Ron Riffe
Storage Software Business Strategy

IBM

IBM Storage Solutions
Efficient. Powerful. Easy.

Smarter Systems for a Smarter Planet

Introducing IBM® Storwize® V7000

A Smarter Planet Drives Inescapable Data Growth

IBM Smarter Planet Vision

The world is flatter and smaller. Now it's becoming smarter.

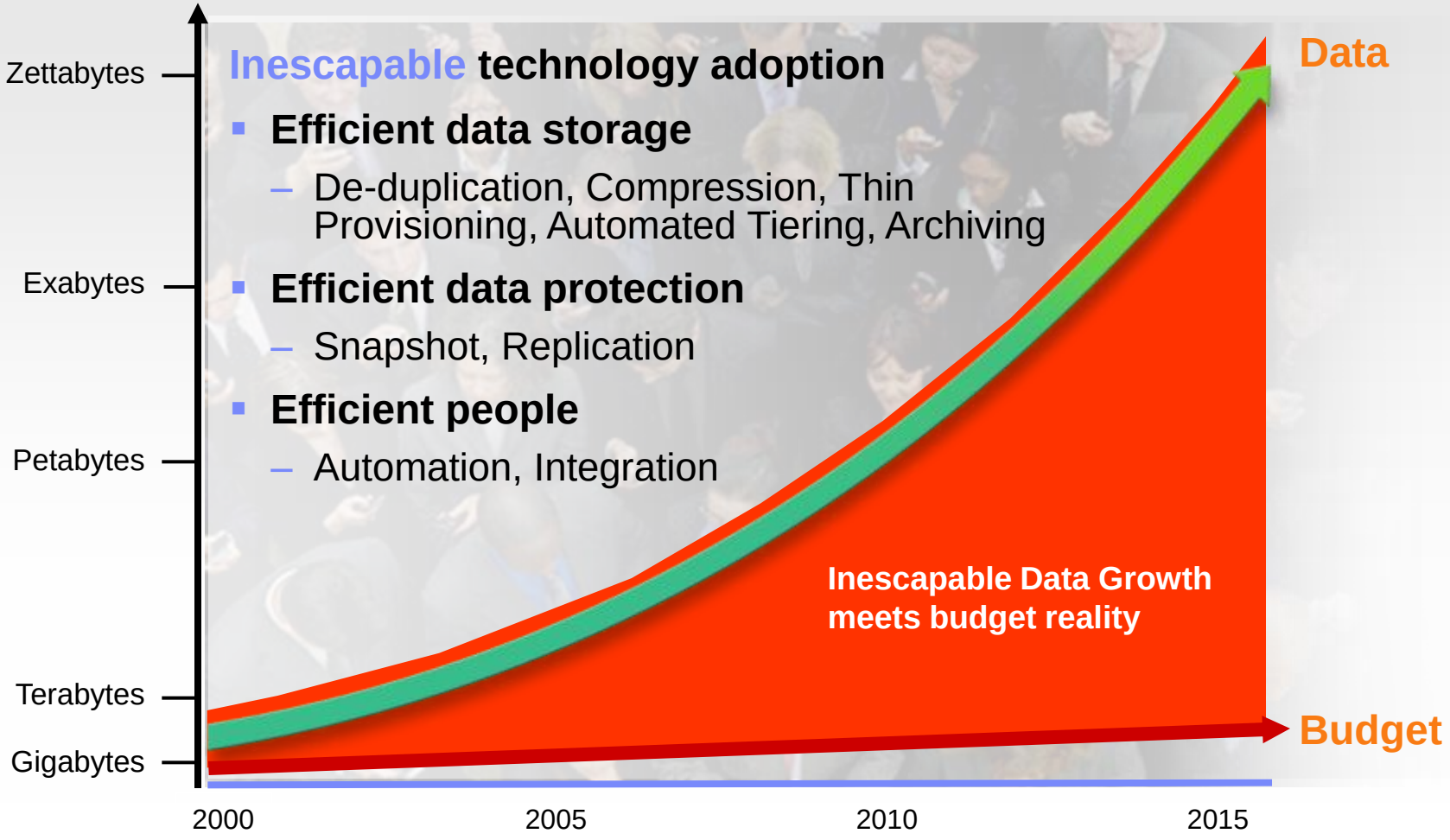
The world is generating 15 petabytes of data daily.

Information is doubling every 18 months. Storage capacity is growing 45% yr.

80% of new data growth is unstructured content.

How do I create an infrastructure that scales quickly and efficiently while driving down cost, protecting information, and saving on labor?

Inescapable Data Growth
Implications for IT Managers



Smart Storage Solutions …

Scale quickly and efficiently **to manage and analyze large amounts of information.**

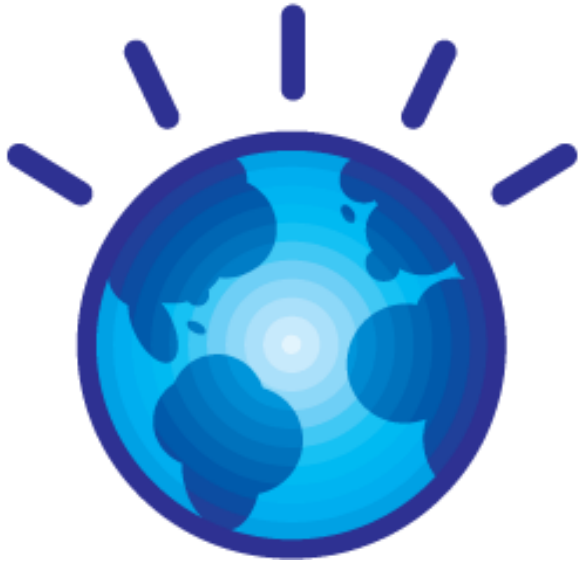
Intelligently balance performance **to differing requirements across multiple workloads.**

Flexibly flow resources **to changing requirements and demands - flowing resources where needed instantly for high utilization and ROI.**

Avoid downtime **by being highly reliable, available and resilient.**

Save energy **by intelligently balancing performance needs with efficiency requirements.**

Automate management tasks **to save on labor and staffing in resource constrained environments.**



Introducing the IBM Storwize V7000

- Control enclosure: **dual controllers and up to twelve 3.5" or twenty-four 2.5" drives in just 2U**
- **Eight 8Gb FC ports plus four 1Gb iSCSI ports per controller pair initially** (10Gb iSCSI and FCoE post-GA)
- Expansion enclosure: **drives only**
- **Up to nine expansion enclosures attach to one control enclosure**

Built-in Software inherited from SVC and DS8000 RAID

- **RAID 0, 1, 5, 6, 10**
- **Storage Virtualization**
  (internal disks and external arrays)
- **Non-disruptive Data Migration**

Efficiency

- **Thin Provisioning**
- **Easy Tier**
  (dynamic data movement across SSD/HDD)

Manageability

- **New User interface** (easy-to-use, web based)
- **Integrated SAN-wide Management**
  (Tivoli Storage Productivity Center)
- **Integrated IBM server and storage mgmt**
  (Systems Director Storage Control)

Replication

- **Application integrated**
  (Oracle, DB2, SAP, Domino, Exchange, SQL Server)
- **Efficient use of space**
  (thin provisioned, incremental, deduplicated)
- **DR automation** (failover/fail back, site switching)
- **IP or Fibre Channel**

Storwize V7000

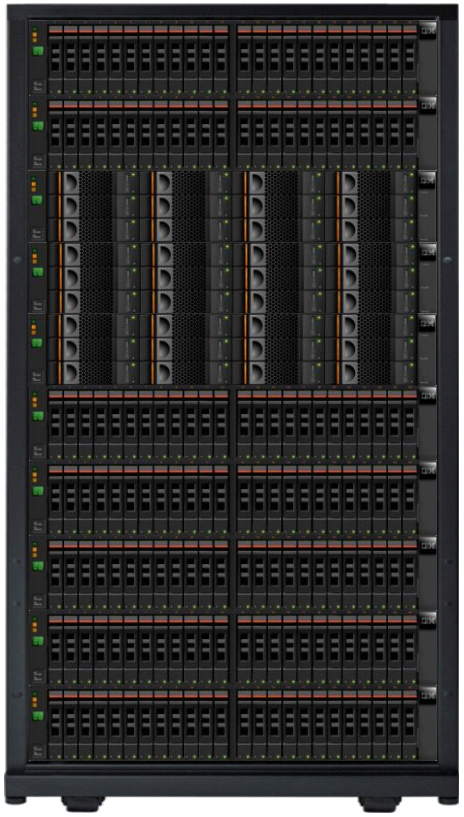
Think **BIG**

Easily add up to 9 expansion enclosures

Expand capacity up to 240TB

Start small

One 24-bay control enclosure

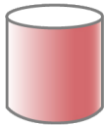


- **Intermix enclosures in the same system**
  - 12-bay and 24-bay
- **Intermix drives in the same enclosure**
  - Solid State (SSD)
  - SAS
  - Near-line SAS (NL-SAS)

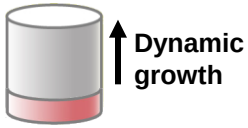
Efficiency Features

Thin provisioning

- ✓More productive use of available storage
- ✓Across all supported host platforms

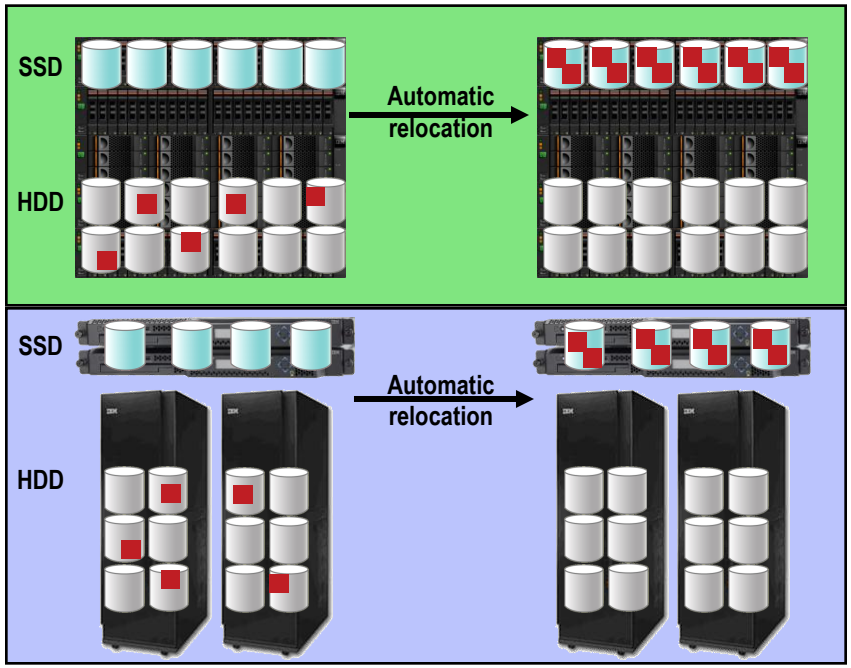


Without thin provisioning, pre-allocated space is reserved whether the application uses it or not.



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

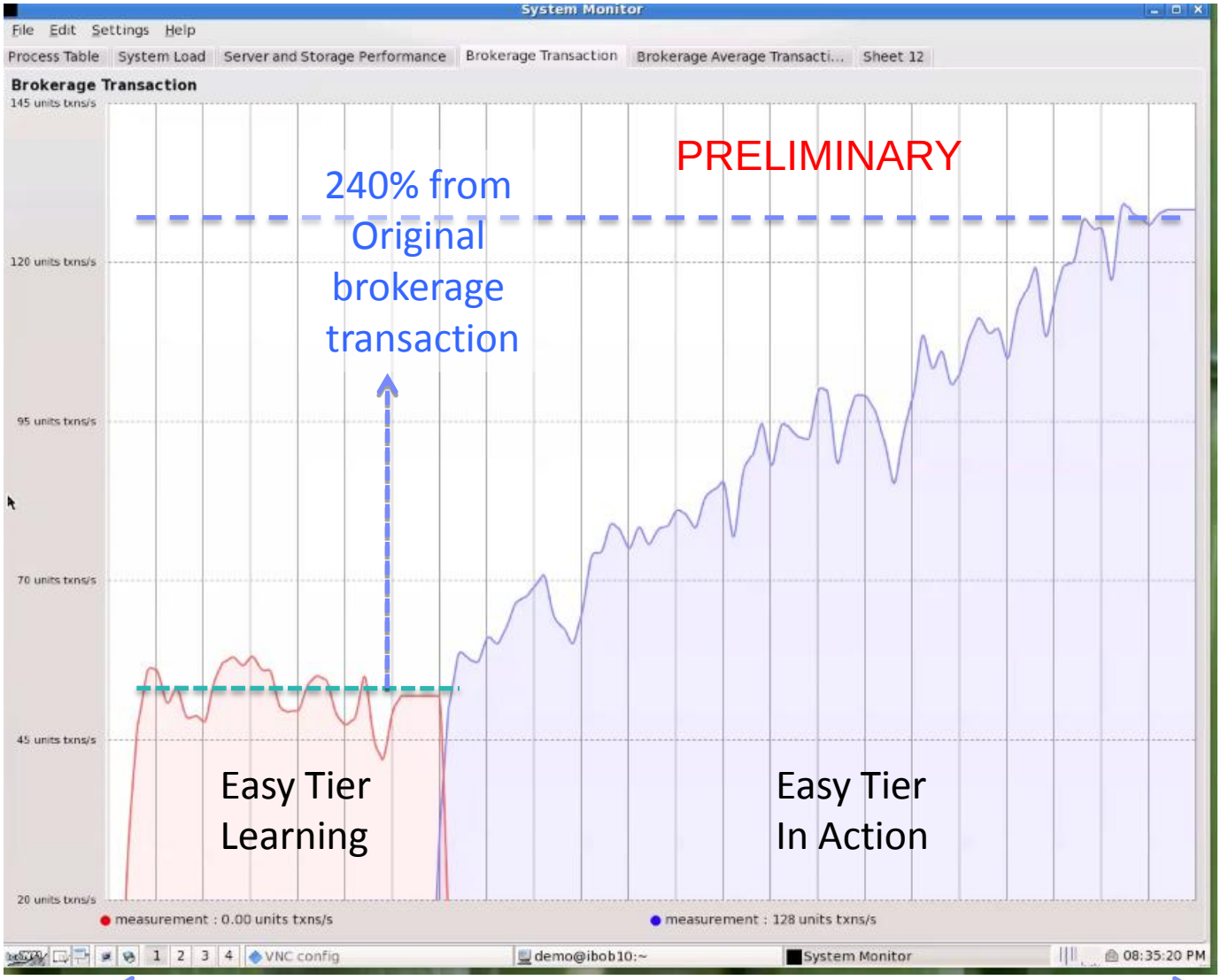
Easy Tier



- ✓"Easy Tier" pools identify the busiest data extents and automatically relocate them to highest performing Solid-state Disks
- ✓Remaining data extents can take advantage of higher capacity, price optimized disks

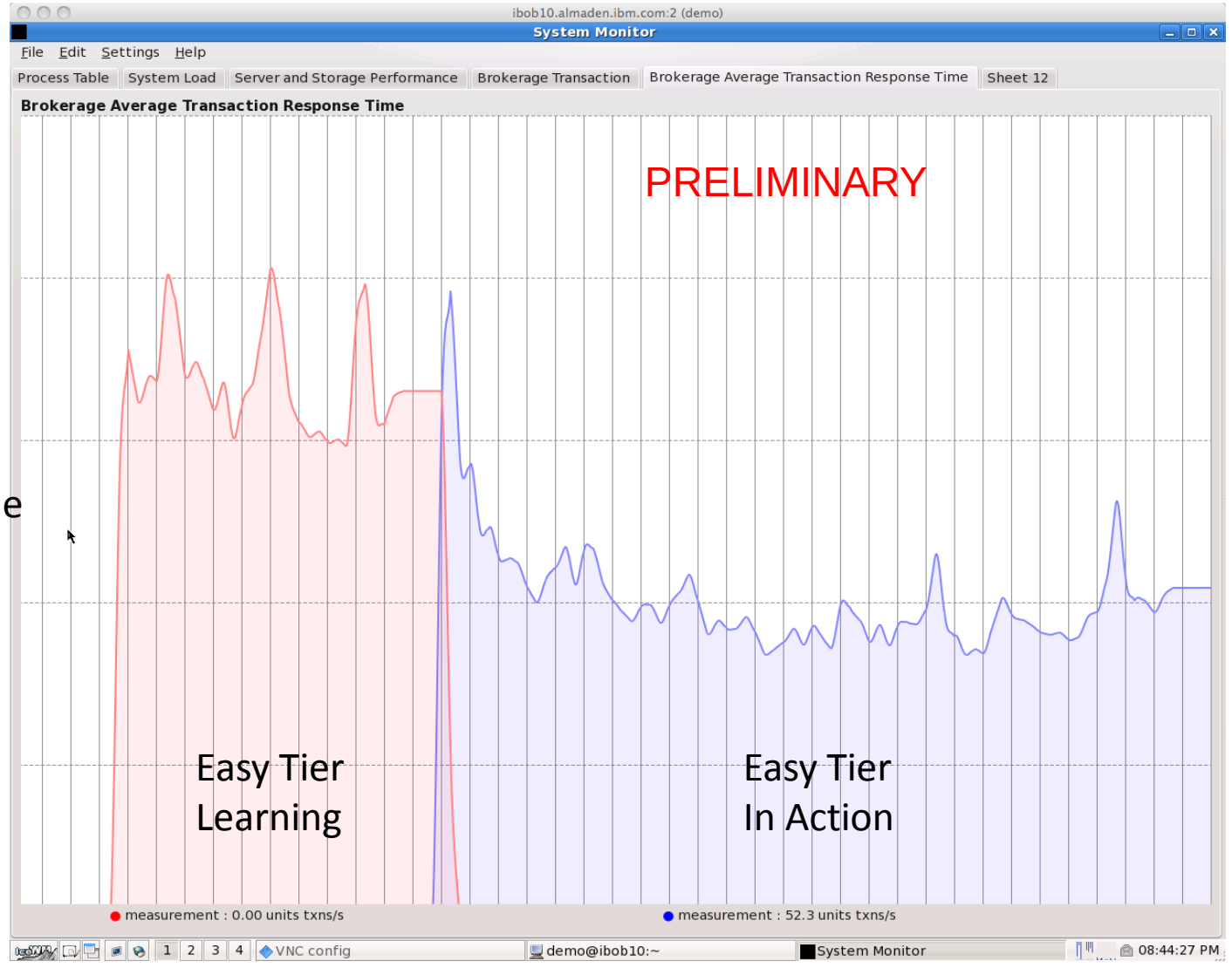
Easy Tier Application Transaction Improvement

Application Transaction Throughput



12 hours (Elapsed Time)

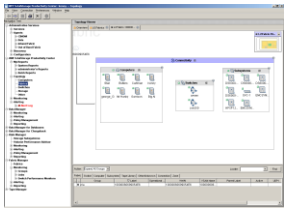
Easy Tier Application Transaction Improvement



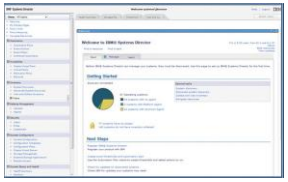
Manageability Features
Overview

- **User Interface**
  - Adopted from the easy-to-use XIV GUI
  - For clients where the Storwize V7000 “is” the infrastructure
- **Enterprise Management**
  - Integrated management with a SAN-wide perspective
  - For clients where the Storwize V7000 is connected to a SAN with other, perhaps heterogeneous storage
- **Server / Storage Management**
  - Integrated management with a Systems and Storage perspective
  - For clients with IBM servers and storage

Easy-to-use management GUI



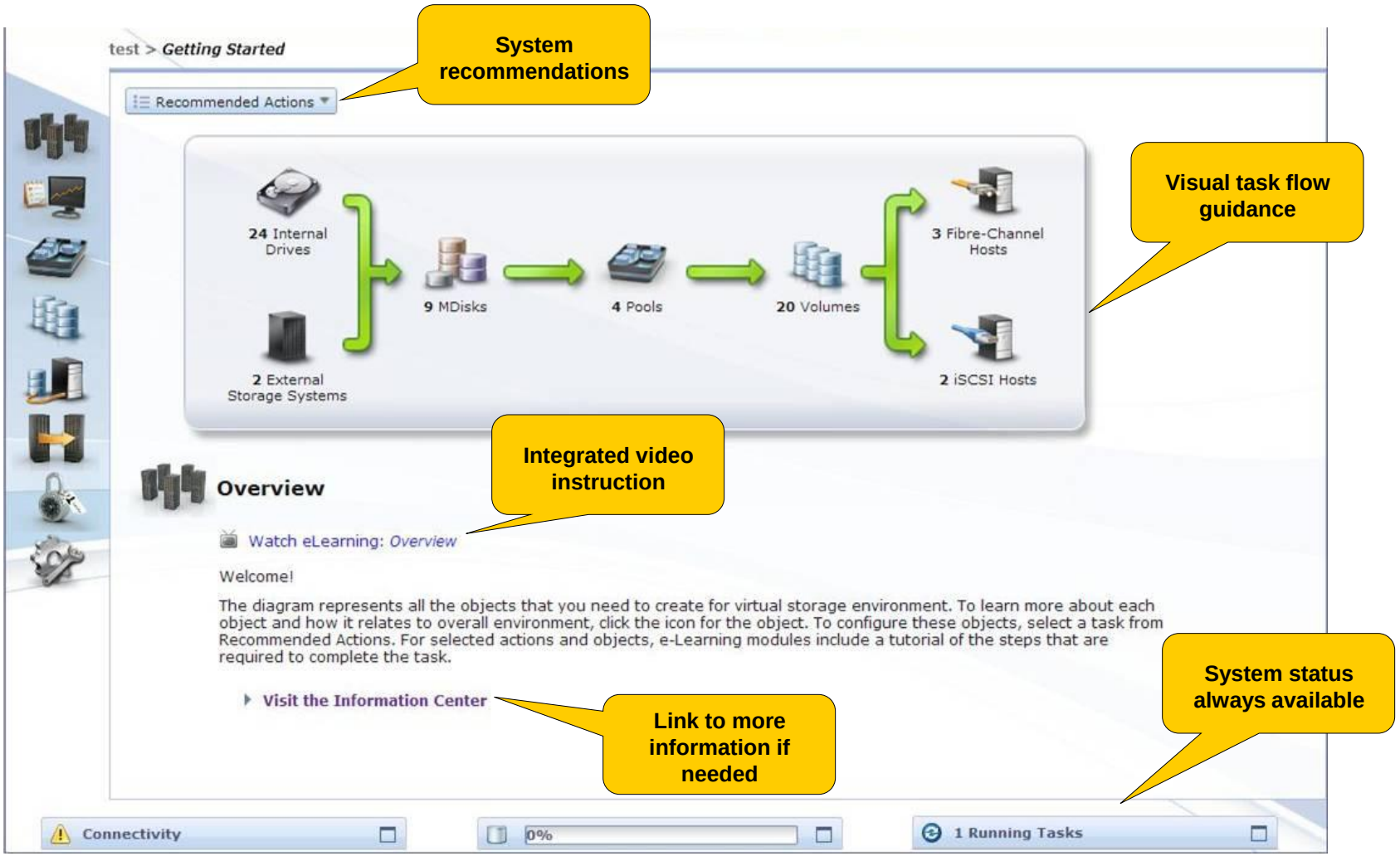
Tivoli Storage Productivity Center
Integrated SAN-wide management

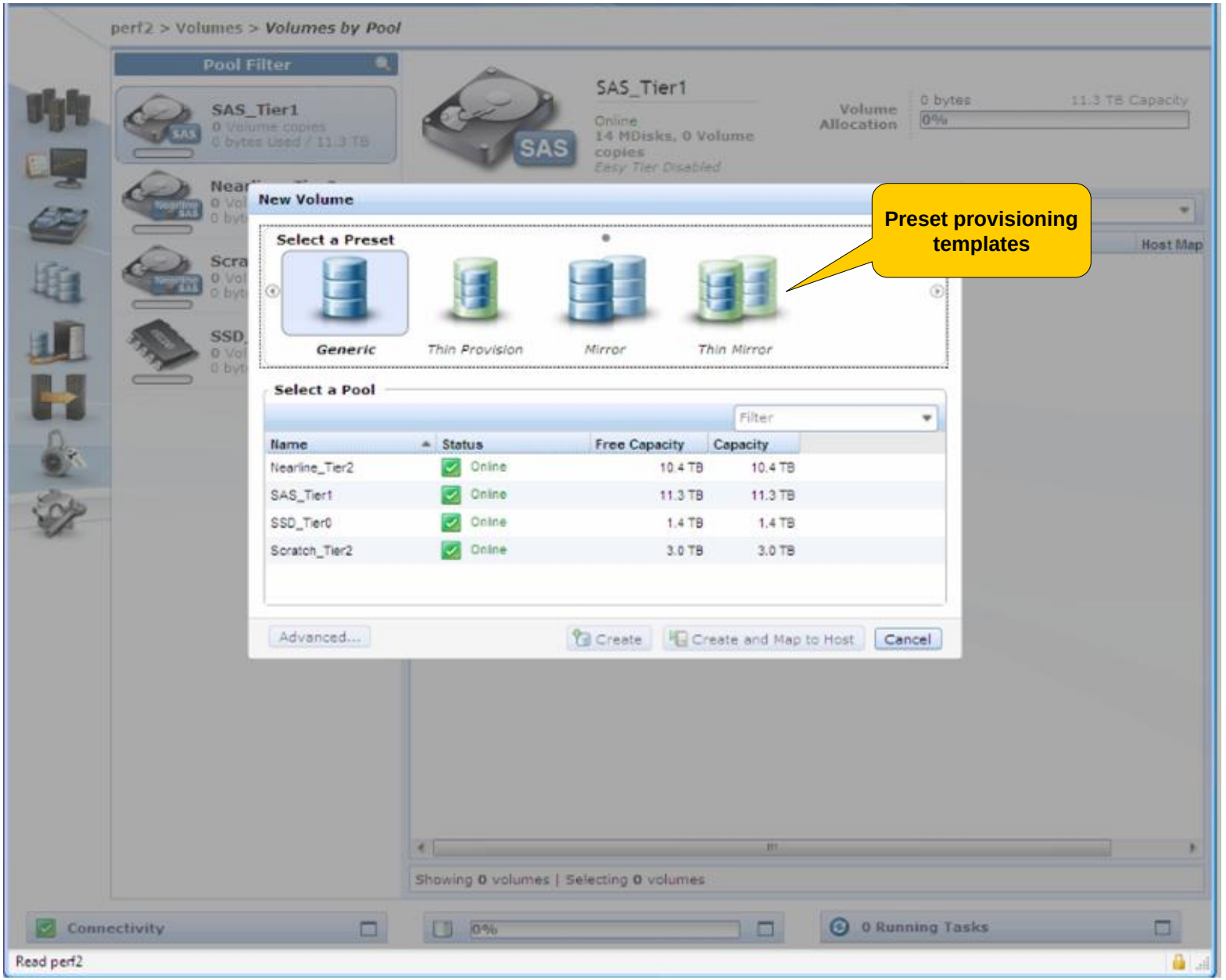


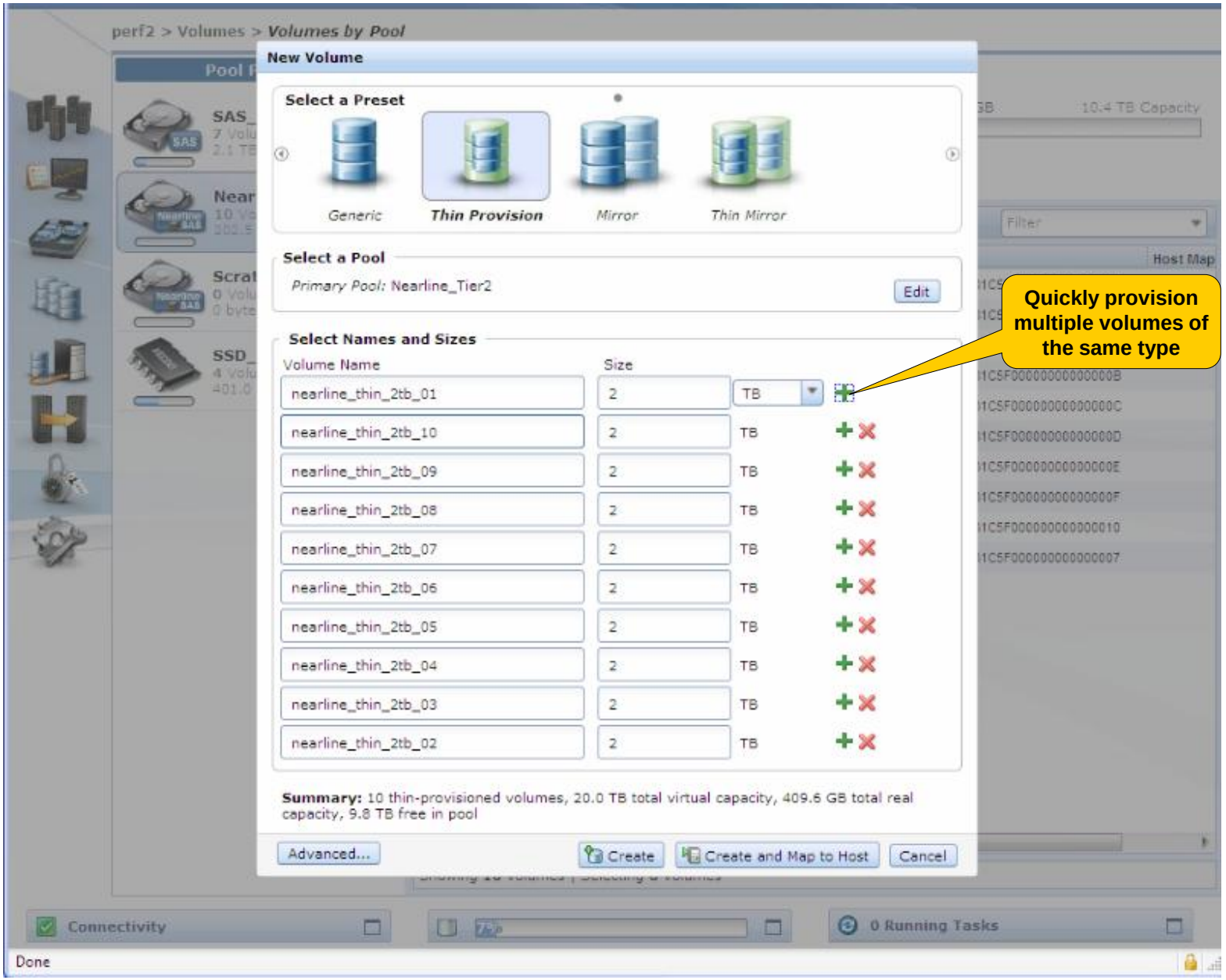
Systems Director Storage Control
Integrated IBM server and storage mgmt

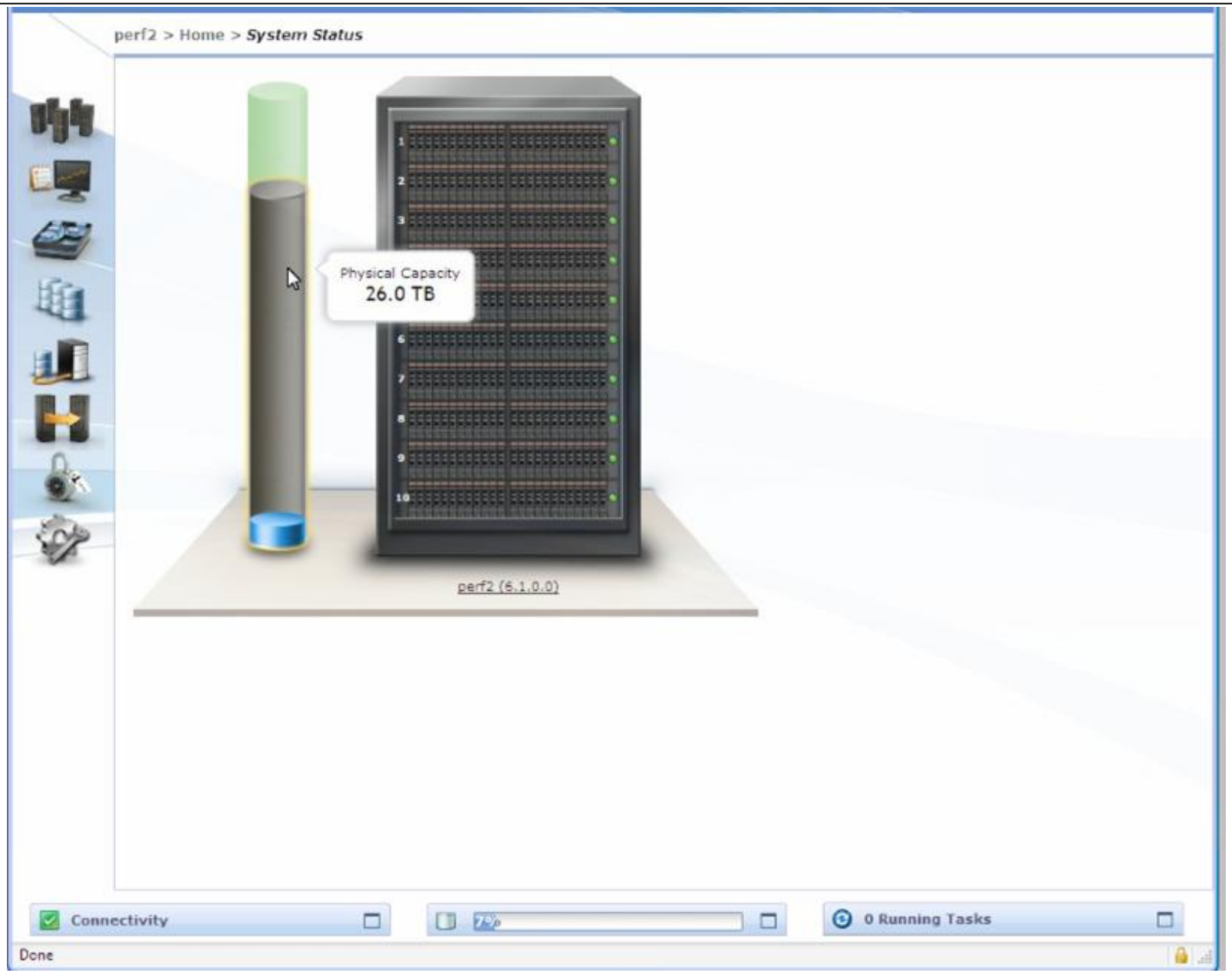
Fresh New User Interface

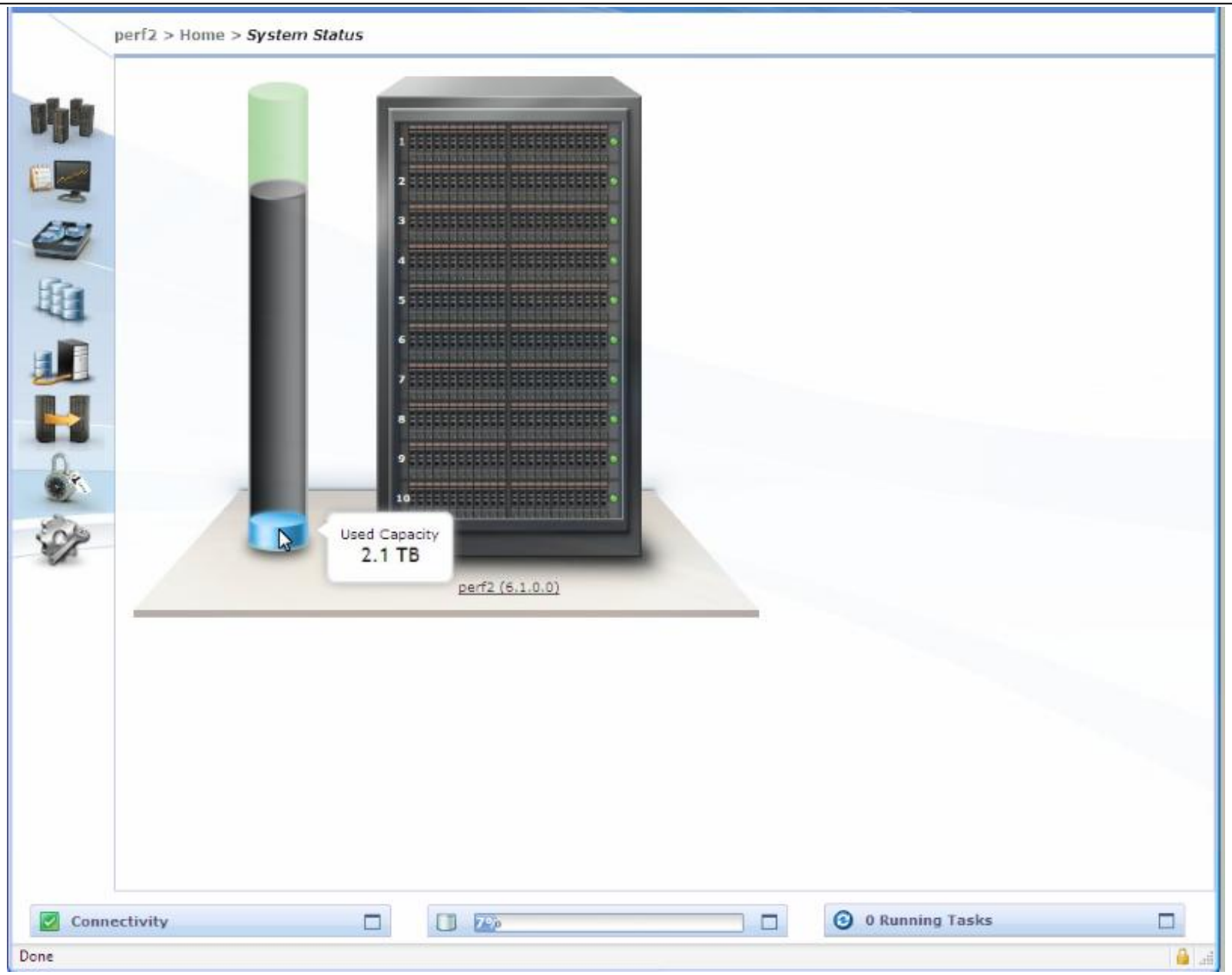
Based on the well-received XIV interface

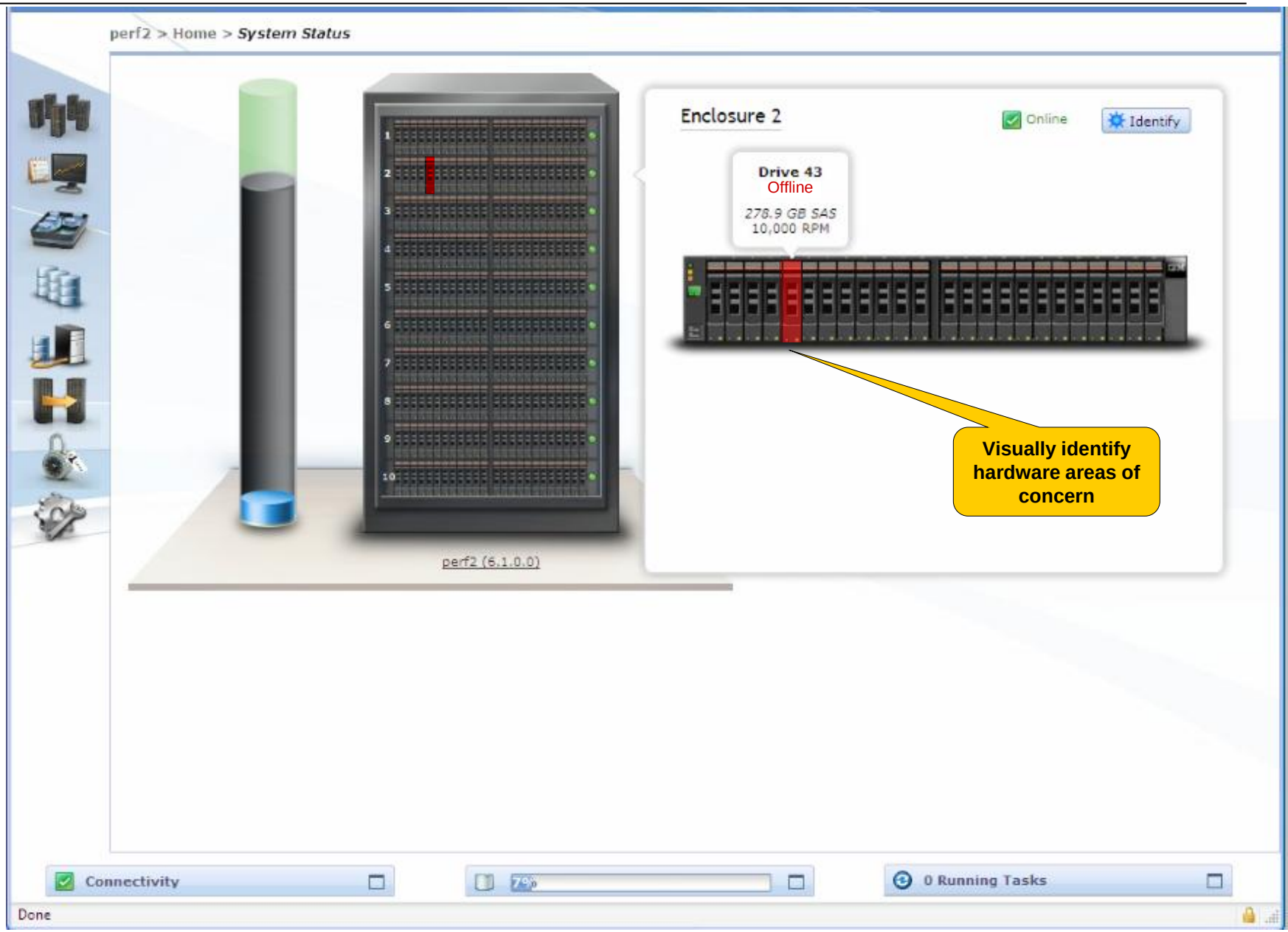












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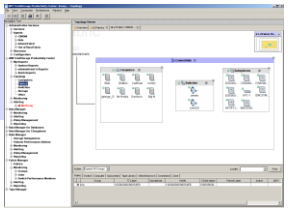

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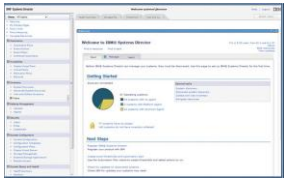
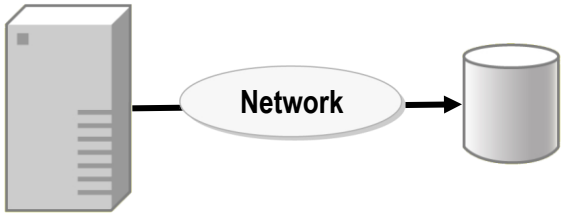


Systems Director Storage Control
Integrated IBM server and storage mgmt

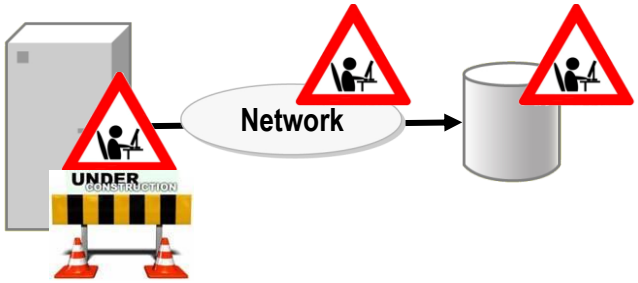
Enterprise Management Features

Visualize the SAN



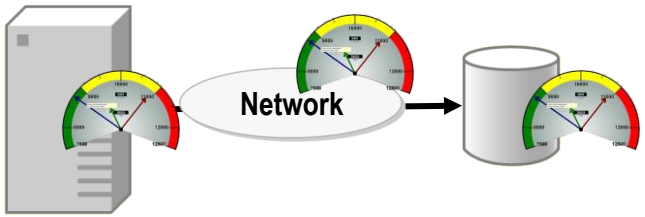
- ✓From virtual machines to the physical server they reside on, through the SAN, to the disk systems …
- ✓Physical topology and logical data path
- ✓Health/Status Monitoring
- ✓Event Management
- ✓Device Capacity Mgmt
- ✓Policy-based Alerting

Provision storage



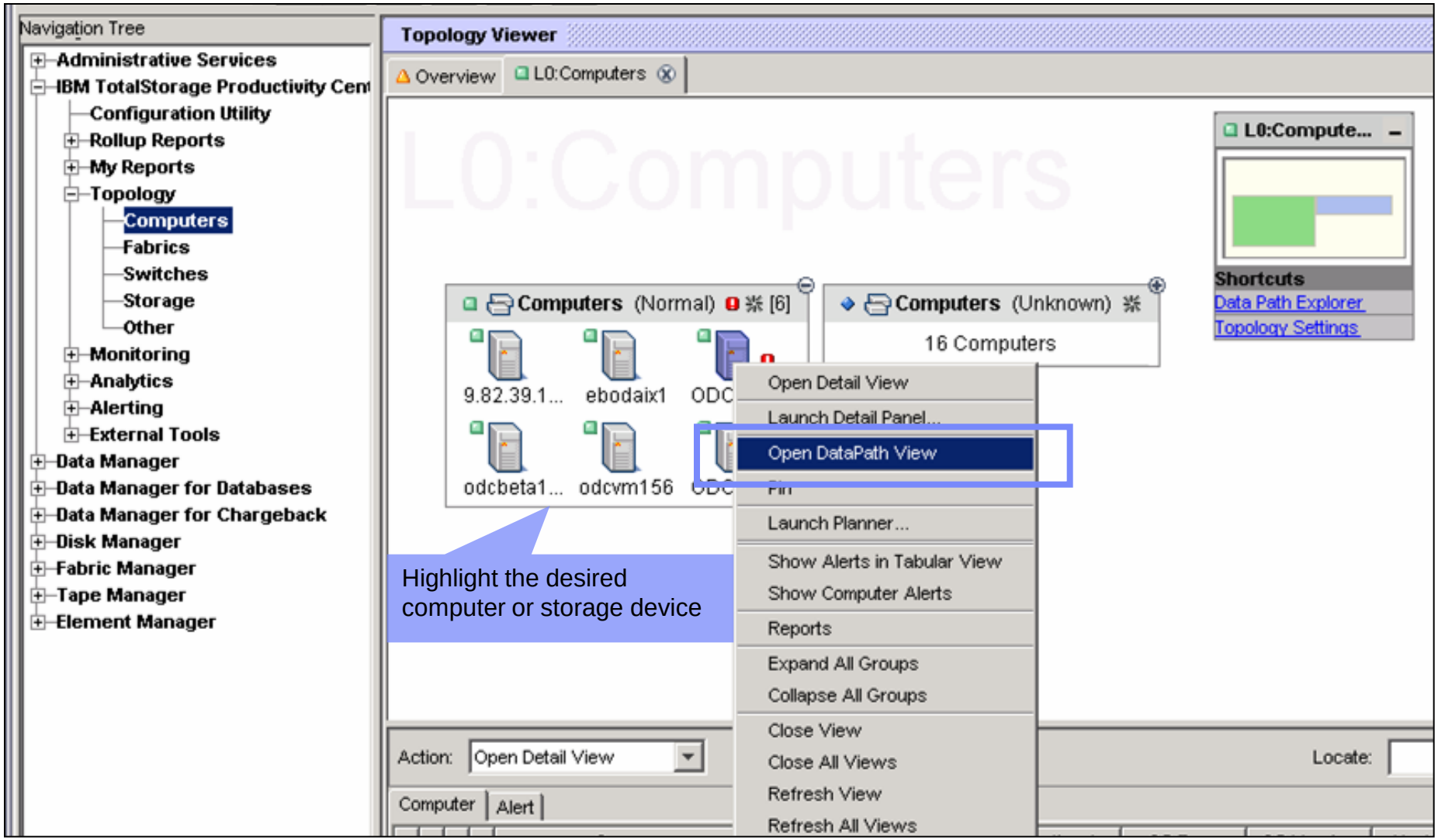
- ✓For new or expanding applications, apply application-centric provisioning policies
- ✓Provision host multi-pathing, SAN zones, and array capacity in a single action

Analyze performance

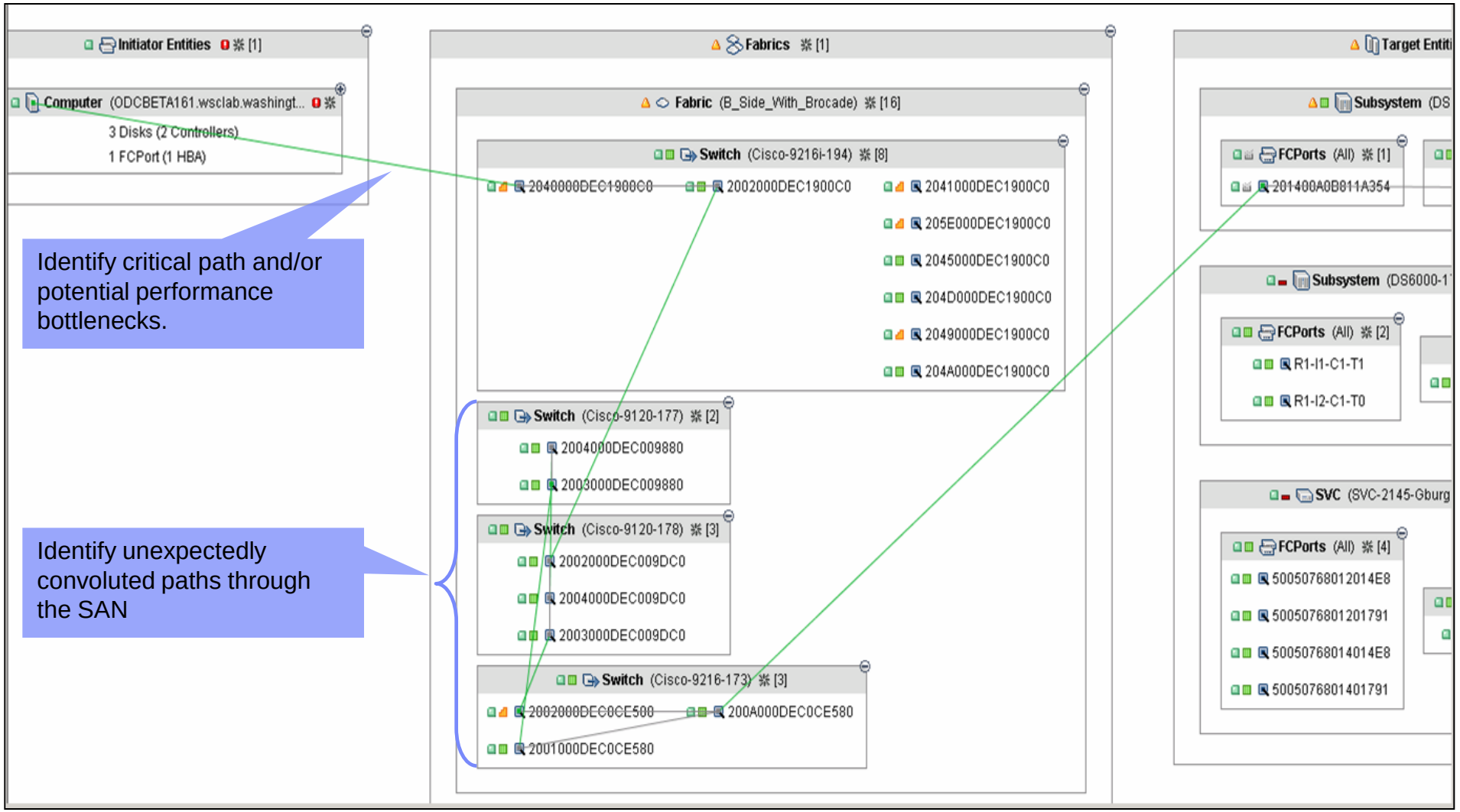


- ✓Isolate application I/O performance problems across the entire data path
- ✓Report on performance history

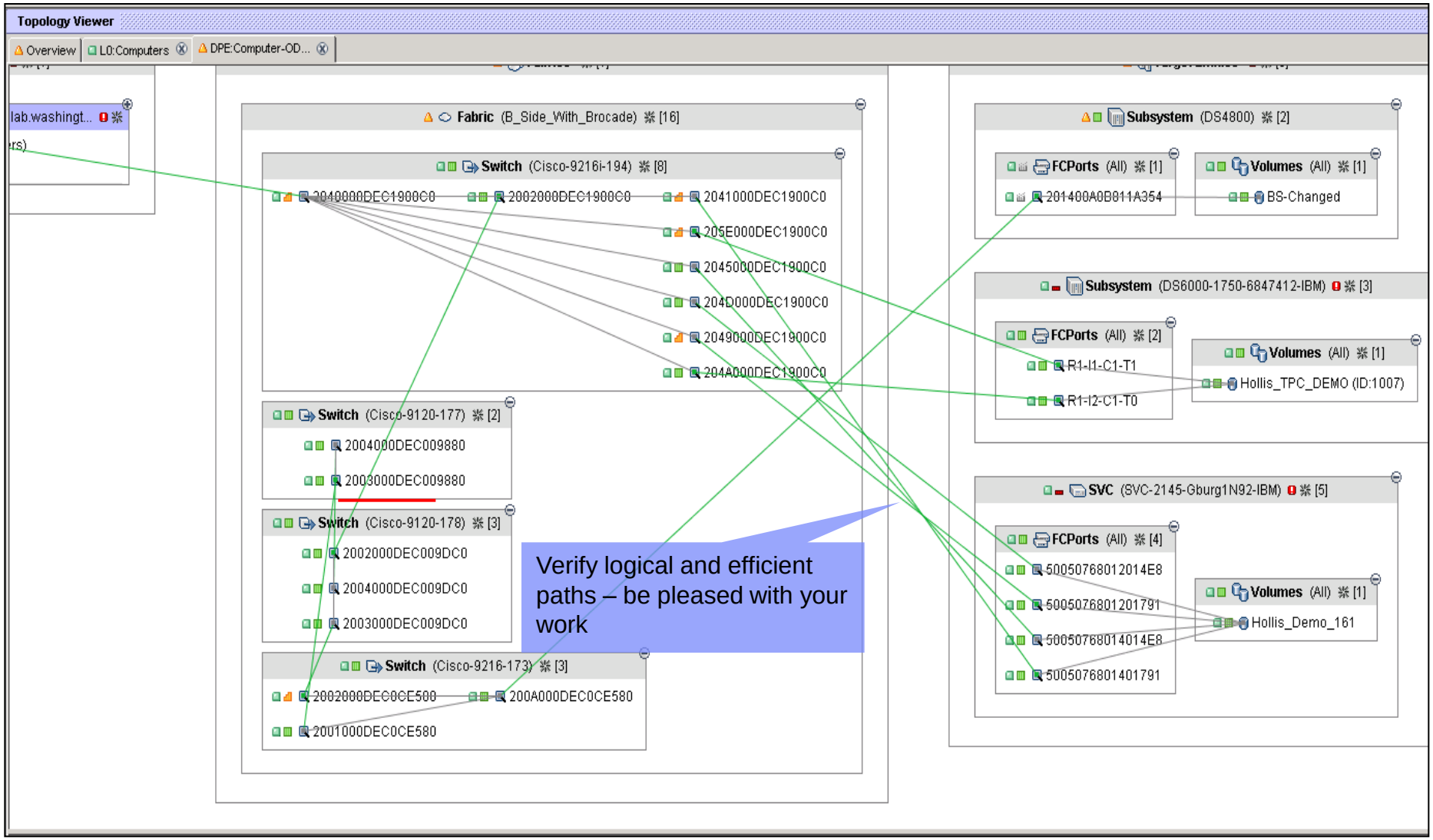
Analyzing Storage Performance



Analyzing Storage Performance



Analyzing Storage Performance



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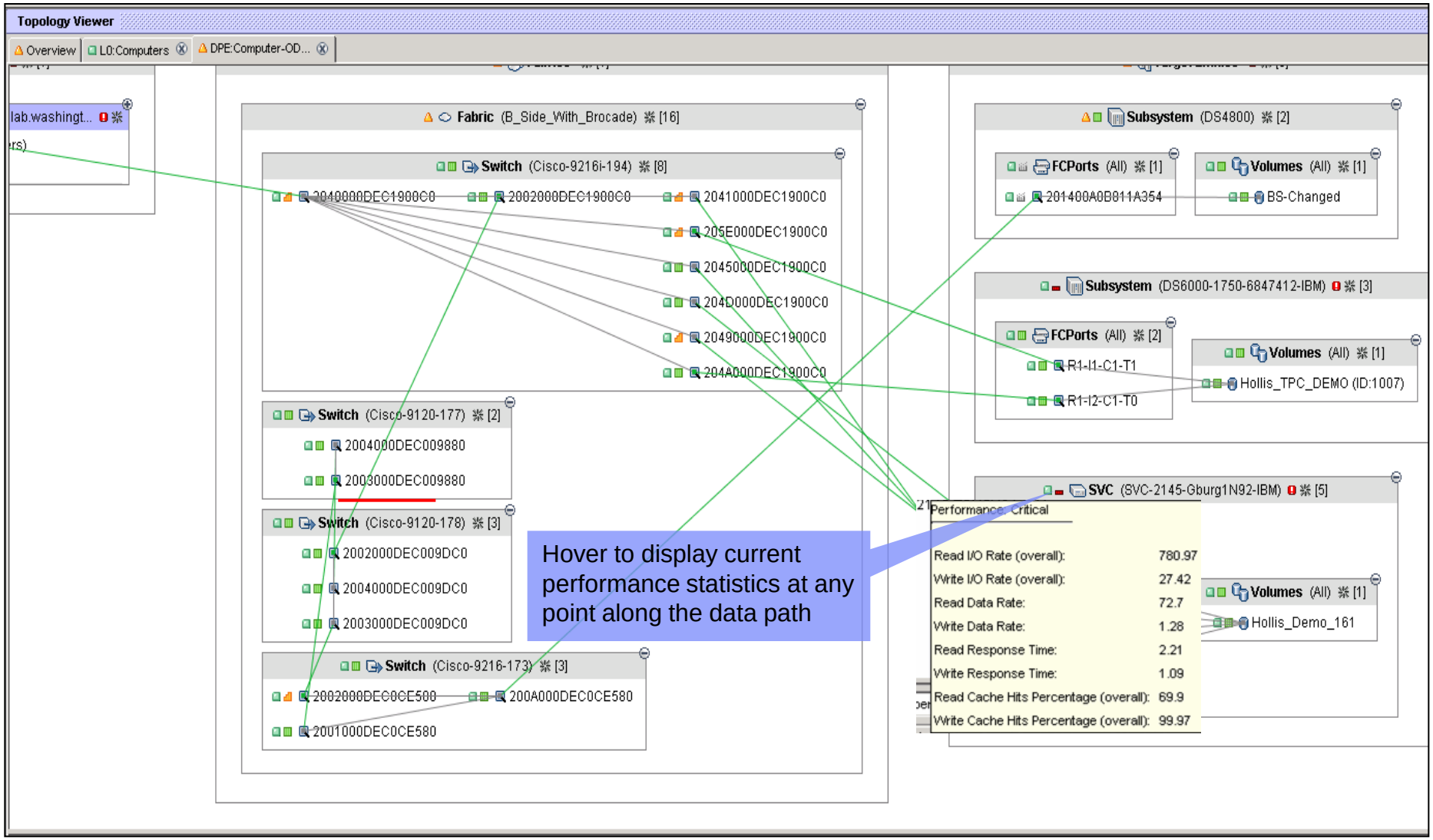
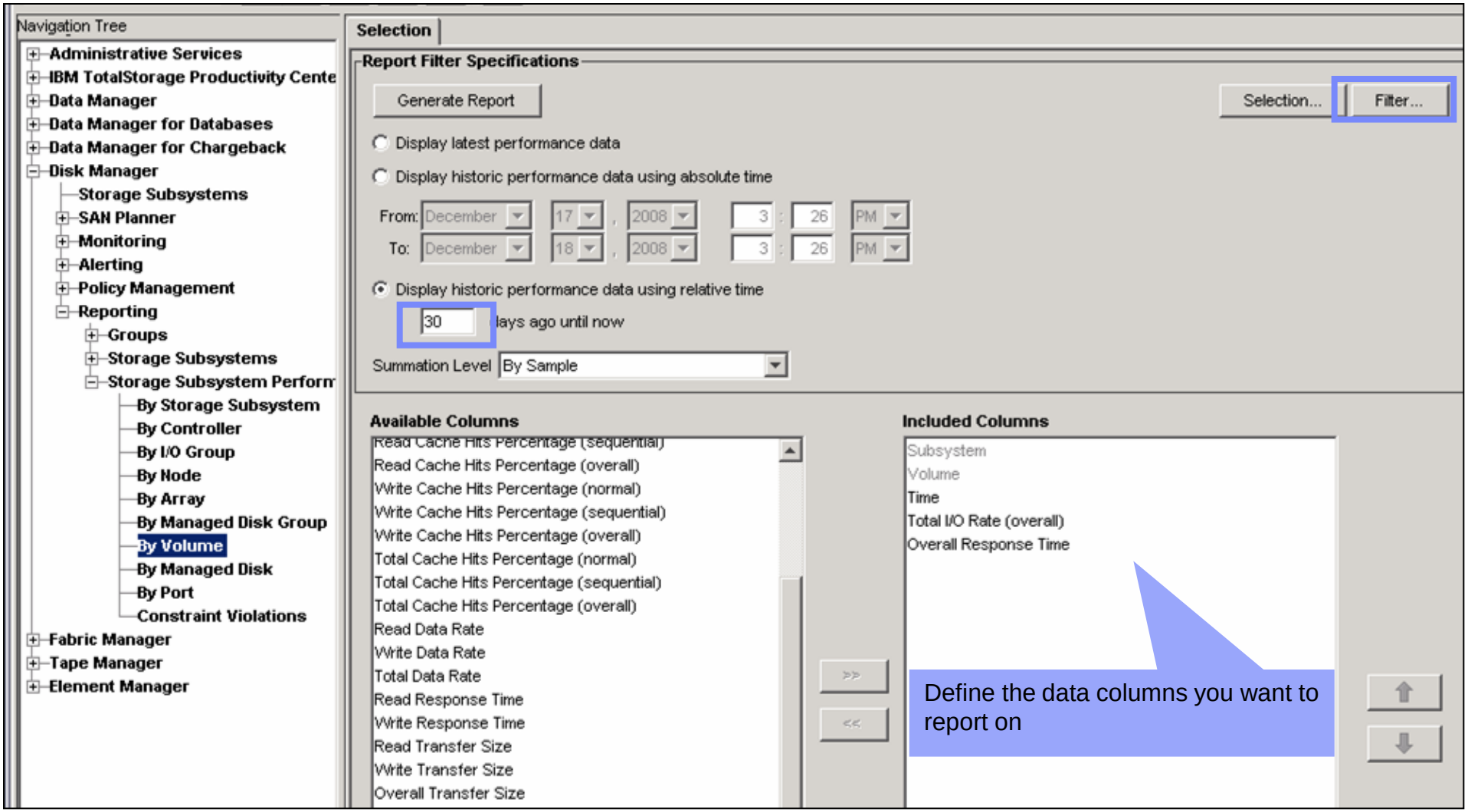
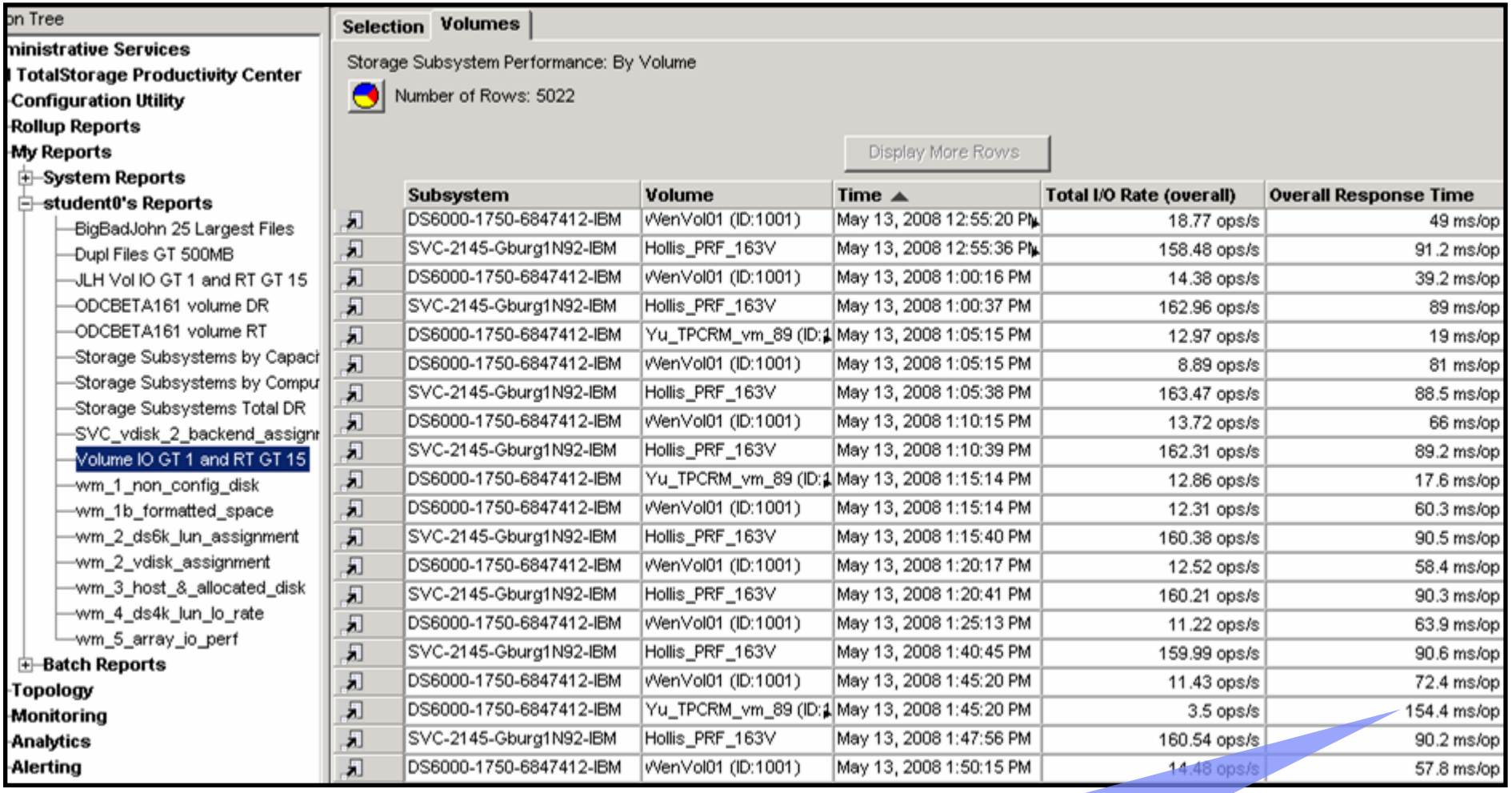


Analyzing Storage Performance

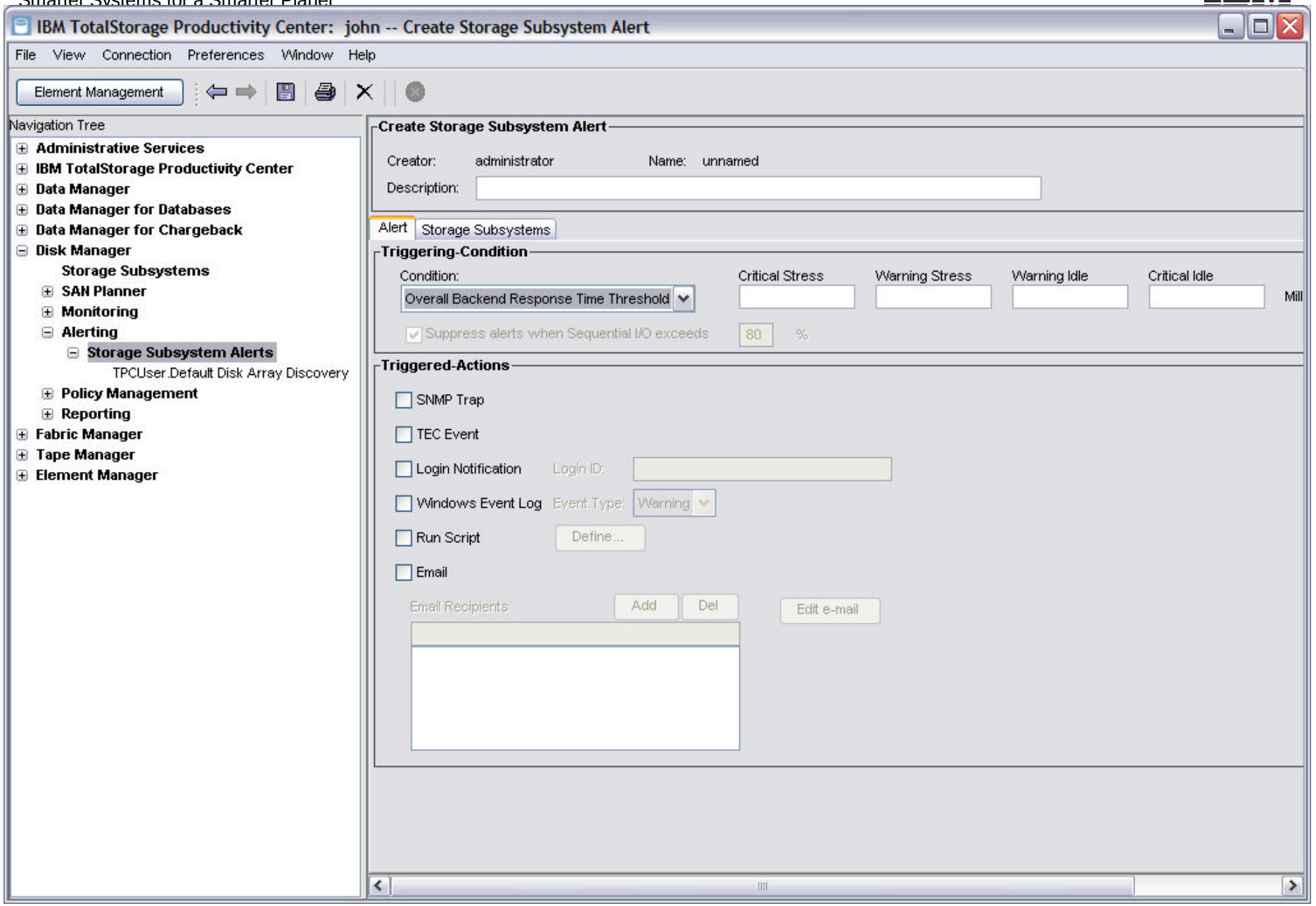


Analyzing Storage Performance



Subsystem	Volume	Time	Total I/O Rate (overall)	Overall Response Time
DS6000-1750-6847412-IBM	WenVol01 (ID:1001)	May 13, 2008 12:55:20 PM	18.77 ops/s	49 ms/op
SVC-2145-Gburg1N92-IBM	Hollis_PRF_163V	May 13, 2008 12:55:36 PM	158.48 ops/s	91.2 ms/op
DS6000-1750-6847412-IBM	WenVol01 (ID:1001)	May 13, 2008 1:00:16 PM	14.38 ops/s	39.2 ms/op
SVC-2145-Gburg1N92-IBM	Hollis_PRF_163V	May 13, 2008 1:00:37 PM	162.96 ops/s	89 ms/op
DS6000-1750-6847412-IBM	Yu_TPCRM_vm_89 (ID:1	May 13, 2008 1:05:15 PM	12.97 ops/s	19 ms/op
DS6000-1750-6847412-IBM	WenVol01 (ID:1001)	May 13, 2008 1:05:15 PM	8.89 ops/s	81 ms/op
SVC-2145-Gburg1N92-IBM	Hollis_PRF_163V	May 13, 2008 1:05:38 PM	163.47 ops/s	88.5 ms/op
DS6000-1750-6847412-IBM	WenVol01 (ID:1001)	May 13, 2008 1:10:15 PM	13.72 ops/s	66 ms/op
SVC-2145-Gburg1N92-IBM	Hollis_PRF_163V	May 13, 2008 1:10:39 PM	162.31 ops/s	89.2 ms/op
DS6000-1750-6847412-IBM	Yu_TPCRM_vm_89 (ID:1	May 13, 2008 1:15:14 PM	12.86 ops/s	17.6 ms/op
DS6000-1750-6847412-IBM	WenVol01 (ID:1001)	May 13, 2008 1:15:14 PM	12.31 ops/s	60.3 ms/op
SVC-2145-Gburg1N92-IBM	Hollis_PRF_163V	May 13, 2008 1:15:40 PM	160.38 ops/s	90.5 ms/op
DS6000-1750-6847412-IBM	WenVol01 (ID:1001)	May 13, 2008 1:20:17 PM	12.52 ops/s	58.4 ms/op
SVC-2145-Gburg1N92-IBM	Hollis_PRF_163V	May 13, 2008 1:20:41 PM	160.21 ops/s	90.3 ms/op
DS6000-1750-6847412-IBM	WenVol01 (ID:1001)	May 13, 2008 1:25:13 PM	11.22 ops/s	63.9 ms/op
SVC-2145-Gburg1N92-IBM	Hollis_PRF_163V	May 13, 2008 1:40:45 PM	159.99 ops/s	90.6 ms/op
DS6000-1750-6847412-IBM	WenVol01 (ID:1001)	May 13, 2008 1:45:20 PM	11.43 ops/s	72.4 ms/op
DS6000-1750-6847412-IBM	Yu_TPCRM_vm_89 (ID:1	May 13, 2008 1:45:20 PM	3.5 ops/s	154.4 ms/op
SVC-2145-Gburg1N92-IBM	Hollis_PRF_163V	May 13, 2008 1:47:56 PM	160.54 ops/s	90.2 ms/op
DS6000-1750-6847412-IBM	WenVol01 (ID:1001)	May 13, 2008 1:50:15 PM	14.48 ops/s	57.8 ms/op

Use the “Drill up” option to go to reports that may provide insight to the root cause



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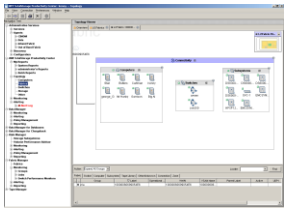
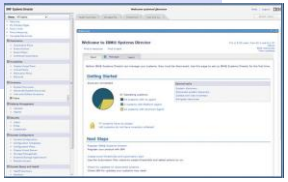
Easy-to-use management GUI



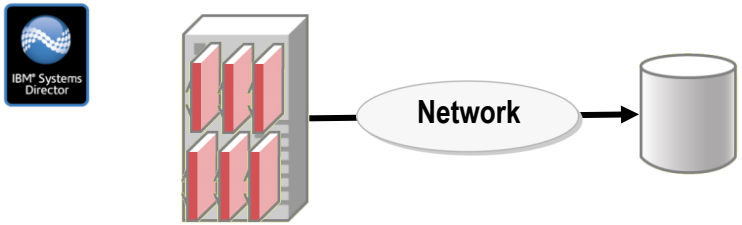
Tivoli Storage Productivity Center
Integrated SAN-wide management



Systems Director Storage Control
Integrated IBM server and storage mgmt

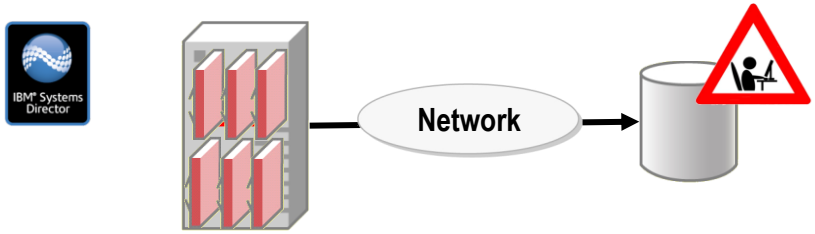
Server / Storage Management Features

Visualize and manage the complete infrastructure



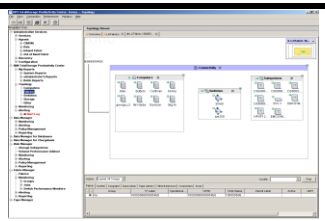
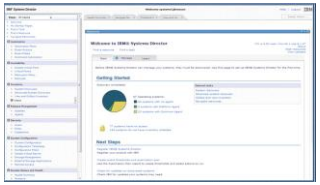
- ✓From virtual machines to the physical server they reside on, through the SAN, to the disk systems …
- ✓Physical and virtual resource relationships and utilization
- ✓Health/Status Monitoring
- ✓Event Management
- ✓Triggered action plans

Provision Virtual Server Images and storage



- ✓For virtual server environments, dynamically provision virtual server images and array capacity in a single action

Manageability Features
Summary

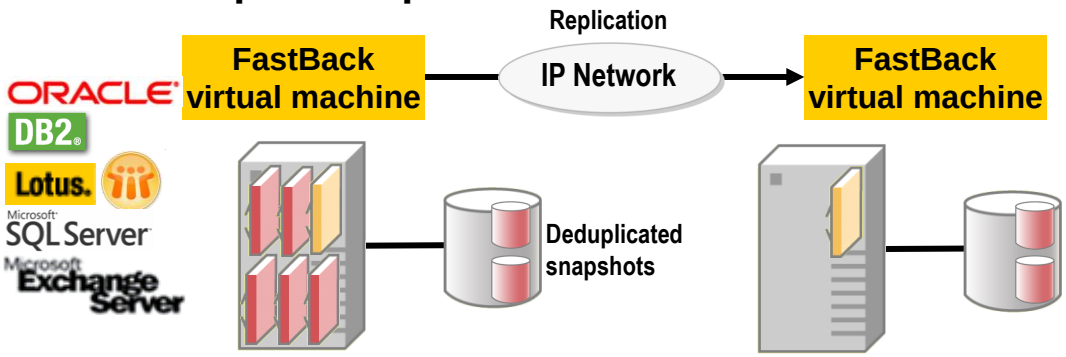
	User Interface	**Enterprise Management** Tivoli Storage Productivity Center	**Server / Storage Management** Systems Director Storage Control
			
Perspective			
Device	✓	✓	✓
Device + surrounding SAN		✓	✓
Servers + Storage			✓
Capabilities			
Health	✓	✓	✓
Capacity	✓	✓	✓
File System Utilization Analytics		✓	
Provisioning	✓	✓	✓
Performance Analytics		✓	
Replication Management	✓	✓	
Recovery Automation		✓	

Replication Features
Overview

- **IP Replication**
  - Application-integrated capabilities for clients needing instant recovery with cost-optimized disaster recovery options
- **Fibre Channel Replication**
  - Application-integrated capabilities for clients needing instant recovery with full-featured enterprise replication solutions

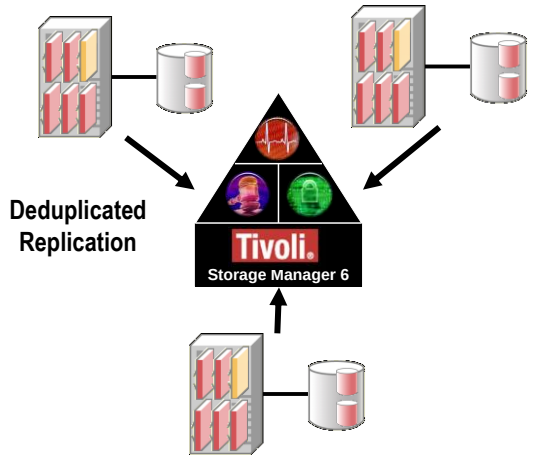
IP Replication Features

Snapshot replication



- ✓Create instant copies of applications or file systems for backup
- ✓Make better use of space with incremental (only changed blocks) and deduplicated snapshots
- ✓Replicate snapshots off-site for disaster recovery

Enterprise snapshot replication



- ✓For enterprise and branch office configurations
- ✓Replicate distributed snapshots to a central Tivoli Storage Manager server for Unified Recovery Management and disaster recovery
- ✓Make better use of network resources by deduplicating data before transmission

Replication Features
Overview

- **IP Replication**
  - Application-integrated capabilities for clients needing instant recovery with cost-optimized disaster recovery options
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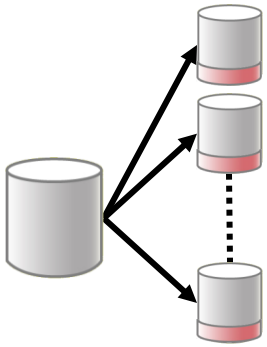
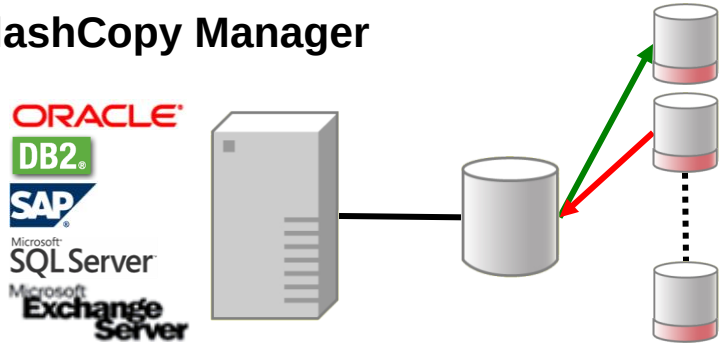
FlashCopy Features

FlashCopy



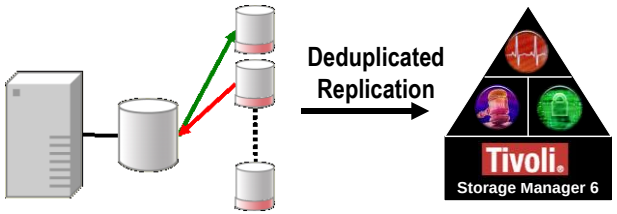
- ✓Create instant application copies for backup or application testing
- ✓Make better use of space with incremental (only changed blocks) or space-efficient (thin provisioned) snapshots

FlashCopy Manager



- ✓Integrated, instant copy for critical applications
- ✓Virtually eliminate backup windows
- ✓Rapidly create clones for application testing
- ✓View inventory of application copies and instantly restore

Enterprise FlashCopy Replication



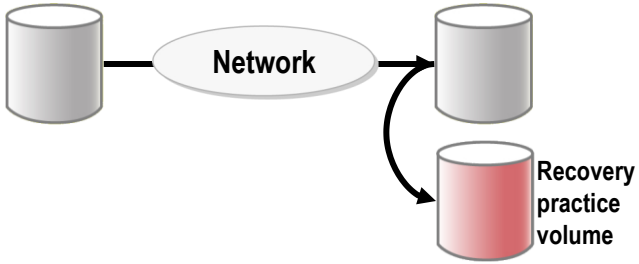
- ✓Replicate FlashCopy's to a central Tivoli Storage Manager server for Unified Recovery Management and disaster recovery
- ✓Make better use of network resources by deduplicating data before transmission

Fibre Channel Mirroring Features

Mirror data off-site

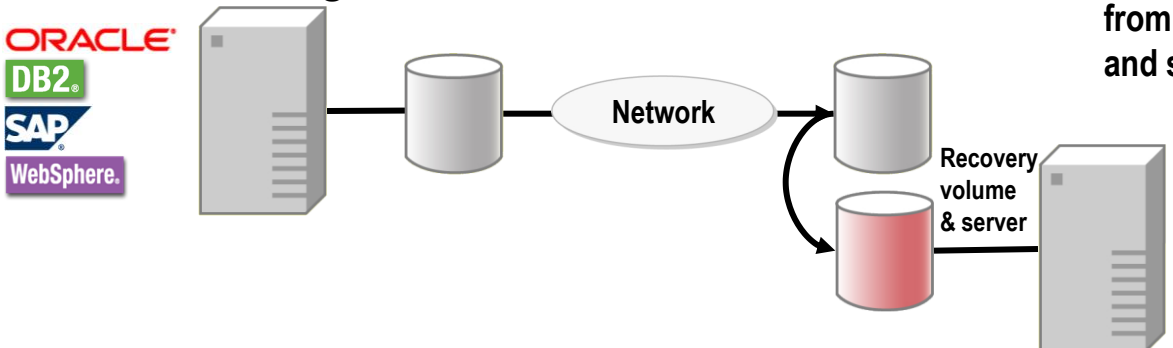
- ✓Synchronously over Metro distances
- ✓Asynchronously over Global distances
- ✓Application-level consistency groups

Practice and Automatically Respond to Disasters



- ✓For critical application consistency groups, freeze the Mirror and take a consistent FlashCopy
- ✓Practice application recovery procedures from the FlashCopy
- ✓Detect mirroring failure and automate failover to Recovery volume
- ✓Automate fail-back after repair

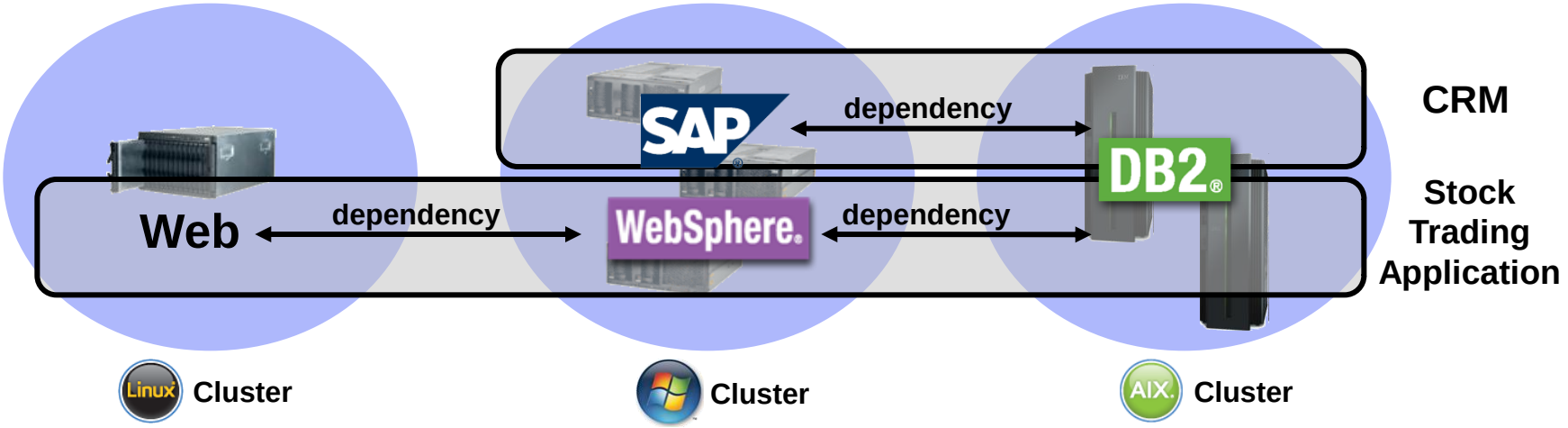
Site Switching Automation



- ✓Monitor and manage IT-wide site switching from a single console (Applications, servers, and storage)

Site Switching

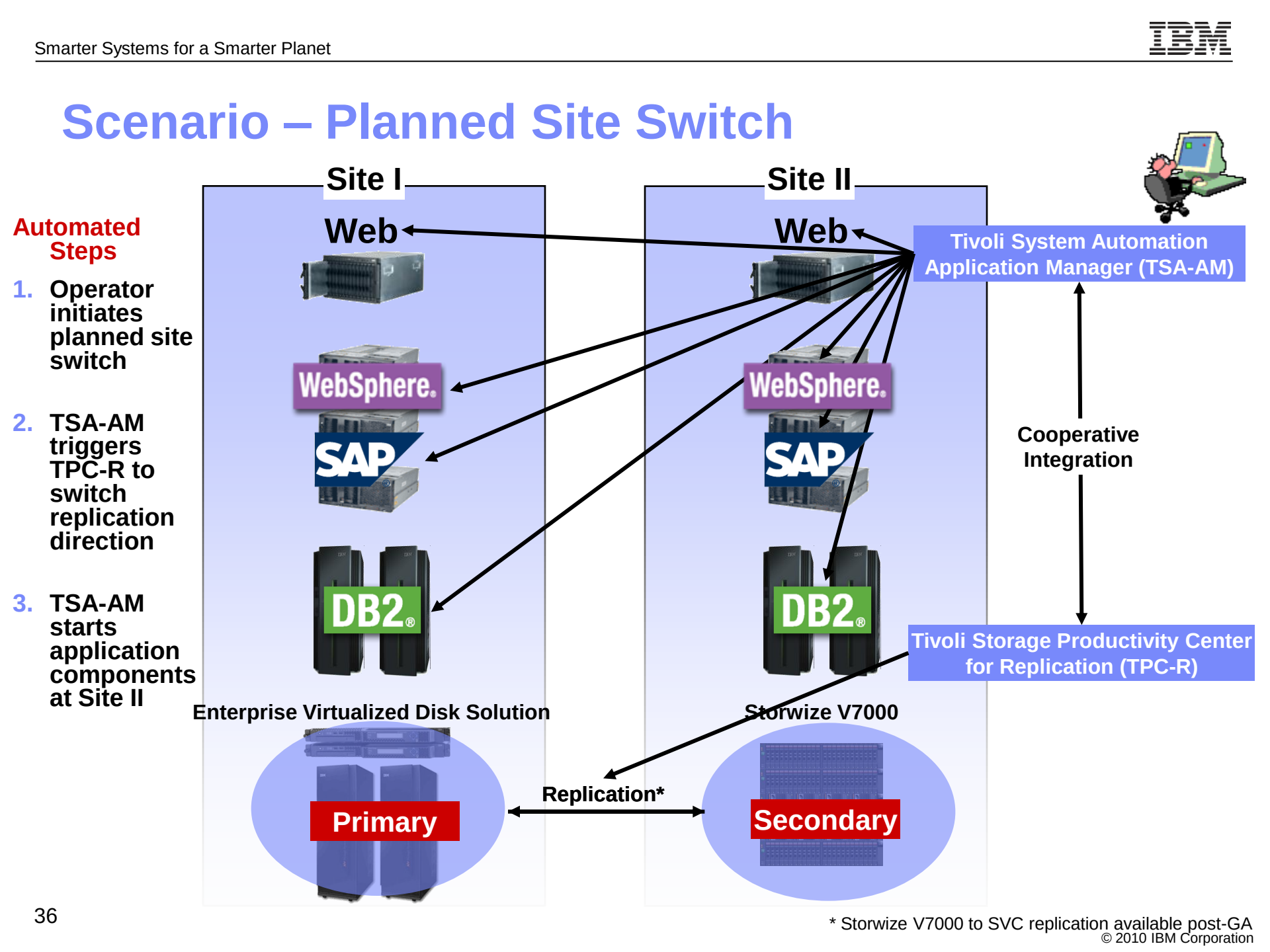
- **Single Cluster automation and high availability can be ensured…**
  - Tivoli System Automation for Multiplatforms on Windows, AIX, Linux and SUN Solaris
  - Other clustering products such as IBM HACMP, Microsoft® Server Cluster, Veritas Cluster on SUN
- **… but Cross-cluster dependencies in many business processes require a wider perspective.**



Scenario – Planned Site Switch

Automated Steps

1. Operator initiates planned site switch
2. TSA-AM triggers TPC-R to switch replication direction
3. TSA-AM starts application components at Site II

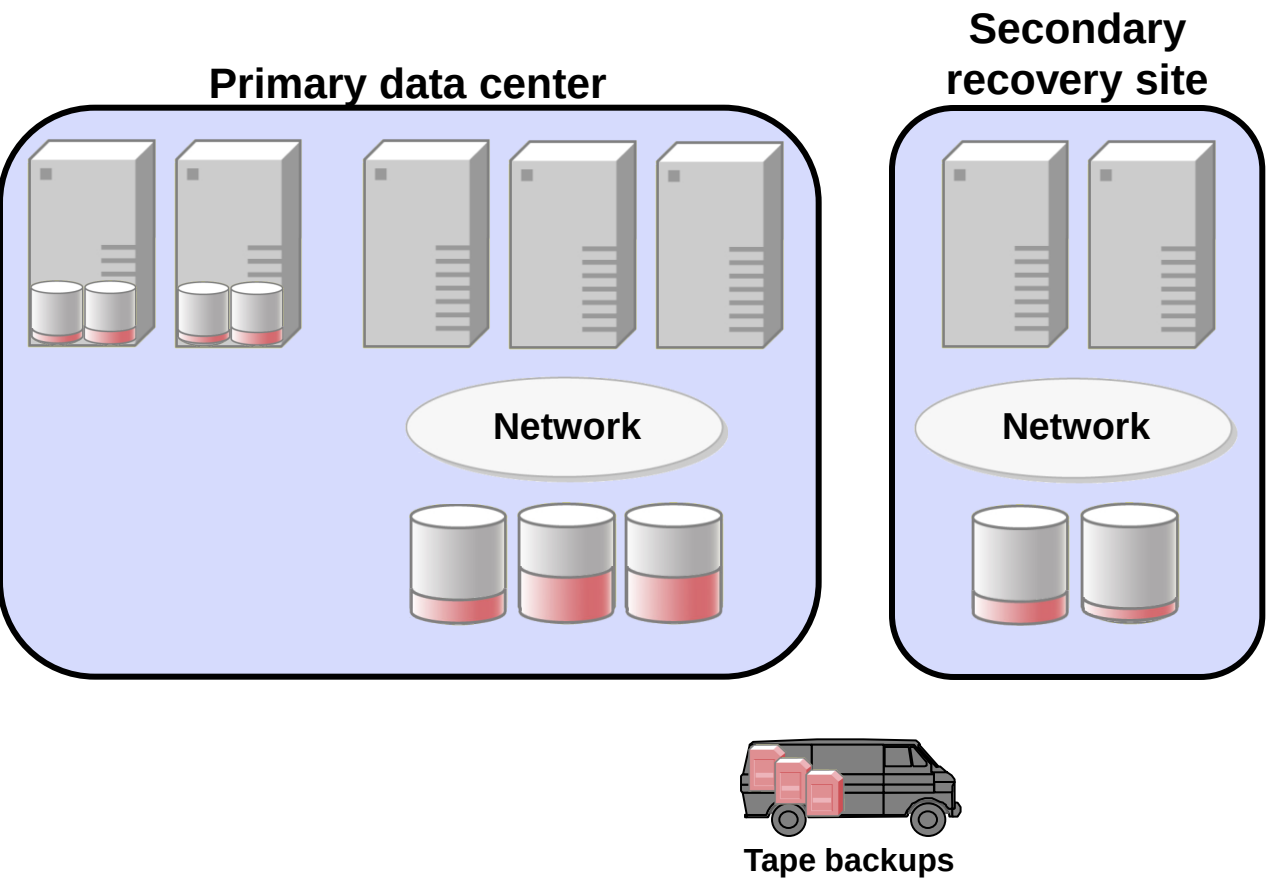


* Storwize V7000 to SVC replication available post-GA

Replication Features
Summary

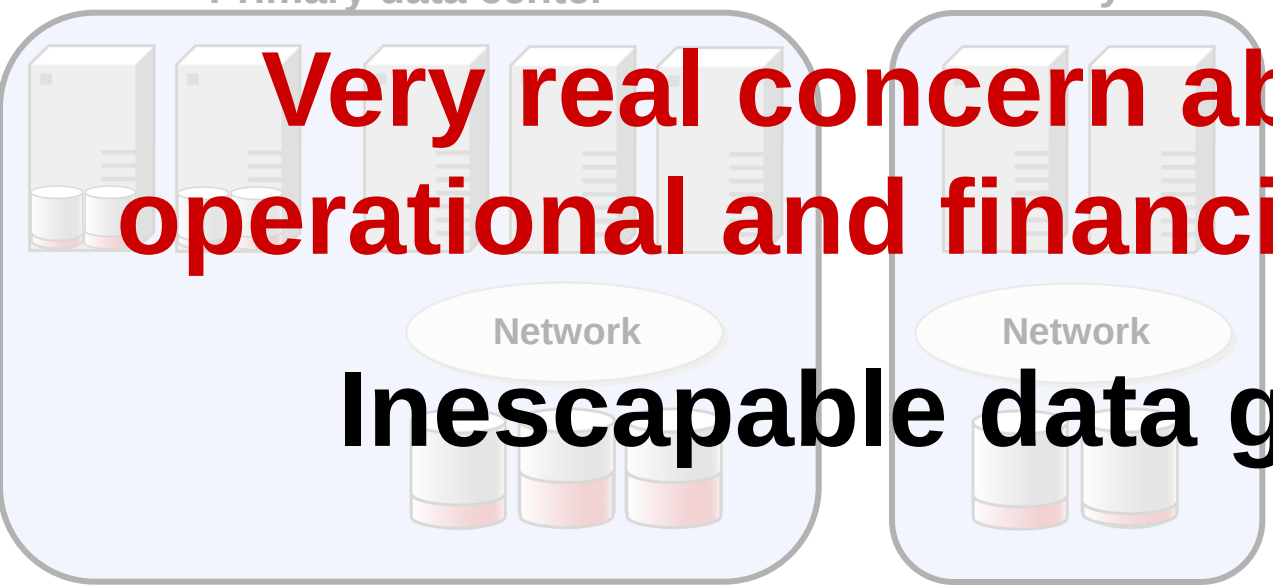
	IP Replication FastBack for Storwize V7000	Fibre Channel Replication FlashCopy and Mirroring
Optimal Client Environment	Entry and Lower Midrange	Upper Midrange
Application integrated		
Out-of-the-box Applications	ORACLE, DB2, Lotus, SQL Server, Exchange Server	ORACLE, DB2, SAP, SQL Server, Exchange Server
Operating Systems		AIX, solaris
Custom application support	✓	✓
Efficient Use of Space		
Incremental snapshot	✓	✓
Thin Provisioned snapshot	✓	✓
Deduplicated snapshot	✓	
Focus on Recovery		
Instant Restore	✓	✓
Off-site replication		
Synchronous mirroring		✓
Asynchronous mirroring		✓
Copy	✓	
Site Switching Automatioon		✓
Enterprise Recovery Management		
Replicate snapshots to Tivoli Storage Manager	✓	✓
Deduplicated network traffic to TSM repository	✓	✓

Do you remember when…



- Multiple points of management
- Low disk utilization
- Manual tape backups…

Do you remember when…



- Multiple points of management
- Low cost utilization
- Manual tape backups…

Very real concern about the operational and financial impact of

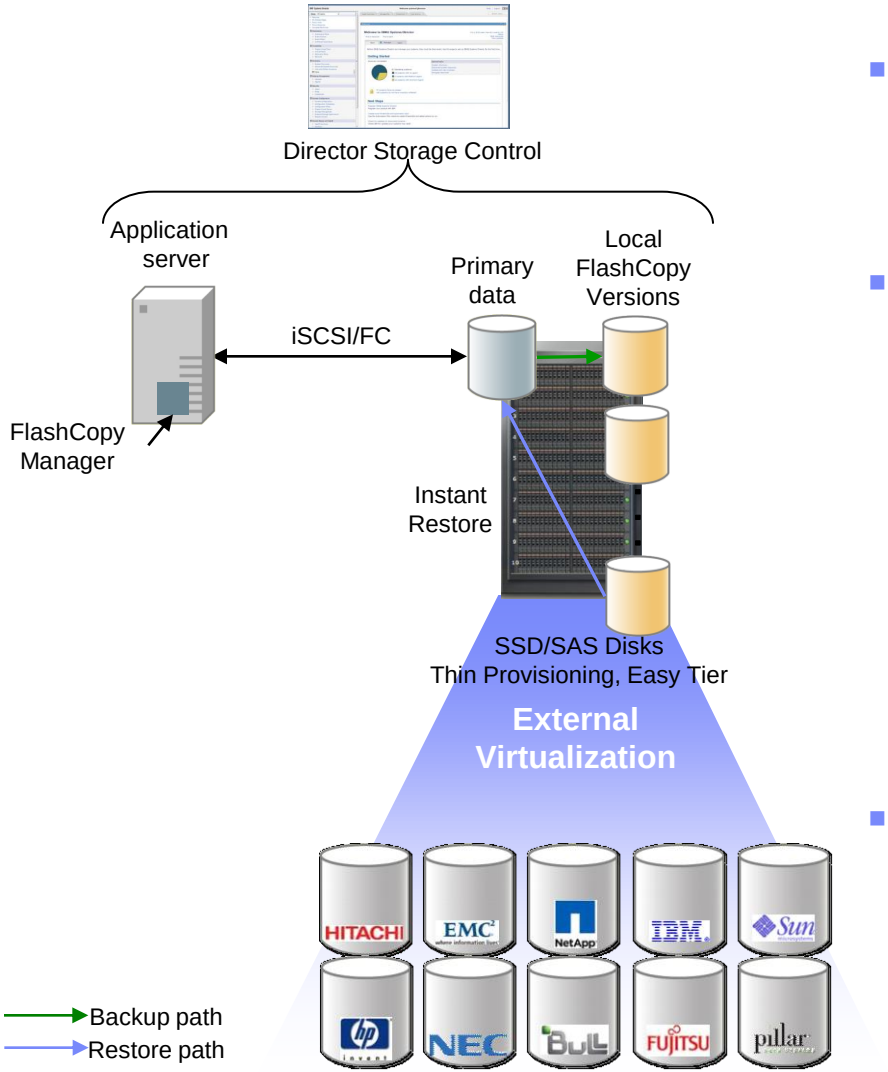
Inescapable data growth

Solution Scenario 1

- **Client characteristics**
  - Runs their business on Windows and Linux

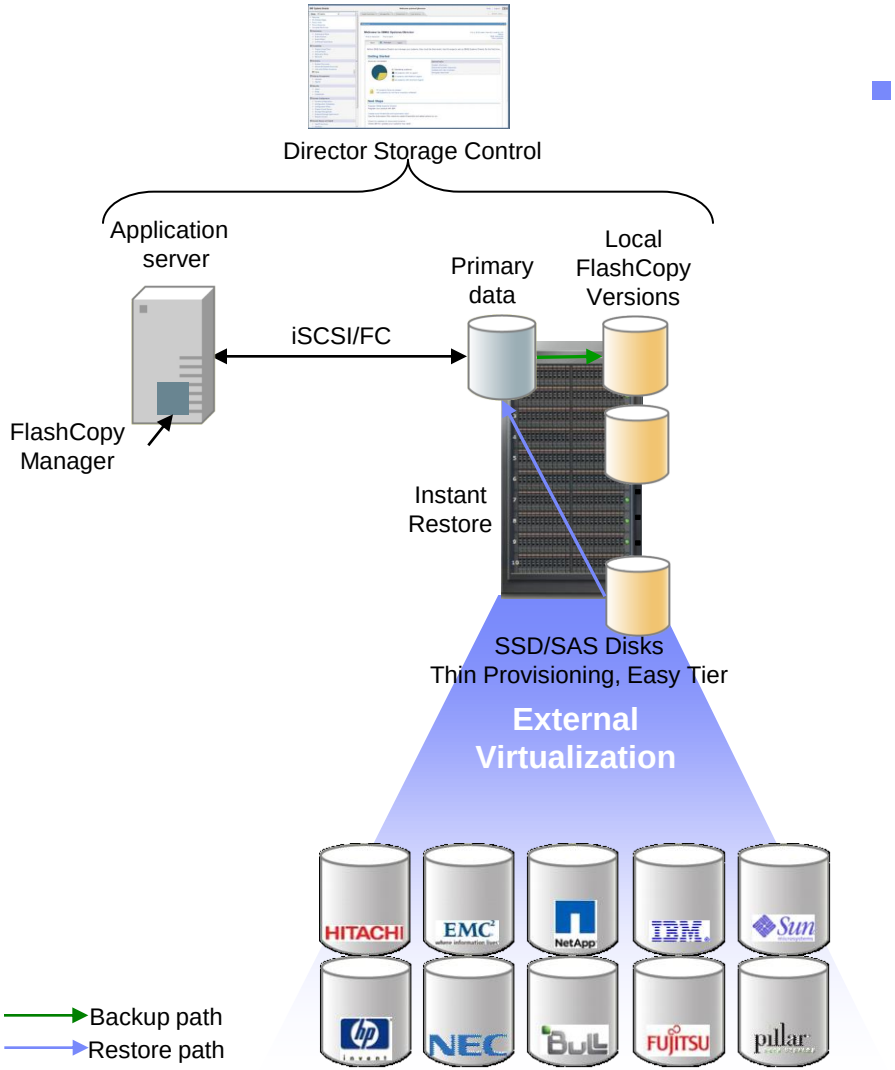
  - Operates only IP networks (iSCSI storage attach)
  - Values simplicity because administrators are responsible for multiple pieces of the infrastructure (servers, storage, etc.)
  - Sensitive to overall solution cost

Storwize V7000
Solutions at a Glance



- **For smaller clients looking for easy-to-use, scalable storage with intelligent support for their business applications**
- **IBM offers an integrated solution formed from extraordinary building blocks**
  - Scalable Storage
  - Efficient utilization of space
  - Application-integrated data protection
  - Simple manageability
  - Transparent data migration
  - Virtualization of external disks
- **For clients with IBM servers, a single point of management for both servers and storage**

Storwize V7000
Solutions at a Glance



- **Efficiency drives capital cost reduction**
  - 30% improvement in storage utilization
    - Virtualization (internal and external)
    - Thin provisioning
  - 120% improvement in throughput
    - Easy Tier with just a 6% mix of Solid State Disks

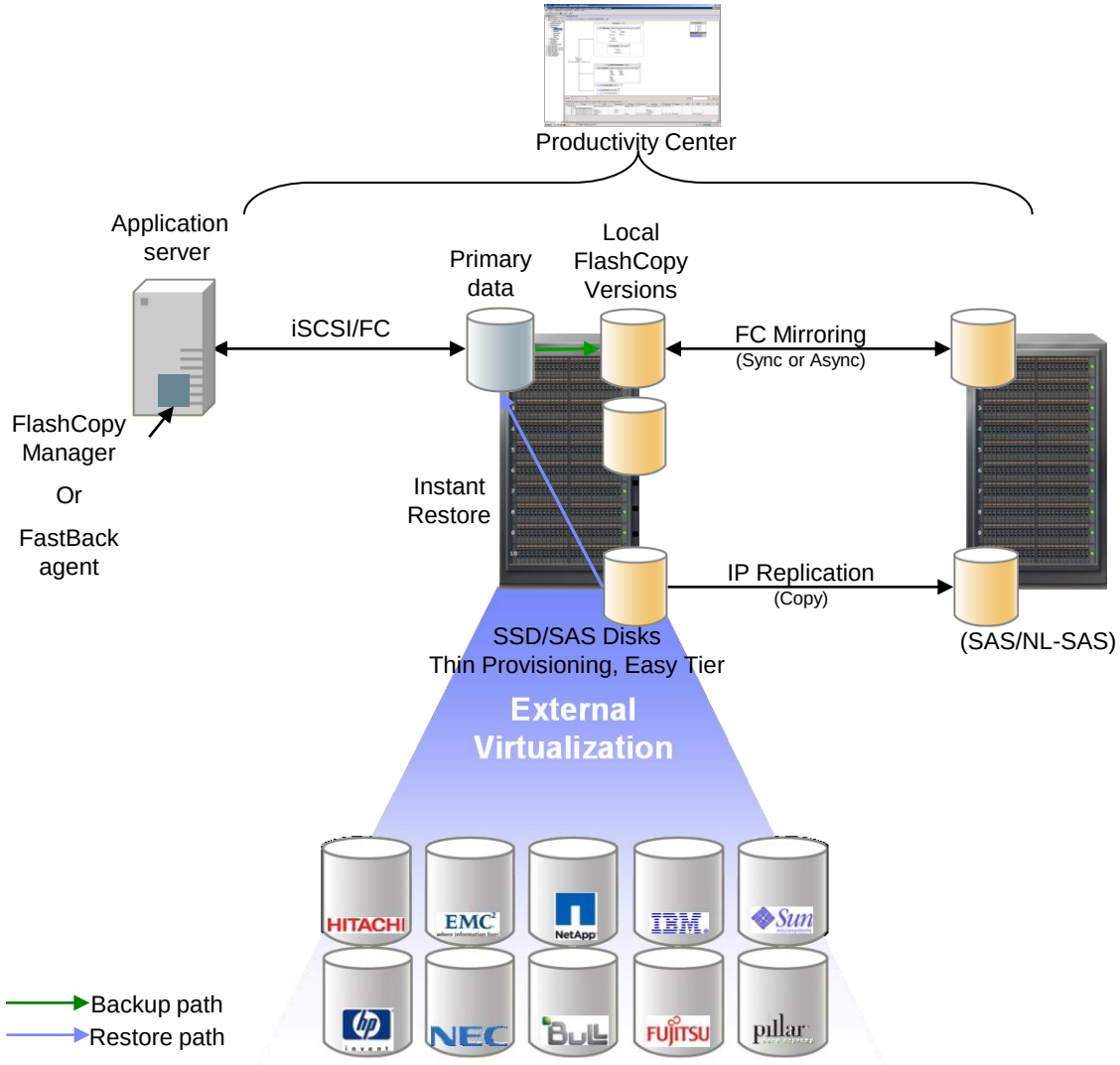
Source: IBM internal study

Solution Scenario 2

- **Client characteristics**
  - Runs their business on Unix, Linux, and Windows

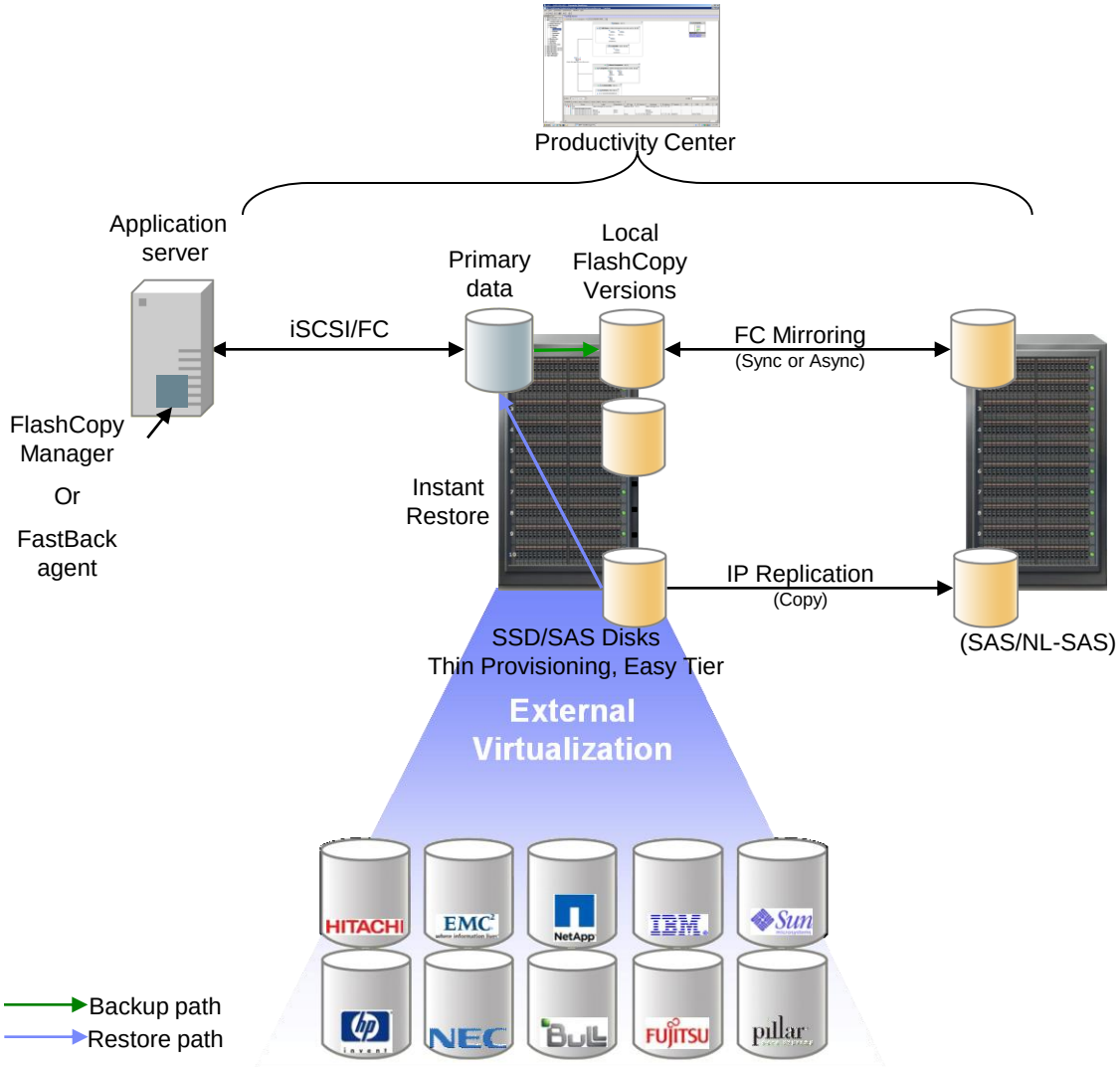
  - Operates Fibre Channel SANs
  - Values efficiency because scale drives environmental and power concerns
  - Exploits enterprise management and automation to enhance productivity of storage administrators
  - Protects against disaster situations by replicating data offsite

Storwize V7000
Solutions at a Glance



- **For larger clients looking to expand the intelligent support for their business applications across sites for disaster recovery protection**
- **IBM offers**
  - IP Replication
  - Fibre Channel Mirroring
  - Enterprise SAN-wide Management

Storwize V7000
Solutions at a Glance



- **Manageability drives operational cost reduction**
  - 19% improvement in capacity and performance management
    - Enterprise SAN-wide management
    - Integrated Server / Storage management
  - 36% improvement in replication management
    - Replication
    - Mirroring
    - Automation

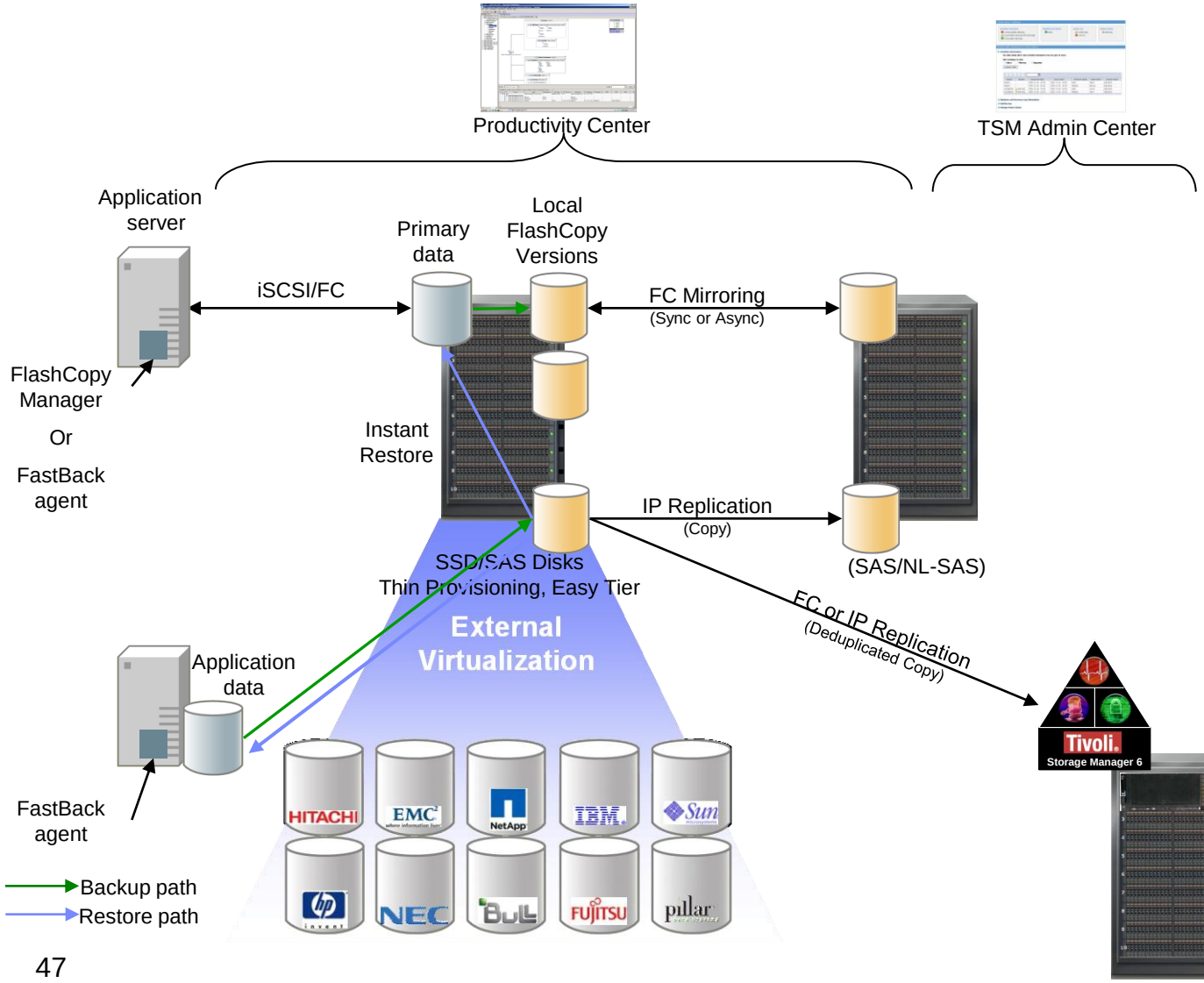
Source: IBM internal study

Solution Scenario 3

- **Client characteristics**
  - Enterprise application data not stored on a SAN or on Storwize V7000

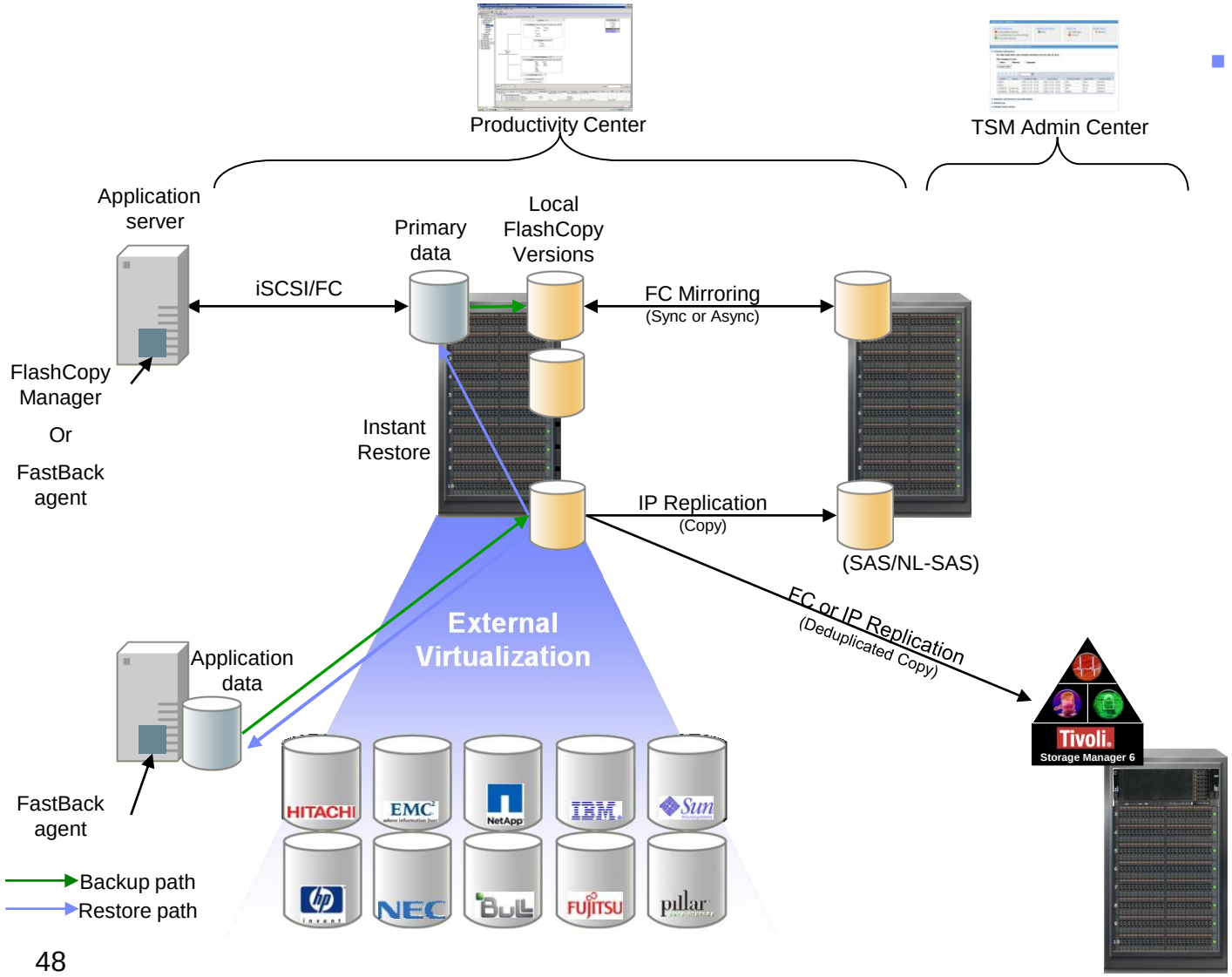
  - Centralized Recovery Management across the enterprise

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**
  - Application-integrated software snapshot for external data
  - Unified Recovery Management with Tivoli Storage Manager

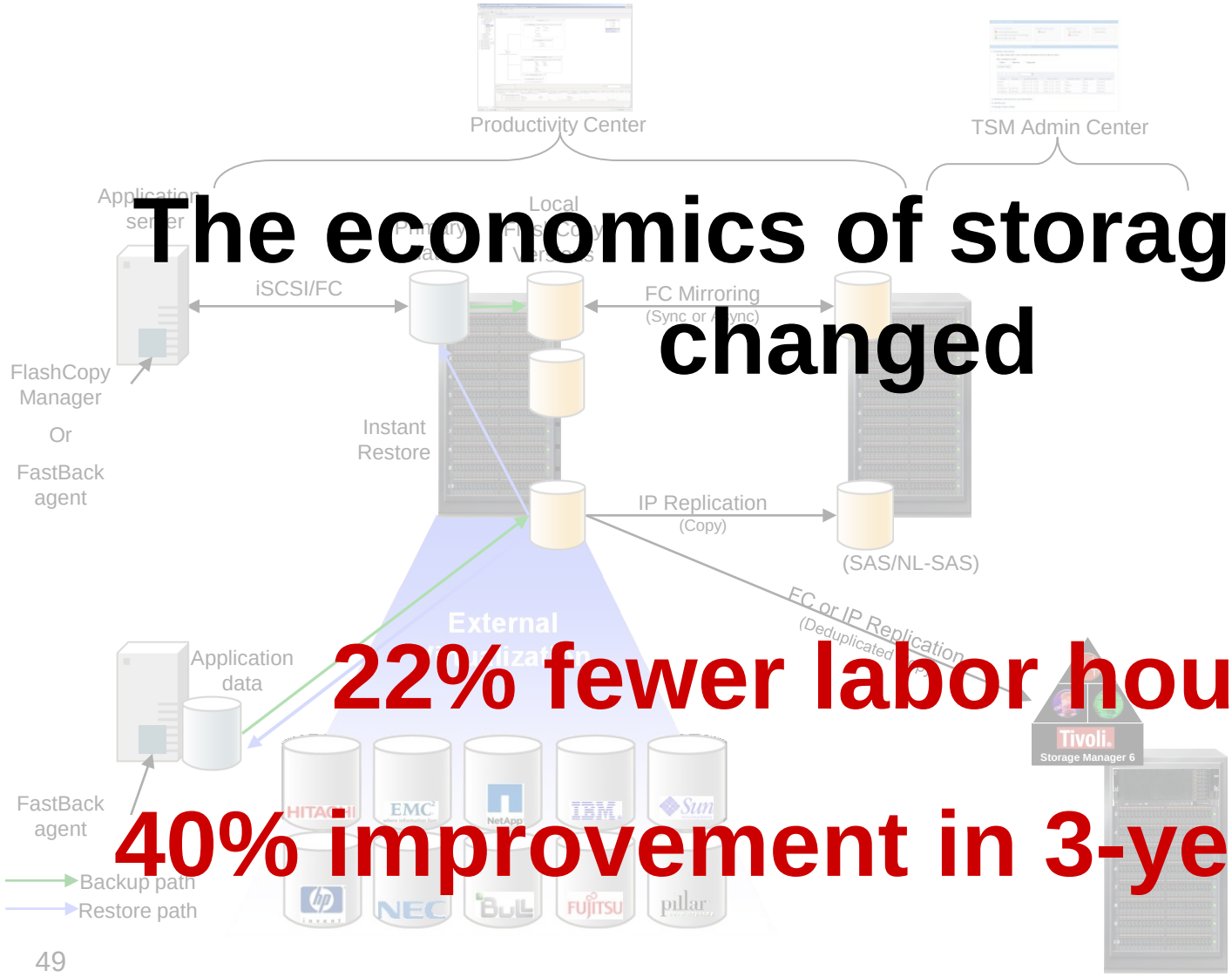
Storwize V7000
Solutions at a Glance



- **Unified Recovery Management drives cost reduction**
  - 31% improvement in data protection management
    - Application-integrated snapshot
    - Disk-based backup
    - Replication automation
  - Up to 25:1 reduction in network bandwidth and storage consumption
    - Deduplication

Source: IBM internal study

Storwize V7000
Solutions at a Glance



The economics of storage have changed

22% fewer labor hours

40% improvement in 3-year TCO

Source: IBM internal study

Inescapable Data Growth

Meet the IBM Storwize V7000