ORACLE
OPTIMIZED SOLUTIONS

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Consolidating Oracle E-Business Suite on Oracle's SPARC SuperCluster

Introduction

Modern business application deployments such as ERP can be complex, time-consuming, and expensive to deploy, with many interoperating and customized components. In order to provide mission-critical operation, applications, databases, operating systems, servers, networking, storage management, and backup software must all be configured correctly. Identifying bottlenecks, tuning the database, optimizing server and storage performance, and ensuring the availability of key systems are all essential to ensure that service-level agreements are met. Complicating matters, sourcing infrastructure components and from a wide variety of vendors—with their separate support contracts and organizations—can add risk, complexity, and cost to an already challenging process.

Oracle's SPARC SuperCluster addresses these concerns by providing an innovative way to accelerate deployment and reduce operational costs throughout the Oracle E-Business Suite lifecycle. Multiple layers of Oracle E-Business Suite infrastructure can be consolidated onto a high performance, highly available SPARC SuperCluster system to reduce total cost of ownership (TCO) and improve Oracle E-Business Suite deployment speed, application performance, and availability. Integrated in a preconfigured, pretested, and ready-to-deploy SPARC SuperCluster engineered system, the solution provides a complete and optimized infrastructure for Oracle E-Business Suite, built around robust compute, networking, storage, virtualization, and management resources. Using SPARC SuperCluster, Oracle E-Business Suite administrators are left free to concentrate on the application itself while relying on a carefully predefined, and pretested hardware and software infrastructure.

This technical white paper describes the deployment of Oracle E-Business Suite on SPARC SuperCluster. It includes an example mapping for consolidating production, QA, and disaster recovery (DR) systems within the flexible SPARC SuperCluster framework along with development and test systems.

Deploying Oracle E-Business Suite on SPARC SuperCluster

SPARC SuperCluster simplifies and accelerates Oracle E-Business Suite deployment by enabling the consolidation of Oracle E-Business Suite onto a single, highly available and scalable platform. A complete, factory-assembled enterprise infrastructure, SPARC SuperCluster dramatically reduces infrastructure complexity while lowering the time needed to get from concept to service deployment. Oracle's proven, tested, application-to-disk infrastructure runs in the prebuilt and pretested SPARC SuperCluster, eliminating the need for complex, multitier, multivendor hardware configurations. Because the entire environment is engineered and optimized to work together, IT organizations can get services based Oracle E-Business Suite up and running faster. Predictable, high-performance applications take advantage of a highly scalable, available, and serviceable platform to eliminate the potential pitfalls and time-consuming troubleshooting. SPARC SuperCluster provides both time savings as well as reduced complexity.

Oracle's SPARC SuperCluster—Everything Needed for Oracle E-Business Suite Deployment

Oracle's SPARC SuperCluster T4-4 is a complete, pre-engineered, and pretested high-performance enterprise infrastructure solution that is faster and easier to deploy than a collection of individual servers. The system combines innovative Oracle technology—the computing power of Oracle's SPARC T4-4 servers, the performance and scalability of Oracle Solaris, the optimized database performance of Oracle Database 11*g* accelerated by Oracle Exadata Storage Servers, and a high-bandwidth, low-latency InfiniBand network fabric—into a scalable, engineered system that is optimized and tuned for consolidating enterprise applications (Figure 1).

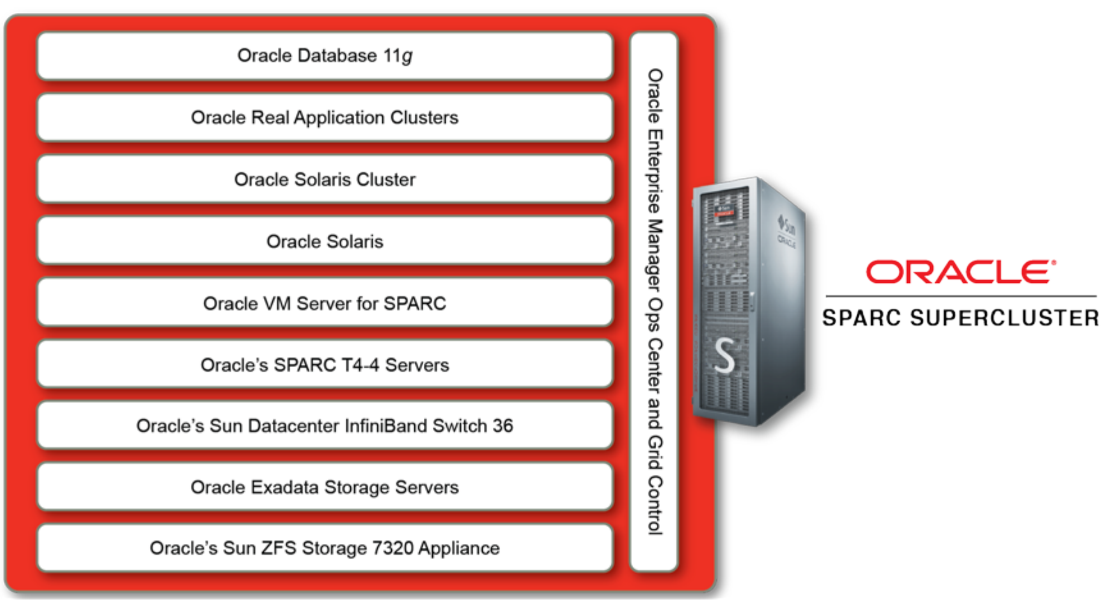

Figure 1. SPARC SuperCluster provides a complete infrastructure for Oracle E-Business Suite in a single enclosure.

All components within the SPARC SuperCluster system, including SPARC T4-4 servers, Oracle's Sun ZFS Storage Appliances, and Oracle Exadata Storage Servers, are interconnected over a fully redundant InfiniBand fabric. Built-in virtualization enables consolidation and helps ensure that applications are isolated from one another and remain highly available, virtually eliminating resource contention and service disruption. With SPARC SuperCluster, the service instances, application servers, and Oracle Database software are all consolidated on the system, eliminating much of the integration effort and deployment time typically associated with clustered solutions and providing other benefits.

- Simplified deployment results from consolidation of one or more Oracle Enterprise Business Suite instances coupled with the use of Oracle Solaris Zones clusters.
- Lower physical infrastructure complexity and maintenance costs result from deploying fewer physical servers.
- Agile virtualization and configuration of services streamlines business processes
- Distribution of system resources provides for higher server utilization and lower infrastructure costs.

Platform Infrastructure

The core components of the SPARC SuperCluster—servers, storage systems, networking components, and the operating system—provide many unique technical advantages to Oracle E-Business Suite applications.

- **SPARC T4-4 Servers.** These servers are designed with performance and consolidation in mind. Each SPARC T4-4 server includes four sockets, each with an eight-core, 3.0 GHz, SPARC T4 processor, two solid-state disks, and a massive 1 TB memory footprint. Chip multithreading technology built into each processor supports 256 threads per server in as little as five rack units (5RU), providing increased computational density to consolidated Oracle E-Business Suite deployments while staying within constrained envelopes for power and cooling. Very high levels of integration help reduce latency and improve overall system security and reliability.
- **Oracle Exadata Storage Servers.** Oracle Exadata Storage Servers deliver extreme database performance to Oracle E-Business Suite 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. Intelligent software enables Oracle Exadata Storage Servers to quickly process database queries and return only the relevant rows and columns to the database server. By pushing SQL processing to Oracle Exadata Storage Servers, all disks can operate in parallel, reducing database server CPU consumption while using significantly less bandwidth to move data between storage and database servers. Oracle Exadata Storage Servers return a query result set rather than entire tables, eliminate network bottlenecks, and free up database server resources. As a result, users often see a 10-fold performance increase when scanning and analyzing data.
- **Sun ZFS Storage 7320 Appliance.** Providing 60 TB of disk capacity for shared file systems, the Sun ZFS Storage 7320 appliance uses flash-enabled Hybrid Storage Pools to accelerate Oracle E-Business Suite application response time. Easy-to-use DTrace Analytics optimize performance with minimal intervention, and powerful storage controllers run multiple data services, increasing efficiency and

deployment flexibility. Oracle Solaris ZFS and self-healing technologies provide superior data integrity, while cluster failover and flash-based write caches ensure data high availability for Oracle E-Business Suite applications.

- **Sun Datacenter InfiniBand Switch 36.** SPARC SuperCluster is built around an InfiniBand fabric for rapid exchange of data among the cluster components. The high-speed, low-latency InfiniBand fabric utilizes a pair of redundant Sun QDR InfiniBand Switches to interconnect all SPARC SuperCluster components: Oracle SPARC T4-4 servers, Oracle Exadata Storage Servers, and Sun ZFS Storage 7320 appliances. The Sun Datacenter InfiniBand Switch 36 is designed specifically for application clusters that comprise of Oracle rackmount servers and storage systems, and delivers the extreme scale, application isolation, and elasticity needed to consolidate and virtualize core Oracle E-Business Suite enterprise business applications.
- **Oracle Solaris.** Optimized for SPARC T4-4 servers, Oracle Solaris delivers high performance, massive threading and batch processing, and high I/O rates critical to the most demanding Oracle E-Business Suite applications. Scalability enhancements, including support for 64-bit memory addressing, large pages, enhanced resource locking with mutex backoff algorithms, enhanced kernel data structures, and library optimizations, enable the platform to support large-scale Oracle E-Business Suite workloads. 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 Oracle E-Business Suite applications and growing data sets.

More information on SPARC SuperCluster can be found in the *A Technical Overview of the Oracle SPARC SuperCluster T4-4* white paper.

Network Infrastructure and Remote Management

The SPARC SuperCluster is a factory-integrated infrastructure complete with a high-performance internal InfiniBand interconnect and comprehensive management tools. The interconnect for a four-node cluster is shown in Figure 2. The solution is designed to create a fully functional Oracle E-Business Suite deployment that can be deployed into production quickly, while merging smoothly into the IT infrastructure and taking advantage of existing data center assets where possible. The "Mapping an Oracle E-Business Suite Deployment to SPARC SuperCluster" section discusses the architecture in more detail.

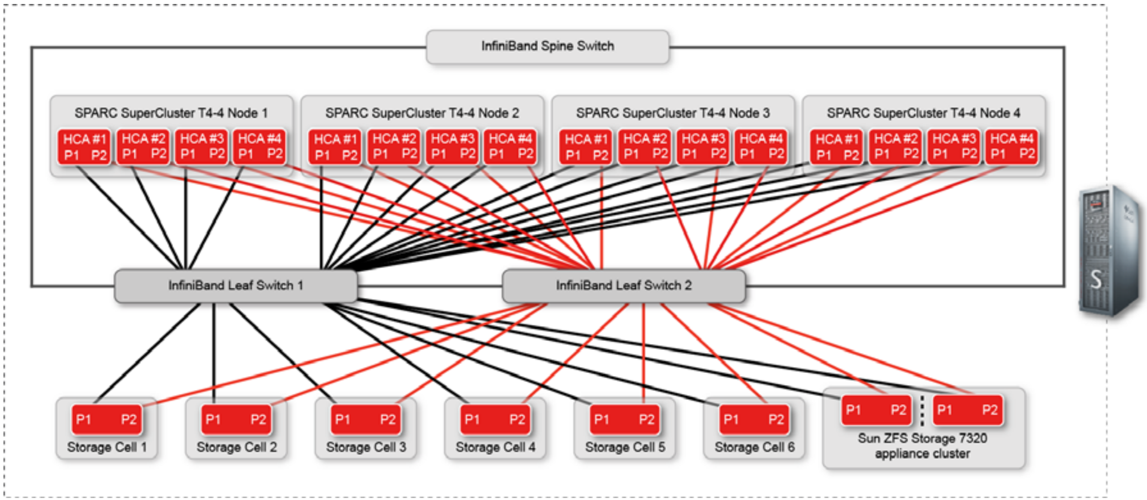

Figure 2. SPARC SuperCluster interconnects all system components over a high-performance, fully redundant InfiniBand fabric (four-node SPARC SuperCluster shown).

- **Redundant networking**. The architecture uses redundant network components and links to promote application availability. Each database or application domain features dual connections to the InfiniBand networks, using separate interface cards connected to separate PCI buses, to support communication with the cluster interconnect, Oracle Exadata Storage Servers, and storage appliances. All tiers within the SPARC SuperCluster architecture communicate using the internal InfiniBand network. Separate redundant 10 gigabit Ethernet interfaces are used for connection to the rest of the data center, and they support incoming client connections and external Oracle E-Business Suite application servers. With optional Fibre Channel cards in the SPARC SuperCluster, the solution supports connections to existing SAN data storage.

- **Built-in remote management tools.** All components within SPARC SuperCluster are connected to a dedicated gigabit Ethernet management network, ensuring physical isolation of management traffic. The management software stack includes Oracle Enterprise Manager 12c Ops Center to govern SPARC SuperCluster components and the Grid Control feature of Oracle Enterprise Manager to manage the Oracle Database. To simplify software maintenance, Oracle tests and aggregates patches for SPARC SuperCluster components. Patches are integration tested for compatibility and stability, verified, and then bundled together for distribution. As a result the entire software stack, even patches and upgrades applied previously, goes through load and stress testing before being released to ensure that patch combinations work as expected.

- **Backup, restore, and disaster recovery**. A variety of backup, restore, and disaster recovery solutions provide both short-term data protection and long-term data preservation for the SPARC SuperCluster. Options vary according to the type of data (structured or unstructured), data protection needs, recovery time, performance, capacity, and service level requirements. For very fast backups to disk storage, the Sun ZFS Storage Appliances in the SPARC SuperCluster can be used to generate and store file system snapshots, storing them either locally or remotely to other Sun ZFS Storage Appliances. Alternatively, snapshots can be stored to Exadata Storage Expansion Racks that are directly connected to the InfiniBand fabric, creating a solution that takes advantage of the Fast Recovery Area in Exadata Storage Servers to instantly get back up and running.

For structured data in the Oracle Database backups can be done with the Oracle Recovery Manager (Oracle RMAN) to disk or to tape through Oracle Secure Backup. Oracle offers an Optimized Solution for Oracle Secure Backup that is designed to perform network backups of heterogeneous clients, including Oracle's engineered systems for Oracle Exadata Database Machine, SPARC SuperCluster, and Oracle Optimized Solutions. For backup, recovery, and long-term archival, tape remains the most cost-effective and reliable storage media available. For Oracle E-Business Suite deployments where longer retention periods and greater capacity are required, Oracle Secure Backup and tape storage can be used for backup, vaulting, and archiving (Figure 3).

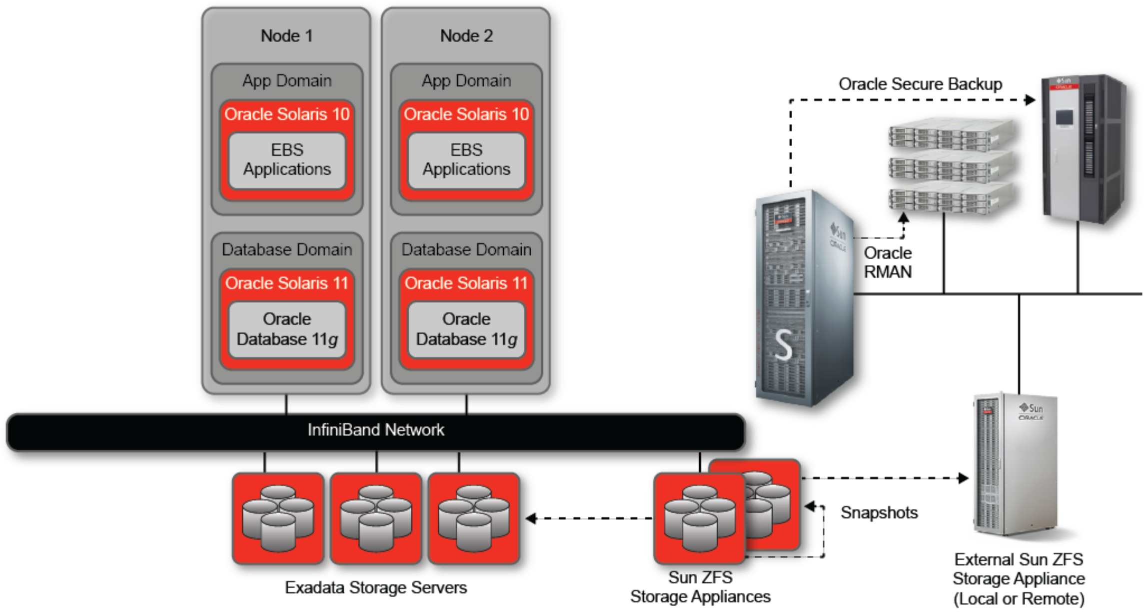

Figure 3. Oracle E-Business Suite on SPARC SuperCluster integrates with Oracle backup tools (two-node SPARC SuperCluster shown).

For disaster recovery scenarios, the Oracle Maximum Availability Architecture, includes best practices that take advantage of Oracle Active Data Guard, Oracle Real Application Clusters (Oracle RAC), Oracle Automatic Storage Management, Oracle Flashback, and the SPARC SuperCluster. Oracle Data Guard can be deployed in conjunction with the snapshot and cloning features of the Sun ZFS Storage Appliance, enabling easy and efficient database cloning to create a remote standby database.

Built-in Virtualization for Simplified Oracle E-Business Suite Application Consolidation

Built-in virtualization technologies isolate workloads and enable resource controls, supporting consolidation of Oracle E-Business Suite deployments within a single platform. Applications certified on Oracle Solaris 8, 9, 10, and 11 can run simultaneously on a SPARC SuperCluster system without modification. Organizations that use Oracle E-Business Suite can consolidate applications securely using these technologies, while at the same time protecting sensitive data, maintaining application availability, and shifting system resources to where they are needed most.

- **Oracle VM Server for SPARC.** Oracle VM Server for SPARC (previously Sun Logical Domains) is a built-in firmware-based hypervisor that supports multiple virtual machines, called domains, on a single system. The hypervisor allocates subsets of system resources (memory, I/O, and CPU) to each domain, isolating each Oracle Solaris instance and Oracle E-Business Suite workload to a virtual machine with dedicated resources. For I/O intensive workloads on SPARC SuperCluster, separate I/O domains can be configured to take advantage of the massive number of I/O ports, enabling I/O performance at bare-metal speed within a virtualized environment.
- **Oracle Solaris Zones.** Using flexible, software-defined boundaries, Oracle Solaris Zones technology is a lightweight virtualization technology that creates multiple private execution environments within a single Oracle Solaris instance. Oracle E-Business Suite applications running within zones are completely isolated, preventing processes in one zone from affecting processes running in another. Zones support fault isolation, feature extremely fast boot times, and can be configured to instantly restart Oracle E-Business Suite applications. Because zones make it easy to prioritize applications and adjust resource allocations, they are ideal for consolidated Oracle E-Business Suite workloads.

Oracle VM Server for SPARC and Oracle Solaris Zones are complementary virtualization technologies that work together to isolate Oracle E-Business Suite applications and control system resources. In the Oracle Optimized Solution for Oracle E-Business Suite on SPARC SuperCluster, Oracle VM Server for SPARC defines at least two virtual servers or domains: one for the underlying database and one or more for the application tier. Figure 4 illustrates a two-node SPARC SuperCluster configuration. Four-node clusters are also available.

To optimize performance of Oracle Exadata Storage Servers, Oracle Solaris 11 runs in the database domains to support the database and, optionally, Oracle RAC. To support Web, applications, and services, Oracle Solaris Zones are configured in the application domains, allowing zone clusters to be created in conjunction with Oracle Solaris Cluster. Though Oracle Solaris 11 is recommended, and Oracle E-Business Suite is certified for Oracle Solaris 11, some third-party applications may not be. Please refer to https://support.oracle.com/CSP/main/article?cmd=show&type=NOT&id=761568.1 for support information on various Oracle E-Business Suite modules.

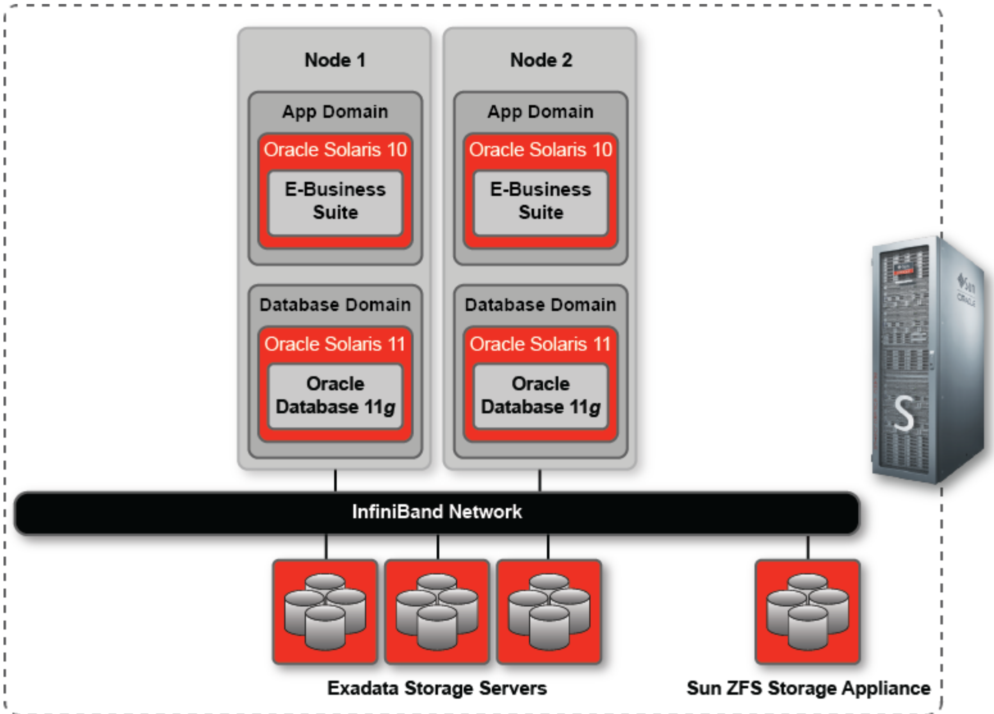

Figure 4. Built-in virtualization technologies provide workload isolation and resource controls (two-node SPARC SuperCluster configuration shown).

High Availability Features to Keep the Oracle E-Business Suite Running

Mission-critical Oracle E-Business Suite applications must be available 24x7x365. To that end, Oracle recommends using an architecture that is integrated, tested, and validated to work together to reduce the risk of deployment problems, interoperability issues, and unplanned downtime.

- **No single point of failure**. The SPARC SuperCluster system provides full built-in redundancy—from compute nodes to storage, network switches to network interface cards (NICs), and power distribution units (PDUs) to power supplies—to support the demands of mission-critical Oracle E-Business Suite applications.
- **Oracle RAC.** Oracle RAC is the preferred implementation option to optimize availability for mission-critical Oracle E-Business Suite workloads. Oracle RAC supports the transparent deployment of the database across the servers within the SPARC SuperCluster system, providing high availability of database services in the event of hardware failures or planned outages.
- **Oracle Solaris Cluster.** Oracle Solaris Cluster optimizes the availability of Oracle E-Business Suite applications by detecting, isolating, and containing failing cluster nodes. Agents—software programs that enable Oracle or third-party applications to take full advantage of Oracle Solaris Cluster features—specify the actions to be taken if a node or service fails or becomes unavailable. In this solution, Oracle E-Business Suite application specific agents are used to manage the availability of components in the complete solution. In addition to Oracle RAC and Oracle Database agents, the HA for Oracle E-Business Suite data service provides a mechanism for the orderly startup and shutdown, fault

monitoring, and automatic failover of Oracle E-Business Suite. High-availability protection for specific components includes the Web Server, Forms Server, Concurrent Manager Server and the Reports Server.

- **Virtual clustering**. Oracle Solaris Cluster supports virtual clustering, allowing Oracle Solaris Zones to function in the same role as physical cluster nodes. Applications that run within dedicated zone clusters are associated with specific cluster management policies. Agent actions can be layered, such as first trying to restart the service in a different zone before attempting to restart it on a different server. This capability helps Oracle E-Business Suite applications achieve the required levels of service.
- **Highly available NFS storage**. In the Oracle E-Business Suite environment, application servers access shared file systems for binaries, configuration files, and log files. Accessed over the high-speed InfiniBand network, Sun ZFS Storage Appliances provide a highly available shared file system. These appliances are configured for redundancy, and they use the built-in self-healing and data integrity features of Oracle Solaris ZFS with cluster failover and flash-based write caches to increase data availability.

Mapping an Oracle E-Business Suite Deployment to SPARC SuperCluster

A typical large-scale Oracle E-Business Suite deployment can be complex, with users at the edge of the network, data center infrastructure hosting the Oracle E-Business Suite modules and components, and storage systems handling information management. Within the data center, a typical Oracle E-Business Suite deployment consists of separate development (DEV), test and quality assurance (QAS), and Production (PRD) systems for each Oracle E-Business Suite application. Oracle E-Business Suite components are commonly deployed with the application and database server layers residing on a single system or with the application and database layers residing on separate systems

The independent hosting of each layer on separate physical servers results in increasing complexity and infrastructure sprawl that makes adding new Oracle E-Business Suite services expensive and time consuming. Because individual servers must be sized for peak demand—a condition that usually occurs only once a week or once a month—they experience very low utilization rates for the rest of the time. With so many servers often running only at 10 to 20 percent of capacity, resource utilization is low, power and cooling demands are high, and data center floor space is over consumed and underutilized. As a result, enterprises running multiple Oracle E-Business Suite applications can quickly find themselves with a large and fragmented environment (Figure 5).

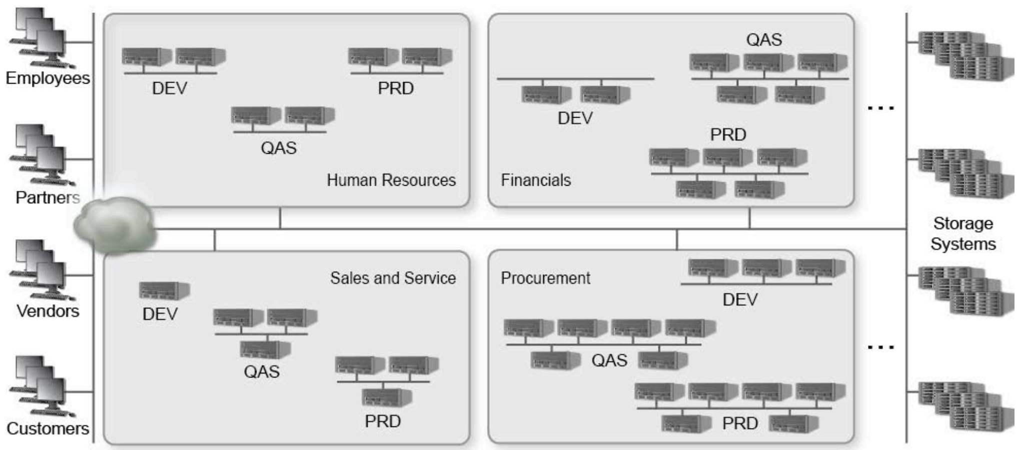

Figure 5. Different development, test, and production systems for each Oracle E-Business Suite application can rapidly lead to complexity and server sprawl.

To greatly simplify Oracle E-Business Suite deployments, production environments for each module can be consolidated onto a SPARC SuperCluster system. Though housed in a single physical rack, the SPARC SuperCluster supplies sophisticated networking and virtualization to provide all of the performance and reliability of deploying Oracle E-Business Suite on separate physical systems. Since Oracle Enterprise Business Suite QA systems typically approximate the size and scale of production systems, they can be deployed on a separate SPARC Supercluster. If QA systems are deployed at a different geographical site, the second SPARC SuperCluster can also serve as a disaster recovery (DR) system, facilitated through Oracle Data Guard. Smaller development, testing, and sandbox environments are then hosted on separate servers, with Oracle RMAN and extract, transform, and load (ETL) placed on additional Sun ZFS Storage Appliances (Figure 6).

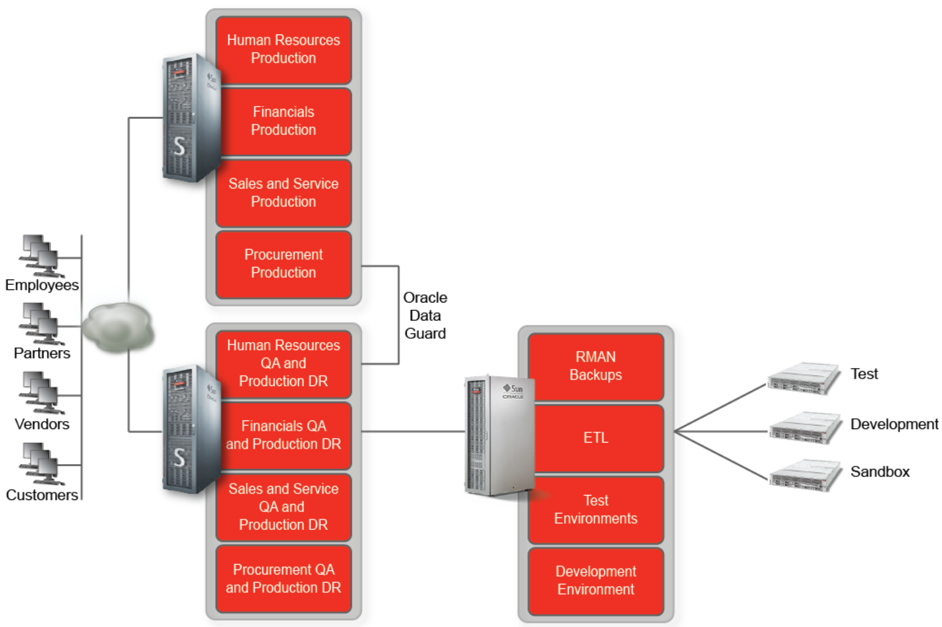

Figure 6. Oracle E-Business Suite QA, development, and testing environments can be consolidated onto a single SPARC SuperCluster, with production systems deployed on a second SPARC SuperCluster to maintain physical isolation.

Production System

The production system contains live data and it is where business processes are executed. To ensure the highest performance and availability, Oracle recommends a two-domain (application, database) EBS deployment on SPARC SuperCluster systems. In this configuration, applications run in Oracle Solaris Zones within an application domain (Logical Domain or LDom) and can be configured for failover by utilizing Oracle Solaris Cluster HA for Oracle E-Business Suite. Databases run in a separate database domain connected to Oracle Exadata Storage Servers.

Figure 7 illustrates a two-node SPARC SuperCluster system with consolidated production Oracle E-Business Suite applications. The Oracle Process Manager and Notification Server (OPMN) providing the Web Services run across the two Oracle Solaris 10 domains in an Oracle Solaris Zone Cluster using agents provided with Oracle Solaris Cluster HA for Oracle E-Business Suite. Likewise, another Solaris Zone cluster is provided for Oracle Concurrent Manager (CM) configured in Parallel Concurrent Processing (PCP) mode. In addition, an external Oracle Database proxy resource is configured in the same zone cluster running the Concurrent Manager to monitor and represent the availability of the specific database services provided by the Oracle RAC 11g Release 2 database domains. The EBS system has a dependency on such database services. This resource enables the coordination of availability between the two types of domains in SPARC SuperCluster systems.

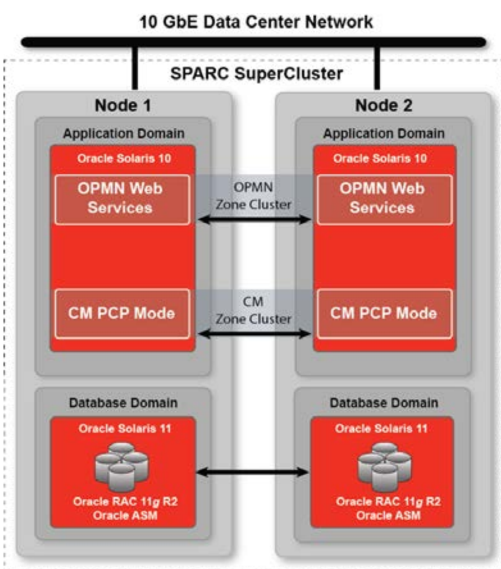

Figure 7. Smaller deployments can consolidate production onto a two-node SPARC SuperCluster system.

Figure 8 illustrates Human Resources, Financials, and Procurement running in an application domain with Oracle Solaris Zone clusters providing failover between the application instances running on separate SPARC SuperCluster nodes. As shown, additional Oracle E-Business Suite instances can be configured to host additional modules, or to provide operational or administrative separation.

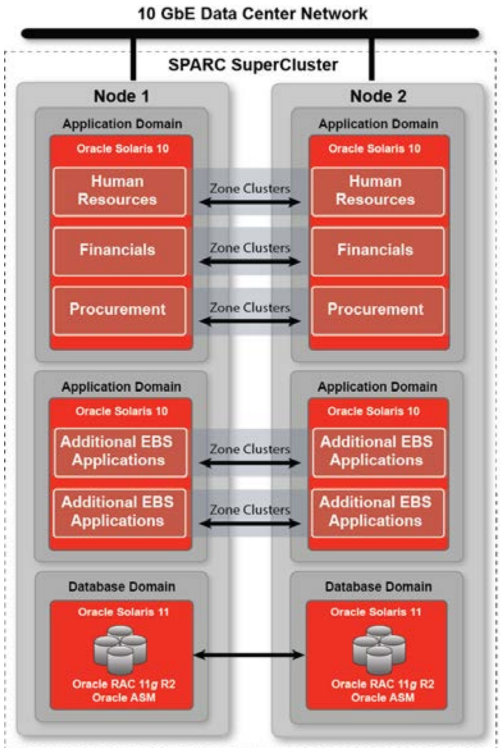

Figure 8. Multiple Oracle E-Business Suite instances can host multiple application modules flexibly.

For larger deployments, a four-node SPARC SuperCluster system can be used as shown in Figure 9. In this case, two nodes are used to run the application domains, and two nodes are used to run the database domains. As with the two-node configurations, multiple Oracle E-Business Suite instances can be configured to host additional modules, or to separate operational or administrative domains.

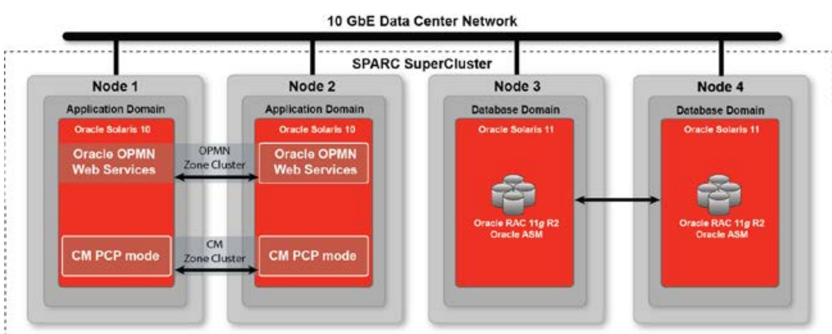

Figure 9. For larger deployments, a four-node production system could locate application and database domains on separate SPARC T4-4 nodes within the SPARC SuperCluster, yielding considerable headroom for both database performance and Oracle E-Business Suite application modules.

Quality Assurance, Disaster Recovery, and Other Systems

When creating, building, and testing Oracle E-Business Suite applications, a number of independent systems must be used.

- **Quality assurance system.** Ideally, a quality assurance system is identical to the production system so that issues can be found and fixed during the verification process. With the ability to control the system, engineers can work together to conduct exhaustive tests on configurations, new functionality, and implementation changes prior to deployment in the production system. If a duplicate environment is not possible, a smaller system can be used in a ratio that enables technical staff to forecast the performance impact.
- **Disaster Recovery (DR) system.** Since Oracle E-Business Suite QA systems typically approximate the size and scale of the production systems, a remotely located QA system can serve double duty as a disaster recovery system on a separate SPARC SuperCluster (Figure 6). With production and QA/DR systems deployed on different sites, Oracle Data Guard can provide transactional consistency and active-active failover for services.
- **Development and test system.** Customization efforts and the development of new functionality typically take place on a small server and database. All maintenance activities, including break-fixes for production processes, tend to be performed on these systems as well.
- **Training and sandbox systems.** Using a small system and database, the training and sandbox systems make it easy for developers to gain experience with applications, test various scenarios prior to incorporating them into the mainstream code base, and conduct feasibility studies for customer-specific requirements or requests.

In many of these environments, developers frequently test new functionality and software products, patch applications, and perform upgrades. Toward this end, many developers and test engineers are given root access to enable them to perform tasks independently, which would be less than ideal on a production system.

Consolidation of Quality Assurance and Disaster Recovery on SPARC SuperCluster

Oracle E-Business Suite QA/DR systems can be consolidated onto a single SPARC SuperCluster system to simplify deployments and shorten the time needed to get a new QA system up and running. As with the application domain on production systems, Oracle Solaris Zones provide a complete runtime environment for Oracle E-Business Suite applications environment, including all required programming tools. The Oracle Database used for the Oracle E-Business Suite Application would be just another instance that is run from the Oracle Database domains and stored on the shared Oracle Exadata Storage Servers. Each zone provides full resource containment and control and fault and security isolation to ensure applications do not hamper one another's access to resources or impact execution. Developers and administrators can manage compute, memory, and I/O resources on a fine-grained basis (statically or during operation) to ensure applications have access to an appropriate amount of resources and no workload consumes the entire platform. As a result, programmers can maintain a one application per server deployment model while simultaneously sharing hardware resources.

Consolidating onto a Single SPARC SuperCluster System

As described, full-scale installations with the need for isolated QA and disaster recovery systems would typically deploy multiple SPARC SuperCluster systems in physically separate geographic locations. For smaller deployments with more modest processing needs and no disaster recovery requirement, a single SPARC SuperCluster could be configured to house both production as well as QA/dev/test systems. Figure 10 illustrates a four-node SPARC SuperCluster that houses a two-node production system and a two-node QA/dev/test system, conveniently consolidated into a single rack.

As with the two-node SuperCluster configuration described previously, each server is divided into two domains (application and database) using Oracle VM Server for SPARC. The application domain is further subdivided into isolated areas using Oracle Solaris Zones. Oracle Solaris Cluster is used to combine zones into clusters to enable failover for critical application services. Oracle Database and Oracle RAC run in the database domain connected to the Oracle Exadata Storage Servers to support highly available data access.

In such a configuration, all production, quality assurance, development and other systems run in isolated areas. Development systems can run Oracle Solaris Zones to maintain the one-application-per-server model preferred by developers, while the production system can run clustered servers to ensure high availability. The QA system replicates all or part of the production environment, enabling applications to be tested in the same environment in which they are deployed.

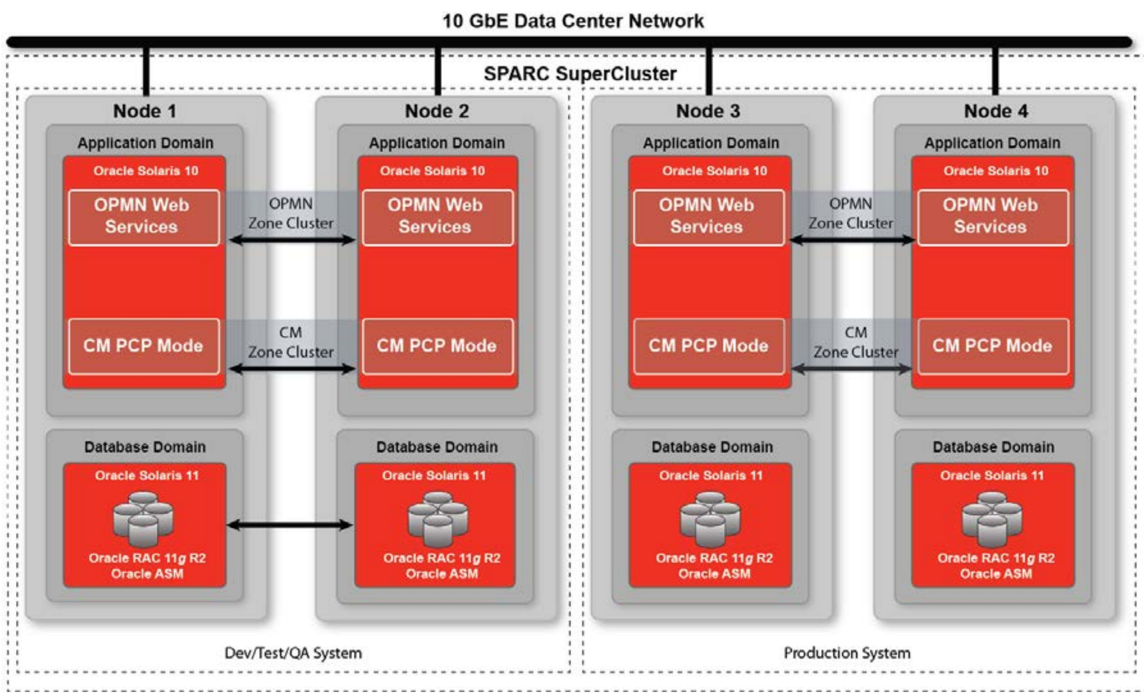

Figure 10. Oracle E-Business Suite deployments with moderate performance or scalability requirements can be consolidated onto a single SPARC SuperCluster system.

Analyzing the Solution's Characteristics

To understand the behavior of the architecture under peak load conditions, determine optimum utilization, verify the scalability of the solution and exercise high availability features, Oracle engineers recently tested the Oracle Optimized Solution for Oracle E-Business Suite running on a SPARC SuperCluster T4-4. The following sections provide an overview and results of the testing that was done.

Table 1 lists software versions used in the testing of Oracle E-Business Suite on SPARC SuperCluster conducted at Oracle.

TABLE 1. ORACLE E-BUSINESS SUITE ON SPARC SUPERCLUSTER

Virtualization	Oracle VM Server for SPARC Oracle Solaris Containers on Oracle Solaris 10
Operating environment	Oracle RAC VM: Oracle Solaris 11 Application Server VM: Oracle Solaris 10 8/11
Clustering	Oracle Solaris Cluster 3.3 5/11 (OSC3.3u1)
Management	Oracle Enterprise Manager Ops Center 11g Release 1 Oracle Enterprise Manager Grid Control (for database)
Database	Oracle RAC 11g Release 2 Oracle Storage Servers Exadata Software version 11.2.3.2 Compute nodes: Exadata Software version 11.2.0.3 DB + bundle patches
Application workload used to test Oracle E-Business Suite on SPARC SuperCluster	Oracle E-Business Suite R12.1.3: • Human Resources Self-Service • Order Management • Financials • Payroll

Oracle E-Business Suite Performance Testing on SPARC SuperCluster

This section provides an overview of various system performance examples when running Oracle E-Business Suite deployed on SPARC SuperCluster.

Performance Testing Configuration and Methodology

Performance testing on SPARC SuperCluster systems follows the methodology developed for sizing Oracle E-Business Suite applications. Selected transactions from common business flows in Oracle E-Business Suite applications have been scripted to automate the load generation. This testing allows large numbers of simulated concurrent users to exercise the system under test. The described methodology allows for repeatable tests to verify performance, scalability and processing accuracy, while tailoring application and environment attributes.

Performance Testing Scenarios Overview and Testing Results

A set of most common transactions operating on the widely used Oracle E-Business Suite application modules were selected to exercise batch processing and online transaction processing using Forms and Web-based user interfaces. Several transactions from HRMS, Order Management, and Financials products were used in the performance testing.

A standard configuration that was described in the Production System section of this white paper was used to generate transactional load on a multi-node Oracle E-Business Suite 12.1.3 environment deployed on SPARC SuperCluster. The Oracle E-Business Suite R12 software was installed on a single NFS4 mount point in general purpose domains, enabling multiple nodes in the deployment to share the Application Tier File System. The database components of Oracle E-Business Suite were deployed in database domains. The Oracle Solaris Zones feature Resource Controls was not used in this testing so both the database tier and the application tier used all the domain system resources without any restrictions.

The performance results illustrated in this document were obtained on a highly available Oracle SPARC SuperCluster T4-4 system as it could be deployed at a customer site, and not on a special-purpose, performance-tuned benchmark setup. There are many critical differences between real-world and one-time benchmark configurations. Designed to reduce latency and overhead, increase throughput and bandwidth, and simplify configurations overall, most benchmarks generally do not implement high availability features. For example, in benchmarks, most data typically is stored on striped local disks instead of using highly available shared storage. For these reasons, the performance results disclosed in this document are designed to provide general guidance for real world deployments, not to be compared with published benchmark results from Oracle or other vendors.

HRMS Self-Service Online Transaction Processing

Workload Description

- Cash Expenses
  - User creates and submits a consolidated expense report that includes various expenses such as airfare, car rental, hotel, meal and entertainment
- Credit Card Expenses
  - Similar to a Cash Expense except that these expenses are paid using a Credit Card
- Timecards
  - User creates a time card entry with information about his/her project along with the tasks worked on and the time spent on each task
- Retrieve Payslip
  - Self explanatory

Throughput Metrics and User Load Distribution

TABLE 2. THROUGHPUT METRICS AND WORKLOAD DISTRIBUTION

THROUGHPUT METRICS
Number of cash expenses created
Number of credit cash expenses created
Number of timecards created

USER LOAD DISTRIBUTION
Cash Expenses 25%
Credit Card Expenses 25%
Timecards 25%
Payslip Retrieval 25%

Java Virtual Machine Configuration

TABLE 3. JAVA VIRTUAL MACHINE CONFIGURATION

	Per Application Node OACore Java Virtual Machines	
Number of Users	Count	Heap Size
2000	12	1.5GB

2000 User Performance Testing Results

In tests with self-service users workloads scaled smoothly when tested separately with 2000 users. Response time only increased imperceptibly, while CPU and Memory utilization rose predictably. Measured HRMS Self-Service Online Transaction Processing performance graph is provided in Figure 11. Measured performance for CPU and memory utilization for the database tier and application tier are provided in table 4.

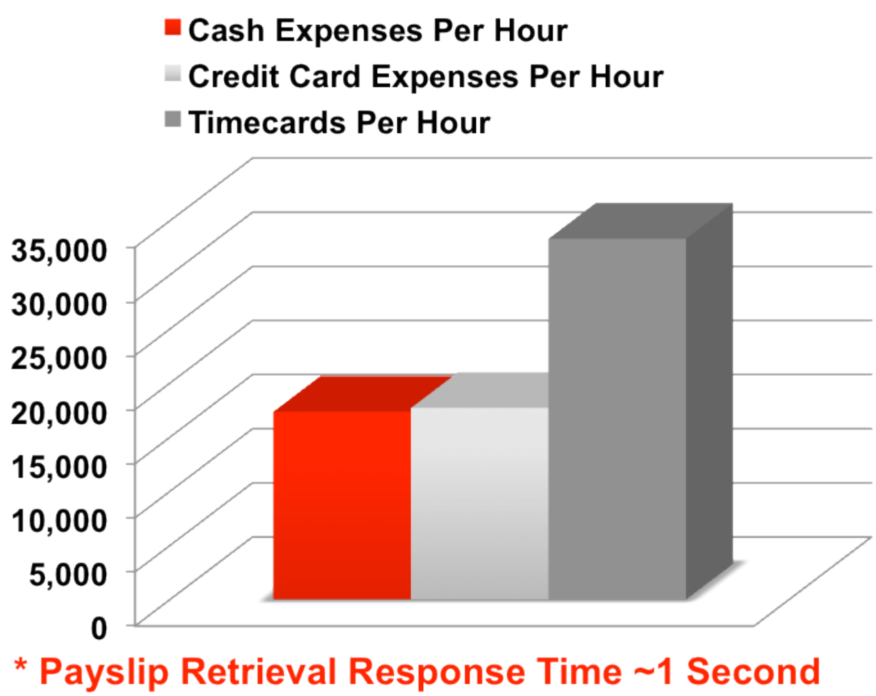

Figure 11. 2000 User Measured HRMS Self-Service Online Transaction Processing performance results

TABLE 4. MEASURED SYSTEM PERFORMANCE FOR MEASURED HRMS SELF-SERVICE ONLINE TRANSACTION PROCESSING PERFORMANCE

	PER NODE CPU AVERAGES		PER NODE MEMORY FOOTPRINT		EXADATA PER CELL STATISTICS	
USER COUNT	DATABASE TIER	APPLICATION TIER	DATABASE TIER	APPLICATION TIER	EXADATA SMART FLASH LOG	EXADATA SMART FLASH CACHE
2000	37%	45%	88GB	27GB	100%	77%

HRMS North America Payroll Batch Processing

Workload Description

- Payroll Process
  - Performs calculations to complete the gross-to-net calculation including earnings, deductions and taxes
- PrePayments
  - Distributes the net pay according to personal pay method – Direct Deposit, Check or Cash
- NACHA
  - Creates a bank interface flat file to be dispatched to banks
- Check Writer
  - Allocates check numbers, creates and prints the pay check along with the paper payslip
- Costing
  - Associates the payroll transaction data with the General Ledger (GL) accounts

Oracle E-Business Suite Configuration

- Two Concurrent Processing nodes in a Parallel Concurrent Processing (PCP) setup
- Total number of Standard Manager processes: 128
- No node affinity. Concurrent requests were load balanced on both CP nodes as well as both instances in clustered database

Tuning Parameters

- Key PAY_ACTION_PARAMETERS
  - CHUNK_SIZE = 20 for Payroll process
  - CHUNK_SIZE = 2600 for PrePayments, NACHA and Costing processes
  - CHUNK_SHUFFLE=Y

Payroll Batch Processing Testing Results

The North America Payroll batch could process 925,000 paychecks per hour. Measured performance graphs for Payroll throughput provided in Figure 12. Measured performance for CPU and memory utilization are provided in table 5.

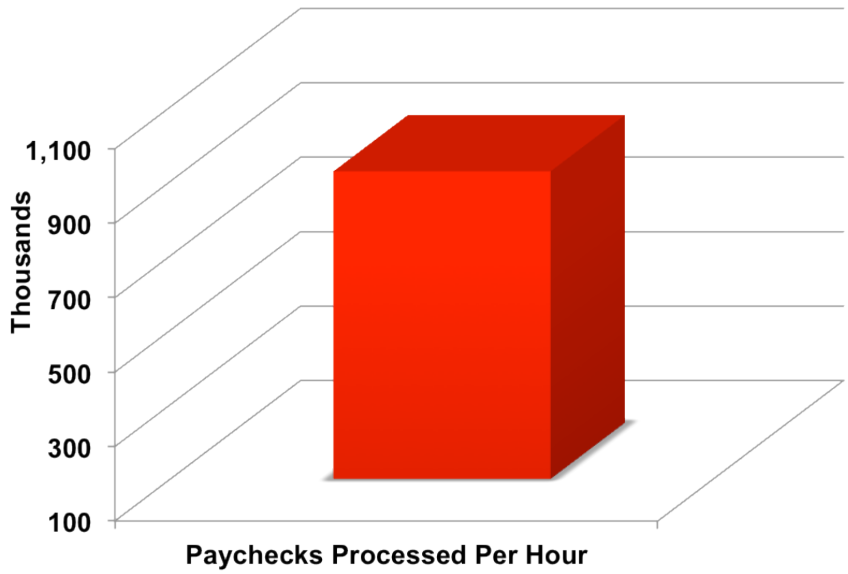

Figure 12. HRMS North America payroll batch processing performance results

TABLE 5. MEASURED SYSTEM PERFORMANCE FOR PAYROLL BATCH PROCESSING PERFORMANCE

PER NODE CPU AVERAGES		PER NODE MEMORY FOOTPRINT	EXADATA PER CELL STATISTICS	
AVERAGE	PEAK	DATABASE TIER	EXADATA SMART FLASH LOG	EXADATA SMART FLASH CACHE
15%	47%	52GB	100%	83%

Order Management Online Transaction Processing

Workload Description

- Create Order
  - User creates and books a five line order from the "Orders" page
- Pick Release
  - User navigates to the "Shipping -> Release Sales Order" page, retrieves a sales order by order number and releases the sales order for delivery
- Ship Order
  - User navigates to the "Shipping -> Transactions" page, finds a particular order in a range of sales orders, completes the confirmation steps and acknowledges that the shipment is complete
- Generate Invoice

- User navigates to the "Transactions -> Transactions" page and generates invoice by entering the source, reference number and line item information for five lines

Throughput Metrics and User Load Distribution

TABLE 6. THROUGHPUT METRICS AND WORKLOAD DISTRIBUTION

THROUGHPUT METRICS
Number of order lines created
Number of invoice lines created

USER LOAD DISTRIBUTION
Create Order 40%
Pick Release 20%
Ship Order 20%
Generate Invoice 20%

Java Virtual Machine Configuration

TABLE 7. JAVA VIRTUAL MACHINE CONFIGURATION

	Per Application Node OACore Java Virtual Machines	
Number of Users	Count	Heap Size
3000	1	1.5GB

	Per Application Node OAForms Java Virtual Machines	
Number of Users	Count	Heap Size
3000	4	1.5GB

3000 User Performance Testing Results

The workload scaled smoothly when tested separately with 3000 concurrent Forms users executing Order Management transactions. Response time only increased imperceptibly, while CPU and Memory utilization rose predictably. Measured performance graphs for Order Management Online Transaction Processing is provided in Figure 13. Measured performance for CPU and memory utilization are provided in table 7.

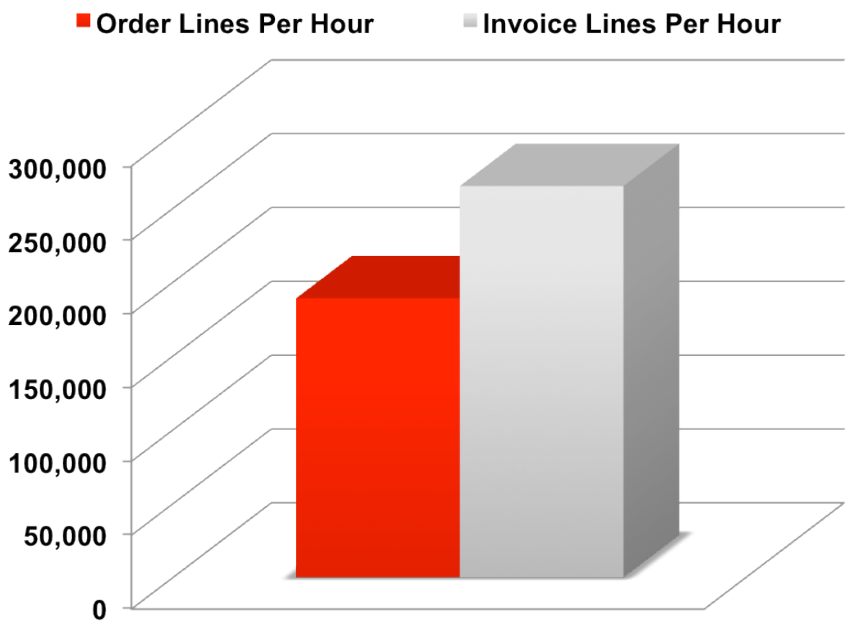

Figure 13. 3000 User Measured Order Management Online Transaction Processing performance results

TABLE 7. MEASURED SYSTEM PERFORMANCE FOR MEASURED ORDER MANAGEMENT ONLINE TRANSACTION PROCESSING PERFORMANCE

	PER NODE CPU AVERAGES		PER NODE MEMORY FOOTPRINT		EXADATA PER CELL STATISTICS	
USER COUNT	DATABASE TIER	APPLICATION TIER	DATABASE TIER	APPLICATION TIER	EXADATA SMART FLASH LOG	EXADATA SMART FLASH CACHE
3000	50%	12%	66GB	94GB	100%	79%

Financials Online Transaction Processing

Workload Description

- Fixed Asset : Create Asset
  - User creates a fixed asset and then queries for a specific asset using asset number
- GL : Journal Entry
  - User creates a journal entry in general ledger and queries for a particular account, checks the balance and journal details
- INV : Insert Misc Transactions
  - User submits an inventory transaction by creating a five line miscellaneous receipt
- INV : Retrieve Item
  - User queries for and views the on hand availability and quantities of specific items

Throughput Metrics and User Load Distribution

TABLE 8. THROUGHPUT METRICS AND WORKLOAD DISTRIBUTION

THROUGHPUT METRICS	USER LOAD DISTRIBUTION
Number of Fixed Assets created	Fixed Asset : Create Asset 25%
Number of General Ledger Journal entries created	GL : Journal Entry 25%
Number of Inventory Miscellaneous transactions completed	INV : Insert Misc Trx 25%
	INV : Retrieve Item 25%

Java Virtual Machine Configuration

TABLE 9. JAVA VIRTUAL MACHINE CONFIGURATION

	Per Application Node OACore Java Virtual Machines	
Number of Users	Count	Heap Size
2000	2	1.5GB

	Per Application Node OAForms Java Virtual Machines	
Number of Users	Count	Heap Size
2000	3	1.5GB

2000 User Performance Testing Results

In tests with HTML and Forms users (2000), the workloads scaled smoothly. Response time only increased imperceptibly, while CPU and Memory utilization rose predictably. Measured performance graphs for Financials Online Transaction Processing is provided in Figure 14. Measured performance for CPU and memory utilization are provided in table 10.

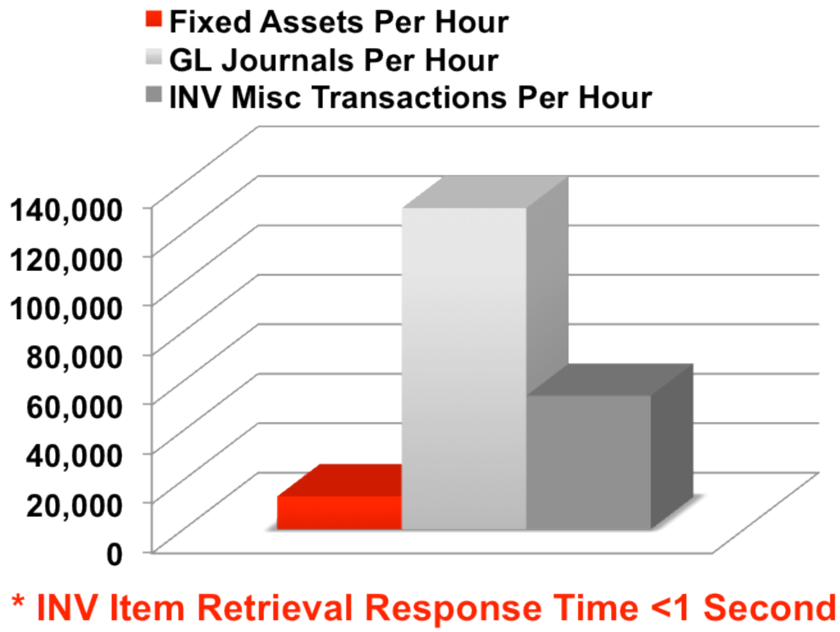

Figure 14. 2000 User Measured Financials Online Transaction Processing performance results

TABLE 10. MEASURED SYSTEM PERFORMANCE FOR MEASURED FINANCIALS ONLINE TRANSACTION PROCESSING PERFORMANCE

	PER NODE CPU AVERAGES		PER NODE MEMORY FOOTPRINT		EXADATA PER CELL STATISTICS	
USER COUNT	DATABASE TIER	APPLICATION TIER	DATABASE TIER	APPLICATION TIER	EXADATA SMART FLASH LOG	EXADATA SMART FLASH CACHE
2000	11%	7%	61GB	48GB	100%	84%

Backup and Recovery Performance Testing

Backup and recovery tests were done to show the performance of the SPARC SuperCluster for backup and recovery and to test the ability to clone an entire Oracle E-Business Suite environment.

For an Oracle E-Business Suite deployment on SPARC SuperCluster systems there are only two key areas of the system that need to be backed up to recover or clone the entire system, the Oracle E-Business Suite code tree that is installed on the internal network attached storage and the database that is installed on the Exadata Storage Servers. For all the backup and recovery tests the Oracle Optimized Solution for SPARC SuperCluster Backup and Recovery solution was used with a deployment of the Sun ZFS Backup Appliance and a tape configuration consisting of a StorageTek SL3000 tape library and StorageTek T10000C tape drives. There are no performance differences between disk and tape backups of the E-Business Suite environment with the exception of the tape system being required to mount tapes to begin the backup or restore. Both disk and tape backup methods could easily take full advantage of the SPARC SuperCluster's extreme I/O abilities for backup and restore.

Backup and Recovery Performance Testing Results

For both half rack and full rack SPARC SuperCluster configurations the backups can be done in approximately one hour and restores can be done in approximately one and half hours, even if the database consumes the entire capacity of the Exadata Storage Servers. The database used to test the environments consisted of a database that was ~350GB and had up to ~750GB of archive logs.

TABLE 11. MAXIMUM BACKUP AND RESTORE RUN TIMES.

SPARC SUPERCLUSTER CONFIGURATION	USABLE DATABASE CAPACITY (TB)	FAST RECOVERY AREA CAPACITY (TB)	MAXIMUM BACKUP RUN TIME (HRS)	MAXIMUM RESTORE RUN TIME (HRS)
HALF RACK	8.4	2.1	1	1.5
FULL RACK	16.9	4.2	1	1.5

TABLE 12. ORACLE E-BUSINESS SUITE TEST DATABASE MAXIMUM BACKUP AND RESTORE RUN TIMES.

SPARC SUPERCLUSTER CONFIGURATION	USED DATABASE CAPACITY (TB)	FAST RECOVERY AREA USAGE (TB)	MAXIMUM BACKUP RUN TIME (MINUTES)	MAXIMUM RESTORE RUN TIME (MINUTES)
HALF RACK	.35	.75	12	16
FULL RACK	.35	.75	6	8

Performance Results Conclusion

The results demonstrate that Oracle E-Business Suite on SPARC SuperCluster can deliver extreme throughput at high concurrency in a Highly Available configuration with headroom for unexpected high seasonal load or future growth.

- Optimum number of JVMs and Forms configured to process thousands of Web-based or Forms based online workloads.
- The CPU and memory requirement depends on the type of the online modules with Forms consuming more memory and less CPU, and Web based modules consuming more CPU and less memory.
- The IB interconnect in SPARC SuperCluster provides customers choice to configure Concurrent Manager on Application tier without performance impact and additional processing capacity in Database tier.
- Businesses are able to run batch processes on single RAC instance with equal or better performance when one node is taken down for maintenance.

Solution High Availability Test Results

To validate high availability of the overall solution, numerous rigorous failure tests were performed under load on the App and Web architecture tiers, as well as on the whole Solaris 10 General Purpose domain (Applications VM), the whole Oracle Solaris 11 database domain (Database VM) and on a complete SPARC T4-4 server node. The following tables list the measured results. The numbers provided in this document are for indication of activities duration and based on the cluster configured using default settings.

Web Server Node Failure

The zone cluster node that was abruptly rebooted was running the Web Server and one instance of OPMN/OC4J. The other zone cluster node was running the other instance of OPMN/OC4J. Upon failure of the zone cluster node, Oracle Solaris Cluster detects the failure and immediately fails over the Web Server and Logical Host associated with that instance on the SuperCluster client access network, as well the Logical Host of the impacted OPMN/OC4J on the internal IB network. The fast fail over of the Logical Host ensures that users are disconnected right away and are able to reconnect as soon as services recovery is completed. The failed zone cluster node is automatically rebooted by the Solaris OS. Oracle Solaris Cluster then automatically re-establishes the zone cluster and restarts the OPMN/OC4J instance.

Table 13 shows the results of failing the zone cluster node running the Web Server and one instance of OPMN/OC4J.

Failure detection time is the duration between the time of the fault injection and the time the zone cluster node is declared out of th10e zone cluster membership.

Services recovery time is the duration between the detection time and the time the Web Server has successfully failed over.

Recovery to full redundancy time is the duration between the detection time and the time the impacted OPMN/OC4J instance is available again.

TABLE 13. WEB SERVER NODE FAILURE DETECTION AND RECOVERY RESULTS

PROCESS STAGE	TIME (IN SECONDS)
Failure detection	11
Services recovery time	12
Full redundancy recovery time	65

OPMN/OC4J Instance Failure

The Web Server and one instance of the OPMN/OC4J are running on the redundant zone cluster node prior to this test. On the other zone cluster node all the processes of the other OPMN/OC4J instance are killed. Oracle Solaris Cluster detects the failure and immediately restarts the OPMN/OC4J instance. The Logical Host associated with the failed OPMN/OC4J instance is not failed over as the failed OPMN/OC4J instance is being restarted. Only user sessions using the impacted OPMN/OC4J instance are disconnected upon the failure of that instance and are able to reconnect to the redundant OPMN/OC4J instance to obtain services right away. User sessions using the other OPMN/OC4J instance are not impacted. When the impacted OPMN/OC4J instance is recovered, new user session will be load balanced again to this instance.

Table 14 shows the results of failing all the processes of an OPMN/OC4J instance. The faulted instance is automatically restarted back by Oracle Solaris Cluster.

Detection time is the duration between the time of the fault injection and the time Oracle Solaris Cluster detects that the processes have failed.

Full recovery redundancy time is the duration between the detection time and time the OPMN/OC4J instance is available again.

TABLE 14. OPMN/OC4J FAILURE DETECTION AND RECOVERY RESULTS

PROCESS STAGE	TIME (IN SECONDS)
Failure detection	0
Service recovery time	0
Full redundancy recovery time	113

Note the recovery time of the impacted OPMN/OC4J instance is greater that the recovery time from the previous test (Web Server node failure) because Oracle Solaris Cluster needs to perform a restart (STOP/START) whereas the previous test just performed a START. The additional 48 seconds (113 – 65) can be attributed to Oracle Solaris Cluster performing a STOP and cleanup for all OPMN/OC4J components prior to performing a START.

Concurrent Manager Node Failure

An instance of the Concurrent Manager is running on each zone cluster node, within a Parallel Concurrent Processing configuration, prior to one zone cluster node being abruptly rebooted. Oracle E-Business Suite Parallel Concurrent Processing ensures that batch reports are still processed on the Concurrent Manager running on the redundant zone cluster node. Additionally, batch reports that were running on the failed Concurrent Manager are automatically restarted on the redundant Concurrent Manager on the redundant zone cluster node. The failed zone cluster node is automatically rebooted by the Solaris OS. Oracle Solaris Cluster then automatically re-establishes the zone cluster and restarts the Concurrent Manager instance.

Table 15 shows the results of failing one of the zone cluster nodes that runs the Concurrent Manager. The faulted zone is automatically rebooted back by the Solaris OS. Oracle Solaris Cluster then automatically restarts the Concurrent Manager instance in the zone.

Detection time is the duration between the time of the fault injection and the time the zone cluster node leaves the zone cluster membership.

Recovery time is the duration between the detection time and time the Concurrent Manager instance is available again.

TABLE 15. CM NODE FAILURE DETECTION AND RECOVERY RESULTS

PROCESS STAGE	TIME (IN SECONDS)
Failure detection	13
Full redundancy recovery time	35

Oracle Solaris 10 General Purpose Domain Failure

The Oracle Solaris 10 General Purpose domain that was abruptly failed was running an instance of OPMN/OC4J and Concurrent Manager within separate zone cluster nodes prior to this test. Upon failure, the Oracle 10 General Purpose domain panics and needs to be manually re-booted. Upon failure of the Oracle Solaris 10 General Purpose domain, Oracle Solaris Cluster detects the failure and immediately fails over the Logical Host associated with the failed OPMN/OC4J instance to the surviving zone cluster node. The fast failover of the Logical Host ensures that user sessions using that instance are disconnected right away and are able to reconnect to the other OPMN/OC4J instance before the impacted OPMN/OC4J instance is recovered. Batch reports remain unaffected as described in the previous test (Concurrent Manager node failure).

Table 16 shows the results of failing one of the General Purpose domains containing one node each of the two zone clusters. The impacted zone cluster nodes run the OPMN/OC4J and Concurrent Manager instances, but not the Web Server.

Detection time is the duration between the time of the fault injection and the time the Oracle Solaris 10 General Purpose domain leaves the global cluster membership.

Services recovery time is the duration between detection time to when the Logical Host for the impacted OPMN/OC4J instance has failed over, enabling impacted users to reconnect.

The Oracle Solaris 10 General Purpose domain is then manually rebooted.

The full redundancy recovery time is the duration from when the zone cluster nodes rejoined and the time the OPMN/OC4J and Concurrent Manager instances are available again.

TABLE 16. ORACLE SOLARIS 10 GENERAL PURPOSE DOMAIN FAILURE DETECTION AND RECOVERY RESULTS

<table>
<tr><th>PROCESS STAGE</th><th colspan="2">TIME (IN SECONDS)</th></tr>
<tr><td>Failure detection</td><td colspan="2">0</td></tr>
<tr><td>Services recovery for impacted users time</td><td colspan="2">10</td></tr>
<tr><td rowspan="2">Full redundancy recovery time</td><td>CM</td><td>OPMN/OC4J</td></tr>
<tr><td>27</td><td>50</td></tr>
</table>

Database Domain Failure

The Oracle Solaris 11 Database domain that was abruptly failed was running an instance of Oracle RAC prior to this test. Upon failure, the Oracle Solaris 11 Database domain panics and Oracle Clusterware detects the failure. Once the Oracle Solaris 11 Database domain is manually rebooted, Oracle Clusterware then automatically re-establishes the cluster and restarts the failed Oracle RAC instance.

Table 17 shows the results of failing one of the database domains containing one Oracle RAC instance.

Detection time is the duration between the time of the fault injection and the time the Oracle Solaris 11 Database domain node leaves the Clusterware cluster membership.

The database services recovery time is the duration between the time the node failure has been detected and the time the surviving Oracle RAC instance completed the dead instance recovery activities.

The database services full redundancy recovery time is the duration between the time the Oracle Solaris 11 Database Domain has been rebooted and joined the Clusterware cluster membership and the time the failed Oracle RAC instance is available again.

TABLE 17. ORACLE DATABASE DOMAIN FAILURE DETECTION AND RECOVERY RESULTS

PROCESS STAGE	TIME (IN SECONDS)
Failure detection	64
Database services recovery time	8
Full redundancy recovery time	155

T4-4 Node Failure

The T4-4 node that was abruptly powered off while running the Web Server and an instance of OPMN/OC4J and Concurrent Manager within separate zone cluster nodes in the Oracle Solaris 10 General Purpose domain; a RAC instance in the Oracle Solaris 11 database domain prior to this test. Upon failure, Oracle Solaris Cluster detects the failure and immediately fails over the Web Server and Logical Hosts associated with the failed instances to the surviving zone cluster node, as described in the earlier test (Web Server node failure). Oracle Clusterware also detects the database domain failure and initiates the database services recovery.

Once the T4-4 is rebooted and the Oracle Solaris 10 General Purpose domain rebooted, Oracle Solaris Cluster then automatically re-establishes the zone clusters and restarts the failed OPMN/OC4J instance and Concurrent Manager instance. Oracle Clusterware also automatically re-establishes the RAC cluster and restarts the failed RAC instance.

Tables 18 and 19 show the results of failing one of the SPARC T4-4 servers.

For the Oracle Solaris 10 General Purpose domain:

Detection time is the duration between the time of the fault injection and the time the GP domain leaves the global cluster membership.

Recovery time for the application services access is the duration between the detection time and the time the Web Server is available again.

After the T4-4 is powered on and Oracle Solaris 10 General Purpose Domain has been rebooted, the full redundancy recovery time for the OPMN/OC4J and Concurrent Manager instances is the duration between the time the zone cluster nodes joined their respective zone cluster membership and the time the OPMN/OC4J and Concurrent Manager instances are available again.

TABLE 18. T4-4 NODE FAILURE DETECTION AND RECOVERY RESULTS

PROCESS STAGE	TIME (IN SECONDS)	
Failure detection	9	
Application services recovery time	22	
Full redundancy recovery time	CM	OPMN/OC4J
	25	40

For the Oracle Solaris 11 Database domain:

Detection time is the duration between the time of the fault injection and the database domain leave the Clusterware membership.

Recovery time for the database services processing is the duration between the detection time and the time the dead instance recovery is completed by the surviving RAC instance.

After the T4-4 is powered on and Oracle Solaris 11 Database Domain has been rebooted, the full redundancy recovery time for the database is the duration between the time the database domain joins the Clusterware membership and the time the RAC instance is restarted.

TABLE 19. DETECTION AND RECOVERY RESULTS

PROCESS STAGE	TIME (IN SECONDS)
Failure detection	61
Database services recovery time	5
Full redundancy recovery time	152

Summary

The complexity of business applications continues to challenge many IT organizations, especially as modules are added. The complete infrastructure offered by Oracle's SPARC SuperCluster enables IT staff to simplify the data center by consolidating Oracle E-Business Suite systems on a pre-tested, ready-to-deploy architecture that can reduce time to deploy, risk, and cost. By taking advantage of Oracle's integrated solution, IT organizations can put more workloads on a high performance, highly-available system with a very compact data center footprint to achieve significantly better resource utilization, further reducing costs and increasing return on investment. Production, QA/DR, development, and test systems can all be isolated from one another, and clustering techniques can ensure that applications and databases remain available for users.

Innovative integration and intelligent engineering built into Oracle's SPARC SuperCluster enables enterprises to take advantage of incremental scalability to easily meet future growth requirements while accelerating Oracle E-Business Suite application performance, simplifying administration tasks, and reducing day-to-day management demands. Because SuperCluster are installed and configured per customer specification, IT managers can rely on the system right out of the box, reducing overall costs and allowing them to pay as they grow as needs increase. In addition, the elimination of expensive third-party specialty hardware and security management software reduces the number of software licenses required and lowers overall acquisition costs. These unique characteristics work together to help IT organizations improve overall productivity, lower total cost of ownership, and reduce deployment risk.

For More Information

For more information on Oracle's technology stack for Oracle E-Business Suite environments, see the references in Table 20.

TABLE 20. REFERENCES FOR MORE INFORMATION

WEB SITES	
Oracle Optimized Solutions	http://oracle.com/optimizedsolutions
Oracle SPARC SuperCluster	http://www.oracle.com/supercluster
Oracle SPARC T-series Servers	http://www.oracle.com/goto/tseries
Oracle Solaris	http://www.oracle.com/solaris
Oracle Solaris Cluster	http://www.oracle.com/us/products/serversstorage/solaris/cluster/features/index.html
Oracle's Sun ZFS Storage Appliance	http://www.oracle.com/us/products/servers-storage/storage/unified-storage/
Oracle E-Business Suite	http://www.oracle.com/applications/e-business-suite.html
ORACLE SPARC SUPERCLUSTER WHITE PAPERS	
A Technical Overview of the Oracle SPARC SuperCluster T4-4	http://www.oracle.com/us/products/servers-storage/servers/sparc-enterprise/supercluster-t4-4-arch-wp-1537679.pdf
ORACLE EXADATA DATABASE MACHINE WHITE PAPERS	
E-Business Suite on Exadata: Oracle Maximum Availability Architecture White Paper	http://www.oracle.com/technetwork/database/features/availability/maa-ebs-exadata-197298.pdf
ORACLE SOLARIS WHITE PAPERS	
Oracle Solaris and Oracle SPARC T4 Servers—Engineered Together for Enterprise Cloud Deployments	http://www.oracle.com/us/products/servers-storage/solaris/solaris-and-sparc-t4-497273.pdf

Oracle Solaris and Oracle Solaris Cluster: Extending Oracle Solaris for Business Continuity	http://www.oracle.com/technetwork/server-storage/solaris-cluster/documentation/solaris-cluster-businesscontinuity-168285.pdf
ORACLE DATABASE WHITE PAPERS	
Oracle Database 11g Release 2 High Availability	http://www.oracle.com/technetwork/database/features/availability/twp-databaseha-11gr2-1-132255.pdf
BACKUP, RECOVERY, HIGH AVAILABILITY, AND DISASTER RECOVERY	
Oracle Optimized Solution for Backup and Recovery	http://www.oracle.com/us/solutions/oracle-secure-backup-opt-solution-347243.html
Oracle Data Guard 11g Data Protection and Availability for Oracle Database	http://www.oracle.com/technetwork/database/features/availability/twp-dataguard-11gr2-1-131981.pdf

ORACLE

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Consolidating Oracle E-Business Suite on
Oracle's SPARC SuperCluster
September 2012

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