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Server Consolidation

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- Migrate legacy applications to newer systems
- Refresh legacy hardware to reduce operating expenses

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Server Consolidation

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Oracle 2nd Special Edition

by Lawrence C. Miller, CISSP

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Server Consolidation For Dummies®, Oracle 2nd Special Edition

Published by
John Wiley & Sons, Inc.
111 River St.
Hoboken, NJ 07030-5774
www.wiley.com

ISBN 978-1-118-78621-5 (pbk); ISBN 978-1-118-78702-1 (ebk)

Manufactured in the United States of America

10 9 8 7 6 5 4 3 2 1

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Introduction

Today's data centers are integral to delivering results that help achieve business goals. Data center managers need to be agile and innovative in rapidly deploying new applications to keep up with changing business requirements. However, most data centers are overly complex and costly to operate and unable to adapt quickly enough to meet business goals. A legacy of application deployment using one server per application has created data centers full of servers of various ages, types, operating systems, and complex networking and storage configurations. As markets continue to evolve, today's data center managers face many challenges including

- **Outdated infrastructure.** According to IDC (International Data Corporation), 44 percent of installed servers today are four to five years old, on average.
- **Growing customer demands.** Variable and unpredictable demands come from both internal and external customers.
- **Increasing operating costs.** Seventy-five percent of data center costs are non-revenue-generating operating expenses (OPEX), and 80 percent of an organization's total IT spend is on maintenance.
- **Diverse applications.** Organizations increasingly need a growing variety of multitenant solutions.

- **Resource constraints.** Limited resources are available, and IT staff is focused on non-revenue-generating projects and support tasks.

To become more aligned with business goals, complexity in the data center needs to be dramatically reduced. A proven method to reduce data center complexity is through server consolidation. Data centers that run consolidated applications on the latest server technology reduce operating costs, increase compute capacity, and improve business flexibility.

For a successful consolidation initiative, it is important to select a server platform that has the following:

- Scalability to support many application instances
- High availability needed for mission-critical applications
- Resource management and virtualization capabilities to simplify managing multiple applications
- Tools to manage the consolidated environment

Oracle's SuperCluster servers, SPARC T-Series and SPARC M-Series servers, Oracle Virtual Compute Appliance, and x86 systems meet and exceed all of the preceding requirements and are ideal platforms for server consolidation.

Server Consolidation For Dummies, Oracle 2nd Special Edition, explores the business and technical benefits of server consolidation, explains where and how organizations should consolidate their most critical systems, and introduces Oracle server consolidation solutions and tools.

About This Book

This book contains volumes of information that rival the U.S. Congressional Record or the complete *Encyclopedia Britannica,* conveniently distilled into five short chapters chock-full of just the information you need! Here's a brief look at what awaits you in the pages ahead.

Chapter 1: Server Consolidation — What and Why. I start by explaining what server consolidation is and some of the business benefits of server consolidation.

Chapter 2: Consolidation — Where and How. In this chapter, you find out about the different types of consolidation, various consolidation issues, and, of course, how to consolidate!

Chapter 3: Oracle Server Consolidation Solutions. Here, you get a broad overview of the many Oracle server solutions for enterprise consolidation projects.

Chapter 4: Oracle Virtualization and Resource Management Consolidation Solutions. This chapter explores Oracle's robust SPARC/Solaris virtualization, Oracle Virtual Networking, Oracle Virtual Compute Appliance, and Oracle's cloud optimized virtualization featuring Oracle's x86 servers utilizing Oracle VM with Oracle Linux and Oracle Solaris. These resource management solutions complement Oracle servers to help you succeed in your consolidation project.

Chapter 5: Ten Best Practices for Server Consolidation. Finally, in that classic *For Dummies* style, I share several industry best practices for server consolidation projects.

Icons Used in This Book

Throughout this book, you occasionally see icons that call attention to important information that is particularly worth noting. You won't find any winking smiley faces or other cute little emoticons, but you'll definitely want to take note! Here's what to expect.

This icon points out information that may well be worth committing to your nonvolatile memory, your gray matter, or your noggin — along with anniversaries and birthdays!

If you're an insufferable insomniac or vying to be the life of a World of Warcraft party, take note. This icon explains the jargon beneath the jargon and is the stuff legends — well, at least nerds — are made of.

Thank you for reading, hope you enjoy the book, and please take care of your writers! Seriously, this icon points out helpful suggestions and useful nuggets of information.

Where to Go from Here

Chapter 1 might be a good place to start. However, if you see a particular topic that piques your interest, feel free to jump ahead to that chapter!

Chapter 1

Server Consolidation — What and Why

In This Chapter

- Understanding the benefits of server consolidation
- Increasing resource utilization
- Consolidating systems for maximum cost efficiency

As Information Technology (IT) organizations support dynamically changing business priorities and cope with economic pressures, maintaining data center agility is critical. By consolidating systems onto the latest server technology and taking advantage of virtualization techniques, enterprises can optimize data center efficiency, gain flexibility, and reduce operating costs — without sacrificing performance or impacting service levels. In this chapter, you discover what server consolidation is all about and its benefits for organizations that undertake a server consolidation initiative.

Recognizing Today's Server Infrastructure Challenges

Many companies spend as much as 80 percent of their IT resources on support and maintenance activities versus revenue-generating IT. Virtually every aspect of a business depends on the services provided by its data center's infrastructure to stay ahead of changing business conditions. Although it's tempting to deploy one server per application or database, such a model can lead to "server sprawl," which is often complex and inflexible and hampers agility as companies look to react to rapidly evolving world markets. Some of the challenges associated with growing costs and complexity that IT organizations must address include

- Increasing operating, administration, facilities, and support costs related to outdated hardware and software
- Increasing user and application demands for more performance, capacity, and flexibility
- Aging servers that are increasingly unable to meet service-level requirements and the need to protect investments in existing applications and skill sets
- Growing demand for multitenant solutions that also increase vendor count and support complexities
- Mounting risk driven by server proliferation (or "sprawl")
- Impending space and power-capacity limitations in the data center

As businesses grow, IT organizations add systems to support data center loads. If not carefully planned, such additions can result in a sprawling, complex network of systems that consume valuable data center floor space, create excessive power and cooling demands, and are costly and difficult to manage. IDC (International Data Corporation) states that nearly 44 percent of installed servers are between four to five years old. Many of these platforms are at maximum capacity, making it difficult for data centers to scale solutions to meet increasing business requirements. Indeed, today's hypercompetitive environment is forcing businesses to find ways to adapt and innovate in order to survive and be profitable. Yet IT is spending all its time and the organization's money keeping systems running instead of deploying new applications. The key to success is finding the right balance between business requirements, costs, and capabilities.

The answer is *server consolidation.*

Server consolidation — bringing together applications, databases, and services onto fewer, highly reliable servers — isn't just a trend but a necessity. By moving to the latest technologies and implementing virtualization techniques, companies can consolidate onto fewer systems with increased compute power, easier manageability, and smaller footprints in the data center — in other words, you can do more with much less!

Why Server Consolidation?

For many years, organizations have deployed new applications on purpose-built servers, which are

servers that host only one application. This one-application-per-server deployment model helps to ensure that

- Server-based applications have sufficient processor, memory, and I/O resources.
- Multiple applications do not conflict with each other.
- Unnecessary services are not running, thereby creating a more stable and secure server environment.

In the case of complex 3-tier enterprise applications, this single-purpose deployment design requires IT organizations to deploy web, business logic, and database servers for each application. Each time a new server is deployed, networking, storage, and management complexity increase. Increased complexity leads to greater costs, reduced system utilization, and less business flexibility.

The requirement for development and test servers for many enterprise applications means additional servers and more server sprawl. Furthermore, production servers for critical applications are often deployed in highly available clusters or other redundant configurations — which adds still more complexity. When initially deployed, production servers typically have enough headroom — in terms of processors and memory — to support spikes in the installed application's workload. Unfortunately, the headroom in each server in an unconsolidated model cannot be

shared with other applications. Furthermore, as the application's uses and its associated data grow, the only way to add more capacity is to add more servers. As the number of servers increases, the number of operating system instances that need to be managed grows, thereby increasing complexity and reducing flexibility in the data center.

Server utilization is normally very low in the one-application-per-server deployment model — typically from 10 to 30 percent — which is not an efficient use of server resources. Each server needs to be large enough to handle spikes in workload, but normally these applications need only a small part of the server's capacity.

Figure 1-1 illustrates the one-application-per-server model in which many small servers each run a single application instance. Each of these servers needs to have enough headroom to meet peak capacity requirements for its workload and cannot "share" headroom with other servers that need more capacity.

If these servers could share headroom, loaning it out to the other servers or borrowing it from other servers, they would have higher server-utilization rates — but this is not possible with disconnected servers. However, if the applications are consolidated — meaning more than one per server, as shown in Figure 1-2, the workload peaks and valleys tend to even out, and the total compute requirement becomes less variable. The more applications that are consolidated, the more even the server usage and the higher the utilization rate.

Applications that are consolidated on a larger server benefit from shared headroom where resources shift dynamically from application to application. IT departments that consolidate many applications onto larger servers commonly achieve up to 70 to 80 percent utilization rates.

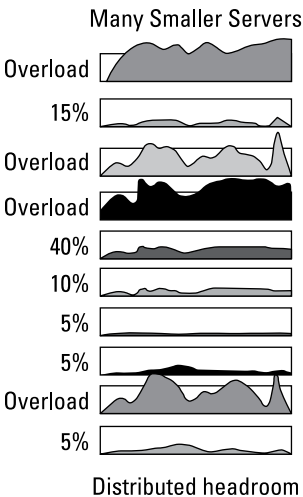


Figure 1-1: Typical server utilization in the one-application-per-server model.

Consolidating applications can lead to much higher server utilization and more efficient use of excess capacity.

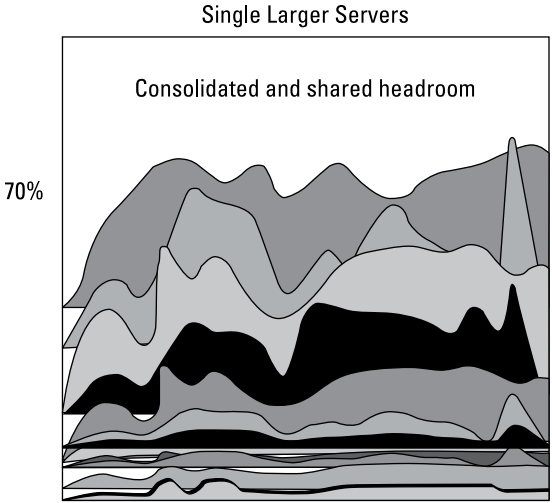


Figure 1-2: Higher server utilization with application consolidation on larger servers.

Reaping the Benefits of Consolidation

Improved server utilization resulting from server consolidation means more efficient use of server resources. This, in turn, improves ROI (return on investment) and reduces the total server hardware required to meet workload requirements. Thus, a key goal of any server consolidation project is to increase server utilization, resulting in:

- Fewer systems to manage in the data center for a more simplified IT infrastructure
- Lower costs associated with infrastructure acquisition, implementation, operation, administration, and support
- Lower power and cooling costs associated with a reduced hardware footprint
- Better overall performance

Consolidating many older and smaller servers onto fewer larger and newer servers, such as multi-purpose (numerous applications) 4 to 16 socket systems, using 8 to 16 core processors, provides many benefits besides improved server utilization. Undertaking a server refresh as part of a server consolidation project yields many technical benefits, including

- Improved performance and scaling
- Enhanced virtualization
- Reduced complexity
- Greater availability
- Simplified system management
- Facilitated path to a cloud deployment

Business benefits resulting from server consolidation include

- Increased capacity for new business-critical applications
- Easier resource deployment for faster time-to-revenue

An example of server consolidation

Most servers that are running only one workload are underutilized in the data center: There are more hardware resources than the workload requires. The result is grossly inefficient use of an organization's assets. Consolidating legacy servers onto newer systems using virtualization technology can help organizations use their resources more efficiently. For example, replacing ten Sun Fire V490 systems running Oracle Solaris 8 with one Oracle SPARC T-Series server running Oracle Solaris 11 would achieve the following benefits:

- No significant change in aggregate throughput performance despite more workloads
- Performance improvement of 2 times or better with new SPARC T5 and SPARC M6-32 servers over previous generation servers
- Significantly reduced space, software licensing, service and support, power, and cooling costs

When replacing older Oracle x86 systems, customers experience up to an 87 percent increase in performance on the new X3 systems. This performance gain enables consolidation of 6 to 8 legacy systems onto a single X3 system featuring Intel's E5-2600 family of processors. Oracle's X3 systems currently hold four industry benchmark world records resulting from higher-power CPUs and fine-tuning of these systems for Oracle applications.

- Lower software licensing, acquisition, and support costs
- Less planned and unplanned downtime
- Ability to reinvest cost savings into new infrastructure demands, such as storage and networking, to keep pace with market dynamics
- Ability to realign IT staff into revenue-generating activities

Chapter 2

Consolidation — Where and How

In This Chapter

- Consolidating new and legacy applications
- Managing workloads with virtualization tools
- Knowing what's important in consolidated servers

Server consolidation in the data center requires a strategic plan in order to achieve maximum benefits for an organization. Knowing your various consolidation options, what issues need to be addressed, how to consolidate, and what hardware is needed are key elements of a successful server consolidation plan — all of which this chapter addresses!

Exploring Consolidation Types

Organizations typically follow either — or both — of the following server consolidation strategies:

- Consolidated deployment of new applications
- Legacy consolidation of existing servers and applications

Consolidated deployment of new applications is a relatively easier undertaking than legacy consolidation of existing servers and data. When deploying newer applications, you usually don't need to worry about legacy software that runs only on older OS versions, data on existing storage devices, or specialized hardware that is no longer available. New application deployments also typically have fewer political issues than legacy applications, for example, with application owners that want to deploy on "their" servers. This makes it easier to match the resources of your server consolidation platform to the actual needs of the application and to configure the system appropriately. New application deployments are likely to have relatively few custom software modifications already implemented and little associated data (unless other data types are converted or integrated into the new application).

Finally, a new application can be installed "clean" on a server consolidation platform, using an appropriate virtualization technology such as hardware partitioning (Dynamic Domains), virtual machines (Oracle VM Server for SPARC and x86 systems), or OS virtualization (Oracle Solaris Zones). I explain these virtualization technologies in Chapter 4.

Consolidation servers can be viewed as large pools of compute resources that can be partitioned using virtualization solutions. Oracle's SPARC and x86 systems running Oracle Solaris virtualization technologies allow you to combine many applications on a single server instance, thereby increasing server utilization.

Although consolidated deployment may be a bit easier, consolidation of legacy applications and systems is more common and provides great benefits. Many consolidation initiatives can replace older servers with newer servers at ratios of 10:1 or 20:1, meaning that dozens of older servers can be replaced by just a few newer servers. Such reductions also help to reduce networking, storage, and management complexity. Furthermore, less space and power are needed, and system availability and stability are greatly improved.

Another big advantage of legacy consolidation is access to application performance metrics. It's possible to measure applications that are in production to determine workload peaks and valleys and average response times. Other metrics include security issues and memory, processor, and storage requirements. This information allows data center managers to create application profiles, thereby making it easier to determine which applications should be consolidated with other applications. The goal is to deploy similar types of applications and match workload peaks and valleys in a single OS instance. Knowing which applications should be combined is a key success factor in server consolidation. A key bit of information that's required when combining applications is what OS the existing applications are running on. It is clearly easier to upgrade from servers with a given OS to a server with the same OS since you avoid many migration and compatibility issues. For example, if you have many applications that run on Oracle's SPARC/Solaris or x86/Solaris servers, it is easier to consolidate to newer SPARC and x86 servers running Oracle Solaris because you have the same software.

Gather application metrics and use that information to plan what applications should be combined on the same OS instance.

When using virtualization solutions to partition consolidation servers, you will have "virtual machines" (VMs) — partitions in physical servers that appear as servers but are actually a subset of the server resources.

To migrate legacy applications from existing physical servers, you should use physical-to-virtual (P2V) migration tools (discussed later in this chapter).

Data associated with a legacy application may also need to be moved onto consolidated storage. Depending on the type and nature of the data, your organization's retention policies, and the location or locations of your data, simply moving the data to a consolidated storage location can be a challenge in itself and will require careful planning.

You should always back up critical data before attempting to move it to a new storage platform.

Considering Application Consolidation Issues

Server consolidation provides an opportunity for organizations to change their data center deployment topology from a closed three-tier architecture that contributes to rampant server sprawl to a more efficient topology that is data-, application-, and web-centric by combining like workloads. For example, it is easier to

combine dozens of database instances than it is to combine database instances with applications and web servers (see Figure 2-1).

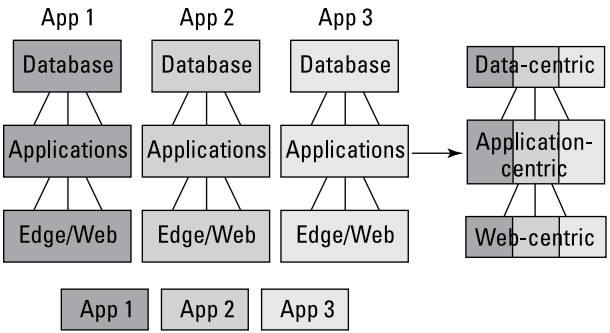


Figure 2-1: Change deployment topology and optimize applications with server consolidation.

In general, organizations want to consolidate similar workloads onto the same platform. Important issues to consider include workload types, security issues, and availability requirements.

Workload types

When planning to consolidate applications, you need to determine the types of workloads that will be combined with other workloads and their attributes. The types of server, storage, and virtualization solutions you use will be based on the workloads themselves. Most modern 3-tier application deployments have three high-level workload categories: the web tier, the application or business logic tier, and the data or database tier.

The web tier is generally not a good option for consolidation because it doesn't provide many benefits. The web tier does not store data, has very short, transient transactions, and uses load balancers to effectively spread the workload among many horizontally scaled servers. The application tier has much greater transaction complexity and may have some storage requirements, making it a good candidate for consolidation. Lastly, the data tier is ideal for consolidation because of its high compute, memory, and storage requirements.

Focus your consolidation efforts on the application and database tiers.

Workload attributes are important when doing consolidation planning. Each workload has different storage, compute model, availability, and security requirements. Key attributes to consider include security requirements, availability requirements, OS versions and patch levels, and compute requirements. Workloads from the same tier (application or data) and with similar attributes (threading, availability, security, and storage, for example) are good consolidation candidates. This leads to fewer application conflicts and enables the use of the most appropriate consolidation server and storage platforms.

Security issues

Security concerns are another important consolidation issue that needs to be addressed. Many organizations may need — or even be required — to physically segregate certain workloads. For example, Internet-facing workloads may need to be consolidated onto

different server platforms from sensitive internal workloads. Research and development systems may warrant their own consolidation platform. Workloads that require certain types of encryption and key management may likewise need to be separated.

Certain regulatory mandates and standards may require physical separation of certain workloads. For example, the Payment Card Industry's Data Security Standard (PCI DSS) details very specific requirements for segregating networks and systems that process and store payment cards (such as credit and debit cards). The PCI Security Standards Council (SSC) also publishes virtualization guidelines (which are frequently relevant in consolidated environments) for organizations that are subject to PCI DSS. Yet another regulatory example, the Sarbanes-Oxley Act (SOX), also sets forth some stringent reporting requirements that need to be considered when planning consolidation projects.

You can learn more about PCI DSS and download the PCI SSC virtualization guidelines (and other official PCI documentation) at `http://pcisecuritystandards.org`. You can learn more about SOX at `www.sec.gov`.

Finally, physical security considerations may also dictate what workloads can be consolidated. For example, certain applications (and their associated data) may have stringent physical security restrictions and access controls that require their host systems to be located in separate equipment cabinets, in more secure data center rooms (for example, requiring biometric access controls), or in only certain geographic locations.

Mission-critical systems and applications

Certain mission-critical systems and applications may warrant consolidation on a platform that is separate from other less critical workloads. For example, you might consolidate your mission-critical systems onto an Oracle SuperCluster for maximum RAS (Reliability, Availability, and Serviceability) and all other enterprise workloads onto several SPARC M-Series or SPARC T-Series servers. (I discuss SuperCluster and SPARC M-Series and SPARC T-Series servers in Chapter 3.) If you are migrating workloads to an x86 architecture, you should consider Oracle Virtual Compute Appliance for the highest level of consolidation or Oracle's x86 systems for the most flexibility in consolidation.

Oracle x86 systems provide the foundation for Oracle's own cloud — Oracle On Demand.

Dynamic Domains, explained in Chapter 4, are appropriate for business-critical workloads where workload isolation is the most important factor.

OS versions and patch levels

Every application, whether legacy or new, supports certain OS versions and patch levels. Applications that are to be combined into a single partition need to support the same OS versions and patch levels. You can use virtualization tools such as Oracle Solaris Zones, Oracle VM for SPARC and x86, and Dynamic Domains (all discussed in Chapter 4) to create various OS and patch levels within a given consolidation server.

Compute requirements

Applications have different memory, threading, and response-time requirements. Some applications require a lot of shared memory, while others need little memory or can use distributed memory. Some applications, especially newer ones, are highly threaded and use all of the cores and threads available in newer servers; others have relatively few threads and require servers with very good single-threaded performance. Some applications require very fast response times, while others need to support large numbers of users. Knowing these compute characteristics will greatly simplify consolidation planning. Again, consolidate applications that have similar compute requirements and make sure that the consolidation server meets those compute requirements.

Knowing How to Consolidate

With an understanding of the different consolidation types and issues (both discussed earlier in this chapter), you can now begin to choose which workloads to consolidate in your data center. Many organizations often "start small" with their consolidation initiatives beginning with nonproduction workloads, such as test or backup environments, before moving on to noncritical production systems and workloads. As with any major project, it is important to get "buy-in" from the appropriate stakeholders. Executive support is a must. Beyond your executive team, you need to identify system owners. For example, your CRM (customer relationship management) application may belong to

marketing, while your accounting systems likely belong to finance. Finally, the users of your various systems and workloads need to be informed and, to the extent necessary, involved in your server consolidation project.

Application owners often like to deploy their applications on "their" servers — servers that they control. Combining applications from different application owners onto consolidation servers can sometimes meet with resistance from the application owners. Having high-level management support can help you overcome some of these political issues.

Understanding the Role of Virtualization

Virtualization is a key enabling technology for server consolidation. Virtualization allows multiple applications to be run on a single physical server in different VEs (virtual environments), creating the effect of a purpose-built server for each of the applications running on the server. This approach avoids potential interoperability issues between applications running in a mixed environment. Deploying applications in virtual environments is simplified by using easy-to-use migration tools. These migration tools are particularly helpful when consolidating existing legacy applications from older servers. There are three migration types for virtualization technology: *cold, warm,* and *live.* Only cold migrations are relevant to server consolidation. P2V and V2V conversions are two examples of cold migrations.

P2V (physical-to-virtual) conversions are most common for server consolidation. A P2V move involves converting an existing *physical* server workload to a *virtual* environment (VE) on a partitioned server. A V2V (virtual-to-virtual) conversion involves converting servers and their associated workloads from one virtualization technology to another. For example, V2V conversions are appropriate for moving from VMware to Oracle VM for x86 systems or moving an Oracle Solaris 10 Container running on a legacy SPARC T-Series server to an Oracle Solaris 11 Zone on a newer SPARC T-Series or SPARC M-Series server. I talk more about SPARC T-Series and SPARC M-Series servers in Chapter 3 and Oracle VM for x86 and Oracle Solaris Zones in Chapter 4.

Virtualized networks are the crucial next step. An essential technology for modern data centers and private cloud infrastructures, they enable a whole new level of performance, simplicity, and agility. Oracle Virtual Networking products virtualize your SAN (storage area network) and LAN (local area network) infrastructure by defining connectivity in software, giving you the flexibility and agility you need. I discuss Oracle Virtual Networking in Chapter 4.

Identifying Server Requirements

Servers used for consolidation must enable reuse of existing applications and provide high capacity, high performance, high availability, serviceability, and effective virtualization/resource management. These servers must often run older applications on newer hardware. Therefore, the consolidation platform must

be able to run older legacy applications as well as new applications. An additional compatibility issue may exist in legacy applications that are not supported by newer hardware or processing architectures. Since multiple applications run on these servers, they need the capacity to handle large numbers and types of workloads. The performance of each application when consolidated with other applications must meet or exceed the performance when deployed by itself on its own server.

Consolidation, by definition, means "putting more eggs in one basket." Thus, a system failure can affect the entire application stack unless high availability is built in at both the virtual machine layer and the application layer. This arrangement ensures application reliability and integrity during both planned and unplanned server downtime. For more information on Live Migration with Oracle VM and application HA with Oracle Real Application Cluster, go to `www.oracle.com/us/technologies/virtualization/overview/index.html`.

In addition to being extremely reliable, consolidation servers must have serviceability features so they can be reconfigured or upgraded with little or no downtime.

Chapter 3

Oracle Server Consolidation Solutions

In This Chapter

- Looking at vertically scalable high-end servers
- Consolidating with Oracle SuperCluster servers
- Using T-Series servers as consolidation platforms
- Scaling high-end SPARC M-Series servers vertically

All servers consist of the same essential components: processors, memory, and I/O (input/output) slots. But different server architectures combine, connect, and utilize these components in different ways.

In this chapter, you find out about the many Oracle hardware solutions for server consolidation. The servers discussed in this chapter all use Oracle SPARC processors and the Oracle Solaris operating system (OS). Optimized for SPARC servers, Oracle Solaris delivers the high performance, throughput, and I/O rates that are critical to single-threaded applications, as well as the most demanding applications. In addition, integrated server, storage, and network virtualization and resource control mechanisms support the vertical

and horizontal scalability and optimized utilization needed for consolidating high-demand enterprise applications and growing data sets.

Vertically Scalable, High-end SMP Servers as Consolidation Platforms

Vertically scalable, high-end servers usually consist of large symmetric multiprocessing (SMP) systems, typically hosting eight or more physical processors (or sockets). These systems run a single instance of an operating system to manage multiple processors, memory subsystems, and I/O components, which are contained within a single chassis. Vertically scaling servers are a great platform for consolidation because they meet the requirements for scalability, availability, and manageability in a consolidation server.

High-end SMP servers have dozens of processor and I/O slots and several terabytes (TB) of RAM. Most vertically scalable servers, such as Oracle's SPARC M-Series servers, can be partitioned using virtualization tools.

Vertically scalable SMP servers are essentially large pools of resources that can support numerous workloads of various sizes and types and thereby simplify application consolidation and deployment.

A high-end SMP server functions as a cloud of resources that are tightly integrated and extremely flexible.

High-end SMP servers greatly simplify application deployment and consolidation. New applications can be deployed without having to install new hardware, and existing applications can grow by taking advantage of the headroom available in these servers. No cabling or provisioning is needed when deploying new applications — and if more capacity is needed, it can be added by installing more processors and memory in existing servers.

In addition to a single high-end SMP server, vertical architectures also include clusters of high-end SMP servers that can be used for a single large application.

Because a high-end SMP system can handle virtually all sizes and types of workloads, organizations can standardize their data centers on a single system, thereby greatly simplifying management, service, and deployment.

Oracle SuperCluster

The SuperCluster is a complete, pre-engineered and pre-tested, high-performance, enterprise-infrastructure solution. Available in half-rack or full-rack configurations, the system leverages Oracle technology — combining the computing power of Oracle SPARC T-Series servers and SPARC M-Series servers, the performance and scalability of Oracle Solaris, and the optimized database performance of Oracle Database accelerated by Oracle Exadata Storage Servers with a high-bandwidth, low-latency InfiniBand network fabric — into a scalable, engineered system that is optimized and tuned for consolidating enterprise applications (see Figure 3-1).

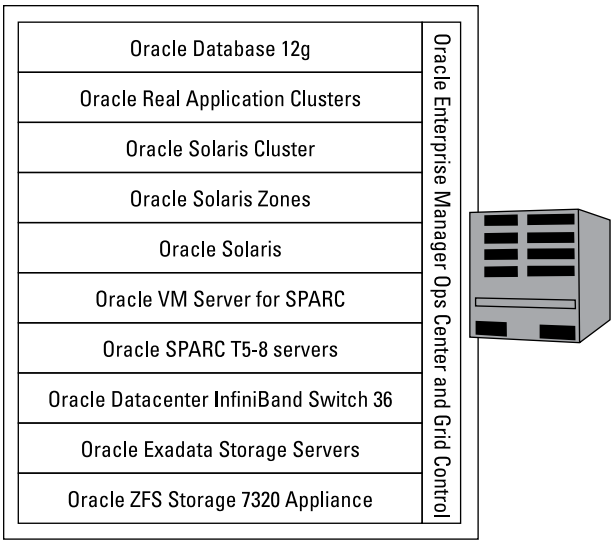


Figure 3-1: Oracle SPARC T-Series servers are ideal for resource-intensive applications.

The core components of SuperCluster include

- **Oracle SPARC M6-32 server.** The SPARC M6-32 server is another option as the compute node in a SuperCluster. Ideal for high-capacity applications, each SPARC M6-32 server is powered by 32 12-core, 3.6 GHz SPARC M6 processors with up to 384 cores, 3,072 threads, and 32TB of RAM per system.

- **Oracle SPARC T5-8 servers.** Ideal for resource-intensive applications, each SPARC T5-8 server is powered by eight 16-core, 3.6 GHz SPARC T5 processors with up to 128 threads per processor for a maximum 1,024 threads per system.
- **Oracle Exadata Storage Servers.** Oracle Exadata Storage Servers deliver extreme database performance to enterprise applications in a highly available, highly secure environment. Optimized for use with Oracle Database, Oracle Exadata Storage Servers employ a massively parallel architecture and Exadata Smart Flash Cache to accelerate Oracle Database processing and speed I/O operations. The Oracle SuperCluster has 64TB or 128TB of uncompressed Exadata Storage Server capacity.
- **Oracle ZFS Storage 7320 Appliance.** Providing up to 432TB of raw capacity, 2TB of read-flash cache per storage controller, and 292GB of write-flash cache per disk shelf system, the Oracle ZFS Storage 7320 Appliance uses flash-enabled hybrid storage pools (HSPs) to accelerate application response time.
- **Oracle Datacenter InfiniBand Switch 36.** Oracle SuperCluster is built around an InfiniBand fabric for rapid exchange of data among the cluster components.

For more information about SuperClusters, go to `www.oracle.com/us/products/servers-storage/servers/sparc/supercluster/supercluster-t5-8/overview/index.html`.

Oracle SuperCluster — real-world results

The Oracle SuperCluster delivers outstanding performance for Oracle customers in numerous industries around the world.

Pharmaceutical distributor. Running Oracle Database 11gR2 and JD Edwards EnterpriseOne. Results include

- Up to 153 times exponential improvements in batch reporting, using ZFS Storage
- 2.5 times performance improvement of JD Edwards sales order processing
- Over 4 times faster after migrating Oracle Database to 11gR2 using the Exadata Storage Servers

Asian consumer packaged goods manufacturer and distributor. Running Oracle Database 11gR2 and Oracle WebLogic. Benefits include

- A fully integrated platform optimized for SuperCluster
- The most advanced and reliable OS (Oracle Solaris 11) virtualized for consolidation
- Automatic policy-based resources allocation using Oracle Virtualization Manager zoning

Oracle SPARC T-Series Servers

Oracle SPARC T-Series servers with Oracle Solaris are ideal consolidation servers for both application and database workloads. The latest SPARC T5 servers offer a 2 times price performance advantage over the

previous generation of servers and currently hold more than 15 world record benchmarks.

SPARC T-Series servers deliver value in the following four areas:

- **Price/Performance.** The best price/performance and value for Oracle and non-Oracle applications with lower acquisition costs and operating expense than other comparable systems.
- **Maximum availability.** Advanced clustering capabilities and configurations available to ensure mission-critical systems and applications are always available.
- **Integration.** Platforms that include key technologies, such as built-in virtualization and systems management tools.
- **Optimization.** System building blocks that run Oracle applications more reliably and with higher performance.

With SPARC T-Series servers, organizations can achieve their consolidation objectives with a complete portfolio that addresses database, batch, middleware, and multithreaded workloads while meeting needs for high availability and simplified operation.

SPARC T-Series servers range from single processor rack and blade versions up to an eight-processor, 128-core rack mount server.

With up to eight 16-core SPARC T5 processors in a single chassis and guaranteed application compatibility for Oracle Solaris applications, SPARC T-Series servers are an ideal platform for consolidating legacy SPARC servers.

SPARC T-Series servers — real-world results

SPARC T-Series servers deliver scalable performance for Oracle customers in numerous industries around the world. For example:

Large university. Consolidated corporate Unix servers to SPARC T-Series servers. SPARC T5 provides better TCO (total cost of ownership) and a future-proof platform for growth.

Results:

- 2 times lower TCO over five years
- Paved way to take over SAP workload running on HP-UX in the future
- Oracle Migration Services
- Minimize business risk moving older PeopleSoft versions through Oracle Solaris's guaranteed application compatibility (learn more at `www.oracle.com/technetwork/server-storage/solaris/overview/guarantee-jsp-135402.html`)

For more information on SPARC T-Series servers, go to `www.oracle.com/us/products/servers-storage/servers/sparc/oracle-sparc/t5-8/overview/index.html`.

SPARC M-Series Servers

Oracle's vertically scaling SPARC M-Series servers deliver innovations and features that enable customers to take advantage of the vertical scaling model for consolidation to achieve

- Higher utilization rates
- Lower TCO
- More predictable service levels
- More efficient use of resources

To achieve solid application performance — a requirement for consolidation projects — organizations need a balanced server with fast processors, a fast interconnect, fast I/O, large memory, a scalable operating system, optimized applications, and an extremely high degree of reliability, availability, and scalability. Oracle's approach to system design has always been focused on achieving balance among these core elements.

Processors and system interconnect

High-end SPARC M-Series servers scale up to 32TB of RAM and up to 32 12-core SPARC M6 processors running at 3.6 GHz. The SPARC M6 processor has excellent single-thread performance and high throughput that make it ideal for just about any workload. Furthermore, the SPARC M6-32 server supports both SPARC M5 processors and SPARC M6 processors in the same chassis, making it easy to expand capacity.

For application performance, it is generally more important that processors run at their maximum capacity (with high rates of utilization) than it is to have the fastest available processor. A fast processor running at 50 percent of its capacity may actually be slower in terms of delivered performance than a slower processor running at 80 percent capacity. Additionally, as the number of processors in a system increases, the bandwidth and latency of the system interconnect becomes more important than the speeds of individual processors in terms of delivered performance.

Input and output (I/O)

The high-end M-Series servers scale up to 64 PCIe Gen3 I/O slots. This large I/O capacity makes it easier to meet the I/O requirements of consolidation projects.

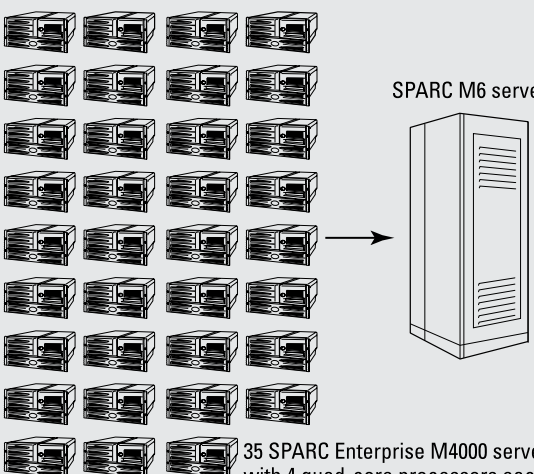
High availability

The high-end M-Series servers are designed to be highly available as single, standalone servers. Availability features include full hardware redundancy, fault-isolated Dynamic Domains, hot-swap of most components, and many reliability features built into the processor and system interconnect. For near-fault-tolerant requirements, M-Series servers can be clustered using either Oracle RAC or Oracle Solaris Cluster.

For more information about Oracle SPARC M-Series servers, go to `www.oracle.com/us/products/servers-storage/servers/sparc/oracle-sparc/m5-32/overview/index.html`.

Case study: Consolidating older SPARC Enterprise servers with newer SPARC M-Series servers

The following example demonstrates how organizations can consolidate older SPARC Enterprise M4000 servers into a single next-generation SPARC M6-32 server (see the figure). This consolidation project results in cost reductions in Oracle Database software, hardware service, and power, cooling, and floor space, while also improving performance, availability, manageability, and TCO.



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A SPARC M6-32 server with 32 12-core processors (a total of 384 cores) has the equivalent performance of more than 35 SPARC Enterprise M4000 servers (with four 3.0 GHz quad-core processors each and a total of 560 cores).

The 35 M4000 servers running Oracle Database software as configured in the figure would require a total of 280 Oracle Database licenses (560 x 0.5 = 280). The SPARC M6 server configured in the figure requires only 192 Oracle Database licenses (384 x 0.5 = 192). This reduction in cores and associated database license costs for the SPARC M6 server pays for the acquisition cost of the new server while still achieving total performance similar to or better than that of the 35 M4000 servers. The existing but unused Oracle Database licenses can then be redeployed for new projects in the organization.

Chapter 4

Oracle Virtualization and Resource Management Consolidation Solutions

In This Chapter

- Understanding Oracle Solaris Zones and Dynamic Domains
- Exploring Oracle VM Server for SPARC and x86
- Introducing Oracle Virtual Networking
- Managing consolidated environments with Oracle Enterprise Manager 12*c*
- Introducing the Oracle Virtual Compute Appliance

Virtualization in the data center is already providing a significant return on investment (ROI) for many enterprises. However, IT staffs still need a better way to build and manage virtualized infrastructures. They need to cut the cost, complexity, and time frames of virtualizing, deploying, and managing multi-tiered applications. They need a faster, more economical

method for scaling capacity, and they need new ways to demonstrate the strategic value of IT and how it aligns with business goals.

Virtualization and resource management technologies enable organizations to deploy many applications together and thereby improve system utilization. These capabilities provide the flexibility and agility to respond to business demands while at the same time reducing costs with better utilization of compute resources.

This chapter explains how Oracle delivers the most complete and integrated virtualization and resource management solutions for a consolidated environment, thereby maximizing enterprise value.

Understanding Oracle Virtualization Technologies

A virtualized server platform must be able to partition its resources so that many applications can coexist on that platform and still run and perform at high levels. All applications need processor, memory, and I/O resources. In a consolidated environment, applications must share these server resources. Virtualization technology must provide separation between applications on the same server in order to prevent

- Any single application from "hogging" server resources

- An error in one application from affecting other applications
- A user on one application gaining unauthorized access to a different application

Not all workloads are the same. Oracle offers four primary types of virtualization technologies to address different consolidation requirements (see Figure 4-1):

- Oracle Solaris Zones
- Oracle VM Server for SPARC
- Oracle VM Server for x86
- Dynamic Domains

For network virtualization, Oracle introduces the new Oracle Virtual Networking solution, an open data center fabric that simplifies complex data center deployments with a wire-once solution and simple software-defined network configurations. A complete fabric for the modern data center, Oracle Virtual Networking supports operating systems including Oracle Solaris, Oracle Linux, Microsoft Windows, and leading hypervisors including Oracle VM, VMware, and Microsoft Hyper-V.

Oracle does not charge for virtualization technologies, and you don't need to purchase virtualization licenses. Support is included as part of Oracle's standard operating system (OS) and server support.

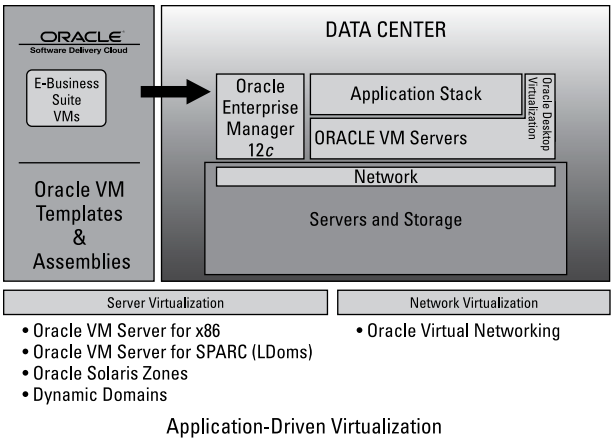

Figure 4-1: Oracle virtualization portfolio — the full stack, end-to-end.

Oracle Solaris Zones

In a consolidated environment, it is necessary at times to maintain the ability to manage each application independently. For example, some applications might have strict security requirements, while other applications might not coexist well with other applications. This requires the ability to control server resource utilization, isolate applications from each other, and efficiently manage multiple applications on the same server. In other words, it requires establishing easily managed virtual server boundaries within a single system on which to provision applications.

Oracle Solaris Zones provide the benefits of consolidation and business agility in data centers today. Zones isolate software applications and services using flexible software-defined boundaries, allowing multiple private execution environments to run side by side within a single instance of the Oracle Solaris OS. With each environment having its own identity, separate from the underlying hardware, it behaves as if it's running on its own system — making consolidation simple, safe, and secure. Zones provide virtualization for SPARC or x86 systems running Oracle Solaris.

With Zones, you can maintain the one-application-per-partition deployment model while consolidating those applications onto shared hardware resources. An integral part of Oracle Solaris, Zones isolate software applications and services using flexible software-defined boundaries and allow many private execution environments to be created within a single instance of Oracle Solaris.

Because multiple Zones running within a single OS instance share a single kernel and a single scheduler, they are highly efficient. There is less duplication of system services, and the single kernel has a complete view of all application workloads, making resource management more precise.

Zones are a software-partitioning solution that creates many partitions within a single instance of the OS.

Oracle VM Server for SPARC

Oracle VM for SPARC provides highly efficient, enterprise-class virtualization capabilities for all Oracle

SPARC servers and SuperClusters (see Chapter 3). This virtualization solution fully optimizes Oracle Solaris and Oracle SPARC servers for your enterprise server workloads and provides the flexibility to deploy multiple Oracle Solaris OS instances on a single server. Oracle VM for SPARC is available on all current Oracle SPARC T-Series and SPARC M-Series servers.

Oracle VM for SPARC leverages a built-in hypervisor to subdivide system resources (processors, memory, network, and storage) by creating partitions called *logical domains* (LDoms). Each logical domain can run a complete Oracle Solaris instance. Each LDom can have different OS and patch levels, thereby enabling you to combine applications with different OS and patch levels (see Figure 4-2).

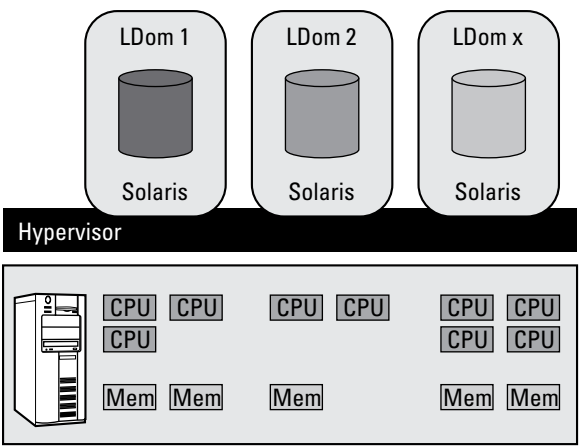

Figure 4-2: Oracle VM Server for SPARC subdivides resources (CPU, memory, and others) with logical domains.

Oracle VM for SPARC includes live migration between servers, which improves availability by being able to move workloads from servers that need service to other servers. It also improves system utilization as workloads can be moved to servers with more resources if workloads increase.

The combination of Oracle VM Server for SPARC integrated with SPARC servers and Oracle Solaris helps to increase flexibility, isolate workload processing, and improve the potential for maximum server utilization.

Oracle VM Server for x86

Oracle x86 systems are the most reliable systems for running Oracle VM Server. Oracle x86 servers are co-engineered to work together with Oracle VM, Oracle Linux, and Oracle Solaris, which form the foundational building blocks to run a variety of implementations whether on premise, in the cloud, or in a hybrid cloud deployment. Oracle's x86 systems, Oracle Linux, and Oracle VM are hardened for mission-critical deployments through their implementation in Oracle's daily operations and Oracle's cloud services — Oracle On Demand.

Oracle's jointly developed stack also offers salient business value in the form of reduced operating expenses and time to value. Organizations with Oracle's x86 systems under a support contract receive licensing and support for Oracle Linux, Oracle Solaris, Oracle VM, and Oracle Enterprise Manager 12*c* at no additional cost. Research by the Edison Group has found total cost of ownership (TCO) savings of up to 50 percent when Oracle's x86 servers are compared to similarly configured third-party servers. The primary differentiator is that Oracle provides a fully integrated hardware and software stack, optimized for cloud environments.

Oracle offers a complete, integrated, and proven foundation for building and managing virtual machines. Unlike traditional virtualization, Oracle's server virtualization uses an application-driven approach by building support for the entire application stack — including database, middleware, and packaged business applications — into the architecture. This "top-down" approach enables IT to deploy entire application stacks in minutes or hours rather than days or weeks.

An Oracle VM Server is comprised of a hypervisor and privileged domain that allows multiple domains or VMs running different OSes (such as Linux, Oracle Solaris, and Windows) on one physical machine (see Figure 4-3).

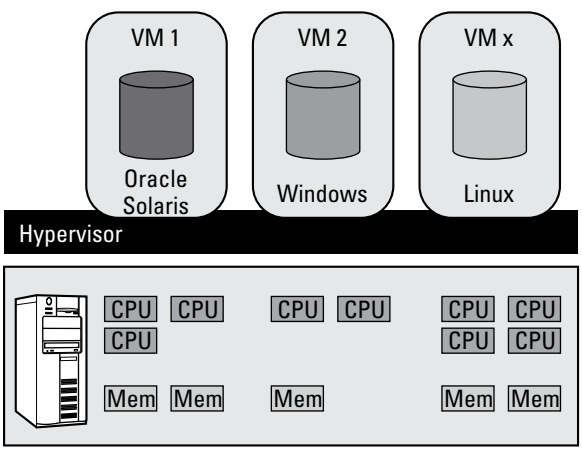

Figure 4-3: Oracle VM for x86 supports various workloads.

Oracle VM Manager controls the virtualization environment, creating and monitoring Oracle VM servers and virtual machines. With a secured command line interface (CLI) and an easy-to-use, browser-based management environment, it broadens the array of services for private cloud. For example, Oracle VM Manager provides the flexibility to control entire virtual server farms from practically anywhere and can be used for a diverse array of tasks. Oracle VM Manager is built using Oracle software, such as Oracle WebLogic Server, and with the option to use either the Oracle Database or MySQL Enterprise Edition as the management repository, IT administrators have still more flexibility in deployment choice with the assurance of tight interoperability.

To enable rapid application deployment, Oracle VM offers Oracle VM Templates as a feature. This feature contains prebuilt, preconfigured, and ready-to-deploy software from Oracle, simplifying and standardizing the rapid deployment of agile, highly elastic private cloud services. There's no installation required; applications, as well as any needed OS patches, are pre-installed. Oracle has removed all the guesswork, and the compatibility of the environment is assured. By using Oracle VM Templates, organizations can eliminate installation and configuration costs and reduce deployment times from days or weeks to hours and minutes. Using Oracle VM Templates, you can virtualize applications seven to ten times faster than compared to traditional Oracle Virtualization technologies. Oracle VM Templates for many key Oracle products are available for download, including Oracle Database,

Oracle Real Application Clusters (Oracle RAC), Oracle E-Business Suite, Oracle's JD Edwards, Oracle Fusion Middleware, and many more, with more than a hundred templates prebuilt and tested. You can find a list of available templates at `www.oracle.com/technetwork/server-storage/vm/templates-101937.html`.

Dynamic Domains

Dynamic Domains, available on Oracle's SPARC M6-32 server, are electronically isolated partitions. They make it possible to run multiple applications and multiple copies of Oracle Solaris on a single server. Dynamic Domains enable administrators to isolate hardware faults or security access and constrain their scope without powering down the system or requiring a reboot of other domains on the same system.

Dynamic Domains separate administration of each domain, so that a security breach in one domain doesn't affect any other domain. Because Dynamic Domains are hardware partitions, they have no overhead, meaning that there is no effect on application performance. The result is a superior level of system availability, security, and performance (see Figure 4-4). Dynamic Domains are now in their fifth generation, making them the most mature and established partitioning option in the UNIX arena.

Solaris Resource Manager

Oracle Solaris's Resource Manager (SRM) is available on all servers running Oracle Solaris to manage resource usage. SRM is not a virtualization solution that partitions servers, rather a technology that can make sure that each application instance in a consolidation server gets its required share of processor and memory resources. SRM uses *resource pools* to control

system resources. Each resource pool may contain a collection of resources, known as *resource sets,* which may include processors, physical memory, and/or swap space. For example, on a 16-processor system, an administrator could define two resource pools, each containing a processor set, with pool A's processor set containing 11 processors and pool B's processor set containing the remaining 5 processors. Resources can be dynamically moved between pools as needed.

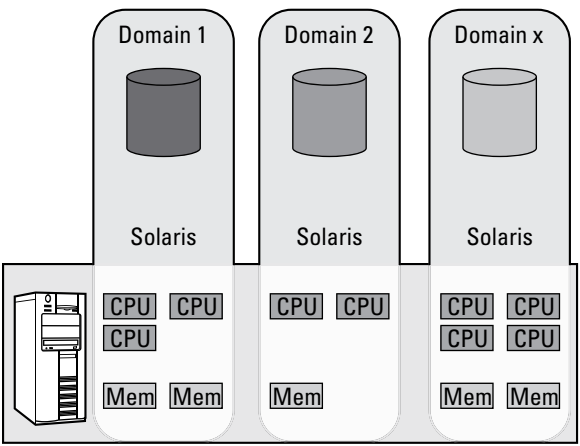

Figure 4-4: Dynamic Domains provide complete resource, security, service, and fault isolation.

Solaris Resource Manager incorporates an enhanced Fair Share Scheduler (FSS), which may be used within a resource pool. When using FSS, an administrator

assigns processor shares to a workload that comprises one or more processes. Shares enable the administrator to specify the relative importance of one workload to another, and FSS translates that into the ratio of CPU resources reserved for a workload. If the workload doesn't request CPU resources, those resources can be used by other workloads. The assignment of shares to a workload effectively establishes a minimum reservation of CPU resources. FSS guarantees that critical applications get their required server resources.

Mixing SPARC Virtualization Technologies

Both Oracle VM for SPARC and Dynamic Domains create partitions with unique Oracle Solaris instances. This means that users can deploy Zones inside of Oracle VM SPARC partitions or inside of Dynamic Domains on M-Series servers. Zones can be deployed inside of Oracle VM for SPARC partitions that reside in Dynamic Domains. This mixing of virtualization technologies provides great flexibility when consolidating applications onto SPARC servers.

Figure 4-5 illustrates how Dynamic Domains, Oracle VM for SPARC partitions and Zones can be used together for optimum utilization of server resources.

Network Virtualization with Oracle Virtual Networking

With many organizations investing heavily in networking solutions, fabric-traffic monitoring, and bandwidth management tools, software-defined networking

solutions become a critical part of server consolidation and virtualization deployments.

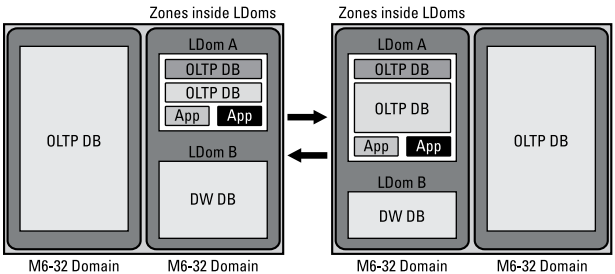

Figure 4-5: Dynamically resize LDoms and Zones for best utilization.

Oracle's newly introduced Oracle Virtual Networking is a combined hardware and software solution, designed to virtualize LAN and SAN connections in order to drive down capital expenditures (CAPEX). For example, in a data center consisting of approximately 120 servers, the capital cost savings from Oracle Virtual Networking can amount to hundreds of thousands of dollars, or about half the overall I/O (Input/Output) infrastructure cost, translating to a CAPEX saving of up to 50 percent.

Oracle Virtual Networking includes a hardware fabric interconnect that sits between your network equipment, your storage components, and your servers. I/O and network components physically connect into Oracle Virtual Networking using normal I/O connections, and your servers physically connect to the Oracle Virtual Networking hardware using InfiniBand. Software in Oracle Virtual Networking is used to create virtual

connections between the servers and I/O and network components. Recabling is done "virtually" instead of having to move physical cables, thus Oracle Virtual Networking greatly reduces cabling complexity.

The Oracle Virtual Networking fabric solution consists of high-performing, low-latency InfiniBand connections that provide bandwidth of up to 40 Gbps per server connection. Throughput of up to 80 Gbps for server-to-server connections — 8 times faster than 10 Gb Ethernet — is also available. This means that organizations can experience performance gains such as 19 times faster virtual machine migrations and 4 times faster application performance. Oracle Virtual Networking can be implemented across both rackmount and blade servers and can be used with Oracle's SPARC and x86 systems, as well as with other third-party servers.

Fabric management is another element lacking in many solutions. Oracle Virtual Networking's integrated quality-of-service (QoS) offers manageability for both storage and network bandwidth via fine-grained traffic policing, ensuring that critical applications deliver the required performance.

By greatly simplifying I/O and network connectivity, Oracle Virtual Networking is a great enabler of server consolidation in the data center. Lastly, change is inevitable in any data center. Oracle Virtual Networking lets you adapt your infrastructure "on the fly" — dynamically adding or removing I/O resources without server reboots. With Oracle Virtual Networking, you

can provision new services and reconfigure resources in minutes, not days.

Managing a Consolidated Environment

One goal of server consolidation is to simplify server management by reducing the number of servers and OS instances that need to be managed. To achieve this goal, IT organizations need advanced data center management and resource management tools that enable complete visibility and control of the consolidated environment.

Oracle Enterprise Manager Ops Center 12*c* further simplifies server management by merging the management of systems infrastructure assets into a unified management console. Through its advanced server lifecycle management capabilities, Ops Center 12*c* provides a converged hardware management approach that integrates the management of servers, storage, and network fabrics, including firmware, OSes, and VMs.

Ops Center 12*c* provides life-cycle management throughout the entire Oracle stack (see Figure 4-6).

Ops Center 12*c* provides asset discovery, asset provisioning, monitoring, patching, and automated workflows. Ops Center 12*c* can discover and manage virtual servers (Dynamic Domains and Oracle Solaris Zones), as well as physical servers.

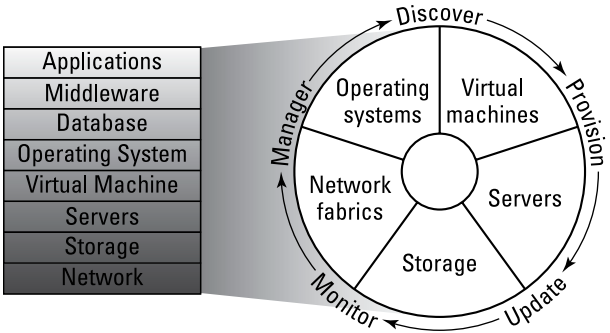

Figure 4-6: Managing consolidated Oracle SPARC and x86 servers with Oracle Ops Center.

Oracle Virtual Compute Appliance

Customers considering consolidation to one platform that can support a mix of applications and operating systems can look to the new Oracle Virtual Compute Appliance to improve time to value. The Oracle Virtual Compute Appliance is an engineered system that radically simplifies the way customers install, deploy, and manage virtual infrastructure to run any Linux, Oracle Solaris, or Microsoft Windows applications.

The Oracle Virtual Compute Appliance also reduces the time needed to launch complete application stacks with Oracle VM Templates and Assemblies. The result is an infrastructure that goes from power on to deploying production workloads in about an hour.

The Oracle Virtual Compute Appliance enables you to reduce business risks by

- Consolidating your workloads while maintaining application isolation
- Reducing the complexity in application deployment and maintenance
- Supporting customers' existing storage, including external storage from Oracle or from other storage vendors

Chapter 5

Ten Best Practices for Server Consolidation

In This Chapter

- Doing server consolidation the right way!

In this chapter, you find out about several (ten, to be exact) best practices that will help you undertake a successful server consolidation project in your organization.

Create a Plan

As with any major project, careful planning is an important key to success. Your plan must be thorough, widely communicated, and flexible. Appoint a project manager, establish appropriate milestones, plan for contingencies, avoid scope creep, and follow project management best practices.

Know What Success Looks Like

Understand that server consolidation is a journey, not a destination. Although this may sound a bit cliché, server consolidation is an ongoing initiative. Establish

clear and objective goals and metrics, including technical and financial targets. Finally, measure and report your progress frequently and make adjustments as necessary.

Design for the Future

Trends such as maturing cloud offerings, the proliferation of mobile devices, and increasing demands on networking and storage, require you to consider not only the business and technology demands of today but also the challenges of the future. Like a skilled chess player, don't just think about your next move. Plan your next three, four, or five moves! How much growth will your company experience over the next 12 months, 3 years, 5 years? How will your application workloads change? What new systems will be deployed? Plan for the unknown and then double your estimates, but be careful not to over-spec your server needs. Build modular whenever possible so that you can upgrade incrementally as your business needs dictate.

Get Buy-In

Today's IT executives are looking for investments that will reduce overall costs while allowing for tightly managed expansion into areas of critical need or segments of IT that will generate income for the organization today and in the future. In addition to executive support and project sponsors, ensure that your application owners, system administrators, and users are all committed to your server consolidation initiative. Recognize and address their concerns: For example, will there be any loss of performance, control, visibility, and/or access? Help them understand the

grander vision and the benefits to the organization (see Chapter 1).

Understand Your Application Workloads

Study your existing application workloads so that you fully understand their nature and resource requirements. Are certain applications

- Dependent on low-latency fabric?
- More I/O intensive than others?
- Open to all areas of the organization, or should they be in a private cloud?
- Subject to regulatory mandates and more stringent security requirements?
- Tied to outside customers and their service-level agreements (SLAs)?
- Mission critical or able to be outsourced?
- Needing high availability and redundancy?

Scale Vertically First

Go deep, then wide. Deploy high-end SMP (symmetric multiprocessing) systems to support your performance, RAS (Reliability, Availability, and Serviceability), and security requirements. These systems enable you to build incrementally as your business needs dictate, without further contributing to today's server-sprawl problems in the data center. Later, you can add additional consolidation servers (scale horizontally) for redundancy or to separate workloads when necessary.

Deploy an Application-Driven Topology

Traditional 3-tier infrastructures consisting of separate web, application, and database servers are becoming passé. An application-driven topology is optimized for application performance to deliver maximum value to the business.

Use the Right Tools

Use P2V and V2V (see Chapter 2) to consolidate legacy applications onto newer consolidation servers. Deploy the right mix of virtualization technologies for the right deployment scenarios and robust management tools for complete control and visibility of your consolidated environment (see Chapter 4).

Prevent Sprawl

Create appropriate policies and processes to ensure that IT organizations know what workloads should be consolidated and when, in order to avoid future sprawl in the data center.

Don't Consolidate Just Because You Can

Not everything should be consolidated. Build the appropriate business cases and understand your ROI before consolidating a given workload or server.

Consolidate servers in the data center to maximize utilization and reduce complexity

Server consolidation is a proven method to reduce data center complexity. Oracle's SPARC and x86 servers, virtualization, and management solutions when running consolidated applications maximize consolidation benefits by reducing operating costs and improving business flexibility. In this book, you find out how.

- ***Understand the role of virtualization technologies* — *in server consolidation and workload migrations***
- ***Develop a consolidation strategy* — *deploy new applications in a consolidated environment or migrate legacy applications to newer systems***
- ***Deploy the latest Oracle systems* — *including Oracle SuperCluster, SPARC T-Series and M-Series servers, and Oracle x86 systems***

Oracle engineers hardware and software to work together in the cloud and in your data center. For more information about Oracle (NYSE:ORCL), visit oracle.com.

Open the book and find:

- **Why server sprawl has become such a challenge in the data center — and its impact**
- **What's important in a consolidation server, including performance, availability, and scalability**
- **How to use virtualization as part of your server consolidation strategy**
- **What application workloads you should consider consolidating**

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