ORACLE SPARC SERVERS

ORACLE ZFS STORAGE APPLIANCE

ORACLE SOLARIS 11

Deploy an Efficient, Reliable SAP Landscape on Cost-Effective Oracle Infrastructure

ORACLE WHITE PAPER | AUGUST 2016

ORACLE

Introduction

Over time, as IT departments strive to satisfy demand for applications and users, the SAP landscape expands exponentially. In many cases, adding servers to meet growth requirements leads to a sprawling landscape that suffers from complexity, fragmented management, and high operational costs. Complexity also causes SAP applications to be more prone to security risks and downtime, which can mean lost business opportunities, added expense, and decreased revenues.

In many companies, high service levels for SAP applications are vital because they support strategic business processes linked directly to revenue generation. For this reason, many companies are consolidating SAP applications on a secure, highly available, and cost-effective Oracle infrastructure based on Oracle SPARC T7 servers. This short paper describes an economical yet scalable SAP solution built on a comprehensive Oracle stack. It outlines solution components and technologies, describing the advantages of an efficient, secure, and reliable Oracle infrastructure.

A Simple, Consolidated Architecture

An Oracle solution architecture consolidates SAP Central Services, SAP application servers, and Oracle Database instances on a highly available Oracle infrastructure (Figure 1).

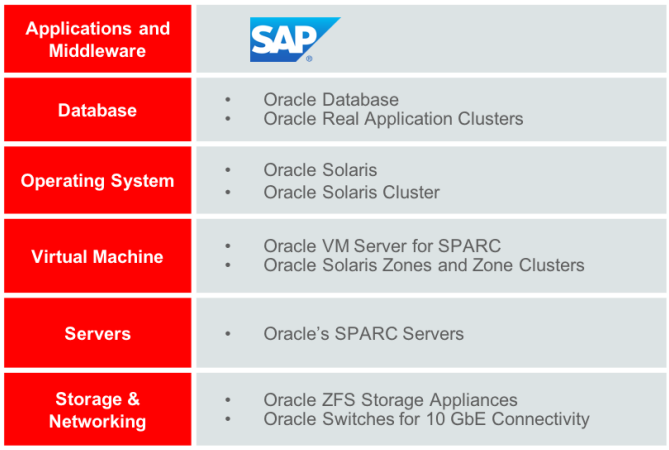

Figure 1. An Oracle infrastructure provides a cost-effective and reliable foundation for consolidating SAP applications.

The solution stack in Figure 1 is based on the following components:

- Oracle Database 12*c* and Oracle Real Application Clusters (Oracle RAC). Oracle Database 12*c* is fully validated and certified for SAP. Oracle RAC supplies a clustered database with a shared cache architecture that supports highly scalable and available database instances.
- Oracle Solaris 11. Optimized for data-driven applications (such as SAP workloads), Oracle Solaris 11 provides high performance, massive threading, and enterprise-level security features. The operating system is specifically engineered for compute and I/O intensive Oracle Database workloads running on Oracle infrastructure.

- Oracle Solaris Cluster. Oracle Solaris Cluster software is configured to provide high availability for SAP systems via failover and multiple master resources, eliminating downtime for critical SAP applications. In addition to providing high availability, clustering SAP application services can also help to increase throughput by balancing load across multiple nodes.
- Built-in virtualization technologies:
  - Oracle VM for SPARC. Built into SPARC M7 processor–based servers, the Oracle VM for SPARC hypervisor controls and partitions resources for virtual environments. In addition, it enables migration of active virtual machines to alternate nodes, enabling replication for cloning, backup, and disaster recovery.
  - Oracle Solaris Zones. Part of the operating system, Oracle Solaris Zones are lightweight containers that provide isolated run-time environments. Processes in one zone cannot impact processes in another, increasing reliability and security. Zone clustering with Oracle Solaris Cluster enables high availability.
- Oracle's SPARC servers. Oracle offers a spectrum of powerful server platforms, including Oracle's SPARC T7 and SPARC M7 server families that are built on SPARC M7 processor technology. The entry-level configuration highlighted in this paper uses redundant SPARC T7-2 servers from the mid-range SPARC T7 server family. Each SPARC T7-2 server features two SPARC M7 CPUs, allowing this configuration to efficiently and economically consolidate SAP application and Oracle Database tiers. By substituting other server models, the solution architecture seamlessly scales.
- Oracle ZFS Storage Appliance. An Oracle ZFS Storage Appliance—such as an Oracle ZFS Storage ZS3-2—provides highly available shared storage that's cost-effective and optimized for database applications. Storage software allows the appliance to receive cues from Oracle Database that promote intelligent I/O processing and automatic optimizations, decreasing the need for manual storage tuning.
- Oracle Ethernet networking. Redundant Oracle Switch ES1-24 switches are configured to create a fault-tolerant high-speed 10 gigabit Ethernet (GbE) fabric to interconnect Oracle infrastructure components.

These Oracle products and technologies are developed synergistically—that is, individual engineering teams design and optimize stack components so that they work better together and deliver superior value. Many customers choose to construct a cost-effective Oracle infrastructure themselves, integrating technologies such as those in this Oracle solution stack for SAP. To speed time-to-production and reduce risk, Oracle Optimized Solution for SAP provides a tested and fully documented architecture that is tuned for optimal performance, security, and availability.

Advantages of Oracle Infrastructure for SAP

Thanks to the constant collaboration of engineering teams across the solution stack, along with the joint efforts on the part of SAP and Oracle development teams, an Oracle infrastructure offers significant advantages and efficiencies for SAP deployments.

Simple and Efficient Consolidation

The density of SPARC T7-2 servers enables efficient consolidation that reduces footprint, conserves energy, and simplifies administration. Solution architects assign system resources (such as CPU cores, memory, I/O, and network devices) to virtualized environments and can reallocate them as needed to improve resource utilization.

Oracle's built-in virtualization technologies enable secure, cost-effective consolidation, allowing SAP application and database servers to run safely in isolated environments on the same physical nodes. Consolidating SAP tiers in this way lowers IT complexity, reduces energy use, and decreases costs. At the same time, virtual server isolation improves application security and reliability.

A Flexible and Scalable Architecture

To match the demands of application workloads as they evolve over time, a SPARC processor–based architecture can easily scale. SPARC T7 servers are available in one, two, or four 32-core SPARC M7 CPU configurations

(Oracle's SPARC T7-1, T7-2, and T7-4 servers, respectively). Solution architects can configure SPARC processor–based servers best suited to the specific workload, site, and budget requirements.

The SPARC processor architecture enables binary compatibility across Oracle's full SPARC server product line. Oracle's SPARC T7 and SPARC M7 servers are fully compatible with Oracle's previous generation SPARC T5 systems. (For more efficient consolidation, however, SPARC M7 processors offer twice as many cores and better performance than that of the SPARC T5 processors.) As Oracle develops new SPARC processor–based servers, such as the recently announced low-end systems based on the SPARC S7 processor (a derivation of the SPARC M7 processor design), they are also binary compatible. This is because SPARC processors adhere to the open and published SPARC architectural specification for the instruction set.

Compatibility across Oracle's SPARC servers means that an Oracle infrastructure is a flexible foundation for SAP deployments. An IT organization might configure small servers (such as single-processor SPARC T7-1 servers) for development (DEV) and quality assurance (QAS), along with cost-effective SPARC T7-2 servers for small production (PROD) workloads (Figure 2). The architecture scales as needed—instead of the systems in Figure 2, configurations can use different SPARC servers with more processors (such as other SPARC T7 models, higher end SPARC M7 servers, or Oracle SuperCluster engineered systems) to meet more demanding SAP requirements.

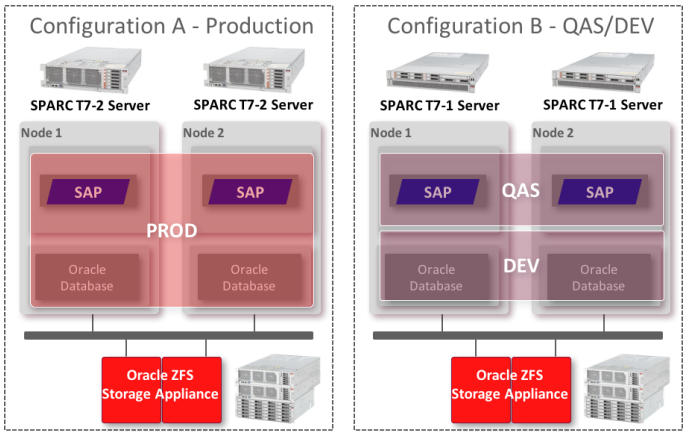

Figure 2. An Oracle infrastructure for SAP is flexible and can easily scale.

Fast Performance

Oracle's SPARC T7-2 servers offer impressive compute performance and I/O throughput for SAP applications. In October 2015, this model produced a world record two-tier result for two processors based on the SAP Standard Application Sales and Distribution (SD) Benchmark.

SPARC M7 processors feature Software in Silicon (SWiS) innovations that allow databases and SAP applications to run faster and with enhanced security. Oracle Database In-Memory, an option for Oracle Database 12*c*, offers a simple in-memory database approach that allows existing SAP applications to access critical database tables loaded into memory. On-chip Data Analytics Accelerators (DAX) can then offload certain Oracle Database In-Memory query processing tasks, operating on in-memory data at full memory speeds. By freeing CPU cores for other tasks, DAX accelerators can boost performance for mixed workloads of OLTP transactions and real-time analytics. (For more information, see "Oracle Database for SAP, Database In-Memory".)

Oracle ZFS Storage Appliance features a hybrid storage design and cache-centric architecture that optimizes storage performance. The appliance caches data automatically using dynamic random access memory (DRAM) or flash, allowing frequently accessed data—often up to 70 to 90 per cent of the total number of I/O operations—to be

served from cache. A multithreaded storage operating system and close integration with Oracle Database also contribute to exceptional I/O performance and efficiency.

Secure Deployments for High Service Levels

Consolidating application and database tiers on an Oracle infrastructure can make it easier to manage an SAP landscape securely and cost-effectively. Simplified infrastructure helps to minimize human error that can sometimes result in security vulnerabilities or data exposure. Following best practices for implementation—such as those defined in Security Technical Implementation Guides (STIGs) for Oracle Database, Oracle Solaris, and Oracle ZFS Storage Appliance—can help to prevent deployment problems and eliminate potential attack vectors.

Oracle also designs safeguards directly into infrastructure stack components. A few examples include:

- Software in Silicon (SWiS) security features. The processors in Oracle's SPARC T7 servers provide innovative, unprecedented memory intrusion protection and comprehensive data encryption. Silicon Secured Memory (SSM) is a SPARC M7 processor feature that can detect memory access violations caused by programming errors or attempted exploits of buffer overruns. In addition, every SPARC M7 CPU has 32 cryptographic instruction accelerators, one per core. These engines support 15 industry-standard algorithms for fast on-chip data encryption. These engines support database encryption for data at rest, as well as fully encrypted live migration of active domains to protect data in motion.
- Virtual network support. Oracle virtualization technologies (Oracle VM for SPARC and Oracle Solaris Zones) support Software-Defined Networking, creating virtual network interfaces, isolated VLANs, and virtual switches. In an SAP solution, virtual networks isolate application, database, storage, and management traffic, safeguarding data and helping to prevent denial-of-service (DoS) attacks that can negatively impact service levels.
- Oracle Solaris 11 security features. Oracle Solaris is an advanced operating system with many military-grade security features that help businesses deploy enterprise applications without compromise. Beyond the protections of application and network isolation, Oracle Solaris 11 supplies fine-grained privileges, granular access controls, and easy-to-use tools for software patching and updates. When an application is fully validated in an Oracle Solaris Zone, it can be securely locked down as a read-only Immutable Zone that can then be cloned to replicate secure production servers. Oracle Solaris 11 also features an OpenSCAP-compatible compliance utility that can automate system configuration checks and detect implementation flaws against predefined, customizable profiles (see "Using the Oracle Solaris Compliance Tool for SAP Installation").

Oracle Infrastructure for High Availability (HA)

To meet stringent service level agreements (SLAs), an Oracle infrastructure features redundant server and storage hardware, redundant switches for multiple data paths, and clustering for critical SAP application and database services (Figure 3).

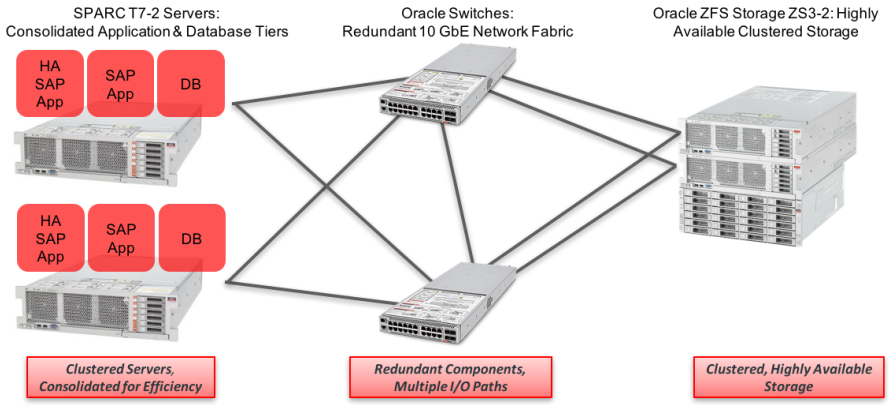

Figure 3. An Oracle infrastructure for SAP uses redundant components, multiple data paths, and clustering for HA.

For continuous data access, the Oracle ZFS Storage Appliance is configured with redundant controllers and multiple data paths. To protect data integrity, appliance software provides advanced error detection and correction, self-healing, triple-RAID parity, and disk mirroring capabilities.

Certain SAP services require HA: SAP Central Services (SCS/ASCS), Enqueue Replication Server (ERS), Primary Application Server (PAS), and mission-critical Additional Application Servers (AAS). Oracle Solaris Cluster can configure failover resources or multiple master resources for these SAP instances, automating fault detection, failover, and restart (Figure 4). Oracle RAC provides clustered database instances; an Oracle External Proxy (provided with Oracle Solaris Cluster) queries Oracle RAC instances to determine database service availability.

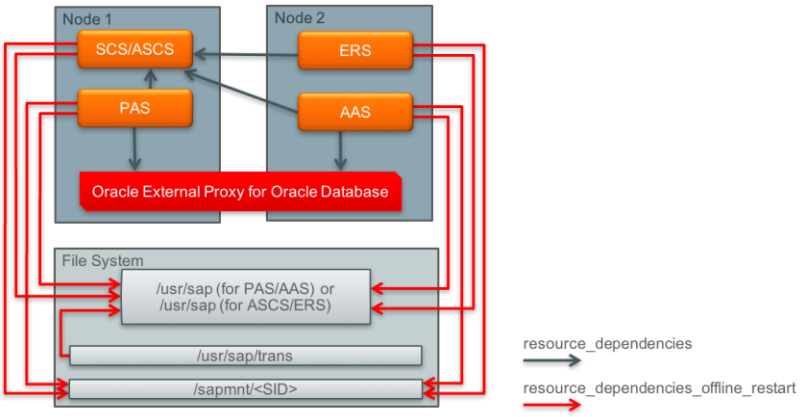

Figure 4. Oracle Solaris Cluster provides fault monitoring, automatic restart, and automatic failover for SAP components.

Oracle Infrastructure for SAP Consolidation

Figure 5 depicts an example virtualization layout for consolidated SAP and Oracle Database services. Oracle virtualization technologies—Oracle VM Server for SPARC and Oracle Solaris Zones—are used in conjunction with Oracle Solaris Cluster software to sandbox application and database servers.

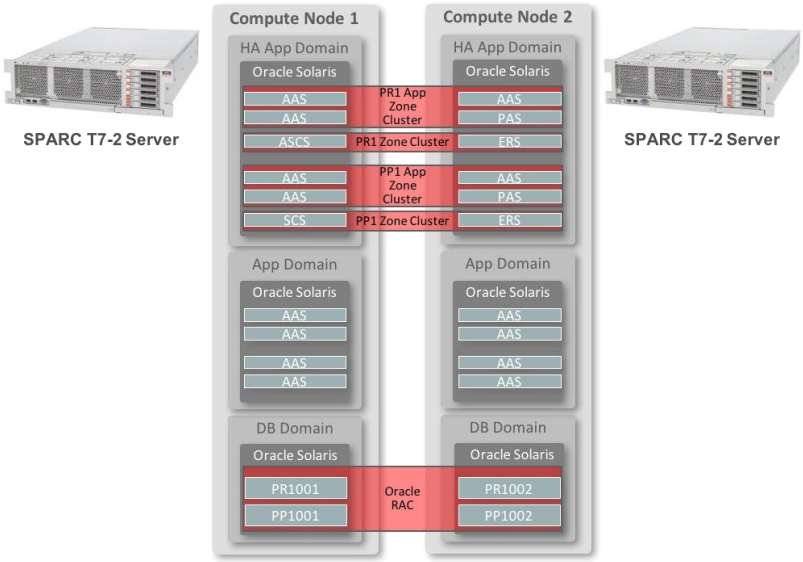

Figure 5. This sample virtual server layout shows how critical SAP and database services are isolated and clustered.

Powerful No-Charge Virtualization

In a typical SAP solution on Oracle infrastructure, physical system resources (such as CPU cores, RAM, and I/O devices) are assigned to separate Oracle VM Server for SPARC logical domains. Domains support effective resource partitioning that prevents resource starvation in the event of system compromise. Each domain runs an independent copy of the Oracle Solaris 11 operating system.

Within each domain, servers are further isolated using Oracle Solaris Zones (Figure 5). In the database domain, a separate Oracle RAC instance is typically created for each SAP System ID (SID); a zone is created on each node to house each Oracle RAC instance. As shown in Figure 5, an HA Application domain hosts (A)SCS, ERS, PAS, and AAS services that require high service levels. In this domain, two zones are constructed for each SAP SID: one for (A)SCS/ERS and one for PAS/AAS services. Oracle Solaris Cluster provides zone clustering, allowing applications to access critical SAP resources across nodes for application continuity. Oracle Solaris Cluster manages application availability across zone clusters, maintaining resource dependencies across nodes and ensuring continuity for critical services.

Network virtualization sandboxes traffic on individual VLANs (Figure 6). Path redundancy combined with IP multipathing provides alternate routes for application, database, storage, and management connectivity.

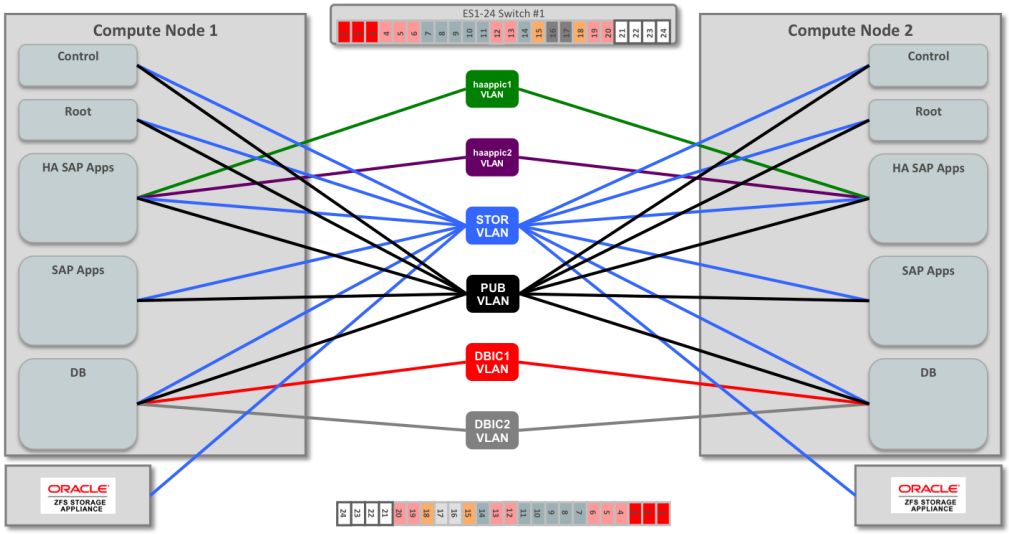

Figure 6. IP multipathing and multiple VLANs interconnect domains and Oracle Solaris Zone clusters.

Storage Efficiency

In the storage architecture, redundant Oracle ZFS Storage ZS3-2 controllers establish multiple I/O paths to shared storage. Disk mirroring is also configured for optimal data protection. The storage appliance can be configured with optional read cache SSDs located in the appliance controllers. Appliance software populates these caches automatically, accelerating reads for frequently accessed data. Write operations to cost-effective SAS hard disk drives (HDDs) can also be cached, using SSDs in disk enclosure trays to improve write performance.

Integrated storage management simplifies common administrative tasks such as snapshots, clones, thin provisioning, and compression and replication. Automating these operations helps to reduce the risk of human error, supports fast and efficient system copies, and lowers storage management costs. As a result, the Oracle ZFS Storage ZS3-2 appliance provides excellent value (see Oracle ZFS Storage Appliance: Extreme Enterprise Efficiency and Performance at an Incredibly Low Price).

IT Administrative Efficiency

Oracle Enterprise Manager enables comprehensive and integrated management of the Oracle infrastructure stack through a single intuitive interface. Oracle Enterprise Manager Ops Center, included with all Oracle servers, supports management and monitoring for server hardware, firmware, operating systems, and virtual servers. It can be used to allocate resources to virtual environments, adjust resource allocations to meet business requirements, and monitor the health of both virtual and physical machines.

Protecting SAP Data and Applications via Backup and Archival

SAP deployments often have stringent data protection requirements. By shortening backup and restore windows, the Oracle ZFS Storage Appliance allows IT organizations to meet strict availability SLAs while reducing complexity, cost, and risk. The appliance can generate file system snapshots, storing them either locally or remotely to another appliance for very fast point-in-time data copies to disk storage. These snapshots enable backups within tight timeframes, greatly simplifying the process of moving large data volumes to secondary media and remote systems.

To address a variety of short-term data protection and long-term archival needs, Oracle offers additional products and technologies to configure site-specific data duplication and backup/restore solutions:

- Oracle VM Server for SPARC enables fully encrypted live migration of active domains while maintaining application services to users. Secure live migration supports replication of virtual servers to remote machines, which can facilitate offline backup operations and application continuity scenarios.
- Oracle Recovery Manager (Oracle RMAN) facilitates backup and restore tasks for structured data in Oracle Databases. Oracle RMAN interacts with server resources to detect block-level corruption during backup/restore operations, and supports the parallelization of backup/restore data streams, retention policies, and detailed backup histories to ease data management.
- Oracle Secure Backup is integrated closely with Oracle RMAN, and can back up structured Oracle Database data to tape or disk, or to Oracle Cloud (Internet) storage. For SAP deployments that require large capacities and long retention, Oracle Secure Backup can be used with tape storage for cost-effective backup, vaulting, and archival.
- Oracle Optimized Solution for Secure Backup and Recovery is a validated architecture for network backups of heterogeneous clients, defining a comprehensive solution for enterprise-wide backup and long-term archival requirements.

In addition, improved integration of Oracle Database and SAP BR*Tools brings the benefit of a safe and easy-to-use SAP administrative interface that also simplifies database backup operations.

SAP Disaster Recovery (DR) Scenarios with Oracle Infrastructure

While Oracle infrastructure enables highly available applications, enterprise SAP deployments must also plan for unforeseen site disasters due to human error, sabotage, or other catastrophic events. Because SAP applications are key to business logistics and operations, an Oracle configuration is often extended to support SAP service delivery from a remote standby location (Figure 7).

Because DR requirements vary according to business goals for application recovery and data loss, Oracle technologies can be integrated into flexible solutions that address a spectrum of requirements. Understanding site-specific business requirements and solution alternatives is the first step in planning a DR configuration.

In a highly available Oracle infrastructure for SAP, Oracle Solaris Cluster supports fault detection and automated failover for SAP resources across a local corporate campus or other smaller locale. By adding Oracle Solaris Cluster Geographic Edition (an Oracle Solaris Cluster option), solution architects can extend failover capabilities across longer distances and enable DR between local (primary) and remote (secondary) sites (Figure 7). At the database tier, Oracle Active Data Guard can provide disaster recovery for Oracle Database instances. For SAP application

servers and unstructured data, Oracle ZFS Storage Appliance snapshots provide file system replication to an appliance at the remote standby site, significantly reducing recovery time.

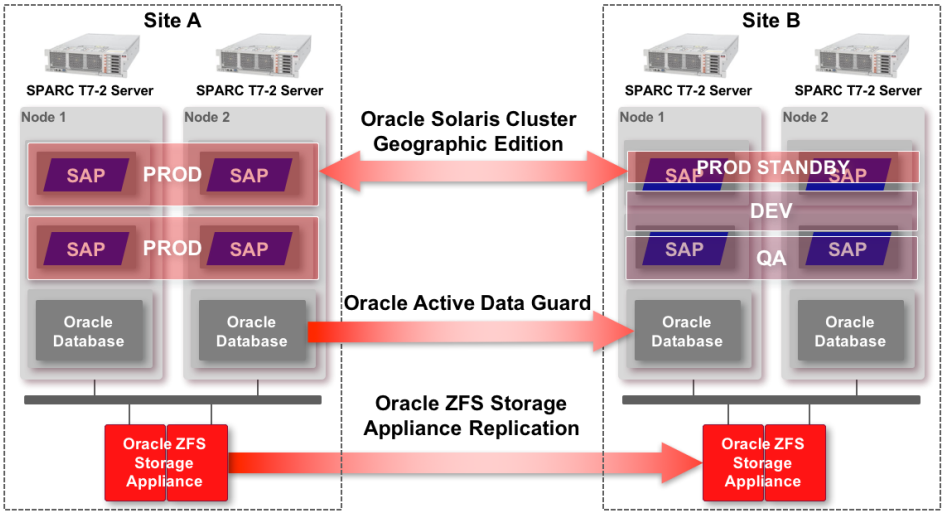

Figure 7. In a DR configuration, the Oracle infrastructure can provide SAP application delivery from a remote site.

For demanding SAP requirements that deploy Oracle SuperCluster engineered systems, the Oracle Optimized Solution for Secure Disaster Recovery defines a complete DR architecture along with validated best practices. This Oracle Optimized Solution fully replicates the primary environment to a standby site, providing extremely fast and more complete recovery for the most revenue-critical SAP applications.

Conclusion

An entry-level Oracle infrastructure—such as the configuration presented here using Oracle's SPARC T7-2 servers—is an economical yet powerful and highly available solution to host SAP applications. With 32 cores per SPARC M7 processor, these servers provide the density needed to consolidate SAP tiers efficiently, reducing data center footprint, decreasing costs, and optimizing resource utilization. Compatibility across Oracle's SPARC server product line protects investments while providing the ability to scale up or down to meet deployment requirements.

The Oracle infrastructure described here is an extremely cost-effective solution for SAP applications. At the same time, it doesn't skimp on what's needed to support demanding service levels. Innovative Software in Silicon features in SPARC M7 processors enhance application security while accelerating mixed OLTP and analytics workloads. And a highly available architecture—with redundant components, software clustering, and I/O multipathing—reduces unplanned downtime to meet stringent SLAs for application continuity. In addition, the Oracle infrastructure is a foundation that is easily extended to a remote site to support disaster recovery.

Oracle engineers work closely with their SAP counterparts. As a direct result, customers benefit from better software integration, tuning, and testing, which in turn improves the overall performance and reliability of services delivered by the infrastructure. Oracle maintains worldwide resources (Oracle Global Technology Centers for SAP, global SAP support and maintenance departments, global SAP consultants, and Oracle SAP solution experts) that are dedicated to promoting and optimizing SAP applications on Oracle infrastructure. The Oracle Solution Center SAP Competency team is a global asset that can also help customers design an SAP landscape to meet capacity and availability requirements.

To get started consolidating your SAP landscape on a cost-effective, highly available Oracle infrastructure, contact your Oracle sales representative.

Resources

For more information about SAP applications on an Oracle infrastructure, visit these sites:

- Oracle Technology Network article series: Best Practices for Migrating SAP Systems to Oracle Infrastructure
- Oracle Database and IT Infrastructure for SAP: oracle.com/us/solutions/sap/introduction/overview/
- Oracle SPARC servers: oracle.com/servers/sparc/
- Oracle ZFS Storage Appliance: oracle.com/storage/nas/
- Oracle Solaris: oracle.com/solaris/
- Oracle Optimized Solution for SAP: oracle.com/solutions/optimized-solutions/sap.html/
- SAP Community Network (SCN) on Oracle site: scn.sap.com/community/oracle
- SAP Community Network (SCN) on Oracle Solaris: scn.sap.com/community/oracle-solaris
- Additional collateral: oracle.com/us/solutions/sap/it-infrastructure/resources/

Oracle Corporation, World Headquarters
500 Oracle Parkway
Redwood Shores, CA 94065, USA

Worldwide Inquiries
Phone: +1.650.506.7000
Fax: +1.650.506.7200

ORACLE

CONNECT WITH US

blogs.oracle.com/oracle
facebook.com/oracle
twitter.com/oracle
oracle.com//us/solutions/SAP

Integrated Cloud Applications & Platform Services

Deploy an Efficient, Reliable SAP Landscape on Cost-Effective Oracle Infrastructure
August 2016