Managing a Virtual World with Tivoli Storage Solutions

Greg Tevis – Tivoli Technical Strategy

PulseANZ 2010

Meet the people who can help advance your infrastructure

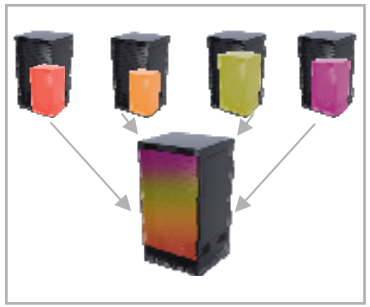
© 2010 IBM Corporation

Agenda

- Introduction to IBM Virtualization Solutions
- Data Protection and Recovery for Virtual Environments
- Management of Virtual Servers and Storage
- Storage Virtualization for Virtual Servers

IT Transformation Roadmap for virtualized environments

Physical Consolidation



- Improve utilization
- Reduce costs
- Lower power usage

Improve capacity utilization by as much as 60%, while reducing the power and cooling costs

Advanced Virtual Resource Pools

- Decouple complexity from scale
- Share resources optimally
- Automate workload management
- Incorporate HA & DR

Hands-free operation, eliminate mundane tasks and manual processes and deploy workloads in minutes

Fully virtualized IT with integrated Service Management

- Sense and respond to workload requirements
- Dynamically move workloads to best-fit infrastructures
- Integrated virtualization management with IT processes

Save time and reduce skill level required for workload provisioning through pre-packaged automation templates

Cloud

- Low cost through economies of scale
- Always on
- Globally available
- Elastic scaling
- Pay for use
- Self-service with rapid provisioning
- Service catalog

Give users the flexibility to request and pay for services they want without the complexities of establishing an IT infrastructure

Comprehensive IBM Virtualization Offerings

Server virtualization

- *System p, System i, System z LPARs, VMware ESX, IBM Smart Business Desktop Cloud*
- *Virtually consolidate workloads on servers*

File and File System virtualization

- *Scale Out NAS (SoNAS), DFSMS, IBM General Parallel File System, N-series*
- *Virtually consolidate files in one namespace across servers*

Disk and tape storage virtualization

- *SAN Volume Controller, ProtecTIER*
- *Industry leading Storage Virtualization solutions*

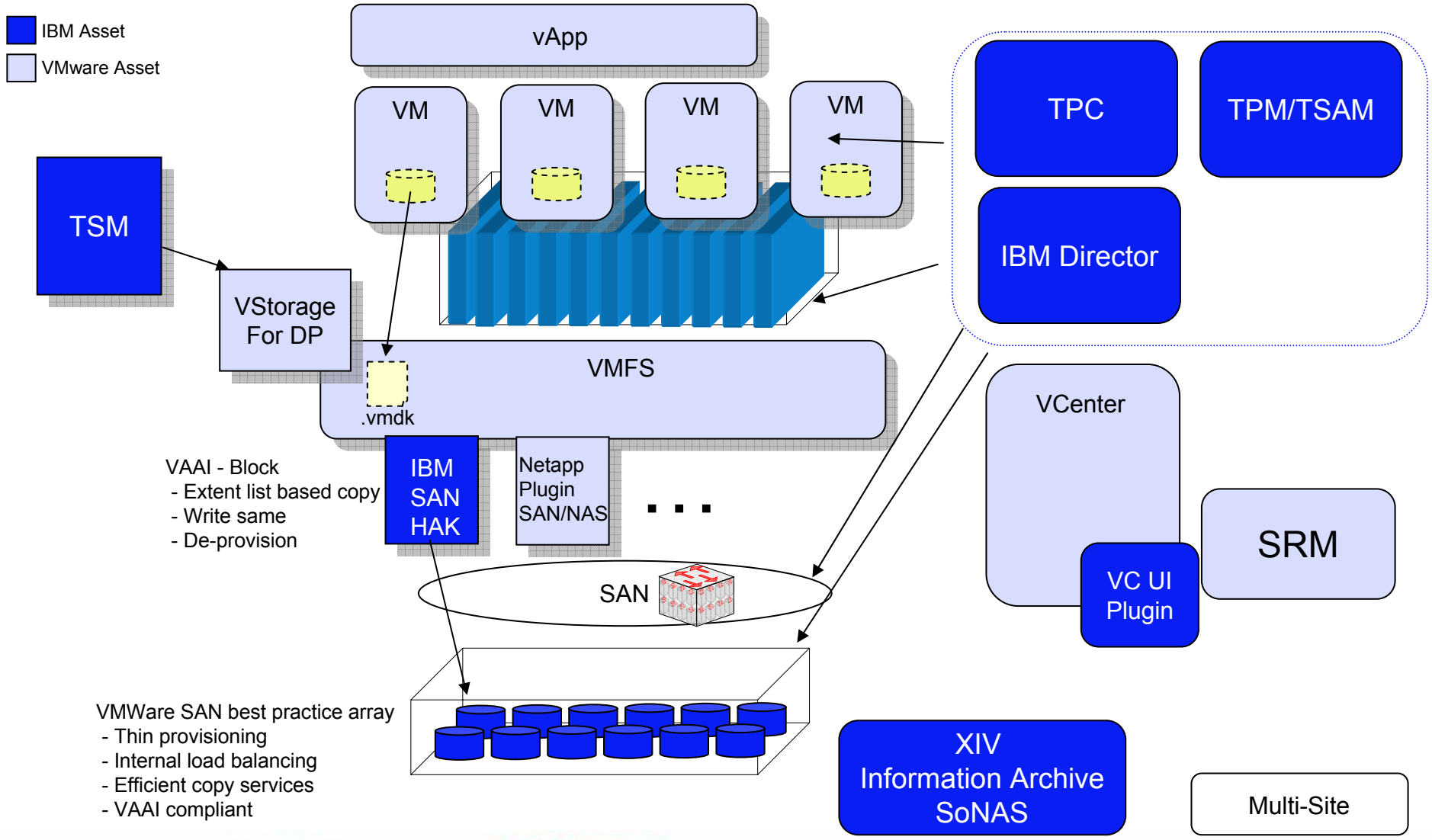
Server and Storage Infrastructure Management

- *Data protection with Tivoli Storage Manager and TSM FastBack*
- *Advanced management of virtual environments with TPC, IBM Director VMcontrol, TADDM, ITM, TPM*
- *Consolidated management of virtual and physical storage resources*

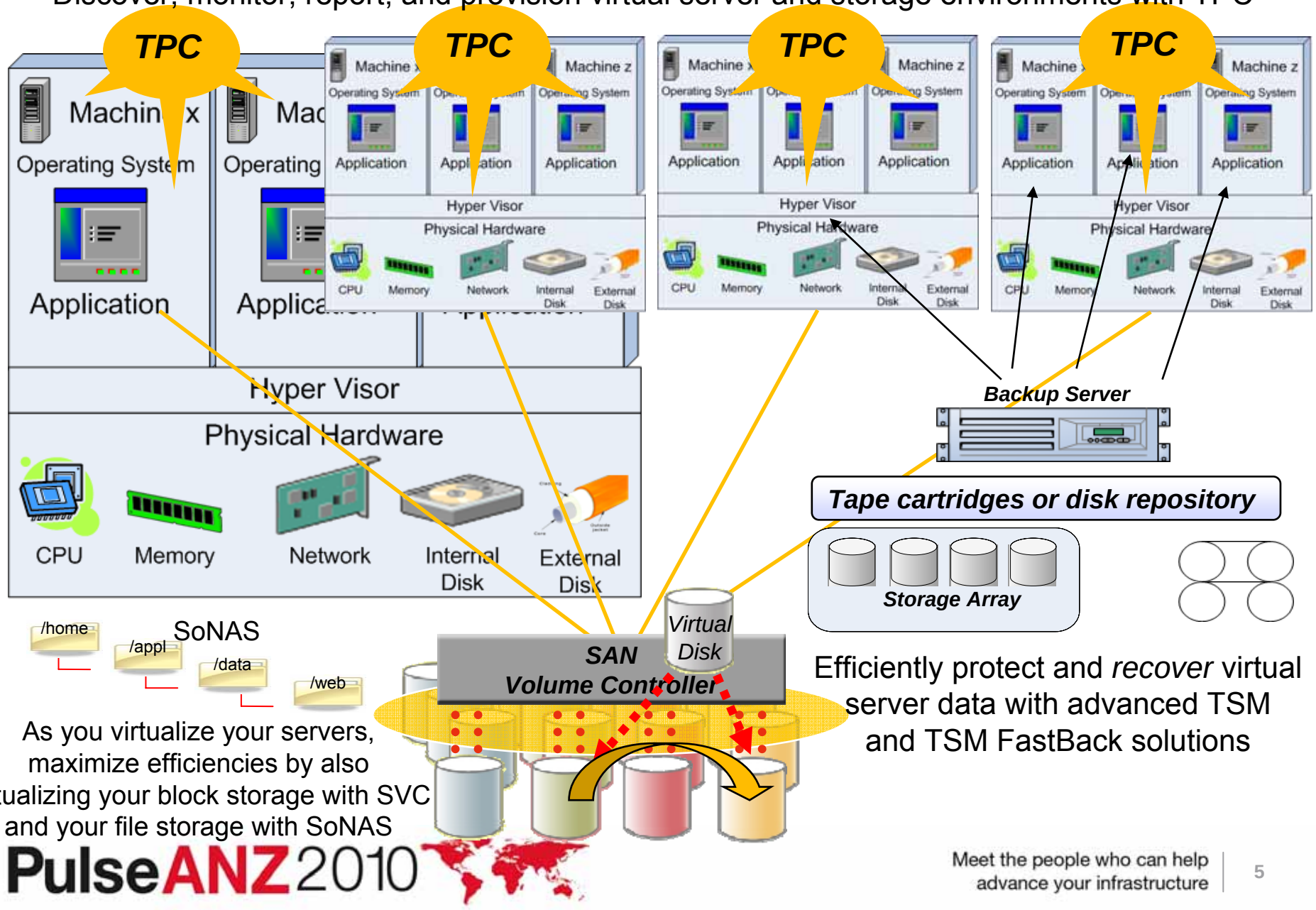
IBM Storage Cloud Solutions

- *Smart Business Storage Cloud (SoNAS), Information Protection Cloud Services*
- *Virtualization and automation of storage capacity, data protection, and other storage services*

Tivoli Storage Architecture for VMware Environments



Discover, monitor, report, and provision virtual server and storage environments with TPC



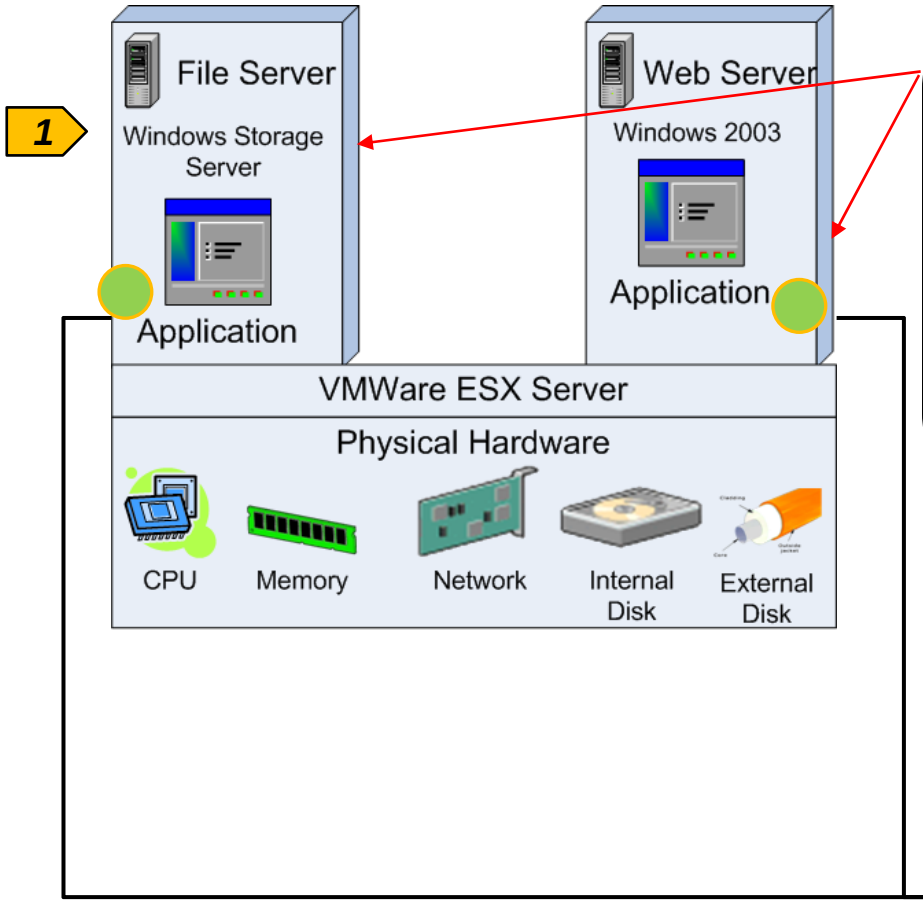
As you virtualize your servers, maximize efficiencies by also virtualizing your block storage with SVC and your file storage with SoNAS

Efficiently protect and *recover* virtual server data with advanced TSM and TSM FastBack solutions

Data Protection and Recovery for Virtual Environments

Tivoli Storage Manager (TSM) and TSM FastBack

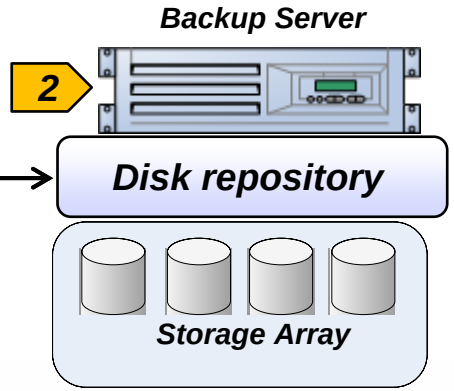
Traditional (Guest OS) Backup using TSM or TSM FastBack



1. Install TSM or TSM FastBack client inside the guest OS

2. Perform very efficient block level incremental snapshots to FastBack server

3. For longer retention you can migrate the data to TSM



TSM, TSM FastBack, or TSM for * agent

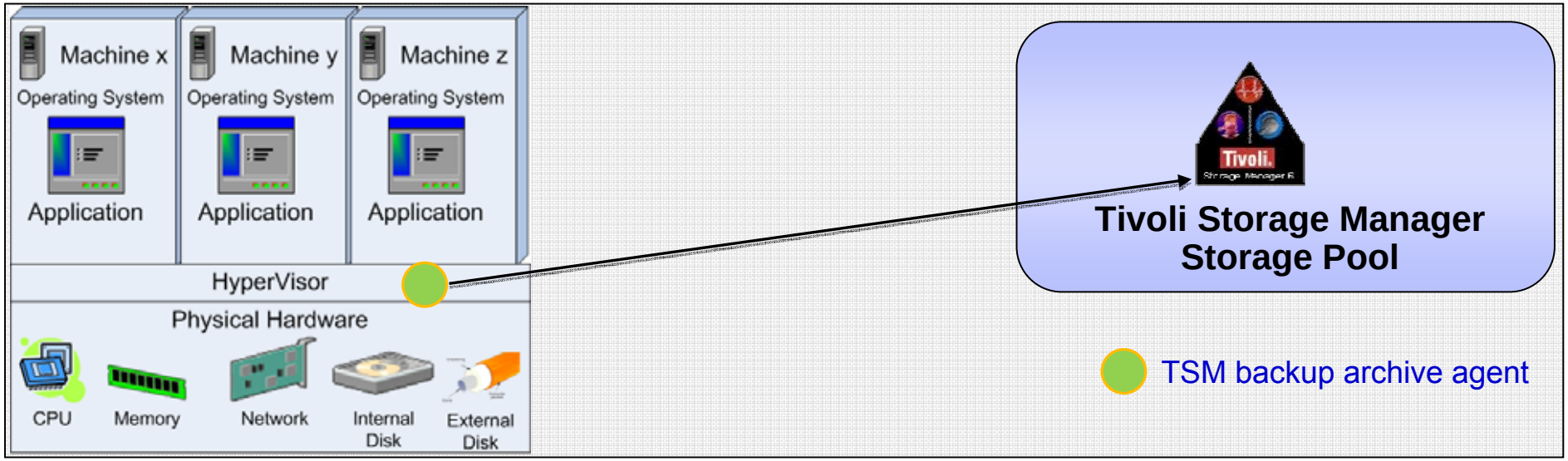
Traditional Guest Backup – Pros and Cons

A large percentage of users are still using this approach. TSM supports many hypervisors (KVM, Hyper-V, VMware, LPARs, Solaris Containers, HP nPartitions, etc) and guest OSs (Windows, Linux, zLinux, z/OS, Solaris, etc). TSM Fastback's Block level incremental forever backup makes it a very good fit for this approach since the Fastback client has very low overhead.

Pros	Cons
Better recovery granularity	Multiple agents
Application awareness during backup	Management challenges
Better recovery for application	Lacking VMWare integration
CDP backup with TSM FastBack	
Business as usual, use existing management methodologies	

Host Based – TSM agent running on the hypervisor

Install the b/a agent on the hypervisor OS, manage the virtual guests as if they were a single physical machine



Host Based – TSM agent running on the hypervisor

Supported for most hypervisors – VMware, Hyper-V, KVM, Xen. Allows backups off of the production virtual guests. VMware is deprecating this option and it is **not** available on ESXi.

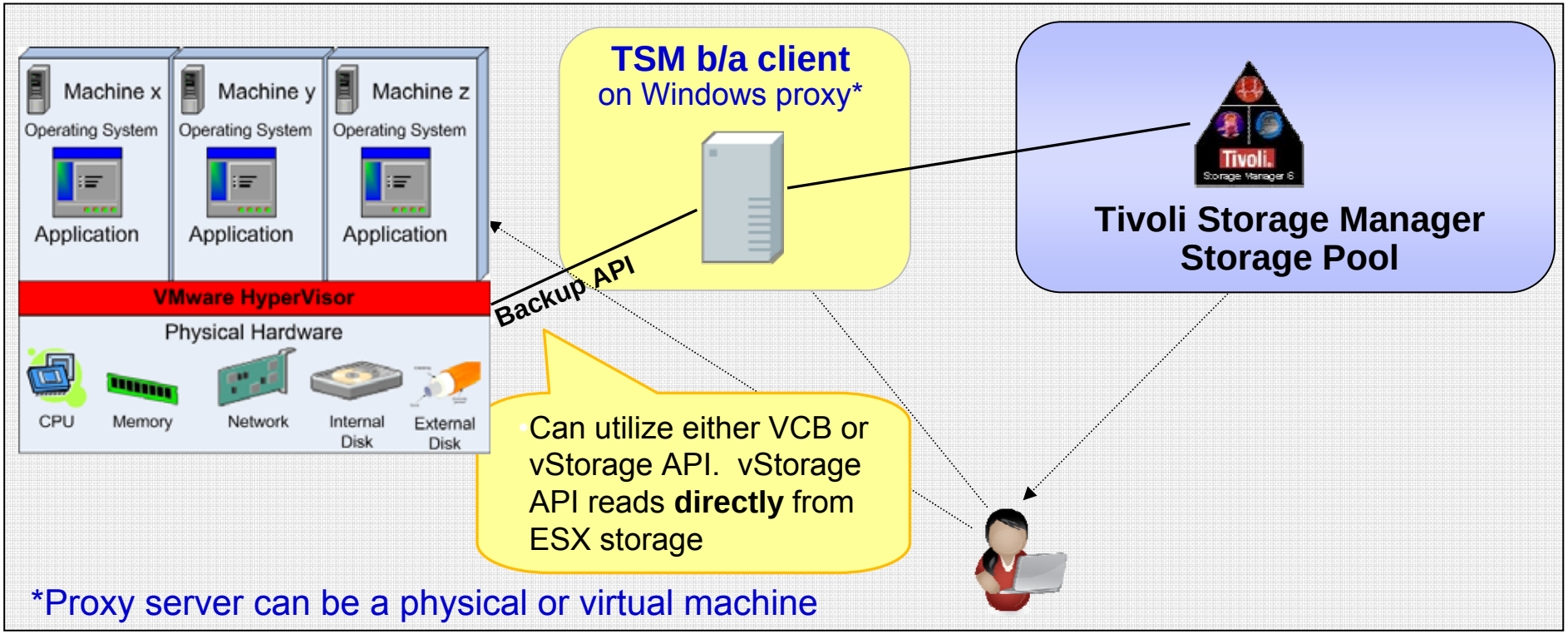
Pros	Cons
Easier to manage	Questionable application integration (with VMware)
Less resource consumption on guest machines	Supports only full virtual disk backups
	VMware is deprecating this approach – Don't use this approach for VMware

ESX Level	TSM Linux x86 Client supported version for ESX Service Console
3.0	5.4 and 5.5
3.5	5.5
4.0	5.5, 6.1, and 6.2

http://www-01.ibm.com/support/docview.wss?uid=swg21394300

Proxy based - TSM b/a client running on a proxy server

Install the TSM agent on a proxy server and access data through VMware API



Proxy based - TSM b/a client running on a proxy server

Supported **only on** VMware, this approach tries to combine the benefits of traditional and host based approaches by providing an API to talk to the console and move the data through the proxy server. This is the recommended approach by Vmware.

Pros	Cons
“Lan Free” backup	Questionable application integration (VMware does trigger VSS for windows guests)
Offloads backups to proxy server	VCB requires an additional data hop
Flexibility – supports both file level and image level backup.	Recovery might be challenging (depending on the type of backup used)
Utilizing VMWare API including Changed Blocks API	
Recommended by VMware	

http://www-01.ibm.com/support/docview.wss?uid=swg21394300

VMware Consolidated Backups (VCB) vs vStorage APIs

VMware introduced the vStorage API in 2009. This is sometimes referred to as vSphere or VADP (vStorage API for Data Protection). vStorage API's biggest advantage over VCB is it allows the proxy server to access the data **DIRECTLY** on the ESX host storage, avoiding the need for the "data hop" required by VCB.

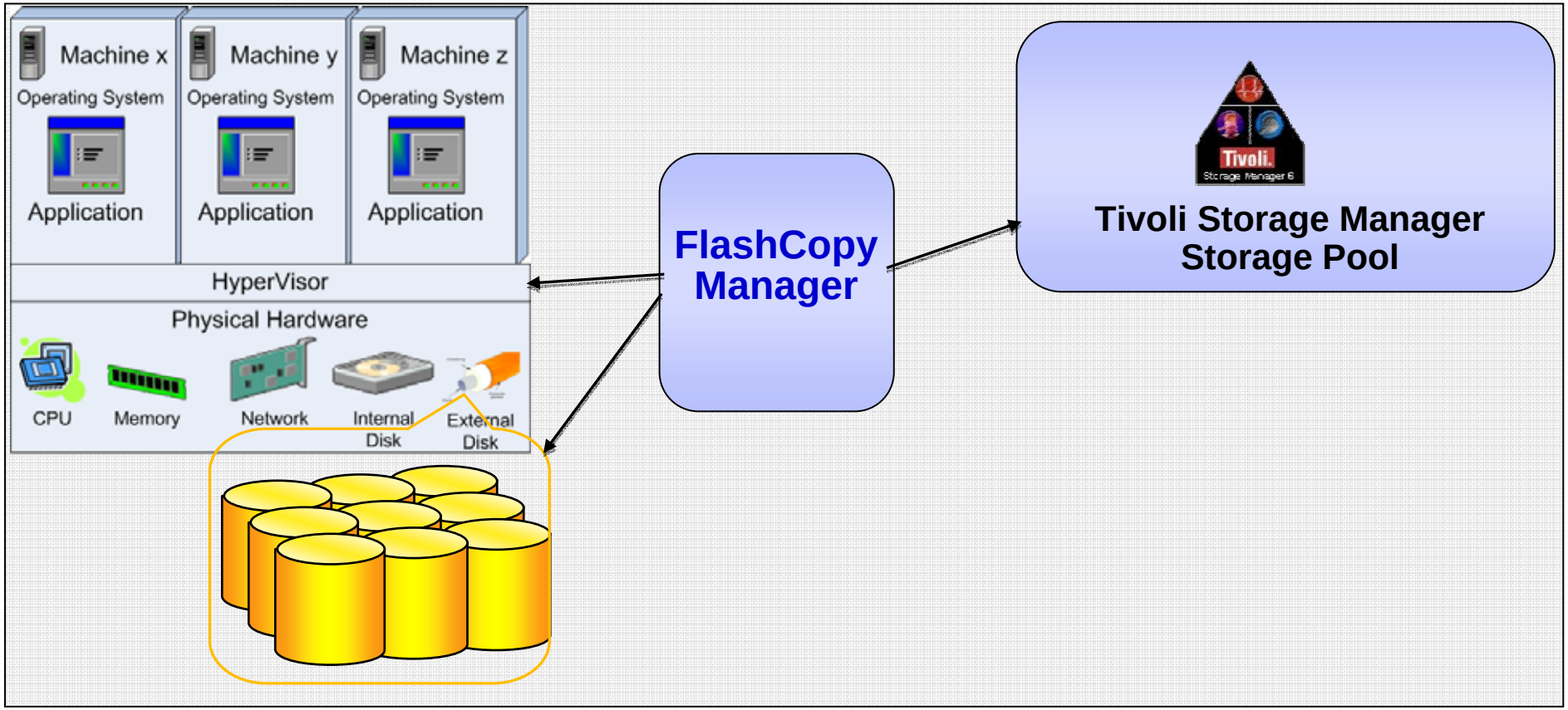
VCB Framework Level	ESX, ESXi Levels	TSM Windows Client
1.0 and 1.1	3.0 and 3.5	5.5 and 6.1
1.5 and 1.5 Update 1	3.0 and 3.5	5.5, 6.1, and 6.2
1.5 Update 1	4.0 (including vSphere)	6.1 and 6.2

ESX, ESXi Levels (vStorage API)	TSM Windows Client
4.x	6.2 (only file level backups)

http://www-01.ibm.com/support/docview.wss?uid=swg21394300

Hardware Based – triggering hardware based snapshots

The “triggering agent” can reside in multiple locations, the host or a proxy server



Hardware Based – triggering hardware based snapshots

This approach is viable for both VMware and Hyper-V and requires a level of integration and coordination between different components:

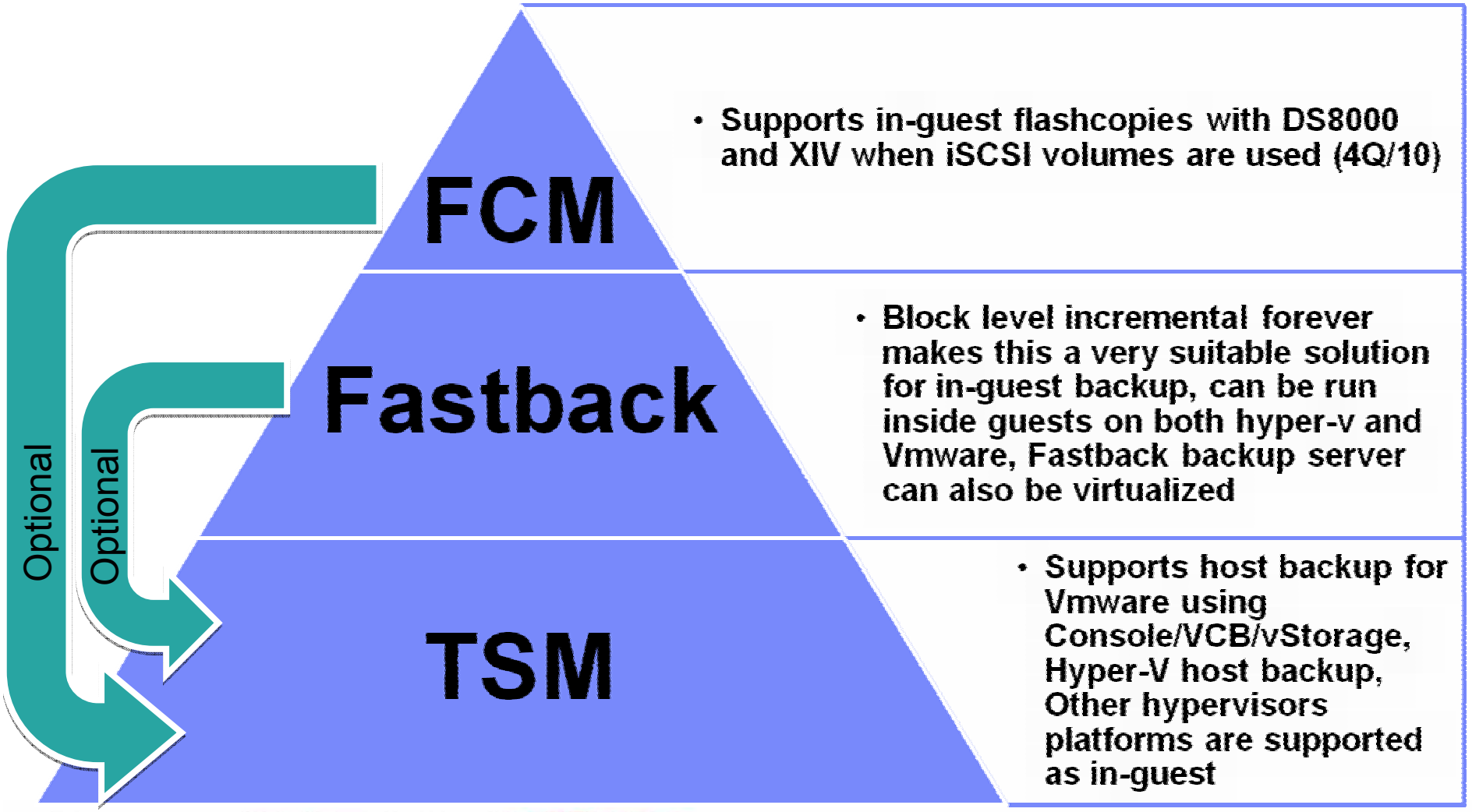
1. Underlying disk subsystem
2. Hypervisor (Hyper-V or VMware)
3. Applications within the guest OS

We will introduce support for hardware based backups in the next major release of FlashCopy Manager

Pros	Cons
Very quick and efficient HW snapshots	HW snapshot will include all the virtual disks that reside on the same LUN
No resource consumption on guest or host	Hard to coordinate the HW Snapshot with the application consistency
Data can be moved to TSM	Recovering the LUN will recover all of the virtual disks on the same LUN

TSM for Virtual Environments

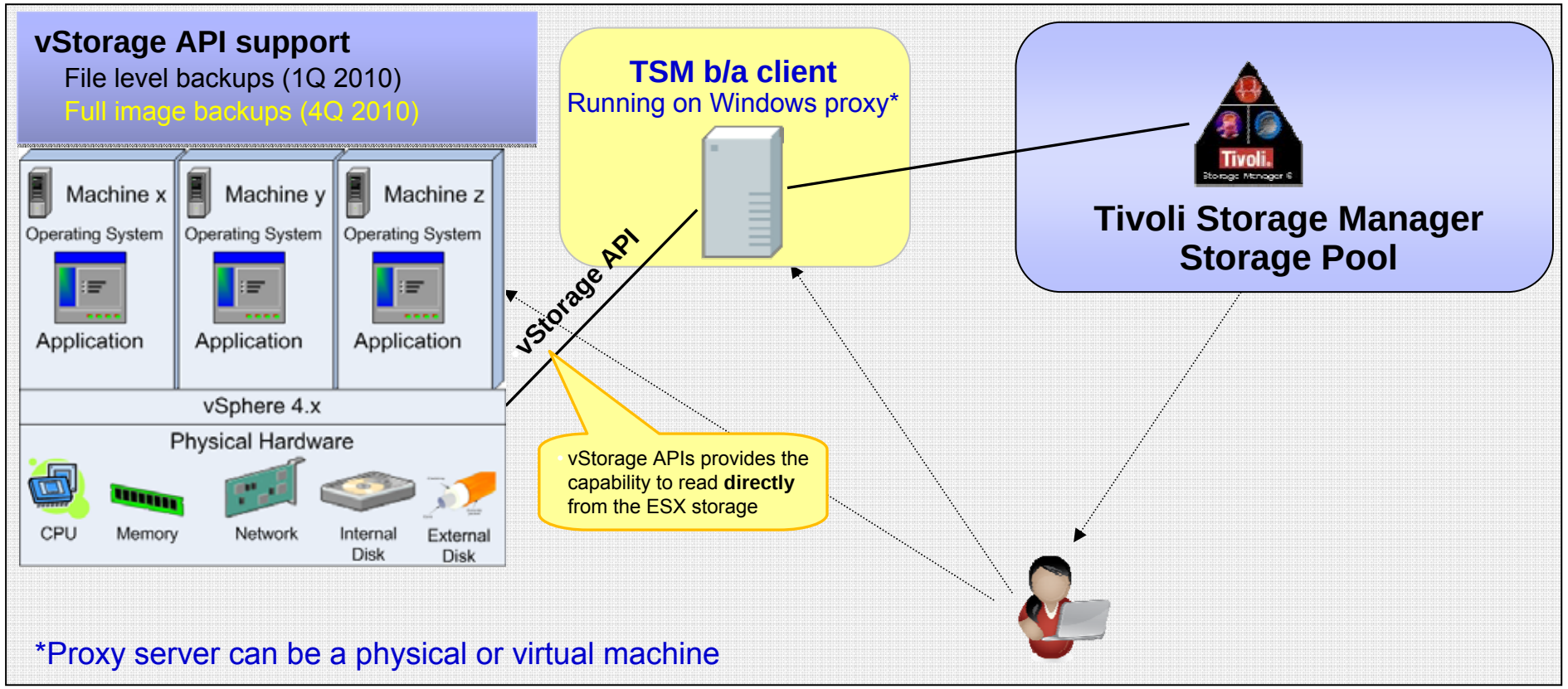
TSM has extensive support for virtual environments today:



End of 2010 Release

TSM b/a client support for vStorage API*

Utilize VMware vStorage API for Data Protection for image-level backup and recovery
File level backup through Proxy server, File level recovery through b/a client (Windows only)
Full image backup and full image restore through Proxy server (using vStorage) New

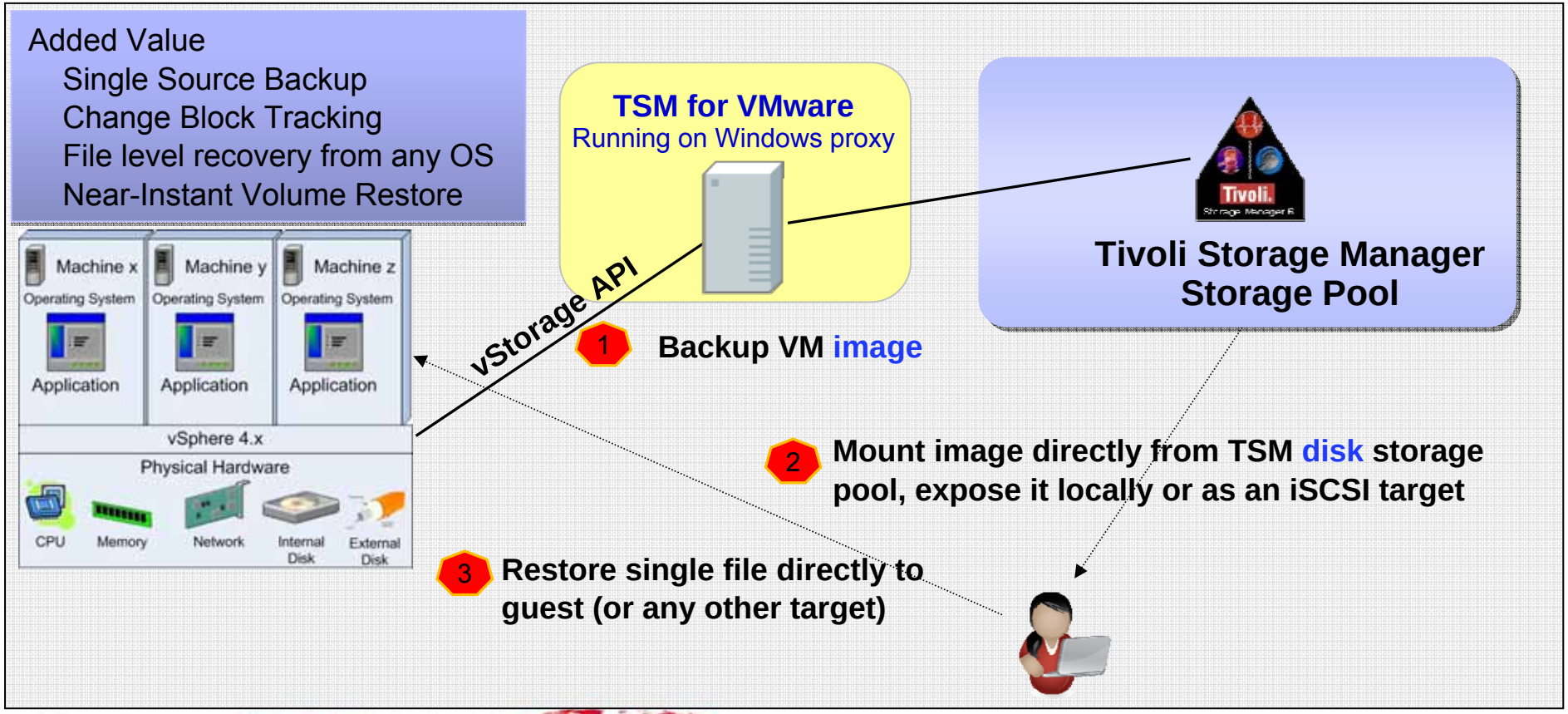


*TSM already supports multiple ways of protecting VM environments, including in guest (TSM or Fastback), Host, VMware APIs

TSM for Virtual Environments – VMware integration

New TDP
End of 2010

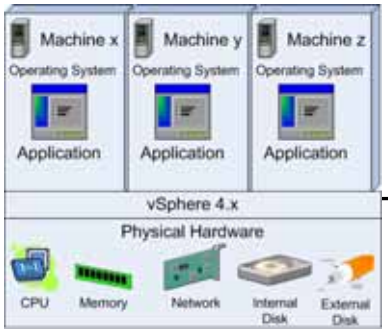
Supports **recovery options** from image backup and vStorage API change block tracking
New TSM for Virtual Environments component enhances the b/a client (Windows only) with:
- Change Block Tracking allowing incremental backups (with periodic fulls)
- File/Volume/Disk/Full VM restores from an image backup (multiple OSs are supported)



2H 2011 release

TSM for Virtual Environments

A common solution for VMware that works with TSM, FastBack and FlashCopy Manager



vStorage API

2010 2011

TSM for Virtual Environments

FlashCopy Manager

Common solution for VMware:
Shares a common UI
Can configure three possible targets
1. TSM Storage Pool
2. FlashCopy Manager
3. TSM FastBack Repository

Various combinations of the above solutions

Common UI integrated with:
VMware vCenter
TSM Admin Center

2011
Hardware Snapshot

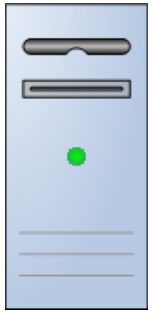
Target 2012
TSM FastBack Repository

Tivoli Storage Manager Storage Pool

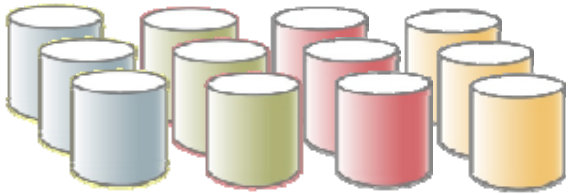
Management of Virtual Servers and Storage

Tivoli Storage Productivity Center (TPC)
IBM Systems Director VMcontrol

What Needs to be Managed?



- **Servers**
  - ESX servers
  - VM images
  - Applications
  - Data Bases
  - File Systems
  - Volume Managers
  - Host Bus Adaptors
  - Virtual HBAs
  - Multi-Path Drivers



- **Storage Components**
  - Volume mapping / virtualization
  - Storage Array provisioning
  - VMFS, NAS filers, SoNAS
  - Tape Libraries

- **Network Components**
  - Switches, hubs, routers
  - Virtual devices
  - Intelligent switch replication

How Does it Need to be Managed?

- Discovery
  - Topology views
  - Asset management
- Configuration Management
  - Provisioning
  - Optimization
  - Problem Determination
- Performance Management
  - Bottleneck Analysis
  - Load Balancing
- Reporting
  - Asset/Capacity/Utilization
  - Accounting/Chargeback
  - Performance/Trending
  - Problem Reports
  - Storage and Data Analysis

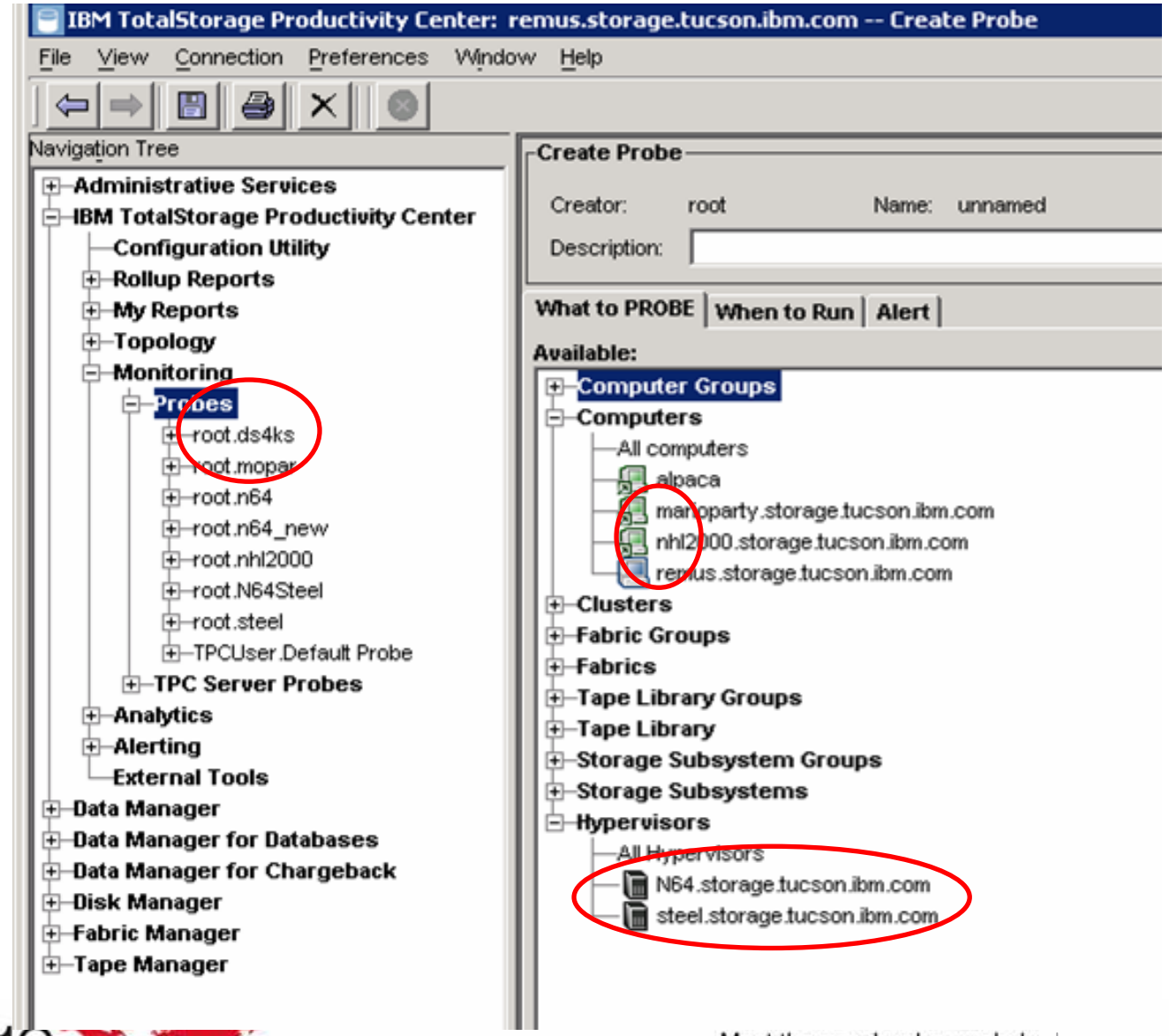
As we are dealing with a network, we need to work with the end-to-end network configuration, not just the individual components

Current TPC Virtual Server Management Capabilities

- TPC provides advanced management for virtual server and storage environments:
  - **Discovery**: ESX server, VM Guest OS images, VMFS, storage and which VM has storage allocated from where
  - **Topology and Visualization**: Hypervisor views including drill down to show all VM images, end to end correlation of SAN storage to ESX server and VM guests
  - **Monitoring and Reporting for ESX server / VM guests**: health status and monitoring, asset reporting, capacity utilization (total, free, used), ..
  - **Problem Determination and root cause analysis of storage problems:** assistance discovering the 'real' problem in a virtual world
  - **Storage Provisioning**: from any storage array to ESX server

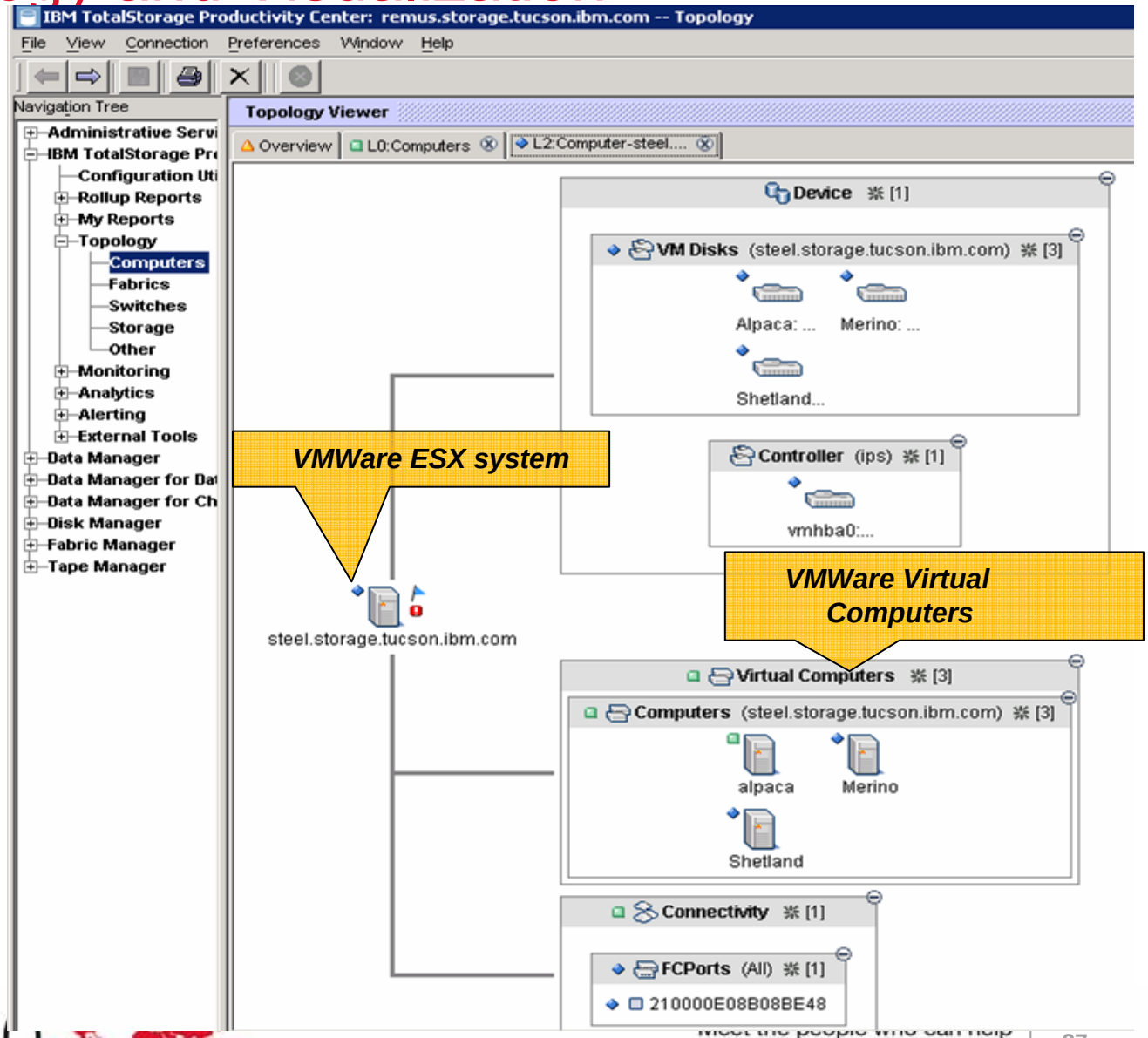
VMWare Discovery

- "Hypervisor" added to the list of entities that can be selected for Probes.
- Hypervisors available to be probed are those found in the Discovery operation performed against Hypervisor systems.
- The virtual machines that have the TPC for Data agent installed will be listed as computer systems in the probe definition screen for systems



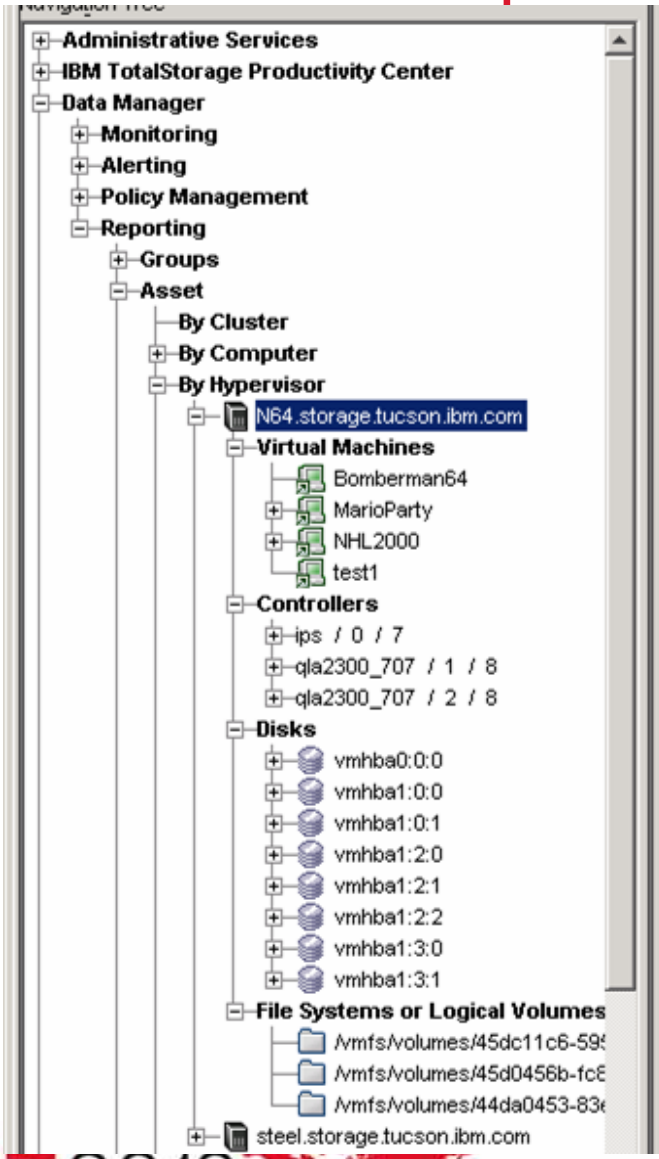
VMWare Topology and Visualization

- Discover and report the logical aspects of the VMWare environment:
  - *VMWare virtual machines and mapping to the host physical machine*
  - *Storage resources used by the ESX server*
- For detailed information on the VMWare virtual machine, it must be running an operating system in the TPC for Data Agent support list and be running a TPC for Data Agent



VMWare ESX Server Properties

- Detailed Asset reports about the VMWare ESX System:

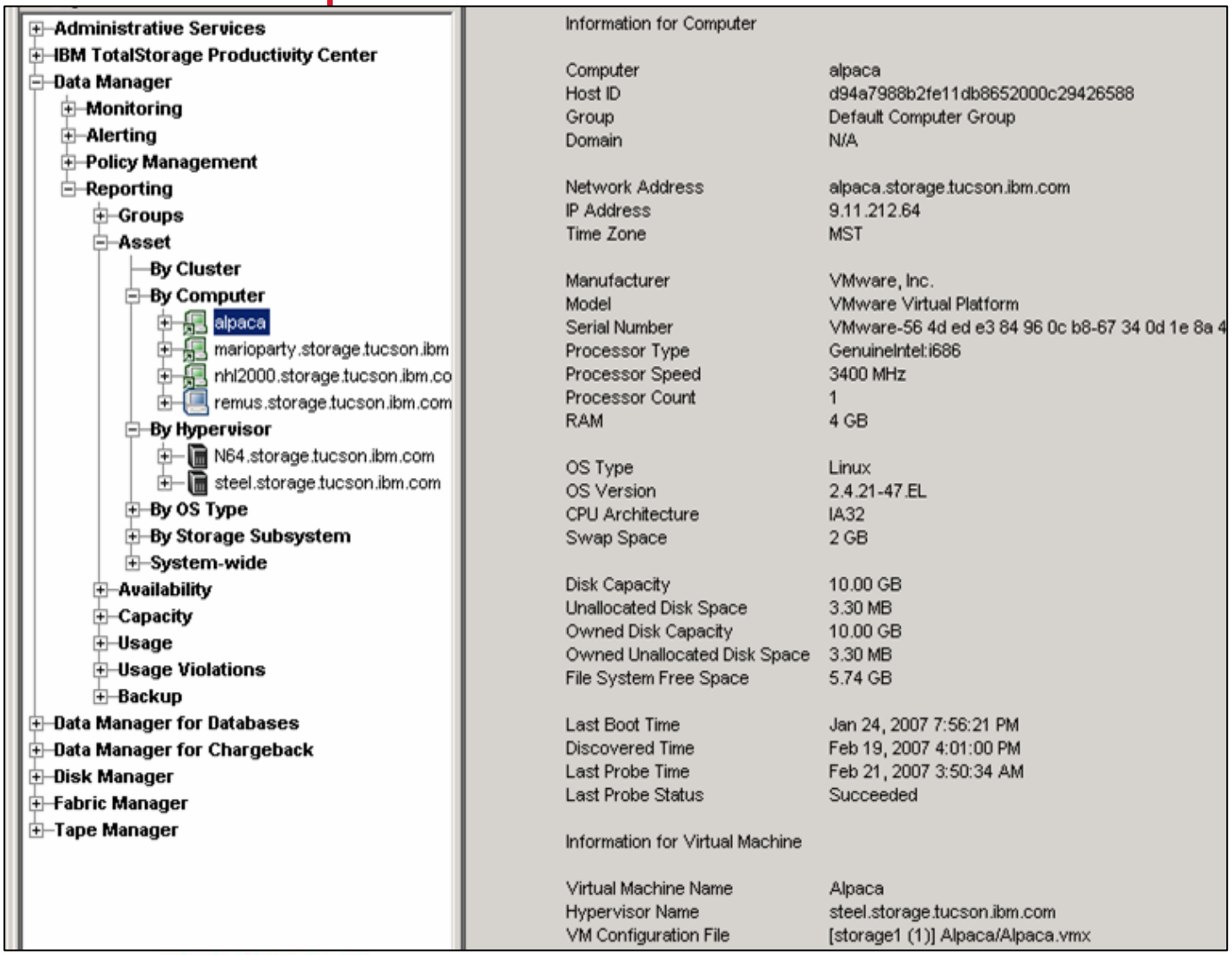


Information for Computer

Computer	N64.storage.tucson.ibm.com
Host ID	N/A
Group	
Domain	N/A
Network Address	N64.storage.tucson.ibm.com
IP Address	9.11.212.66
Time Zone	N/A
Manufacturer	IBM
Model	eserver xSeries 346 -[8840Z24]-
Serial Number	d67184ed-08b4-4a12-b929-aa881d1b138c
Processor Type	Intel x86 compatible
Processor Speed	3400 MHz
Processor Count	2
RAM	4 GB
OS Type	VMWare ESX
OS Version	3.0.1
CPU Architecture	IA32
Swap Space	0
Disk Capacity	171.73 GB
Unallocated Disk Space	N/A
Owned Disk Capacity	136.73 GB
Owned Unallocated Disk Space	0
File System Free Space	73.28 GB
Last Boot Time	Jan 31, 2007 6:36:22 PM
Discovered Time	Feb 21, 2007 3:12:10 PM
Last Probe Time	Feb 21, 2007 6:50:01 PM
Last Probe Status	In Progress

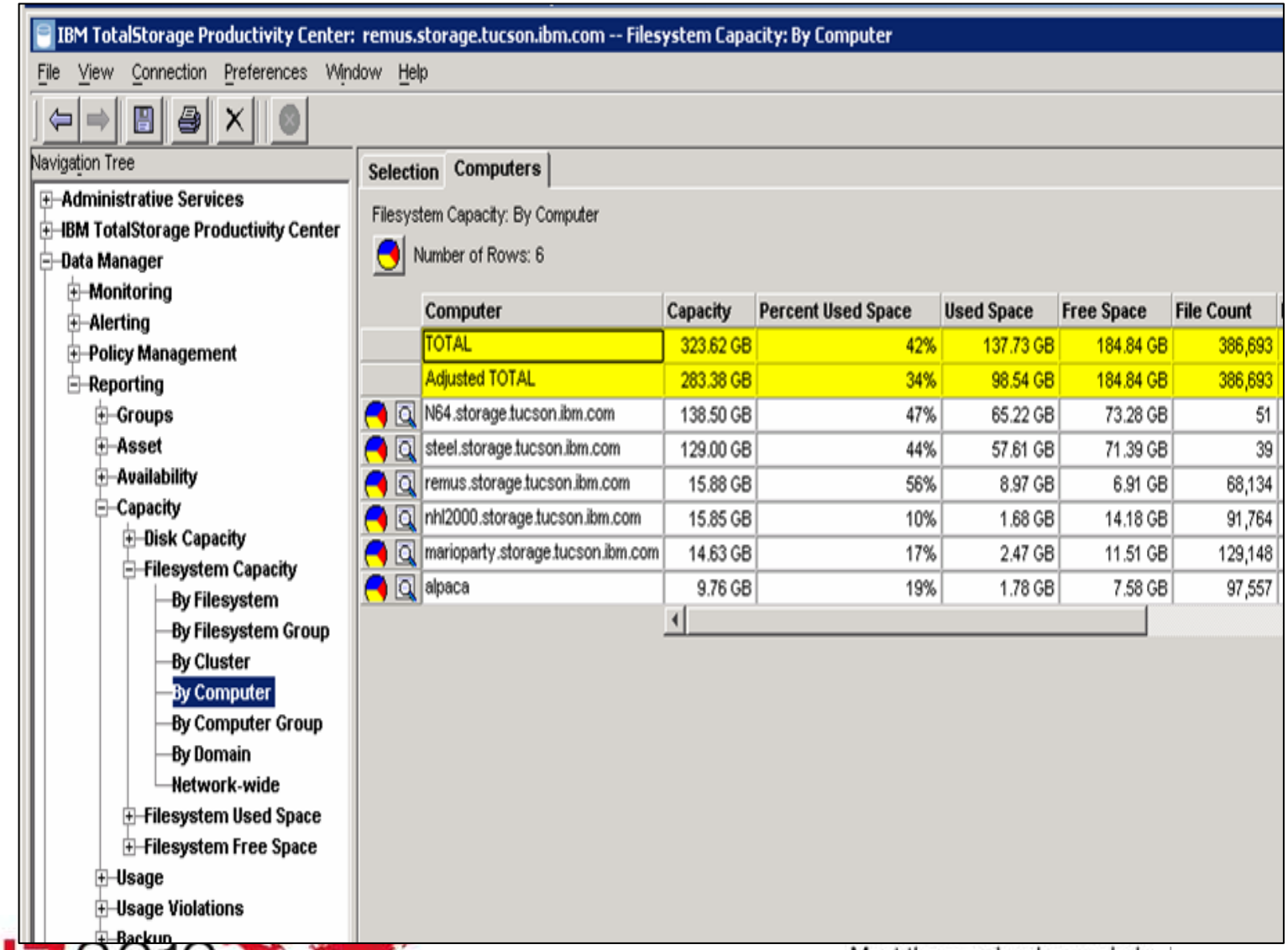
VMWare Guest OS Properties

- Detailed Asset reports about VMWare Guests with the TPC for Data Agent:



VMWare Capacity Utilization Report

- Detailed Capacity Reports for VMWare ESX System and managed systems with TPC for Data Agent:

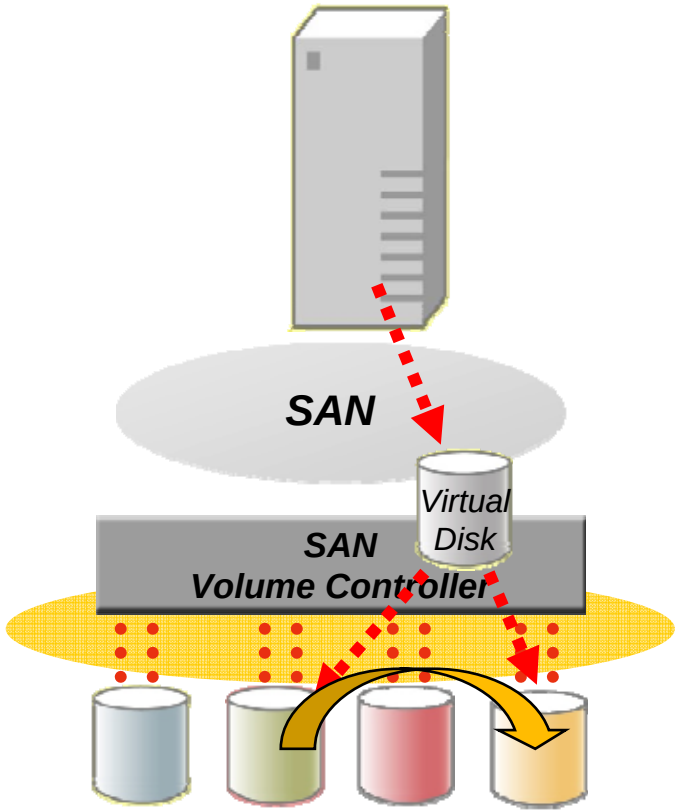


Storage Virtualization for Virtual Servers

SAN Volume Controller (SVC)
Scale Out NAS (SoNAS)

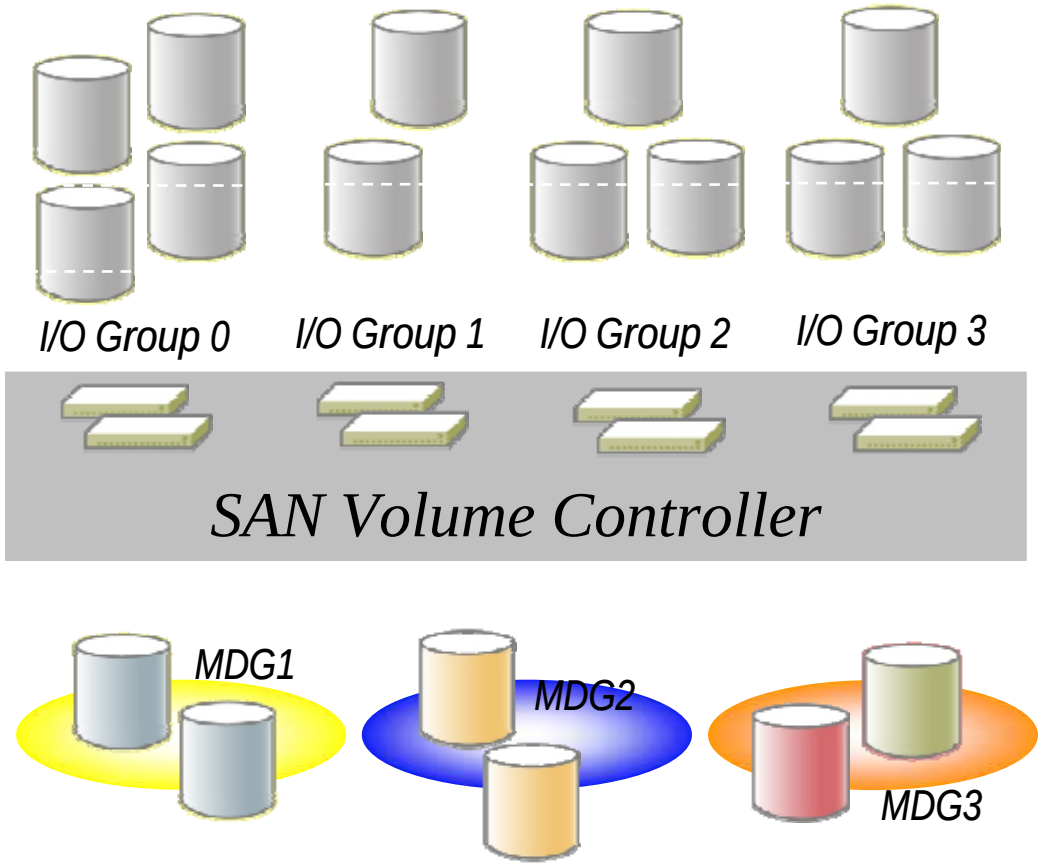
Storage Management

- **Only the SAN Volume Controller seen by the storage disk arrays**
  - No advanced function software licensing required on the storage controller
  - Simply provision all the storage to the SAN Volume Controller
  - Replacing storage does not require changes to the host
  - Allows thin provisioning, grow your storage only when required



SVC storage virtualization is a perfect match for virtual server environments

SAN Volume Controller Terminology



Virtual Disks (Vdisk):

- *Max 1024 disks per I/O group*
- *Size 16MB – 2TB*
- *Max 8PB addressable (2 billion extents)*

Each virtual disk assigned to:

- *Specific Node-pair*
- *Specific MDG*

Cluster:

- *One to four node-pairs*

Managed Disks (Mdisk):

- *LUNS from up to 64 physical arrays*
- *128 Managed Disk Groups (MDG)*
- *128 LUNs per group*
- *Max 4096 LUNs per cluster*

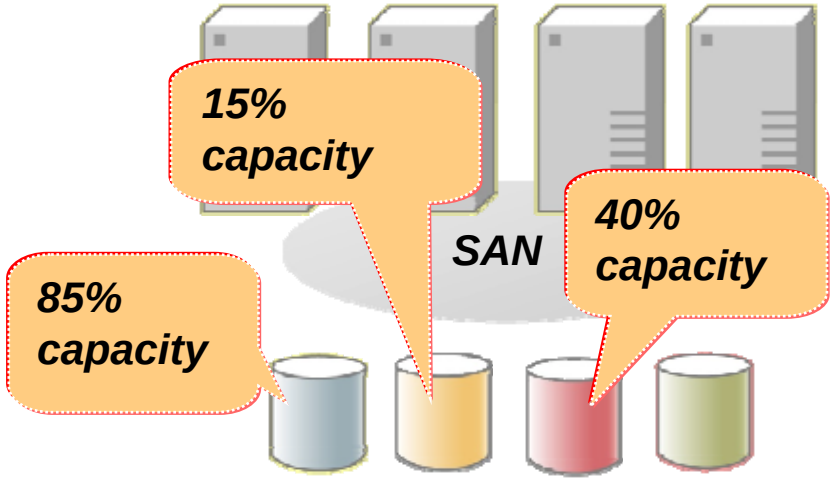
Optimized Storage Resource Utilization

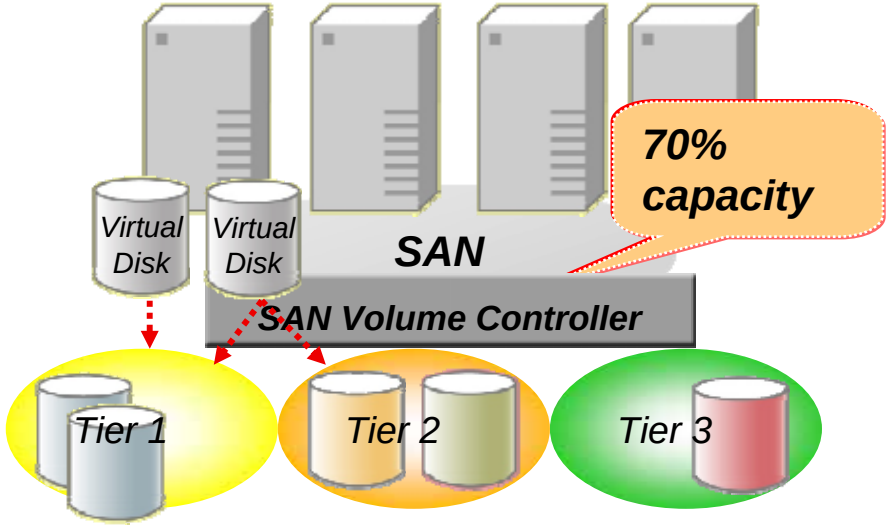
Traditional SAN

- Shared physical network
- Limited capacity sharing
- Capacity purchased for, and owned by individual processors
- Poor capacity utilization

SAN Volume Controller

- Hosts own “virtual” disks
- Capacity can be more easily reallocated
- Capacity purchases can be deferred until the physical capacity of the SAN reaches a trigger point.





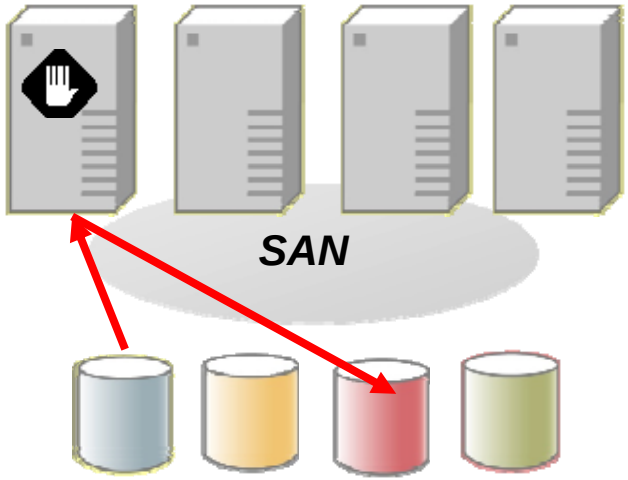
Improved Application Availability

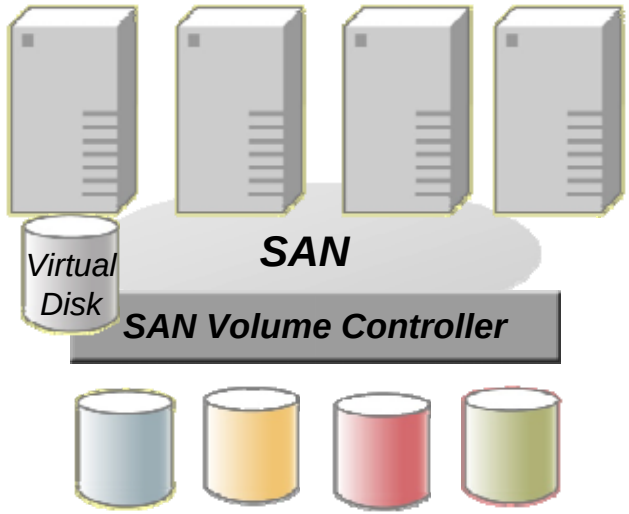
Traditional SAN

1. Stop the application
2. Move data
3. Re-establish host connections
4. Restart application

SAN Volume Controller

1. Move data
2. Host systems and applications are not affected





Real World Example of SVC Provisioning with TPC/TPM

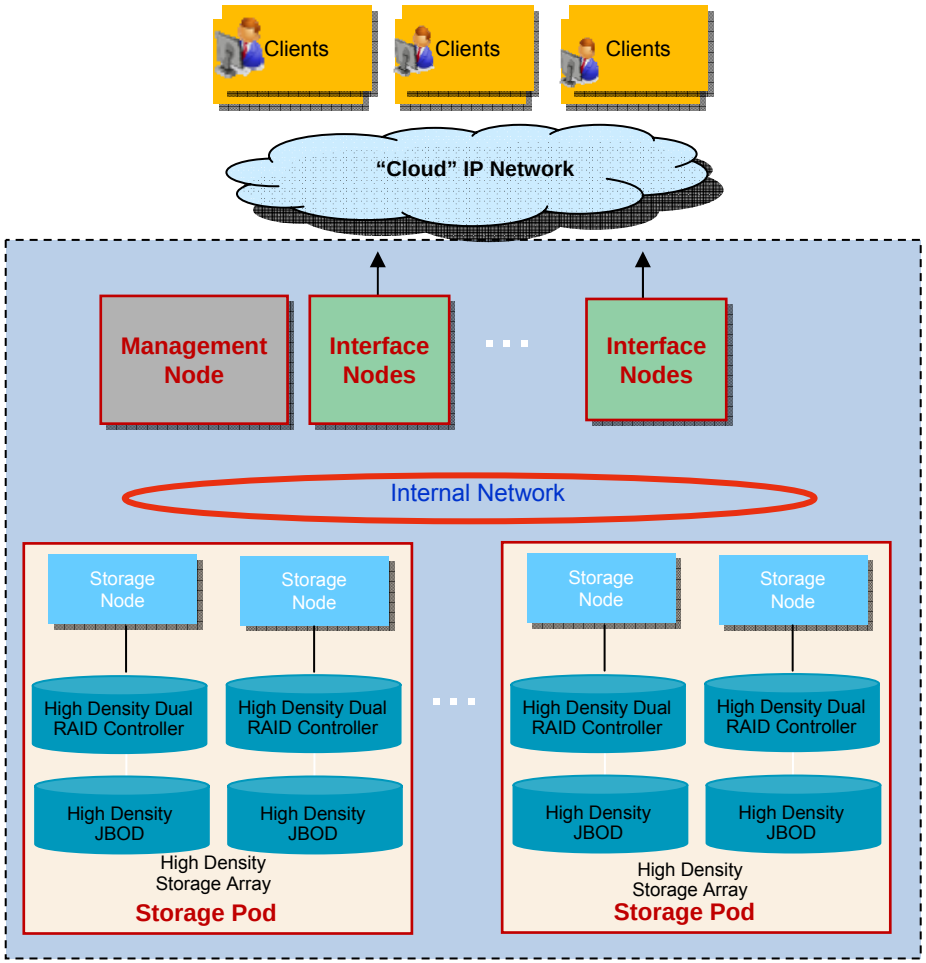
- Manual Server Recovery
  - OS provisioning (1-3 hrs.)
  - Environment Customization (2 hrs.)
  - SAN Provisioning (5 days)
  - File System Creation (1-8 hrs)
  - Data Recovery (1-5 hrs)

- *Automated Status*
  - *Done (1 hr)*
  - *Done (0.5 hr.)*
  - *Done (0.5 hr.)*
  - *Done (1hr)*
  - *Done (0.5 – 1 hr)*

Complete End to End Storage Provisioning is critical for virtual server environments

40X improvement time saving
Manual 160 hours Automated 4 hours

IBM Scale Out NAS – System Managed Storage in a Box



- Enterprise class solution for IP based file system storage (NFS, CIFS, FTP, ..)
- One global repository for application and user files: >1B files per file system, 256 filesystems per SoNAS, simplified management of PBs of storage
- Extreme performance (near linear aggregate throughput) and extreme capacity scaling
- Work load and data is evenly distributed across all nodes and disk pools, eliminating hot spots
- Policy based tiered storage - high-performance SAS and high-capacity SATA HDD's
- Provision, monitor, report, chargeback by application, user, department, etc
- Accelerated backup, HSM and recovery by TSM

Can deploy as private or public (future) cloud

Summary

- IBM Tivoli offers superior management solutions that are especially instrumented for virtual server and virtual storage environments
- IBM TSM and TSM FastBack offer a variety of data protection and recovery approaches for virtual server data
- IBM System Storage SAN Volume Controller (SVC) and SoNAS deliver a dynamic, virtualized storage infrastructure that improves storage resource utilization and efficiency
- IBM Tivoli Productivity Center makes your existing virtual server and storage environment more flexible
- SVC and TPC serve as a platform for advanced provisioning and automation with IBM Tivoli Service Management

Trademarks and disclaimers

Intel, Intel logo, Intel Inside, Intel Inside logo, Intel Centrino, Intel Centrino logo, Celeron, Intel Xeon, Intel SpeedStep, Itanium, and Pentium are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries./ Linux is a registered trademark of Linus Torvalds in the United States, other countries, or both.

Microsoft, Windows, Windows NT, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both. IT Infrastructure Library is a registered trademark of the Central Computer and Telecommunications Agency which is now part of the Office of Government Commerce. ITIL is a registered trademark, and a registered community trademark of the Office of Government Commerce, and is registered in the U.S. Patent and Trademark Office. UNIX is a registered trademark of The Open Group in the United States and other countries. Java and all Java-based trademarks are trademarks of Sun Microsystems, Inc. in the United States, other countries, or both. Other company, product, or service names may be trademarks or service marks of others. Information is provided "AS IS" without warranty of any kind.

The customer examples described are presented as illustrations of how those customers have used IBM products and the results they may have achieved. Actual environmental costs and performance characteristics may vary by customer.

Information concerning non-IBM products was obtained from a supplier of these products, published announcement material, or other publicly available sources and does not constitute an endorsement of such products by IBM. Sources for non-IBM list prices and performance numbers are taken from publicly available information, including vendor announcements and vendor worldwide homepages. IBM has not tested these products and cannot confirm the accuracy of performance, capability, or any other claims related to non-IBM products. Questions on the capability of non-IBM products should be addressed to the supplier of those products.

All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

Some information addresses anticipated future capabilities. Such information is not intended as a definitive statement of a commitment to specific levels of performance, function or delivery schedules with respect to any future products. Such commitments are only made in IBM product announcements. The information is presented here to communicate IBM's current investment and development activities as a good faith effort to help with our customers' future planning.

Performance is based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput or performance that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput or performance improvements equivalent to the ratios stated here.

Prices are suggested U.S. list prices and are subject to change without notice. Starting price may not include a hard drive, operating system or other features. Contact your IBM representative or Business Partner for the most current pricing in your geography.

Photographs shown may be engineering prototypes. Changes may be incorporated in production models.

© IBM Corporation 1994-2010. All rights reserved.

References in this document to IBM products or services do not imply that IBM intends to make them available in every country.

Trademarks of International Business Machines Corporation in the United States, other countries, or both can be found on the World Wide Web at http://www.ibm.com/legal/copytrade.shtml.