



# Oracle Optimized Solution for PeopleSoft

Consolidating Multiple PeopleSoft Applications on  
SPARC T5-8 Servers

ORACLE WHITE PAPER | LAST UPDATED JUNE 2015





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## Introduction

Oracle's PeopleSoft applications provide powerful enterprise resource planning (ERP) modules designed to meet the most complex business requirements. Implementing sophisticated solutions involves extensive research, planning and testing. Designing a resilient and high performance architecture, choosing hardware and software, testing and validating the concept, and deploying components to perform efficiently and securely, consumes valuable resources and entails a lengthy time to ROI. In today's highly competitive markets, it has become critical for enterprises to shorten the time to production in order to reap application benefits sooner.

Historical common practices have involved isolating PeopleSoft modules on numerous separate physical servers, and deploying web, application, and database tiers on independent physical systems. Implementing high availability usually meant doubling the number of physical servers with scaling complicating matters even further, as some business-critical modules gradually needed multiple servers themselves just to handle growing sizing requirements. Development, quality assurance, and test systems add an additional layer of complexity. With a large number of individual deployed servers, a typical ERP environment can quickly become complex and inefficient, and, as a result, extremely challenging and costly to manage.

Previous Oracle Optimized Solutions have successfully demonstrated the best practices to integrate web, application, and database tiers for PeopleSoft environments onto a single consolidated platform. This Oracle Optimized Solution for PeopleSoft goes one step further, providing a tested and validated solution for consolidating multiple PeopleSoft applications onto a single highly available platform, with performance, security, and scalability built into the architecture. To achieve this goal, Oracle engineers deployed all tiers of three PeopleSoft environments (Oracle's PeopleSoft Human Capital Management, PeopleSoft financial management solutions, and PeopleSoft Campus Solutions) onto a clustered pair of Oracle's SPARC T5-8 servers backed by a highly available shared storage and redundant networking. This paper describes the architecture, components, configuration, tuning, and test results of Oracle Optimized Solution for PeopleSoft, allowing the deployment of multiple PeopleSoft applications on a powerful, reliable and greatly simplified consolidated platform.

## Solution Overview

The "Oracle Optimized Solution" approach helps reduce the risk and cost of implementing PeopleSoft environments by simplifying and optimizing the underlying infrastructure. The solution incorporates best-of-breed hardware and software components, all engineered to work together as a cohesive system. Based on two clustered SPARC T5-8 servers from Oracle, the solution represents a complete enterprise infrastructure, greatly reducing the time needed to get from concept to production. Because the entire environment is tested, validated, and documented, IT organizations can get services up and running faster. With Oracle Optimized Solutions, high-performance

applications take advantage of a highly reliable, available, secure, and serviceable platform to eliminate the potential pitfalls and time-consuming troubleshooting that are associated with today's enterprise implementations.

### The Integrated Enterprise Application Stack

Oracle Optimized Solution for PeopleSoft is based on PeopleSoft modules that provide rich self-service capabilities and extensive business process automation. Not only are the PeopleSoft modules tested together, but the solution also provides a fully integrated and tested enterprise application stack that includes all tiers of all modules (Figure 1), all the way down to the storage.

Applications	<ul style="list-style-type: none"> <li>• PeopleSoft Human Capital Management (HCM)</li> <li>• PeopleSoft Financial Management (FMS)</li> <li>• PeopleSoft Campus Solutions (CS)</li> </ul>
Middleware	<ul style="list-style-type: none"> <li>• PeopleSoft Enterprise PeopleTools</li> <li>• Oracle WebLogic Server + Oracle Tuxedo</li> </ul>
Database	<ul style="list-style-type: none"> <li>• Oracle Database</li> <li>• Oracle Real Application Clusters</li> </ul>
Operating System	<ul style="list-style-type: none"> <li>• Oracle Solaris 11</li> <li>• Oracle Solaris Cluster</li> </ul>
Virtual Machine	<ul style="list-style-type: none"> <li>• Oracle VM Server for SPARC</li> </ul>
Servers	<ul style="list-style-type: none"> <li>• SPARC T5-8 Server</li> </ul>
Storage	<ul style="list-style-type: none"> <li>• Oracle ZFS Storage Appliance</li> </ul>

Figure 1. Oracle Optimized Solution for PeopleSoft includes a fully integrated and tested software and hardware solution stack.

### Solution Software Stack

The integrated software components of the solution stack include the following:

- » **PeopleSoft Human Capital Management.** PeopleSoft HCM delivers a robust set of best-in-class human resources functionality that lets organizations increase productivity, accelerate business performance, and lower the cost of ownership.
- » **PeopleSoft Financial Management.** PeopleSoft Financial Management reduces costs by automating, centralizing, and standardizing global transactional processes. Organizations can manage risks and reduce compliance costs with end-to-end processes for governance, risk, and compliance.
- » **PeopleSoft Campus Solutions.** Oracle's comprehensive PeopleSoft Campus Solutions suite is the leader in fulfilling higher education's requirements for a student system, enabling the transformation to a global campus. PeopleSoft Campus Solutions have been tested, tuned, and optimized on Oracle Solaris, and leverage Oracle's SPARC multi-threading architecture to provide highly scalable services, helping universities optimize investments in IT infrastructure and resources as well as improve administration effectiveness.




- » **PeopleSoft PeopleTools.** PeopleSoft PeopleTools provides a comprehensive development toolset that supports the creation of PeopleSoft applications.
- » **Oracle WebLogic Server.** Oracle WebLogic Server, Enterprise Edition is the application server of choice for demanding customer environments the world over. Proven clustering technology, cross-domain management, and comprehensive diagnostic tools are standard with Oracle WebLogic Server, Enterprise Edition, and they are well integrated with the Oracle portfolio for superior interoperability and support across the technology stack.
- » **Oracle Tuxedo.** Oracle Tuxedo is Oracle Fusion Middleware's strategic transaction processing product and is a leading platform for distributed transaction processing. It provides mainframe-class scale and performance on open, distributed systems, and it is the premier platform for re-hosting mainframe applications on mainstream hardware.
- » **Oracle Database 11g Enterprise Edition.** Oracle Database 11g is designed for rapidly evolving data center environments and provides efficient, reliable, and secure data management for mission critical transactional applications, query-intensive data warehouses, and mixed workloads.
- » **Oracle Real Application Clusters (Oracle RAC).** Oracle RAC is an option to Oracle Database, Enterprise Edition. Oracle RAC is a cluster database with a shared cache architecture that overcomes the limitations of traditional shared-nothing and shared-disk approaches to provide highly scalable and available database solutions for business applications. Oracle RAC enables a single database to run across a cluster of servers, providing high availability, performance, and scalability without application modification.
- » **Oracle Solaris 11.** The Oracle Solaris operating system includes innovative, built in functionality, such as near wire-speed networking throughput and high availability features that deliver industry-leading performance. No-cost, no-overhead virtualization features help optimize resource utilization, and advanced security features provide the isolation and control required by governments, financial institutions, and human resources (HR) environments. In this solution, Oracle Solaris 11 runs in both the database and application domains.
- » **Oracle Solaris Cluster.** Oracle Solaris Cluster offers solutions for mission-critical applications in physical and virtual environments, and for both local and global data centers. Leveraging Oracle Solaris Zones to consolidate multitier applications and databases, Oracle Solaris Cluster ensures the highest level of availability for PeopleSoft 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, PeopleSoft 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 Oracle External Proxy data service and the HA for WebLogic and PeopleSoft data services provide a mechanism for the orderly startup and shutdown, fault monitoring, and automatic failover of PeopleSoft services. The coordination of services availability is not only about these components themselves but also between each component and the storage and network elements that it uses, and between the components, even crossing virtualization boundary such as Oracle VM Server for SPARC and Oracle Solaris Zones.  
For more information on Oracle Solaris Cluster, download the document “Oracle Solaris Cluster Features and Benefits” from [oracle.com/technetwork/server-storage/solaris-cluster/overview/features-cluster-166765.pdf](http://oracle.com/technetwork/server-storage/solaris-cluster/overview/features-cluster-166765.pdf).

## Backup, Restore and Disaster Recovery

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.

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. Oracle offers Oracle Optimized Solution for 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 PeopleSoft deployments



where longer retention periods and greater capacity may be required, Oracle Secure Backup and tape storage can be used for backup, vaulting and archiving.

For disaster recovery scenarios, Oracle Optimized Solution for 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 Backup and Recovery” and “Oracle Optimized Solution Disaster Recovery” sections.

### The Importance of Security for ERP Systems

ERP systems have transformed core business functions in the modern enterprise, improving and automating processes across the organization, from human resources to product development and from finance to sales. As these systems expand to integrate and unify a multitude of business functions and core processes, they also aggregate an increasing amount of business-critical and confidential data—including intellectual property, financial data, and personal information—into a central repository. This high concentration of critical data and key business processes makes an attractive target for cyber attacks and can increase the risk of security breaches. As a result, security has become a major concern when designing and deploying ERP environments. Several methods exist for increasing data protection and safeguarding ERP systems.

#### **Simplify the Infrastructure**

Most PeopleSoft environments have a fairly complex infrastructure, making implementation and management complicated. This complexity increases the risk of security vulnerabilities. An ERP implementation as a whole is only as secure as its most vulnerable component, and it can be challenging to securely configure the myriad of interacting components and products in a heterogeneous system. Oracle Optimized Solutions simplify ERP implementations through the use of consolidation and virtualization technologies. Oracle also offers security guidelines and recommendations and many Oracle components have security built-in by default.

#### **Reduce Implementation Flaws**

Secure software is important but not sufficient by itself. Most security vulnerabilities arise from flawed implementation and architecture, including improper configuration and access control, lack of patch management, unencrypted communications, and inadequate security policies and processes. Based on current security best practices, Oracle Optimized Solutions provide proven and tested architecture recommendations for increased ERP system protection.

#### **Eliminate Performance and Cost Penalties**

Many security processes, such as on-the-fly encryption/decryption, can have a significant negative impact on the performance and cost of a PeopleSoft system. Oracle Optimized Solutions leverage SPARC-based systems that offer high-performance security using Cryptographic Instruction Accelerators that are directly integrated into the processor cores. By providing wire-speed security capabilities, Oracle systems eliminate the performance and cost penalties typically associated with real-time, secure computing.

## Solution Architecture

### Overall Architecture

Oracle Optimized Solution for PeopleSoft is based on a highly available infrastructure that includes compute, networking, and storage (Figure 2). All hardware and network components in the solution are redundant to ensure highly available service delivery and business continuity.

- » Two clustered SPARC T5-8 servers provide virtualized domains for web, application, and database tiers for multiple environments.
- » Two redundant Oracle Switch ES1-24 switches provide a fault-tolerant high-speed 10 gigabit Ethernet (GbE) fabric interconnecting all of the components in the solution.
- » Two clustered Oracle ZFS Storage ZS3-4 appliances provide shared, scalable and highly available storage to all the components of the solution.

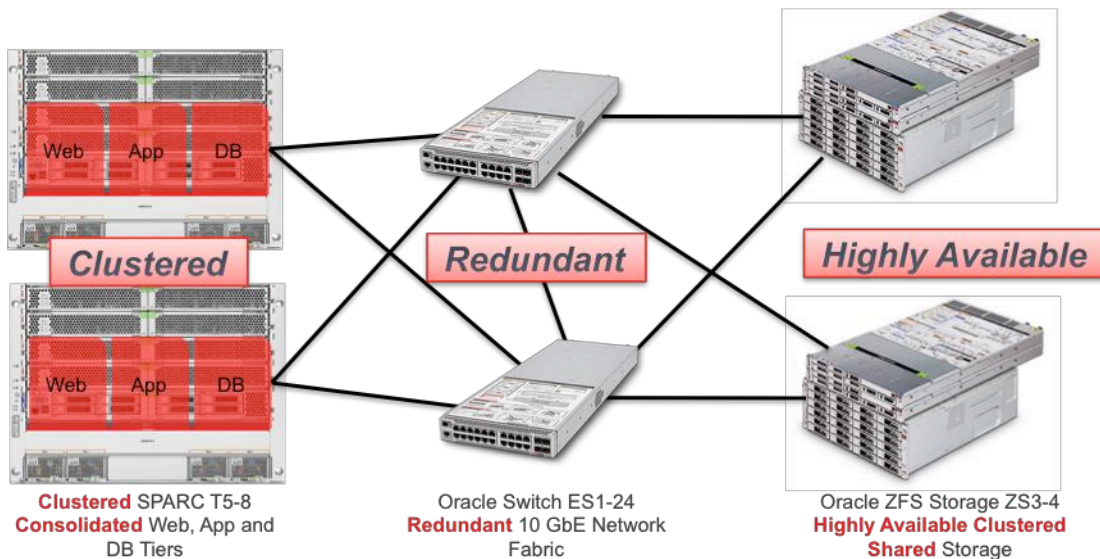


Figure 2. Oracle Optimized Solution for PeopleSoft solution architecture provides redundant infrastructure for compute, networking, and storage.

Developed to provide a high-performance consolidation platform for multiple PeopleSoft applications, this Oracle Optimized Solution has been tested running concurrent workloads with PeopleSoft HCM, PeopleSoft financial management solutions (FMS), and PeopleSoft Campus Solutions (CS). As shown in Figure 3, the application, web, and database tiers are consolidated and isolated using a combination of proven no-cost no-overhead Oracle virtualization technologies—Oracle VM Server for SPARC and Oracle Solaris Zones. Oracle Solaris Cluster provides high availability at the application and web layers while Oracle RAC provides load sharing, scalability and high availability for the database tier.

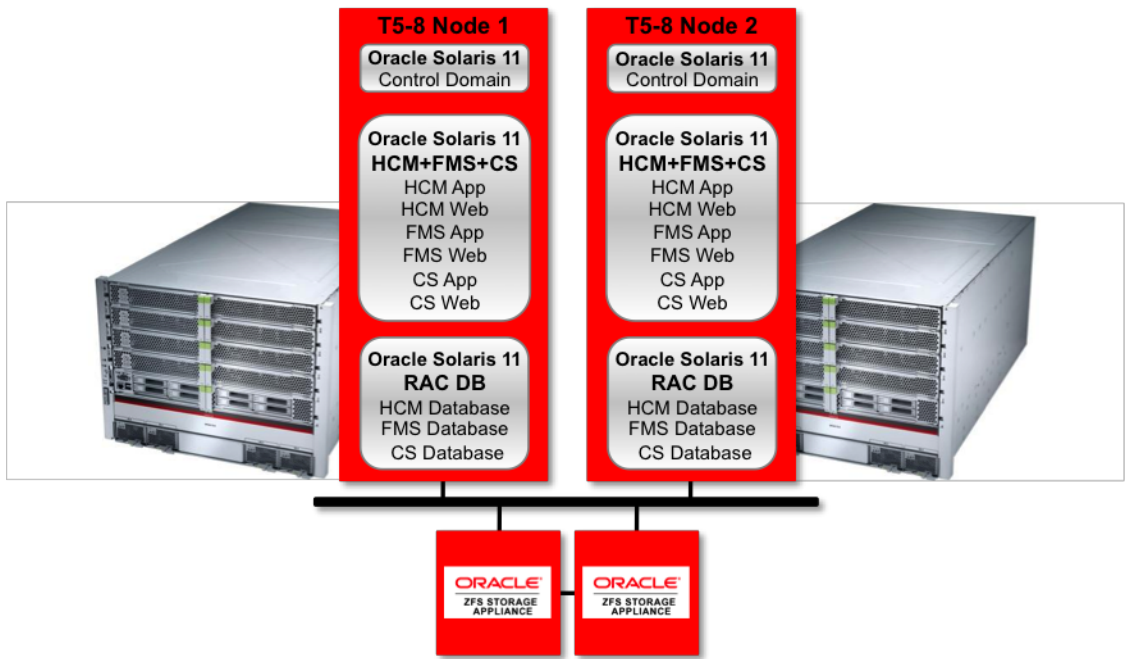


Figure 3. Each redundant SPARC T5-8 server is divided into three logical domains using Oracle VM Server for SPARC. Oracle Solaris Zones is used to virtualize the application, web, and database tiers for each PeopleSoft application.

## Oracle Virtualization and Consolidation Technologies

Oracle's full range of server virtualization technologies provides varying degrees of isolation, resource management granularity, and flexibility, and can be used separately or together to tackle specific deployment challenges. As shown in Figure 4, Oracle server virtualization technologies are used to partition and isolate the clustered server resources into three domains containing nine Solaris zones.

In Oracle Optimized Solution for PeopleSoft, Oracle VM Server for SPARC is used to partition the servers into multiple domains, with Oracle Solaris Zones technology further partitioning those domains into isolated zones.

### Oracle VM Server for SPARC


Oracle VM Server for SPARC offers domains with zero overhead, any mix of Database Domains and Application Domains, and Oracle Solaris 11 or Oracle Solaris 10 for Application Domains.

### Oracle Solaris Zones

Both Database Domains and Application Domains contain several Oracle Solaris Zones, allowing the domain resources to be partitioned further and allowing for workloads isolation and granular resources management.

### Oracle Solaris Cluster

Oracle Solaris Cluster extends Oracle Solaris to deliver the infrastructure required for deploying mission critical workloads in private, public and hybrid clouds as well as enterprise data centers. Oracle Solaris Zone Clusters provide high availability and failover between the web, application, and database zones for each application running on the clustered servers.



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 PeopleSoft applications achieve the required levels of service. These capabilities help PeopleSoft applications achieve the required levels of service, including the fastest automatic re-establishment of full active/active redundancy of all the tiers.

Oracle Solaris Cluster main benefits for PeopleSoft infrastructures include:

### High Availability

- » **Kernel integration.** Kernel integration enables instant server failure detection and load resilient heartbeats for faster and more reliable application recovery and reduced downtime.
- » **Storage fencing.** Fencing helps ensure data integrity in case of server outages by preventing failing nodes to access storage and corrupt data. With Oracle Solaris Cluster, the appropriate fencing protocol can be discovered automatically or chosen per storage device to adapt to the available hardware: choices include SCSI 3, SCSI 2, per-device discovery, or no SCSI fencing. Oracle Solaris Cluster has a unique integration with the ZFS Storage Appliance to provide I/O fencing at the NFS level, preventing evicted or failed nodes to accidentally write to the share storage, and automatic NFS file locks release, to ensure the success of the recovery of components using the shared file system.
- » **Quorum.** Quorum helps prevent data corruption caused by catastrophic situation, such as split brain or amnesia, which leads to data corruption. Supported Quorum Devices include disk-based quorum, software quorum, as well as quorum server. This flexibility allows customers to tailor their quorum solution to their storage and system topology, satisfying a wide range of HA and cost requirements.
- » **Component monitoring.** Constant monitoring enables the prevention of outages through early detection of failures. All components of Oracle Solaris Cluster, including server, network, disks, storage resources, and quorum, are monitored. Health and effective availability of file systems, such as ZFS storage pools, Oracle ZFS Storage Appliance NFS shares, and global devices used by the clustered applications are monitored, and corrective action is initiated when possible. All disk paths can be monitored and configured to automatically reboot a node in case of multiple path failure. Active monitoring brings increased service availability through early detection of issues, such as outages and operator errors, and easier error diagnostics during application bring-up phase. The Process Monitoring Framework in Oracle Solaris Cluster is a unique integration with Oracle Solaris to enable specific application agents to very quickly detect the abnormal termination of the application processes, such as when they encounter a fatal SW defect. This is done via a notification by the OS and not by active polling of the application component. The agent then can take the appropriate recovery action to reestablish the availability of the component.
- » **Integration with Oracle Solaris service management facility services.** Administrators can easily move Oracle Solaris service management facility-enabled applications from a single-node Oracle Solaris environment to a multi-node Oracle Solaris Cluster environment, increasing availability with little or no development effort.
- » **Configuration checker.** The checker enables detecting vulnerable cluster configurations regularly and rapidly, limiting failures due to mis-configuration throughout the lifetime of the cluster.
- » **End to end availability coordination.** The components managed by Oracle Solaris Cluster have dependencies on the storage and networking elements they use, but also on services from other applications or database services in the stack. Resource dependencies can be configured to reflect such relationships, even in case the components are isolated in different zones or logical domains. This capability allows components startup and hence recovery to be properly coordinated, avoiding failures to start caused by unsatisfied dependencies. Specifically in this solution, the Oracle External Proxy (Oracle EP) resource in the application domain represents the availability of the Database service running in the database domain. The resource managing the application servers or process scheduler in the PeopleSoft environment will have a dependency setup on the Oracle EP resource. In addition to being able to manage Oracle WebLogic servers in either active/active or active/standby configurations, Oracle Solaris Cluster can also manage the Oracle WebLogic Admin server, a critical component of the Oracle WebLogic architecture. The Oracle WebLogic Admin server is a single instance and can be made highly available with Oracle Solaris Cluster by using the active/standby configuration.

## Virtualization

- » **Oracle Solaris Zone Clusters.** Oracle Solaris Zone clusters are virtual clusters based on zones. They are perfect environments to consolidate multiple applications or multi-tiered workloads onto a single physical cluster configuration. Oracle Solaris Zone clusters provide an Oracle Solaris Cluster virtualization technology certified for Oracle RAC, including with Oracle RAC 12c. For more details, see [oracle.com/technetwork/database/virtualizationmatrix-172995.html](http://oracle.com/technetwork/database/virtualizationmatrix-172995.html).
- » **Oracle Solaris Failover Zones.** Oracle Solaris failover zones protect the availability of applications at the zone level. It monitors and controls the zone itself, automatically failing over the full workload between servers in case of a failure, or switching it over on request. Resource dependencies are managed as well as load balancing and priority policies. This feature is ideal for packaged, closed workloads and supports both Oracle Solaris 11 and 10 zones on Oracle Solaris 11, facilitating migration (and Oracle Solaris 8 and 9 on Oracle Solaris 10).
- » **Oracle VM Server for SPARC support.** Oracle Solaris Cluster provides protection from failure, management of resource dependencies, and cluster load balancing to Oracle VM Server for SPARC domains, either at the application level or at the virtual guest level. When the domain is configured as standard cluster node, Oracle Solaris Cluster provides failover and management of the applications running within the virtual guest. When the domain is configured as a failover resource, it is failed over automatically in case of failure. Upon request, it can also be moved across servers using warm/live migration.

## Disaster Recovery

- » **Campus Cluster.** To limit service outages due to a local outage (such as power cut, building flooding), it is possible to stretch a cluster across a campus or metropolitan area. Oracle Solaris Cluster automates the failover procedures in case of an outage, minimizing human error and improving the recovery time and overall availability of the protected services.
- » **Geographic Cluster.** Oracle Solaris Cluster Geographic Edition feature protects applications from unexpected disruptions by using multiple clusters separated by a long distance and by using a redundant and secure infrastructure between these clusters. Combined with data replication software, this option enables services to tolerate disasters by migrating applications to a geographically separated secondary cluster. Any supported application can be deployed, including in an Oracle Solaris Zones configuration. Supported replication technologies include Oracle's StorageTek Availability Suite, Oracle Data Guard, MySQL Replication, Oracle ZFS Storage Appliance replication, and EMC SRDF. For replication technologies that are not supported out-of-the-box, a script-based replication module can be used to enable integration.

## Oracle Clusterware

Oracle Clusterware provides availability and scalability for the database instances between the two clustered servers. Oracle Clusterware is an independent cluster infrastructure, which is fully integrated with Oracle RAC, capable of protecting any kind of application in a failover cluster. Oracle Clusterware is an integral component of the Oracle Grid Infrastructure suite of products, which includes Oracle Automatic Storage Management and Oracle Cloud File System.

Oracle Clusterware is a complete clustering solution that can be used outside of Oracle RAC. In these environments, Oracle Clusterware serves as a failover cluster solution, protecting any kind of application. In both environments, Oracle Clusterware is capable of managing resources, processes, and applications in the cluster as well as for maintaining node membership and ensuring fencing.

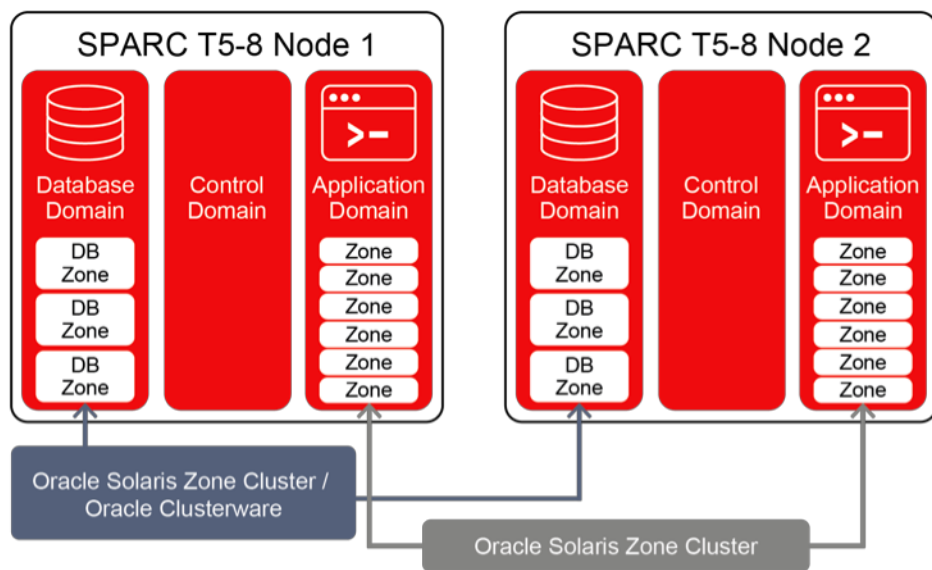


Figure 4. Oracle's layered virtualization ensures isolation and redundancy within the system, with logical domains divided into Oracle Solaris Zones and failover provided by Oracle Solaris Cluster or Oracle Clusterware.

## Logical Domains

Three domains create virtual server environments that run separate instances of Oracle Solaris to host services as described in the sections that follow.

### Control Domain

The control domain is used to configure domains and manage resources. The control domain forms the basis for communications between the hypervisor, the hardware platform, and the other domains, allowing for the creation and control of logical domains, services, and devices. The control domain is also a service domain providing two virtual disks to the database domain.

The control domain is a single logical domain (LDom) that serves as the control point for virtualization of the server. The control domain is the first domain to boot on a power-up, and is both an I/O domain and service domain.

In this optimized solution, the control domain is configured with:

- » Processing: Eight SPARC T5 cores ( $\frac{1}{2}$  socket)
- » No network connectivity
- » Local storage (two mirrored HDDs)

The control domain provides two virtual disks to the database domain, to be part of the boot and swap mirrors as described later in this document.

### Database Domain

The database domain is a guest domain that hosts three Oracle Solaris Zones to provide isolation for Oracle databases for PeopleSoft HCM, PeopleSoft financial management solutions, and PeopleSoft Campus Solutions environments. In this Oracle Optimized Solution, the database domain is configured with:

- » Processing: 58 SPARC T5 cores ( $3 \frac{1}{2}$  sockets)

- » Memory: 1 TB RAM
- » Network connectivity: Three dual-port 10 GbE cards
- » Local storage: 4 HDDs (One mirrored pair as an OS zpool, one mirrored pair as swap zpool)

### Application Domain

The application domain is an I/O domain that hosts a total of six Oracle Solaris Zones to provide isolation for application and web tiers for PeopleSoft HCM, PeopleSoft financial management solutions, and PeopleSoft Campus Solutions environments. In the optimized solution, the application domain is configured with:

- » Processing: 64 SPARC T5 cores (4 sockets)
- » Memory: 1 TB RAM
- » Network connectivity: Three dual-port 10 GbE cards
- » Local storage: Two HDDs (1 mirrored pair as an OS zpool)

The application domain provides two virtual disks to the database domain, to be part of the boot and swap mirrors as described later in this document.

Figure 5 illustrates the Oracle Solaris Zone Cluster configuration between the two SPARC T5-8 servers. Corresponding Oracle PeopleSoft zones in both the application domain and the database domain are thus configured for failover. Consistent with the testing described in this paper, the illustration shows Oracle RAC deployed in Oracle Solaris Zone clusters.

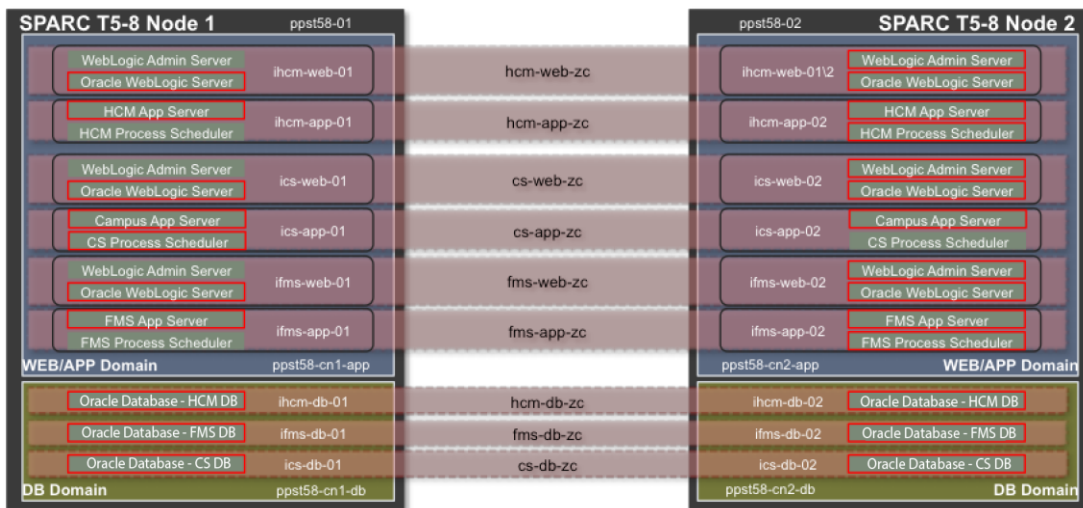


Figure 5. Oracle Solaris Zones and zone clusters provide isolation and high availability for web, application and database (DB) tiers for consolidated Oracle PeopleSoft workloads.

### Storage Architecture

Oracle Optimized Solution for PeopleSoft provides carefully configured storage to deliver both optimal performance and availability.



### Internal Server Storage Layout

The SPARC T5-8 server offers up to eight internal hot-pluggable SAS-2 10k rpm disk drives or SSDs. For this solution a fully loaded configuration with eight SAS disk drives was selected. The internal disk drives in each SPARC T5-8 server are used to provide root and swap space for the control, database, and application domains (Figure 6).

- » The control domain uses a mirrored zpool using disks HDD0 and HDD1, to provide the storage for the OS root and the zone cluster root path. Disks HDD2 and HDD3 on are exported as virtual disks by the control domain and used by the database domain.
- » The application domain uses a mirrored zpool using disks HDD4 and HDD5, to provide the storage for the OS root and the zone cluster root path. Disks HDD6 and HDD7 on are exported as virtual disks by the application domain and used by the database domain.
- » The database domain uses two mirrored zpools, one for the OS root and zone cluster path, the other for swap space for Dynamic Intimate Shared Memory (DISM) since large swap space is required for database virtual memory usage. To eliminate single points of failure, each mirror in the database domain is created using one virtual disk exported by the control domain and one virtual disk exported by the application domain.

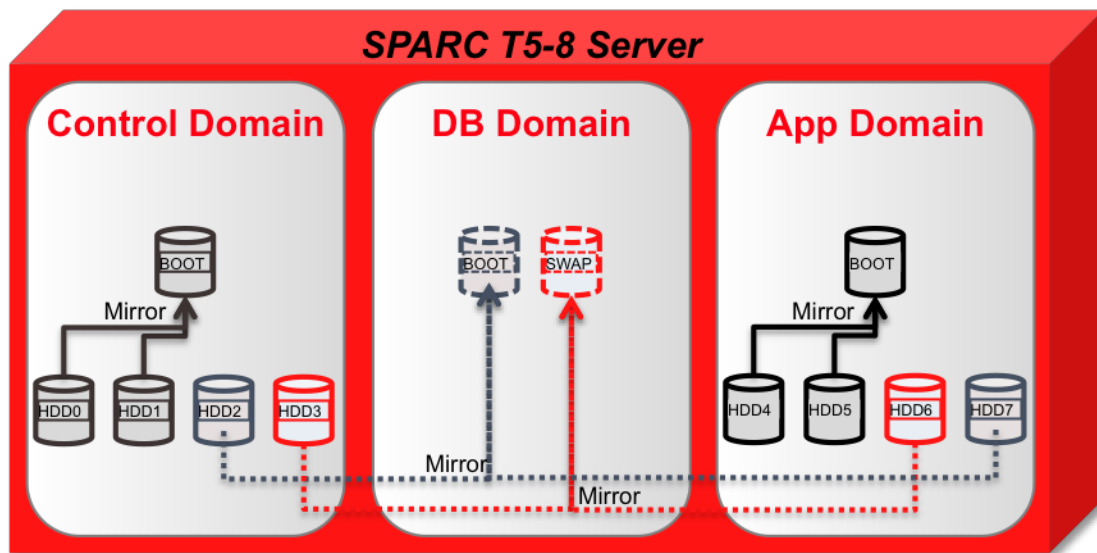


Figure 6. SPARC T5-8 server internal disk configuration.

For more information on availability best practices using Oracle's SPARC T5-8 server and ZFS pools, please visit the following online resources:

Example of configuring a SPARC T5-8 server:

[blogs.oracle.com/jsavit/entry/availability\\_best\\_practices\\_example\\_configuring](https://blogs.oracle.com/jsavit/entry/availability_best_practices_example_configuring)

Using a mirrored ZFS pool with virtual disks:

[blogs.oracle.com/jsavit/entry/availability\\_best\\_practices\\_using\\_a](https://blogs.oracle.com/jsavit/entry/availability_best_practices_using_a)

## Highly Available Shared Storage

The Oracle ZFS Storage ZS3-4 appliance offers application engineered-storage that is optimized for Oracle software. The appliance delivers highly available, shared storage for extreme performance and offers integrated analytics. In this Oracle Optimized Solution, the Oracle ZFS Storage ZS3-4 appliance provides NFS shares for data access and iSCSI LUNs for Oracle Solaris Cluster quorum devices. As configured for this solution, the appliance includes the following:

- » Two controllers in an active-active cluster, each with:
  - » Two 512 GB 10K RP HDDs
  - » Four 512 GB SATA SSD 2.5-inch read-flash accelerators
  - » Four Dual 10 GbE cards
- » Four disk shelves with 24 drive bays, each with:
  - » Data: Twenty 300 GB 10K RPM 3.5-inch SAS HDDs (5.46 TB)
  - » Log: Four 73 GB SLC SAS SSD 3.5-inch write-flash accelerators (273 GB)

## I/O Layout

To accomplish the highest degree of reliability and flexibility, the SPARC T5-8 server provides extensive I/O capabilities. Figure 7 illustrates the mapping of I/O root complex connections between the four processor modules in each SPARC T5-8 server and the 16 PCIe I/O slots the system provides. Each CPU supports two I/O root complexes, connected to the PCIe I/O slots using four PCIe switches.

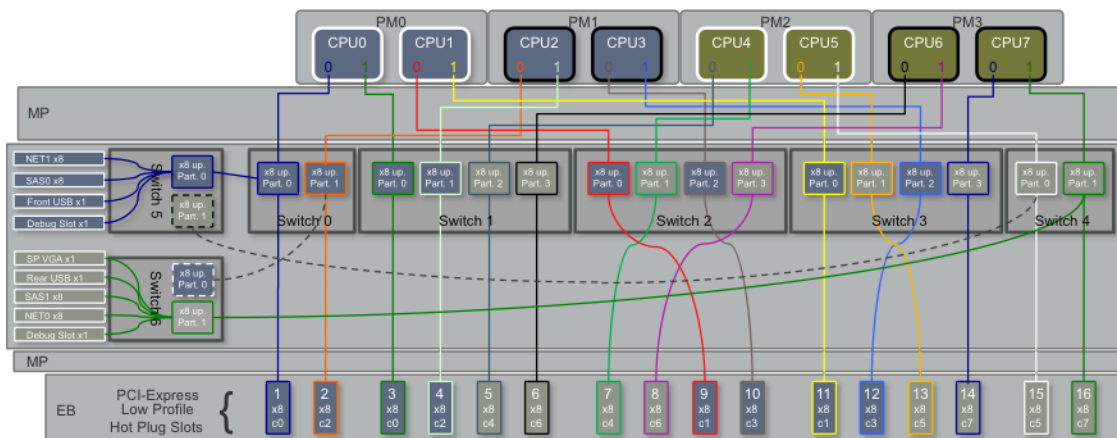


Figure 7. SPARC T5-8 server internal I/O root complex mapping from processor modules to PCIe I/O slots.

The application and database domains each own three dual-port 10 GbE cards allowing for 6 physical network connections per domain. This is to provide redundant connectivity, using two switches, to all VLANs. For increased fault resilience, the PCIe expansion cards have been populated in specific slots so that each domain uses cards going through separate internal paths using different CPUs, Processor Module, and PCIe switches (Table 1). The database domain owns the 10 gigabit Ethernet cards in slots 4, 11, and 12, and the application domain owns the 10 gigabit Ethernet cards in slots 5, 8, and 16.

**TABLE 1. SPARC T5-8 SERVER INTERNAL PATH TO DOMAIN AND VLAN MAPPING**

PCIe Slot	PCIe Switch	Processor Module	CPU	Root Complex Path	Cards	LDOM	VLAN
1	0	0	0	/pci@300/pci@1/pci@0/pci@6			
2	0	1	2	/pci@400/pci@1/pci@0/pci@c			
3	1	0	0	/pci@340/pci@1/pci@0/pci@6			
4	1	1	2	/pci@440/pci@1/pci@0/pci@c	10 GbE	DB domain	Port 0: PUB Port 1: STOR
5	1	2	4	/pci@500/pci@1/pci@0/pci@e	10 GbE	App domain	Port 0: PUB Port 1: STOR
6	1	3	6	/pci@600/pci@1/pci@0/pci@8			
7	2	2	4	/pci@540/pci@1/pci@0/pci@e			
8	2	3	6	/pci@640/pci@1/pci@0/pci@8	10 GbE	App domain	Port 0: D2IC1 Port 1: PUB
9	2	0	1	/pci@380/pci@1/pci@0/pci@a			
10	2	1	3	/pci@480/pci@1/pci@0/pci@4			
11	3	0	1	/pci@3c0/pci@1/pci@0/pci@e	10 GbE	DB domain	Port 0: D1IC1 Port 1: PUB
12	3	1	3	/pci@4c0/pci@1/pci@0/pci@8	10 GbE	DB domain	Port 0: STOR Port 1: D1IC2
13	3	2	5	/pci@580/pci@1/pci@0/pci@a			
14	3	3	7	/pci@680/pci@1/pci@0/pci@4			
15	4	2	5	/pci@5c0/pci@1/pci@0/pci@8			
16	4	3	7	/pci@300/pci@1/pci@0/pci@4	10 GbE	App domain	Port 0: STOR Port 1: D2IC2

### Database Availability Options

Multiple database configuration choices are available for Oracle Optimized Solution for PeopleSoft, allowing organizations to choose the level of features and availability that best suits their needs and applications. Single-instance Oracle Database configurations can be used as well as Oracle RAC. Both can be run either directly in an Oracle Solaris Zone within the Database Domain, or they can be deployed in an Oracle Solaris Zone cluster for additional features such as storage I/O fencing or full stack synchronization with affinities and dependencies between the tiers. One can choose to run Oracle RAC on top of Oracle Solaris Cluster, in which case, Oracle Clusterware will still manage all Oracle RAC databases on the system.

Oracle Solaris Zone clusters can be configured so that domains and/or Oracle Solaris Zones can be automatically failed over between the two clustered servers in the event of a failure. To help select the right implementation for specific needs, Table 2 enumerates some of the main attributes and benefits of the possible combinations.

**TABLE 2. ORACLE DATABASE AVAILABILITY OPTIONS**

<b>Oracle Database</b>	<b>Attributes and Benefits</b>
Single instance database	<ul style="list-style-type: none"> <li>» <i>Low cost</i></li> <li>» <i>Single point of failure (no HA)</i></li> </ul>
Single instance database in an Oracle Solaris Zones cluster	<ul style="list-style-type: none"> <li>» <i>Low cost</i></li> <li>» <i>Highly available</i></li> <li>» <i>Storage I/O fencing for database integrity protection</i></li> <li>» <i>Faster failure detection (0-1 second vs. 30 seconds)</i></li> <li>» <i>Security through database isolation</i></li> <li>» <i>Full stack synchronization with affinities and dependencies between tiers</i></li> <li>» <i>Disaster recovery (with Oracle Solaris Cluster Geographic Edition)</i></li> </ul>
Oracle RAC database	<ul style="list-style-type: none"> <li>» <i>Scalable – Capacity on Demand</i></li> <li>» <i>Highly available</i></li> <li>» <i>Load Balancing</i></li> <li>» <i>Row Locking</i></li> <li>» <i>Multi-version Read Consistency</i></li> </ul>
Oracle RAC database in an Oracle Solaris Zones cluster	<ul style="list-style-type: none"> <li>» <i>Scalable – Capacity on Demand</i></li> <li>» <i>Highly available</i></li> <li>» <i>Load Balancing</i></li> <li>» <i>Row Locking</i></li> <li>» <i>Multi-version Read Consistency</i></li> <li>» <i>Storage I/O fencing for database integrity protection</i></li> <li>» <i>Faster failure detection (0-1 second vs. 30 seconds)</i></li> <li>» <i>Security through database isolation</i></li> <li>» <i>Full stack synchronization with affinities and dependencies between tiers</i></li> <li>» <i>Disaster recovery (with Oracle Solaris Cluster Geographic Edition)</i></li> </ul>

For additional recommendations and best practices to achieve optimal high availability at the lowest cost and complexity, refer to Oracle Maximum Availability Architecture (MAA) documentation available from Oracle Technology Network at [oracle.com/technetwork/database/features/availability/oracle-database-maa-best-practices-155386.html](http://oracle.com/technetwork/database/features/availability/oracle-database-maa-best-practices-155386.html).

### Network Architecture

The network architecture of Oracle Optimized Solution for PeopleSoft is illustrated schematically in Figure 8. The network fabric is fully redundant, and will stay operational in the event a cable or one of the switches fails.

Data security is ensured through network segregation. As such, client, inter-domain, and storage traffic are isolated using redundant VLANs. Six 10 gigabit Ethernet cards are installed in each SPARC T5-8 server node. The dual Oracle ZFS Storage ZS3-4 appliance heads are also redundantly connected to the 10 gigabit Ethernet network, and are connected to the storage VLAN (STOR).

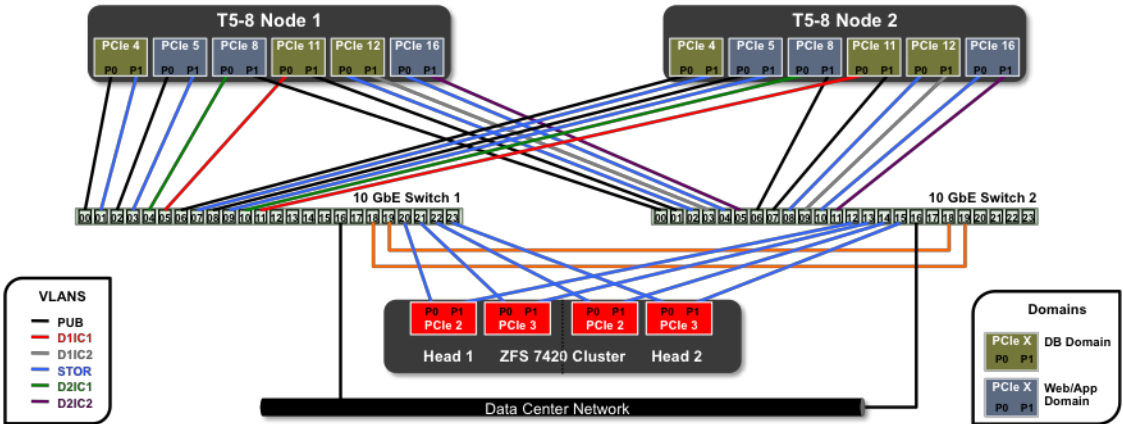


Figure 8. The 10 gigabit Ethernet network architecture for the optimized solution is segregated and redundant.

IP multipathing combined with redundant VLANs are configured to ensure highly available zone cluster interconnects between the two cluster nodes (Figure 9). Separate VLANs are provided for storage (VLAN STOR), for public access (VLAN PUB), and to interconnect domains and zone clusters across the two clustered SPARC T5-8 servers (VLANs D1IC1, D1IC2, D2IC1 and D2IC2).

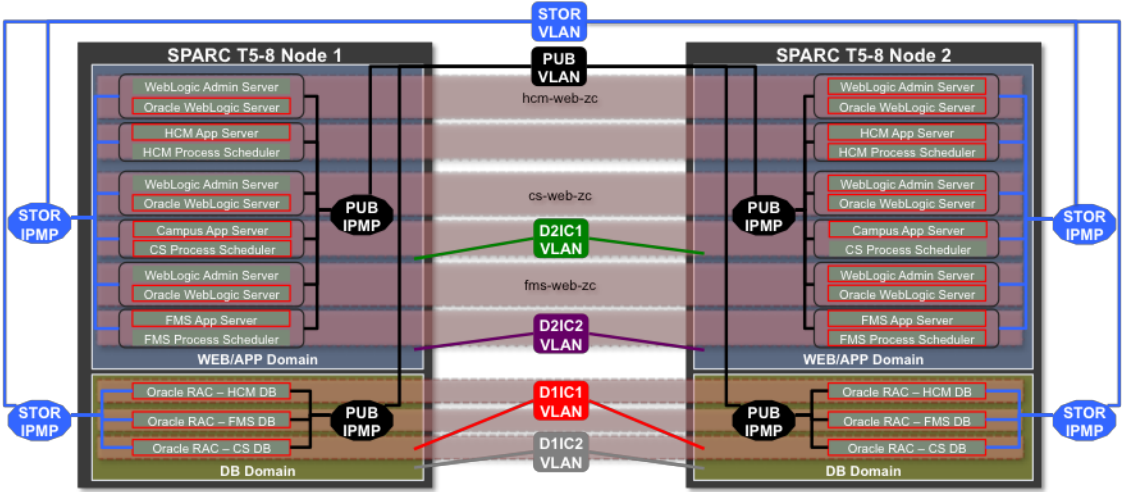


Figure 9: IP multipathing combines with VLANs to interconnect Oracle Solaris Zone clusters in the optimized solution.

Each domain owns six network interconnects used for shared storage access, cluster nodes interconnect and data center uplink. Table 3 and Table 4 list the network interfaces and VLANs used by the database domain and the application domain respectively.

**TABLE 3. NETWORK INTERFACES AND VLANS USED BY THE DATABASE DOMAIN**

PCIe Slot	Port	Interface	VLAN	Purpose
4	0	net2	PUB	Data center uplink
4	1	net4	STOR	Shared Storage access
11	0	net0	D1IC1	Cluster interconnect
11	1	net1	PUB	Data center uplink
12	0	net3	STOR	Shared Storage access
12	1	net5	D1IC2	Cluster interconnect

**TABLE 4. NETWORK INTERFACES AND VLANS USED BY THE APPLICATION DOMAIN**

PCIe Slot	Port	Interface	VLAN	Purpose
5	0	net2	PUB	Data center uplink
5	1	net3	STOR	Shared Storage access
8	0	net4	D2IC1	Cluster interconnect
8	1	net5	PUB	Data center uplink
16	0	net6	STOR	Shared Storage access
16	1	net7	D2IC2	Cluster interconnect

## Security Mechanisms

Security should be considered in the initial architecture definition and design phases of PeopleSoft systems, rather than during or after implementation. Many security vulnerabilities can be avoided by following recommendations included in Oracle’s pre-tested and evaluated implementation documentation. The following are several examples of security mechanisms implemented in this solution.

### OS Security

- » **Oracle Solaris and Oracle Solaris Cluster Secure by Default.** Upon installation, Oracle Solaris and Oracle Solaris Cluster are configured by default with a large set of network services disabled. This hardened setup is called “Secure By Default” (SBD).
- » **Tier isolation using Oracle VM Server and Oracle Solaris Zones.** Oracle VM Server provides isolated execution environments called domains. Each domain is an independent instance in which the Oracle Solaris OS can be hardened using existing security guidelines. Additionally, Oracle Solaris Zones provide an application execution environment that isolates processes from the rest of the system within a single instance of the Oracle Solaris OS. This combination of Oracle VM Server, Oracle Solaris Zones, and network partitioning allows enforcement of strict, role-based administration rights across the PeopleSoft environment.

### Network Security

- » **Network isolation through segregation (VLANs).** A virtual local area network (VLAN) is a subdivision of a local area network at the datalink layer of the protocol stack. Network security can be improved by separating data traffic into multiple VLANs. Then, groups of users can be assigned to each VLAN and differing security policies can be enforced for each workgroup on a per-VLAN basis.

- » **Isolation of storage data traffic and application data traffic.** Network security can be further increased by using dedicated VLANs to isolate storage data traffic and application data traffic between the application and database tiers.
- » **Physically separated systems management network.** In this solution, the systems management network uses a physically separate network infrastructure, including switches, cables, and ports. This isolates management traffic from data traffic and increases network security.
- » **Dedicated cluster interconnect networks.** Using tagged VLANs, a pair of dedicated, redundant, private interconnects is configured for each cluster, ensuring that IP traffic from one cluster does not interfere with IP traffic from another cluster.

#### Storage Security

- » **Restricted access to NFS file systems using NFS exceptions.** Access to NFS file systems on shared storage is restricted to specific hosts or networks using NFS exceptions.
- » **Block storage device security using target groups and initiator groups (iSCSI LUNs).** Target and initiator groups are defined to grant or restrict access to block storage devices. Target groups define which network interfaces the block storage devices are visible on. Initiator groups define which clients have access to which block devices.
- » **Physically isolated data and administrative traffic.** Data traffic and systems management are isolated through the use of physically separate networks and interfaces on Oracle ZFS Storage Appliance.

## Analyzing Solution Performance

To understand the behavior of the architecture under normal and peak load conditions, determine optimum utilization, and verify the scalability of the solution, Oracle engineers tested Oracle Optimized Solution for PeopleSoft running combinations of multiple workloads, OLTP and batch, for each application server. Engineers tested the solution running the workloads individually, then concurrently to evaluate the performance and finally performed failover testing under load to validate system and application availability.

#### Test Environment

The high-level architecture for testing the solution is shown in Figure 10. To provide OLTP loads to the infrastructure, Oracle Application Testing Suite was used and connected through an F5 BIG-IP Application Delivery Controller (ADC), which acts as a load balancer for the environment. F5 has designed and tested a comprehensive Application Ready Solution infrastructure for Oracle's PeopleSoft Enterprise applications. Working with the Oracle Optimized Solutions team, F5 and Oracle engineers have collaborated to generate up to 20,000 concurrent online users for the PeopleSoft HR Self-Service workloads.

The BIG-IP Local Traffic Manager used in this architecture provides application health checking, load balancing, high availability, user persistence, and One-Connect. Health checking using application URLs ensures that only the servers that respond correctly are used to serve the application. Load balancing allows the traffic to be evenly distributed among the virtualized PeopleSoft web servers. High availability is ensured by creating a single virtual server, backed by a pool of multiple physical servers. User persistence is provided based on HTTP cookies. One-Connect is a TCP multiplexing feature that reduces TCP connection load on the server pool.

The OLTP testing process was conducted as follows:

- » The Oracle Application Testing Suite load generator runs scripts to simulate large numbers of simultaneous user requests.
- » The F5 BIG-IP 4200v balances user requests across all of the available web servers running on both SPARC T5-8 servers.

- » Consolidated web, application, and database tiers on the paired SPARC T5-8 servers process the requests, accessing storage on the Oracle ZFS Storage ZS3-4 appliance.

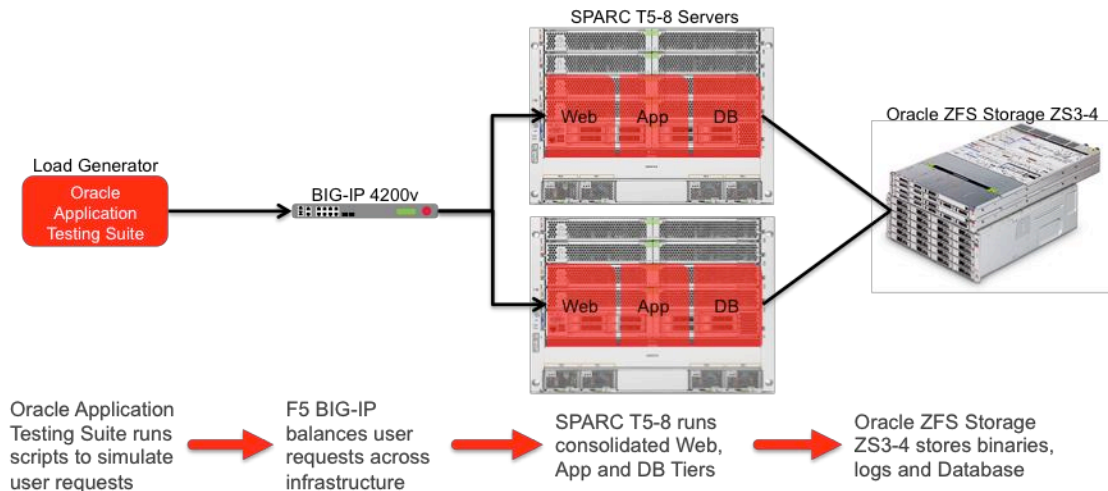


Figure 10. Test environment for Oracle Optimized Solution for PeopleSoft.

## Configuration Details

For the test configuration, dual SPARC T5-8 servers were deployed, along with dual Oracle ZFS Storage ZFS3-4 appliances, and dual Oracle Switch ES1-24 10 gigabit Ethernet switches. Each SPARC T5-8 server was configured with:

- » Eight SPARC T5 3.6 GHz processors from Oracle
- » 2 TB of RAM (128 16GB DDR3-1066 DIMMs)
- » Eight 300 GB 10K rpm 2.5-inch SAS hard disk drives (HDDs)
- » Six dual-port 10 gigabit Ethernet PCIe cards

The server and storage resources were configured as described in the “Solution Architecture” section. Revisions for the various software components used in the solution are listed in Table 5.



**TABLE 5. SOFTWARE REVISIONS UTILIZED IN THE SOLUTION**

Software Revision Utilized
Oracle PeopleSoft Payroll for North America 9.1
Oracle PeopleSoft Human Capital Management 9.1 Feature Pack 2
Oracle PeopleSoft Financials 9.1 Feature Pack 2
Oracle PeopleSoft Supply Chain Management 9.1 Feature Pack 2
Oracle PeopleSoft Campus Solutions 9.0
Oracle PeopleSoft PeopleTools 8.52.02
MicroFocus Server Express 5.1 WP6
Oracle PeopleSoft Payroll for North America 9.1
Oracle Solaris 11.1 SRU 7.5
Oracle VM Server for SPARC 3.0
Oracle Solaris Cluster 4.1 SRU 3
Oracle Database 11.2.0.3.0
Oracle WebLogic Server 10.3.5.0
Oracle Tuxedo, Version 10.3.0.0, 64-bit

Oracle ZFS Storage Appliance was configured with separate application and database pools, as described in Table 6. All shares were enabled for mirroring, along with NFS, and iSCSI access.

**TABLE 6. ORACLE ZFS STORAGE ZS3-4 CONFIGURATION**

Pools	Definition	Sizing
Three application pools	AppHCM (PeopleSoft Human Capital Management (HCM))	547 GB
	AppCampus (PeopleSoft Campus Solutions (CS))	547 GB
	AppFMS (PeopleSoft financial management solutions (FMS))	547 GB
Four database pools	DBHCMDATA (PeopleSoft HCM database)	3.42 TB
	DBHCMREDO (PeopleSoft HCM database redo logs)	808 GB
	DBFMSCSDATA (shared by PeopleSoft FMS and CS databases)	1.87 TB
	DBFMSCSREDO (shared by PeopleSoft FMS and CS redo logs)	821 GB

### Testing Methodology

To test the solution, data was captured for every test run as loads were applied to the system, including CPU utilization, memory usage, I/O stats, and average response time (latency). The collected data was used to further tune the environment and assess the maximum number of concurrent users for which the response times stayed under the target of one second average.

- » Tuning was performed for PeopleSoft workloads running individually.
- » Tuning was then performed for consolidated PeopleSoft workloads running concurrently.
- » High availability was tested by injecting faults while measuring the impact on running workloads.

## PeopleSoft Workloads Used

Different PeopleSoft workloads exert pressure on the system differently, and understanding workload characteristics is essential for designing platforms that consolidate multiple workloads.

### PeopleSoft HR Self-Service Workload

The PeopleSoft HCM HR Self-Service benchmark simulates online users in a very large organization performing typical HCM transactions. Activities include viewing paychecks and updating an employee profile by employees, managers, and human resource administrators, and the benchmark returns values for search and saved transaction times. A business transaction is defined as a series of HTML pages that guide a user through a particular scenario, such as promoting an employee.

As a workload, HR OLTP is extremely application tier-intensive, with most of the activity focused in the PeopleSoft application server. Database usage is minimal and the ratio of Oracle WebLogic Server to PeopleSoft application servers is important. Application server cache files are also very I/O-intensive. There are 14 PeopleSoft business processes tested in the benchmark.

- » *Employee Self-Service* consists of 60% of the workload, and includes:
  - » eProfile. Update employee personal information: update home address, update home phone
  - » eBenefits. View benefits summary, benefits change life
  - » ePay: View paycheck, update direct deposit information, add profile items
- » *Manager Self-Service* consists of 20% of the workload, and includes:
  - » eDevelopment. View employee info
  - » eProfile. Initiate termination
  - » eProfile. Initiate promotion
  - » eCompensation. Initiate employee salary change
- » *HR Administration* consists of 20% of the workload, and includes:
  - » Add a Person, Hire a Person, and Add a Job

### PeopleSoft Payroll Workload

The PeopleSoft Enterprise Payroll (North American) benchmark represents typical batch workloads for a very-large organization processing employee payroll. The application calculates gross to net earnings, deductions and taxes, and is fully integrated with other Oracle's PeopleSoft Enterprise products, allowing for coordination of a wide range of salary, reward, and expense payments. There are 500,480 active employees in the benchmark, and each employee has 11 months of payroll history. In this benchmark there are a total of 500,480 payments, and the workload has five payroll processes tested. The benchmark metric is the cumulative elapsed time taken to complete Paysheet Creation, Payroll Calculation, and Payroll Confirmation business application processes. The other two processes are Print Advice Forms and Create Direct Deposit File.

Payroll is a batch process dependent on COBOL processes. The workload is database intensive, and is thus parallelized into multiple Pay Groups for faster execution. The SPARC T5 processor is ideal for more parallelized job streams, but the higher level of parallelization also results in more I/O traffic.

## PeopleSoft Financials Workload

The PeopleSoft Enterprise Financials benchmark emulates a large enterprise that processes and validates a large number of financial journal transactions before posting the journal entry to the ledger. PeopleSoft Financials are mostly batch oriented, and can be I/O-intensive. Customers expect batch process to complete within given service level agreement (SLA). It is possible to parallelize and run multiple job streams for faster execution.

The validation process certifies that the journal entries are accurate, ensuring that ChartFields values are valid, debits and credits equal out, and that inter/intra-units are balanced. Once validated, the entries are processed, ensuring that each journal line posts to the correct target ledger, and then changes the journal status to "posted." In this benchmark, the Journal Edit and Post is also configured to edit and post PeopleSoft General Ledger Journals accounting for Inter/Intra Unit transactions in multiple currencies, which are validated against combination editing rules with multiple ChartFields. The benchmark processes 20 million journal lines using AppEngine for Edits and COBOL for Post processes.

The two general ledger batch processes measured in this benchmark are:

- » *Journal Edit* validates Journal entries to ensure that each individual ChartField value is valid, that the combination of ChartFields is correct, and that the debit/credit amounts are balanced.
- » *Journal Post* summarizes detailed line activity of journals with valid status and post the aggregated result to detail ledger.

## PeopleSoft Campus Solutions Workload

The PeopleSoft Campus Solutions workloads represent online and batch workloads that simulate a large educational institution where peak load is during student registration. The large number of hardware strands in SPARC T5 processors provides a very good scaling architecture for Campus Solutions workloads. The Process Scheduler and application server are both very CPU intensive and can get extremely busy when students are enrolling for new term. I/O activity is typically moderate.

The PeopleSoft Campus Solutions workloads used to test this Oracle Optimized Solution are comprised of two batch processes and one OLTP process.

- » The two batch processes simulate and calculate the time it takes to print 10,000 invoices and 10,000 transcripts.
- » The online process simulates a typical student enrollment and navigation business process with a data composition of 600K records with five years worth of history. The simulated students log on to PeopleSoft Enterprise and navigate to the student center page to submit eight different online transactions including: enrolling to a class, calculating tuition, making payments, or reviewing degree progress data before signing out. All these transactions are well defined in this workload.

20% of the total number of simulated concurrent users enrolled into different classes, where as the rest of the users engaged in submitting other transactions mentioned above. The PeopleSoft Campus Solutions online business process mix is derived from the following:

- » Accept/Decline Awards
- » Calculate Tuition
- » Drop Class
- » Enrollment Backpack
- » Add Class
- » Load Student Center
- » Make A Payment
- » Schedule Planner Validation

## Performance With Individual Workloads

The sections that follow provide performance results derived from separately testing individual PeopleSoft workloads on the consolidated SPARC T5-8 platform.

### PeopleSoft HR Self-Service 9.1 Performance

To evaluate PeopleSoft HR Self-Service performance, testing was performed with a two-node Oracle RAC database. The testing methodology included the following:

- » Unicode database
- » 10,000 concurrent users per node, two Oracle RAC database nodes, two application server nodes, two web server nodes, no process scheduler
- » Oracle's Direct NFS (dNFS)

The configuration parameters for the test configurations are given in Table 7.

**TABLE 7. PER-TIER CONFIGURATION INFORMATION**

Tier	Configuration	
Web server configuration	Managed servers	40
	Java Virtual Machine (JVM) heap per server	3 GB
Application server configuration	Number of domains	6
	PSAPPSRV per domain	55
	Jolt handlers per domain	250
	Clients per handler per domain	30
Database server configuration	Database System Global Area (SGA)	96 GB

Response times with 20,000 users were under the target of one second average (Table 8).

**TABLE 8. SIMULATING 20,000 CONCURRENT USERS ON TWO NODES WITH AN ORACLE RAC DATABASE**

### Resource Allocations

Virtual Machine (LDOM)	Processors (Cores)	Memory
Web	1 (16 cores)	2 TB
Application	5 (80 cores)	
Database	4 (64 cores)	2 TB

### Resource Utilization

Tier	% CPU (Node 1/2)	Memory
Web	18/20	60/60 GB
Application	7/8	87/90 GB
Database	5/5	99/99 GB

### Average Transaction Response Times

Average search	~1 second
Average save	Under 1 second

### PeopleSoft Payroll 9.1 North America Performance

To evaluate PeopleSoft Payroll 9.3 performance, testing was performed with a dual-node Oracle RAC Unicode database. The configuration parameters for the test configuration are given below, and in Table 9.

- » Unicode database
- » Multiple pay checks
- » Two Oracle RAC database nodes with process scheduler on a single node
- » Oracle's Direct NFS (dNFS)

**TABLE 9. PEOPLESOFT PAYROLL 9.1 CONFIGURATION INFORMATION**

#### Configuration Information

Process scheduler configuration	Domains PSAESRV per domain	1 128/64/32
Database server configuration	Database SGA	96 GB

Testing simulating 500,450 employees was performed on a two-node Oracle RAC database with the process scheduler on a single node (Table 10) and achieved close to 1.7 Millions payments processed per hour.

**TABLE 10. SIMULATING 500,450 EMPLOYEES WITH A TWO-NODE NODE ORACLE RAC DATABASE**

Business Process	Database 64 Cores – 2 Nodes		Process Scheduler 40 Cores – 1 Node	
	CPU (%)	Memory (GB)	CPU (%)	Memory (GB)
Payroll 128 job streams	13/8	111/108	12	34
Payroll with 64 job streams	7/6	104/105	6	17
Payroll with 32 job streams	4/3	105/101	4	9

Average Transaction Response Times	Payments per hour	Payments per minute
128 job streams	1.66 million	27,700
64 job streams	1.26 million	21,000
32 job streams	0.79 million	13,150

## Consolidated HR Self-Service and PeopleSoft Payroll for North America Performance

To understand the impact of consolidating multiple PeopleSoft applications on the same platform, testing was performed that combined both PeopleSoft HR Self Service and North American Payroll. A consolidated workload of 20,000 concurrent PeopleSoft HR Self-Service users and 500K employees payroll was run with a two-node Oracle RAC database. The tested configuration included:

- » Two workloads running concurrently with two-node Oracle RAC database
- » OLTP workload consisting of PeopleSoft HR Self-Service with 20,000 users (10,000 users per node), two Oracle RAC database nodes, two application server nodes, and two web server nodes
- » Batch workload consisting of PeopleSoft Payroll for North America with two Oracle RAC database nodes and the process scheduler on a single node.

Configuration information is listed in Table 11 and performance information in Table 12.

**TABLE 11. PER-TIER CONFIGURATION INFORMATION (20,000 CONCURRENT PEOPLESOFT HR SELF-SERVICE USERS AND 500K EMPLOYEE PAYROLL)**

Tier	Configuration	
Web server configuration	Managed servers	40
	JVM heap per server	3 GB
Application server configuration	Number of domains	6
	PSAPPSRV per domain	55
	Jolt handlers per domain	250
	Clients per handler per domain	30
Database server configuration	Database SGA	96 GB

Response times with 20,000 users were under the target of one second average while the Payroll batch workload processed over 1.4 Millions payments per hour.

**TABLE 12. SIMULATING 20,000 CONCURRENT USERS AND 500K EMPLOYEE PAYROLL WITH ORACLE RAC**

### Resource Allocations

Virtual Machine (LDOM)	Processors (Cores)	Memory
Web	1 (16 cores)	2 TB
Application	5 (80 cores)	
Database	4 (64 cores)	2 TB

### Resource Utilization

Tier	% CPU (Node 1/2)	Memory
Web	21/19	60/60 GB
Application	16/7	93/82 GB
Database	10/11	101/103 GB

### Average Transaction Response Times

Employee payroll (128 job streams)	1.41 million payments per hour 23,500 payments per minute
HR Average search	~1 second
HR Average save	Under 1 second

### PeopleSoft Financials General Ledger 9.1 Performance

Oracle engineers tested PeopleSoft General Ledger 9.1 FP2 with the following configuration:

- » Unicode database
- » Combination edit
- » Two-node configuration with two Oracle RAC nodes and process scheduler on a single node
- » Kernel NFS (kNFS)
- » A 20 million entry edit and post journal.

The results of the testing are shown in Table 13. With 32 concurrent jobs, the workload processed over 2.8 Millions journal lines per minute.

**TABLE 13. SIMULATING 20 MILLION EDIT AND POST JOURNAL USING AN ORACLE RAC DATABASE**

Business Process	Database 32 Cores		Process Scheduler 8 Cores		Journal Lines per Minute
	CPU (%)	Memory (GB)	CPU (%)	Memory (GB)	
Journal lines with 32 streams	7/13%	96/97 GB	4%	3.5 GB	2,868,852
Journal lines with 16 streams	6/3%	97/96 GB	2%	1.5 GB	1,881,520

### PeopleSoft Campus Solutions 9.0 OLTP Performance

Testing of PeopleSoft Campus Solutions was performed to characterize both standalone and consolidated performance. Testing included:

- » Self-Service OLTP testing simulating 8,000 concurrent users
- » Batch testing to generate 10,000 invoices and 10,000 transcripts
- » Consolidated performance testing 5,000 concurrent users and 10,000 invoices and 10,000 transcripts

Table 14 illustrates the configuration of the system for OLTP performance testing that included:

- » Non-Unicode database
- » Two-node configuration with two Oracle RAC nodes
- » Oracle's Direct NFS (dNFS)

**TABLE 14. PER-TIER CONFIGURATION INFORMATION (8,000 CONCURRENT PEOPLESOFT CAMPUS SOLUTIONS USERS)**

Tier	Configuration	
Web server configuration	Managed servers	16
	JVM heap per server	3 GB
Application server configuration	Number of domains	2
	PSAPPSRV per domain	40
	Jolt handlers per domain	200
	Clients per handler per domain	20
Database server configuration	Database SGA	32 GB

Table 15 provides the performance information from PeopleSoft Campus Solutions OLTP testing with 8,000 concurrent users and an average response time under one second.

**TABLE 15. SIMULATING 8,000 CONCURRENT USERS WITH A TWO-NODE ORACLE RAC DATABASE**

**Resource Allocations**

Virtual Machine (LDOM)	Processors (Cores)	Memory
Web/Application	1 (16 cores)	2 TB
Database	1 (16 cores)	

**Resource Utilization**

Tier	% CPU (Node 1/2)	Memory
Web	5/3	23/22 GB
Application	33/24	12/13 GB
Database	6/6	32/32 GB

**Average Transaction Response Times**

Logon	< 0.5 second
Load student	< 0.5 second
Page load	90% < 1 second; 10% 2-3 seconds
Page save	1-2 seconds

**PeopleSoft Campus Solutions 9.0 Batch Performance**

Batch testing of PeopleSoft Campus Solutions utilized:

- » Non-Unicode database
- » A two-node Oracle RAC configuration, with the process scheduler on a single node
- » Oracle's Direct NFS (dNFS)



Table 16 shows batch performance testing results for PeopleSoft Campus Solutions with almost 200,000 invoices printed per hour and over 80,000 transcripts processed.

**TABLE 16. PROCESSING 10,000 INVOICES AND 10,000 TRANSCRIPTS USING A TWO-NODE ORACLE RAC DATABASE**

Business Process	Database 16 Cores, 1 TB		Process Scheduler 16 Cores, 1 TB	
	CPU (%)	Memory (GB)	CPU (%)	Memory (GB)
Print invoices	1/1	32/32	16	9
Process transcripts	3/2	32/32	14	7

Process (streams)	Throughput
Print Invoice (8 job streams)	197,800 invoices per hour
Process Transcripts (8 job streams)	70,450 transcripts per hour

#### PeopleSoft Campus Solutions 9.0 Combined OLTP/Batch Performance

Once standalone OLTP and batch results were collected, consolidated testing was performed that ran both workloads concurrently. Table 17 and Table 18 illustrate consolidated PeopleSoft Campus Solutions testing results for 5,000 concurrent users and 10,000 invoices and 10,000 transcripts.

**TABLE 17. CONFIGURATION INFORMATION FOR CONSOLIDATED PEOPLESOFT CAMPUS SOLUTIONS TESTING**

Tier	Configuration	
Web server configuration	Managed servers	12
	JVM heap per server	3 GB
Application server configuration	Number of domains	2
	PSAPPSRV per domain	32
	Jolt handlers per domain	200
	Clients per handler per domain	20
Process scheduler configuration	Number of domains	2
	PSAESRV per domain	8
Database server configuration	Database SGA	32 GB

Running OLTP and Batch processes simultaneously, the test demonstrated the 5,000 concurrent online users with one second average response time can be supported while batch processes print over 100,000 invoices per hour and process almost 50,000 transcripts per hour.

**TABLE 18. SIMULATING 5,000 CONCURRENT USERS AND 10,000 INVOICES AND 10,000 TRANSCRIPTS WITH A TWO-NODE ORACLE RAC DATABASE**

**Resource Allocations**

Virtual Machine (LDOM)	Processors (Cores)	Memory
Web/Application	1 (16 cores)	2 TB
Database	1 (16 cores)	

**Resource Utilization**

Tier	% CPU (Node 1/2)	Memory
Web	2/2	17/17
Application	16/16	11/10
Database	5/4	32/32

**Batch Processing**

10,000 invoices (8 job streams)	108,430 invoices per hour
10,000 transcripts (8 job streams)	47,870 transcripts per hour

**Student Self-Service (OLTP)**

Average logon	< 0.5 seconds
Average load student center	< 0.5 seconds
Average page load	90% of transactions < 1 second 10% of transactions 2-3 second
Average page save	1-2 seconds

**Performance With Consolidated Workloads**

To evaluate the consolidated performance of Oracle Optimized Solution for PeopleSoft, performance testing was performed running all six workloads concurrently onto a single redundant SPARC T5-8-based server platform. All the stand-alone workloads tested previously were combined and run simultaneously on the platform, including:

- » PeopleSoft HCM:
  - » OLTP: PeopleSoft HR Self-Service with 15,000 users
  - » Batch: PeopleSoft Payroll North America with 500,480 payments
- » PeopleSoft Financial Management Solutions
  - » Batch: General Ledger with 20,282,788 journal lines
- » PeopleSoft Campus Solutions
  - » OLTP: Self-service with 5,000 users
  - » Batch: Invoice printing with 10,000 invoices
  - » Batch: Transcript processing with 10,000 transcripts

Note: The average CPU and memory utilization statistics are for the 60-minute duration where 4 batch processes along with 5,000 Campus Solutions users and 15,000 HR users ran concurrently for the first 7 minutes. (Print

Invoice batch completed first). Once the last batch process completed after 32 minutes, only the Campus Solutions and HR OLTP tests ran concurrently for the rest of the 28 minutes.

Table 19 shows the resource allocation for the consolidated testing.

**TABLE 19. RESOURCE ALLOCATION FOR THE CONSOLIDATED WORKLOAD TESTING**

Application	Component	Sockets	Cores	Memory
PeopleSoft HCM	Database server	4	64	4 TB shared across all application components running on two SPARC T5-8 servers (2 TB per server)
	Application server / process scheduler	5	80	
	Web server	1	16	
PeopleSoft Financial Management Solutions	Database server	2	32	
	Process server	1	16	
PeopleSoft Campus Solutions	Database server	1	16	
	Application server / Process scheduler / web server	1	16	

Results from the consolidated workloads testing are shown in Table 20.

The environment was capable of sustaining simultaneously 15,000 HCM HR Self-Service users and 5,000 Campus Student Self-Service users while processing 1.2 Millions Payroll payments per hour, 2.4 Millions General Ledger journal lines per minute, over 91,000 Campus invoices printed per hour and over 44,000 Campus transcripts processed per hour.

**TABLE 20. CONSOLIDATED WORKLOAD TESTING WITH COMBINED WORKLOADS RUN SIMULTANEOUSLY**

Application	Workload	Type	Load	Result
PeopleSoft HCM	Self-Service	OLTP	15,000 users	Average search: ~ 1 second Average save: < 1 second
	Payroll	Batch	500,480 payments	1,177,600 Payments per hour
PeopleSoft Financials	General Ledger	Batch	20,282,788 journals	2,366,720 journal lines per minute
PeopleSoft Campus Solutions	Student self-service	OLTP	5,000 users	Average logon < 0.5 seconds Average Load < 0.5 seconds Page Load 80% < 1 second, 15% 2-3 seconds, 5% 3-3.5 seconds Page Save 1-2 seconds
	Invoice printing	Batch	10,000 invoices	91,185 invoices per hour
	Transcript processing	Batch	10,000 transcripts	44,280 transcripts per hour

## Performance Results Analysis

In order for a consolidated system to be acceptable, it must demonstrate performance levels that are competitive with stand-alone application deployments. Oracle's consolidated application performance testing has shown that the Optimized Solution for PeopleSoft provides a very compelling solution in terms of performance. Table 21 lists performance metrics for all of the consolidated applications, comparing performance results from the consolidated workloads with those seen in individual workload testing. These results show that Oracle Optimized Solution for PeopleSoft provides substantial consolidation benefits, such as simplification and high efficiency, while delivering very attractive performance metrics that make the platform an ideal PeopleSoft consolidation infrastructure.

**TABLE 21. CONSOLIDATED WORKLOAD COMPARED TO INDIVIDUAL WORKLOAD PERFORMANCE RESULTS**

Application	Individual Workload	Consolidated Workload
PeopleSoft HCM: HR Self-Service	20,000 users with sub-second response times	15,000 users with sub-second response times
PeopleSoft HCM: Payroll North America	Up to 1.7 million payments per hour	Up to 1.2 million payments per hour
PeopleSoft financial management solutions: General Ledger	Up to 2.9 million journal lines processed per minute	Up to 2.4 million journal lines processed per minute
PeopleSoft Campus Solutions	8,000 self-service users 197,800 invoices per hour 70,450 transcripts per hour	5,000 self-service users 91,185 invoices per hour 44,280 transcripts per hour

## Analyzing Solution Availability

While consolidation solutions are very compelling from a cost and simplification perspective, it is critical that they also deliver in terms of service availability. Oracle Optimized Solution for PeopleSoft is specifically designed to offer a high availability solution for PeopleSoft deployments that ensures minimum-to-no service level impact by ensuring fast detection times, short failover times and automated recovery to fully redundant infrastructure.

To evaluate the fault tolerance characteristics of the solution, Oracle engineers subjected the functioning system to a number of targeted failure injections. The goal was to evaluate the ability of the consolidated platform to ensure little to no disruption to user activities while software and hardware failures were occurring. To simulate an environment as close as possible to a real world deployment, the availability testing was performed under a combination of OLTP and batch workloads.

- » OLTP workload: PeopleSoft HCM HR Self-Service with 2,000 very aggressive Oracle Application Testing Suite users (configured with no Think Time, and 20 seconds of Iteration Delay)
- » Batch workload: PeopleSoft Financials general ledger with a 20-million edit and post journal.

In order to test the capability of the architecture in the worst-case scenario, the maximum components were artificially placed on the node that was subjected to intentional fault injections.

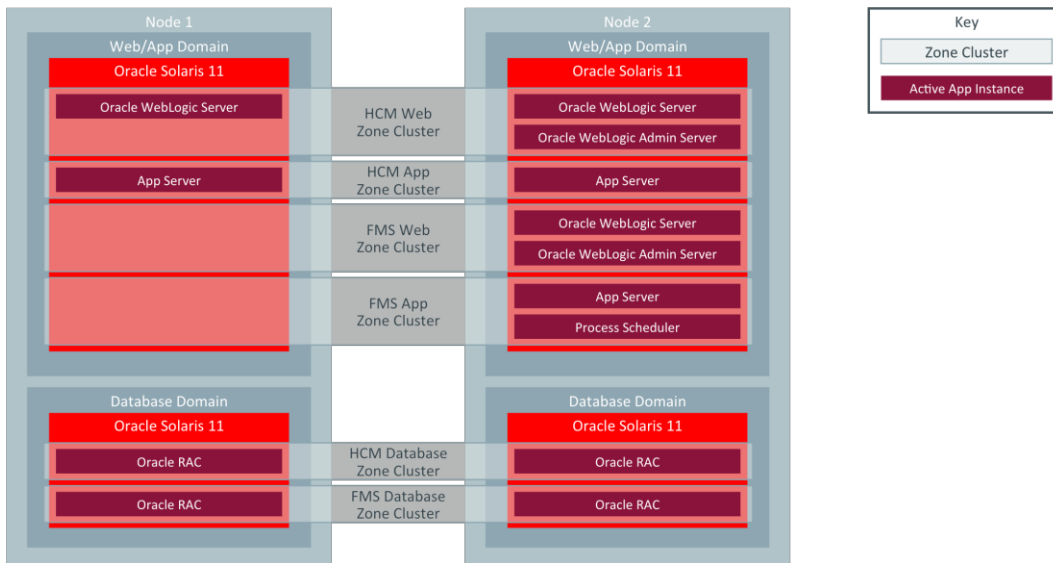


Figure 11. Availability test environment initial state.

## Compute Tier Fault Injections

### Forcing a Web Server Failure

This test was designed to evaluate the loss of all the Oracle WebLogic server instances running in the HCM Web zone cluster on node 2, affecting the virtualized web servers for PeopleSoft HCM HR Self Services. The failure was introduced with a process kill (pkill) command with the system under load. PeopleSoft HCM HR Self Services was the only workload running during this test as it only impacts the HCM OLTP workloads. As shown in Table 22, the solution provided extremely fast detection and recovery times.

**TABLE 22. FAILURE RESPONSE TO LOSS OF THE WEB SERVER INSTANCES ON ONE NODE**

Task	Time	Observations
Failure detection	0 second	Immediate failure detection
PeopleSoft HCM Web services recovery	From 1 min 16 secs to 2 mins 25 secs	The Web Server instances were automatically restarted on Node 2. The first instance recovered after 1 minute and 16 seconds, the last after 2 minutes and 25 seconds.
PeopleSoft HCM Recovery back to full redundancy	2 mins, 25 secs	All failed Web server instances automatically restarted and back to initial redundancy within less than 3 minutes without human intervention.

### Forcing an App Server Failure

This test case was designed to evaluate the loss of all the Application server instances running in the HCM App zone cluster on node 2, affecting the virtualized app servers for PeopleSoft HCM HR Self Services. The failure was introduced with a process kill (pkill) command with the system under load. PeopleSoft HCM HR Self Services was the only workload running during this test as it only impacts the HCM OLTP workload. As shown in Table 23, the solution provided extremely fast detection and recovery times.

**TABLE 23. FAILURE RESPONSE TO LOSS OF THE APP SERVER INSTANCES ON ONE NODE**

Task	Time	Observations
Failure detection	9 to 17 seconds	Near Immediate failure detection
PeopleSoft HCM App services recovery	From 1 min 40 secs to 1 min 49 secs	The App Server instances were automatically restarted on Node 2. The first instance recovered after 1 minute and 40 seconds, the last after 1 minute and 49 seconds.
PeopleSoft HCM Recovery back to full redundancy	2 mins, 06 secs	All failed App server instances automatically restarted and back to initial redundancy within less than 3 minutes without human intervention.

### Forcing a Web / Application Domain Failure

This test was designed to evaluate the loss of an application domain containing four Oracle Solaris Zone clusters, affecting virtualized web and application servers for both PeopleSoft HCM and financial management solutions. The failure was introduced by a forced domain panic with the system under load with the consolidated workload as described above. In addition to the components providing the workload processing, the failure also impacted the HCM WebLogic Admin Server, FMS WebLogic Server and Admin Server, FMS App server. These components were also recovered by Oracle Solaris Cluster. As shown in Table 24, the solution provided extremely fast detection and recovery times.

**TABLE 24. FAILURE RESPONSE TO LOSS OF A WEB / APPLICATION DOMAIN**

Task	Time	Observations
Failure detection	1 sec	Immediate failure detection
PeopleSoft HCM and application services recovery	13 secs	PeopleSoft HCM services to impacted users recovered in 13 seconds, all users able to continue HR transactions without errors 14 seconds after outage event.
PeopleSoft financial management solutions process scheduler recovery	2 mins 25 secs	PeopleSoft financial management solutions environment able to process batch jobs without errors 2 minutes 26 seconds after outage event.
PeopleSoft HCM back to full redundancy	9 mins 58 secs	Failed domain automatically restarted with all application instances back to initial redundancy within less than 10 minutes without human intervention.

### Forcing a Control Domain Failure

This test was designed to evaluate the loss of a control domain providing 2 virtual disks to the database domain and one virtual switch used by one virtual network interface (for the management network) in the database domain. The failure was introduced by a forced domain panic with the system under load with the consolidated workload as described above. As shown in Table 25, the solution provided extremely fast detection and recovery times.

Note: By design, there is no PeopleSoft workload running in the control domain.

**TABLE 25. FAILURE RESPONSE TO LOSS OF A WEB / APPLICATION DOMAIN**

Task	Time	Observations
Failure detection	17 sec	Near immediate failure detection
Virtual I/O and Virtual disks Redundancy recovery	1 min 40 secs	Control Domain restarted and I/O redundancy recovered in 1 minute 40 seconds. No Impact on HR transactions or FMS batch processes.

**Forcing a Database Domain Failure**

Database domain failure was also tested. In this case, the database domain was intentionally taken down with a forced panic, affecting Oracle RAC database instances for both PeopleSoft HCM and PeopleSoft Financials. In addition, as with the previous test, the failure also impacted the HCM WebLogic Admin Server, FMS WebLogic Server and Admin Server, FMS App server. Detection and recovery times from the outage are shown in Table 26.

**TABLE 26. FAILURE RESPONSE TO LOSS OF A DATABASE DOMAIN**

Task	Time	Observations
Failure detection	0 sec	Immediate failure detection
PeopleSoft HCM database services recovery	30 secs	PeopleSoft HCM services to impacted users recovered in 30 seconds after outage event occurred, all users able to continue HR transactions without errors.
PeopleSoft financial management database services recovery	25 secs	PeopleSoft financial management solutions environment able to process batch jobs without errors 25 seconds after outage event.
PeopleSoft HCM database services recovery back to full redundancy	14 mins 25 secs	Failed domain automatically restarted with all database instances back to initial redundancy within less than 15 minutes, without human intervention.
PeopleSoft FMS database services back to full redundancy	14 mins 12 secs	Failed domain automatically restarted with all application instances back to initial redundancy within less than 15 minutes without human intervention.

**Forcing a SPARC T5-8 Server Node Failure**

Finally, fail-over testing was performed by initiating an ungraceful failure of a complete compute node through a "dirty power off". The failed node contained the all of the active components before power was removed. Recovery times from the outage are shown in Table 27.

**TABLE 27. FAILURE RESPONSE TO LOSS OF A COMPLETE SPARC T5-8 SERVER NODE**

Task	Time	Observations
Failure detection	10 secs	Near immediate failure detection; 9 seconds for Web/App domain, 10 seconds for database domain
PeopleSoft HCM web and application services recovery	11 secs	PeopleSoft HCM services to impacted users recovered in 25 seconds after outage event occurred, all users able to continue HR transactions without errors 35 seconds after outage event occurred
PeopleSoft HCM database services recovery	25 secs	
PeopleSoft financial management database services recovery	28 secs	PeopleSoft financial management solutions environment able to process jobs without errors 2 minutes, 45 seconds after outage event occurred.
PeopleSoft financial management database services recovery	2 mins 35 secs	

**Failover Testing Analysis**

The combined fail-over testing demonstrated that the consolidation of PeopleSoft environments on SPARC T5-8 servers delivers very high availability for mission-critical PeopleSoft enterprise deployments. Using the Oracle Solaris Cluster framework, the observed failure detection time was within seconds, and the end-to-end service recovery time was under one minute in all test cases. These findings show that there would be very little to no impact to end users, even in the event of a catastrophic failover of a whole system. Best of all, no human intervention is required for fail-over and recover to full redundancy unless a whole system shuts down. Table 28 summarizes detection and recovery times for the three fail-over test cases.

**TABLE 28. FAILURE DETECTION AND RECOVERY SUMMARY FOR DOMAIN AND COMPLETE SYSTEM FAILURE**

Test Case	Detection	Recovery
Application domain failure	1 sec	OLTP: 13 seconds Batch: 2 minutes, 25 seconds
Database domain failure	0 sec	OLTP: 30 seconds Batch: 25 seconds
Node failure with web, application, and database tiers	10 secs	OLTP: 25 seconds Batch: 2 minutes 35 seconds



## Network Tier Fault Injections

To validate the network architecture and configuration, testing was conducted where one of the 10 GbE switches was shut down while the environment was running a combination of OLTP and batch workloads.

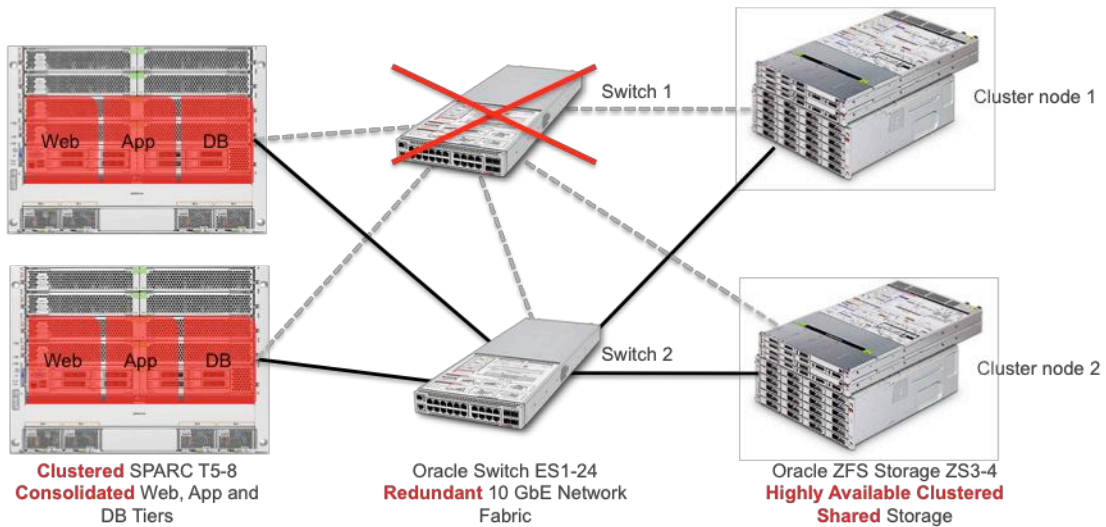


Figure 12. Network switch failure simulation.

On the degraded environment the HCM HR workload stayed stable at 2,000 users with no failed transactions and no users with errors. The Financials batch process completed successfully with a completion time 20 seconds longer than baseline (7 minutes 43 seconds vs. 7 minutes 23 seconds).

## Storage Tier Fault Injections

### Storage Controller Planned Failure

The goal of this test was to simulate a planned outage of one of the Oracle ZFS Storage Appliance such as when one of the controller heads requires to be taken offline for planned servicing. The test was conducted under the same combination of OLTP and batch workloads as previously. A Takeover command was issued on controller node 2 to gracefully take over control of all the resources owned by head 1.

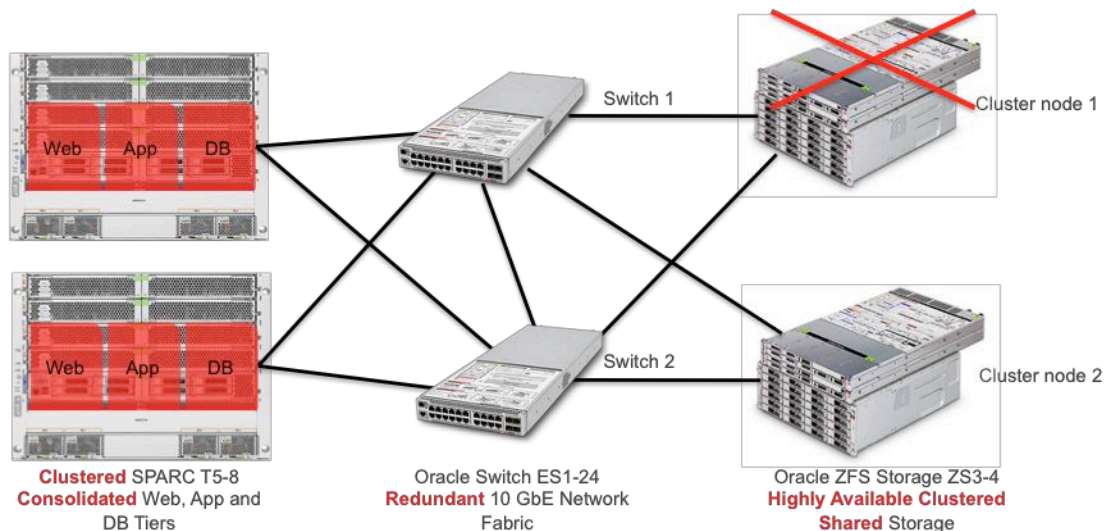


Figure 13. Planned outage of one of the storage controller heads.

On the degraded environment the HCM HR workload stayed stable at 2,000 users with a drop in transactions per second for one minute and 49 seconds during takeover process but no failed transactions and no users with errors. The Financials batch process completed successfully with a completion time 2 minutes and 11 seconds longer than baseline (9 minutes 34 seconds vs. 7 minutes 23 seconds).

#### Storage Controller Power Loss Failure

This test is similar to the previous except that the goal was to simulate an ungraceful power down outage of one of the ZFS Storage Appliance heads such as in the event of a power loss. The test was conducted under the same combination of OLTP and batch workloads as previously. The command “stop /SYS -f” was issued from the ILOM service processor on ZFS SA controller node 1 to simulate a power outage.

On the degraded environment the HCM HR workload stayed stable at 2,000 users with a drop in transactions per second to zero for less than 2 minutes with failed transactions and users with errors. The Financials batch process completed successfully with a completion time 2 minutes and 2 seconds longer than baseline (9 minutes 25 seconds vs. 7 minutes 23 seconds).

#### Availability Results Analysis

Our testing using real world workloads has shown that the architecture and configuration recommended in Oracle Optimized Solution for PeopleSoft ensure application fault tolerance with little to no impact on end users activity in the event of a failure in the compute, network or storage tiers. Failure detection is immediate and failover mechanisms are in place to guaranty no service level impact. In addition recovery mechanisms automatically return the infrastructure to a fully redundant state by restarting the failed components within seconds of the failure event.

## Best Practices for Optimizing Application Performance

Workload optimization is vital to achieving the best possible deployment results. Testing revealed several best practices that organizations can use to achieve optimal deployment availability and performance. The following sections outline the particular settings addressed and apply to the majority of batch and online PeopleSoft workloads.

The values provided in this section should be adapted and tuned according to the specific environment and configuration.

### Best Practices for PeopleSoft Batch Processes

One recommended practice for configuring workload processes is to create concurrent batch jobs. The following steps set up batch jobs that execute concurrently:

- » Increase Max Concurrent of Cobol SQL processes to desired number of concurrent Batch job streams
- » Create multiple PSAESRV processes on the process scheduler server.
- » Set the value of Max Instances to the desired number in the [PSAESRV] section of the psprcs.cfg configuration file.
- » Log in to PeopleSoft Internet Architecture (PIA) and set the same value for the Max API Aware field in the Process Scheduler -> Servers -> PSUNX -> Server Definition Web interface. The Max API Aware value should be larger than, or equal to, the total of Max Concurrent values set for all of the process types including Application Engine and Cobol SQL.
- » Split the workload into multiple batch jobs.

### Temporary Files

While executing business transactions, PeopleSoft Application Server creates and destroys temporary files dynamically and transparently in the `/var/tmp` directory on Oracle Solaris. This behavior may keep the underlying I/O device busy under load. On a very busy system, the I/O device could become a bottleneck and significantly slow transaction execution. In such situations, replacing the I/O device with a high performing device or pointing the `/var/tmp` to the temporary filesystem, `/tmp`, can improve the performance of the application server.

For example:

```
# mv /var/tmp /var/tmp_orig ; ln -s /tmp /var/tmp
```

### Optimize Oracle Database

There are a few recommended database practices when running PeopleSoft Batch workloads.

#### Data Partitioning

Partitioning is a data volume management technique that addresses the key problem of supporting very large tables and indexes by allowing tables and indexes to be broken down into smaller and more manageable pieces called partitions. It is a good idea to partition hot tables that contain millions of records. Once partitions are defined, SQL statements can access and manipulate the data in smaller partitions rather than the entire table or index. It is advisable to choose a partition key that will allow each concurrent job stream to operate on an individual partition.

#### Optimize Statistics

By default, Oracle Database 10g and 11g database use the Oracle Cost-Based Optimizer. When using the Oracle Cost-Based Optimizer, table and index statistics play a vital role in query performance. Maintaining these statistics is critical to optimal database and query performance. From time to time, gather statistics for objects where the

statistics become stale over time because of changing data volumes or changes in column value. New statistics should be gathered after a schema object's data or structure are modified in ways that make the previous statistics inaccurate. In general we generate statistics without histogram.

For example, after loading a significant number of rows into a table, collect new statistics on the number of rows. After updating data in a table, new statistics on the average row length are needed. PeopleSoft recommends gathering the statistics for the whole schema and for each individual table with the following SQL queries:

```
DBMS_STATS.GATHER_SCHEMA_STATS (ownname => [table_owner], ESTIMATE_PERCENT =>
DBMS_STATS.AUTO_SAMPLE_SIZE, method_opt => 'FOR ALL INDEXED COLUMNS SIZE 1');
DBMS_STATS.GATHER_TABLE_STATS (ownname => [table_owner], tabname => table_name]
ESTIMATE_PERCENT => DBMS_STATS.AUTO_SAMPLE_SIZE, method_opt=> 'FOR ALL INDEXED COLUMNS
SIZE 1', CASCADE => TRUE);=
```

### Database Indexes

Indexes are vital to database operation. Several best practices can help to optimize database indexes:

#### Exercise Caution When Creating New Indexes

Performance issues may or may not be caused by a missing index. Be careful about adding new indexes to resolve a performance issue. If a new index appears to resolve a critical performance problem, monitor the overall performance of the database, not just the targeted query. It is critical to ensure that the new index does not cause unintended side effects.

#### Keep Indexes from Affecting DML Operation Performance

If Oracle Data Manipulation Language (DML) statements that modify data—such as `INSERT`, `UPDATE`, or `DELETE`—are being executed many times on a table, make sure that the addition of a new index on the same table does not negatively affect the performance of the DML operations. This is generally not a problem if the SQL queries being executed are retrieving—but not adding or modifying—the existing data. In all other cases, there is some index maintenance overhead. For example, if 10 indexes are created on a table named `TEST`, adding a new row of data to the `TEST` table may require the database management system to update all 10 indexes.

#### Instrument Indexes on Heavily Operated Tables

From time to time, the indexes on heavily operated tables should be instrumented and the index usage monitored for periods of bursty database activity. To instrument an index to monitor usage, run the following SQL command:

```
ALTER INDEX <INDEX_NAME> MONITORING USAGE;
```

To stop monitoring the index usage once database activity declines, run:

```
ALTER INDEX <INDEX_NAME> NOMONITORING USAGE;
```

#### Validate Instrumentation

Once instrumented, query the `V$OBJECT_USAGE` view in the database intermittently to check whether the instrumented index is being used in executing any SQL queries.

```
SELECT USED, START_MONITORING
FROM V$OBJECT_USAGE
WHERE INDEX_NAME LIKE '%<INDEX_NAME>%'
/
```

### Function-Based Indexes

Function-based indexes with descending columns are being recreated as regular indexes with ascending columns.

## Object Privileges

Ensure the database user `PSADMIN` has the privilege to select rows from `V$MYSTAT` and `V$SESSION` views. Missing the `SELECT` privilege on those views could lead to a number of cursor invalidations and cause the database to eventually exhibit poor performance under load on the system.

```
GRANT SELECT ON V_$MYSTAT to PSADMIN;  
GRANT SELECT ON V_$SESSION to PSADMIN;
```

## Database Initialization Parameters

For best performance, Oracle recommends setting certain database initialization parameters to match the specific PeopleSoft PeopleTools and Oracle Database versions running in the environment. These parameters should be set in a `PFILE` or a Server Parameter File (`SFILE`), depending on which is the designated Oracle Database initialization parameter file (`SFILE` in our test environment). For more information, see Oracle Support document ID 747587.1, *PeopleSoft Enterprise PeopleTools Certifications*.

To optimize the Oracle RAC database recovery time, the following tuning was also added:

```
alter system set fast_start_mttr_target=20;
```

## Optimizing PeopleSoft OLTP Applications

Some parameters affect different components of the Oracle PeopleSoft environment and should be modified to obtain the best possible results.

### Best Practices for Configuring PeopleSoft OLTP Applications and Web Servers

For optimal performance, the following settings in Table 29 should be modified in the `psappsrv.cfg` file:

**TABLE 29. PEOPLESOFT OLTP APPLICATION AND WEB SERVER PARAMETERS IN PSAPPSRV.CFG**

#### Key Jolt Listener Settings

Min Handlers=XX	The minimum number of handlers should be at least the expected concurrency divided by <b>Max Clients per Handler</b> . For example, if 100 users is the expected concurrency, <b>Min Handlers</b> should be set to a value superior to $100/10 = 10$ .
Max Handlers=XY	A few additional handlers should be configured to handle peak loads.
Max Clients per Handler=XZ	The default value for <b>Max Clients per Handler</b> is 40, for our tests we used a value of 10. In a production environment with large numbers of concurrent users this value should be higher than 10.

#### Key PSAPPSRV Settings

Min Instances=YX	This value should be monitored and adjusted depending on the workload. The general value for minimum instances used in this test is one PSAPPSERV process per 100 concurrent users. For example, if the expected concurrency is 500 users, set <b>Min Instances = Max Instances = 5</b> .
Max Instances=YY	<b>Max Instances</b> should always be set to a value superior to the value of <b>Min Instances</b> .

#### Other Key PSAPPSRV Settings (PeopleSoft HRMS)

Recycle Count=ZX	To minimize disruptions, <b>PSAPPSERV recycle count</b> was set to zero (0) during our testing. However, in a production environment, this value should always be higher than zero and adjusted depending on the frequency of restarts of the domain and on the amount of memory.
------------------	---

Oracle also recommends monitoring the PSAPPSRV queue size. Using the `psadmin` command line utility, monitor the PSAPPSRV queue size and increase or decrease the number of PSAPPSRV instances as needed.

### PeopleSoft Application Server Cache (PeopleSoft HCM HR)

In order to improve responsiveness, the PeopleSoft Application Server tries to minimize database access by caching metadata and objects in memory and when necessary on the file system. On a busy system, the I/O device(s) that holds the actual cache files could become a bottleneck, causing significant delays in server responses to clients. In such a situation, consider spreading the application server cache files on a high performing I/O device. During this test the cache files were stored in shared storage on Oracle ZFS Storage Appliance.

### Oracle WebLogic Server Settings

There are a number of recommended best practices for configuring Oracle WebLogic Server to obtain optimal performance.

#### Distribute the User Workload for the Web Server Domain

Configure one Web server domain to handle 400 to 500 concurrent users at most. For example, if the expected concurrency is 1200 users, configure at least three identical web domains.

#### Enable Web Server Load Balancing

If multiple application servers are to be used for scalability or reliability purposes, edit

`<web_domain>/applications/peoplesoft/PORTAL/WEB-INF/psftdocs/ps/configuration.properties` to make the Web server balance the load. The following parameter sets the Web server to load balance among server1, server2, through servern in a round-robin fashion:

```
psserver=<server1>:<jslport>,<server2>:<jslport>,...,<servern>:<jslport>
```

#### Modify File Descriptor Settings in the .profile File

For both the Oracle WebLogic application and Web servers, the file descriptor settings should be modified in the `.profile` file to set the shell limit for the number of open files. In addition, modify the value of the parameter `MAX_FILE_DESCRIPTOR` to 4096 in the `PS_HOME/webserve/<domain_name>/bin/setEnv.sh` script to reflect the file descriptor limit configured in `.profile`.

```
/* For the application servers */
ulimit -SH -n 1024

/* For the Web servers */
ulimit -SH -n 4096
```

#### Set the Shell Limit for Open Files in \$WL\_HOME/common/bin/commEnv.sh

If the solution environment uses the Oracle WebLogic Web server, the same Web server shell limit for open files should be set in `$WL_HOME/common/bin/commEnv.sh`. The `ulimit -n` statement is found in the `resetFd()` sub-function in `commEnv.sh`.

```
ulimit -SH -n 4096
```

### Java Virtual Machine Settings

There are also recommended best practices to achieve optimal performance for the Java Virtual Machine.

#### Set Shell Variables in the setEnv.sh File

Edit the `JAVA_OPTIONS_SOLARIS` variable to tune the Java Virtual Machine (JVM) options that are appropriate for the deployment.

For example:

```
JAVA_OPTIONS_SOLARIS="-server -Xms512m -Xmx1024m -XX:PermSize=256m -XX:MaxPermSize=256m -
Dtoplink.xml.platform=oracle.toplink.platform.xml.jaxp.JAXPPPlatform -
Dcom.sun.xml.namespace.QName.useCompatibleSerialVersionUID=1.0 -XX:+DisableExplicitGC -
Xnoclassgc -Xrs -Xss256k -Xverify:none -XX:+UseParallelGC -XX:ParallelGCThreads=4 -
XX:LargePageSizeInBytes=256m -Dweblogic.threadpool.MinPoolSize=50 -
Dweblogic.threadpool.MaxPoolSize=75 -Dweblogic.SocketReaders=10 -
Dweblogic.MuxerClass=weblogic.socket.NIOSocketMuxer -Dweblogic.management.discover=false
-Dweblogic.diagnostics.debug.DebugLogger.DISABLED=true -Dweblogic
.GatheredWritesEnabled=true -Dweblogic.ScatteredReadsEnabled=true -
Dweblogic.configuration.schemaValidationEnabled=false -Djava.net.preferIPv4Stack=true"
```

### Monitor JVM Garbage Collection (GC) Activity

Add the following JVM options to the above parameters:

```
-verbose:gc -XX:+PrintGCDetails -Xloggc:/tmp/gc.$$$.log
```

### Inter-Process Communication (IPC) Settings

The Oracle Solaris project facility lets administrators control resources used by processes and simplify certain parameter settings. For this reason, projects should be used for setting certain parameters such as shared memory size and the maximum number of message queues.

For example, sometimes the default value for the maximum number of message queues (128) cannot handle an application server instance configured for a large number of users. When all message queues are filled, the following error message occurs as the application server processes are booting.

```
Booting server processes ...
exec PSSAMSRV -A -- -C psappsrv.cfg -D CS90SPV -S PSSAMSRV :
Failed.
113954.ben15!PSSAMSRV.29746.1.0: LIBTUX_CAT:681: ERROR: Failure to create message queue
113954.ben15!PSSAMSRV.29746.1.0: LIBTUX_CAT:248: ERROR: System init function
failed, Unixerr = :
msgget: No space left on device
113954.ben15!tmboot.29708.1.-2: CMDTUX_CAT:825: ERROR: Process PSSAMSRV at ben15 failed
with /T
tperrno (TPEOS - operating system error)
```

### Set the Project Resource Control to a Value Larger Than the Default of 128

In the above situation, Oracle recommends setting the project resource control `project.max-msg-ids` to a value larger than the default of 128. As a best practice, Oracle recommends setting the value to double that amount. To increase the `max-msg-ids` to a value of 256, perform the following steps:

» Get the project ID.

```
% id -p
uid=222227(psft) gid=2294(dba) projid=3(default)
```

» Increase the maximum value for the message queue identifiers to 256 using the `prctl` utility.

```
# prctl -n project.max-msg-ids -r -v 256 -i project 3
```

» Verify the new maximum value for the message queue identifiers.

```
# prctl -n project.max-msg-ids -i project 3
project: 3: default
NAME PRIVILEGE VALUE FLAG ACTION RECIPIENT
project.max-msg-ids
privileged 256 - deny -
```

```
system          16.8M  max    deny    -
```

» The following command makes this setting persistent across system reboots.

```
# projmod -p 3 -c "PeopleSoft IPC tuning" -K "project.max-msg-ids=(priv,256,deny)" default
```

### Increase the Size of project.maxshm-memory

By default, the `maximum` shared memory segment size is set to 25% of installed physical memory. If a large System Global Area (SGA) is needed for the database, the `project.maxshm-memory` resource control should be increased so that the database can start successfully. If `project.max-shm-memory` is set too low, Oracle Database outputs the following error during startup:

```
ORA-27102: out of memory
```

The following example illustrates how to increase the maximum allowed shared memory to 32 GB under project default.

```
# projmod -p 3 -c "Fix to ORA-27102 out of mem" -K "project.max-shm-memory=(priv,32G,deny)" default
```

## Best Practices for a Secure PeopleSoft Implementation

A PeopleSoft environment cannot rely solely on perimeter security. A combination of system-wide security measures and best practices—including rule of least privilege, strong authentication, access control, encryption, auditing, disabling of unnecessary services, anti-malware 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, CIS Benchmarks, ISACA publications, or DoD STIGs when designing a PeopleSoft environment.

### Security Technical Implementation Guides (STIGs)

STIGs are continually updated and currently available for Oracle Integrated Lights Out Manager (Oracle ILOM), Oracle Solaris, Oracle Database, Oracle WebLogic, Oracle ZFS Storage Appliance, InfiniBand and Ethernet switches, and Oracle Exadata Storage Servers. A list of STIGs relevant to this solution is shown in Table 30.

TABLE 30. EXAMPLES OF RELEVANT STIGS

STIG Name	Location
Oracle Solaris	<a href="http://iase.disa.mil/stigs/os/unix-linux/Pages/solaris.aspx">iase.disa.mil/stigs/os/unix-linux/Pages/solaris.aspx</a>
Oracle Database 11g Release 2	<a href="http://iasecontent.disa.mil/stigs/zip/Apr2015/U_Oracle_Database_11-2g_V1R3_STIG.zip">iasecontent.disa.mil/stigs/zip/Apr2015/U_Oracle_Database_11-2g_V1R3_STIG.zip</a>
Oracle ILOM	<a href="http://iase.disa.mil/stigs/app-security/database/Pages/exadata_lights.aspx">iase.disa.mil/stigs/app-security/database/Pages/exadata_lights.aspx</a>
Oracle Exadata Storage Server	<a href="http://iase.disa.mil/stigs/app-security/database/Pages/exadata_storage.aspx">iase.disa.mil/stigs/app-security/database/Pages/exadata_storage.aspx</a>
Oracle Sun Data Center InfiniBand Switch 36	<a href="http://iase.disa.mil/stigs/app-security/database/Pages/exadata_infiniband.aspx">iase.disa.mil/stigs/app-security/database/Pages/exadata_infiniband.aspx</a>
Oracle ZFS Storage Appliance	<a href="http://iase.disa.mil/stigs/app-security/database/Pages/exadata_zfs.aspx">iase.disa.mil/stigs/app-security/database/Pages/exadata_zfs.aspx</a>



## Component-Level Security Recommendations

### 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.

### Component Patching

Ensure that all components are using the most recent firmware and software versions to the extent possible. This 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 multi-tier architecture. This enables per-tier security policy monitoring and enforcement mechanisms including network, application, and database firewalls and 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 datasets for any locations that could potentially house sensitive or regulated data. This automatically takes advantage of cryptographic acceleration in Oracle Solaris.

For databases, use Transparent Data Encryption (TDE) to protect tablespaces that may store sensitive or regulated data. This also automatically takes advantage of cryptographic acceleration in Oracle Solaris on SPARC.

### Secure the Database

Refer to Oracle Optimized Solution for 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. These advantages include kernel root kit prevention, prevention of direct memory and device access, and improved control over security configuration (via `zonecfg (1M)`). It 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. Baseline security audit policy should include login/logout activity, administrative actions, and security actions, as well as specific command executions for Oracle Solaris. This enables auditing of a core set of security critical actions without overburdening the system or database.

## 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.

## Strong Authentication

Many intellectual property attacks use stolen credentials. Implementing strong authentication methods, such as Kerberos, RADIUS, and SSL, can help prevent unauthorized access.

## 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 can help alleviate the burden of identity management.

A full list of relevant component security recommendations is shown in Table 31.

**TABLE 31. EXAMPLES OF COMPONENT SECURITY RECOMMENDATIONS**

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

Developer's Guide to Oracle Solaris 11 Security	<a href="https://docs.oracle.com/cd/E36784_01/html/E36855/index.html">docs.oracle.com/cd/E36784_01/html/E36855/index.html</a>
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## PeopleSoft-Specific Security Recommendations

There are also many security recommendations specific to PeopleSoft environments. A list is provided in Table 32.

**TABLE 32. EXAMPLES OF PEOPLESOFT-SPECIFIC SECURITY RECOMMENDATIONS**

Name	Location
Securing Your PeopleSoft Application Environment	<a href="https://download.oracle.com/peopletools/documents/Securing_PSFT_App_Environment_May_2010%20v4.pdf">download.oracle.com/peopletools/documents/Securing_PSFT_App_Environment_May_2010%20v4.pdf</a>
Understanding PeopleSoft Security	<a href="https://docs.oracle.com/cd/E39904_01/hcm92pbr0/eng/hcm/hhaf/concept_UnderstandingPeopleSoftSecurity-e32979.html">docs.oracle.com/cd/E39904_01/hcm92pbr0/eng/hcm/hhaf/concept_UnderstandingPeopleSoftSecurity-e32979.html</a>
Oracle Security Products Integrated with, or Interoperable with, PeopleSoft Applications	<a href="https://oracle.com/us/products/applications/peoplesoft-enterprise/tools-tech/security-products-for-peoplesoft-1932223.pdf">oracle.com/us/products/applications/peoplesoft-enterprise/tools-tech/security-products-for-peoplesoft-1932223.pdf</a>
Security Administration	<a href="https://docs.oracle.com/cd/E38689_01/pt853pbr0/eng/pt/tsec/index.html">docs.oracle.com/cd/E38689_01/pt853pbr0/eng/pt/tsec/index.html</a>
Protecting and Managing PeopleSoft Applications with Database Vault	<a href="https://docs.oracle.com/cd/E38689_01/pt853pbr0/eng/pt/tadm/task_ProtectingandManagingPeopleSoftApplicationswithDatabaseVault-647d21.html">docs.oracle.com/cd/E38689_01/pt853pbr0/eng/pt/tadm/task_ProtectingandManagingPeopleSoftApplicationswithDatabaseVault-647d21.html</a>
Understanding PeopleSoft CRM Security	<a href="https://docs.oracle.com/cd/E41340_01/crm92pbr0/eng/crm/ccrm/concept_UnderstandingPeopleSoftCRMSecurity-0964d7.html">docs.oracle.com/cd/E41340_01/crm92pbr0/eng/crm/ccrm/concept_UnderstandingPeopleSoftCRMSecurity-0964d7.html</a>
PeopleSoft HCM Security Overview (training)	<a href="https://education.oracle.com/pls/web_prod-plq-dad/db_pages.getCourseDesc?dc=D80970">education.oracle.com/pls/web_prod-plq-dad/db_pages.getCourseDesc?dc=D80970</a>
PeopleSoft Security Rel 8.53 (training)	<a href="https://education.oracle.com/pls/web_prod-plq-dad/db_pages.getCourseDesc?dc=D81914">education.oracle.com/pls/web_prod-plq-dad/db_pages.getCourseDesc?dc=D81914</a>

## Conclusion

Beyond consolidating application tiers of a single PeopleSoft application, Oracle Optimized Solution for PeopleSoft provides recommendations and reproducible data points for consolidating multiple PeopleSoft applications onto a single redundant, secure, and scalable platform. The solution provides an integrated software and hardware application stack that is tested and optimized for performance at every level. Oracle's powerful and flexible SPARC T5-8 servers provide the performance and capacity to host multiple PeopleSoft applications, with Oracle's virtualization technologies ensuring isolation and redundancy for key application components. The highly available Oracle ZFS Storage Appliance provides consolidated shared storage for the solution, making it easy to allocate and adjust storage as needs dictate.

Testing for this Oracle Optimized Solution has shown that multiple PeopleSoft applications such as PeopleSoft Human Capital Management, PeopleSoft Financials, and PeopleSoft Campus Solutions can all be effectively consolidated while delivering high performance and fault tolerance. Availability testing has likewise shown that the system can detect and recover from planned or unplanned events in any part of the architecture, keeping systems up and users productive. Moreover, these tests have demonstrated the considerable flexibility and scalability of Oracle's SPARC T5-8 server and Oracle ZFS Storage Appliance, making them ideal building blocks for a consolidation platform designed for the most demanding and business-critical PeopleSoft applications.

## For Additional Information

For more information on Oracle's technology stack for Oracle Optimized Solution for PeopleSoft, see the references listed in Table 33.

**TABLE 33. REFERENCES FOR MORE INFORMATION**





Reference	Location
Oracle Optimized Solutions	<a href="http://oracle.com/optimizedsolutions">oracle.com/optimizedsolutions</a>
Oracle's SPARC T-Series servers	<a href="http://oracle.com/goto/tseries">oracle.com/goto/tseries</a>
Oracle networking products	<a href="http://oracle.com/goto/tseries">oracle.com/goto/tseries</a>
Oracle Solaris	<a href="http://oracle.com/solaris">oracle.com/solaris</a>
Oracle Solaris Cluster	<a href="http://oracle.com/us/products/servers-storage/solaris/cluster/overview/index.html">oracle.com/us/products/servers-storage/solaris/cluster/overview/index.html</a>
Oracle ZFS Storage Appliance	<a href="http://oracle.com/goto/zfs">oracle.com/goto/zfs</a>
Oracle Optimized Solution for Backup and Recovery	<a href="http://oracle.com/us/solutions/oos/oracle-backup-and-recovery/overview/index.html">oracle.com/us/solutions/oos/oracle-backup-and-recovery/overview/index.html</a>
Oracle Optimized Solution for Disaster Recovery	<a href="http://oracle.com/technetwork/server-storage/hardware-solutions/oo-soln-disaster-recovery-1970458.html">oracle.com/technetwork/server-storage/hardware-solutions/oo-soln-disaster-recovery-1970458.html</a>
PeopleSoft Best Practices Center	<a href="http://oracle.com/technetwork/middleware/fmw4apps/peoplesoft/index.html">oracle.com/technetwork/middleware/fmw4apps/peoplesoft/index.html</a>
Oracle Maximum Availability Architecture	<a href="http://oracle.com/goto/maa">oracle.com/goto/maa</a>
"Oracle Solaris and Oracle Solaris Cluster: Extending Oracle Solaris for Business Continuity"	<a href="http://oracle.com/technetwork/server-storage/solaris-cluster/documentation/solaris-cluster-businesscontinuity-168285.pdf">oracle.com/technetwork/server-storage/solaris-cluster/documentation/solaris-cluster-businesscontinuity-168285.pdf</a>
"Best Practices - Top Ten Tuning Tips"	<a href="http://blogs.oracle.com/jsavit/entry/best_practices_top_ten_tuning1">blogs.oracle.com/jsavit/entry/best_practices_top_ten_tuning1</a>



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