Sun ORACLE® | SUN ZFS STORAGE APPLIANCE

Optimizing Oracle Virtual Desktop Infrastructure with Oracle's Sun ZFS Storage Appliance

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Introduction

Faced with resource constraints and ever increasing user demands, today's IT organizations seek to better utilize IT infrastructure and more closely align IT services with business needs. Virtualization has been hailed as a means to accomplish these objectives, and after realizing significant benefits from server virtualization projects, many IT organizations are now expanding their virtualization efforts to address their desktop infrastructures.

Newer technologies for desktop virtualization are seen as logical next steps in the process of consolidating and optimizing the data center infrastructure. Like earlier server virtualization efforts, desktop virtualization can help IT organizations reduce the time and cost associated with operating and maintaining the IT environment. Desktop virtualization makes it easier to deploy and manage desktop systems as well as protect desktop data.

This paper reviews the typical challenges IT organizations face when managing large numbers of user desktop systems and explains how Oracle's integrated desktop virtualization and storage solution can help. Oracle's solution, which is based on Oracle Virtual Desktop Infrastructure and Oracle's Sun ZFS Storage Appliance, can radically reduce desktop infrastructure costs while delivering unmatched protection of desktop data.

Challenges with Desktop Infrastructures

Many large enterprises have hundreds or even thousands of desktop systems that are not standardized or virtualized. These environments are incredibly complex and challenging to maintain and the data residing on these desktops is often not well protected in terms of backups. The primary challenges can be grouped into three major categories:

- **Manageability**
  Labor costs to maintain and manage user desktop systems continue to rise as IT staff struggle with the complexity of, troubleshooting, tracking and managing updates as well as frequent and costly refresh cycles. Help desk support can also be costly for a diverse range of desktop systems and software applications.

- **Flexibility**
  The continuing trends toward a mobile workforce and making information readily available to customers and third parties are forcing greater access to enterprise information. Yet traditional desktop systems were not designed for this paradigm. Many users have limited access to data and applications because their desktop systems are running a single operating system and legacy enterprise applications are often poorly integrated with the desktop.

- **Data protection and security**
  Industry analysts estimate that as much as 60% of enterprise data resides outside of the data center, much of it likely unprotected on desktop systems. A centralized backup of data that is widely distributed across a diverse range of desktop systems becomes complex and cost-prohibitive. When end users are asked to backup their own data, the organization is at risk of data loss. Desktop PCs and laptops, with their vulnerability to loss, viruses, spyware, and penetration by hackers, can also pose a significant security risk for data that is stored locally.

Oracle's Integrated Desktop Virtualization and Storage Solution

Only Oracle offers the industry's most complete and integrated virtualization portfolio, which includes solutions for virtualizing and managing the full hardware and software stack. With a focus on integrated management, testing, and support from applications to storage, Oracle's virtualization offerings enable IT organizations to reduce the cost and complexity of deploying and maintaining a virtualized infrastructure.

Oracle's integrated desktop virtualization and storage solution combines network-attached storage with desktop virtualization, making it easy to centralize and standardize the desktop infrastructure while also providing greater protection of desktop data and lowering desktop infrastructure costs. The solution also offers alternatives, enabling data center managers to support multiple desktop environments and choose from Oracle or third party offerings to host their desktop virtual machines (VMs). The solution provides a complete desktop infrastructure stack that integrates the virtualization platform with storage and connects the desktop environment to the virtualization layer.

Oracle Virtual Desktop Infrastructure

A primary component of Oracle's integrated desktop virtualization and storage solution architecture is Oracle Virtual Desktop Infrastructure, an all-in-one solution for managing, hosting, and providing access to virtual desktops running on virtual machines in the data center. Oracle Virtual Desktop Infrastructure acts as a gateway between the end-user and the corporate data center where desktop data and other business-critical information are securely and reliably stored. It simplifies desktop deployment and management by providing seamless integration with the virtual machine infrastructure and supporting a wide choice of virtual desktop operating systems, including Microsoft Windows 7, Windows Vista, Windows XP, Windows 2000, Oracle Linux, Oracle Solaris, SUSE Linux Enterprise Desktop, and Ubuntu.

Oracle Virtual Desktop Infrastructure provides a seamless user experience, enabling end users to easily move their live desktop sessions to and from any supported thin-client or PC. As shown in Figure 1, desktop clients can connect to Oracle Virtual Desktop Infrastructure with the Oracle Virtual Desktop Client or any client that uses Oracle's optimized Appliance Link Protocol (ALP) or Adaptive Internet Protocol (AIP). Oracle Virtual Desktop Infrastructure also provides integration with Microsoft Active Directory and LDAP, enabling assignment of virtual desktops to existing users and groups within the organization.
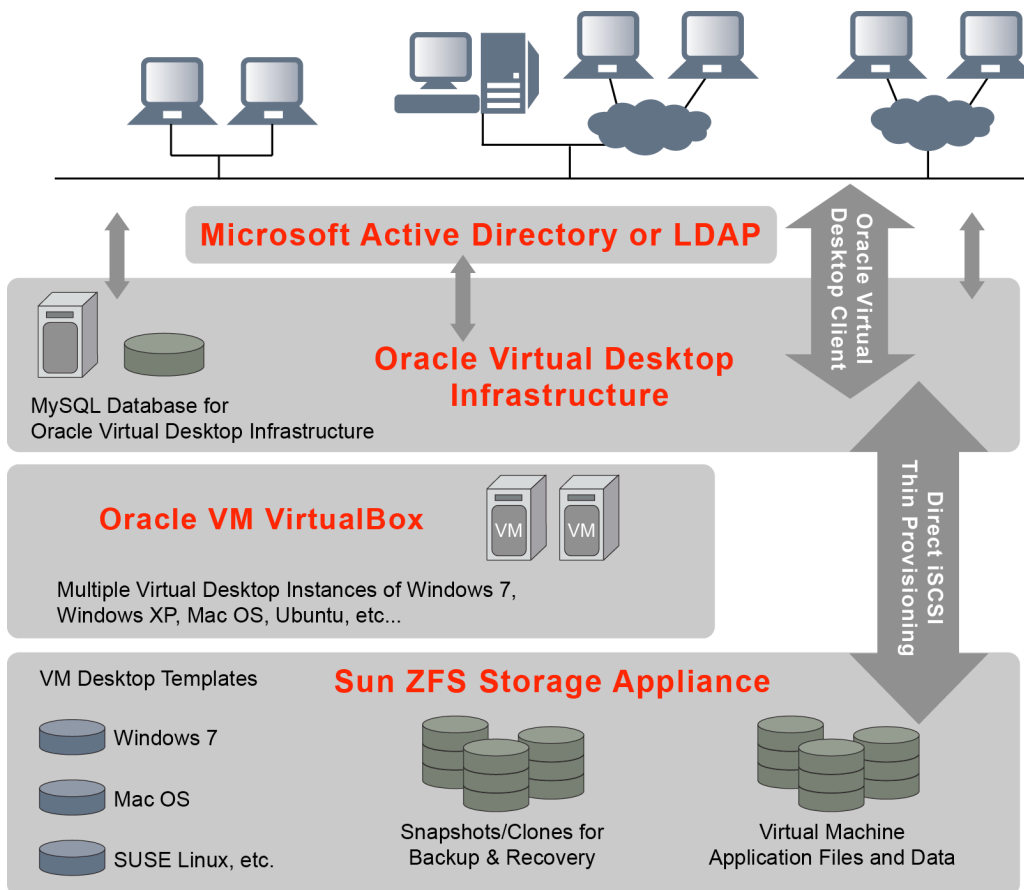

Figure 1. Oracle's integrated desktop virtualization and storage solution architecture

Oracle Virtual Desktop Infrastructure can also be deployed in a high availability configuration that helps to ensure that virtual desktops are always available and ready to deliver optimal performance. For auditing or compliance purposes, Oracle Virtual Desktop Infrastructure also provides tools for tracking access and usage information.

Oracle VM VirtualBox

Client virtual machines can be hosted by Oracle VM VirtualBox or a third party virtualization platform. The virtualization platform provides core functionality such as creating and storing virtual machines, starting, stopping, and snapshotting virtual machines, and management of virtual desktops.

Oracle VM VirtualBox, which is included with Oracle Virtual Desktop Infrastructure at no extra charge, makes it easy for administrators to provision and manage the desktop infrastructure. It has the unique advantage of being integrated with the Sun ZFS Storage Appliance to automate storage provisioning for virtual desktops. This can result in faster desktop provisioning and reduced costs for the desktop infrastructure. The reliability and data protection features of the Sun ZFS Storage Appliance can result in better reliability and productivity for desktop users.

Sun ZFS Storage Appliance

Centralized storage for desktop data is provided by the Sun ZFS Storage Appliance, which enables cost-effective data protection for hundreds or thousands of virtual desktops. The entire desktop infrastructure can be backed up quickly and easily from this centralized network storage appliance, a task that is complex and labor-intensive with conventional desktop infrastructures.

Sun ZFS Storage Appliances provide an easy-to-use appliance package, enabling organizations to dramatically simplify their storage deployment and management while also reducing costs. These appliances provide unmatched simplicity and ease-of-use through an intuitive and powerful browser user interface (BUI). Unique to the Sun ZFS Storage Appliance is DTrace Analytics, which allows administrators to quickly diagnose and resolve performance issues across the storage environment while at the same time providing the ability to record and play back storage workload events for further analysis.

The Sun ZFS Storage Appliance leverages the same scalable computing technologies used in Oracle's servers and adds densely packaged high-capacity disk drives along with an intelligent high performance cache that is enabled by high-performance SSDs. Most of the integrated data services and an extensive set of network protocols are included in the appliance at no extra cost. These hardware and software components are integrated together in an appliance framework that greatly simplifies deployment and enables breakthrough storage performance with exceptional economics.

Table 1 highlights the business benefits of the rich set of data services in Sun ZFS Storage Appliances.

TABLE 1. BUSINESS BENEFITS OF KEY SUN ZFS STORAGE APPLIANCE FEATURES

FEATURE CATEGORY	ADVANTAGES	BUSINESS BENEFIT
Storage efficiency	Compression, and deduplication features help organizations squeeze more data into the same physical storage capacity. Thin provisioning enables on-demand allocation rather than requiring up-front allocation of physical storage.	Save costs by avoiding or postponing additional disk capacity purchases.
Data protection	Data Protection is key to maintaining data availability. Not only does the Sun ZFS Storage Appliance make it easier to backup desktop data, but it also includes error detection and error correction features, including triple mirroring and RAID options that can help reduce the risk of problems that might require restoring data from a backup.	The increased data availability offered by the Sun ZFS Storage Appliance in this solution helps keep users productive and helps reduce the risk of downtime or delays that can lead to lost revenue for the business.
System management	The Sun ZFS Storage Appliance goes beyond traditional storage management offerings to include DTrace Analytics, which allows the data center professional to observe, diagnose, and correct virtual desktop storage issues in real time.	Optimized storage performance and reduced downtime can keep users more productive and help the business operate more efficiently.

Centralize and Standardize the Desktop Architecture

Virtualization enables a centralized desktop infrastructure that offers simplicity and standardization, making the environment much easier and less costly to manage than conventional desktops. When all desktop data is centralized on the Sun ZFS Storage Appliance, it is much easier to implement procedures that protect desktop data and enhance storage efficiency. Scanning for viruses, deduplicating data, or performing backup and recovery procedures is quite simple on a single centralized storage appliance. By contrast these procedures can be nearly impossible to effectively implement across a large number of geographically distributed desktop systems.

A centralized desktop infrastructure also increases overall reliability through the use of standardized virtual desktop environments and by eliminating the need to maintain software across hundreds or thousands of desktops. Thus the risk of configuration errors and security vulnerabilities are greatly reduced. An operating system can be updated or patched once in the centralized storage environment and quickly rolled out to hundreds of desktops at a time. Troubleshooting problems is also easier because the software stack is identical across many desktops and support engineers don't have to worry about configuration discrepancies.

Protect Existing Investments

When deploying a virtual desktop infrastructure, it's always important to sustain the lowest total cost of ownership possible. To that end, Oracle Virtual Desktop Infrastructure can provide three ways to achieve lower TCO.

To protect investments in existing desktop systems, the Oracle Virtual Desktop Client runs on the existing Windows PCs, Macs, or Apple iPads and gives users access to their virtual desktop environment. This means, for example, that an Apple iPad using the Oracle Virtual Desktop Client can function as a Microsoft Windows desktop with all its associated applications. The iPad could also be used to run an Oracle Solaris desktop, Linux desktop, or any other supported desktop environment. Other client desktops and thin clients can be added to the desktop infrastructure over time to help further reduce operating costs and conserve electricity.

Secondly, Oracle Virtual Desktop Infrastructure also supports a choice of virtualization environments, enabling organizations to keep the desktop infrastructure consistent with their virtualization platform of choice. Oracle VM VirtualBox is the default hypervisor in Oracle Virtual Desktop Infrastructure, and VMware vSphere and Microsoft Hyper-V are also supported as third party hypervisor solutions. In addition, the Sun ZFS Storage Appliance can also be used with third party virtual desktop solutions other than Oracle Virtual Desktop Infrastructure.

Finally, another way that Oracle Virtual Desktop Infrastructure can help reduce TCO is by enabling connectivity to application virtualization solutions that allow desktops to access existing enterprise applications. The Sun ZFS Storage Appliance is fully supported with Oracle Virtual Desktop Infrastructure using Oracle Secure Global Desktop and with Citrix XenDesktop using XenApp. Both solutions give users fast and easy access to applications and data from a wide variety of devices. Users can access centralized applications such as an enterprise resource planning (ERP) system without having to make further investments in the desktop environments. For example, by using Oracle Secure Global Desktop on a Mac or an old PC running Windows 98, the user can connect to an application that would normally require a Windows 7 or UNIX client. In this way, numerous devices, including those already installed in the desktop infrastructure, can be utilized to access applications through Oracle desktop virtualization. Users can get quick response to improve productivity while desktop infrastructure costs are kept sustainable.

I/O Performance That Scales to Meet User Demands

Some users fear that a virtualized desktop infrastructure will provide subpar performance compared to having all of their data on local disk. The Sun ZFS Storage Appliance is designed for high I/O throughput and can deliver similar performance to local disk storage even for large deployments. With large memory capacity and high-performance flash-based cache, Sun ZFS Storage Appliances offer highly scalable I/O throughput. As desktop data storage needs grow, both capacity and performance throughput in the Sun ZFS Storage Appliance can be scaled without incurring downtime (with the clustered option), thus keeping users productive at times when they need it most.

Low Risk Fast Deployment

Deployment is made easy and is accelerated through the use of virtual desktop templates and integration and seamless integration between Oracle Virtual Desktop Infrastructure and the Sun ZFS Storage Appliance. The integrated approach eliminates the need to individually provision virtual desktops and provisioning can be automated for more efficient deployment.

Furthermore, the solution can consist entirely of Oracle components, eliminating multi-vendor integration and support issues. The components have also been pre-tested to work together to prevent unanticipated delays in deployment.

Enable Reliable Protection of Desktop Data

Many enterprises simply do not backup desktop data and are at risk of losing valuable intellectual property as well as staff time in the event of a disaster. Advanced data protection features on the Sun ZFS Storage Appliance greatly simplify data protection. Critical data services such as snapshots and clones provide instant and optionally unattended backups that can be used in the short term for virtual desktop file recovery. Snapshots of a user's data are also accessible by the user from the user's virtual desktop storage, simplifying recovery tasks and making it possible for users to retrieve their data when they need to. Numerous third party backup and recovery solutions are also integrated with the Sun ZFS Storage Appliance to provide an important long term backup and recovery solution for the virtual desktop infrastructure.

High Availability Options

Sun ZFS Storage Appliances offer enhanced availability for desktop data through cluster configurations that offer failover capabilities. Sun ZFS Storage Appliance cluster models provide dual controllers that have shared access to the data disks. The secondary controller can then take over for primary controller in the event of failure or planned maintenance. Cluster configurations can also be used to enhance performance.

Simplified Disaster Recovery

The built-in remote replication feature in the Sun ZFS Storage Appliance greatly simplifies disaster recovery[1]. The entire virtual desktop infrastructure stored on the Sun ZFS Storage Appliance can be automatically and continuously replicated to a remote Sun ZFS Storage Appliance at a standby site, providing a consistent copy that can be used to quickly recover thousands of desktops in the event of a disaster. Replication is supported between different platforms of the Sun ZFS Storage Appliance family, making it possible to have a larger storage system at the standby site if greater capacity is necessary for supporting other functions such as development and test.

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[1] Requires a purchased license for the Sun ZFS Storage Appliance "Replication" capability.

Reduce Costs and Improve Operational Efficiency

One of the primary benefits of consolidating desktop data into a virtualized infrastructure is reducing storage space requirements, thereby reducing capital costs for disk capacity and operating costs, such as power and cooling. Key features of the Sun ZFS Storage Appliance such as thin provisioning, compression, and deduplication work in concert with Oracle Virtual Desktop Infrastructure rapid iSCSI provisioning to improve storage efficiency.

When new desktop environments are provisioned, storage is automatically allocated on the Sun ZFS Storage Appliance and thin provisioning enables the storage allocation to be on-demand. By not requiring up-front allocation of future physical storage needs, capital expenditures can be reduced or delayed.

Deduplication can also create significant savings for desktop data. For example, without data deduplication, when a 1MB file is emailed to 100 people, the system will store 100 identical copies of the file. By contrast, in a deduplication environment, only one copy of the file is stored. The Sun ZFS Storage Appliance supports block-level deduplication, which means that when saving multiple different versions of large documents such as PowerPoint presentation files, only the blocks that are unique in the different versions would be stored more than once. With the Sun ZFS Storage Appliance, compression can also be combined with deduplication to further reduce physical storage needs. The scalable compute power available within the Sun ZFS Storage Appliance enables these functions to happen in real time, enabling the storage infrastructure to be continuously maintained at peak efficiency — something that most competitive solutions don't offer.

For organizations that have already centralized storage of their desktop data, migrating data to another platform can include additional labor costs for data migration as well as an element of risk with respect to data loss. The shadow data migration feature of the Sun ZFS Storage Appliance provides a highly efficient means to migrate desktop data from another file server, enabling the organization to begin leveraging their investment in their new Oracle virtual desktop infrastructure even before the migration is complete, thereby reducing risk of data loss and lowering deployment costs.

Lower Administration Costs

Simplified administration and management in the Sun ZFS Storage Appliance can help administrators quickly roll out a desktop infrastructure, add new users, or expand user storage capacity. The appliance includes a Browser User Interface (BUI) management interface that enables the environment to be managed without a highly trained storage administrator. It provides high-level functions and enables aggregated management of resources, resulting in fewer, simpler steps to accomplish many administrative tasks.

A recent study by Edison Group showed the following advantages for Sun ZFS Storage Appliances versus a comparably configured NetApp appliance:

• 36% less time required to provision and configure the storage and its connectivity

• 36% less time required for administrative tasks

• 31% less time spent troubleshooting

Better Visibility to Find and Fix Performance Issues

Administration costs can also be affected by time spent addressing performance bottlenecks in the virtual desktop infrastructure. DTrace Analytics, which is also included in the appliance at no cost, makes it easier to trace the source of performance bottlenecks and fix them. Virtual desktop storage workload activity can be observed instantly from the built-in dashboard that provides at-a-glance observability into the entire virtual desktop infrastructure. Administrators can then drill down for in-depth analysis to pinpoint performance issues. As illustrated in Figure 2, real-time data and analytics give administrators the ability to spot issues such as over-taxed disks and files as well as applications that are consuming excess disk or CPU cycles. These features can help administrators quickly isolate problems arising from a physical server or even an individual virtual desktop. This helps to minimize productivity loss from downtime as well as optimize storage performance and capacity use.
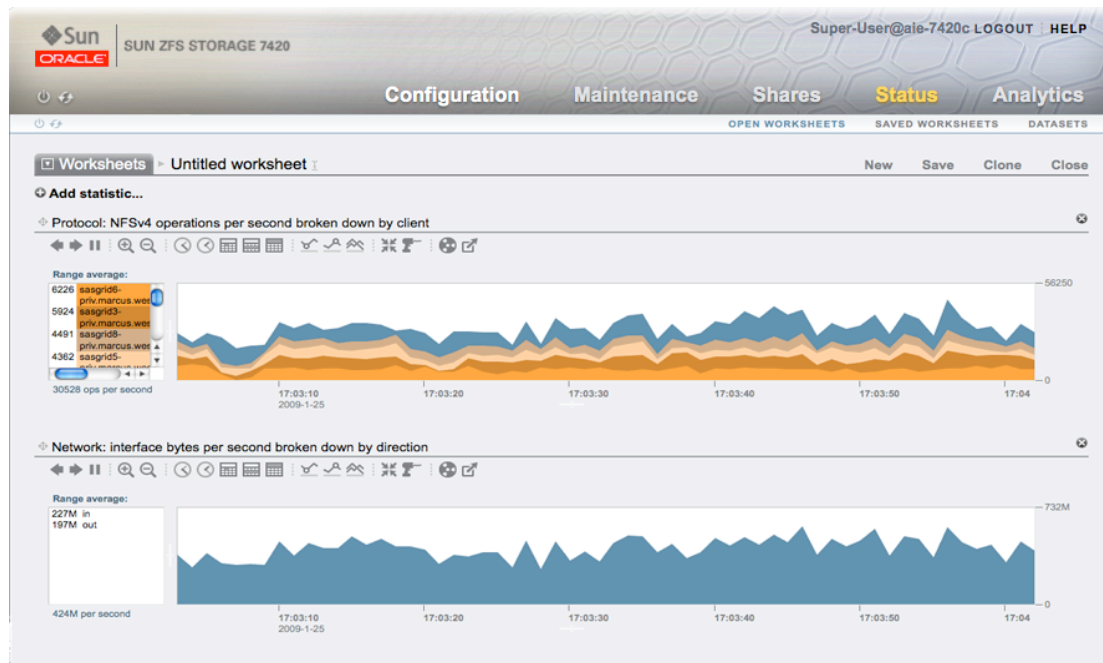

Figure 2.DTrace Analytics screenshot showing real-time storage performance statistics.

Reduced Costs for Data Services

Most data services are included in Sun ZFS Storage Appliances at no extra cost. Key features such as data compression, data deduplication, snapshots error correction, and a browser-based system management interface are all bundled with Sun ZFS Storage Appliances at no extra cost. Other storage platforms often charge hefty license fees to support these features or additional protocols such as iSCSI, FC, NFS, or CIFS. The only software license fees associated with Sun ZFS Storage Appliances are for replication and cloning and even these are a fraction of the cost of the license fees charged on some storage platforms.

Furthermore, because most data services are included in Sun ZFS Storage Appliances, annual software maintenance fees are greatly reduced compared to other storage platforms.

Oracle Desktop Virtualization in Action—Gunsan City Hall, South Korea

Located three hours south of Seoul in South Korea, Gunsan is a port city known for heavy industry and for being a key gateway to China and Northeast Asia. The city's vision is to become an international tourism and business center driven by eco-friendly growth. To support this vision, Gunsan City Hall is moving to a more eco-friendly virtual desktop environment based on Oracle Virtual Desktop Infrastructure and Oracle's Sun Ray Clients.

With their traditional PC desktop model, Gunsan City Hall had realized that managing and replacing hundreds of PCs was becoming cost-prohibitive. The IT department also wanted to avoid wasting administrative resources on asset management.

In May 2010, Gunsan City Hall conducted a desktop virtualization trial, replacing 100 desktop PCs with Oracle's Sun Ray Clients with the aim of substituting 1,600 PCs with virtual desktops by 2013. Moving to a virtual desktop environment enabled Gunsan City Hall to cut desktop-related power consumption by 50% while also improving overall manageability and security. City administration information is now more secure as well, with data stored on a centralized Sun ZFS Storage Appliance rather than distributed across desktop hard drives that are more vulnerable to internal and external breaches.

Prior to the virtual desktop deployment, IT staff also found it difficult to carry out complicated data backup procedures for PC desktops, creating risk of data loss. Centralized data management with the Sun ZFS Storage Appliance has removed this risk and data is now automatically and continuously backed up. Daily data backups that used to take three to four hours are now completed in just 10 minutes.

User satisfaction with the new environment is another sign of the project's success. Regular network and application management has enhanced system stability and performance, increasing staff productivity and enabling them to provide more responsive service to constituents. For further information about the Gunsan City Hall implementation, visit
http://www.oracle.com/us/corporate/customers/gunsan-city-hall-1-sun-cs-354358.pdf.

Conclusion

The combination of Oracle Virtual Desktop Infrastructure with the Sun ZFS Storage Appliance brings reliable data protection in a cost-effective desktop infrastructure solution that can help drive operational efficiencies and enhance security. The solution components have been tested together by Oracle, enabling organizations to deploy a proven end-to-end solution that can improve user productivity as well as limit service interruptions and downtime.

Perhaps most importantly, Oracle's offering is the only combined desktop virtualization and storage solution that simplifies and accelerates problem resolution through sophisticated storage analytics, enabling administrators to save valuable time and deliver high service levels so that users can be more productive.

Organizations that have already standardized on a third party hypervisor or desktop virtualization solution can also take advantage of the Sun ZFS Storage Appliance to reduce the cost and complexity of protecting and managing their desktop data.

For further information, contact an Oracle representative or review the Web sites and white papers referenced below.

References

Visit the Web sites listed in Tables 2 and 3 for additional information.

TABLE 2. WEB SITES FOR ADDITIONAL INFORMATION

PRODUCT OR SOLUTION AREA	WEB SITE URL
Oracle Virtualization technologies	http://www.oracle.com/virtualization/
Oracle Virtual Desktop Infrastructure	http://www.oracle.com/us/technologies/virtualization/061153.html
Oracle VM VirtualBox	http://www.oracle.com/us/technologies/virtualization/061976.html
Oracle Sun Ray Clients	http://www.oracle.com/us/technologies/virtualization/061984.html
Oracle Secure Global Desktop	http://www.oracle.com/us/technologies/virtualization/061996.html
Sun ZFS Storage Appliances	http://www.oracle.com/unified-storage
Gunsan City Hall case study	http://www.oracle.com/us/corporate/customers/gunsan-city-hall-1-sun-cs-354358.pdf

TABLE 3. RELATED WHITE PAPERS

WHITE PAPER TITLE	WEB SITE URL
Higher Security, Greater Access with Oracle Desktop Virtualization	http://www.oracle.com/us/technologies/virtualization/ oracle-desktop-virtualization-wp-167766.pdf

The Sun ZFS Storage Appliance with Citrix Desktop and Application Virtualization	http://www.oracle.com/us/products/servers-storage/storage/unified-storage/zfs-storage-citrix-xen-desktop-vdi-427295.pdf
Oracle Solaris ZFS Storage Management	http://www.oracle.com/technetwork/server-storage/solaris11/documentation/oraclesolariszfsstoragemanagement-360232.pdf
The Most Complete and Integrated Virtualization: From Desktop to Datacenter	http://www.oracle.com/us/technologies/virtualization/virtualization-strategy-wp-183617.pdf
Oracle Desktop Virtualization – Simplified Client Access for Oracle Applications	http://www.oracle.com/us/technologies/virtualization/client-access-for-oracle-apps-428850.pdf

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