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OPTIMIZED SOLUTIONS

An Oracle White Paper
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Oracle Optimized Solution for E-Business Suite

A Technical White Paper

ORACLE

Introduction

Whether deploying new application services, modernizing existing business-critical services, or increasing solution availability, selecting and implementing a hardware architecture that will perform optimally and meet service level agreements is a complex feat. There is an almost endless combination of hardware components, and new technologies are continually being introduced. Planning to meet today's needs, as well as future capacity and processing power requirements, can be a daunting task.

This paper describes an optimized architecture for deploying Oracle® E-Business Suite using Oracle's Sun servers and disk storage, and utilizing leading database, virtualization, and clustering technology from Oracle. This pretested, high-performance architecture can be used to accelerate database transactions and increase system availability. Oracle Database 11*g*, Oracle Real Application Clusters (Oracle RAC), the Oracle Solaris 10 operating system, and Oracle Solaris Cluster provide a solid, highly available foundation for running Oracle E-Business Suite applications. The system and storage selected for this implementation—including Oracle's SPARC® T-Series and SPARC Enterprise M-Series servers, and Sun Storage 6000 arrays—are highly scalable, providing flexibility, compute power, and capacity for even the largest enterprises. Virtualization capabilities of Oracle's SPARC server platforms, including electrically isolated server Dynamic Domains, and powerful virtualization tools integrated into the Oracle Solaris operating system, can be used to implement server consolidation, a deployment strategy that can help reduce the cost and complexity of architectures, control datacenter sprawl, and increase hardware utilization levels.

The remainder of this paper describes the architecture in detail, presents a test environment used to verify high availability and gather performance characterization information, and provides example sizing guidelines. Although the testing described in this paper focuses on Oracle E-Business Suite Core Financials, HR Self-Service, Order Management, Customer Service, and Procurement, high availability capabilities and sizing guidelines are applicable to other Oracle E-Business Suite applications.

Architecture Overview

Figure 1 depicts a very high-level representation of the multitier Oracle E-Business Suite architecture. The application tier contains multiple application servers, each running one or more Oracle E-Business Suite applications. A load-balancing router distributes workload from Oracle E-Business clients across the multiple application servers. Each application server can run a single application or multiple applications, depending on deployment requirements. The application servers communicate with the database tier, which contains Oracle Database 11*g* with Real Application Clusters technology.

This architecture is highly flexible and scalable, helping organizations easily adapt to changing business priorities. Multiple servers can be added for increased performance or to provide higher availability, or multiple smaller application servers can be consolidated onto a larger system to simplify administration and reduce cost and complexity of the deployment. Using virtualization technologies, such as Oracle Solaris Containers and the Dynamic Domain capabilities in SPARC Enterprise M-Series servers, system resources can be allocated and reassigned to each tier as needed. Compared to other competitive and proprietary virtualization technologies, using Oracle's hardware and software virtualization technologies can provide significant cost savings when consolidating an Oracle E-Business Suite infrastructure. Consolidation of multiple servers onto a smaller number of energy-efficient, high-performance servers can optimize scalability while reducing datacenter complexity, lowering operating costs, and delivering high availability for business critical applications in Oracle E-Business Suite.

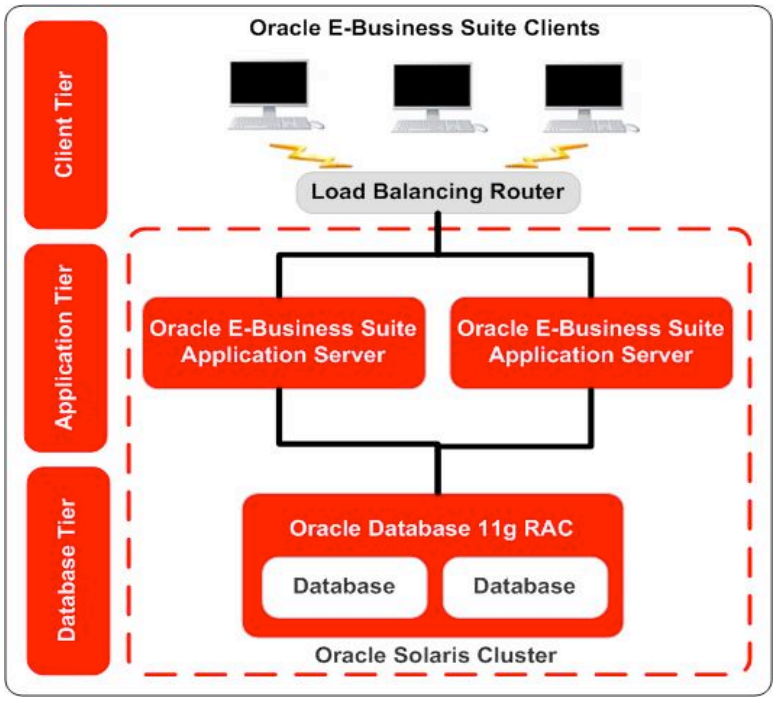

Figure 1. Architectural overview

Key Components

The key to choosing the right hardware and software elements resides in understanding the appropriate balance of performance, availability, cost, and expected future capacity requirements. In order to better replicate a real enterprise-class scenario, the deployment environment described in this white paper was implemented using systems and software that have integrated redundancy and reliability mechanisms.

The components selected for this scenario are listed in Figure 2 and described in the following sections.

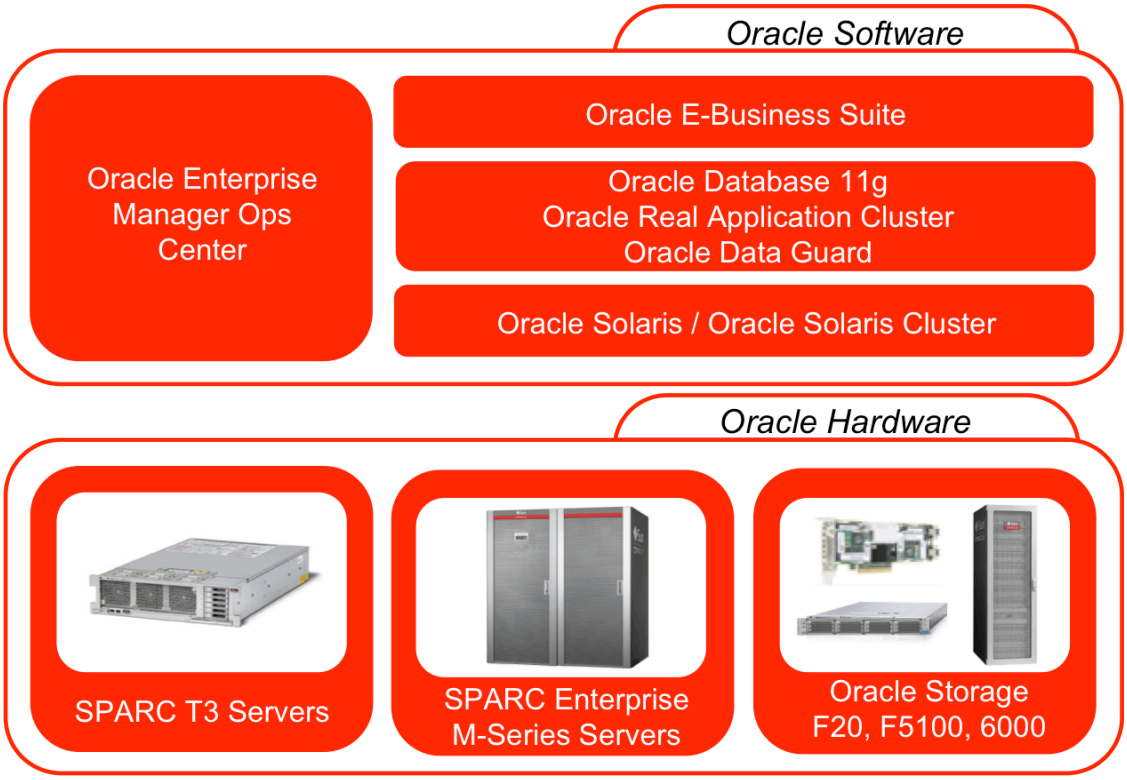

Figure 2. Overview of software and hardware components

Software Components

The major software components used in this scenario include Oracle E-Business Suite, Oracle Database 11*g* Release 2 with Oracle Real Application Clusters (Oracle RAC) and Oracle Data Guard, Oracle Solaris 10 with Oracle Solaris Containers, Oracle Solaris Cluster, Sun QFS, and Oracle Enterprise Manager Ops Center.

Oracle E-Business Suite

Oracle E-Business Suite (EBS), an integrated suite of business applications, is designed to address the most complex business requirements. Oracle E-Business Suite applications provide complete business and industry solutions, enabling organizations to significantly improve execution performance through

greater efficiency and collaboration. Applications include those for customer relationship management (CRM); enterprise resource planning (ERP), including financial management and human capital management; supply chain management, including order and price management; and procurement, manufacturing, and product lifecycle management. This powerful, comprehensive suite of integrated, global business applications provides an end-to-end view across all lines of business that targets employees with relevant information tailored to their role.

Oracle Database 11*g* Enterprise Edition

Oracle Database 11*g* is a full-featured data management solution providing efficient, reliable, and secure data management for mission-critical transactional applications, query-intensive data warehouses, and mixed workloads. With new self-managing capabilities, Oracle Database 11*g* also eliminates time-consuming, error-prone administrative tasks, so database administrators can focus on strategic business objectives instead of performance and availability fire drills. Oracle offers a wide range of options, including Oracle Real Application Clusters and Oracle Data Guard, that extend the power of Database 11*g* Enterprise Edition in performance and availability for demanding large-scale, mission-critical business applications.

- *Oracle Real Application Clusters*

  Oracle Real Application Clusters (Oracle RAC), with Oracle Database 11*g* Enterprise Edition, enables a single database to run across a cluster of servers, providing fault tolerance and increased performance and scalability with no application changes necessary. If a clustered node fails, Oracle Database continues to run on the surviving nodes. When more processing power is needed, another node can be added to the cluster without interrupting user access to data. Oracle RAC forms a key foundation for mission-critical enterprise deployments, providing the highest level of database availability along with flexibility in scaling.

- *Oracle Data Guard*

  Oracle Data Guard, with Oracle Database 11g Enterprise Edition, enhances quality of service by offloading resource-intensive activities from a production database to one or more synchronized standby databases. Oracle Data Guard enables read-only access to a physical standby database for queries, sorting, reporting, Web-based access, and so on, while continuously applying changes received from the production database. Oracle Data Guard also enables the use of fast incremental backups when offloading backups to a standby database and can provide additional benefits of high availability and disaster protection against planned or unplanned outages at the production site.

Oracle Solaris 10

The latest version of Oracle's enterprise-class operating system, Oracle Solaris 10 provides a rich, coherent platform for building and running mission-critical business applications like Oracle E-Business Suite. Its innovative, built-in features deliver industry-leading performance, security, and availability, and numerous advanced capabilities include:

- *Oracle Solaris DTrace*—Oracle Solaris DTrace technology in Oracle Solaris provides a comprehensive view of the entire system. These dynamic instrumentation and tracing capabilities, which can be safely used on production systems without modifying applications, make it fast and easy for administrators to identify and address performance bottlenecks.
- *Oracle Solaris Containers*—An integral part of Oracle Solaris 10, this virtualization technology uses flexible, software-defined boundaries to isolate software applications and services and allow multiple private execution environments to be created within a single instance of Oracle Solaris 10. Each environment has its own identity, including a discrete network stack, making consolidation simple, safe, and secure. System administrators can quickly provision new Oracle Solaris Containers and dynamically control application and resource priorities to achieve predictable service levels.
- *Predictive Self Healing*—The predictive self healing capabilities in Oracle Solaris automatically diagnose, isolate, and facilitate recovery from many hardware and application faults. The fault management architecture in Oracle Solaris continuously monitors data relating to hardware and software errors, while the service management facility monitors software services and can automatically restart services that are accidentally terminated, fail as a result of a software error, or are interrupted by an underlying hardware problem.
- *Networking*—The open, programmable Oracle Solaris networking stack provides near wire-speed throughput. Oracle Solaris 10 speeds application performance via Network Layer 7 Cache and enhanced TCP/IP and UDP/IP performance, and supports 10 GbE and hardware offloading.
- *Advanced Security*—Oracle Solaris 10 includes integrated security, including trusted extensions, for the separability and control required by governments, financial institutions and HR environments without sacrificing hardware and application compatibility.

Oracle Solaris Cluster

Oracle Solaris Cluster offers the best high availability platform for Oracle Solaris, extending its reach from a single node to multisystem, multisite, and global disaster recovery solutions. Oracle Solaris Cluster offers comprehensive and robust capabilities for keeping businesses, especially those running Oracle Database and applications, up and running in the face of nearly every conceivable situation. As a mature and robust solution, Oracle Solaris Cluster offers a high degree of flexibility in how it can be deployed and the technologies it supports. With Oracle Solaris Cluster, organizations can mix systems and assemble clusters of up to 16 servers (nodes), and can potentially reduce software licensing fees, system management overhead, and hardware costs for mission-critical applications deployments.

Oracle Solaris Cluster Geographic Edition software, a layered extension of the Oracle Solaris Cluster software, can protect applications from both planned and unplanned outages at a primary site. This software uses multiple clusters separated by long distances and a redundant infrastructure that replicates data between the clusters. During unplanned outages of the primary site, such as a local disaster, control can transferred to a remote disaster recovery site. Similarly for planned outages—when maintenance is required at the primary site, or simply to test the disaster recovery procedures—services can be switched to the secondary site. When recovery or testing is complete, services are switched back to the primary location, with minimal impact to clients.

Sun QFS

The Sun QFS shared file system provides a high-performance, high-capacity file system that can be accessed by multiple servers over a storage area network (SAN). Data can be written and accessed at device-rated speeds, providing superior application I/O rates. This file system supports very large files (up to 2^{63} bytes in length) that can be striped across multiple disks or RAID devices, and a virtually unlimited number of files and file systems. File system metadata is stored separately from data to help improve high-performance RAID cache utilization, reduce latency, and provide cost-effective metadata mirroring for added protection. Sun QFS also provides fast file system recovery after system failures. Even multi-terabyte Sun QFS file systems can be remounted immediately after a system failure, unlike standard UNIX file systems that require a lengthy file system check

Oracle Enterprise Manager Ops Center

Oracle Enterprise Manager Ops Center provides comprehensive management across the entire stack of Oracle servers, operating systems, and Oracle Solaris virtualization technologies. Oracle Enterprise Manager Ops Center provides comprehensive monitoring and virtualization management, and can dramatically improve the efficiency of IT operations with its asset management and discovery, automated provisioning, intelligent patching, and centralized management capabilities.

Hardware Components

The major hardware components used in this scenario include SPARC T-Series and M-Series servers, and Sun disk storage, including the Sun Storage 6180 and 6780 arrays.

SPARC T-Series Servers

The architecture includes SPARC T3-1 and SPARC T3-2 servers. Powered by the UltraSPARC T3 processor respectively, these servers blend the performance and scalability of midrange servers with the economies of an energy-efficient chip multithreading (CMT) design. The SPARC T3 processors pack 16 cores and 128 simultaneous threads of execution, plus key computing, networking, security, and I/O functions, onto a single piece of silicon. Integrated on-chip 10 GbE and cryptographic acceleration speed performance and help deliver fast and secure Web transactions. Better integration means fewer parts, which in turn delivers higher reliability through the reduced risk of component failures.

Table 1 lists configuration and sizing details for the SPARC T3-1 and SPARC T3-2 servers.

TABLE 1. SPARC T3-1 AND SPARC T3-2 SERVERS

COMPONENT	SPARC T3-1 SERVER	SPARC T3-2 SERVER
Processors	1 SPARC T3 processor • 16 cores, 8 threads per processor • Up to 128 threads per system	2 SPARC T3 processors • 16 cores, 8 threads per processor • Up to 256 threads per system

Main memory	Up to 128 GB	Up to 256 GB

SPARC Enterprise M-Series Servers

Oracle's SPARC Enterprise M-Series servers running Oracle Solaris are ideal for mission-critical applications that require best-in-class availability, scalability, and manageability. The SPARC Enterprise M-Series server family includes systems designed for optimal performance on all application tiers, from highly concurrent Web applications to complex enterprise applications and data warehouses. Built on the latest quad-core SPARC64 VII and dual-core SPARC64 VI processors, this server family scales from the mid-range SPARC Enterprise M5000 servers to the high-end SPARC Enterprise M9000 server.

The option to mix and match different speeds and generations of SPARC64 processors in existing M-Series servers protects investment and enables easy and low-cost upgrades. Mainframe-class RAS features are standard, including automatic recovery with instruction retry, memory error-correcting code (ECC) protection with extended ECC support, guaranteed data path integrity, total SRAM and register protection, and configurable memory mirroring. In addition, major system components are redundant and hot-swappable, providing superior reliability and availability. Dynamic Domains provide flexibility, with CPU board-level domains for large mission-critical workloads requiring maximum isolation and single socket-level domains for finer granularity with high isolation.

Table 2 lists configuration and sizing details for the SPARC Enterprise M5000, M8000, and M9000 servers.

TABLE 2. SPARC ENTERPRISE M-SERIES SERVERS

COMPONENT	SPARC ENTERPRISE M5000	SPARC ENTERPRISE M8000	SPARC ENTERPRISE M9000
Processors	Up to 8 quad-core SPARC64 VII+ processors	Up to 16 quad-core SPARC64 VII+ processors	Up to 32 quad-core SPARC64 VII+ processors
Main memory	Up to 512 GB	Up to 1 TB	Up to 2 TB
Domains	Up to 4 Dynamic Domains	Up to 16 Dynamic Domains	Up to 24 Dynamic Domains

Sun Storage 6180 and 6780 Arrays

The Sun Storage 6000 storage array family provides outstanding performance and scalability along with enterprise-class reliability availability features. This modular family of Fibre Channel (FC) storage arrays scales from the midrange Sun Storage 6180 array (224 TB total capacity) to the high-end, high-capacity Sun Storage 6780 array (896 TB total capacity), suited for compute-intensive applications and large consolidation environments. Common expansion modules across the storage product family provide seamless scalability and expansion, protecting investment as requirements change. The systems include a rich set of data management features and data services at no extra cost.

Both the Sun Storage 6180 and 6780 arrays include dual active RAID controllers with mirrored, battery-backed cache to protect data in the event of a power outage. Redundant, hot-swappable

controllers and drives and global hot spares with automated failover/failback provide increased data availability. Data encryption services deliver government-grade, cost-effective data protection throughout the lifecycle of the drive.

The Sun Storage 6180 array supports intermixing both Fibre Channel (FC) and SATA drivers; the Sun Storage 6780 can also be configured with 73 GB Solid State Disk drives that deliver huge performance improvement over 15K FC hard disk drives with lower power space requirements. In addition, the Sun Storage 6780 array includes additional cache memory options for increased cache hit rates and enhancement performance for cache mirroring.

Table 3 lists configuration and sizing details for the Sun Storage 6180 and 6780 arrays.

TABLE 3. SUN STORAGE 6180 AND 6780 ARRAYS

COMPONENT	SUN STORAGE 6180 ARRAY	SUN STORAGE 6780 ARRAY
Controller	Dual FC RAID controller cards	Dual FC RAID Controller cards
Host interfaces	Four or eight 8 Gbps FC host interfaces	Eight or sixteen 4 Gbps/8Gbps FC host interfaces
Cache	Up to 4 GB	Up to 32 GB
Dynamic capacity expansion	Up to 112 drives, 224 TB	Up to 448 drives, 896 TB

Architecture Details

Figure 3 illustrates the relationship between the hardware and software components of the Oracle Optimized Solution for E-Business Suite architecture. This solution uses a traditional tiered architecture: the application tier includes Oracle E-Business Suite applications, and the database tier includes Oracle Database 11*g* with RAC.

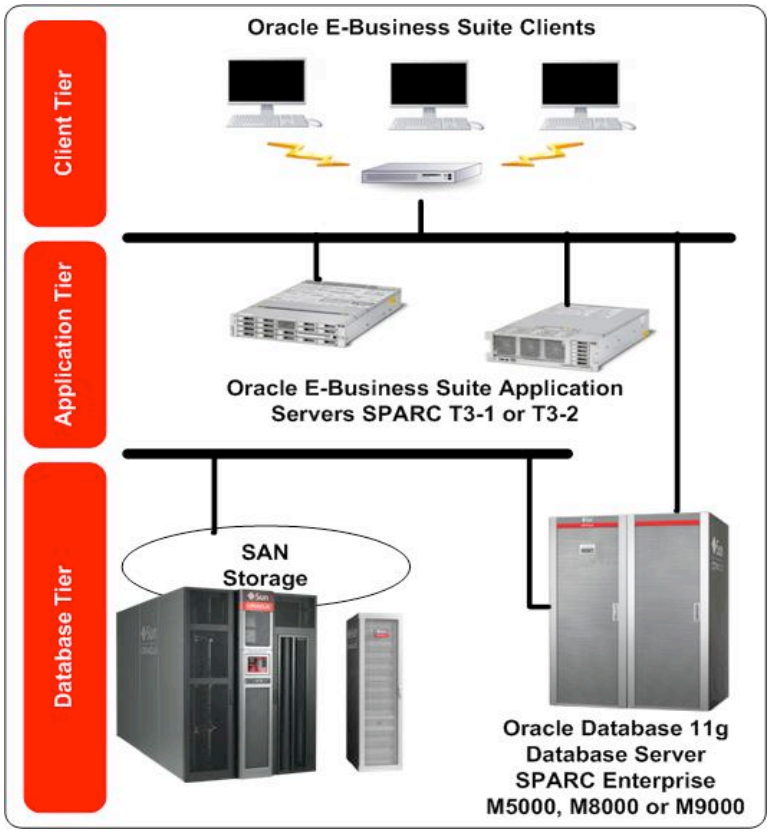

Figure 3. Architectural overview

A load-balancing router provides the front-end interface to the Oracle Optimized Solution for E-Business Suite, distributing the workload requests from the Oracle E-Business Suite clients across the multiple servers. In the application tier, SPARC T3-1 or SPARC T3-2 servers are configured with multiple Oracle Solaris Containers and run the Oracle E-Business Suite applications. The multiple Solaris Containers can run different applications or multiple instances of a single application, depending on consolidation and optimization needs.

In the database tier, SPARC Enterprise M-Series servers are configured with two or more Dynamic Domains. Each Dynamic Domain is provisioned with the desired amount of RAM and number of CPUs to satisfy the compute power desired for each Oracle Real Application Clusters node. The Dynamic Domains are configured to share storage from a Sun Storage 6180 or 6780 storage array to meet the shared storage requirements of Oracle Real Application Clusters.

Oracle Enterprise Manager Ops Center brings all components of the solution together into a single management and monitoring package.

Note—Although it is outside the scope of this white paper, the storage tier should also include any disk or tape storage devices needed to provide data protection to meet an organization's business requirements.

Oracle Solaris Cluster is configured to manage multiple virtual clusters from the application and database tiers in a single cluster configuration, as shown in Figure 4.

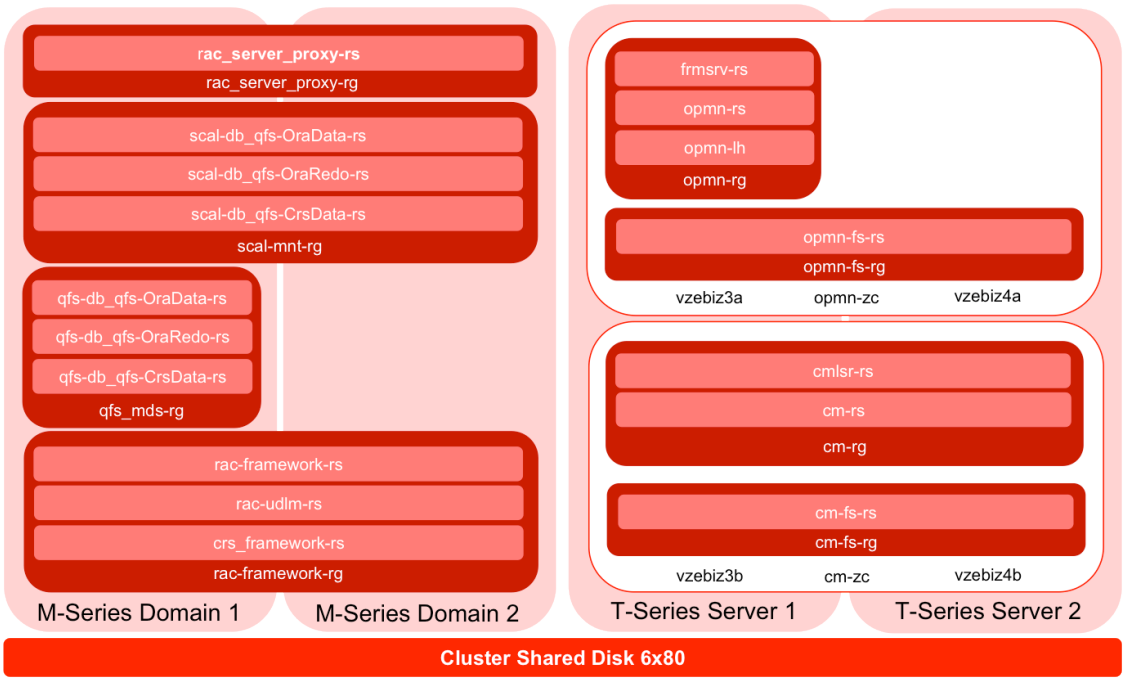

Figure 4. Overview of cluster configuration

Both SPARC T-Series servers and both Dynamic Domains in the SPARC Enterprise M-Series server are configured as cluster nodes. Two zone clusters are created spanning the SPARC T3-2 server cluster nodes, providing redundancy and increased availability in the event of failure. These zone clusters are used to deploy the E-Business Suite applications: the CM Zone Cluster includes the Concurrent Managers (CM) services, and the OPMN Zone Cluster contains the Oracle Process Management Notification (OPMN) services. Oracle Solaris Containers are created within these zone clusters, providing isolation of applications. Similarly, the Oracle Database 11*g* with RAC spans both Dynamic Domains in the SPARC Enterprise M-Series server.

Using Oracle Solaris Cluster, multitier applications and databases can be consolidated in a shared cluster of hardware. Deployed in separate zone clusters, the applications run fully isolated across the clustered machines. In addition, Oracle Solaris Cluster provides high availability, protecting against both hardware and software errors. Tightly coupled with the Oracle Solaris operating system, Oracle Solaris Cluster quickly and automatically detects failures and initiates application recovery to provide maximum availability of business services.

Disaster Recovery Architecture

If desired, disaster recovery can be added to the Oracle Optimized Solution for E-Business Suite, as shown in Figure 5. This configuration includes clusters at both the primary data site and a geographically separate disaster recovery site. Oracle Solaris Cluster Geographic Edition is used to connect the local cluster on the primary site to a remote cluster the disaster recovery site, delivering seamless migration to and from the disaster recovery site. Data replication, the process of continuously copying data from the primary cluster to the secondary cluster, ensures the secondary cluster has a recent copy of the data on the primary cluster.

Oracle Data Guard is used to keep the database that is stored on the Sun Storage 6780 array synchronized between the primary datacenter and the disaster recovery site.

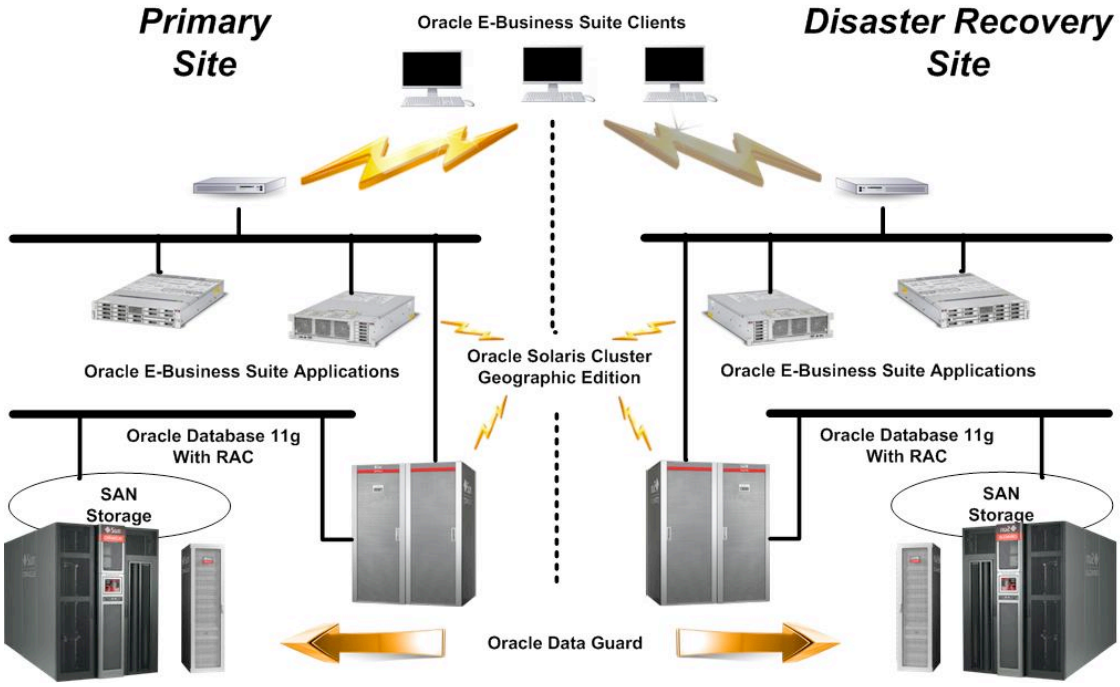

Figure 5. Disaster recovery architecture

Oracle Solaris Containers and Oracle Solaris Cluster deliver flexibility that can simplify adding disaster recovery to this Oracle E-Business Suite architecture. Depending on service level agreements, the recovery site may require less processing power than the primary datacenter. Virtualized operating systems in Oracle Solaris Containers can be run on any SPARC server platform, so there are fewer

limitations when building a server infrastructure. Different server platforms and configurations of servers can be used at the disaster recovery site to meet performance requirements.

Testing Overview

The following sections describe the workload description and the test environment. This test environment was used to confirm the high availability of the Oracle Optimized Solution for E-Business Suite and to provide example performance data for suggested sizing guidelines.

Workload Description

The Oracle E-Business Suite workload used for the testing is focused on ERP applications, and represents a mixed workload that models most common transactions used in enterprise application modules. The workload includes a combination of OLTP and batch processes. For the OLTP portion, a model with 3,000 active online users is used. The online modules include Order Management, Procurement-to-Pay, Customer Service, and HR Self-Service weighted in equal percentages across these modules. The two batch processes include the HRMS (Human Resources Management System)-Payroll process and the Order to Cash process with Payroll support for 10,000 employees and Order to Cash support for 50,000 order lines.

The HRMS-Payroll process involves the complete payroll process, which includes:

- Payroll Process: Identifies all employees to be processed and performs calculations required to complete the gross-to-net calculations, including earnings, deductions, and taxes. The specific groups of employees processed can be controlled by multiple parameters to the payroll process, including the ability for users to define a rule-based set of employees.
- PrePayments: Distributes the net pay for each employee across the various payment methods (Direct Deposit, Check or Cash). This can be run for a single payroll process or across multiple payroll processes.
- External Archiving Process(Pro-C, PL/SQL): Replicates the results of the Payroll run into a separate archive for audit purposes. This data is primarily used for Payslips (both printed and online), as a source for check and direct deposit printing, third party interfaces, and tax remittance reporting.
- NACHA: This is the US version of the Global Direct Deposit process, which creates the back interface file as per NACHA rules, based on the rules in the Pre Payment process.
- Check Writer: (Oracle Report Writer) This process allocates check numbers and creates/prints the payroll check and associated paper payslip.
- Costing: This process associates the payroll transaction data with the General Ledger (GL) accounts in preparation for transfer of the data to GL. This process uses a sophisticated hierarchical rules-based engine to determine the mapping of the HRMS data and payroll results to the GL accounts.

The Order to Cash process involves the entire flow from Order to Cash:

- High Volume Order Processing (HVOP): The HVOP program processes orders by reading the rows from the Order Management Interface tables and converting the interface records into permanent order headers and their respective order lines. The orders are then booked and advanced to the shipping state.
- Pick Release (and Ship Confirm): Pick Release finds and releases the eligible delivery lines that meet the release criteria, and creates move orders. The process of transacting move orders creates a reservation and determines the inventory source sub-inventory.
- Ship Confirm: This process confirms that items have shipped. When a delivery is ship-confirmed, Shipping Execution confirms that the delivery lines associated with the delivery have shipped.
- Interface Trip Stop: The deliveries created in the previous step are then assigned to trips, which may involve multiple stops depending upon the shipping address of the deliveries. SRS has been modified to accept Organization code as a parameter and process the trip stops for the specified organization. Interface Trip Stop-SRS has also been enhanced to spawn multiple child processes to process trip stops in parallel. The parameter Stops per Batch is used to specify the number of stops to be processed by each thread of the Interface Trip Stop-SRS.
- INV Material: The material transaction manager is configured to execute material transactions by periodic concurrent request submissions and by direct submission of multiple transaction managers via the benchmark SQL script. The execution interval is set to 5 minutes.
- Auto-Invoice: The Auto-Invoice process is used to import invoices, credit memos, debit memos, and on-account credits. Receivables ensures that the data imported is accurate and valid.
- Revenue Recognition: Revenue Recognition program generates the revenue distribution records for the invoices and credit memos that use Invoicing and Accounting Rules. Accounting Rules were assigned to recognize revenue over a 12-month accounting period. The Revenue Recognition program creates distribution records for the invoices and credit memos that are created in the Receivables process and imported using Auto-Invoice.
- Transfers to General Ledger and Journal Import: The General Ledger Interface program transfers Receivables transaction accounting distributions to the general ledger interface table and creates either detailed or summarized journal batches. The Receivables process creates unposted journal entries in general ledger and executes Journal Import from Oracle General Ledger. It posts journal batched in Oracle General ledger to update account balances.
- General Ledger Auto-post: This posts journal batches to update the account balances of the detail and summary accounts. It can post actual budget or encumbrance journal batches.

Although this white paper focuses on ERP, performance results and sizing guidelines are applicable to other Oracle E-Business Suite applications.

Test Environment

The test environment is implemented as described in the previous section (see Figure 4), using two SPARC T3-2 servers and a SPARC Enterprise M8000 server. This configuration is suited for large enterprise environments supporting thousands of users.

Oracle Solaris Cluster 3.3 software is used in the Oracle E-Business Suite deployment test environment. The test configuration includes four cluster nodes: the two SPARC T3-2 servers are each configured as cluster nodes, and each of the two Dynamic Domains on the SPARC Enterprise M8000 server are additionally configured as cluster nodes.

Application Tier Configuration

E-Business Suite 12.1.1 services are deployed in Solaris Zone Clusters configured on two SPARC T3-2 server nodes. Two separate zone clusters are created: opmn-zc and cm-zc. The opmn-zc zone cluster includes the Oracle Process Management Notification (OPMN) services; the cm-zc zone cluster includes the Concurrent Managers (CM) services. The application tier binaries are stored on a shared Oracle Solaris Cluster file system on the Sun Storage 6780 array.

Database Tier Configuration

The example database is deployed using Oracle RAC 11.2.0.1 with Oracle Solaris Cluster on a SPARC Enterprise M8000 server. Two Dynamic Domains are created and used as nodes in the Oracle Solaris Cluster. The Oracle RAC database files are stored on shared Sun QFS file systems on a Sun Storage 6780 array.

Figure 6 shows the configuration and resource allocation of the two Dynamic Domains (Domain 0 and Domain 1). The SPARC Enterprise M8000 server contains four CPU/Memory Units (CMUs) and four I/O Units (IOUs). Domain 0 uses CMU 0 and IOU 0; Domain 1 uses CMU 1 and IOU 1. The remaining CMUs and IOUs are unused in this configuration and are available for expansion.

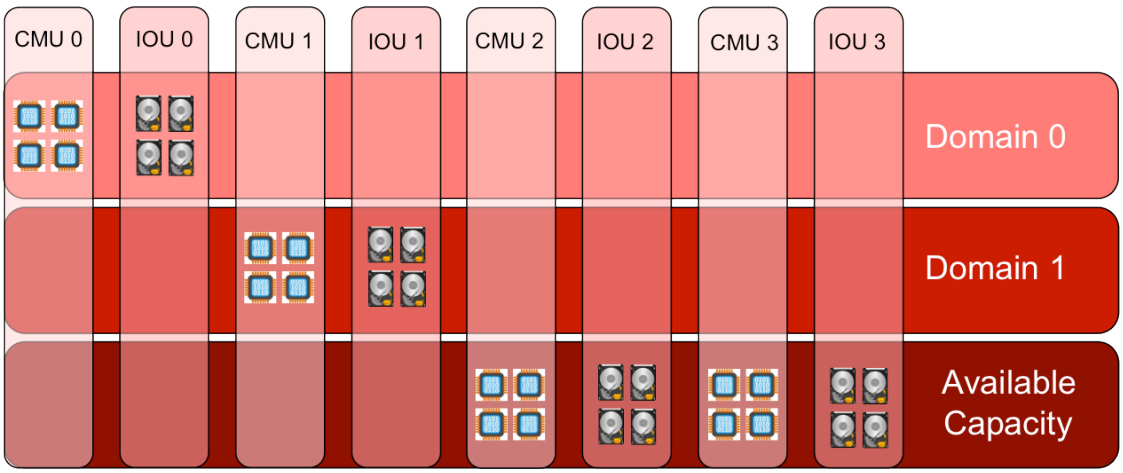

Figure 6. Resource allocation in the SPARC Enterprise M8000 server

Storage Configuration

A Sun Storage 6780 array is used in this configuration for shared storage. In addition, local storage on the nodes is used for the Oracle Solaris Cluster installation, Oracle Database 11*g* installation, and zone cluster root file systems.

The Sun Storage 6780 array is configured with both RAID 1 and RAID 5 volume groups. LUNs configured on the Sun Storage 6780 array are shared between both database nodes in the Oracle RAC configuration, and between both cluster nodes in the application tier. Table 4 lists the LUN configuration on the Sun Storage 6780 array used in the test environment.

TABLE 4. SUN STORAGE 6780 ARRAY LUN CONFIGURATION

SIZE	RAID LEVEL	FILE SYSTEMS
6 GB	RAID 5	QFS file system for cluster-related files: Cluster Ready Services (CRS) Voting and Oracle Cluster Registry (OCR) files
1.7 TB	RAID 5	Oracle RAC data files and flash recovery area
450 GB	RAID 1	Oracle RAC online redo log files
100 GB	RAID 5	Oracle Solaris Cluster cluster file system for application tier deployment (OPMN)
100 GB	RAID 5	Oracle Solaris Cluster cluster file system for application tier deployment (CM)

High Availability Configuration

An IP network multipathing (IPMP) group is configured for the redundant public network interfaces of the cluster. Oracle Solaris Cluster provides the redundancy of the cluster interconnects via its `clprivnet` feature. Jumbo frames (MTU 9000) are configured on the `nxge` interconnect interface, which is the private network interface for Oracle RAC in this cluster.

Multiplexed I/O (MPxIO) is configured for the Fibre Channel links to the storage array. MPxIO helps protect against I/O controller failures by automatically switching to an alternate controller.

Specific Oracle Solaris Cluster resources are configured for the high availability of the file systems used by Oracle RAC and the application tier. In addition, Oracle Solaris Cluster resources are configured in the zone clusters to provide high availability for the OPMN and CM components. Finally, specific Oracle Solaris resources as well as Oracle Clusterware resources are configured to provide the integration of HA services for the Oracle RAC database instances on the database nodes.

High Availability Testing

Many tests were run to verify the cluster configuration and cluster enhanced features for Oracle Solaris Cluster running Oracle E-Business Suite. All of the cluster testing was performed with the workload described above running. Table 5 lists three of the tests cases and test results with comments for each test case used in the testing.

TABLE 5. ORACLE SOLARIS CLUSTER TEST CASES FOR ORACLE E-BUSINESS SUITE

TEST CASE	RESULTS	COMMENTS
Application Tier – Kill all the OPMN processes at once to simulate a software lockup in the application tier	Failure detection time = 0 seconds Recovery time = 1 minute 52 seconds	In this test the cluster will recover the clustered resources in the application tier on the node that survived the failure
Application Tier – Immediate power off of an application tier server to simulate a power failure in the application tier	Failure detection time = 10 seconds Recovery time = 2 minutes 8 seconds	In this test the cluster will recover the clustered resources in the application tier on the node that survived the failure The forms server component recovery was 16 seconds, the OPMN oc4j components took 122 seconds
Database Tier – Immediate power off of a RAC node of a database node that is running in one of the domains in the database server to simulate a power failure in the database tier	Failure detection time = 10 seconds Recovery time = 38 seconds or 28 seconds	In this test the cluster will recover the clustered resources in the database tier on the node that survived the failure Failover is 38 seconds with QFS metadata server failover and 28 seconds without

Sizing Guidelines

Hardware configurations for small, medium, and large configurations are provided in the following sections. These sizing guidelines are based on the testing in this scenario and are intended to be used as a starting point in determining the configuration for a given deployment. For accurate sizing information, contacting a local Oracle representative is encouraged and recommended.

Small Configuration

A small configuration assumes maximum throughput/hour supporting up to 5,000 Payroll employees and 10,000 order lines with 200 to 1,000 online users. For this particular configuration, the following hardware components (see Table 5) are recommended.

TABLE 5. SIZING FOR SMALL CONFIGURATIONS

COMPONENT	CONFIGURATION DETAILS
Application Tier Server	2 SPARC T3-1 servers • 1 CPU • 32 GB RAM
Database Tier Server	SPARC Enterprise M5000 server • 4 CPUs • 64 GB RAM
Storage Tier	Sun Storage 6180 array with 1–3 expansion trays

For the application tier of a small configuration, a SPARC T3-1 server is suggested because of its high throughput capabilities on Web-based applications, small footprint, and low power consumption.

For the database tier, a SPARC Enterprise M5000 server with four CPUs and 32 GB of RAM is suggested. This server configuration offers plenty of expansion capabilities and the opportunity to run other database instances in the available headroom. If additional CPUs are added, an additional Dynamic Domain can be configured which can be used for the application server.

The storage portion of this configuration is described as a single Sun Storage 6180 array which can contain up to 16 hard drives. This array can be further expanded to an additional one to three trays with 16 drives each for a total capacity of 128 GB of raw storage capacity, which is generally more than sufficient storage for the application discussed in this paper. Because the Sun Storage 6180 array is a SAN array, it can also be used for multiple applications by creating one or more LUNs and sharing them over the network.

Medium Configuration

A medium configuration assumes maximum throughput/hour supporting up to 10,000 Payroll employees and 50,000 order lines with 1,001 to 3000 online users. For this particular configuration, the following hardware components (see Table 6) are recommended. The medium configuration differs from the small configuration primarily in the compute area of the architecture, with an additional server in the application tier and a more powerful server recommended for the database tier. The storage recommendations remain consistent with those of a small configuration, or an independent storage controller can be introduced to speed up capacity upgrades.

TABLE 6. SIZING FOR MEDIUM CONFIGURATIONS

COMPONENT	CONFIGURATION DETAILS
Application Tier Server	2 SPARC T3-1 servers • 1 CPU • 64 GB RAM
Database Tier Server	SPARC Enterprise M5000 server • 8 CPUs • 128 GB RAM
Storage Tier	Sun Storage 6180 array with 1–3 expansion trays

For the application tier of a medium configuration, two SPARC T3-1 servers are suggested because of their high throughput capabilities on Web-based applications, small footprint and low power consumption.

For the database tier of a medium configuration, a SPARC Enterprise M5000 server with eight CPUs and 128 GB of RAM is suggested, offering plenty of expansion capabilities or the opportunity to run other database instances in the available headroom. If additional CPUs are added, an additional Dynamic Domain can be configured which can be used for the application server.

The storage portion of this configuration is described as a single Sun Storage 6180 array. Because the Sun Storage 6180 array is a SAN array, it can also be used for multiple applications by creating one or more LUNs and sharing them over the network.

Large Configuration

A large configuration assumes maximum throughput/hour supporting up to 50,000 Payroll employees and 250,000 order lines with more than 3000 (and up to 10,000) online users. For large enterprises, the following hardware components listed in Table 7 are recommended.

TABLE 7. SIZING FOR LARGE CONFIGURATIONS

COMPONENT	CONFIGURATION DETAILS
Application Tier Server	2 SPARC T3-2 servers, each with: • 2 CPUs • 128 GB RAM
Database Tier Server	SPARC Enterprise M8000 server • 16 CPUs • 512 GB RAM
Storage Tier	Sun Storage 6780 array with 8–28 expansion trays

For the application tier of this configuration two SPARC T3-2 servers are suggested because of their high throughput capabilities on Web-based applications, small footprint and low power consumption.

For the database tier of this configuration, a SPARC Enterprise Sun M8000 server in a medium configuration with sixteen CPUs and 512 GB of RAM is suggested, offering plenty of expansion capabilities or the opportunity to run other database instances in the available headroom. If other CPUs are added, an additional Dynamic Domain can be configured which can be used for the application server.

Large environments will be able to leverage an Sun Storage 6780 array extensively for multiple applications including Oracle E-Business Suite applications. This array provides capacity for future growth and offers a full feature set to address enterprise needs.

Conclusion

The complete, integrated Oracle E-Business Suite architecture—which includes all necessary components, from business applications, database, virtualization, and clustering technologies to high-performance servers and storage—can be used to accelerate database transactions and increase system availability. Based on Oracle's Sun servers and storage, this architecture provides the compute power, scalability, and capacity for even the largest enterprises. Oracle's SPARC Enterprise M-Series servers include electrically isolated Dynamic Domains, mainframe-class RAS features, and redundant and hot-swappable major system components, for superior reliability and availability. Oracle's SPARC T-Series servers with chip multithreading (CMT) technology, providing hundreds of consecutive execution threads, and high performance networking capabilities enable multiple instances of applications to run on a single system.

Deploying the Oracle Optimized Solution for Oracle E-Business Suite delivers on cost savings and simplified management using virtualization and clustering technologies available from Oracle. The virtualization technologies found in Oracle Solaris Containers and in the SPARC Enterprise servers enable the Oracle E-Business Suite application and database tiers to be consolidated securely and

effectively, offering many benefits such as better resource utilization, smaller datacenter footprint, ease of management, and lower power consumption.

Combining the clustering technologies found in Oracle Solaris Cluster and Oracle Real Application Clusters simplifies keeping Oracle E-Business Suite applications online 24/7 in a local datacenter. These technologies also simplify disaster recovery at a remote site, making it as simple as a cluster failover to switch to a disaster recovery site and then back to the production site.

References

TABLE 8. REFERENCES FOR MORE INFORMATION

TOPIC	DESCRIPTION	URL
Software	Oracle E-Business Suite	www.oracle.com/us/products/applications/ebusiness/index.html
	Oracle Database 11*g* Release 2	www.oracle.com/technetwork/database/enterprise-edition/overview/index.html
	Oracle Real Application Clusters	www.oracle.com/us/products/database/options/real-application-clusters/index.htm
	Oracle Solaris 10	www.oracle.com/us/products/servers-storage/solaris/index.html
	Oracle Solaris Cluster	www.oracle.com/us/products/servers-storage/solaris/cluster-067314.html
	Oracle Solaris Containers	www.oracle.com/us/products/servers-storage/solaris/virtualization-066073.html
	Oracle Enterprise Manager Ops Center	www.oracle.com/us/products/enterprise-manager/opscenter/index.html
Hardware	SPARC Enterprise Servers	www.oracle.com/us/products/servers-storage/servers/sparc-enterprise/index.html
	Sun Storage 6180 Array	http://www.oracle.com/us/products/servers-storage/storage/unified-storage/047193.html
	Sun Storage 6780 Array	www.oracle.com/us/products/servers-storage/storage/disk-storage/031724.htm

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