

Gain efficiency and simplicity with the **Storwize® V7000**



Curtis Neal

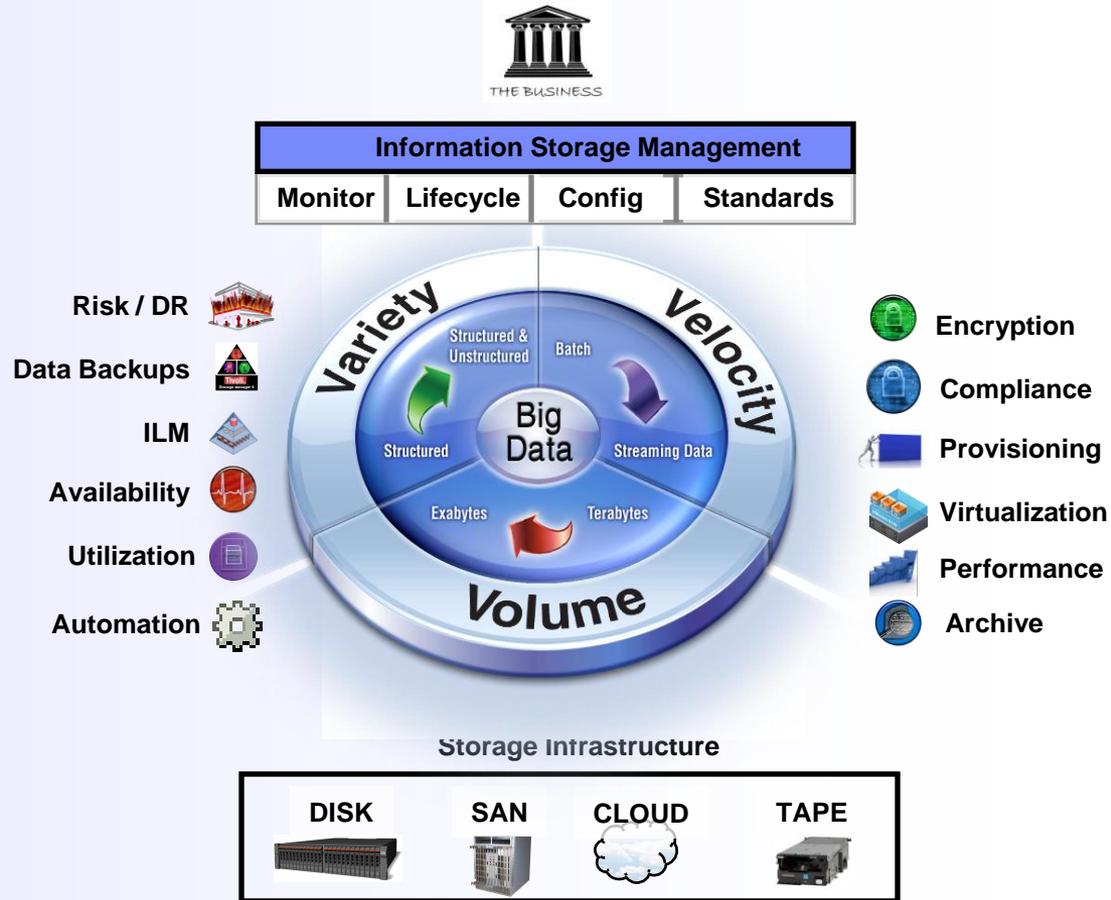
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Systems and infrastructure are reaching a breaking point.

- | | |
|--|--|
| Aerospace & Defense | Healthcare (Life Sciences) |
| Automotive | Insurance |
| Banking (Financial Markets) | Manufacturing (Consumer Products) |
| Chemicals & Petroleum | Retail (Wholesale distribution & Services) |
| Education | Telecommunications |
| Electronics | Travel & Transportation |
| Energy & Utilities | Cross Industry |
| Government (Central/Federal, Local/Provincial/State) | |



Smarter Systems are Creating an Information Explosion

▪ Inescapable Data Growth

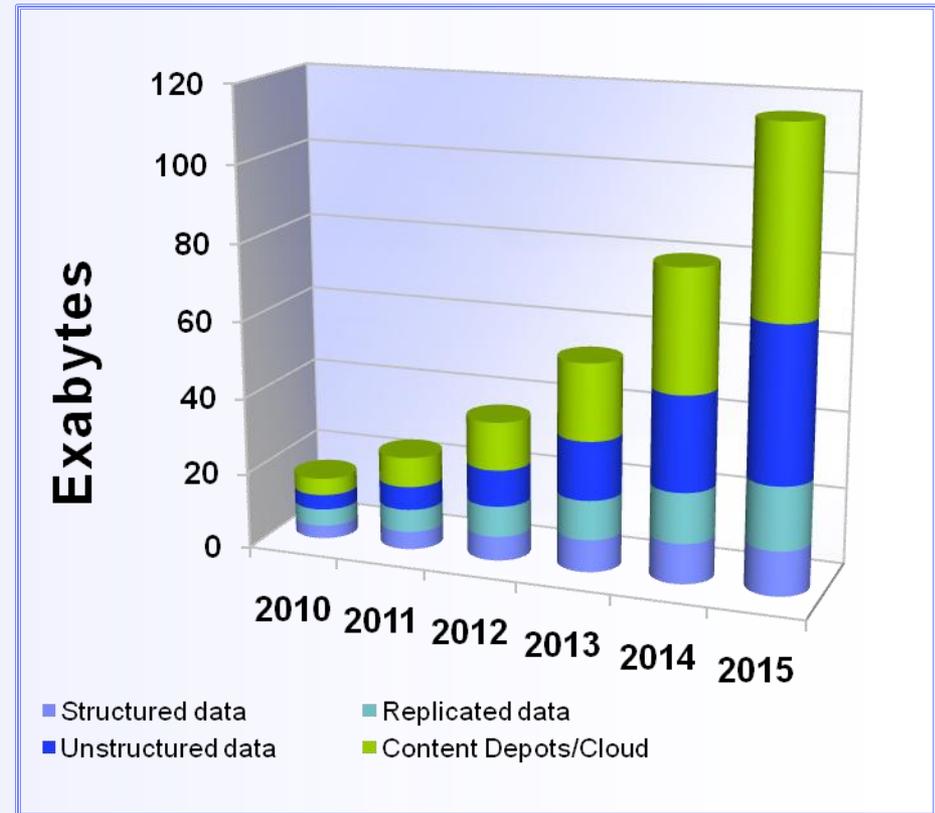
- IDC predicts 500% over next 4 years
- Gartner predicts 650% over next 5 years

▪ Big Data: Designed for data

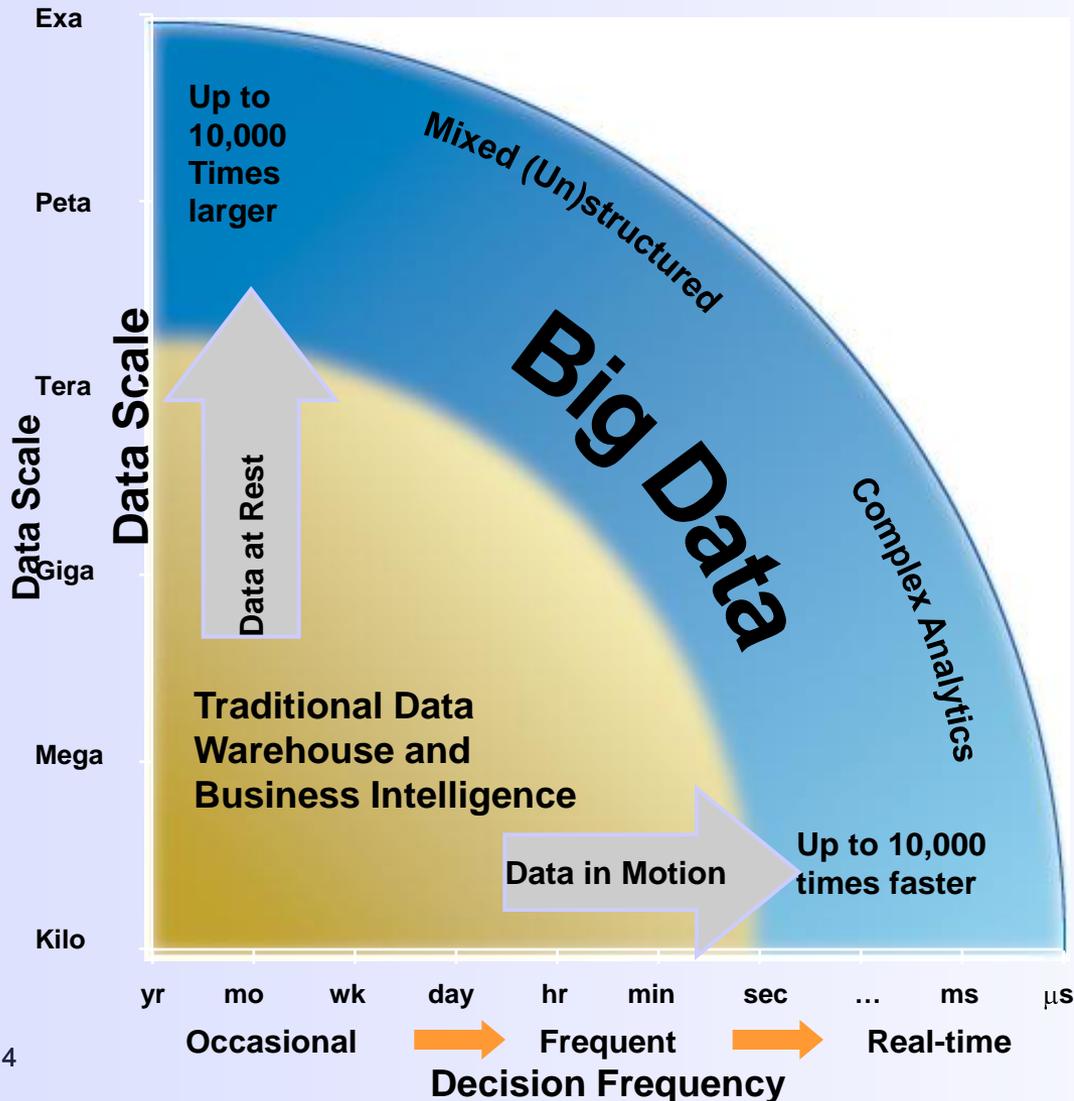
- Remove barriers to harnessing all available information and unlock insights to make informed choices

▪ Inescapable technology adoption

- **Clients must be more efficient in data storage**
 - De-duplication, Compression, Thin Provisioning, Automated Tiering, Archiving
- **Clients must stop copying and transmitting backup copies everywhere**
 - Snapshot, Replication
- **Clients must make their people more efficient**
 - Automation, Integration



Big Analytics Solutions Emerging to Capture new Business Value



Homeland Security
600,000 records/sec, 50B/day
1-2 ms/decision
320TB for Deep Analytics



Telco Promotions
100,000 records/sec, 6B/day
10 ms/decision
270TB for Deep Analytics



DeepQA
100s GB for Deep Analytics
3 sec/decision



Smart Traffic
250K GPS probes/sec
630K segments/sec
2 ms/decision, 4K vehicles

IT organizations are engaging with IBM to succeed in Smarter Computing

To create advantage by transforming the economics of your IT, starting with **Optimized Storage**

A choice of Virtual Disk storage architectures – each fit for purpose

IBM continues to Innovate **Physical and Virtual Tape**. It's a universally, scalable and secure storage repository.

Improve backup infrastructure with Physical and Virtual Tape

IBM Network attached storage (NAS) solutions provide a wide-range of network attachment capabilities to a broad range of host

Storage technology enhancements that hone capabilities for specific workloads

IBM Software helps clients build the capabilities to transform their industries and the world.

Software for complete solution implementation and management

Innovative server systems design has long been a mainstay at IBM. As we celebrate 100 years of innovation

A single multi-architecture solution, optimized for multiple workloads

Cloud Computing – High Level Cloud Architecture Storage Focus

Cloud Ready

- Integrated virtualization management with IT service delivery processes
- Elastic scaling , Pay for use
- Self-service provisioning

Automation

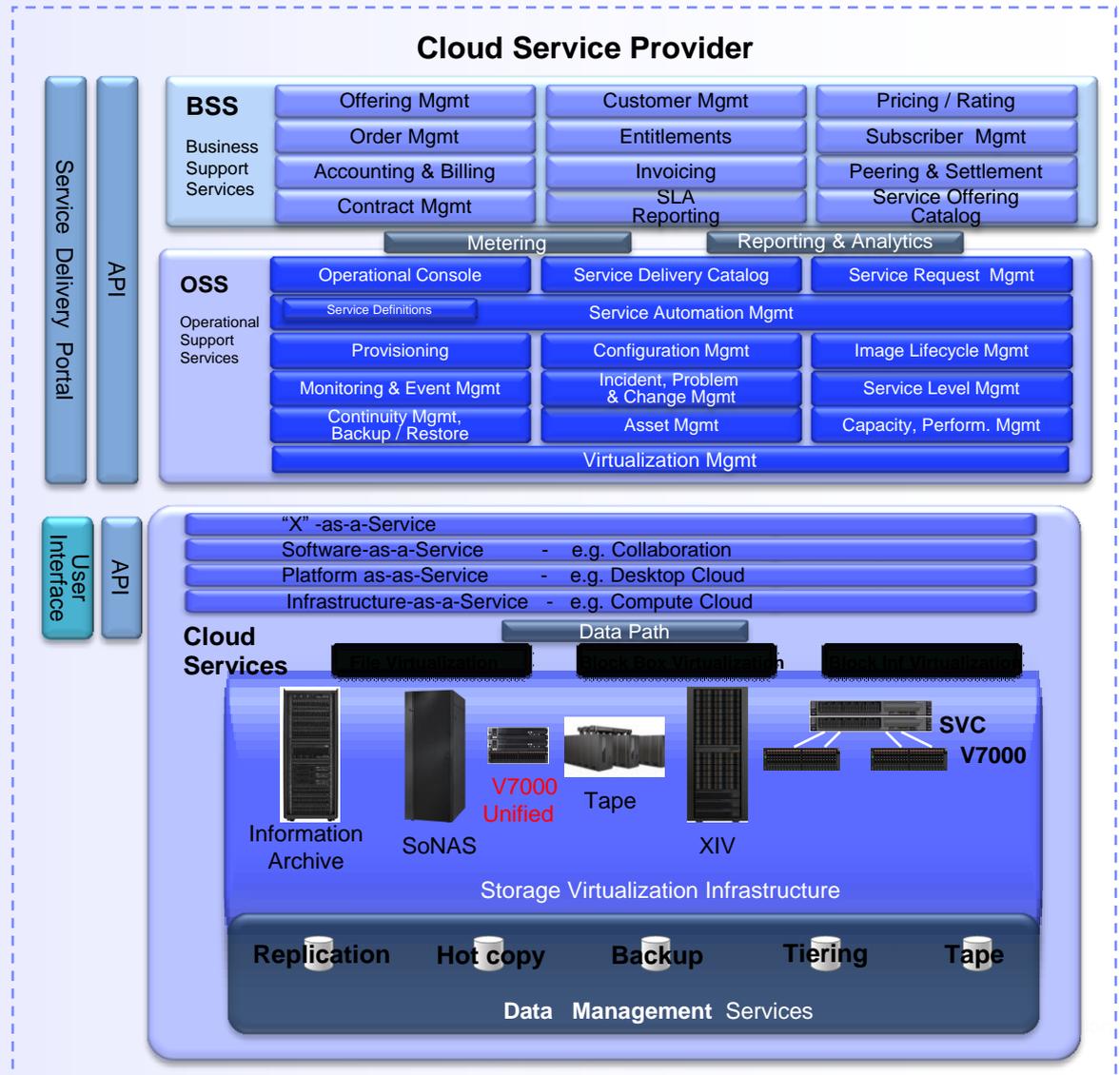
- Automated provisioning Pool standardized virtualized building blocks
- Plug-and-play capacity across HW
- Management of the virtualized environment

Virtualization

- Remove physical resource boundaries
- Increased hardware utilization
- Reduce software licensing costs

Physical Consolidation

- Reduce infrastructure complexity
- Improve facilities management
- Improve operational costs/reduce TCO



IBM Storwize V7000 – Unified Storage Solution

V7000 Unified supports a 6U block and file solution managed from one GUI

New!

- **New Storwize V7000 Unified Enhancements V6.3**

- Unified block and file (SAN and NAS) storage
- Upgradable from existing Storwize V7000 systems
- IBM Active Cloud Engine policy-based management

- **Global Mirror enhancements**

- Low bandwidth mirroring option
- SVC and V7000 can participate together in Metro Mirror / Global Mirror

- **New GUI features**

- Usability improvements
- Realtime stats history

- **User security enhancements**

- LDAP authentication
- CLI Password login

- **Mirrored Volume timeout configuration**
- **Round-robin storage system port selection**
- **3TB drive support**
- **200GB/400GB SSD option**

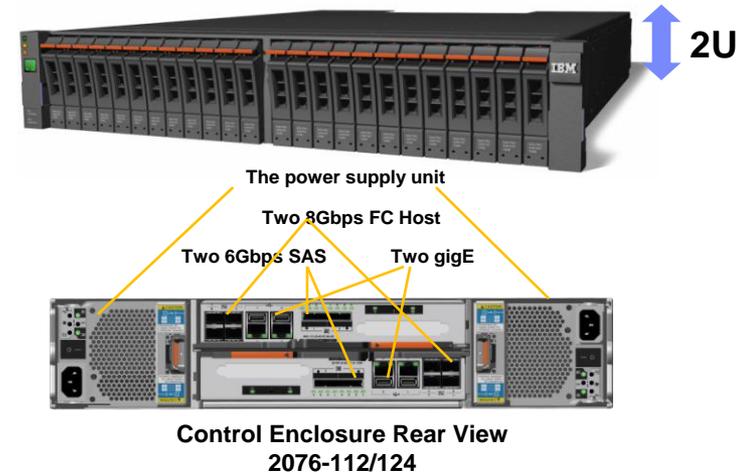


- ➔ **One** system
- ➔ **One** management framework
- ➔ **One** GUI
- ➔ **One** unified block and file solution

IBM Storwize V7000 – Unified Storage Solution

Storage Virtualization provides TCO savings and Optimize IT infrastructure .

<p>Architecture</p>	<ul style="list-style-type: none"> • Enterprise class function for mid size clients • Thin provisioning – included — Reduces CapEx • New GUI – Reduces complexity • Modular 2U building blocks that can be housed in existing standard 19” rack alongside servers or other storage • Small initial capacity point starting at 1TB and can grow in single drive capacity increments
<p>Application Availability</p>	<ul style="list-style-type: none"> • Change storage without interrupting applications • Allocate more storage to applications automatically • Non-disruptive data migration between heterogeneous devices • Virtual LUN Mirroring
<p>Performance</p>	<ul style="list-style-type: none"> • Gives clients the ability to tune and/or tier data placement to maximize performance across diverse application needs or service levels • Easy Tier – included -Improves performance by up to 300%
<p>Point in Time Copy</p>	<ul style="list-style-type: none"> ▪ FlashCopy – included – the ability to use FlashCopy will be part of the base software licensing or part of the external storage management licensing to use it with externally managed disk
<p>Any Distance Remote Copy</p>	<ul style="list-style-type: none"> • (Metro Mirror) Up to 300km between sites synchronous • (Global Mirror) Up to 8000km between sites asynchronous • Metro and Global Mirror delivered as single feature



Proven IBM Software functionalities

- RAID 0, 1, 5, 6, 10
- Storage Virtualisation (*local and external disks*)
- Non-disruptive Data Migration
- Global & Metro Mirror (*multi cluster*)
- FlashCopy (*256 targets, cascaded, incremental*)
- Thin Provisioning
- Scaling across controllers within a cluster
- Mix drive sizes and HDD/SSD in enclosure
- Eight 8Gbps FC ports plus four 1Gbps iSCSI

IBM Storwize V7000 — For Clients who Need Space Efficiency

- **Compact packaging: controllers and disk in just 2U**
 - Add expansion enclosures for more capacity
 - Scales from entry to 240 drives without disruption
 - 12 and 24 *bay disk storage enclosures* can be
- **Clustered systems provide new customer options to independently grow capacity and performance**
 - Up to 480TB raw capacity in one standard rack
- **Drive Choices**
 - Drive sizes can be intermixed in an enclosure

High Performance	<ul style="list-style-type: none"> ▪ 2.5" Solid State Drives <ul style="list-style-type: none"> – 200 GB, 300 GB, 400 GB ▪ 2.5" 15K SAS Disk Drives <ul style="list-style-type: none"> – 146 GB, 300 GB 
Medium Performance	<ul style="list-style-type: none"> ▪ 2.5" 10K SAS Disk Drives <ul style="list-style-type: none"> – 300 GB, 450 GB, 600 GB 
Lowest Cost	<ul style="list-style-type: none"> ▪ 2.5" 7.2K Near-Line SAS Disk Drive <ul style="list-style-type: none"> – 1 TB 
Lowest Cost	<ul style="list-style-type: none"> ▪ 3.5" 7.2K Near-Line SAS Disk Drives <ul style="list-style-type: none"> – 2 TB, 3 TB 

Start small

One 24 bay control enclosure



Scale Up

Easily add up to 9 expansion enclosures



Scale Up

Easily add up to 9 expansion enclosures



IBM Storwize V7000 Storage Benefits

Integrated no-charge Easy Tier function

- Expected to deliver similar benefits to DS8000 Easy Tier
- Application throughput improved up to 300%, up to 40% reduced power and cooling

Integrated no-charge thin provisioning function

- Expected to reduce disk capacity required by 20% or more; reduce disk capacity for copies by 75% or more

Thin provisioning



Without thin provisioning, pre-allocated space is reserved whether the application uses it or not.

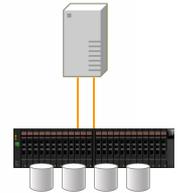


↑ **Dynamic growth**

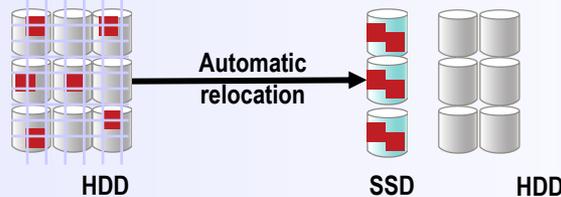
With thin provisioning, applications can grow dynamically, but only consume space they are actually using.

Multi-Path Drivers

- Choice of is yours
 - IBM SDD (Subsystem Device Driver)
 - MPIO (Window, AIX), MPxIO (Solaris),
 - DM-MP (Linux)
 - PVLinks (HP-UX)
 - Symantec DMP
 - VMware Qlogic MPP
 - Powerpath for AIX



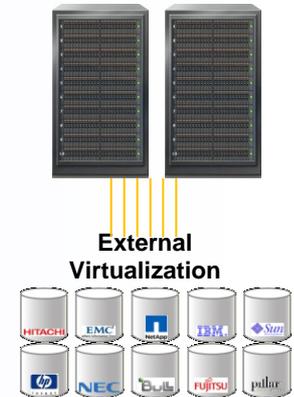
“Easy Tier”



- Busiest data extents are identified and automatically relocated to highest performing Solid-state Disks
- Remaining data extents can take advantage of higher capacity, price optimized disks

Scalability

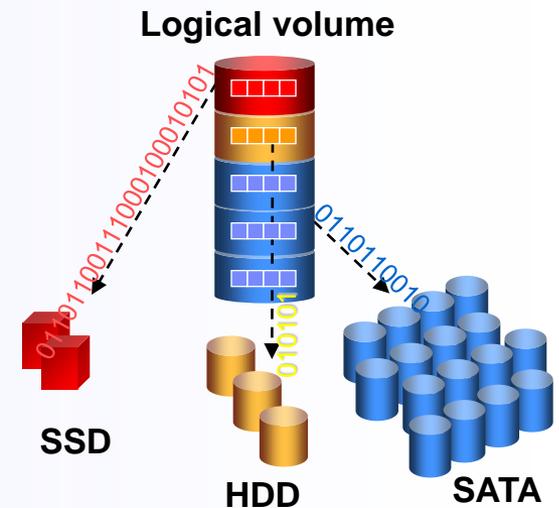
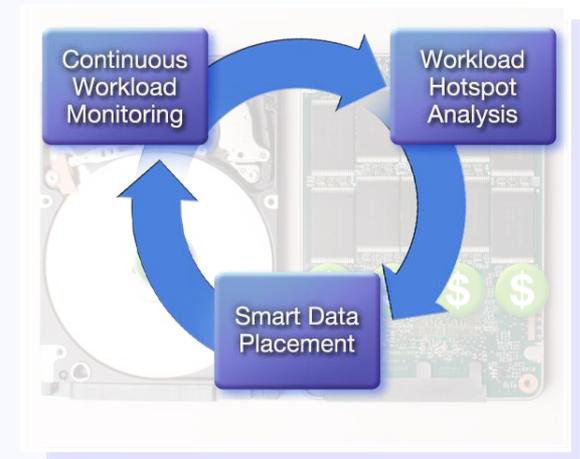
- For high capacity applications such as archive, dynamically add capacity by adding disk enclosures or virtualize external disk systems



Easy Tier is SMART Storage

Client Challenges with SSD - *High performance (IO/Sec) but high cost (\$/Gbyte)*

- **Smart storage –Benefits go beyond performance**
 - Optimizes SSD deployments by migrating only hottest data to SSDs
 - Assures clients that they are not overspending on expensive SSDs unnecessarily
 - Reduces administrative effort and costs by automating data placement
 - New tooling enables clients to see exactly how much their existing workloads can benefit from how many SSDs; no more guessing
- **Easy Tier 1**
 - Automated movement of data based on actual workload performance – f or Easy Tier 1 (SSD + HDD), key customer values
 - Flexibility to move 1GB or Mod 1 segments or full volumes
- **Easy Tier 2**
 - Easy Tier automatic mode now supports migration between any two tiers
 - Automatic *extent* rebalancing within a tier
 - Rank depopulation
- **Storage Tier Advisor Tool (STAT):**
 - Download and install Storage Tier Advisor Tool (STAT):
 - <http://www-01.ibm.com/support/docview.wss?uid=ssg1S4000935>
 - Run Easy Tier measurement minimum 24 hours



Automated and granular

STAT Output: System Summary

IBM® Storwize® V7000




System Summary

The data is collected from Fri Apr 01 18:15:33 UTC 2011 to Sat Apr 02 10:05:34 UTC 2011

Storage Tier Advisor Tool version: 7.1.0.0

Total Volumes Monitored	25
Total Capacity Monitored	500G
Hot Data Capacity (% of Total)	169G (33%)
Capacity Allocated on SSD/Total SSD Capacity	0G/0G
Estimated Migration Time	3.2 hours

Recommended SSD Configuration ^{*1}

Pool ID	SSD Configuration	Predicted Performance Improvement ^{*2}
System wide	All Added 1 900G SSD Array(s) (RAID5) ^{*3}	70.0% ~90.0%
0x0000	Performance Improved by Adding 1 SSD Array(s) ^{*3}	70.0% ~90.0%

System Summary

System Recommendation

Storage Pool Recommendation

Volume Heat Distribution

^{*1} The recommended SSD configuration is only the suggested SSD capacity to add or to take advantage of the existing SSD resource, for detailed physical configuration, please consult IBM service team.

^{*2} The predicted performance improvement is the possible response time reduction at the backend in a balanced system configuration, and it may vary with different system workload and configuration.

^{*3} Assume the SSD Array will be configured as RAID5 (3+P), and the equivalent capacity is 900G.

LEGAL DISCLAIMER:

The "Storage Tier Advisor Tool" uses limited storage performance measurement data from a user's operational environment to model potential unbalanced workload (a.k.a skew) on disk and array resources. It is intended to supplement and support, but not replace, detailed pre-installation sizing and planning analysis. It is most useful to obtain a "rule of thumb" system-wide performance projection of cumulative latency reduction on arrays and disks when a Solid State Disk configuration and the IBM Easy Tier™ function are used in combination to handle workload growth or skew management.

STAT Output: Volume Heat Distribution

The measurement functionality of Easy Tier can be enabled without purchasing SSDs

To start using Measurement Function

- The measurement functionality of Easy Tier can be enabled without purchasing SSDs
- Easy Tier will produce a performance summary file which can be copied from the system for analysis
 - Review file on a daily basis
- IBM Storage Tier Advisor Tool (STAT) can analyze data
 - <http://www-01.ibm.com/support/docview.wss?uid=ssg1S4000935>
- Whitepaper on how to use STAT:
 - <https://www-03.ibm.com/support/techdocs/atmastr.nsf/WebIndex/WP101852>

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IBM



Volume Heat Distribution

The data is collected from Fri Apr 01 18:15:33 UTC 2011 to Sat Apr 02 10:05:34 UTC 2011

Storage Tier Advisor Tool version: 7.1.0.0

Volume ID *1	Copy ID	Pool ID	Configured Size *2	Capacity on SSD *3	Heat Distribution *4
0x0007	0x0000	0x0000	20.0G	0.0G	18.3G 1.8G
0x0010	0x0000	0x0000	20.0G	0.0G	20.0G
0x0003	0x0000	0x0000	20.0G	0.0G	19.8G 0.3G
0x000a	0x0000	0x0000	20.0G	0.0G	20.0G
0x0006	0x0000	0x0000	20.0G	0.0G	20.0G
0x0008	0x0000	0x0000	20.0G	0.0G	20.0G

IBM Storwize V7000 Unified & ISV Enablement

- **Commitment to enablement, integration and optimization for enhanced customer value**

- Reduce complexity, improve utilization, and cut costs
- Deliver continuous and reliable access to information
- Visible through dedicated partnerships and ongoing work with:



Microsoft

ORACLE



Tivoli software

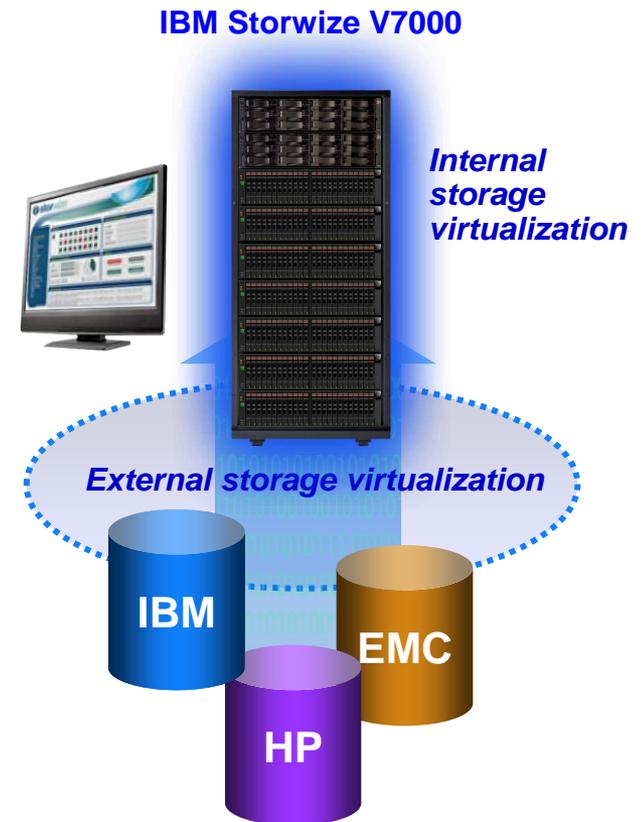


- **Targeted solution areas include:**

- Backup / restore
- High availability, disaster recovery, clustering
- Database and performance optimization
- Virtualization
- Industry solutions (Healthcare, Telco, etc.)
- Operations management

VMware...and IBM Storwize V7000 as a complete virtualization solution

- Storwize V7000 virtualizes its own internal storage and external disk systems storage
- Storwize V7000 acts as the virtualization layer between the host and external storage system.
- Up to 32 PB of external storage can be managed by a single IBM Storwize V7000 system
- As Storwize V7000 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

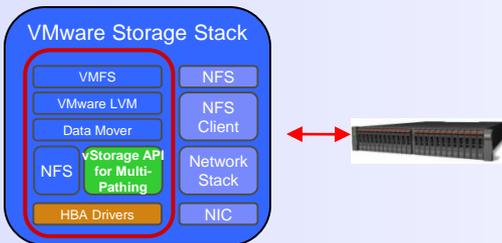


VMware Server and V7000 Storage Hypervisors

Virtualize the complete infrastructure

vStorage APIs for Array Integration

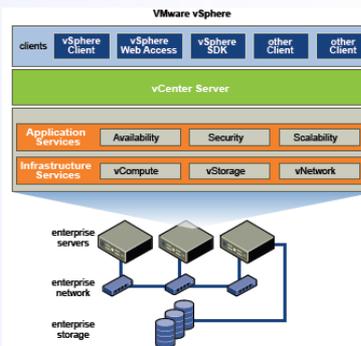
- Integration with vStorage APIs to enable VMware control over common storage operations in a virtual server environment
- Includes the following operations:
 - Optimized VM provisioning (Write Same)*
Uses storage system to zero out new volumes
 - Block locking (Atomic Test & Set)*
Improved VMFS performance with less reservation conflicts
 - Fast copy (optimized cloning, XCOPY)*
Storage-side volume to volume cloning



vStorage APIs

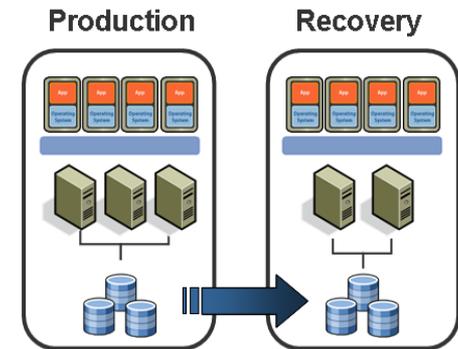
VMware vCenter plug-in

- The Storwise VMware plug-in for VMware vCenter provides VMware administrators direct control of their V7000 based VM storage through the vCenter console
- Provides additional capabilities to VMware vCenter:
 - View rich information on the underlying storage. View allocated storage per VM, per Host, per Datacenter
 - Seamless association of datastores with SVC storage VDisks through creation, deletion, cloning and resizing of datastores



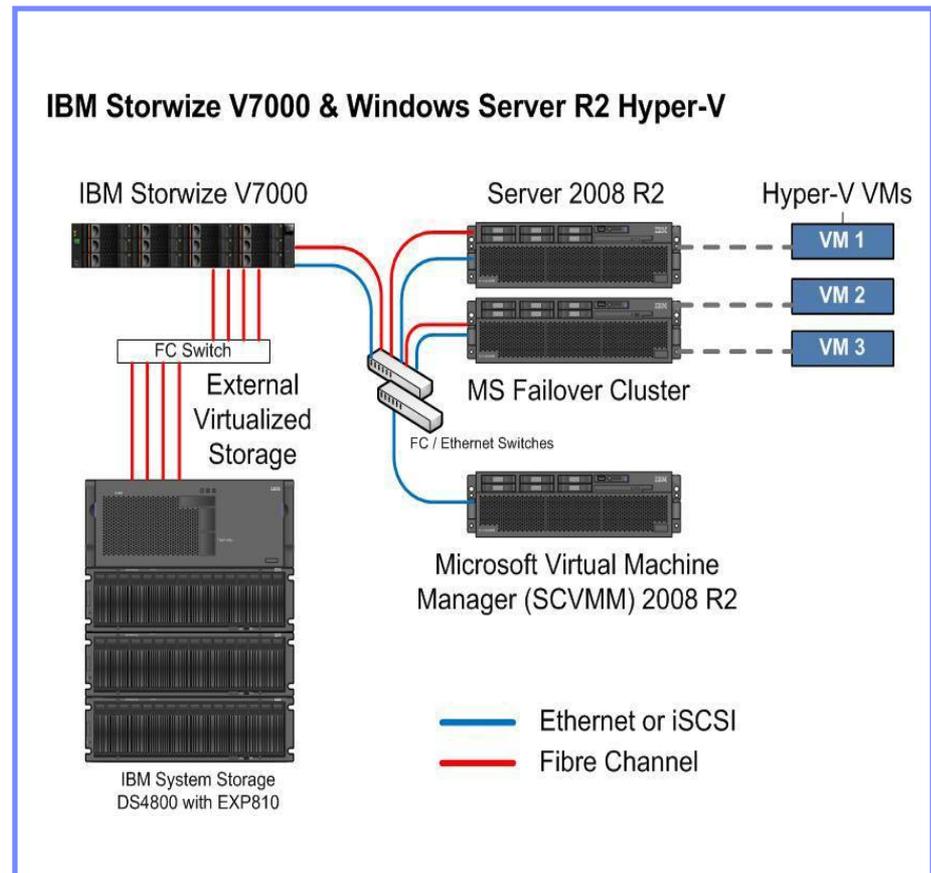
Site Recovery Manager

- Solution for disaster recovery
 - Sync (Metro Mirror)
 - Async (Global Mirror)
 - IBM written Plugin
- Simplifies and automates disaster recovery processes
 - Setup
 - Testing



Virtual Machines with IBM Storwize V7000 and Microsoft Hyper-V™

- Virtualized server or storage environment enables more efficient use of computing resources by sharing hardware resources.
- IBM Storwize V7000 combined with Microsoft Hyper-V provides a fully virtualized solution for flexible infrastructure that can grow and change with your business, reducing the costs of managing and operating your infrastructure.
- The unique ability to move both servers and storage without downtime significantly improves Service Level Agreement's (SLA) and minimizes impacts on users and customers.



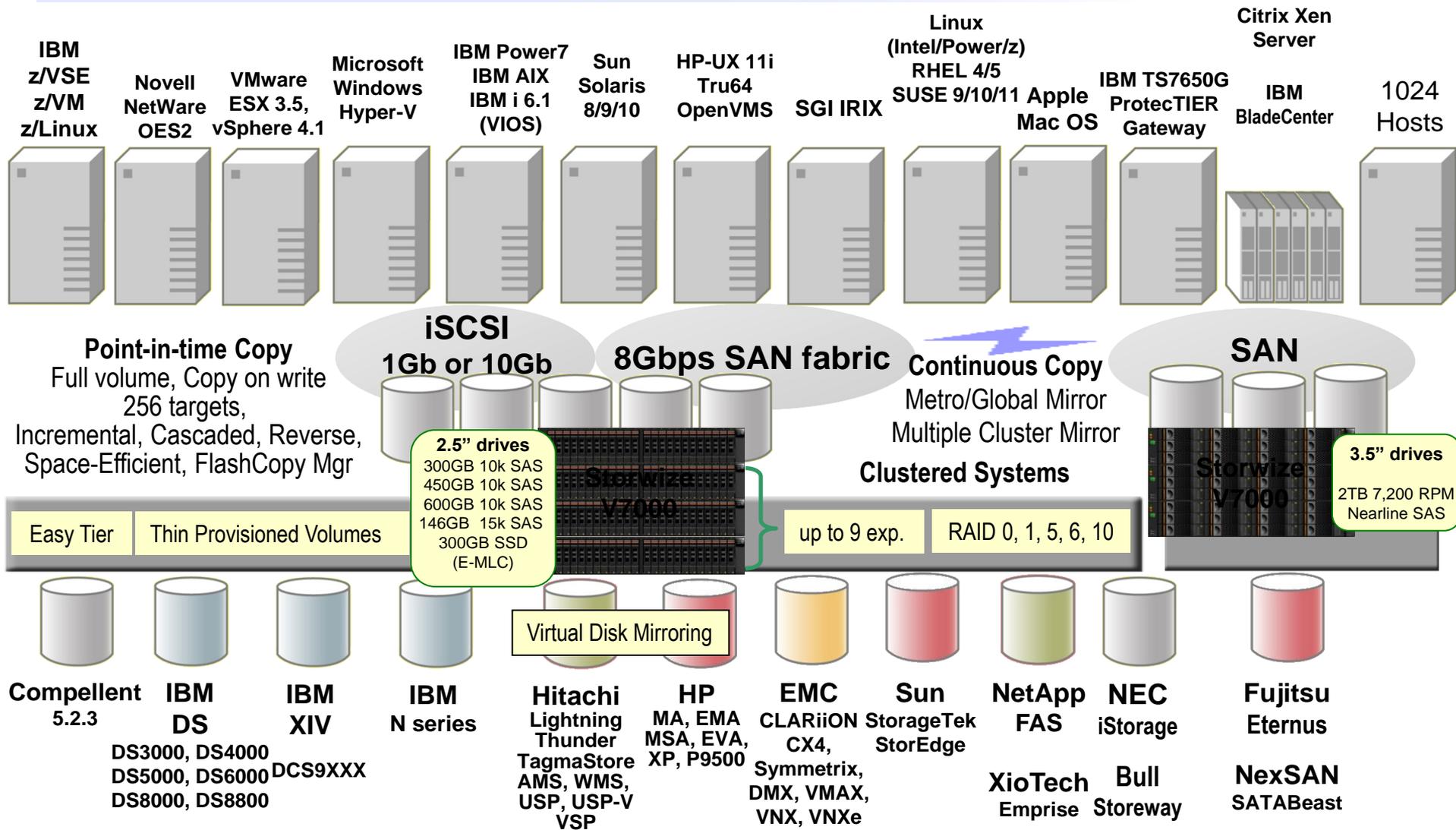
Real-time Performance Statistics

New!



- Gathers system level performance statistics (CPU utilization; port utilization and I/O rates; volume and MDisk I/O rate, bandwidth, latency) in real time with sampling rates down to 5 sec.
- Provides a snapshot view for immediate monitoring with 5-minutes of performance history
- Get “immediate” monitoring during environmental changes
- Troubleshoot sudden drops in performance
- Pair up with TPC for complete performance solutions

IBM Storwize V7000 Supported Environments



Data Protection/High Availability Features

• Snapshots

- Space efficient, differential snapshots
- Includes Microsoft Windows VSS integration

• Synchronous Replication

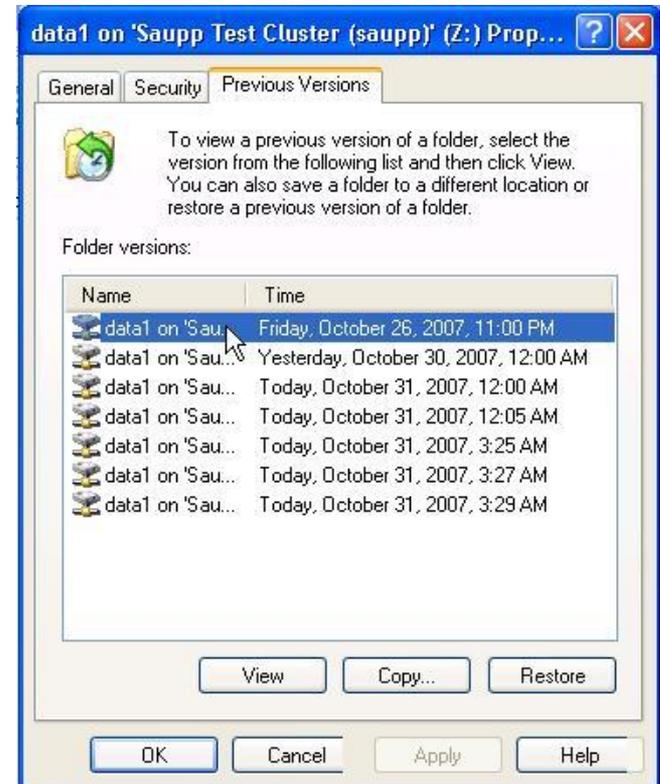
- File, Set of files or entire file system
- Single site in initial release

• Asynchronous Replication (Release 1.1.1)

- Any file system sub-tree from one cluster to another
- Batched based, hub and spoke

• High Availability (HA) Features

- Redundant Interface Nodes: allows access to data by users
- Redundant Storage Nodes: allows access to storage
- Redundant private 1GbE internal management network
- Redundant private DDR Infiniband data network
- RAID 5/6: Protects against individual disk failures



Snapshots Integrated into Windows Explorer using the Volume Shadow Copy Services (VSS)

Snapshots in Linux/Unix →
/.snapshots

IBM Storwize V7000 — Virtual Business Copy Services

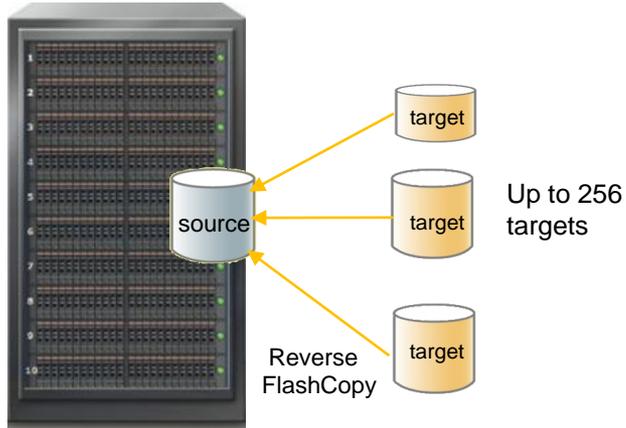
Enhanced!

FLASHCOPY

Target is time-zero copy of the source
Up to 256 Consistency groups supported

Source and target volumes may be on internal or external disk

- BACKGROUND FULLCOPY
- BACKGROUND NOCOPY
- FLASHCOPY USING CONSISTENCY GROUP
- INCREMENTAL FLASHCOPY
- MULTIPLE FLASHCOPY
- CASCADED FLASHCOPY
- SPACE EFFICIENT FLASHCOPY
- MULTIPLE REVERSE FLASHCOPY



DISK MIRRORING

Up to 300km between sites for business continuity using synchronous remote replication.

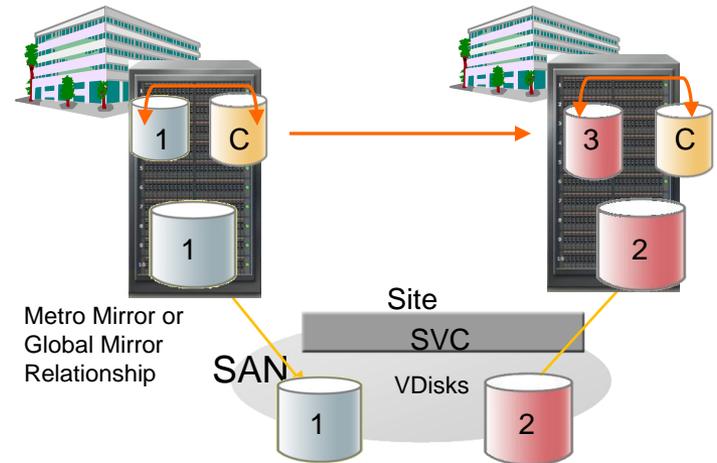
Up to 8000km between sites for business continuity using synchronous remote

Metro and Global Mirror delivered as single feature

Offers great implementation flexibility

Operates between SVC clusters at each site

Local and remote volumes may be on any SVC supported disk systems



Snapshot Management by the User

- To establish snapshot r

- Create a rule

- User names th
 - The rule conta specific hours manually.
 - The rule conta various period
 - User may crea

- Associate a rule wi

- A rule may be
 - A file system c
 - Multiple rule weekends
 - The differen snapshots c
 - The total nu associated v

- Snapshots are then cre

New File Set ✕



Basic



Custom

Name ▼

Quota ▼

Snapshot ▲

Select one or more snapshot rules.

	Name	Keep Hour	Keep Day	Keep Week	Keep Month
<input type="checkbox"/>	Once a hour	5	5	3	3
<input type="checkbox"/>	Once a week – Wed	0	0	5	1
<input type="checkbox"/>	Twice a month – 1 st , 15 th	0	0	0	5

Summary ▼

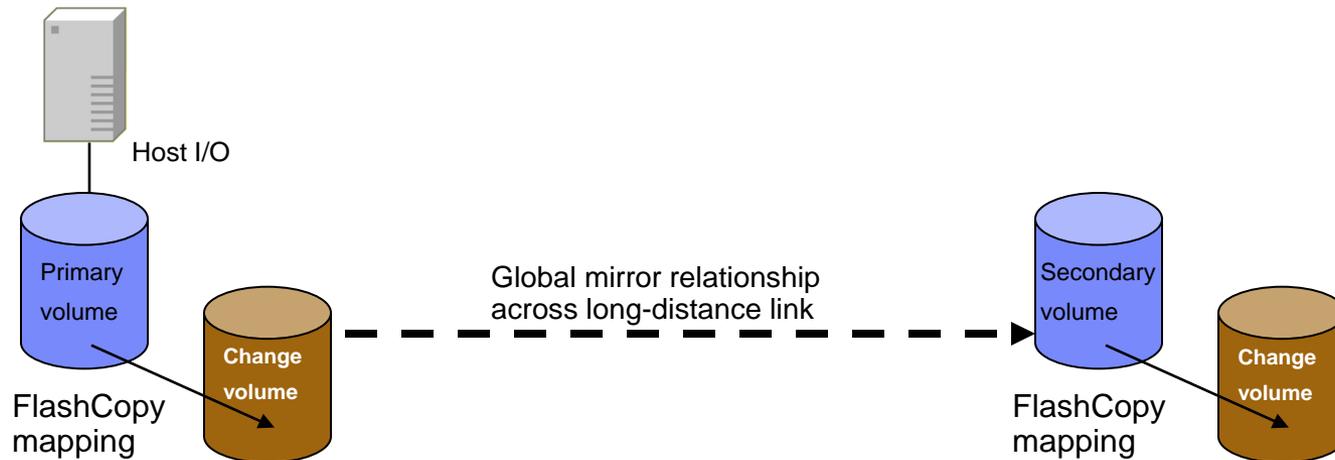
New Snapshot Management Features

- **Snapshots available on a file set in addition to a file system**
 - Space occupied by a snapshot is charged against the file set quota
 - 32 snapshots are reserved for services such as NDMP
 - 224 snapshots per file system
 - 224 snapshots per file set – not charged against the file system

- **Rules are defined to set schedules for all file systems or sets - cron jobs are not used**
- **Rules define retention policies to control retention of snapshots, automatically deleting the oldest snapshots as new ones are created, maintaining a set number of snapshots for specified periods**
- **Snapshots may be named, or default to the Windows standard of @GMT-date-time**
- **Additional CLI commands added to facilitate management of snapshots**
- **Existing snapshot functions and features remain**
- **No new file restore functions – existing restore options remain**

Global Mirror Relationship with Change Volumes

Balance Remote Data Currency With Network Bandwidth Cost



- A Global Mirror relationship consists of two volumes – primary and secondary
- In 6.3.0, each of these *may* be associated with a change volume
 - Not enabled by default
- Change volumes are used to record changes to the remote copy volume
 - Changes can then be copied to the remote cluster asynchronously
- FlashCopy relationship exists between remote copy volume and change volume

IBM Active Cloud Engine™ for Storwize V7000 Unified

V7000 Unified

- Unified block and file storage system with a tightly integrated management console
- Support for **NFS/CIFS/FTP/HTTPS/SCP** file protocols in addition to existing block functions
- File replication and file level snapshots for business continuity and disaster recovery
- IBM Active Cloud Engine™ technology delivers automated storage efficiency capabilities
 - True policy-based management of files
 - With user-defined policies
- **Storwize V7000 Unified is comprised of V7000 and two additional servers – the Gateway Nodes**
 - System-X (x3650M3 servers)
 - Quad Core 2.5 Ghz Xeon, 72G RAM, 2x8G FC, 2x10GEth, 4x 1GEth
 - OS is RHEL 6.1

6U



IBM Active Cloud Engine™ for Storwize V7000 Unified

■ IBM Active Cloud Engine

- **Policy-driven engine** that helps improve storage efficiency by automatically
 - Placing files when they are created on the appropriate storage
 - Moving files during their life to the right tier of storage including tape in a TSM hierarchy
 - Deleting expired or unwanted files
 - Identifying files for backup or replication to a DR location
- **High-performance: can scan billions of files in minutes**

■ IBM Active Cloud Engine Value

- **Lowers storage cost** by moving files transparently to the most appropriate tier of storage
- **Controls storage growth** by moving older files to tape and deleting unwanted or expired files
- **Enhances administrator productivity** by automating file management
- **Improves data protection** by identifying files for backup or DR

- **IBM SONAS also supports Active Cloud Engine with the functions above and additional capability for data movement among storage systems**

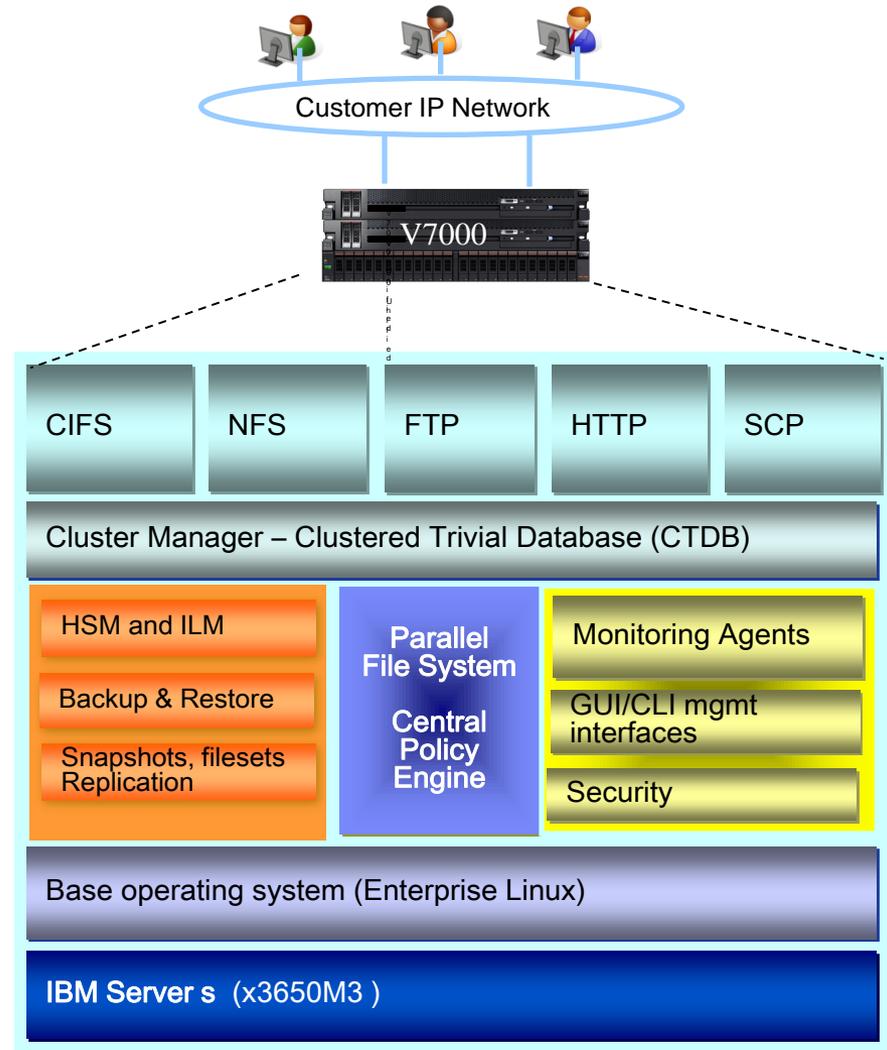


Storwize V7000 Unified – Gateway Nodes + NAS Software

- **Software stack providing the NAS file services**
 - IBM GPFS, TSM
 - Open source CTDB, SMB, NDMP, Security

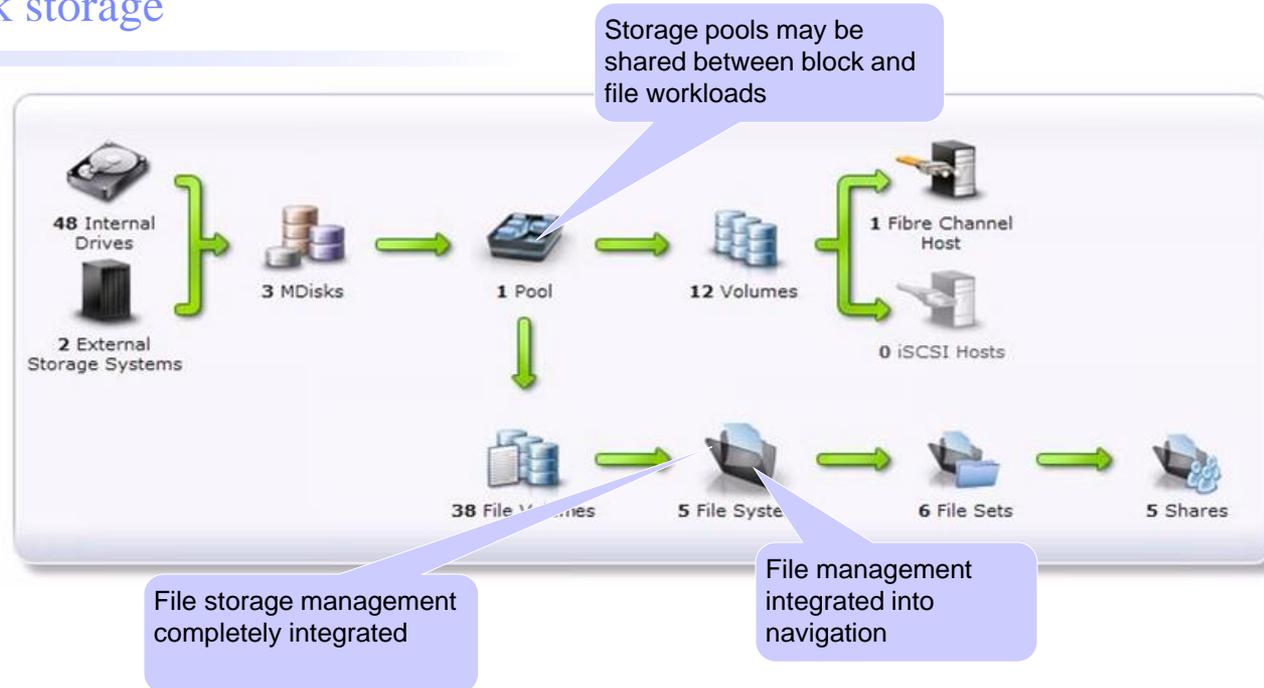
- **V7000 Unified presents single management interface**
 - GUI hosted on File Module provides access to all features
 - CLI hosted on File Module forwards requests to File or Block layers as needed

- **Features / Business Value**
 - ILM/HSM capability helps clients leverage different storage pools for different needs and automate the placement and movement of data between these pools quickly, transparently without any administrator involvement. Powerful policy engine in SONAS scans millions of metadata files super fast and takes action based on policies.



Storwize V7000 Unified User Interface

Truly integrated file and block storage



Manage block and file applications with a single storage system

Support file access protocols

- NFS, CIFS, FTP, HTTPS, SCP

Simplify administration with an intuitive GUI for block and file data

- Not a launcher for two different interfaces

Define Active Cloud Engine ILM Policies in the GUI

New File System

Single File System Pool Migration - ILM Custom

Name and File System Pool

Migration Policy

Enable file migration

Migration Thresholds:

Start threshold: 95 %

Stop threshold: 85 %

Migration Start Time:

As soon as threshold is reached

Specify: HH:MM

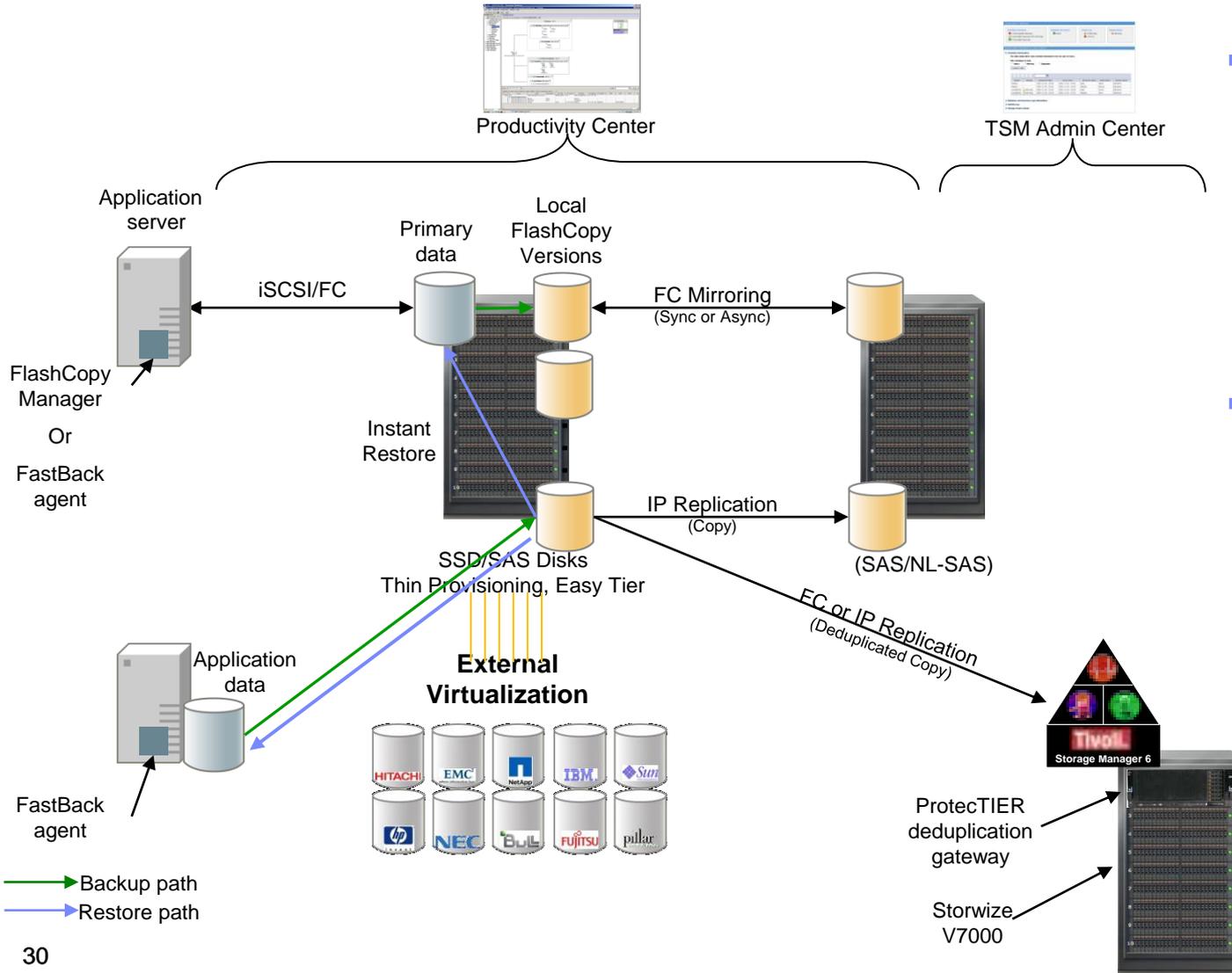
Exclusion list (files not to migrate)

File Attribute	Operator	Value	
Size	<	11 MB	+ -
Last accessed	<	2 Days	+ -

OK Cancel

This dialog is modeled on the Storwize V7000 volume creation dialog

Storwize V7000 Solutions at a Glance



- For clients looking to integrate with enterprise recovery management or to extend these solutions to data not currently stored on Storwize V7000
- IBM offers
 - Virtualization of external disk arrays
 - Application-integrated software snapshot for external data
 - Unified Recovery Management with Tivoli Storage Manager



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