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Executive Overview

It wasn’t long ago that only the world’s largest enterprises managed more than a few terabytes of data. Today thousands of companies have data stores in the petabyte range—and the tidal wave of data growth shows no sign of abating. The mainframe continues to be a platform of choice for hosting data-intensive, business-critical applications, and the mainframe market continues to grow and expand. But the storage demands in mainframe environments are expanding and evolving even faster.

The key issue for IT managers: **How do you keep storage costs low without sacrificing performance, reliability, availability, or flexibility?** This question is particularly complex for mainframe tape storage operations where virtual tape solutions allow a mix of performance disk, capacity optimized disk, and physical tape to be utilized in a tiered storage setup. This use of tiered storage allows IT operations to meet business requirements at minimal cost and maximum efficiency. But deploying and managing these solutions can be complex and time-consuming. Mainframe storage administrators need new solutions that simplify tape operations while improving performance and business continuity/disaster recovery capabilities at the same time.

The next evolution of mainframe tape storage has arrived. Oracle’s StorageTek Virtual Storage Manager System 6 provides a simpler, smarter solution for managing multiple tiers of storage in a mainframe environment. It takes mainframe tape storage operations to new levels of simplicity, flexibility, and reliability while delivering low TCO and investment protection.

This paper provides a brief recap of developments that have reshaped the mainframe tape storage landscape, an overview of Oracle’s approach in addressing the new needs of mainframe tape storage, and the unique capabilities and advantages of the StorageTek Virtual Storage Manager System 6.
New Challenges in Mainframe Data Storage

IT managers are grappling with three core challenges that impact mainframe storage: managing data growth, reducing complexity, and providing better data protection and long-term archiving solutions. Together, these challenges have led to an upward spiral in complexity and storage costs. This section examines each of these challenges in more detail.

Managing Data Growth

There is no question that the exponential growth in the volume of data will continue in the years ahead. Enterprise private cloud, business intelligence, real-time analytics, more demanding regulatory and compliance requirements, new business applications under mainframe control, and longer retention requirements are all increasing the demand for mainframe storage—despite forecasts of a shrinking mainframe market years ago. The mainframe has evolved to meet today’s customer requirements through increased MIPS, smaller footprint, and the ability to run Linux.

According to independent research firm IDC, mainframe storage capacity will grow at a CAGR of 26.1% from 2012-2016. And data growth is being compounded by the ever-increasing lifetime value of data. Today data is the currency of business intelligence, informing and guiding decision-making at the highest level. Data-fueled analytics applications are now used to determine everything from product design to promotional campaigns to business strategy. As a result, many companies are now preserving data for extended periods of time—which in turn increases overall storage costs and complexity. This is particularly heartfelt in the mainframe world where the average cost of enterprise-class storage (measured by $/GB) is 2x that of open systems NAS, 1.6x that of open systems Fibre Channel SAN, and 2.6x that of switched SAS.

Protecting Data and Meeting Compliance Requirements

Data growth is also being driven by new or expanding regulatory acts such as HIPAA, COBIT, Basel-II, Sarbanes-Oxley, etc. To achieve compliance, data must be protected, and protecting data often means keeping multiple copies for longer periods of time, which in turn compounds the data growth and storage cost issues.

Consequently, enterprises are looking for more efficient and cost-effective ways to protect and archive mainframe data over extended time periods. They need more—and more sophisticated—data protection, disaster recovery and long-term archiving options. These data protection and archiving capabilities need to be highly flexible to meet the customization requirements of individual customers or customer segments.

At the same time, mainframe administrators are looking to reduce complexity in their tape operations and attain their RPO and RTO objectives. Balancing this need for more and better data protection, disaster recovery and archiving capabilities—without building in additional levels of complexity—is a key challenge facing mainframe storage architects today.

Dealing with Increased Complexity

The massive increase in the sheer volume of data, coupled with today’s more demanding data protection and compliance requirements, has led to corresponding increases in the number and diversity of solutions dedicated to storing and managing all that data—and the result is mushrooming complexity on multiple fronts:

» Longer hardware and software deployment times, including more complexity in initial system configuration, installation, and setting of data management policies

1, 2 Source: IDC Worldwide Enterprise Storage Systems 2012-2016 Forecast.
» Complexity in supporting data and policy management across geographically dispersed environments
» Resource intensive system administration and maintenance, including scaling, adding capacity or performance, upgrading firmware (service patches), rolling out new features, etc.
» Supporting business continuance/disaster recovery (BC/DR) requirements in an increasingly heterogeneous environment

Improvement in each of these areas is becoming an urgent priority, because reduced complexity leads to increased asset utilization and operational efficiency, higher staff/management efficiency, and lower overall costs.

Controlling Storage Costs

As new applications and use cases are brought under mainframe control, storage requirements become more volatile and unpredictable, leading in turn to higher storage costs. For example, the “spiky” nature of demand for some application services leads many mainframe administrators to overprovision storage, leading to both excessive capital expenditures and lower utilization rates. Mainframe managers are also seeing increasing issues in the performance of their applications as a result of data growth, and they often look to hardware—additional compute and storage—as the way to resolve these issues.

Simply put, the trends impacting mainframe storage are diverse but they all lead to the same result: increasing costs. That is why storage efficiency has become an overarching goal for mainframe managers. In a recent survey of mainframe users by BMC Software, 69 percent of respondents identified “keeping IT costs down” as their top priority and major focus area, up from 60 percent in 2011\(^3\).

The question is, how can future virtual tape solutions meet all of the core needs of the mainframe environment without adding additional pressure to the already-overstretched IT budget? The next sections describe Oracle’s answer.

Oracle’s Approach: Outpace Evolving Demands with a More Evolved Virtual Tape Solution

The ever-increasing volume and constantly changing value of data, coupled with the growing diversity and volatility of mainframe workloads, makes it clear that a next-generation mainframe tape storage solution must deliver a unique combination of attributes. These are the design criteria of the next-generation StorageTek Virtual Storage Manager System 6.

» Fully harness the efficiency gains of tiered storage in a virtual tape environment. Virtual tape offers many advantages for mainframe data storage, but the efficiency of virtual tape can be optimized by employing a tiered storage architecture that includes performance disk, capacity-optimized disk, and physical tape. By balancing and optimizing the mix of media, a tiered storage solution can help minimize costs while ensuring that each application receives the levels of performance and availability required, as well as the applications’ RTO/RPO objectives for business continuance.

» Simplify the mainframe storage environment. Oracle is focused on simplifying all facets of mainframe tape operations. This includes initial deployment, system expansion, data protection and disaster recovery options, as well as the setting and management of policies for data migration in a tiered storage architecture—assuring that the right data is at the right level of storage at every point in its lifecycle.

» Compatibility with both legacy systems and emerging innovations. It is hard to reduce the total cost of ownership (TCO) for mainframe tape storage when new systems can’t support or integrate with older systems. Oracle’s commitment to investment protection means ensuring that new systems, features, and future innovations

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\(^3\) Source: BMC Software’s “2012 Worldwide Survey of Mainframe Users,” a survey of 1,264 mainframe users worldwide.
are compatible and coexist with legacy StorageTek Virtual Storage Manager products, while maintaining existing data management policies.

Oracle’s strategy has been to ensure the optimal cost and availability of data while maintaining backward and forward compatibility with existing and future Oracle virtual tape, physical tape, and software investments. In short, Oracle is focused on three overarching design criteria—simplicity, flexibility, and reliability—which combine to deliver lower TCO for mainframe tape storage.

**Delivering on the Demands: StorageTek Virtual Storage Manager System 6**

Oracle’s StorageTek Virtual Storage Manager System 6 is the first and only mainframe virtual tape storage system to provide a single point of management for the entire tape environment, both virtual and physical. With support for tiered storage (including two tiers of both disk and physical tape), it provides the flexibility to balance performance, capacity, and availability so that the right data is on the right device at the right cost. Key capabilities include:

» 3.2x the performance and more than 17x the total disk capacity of the previous generation
» Sustained system throughput up to 2000 MB/sec
» Non disruptive code load capability
» End-to-end high-availability architecture for five-nines availability (99.999%)
» Unique triple-parity RAID architecture throughout the system to minimize disk rebuild times in case of failure without impacting production
» 7x lower five-year TCO than the previous generation
» Backwards compatibility with previous generations of StorageTek Virtual Storage Manager systems

**Simplicity**

StorageTek Virtual Storage Manager System 6 brings order to the chaos of managing massive volumes of data and diverse application workloads.

First, it is simple to deploy. StorageTek Virtual Storage Manager 6 deploys as a single, pre-integrated system that is easily optimized to meet an organization’s specific capacity, performance, and disaster recovery requirements. This reduces implementation timeframes and allows administrators to bring applications online sooner. The newest system provides co-existence and full data interchange with all other legacy StorageTek Virtual Storage Manager systems, streamlining integration with current resources and providing investment protection.

StorageTek Virtual Storage Manager System 6 also simplifies operations, saving time and money. It is simple to manage because it provides a single point of control for policy-driven data and system management, so more data can be managed by one administrator. Configuration changes can be made dynamically, so administrators can react to change without disruption, with no vendor access required to change policies. Many tasks that were previously handled manually can now be automated, so IT staff can focus on higher-value activities and more strategic assignments.

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“Oracle is confirming its commitment to the mainframe virtual tape market with the introduction of the next generation of the StorageTek virtual tape technology. Oracle’s Virtual Storage Manager 6 is a feature-rich product that leverages the strong mainframe heritage of the StorageTek brand.”

— Robert Amatruda, Research Director, Data Protection and Recovery, IDC

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4 TCO is measured as acquisition cost plus support costs over five years.
In addition, the system provides complete data interchange among previous-generation StorageTek Virtual Storage Manager systems, so data created on one system can be recalled into another, providing the highest level of investment protection.

Furthermore, StorageTek Virtual Storage Manager System 6 is easy to scale. Customers can start small and grow non-disruptively to 1,600 terabytes of effective (4:1 compression) disk storage in a single rack. Through clustering of StorageTek Virtual Storage Manager units, customers can scale capacity to over 819 petabytes of disk storage. And by migrating to physical tape, customers can extend to virtually unlimited capacity to meet ongoing long-term data retention and compliance needs.

**Flexibility**

Multiple dimensions of flexibility are required in today’s mainframe storage environments, and StorageTek Virtual Storage Manager System 6 delivers in multiple ways. It can be deployed as a disk-only solution, or in a disk-plus-physical-tape configuration. Disk-only can include the StorageTek Virtual Library Extension (VLE) which provides a second tier of low cost, capacity optimized disk storage. StorageTek VLE also provides a low-cost, simple-to-implement replication solution for data protection.

To maximize overall storage efficiency in large-scale operations, StorageTek Virtual Storage Manager System 6 can also be deployed in disk + physical tape configurations. Having a physical tape storage tier can also provide a form of “overdraft protection” in the event the disk fills up. This eliminates the need to over-provision disk to prevent buffers from filling up and tape jobs being terminated.

Equally important, StorageTek Virtual Storage Manager System 6 supports both single-site and multi-site deployments. Multi-site options are flexible enough to meet the specific data protection and disaster recovery needs of each customer, customer installation or individual application.

Figure 1. StorageTek Virtual Storage Manager System 6 can support multiple configurations and multiple sites managed from a single point of control.

StorageTek Virtual Storage Manager System 6 also supports a wide range of physical tape technologies that can be mixed and matched, including multiple generations within a single tape technology. High-capacity, high-performance tape is supported through Oracle’s StorageTek T10000D tape drives, enabling customers to reduce their physical
tape requirements by consolidating more data within a single tape cartridge. Enterprise-class tape automation options include Oracle’s StorageTek SL8500 modular library system as well as Oracle’s StorageTek SL3000 modular library system.

And when it comes to flexible BC/DR, StorageTek Virtual Storage Manager System 6 is in a class by itself. It provides a comprehensive hierarchy of BC/DR capabilities, including simple Ethernet-based disk replication, channel extended physical tape, multiple clustering options, and basic physical tape export to a tape library or vault.

### Capabilities

**Export / Import**
- Manual ejects and vaulting or enters into remote library

**Channel extended RTDs**
- DR site protection for physical tape

**VLE to VLE replication**
- GbE or 10 GbE – eliminates the need for FICON
- Reduces overhead in StorageTek Virtual Storage Manager 5

**Clustering**
- Synchronous or asynchronous
- FICON or GbE
- High availability / fault tolerant configurations

**Cross TapePlex Replication (CTR)**
- Electronic data sharing across separate TapePlexes

Figure 2. Oracle delivers the DR options to flexibly meet a broad range of business and technical requirements.

### Reliability

In addition to the BC/DR capabilities mentioned above, StorageTek Virtual Storage Manager System 6 provides mainframe-class reliability and availability features designed to minimize business risk and downtime. Customers’ jobs are not impacted by hardware failures; they can be recovered “on the fly.” To accomplish this, the system architecture delivers extremely high levels of availability through features such as:

- Active/active, redundant processing nodes with high-speed interconnect
- Fully redundant disk communication paths
- Automatic failover of all critical system components
- Hot-swappable componentry
- Non Disruptive Code Loads
- Triple-parity RAID

StorageTek Virtual Storage Manager System 6 also provides sophisticated data integrity checking, including read/write CRC on every tape block and after each compress/decompress cycle. Consequently, over the lifetime of the data, virtual tape blocks are protected by at least one CRC at all times.
The Net Result: Lower TCO and Investment Protection

The combination of simplicity, flexibility, and reliability results in lower operational costs and reduced capital outlays for both initial deployment and future system enhancements, translating to lower TCO. In fact, virtual tape environments built with Virtual Storage Manager 6 have up to 7x lower TCO than those built on previous generations of StorageTek Virtual Storage Manager and StorageTek enterprise tape.

Compatibility, coexistence, and full data interchange between the StorageTek Virtual Storage Manager System 6 and previous-generation systems compounds the TCO advantage while protecting previous investments.

Simply put, the StorageTek Virtual Storage Manager System 6 takes the $/GB for mainframe storage to new lows and reduces the TCO for virtual tape systems—while taking simplicity, flexibility, and reliability to new heights.

Conclusion: Highly Evolved Tape Storage is Available Today

Mainframe tape storage solutions have come a long way since the UNIVAC-1 was introduced in 1951. As the pace of change has accelerated in recent years, many assumed the mainframe’s lifespan was coming to an end. Instead, continued innovation has made the mainframe not only viable in the long term but a platform of choice for modern applications.

The latest generation of the StorageTek Virtual Storage Manager proudly extends that innovation to mainframe tape storage, delivering unprecedented levels of simplicity, agility, reliability, and economy. In the process, it also extends the business opportunities—and the value—of the mainframe as a platform for transformative business advantages.

<table>
<thead>
<tr>
<th>Feature</th>
<th>StorageTek Virtual Storage Manager System 5</th>
<th>StorageTek Virtual Storage Manager System 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustained Write @4:1</td>
<td>600 MB/s</td>
<td>2000 MB/s</td>
</tr>
<tr>
<td>FICON Ports</td>
<td>16 * 4 Gb</td>
<td>8 * 8 Gb</td>
</tr>
<tr>
<td>Replication</td>
<td>ESCON/FICON/IP</td>
<td>IP</td>
</tr>
<tr>
<td>Redundancy</td>
<td>Dual Cluster</td>
<td>Dual Node</td>
</tr>
<tr>
<td>RTDs</td>
<td>Single path to RTD</td>
<td>Multiple paths to RTD</td>
</tr>
<tr>
<td>VLE Connectivity</td>
<td>4 * 1 Gb IP ports</td>
<td>8 * 1 Gb IP ports</td>
</tr>
<tr>
<td>Capacity</td>
<td>1-90 TB effective</td>
<td>10 TB – 1.6 PB effective</td>
</tr>
</tbody>
</table>

Figure 3. What’s new in StorageTek Virtual System Manager System 6.
Learn More

Or call 1-800-ORACLE1 to speak to a representative. Table 1 below provides links to additional resources.

### TABLE 1. WEB RESOURCES FOR FURTHER INFORMATION

<table>
<thead>
<tr>
<th>Web resources Description</th>
<th>Web Resources URL</th>
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The Next Evolution of Mainframe Tape Storage
May 2015