IBM System Storage™
Irresistiblemente Poderosa: Familia Storwize

To realize the promise of a Smarter Planet, enterprises must address the IT challenges that have emerged

31.9 million servers worldwide

Last 10 years servers up **2X** and virtual machines up **42% CAGR**

The volume of digital content, up 48% from 2011, is expected to reach 2.7 ZB (1ZB = 1 billion terabytes) in 2012 and 8ZB by 2015.

Internet connected devices—**22B in 2020 (24.9% CAGR)**

Since 2000 security vulnerabilities grew **eightfold**

Data centers have **doubled** energy use in past 5 years

And respond to demands for new services…

Real-time analytics workloads growing 13% CAGR with related server spend **growing 3x average**
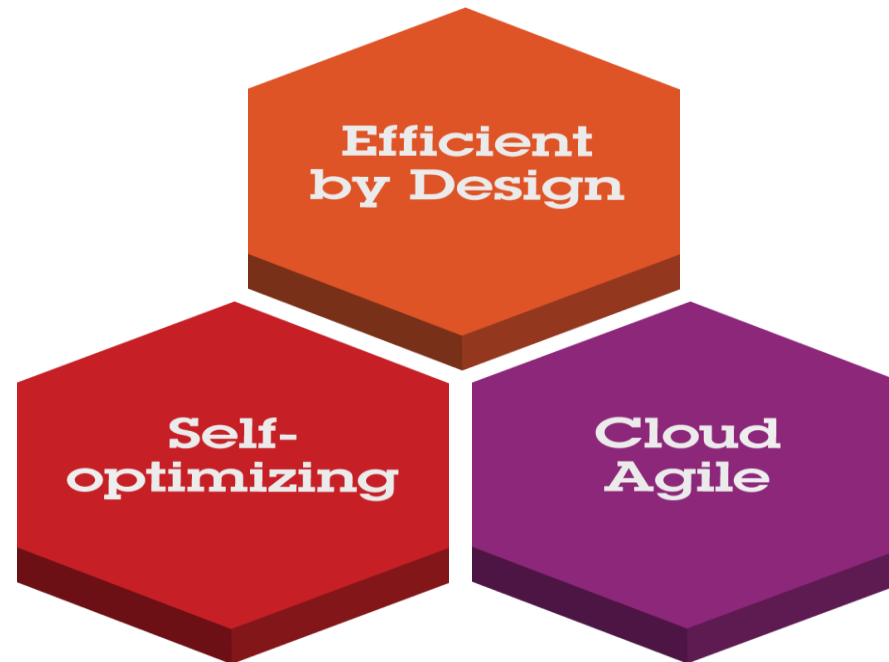
Collaborative software workloads growing 10% CAGR

…**while dealing with constraints like a flat budget.**

Introducing IBM Smarter Storage for Smarter Computing

Efficient by Design
Manage cost and capacity growth

Self-optimizing
Improve performance and productivity

Cloud Agile
Increase information access and improve ROI

On today's Smarter Planet, businesses globally are challenged to innovate while managing an unprecedented rate of data growth

2.7 zettabytes of digital data in 2012, up 48% from 2011

90% of organizations expect to adopt or deploy a cloud model in the next 3 years

Big Data can increase data volumes by 2x to 3x

Analytically savvy companies are 2x more likely to outperform their industry peers

Labor costs will be 70% of IT spend by 2013

Leading organizations achieve 25% higher disk utilization than average

Source: Industry Analysts and IBM Market Intelligence

Megabytes, Gigabytes, Terabytes...... What are they?

- Bit
- Bits
- Bytes
- Kilobytes
- Megabytes
- Gigabytes
- Terabytes
- Petabytes
- Exabytes
- Zettabytes
- Yottabytes
- Brontobytes
- Geopbyte

Why IBM System Storage?

- **Heritage of Distinction**
  - 50+ years in storage business
  - Innovation leadership - Invented many of the storage technologies employed today

- **Leadership in Storage Today**
  - Over $5 billion revenues
  - Leading and growing market share
  - Over 5,000 people
  - In 170 countries
  - Over 1,000 IBM Business Partners

- **Research for a Bright Future**
  - 15 development labs worldwide
  - Over $500 million in R&D annually
  - More US patents than any other vendor
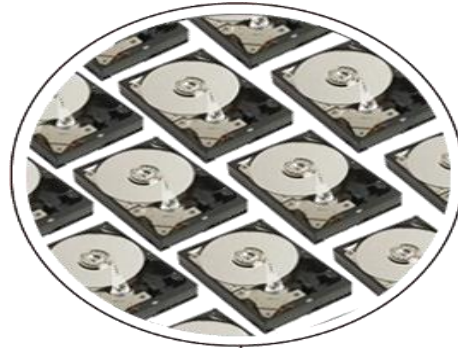 - Acquiring new technologies to boost in-house innovation

IBM heritage of innovation and leadership in storage
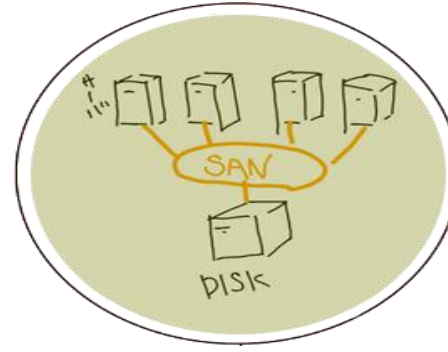
1956

First magnetic hard disk drive
IBM 305 RAMAC (Random Access Method of Accounting and Control). Capacity of the 305's 50 two-foot diameter disks was 5 megabytes.

1993

First distributed storage
IBM 9337 Disk Array Subsystem is first reliable storage system using multiple, low-cost disk drives as single logical unit.

2003

Storage network virtualization
IBM SAN Volume Controller provides single, centralized point of control over data in heterogeneous storage environments.
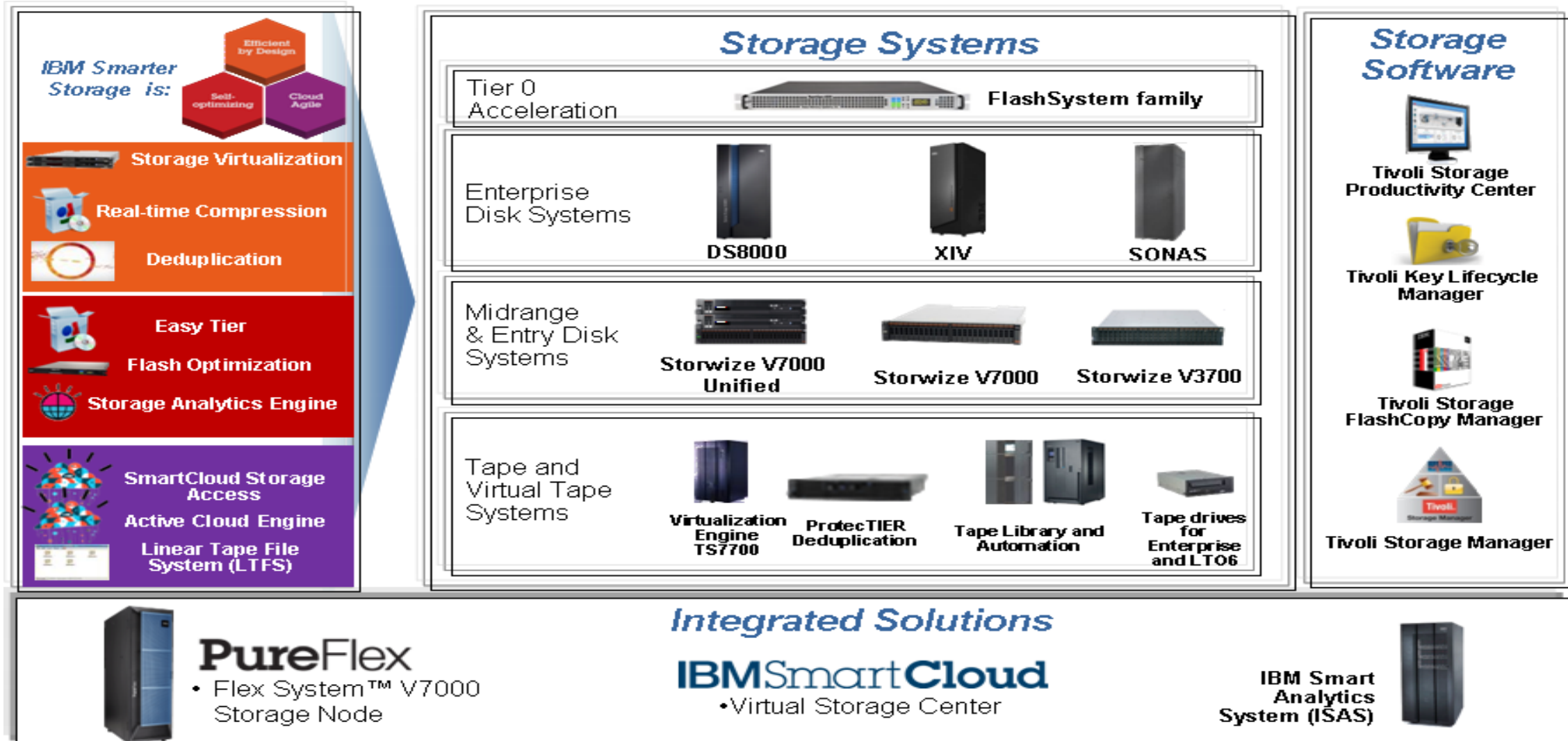
2010

First Intelligent data placement
IBM System Storage Easy Tier first to automatically move most active data to faster solid-state drives for real-time analysis and less urgent data to tape.

Storage Acquisitions: 2007 Softek, Princeton Softech and Novus Consulting Group
2008 XIV, FilesX and Diligent 2010 Storwize, Inc.

IBM Smarter Storage is an approach for the design and deployment of storage

IBM Smarter Storage is:

- Efficient by Design
- Self-optimizing
- Cloud Agile

- Storage Virtualization
- Real-time Compression
- Deduplication

- Easy Tier
- Flash Optimization
- Storage Analytics Engine

- SmartCloud Storage Access
- Active Cloud Engine
- Linear Tape File System (LTFS)

Storage Systems

Tier 0 Acceleration — FlashSystem family

Enterprise Disk Systems — DS8000, XIV, SONAS

Midrange & Entry Disk Systems — Storwize V7000 Unified, Storwize V7000, Storwize V3700

Tape and Virtual Tape Systems — Virtualization Engine TS7700, ProtecTIER Deduplication, Tape Library and Automation, Tape drives for Enterprise and LTO6

Storage Software

- Tivoli Storage Productivity Center
- Tivoli Key Lifecycle Manager
- Tivoli Storage FlashCopy Manager
- Tivoli Storage Manager

Integrated Solutions

PureFlex
- Flex System™ V7000 Storage Node

IBMSmartCloud
- Virtual Storage Center

IBM Smart Analytics System (ISAS)

Meet the Storwize family

Family of storage systems and storage virtualization systems

- One code base on all platforms
- One set of functions (selectively licensed)
- One user interface
- One Command Line Interface

SAN Volume Controller

Flex System V7000

Storwize V7000 Unified

Storwize V7000

New!

Storwize V3700

IBM Storwize V7000 Unified

What is Storwize V7000 Unified

- A combined block (Storwize V7000) and file storage system with a tightly integrated management console

- Support for NFS/CIFS/FTP/HTTP/SCP file protocols in addition to existing block functions

- File replication and file level snapshots for business continuity and disaster recovery

- Integrated IBM Real-time Compression capability enables use of compression for active primary data (unlike EMC and NetApp, which are limited to low activity data)

- 4-way clustering support, doubles maximum system physical capacity to 960 drives or 1.4 PB

Why It Matters

- Provides greater flexibility for provisioning of storage resources and improves overall capacity utilization

- Unified console simplifies storage administration with a single user interface and common CLI

- Enables deployment of a broad set of applications from within a single storage system, especially in shared storage environments

6U

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

Storage Virtualization

Incredible Ease of Use

Easy Tier

New!

New!

Real Compression

Clustered Scalability

Intuitive GUI

IBM Storwize V7000 with Integrated Real-time Compression

Real-time Compression

What this is

- Easy-to-use real-time compression fully integrated into 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

RtC: Why Its Has Performance Differentiation?

1 MB – "chunk"

100 byte update

IBM **Real-time Compression**

Tradicional approach for data compression (technology that most Storage competitors use)

Must decompress entire file to edit

Much more I/O

More 'CPU work'

Network impact

No way to make real-time

Traditional	Real-time
1 MB Read	0 MB Read
1 MB Decompress	0 MB Decompress
100 Byte Update	0 Byte Update
1 MB Compress	100 Byte Compress
1 MB Write	< 100 Byte Write
2 MB I/O	< 100 Byte I/O

No need to decompress data to modify data

No application performance impact

The only storage compression solution that works in real time on active data

Efficient and Fast Capacity Provisioning
And Now with Real-Time Compression

Capacity savings

High availability

Capacity savings and high availability combined
                    (***Thin Mirror***)

Space savings through Reat-Time Compression (RtC) for active data

Fast, flexible and centralized provisioning

Efficient Data Protection
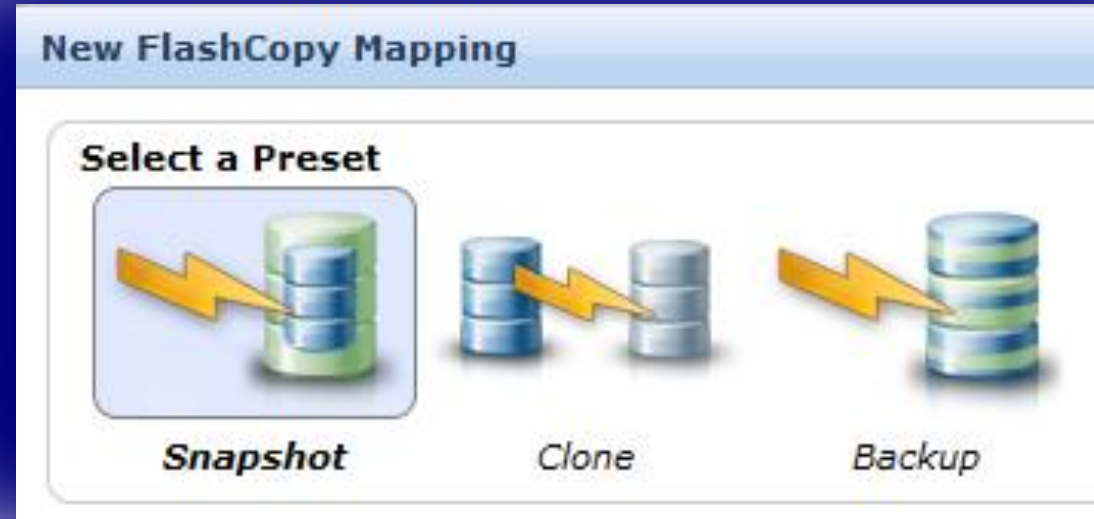
Fast and easy to configure Snapshots

75% capacity savings with Space-efficient FlashCopy™

Data recovery in seconds or minutes through Reverse FlashCopy

Integrated data protection through native NDMP and IBM TSM client

Optional: Metro and Global Mirror for **remote data replication**
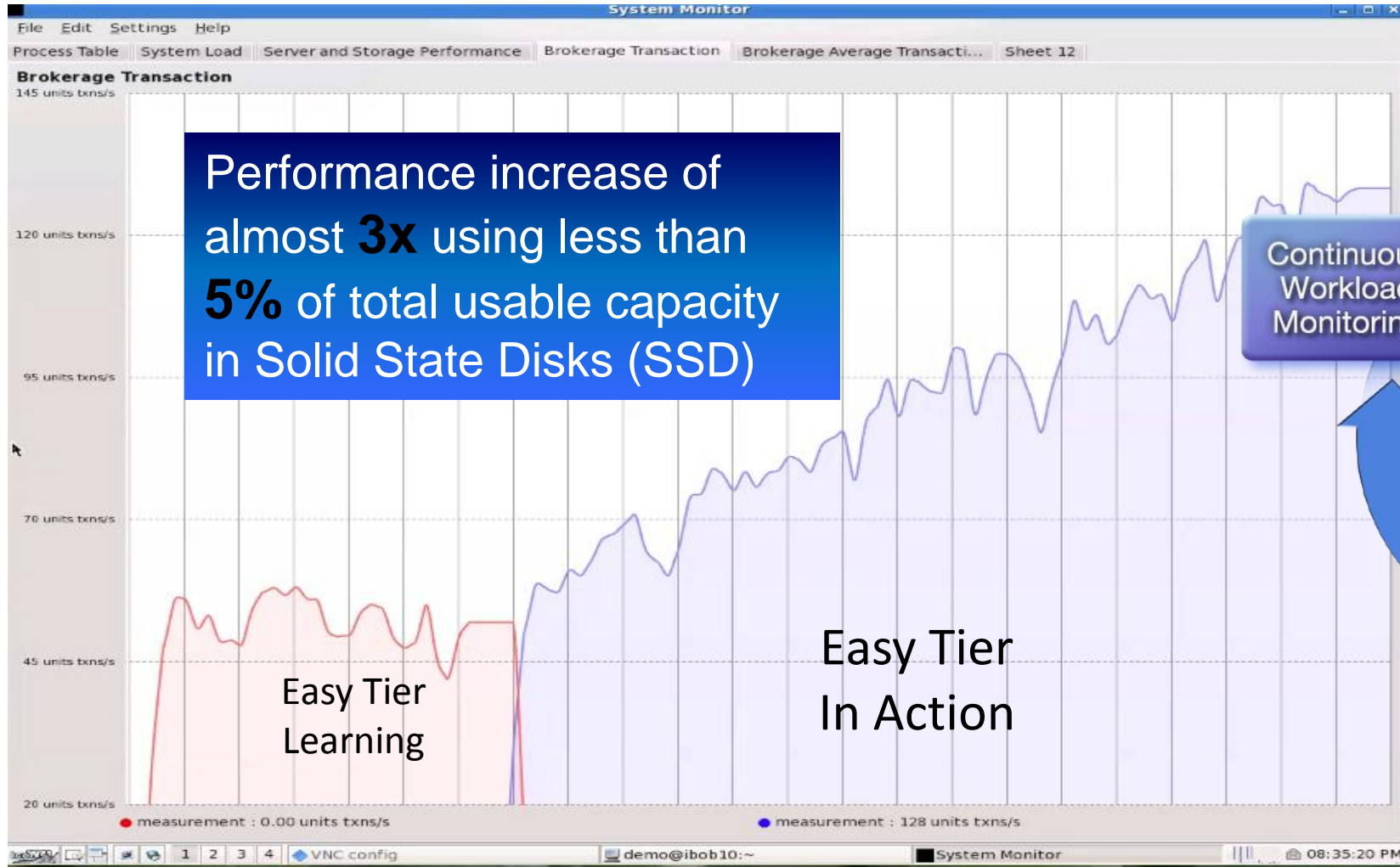
Real-Time Compression (RtC)

Efficiency and Performance for active data

High compression rates

Dependendind on application, performance can increase

Reduction of costs (acquisition, operations, maintenance, etc)
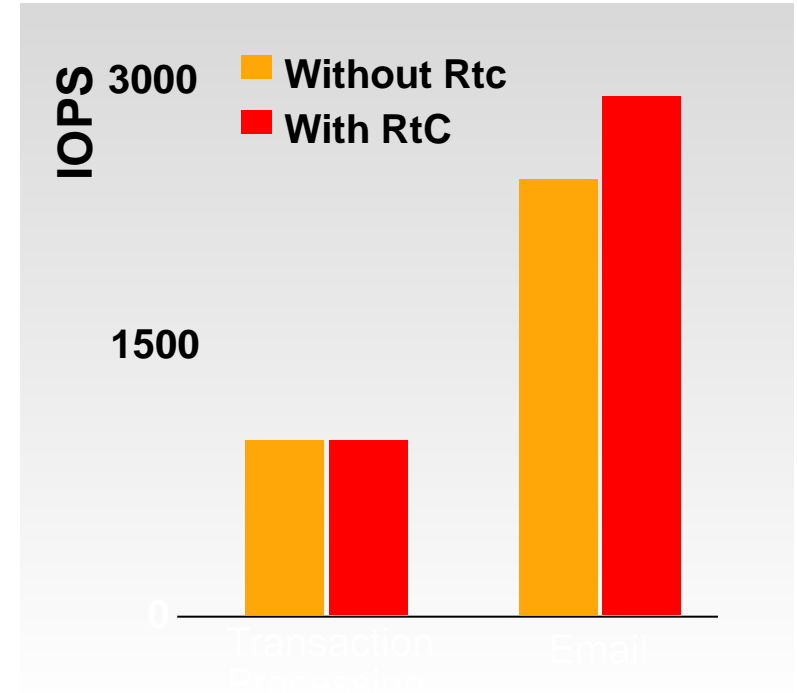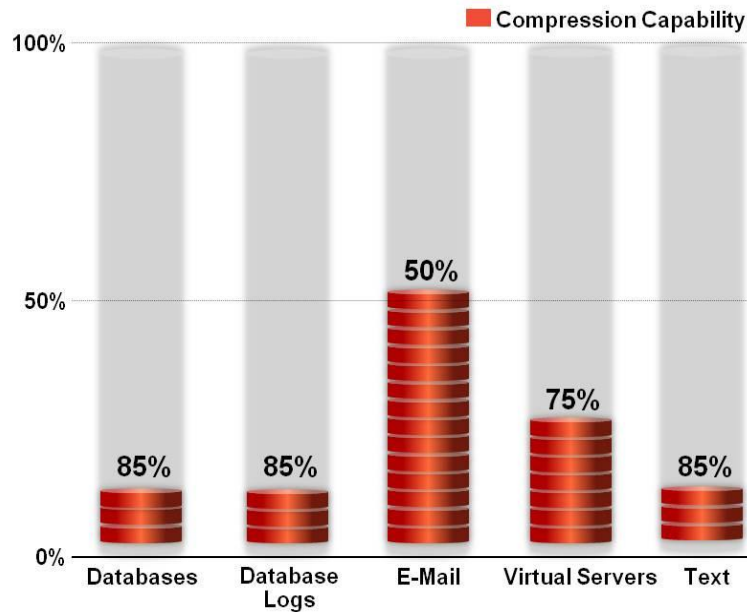
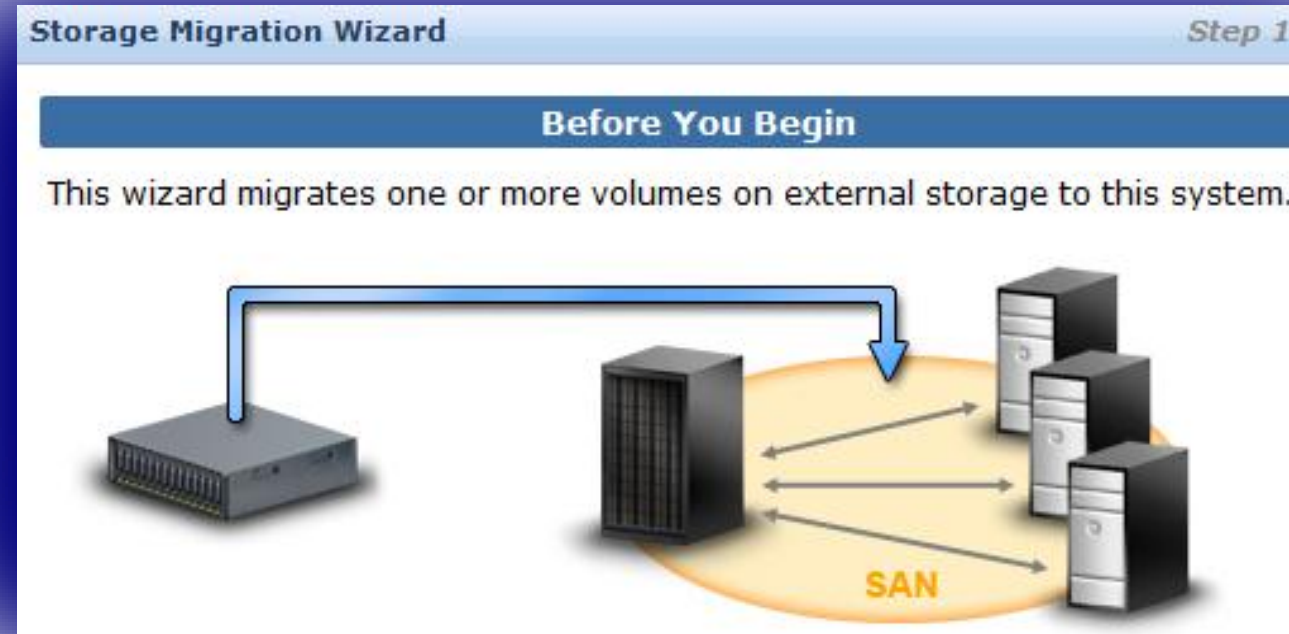## Immediate results and benefits!!!

IBM Easy Tier: Automated Tiered Storage

Performance increase of almost 3x using less than 5% of total usable capacity in Solid State Disks (SSD)

Easy Tier Learning

Easy Tier In Action

Continuous Workload Monitoring

Workload Hotspot Analysis

Smart Data Placement
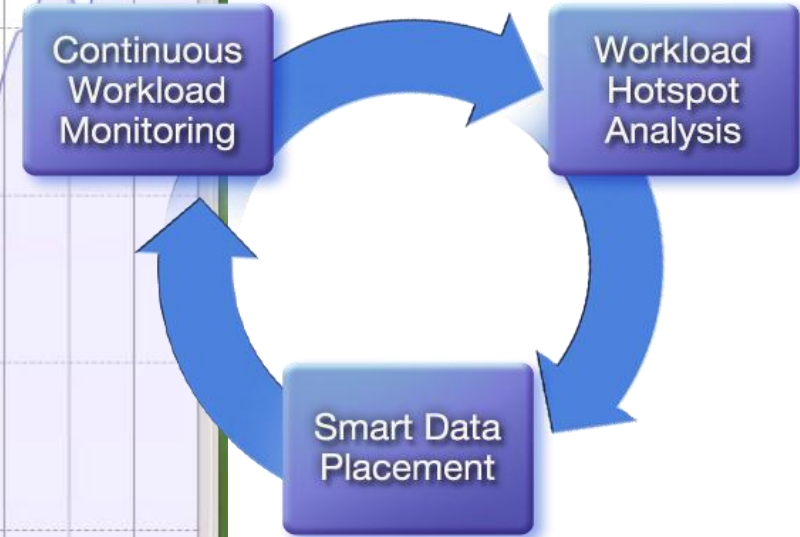
Efficient Online Data Migration, with no Additional Licensing Costs

Online and transparent data migration, with little to no performance impact to applications

Wizard to configure data migration

Migration to thin provisioning volumes to **recover wasted capacity**

IBM Storwize V7000 Unified - Virtualized Storage

- All IBM Storwize V7000 Unified storage is virtualized
  - Enables rapid, flexible provisioning and simple configuration changes
  - Enables non disruptive movement of data among tiers of storage, including Easy Tier
 - Enables data placement optimization to improve performance

- Storwize V7000 Unified also virtualizes external Fibre Channel storage
  - Capacity from existing storage systems becomes part of Storwize V7000 Unified   system
  - Single user interface to manage all storage, regardless of vendor: Designed to   significantly
    improve productivity
  - Virtualized storage inherits all Storwize V7000 Unified rich function including   FlashCopy, Eas
    Tier, Real-time Compression and thin provisioning
  - Helps improve existing storage utilization
  - Improve availability by practically eliminating storage-related causes of
    application downtime
  - Migrate data from external storage to Storwize V7000 Unified storage or   k
    external storage as part of Storwize V7000 Unified system long-term
  - Extends life and enhances value of existing storage assets
  - Supports storage systems from IBM, EMC, HP, 3PAR, Sun/Oracle,
    NetApp, Fujitsu, Bull, Compellent, NEC, Pillar, and more

External Virtualization

HITACHI   EMC   NetApp   IBM.   Sun

hp   NEC   BULL   FUJITSU   pillar
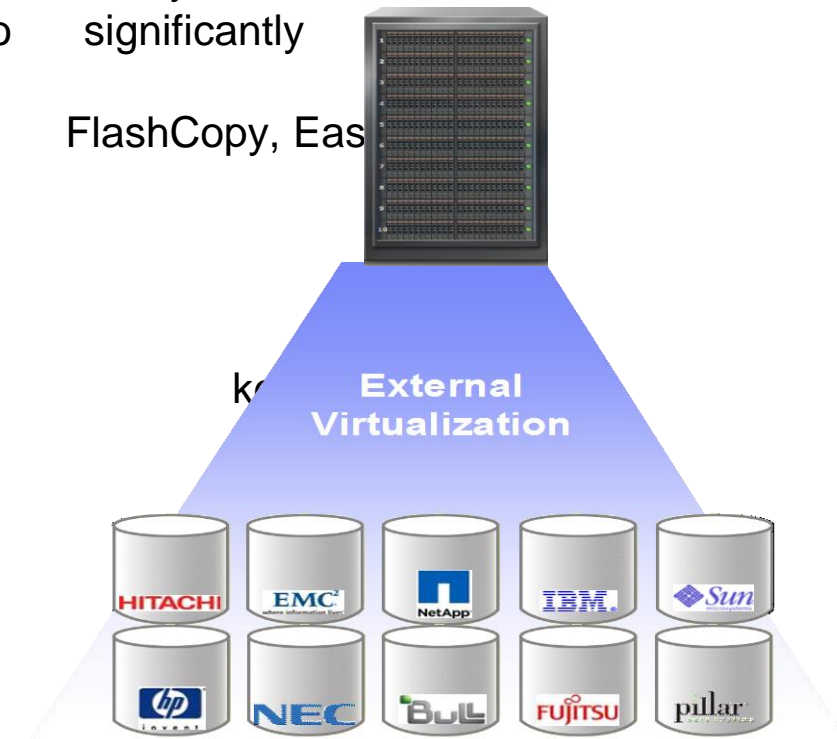
VMware

…and IBM Storwize V7000 Unified as a complete virtualization solution

IBM Storwize V7000 Unified

- Storwize V7000 Unified virtualizes its own internal storage and external disk systems storage

- Storwize V7000 Unified acts as the virtualization layer between the host and external storage system.

- External storage can be managed by a single IBM Storwize V7000 Unified system

- As Storwize V7000 Unified virtualizes storage, volumes can be non-disruptively moved between external and internal storage capacity

- Tight integration with VMware includes complementary plug-ins:
  - VMware vCenter Server
  - VMware vStorage APIs for Array Integration (VAAI)
  - VMware Site Recovery Manager (SRM)

- Improved application-aware backups and restores
  - IBM Tivoli FlashCopy Manager for VMware

Internal storage virtualization

External storage virtualization

IBM

EMC

HP
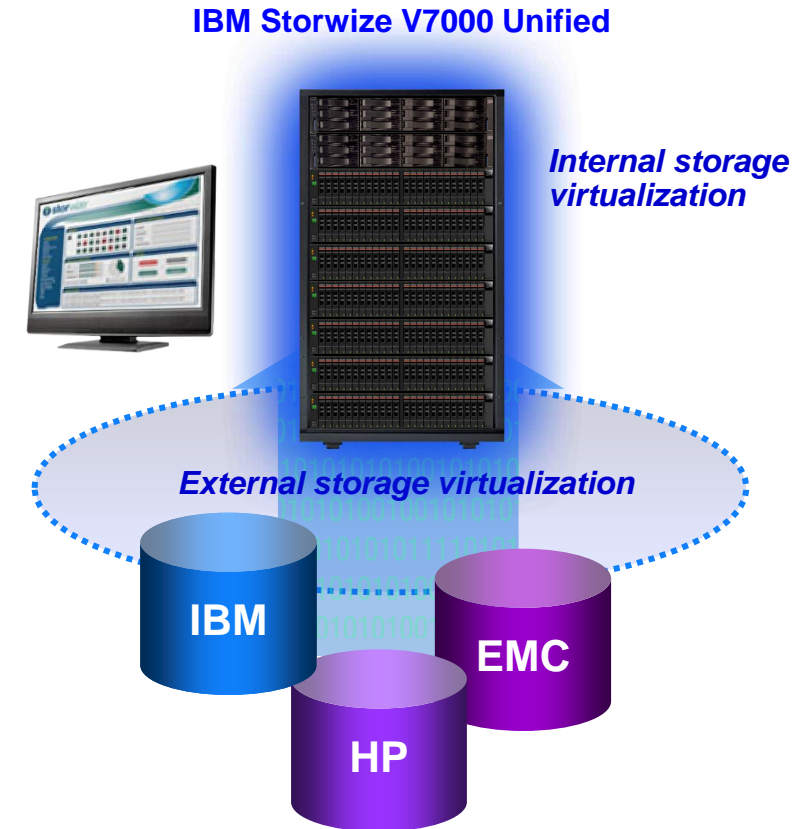
Benefits to You - IBM Storwize V7000

- **Modular, midrange disk storage that grows as your needs grow**
  - Scales to 240 HDDs (ten 24 bay control enclosures) in a single system
  - Clustering scales to 960 HDDs (twenty 24 bay control enclosures)
- **Enterprise class capabilities in a midrange offering**
  - Virtualization, thin provisioning, FlashCopy, Easy Tier all built in
  - Sophisticated local and remote mirroring
- **High Performance in a Midrange Disk System**
  - Up to almost 1M IOPS
  - Up to 82,000 IOPS for "database-like" 70/30 R/W workload
- **Easy to set up and manage**
  - Innovative, intuitive GUI eliminates complexity
  - Non-disruptive data migration included, unique in a product of this class
- **IBM Real-time Compression**
  - Enables storing up to five times more active data in the same physical disk space
- **Ushering in a new era in storage efficiency**
  - Save up to 75% of space using space efficient FlashCopy
  - Increase disk utilization up to 30%
- **Support for 10Gbps iSCSI server attach**
  - Up to 7x improvement in iSCSI throughput vs. 1Gbps iSCSI
  - Upgradable from existing Storwize V7000 systems
- **Investment protection**
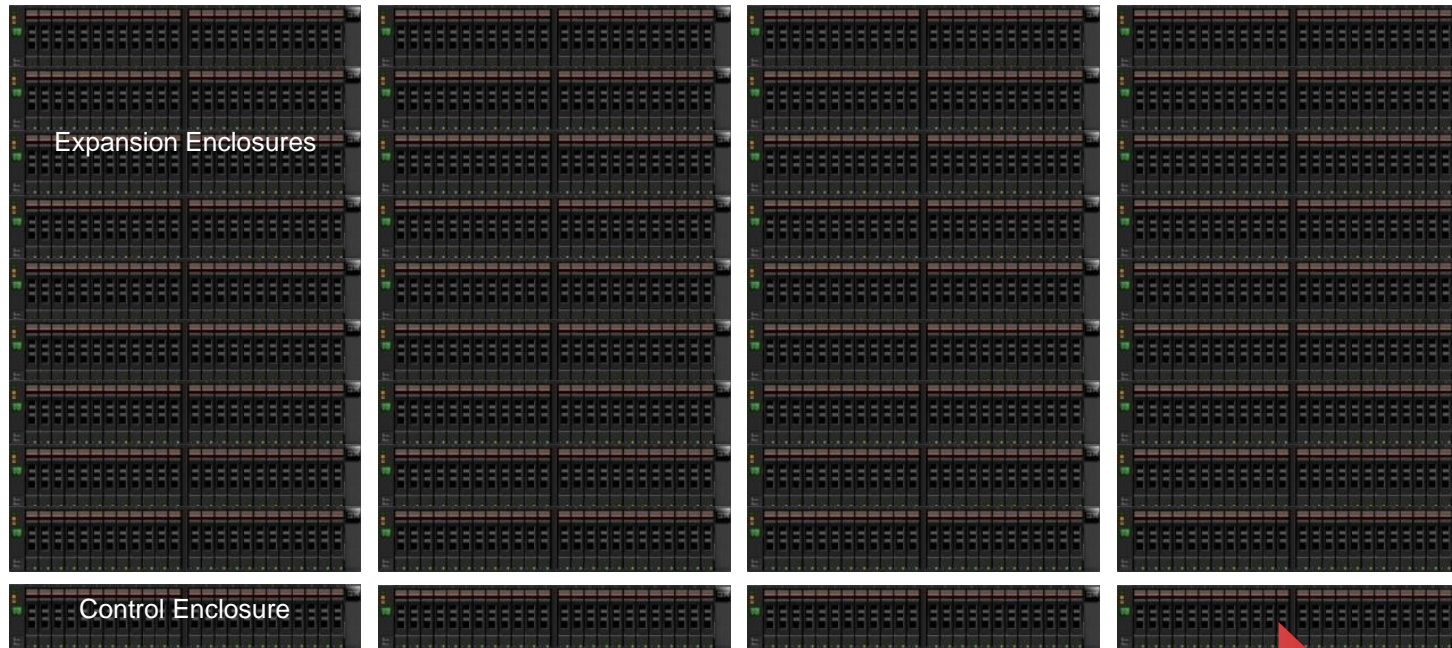 - Virtualize external storage arrays and extend asset life

Expand Easily
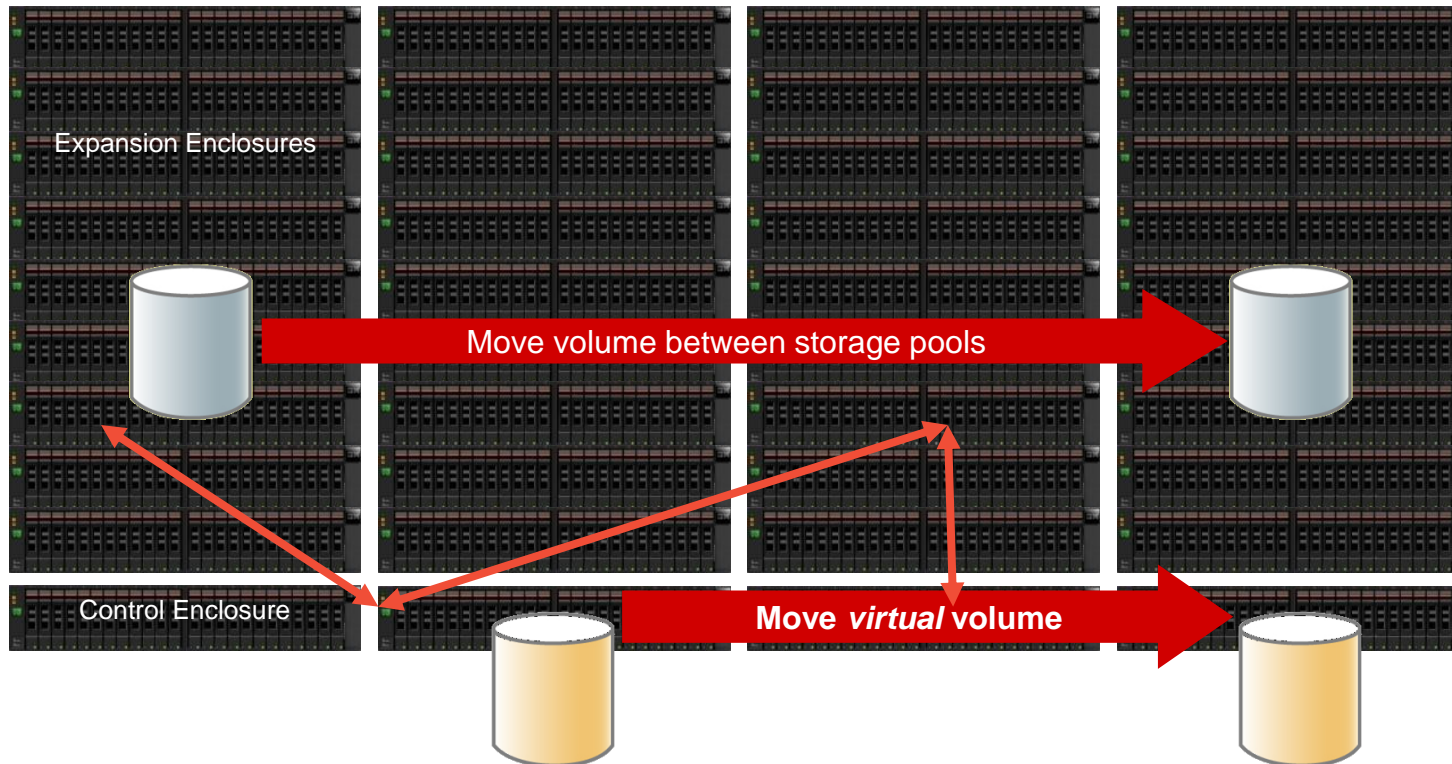

Start Small

Four-way Clustering of Storwize V7000

Scale Up (up to 240 drives)

Expansion Enclosures

Control Enclosure

**Scale Out (up to 960 drives)
+ External virtualization for more capacity**

- *Business growth* – Up to 4X capacity and up to 4X throughput scalability

- *Fully upgradable* without disruption from smallest to largest configurations: minimizes need to purchase hardware in advance of need

- *Greater efficiency* –Enables more consolidation, including external virtualized storage

- *Increase performance, connectivity and cache*

- *Clustered system operates and is managed as a single system*

Non-disruptive Volume Move

Expansion Enclosures

Control Enclosure

Move volume between storage pools

Move *virtual* volume

- Storwize V7000 supports moving a volume without disruption from storage pool to another
  - Includes moving between internal and external virtualized storage
- A volume is presented to servers by a single control enclosure
- Now, a volume can be moved from one control enclosure to another without disruption to applications
- Supports load balancing across an entire clustered system
- Helpful when adding control enclosure to a Storwize V7000 system

Storwize V7000 and Storwize V7000 Unified ISV Enablement

- **Commitment to enablement, integration and optimization for enhanced customer value**
  - Increasing interoperability matrix using IBM or Partner qualified solutions
  - Reduce complexity, improve utilization, and cut costs
  - Deliver continuous and reliable access to information
  - Visible through ongoing work and dedicated partnerships

- **Targeted solution areas include:**
  - Anti-Virus
  - Backup / restore
  - Virtualization
  - High availability and disaster recovery
  - Database and performance optimization
  - Industry application solutions
    - Healthcare, Telco, Financial Markets and more

- **Over 70 technical enablement white papers are currently available**
  - Over 50 additional projects/deliverables planned through 2012

IBM Storwize V3700 Overview

Storwize entry-level client solution

- Enclosures contains up to twelve LFF (3.5") or twenty-four SFF (2.5") drives in just 2U

- Control enclosure: dual active-active controllers and drives
  - 8 GB Cache (4 GB per controller) standard; optional upgrade to 16 GB
  - 1Gb/s iSCSI host ports standard plus optional 8Gb/s FC or 10Gb/s iSCSI/FCoE host interface upgrades

- Expansion enclosure:
  - Up to four expansion enclosures attach to one control enclosure
  - Up to 120 SFF or 60 LFF drives for up to 180 TB raw capacity
  - Mix drive sizes and HDD/SSD in same enclosure
  - Dual-active expansion canisters

- RAID levels 0, 1, 5, 6, and 10

- Redundant, hot-swappable components (i.e., power supplies and fans)

- AC power (110 to 240 V)

- FlashCopy (64 FlashCopy targets included)

IBM Storwize V3700 photo view

Storwize entry-level client solution

2U - 24 Drive Enclosure
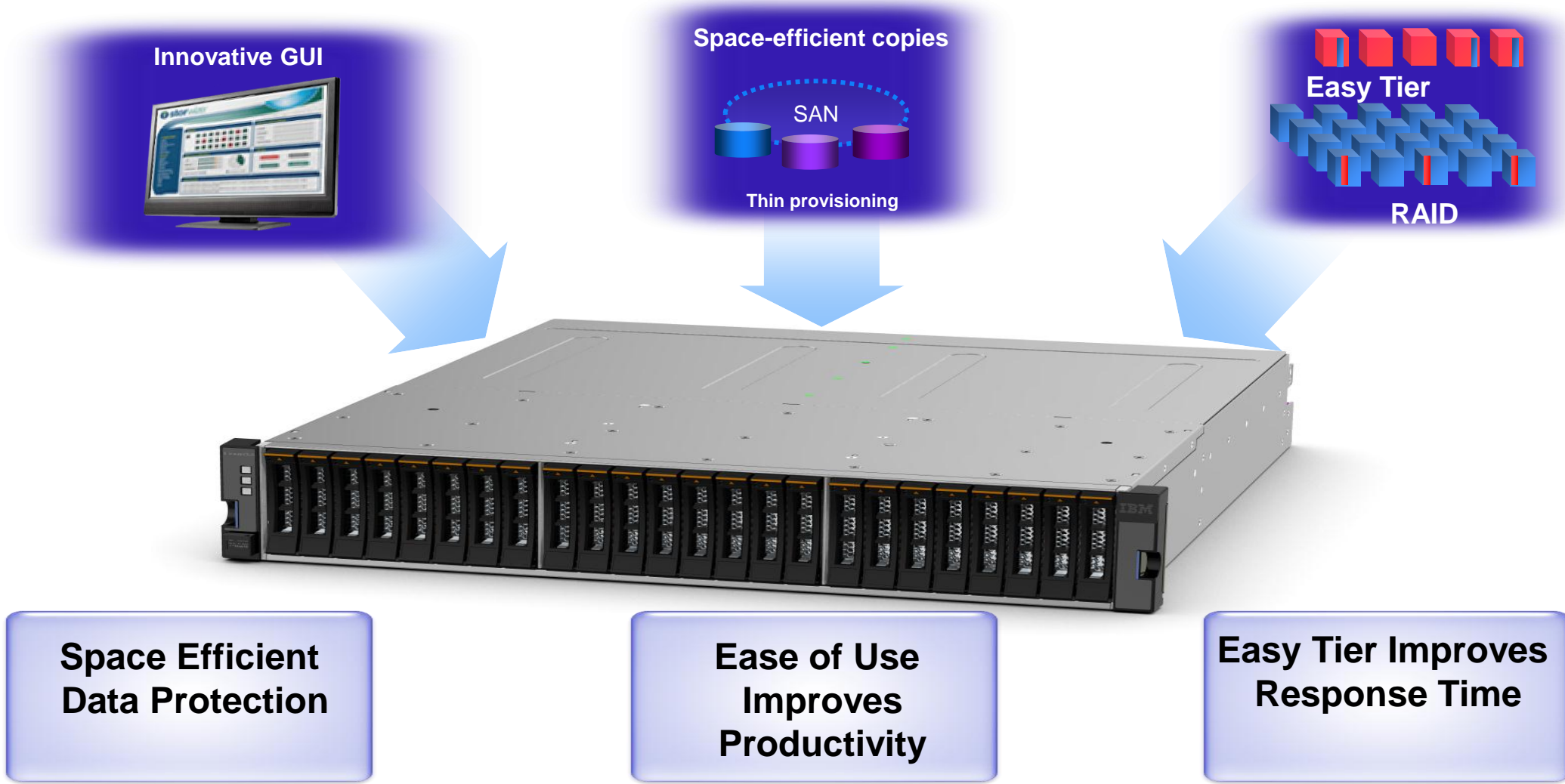

Front - 2U 12 Drive Enclosure

Back – Control enclosure

Back – Expansion Enclosure

IBM Storwize V3700 Storage System

- **Easy to set up and manage**
  - Innovative, intuitive GUI eliminates complexity
  - Adopted from easy-to-use Storwize V7000

- **Modular, Entry level storage that grows as your needs grow**
  - Scales up to 120 SFF or 60 LFF HDDs

- **Advanced software capabilities in an entry level offering**
  - Thin provisioning, FlashCopy, Data Migration, built in

- **Non-disruptive** migration eliminates cost of add-on migration tools

- **High performance drive intermix**
  - Easy Tier[1], SSD, 15K and 10K rpm drives

1 Statement of Direction. IBM Plans are subject to change without notice

Thank you for your time today.

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