

Oracle Optimized Solution for Oracle E-Business Suite

A High-Performance, Flexible Architecture on SPARC T5-2 Servers and Oracle Exadata


ORACLE WHITE PAPER | OCTOBER 2015





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Introduction

Oracle E-Business Suite is a comprehensive suite of integrated, global business applications that enable organizations to make better decisions, reduce costs, and increase performance. Businesses of all sizes around the world use Oracle E-Business Suite for their enterprise resource planning (ERP) needs. And regardless of size, all businesses benefit from flexible, cost-effective implementations that deliver high performance and high availability (HA) for these business-critical applications.

Oracle Optimized Solution for Oracle E-Business Suite provides a complete and tested infrastructure for Oracle E-Business Suite, which is built around robust compute, networking, storage, virtualization, and management resources. Multiple layers of Oracle E-Business Suite can be consolidated onto high-performance, highly available Oracle systems to reduce total cost of ownership (TCO) and improve Oracle E-Business Suite deployment speed, application performance, and availability. Using Oracle systems, Oracle E-Business Suite administrators are left free to concentrate on the applications themselves while relying on a carefully predefined hardware and software infrastructure.

Oracle E-Business Suite is a very scalable set of applications that provides the flexibility to be implemented from a small to a very large deployment. And Oracle Optimized Solution for Oracle E-Business Suite on SPARC T5 and Oracle Exadata provides a choice of platforms to best fit the size requirements of a wide range of customer environments. The innovative solution described in this technical white paper is based on Oracle's SPARC T5 servers and Oracle Exadata Database Machine (hereafter referred to as Oracle Exadata). It provides a flexible, lower-cost architecture that takes advantage of the database optimization and performance of Oracle Exadata for small- to medium-size implementations of Oracle E-Business Suite. This solution complements Oracle Optimized Solution for Oracle E-Business Suite on Oracle SuperCluster, which is designed for medium to large mission-critical enterprise deployments.

This technical white paper describes the deployment of Oracle E-Business Suite on Oracle's SPARC T5 servers and Oracle Exadata. It includes an example mapping for consolidating production, Quality Assurance Service (QAS), backup, and disaster recovery (DR) systems within a flexible Oracle system framework along with development and test systems. Relevant embedded technologies are also described along with other Oracle Optimized Solutions that can contribute to Oracle E-Business Suite deployments.

Solution Overview

Oracle Optimized Solution for Oracle E-Business Suite on SPARC T5 and Oracle Exadata provides a low-cost, simple, and rapid way to modernize the deployment of Oracle E-Business Suite by consolidating the suite on a single system and taking advantage of the extreme performance of the database provided by Oracle Exadata. The following sections describe the solution's architecture and provide information about relevant Oracle technologies.

Oracle Technologies—Everything Needed for Oracle E-Business Suite Deployment

Oracle Optimized Solution for Oracle E-Business Suite on SPARC T5 and Oracle Exadata includes everything needed for a low-cost, highly available deployment of Oracle E-Business Suite that delivers performance only possible on Oracle systems. This solution combines innovative Oracle technology—the computing power of Oracle's SPARC servers, the performance and scalability of Oracle Solaris, and the optimized database performance of Oracle Database 11g accelerated by Oracle Exadata—into an affordable and scalable system (Figure 1).

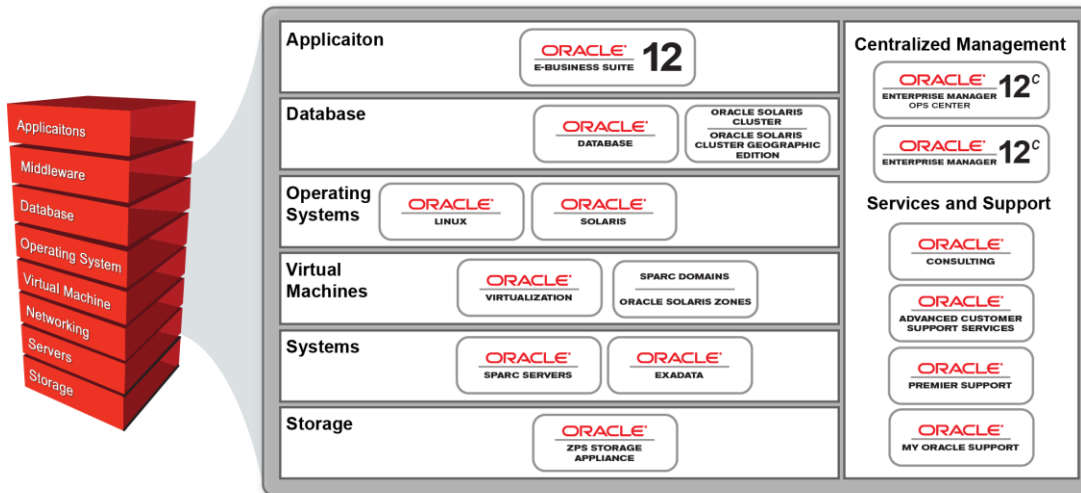


Figure 1. Oracle technologies provide a complete infrastructure for deploying Oracle E-Business Suite.

This solution features Oracle's powerful and scalable SPARC servers and utilizes two Oracle virtualization technologies: Oracle VM Server for SPARC and Oracle Solaris Zones. Built-in no-cost virtualization enables efficient and affordable consolidation and helps ensure that applications are isolated from one another and remain highly available, virtually eliminating resource contention and service disruption. Oracle Solaris Cluster provides an HA environment that enables critical applications to be available 24x7x365. Highly available shared storage for this solution is provided by Oracle ZFS Storage Appliances. And Oracle Exadata provides integrated database acceleration for Oracle Database.

The complete architecture—application and database servers, storage systems, networking, virtualization and clustering technology, and Oracle Database and application software—is consolidated and validated, eliminating much of the integration effort and deployment time typically associated with clustered solutions and providing other benefits, including:

- » Simplified deployment resulting from the consolidation of one or more Oracle E-Business Suite instances coupled with the use of Oracle Solaris Zones clusters
- » Lower physical infrastructure complexity and maintenance costs resulting from deploying fewer physical servers

- » Agile virtualization and configuration of services that streamline business processes
- » Distribution of system resources providing for higher server utilization and lower infrastructure costs

Platform Infrastructure

The primary hardware and software components contained in Oracle Optimized Solution for Oracle E-Business Suite on SPARC T5 and Oracle Exadata are listed in Table 1.

TABLE 1. CORE HARDWARE AND SOFTWARE COMPONENTS

Hardware	Software
<ul style="list-style-type: none"> » SPARC T5 servers » Oracle Exadata » Oracle ZFS Storage Appliance 	<ul style="list-style-type: none"> » Oracle E-Business Suite Release 12.1.3 » Oracle Database 11g Release 2 with Oracle Real Application Clusters (Oracle RAC) » Oracle Solaris 11, Oracle Linux » Oracle Solaris Cluster » Oracle Enterprise Manager

The following core components of this Oracle system provide many unique technical advantages to Oracle E-Business Suite applications:

- » **Oracle's SPARC servers.** SPARC servers are designed with performance and consolidation in mind. Chip multithreading technology built into each processor provides increased computational density for 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.** Oracle Exadata—an engineered system that includes database servers, storage servers, and a high-speed InfiniBand internal fabric that connects all servers and storage—delivers extreme database performance to Oracle E-Business Suite applications in a highly available, highly secure environment. Optimized for use with Oracle Database, Oracle Exadata employs a massively parallel architecture and Oracle Exadata Smart Flash Cache to accelerate Oracle Database processing and speed I/O operations. Intelligent software enables Oracle Exadata Storage Server 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 Server, 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 Server returns a query result set rather than entire tables, eliminating network bottlenecks, and freeing database server resources. As a result, users often see a 10-fold performance increase when scanning and analyzing data.
- » **Oracle ZFS Storage Appliance.** Providing up to 6.9 PB of disk capacity for shared file systems, Oracle ZFS Storage 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, and cluster failover and flash-based write caches ensure data high availability for Oracle E-Business Suite applications.
- » **Oracle Solaris.** Optimized for 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, 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. The compute nodes in this solution run Oracle Solaris.
- » **Oracle Linux.** Used in all x86-based Oracle engineered systems, Oracle Linux provides advanced scalability and reliability and delivers extreme performance. It is the only Linux distribution with production support for zero-downtime kernel updates with Ksplice, providing the ability to apply patches for security and perform other

updates without a system reboot. Oracle Linux also includes DTrace for real-time diagnostics and the powerful Btrfs file system. The Oracle Exadata Storage Servers in this solution run Oracle Linux.

Network Infrastructure and Remote Management

This solution is architected to provide a fully functional Oracle E-Business Suite deployment that can be placed into production rapidly while merging smoothly into the existing IT infrastructure. The architecture uses redundant network components and links to enable applications to run reliably with a minimum of downtime.

Figure 2 shows the highly available network infrastructure used in this solution. Separate redundant 10 GbE switches connect the application nodes (SPARC T-Series servers), Oracle Exadata, and Oracle ZFS Storage Appliance to the rest of the data center. These switches also support incoming client connections and connections to external Oracle E-Business application servers.

A dual-controller Oracle ZFS Storage Appliance configuration, with connections to both switches, is recommended. Use of redundant controllers, switches, and network connections increases the availability of the network infrastructure.

Oracle Exadata uses an internal high-performance, low-latency InfiniBand fabric to interconnect its database servers and storage. In addition, all Oracle Exadata components are connected to a dedicated GbE management network, ensuring the physical isolation of management traffic.

Oracle Enterprise Manager Cloud Control, with available agents on each of the components in this solution, provides the tools for remote management.

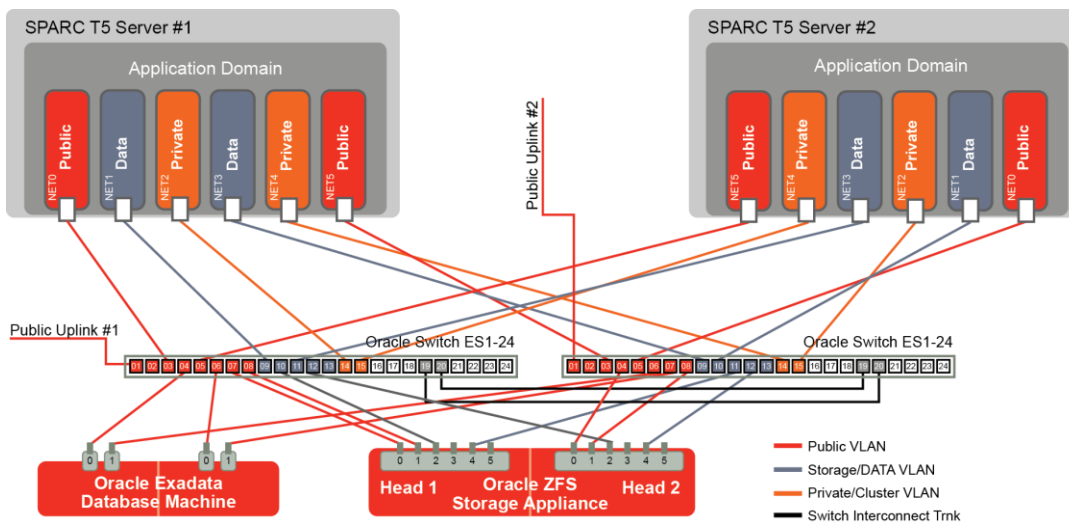


Figure 2. Redundant switches and NICs provide increased availability for the network infrastructure.

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

The solution's 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 releases 8, 9, 10, and 11 can run simultaneously without modification. Organizations that use Oracle E-Business Suite can securely consolidate applications using Oracle virtualization technologies, while at the same time protecting sensitive data, maintaining application availability, and shifting system resources to where they are needed most.

The built-in virtualization technologies include the following:

- » **Oracle VM Server for SPARC.** Oracle VM Server for SPARC is a built-in firmware-based hypervisor on SPARC T-Series servers 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, 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.** The lightweight Oracle Solaris Zones virtualization technology uses flexible, software-defined boundaries, to create 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 this solution, Oracle VM Server for SPARC defines virtual servers or domains for the application tier on the compute nodes. Figure 3 illustrates a two-node configuration, with an application domain created on each compute node.

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 non-Oracle applications might not be certified for Oracle Solaris 11. For support information on various Oracle E-Business Suite modules, please refer to <https://support.oracle.com/CSP/main/article?cmd=show&type=NOT&id=761568.1>.

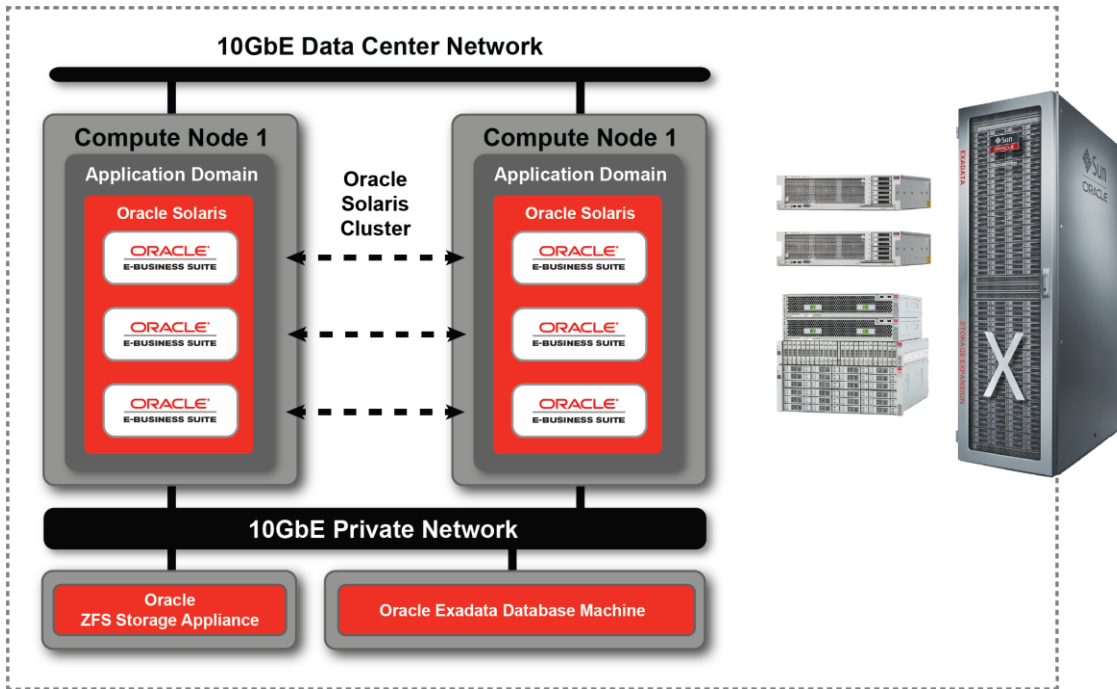


Figure 3. Built-in, no-cost virtualization technologies provide workload isolation and resource controls.

High Availability Features to Keep Oracle E-Business Suite Running

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

Recommendations include the following:

- » **Redundant configurations.** Oracle's SPARC T-Series servers are designed with redundant power supplies and fans, hot-pluggable disk drives, dual disk controllers, and a Fault Management Architecture including Predictive Self Healing (a feature of Oracle Solaris) for increased reliability, availability, and serviceability (RAS). The Oracle system can be configured with redundancy—such as multiple compute nodes, redundant network switches and network interface cards (NICs), and redundant storage controllers—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 multiple servers within the 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 non-Oracle 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, the Forms Server, the 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. These capabilities help 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 a 10 GbE private network, Oracle ZFS Storage Appliances provide a highly available shared file system. These appliances can be 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.

Backup, Restore, and Disaster Recovery Solutions

Additional Oracle Optimized Solutions are available to provide backup, restore, and disaster recovery solutions for both short-term data protection and long-term data preservation. Appropriate technology varies 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, Oracle ZFS Storage Appliance can be used to generate and store file system snapshots, storing them either locally or remotely to other Oracle ZFS Storage Appliances (Figure 4). Alternatively, snapshots can be stored to Exadata Storage Expansion Racks from Oracle that are directly connected to the InfiniBand fabric, creating a solution that takes advantage of the Fast Recovery Area in Oracle Exadata Storage Server to instantly get back up and running.

For structured data in Oracle Database, backups can be done with Oracle Recovery Manager (Oracle RMAN)—either to disk or to tape—through Oracle Secure Backup. Cloud-based database backups are also available with Oracle Database Backup Service, and they provide scalable storage with utility-like costs and no up-front capital

investment. Oracle offers Oracle Optimized Solution for Secure Backup and Recovery, which is designed to perform network backups of heterogeneous clients. For backup, recovery, and long-term archival, tape remains the most cost-effective and reliable storage media available. For Oracle E-Business Suite deployments in which longer retention periods and greater capacity are required, Oracle Secure Backup and tape storage can be used for backup, vaulting, and archiving.

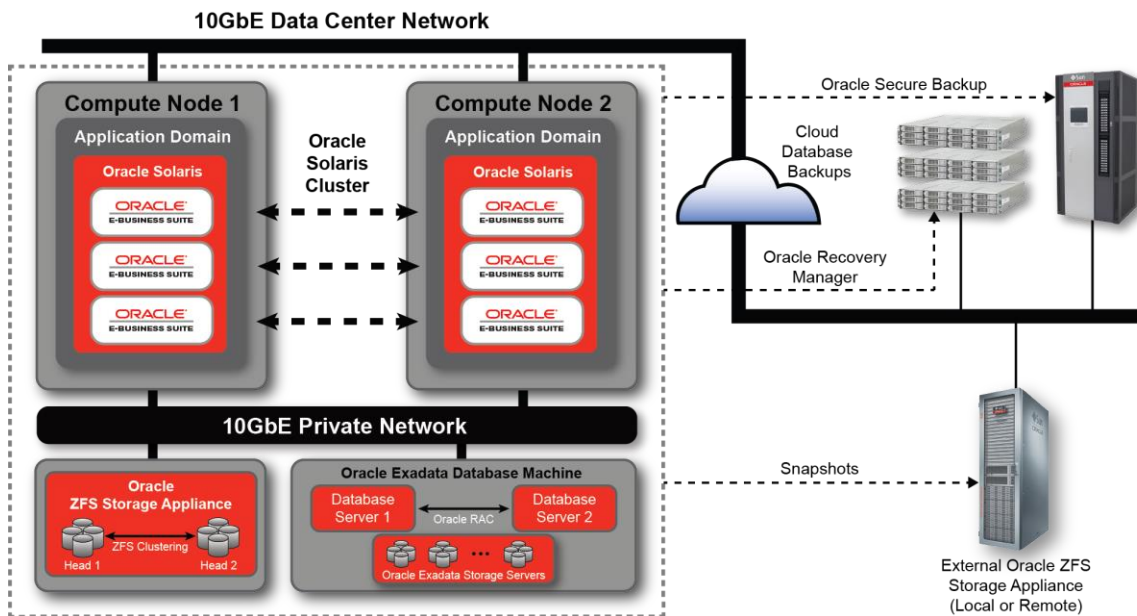


Figure 4. Oracle Optimized Solution for Oracle E-Business Suite on SPARC T5 and Oracle Exadata integrates with Oracle backup tools.

For disaster recovery scenarios, Oracle Optimized Solution for Secure Disaster Recovery includes best practices that take advantage of Oracle Active Data Guard, Oracle RAC, Oracle Automatic Storage Management, and Oracle Flashback. Oracle Active Data Guard can be deployed in conjunction with the snapshot and cloning features of Oracle ZFS Storage Appliance, enabling easy and efficient database cloning to create a remote standby database. For more information about backup, restore, and disaster recovery solutions, see the “Oracle Optimized Solution for Secure Backup and Recovery” and “Oracle Optimized Solution for Secure Disaster Recovery” sections later in this paper.

Built-in Security Technology and Comprehensive Tools for Secure Deployment

There is no single product or solution that can prevent all types of security attacks. Oracle Optimized Solution for Oracle E-Business Suite on SPARC T5 and Oracle Exadata provides a comprehensive and flexible set of security capabilities, and each security mechanism reinforces the others to deliver end-to-end security. Security is designed from the inside out to satisfy the security risk requirements for different business needs when deploying Oracle E-Business Suite.

Salient security capabilities provided with this solution are discussed in the following sections.

Cryptographic Acceleration for Oracle E-Business Suite

Security has taken unprecedented importance in all facets of the IT industry. Therefore, organizations are proactively adopting cryptographic mechanisms to protect their businesses and information from unauthorized access and to ensure its confidentiality and integrity during transit and in storage. Adopting Secure Sockets Layer

(SSL) and Transport Layer Security (TLS) encryption for data in transit and using encrypted data at rest has become critical for delivering end-to-end security for multitier business applications and to meet regulatory compliance mandates. Cryptographic operations, however, are heavily compute intensive, burdening the host system with additional CPU cycles and impacting network bandwidth, potentially resulting in significant degradation of the overall throughput of the system and its hosted business applications.

Cryptographic acceleration in this solution is provided by the following:

- » **SPARC T5 processor.** The SPARC T5 processor is the fifth-generation processor of Oracle's SPARC T-Series family, and it leverages a fundamental redesign of the core within the SPARC multicore/multithreaded processor architecture to provide approximately three times the single-threaded throughput compared to its predecessor. The SPARC T5 processor also includes on-chip/on-core based cryptographic acceleration. Thus, the SPARC T5 processor eliminates the need for expensive custom hardware and software development by integrating high-performance computing, security, and I/O onto a single chip. As a result, the on-board stream-processing unit (SPU) is designed to achieve wire-speed encryption and decryption on the processor's 10 GbE ports. The logical depiction of the SPU in the SPARC T5 processor is shown in Figure 5.

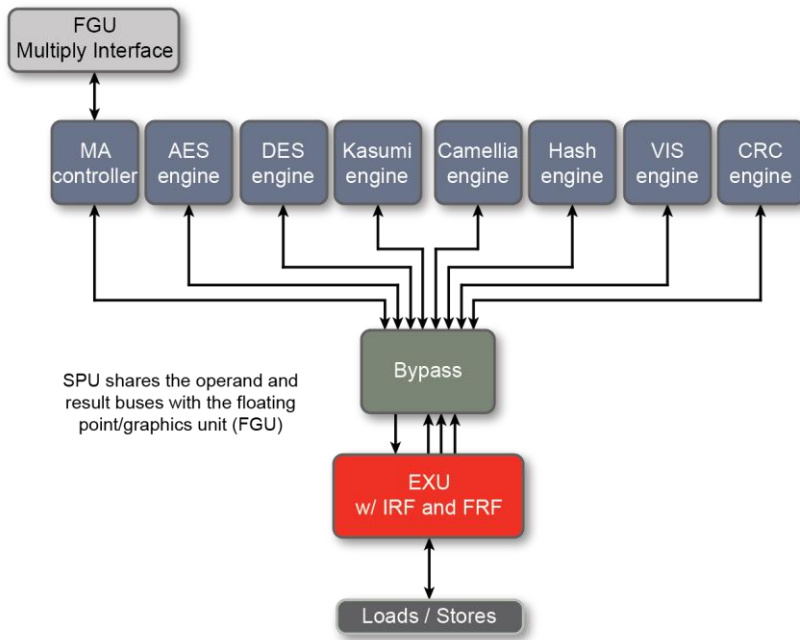



Figure 5. Oracle's SPARC T5 processor—logical depiction of SPU.

- » **Oracle Solaris Cryptographic Framework.** The use of SPARC T5 hardware-assisted cryptographic acceleration for end-to-end Oracle E-Business Suite security yields tangible, immediate, and cost-efficient results in the form of faster secure transactions and better response times. These improvements are all accomplished without any additional security equipment costs, changes in power usage profiles, or elaborate system configurations. In practice, the Cryptographic Framework feature of Oracle Solaris acts as the core intermediary between the applications and the underlying hardware. The framework enables Oracle E-Business Suite and other applications to automatically leverage the hardware-assisted cryptographic acceleration functions. The Cryptographic Framework libraries provide a set of cryptographic services and application programming interfaces (APIs) whereby both kernel and Oracle E-Business Suite application modules can transparently delegate the cryptographic operations to hardware without adding any new code.

Oracle E-Business Suite 12 infrastructure components also gain significant security operation performance by offloading and delegating cryptographic operations. The on-core cryptographic acceleration capability of the SPARC T5 processor accelerates security for Oracle HTTP Server, Oracle Application Server, Oracle Database,



Oracle ZFS Storage Appliance, and the network. SPARC T5 processor-based servers have demonstrated high-performance enterprise security with consistent scalability for Oracle E-Business Suite 12 applications and Oracle Database, while also delivering reductions in space, power consumption, and cost.

More information on securing Oracle E-Business Suite applications can be found in the white paper [“The Fully Encrypted Data Center: Encrypting Your Data Center on Oracle’s SPARC Servers.”](#)

Secure Isolation

The various functional components in this solution share the compute, memory, and network resources of the underlying platform, and multiple systems interconnect through a common network. This architecture requires a mechanism that provides isolation to protect each function from any potential security compromise in any part of the system that could propagate to the rest of the system. The following isolation mechanisms form an integral part of the security provided by Oracle Optimized Solution for Oracle E-Business Suite on SPARC T5 and Oracle Exadata:

- » **System virtual machine (hypervisor virtual machine) isolation.** Oracle VM Server for SPARC provides confined virtual environments (*logical domains*) to deploy Oracle E-Business Suite applications and Oracle Database. Processing inside a logical domain cannot affect the operation or processes outside the virtual machine.
- » **Hosted virtual machine isolation.** Oracle Solaris Zones provide a confined environment for the execution of the different components of Oracle E-Business Suite, such as Web Services, Form Services, and Concurrent Processing. Applications operating inside the virtual environment created by Oracle Solaris Zones cannot affect the operation of processes outside the virtual machine.
- » **Network isolation.** Network isolation protects in-transit data. Network traffic is easily isolated by configuring virtual networks (VLANs) within Oracle Solaris to provide greater security and data protection.

Secure Access Control

Secure access control, an important aspect of any system, ensures that authenticated users access only what they are authorized to access. There are two main ways to implement access control security in Oracle E-Business Suite: “traditional” Oracle E-Business Suite responsibility-based security (usually referred to as *function security*) and Role-Based Access Control (RBAC). These two methods overlap in functionality, and RBAC incorporates and builds upon responsibility-based security. My Oracle Support Document 1537100.1, [“Function Security and Role Based Access Control \(RBAC\) in Oracle E-Business Suite,”](#) discusses the main similarities and differences between the two types of security setups.

To limit access, administrators can also make a subset of Oracle E-Business Suite Release 12 functionality accessible via the internet to external users. For more information, please refer to My Oracle Support Document 380490.1, [“Oracle E-Business Suite Release 12 Configuration in a DMZ.”](#)

Data Protection

Oracle Database provides multiple ways to secure data.

- » To protect the data physically stored within the database, **Transparent Data Encryption (TDE)** provides automatic encryption and decryption of an entire tablespace or specific columns of a table, without the user or application having to manage the encryption key. This functionality is performed by specifying the `ENCRYPT` keyword along with the column name when a table is created.
- » **Oracle Data Masking** protects confidential data in non-production environments: data can be shared with non-production users without revealing sensitive information. For example, names, social security numbers, and salary information can be masked before being made available to non-production environments such as development and test (see Figure 6).
- » **Oracle Database Vault** protects against insider threats, helps meet regulatory compliance requirements, and enforces separation of duties. My Oracle Support Document [1091083.1](#) provides information on integrating Oracle E-Business Suite Release 12 with Oracle Database Vault.

LAST_NAME	SSN	SALARY
AGUILAR	203-33-3234	40,000
BENSON	323-22-2943	60,000

LAST_NAME	SSN	SALARY
ANSKEKSL	323-23-1111	60,000
BKJHHEIEDK	252-34-1345	40,000

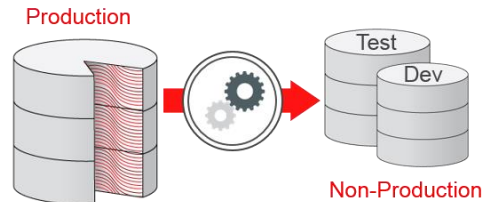


Figure 6. Using Oracle Data Masking to protect sensitive information in non-production environments.

Compliance

The number and complexity of regulations designed to protect data privacy, to secure data at or below specified acceptable levels, and to enforce transparency and accountability make compliance a prevalent business concern.

- » The Oracle Solaris audit facility, which is enabled by default in Oracle Solaris 11, records actions taken by users and services on the operating system. The audit facility uses policies that can track system, administrator, and end-user activity.
- » To ensure proper governance, risk management, and compliance (GRC), the following security mechanisms can be used with Oracle Optimized Solution for Oracle E-Business Suite on SPARC T5 and Oracle Exadata:
 - » The **flexfield value set** security feature (new in Oracle E-Business Suite 12.2) can be used to help ensure that different administrators have non-overlapping responsibilities. The primary intent of this feature is to prevent fraud or theft by an individual acting alone. This separation of duties (SoD) is a requirement for many regulations such as Sarbanes-Oxley (SOX) Act, Health Insurance Portability and Accountability Act (HIPAA), and European Union Data Protection Directive.
 - » The Oracle E-Business Suite security system can be integrated with **Oracle Audit Vault and Database Firewall** to consolidate database audit trails into a secure centralized repository, detect and alert on suspicious activities (including privileged users), and provide out-of-the-box compliance reports for SOX, Payment Card Industry (PCI), and other regulations.
- » For many organizations, the greatest GRC challenge is creating a consolidated view of compliance, risk, and internal controls. Oracle Enterprise Governance, Risk, and Compliance Manager helps provide a reduction in overlapping policies, risks, and controls. The white paper "[Harnessing Oracle Governance Risk and Compliance Applications to Improve Your E-Business Suite 12 Upgrade](#)" provides specific recommendations for when and how to leverage Oracle Enterprise Governance, Risk, and Compliance Manager to fully realize the benefits of Oracle E-Business Suite Release 12.

Security Best Practices for Oracle E-Business Suite Deployments

In today's environments, a properly secured system is critical. A combination of system-wide security measures and best practices—including the rule of least privilege, strong authentication, access control, encryption, auditing, disabling of unnecessary services, antimalware protections, and configuring system services for enhanced security—should also be implemented for secure operations.

Oracle highly recommends leveraging existing recommendations and guidelines from product security guides, Center for Internet Security (CIS) benchmarks, ISACA publications, and Department of Defense (DoD) Security Technical Implementation Guides (STIGs).

The following sections provide security resources, including relevant My Oracle Support Documents and STIGs, as well as component-level security recommendations for Oracle E-Business Suite.

Security Technical Implementation Guides

STIGs are continually updated and currently available for many Oracle products. A list of STIGs relevant to this solution is shown in Table 2.

TABLE 2. EXAMPLES OF RELEVANT STIGS

STIG	Location
Oracle Solaris	iase.disa.mil/stigs/os/unix-linux/Pages/solaris.aspx
Oracle Database 11g Release 2	iasecontent.disa.mil/stigs/zip/Apr2015/U_Oracle_Database_11-2g_V1R3_STIG.zip
Oracle Integrated Lights Out Manager	iase.disa.mil/stigs/app-security/database/Pages/exadata_lights.aspx
Oracle Exadata Storage Server	iase.disa.mil/stigs/app-security/database/Pages/exadata_storage.aspx
Oracle's Sun Datacenter InfiniBand Switch 36	iase.disa.mil/stigs/app-security/database/Pages/exadata_infiniband.aspx
Oracle ZFS Storage Appliance	iase.disa.mil/stigs/app-security/database/Pages/exadata_zfs.aspx
Oracle WebLogic Server 12c	iase.disa.mil/stigs/Documents/u_oracle_weblogic_server_12c_v1r1_stig.zip
DoD Secure Telecommunications	iase.disa.mil/stigs/net_perimeter/telecommunications/Pages/index.aspx
Oracle Linux 6 Manual STIG	iasecontent.disa.mil/stigs/zip/Apr2015/U_Oracle_Linux_6_V1R2_STIG.zip
Storage Area Network (SAN)	iase.disa.mil/stigs/Documents/u_storage_area_network_v2r2_stig.zip

For more STIGs, please see the website iase.disa.mil/stigs/Pages/index.aspx.

My Oracle Support Documents

My Oracle Support Document 403537.1, "[Secured Configuration Guide for Oracle E-Business Suite Release 12](#)," provides practical advice for securing configurations of Oracle E-Business Suite Release 12.0, 12.1, and 12.2. The document also includes a set of scripts to verify the proper setting of many of the configuration parameters. Recommendations for securing different areas of an Oracle E-Business Suite deployment include:

- » Securing client connections on the network
- » Managing user privileges
- » Configuring the database for auditing
- » Securing the application server
- » Enabling and using Oracle E-Business Suite audit features
- » Securing the desktop used to run web browsers that connect to Oracle E-Business Suite
- » Hardening the overall system

Table 3 lists relevant My Oracle Support Documents that contain security information for Oracle E-Business Suite.

TABLE 3. RELEVANT MY ORACLE SUPPORT DOCUMENTS

Document ID	Title
403537.1	<i>Secured Configuration Guide for Oracle E-Business Suite Release 12</i>
1351701.1	"Contrasting Fusion Applications Security with Oracle E-Business Suite Security"
1537100.1	"Function Security and Role-Based Access Control (RBAC) in Oracle E-Business Suite"

Component-Level Security Recommendations

Oracle recommends the following component-level security guidelines:

- » **Change system default passwords.** Using known vendor-provided default passwords is a common way cyber criminals gain unauthorized access to infrastructure components. Changing all default passwords to stronger, custom passwords is a mandatory step during infrastructure deployment.
- » **Keep component patching current.** Ensure that all components are using the most recent firmware and software versions to the extent possible. This tactic ensures that each component is protected by the latest security patches and vulnerability fixes.
- » **Leverage isolated, purpose-based network interfaces.** Network interfaces, virtual or physical, should be used to separate architectural tiers, such as client access and management. In addition, consider using network interfaces to separate tiers within a multitier architecture. This enables per-tier security policy monitoring and enforcement mechanisms including network, application, and database firewalls as well as intrusion detection and prevention systems.
- » **Enable encrypted network communications.** Ensure all endpoints use encrypted network-based communications, including secure protocols, algorithms, and key lengths. For Oracle WebLogic, use the UCrypto provider to ensure that cryptography leverages the hardware assist capabilities of the SPARC platform.
- » **Enable encrypted data-at-rest protections.**
 - » Use encrypted swap, `/tmp`, and ZFS data sets for any locations that could potentially house sensitive or regulated data. This automatically takes advantage of cryptographic acceleration in Oracle Solaris.
 - » Use tape drive encryption to protect data that must leave the data center for off-site storage.
 - » For databases, use Transparent Data Encryption (TDE) to protect tablespaces that might store sensitive or regulated data. TDE automatically takes advantage of cryptographic acceleration in Oracle Solaris on SPARC systems.
- » **Secure the database.** Refer to Oracle Optimized Solution for Secure Oracle Database security best practices and recommendations.
- » **Deploy application services in Oracle Solaris non-global zones.** Deploying applications within Oracle Solaris non-global zones has several security advantages, such as kernel root kit prevention, prevention of direct memory and device access, and improved control over security configuration (via `zonecfg (1M)`). This approach also enables higher assurance auditing, because audit data is not stored in the Oracle Solaris non-global zone, but rather in the Oracle Solaris global zone.
- » **Implement a baseline auditing policy.** Use audit logs and reports to track user activity—including individual transactions and changes to the system—and to flag events that fall out of normal parameters. These should be implemented at both the Oracle Solaris and database levels. The baseline security audit policy should include login/logout activity, administrative actions, and security actions, as well as specific command executions for Oracle Solaris. This tactic enables auditing of a core set of security critical actions without overburdening the system or database.
- » **Follow the rule of least privilege.** Increase access control by granting only those privileges that a given individual needs. This should be implemented at both the ERP system level and the infrastructure level.
- » **Use strong authentication.** Many intellectual property attacks use stolen credentials. Implementing strong authentication methods, such as Kerberos, RADIUS, and SSL, can help prevent unauthorized access.
- » **Leverage role-based access control.** As the number of applications and users increases, user-based identity management can quickly become time consuming and labor intensive for IT staff. Consequentially, many users are granted inappropriate authorities. Though it requires increased efforts during the design and implementation phases, role-based access control (RBAC) is a popular option for low-maintenance, scalable access control, and it can help alleviate the burden of identity management.

A full list of relevant component security recommendations is shown in Table 4.

TABLE 4. EXAMPLES OF COMPONENT SECURITY RECOMMENDATIONS

Resource	Location
<i>Oracle Solaris 11 Security Guidelines</i>	docs.oracle.com/cd/E36784_01/html/E36837/index.html
<i>Oracle Solaris 11.2 Security Compliance Guide</i>	docs.oracle.com/cd/E36784_01/pdf/E39067.pdf
"Secure Deployment of Oracle VM Server for SPARC"	oracle.com/technetwork/articles/systems-hardware-architecture/secure-ovm-sparc-deployment-294062.pdf
<i>Oracle Solaris Cluster Security Guide</i>	docs.oracle.com/cd/E39579_01/html/E39649/index.html
"User Authentication on the Solaris OS: Part 1"	oracle.com/technetwork/server-storage/solaris/user-auth-solaris1-138094.html
<i>Oracle ILOM Security Guide</i>	docs.oracle.com/cd/E37444_01/html/E37451/index.html
<i>Database Advanced Security Administrator's Guide</i>	docs.oracle.com/cd/E11882_01/network.112/e40393/toc.htm
"Oracle Database 12c Security and Compliance"	oracle.com/technetwork/database/security/security-compliance-wp-12c-1896112.pdf
"Best Practices for Deploying Encryption and Managing Its Keys on the Oracle ZFS Storage Appliance"	oracle.com/technetwork/server-storage/sun-unified-storage/documentation/encryption-keymgr-1126-2373254.pdf
<i>Securing the Network in Oracle Solaris 11.2</i>	docs.oracle.com/cd/E36784_01/html/E36838/index.html
<i>Securing Users and Processes in Oracle Solaris 11.2</i>	docs.oracle.com/cd/E36784_01/html/E37123/index.html
<i>Securing Systems and Attached Devices in Oracle Solaris 11.2</i>	docs.oracle.com/cd/E36784_01/html/E37121/index.html
<i>Securing Files and Verifying File Integrity in Oracle Solaris 11.2</i>	docs.oracle.com/cd/E36784_01/html/E37122/index.html
<i>Managing Encryption and Certificates in Oracle Solaris 11.2</i>	docs.oracle.com/cd/E36784_01/html/E37124/index.html
<i>Developer's Guide to Oracle Solaris 11 Security</i>	docs.oracle.com/cd/E36784_01/html/E36855/index.html
"Configuring Oracle GoldenGate Security"	docs.oracle.com/goldengate/1212/gg-winux/GWUAD/wu_security.htm#GWUAD354
"Managing Security for Backup Networks"	docs.oracle.com/cd/E26569_01/doc.104/e21477/network_security.htm#OBINS277

Mapping an Oracle E-Business Suite Deployment to SPARC T5 Servers and Oracle Exadata

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), quality assurance service (QAS), production (PRD), and test 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 server 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 overconsumed and underutilized. As a result, enterprises running multiple Oracle E-Business Suite applications can quickly find themselves with a large and fragmented environment (Figure 7).

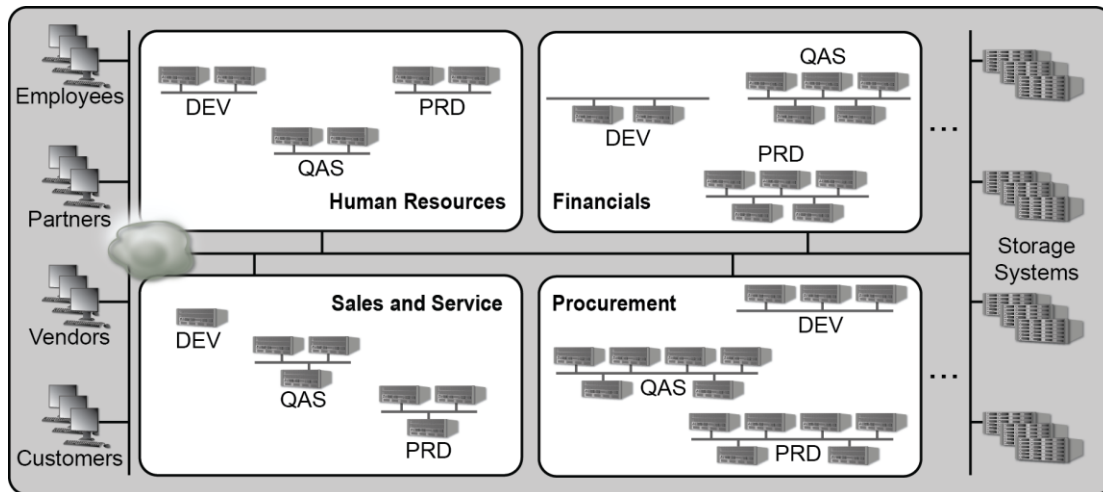


Figure 7. Different development, test, and production systems for each Oracle E-Business Suite application can rapidly lead to complexity and server sprawl.

Consolidating to Oracle Systems

To greatly simplify Oracle E-Business Suite deployments, production environments for each module can be consolidated onto a single deployment running SPARC T-Series servers and Oracle Exadata, as described in this solution. This solution supplies sophisticated networking and virtualization to provide all the performance, security, and reliability of deploying Oracle E-Business Suite on multiple separate physical systems. In addition, further application consolidation is possible by deploying other applications to additional domains that can be created on the SPARC T-Series servers. Additional databases, used by applications other than Oracle E-Business Suite, can also be deployed on the Oracle Exadata system in this solution, enabling further database consolidation for an enterprise.

Because Oracle E-Business Suite QAS systems typically approximate the size and scale of production systems, they can be deployed on a separate, local Oracle system facilitated through Oracle Active Data Guard. Test and development systems can be deployed at a different geographical site in order to maintain physical isolation. Facilitated by Oracle Optimized Solution for Secure Enterprise Cloud Infrastructure, Oracle Optimized Solution for Oracle E-Business Suite provides a complete optimized architecture for a remote enterprise cloud infrastructure deployment. The remote Oracle system provides smaller development, test, and sandbox environments and also serves as a disaster recovery system. This architecture orchestrates the environments for Oracle E-Business Suite deployment with Oracle systems and displaces multiple costly sprawled systems, thereby reducing complexity and resulting in lower TCO (Figure 8).

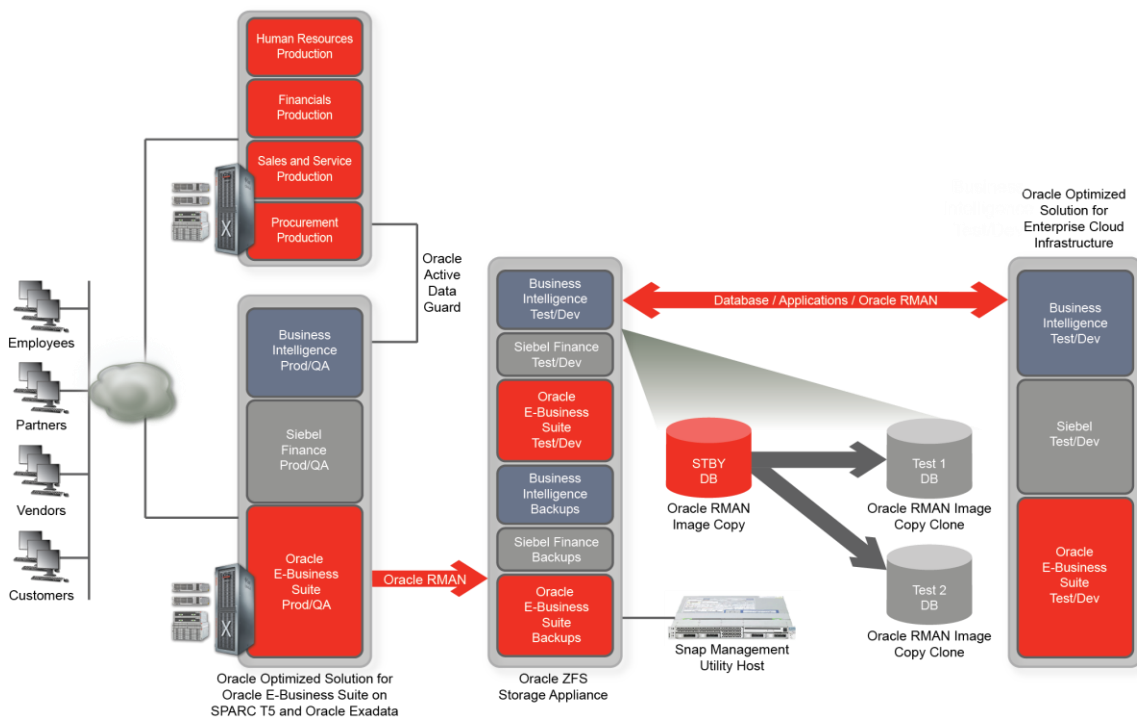


Figure 8. Simplify and reduce TCO by consolidating Oracle E-Business Suite and other Oracle application environments on Oracle systems, using Oracle ZFS Storage Appliance and Oracle Optimized Solution for Secure Enterprise Cloud Infrastructure to provide backup and disaster recovery services.

For more information on Oracle Optimized Solution for Secure Enterprise Cloud Infrastructure, see the following website: oracle.com/solutions/optimized-solutions/enterprise-cloud-infrastructure.

A Basic Production System

The production system contains live data and it is where business processes are executed. To ensure the highest performance and availability for the Oracle E-Business Suite deployment, Oracle recommends configurations with two or more compute nodes, each running one or more application domains (logical domains). Applications run in Oracle Solaris Zones within an application domain and can be configured for failover by utilizing Oracle Solaris Cluster with Oracle E-Business Suite applications. Database servers within Oracle Exadata run the Oracle Database instances, which are stored on Oracle Exadata Storage Servers.

Figure 9 illustrates a two-node production system with consolidated Oracle E-Business Suite applications. Oracle Process Manager and Notification Server provides the web services that run across the two Oracle Solaris domains in an Oracle Solaris Zone cluster using agents provided with Oracle Solaris Cluster for use with Oracle E-Business Suite. Likewise, another Oracle Solaris Zone cluster is provided for Oracle Concurrent Manager configured in Parallel Concurrent Processing mode. In addition, an external Oracle Database proxy resource is configured in the same zone cluster running Oracle Concurrent Manager to monitor and represent the availability of the specific database services provided by the Oracle RAC 11g Release 2 database. The Oracle E-Business Suite system has a dependency on such database services. This resource enables the coordination of availability between the two types of domains in the Oracle system.

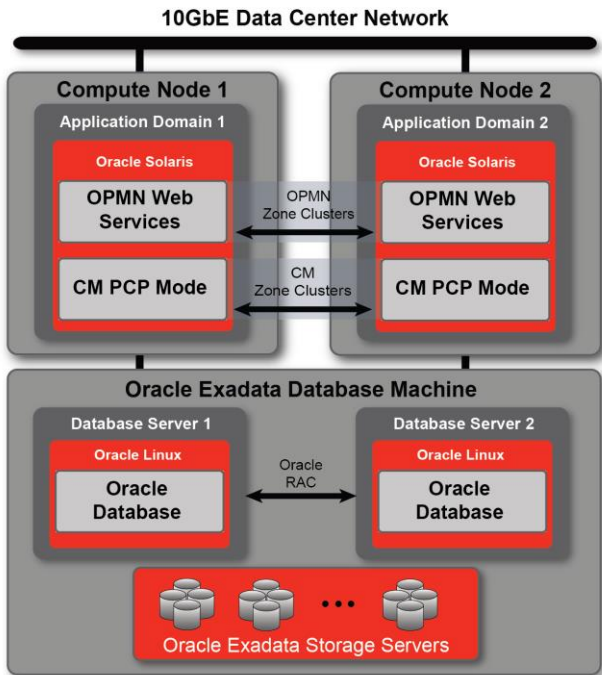


Figure 9. Smaller deployments can consolidate Oracle E-Business Suite and other production applications onto a two-node system. Separate zone clusters are used for Oracle Process Manager and Notification Server (OPMN) and Oracle Concurrent Manager configured in Parallel Concurrent Processing mode (CM PCP mode).

Figure 10 illustrates Oracle E-Business Suite running multiple instances of an application domain. Oracle Solaris Zone clusters provide failover capabilities for the application instances running on separate compute nodes. Additional domain instances can be configured to host additional Oracle E-Business Suite applications or other applications, as shown, or to provide operational or administrative separation.

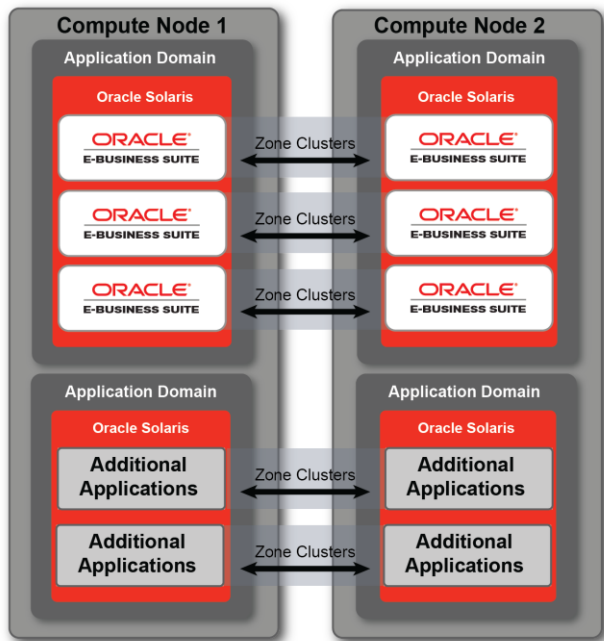



Figure 10. Multiple Oracle E-Business Suite applications or additional application instances can be hosted flexibly.

Test Systems, Disaster Recovery Systems, and Other Systems

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

- » **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.
- » **Backup and recovery system.** The Oracle systems and Oracle E-Business Suite applications are designed for resiliency and high availability; however, protection of data from natural and manmade disasters is essential to business operations. Oracle Solaris operating system and unstructured data (that is, non-database data) reside in shared file systems on Oracle ZFS Storage Appliance. This data must be backed up in order to provide for a quick recovery process in the event of a disaster. Oracle Database is a vital element and must be backed up as well, to ensure against loss of business- or mission-critical data. For more information on backup and recovery, see the section “Oracle Optimized Solution for Secure Backup and Recovery.”
- » **Disaster recovery (DR) system.** Because Oracle E-Business Suite QAS systems typically approximate the size and scale of the production systems, remotely located QAS (or development, test, training, and sandbox) systems can serve double duty as a disaster recovery system on separate Oracle systems, as previously shown in Figure 8. With production and QAS/DR systems deployed on different sites, Oracle Active Data Guard can provide transactional consistency and active-active failover for services. For more information on DR see the section “Oracle Optimized Solution for Secure Disaster Recovery.”
- » **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.

Solution Scalability

Customers deploying enterprise solutions are frequently looking for the ability to expand in the future without disrupting current operations. Oracle Optimized Solution for Oracle E-Business Suite configurations scale and expand easily on SPARC T5 servers and Oracle Exadata. For the smallest deployments where high availability is not required, this solution can be deployed on a single SPARC T5 server and an eighth-rack configuration of Oracle's Exadata Database Machine X4-2. However, Oracle recommends a minimum of two compute nodes and a quarter-rack configuration of Exadata Database Machine X4-2 for most implementations, because redundant components provide higher availability. Additional compute, networking, and storage resources can be added when growth is required, providing very granular scalability. For database storage expansion, Oracle's Exadata Storage Expansion Rack is available in quarter-rack, half-rack, and full-rack configurations.

Oracle E-Business Suite applications can be scaled up to additional processor threads as more performance is required using Oracle's built-in virtualization technologies to manage and utilize available resources. Oracle E-Business Suite and unstructured data storage can also be easily backed up or expanded using Oracle ZFS Storage Appliances, while additional Exadata Storage Expansion Racks can be added for database storage scalability. For more information on Exadata Storage Expansion Racks, refer to the following website: oracle.com/engineered-systems/exadata/.

Consolidation of Quality Assurance, Disaster Recovery, and Other Systems

Oracle E-Business Suite QAS/DR systems can be consolidated onto a single Oracle system to simplify deployments and shorten the time needed to get a new QAS system up and running. As with the application domain on production systems, Oracle Solaris Zones provide a complete runtime environment for an Oracle E-Business Suite applications environment, including all required programming tools. The Oracle Database instance used for Oracle E-Business Suite would be just another instance that is run by the Oracle Exadata database servers and stored on the shared Oracle Exadata Storage Servers. Each zone provides full resource containment and control, plus 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 Oracle System

As described, full-scale installations with the need for isolated QAS and DR systems would typically deploy multiple Oracle systems in physically separate geographic locations. For smaller deployments with more modest processing needs and no DR requirement, a single Oracle system could be configured to house both production as well as QAS/DEV/test systems. Figure 11 illustrates a two-node configuration that houses a two-node production system conveniently consolidated into a single system.

As with the two-node configuration described previously, each server is configured with an application domain 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 on the Oracle Exadata database servers to support highly available data access.

In such a configuration, all production, quality assurance, development, and other systems run in isolated zones. 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 QAS system replicates all or part of the production environment, enabling applications to be tested in the same environment in which they are deployed.

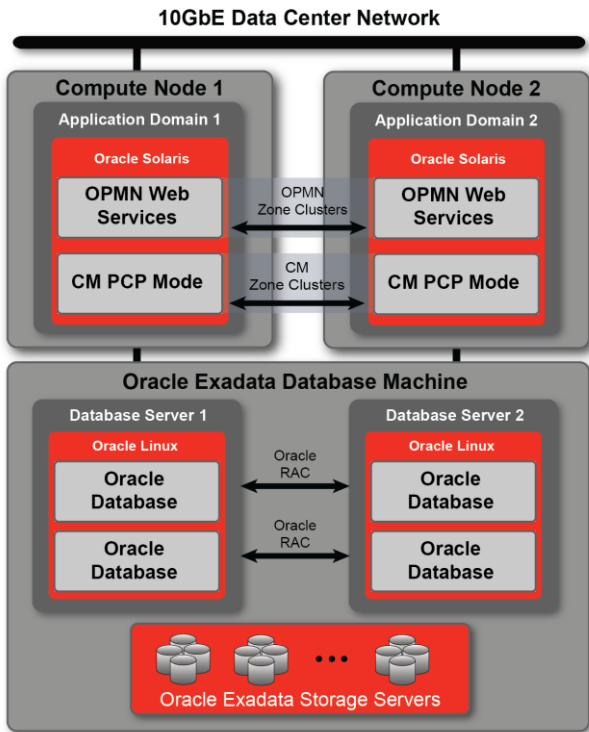


Figure 11. Oracle E-Business Suite deployments with moderate performance or scalability requirements can be consolidated onto a single Oracle system. Separate zone clusters are used for Oracle Process Manager and Notification Server (OPMN) and Oracle Concurrent Manager configured in Parallel Concurrent Processing mode (CM PCP).

Cloud-Based Deployments

This solution can be integrated with both public and private cloud services. Oracle E-Business Suite software can run on hardware located in an on-premises data center and interoperate with cloud-based solutions such as Oracle Human Capital Management Cloud (Oracle HCM Cloud). See Figure 12.

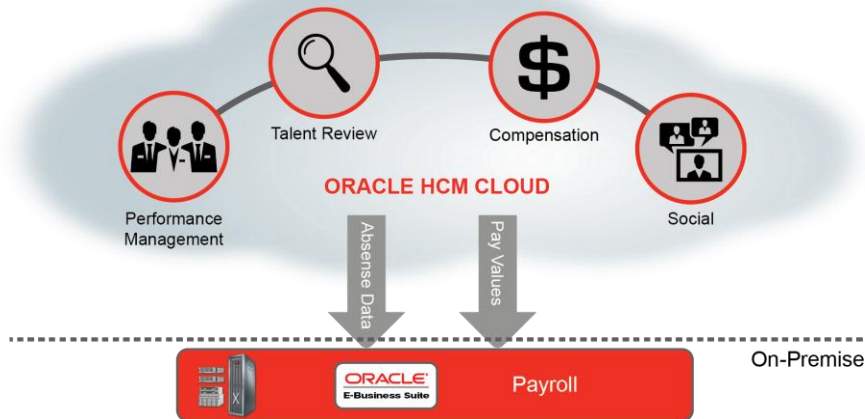


Figure 12. Oracle E-Business Suite software can interoperate with cloud-based solutions such as Oracle HCM Cloud.

With cloud computing, organizations can access a virtually unlimited pool of computing and storage resources over the internet and benefit from the ability to provision resources dynamically and pay only for what they use. Oracle Cloud is the industry’s broadest and most integrated public cloud, offering best-in-class services. Oracle also provides a complete portfolio of platform and infrastructure offerings for organizations needing a dedicated, internal private cloud. For more information on Oracle Cloud solutions, see oracle.com/cloud.

Additional Oracle Optimized Solutions for Oracle E-Business Suite Deployments

Oracle Optimized Solutions are designed, tested, and fully documented architectures that are tuned for optimal performance and availability. These solutions are based on uniquely matched components including the Oracle E-Business Suite enterprise applications, Oracle servers, storage, operating systems, virtualization, database, and middleware. Oracle Optimized Solutions are proven to save money, reduce integration risks, and improve user productivity. Built with flexibility in mind, they can be deployed as complete solutions or easily adapted into existing environments. The Oracle Optimized Solution approach helps ease Oracle E-Business Suite deployment with optimized backup, recovery, and disaster recovery, and it lowers risk even further by enhancing the complete end-to-end deployment through appropriate services from Oracle Consulting.

Oracle Optimized Solution for Secure Backup and Recovery

Oracle Optimized Solution for Oracle E-Business Suite on SPARC T5 and Oracle Exadata provides flexible and low-cost deployment options that deliver accelerated processing and database optimization. Oracle Optimized Solution for Secure Backup and Recovery matches the innovation built into this solution, providing higher capacity and performance with greater operational efficiency at less cost. Oracle offers this complete, pretested, high-performance backup and recovery solution, which can be applied to back up Oracle E-Business Suite on Oracle systems. This backup solution delivers virtually unlimited scalability with centralized management, accelerates data protection processing with industry-leading performance, and provides breakthrough cost structures. Oracle Optimized Solution for Secure Backup and Recovery provides comprehensive support for Oracle E-Business Suite data and Oracle Database as well as for the Oracle Solaris operating system components and the network infrastructure. Using Oracle RMAN and Oracle Active Data Guard data protection software, administrators can back up data residing on the preconfigured Oracle ZFS Storage Appliance.

This data can also be backed up to high-performing encrypted tape, for cost-effective, long-term storage. Oracle Optimized Solution for Secure Backup and Recovery can be four times less expensive than comparable competitive tape backup solutions. Oracle Secure Backup—the tape management software component for tape backup—employs the lowest-cost tape storage media and is ideal for older backup copies and long-term data retention. When Oracle Optimized Solution for Secure Backup and Recovery is deployed in replicated configurations, it eliminates the need for complex third-party deduplication techniques, because simple tape and disk backups can be performed at one or both sites for complete data protection.

Protecting Oracle E-Business Suite on Oracle Systems

Oracle Optimized Solution for Secure Backup and Recovery features a scalable, multitier architecture that includes backup clients, media servers, administrative servers, Oracle’s disk storage devices, and encrypted tape devices, as shown in Figure 13. Cloud-based database backups are also supported with Oracle Database Cloud Service. Designed to be software-agnostic, the solution can work with Oracle RMAN, Oracle Secure Backup, Symantec NetBackup, or other non-Oracle backup software. For illustration purposes, the following explanation refers to use of Oracle Secure Backup software throughout for the tape management component of the solution.

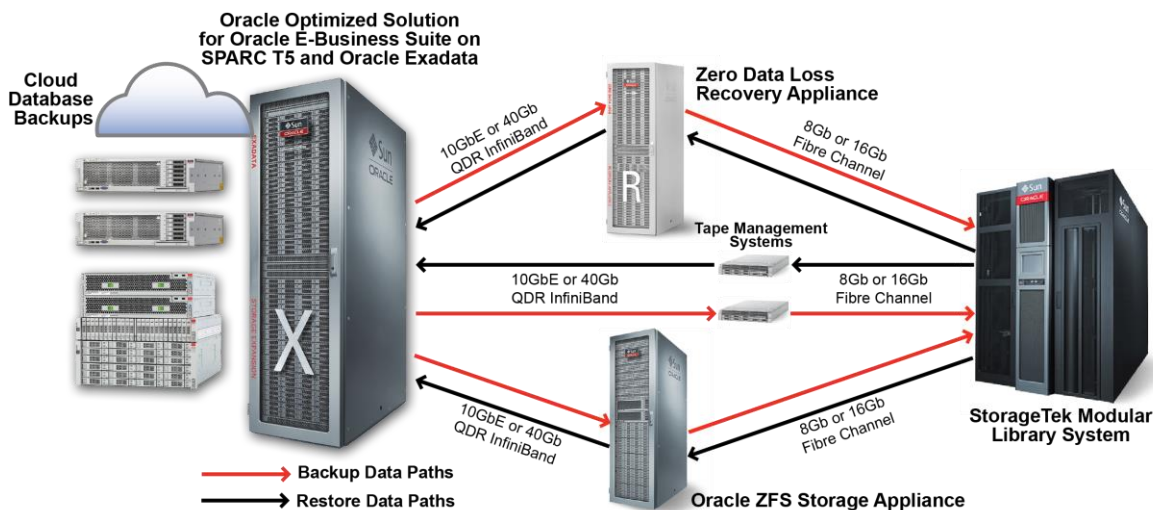



Figure 13. Oracle Optimized Solution for Secure Backup and Recovery supports heterogeneous clients.

Note that in disk-only environments where tape-based backups are not required, no backup software is required. Disk backups can be completed using the operating system and Oracle Database tools, such as Oracle RMAN, alone.

There are three elements within the Oracle system that must be backed up in order to protect against loss of data and operations.

- » **Oracle E-Business Suite and Oracle Solaris.** The applications, operating system, domains, and Oracle Solaris Zones within the Oracle system must be backed up in order to provide for a quick recovery process in the event of a disaster. Applications installed on the internal Oracle ZFS Storage Appliance are backed up with Network Data Management Protocol (NDMP) because they are installed on NFS shares.
- » **Oracle Database.** Oracle Database is a vital element and must be backed up to ensure against loss of business- or mission-critical data.
- » **Solution network infrastructure.** The network infrastructure consists of the switch configurations for the 10 GbE networks. Once the switches are configured, their configuration information should be backed up to preserve the settings.



The data protection features of Oracle Optimized Solution for Secure Backup and Recovery provide a complete backup and recovery capability for the data storage, network switching infrastructure, operating system, domains, zones, and database. The result is an end-to-end solution that ensures the fastest, most reliable backup and recovery for Oracle systems.

For more information on backup and recovery, please see the Oracle Optimized Solution for Secure Backup and Recovery web page (oracle.com/solutions/optimized-solutions/backup-and-recovery).

Oracle Optimized Solution for Secure Disaster Recovery

Oracle E-Business Suite running on Oracle systems, as described in this solution, is designed for high availability. At the same time, enterprise deployments need protection from unforeseen disasters and natural calamities. Planning for disaster recovery depends on many factors, including cost, existing infrastructure capabilities, requirements for compliance with government regulation, and other business objectives. A practical and cost-efficient approach to ensure uninterrupted business operations during a disaster is to have an independent copy of the operating environment up and running at a geographically distant, remote secondary site. In this scenario, the remote site hosts a redundant application tier and a synchronized standby database. Remote disaster recovery sites do not have to simply sit idle until called upon for service recovery. To increase the return on investment of disaster recovery site resources and improve productivity, the remote infrastructure can be leveraged for essential non-time-critical activities, such as development and test work along with analysis and reporting tasks, as previously illustrated in Figure 8.

Disaster Recovery Strategy for Oracle E-Business Suite on Oracle Systems

Oracle systems use a complete framework of technologies to provide disaster recovery support for Oracle E-Business Suite applications and databases deployed on the platform. Oracle Optimized Solution for Secure Disaster Recovery ensures that all data, applications, and systems are replicated and ready for operation if the primary site becomes unavailable. Through full system integration and duplication of all system components at the remote disaster recovery site, the solution provides faster and more complete operations recovery than other options and eliminates the need for high-performance systems to recover production operations.

Figure 14 shows the basic configuration for Oracle Optimized Solution for Secure Disaster Recovery in a local primary and remote secondary site for disaster recovery protection. Oracle E-Business Suite applications are run on the Oracle system platform using Oracle ZFS Storage Appliance for storage and Oracle's StorageTek SL3000 modular library system for onsite backup and archiving. Oracle Enterprise Manager and Oracle Solaris Cluster Geographic Edition provide management and failover capabilities.

Oracle Active Data Guard and Oracle ZFS Storage Appliance provide replication of both applications and unstructured data from the primary site to the secondary site, continually or periodically, depending on business needs. Tape backups can be run at both the local and remote sites for increased redundancy and protection of valuable data. Cloud-based database backups are supported with Oracle Database Backup Service.

For more information on disaster recovery, please see the Oracle Optimized Solution for Secure Disaster Recovery web page (oracle.com/solutions/optimized-solutions/disaster-recovery).

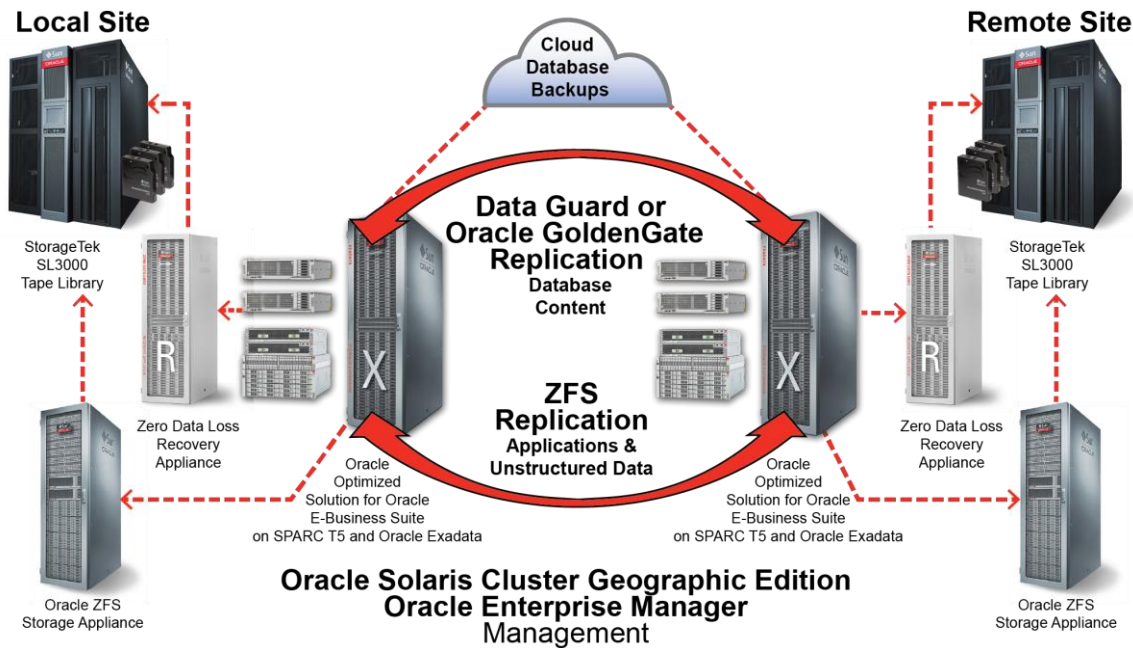


Figure 14. Oracle systems can be deployed as a part of an effective disaster recovery topology.

Oracle E-Business Suite Application and Database Data Failover

In this solution, applications and unstructured data (that is, non-database data) reside in shared file systems on Oracle ZFS Storage Appliance. Snapshot-based replication and remote replication of data is supported from the source Oracle ZFS Storage Appliance to any number of target appliances. In the event of a disaster that impacts the service of the primary appliance, administrators activate service at the remote disaster recovery site. When the primary site has been restored, normal service is then resumed and recovery time is dramatically reduced, compared to traditional offline backup architectures.

Data Guard (a feature included with Oracle Database, Enterprise Edition) provides management, monitoring, and automation tools to create and maintain synchronized standby copies of production databases for protection against failures, corruption, and disasters at the primary site. If the primary site fails, operations can be quickly transferred to the secondary site for uninterrupted service. Data Guard improves return on investment of disaster recovery sites. Because the standby databases are fully operational, they can also be used to minimize downtime during planned maintenance on the primary production environment. Moreover, adding Oracle Active Data Guard allows read-only access to standby databases to offload queries, reporting, and backups from the primary database, improving overall performance of the environment.

Planning for protection from disasters and other catastrophic events is essential for businesses and organizations. Oracle Optimized Solution for Secure Disaster Recovery supports a range of options to provide the disaster recovery solution that best meets an organization's needs. Oracle Maximum Availability Architecture, Oracle's best practices blueprint for high availability, contains additional backup and recovery information based on proven Oracle technologies, expert recommendations, and customer experiences. For more information on Oracle Maximum Availability Architecture, see oracle.com/technetwork/database/features/availability/maa-096107.html.

Oracle Consulting Services

Oracle systems provide high performance and productivity for IT processes, transactions, applications, and workloads critical to the success of business organizations. To help reduce the deployment risk and take maximum advantage of this technology, Oracle Consulting delivers a suite of services that can help organizations implement and migrate new technology solutions while staying focused on critical business needs. Services provided by Oracle Consulting help to plan, architect, and implement a solution based on unique business environments, helping organizations achieve a successful low-risk deployment. Oracle Consulting and Oracle Advanced Customer Support Services together provide five categories of services for architecture optimization with proven success for faster adoption, as depicted in the Figure 15.

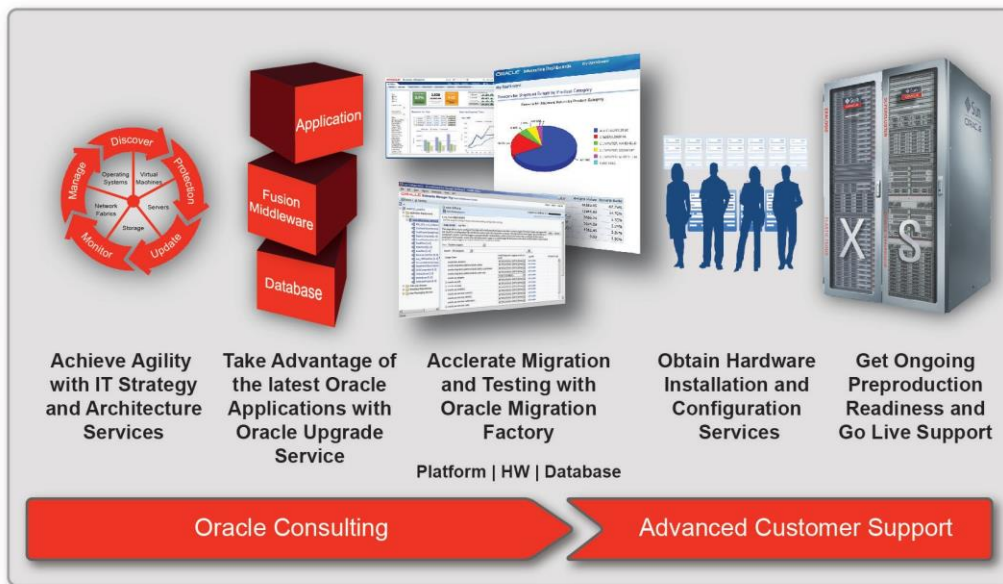


Figure 15. Drive faster adoption and lower deployment risk with five architecture optimization services provided by Oracle Consulting and Oracle Advanced Customer Support Services.

Optimized Solution Goals for Oracle E-Business Suite

Oracle Consulting will provide a prebuilt architecture optimized to rapidly migrate, upgrade, and implement Oracle E-Business Suite and other Oracle Applications by significantly simplifying the effort to move, upgrade, and implement Oracle Applications on Oracle systems. This process leverages organizations' existing investments, skills, and operations, while offering the most cost-effective solution—with very low overall risk. The following are the goals of Oracle Consulting:

- » **Ensure rapid adoption.** Provide a preconfigured, integrated, complete system and architecture that is standards-based, rapidly deployable, scalable, highly available, manageable, and secure without compromising performance.
- » **Maximize value.** Provide IT strategy and architecture services to help maximize the value of IT portfolios and quickly harness new solutions, such as Oracle's servers and storage, engineered systems, big data, and cloud solutions.

A summary of Oracle Consulting services and Oracle Advanced Customer Support Services for architecture optimization is shown in Table 5.

TABLE 5. ARCHITECTURE OPTIMIZATION SERVICES OVERVIEW

Service	Features
Oracle Consulting IT Strategy and Architecture	<ul style="list-style-type: none"> » IT strategy and architecture services help maximize the value of IT portfolios and quickly harness new solutions, such as Oracle servers, storage, engineered systems, big data, and cloud solutions. » Business architecture services ensure business process optimization and provide organizational change management. » These services leverage certified architectures and best-practice methodologies.
Oracle Consulting Application and Upgrade Services	<ul style="list-style-type: none"> » Provide functional and technical expertise for Oracle E-Business Suite and Oracle's Siebel, PeopleSoft, and JD Edwards applications » Provide delta training, fit/gap analysis, and configuration to ensure application optimization » Provide exposure and training for new releases » Provide customizations, extensions, modifications, localizations, and integrations (CEMLI) analysis (free service)
Oracle Consulting Oracle Migration Factory	<ul style="list-style-type: none"> » Provides platform migration services that include Oracle hardware, Oracle Database, and technology migrations » Leverages Oracle Migration Factory for a lower-cost, reduced-risk, factory-based approach. Provides Automated Database Migration Service option with Oracle Advanced Customer Support Services via Oracle Advanced Support Gateway » Provides an integrated testing solution that ensures migration quality, scalability, and the availability of Oracle Applications and technology
Oracle Advanced Customer Support Services Hardware Installation and Configuration: Fixed Scope/Fixed Price	<ul style="list-style-type: none"> » Deliver comprehensive installation, configuration, and testing services to shorten time to deployment and enhance new server and storage stability and performance » Provide system installation, including critical patches, updates, and common upgrades(such as CPU and memory upgrades) using proven methodologies and best practices
Oracle Advanced Customer Support Services Preproduction Support and Readiness and Go-Live Support: Fixed Scope/Fixed Price	<ul style="list-style-type: none"> » Assess go-live and operational readiness and provide a dedicated Technical Account Manager to guide go-live plan » Provide a production support review and plan

Who better to advise about, architect, assist with, and assess Oracle engineered systems than the experts who built them? For more information on the available Oracle Consulting services, please refer to the following websites: [Oracle Consulting for Oracle E-Business Suite](#), [Oracle Consulting for Oracle Engineered Systems](#), and [Oracle Migration Factory](#).

Summary

The complexity of business applications continues to challenge many IT organizations, especially as modules are added. The complete infrastructure offered by Oracle Optimized Solution for Oracle E-Business Suite enables IT staff to simplify the data center by consolidating Oracle E-Business Suite systems on a pretested, flexible, and scalable architecture. IT organizations can put more workloads on this high-performance architecture with a compact data center footprint to achieve significantly better resource utilization, further reducing costs and increasing return on investment. Production, QAS/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 this solution enable 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. The

elimination of expensive non-Oracle 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.

References

For more information on Oracle's technology stack for Oracle E-Business Suite environments, see the references in Table 6.

TABLE 6. REFERENCES FOR MORE INFORMATION

Websites	
Oracle Optimized Solutions	oracle.com/optimizedsolutions
Oracle Maximum Availability Architecture	oracle.com/technetwork/database/features/availability/maa-096107.html
Oracle's SPARC T-Series servers	oracle.com/goto/tseries
Oracle Solaris	oracle.com/solaris
Oracle Solaris Cluster	oracle.com/us/products/servers-storage/solaris/cluster/overview/index.html
Oracle ZFS Storage Appliance	oracle.com/us/products/servers-storage/storage/unified-storage
Oracle Exadata Database Machine	oracle.com/engineered-systems/exadata/index.html
Oracle's Exadata Storage Expansion Racks	oracle.com/us/products/database/exadata/expansion-storage-rack/overview/index.html
Oracle E-Business Suite	oracle.com/us/products/applications/ebusiness/overview/index.html
Oracle Optimized Solution for Secure Backup and Recovery	oracle.com/solutions/optimized-solutions/backup-and-recovery
Oracle Optimized Solution for Secure Disaster Recovery	oracle.com/solutions/optimized-solutions/disaster-recovery
Oracle Technology Network	oracle.com/technetwork/index.html
Oracle Consulting	oracle.com/us/products/consulting/overview/index.html
White papers	
"E-Business Suite on Exadata: Oracle Maximum Availability Architecture"	oracle.com/technetwork/database/features/availability/maa-eps-exadata-197298.pdf
"Oracle Solaris and Oracle SPARC T4 Servers—Engineered Together for Enterprise Cloud Deployments"	oracle.com/us/products/servers-storage/solaris/solaris-and-sparc-t4-497273.pdf
"Oracle Database 11g Release 2 High Availability"	oracle.com/technetwork/database/features/availability/twp-databaseha-11gr2-1-132255.pdf
"Oracle Data Guard 11g Data Protection and Availability for Oracle Database"	oracle.com/technetwork/database/features/availability/twp-dataguard-11gr2-1-131981.pdf
My Oracle Support Document 1558827.1, "Oracle Optimized Solution for Oracle E-Business Suite"	support.oracle.com/epmos/faces/DocumentDisplay?id=1558827.1
Security resources	
Oracle E-Business Suite System Administrator's Guide – Security (Release 12.1)	docs.oracle.com/cd/E18727_01/doc.121/e12843/T156458T156461.htm



<i>Oracle E-Business Suite Security Guide (Release 12.2)</i>	docs.oracle.com/cd/E26401_01/doc.122/e22952/T156458T156461.htm
<i>Oracle Database Security Guide 11g Release 2 (11.2)</i>	docs.oracle.com/cd/E11882_01/network.112/e36292/title.htm
My Oracle Support Document 946372.1, "Secure Configuration of Oracle E-Business Suite Profiles"	support.oracle.com/epmos/faces/DocumentDisplay?id=946372.1
<i>Oracle Database Security Guide 12c Release 1 (12.1)</i>	docs.oracle.com/database/121/DBSEG/E48135-11.pdf
<i>Oracle Solaris 11 Security Guidelines</i>	docs.oracle.com/cd/E26502_01/pdf/E29014.pdf







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Integrated Cloud Applications & Platform Services

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Oracle Optimized Solution for Oracle E-Business Suite
October 2015
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