



Storage Resource Management: A Foundation for the Shift to a Storage Utility

Executive Summary

Enterprises continue to grapple with the growth of storage. At the same time, many companies are improving metrics used to measure service levels as well as capacity. A key problem many companies face is managing the increasing complexity of data. While a lot of industry emphasis has been on better provisioning of storage, customers want to understand capacity across heterogeneous storage environments as well as the service levels of storage networks and storage systems.

In the last several years, storage resource management (SRM) evolved from simple capacity management to managing the holistic storage environment. SRM will be a key foundation technology for the rollout of the storage utility model (see Exhibit 1). SRM currently captures the attributes and value of the stored data, establishes and measures storage service levels, and enables chargeback to departments based on storage usage. In the future, SRM will be more integrated with storage automation tools, information lifecycle management and infrastructure management.

Exhibit 1

The Storage Utility Architecture

Source: The Yankee Group, 2004

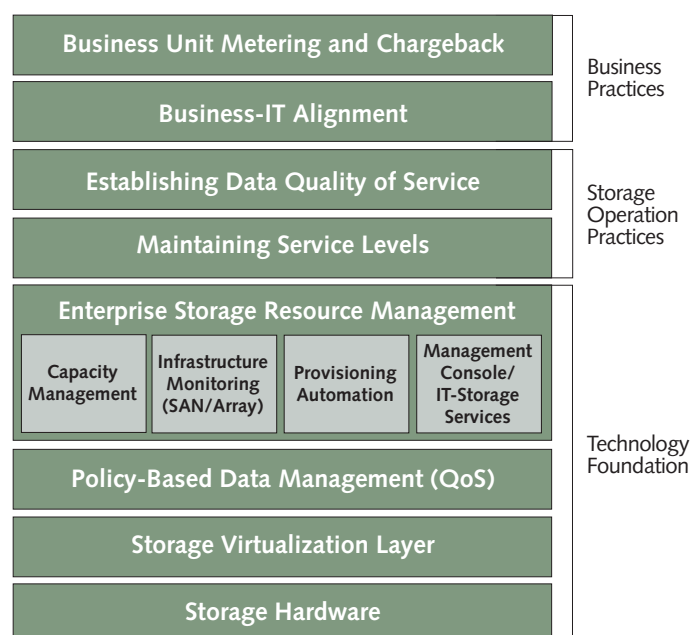


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I. Introduction

Increasing storage complexity is forcing storage administrators to be more efficient in managing their storage environments. One way to improve efficiency is to redesign storage operations as one would a data center service. In addition, the shift to a service model approach fundamentally changes the way customers plan, deploy, provision and manage storage, defining the term *storage utility*.

Before delving into an in-depth technology discussion, it is important to investigate how enterprises are managing storage currently. The reality is that customers are spending more time managing their storage environments than almost any other part of their data center infrastructure.

These are some of the key challenges facing customers in managing storage environments:

- **Heterogeneous storage environments:** Storage from multiple vendors means customers must manage each storage array as an island.
- **Storage system inefficiencies:** Storage systems are underutilized—only 35 to 50 percent utilized—thanks to the challenges of managing multiple arrays.
- **Storage provisioning is an inexact science:** Most customers estimate provisioning and establish general scripts to provision storage. This leads to allocating too much storage.
- **The road to network storage can be bumpy:** For customers, determining the best migration strategies as well as the best storage network architecture can be complex.
- **Storage management is a growing portion of enterprise storage:** Recent Yankee Group research suggests storage management is starting to rival storage systems for budget dollars, increasing emphasis on return on investment.
- **Staffing levels have not increased, but storage infrastructure has grown:** Therefore, the responsibilities of storage administrators have increased and the need for more intelligent management tools has grown.

- **Customers have not deployed policy-based automation tools because few work in heterogeneous environments:** Enterprises have improvised by setting up their own ways of monitoring system availability, performance and ongoing operational changes.
- **Storage management tools are blending together to provide customers a more integrated view of storage infrastructure:** SRM will integrate with provisioning tools, SAN management, storage automation engines and management consoles as customers consolidate the tools they use to manage their storage environments.

This report provides an overview of the evolving role SRM plays in enterprises' storage management strategies, how it assists with key challenges, how it can be leveraged today to speed the enterprise shift to storage utility models, and how it will evolve in the coming years. The Yankee Group also will examine how storage management market leader VERITAS Software provided significant technological and business benefits through a customer deployment, as well as an overview of its key SRM products. In addition, we will provide decision criteria to consider when evaluating storage resource management. VERITAS Software sponsored this custom research report.

II. The Need for a Storage Utility

The shift to a storage utility is being driven on two levels:

1. **The business level**, as Global 2000 companies reevaluate their IT practices
2. **Expanding pure technology requirements**, as storage decision-makers realign how they manage storage

These pressures sandwich IT executives that need to demonstrate and deliver value in managing the entire data center infrastructure—not just storage (see Exhibit 2).

IT executives must justify investments with business rationale. Two questions face these executives: How does one measure the value of information technology? How are business units leveraging the existing storage infrastructure? Today's chief information officer mantra underscores a number of key goals: contain costs, mitigate risks, establish a service bureau approach for managing IT infrastructure and improve the flexibility of rolling out new technologies or services.

IT executives must improve their overall tactics for managing storage.

First, because the percentage of the IT budget devoted to storage is growing, IT executives need to align storage with business operations and objectives. Second, executives need to centralize and monitor storage systems, networks and operations (such as data replication and backups). Finally, storage administrators must establish service levels for storage infrastructure. This continues to be a problem as IT executives grapple with headcount shortages.

The benefits of a storage utility architecture fall into three categories:

1. **Establishing and stabilizing service levels:** Especially because of compliance regulations, creating different service levels and policies for different kinds of applications and measuring service level success is critical.

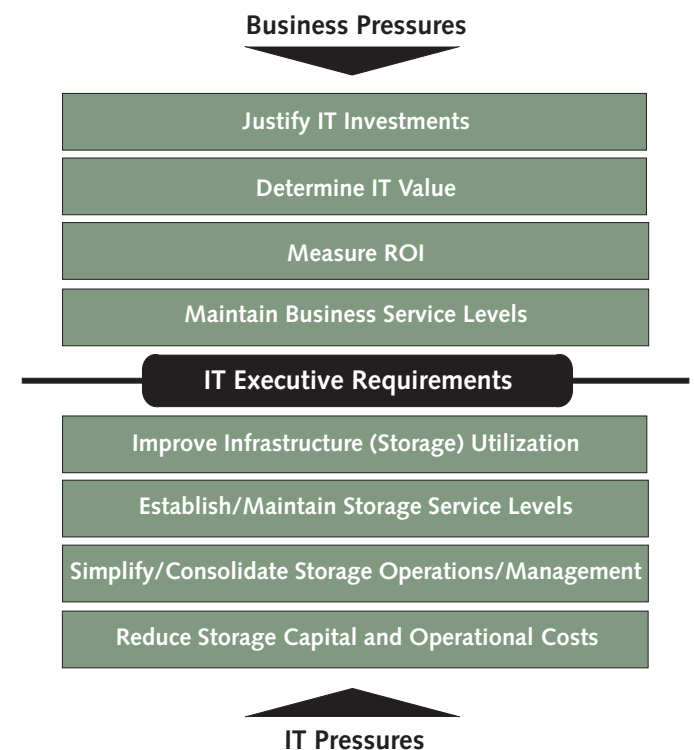
2. **Reducing or consolidating capital investments for storage hardware:** By using pooled infrastructures, customers will be better able to improve their utilization of existing storage systems and storage networks. This will extend the investment and provide clear measurement of where ROI is greatest.
3. **Reducing or eliminating operational expenditures:** Complexity is increasing, yet IT staffing levels will remain level or decline. Therefore, it is more important to centralize storage management. Once companies establish a common way of managing storage, using best practices to automate storage processes will be the long-term objective.

Recent Yankee Group research suggests that storage efficiency remains a core problem for administrators. A June 2003 Yankee Group survey of 289 storage decision-makers found that 55 percent of those surveyed said that storage utilization and capacity management provide the most important metric of true technology and financial benefits.

Exhibit 2

The Tipping Point of the Storage Utility: IT Executive Pressures

Source: The Yankee Group, 2004



Defining the Stages of Migration to a Storage Utility

There are number of stages associated with migrating to a storage utility architecture. However, the process of establishing a storage utility architecture will take some time to complete. Enterprise storage resource management tools that monitor, perform capacity management and integrate with other storage management tools for various services within the storage environment are key ingredients.

However, the technology foundation will not be enough. Customers need to change how they manage storage environment operational issues. For example, companies needs to replace the traditional “firefighting” many storage administrators practice (out of sheer desperation to keep storage operations functioning) with a tiered strategy that elevates failures based on business priorities. Therefore, an ERP application failure in which a storage array reaches capacity and causes faults at the application level would be handled more aggressively than a port failure in a Fibre Channel switch that does not affect overall storage area network availability.

The bottom line: storage administrators need to quantify the different classes of data they support then set service levels and policies that will support these classes based on their importance to business operations. Customers should consider the following high-level stages:

- **Define service levels:** During this assessment stage, customers need to quantify application data that should be treated as mission-critical, operational, back-up and archive. Administrators then should assign metrics in support of performance, availability, back-up/disaster recovery policies, security and retention requirements.
- **Establish the technology foundation:** Once storage administrators have a clear sense of requirements, they should consider technologies that will assist rolling out a storage utility architecture, such as storage virtualization, provisioning, SAN/infrastructure management/monitoring tools and SRM.

- **Understand capital and operational investments:** Capturing the cost of investing in storage is a significant challenge for customers. Most IT executives might have a sense of the capital expenditures it took to build a new storage network, add a storage array or deploy new storage management software. However, it is harder for them to quantify ongoing operational costs. One way to resolve this is to align support of a specific storage operation (such as backup or data replication to a remote site) with the costs associated with maintaining a specific application or service level. This information will enable customers to allocate costs of operations and capital investments back to business units based on usage.
- **Capture key information:** Customers should examine storage capacity, usage and the monitoring of service levels. This information will be crucial to establishing a common set of metrics and services that can be charged back to business units.
- **Set up a chargeback mechanism:** At this final stage of migration, customers aggregate the identifiable service levels, how much it costs to support those service levels and which departments are using these systems. This information then is weaved into a chargeback mechanism that will bill business units. Some SRM tools include information on consumers of storage services; the tools also assist in calculating financial values for that usage. Many customers will elect to either generate monthly bills for business units or use the information as a bargaining chip to ask for budgetary contributions from business units.

III. Storage Resource Management Product Overview

Storage resource management today is not a single tool, but a variety of tools that together help customers monitor storage resources. This includes capacity management, availability and performance based on preset thresholds. Increasingly, SRM will blend with SAN management, management consoles, storage provisioning and automation tools, and broader service management tools. The Yankee Group refers to this broader market segment as enterprise storage resource management.

A key limitation of storage management tools has been the inability to actively manage the storage environment. Although there is a lot of actual data and other information available to storage administrators about the status of various storage devices, their ability to make changes based on this information is limited. This could be described as passive management—giving administrators information they cannot do anything with. However, as more storage workflow and automation tools become available, customers will integrate these tools with SRM products to set thresholds that trigger actions in response.

The State of the ESRM Landscape

Today, the enterprise storage resource management market is relatively young. Product functionality varies, from capacity management to more advanced storage system and storage network monitoring. Storage software vendors provide products in the following categories:

- **Capacity management:** These reporting and monitoring tools for heterogeneous storage hardware capacity provide a variety of reports on capacity. This also includes quota management and file blocking, especially important in more dynamic windows environments.
- **Infrastructure monitoring:** These tools monitor availability and performance of storage networks and arrays—also known as management consoles or dashboards.

- **Storage provisioning and automation:** These include provisioning tools and storage automation workflow engines that automate third-party software tasks. Storage provisioning is commonly a part of management consoles rather than standalone tools.
- **Storage services console:** The newest addition to this market sector, storage services consoles combine the products listed above with data management tools. The services console will establish, enforce and report on service levels set by storage administrators.

Most products today are a mix of capacity management and infrastructure monitoring; the architectures are either host-, file- or array-focused. Stronger SRM products provide multiple views to manage physical/logical capacity. They also offer heterogeneous support of storage arrays and network devices. A growing number of tools offer application-specific modules for applications such as e-mail, databases, and file and content management.

Key Benefits of SRM

Storage resource management has clear benefits that mirror the many advantages of migrating to a storage utility. In addition, depending on the kind of SRM tool selected, the benefits will vary. The common benefits include the following:

- **Simplifying and automating tasks:** This includes automating the process of adding additional capacity for applications as well as monitoring and reacting to storage availability and performance problems.
- **Improving storage efficiency:** Storage administrators can increase storage utilization and reclaim wasted capacity on storage systems. In addition, many SRM tools collect usage information the enterprise can leverage for chargeback.
- **Advancing cost justification for storage capital and operational expenditures:** Both data collection and storage class of service enforcement create significant opportunities for storage executives to make a case for storage cost justification.

- **Alignment of IT and business requirements:** Providing management tools to bridge the gap between business and IT requirements should lead to stronger integration and improved decision-making for IT executives managing storage operations. Using SRM tools to manage storage services should give decision-makers valuable data, such as how business operations are using storage and other data center components, the value attached to this usage, and the available revenue stream that can be allocated to support new storage services.
- **Solidifying and improving service levels:** One of the biggest problems facing storage administrators has been finding common practices and storage management software that will organize and enforce service-level agreements. SRM tools assist in organizing classes of storage that need to have different levels of availability and performance, with clear policies on usage, availability and performance.

IV. Product Spotlight: VERITAS SRM Strategy

VERITAS' product strategy covers three common elements: business and IT service management, storage asset management and storage infrastructure management. All three elements are crucial for customers considering a shift to a storage utility. VERITAS has aligned its product line to reflect the three different SRM requirements customers would evaluate as part of a storage utility model (see Exhibit 3). First, VERITAS' CommandCentral Storage lays the groundwork by providing physical storage infrastructure management. In addition, CommandCentral Storage is a strong storage asset tool that monitors storage consumption by users, application or file type. StorageCentral is VERITAS' Windows-based SRM tool; it offers quota management, capacity management, and enforcement of storage usage policies. CommandCentral Service rounds out VERITAS' strategy by delivering an IT service management portal that manages storage (and other data center) service levels, and translates this into actual costs analysis by business line or group. This section takes an in-depth look at all three products.

CommandCentral Storage - Operations Module

In the simplest terms, CommandCentral Storage gives storage administrators three basic storage management functions for heterogeneous storage environments: build, monitor and correct.

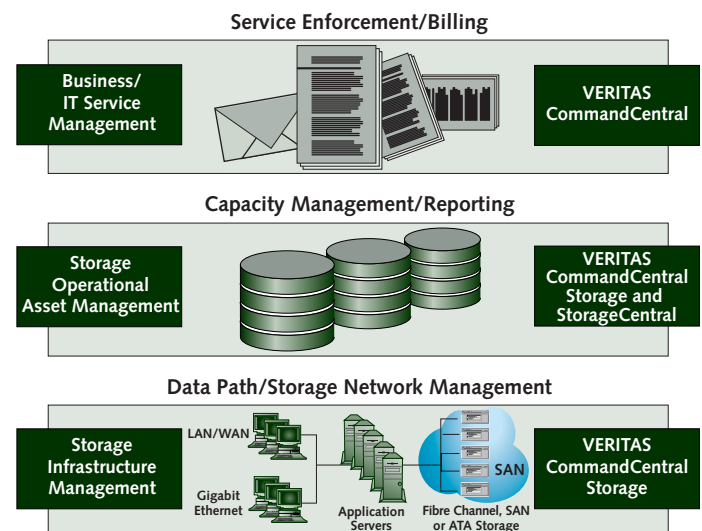
Customers can use the build function to provision storage (both automated and assisted storage provisioning), perform LUN and zone management, and automatically discover and visualize the relationships hosts, networks switches and storage systems.

Customers considering a migration to a storage utility architecture need to consider deploying a number of foundation technologies as part of their migration process. CommandCentral Storage, which is one of these foundation tools, provides overall management of the data path from the application to the disk within storage networks.

Exhibit 3

VERITAS SRM Product Strategy

Source: The Yankee Group, 2004



CommandCentral Storage captures performance and availability statistics, and acts as a strong monitoring tool for storage service levels at the infrastructure level.

CommandCentral Storage then monitors resources in the data path, logging events that affect the health of the storage network, such as capacity, performance and availability. It notifies storage administrators of events via a console, SNMP traps that can be sent to an enterprise management framework, e-mail and event logging.

Finally, CommandCentral Storage can correct faults detected in the data path via a number of operations, including executing a user-defined script and automating the provisioning of new storage to eliminate application downtime.

CommandCentral Storage - Data Module

Understanding the existing usage and assets within the storage environment is crucial to rolling out a storage utility. VERITAS CommandCentral Storage provides a data center-wide view of storage capacity, pinpointing not only existing capacity of storage arrays but also identifying application storage usage. Its most understated functionality is the ability to give customers a view into the future by collecting existing capacity, tracking incremental changes in capacity, and then using trend analysis to predict future storage capacity needs. CommandCentral Storage is one of several storage asset management tools, which also include StorageCentral.

One of CommandCentral Storage's key features is its storage usage analysis. This includes the ability to review utilization by both physical and logical resources such as server and volumes as well as by user and application. The tool also can organize utilization by file type, size and age. Therefore, it can detect unwanted file types, duplicates and the fastest growing servers and volumes. CommandCentral Storage provides asset management through its reporting across heterogeneous servers and storage types (SAN, NAS and DAS). Storage administrators can then drill down to server and volume information by user, department and application.

A last set of features focuses on the ability to examine storage usage at the application level. This includes consolidated and drill-down views of databases and e-mail storage, including the relationships between servers, databases and tables, as well as mail servers, mail storage and mailboxes. CommandCentral Storage also can forecast future storage requirements at the enterprise-wide, server, database, e-mail or backup levels.

Understanding the projections for storage growth and how this applies to making better-informed storage planning and purchase decisions is another key element in storage utility. In addition, the ability to accurately see current usage patterns as well as predict future storage requirements provides the foundation of any storage utility.

CommandCentral Storage can deliver detailed reports on the existing storage environment. It also can forecast future storage requirements at the enterprise-wide, server, database, e-mail or backup levels. This capability enables the user to purchase storage as required, enabling companies to avoid excess capital expenditures. It provides an incentive for users and departments to better manage their current resources by educating them on their usage patterns before capacity problems surface.

StorageCentral

StorageCentral is VERITAS' Windows-based storage resource management tool; it provides quota management, capacity management, and enforcement of storage usage policies. StorageCentral produces a number of pre-defined reports to determine storage allocation and who is using Windows-based shared storage, along with drill-down capabilities to administrator directories, groups of files and individual files. This tool also provides custom policies around space allocation, overdrafts, alerts and blocked file types. Lastly, StorageCentral can establish thresholds for utilization, with alert messaging and actions as a result of the alert (either scripts or elevation of the alert to another administrator).

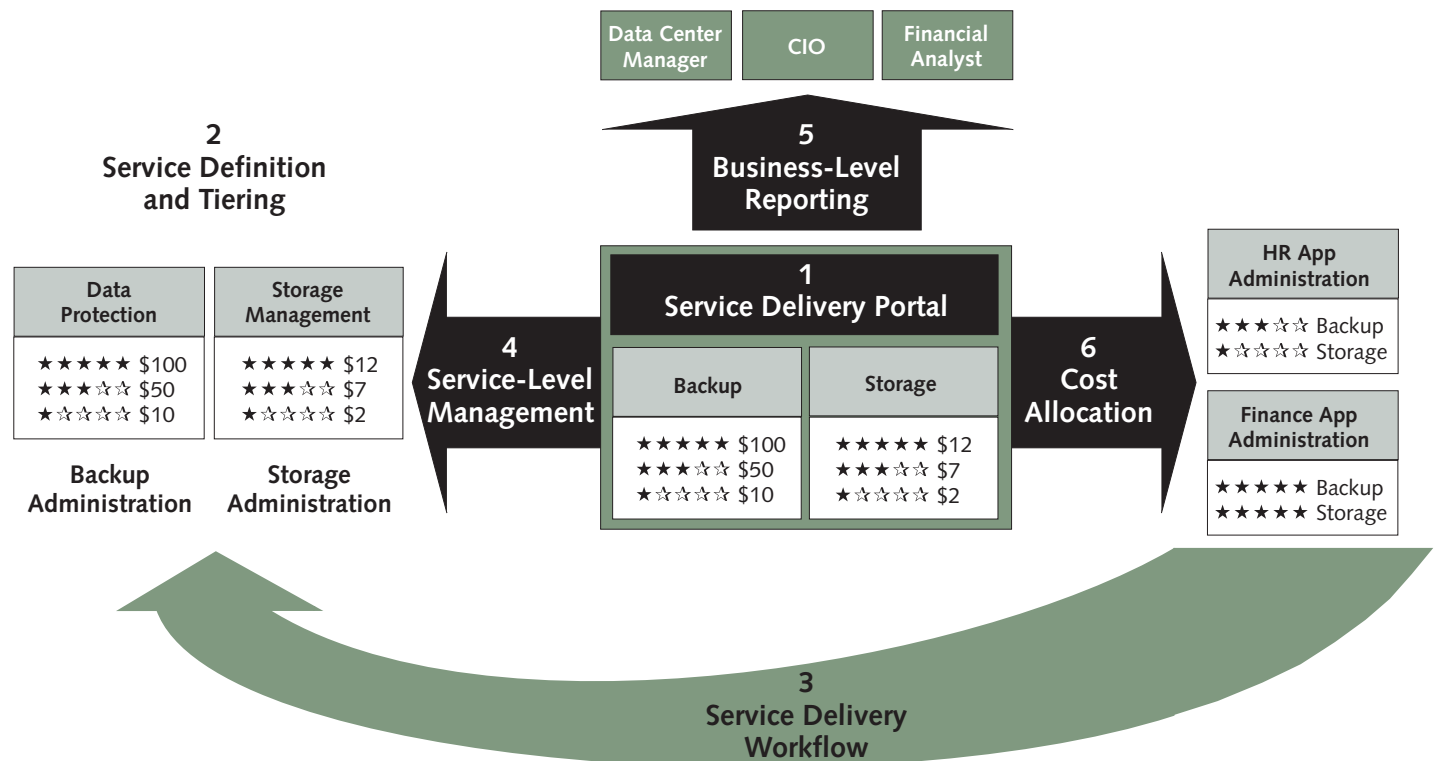
CommandCentral Service

The CommandCentral Service is one of the first policy-based management products to deliver an essential storage utility function: identifying, managing and quantifying storage classes of service. Designed as an IT services portal that will extend beyond the storage environment to other IT data center services over time, CommandCentral Service gives IT executives the ability to define, measure and monitor service levels for a variety of different storage services and applications. It also maps and reports on usage and consumption to business line management, improving the link between IT and business managers with role-based management (see Exhibit 4). Much of the information collected comes from other VERITAS products, such as CommandCentral Storage, NetBackup, Backup Exec, Networker, and a growing number of third-party backup/recovery, SRM reporting, and IT workflow products.

One of the most significant capabilities of this product is its ability to define the costs of sustaining a storage service or class of storage for IT executives. These calculations enable the storage team to define what is charged back to business usage. Usage could include unit, user or application storage capacity, and delivery of a specific storage service such as disaster recovery or backups. This software also can act as a service bureau within the storage group, providing service requests and approval workflows. Lastly, a huge benefit of CommandCentral Service is its ability not only to define services (such as those designed by both IT and business managers), but to measure the success of the storage group in delivering that service.

The broader view of this product will extend beyond just the storage environment in the coming years to application and server management. Tools such as CommandCentral Service likely will integrate with third-party products, which VERITAS already has started to do with its support of more than 20 third-party storage and IT management products.

Exhibit 4
 VERITAS CommandCentral Linkage Between Business and IT
 Source: VERITAS and the Yankee Group, 2004



V. A VERITAS Case Study

This section looks at a specific example of how a communications and business integration solutions provider deployed the VERITAS products that lay the foundation for a broader storage resource management strategy. This customer standardized on several VERITAS products to manage its storage area networks and support its core applications. The customer runs a number of CRM and custom applications on a variety of databases including Sybase, DB2/UDB and Microsoft SQL Server.

The production environment consists of two EMC 8730 Symmetrix (RAID 1), and 24 16-port Brocade 3800 and 2800 Fibre Channel switches in a core-edge fabric configuration. There are 104 Solaris and Windows servers with multi-paths to the storage.

- **The customer deployed CommandCentral Storage** for complete infrastructure management of the storage arrays and Fibre Channel switches, as well as capacity planning, event notification and reporting.
- **VERITAS Volume Manager and VERITAS File System** are standard on all the Solaris and Windows servers.
- **VERITAS Cluster Server** is the clustering solution for the Solaris servers.
- Backups are executed over a separate SAN. **VERITAS NetBackup** is used to stream backups to disk (two Network Appliance R100s) and then later vaulted to a tape library.

The Challenges

About 2 years ago, the customer decided to merge the separate IT teams (a 10-person team and a 16-person team) managing the Solaris and Windows servers. The customer wanted to use standard tools to manage its heterogeneous platforms. With a standard set of tools, the customer hoped to reduce management costs and scale without additional labor by cross-training employees to manage both platforms.

The company's IT budgets were under scrutiny. The company was pushing to reduce storage management costs and lower total cost of ownership. In addition, the customer did not have the tools to enable it to peer into the storage to understand capacity utilization. Storage allocation and capacity planning were difficult and time-consuming tasks. Business units were also seeking higher service level agreements for applications. The team needed to do more—faster—with the same number of people.

The Benefits

Previously, the customer used a disparate set of applications from EMC and Brocade. CommandCentral Storage gave the customer a single point of management for the entire storage and fabric infrastructure. From a single console, the customer could perform such tasks as storage resource management and zoning. Some tasks that took more than an hour now take about 30 minutes. Because CommandCentral Storage masks so much of the complexity of storage, employees that are not storage experts are able to manage the storage.

With more than 150 standard reports available in CommandCentral Storage, the customer now has advanced reporting capabilities. The customer uses these reports for capacity trending and planning and even trending of events and alerts. For the first time, the customer is able to at least entertain the idea of chargebacks or transferring the storage budget to the business units.

In addition, because of VERITAS' approach to openness, through some customization, the customer was able to integrate CommandCentral Storage with applications such as NetIQ and MicroMuse NetCool. Event and alert notifications are delivered to the pagers of the IT team.

Since making the decision to standardize with VERITAS products, the customer has been able to manage the infrastructure with existing staff levels and ease the deployment of additional servers and storage. In 18 months, the infrastructure has grown from 35 servers on the SAN, to more than 104 and has increased storage capacity from 9 TBs usable in each Symmetrix to roughly 14 TBs in each.

The business units have seen the difference as well: faster responses to their requests, faster implementations and faster server builds.

VI. How Customers Can Prototype Storage Utilities with SRM

Key technologies to build a storage utility are here today. Yet, in numerous discussions with enterprise customers, the Yankee Group has found that best practices for migrating to a storage utility have not been developed. The migration to the storage utility model will take time. Most customers are starting their transition processes with specific projects first before shifting their entire operations to this approach. The storage utility model is more than just adoption of new technologies; it is a different deployment architecture, management model and IT philosophy.

Where can customers start?

The first step is to identify a specific storage operation or project that could be rolled out using the storage utility approach. For example, implementing a data retention strategy, doing a storage consolidation project, deploying a new SAN, or upgrading a backup or disaster recovery process are good examples of projects that could be integrated with SRM products and set up as a storage service.

Here are some other actions customers should consider in their planning process for the storage utility that can be accomplished by deploying SRM tools today:

- **Establish data quality of service:** Classify how important different kinds of storage data are to the operation of the business. Assign values around the performance, availability, security, backup, retention and disaster recovery.
- **Determine the current capacity of your existing storage environment:** Deploy capacity management tools to determine how business units, applications and groups are using your data center's existing storage systems as well as direct-attached storage. This information will be valuable for considering service levels as well as chargeback of these units. Educating business units on their consumption, growth and misuse of corporate storage environments could be valuable.
- **Prototype charging for a service:** Start by calculating the capital and ongoing costs of doing backups or some other storage service you wish to roll out, and determine how this cost could be spread across the consumers of storage as a service. This will require the support and commitment of senior IT and business managers.
- **Start enforcing service levels:** Design a monitoring system and strategy that improves the uptime, performance and responsiveness of a storage service. This should allow you the ability to evaluate what ultimately will be required to support these services, as well as assist in determining the cost of achieving this service level.
- **Discuss storage strategic planning with business units:** Although many business unit managers might not understand what a SAN is, they certainly understand the concept of application downtime and the impact it would have on their ability to conduct business. This could be an opportunity to educate them on the costs associated with maintaining the storage environment, as well as determining what business processes and initiatives should get priority as part of IT and storage planning processes. At the same time, it will be useful to know the growth rate of the storage environment during these discussions.

VII. What the Future Holds for SRM

Storage resource management will continue to have a role as the foundation of policy-based storage management. As we noted earlier, SRM is converging with a number of other products that include SAN management, management consoles, provisioning, and storage automation/workflow tools. In the next 2 years or more, customers likely will deploy service managers that provide the foundation platform onto which customers add additional storage management modules. SRM will also play a crucial role in the evolution of information lifecycle management (ILM), which tracks data from inception to deletion. By monitoring the availability and location of this data, SRM tools will become of the engines that drive ILM policies.

Other industry trends and customer demands should accelerate deployment of SRM tools over the next 2 years. Customers in need of a heterogeneous storage management strategy will look to SRM because of its ability to encompass storage, operating systems and servers.

Additionally, the need for a uniform management platform to manage storage devices, networks and the data itself will only increase as data centers get more complex with the emergence of blade servers, modular storage systems, and different kinds of storage networks (IP and Fibre Channel). This will also lead to further integration with server management, server provisioning and broader enterprise management frameworks. Lastly, the emergence of information lifecycle management, spawned by growing regulatory compliance issues, will drive an increase in the need to locate and monitor data. It also will provide another motivation for customers to consider classifying their corporate data, and lead to the establishment of storage classes of service and quality of service levels.

VIII. Conclusions

The shift to a storage utility model will not come overnight. It will take a staged, prototyping process to for enterprise customers to migrate their core data center storage environments to this new model. The deployment of storage resource management tools will be crucial to this migration.

Customers can immediately realize fundamental cost efficiencies by using SRM as well as see demonstrated long-term benefits. Understanding current capacity and future growth will provide financial benefits, slowing capital expenses for additional storage equipment, while giving IT executives an understanding of which business unit is consuming storage. Over a longer period of time, this awareness will translate into direct contributions from business units that will pay for usage either on a monthly, annual or budget contribution level. This will take time, and will require IT executives to educate business line management on the expenses as well as the benefits realized by this new alignment of business and IT priorities.

Finally, SRM evolved from early products that provided fancy charts that one cannot do anything about. Tools such as those from VERITAS now provide not only deep insight into the current status of capacity, availability and overall performance of the storage environment, but policies and integration with other tools to take corrective action in support of service levels.

This poses a new challenge for storage administrators: defining and organizing classes of storage and storage service levels. Storage administrators and IT decision-makers have to work to better quantify actual storage and IT costs, and share those costs effectively with business units. This means that rationalizing business usage of storage and other infrastructure will be essential as part of any migration to the storage utility model.

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