



# The BUSINESS BENEFITS of **VIRTUALIZATION AND CONSOLIDATION WITH SUN AND VMWARE**

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## Chapter 1

# Introduction

Chief Information Officers (CIOs), Chief Technology Officers (CTOs), and the IT organizations they run are finding themselves in a similar crunch. As they are asked to deploy ever more business-critical applications, maintain existing ones, and meet stringent service-level agreements, their infrastructure is running out of space, power, and cooling capacity. As they have aged, data centers that were once bastions of discipline and predictability are now saddled with server sprawl and low per-server utilization levels — all of which contribute to excessive and inefficient use of space, power, and cooling. The reasons for the current crunch are mostly historic:

- As IT organizations have deployed applications over the years, they have tended to implement silo architectures, where each silo is configured with its own server, storage, and network infrastructure. Resource sharing between silos is virtually non-existent, each one with its own brand of servers, each server sized to handle the maximum imaginable workload. Applications are bound to specific hardware, and scaling or adapting them to meet new demands is a challenge.
- Historically, application architecture best practices have dictated the use of separate servers per function as a way to isolate performance, scalability, and security issues, a trend which has contributed to even lower server utilization and has also limited resource sharing between functions

### Disruptive Technologies from Sun and VMware

The combination of server technologies from Sun and Virtual Infrastructure 3 from VMware can disrupt the data center status quo and provide organizations with a new set of choices that can increase flexibility, reduce cost, and attack the space, power, and cooling crunch head-on. This powerful combination of technologies can be used to re-host legacy applications while providing a standard platform for all future application deployments.

- The data center of the future is built on virtualization technology that liberates organizations from special-purpose appliances and allows them to use flexible, interchangeable, high-performance, general-purpose computing systems. The virtualized data center can help reduce costs and increase agility by enabling IT organizations to dynamically deploy applications in virtual machines across a standard server infrastructure.
- The power of Sun x64 servers, powered by AMD Opteron™ processors, is such that performance is no longer a reason to deploy a single function per server. With the workloads of multiple legacy servers consolidated onto a single server, IT organizations could economize on space, power, and cooling. Sun's use of open standards in its x64 server product line means that organizations can use a single platform to host applications that are based on the Solaris™, Linux, or Microsoft Windows Operating Systems on the bare metal or in a virtualized environment. With the choice of a single product line from Sun, IT organizations can deploy applications based on one operating system today, and re-deploy the same servers using a different operating system tomorrow.
- VMware Virtual Infrastructure 3 helps to make the virtual data center a reality. It provides an environment whereby multiple operating system instances can run on the same physical platform, with security to isolate each OS instance, and resource controls to manage service levels. It allows IT organizations to dynamically allocate resources to applications by moving virtual machines between physical servers even while they are running. It provides tools to help move legacy applications from obsolete, power-hungry servers onto state-of-the-art Sun x64 servers without the need to re-create existing operating system installations. And for new applica-

tions, it can host multiple instances of the Solaris 10 OS as well as multiple versions of Linux and Microsoft windows.

- Sun's choice of power-conscious AMD Opteron servers is the right choice for data centers facing the space, power, and cooling crunch. From a perspective of power, one rack of Sun Fire™ X4100 servers populated with dual-core AMD Opteron processors requires 24 percent less power than the Intel Xeon DP processor-based solution to provide a similar number of CPU cores. In addition to power savings, Sun x64 servers can provide high-density solutions to alleviate the space crunch. The Sun Blade™ 8000 modular system, configured with the maximum of 10 Sun Blade X8400 server modules, can host up to 80 processor cores in only 19 rack units, with efficient, shared, redundant power and cooling.

The combination of Sun server technologies and VMware Virtual Infrastructure 3 helps CIOs, CTOs, and their IT organizations to move from a model of independent, inefficient application silos to a virtual model, where applications are deployed across a common pool of resources that can be configured and reconfigured the moment that business requirements change. For the first time, organizations can truly do more with less.

## Chapter 2

# The Role of Virtualization

Virtualization technologies allow IT organizations to consolidate multiple workloads onto a single server, resulting in more efficient use of each server, and fewer servers to install, support, and manage. Virtualization is a technique that has been available for years, and it can be employed at many architectural levels. For example, everyone knows that the Apache Web server can support multiple sites, a feature that hosting providers have long used in preference to deploying a server per Web site. If a customer needs their own instance of Apache, down to their own plug-ins and their own set of configuration files, virtualization needs to happen at a lower level in order to run multiple customers on a single server.

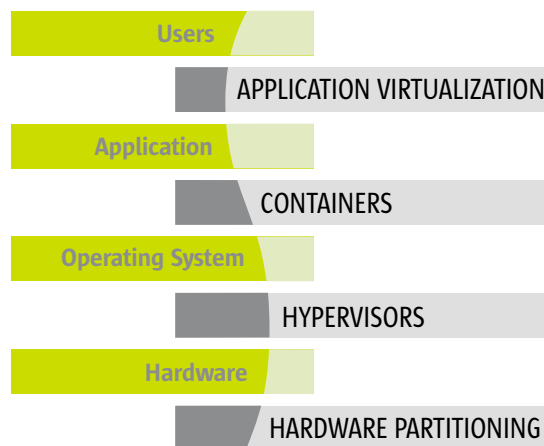


Figure 1. Virtualization technologies give the illusion of a dedicated environment to the client in the layer above.

Virtualization begins with a single environment and creates the illusion of multiple environments to the client logically above the virtualization layer (Figure 1). Regardless of layer, the application or operating system has the illusion that it owns its environment. Four different virtualization technologies are used in products from Sun and partners such as VMware today:

- *Hardware partitioning* uses multiple, secure, electrically-isolated domains on a single server platform. Sun's Dynamic System Domains technology is available on mid-range and high-end UltraSPARC® processor-powered servers.
- *Hypervisors* create an illusion that each operating system has its own, dedicated hardware, despite the fact that each operating system only 'owns' a part of the hardware platform. VMware Virtual Infrastructure 3 creates a virtualized environment for each guest operating system so that each operating system instance believes that it is running on bare hardware.
- *Containers* partition a single operating system instance to give each application the illusion that it has its own environment and its own dedicated set of resources. Solaris Containers technology, which runs on UltraSPARC and AMD Opteron processor-powered servers, combines partitioning and resource management to allow multi-

ple applications to use the same operating system instance, while believing that they have the operating system to themselves. Multiple instances of the Apache Web server, for example, could be deployed into separate Solaris Containers, allowing each one to have full access to the peripherals, network interfaces, and system resources that are allocated to it.

- *Application Virtualization* refers to the use of applications such as Web and Mail servers that can support many different clients, each with their own distinct environments.

## Virtualizing the Hardware

When IT organizations virtualize the hardware with hypervisor technology such as VMware Virtual Infrastructure 3, they empower themselves to make more flexible, dynamic choices in their application deployment and their allocation of resources — business benefits that affect the bottom line through higher server utilization, fewer server to manage, and more agility to meet rapidly-changing business requirements.

- *Instant provisioning.* When IT organizations standardize on an operating system and a specific set of patches, they can create a “golden master” virtual disk image, and deploy virtual servers simply by making new copies of the disk image files.
- *Zero downtime maintenance.* Through the use of VMware VMotion technology, IT organizations can migrate running applications from one server to another, allowing servers to be maintained or even replaced without impacting the running services.
- *Freedom from vendor-imposed upgrade cycles.* VMware Virtual Infrastructure 3 virtualizes the hardware itself, including the processor, memory, disk, and I/O resources. Because the hardware that the operating system sees is virtual, not physical, the OS and the software installed on it can be moved from server to server without concern for the underlying platform — freeing IT organizations from vendor-imposed hardware and software upgrade cycles.
- *Pooling hardware resources.* VMware Virtual Infrastructure 3 virtualizes hardware resources. Rather than requiring storage systems to provide one or more secure, independent logical units to each guest operating system, IT organizations can manage a guest operating system’s disk devices as easily as managing files on a single, shared, centralized storage system. The software allows administrators to create virtual network devices that pass network traffic between guest operating systems without the expense associated with switch hardware.
- *Virtual hardware to support legacy operating systems.* VMware Virtual Infrastructure 3 provides guest operating systems with virtual hardware they expect, including obsolete hardware required by operating systems such as Microsoft Windows NT. With VMware’s P2V (Physical-to-Virtual) Assistant, IT organizations can migrate entire environments from physical servers whose service plans have expired to virtual machines running on state-of-the-art Sun x64 servers. This helps address both performance and space, power, and cooling concerns by supporting multiple such environments per server.
- *Dynamic resource sharing.* Because VMware Virtual Infrastructure 3 virtualizes disk drives as flat files, these files can be moved from server to server to optimize utilization levels and to manage service levels. Through VMware Virtual Infrastructure 3’s resource management capabilities, IT organizations can tune the resources allotted to each guest operating system, enabling them to meet service-level agreements while making more economical use

of hardware resources. Resource allocation can be used to manage complimentary applications on the same server. For example, it could be configured to favor a busy On-Line Transaction Processing (OLTP) database during the day, while favoring long-running data warehousing operations at night. For even more dynamic resource management, VMware VMotion technology can dynamically migrate running environments between servers, giving IT organizations the ability to respond to workload fluctuations in real time.

- *Security and Fault Isolation.* Virtualizing at the hardware level encapsulates each guest operating system in its own virtual machine, containing faults to a single environment. This helps increase reliability by limiting the propagation of faults, and allowing them to be handled by software, rather than hardware mechanisms. Likewise, because each virtual machine isolates its guest operating system and applications, any security flaw affecting one environment does not affect another.
- *Business continuity and backups.* With operating systems and applications encapsulated into disk files, they can be backed up as a complete unit, and they can be migrated to a secondary data center, ready to activate in the event of a failure at the primary location.

## Chapter 3

# VMware Virtual Infrastructure 3 at Work

One of the easiest ways to see the business benefits of the combination of Sun x64 servers and VMware Virtual Infrastructure 3 is to consider some examples of how it can be used. This chapter presents three such examples: server consolidation, business continuity, and hosted desktops.

### Server Consolidation

One of the most common reasons for IT organizations to deploy VMware Virtual Infrastructure 3 is to consolidate a wide range of existing server platforms onto a smaller set of state-of-the-art servers. Virtually all data centers host a wide range of servers, each set purchased because it was well-suited to a particular operating system or application at the time. Compared to today's technology, these systems are often slow and energy-inefficient. Applications whose components were deployed one per server now could be powered easily by a smaller number of modern servers, saving space, power, and cooling. Some organizations need to continue to run legacy applications on legacy operating systems (such as Microsoft Windows NT) but are faced with expired service contracts on hardware that cannot be replaced due to the lack of drivers for new hardware (such as USB).

VMware Virtual Infrastructure 3 can support a heterogeneous environment including multiple instances of the Solaris 10 OS, and different instances and versions of Linux, FreeBSD, Novel Netware, and Microsoft Windows operating systems (Figure 2). VMware Virtual Infrastructure 3 implements abstractions that provide each of these systems with the hardware they expect to see so, for example, a legacy operating system like Microsoft Windows NT can run in a virtual machine on a server with modern peripherals — interfaces that could not be accommodated by the operating system if run on the native hardware. VMware P2V Assistant software assists in the physical-to-virtual transition by creating and moving images from physical servers into virtual disks used by VMware Virtual Infrastructure 3.

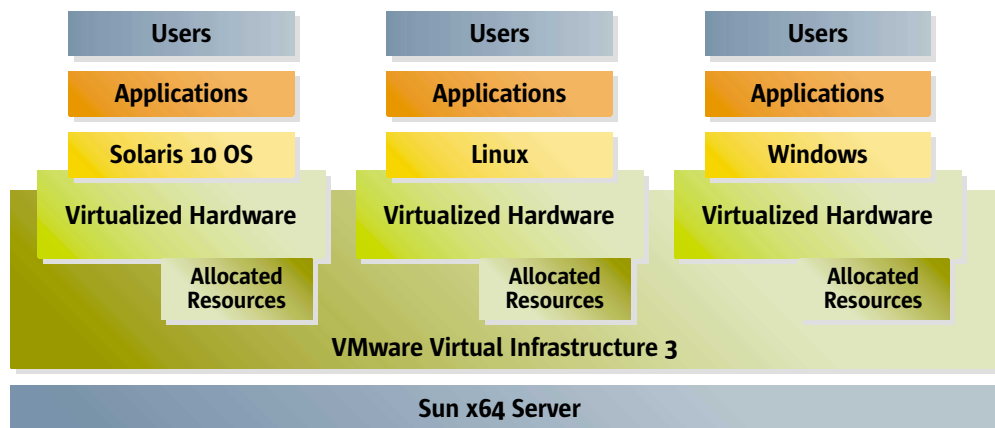


Figure 2. VMware Virtual Infrastructure 3 allows IT organizations to support heterogeneous workloads all on the same, powerful, Sun x64 server.

## Business Continuity

Just the act of server consolidation can increase application availability because economies of scale make it easier to use larger servers with improved reliability, availability, and serviceability over smaller ones. But failures ranging from a single server to an entire regional data center can bring a business to its knees. Fortunately, virtualized environments provide straightforward solutions for both disaster recovery and business continuity:

- *Within a data center.* In the event of a server failure within a data center, VMware VMotion software can bring up the virtual machine from the failed server to any other server that can access the same storage-area network. Using the VMware VirtualCenter management software included with VMware Virtual Infrastructure 3, IT organizations can dynamically change resource allocation and even repurpose hardware resources to accommodate the workload formerly handled by the failed server.
- *Between data centers.* IT organizations can prepare for a disaster taking an entire data center offline by using VMware VirtualCenter to periodically create copies of running virtual machines to an off-site location. In the event that a regional disaster causes an entire data center to fail, critical applications can be re-started to the state at which the copy was made by activating the copies in the secondary data center location. Re-deploying applications in a virtual data center can be done in minutes to hours, rather than the days to weeks that re-installing operating systems and applications on backup servers could take. Because guest operating systems run in a virtual environment, they can be hosted transparently on different servers than the original ones on which they were running.

## Hosted Desktop Environment

For years, Sun and its customers have been able to significantly change their cost equation by centralizing their computing resources and accessing applications through Sun Ray™ ultra-thin clients. Sun Secure Global Desktop Software takes this concept a step further by providing access to server-based applications running on Windows Solaris, Linux, HP-UX, AIX, mainframe, and mid-range systems, making them available on an even more wide range of client platforms and devices. Sun Secure Global Desktop enables the truly mobile enterprise, allowing employees to access their enterprise and desktop applications at their desks using Sun Ray ultra-thin clients or full-featured desktop and laptop systems. Away from the office, they can access the same resources over the Internet using everything from thin clients to wireless devices and PDAs.

This architecture can leverage the economics of centrally managed, shared server resources while providing access to enterprise-critical applications. Using VMware Virtual Infrastructure 3, IT organizations can host application servers using supported operating systems in virtual environments on Sun x64 servers. Today, with the ability of VMware Virtual Infrastructure 3 to support the Solaris 10 OS, even the Sun Secure Global Desktop software itself can be hosted in a virtual environment. This give the utmost in consolidation and flexibility by allowing all of the application server and access server functions in Figure 3 to be hosted and resources managed through VMware Virtual Infrastructure 3.

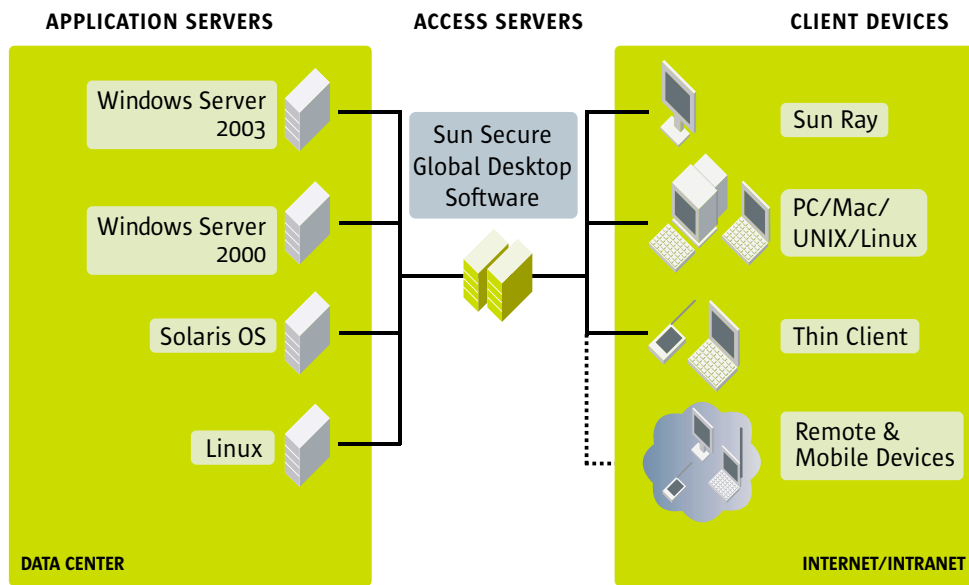


Figure 3. Using virtualization and Sun x64 servers, IT organizations can consolidate their application servers and provide employees with access from virtually anywhere — all within a virtualized environment.

## Chapter 4

# Summary

The combination of Sun x64 servers, VMware Virtual Infrastructure 3, and new support for the Solaris 10 Operating System changes the equation for IT organizations and those who run them. Virtual Infrastructure 3 gives IT organizations the ability to quickly respond to rapidly-changing business conditions through the use of a virtualized data center that can adapt in real time. With the ability to support all three major operating systems — Solaris, Linux, and Microsoft Windows — on the same server at the same time, IT organizations can attack the space, power, and cooling crunch head on. By consolidating multiple workloads from under-utilized servers onto a smaller number of space and power-efficient Sun x64 servers, they can help reduce their space, power, and cooling requirements. In addition, by choosing Sun x64 servers that include features such as redundant, hot-swappable power, cooling, and disk drives, they can help increase overall availability beyond what could be achieved with typical 1U servers configured without redundancy.

But that's not all. Moving to a virtualized environment and standardizing on a server platform gives IT organizations additional benefits that can help them to better manage their resources, including:

- Freeing them from vendor-imposed upgrade cycles for both hardware and software
- Providing support for legacy systems on modern, state-of-the-art servers
- Dynamic resource sharing that allows resources within servers and among pools of servers to be balanced and changed dynamically in response to changes in workload or business priorities
- Security and fault isolation that helps to increase availability
- Facilitating the use of pooled, centralized storage systems without the need to assign a unique and secure logical unit to each server or application
- Instant provisioning by copying 'golden master' installations of operating systems and patches
- Business continuity support through copying and migrating virtual disk images
- Maintenance with zero downtime through the ability to migrate running virtual machines to alternate platforms when a server must be powered off for maintenance

Sun and VMware is a virtually unbeatable combination of technologies for IT organizations wishing to break free from the legacy of individual functions and applications deployed onto individual servers with low utilization levels. You can see a demonstration of VMware solutions at your nearest Sun Solution Center, where Sun helps take the guesswork and the risk of implementing solutions.

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