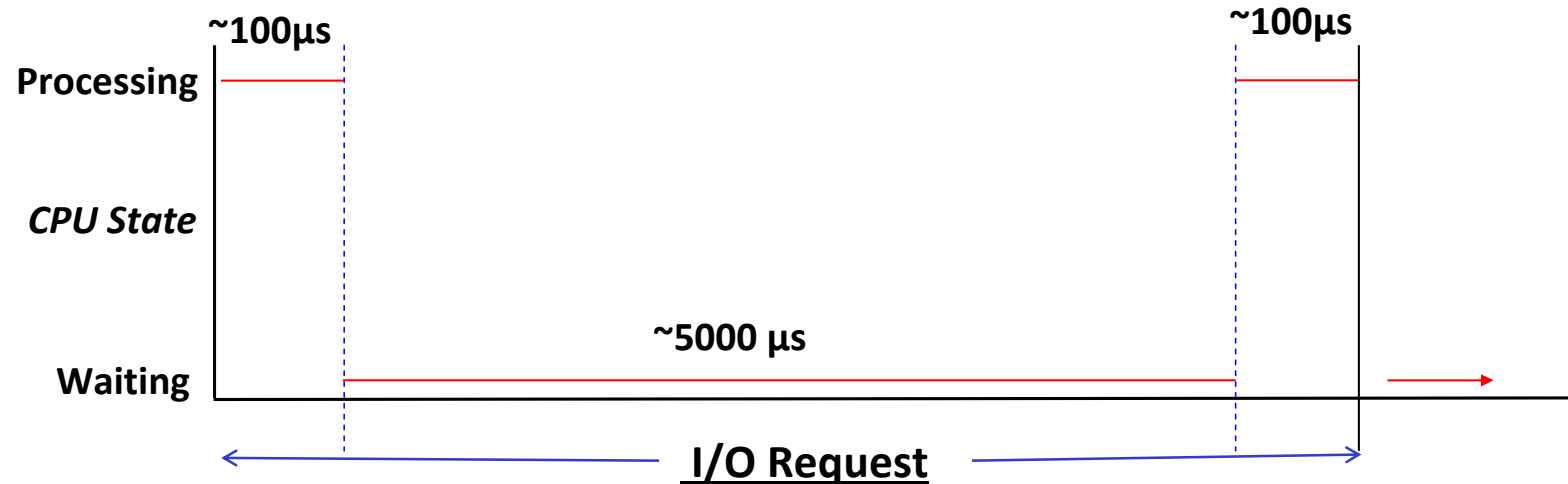
I/O Request

I/O Serviced by Ramsan Flash

- Issue I/O request ~ 100 μs, Wait for I/O to be serviced ~ 200 μs, Process I/O ~ 100 μs

- CPU Utilization = Processing time / (Wait time+ Processing time) = 200 / 400 = <u>~50%</u>

~100μs
~100μs

Processing

CPU State

12 X Application Benefit by only Changing storage latency

~200 μs

Waiting

I/O Request

5 reasons why Flash Storage is a "must" in every data center

What if you could...

1. Reduce DB and "per core" licensing

2. Improve application efficiency

3. Improve server efficiency

4. Increase storage operations efficiency
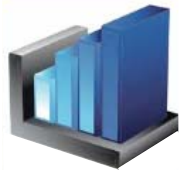
5. Lowest Latency!

Application Sweet Spots: *Do More, Do it Faster!*

OLTP Databases

– Financial, gaming, real-time billing, trading, real-time monitoring, query acceleration (DB2/Oracle), etc.
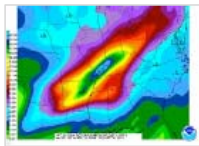
Analytical applications (OLAP)

– Business intelligence, batch processing, ERP systems, reporting, massive data feeds, etc.

Virtual Infrastructures

– VDI, Consolidated virtual infrastructures, user profiles, etc.

HPC/Computational Applications

– Simulation, modeling, rendering, FS metadata, scratch space, video on demand, thread efficiency, etc.

Cloud-scale Infrastructures

– On-demand computing, content distribution, web, caching, metadata, GPFS, active file management, etc.

Financial	Government	E-Commerce	HPC	Telecom

SSD Hersteller

mehr als 200 Anbieter

Warum TMS?

tms

Solid State Storage Leader

Deep Domain Expertise

Global Enterprise Customers

Strong Financial Performance

World Class Team

- **Höchste Performance**, **höchste Reliabilität,** geringste Latency, geringster Energie Verbrauch in der Branche Systeme sind 200% schneller als andere

- **34 Jahre** Erfahrung im Design von SSDs
30+ Patente
20 Generationen von Speicher Systemen

- Wachsende Kunden Basis in über 34 Ländern

- Kein Venture Capital / Keine langfristigen Schulden

- **Über 400 Mann-Jahre Erfahrungen mit** SSD

Hardware Accelerated with Extreme Parallelism

FLASH Media

Lookup
Table
RAM

Write Buffer RAM

CPU

Flash
Controller
FPGA**

CPU
RAM

I/O Interface
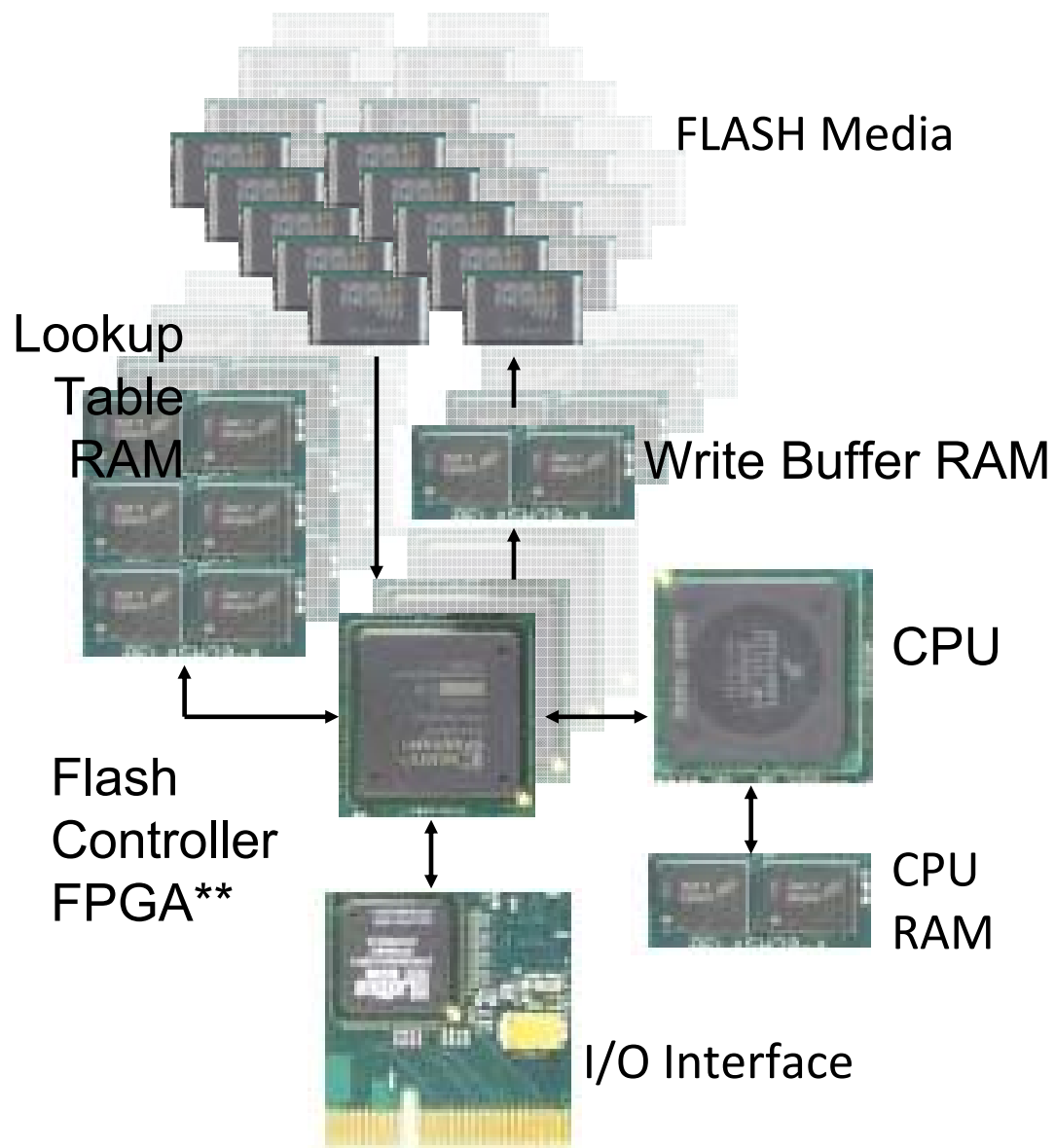
- No CPU in data-path but FPGAs

- Hardware instead of "Lines of Code"

- The Lookup Tables and Write Buffer is RAM

- Extreme paralellism

- A RamSan-810 has 40 controllers, so it can do 1440 4KB operations simultaneously

"You cannot increase performance by adding lines of code."

*DMA = Direct Memory Access
**FPGA = Field Programmable Gate Array

RamSan Choices
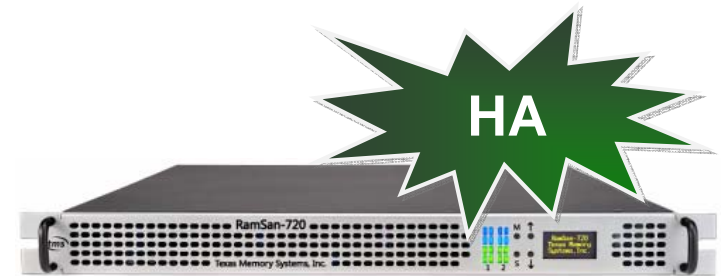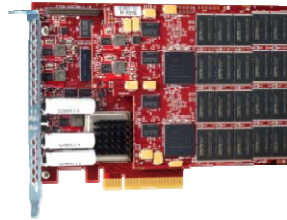
RamSan-70	RamSan-710/810	RamSan-720/820
SLC Flash	SLC (7) / eMLC (8) Flash	SLC (7) / eMLC (8) Flash
90/30 us R/W Latency	100/25 us R/W Latency	100/25 us R/W Latency
450 or 900 GB	1-5 or 2-10 TB	(5/10) or (10/20) TB w/HA
1.5M IOPS (512B)	450K/400K IOPS (4K)	500K/450K IOPS (4K)
2.5 GB/s	5/4 GB/s	5/4 GB/s
Full-height, half-length PCIe x8 2.0	1U rackmount, 4x 8Gb FC ports, 4x 40Gb QDR InfiniBand	1U rackmount, 4x 8Gb FC ports, 4x 40Gb QDR InfiniBand

2D Flash RAID™ (RamSan 720 / 820)

External Interfaces *(FC, IB)*

Interface **A**

Interface **B**

RAID Controllers

RAID Controller **A**

RAID Controller **B**

RAID 5 within Flash Modules *(9 data + 1 parity)*

TMS
2D Flash RAID™

RAID 5 across Flash Modules *(10 data + 1 parity + 1 hot spare)*
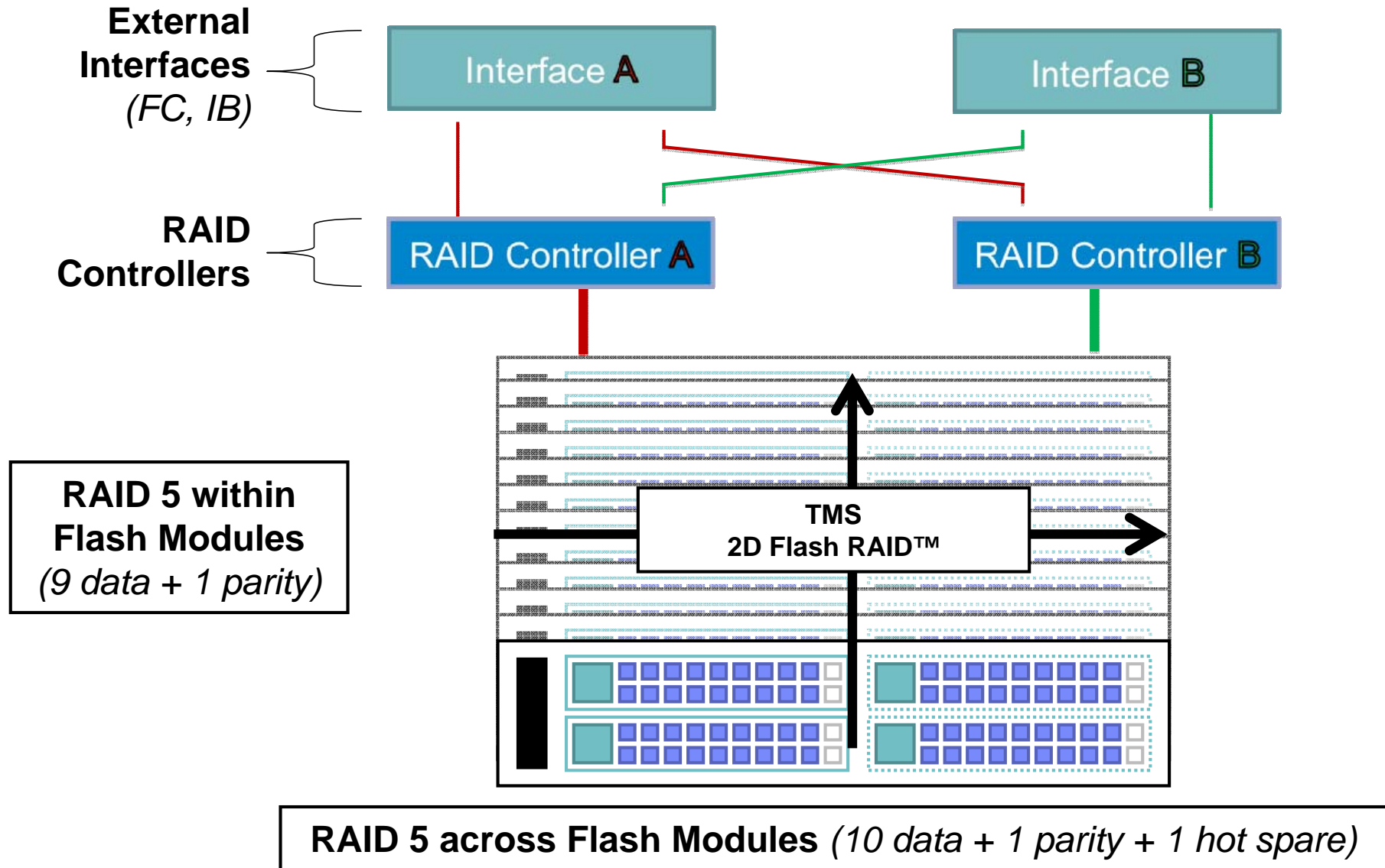
Performance Scenario: Oracle RAC, 4 Nodes   ORACLE®

Enterprise Array, No Flash	**RamSan**

2 million queries
12.25 minutes to complete
 	
16K Total IOPS
    4K per RAC Node
	2 million queries
	1.3 minutes to complete
	
	160K Total IOPS
	    40K per RAC Node

```
[oracle]$ time ./spawn_50.sh

real    12m15.434s
user    0m5.464s
sys     0m4.031s
```

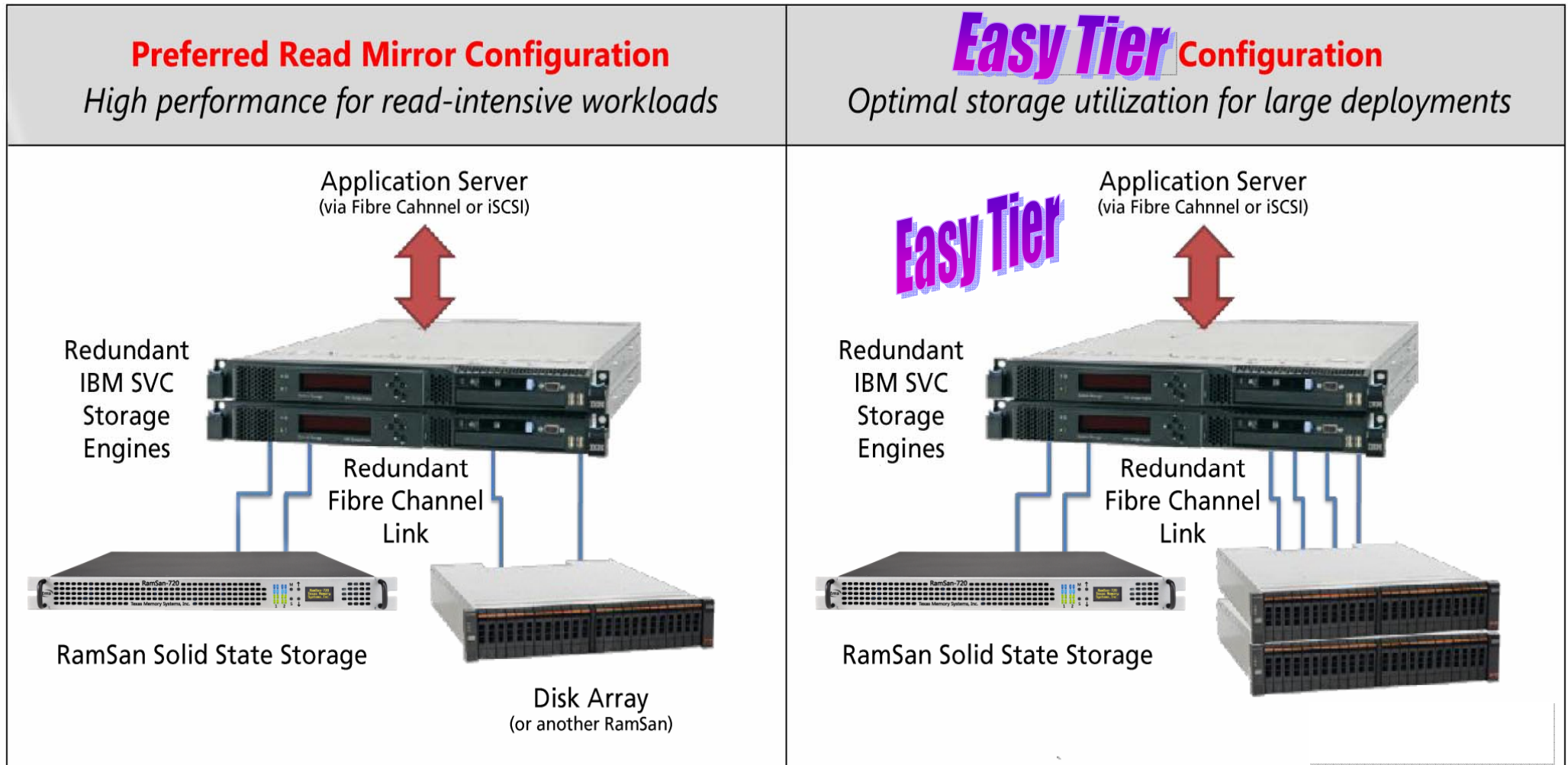```
[oracle]$ time ./spawn_50.sh

real   1m19.838s
user   0m4.439s
sys   0m3.215s
```

# A factor of about 10x improvement!

# SVC and RamSan – Combines Performance with Functionality
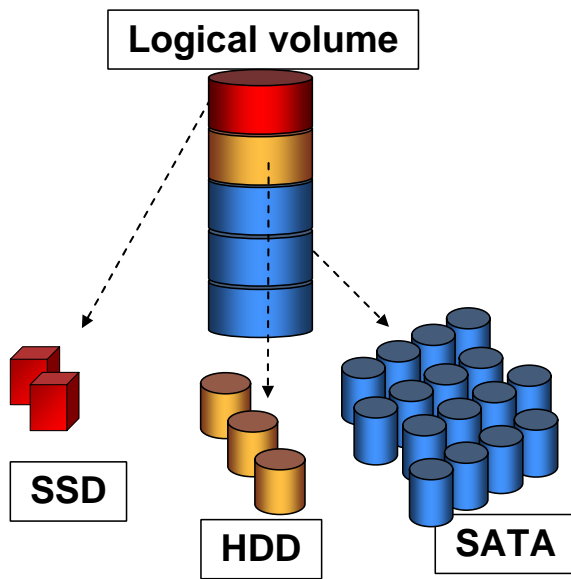
## Basic RamSan SVC Configurations

In most cases, a basic RamSan SVC configuration includes one RamSan and one or more disk arrays connected via Fibre Channel to two IBM SVC Storage Engines, which use Fibre Channel to connect to application servers.



**Preferred Read Mirror Configuration**
*High performance for read-intensive workloads*

Application Server
(via Fibre Cahnnel or iSCSI)

Redundant IBM SVC Storage Engines

Redundant Fibre Channel Link

RamSan Solid State Storage

Disk Array
(or another RamSan)

**Easy Tier Configuration**
*Optimal storage utilization for large deployments*

Easy Tier

Application Server
(via Fibre Cahnnel or iSCSI)

Redundant IBM SVC Storage Engines
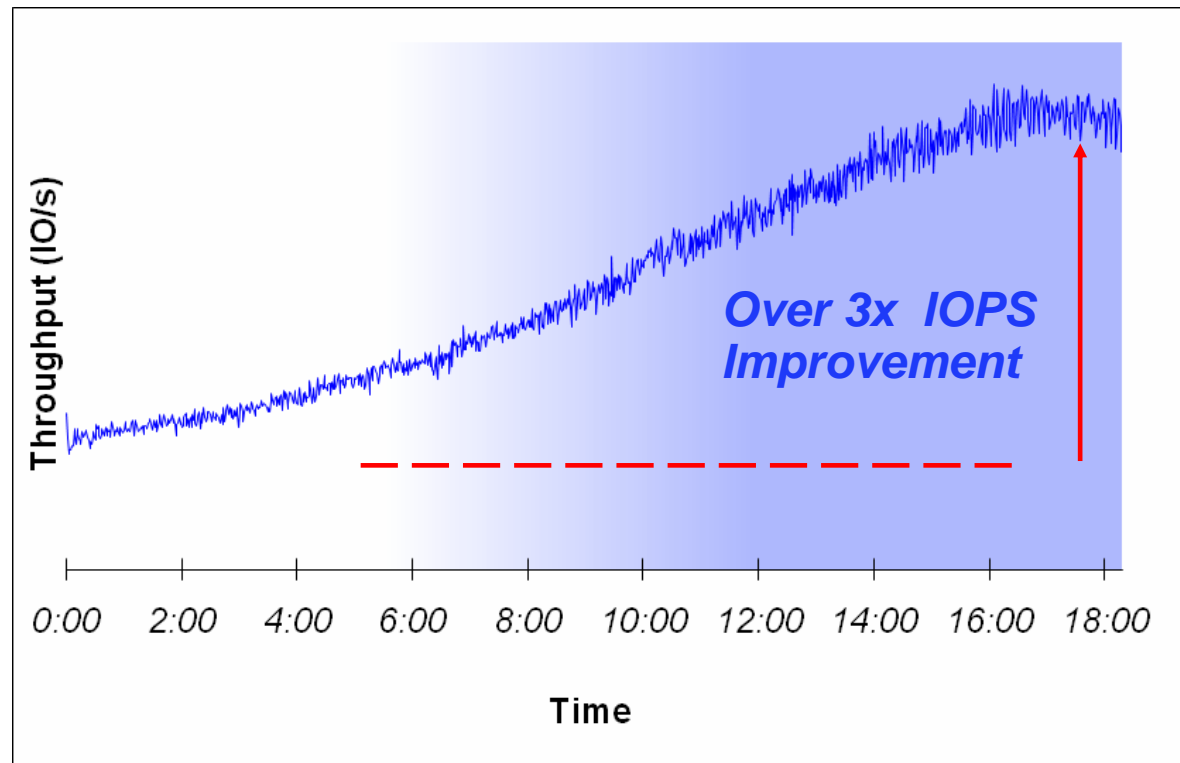
Redundant Fibre Channel Link

RamSan Solid State Storage

# Storage Easy Tier technology
## System learns workload, does automated relocation, removes user complexity

*Easy Tier for DS8000,*
*SVC V7000*

**Logical volume**

**SSD**

**HDD**

**SATA**

System configuration:
2.3 TB SSD + 96 TB SATA

Throughput (IO/s)

*Over 3x  IOPS Improvement*

0:00   2:00   4:00   6:00   8:00   10:00   12:00   14:00   16:00   18:00

Time

Source:  Storage Performance Council, April 2010: http://www.storageperformance.org/results/benchmark_results_spc1#a00092

Easy Tier provides better performance in **1/2** the floor space & with **40%** less energy consumed
96 SATA HDDs + 16 SSDs (5.7 KW) vs. 192 FC HDDs (9.5 KW)
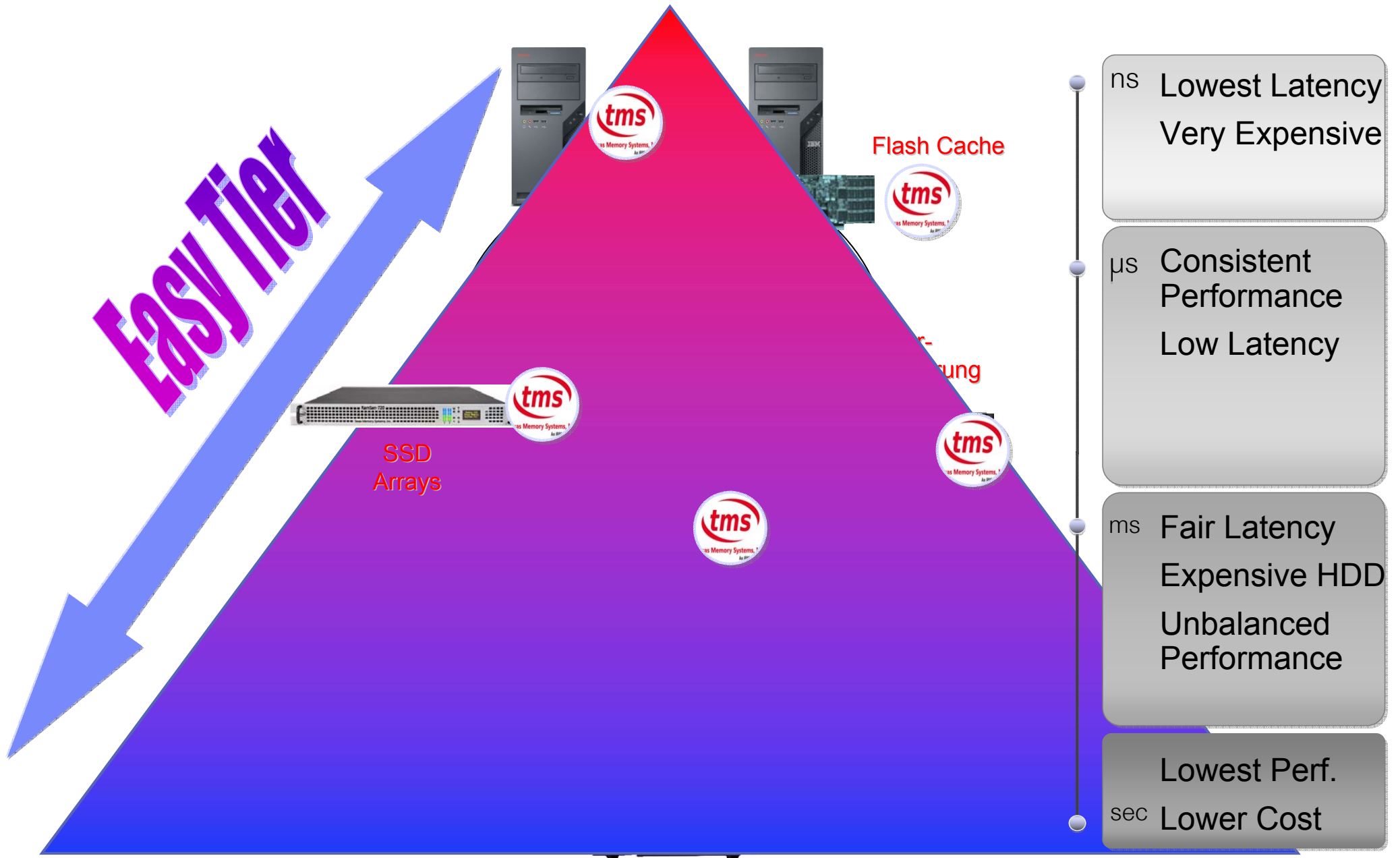
# GB Kunde aus Stuttgart
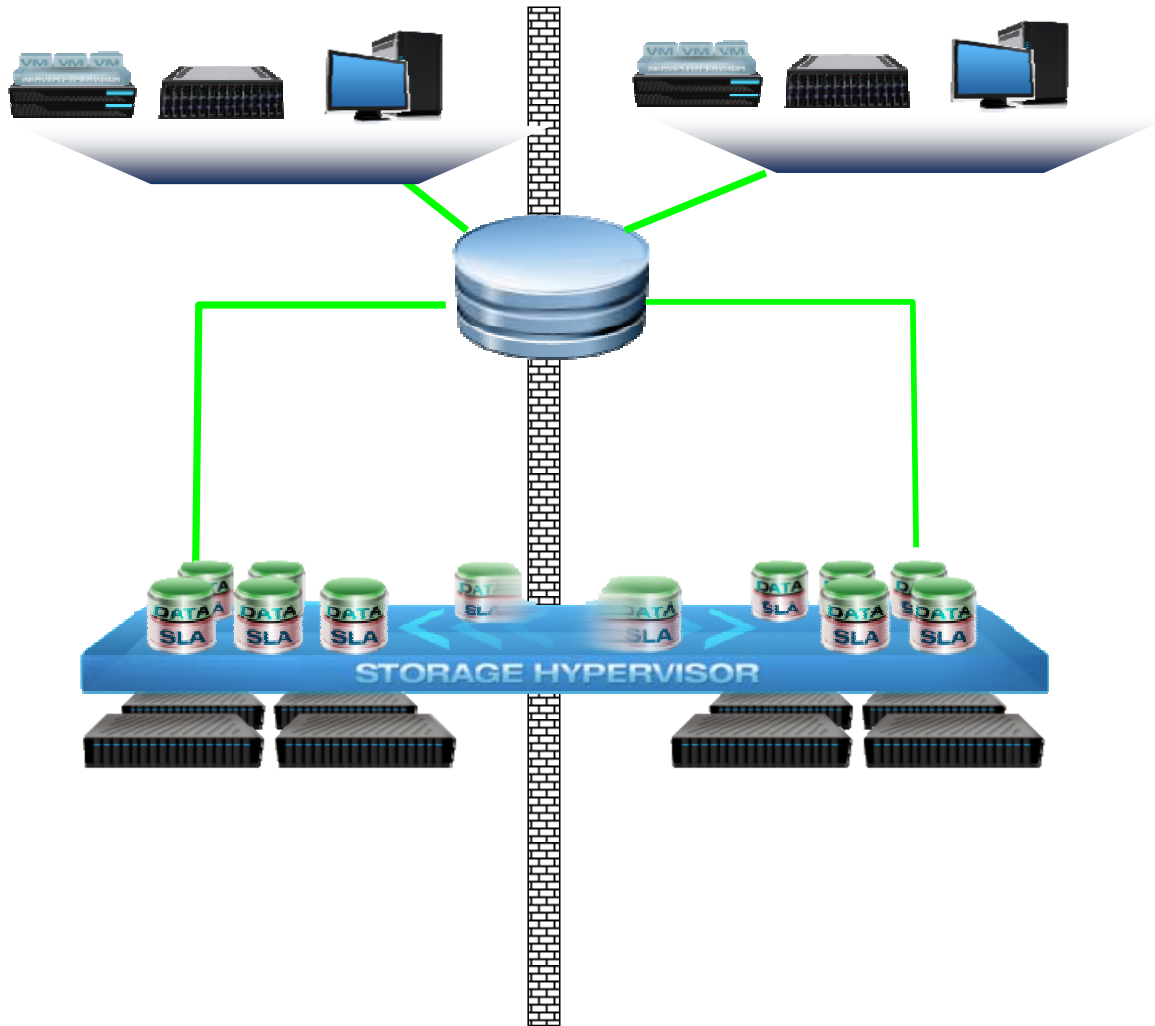
- SAP, VMware
- 2x 200TB

- IBM SVC
- IBM Disk, EMC
- RamSan (2x)

- Tiering

**Batch-Jobs (SAP):
von 7h auf 2min!**

STORAGE HYPERVISOR

# Einsatz von SSD/Flash im Rechenzentrum – heute und morgen



Easy Tier

Flash Cache

SSD Arrays

| | |
|---|---|
| ns | Lowest Latency<br>Very Expensive |
| µs | Consistent Performance<br>Low Latency |
| ms | Fair Latency<br>Expensive HDD<br>Unbalanced Performance |
| sec | Lowest Perf.<br>Lower Cost |

# Storage Performance Council (SPC) results

SPC Benchmark 1 (SPC-1) results page – http://www.storageperformance.org/results/benchmark_results_spc1
SPC Benchmark 2 (SPC-2) results page – http://www.storageperformance.org/results/benchmark_results_spc2
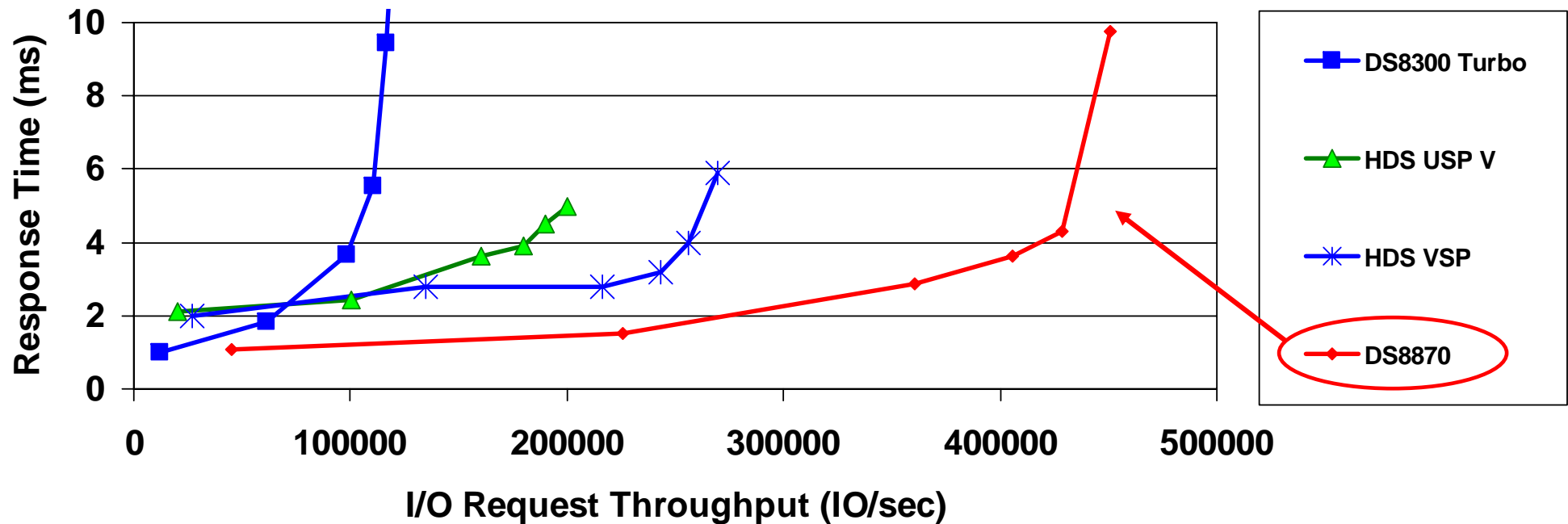
**Storage Performance Council**

- **SPC-1 throughput 451.082 IOPS**
  - #1 result for, enterprise-class all-HDD systems

- **SPC-2 throughput 15.424 MB/s**
  - #1 result

- **Internal benchmarks:**

| | DS8300 (R4.3) | DS8700 (R5) | DS8800 (R6) | DS8870 (R7) | *Increase* |
|---|---|---|---|---|---|
| | P5+ 4-way | P6 4-way | P6+ 4-way | P7 16-way | *vs. DS8800* |
| Seq. Read (GB/s) | 3.9 | 9.7 | 11.8 | 21.0 | 1.8x |
| Seq. Write (GB/s) | 2.2 | 4.7 | 6.7 | 11.0 | 1.6x |
| DB z/OS (K IOPS) | 165 | 201 | 204 | 640 | 3.1x |
| DB Open (K IOPS) | 165 | 191 | 198 | 550 | 2.8x |

# SPC-1 comparison vs. competition*)

## Higher throughput with 451K IOPS and lower response time!

**SPC-1 Published Results**

Response Time (ms) vs. I/O Request Throughput (IO/sec)

Legend:
- DS8300 Turbo
- HDS USP V
- HDS VSP
- DS8870

**\*) Source: Published SPC-1 results: http://www.storageperformance.org/results/benchmark_results_spc1**
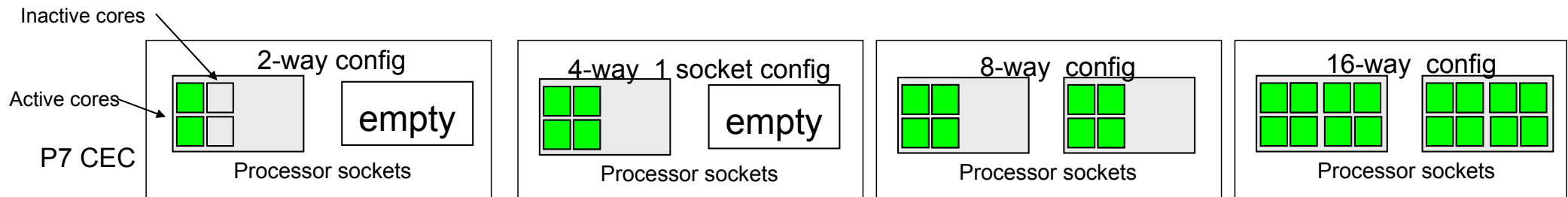
- DS8300 Turbo:       480 × 73 GB 15K HDDs, RAID-10, 256 GB Cache
- HDS USP V:       1024 × 146 GB 15K HDDs, RAID-1, 256 GB Cache
- HDS VSP:       1152 × 146 GB 15K HDDs, RAID-1, 512 GB Cache + 512 GB Cache Flash
- DS8870:       1536 × 146 GB 15K HDDs, RAID-10, 32 × 8Gb FCP, 1024 GB Cache

**EMC refuses to publish results, so we can assume less-than-impressive performance**
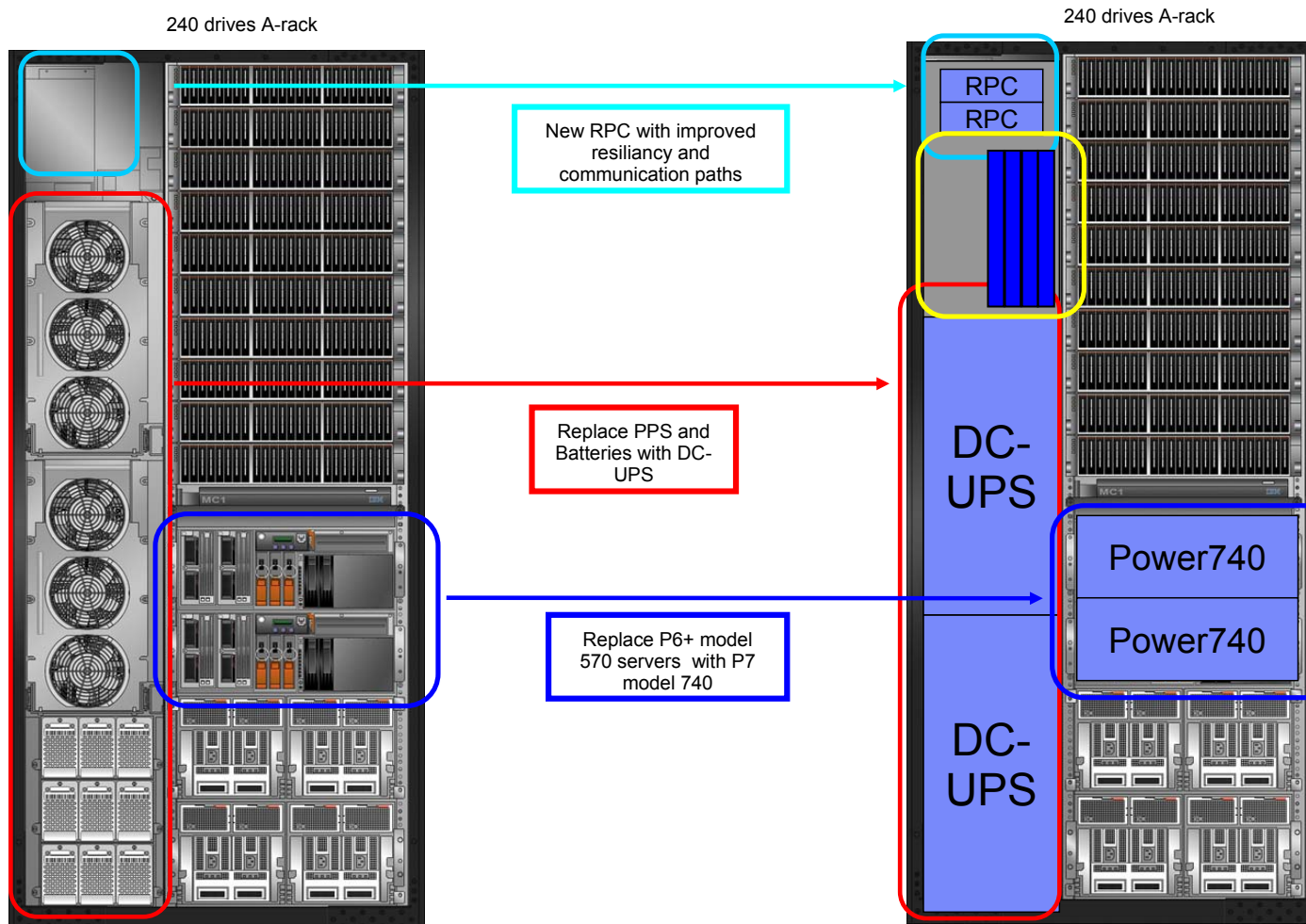
# DS8870  - R7 configuration table

| System Class | Active Processor Config per CEC | Processor Cards per CEC | Total System Memory Sizes (GB) | NVS Sizes (GB) | CEC DIMM Size (GB) / # of DIMM's per CEC / # of Memory Controlers | Expansion Frame | IOA's Max DA Pairs/Max HA's | Max DDM's |
|---|---|---|---|---|---|---|---|---|
| Business Class*** | 2- core | 1x4 core | 16 | 1 | 4(GB)x2x1 | No | 2/4(32 ports) | 144 |
| | | | 32 | | 4(GB)x4x1 | | | |
| Enterprise Class | 4-core | 1x4 core | 64 | 2 | 4(GB)x8x1 | No | 4/8(64 ports) | 240 |
| | 8-core | 2x4 core | 128 | 4 | 4(GB)x16x2 | 0, 1 or 2 | 8/16(128 ports) | 1056 |
| | | | 256 | 8 | 4(GB)x32x4 | 0, 1, 2 or 3 | 8/16(128 ports) | 1536 |
| | 16-core | 2x8 core | 512 | 16 | 8(GB)x32x4 | 0, 1, 2 or 3 | 8/16(128 ports) | |
| | | | 1024 | 32* | 16(GB)*x32x4 | | | |

\*  - Business Class upgradeable to Enterprise Class, however requires additional FO/FB cycle to adjust NVS size

Inactive cores

Active cores

P7 CEC

2-way config

empty

Processor sockets

4-way  1 socket config

empty

Processor sockets

8-way  config

Processor sockets

16-way  config

Processor sockets

# Rack changes DS8800 to DS8870

➢ System rack dimensions unchanged from previous models

➢ Location of drives, adapters, host cables carry forward.

240 drives A-rack

240 drives A-rack

New RPC with improved resiliancy and communication paths

RPC
RPC

Replace PPS and Batteries with DC-UPS

DC-UPS

DC-UPS

Power740

Power740

Replace P6+ model 570 servers with P7 model 740

All IO-bay slots can be filled with direct PCIe connections to the Ultra SSD Drawers, allowing for up to 8 per DS8870.

The new Power7 Controllers contain new enterprise class storage hardware:

• Faster PCIe Interface Cards to IO Bays

• Direct PCIe-PCIe connections between controllers

• Direct high speed connection to power system for better reliability and monitoring

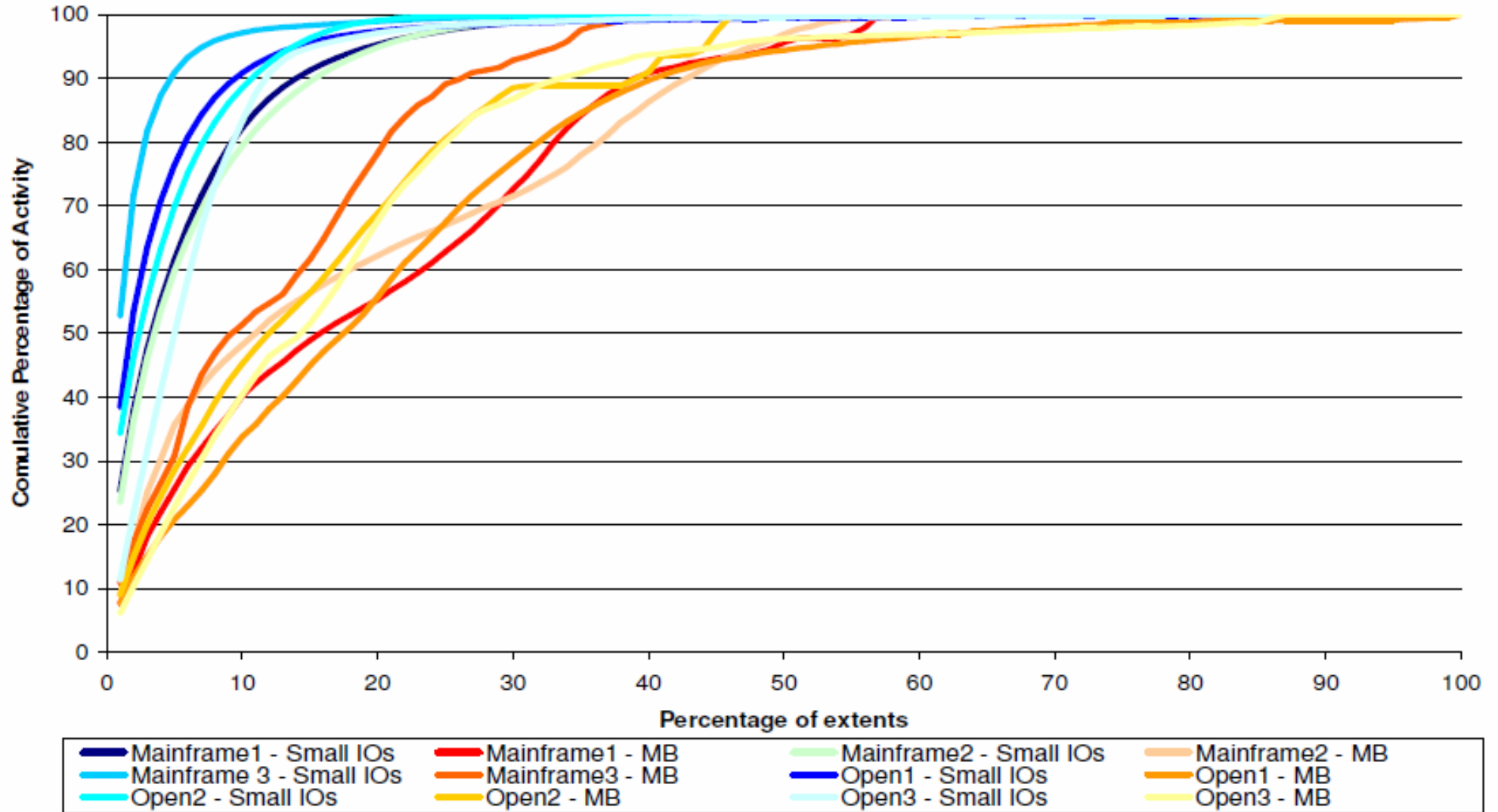# DS8000 integration of EXP30 Ultra SSD storage

SoD: Annc. Letter 116-106

Coming

Will be implemented with RamSan

- 1U drawer ... Up to 30 SSD
- Optimised for SSD performance
- Two large-cache SAS adapters especially designed for SSD
  - With 387 GB drives = up to 11.6 TB
  - Directly connected to DS8000 internal PCIe fabric
- Enterprise class RAS
  - High-Availability 2W Cluster
  - RAID 5 and 6 and mirrored/protected write cache
- Easy Tier Enabled

*Statements of IBM's future plans and direction are provided for informational purposes only. Plans and directions are subject to change without notice

# Workload Skew for Different Environments



Legend:
- Mainframe1 - Small IOs
- Mainframe1 - MB
- Mainframe2 - Small IOs
- Mainframe2 - MB
- Mainframe 3 - Small IOs
- Mainframe3 - MB
- Open1 - Small IOs
- Open1 - MB
- Open2 - Small IOs
- Open2 - MB
- Open3 - Small IOs
- Open3 - MB

# Easy Tiering

Extent Pool P0

Easy Tier across 3 Tiers

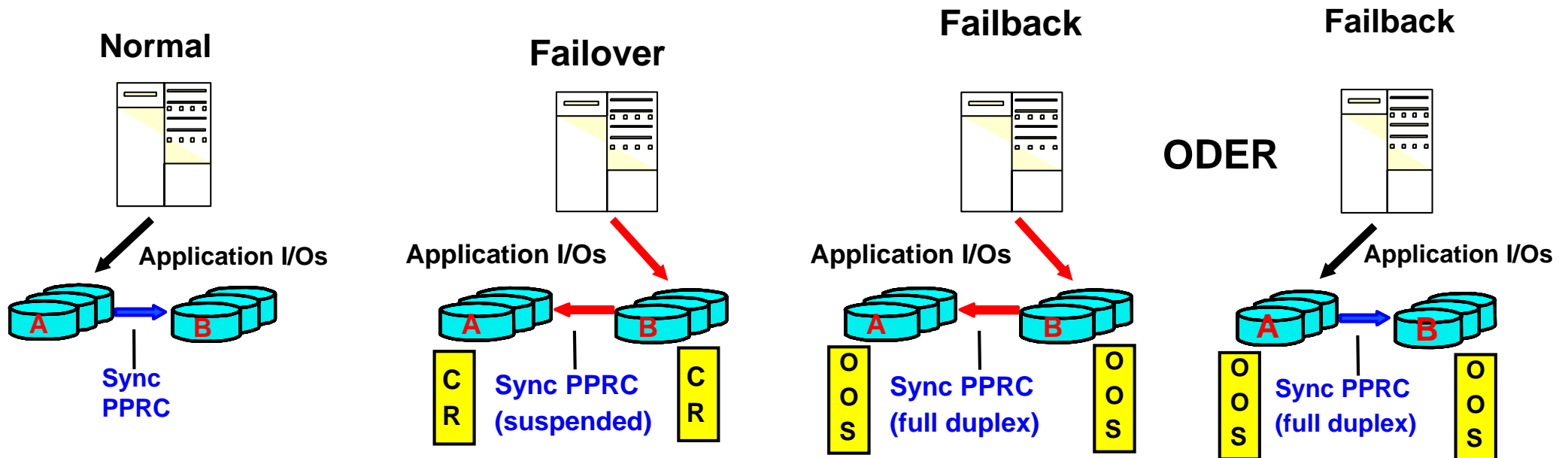Extent Pool P1

Easy Tier within homogenous pool
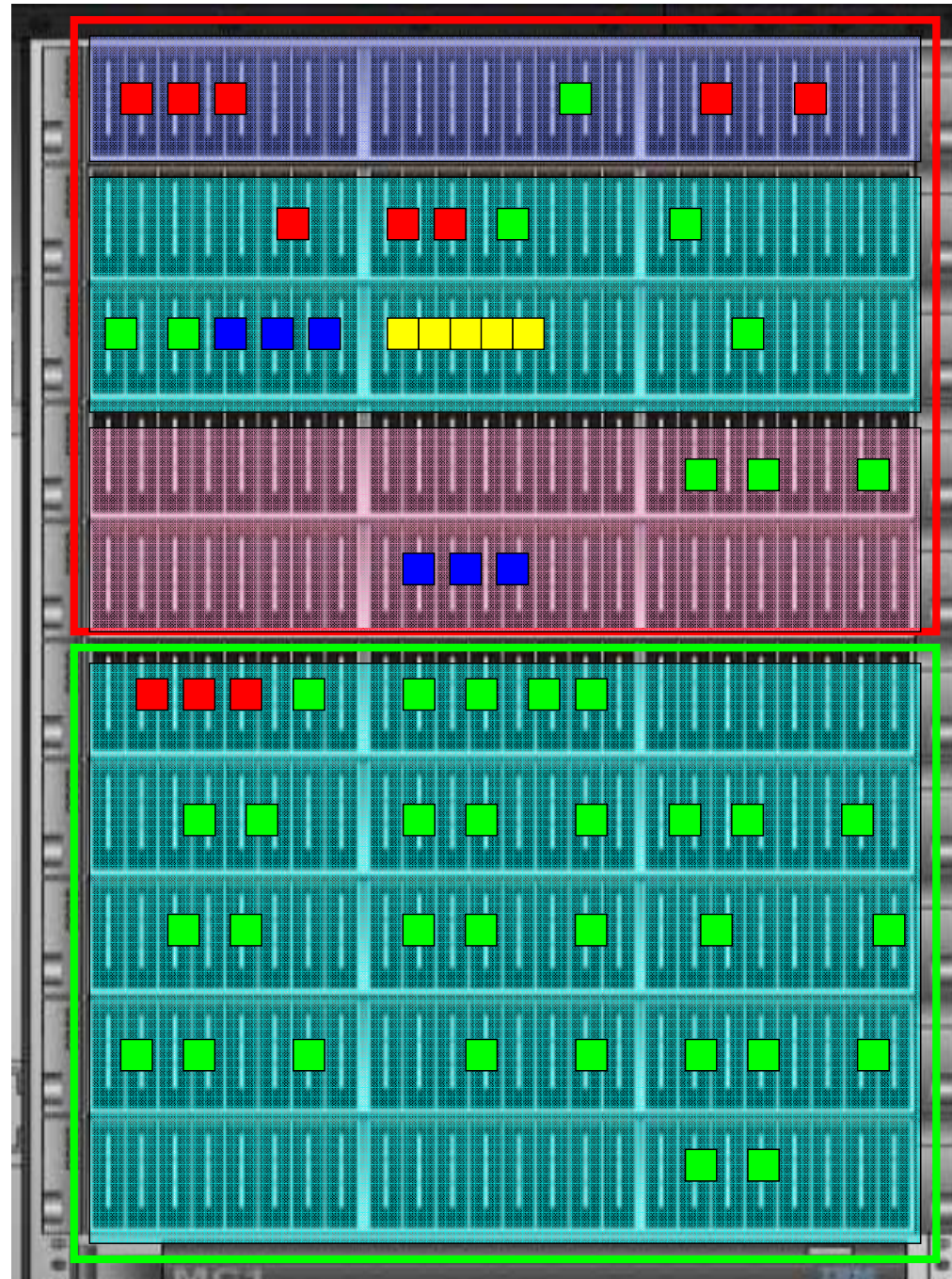


SSD / Flash

FC / SAS

Nearline

FC / SAS

# Metro Mirror (PPRC) Failover / Failback

- Methode zur Umkehr der Spiegelrichtung und danach Wiederherstellung des ursprünglichen Zustandes
- Geeignet für Disaster Recovery Tests
- Die Mitführung von Change Bittmaps erlaubt eine sehr schnelle Resynchronisierung



**Normal**

Application I/Os

A → B

Sync
PPRC

**Failover**

Application I/Os

A ← B

C R | Sync PPRC (suspended) | C R

**Failback**

Application I/Os

A ← B

O O S | Sync PPRC (full duplex) | O O S

**ODER**

**Failback**

Application I/Os

A → B

O O S | Sync PPRC (full duplex) | O O S

**Faster Resynchronization
Less Resource Consuming**

# IBM Disk- and virtualization Systems

- **Virtualization as independent layer in a SAN – separation of HW and logic**

- **Standardized storage services**

- **Ease of administrations by virtualising all LUNs**

- **Increase performance by memory cache of SVC nodes**

- **Striping across many drives, arrays, subsystems**

- **Optimum usage / utilization of SAN storage (no boundaries)**

- **Storage Pools**

**SVC**

**V7000Unified**

**V7000**
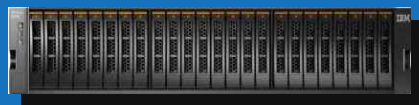
**V3700**

- **EasyTier / automatic tiering**

- **High availability solution with SVC stretched clusters**

- **Remote Mirroring solutions independent of storage subsystem**

- **Online volume migration**

- **Snapshots for all managed disks**

- **Thin-Provisioning**

- **Dynamic volume expansion or shrink**

- **Quality of service with I/O governing**

- **RACE compression**

# SVC Funktion interner Datenspiegel (vdisk Mirror)
# Erweiterung zur hochverfügbaren Stretched Cluster Lösung

**Virtual Disk Mirror**
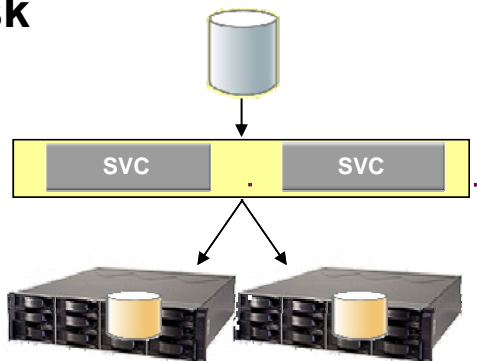


**Stretched Cluster Anwendung**



DC 1    DC 2
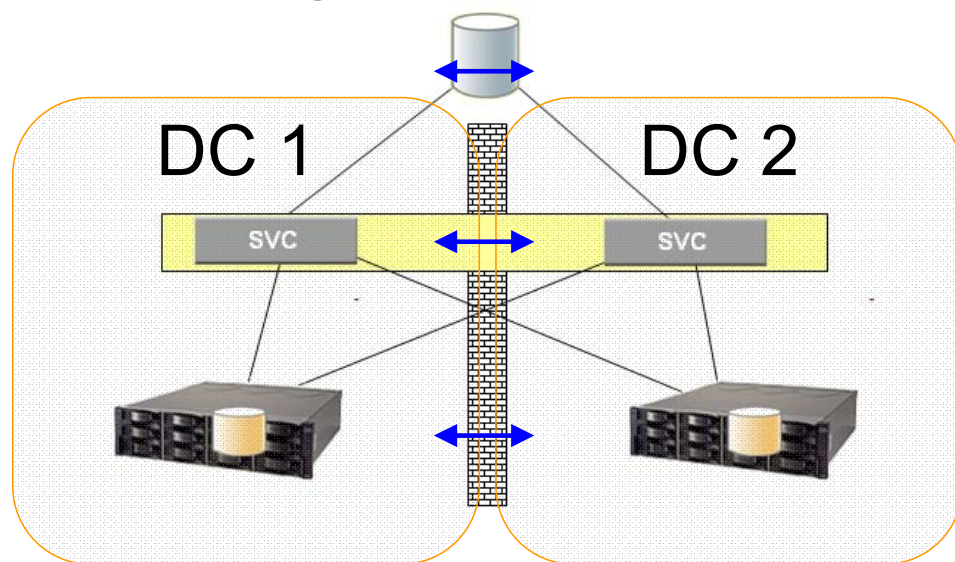
**Transparentes Verschieben**
**(*Motion*) auf allen Ebenen**

**Interner Datenspiegel**

- Schützt vor Ausfall eines Speichersystems
- Transparenter Failover für Server
- Keine Lizenz erforderlich

**No Single Point of Failure Konzept Stretched Cluster**

- Transparenter Failover beim Ausfall einer Site
- Auch für zLinux und FC attached zVM, zVSE

# IBM SVC und Storwize V7000 with Integrated Real-time Compression

## What this is

- Easy-to-use real-time compression fully integrated into SVC/Storwize V7000 for active primary data such as production databases and e-mail applications

- Compression technology that operates immediately as data is written to disk so no space is wasted storing uncompressed data awaiting post-processing
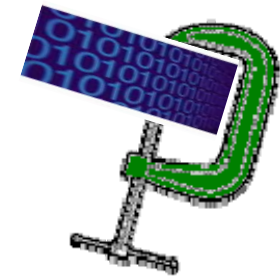
## Why It Matters

- Store up to five times more active data in the same physical disk space

- Compression helps reduce storage purchase costs, rack space, power and cooling, and software costs for additional functions

- Deferral of storage costs throughout the lifetime of the system

- Immediate extra free space on primary storage

- Compression can help freeze storage growth or delay need for additional purchases

- Savings on the back-end storage including Disaster Recovery, allowing for extra backup retention

- Transparency to users and support staff

# SVC Compression ohne Komplexität und Performanceverlust!

- Lizensiert auf TB Basis (Größe der LUNs)

- Real-time Compression als Volume in die GUI integriert

- Compression der Daten beim Initial Write
  - Weniger Daten werden gespeichert
  - Weniger I/O's im Backend

- Keine Performanceverlust

- Einfache Konvertierung von bestehenden LUNs in Compressed-LUNs
  - Volume mirroring Basis Funktion
  - Auch externe Volumes können konvertiert werden
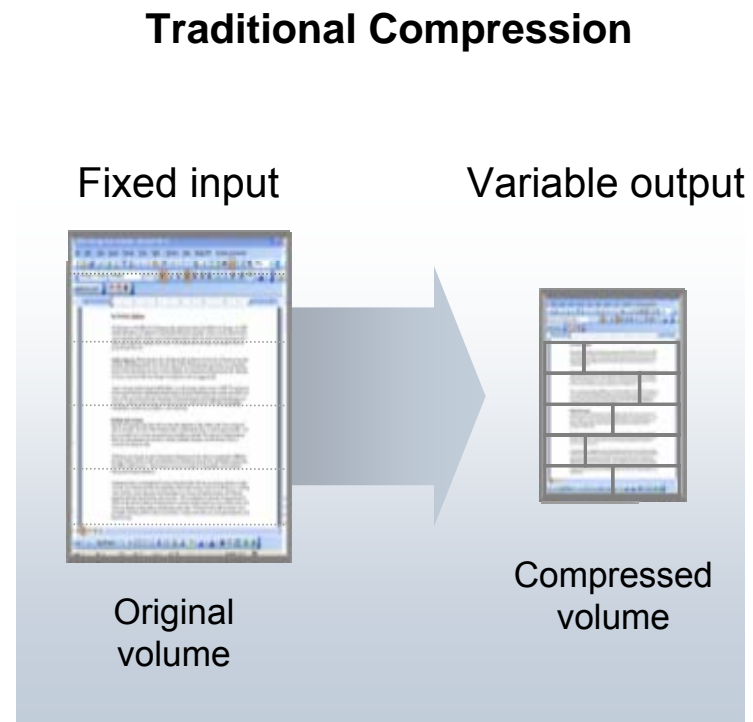  - Kein "process scheduling" oder "post processing"!
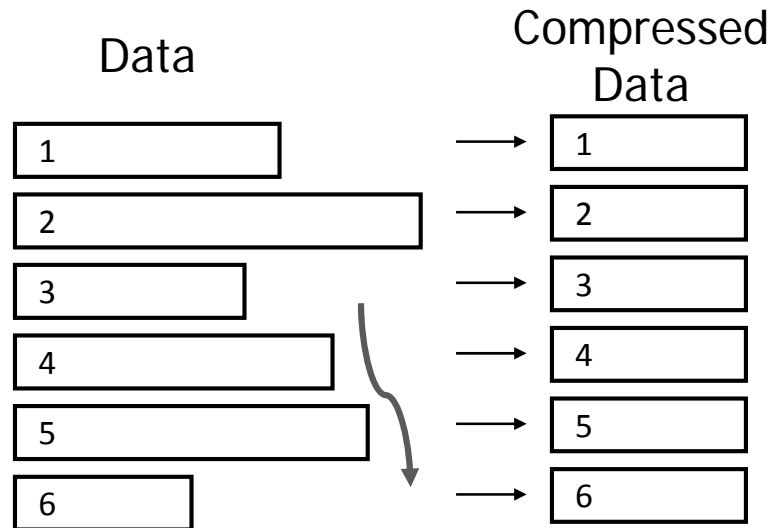  - Sizingtools ("Comprestimator")
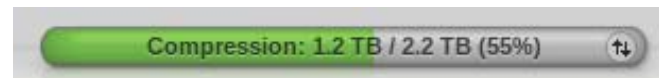




*IBM Data-compression: einfach, schnell, effizient*

# Traditional Compression

- Traditional compression engines break volumes up into fixed-sized chunks and compress them
- Some or all data written is stored uncompressed and only compressed later
  - Reduces efficiency because additional storage needed for data waiting to be compressed
- Compression ratios depend on chunk size used
  - Big chunks can have poor I/O performance
  - Small chunks offer lower compression ratios
  - Compression typically degenerates over time creating fragmentation requiring more garbage collection
  - Poorer I/O performance

**Traditional Compression**

Fixed input            Variable output



Original volume        Compressed volume

# Variable Input Fixed Output

Data

Compressed Data

| 1 |
| 2 |
| 3 |
| 4 |
| 5 |
| 6 |

| 1 |
| 2 |
| 3 |
| 4 |
| 5 |
| 6 |

Compressed Data

| 1 |
| 2 |
| 3 |
| 4 |
| 5 |
| 6 |

- RACE flips this approach, taking a variable data stream size and producing "fixed" output units
  - Compressed volumes have a consistent layout
  - Temporal locality: data that's accessed together is compressed together
  - Variable sized input chunks get better compression
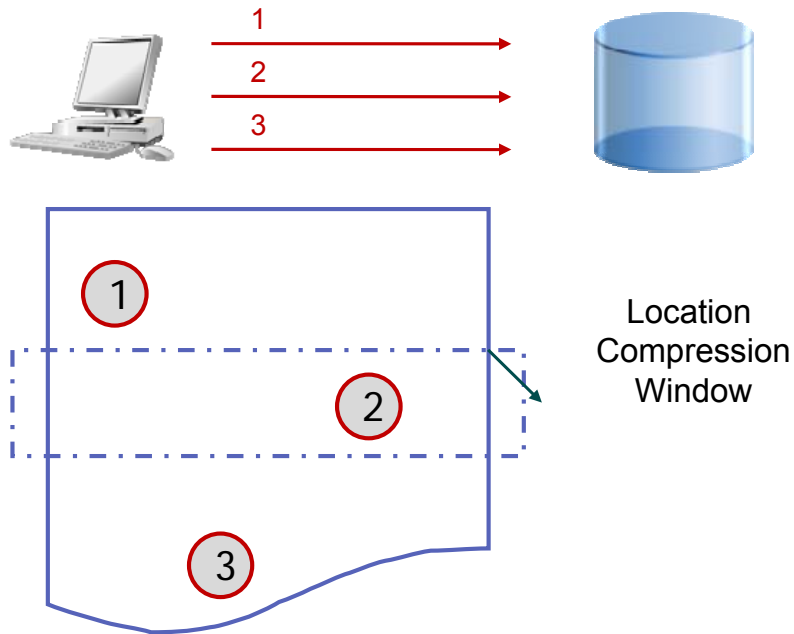  - Requires fewer disk I/Os
  - Delivers better performance
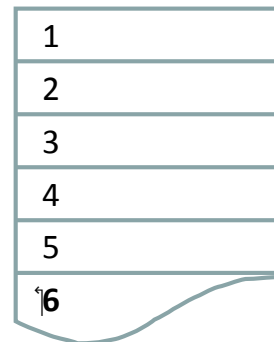
- No Fragmentation
- Consistent performance over time
- Consistent compression ratio over time

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# Compression Without Compromise
## *Designed for Real-Time Random Access to Active Data*
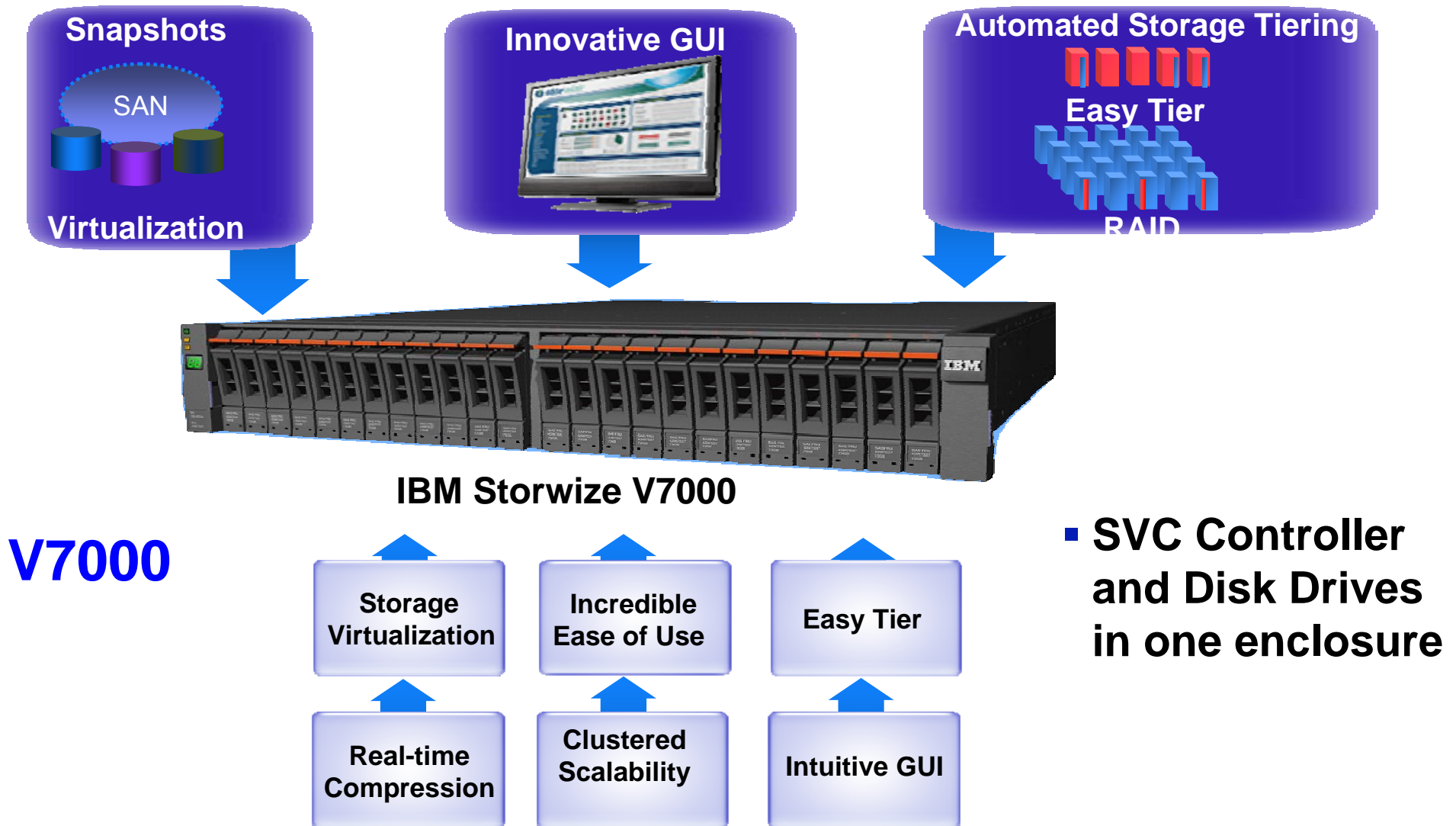
1

2

3

Location
Compression
Window

1

2

3

- Applications make multiple updates to data
- Traditional compression uses fixed-sized chunks and compresses each update based on its physical location on a volume
- In this example, **three** separate compression actions

- RACE compression acts on data that is written around the same time ("temporal locality") not according to physical location
- Temporal locality is more related to real system operation
    - Applications may make related updates to different parts of a volume
- RACE takes advantage of the structure of the data and its relations
- In this example, only **one** compression action
- Better compression and decompression efficiency and performance

Temporal
Compression
Window

1  2  3
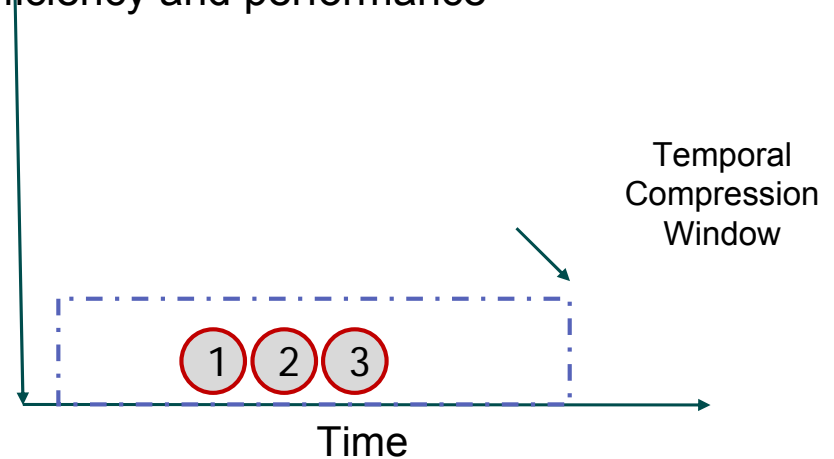
Time

# Technology Integration Continues, Storage Efficiency Continues

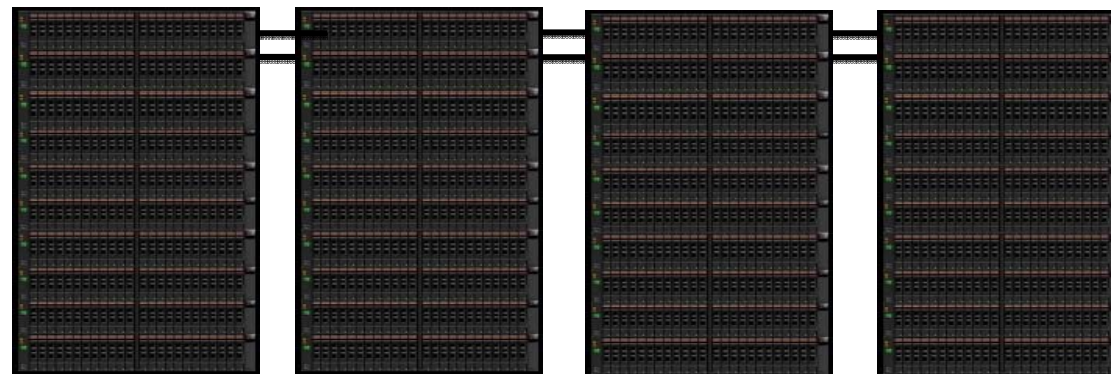*…IBM brings you IBM Storwize V7000 Storage System with <u>integrated Real-time Compression</u>*

**Snapshots**

SAN

**Virtualization**

**Innovative GUI**

**Automated Storage Tiering**

**Easy Tier**

RAID

**IBM Storwize V7000**

**V7000**

| Storage Virtualization | Incredible Ease of Use | Easy Tier |

| Real-time Compression | Clustered Scalability | Intuitive GUI |

- **SVC Controller and Disk Drives in one enclosure**

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36

# IBM Storwize V7000 Clustered System

*Clients can Scale UP and/or Scale OUT as business needs demand*

- *SCALE UP to add capacity*
- *SCALE OUT to add performance with up to 960 disk drives*
- **Cluster four systems to provide smarter scalability**
- **Buy only as much capability as you need, when you need it**
- **Increase performance, connectivity and cache**
- **Clustered system operates and is managed as a *single* system**

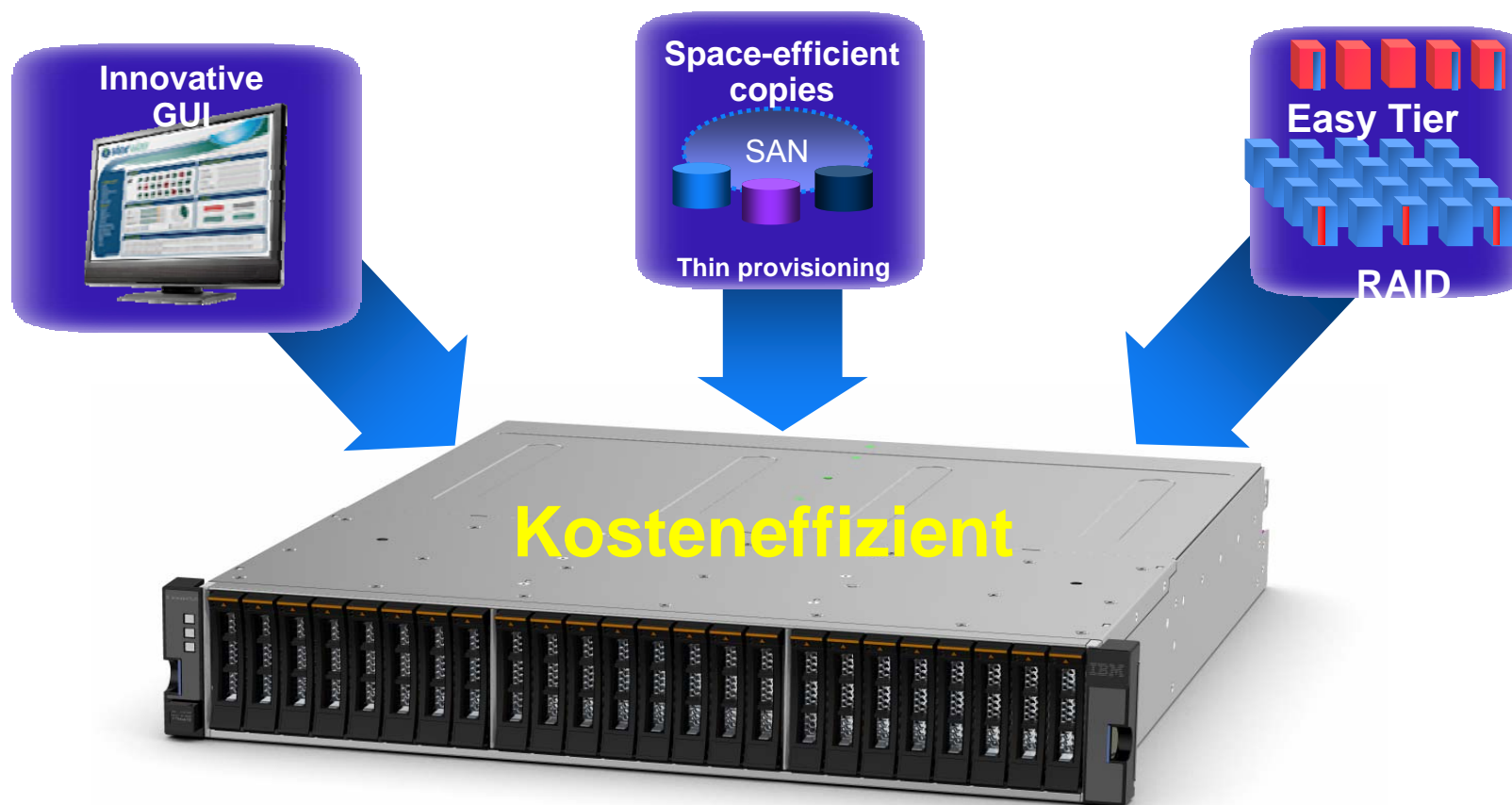**Start Small**

**One 24 bay control enclosure**

**Cluster Up to 4X V7000**

Note: IBM Storwize V7000 Unified does not currently support clustered systems.  A maximum of 240 drives are currently supported.

# Das "Smarter Storage" Konzept: V3700, der kleine Bruder der V7000

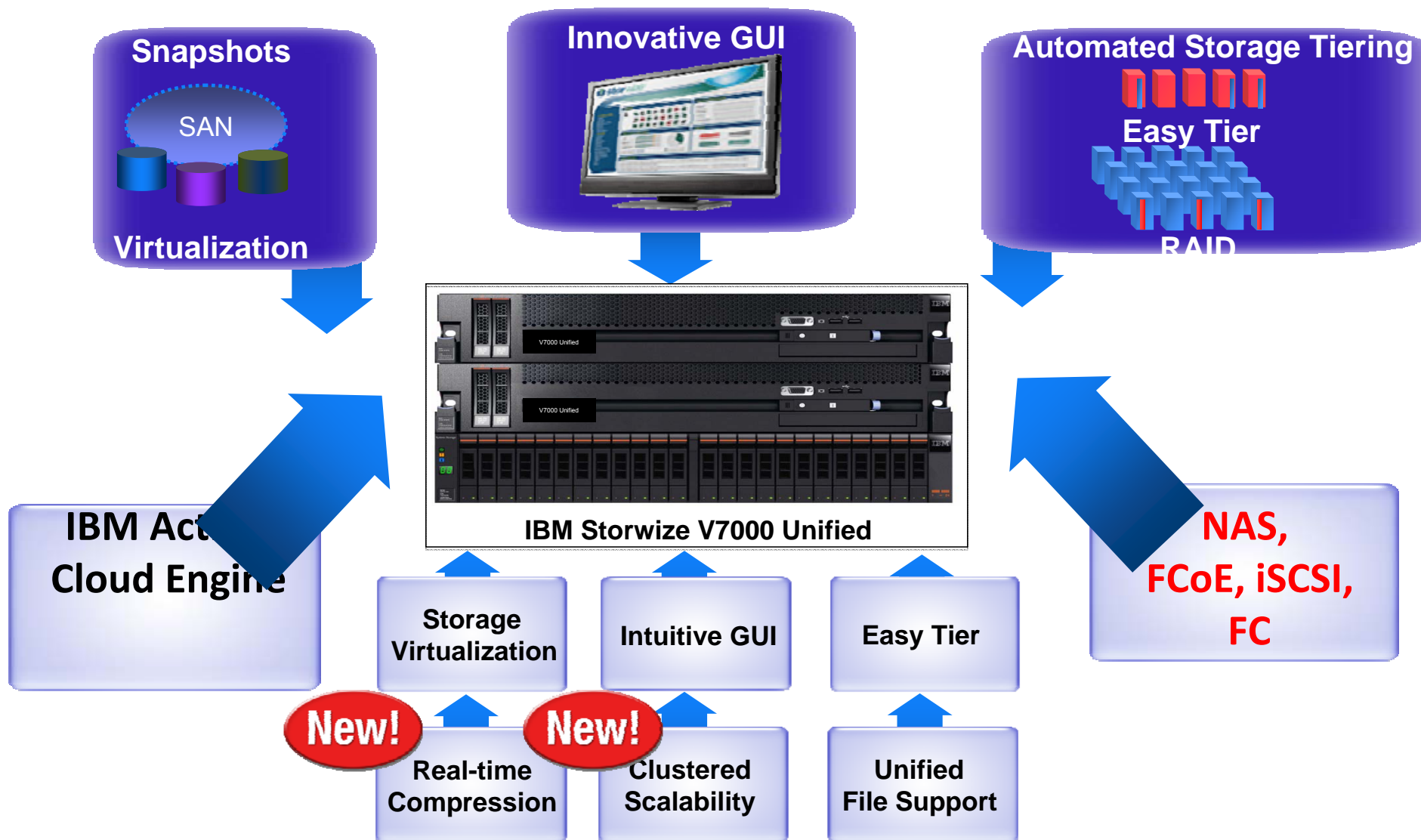IBM bringt das Beste aus den IBM Speichertechnologien in ein Entry System



**Innovative GUI**

**Space-efficient copies**

SAN

**Thin provisioning**

**Easy Tier**

**RAID**

**Kosteneffizient**

**Platzsparende Daten-sicherung**

**Einfache Bedienbarkeit verbessert Produktivität**

**Easy Tier verbessert Antwortzeiten**

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# V7000 Unified, Storage Efficiency Continues

*…IBM brings you IBM Storwize V7000 Unified Storage System with integrated Real-time Compression and 4-Way Clustering*

**Snapshots**

SAN

**Virtualization**

**Innovative GUI**

**Automated Storage Tiering**

**Easy Tier**

RAID

**IBM Storwize V7000 Unified**

**IBM Active Cloud Engine**

**Storage Virtualization**

**Intuitive GUI**

**Easy Tier**

**NAS, FCoE, iSCSI, FC**

**New!** **Real-time Compression**

**New!** **Clustered Scalability**

**Unified File Support**

# Intuitive GUI is Truly Integrated

- **One administration interface for block and file data**
  - Not a launcher for two different interfaces
- **Integrated data protection**
  - Built-in NDMP and IBM Tivoli Storage Manager client
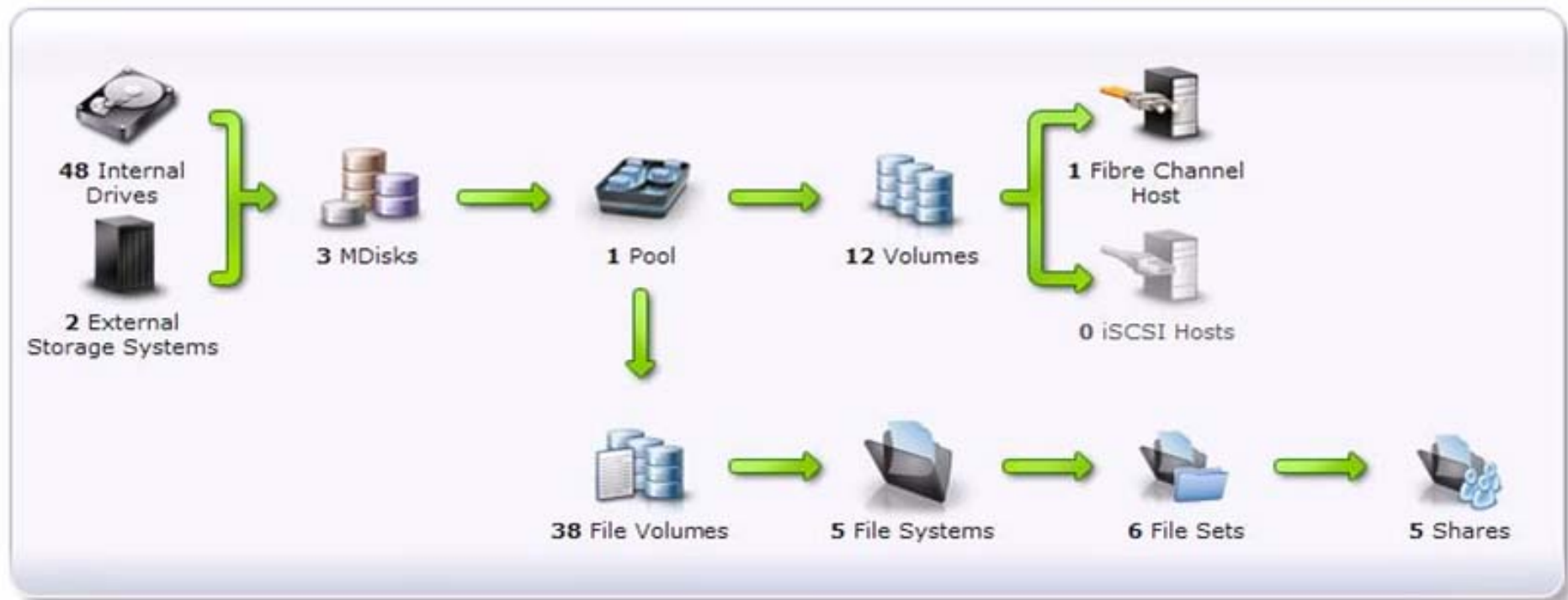
# To deliver on its promised value, cloud storage must provide a few key capabilities.



- **Self-Service** ability to manage their own IT environment in their own way



- **Quick Access** getting the right data to the right people at the right time



- **Pay per use** pay only for what is consumed



- **Elasticity** capacity growth without constraints, release resources when not needed

# Introducing IBM SmartCloud Storage Access

- **Self-service**
  - Capacity provisioning, monitoring, reporting
- **Web-based access**
  - Simple GUI via Internet
- **Capacity elasticity**
  - Automated or policy-driven
- **Monitoring and reporting capability**
  - End-user and administrator
- **Service Class**
  - Gold, Silver, Bronze
- **Secure**
  - Access controls
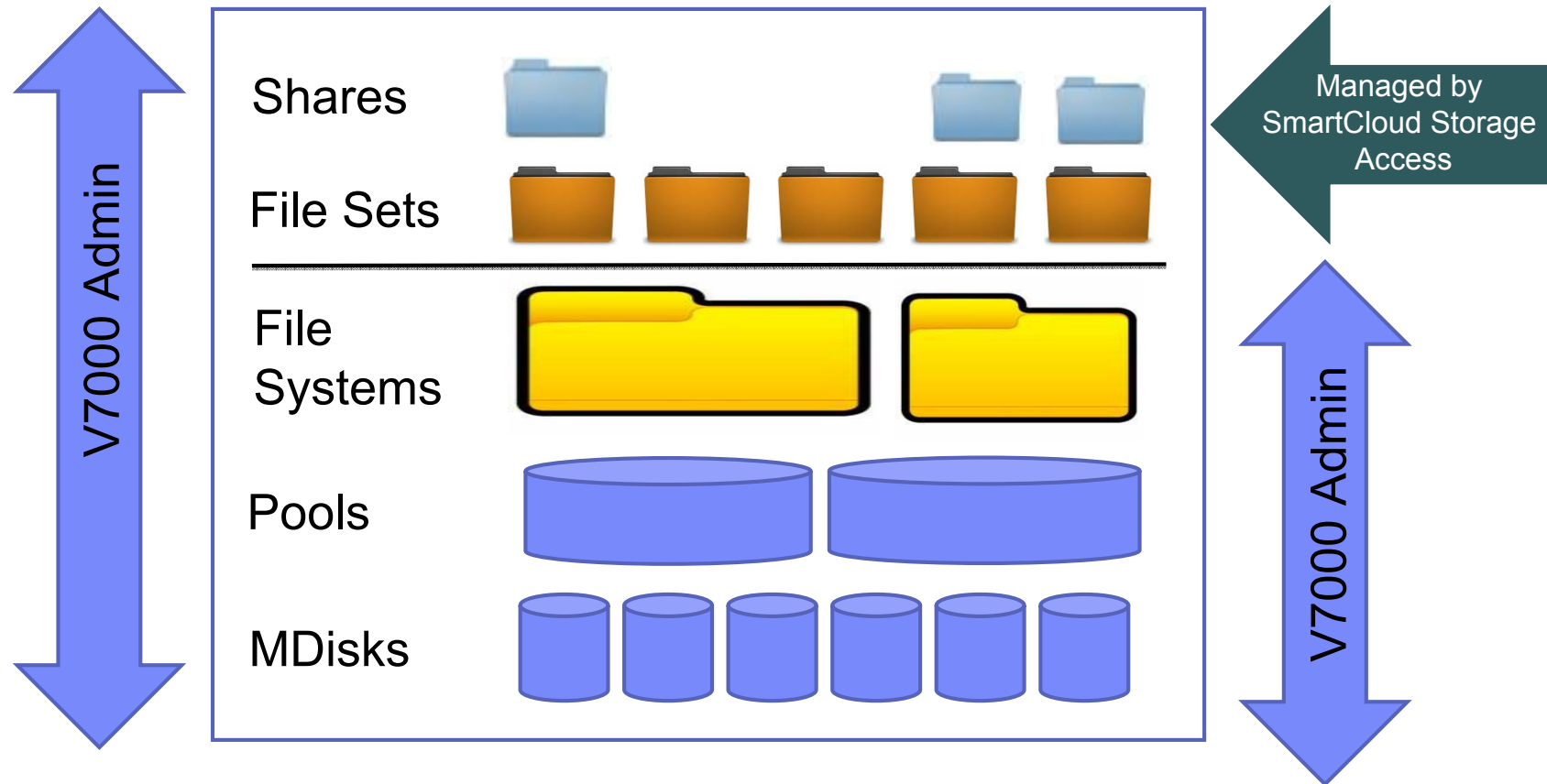- **Approval**
  - Complete approval control process
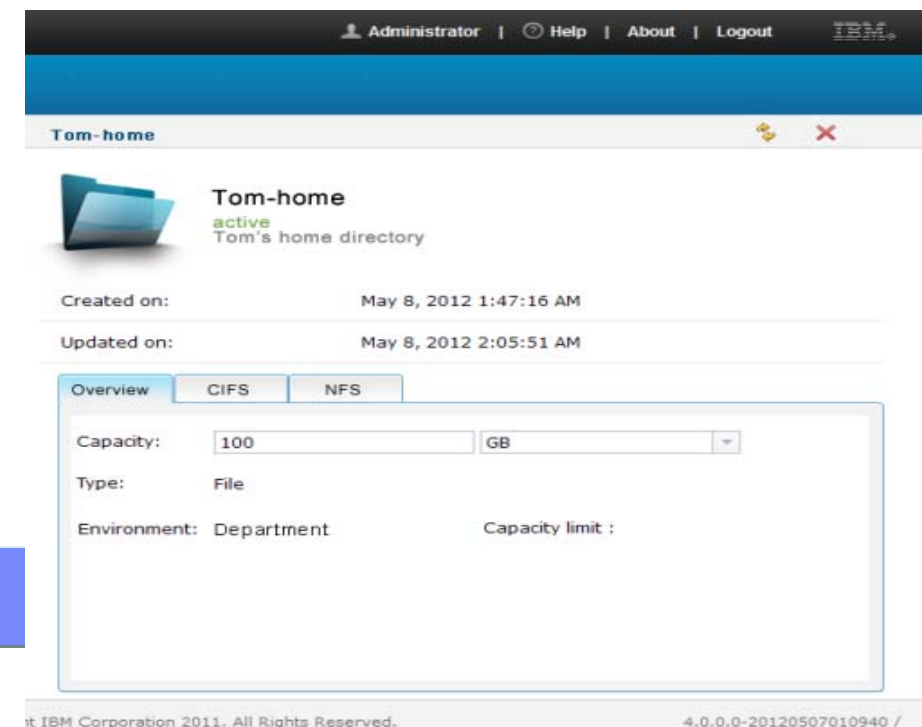
**Enables private cloud storage service**

# V7000 Unified  SmartCloud Storage Access management

**Without SmartCloud Storage Access**

**With SmartCloud Storage Access**

Shares

File Sets

Managed by SmartCloud Storage Access

File Systems

Pools

MDisks

V7000 Admin

V7000 Admin

V7000 Unified structure

# XIV Announcement Highlights

*Announce: February 5, 2013; General Availability: March 7, 2013*

**Price-performance efficiencies for cloud and virtualization**

**Cloud Agile**

**Up to 5X 10Gb iSCSI throughput**

**Windows Server 2012 support**

➡ Bullet-proof cost-effective speed for IP-based SANs

Value for Microsoft Hyper-V, VSS, and MSCS

**Higher performance and availability, ALWAYS tuning-free**

**Self-optimizing**

**Up to 4.5X boost in DB performance with enhanced SSD caching**

**Up to 13.7 GB/s sequential read per rack**

**Dramatically reduced drive rebuild times**

➡ OLTP Tier-1 applications

High throughput for Analytics, Streaming Media, and Backup

XIV provides the lowest rebuild times of a 2TB drive in 26 minutes at 100% utilization

**Reduced TCO through energy efficiency and capacity optimization**

**Efficient by Design**

**Up to 16% reduced power consumption**

**Extended Space Reclamation/UNMAP**

➡ Reduce $ and carbon footprint

Stretch your TBs; defer CapEx Efficient thin provisioning

# XIV Model 214 - New CPU

- **New 6-core CPU**
  - Intel Xeon E5645
  - 2.4 GHz
    - Sized to support module I/O processing
    - Key benefit of XIV architecture
  - XIV uses Intel Hyper-Threading
    - Delivers 2 logical processing threads per physical core
      - ✓ 6 physical CPUs per module
      - ✓ 12 logical CPUs per module
    - 15 Module system
      - ✓ 90 physical cores
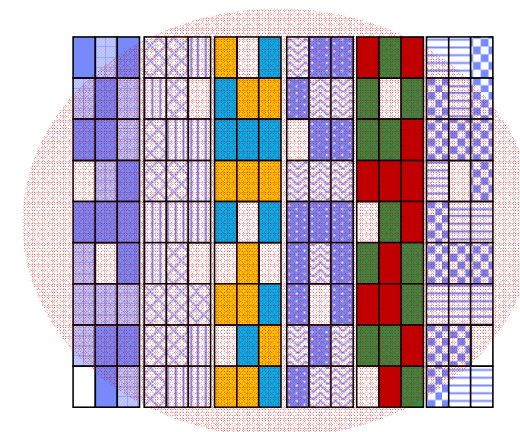      - ✓ 180 logical cores (hyper-threading)

- **Support for:**
  - New high-speed iSCSI interfaces
    - Utilizes Light Weight IP Stack (LWIP)
  - Platform for future hardware/software enhancements
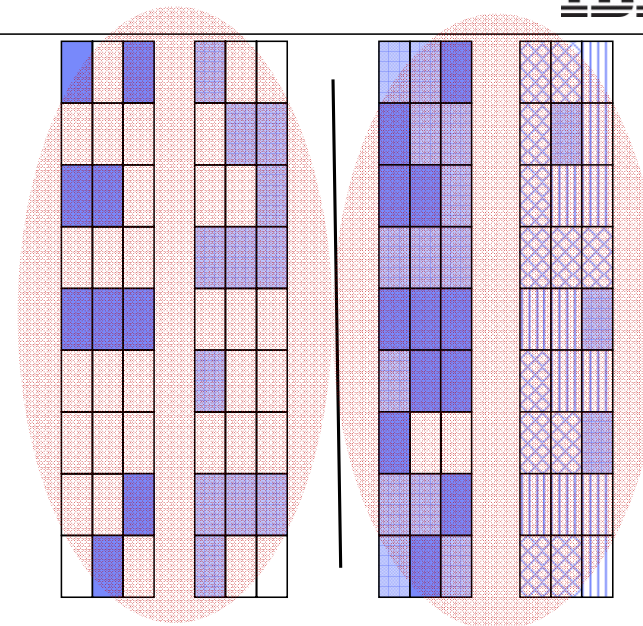


**Multiprocessing**
**2-core processor**

**Multiprocessing**
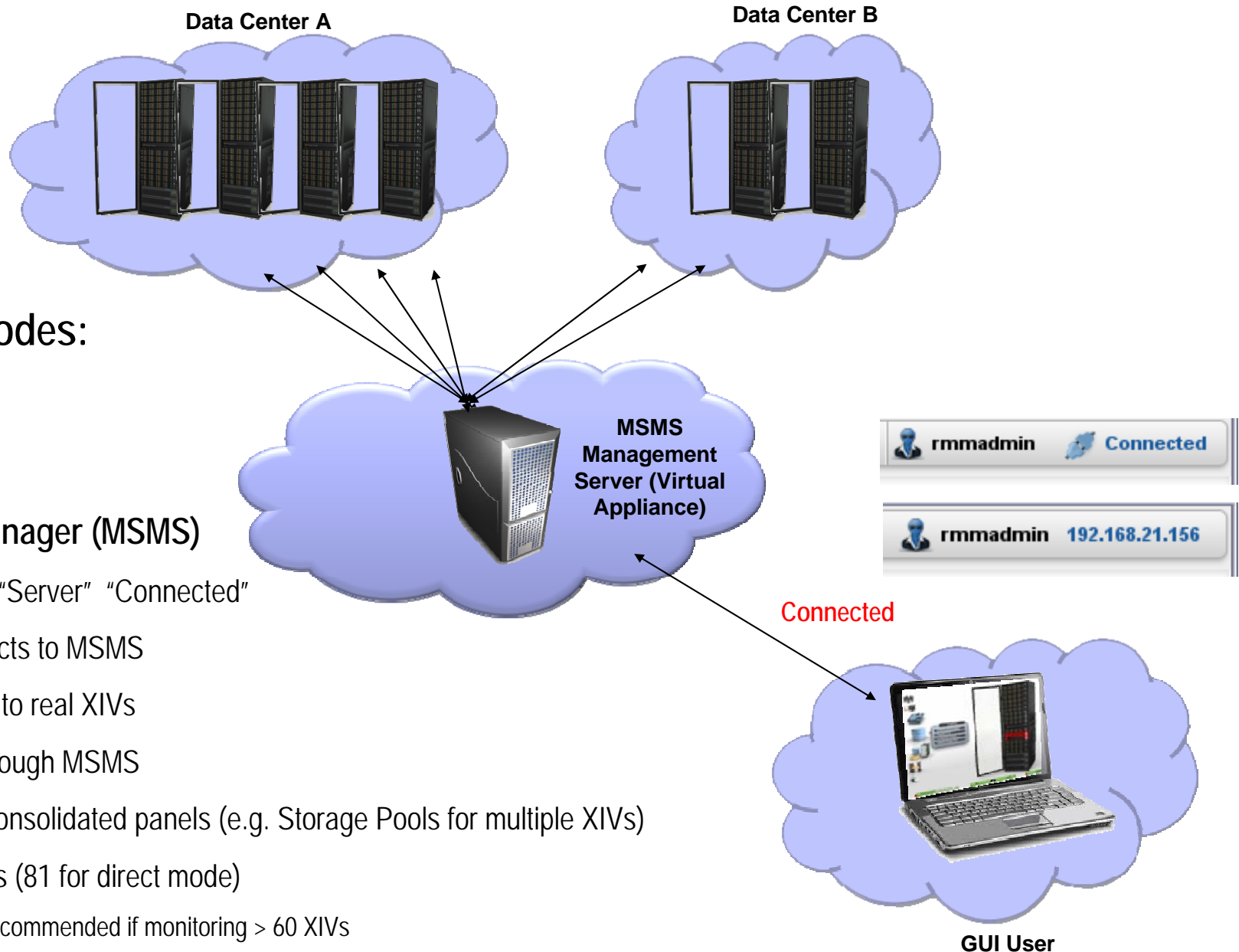**2-core processor with Hyper-Threading**

http://cache-www.intel.com/cd/00/00/01/77/17705_htt_user_guide.pdf



**XIV 6-core CPU**

**with hyper-threading**

Cloud agile  **Self-optimizing**  Efficient by design

# XIV GUI 4.0 Multi-System Manager (MSM) Mode

**Data Center A**

**Data Center B**

- 3 XIV GUI 4.x modes:
  - ▶ Demomode
  - ▶ Direct
  - ☆ ▶ **Multi-System Manager (MSMS)**
    - Also "Manager" "Server" "Connected"
    - GUI client connects to MSMS
    - MSMS connects to real XIVs
    - All actions go through MSMS
    - Allows viewing consolidated panels (e.g. Storage Pools for multiple XIVs)
    - Max 144 systems (81 for direct mode)
      - – MSMS mode recommended if monitoring > 60 XIVs

**MSMS Management Server (Virtual Appliance)**

rmmadmin   Connected

rmmadmin   192.168.21.156

Connected

**GUI User**

# MSMS 1.1 - Consolidated Views (All Systems or Group of Systems)

- Storage Pools
- Volumes by Pools
- Volumes and Snapshots
- Consistency Groups
- Hosts and Clusters
- Host Connectivity
- QoS Performance Class
- Volumes by Hosts
- iSCSI Connectivity
- Mirroring
- Migration
- Users
- **Usage**
  - ➢ Check server connectivity to multiple XIVs
  - ➢ Check mirror master and secondary configuration or status



- Change password (or edit or delete user) for same user across multiple systems

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