



# Request for Information Storage Virtualization Solutions

*Deadline: March 26, 2004*

*RSVP by March 10, 2004*

## Introduction

Network Computing will publish a feature story on **storage virtualization solutions** in our **June 10, 2004 issue**. A major element of this story will involve our analysis of vendor responses to a mock Request for Information (RFI) submitted on behalf of a mythical medium-size mortgage lending company, Ruthless Home Finance (RHF).

You have been selected as a vendor that RHF would likely consider as a storage virtualization solution provider. To participate, you will need to answer the questions and address issues that make up the **Deliverables** portion of the RFI. If a question is not applicable or relevant, please so indicate.

**Please note:** Products proposed in this RFI **MUST** be shipping at time of your response. No beta products, please. We reserve the right to examine a test unit (either in our lab or at a customer site) of any product submitted. In addition, any information returned to Network Computing in response to this RFI may be published in print and/or in electronic form on our Web site, [www.networkcomputing.com](http://www.networkcomputing.com).

This RFI (Request for Information) is proprietary to Network Computing and CMP Media, LLC. It is drafted and disseminated for the sole purpose of generating information on storage virtualization products for publication in Network Computing on June 10, 2004.

## Schedule and Logistics

Please respond to this questionnaire by entering information directly into this file. Feel free to attach supporting information but recognize that delivering a concise response will enable us to better focus on the key capabilities of your solution.

If you have any questions about the overall project or specific RFI questions, please contact the lead author, Jon Toigo, ([jtoigo@intnet.net](mailto:jtoigo@intnet.net) or 727-736-5367). Steven Schuchart ([sschuchart@nwc.com](mailto:sschuchart@nwc.com)) will be assisting on this project.

Please return the questionnaire to Mr. Toigo via the above e-mail address. Additional materials that cannot be submitted electronically may be sent to him at the following address:

**Jon Toigo**  
**Toigo Partners International & the Data Management Institute**  
**1538 Patricia Avenue**  
**Dunedin, FL 34698**

RFI responses must be received via e-mail, US mail or delivery service by 5 p.m. on March 26, to be included in the June 10 issue.

Vendor response:

Vendor company name: [VERITAS Software Corporation](#)

Vendor service name (if any): [Enterprise Consulting Services](#)

Vendor contact name: [Mike Dutch, Product Management](#)

Vendor contact telephone number: [+1.408.464.9185 \(mobile\)](#)

Vendor contact e-mail address: [mike.dutch@veritas.com](mailto:mike.dutch@veritas.com)

Date of submission: [2004-April-16](#)

## Grading of Vendor Responses

For each question, a numeric grade will be given based on the vendor response. The grading system will take into account the capabilities of the solution, the suitability of the solution to the hypothetical company's needs, the cost of the solution, and the completeness of the response.

### 1. Scenario

Ruthless Home Finance Co., notorious for putting late-paying customers out into the streets, has capitalized on the lower interest rates and the refinancing boom to grow its business. RHF has built a huge portfolio of home loans, and its loan processing business continues to expand more quickly than ever before in its 100 year history.

In a strategic move, the company decided to stop "shelving" its loans (holding and processing payments on loan instruments throughout the life of the note) and, instead, to begin creating mortgage-backed securities for resale to investors. To facilitate its move into the world of securities sales, RHF purchased Wishful Thinking Investments, a small financial services firm.

The surge in new business and the merger have placed a serious strain on RHF's IT infrastructure – storage in particular. Currently, key business processes and their storage infrastructure components are as follows:

1. Mortgage applications are taken via the Web. This activity uses about 4 TBs of storage provided by Sun Microsystems disk arrays directly attached to Web servers. The data itself is a mixture of changing and static information about loan programs and customer particulars. This is critical information and would represent a significant loss to the company were it to become unavailable for any length of time during the loan qualification process.
2. Internal work files used by loan underwriters and administrators are stored on network-attached storage arrays today because the volume of data outgrew the local storage on user PCs. About 4 TB of stored work files are located in private shares of SNAP NAS platforms, protected by the user's own PC logins.
3. Enterprise Resource Planning is also becoming a critical application for RHF. The ERP server has a dedicated storage array, an EMC Clariion, with approximately 6 TB capacity.
4. The pride and joy of Ruthless Home Finance is its data-mining operation. Data mining enables them to discern "value-added upgrades" that they can tack onto a mortgage loan, enabling them to net more money per customer. Several full-time data mining specialists (called "the loan sharks" internally) work in a clustered computing environment against a common data mart situated on a shared direct-attached HP storage array with about 1 TB of storage capacity. Their data is regarded as critical.
5. The company's e-mail is hosted on a Network Appliance NAS, sold to it as a one-stop-shop solution by a local reseller. It holds about 2 TB of e-mail, including SPAM (and customer complaints, which are treated the same as SPAM.) State and federal laws require that this data be retained for the life of the loan and that it be kept private and confidential unless the customer consents to its release. No one has any idea how to meet these requirements.

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6. About 4 TB of capacity is provided on a direct-attached storage array from XioTech to support the operations of the document imaging crew, which scans and digitizes loan docs so the company will have an electronic copy of the rain forest it killed to make the mortgage. This data is retained on-line for six months to deal with customer inquiries, then gets backed up to tape with the original paper documents and migrated to Salt Mine Storage Company.

7. There is a “stovepipe minicomputer system” used for mortgage loan servicing and business operations that is excluded from this discussion because of its proprietary architecture.

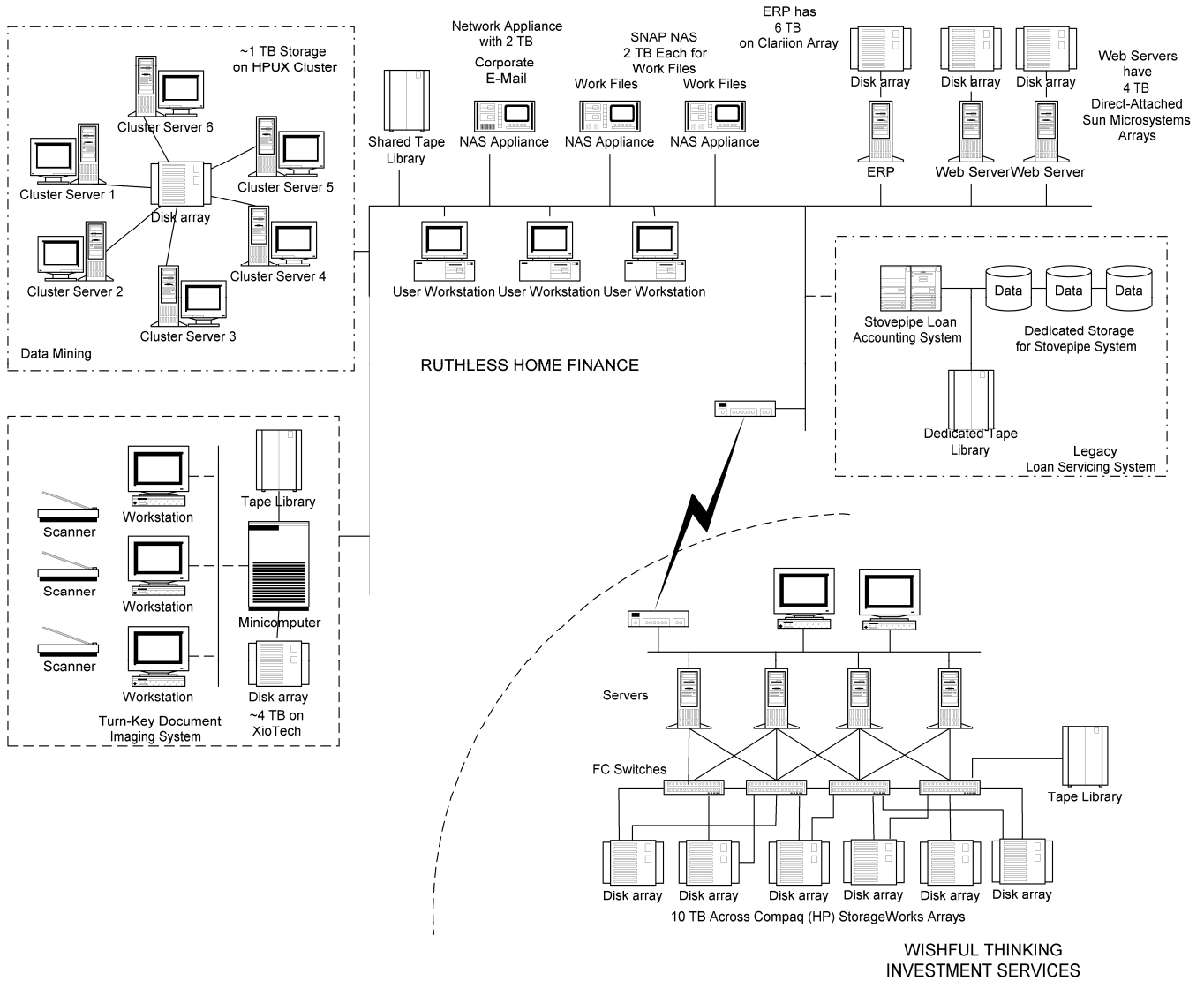
8. The newly acquired company, Wishful Thinking, uses a Fibre Channel fabric for all of its data storage. About 10 TB of Compaq/HP Storageworks storage is shared via a Fibre Channel fabric built from a cascade of small 16-port Brocade FC switches. Ruthless bought the company in part because of the expandability of FC SANs. However, the Wishful Thinking SAN has reached a limit to growth based on its use of small switches. No additional nodes may be added to the SAN.

RHF’s CTO has held off on implementing virtualization technology for several years because of the negative press and commentary surrounding the technology. Recently, he has been reading success stories involving virtualized storage environments and thinks that it might hold promise as a way to manage his varied infrastructure more efficiently so that storage is allocated to applications that need it dynamically. He is wondering how well virtualization solutions can work with his heterogeneous storage equipment and mixed storage topologies (direct-attached, NAS and SAN). Specifically, he is seeking to use virtualization to:

1. Automate capacity allocation, so he gets better use out of the capacity he has.
2. Augment data security, so that only those with permissions to files and datasets have access – this is basically to satisfy pesky regulators within the Federal Financial Information Examination Council.
3. Improve data protection by automating data replication as a function of virtualization and provide easier access to disk and tape assets at both RHF and Wishful Thinking.
4. Integrate different storage assets and establish a multi-tiered storage infrastructure that will deliver better capacity utilization efficiency.

Assume that the management of RHF has money to spend on the right solution, provided you can argue a sensible business value proposition. The company is currently considering the deployment of a second SAN to handle e-mail, ERP and data mining. RHF was considering an EMC-based solution until problems surfaced regarding its ability to interoperate with the Compaq/HP SAN already deployed at Wishful Thinking. The IT manager wonders whether virtualization could enable the two non-compatible SANs to work together.

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Here is a high level diagram of the current infrastructure at Ruthless Home Finance/Wishful Thinking Investment Services.

## 2. System Architecture

Provide an overview of your virtualization architecture, including topology requirements, location of virtualization services, scalability features, performance attributes, high-availability features, and management capabilities. Please describe how heterogeneous storage is included in your solution.

Ruthless Home Finance Co. is challenged with rapidly growing profitable services using a heterogeneous IT infrastructure assembled from tactical solutions and by its recent strategic acquisition of Wishful Thinking Investments. Leveraging its substantial investment in IT to better align with its business goals is further complicated by regulatory compliance issues. VERITAS proposes a comprehensive partnership with the company to plan, deploy, and support a flexible solution that will increase the company's competitiveness by allowing it to better adapt to change.

Like many rapidly-growing small companies, Ruthless Home Finance (RHF) has outgrown its current IT infrastructure. Unless changes are made, RHF faces several problems, including:

- **Rapid Data Growth.** The successful business model used by ruthless is generating a great amount of data. This data must be stored on expensive disk, backed up, processed, and moved to different applications in the network. As this data grows, these processes become more time consuming and more expensive.
- **Regulatory Compliance.** In addition to storage space and administrative overhead, the nature of the data recorded at RHF forces them to protect and archive it in compliance with recent laws governing the privacy of customer data and the lifespan of financial data.
- **Heterogeneous Hardware.** RHF's segmented applications as well as their recent acquisition of Wishful Thinking Investments (WTI) have created an environment with heterogeneous servers, storage devices and applications. As data continues to grow, managing these independently becomes more problematic. If RHF continues without a mediation layer that supports all operating systems and storage devices, they must maintain a support matrix for each combination of host and storage types (M\*N) rather than a support matrix for each host and storage type (M+N).

Clearly, these problems are significant and won't be solved instantly. VERITAS proposes a comprehensive partnership with the company to plan, deploy, and support a flexible solution that can be implemented in stages as RHF has the time and resources.

**Initial planning** efforts will focus on understanding the processes and organizations involved in providing IT services to the business units and identifying any gaps or mismatches. The near term solution will relieve pressing technology pain points and lay a strategic foundation for adding value-add services over time. An **intermediate** term solution raises visibility into resource consumption, allowing the infrastructure to be aligned with overall business priorities, rather than sub-optimized in application islands. The **long-term** strategy is to assure that best practices are implemented to manage IT complexity while providing quality service in an affordable, manageable, and secure environment.

The planning phase, whether achieved in-house or with the assistance of VERITAS, assesses the current environment so best practices can be established and automated while prioritizing pre-requisites, business value, and risk mitigation. While Italian economist Vilfredo Pareto was referring to wealth distribution in 1906, his 80/20 principle suggests that addressing the "low hanging fruit" with storage virtualization software may provide the biggest "bank" for the buck. In product terms, "storage virtualization software" includes the products in the VERITAS Storage Foundation™ (VSF) family.

### Near-Term Plan

The near term plan establishes the physical infrastructure to consolidate application islands and maximize the scope of installation policies to ensure responsible consumption and reliable service delivery. While tactical software upgrades could benefit specific applications, the customer can achieve greater benefits over time by building upon an architecture that can grow with and adapt to changing business requirements. Building upon the experience of Wishful Thinking Investments, Ruthless Home Finance can familiarize its staff with processes that leverage a networked storage environment. Recognizing that the distance between its locations is not sufficient to recover from local disasters, it will extend its relationship with Salt Mine Storage Co. to implement a disaster recovery and regulatory compliance plan.

### Intermediate-Term Plan

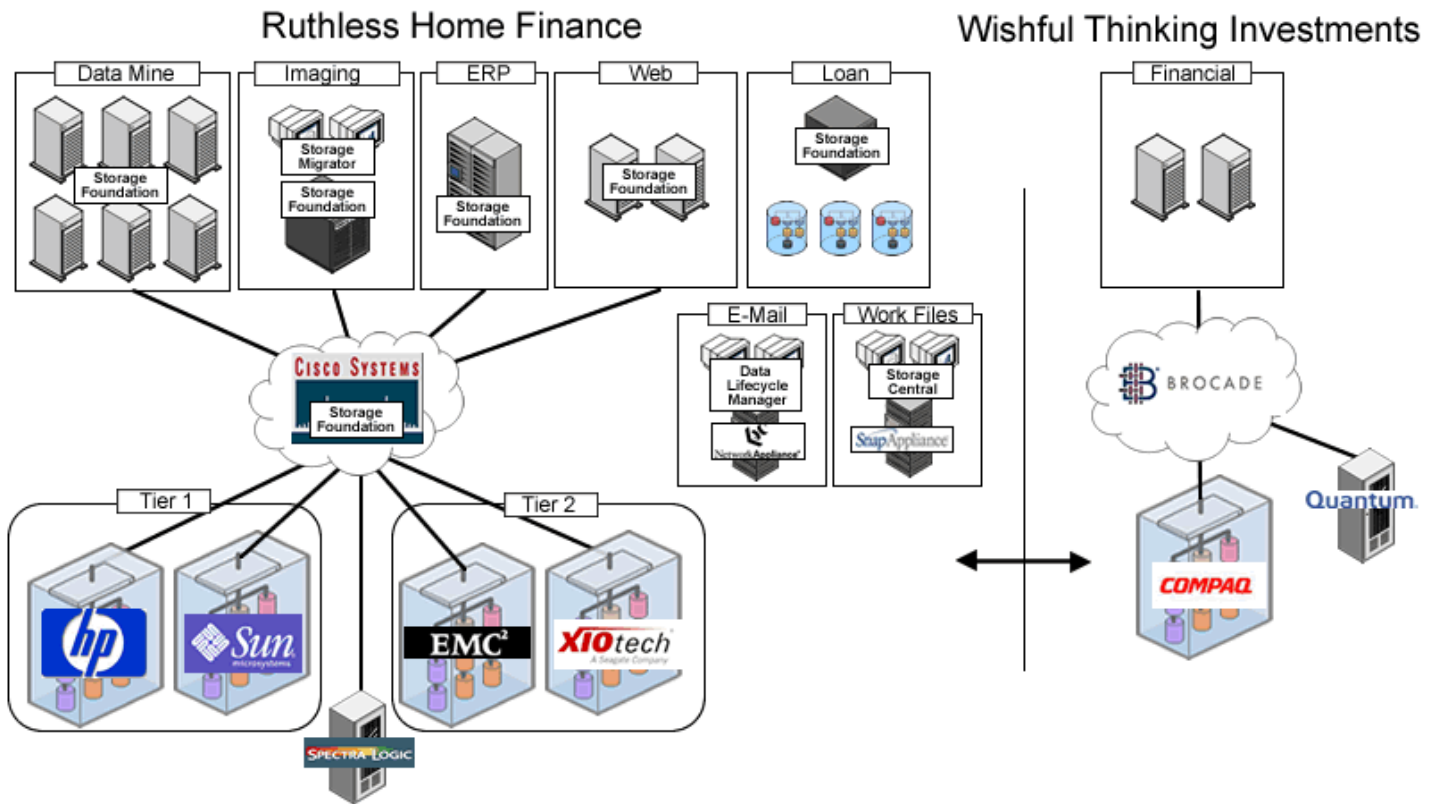
The intermediate term plan phases in additional capabilities to optimize specific applications within the context of overall business priorities and product availability. The controls and processes refined previously can now be automated, freeing skilled staff to focus on strategic initiatives, often building morale by offering more rewarding activities. The disaster

recovery and regulatory compliance plan is enhanced using host-based and network-based technologies to resume critical business operations through more rapid application failover and data recovery.

**Long-Term Strategy**

The strategic roadmap optimizes the use of heterogeneous computing, networking, and storage components to deliver flexible and accountable IT services that are aligned with business operations. VERITAS provides software for virtualization, centralized management, and service level attainment, developing a strategic partnership with each customer to become their trusted advisor.

The following diagram illustrates the physical infrastructure recommended for the near-term. SAN-attached applications are depicted with a shaded background while NAS-attached applications are connected to the filers by a thin black line. The legacy loan servicing “stovepipe” system is not shown though if it uses SCSI storage, consolidation within the SAN is feasible if the customer acknowledges the risk of supporting a system that has not been fully tested and qualified for support.



A Cisco MDS 9509 Multilayer Director is introduced at the Ruthless Home Finance data center to pool and tier storage for the critical web services, enterprise resource planning, and data mining applications. Storage used for document imaging applications will also be placed on the storage network and if desired, the proprietary stovepipe system can be consolidated as well. VERITAS Storage Foundation™ for Networks (VSN) virtualization software operates within the network to provide virtual LUNs to the application servers. VSN operates on 32-port Advanced Services Modules (ASM) within a Cisco MDS 9000 fabric (reference: <http://www.cisco.com/en/US/products/hw/ps4159/ps4358/index.html>).

VSN is highly scalable, highly available, with negligible performance impact relative to whether virtualization is used. There are no architectural scalability limits though licensing restrictions currently restrict access to 32 hosts per ASM. Although VSN offers the simplicity of an in-band approach (from the application host perspective) it achieves the performance benefits of an out-of-band approach by distributing processing throughout the intelligent fabric. Customizable service groups provide transparent (to applications) failover of services to any other ASM in the fabric should hardware fail. SAN management capabilities are integrated within the same storage administrator GUI used to configure virtual storage. All leading enterprise arrays from EMC, IBM, HDS, HP, and Sun have been fully qualified as well as generic JBOD

support. Mid-range storage arrays from these vendors will be fully supported during 2H04 when Active/Passive array support is qualified. In the meantime, mid-range arrays may be used in JBOD mode, with HA provided by mirroring across enclosures.

The NAS environment includes the loan work files stored on SNAP NAS (for example, a Snap Server 4500 and two Snap Disk 10 arrays) and the electronic mail stored on the Network Appliances filer. While these applications could also be consolidated by migrating the NAS backend storage to the SAN environment, using the VERITAS file system, such complexities are not essential in the near term when potential organizational resistance to the new environment could reach its peak.

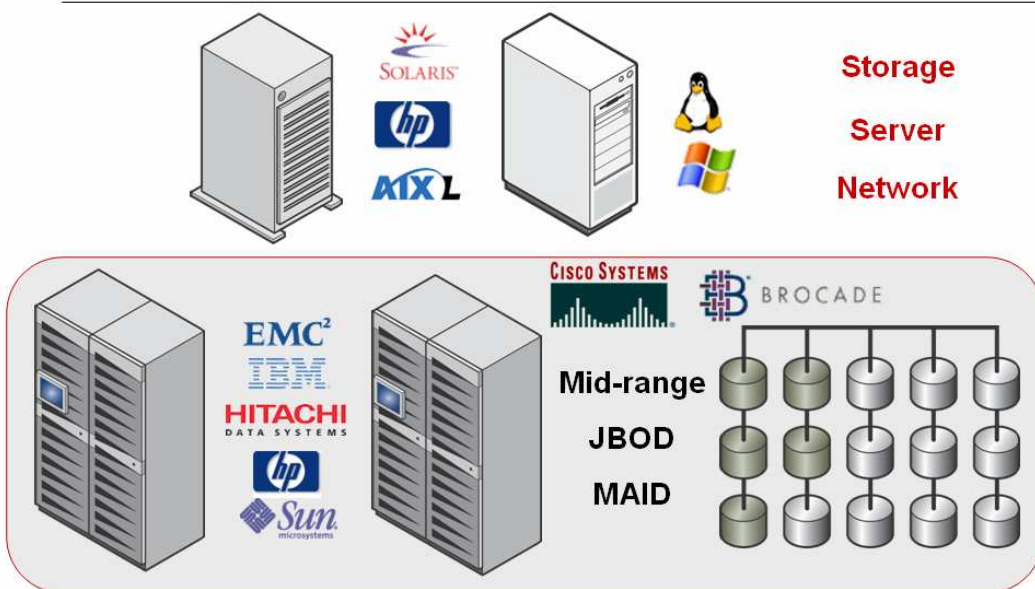
This proposal provides solutions to enhance revenue and profitability while protecting and securing the information critical to operating the business.

- Optimize performance and availability of the web servers, ERP, and data mining applications will allow the company to rapidly process high volumes of mortgage applications and improve the timeliness of its profitable business intelligence activities.
- Improve resource utilization through more flexible LUN configuration and provisioning will postpone future storage acquisitions and prevent application impacts that would have resulted from space constraints within the islands.
- Leverage skills in a centralized and consistent management interface across different servers, storage devices, and intelligent networks will allow IT staff to manage more storage and reduce the need for platform-specific skills.
- Automate mundane error-prone tasks using relocation policies (“quality of storage service”) and template-based allocation (“intelligent storage provisioning”) will further enhance productivity as staff are freed to work on more strategic initiatives such as refining business continuance and regulatory compliance policies and procedures.

### Storage Virtualization

The S.N.I.A. defines virtualization as “integrating one or more (back end) services or functions with additional (front end) functionality for the purpose of providing useful abstractions”. While block aggregation provided by volume managers and file systems providing name space mapping are often included within “storage virtualization” definitions, many other capabilities are provided by the VERITAS Storage Foundation product family. Virtualization in the server optimizes application availability and performance and automates service level attainment. Virtualization in the network improves interoperability, insulates application servers from disruptive events, and virtualizes enclosures and SCSI targets as well as storage capacity. Virtualization in the storage subsystem aggregates disk blocks in a single enclosure to heterogeneous hosts. Each solution brings unique value to the customer and when used together enables building a storage utility to simply storage management and lower total costs. The following diagram illustrates storage virtualization operating at multiple levels (put the presentation that accompanies this document in slideshow mode, reading the embedded notes).

## Storage virtualization



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Storage virtualization software on both the application server and in the network is recommended. Host software provides the intelligence to optimize applications according to installation policy while network software performs data-intensive operations and decouples business application decisions from information technology schedules. While storage virtualization is readily associated with the operation of aggregating blocks of storage into useful objects such as logical units, volumes, and file systems, the value of naming these objects is often overlooked but allows data to be moved to different devices without application downtime. Virtualizing storage for direct-attached storage environments is also provided by host software. Storage provisioning services include optimizing the use of resources (striping, re-size, re-layout), online media protection (RAID, hot sparing, hot relocation), file system and database integration, and server-based multipathing for path failure protection and path load balancing. Server-based virtualization software also provides data migration into and out of network-based virtualization while applications are accessing the data.

Network software extends virtualization to enclosures, ports, data paths, and command sets, providing opportunities to reduce costs and improve availability not previously available. For example, some serial testing activities can be performed in parallel by sharing one or more heterogeneous physical devices when the test activity requires an apparently dedicated device. Applications that require specific SCSI commands can now use storage that was not previously usable. A practical example of this is that Oracle RAC (which requires SCSI-3 persistent group reservation) can be run with any storage device supported by VSFN -- even those that do not implement PGR such as legacy enterprise storage (HDS 7700E) or even JBOD. Virtualizing the entire device offers many other useful capabilities that offer value to a datacenter. For example, you can create as many LUN 0 devices to boot from as you would like. Simulating a rolling disaster can also increase confidence that business continuance plans are credible. The impacts of pulling a cable or losing an entire storage enclosure can be tested remotely by simply deleting a virtual target or a virtual enclosure, thereby injecting transport and SCSI level errors. The above digression was intended to clarify why some capabilities not normally thought of as storage virtualization are included in the recommendations below.

The **web servers** used to accept mortgage applications can benefit from host and network software. While VSFN masks physical device limitations, VERITAS Storage Foundation™ for Databases optimizes application performance, availability, and management flexibility. Raw disk databases (Oracle, DB2, and Sybase) may be converted-in-place to use the VERITAS extent-based file system to eliminate downtime typically associated with expanding raw databases. Creating the file system on top of volume sets allows the database to be partitioned so more frequently used data is kept on storage with higher performance capabilities. Quick I/O and Cached Quick I/O can also be used to bypass file system locking and buffering to further improve performance. Storage mapping enables database objects to be mapped to physical disks, enabling performance hot spots to be detected and corrected. Other VERITAS products could also be used to optimize performance and availability such as VERITAS Cluster Server Traffic Director which can manage incoming IP traffic based on content and service group requests, but these are outside the scope of storage virtualization.

The **ERP** system can be used to enhance profitability of the company by reducing costs and increasing staff productivity. While VSFN eliminates single points of device failure and the impact to application servers of disruptive storage events, the same virtualization software used on the web servers, VERITAS Storage Foundation™ for Databases, can also be used to pool and tier storage as well as optimize application availability and performance.

Storage tiers allows the Quality of Storage Service specified in a service level agreement to be automated. A relocation policy allows files to be transparently relocated to another tier of storage based on size, reference, or update patterns. Files are subsequently accessed directly from the new storage tier, instead of recalling it to the original tier as in hierarchical storage migration. QoS allows the company to reduce costs while satisfying expected services levels.

As you will notice in the diagram, we recommend segmenting the storage into two tiers. This allows RHF to use the Quality of Storage Service feature in VERITAS Storage Foundation to move frequently accessed files to the higher tier, while migrating less-frequently accessed files to the lower tier of storage. This migration of files is done in a completely transparent way to the application, database and end-user. Files are automatically moved to the most appropriate storage device without any disruption. Users and applications continue to access the files through the same directory path. The relocation policies can be set to move files based on age, size, owner, date last accessed or file name. Files are subsequently accessed directly from the new storage tier, instead of recalling it to the original tier as in hierarchical storage migration. This feature allows RHF to save space on the high-end storage arrays by moving less-critical files to cheaper classes of storage.

### *Reducing Unplanned Downtime*

Availability can be enhanced using the HA version of the product which supports application failover as well as the media protection capabilities previously mentioned. Downtime for database backups can also be reduced by using copy-on-write file system checkpoints. Server-based dynamic multipathing improves performance by load balancing and eliminates an HBA from being a single point of failure. However, path failures to physical storage devices are hidden from server-based multipathing solutions *when* network-based storage virtualization is used. Network-based multipathing provides recovery of such path failures while it insulates the application server from intrusive path recovery scenarios.

### *Reducing Planned Downtime*

Downtime for database backups can also be reduced by using copy-on-write file system checkpoints. These checkpoints allow RHF to take instant copies of the database or file system. That copy can be used for backup or off-host processing applications. And, since Storage Foundation virtualizes storage from multiple vendors, data that exists on an expensive storage array can be mirrored to a less-expensive array for these snapshots. Again, this allows RHF to save space on expensive storage arrays, and is an included feature of VERITAS Storage Foundation.

Server-based dynamic multipathing (DMP) improves both performance and availability. We recommend that RHF turn on the DMP feature included in Storage Foundation. This balances I/O across all available paths between the server and the storage device. Not only will this improve performance, but it will also automatically move I/O to an available path if one of the paths is disconnected.

The **Data Mining** application's focus on identifying value-added mortgage upgrades can be enhanced by increasing the timeliness and currency of the information replicated to the HP-UX cluster data mart. [VERITAS Storage Foundation™ Cluster File System](#) can improve performance by enabling load sharing between the servers in the cluster accessing the datamart. Each server can directly access the same files at the same time. Intelligent range locking and I/O fencing ensures that data remains consistent. In addition, like all Storage Foundation products, storage can be provisioned and resized online using company-defined standard templates, transparently allocating data to the appropriate tier of storage.

Snapshots, used to reduce datamart outages and refresh data from operational databases, are available at the file-level (space-saving storage checkpoints using copy-on-write technology) and the LUN-level (created in the network using VSFN, enabling servers to handle more data mining workload). The HA version of the product also incorporates [VERITAS Cluster Server™](#) to automatically and proactively monitor, restart, and manage up to 32 nodes from a single console.

Portable Data Containers, available in Storage Foundation further speed the access of data at the datamart. Portable Data Containers are a feature that allows data to be accessed directly by different operating systems. Therefore, the snapshot of data taken from Web Application running Oracle on Solaris can be directly accessed by the HP-UX servers. Storage Foundation automatically handles data conversion. Not only does this eliminate the need to do a full backup and restore to move the data over to the new operating system, but it also reduces the amount of disk required for transporting this data. Only one copy, instead of two (plus a copy on tape) is required. This capability, currently available on Solaris, will be available on the HP-UX platform in 2005.

The **Document Imaging** workload can also be optimized for performance, availability, and service level automation using the same techniques as for the other applications attached to the storage network. We also recommend implementing the same Quality of Storage Service feature that the ERP system will be using. This feature keeps the most recent images of documents stored on high-performance disks. As the document becomes older, and less valuable, it can be moved to the tier two disk. Finally, using [VERITAS Data Lifecycle Manager](#) (Windows) or the [VERITAS NetBackup Storage Migrator](#) (Solaris, HP-UX, Irix, Windows, Exchange), the image can be migrated to tape which keeps RHF in line with regulatory compliance laws. This migration between the two disk tiers and off to tape is done seamlessly, without changing the way the users or applications access the files. This process augments the current archival of tapes and original documents to the Salt Mine Storage Company for records retention purposes.

The **Financial applications** at the Wishful Thinking Investments location already leverage a dual Brocade fabric storage network to maximize Wintel server access to a 10 TB HP/Compaq disk storage pool with data backed up to Quantum tape libraries. Bridging the data centers of RHF and WTI will facilitate information sharing and better compliance with company policies but in the near term organizational relationships will be nurtured by sharing WTI expertise in deploying storage networks at RHF. [VERITAS Volume Replicator](#) could also be used to replicate data between locations if fabric interoperability was in question or if electronic vaulting was selected to improve their current data protection strategies.

Two other approaches are also viable to consolidate the storage networks stated to have compatibility issues. One approach is to standardize on a single fabric, in this case Cisco since no additional nodes may be added at the WTI site. Although technically practical, there is more incentive to protect existing investments in resources, skills, and procedures, and to use a multi-vendor purchasing policy to achieve the most favorable terms for new products and services. For this reason, [VERITAS Storage Foundation™](#) will be used in the near term to optimize performance and availability as described previously though the benefits of tiered disk storage will not be available as long as only a single storage device type is available. In the intermediate term, next year, the storage virtualization capabilities of this solution will be enhanced to allow consolidation of storage networks currently managed as islands because of limitations posed by incompatible hardware devices. This “SAN-VM” technology separates the I/O access path used to access data from the paths used to communicate metadata and centrally manage the storage configuration, providing a foundation to provide the following features:

- Offload configuration tasks from application hosts to management servers
- Manage data center-wide policies (as opposed to single host policies)
- Increase media utilization by letting volumes from multiple hosts aggregate blocks in the same disk group
- Offload data movement from application hosts to another server or the network
- Minimize application server upgrades by leveraging features deployed on management servers

The **Legacy Loan Accounting System** using proprietary hardware need not remain a stovepipe if the system uses standard SCSI protocol to access its external disk storage and offers economical attachment to the storage network. Of course, consolidation within the SAN is only feasible if the customer acknowledges the risk of supporting a system that has not been fully tested and qualified for support. From a technical perspective, VSFN can support even proprietary platforms because it does not operate on the application server, rather it appears as a disk array exporting LUNs.

The **Electronic Mail Server** hosted on a 2TB filer from Network Appliance suffers from large volumes of SPAM that sap productivity from staff processing loan-related email and exposes the company to security exposures. Regulatory compliance demands that loan-related email be kept private and archived for the life of the loan. [VERITAS StorageCentral™ : Network Appliance Edition](#) can block (“file screening” in NetApp parlance) inappropriate file types such as MP3s, scripts, and viruses, removing data that might otherwise consume space or be archived needlessly. Media utilization can also be improved with quotas, automated file clean up, and usage reports for capacity planning purposes. While StorageCentral can help identify specific file types, the company’s data protection products assume the role of implementing the appropriate security and archival policies. By using [VERITAS Data Lifecycle Manager](#) RHF can efficiently use the NAS storage by archiving old email, deleting SPAM and delete duplicate attachments.

The **Loan Work Files** stored on 4 TB of SNAP 4TB NAS would benefit from being centrally managed so a company-wide data protection strategy can be implemented. While support for SNAP and NTAP NAS storage is provided by [VERITAS NetBackup](#), RHF is using other procedures for protecting its filer data.

### Management Services

Finally, a single management and reporting service is needed to ensure that the most critical applications are meeting service levels and that the less-critical applications are not dominating resources. Therefore, VERITAS recommends that RHF implement VERITAS CommandCentral Service. CommandCentral Service monitors storage utilization as well as storage functions such as backup operations. Using CommandCentral Service, The resources at RHF can be divided into lines of business, with specific service-levels and costs associated with each resource. CommandCentral Service can then report on the usage of each resource, providing both business-level and technical reports that indicate the cost of each service.

In addition, CommandCentral Service provides a portal through which application owners can request additional storage or services. These requests follow a simple workflow to notify the IT administrators to make the changes. If desired, the cost of the service can be charged back to the requestor.

### Additional considerations:

While not directly associated with Virtualization, there are a few other storage-related technologies that could help RHF.

- The distance between RHF and WTI is not far enough to provide a true DR site, but it can be used to provide local clustering and availability. The majority of outages are localized, so implementing clustering and mirroring between

the two sites would significantly improve availability. Beyond that, we would recommend using VERITAS Volume Replicator to replicate data over any IP network to provide true disaster recovery. Since it does not appear that RHF has operations in another geographical location, we would recommend co-locating the disaster recovery site.

- Certain critical database and web applications at RHF may benefit from performance monitoring utilities. VERITAS offers an integrated suite of products that can monitor and correct performance problems. These products work closely with and leverage the Storage Foundation product family.

### 3. Heterogeneous Device Type Support

**Please describe the range of storage devices you support with your solution as related to RHF's needs. Be as specific as possible regarding both device platform and models supported. If you do not list a specific platform identified in the current system drawing, we will assume that you do not support it, (Please note that the Wishful Thinking SAN is a dual fabric deployment.)**

VERITAS virtualization software supports all server, disk, and tape library platforms listed in system drawing. Interoperability matrices for hardware (HCL) and software (SCL) are available at <http://support.veritas.com>. Network hardware interoperability for currently available VERITAS Storage Foundation™ for Networks (VSN) platforms is available [here](#). The Cisco MDS 9000 Family Interoperability Support Matrix is available [here](#).

Virtualization in the network reduces the M host types X N storage device types interoperability matrix.

**Specifically, please address the role that your virtualization solution can play in redressing SAN interoperability obstacles. Clarify what you can do to support heterogeneous SANs such as the EMC SAN and Compaq/HP SAN scenario envisioned by RHF IT management.**

Use dual fabric to eliminate a fabric as a single point of failure. Using different fabric vendors improves affordability through competitive pressure. Configuring each fabric using equipment from a single vendor ensures supportability.

### 4. Support for Platforms-In-Place

**While RHF is considering the deployment of a second SAN to host data for ERP, email and data mining, they wish to keep some direct attached arrays and NAS platforms in place. Identify how these platforms could be integrated into your virtualization solution (if at all) so that a rip-and-replace strategy is not required.**

Because Storage Foundation can operate in both the network and on the application host, the benefits of virtualization can be realized by both the SAN-attached applications as well as those that will continue to be direct-attached.

Every operating system and application that is currently in place at RHF can be supported by VERITAS Storage Foundation. Therefore, upgrades can be done over time. In addition, when it comes time to move certain applications to the SAN, Storage Foundation can simplify the process of consolidation through the use of Portable Data Containers. This technology allows data that has been created on one operating system to be migrated and accessed by another operating system.

Finally, the Quality of Storage Service feature in Storage Foundation makes storage consolidation easy as well. If a new storage array is required, QoS can dynamically moves the files to the new storage array without any downtime or change in the way the users or applications access the files. The older array can then be repurposed for other activities.

### 5. Support for Data Protection Strategies

**RHF wants to leverage its existing investment in tape library technology, as well as its legacy disk platforms, to provide enhanced data protection. But it is concerned about some of the stories it has heard about conflicts between virtualization software and data replication, mirroring and tape backup and restore software. Please explain:**

1. **How your solution would enable disk-to-disk data transfers and what impact these transfers would have on application, LAN and SAN performance.**

Point-in-time copies (split mirrors, instant full volume snapshots, instant space-saving snapshots) created on the host or in the network can be used to source backup or recovery operations. NetBackup Advanced Client 5.0 is particularly useful for managing snapshot versions.

Storage Foundation provides a number of options for disk-to-disk data transfers. These transfers can be throttled to accommodate the available LAN and SAN bandwidth. For example, RHF could choose from any of the following disk to disk transfer methods:

**Full Volume Snapshots.** This creates a full copy of the data, then snaps the data off so it can be used by another server or application. These snapshots require double the disk space but are very reliable. In addition, once a full copy is made, Storage Foundation only resynchronizes the changed blocks of data for faster data refresh and minimal I/O on the network.

**Space-Optimized Volume Snapshots.** This takes an instant snapshot of the data, but uses copy-on-write technology to only copy the changed blocks of data. As the name infers, this reduces the amount of disk space as well as network traffic.

**File System CheckPoints.** Similar to the space-optimized Snapshots, File system checkpoints take an instant snapshot of the data, but uses copy-on-write technology to only copy changed files. In addition to the space and time advantages, these snapshots are full read/writable, therefore the CheckPoint can be backed up, used for a development environment or used for file versioning. Since these checkpoints are simply stored in a new directory in the file system, users can restore their own files without requiring the backup administrator to find the file on tape.

Each of these snapshot technologies is available in the Storage Foundation product. They are managed from the same interface and they support all major operating systems and storage arrays.

In addition, these snapshots integrate with VERITAS NetBackup 5.0. If RHF decides to move to NetBackup in the future, they can initiate and recover these snapshots directly from the Netbackup console.

The mirroring and replication features in Storage Foundation are equally friendly to device heterogeneity. Data can be mirrored and replicated between different storage types. In order to preserve network bandwidth, replication over an IP network can be throttled using asynchronous data transfer.

2. **How your solution will support tape backups and restores and what impact would accrue to using your virtualization software in conjunction with backup and restore software from Bakbone, RHF's current provider, and Legato, Wishful Thinking's current backup provider. Tape libraries are from Spectra Logic at RHF and Quantum at Wishful Thinking.**

VERITAS Storage Foundation includes a file change log that keeps track of what files changed (or were deleted), when they changed, and how they changed. This log is available to any backup vendor. Therefore, the time it takes to scan the file system (often the slowest part of a backup operation) can be almost eliminated.

This log tracks changed and deleted files with negligible server overhead. Backup software scripts can use this information to initiate incremental backups rather than scanning files to determine what needs to be backed up.

Of course, VERITAS recommends eventually replacing RHF's current backup providers with NetBackup, but our Storage Virtualization software works equally well with Legato and Bakbone.

Storage Migrator, which will be used to migrate files from the tier two storage out to tape supports the existing tape libraries RHF uses.

3. **How your virtualization solution could enhance data security and prevent unauthorized access.**

The Cisco MDS 9000 family provides a comprehensive security framework, ideal for enabling physical consolidation while allowing for complete insulation using virtual fabrics, known as VSANs. The familiar industry standard fabric zoning capabilities are fully supported within each VSAN. VERITAS Storage Foundation™ for Networks leverages VSANs by insulating the physical storage pool from the virtual storage provisioned to consuming applications. Standard LUN security (zoning, LUN binding/mapping and LUN masking) features support the virtual ports and virtual LUNs. The SAN Management capabilities integrated within the VSFN product graphical user interface (as well as in the [CommandCentral Storage](#),/ [SANPoint Control](#) management products) also fully support these LUN security features for these virtual objects.

The Cisco MDS 9000 family also supports RADIUS authentication, SNMPv3, role-based access control, Secure Shell Protocol (SSH), Secure File Transfer Protocol (SFTP), Fibre Channel Security Protocol (FC-SP), hardware-enforced zoning, LUN zoning, read-only zones, ACLs, port security, and VSAN-based access control.

VERITAS Storage Foundation also support file system permissions and with the introduction of SAN-VM technology, volumes can be attached to heterogeneous hosts simultaneously as R/O, R/W, Exclusive R/O, and Exclusive Write.

## 6. Return On Investment

Like many organizations, RHF is increasingly focused on analyzing return on investment (ROI) for new technology initiatives. Please provide a brief overview of how you think virtualization in general, and your solution in particular, can deliver compelling return on investment for an organization like RHF that is attempting to improve capacity allocation and utilization efficiency on its storage infrastructure without increasing staff headcount. Include any in-house ROI models that you share with prospective customers. If you have more in-depth white-papers available on this topic, please include them as supplements to your RFI response.

While it is difficult to calculate the exact return on investment without knowing additional details regarding RHF's infrastructure and operating expenses, VERITAS estimates ROI will come in at least five ways:

1. **Increased Storage Utilization through disk pooling.** By virtualizing disks in a SAN environment, unused disk space at RHF can be allocated to other applications. Better visibility into storage usage will also lead to a reduction in lower hardware costs due to the reduced need to over-provision storage.
2. **Reduced cost of disk with tiers of storage.** The Quality of Storage Service feature in VERITAS Storage Foundation moves older files from expensive disks to less-expensive disks. This will allow RHF to defer the purchase of expensive storage arrays.
3. **Reduced operating expenses with a common management framework.** Since VERITAS Storage Foundation works every major array and operating system, the IT administrators at RHF can become familiar with a common management framework for every host and operating system. There is no need to learn a different interface for snapshots, replication, mirroring, virtualization, etc on every different platform. Simply use a single interface for all functions on all operating systems.
4. **Increased negotiating leverage with hardware vendors.** By using VERITAS software, RHF is not locked into a proprietary operating system or disk array. They can negotiate for better prices from all vendors.
5. **Reduced application downtime.** Operations at RHF will stay online all the time through the use of storage and application availability. Storage Foundation HA includes technologies that not only provide storage availability, but also clustering technology to recover from application and database failures.

To illustrate these points using real-world examples, the Yankee Group recently completed a study of three large VERITAS customers using VERITAS Foundation Suite (former name for Storage Foundation). The study is attached, and the key findings are listed below:

### Government Agency

- 204% ROI
- 15-Month Break-even Point
- 25% reduction in time spent on storage management tasks

### Service Provider

- 201% ROI
- 11 Month Break-even Point
- Employees Devoted to SAN Management Cut from 12 to 3
- 29 System administrators segmented by operating system combined into a single team of 12 administrators for all operating systems.
- Storage Administrators able to do same task in 50 percent of the time.

- 99.999 percent Server Uptime, 100 percent SAN Uptime
- Saved 10 TB of EMC Storage

#### **Financial Services Company**

- 205% ROI
- 13 Month Break-even Point
- Storage utilization increased from 25 percent to 85 percent
- Administrator productivity increased by 50%
- Estimate one minute of unplanned downtime per year

A 200% return on investment is not unreasonable based on the estimated costs and benefits detailed in the accompanying spreadsheet.

## **7. Cost of Ownership**

**Provide a detailed description of your product/service pricing. This should include cost of devices (where applicable), cost of software, cost of deployment services, and recurring support/maintenance costs. If your product has unique attributes that are specially aimed at minimizing total system cost of ownership, please describe them.**

The VERITAS Storage Foundation family of products is designed to reduce TCO by integrating all key storage management features in a single family of products. There is no need to purchase, maintain and be trained on dozens of different interfaces for every operating system in an environment.

Unlike many competitors, VERITAS Storage Foundation integrates all major virtualization functions (disk pooling, replication, file system, snapshots, multipathing) in a single product, reducing the license, maintenance and training costs for RFI.

The attached spreadsheet lists the price points for the various components that make up VERITAS' proposed solution, including maintenance, support, consulting and education.

## **8. Support Services**

**Describe the full range of support services provided by your organization, including pre-implementation planning, implementation services, product training, and ongoing product support services. Please be as specific as possible regarding services provided, including a description of additional costs if they haven't been explicitly addressed in section 7.**

VERITAS offers a full range of [support](#), [education](#) and [consulting services](#).

**Support:** Customers can choose from VERITAS Support services that are available as complete, around the clock, 365-days a year technical assistance as well those that are for business-hours only. We also offer web-based support and provide free, moderated discussion forums for customers to help each other.

**Education:** VERITAS offers education and certification for all products. Courses range from web-based tutorials to full week-long technology classes.

**Consulting:** VERITAS focuses on three areas of consulting. These three areas reflect the typical lifecycle of bringing new data availability technology into your business. This framework allows you to enter at any point in the cycle, giving you full control over services when you need them. Pricing for VERITAS consulting services can be seen above. However, our virtualization products do not typically require extensive consulting engagements.

1. **Assess and design** - Assesses IT infrastructure and solution integration issues. Our Design services define the architecture of your desirable data availability environment.
2. **Delivery** - Applies best practices to get the VERITAS products in your operation up and running quickly and efficiently.

3. **Optimization** - Keeps the VERITAS technology in your business running at optimum performance levels and offer extensions to the functionality of your VERITAS solution.

VERITAS announced on May 3, 2004 the extension of its global services offerings with the formation of four consulting practices that include: disaster recovery, storage management, application performance management and utility computing. Consulting services are intended to complement existing professional service and technical support offerings to ensure that customers can fully realize the promise of utility computing and the cost and productivity benefits that accompany aligning IT services with changing business needs.

VERITAS consulting services are available to customers through their sales account managers and cover the following areas:

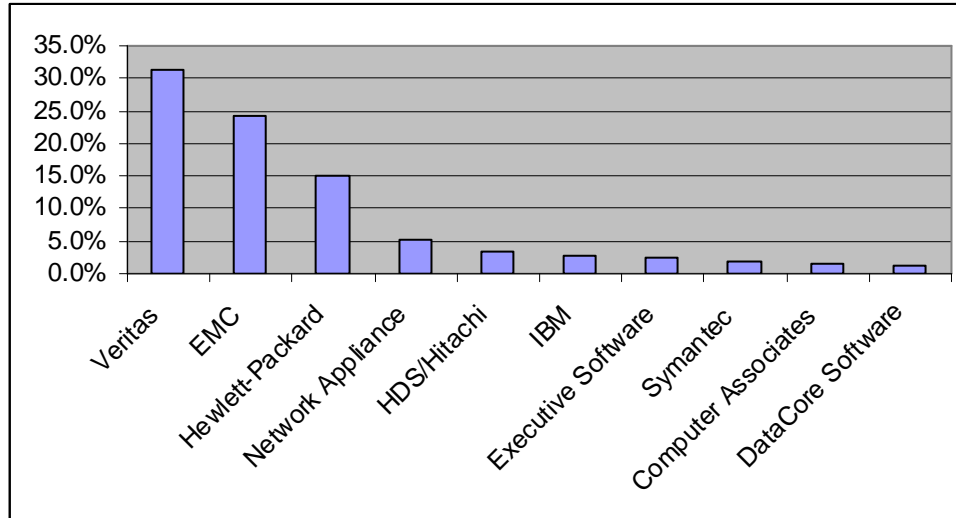
- Disaster Recovery – Certified disaster recovery professionals along with engineers and architects consult and advise in the development of comprehensive Disaster Recovery Programs that minimize the impact of unplanned downtime.
- Storage Management – Professionals consult and advise in identifying sub-optimal areas of storage service and offer product independent reference models for benchmarking. They facilitate the development of open architectures, processes and organizations that optimize the use of existing resources and lay the foundation for evolving to a utility computing infrastructure.
- Application Performance Management – Professionals consult and advise in identifying mission critical application performance bottlenecks, ensuring immediate improvements are recommended and implemented to improve user satisfaction and productivity. In addition, alerts and reports are created to identify trends before they become problems to save both time and money while avoiding future slow downs.
- Utility Computing – Professionals consult through executive and technical workshops to baseline IT assets and conduct operational assessments that benchmark operational efficiency to determine class of IT service across the areas listed above. The utility transformation program includes program management to execute a pragmatic “building block” approach to the deployment of service level agreements and the metering and charge back of IT services.

## 9. Market Positioning

**Describe how your product fits into the overall storage virtualization market. We encourage you to provide explicit comparisons with competitive offerings and to include any competitive feature matrices you may have.**

As one of the pioneers of storage virtualization software, VERITAS leads the storage management market with approximately 35 percent market share according to Gartner Research (Gartner groups virtualization with core storage management in the 2003 study. The 2002 study split virtualization out and listed VERITAS as having 70% of the virtualization market).

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Core Storage Management Market Share - Source: Gartner Dataquest (April 2004)

When evaluating virtualization technologies from each vendor, RHF should pay particular attention to the following areas:

**Heterogeneity:** VERITAS Storage Foundation supports all major operating systems and all major storage arrays. This gives RHF the flexibility to deploy the solution in its existing environment without discarding any hardware. In addition, RHF is free to purchase storage and server hardware that best supports their applications without sacrificing compatibility.

**Vendor Viability:** It is critical that the vendor is not only viable, but is clearly committed to maintaining the product line in the future. VERITAS is one of the largest, fastest-growing software companies in the world and has maintained the Storage Foundation product line as one of its flagship products for more than a decade. More than 1600 of the global 2000 companies use Storage Foundation so RHF will be always be able to find qualified, trained administrators.

**Reliability / Availability:** The Virtualization product RHF chooses not only needs to be stable and provide high levels of server and storage availability. The Storage Foundation product line includes features for storage availability as well as an integrated High Availability version that includes VERITAS Cluster Server for complete application and database availability.

**Cost:** The proposed VERITAS solution can be rolled out in phases, without requiring the customer to purchase large amounts of new hardware. This lets RHF ease into virtualization for critical applications first, followed by other business processes.

**Ability to Solve Specific RHF Problems:** Clearly, the chosen vendor needs to solve the specific RHF problems identified in this RFI. The VERITAS Storage Foundation family of products includes features (listed below) that are designed to solve the specific problems RHF is experiencing.

### COMPREHENSIVE STORAGE FOUNDATION VIRTUALIZATION CAPABILITIES

VERITAS Storage Foundation™ for Networks, Cisco extends VERITAS' proven storage virtualization technology to free application servers from data intensive operations. VERITAS Storage Foundation™ optimizes application availability and performance and automates installation-specific service levels to match business policies with storage capabilities. Each solution brings unique value to the customer and when used together enable building a storage utility to simplify storage management and lower total costs, today.

### GENERAL COMPETITIVE ADVANTAGES

VERITAS Virtualization software competes mostly with the lite virtualization technologies provided in the operating system as well as free virtualization tools that are shipped with the storage arrays from various hardware vendors.

VERITAS has three key advantages over the tools offered in the competing solutions:

1. **Heterogeneous Operating System Support.** VERITAS virtualization technologies support every major operating system and every major storage array. This lets them choose the hardware that best meets their business-needs

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and allows them to use the same interface for all storage – reducing support and training costs. Every other major virtualization vendor is also trying to sell hardware as part of their overall strategy.

2. **Greater Features.** As the leading virtualization vendor, VERITAS has a number of industry-exclusive features, including the following:
  - a. *Quality of Storage Service:* Gives administrators the ability to move files to the most appropriate storage array without affecting the way users and applications access those files. Unlike traditional HSM solutions, VERITAS moves the files transparently to the user and does not relocate the file back to the original storage device every time it is accessed.
  - b. *Portable Data Containers:* Makes it possible to access data from different operating systems quickly and easily... without data movement.
  - c. *Provisioning Templates:* Creates templates of commonly-created storage configurations to speed up storage provisioning, eliminate configuration errors and create company-wide consistency.
  - d. *Heterogeneous Dynamic Multipathing:* The industry's only multipathing software that works across heterogeneous arrays AND heterogeneous operating systems.
  - e. *Multiple Levels of Virtualization:* Integrated SAN and Host-based virtualization products offer the best of both worlds.
3. **Integration:** VERITAS integrates File System, Volume Management, Snapshot and Replication functions into a single product. This integration provides both technical and packaging benefits; to illustrate:
  - Volume Manager/File System I/O synchronization work together to dynamically tune the I/O based on the access pattern of the application or database. For example, if Oracle is writing 4KB blocks, the file system and Volume Manager can communicate to both use 4KB buffers for maximum throughput
  - The same features from EMC, the customer would need to purchase PowerPath, TimeFinder and SRDF as well as a file system from another vendor. Each of these products has a separate interface and independent license and support costs. In contrast, to get these features from VERITAS, the customer only needs to purchase VERITAS Storage Foundation. Volume Management, File System and Snapshot functions are all performed from the same, intuitive interface.

### SPECIFIC COMPETITIVE ANALYSIS

The following assessments are based on industry trade press articles or other publicly available information and may or may not be accurate. Customers are encouraged to assess company vision and ability to execute. Actual prices vary by channel partner and customer and are ballpark indicators of "list prices" for planning purposes only.

#### **Comments regarding IBM SAN Volume Controller operating within the Cisco Caching Services Module (CSM):**

- No mirroring is provided, relying on hardware RAID, so each disk system becomes a single point of failure.
- Cannot change the RAID level (for example, mirrored to RAID 10) while applications access the data
- Only a single snapshot of a virtual LUN may be made. Fast resynchronization of mirror not possible.
- Network software failover occurs only between nodes that operate within a single blade (CSM).
- Hardware cost is prohibitive. A CSM must be purchased, occupies a switch slot, and has an embedded disk drive subject to failure. Switching modules must also be purchased, and backplane bandwidth consumed in order to direct traffic to this in-band appliance with a switch blade form-factor.
- Software licensing is based on managed capacity, effectively raising prices as the storage pool grows larger.
- Performance is constrained by the in-band appliance model despite customer investments in hardware cache. Processors within the CSM are likely to be not as upgradeable as the SVC appliance and so less powerful. This may explain in part why published throughput is
- Network-based load balancing and path failover software is not provided for heterogeneous storage.
- Different host-based multipathing software is required, depending on the host x storage product mix.

- SAN Management software (topology visualization, zoning, etc.) not integrated within product GUI

**Comments regarding FalconStor Software IPStor:**

- In-band appliance model results in more boxes to manage and entrusts data access between reliable servers and storage devices to whitebox roll-your-own appliances (“IPStor Servers”).
- High availability software (“DynaPath”) to failover appliance pairs is optional and must be configured and priced separately. To scale the solution, a pair of hardware appliances and the failover software must be correctly configured in the data path. Costs to consider include servers, HBAs, operating systems, IPStor licensing, maintenance costs, and the costs associated with consuming needed switch and storage ports.
- Scalability of capacity and performance is limited, requiring whitebox appliances to intercept access to each backend storage device. High availability configurations may introduce half as many appliances as there are application servers. For example, installations ranging from 5 to 20 application servers may use 2 to 8 appliances to access 1 to 12 TB of backend storage.
- Software installed on each application server (“SAN Client”) is specific to each operating system platform. Are company resources sufficient to maintain currency as new platform releases are made available?
- SAN Clients may use a proprietary protocol (“SAN/IP”) to access virtualized storage over IP networks.
- Are claims of heterogeneous support supported by qualification efforts?
- Do cooperative support agreements with other vendors allow support of the complete customer environment or just their software product?

**Comments regarding Store-Age Storage Virtualization Manager:**

- The metadata server appliance software is based on the VxWorks embedded operating system which may delay the introduction of additional features.
- High availability is optional and configured as a pair of hardware appliance with failover software.
- Switch ports are consumed when attaching the hardware appliance to the fabric.
- Does the appliance appear on the fabric vendor's interoperability matrix as a tested and supported device?
- Manufacturing the PCI board and outsourcing assembly spreads resources and focus between hardware and software design and may raise quality control issues.
- The two copper DB9 FC connectors need media interface adapters to connect to modern optical FC fabrics
- Software installed on each application server (“SVC device driver”) is specific to each operating system platform. Are company resources sufficient to maintain currency as new platform releases are made available?
- Can the host multipathing function in the SVC device driver coexist with other host multipathing solutions?
- Are claims of heterogeneous support supported by qualification efforts?
- Do cooperative support agreements with other vendors allow support of the complete customer environment or just their software product?

## 10. Vendor Viability

**Briefly describe your company history, key members of your management team, your current level of market penetration, your profitability, and your prospects for increased future market share.**

VERITAS Software Corporation (NASDAQ: VRTS) is headquartered in Mountain View, Calif., and employs more than 6,600 people in 39 countries. With annualized revenues over \$1.77 billion in 2003, VERITAS Software ranks among the top 10 software companies in the world and is the leader in backup, replication, storage management and high availability solutions.

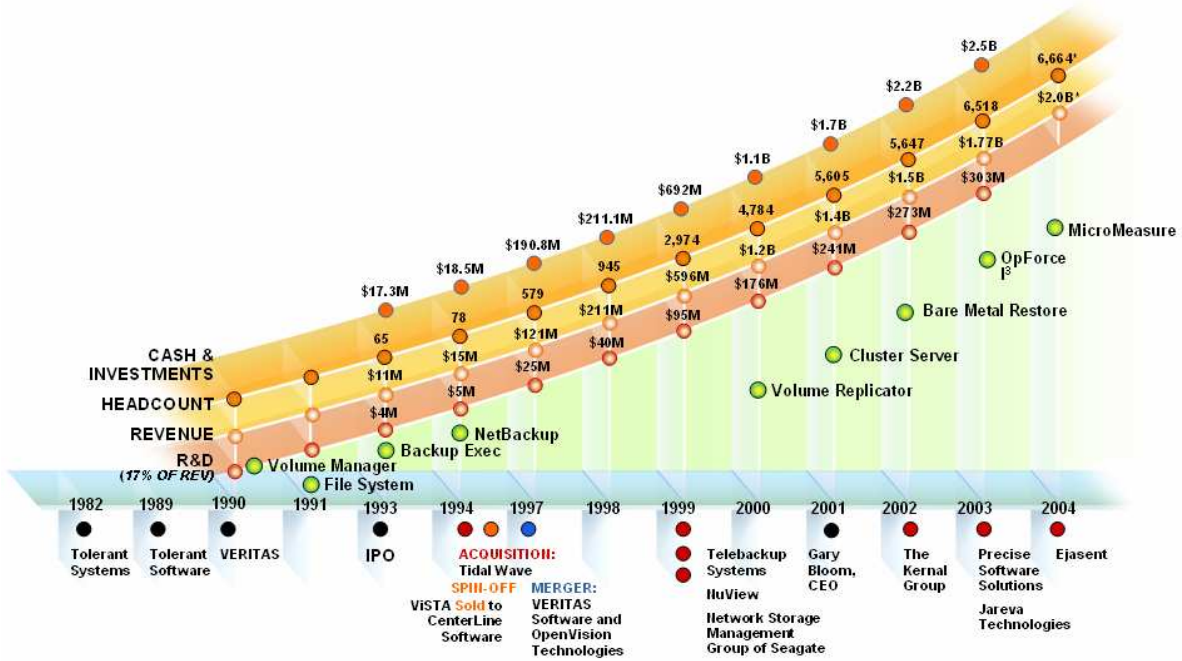
VERITAS products for data protection, storage & server management, high availability and application performance management are used by 99 percent of the Fortune 500.

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Investment information is available from [VERITAS](#) and from web sites like [Hoovers](#), [S&P](#), and [Yahoo Finance](#).

Technical resources for our vibrant technical community are available from the [VERITAS Architect Network](#).

VERITAS's leadership position within the industry is illustrated by the company's history of continuous growth, depicted below.



\*2004 Revenue \$2.0B projection; Headcount as of March 2004