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# Running SAP NetWeaver on the Oracle Exalogic Elastic Cloud

## An Architectural Overview

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## Preface

As of August 2011, running SAP on Oracle Exalogic Elastic Cloud is officially supported by SAP, documented in [SAP Note 1617188](#).

SAP customers are traditionally facing the challenge to build up infrastructures for deploying SAP out of individual components: Servers, storage, networking, etc. This introduces a high amount of complexity and therefore risk, as well as sub-optimal performance due to lack of integration.

We believe that the right point of integration is at the factory level, where server, storage, networking and software engineers can build a highly integrated, optimized and tested solution that is ideally suited for customer needs. Oracle Exalogic Elastic Cloud is such an Engineered Solution.

This document outlines the value of using SAP on Oracle Exalogic Elastic Cloud and the Oracle Exadata Database Machine and discusses architectural and practical considerations when deploying SAP on Exalogic and Exadata.

We begin with a short overview of Exalogic as a system and the close interaction with Exadata as its back-end database. We then discuss the prerequisites for running SAP on Exalogic including architectural, version and other requirements. We explore the role of the included ZFS Storage Appliance system for providing shared storage to the application server nodes and offer other potential uses for it. Finally, we outline the installation process for SAP on Exalogic, including HA considerations and explore ways to easily scale an SAP environment across multiple systems and to include additional ZFS Storage Appliance Systems.

It is recommended to also read the Oracle white paper [Using SAP NetWeaver with the Oracle Exadata Database Machine](#) for details on setting up the Oracle database environment for SAP on Exadata.

## Simplicity, Reliability and Performance for SAP Deployments

Most SAP customers follow three goals when deploying SAP landscapes:

- *Simplicity*, so they can quickly and effortlessly install, customize and operate their SAP application landscape, at minimum TCO.
- *Reliability*, so that running the infrastructure for SAP doesn't interfere with offering services to users and running business operations.
- *Performance*, to minimize transaction times for users, while enabling new business opportunities based on superior, previously unavailable performance levels.

There are two fundamental types of infrastructure for deploying SAP, with varying potential to deliver against these goals:

- Traditional, high-end, vertically scalable Unix servers: These systems provide great reliability and performance, but come at a relatively high cost.
- Commodity, horizontally scalable x86 systems: While offering high performance at low cost, these systems are complex to integrate, test, deploy, operate and service due to their highly distributed nature and the differences in quality, make and configuration across component vendors. Reliability has to be achieved through fail-over mechanisms, assuming that every component can fail at any time.

Now, there is a third choice for SAP infrastructures that combines the best of both worlds: Engineered Systems.



In an Engineered System, standard, high quality and high performance x86 server, storage and networking components are designed, integrated, tested and assembled at the factory level. The result is a simple, reliable and fast system, ready to be deployed as a whole. Typical deployment times for an Engineered System are about 10% of the time for traditional deployments, reducing set-up time from months to days for a full rack solution.

Oracle Exalogic is the Engineered System for running middleware and packaged applications, capable of virtually unlimited scale, unbeatable performance, and previously unimagined management simplicity.

Exalogic hardware is pre-assembled and delivered in standard 19" 42 Unit rack

configurations. Each Exalogic configuration contains a number of hot-swappable compute nodes, a clustered, high-performance disk storage subsystem, and a high-bandwidth, low-latency InfiniBand interconnect fabric to connect every individual component within the configuration as well as to externally connect additional Exalogic or Exadata Database Machine racks and storage expansions.

In addition, each configuration includes multiple 10 Gigabit Ethernet ports for integration with the data center service network and Gigabit Ethernet ports used for integration with the data center management network.

Exalogic is part of Oracle's Engineered Systems family, designed to provide *simplicity* for application deployment: By offering modular building blocks that are designed, integrated, tested, shipped, installed, configured and operated as a whole, Exalogic radically reduces complexity for SAP environments. For SAP customers, this means a quick, efficient and easy-to-deploy way of providing infrastructure for SAP landscapes.

All Exalogic configurations are fully redundant at every level and are designed with no single point of failure. Furthermore, all components are highly standardized, factory-integrated, certified and tested, with a single point of contact for all storage, server, OS and system management service needs.

But not only does this mean that there is less work to do to set it up, it also means that all customers run the same Exalogic configuration that was tuned and tested at the Oracle factory, substantially reducing risk of errors, simplifying diagnosis, and standardizing operations.

Together with SAP's and Oracle's own high availability techniques, this offers unprecedented levels of *reliability* for SAP infrastructure deployments.

Each Exalogic compute node is a fully self-contained unit of compute capacity with multi-core x86 Xeon processors, redundant power supplies, fast ECC memory, and redundant InfiniBand Host Channel Adapters. Each compute node also contains two solid-state disks (SSDs), which host the operating system images used to boot the node and act as high-performance local swap space and storage for diagnostic data.

Exalogic is tuned for a wide range of workload types— process-intensive, data-intensive, I/O-intensive, etc.—and thus there is no need to configure parameters for a particular environment. The built-in InfiniBand interconnect offers 4x more bandwidth and a 10<sup>th</sup> of the latency per link than traditional 10 GbE networks.

The combination of fast, multi-core processors, fast ECC memory, a fast, scalable InfiniBand fabric and fast solid-state disks deliver unprecedented levels of *performance* and short transaction times for even the most demanding SAP environments.

Exalogic provides simplicity, lowers the time to and the risk of deployment, offers high levels of performance and scalability, making it an ideal, stable and reliable infrastructure solution for running the application server tier of a typical 3-tier SAP installation.

## Combining the Oracle Exalogic Elastic Cloud with the Oracle Exadata Database Machine for SAP NetWeaver

When running SAP NetWeaver on Oracle Exalogic, it uses an Oracle database for SAP running on an Oracle Exadata database machine.

The Oracle Exadata Database Machine is an easy to deploy solution for hosting the Oracle Database that delivers the highest levels of database performance available. The Exadata Database Machine is composed of database servers, Oracle Exadata Storage Servers, an InfiniBand fabric for storage networking and all the other components required to host an Oracle Database. It delivers outstanding I/O and SQL processing performance for online transaction processing (OLTP), data warehousing (DW) and consolidation of mixed workloads. Extreme performance is delivered for all types of database applications by leveraging a massively parallel grid architecture using Real Application Clusters and Exadata storage. Database Machine and Exadata storage delivers breakthrough performance with linear I/O scalability, is simple to use and manage, and delivers mission-critical availability and reliability.

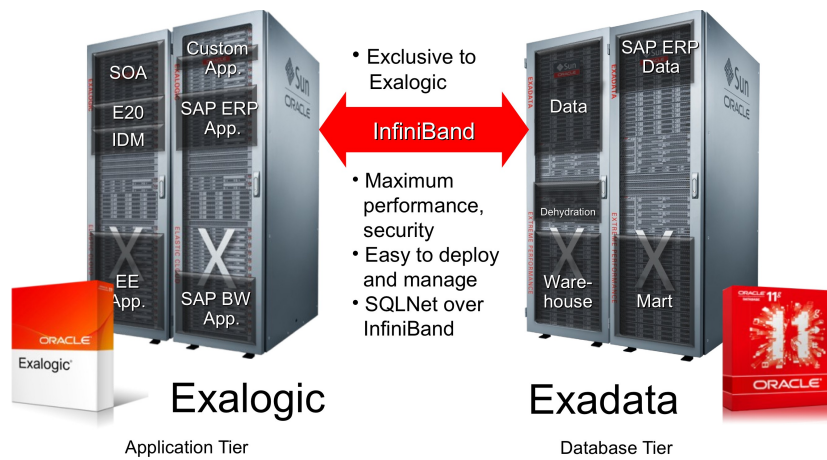
The same benefits of an Engineered System that apply to Exalogic also apply to Exadata: All components have been engineered together, take less time to set up, offer simplified operation, reducing risk of errors, simplifying diagnosis, and enabling more efficient, lower-cost operation.

Exalogic connects to Exadata through the same high-speed, low-latency InfiniBand fabric that is used inside the systems, providing a scalable and powerful networking foundation for communication between nodes in a system, as well as for scaling across multiple Exadata and Exalogic racks.

The InfiniBand fabric that spans Exalogic and Exadata components provides the following key ways of simplifying and accelerating SAP NetWeaver installations running on Exalogic:

- NFS mounts from the ZFS Storage Appliance to SAP application nodes in Exalogic use the InfiniBand infrastructure for faster data transport than traditional TCP/IP over 10 GbE. This benefits both SAP application servers running in Exalogic and Enqueue Servers running on Oracle Exadata.
- SAP application servers running the ABAP stack use Oracle Net through Oracle Instant Client to connect to the Oracle database. This enables them to easily use the SDP protocol over InfiniBand at high bandwidth and low latency, bypassing the traditional TCP/IP stack.
- All remaining standard TCP/IP connections running on the InfiniBand fabric will benefit from the 4x higher bandwidth per network connection compared to 10 GbE.
- Both networking and storage connections to and from SAP NetWeaver application server nodes are handled through a single fabric, reducing complexity and improving reliability through using reduced component counts.

In addition, IP over InfiniBand can be used for the communication between the SAP work processes and the Enqueue Server on Exadata.



Compared to typical alternatives, Oracle Exalogic delivered 2-3x improved OLTP performance due to its superior I/O connectivity to Exadata<sup>1</sup>. While detailed SAP performance data is not yet available, we expect Exalogic to deliver similar performance gains for SAP NetWeaver as well.

Exalogic is also the best solution for realizing the full performance benefits of Exadata for SAP, because it integrates directly into the the heart of the Exadata backplane: The InfiniBand fabric.

Simplicity is another key advantage for SAP on Exalogic: Because all components of Exalogic have been engineered, assembled and tuned together at the factory, set-up time is reduced by up 95%. And by reducing risk of errors, simplifying diagnosis, and enabling more efficient, lower-cost operation, total infrastructure costs can be reduced by as much as 60%.

## Prerequisites for running SAP NetWeaver 7.0 on Oracle Exalogic Elastic Cloud

When using Oracle Exalogic Elastic Cloud in SAP environments, the following prerequisites need to be in place:

- Only SAP NetWeaver 7.x or higher is supported, including SAP products which are based on SAP NetWeaver 7.x. Please check the [SAP Product Availability Matrix](#) for details regarding supported SAP product releases.

Examples include:

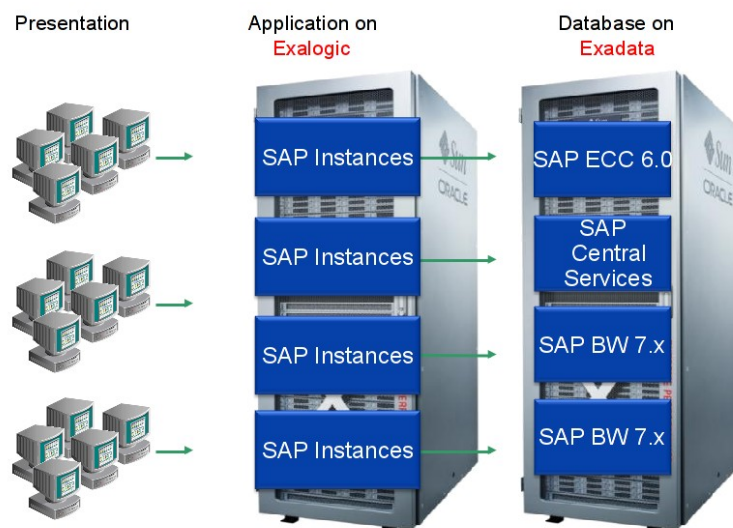
- SAP ERP (ECC) 6.0
- SAP BW 7.x
- SAP CRM 2005 / 2007 / 7.x
- SAP PLM 6.0 / 7.0x

<sup>1</sup>See Oracle White Paper: [Oracle Exalogic Elastic Cloud: A Brief Introduction](#)

- SAP SRM 2005 / 2007 / 7.x
- SAP SCM 2005 / 2007 / 7.x
- SAP Oil&Gas 2005 / 6.x
- SAP Banking Services 5.0 / 6.0 / 7.0 / 8.0
- Running SAP on Exalogic is only supported as a Three-Tier SAP installation. SAP instances run on the Oracle Exalogic Elastic Cloud server nodes.

The Oracle database for SAP must run on an Oracle Exadata system. Oracle Exalogic can only be used in combination with Oracle Exadata and may not be used in combination with other database server hardware or other non-Oracle databases. In this setup, SAP Central Services need to run on the Exadata system.

The following image illustrates the relationship between the SAP components, Exadata and Exalogic in a Three-Tier configuration:



Please see the Oracle white paper [Using SAP NetWeaver with the Oracle Exadata Database Machine](#) for details on how to set up Exadata for use with SAP.

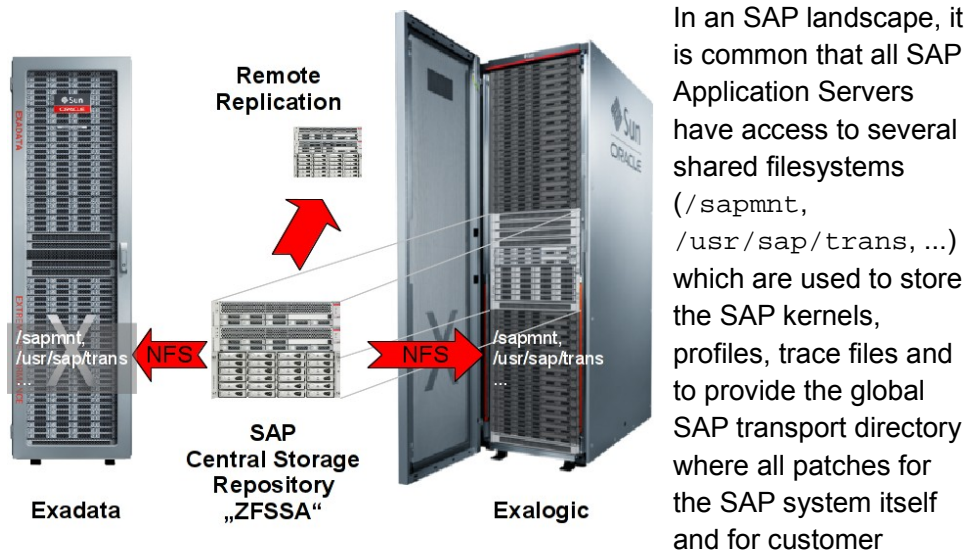
- Only Unicode installations of the SAP Software are supported.
- As of this time, only Oracle Exalogic X2-2 models are supported.
- As of this time, only Oracle Linux is supported as the operating system on the Oracle Exalogic Elastic Cloud server nodes. The minimum release is Oracle Linux 5 Update 5. Both kernels are supported: The Red Hat Enterprise Linux compatible kernel and the Unbreakable Enterprise Kernel (UEK), which is recommended.
- Solaris 11 support is planned for late Q4CY2011.
- The minimum supported Oracle Database Release is 11g Release 2 Patchset 1 (11.2.0.2) on Oracle Exadata with SAP Software on Oracle Exalogic.

## Using the ZFS Storage Appliance in Exalogic for SAP Environments

In the Oracle Exalogic Elastic Cloud system, all server nodes are connected to a central ZFS Storage Appliance through the InfiniBand interconnect. The ZFS Storage Appliance provides a fast, reliable, flexible and easy to use shared storage system with advanced storage services such as online compression and de-duplication, snapshots and clones as well as a rich family of access protocols including NFS, CIFS, HTTP, iSCSI and FC without additional costs.

Currently, the ZFS Storage Appliance inside Exalogic ships with a raw capacity of 40TB, providing a net data capacity of about 18TB after subtracting hot-spare and mirroring space requirements.

The ZFS Storage Appliance included in the Oracle Exalogic Elastic Cloud is ideally suited to act as a „Central Storage Repository for SAP“ by providing shared file systems in a highly available and high performance manner for the complete SAP landscape, consisting of application servers running on Exalogic servers nodes and the SAP Central Services running on Exadata. This configuration offers one of the highest potential service levels and throughput compared to more traditional implementations.



written applications (programs) are stored.

The ZFS Storage Appliance supports the concepts of Projects and Shares for allocating and organizing storage to users, applications and other consumers. In the case of SAP storage for Exalogic, the following strategy is recommended:

- One project "trans" with one share "saptrans" for the `/usr/sap/trans` directory.
- One project "oracle" with one share for providing the `/oracle` directory and one share per Oracle client software release, mounted as `/oracle/client/<RELEASE>`.

- One project per SAPSID, with three shares per project:
  1. “usrsap” for the `/usr/sap/<SAPSID>` directory,
  2. “sapmnt” for the `/sapmnt/<SAPSID>` directory,
  3. “oracle” for the `/oracle/<SAPSID>/<RELEASE>` directory.

Furthermore, additional Oracle ZFS Storage Appliances connected to Exadata and Exalogic using the same back-plane InfiniBand network can be used as a target for very fast backups from the Oracle Exadata Database Machine and from Oracle Exalogic, providing a simple, reliable and powerful off-site backup and replication option.

Using the Oracle ZFS Storage Appliance as the Central Storage Repository leverages also the facility to easily create unlimited additional Application Servers with minimal effort using the ZFS “snapshot” and “clone” capabilities of the appliance.

Because of the broad variety of supported protocols, including HTTP which allows access to the ZFS appliance through WebDAV, ZFS Storage Appliances can be used in combination with Exalogic to implement SAP's ILM concept using either the standard ArchiveLink ADK or the XML Direct Archiving Service.

## Installing SAP NetWeaver 7.x on the Oracle Exalogic Elastic Cloud

The following steps assume that an Oracle Exadata Database Machine has been already set up as the Oracle Database for SAP in accordance with the Oracle white paper [Using SAP NetWeaver with the Oracle Exadata Database Machine](#). Exadata needs to be connected to Exalogic using the built-in InfiniBand fabric.

- Perform a standard install of Exalogic with the latest supported release of Oracle Linux on all compute nodes as documented in the standard Exalogic install and configuration procedures.
- Set up Oracle Linux for installation of SAP in accordance with standard SAP Linuxlab procedures.
- Set up the built-in Oracle ZFS Storage Appliance in Exalogic for providing the `/sapmnt`, `/usr/sap`, `/usr/sap/trans`, `/oracle`, `/oracle/client` and any other necessary NFS shares. Set up all Oracle Linux nodes for mounting these shares from the ZFS Storage Appliance.
- Perform a standard installation of SAP on one node in Exalogic, using the NFS shares created above. [See SAP Note 1567511 – Oracle Linux 5.x SAP installation and upgrade](#) for details.
- Use RMAN to move the SAP database onto Exadata and enable RAC on the Exadata machine.
- Install additional SAP instances on Exalogic and connect them with the corresponding RAC nodes on Exadata according to your needs.

## High Availability for SAP NetWeaver on Oracle Exalogic and Oracle Exadata

Inside Oracle Exalogic, all servers, networking components and connections as well as other infrastructure components such as power distribution systems are fully redundant. Similarly, the Oracle Exadata Database Machine, where the Oracle database for SAP and the SAP Central Services are running, is composed out of fully redundant components as well.

Therefore, Exalogic and Exadata are ideally suited for setting up a highly available infrastructure for SAP. Since both systems leverage industry standard x86 servers for running applications, standard practices like Oracle RAC, Oracle Clusterware or Oracle Data Guard can be used unchanged for making the Oracle database, SAP services and application servers highly available.

The following SAP support notes are helpful in setting up HA for SAP on Exalogic and Exadata:

- [SAP Note 1552925 – Linux: High Availability Cluster Solutions](#)
- [SAP Note 1496927 – Protection of SAP instances through Oracle Clusterware](#)

## Expanding Capacity through multiple Exadata and Exalogic systems

In addition to extreme performance, lower risk, simplified deployment and operations, Exadata and Exalogic offer a simple and comprehensive way of scaling the SAP NetWeaver infrastructure.

Within a rack, both Exadata and Exalogic offer deployment units of a quarter, half or a full rack. By using the InfiniBand fabric, multiple racks can be joined together to quickly and easily grow the underlying infrastructure.



For growing SAP NetWeaver 7.x environments, this capability offers a simple, quick, low-risk, and modular growth path. This avoids the typically long, complex, time and resource intensive, and error-prone process of selecting, qualifying, acquiring, testing, and quality assuring of multiple individual components.

Instead, with the Oracle Exalogic Elastic Cloud and the Oracle Exadata Database Machine, infrastructure for SAP environments of any size can now be installed and expanded in a matter of days instead of months, while substantially reducing TCA and TCO costs.

## Conclusion

The Oracle Exalogic Elastic Cloud offers a simple, reliable and high performance solution for providing infrastructure to SAP application servers, in combination with the Oracle Exadata Database machine.

Installation of SAP on Exalogic is straightforward and leverages existing Oracle Linux best practices for running SAP on x86 systems, as well as the innovative Oracle ZFS Storage Appliance that is built-in into Exalogic.

High availability for SAP can be achieved through leveraging standard mechanisms such as Oracle RAC, Oracle Clusterware, Oracle Data Guard etc.

Through growing Exalogic and Exadata from Quarter to Half and Full Rack configurations and by adding more racks of Exalogic and Exadata, Exalogic provides a very flexible and scalable infrastructure solution for SAP, while maintaining simplicity and high levels of stability.

With Oracle Exalogic and Oracle Exadata, deploying simple, reliable and high performance infrastructure for SAP can now be achieved quickly, cost-effectively and at low risk, compared to traditional ways of deployment.



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