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Oracle VM Server for SPARC Technology Primer

ORACLE

Introduction

In today's economic climate, doing more with less takes on new meaning. Escalating time to market concerns and other business pressures force organizations to act quickly, with administrators often choosing to avoid possible system security, availability, and performance conflicts by simply deploying only one application per server. The result is a sprawling compute infrastructure that is costly to manage and leaves systems underused.

Although consolidation gives enterprises the opportunity to better use resources, deploying multiple applications on a single server often yields poor performance, greater operational and management complexity, and potential application failure. For example, tuning and maintenance requirements might not align easily across the diverse requirements of several applications. Moreover, one ill-behaved application that is not properly resource constrained can starve other colocated software of resources. Simple consolidation methods fail to provide the secure boundaries required by applications that access sensitive data.

The ability to isolate programs running on a consolidated server helps IT groups deliver on application performance and security requirements and meet custom tuning needs. By combining workloads and using virtualization techniques, growing enterprises can maximize the use of compute platforms; simplify IT infrastructure; and produce new levels of efficiency, manageability, and agility.

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Virtualization Technology—Choices and Trade-Offs

Many virtualization technologies are available, each with their own set of advantages, making it important to understand when, how, and if they can best be deployed. Providing varying degrees of flexibility, availability, and security, these virtualization technologies can be used separately or together to effect better resource use and reduce infrastructure complexity (see Figure 1). Solutions are available at every layer of the infrastructure—from operating system (OS) and resource virtualization to virtual machines (VMs) and hard partitioning—to help companies consolidate and save.

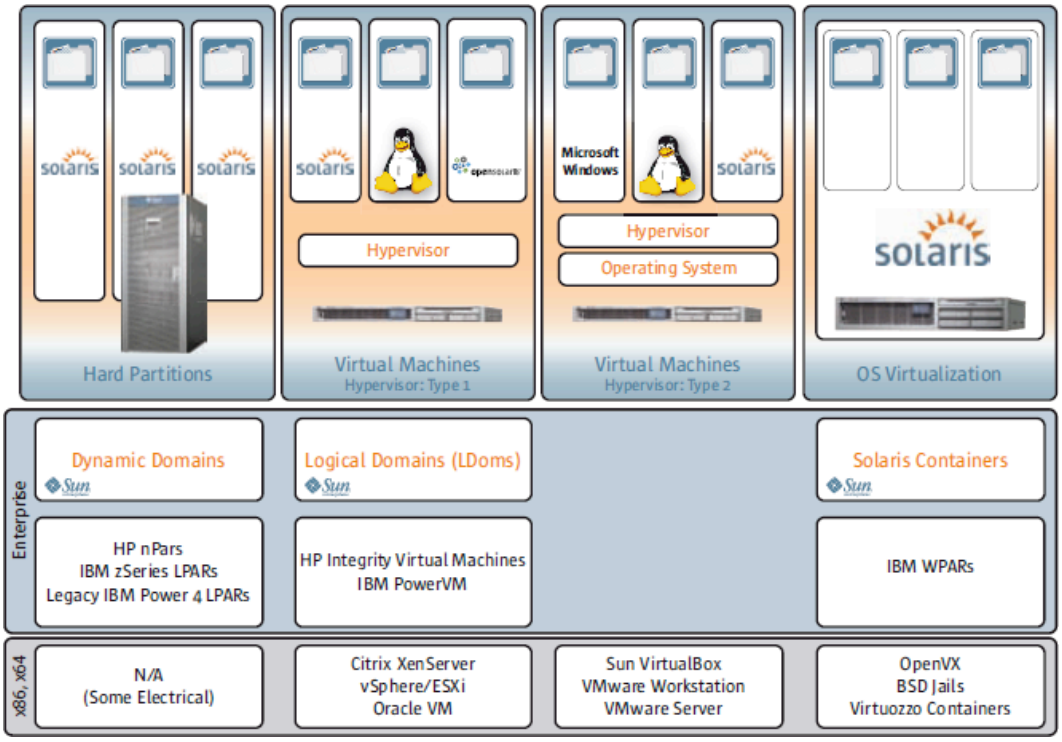

Figure 1. Virtualization solutions provide varying degrees of flexibility, availability, and security.

Hard Partitions

Hard partitioning tools assign physical CPU, memory, and I/O resources to specific domains that run independent OS instances. The granularity of resource assignment is dictated by the hardware and is often based on printed circuit board boundaries or subboard domaining. Providing isolation down to the hardware layer, hard partitions keep faults in one partition from affecting applications running in other partitions, thereby increasing reliability.

Hard partitions are distinguished by their use of hardware to subdivide a computer's physical resources, such as its CPU and RAM. Hard partitions typically have very low overhead and high reliability with strong isolation between different domains. In addition, they usually have a fixed architectural limit on the number of domains that can be supported, and can limit the amount of resource granularity or sharing to large portions of the system.

Most major enterprise hardware platforms provide some form of hard partitioning. On midrange and high-end Sun servers from Oracle, hard partitioning is provided by Dynamic Domains. This technology enables a single system to be logically divided into multiple electrically isolated partitions, each running its own instance of the Oracle Solaris operating system (OS). Failures are contained within a domain, increasing availability and providing a reliable, secure platform for running multiple applications simultaneously. As implemented on SPARC Enterprise M-Series servers, hard partitions support the physical insertion or removal of system boards from a running domain—without stopping the server or OS. Other platforms also support hard partitioning; for example, HP systems based on Intel Itanium processors that include electrical isolation provide board-level partitioning through HP nPartitions (nPars). Each nPar has its own processor, memory, and I/O resources, and resources can be moved from one nPar to another without having to physically remove and add hardware.

Virtual Machines

VMs enable a physical system to run multiple different OSes at the same time and make it possible to partition compute resources on conventional hardware in a safe and effective manner, without significantly sacrificing performance or functionality. One or more OS execution domains host multiple diverse OSes simultaneously to increase flexibility and server use. Several types of VM technologies are available.

- **Oracle VM Server for SPARC.** Provided as a no-cost facility on Sun SPARC Enterprise T-Series systems - Sun servers incorporating processors with chip multithreading (CMT) technology, Oracle VM Server for SPARC (previously called Sun Logical Domains) provides a full VM that runs an independent OS instance and contains virtualized CPU, memory, storage, I/O, console, and cryptographic devices. A hypervisor, written as firmware and tightly integrated with the hardware, sits between the physical hardware and the VM layer to manage the control and isolation of resources. Many aspects of logical domains technology are virtualized, such as disks and networking, whereas other resources, such as virtual CPUs and memory, are not shared between domains. With the ability to create multiple independent VMs quickly using the hypervisor built into every Sun SPARC Enterprise T-Series server, Oracle VM Server for SPARC makes it easy to deploy multiple OSes simultaneously on a single system.
- **HP Virtual Partitions.** Similar to Oracle VM Server for SPARC, HP Virtual Partitions (vPars) can be used to partition systems. However, HP vPars offer more-limited functionality. Multiple copies of the OS—but only the HP-UX OS—can be run on the system at one time. And

although CPU and memory resources can be moved dynamically among partitions, this flexibility comes at a significant additional cost. In addition, scalability and migration are restricted in the vPars environment. Only eight partitions can be created on a system, and moving from a vPar environment to another HP VM technology-based system often is difficult due to architectural incompatibilities.

- **IBM Logical Partitions.** Available on IBM POWER4 servers, Logical Partitions provide core-level hard partitioning technology. Users can create soft blade servers and broker resources between these partitions to gain flexibility. However, some resources, such as add-on networking or cryptography adapters, cannot be partitioned, shared, or abstracted, limiting the use of these valuable resources.

Operating System Virtualization

OS virtualization allows multiple private execution environments to be created within a single instance of an OS. With flexible, software-defined boundaries, virtual OS environments are independent of the hardware layer and are available to all platforms that support the OS.

On Sun platforms, OS virtualization is made possible by Oracle Solaris Containers technology. Oracle Solaris Containers use features in Oracle Solaris to provision compute power into secure, isolated runtime environments for individual applications using flexible, software-defined boundaries. Each environment holds a unique identity and maintains resource and namespace isolation. In addition, administrators can configure separate network connections with exclusive IP stacks and allocate disk and storage for individual containers.

Applications can be managed independently of each other, even while running in the same instance of Oracle Solaris. Linux applications can even run within an Oracle Solaris Container on x86 platforms without modification, enabling organizations to consolidate Oracle Solaris and Linux applications on one system to effect better resource use. With Oracle Solaris Containers technology, organizations gain new levels of resource containment and security isolation to prevent unauthorized access and malicious intrusions.

Because all containers run under a single Oracle Solaris kernel, this methodology allows for fine-grained control over rights and resources within a consolidated server—without increasing the number of OS instances to manage. This reduces the administrative burden of patching and maintaining multiple OS images; however, it can create a single point of failure for multiple services and introduce operational dependencies.

In contrast, IBM Workload Partitions (WPARs) are tightly linked to the OS, and can only host AIX virtual environments. With a dependence on NFS for I/O operations, WPARs incur complexities and operational overhead that can limit the usefulness of the technology in practical situations. Live migration of virtual environments is supported, but per-core licensing costs can be prohibitive for many virtualization projects.

Resource Management

Resource management tools aid consolidation strategies that require resource boundaries between applications. With no privileges to access underlying hardware, resource management software leverages OS controls to govern the use of CPU, memory, and I/O resources. On Oracle platforms, Oracle Solaris Resource Manager can set and enforce policies that guarantee a share of CPU cycles and virtual memory space to individual applications. Other controls include upper limits on the process count, number of logins, and connect time for each system userID.

Oracle Solaris Resource Manager software can be used along with other virtualization technologies to further define resource rights for each virtualized boundary, for example, to dynamically allocate specific processors and individual processor cores to a Oracle Solaris Container. The power to define and readily adjust compute resource levels within virtualized environments can help enterprises improve hardware use and better guarantee the quality of service for individual applications.

Oracle VM Server for SPARC—A Deeper Look

Designed to work with the unique characteristics of Sun servers with CMT technology, Oracle VM Server for SPARC brings partitioning capabilities to entry-level servers. A single physical system can be split into multiple independent virtual systems (see Figure 2). One VM—the governing primary logical domain—contains a host OS and a Logical Domains Manager with the intelligence to work with the hypervisor to create and reconfigure other logical domains and allocate resources.

The hypervisor located in the server does most of the work. It abstracts the hardware, exposes resources to partitions, and creates communication channels between logical domains that provide a conduit for services, such as networks and shared devices. With this technology, users can allocate various system resources, such as memory, CPUs, and devices, into logical groupings and create multiple discrete systems, each with their own OS, resources, and identity within a single computer system. By careful architecture, a logical domains environment can help companies achieve greater resource use, better scaling, and increased security and isolation.

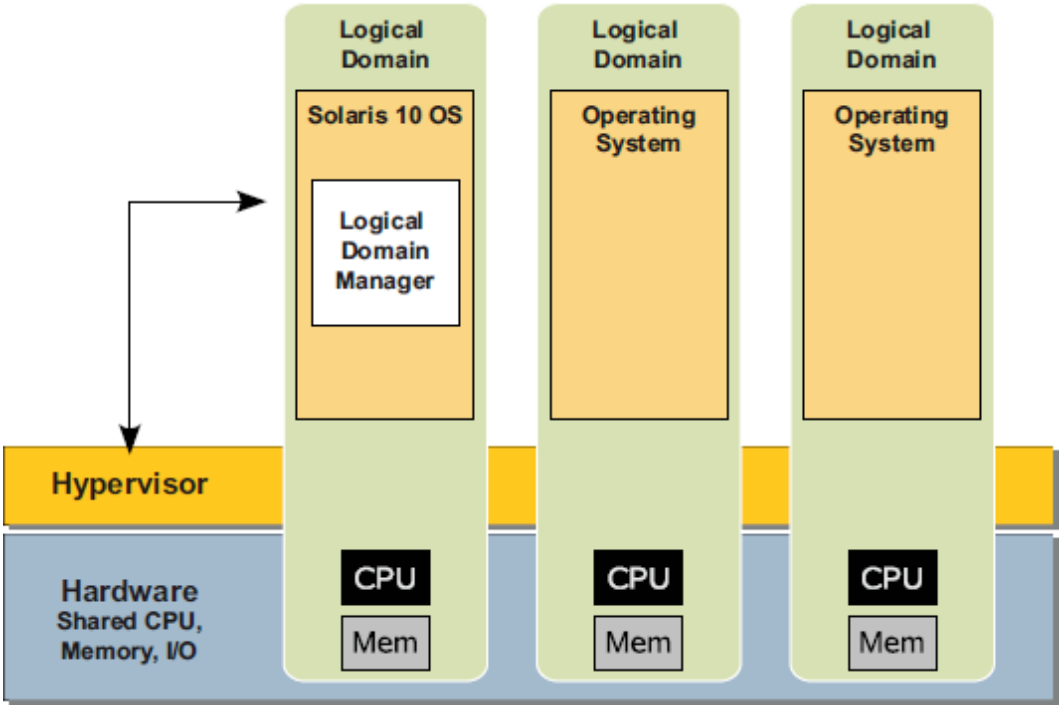

Figure 2. Oracle VM Server for SPARC allows a system to be split into independent virtual systems.

Supporting Multiple Operating Systems

A key concern in today's heterogeneous environments is finding ways to protect investments in OSes and applications while reducing server footprints. Oracle VM Server for SPARC lets a variety of OSes—such as Oracle Solaris, OpenSolaris, and Linux environments—run in isolated application execution environments at the same time on the same system. Each logical domain runs its own instance of the OS, as well as any application software, and can take advantage of the resources and services provided by the underlying hardware to complete tasks.

Because each logical domain hosts a unique OS instance, the specific configuration needs of hosted applications can be addressed individually. In addition, secure logical domain channels ensure sensitive data routes to the proper logical domain. By taking advantage of logical domains, enterprises can increase flexibility and securely isolate applications while reaping the benefits of a consolidated platform.

Delivering Processing Power

In a virtualized environment, multiple OSes, applications, and services must share physical resources without stepping on one another. In an Oracle VM Server for SPARC environment, hardware resources, such as CPU threads and memory, are uniquely assigned to different logical domains, with no sharing of those resources. The unique thread-rich environment provided by

Sun servers with CoolThreads technology allows individual threads to be allocated to logical domains as dedicated virtual CPUs. Similarly, the hypervisor controls access to physical memory and handles all mapping functions required to properly provide a secure, unique memory space to each logical domain.

Optimizing I/O Performance

Today's powerful servers have tremendous processing capabilities. With more memory and processor cores using CMT technology, such servers are helping to alleviate CPU bottlenecks and speed processing throughput. However, applications can only process information that they actually have stored. With more applications and services running on a system—and moving information to and from disks—it is imperative that virtualized systems be able to handle the I/O demands generated by data-intensive environments.

Oracle VM Server for SPARC supports a variety of I/O device configurations to optimize for performance, flexibility, or reuse of resources. For ultimate performance and traffic separation, Oracle VM Server for SPARC allows PCI buses and I/O devices on those buses to be owned and accessed solely by an individual domain (I/O domain). The physical I/O devices owned by a domain can be used to provide I/O services to other domains via virtual devices, fostering greater reuse of I/O facilities and supporting the sharing of I/O devices.

Virtual devices can be configured to share bandwidth on physical ports or separated on a port or controller basis. This flexibility lets administrators choose the optimal mix of separation, performance, and consolidation (see Figure 3). As a result, the number of virtual devices offered can substantially exceed the amount of physical I/O devices present on a system, enabling many logical domains to fully use physical I/O bandwidth capacity and speed throughput. In addition, implementing more than one I/O domain enables solutions with redundant paths to external devices to be created.

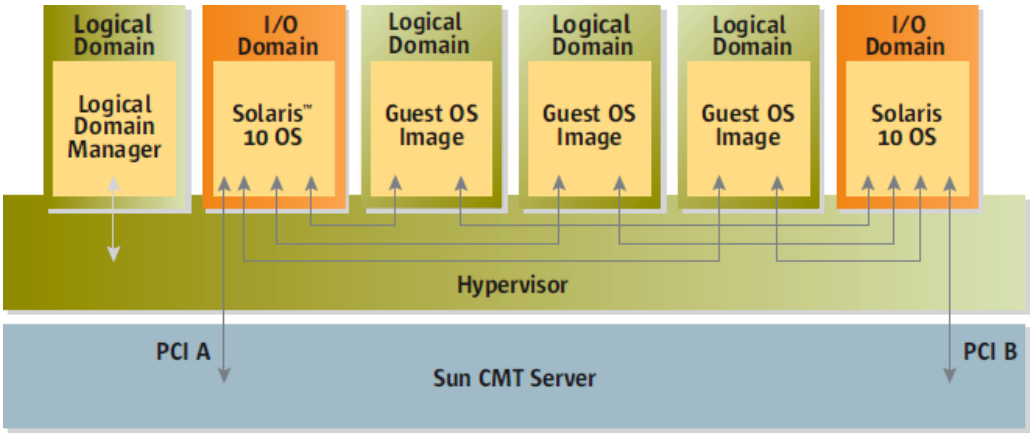

Figure 3. Each logical domain has its own secure partition of server resources. Physical I/O is performed by I/O domains that "own" one or more PCI buses.

Several types of I/O devices can be supplied to logical domains and used in a wide array of configurations. In a logical domain environment, virtual networks are used for domain-to-domain and domain-to-real world communication. Each virtual network is connected to a virtual switch that can be connected to a physical port to enable guests to talk to devices in the real-world network. Virtual LAN networking is fully supported in these virtual networks and switch services, providing for further traffic separation and integration with existing datacenter traffic separation requirements. Combined with support for jumbo frames on virtual networks and switches, logical domains provide flexibility to meter bandwidth, accessibility, and security.

Virtual disks are provided to give domains the ability to boot from "local" disks as well as to provide "local" storage repositories for the applications that run in the domains. Logical domains see virtual disks as local SCSI disks, even though the underlying storage medium can be virtualized from a variety of block storage media, including local physical disks on the host server, logical unit numbers (LUNs) on storage networks, NFS file systems, Oracle Solaris ZFS, and iSCSI disks—even disk image files contained on the file systems supported by Oracle Solaris. Logical domains can take advantage of hardware RAID, MPxIO, SAS, SATA, SCSI, and Fibre Channel Arbitrated Loop technologies to balance availability, performance, and cost. Entire physical disks, or slices of disks, can be abstracted as a virtual disk for a logical domain, and redundancy features are built in to provide invisible disk failover for greater reliability.

Clustered and Shared Environments

Oracle VM Server for SPARC works with Sun QFS software, Sun Storage Archive Manager, and Automated Cartridge System Library Software. When Oracle Solaris Cluster is used, virtual storage devices used by the Sun QFS software

- Must be backed by whole SCSI or Fibre Channel LUN disk arrays
- Must not be shared with other guest domains on the same server

(Note that virtualized partial LUN disk arrays are not supported.)

Using Network Bandwidth Effectively

Most computing platforms are only able to virtualize processor cores and memory. Sun servers with CoolThreads technology bring virtualization technology to the I/O channel by extending the parallel computing model with interface sharing, partitioning, and network virtualization. Oracle VM Server for SPARC takes advantage of these unique capabilities and gives guest OSes and applications access to a wide range of virtual network devices, switches, and interfaces. The actual physical hardware devices are abstracted by the hypervisor and presented to the logical domains on the system. Each logical domain believes it owns the entire network interface card (NIC) and the bandwidth it provides, yet in practice only a portion of the total bandwidth can be allotted to the domain. As a result, every NIC can be configured as demand dictates, with each domain receiving bandwidth on an as-needed basis.

Delivering Resources to Workloads

Spikes in demand and changing business needs cause individual IT services to use varying amounts of compute capacity over time. The Logical Domains Manager enables administrators to optimize the use of compute resources by modifying the number and type of virtual resources, including CPU, memory, and I/O devices assigned to a logical domain. Some reconfiguration tasks can take place dynamically, allowing the compute capacity of a logical domain to grow or shrink—without need to reboot the OS or interrupt application processing. Reconfiguration of a domain's virtual CPU count, disk configuration, and network connectivity is possible without rebooting the domain, and changes are seen immediately. Delayed reconfiguration is required when the amount of memory assigned to a domain or the number of hardware cryptographic acceleration units allocated to a domain is changed, with specified virtual device configuration changes implemented upon the next reboot or power cycle of the logical domain.

Migrating Resources with Ease

Whether for planned maintenance, disaster recovery purposes, adoption of new hardware, or efforts to improve server use, organizations often need to migrate an entire software stack from one server to another. Consolidating multiple servers onto fewer systems can be done by migrating servers onto containers or logical domains. To ease this process, system administrators can take advantage of the domain migration features of logical domain technology.

For example, the Oracle VM Server for SPARC P2V migration tool automatically converts an existing physical system to a virtual system that runs in a logical domain on a CMT system. It creates a file system image of the source system based on configuration information, creates the logical domain on the target system, restores the file system to one or more virtual disks, and converts the logical domain on the target system using the standard Oracle Solaris upgrade process. By using domain migration, the domain hardware description, OS, and applications can be redeployed quickly to a logical domain on another platform. Administrators can rapidly migrate entire software stacks from one platform to another to regularly adjust consolidated platform workloads and maximize the use of every compute resource. Oracle VM Server for SPARC also provides a domain migration tool to facilitate the migration of existing running domains between physical hosts. This facility enhances an administrator's ability to consolidate and use resources, and supports the planning of hardware upgrades and proactive service windows—with minimal impact to applications running in the migrating domains.

Although migration can contribute to availability efforts, other tools are designed to address high-availability concerns. For example, organizations needing fast failover of services from one machine to another in the event of a server disruption can take advantage of the Oracle Solaris Cluster software, which works alongside Oracle Solaris Containers and Oracle VM Server for SPARC.

Simplifying Management

System management and administration has long been a difficult issue for organizations. With physical systems being partitioned into tens or even hundreds of VMs and devices, the need for simplified management takes on new importance. To help this effort, Oracle provides several tools that can help speed and simplify logical domain deployment and administration.

- **Logical Domains Manager.** The Logical Domains Manager makes creating, reconfiguring, and managing logical domains easy. This intelligent administrative interface keeps track of the mapping between the physical and virtual devices in a system, and communicates with the hypervisor and logical domains on the system to sequence changes, such as the removal of resources or creation of a logical domain. Graphical and command-line variants of the management interface are provided, as well as programmatic access to reconfiguration APIs. In addition, third-party system management tools work in logical domain environments, letting administrators continue to work with the tools with which they are familiar for common system administration tasks.
- **Configuration Assistant.** The Oracle VM Server for SPARC Configuration Assistant can help you easily create logical domains. After gathering the configuration data, the Configuration Assistant determines the best way to create a deployment to suite your requirements. The Configuration Assistant is available as both a graphic user interface (GUI) and terminal-based tool.
- **Oracle Enterprise Manager Ops Center.** Oracle Enterprise Manager Ops Center provides centralized lifecycle management for physical and virtual resources. Administrators can discover and provision hardware, software, and virtual assets across distributed datacenters, and automate the patching of OSes and logical domains to minimize downtime. In addition, the software makes it easy to manage and monitor physical and virtual environments and aggregate historical information for trend analysis.

Delivering Data Reliability

In today's competitive business climate, ensuring access to data can mean the difference between business success and failure. Understanding the importance of stability, Sun servers, Oracle Solaris, and Oracle VM Server for SPARC, are designed to eliminate data disruptions. Indeed, Oracle Solaris includes several built-in reliability tools that continue to work in virtualized environments.

In Oracle VM Server for SPARC environments, I/O redundancy can be supported through standard Oracle Solaris features, including the Oracle Solaris Volume Manager and Oracle Solaris ZFS. With reliability established in I/O domains, reliable storage can be provided to guest domains without placing administrative burden on the storage configuration in those domains. In addition, guest domains can use the same software features to implement redundancy in the guest domain, using virtual disks.

- **Oracle Solaris volume manager.** Oracle Solaris volume manager—Oracle's long-standing volume manager tool—can manage data in logical domains. This storage management solution provides high data availability and reliability, enhanced system and I/O performance, and simple large system and disk administration. A host of features enhance availability, including software RAID capabilities, soft partitioning, and hot spare support. I/O and system capacity and performance are aided by disk striping and spanning techniques and a performance monitor that helps identify potential bottlenecks.
- **Oracle Solaris ZFS.** Oracle Solaris ZFS uses several techniques to keep on-disk data self-consistent and eliminate silent data corruption, such as copy-on-write and end-to-end checksumming. Because the file system is always consistent, time-consuming recovery procedures like fsck are not required if the system is shut down in an unclean manner. In addition, data is read and checked constantly to help ensure correctness, and any errors detected in a mirrored storage pool are automatically repaired to protect against costly and time-consuming data loss and previously undetectable silent data corruption. Corrections are made possible by a RAID-Z implementation that uses parity, striping, and atomic operations to aid the reconstruction of corrupted data. Other Oracle Solaris ZFS features, such as snapshots and cloning, can be used to further enhance data recovery and security.

Data reliability in guest domains is strengthened when multiple interfaces to external storage are configured. This allows guest domains to access storage through two I/O domains. Availability is increased by using two redundant paths to storage so that the failure or rebooting of an I/O domain, or failure of any component in the path to storage, does not interrupt access. These dual paths to disks can be provided to the logical domains automatically, without the need to inform or configure the logical domain.

Putting Oracle VM Server for SPARC to Work

Changing business demands are driving IT organizations to look for new technologies that can keep the datacenter operating at peak performance. Those looking to consolidate systems are finding that deploying Oracle servers with CMT and Oracle VM Server for SPARC can help effect better resource use and reduce administrative cost and complexity.

Consolidate and Save

Most application architectures for modern services delivery rely on a multiplexed data model in which many applications work together and share information to produce a service. Oracle VM Server for SPARC lets organizations consolidate systems, and possibly even entire datacenter tiers, onto a single server. For example, Oracle VM Server for SPARC can be used to combine several small servers onto a single platform. Three systems—an Oracle Solaris platform running an accounting program, another running a proprietary database, and an OpenSolaris system running an open-source application and Web server—can be consolidated onto a single Sun

server with three logical domains (see Figure 4). One domain runs the financial application on Oracle Solaris, another runs the database application, and the last one runs the OpenSolaris OS and Web server application. Resources are assigned based on consumption needs, with the database domain in this case receiving slightly more CPU and memory resources than the other applications.

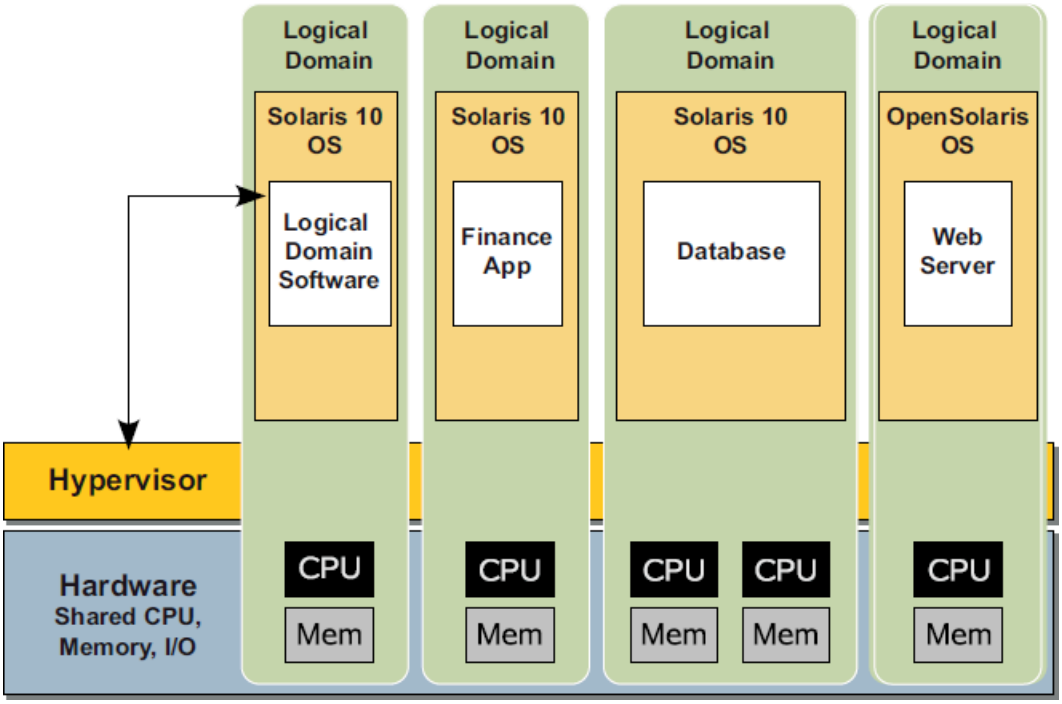

Figure 4. Oracle VM Server for SPARC can be used to consolidate multiple systems onto a single server.

Effect Better Resource Use

Few organizations are able to use systems fully. In fact, many industry analysts estimate that most systems are run at only 15 percent of capacity. By consolidating a large number of vastly underused systems onto fewer servers with Oracle VM Server for SPARC, companies can raise efficiency levels and reduce administration costs.

For example, consider a software development organization with separate test, development, and quality assurance (QA) environments. Each area uses a number of servers, each with its own operating environment and programming tools. These systems can be consolidated onto a single system with Oracle VM Server for SPARC, enabling the test, development, and QA teams to share fewer compute resources—without compromising function or performance.

In this scenario, the test, development, and QA environments run on one system (see Figure 5). One domain runs the Oracle Solaris 10 OS and the tools needed by the testing organization. A second domain also runs Oracle Solaris—even an older version of Oracle Solaris using Oracle

Solaris Containers—as well as the compilers, debuggers, and other associated tools needed by the development team. A third domain runs the software needed by the QA group.

In addition, Oracle Solaris Containers can be used in conjunction with Oracle VM Server for SPARC to reduce the number of unique OS versions required and to simplify the administrative effort. However, if multiple kernels need to be used and patched independently, Oracle Solaris Containers cannot be used. Oracle VM Server for SPARC can, however, be used in this situation or other scenarios where various applications cannot be consolidated in a single environment due to different patch- and kernel-level requirements.

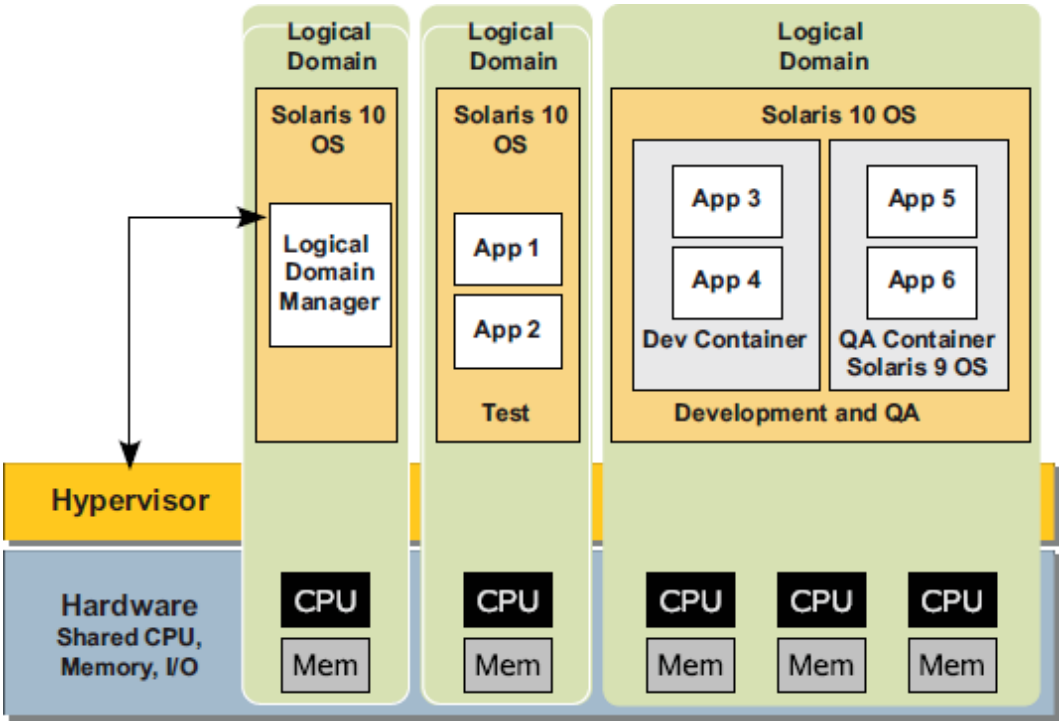

Figure 5. Multiple systems can be combined on one server to effect better resource use and simplify management, without sacrificing performance.

Speed Deployment

Getting systems up and running fast can be the difference between success and failure. Oracle VM Server for SPARC can be used in conjunction with features of Oracle Solaris ZFS to replicate known good domains and deploy similar systems quickly. Oracle Solaris ZFS snapshot and cloning capabilities can help administrators very efficiently replicate a complete application environment, including the OS, patch set, and tuning configurations. An administrator can take a copy of a previously prepared and certified boot disk for one domain and redeploy multiple copies of that image as a preinstalled boot disk for other domains. The procedure is nearly instantaneous, supporting extremely fast provisioning of new application environments. By

taking advantage of the power of Oracle VM Server for SPARC and Oracle Solaris, organizations can avoid waiting for the procurement, deployment, and provisioning of new hardware resources and launch new business applications and services more rapidly, as well as simplify and speed the backup process.

These same virtualization and cloning features can also help organizations safely and more-quickly develop, test, and roll out new applications that leverage the innovative capabilities of Oracle Solaris. The impact of new OS innovations on application performance and system operation can be tested safely in one domain. Once a configuration is certified, administrators can snapshot an image and leverage the virtual device capability of Oracle VM Server for SPARC to transport an entire software stack from one domain to another on the same system or a different physical machine. By easing software migration, Oracle VM Server for SPARC and Oracle Solaris can help enterprises speed integration of new capabilities and create more-flexible infrastructures.

Keep Applications Secure

The pressures associated with an increasingly connected business economy, regulatory compliance, and demand for the protection of business and consumer information are forcing IT organizations to seek the best-available methods for guarding against breaches. Oracle VM Server for SPARC and the features inherent in Sun servers with CoolThreads technology and Oracle Solaris can be used to maximize isolation and security.

- Oracle VM Server for SPARC can be used to create completely separate OSes and hardware resources, providing extremely high levels of isolation for applications and services. Sensitive data can be isolated from systems and applications that should not have access, simply by placing it in a logical domain. In addition, logical domains can be combined with Oracle Solaris Containers if additional security is required.
- One aspect of keeping information secure is ensuring other applications and services cannot purposefully or accidentally access data as it is being used by the system. With Oracle VM Server for SPARC, CPUs and memory are not shared between logical domains, minimizing the ability of runaway applications to gain access to data being worked on in another logical domain. In addition, administrators can choose whether—and how—to share I/O devices, providing another security measure as data moves into and out of the system.
- In a virtualized environment, isolation is imperative. Oracle VM Server for SPARC provides strong workload isolation. A failure in one guest domain does not bring down other guest domains on the system. In addition, the hypervisor, which has access to all memory and I/O devices, is not accessible from any guest domain. This isolation increases security and prevents unauthorized access to data and resources. As long as traditional OS security remains uncompromised on the server, no domain can access the content of another domain.

- Taking advantage of leading-edge security features in Oracle Solaris can help organizations enhance approaches to IT security. Oracle Solaris offers companies access to the latest security features that help prevent, detect, and respond to security threats. Features that enhance privileges and authorizations deliver a level of protection that helps organizations create an infrastructure fortified against attacks from viruses, worms, or Trojan horses.
- Businesses in every industry are more concerned than ever about secure communications and data privacy. The Sun servers that underpin Oracle VM Server for SPARC incorporate powerful CMT processors with built-in hardware cryptographic units to radically simplify and accelerate cryptographic operations. These powerful processors support a wide variety of cryptography standards, including Data Encryption Standard (DES), Triple DES, Advanced Encryption Standard, Rivest Cipher 4, Secure Hash Algorithm (SHA1), SHA256, message digest algorithm (MD5), Rivest Shamir Adleman (RSA) to 2048 key, and elliptic curve cryptosystem encryption algorithms. These hardware cryptographic accelerators are available to Oracle VM Server for SPARC at no cost, at full speed, and without compromise.

Conclusion

Now more than ever before, doing more with less has become not only a top priority, but an actual necessity. A sprawling compute infrastructure that is costly to manage and leaves systems largely underused will have a devastating effect on any company's bottom line. By combining workloads and using virtualization techniques, companies can maximize the use of compute platforms; simplify IT infrastructure; and bring new levels of use, efficiency, manageability, and agility to a growing enterprise. With Oracle VM Server for SPARC, a single system can be split into multiple independent virtual systems, making it easy to deploy multiple OSes simultaneously within a single physical system. Oracle VM Server for SPARC helps companies achieve greater resource use, better scaling, and increased security and isolation—keeping the datacenter operating at peak performance.

For more information about Oracle VM Server for SPARC, visit oracle.com/virtualization.

Oracle is committed to developing practices and products that help protect the environment

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