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TECHNOLOGY UPDATE

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No. 21 Oracle for SAP, May 2012
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Hardware and Software
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Engineered to Work Together

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DEAR SAP CUSTOMER,

Hardware and Software Engineered to Work Together.
Oracle provides the world's most complete, open, and integrated technology stack including database, business software, operating systems, servers, and storage. Oracle technologies make SAP applications run better.

Oracle Corporation and SAP AG have had an ongoing commitment to our tens of thousands joint customers for 24 years and our longstanding reseller and customer support agreements provides enhanced access to Oracle database technology and world class customer support.

Oracle's product strategy provides flexibility and choice across the IT infrastructure. More than two-thirds of all mid-size to large enterprise SAP customers in every industry entrust their application deployments to Oracle databases, and companies are running SAP applications with Oracle databases on all major operating systems. Since 1988, SAP has used Oracle as a Tier 1 Develoment Database on which SAP develops, ports and migrates its products to function optimally with Oracle's database functionalities. All certified Oracle database options are constantly optimized for SAP applications.

With Oracle Sun server, storage, and virtualization technology as well as the Oracle Solaris and Oracle Linux operating systems, Oracle offers a complete technology stack for SAP customers. Every layer is integrated to work together as a single system. Oracle's open architecture and multiple operating system options provide excellent system availability, scalability, energy efficiency, powerful performance, and a low total cost of ownership.

Today's data management demands require extreme performance for all workloads. With the Oracle Exadata Database Machine, Oracle has changed the game with a unique architecture that can deliver extreme performance for data warehousing, OLTP and mixed workloads, while also lowering your IT costs with the unique features of Oracle Exadata that deliver better performance and value to your organization. Oracle Exadata Database Machine includes Oracle Exadata Storage Software with Oracle Automatic Storage Management (ASM) that is used as the file system and volume manager for Exadata. Oracle ASM provides a consolidated environment where multiple databases can be stored and managed within the same disk group, to deliver the industry's best performing database solution, running on Oracle Linux and Oracle Solaris. A fast growing number of SAP customers are deploying Exadata in BW and ERP production environments today.

The new SPARC SuperCluster is available for SAP customers and will provide the opportunity to reap the benefits of Engineered Systems while leveraging their existing investments in SPARC and Solaris technology.

Please read in this 2012 edition, how the Swiss company Glencore and a German Automotive SAP customer demonstrate the significant improvement of consolidation, performance and return of investment for their worldwide SAP business by using Oracle Exadata Database machines. More Exadata for SAP customer success stories will be available soon at www.oracle.com/sap. Read also why customers such as Stadtwerke of Munich moved from single instance to Oracle Real Application Clusters for SAP with Automatic Storage Management and why SAP customers Astelit LCC in Kiev/Ukraine and FEMSA in Mexico are benefitting from Oracle database 11*g* Grid Control for monitoring their SAP systems. The German SAP customer Heidelberger Druck will explain, how they have saved 56% database storage by using Oracle Advanced Compression (ACO) and Enel in Italy has reduced the monthly data growth rate to 40% by using ACO. The Oracle partner All4IT in France has successfully implemented the Oracle Resource Manager to optimize the management of multiple instances of SAP ERP and DELL Corporation will describe the benefits of the migration from RHEL to Oracle Linux.

See the article about Oracle Advanced Customer Services (ACS) for SAP customers, including: database migrations (Oracle-to-Oracle "O2O" and "Triple O"), performance tuning, health check and internal training workshops.
For more information or to see current and previous editions of this newsletter online, go to: www.oracle.com/sap.
We welcome your comments and questions, please contact us at: saponoracle_de@oracle.com

Sincerely

Gerhard Kuppler
Senior Director Corporate SAP Account,
Oracle Corporation

ORACLE DATABASE 11*g* RELEASE 2 FUNCTIONALITY CERTIFIED BY SAP

INTRODUCTION

Oracle Database 11*g* Release 2 Enterprise Edition delivers industry leading performance, scalability, security and reliability on a choice of clustered or single-servers, running Windows, Linux, and UNIX. It provides comprehensive features to easily manage the most demanding transaction processing, business intelligence, and content management applications.

Oracle Database 11*g* Release 2 Enterprise Edition comes with a wide range of options to extend the world's #1 database to help grow your business and meet your users performance, security and availability service level expectations.

SAP has certified Oracle Database 11*g* Release 2 (please see **SAP Note 1398634**) with the following details:

- Only SAP products based on SAP Kernel 6.40_EX2, 7.x and higher are certified with Oracle Database 11.2.
- A general release of Oracle Database 11*g* Rel. 2 is not provided for earlier SAP releases (SAP R/3 3.1I up to and including SAP R/3 4.6C). Similar to Oracle Database Version 10.2, there is only a temporary 11.2 release in direct connection with an SAP upgrade project for these older SAP versions.
- The SAP release of Oracle Real Application Clusters (RAC) 11*g* Release 2 occurred at the same time as the general release of Oracle Database 11*g* Release 2 in the SAP environment. For information about Oracle RAC support, (see SAP Note 527843). It contains important details about the released RAC configurations.
- As of Oracle 11*g* Database version 11.2.0.2, SAP fully supports Oracle Automatic Storage Management Oracle (ASM) and its extended functionality to manage ALL data: Oracle Database files, Oracle Clusterware files and non-structured general purpose data such as Oracle and SAP kernel binaries, external files and text files. Oracle ASM simplifies, automates and reduces cost and overhead by providing a unified and integrated solution stack for all file management needs, eliminating the need for 3rd party volume managers, file systems and clusterware platforms. Oracle ASM has two major enhancements that are important for running SAP:
- Oracle Cluster Repository (OCR) and voting files can be stored on Oracle ASM.
- Oracle RDBMS Home can be stored on Oracle's new cluster file system ACFS.

This makes Oracle ASM the preferred storage platform for SAP running on Oracle Real Application Clusters as well as for SAP systems running on a single instance Oracle Database (for more information about Oracle ASM, see the article on page 32).
For details see **SAP Note 1550133**.

Oracle Database 11*g* Release 2 provides customers more benefits: saving disk space with lower hardware costs, more performance, higher security, better manageability, exceeding productivity and at least in an outstanding high availability/disaster recovery for SAP applications. The following provides a list of important features available for SAP customers today and many of them are unique to Oracle.

OLTP Table Compression

Oracle Database 11*g* introduced a new feature called OLTP Table Compression that allows data to be compressed during all types of data manipulation operations, including conventional DML such as INSERT and UPDATE. In addition, OLTP Table Compression reduces the associated compression overhead of write operations making it suitable for transactional or OLTP environments as well. OLTP Table Compression, therefore, extends the benefits of compression to all application workloads.

ORACLE DATABASE 11*g*

Oracle's OLTP Table Compression, part of Advanced Compression, uses a unique compression algorithm that eliminates duplicate values within a database block, even across multiple columns. Compressed blocks contain a structure called a symbol table that maintains compression meta data. When a block is compressed, duplicate values are eliminated by first adding a single copy of the duplicate value to the symbol table. When compared with competing compression algorithms that maintain a global database symbol table, Oracle's unique approach offers significant performance benefits by not introducing additional I/O when accessing compressed data.
The benefits of OLTP Table Compression go beyond just on-disk storage savings. One significant advantage is Oracle's ability to read compressed blocks directly without having to first uncompress the block. Therefore, there is no measurable performance degradation for accessing compressed data. In fact, in many cases performance may improve due to the reduction in I/O since Oracle will have to access fewer blocks. Further, the buffer cache will become more efficient by storing more data without having to add memory. Since Oracle Database Rel. 10.2.0.2, SAP has certified the use of Index compression to save disk space for indexes and reduce total database size on disk. Customer experiences show that even after a full database reorganization has taken place, an additional 20% of total disk space reduction for the whole database can be achieved using index compression.

SecureFile Data Compression

SecureFiles is a new feature in Oracle Database 11*g* that introduces a completely re-engineered large object (LOB) data type to dramatically improve performance, manageability, and ease of application development. SecureFiles data is compressed using industry standard compression algorithms. Compression not only results in significant savings in storage but also improved performance by reducing IO, buffer cache requirements, redo generation and encryption overhead. SecureFile compression provides significant storage and handles in-line and out-of-line LOB data which are getting more and more important in SAP applications and are widely used in SAP products such as SAP CRM, SAP XI, SAP NetWeaver Portal, and even in SAP ERP.
Almost all non-cluster tables in SAP ERP use out-offline LOBs that are unique to the Oracle database.

RMAN Backup Compression

The continuous growth in enterprise databases creates an enormous challenge to database administrators. The storage requirements for maintaining database backups and the performance of the backup procedures are directly impacted by database size. Oracle Advanced Compression includes compression technology that can dramatically reduce the storage requirements for backup data. Due to RMAN's tight integration with Oracle Database, RMAN backup (widely used by SAP customers) data is compressed before it is written to disk or tape and doesn't need to be uncompressed before recovery – providing an enormous reduction in storage costs.

Data Pump Compression

The ability to compress the meta data associated with a Data Pump job was first provided in Oracle Database 10*g* Release 2. In Oracle Database 11*g*, this compression capability has been extended so that table data can be compressed on export. Data Pump compression is an inline operation, so the reduced dump file size means a significant savings in disk space. Unlike operating system or file system compression utilities, Data Pump compression is fully inline on the import side as well, so there is no need to uncompress a dump file before importing it. The compressed dump file sets are automatically decompressed during import without any additional steps by the Database Administrator.

Data Guard Network Compression

Data Guard provides the management, monitoring, and automation software infrastructure to create, maintain, and monitor one or more standby databases to protect enterprise data from failures, disasters, errors, and data corruptions. Data Guard maintains synchronization of primary and standby databases using redo data (the information required to recover a transaction). As transactions occur in the primary database, redo data is generated and written to the local redo log files. Data Guard Redo Transport Services are used to transfer this redo data to the standby site(s).

ORACLE DATABASE 11g

With Advanced Compression, redo data may be transmitted in a compressed format to reduce the network bandwidth in an efficient way. Redo transport compression is no longer limited to compressing redo data only when a redo gap is being resolved. When compression is enabled for a destination, all redo data sent to that destination is compressed.

Deferred Segment Creation

Beginning in Oracle Database 11*g* Release 2, when creating a table in a locally managed tablespace, table segment creation is deferred until the first row is inserted. In addition, creation of segments is deferred for any LOB columns of the table, any indexes created implicitly as part of table creation, and any indexes subsequently explicitly created on the table.
The advantages of this space allocation method for customers running Oracle database underneath their SAP applications are the following:

- Empty database objects will not consume any disk space
- Very important for SAP environments as 60-70% of all tables, LOBs, indexes and partitions in a SAP installation are empty
- Makes database installation for SAP a lot faster because creation of empty tables, LOBs, and indexes are dramatically faster
- Oracle Data Dictionary Space queries run substantially faster

Enhanced Add COLUMN Functionality

Before Oracle Database 11*g* adding new columns with DEFAULT values and NOT NULL constraint required both an exclusive lock on the table and the default value to be stored in all existing records.
Now in Oracle Database 11*g*, the database can optimize the resource usage and storage requirements for this operation, default values of columns are maintained in the data dictionary for columns specified as NOT NULL. Adding new columns with DEFAULT values and NOT NULL constraint no longer requires the default value to be stored in all existing records. This not only enables a schema modification in subseconds and independent of the existing data volume, it also consumes no space. Especially for large tables, updating table column results in reduced execution time and space saving.

Because ADD column is very common within SAP BW applications and SAP upgrades, enhanced ADD Column Functionality leads to:

- Factor 10-20 performance improvement for SAP BW during ADD column process
- Saving large amount of disk space

Compared to Oracle Database 10*g*, the listed Oracle Database 11*g* features give the following results:

	Without Compression	With Compression and other space optimizations	Space Savings
Database (fully reorganized)			
SAP ECC 6.0	4,782 GB	1,976 GB	59%
SAP BW 7.0	1,413 GB	543 GB	62%
SAP CRM 7.0	950 GB	334 GB	64%
RMAN Backup (for compressed database)	2,817 GB	667 GB	76%
Export Data Pump	973 GB	156 GB	84%

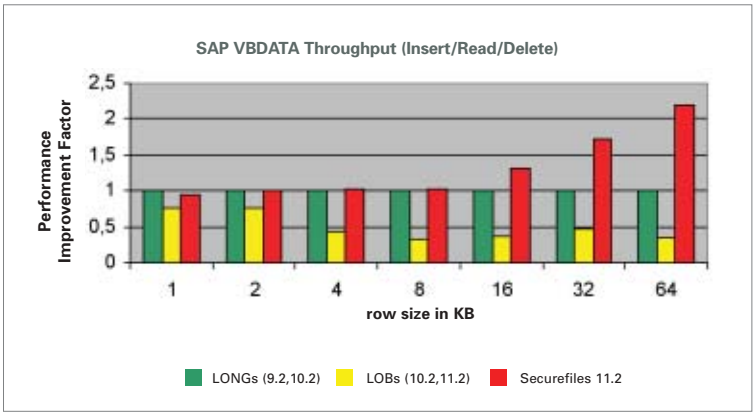
SecureFile Performance

SecureFiles offer the best solution for storing file content, such as images, audio, video, PDFs, and spreadsheets. Traditionally, relational data is stored in a database, while unstructured content—both semi-structured and unstructured—is stored as files in file systems. SecureFiles is a major paradigm shift in the choice of files storage. SecureFiles is specifically engineered to deliver high performance for file data comparable to that of traditional file systems, while retaining the advantages of the Oracle Database. SecureFiles offers the best database and file system architecture attributes for storing unstructured content.

SAP customers benefit from SecureFiles because of:

- Significantly faster access times compared to LOBs in SAP environments
- Increased transaction throughput on SAP cluster tables especially with RAC
- Prerequisite for compression of SAP tables containing LOBs (e.g. cluster tables)

Overall transaction throughput increases when LOB data is stored in SecureFiles (see figure beside). LOB data stored in SecureFiles delivers equal or better performance compared with LOB data stored in LONG or BasicFiles (LOB implementation prior to Oracle Database 11*g*). SecureFiles improve dramatically the scalability of SAP applications running against Oracle Database 11*g* RAC but also Oracle Database 11*g* Single Instance benefits substantially from SecureFiles. Therefore, a clear recommendation is given to migrate all existing LONG and Basicfile LOB data to SecureFiles.



Tablespace Encryption

On many agendas, security is in the forefront and becoming much more important for customers. Oracle has a lot of features in the area of security. Especially for SAP customers, it is now very easy to encrypt sensitive data. Included within the Advanced Security Option (ASO) is the technology to encrypt all data in a tablespace. Prior to Oracle Database 11*g*, Oracle provided security features such as Column Encryption through Transparent Data Encryption (TDE) and Client Server (SAP Application Server) Network Encryption.

Additional Encryption

Advanced Security Option (ASO) within Oracle Database 11*g* includes RMAN Backup Encryption, so no one can read data from a (stolen) backup. In addition customers can easily encrypt export file with Oracle Data Pump unstructured LOB data with SecureFile Encryption.

DG Secure Network Transport

Data Guard provides a secure environment and prevents tampering with redo data as it is being transferred to the standby database. To enable secure transmission of redo data, set up every database in the Data Guard configuration to use a password file, and set the password for the SYS user identically on every system.

More Security – Database Vault

Oracle Database Vault is also certified for use with SAP applications. With Oracle Database Vault, protective realms around SAP application database objects can be established to prevent privileged database users from accessing sensitive data and to enforce separation of duties among privileged database users.

BR*Tools Support for Oracle Database 11g

As of version 7.20, BR*Tools support the new features provided by Oracle Database 11*g* Release 2 which makes it very easy to implement them even in existing systems (see SAP Note 1430669).
In particular, the following operations are possible:

- BRSPACE provides special options for online reorganization, which allow you to activate the new OLTP table compression
- To convert the "old LOBs" (data type LONG or LOB) to the "new LOBs" (data type SecureFiles), BRSPACE provides a new action "lob2lob" within the reorganization function "tbreorg"
- As of patch 3, BRSPACE 7.20 supports the management of the index compression for Oracle Database 10*g* as well as Oracle Database 11*g* (see SAP Note 1464156)
- BRSPACE allows you to set the compression and encryption attributes at tablespace level when you create a new tablespace. Tables that are created in (or moved to) such a tablespace then implicitly adopt these attributes, except if they are set explicitly at table level
- BRSPACE is aware of columns which contain data that are compressed by SAP. It makes sure that the useless overhead of an additional compression is avoided

Real Application Testing (RAT)

- Database Replay provides DBAs and system administrators with the ability to faithfully, accurately and realistically rerun actual production workloads, including online user and batch workloads, in test environments. By capturing the full database workload from production systems, including all concurrency, dependencies and timing, database Replay enables you to realistically test system changes by essentially recreating production workloads on the test system, something that a set of scripts can never duplicate. With database Replay, DBAs and system administrators can test: Database upgrades, patches, parameter, schema changes, etc.
- Configuration changes such as conversion from a single instance to Oracle RAC, Oracle ASM, etc.
- Storage, network, interconnect changes
- Operating system, hardware migrations, patches, upgrades, parameter changes statistics by running the SQL statements serially before and after the changes
- SQL Performance Analyzer (SPA) can predict and prevent SQL execution performance problems caused by environment changes. SQL Performance Analyzer provides a granular view of the impact of environment changes on SQL execution plans and statistics by running the SQL statements serially before and after the changes.

The Oracle/SAP Development Team recently concluded comprehensive testing of SAP applications using Real Application Testing to measure the effects of Advanced Compression for OLTP and SecureFiles on DML operations for SAP ERP. The testing activity consisted of using Database Replay to capture a production workload from a Oracle Database Rel. 10.2.0.4 SAP database. This workload was then replayed multiple times against both compressed and non-compressed Oracle Database 11*g* Release 2 databases.

The test results can be read in the newsletter **http://www.oracle.com/newsletters/sap/volumes/volume19-en.pdf** on page 12.

Direct NFS

With Oracle Database 11*g* Release 2, you can configure Oracle Database to access NAS devices directly using Oracle Direct NFS Client, rather than using the operating system kernel NFS client. Oracle Database will access files stored on the NFS server directly through the integrated Direct NFS Client eliminating the overhead imposed by the operating system kernel NFS. These files are also accessible via the operating system kernel NFS client thereby allowing seamless administration.

SAP customers can benefit from Direct NFS in the following way:

- Improves throughput of NAS solutions such as NetApp
- Up to 50% more database throughput in NAS environments with multiple NICs
- Up to 20% CPU savings on database server
- Works for Single Instance and Real Application Clusters (RAC)
- Works for UNIX, Linux and Windows Platforms
- Highly Available Network Solution
- Faster, easier and more available than any OS or NAS based bonding or trunking solution
- Direct NFS with NAS may provide higher throughput than traditional, more complex SAN solutions
- Superior to any bonding solution – faster and easier
- Better throughput than most SAN solutions

Online Patching

A regular RDBMS patch is comprised of one or more object files and/or libraries. Installing a regular patch requires shutting down the RDBMS instance, relinking the Oracle binary, and restarting the instance; uninstalling a regular patch requires the same steps. With Oracle Database 11*g*, it is possible to install single or bundle patches completely online, without requiring the database instance to be shut down, and without requiring RAC or Data Guard configurations. With online patching, which is integrated with OPatch, each process associated with the instance checks for patched code at a safe execution point, and then copies the code into its process space.

Snapshot Standby

Easy conversion of a physical standby database to a reporting database – A physical standby database can be opened read/write for reporting purposes, and then flashed back to a point in the past to be easily converted back to a physical standby database. At this point, Data Guard automatically synchronizes the standby database with the primary database. This allows the physical standby database to be utilized for read/write reporting activities for SAP applications e.g. NetWeaver BI.

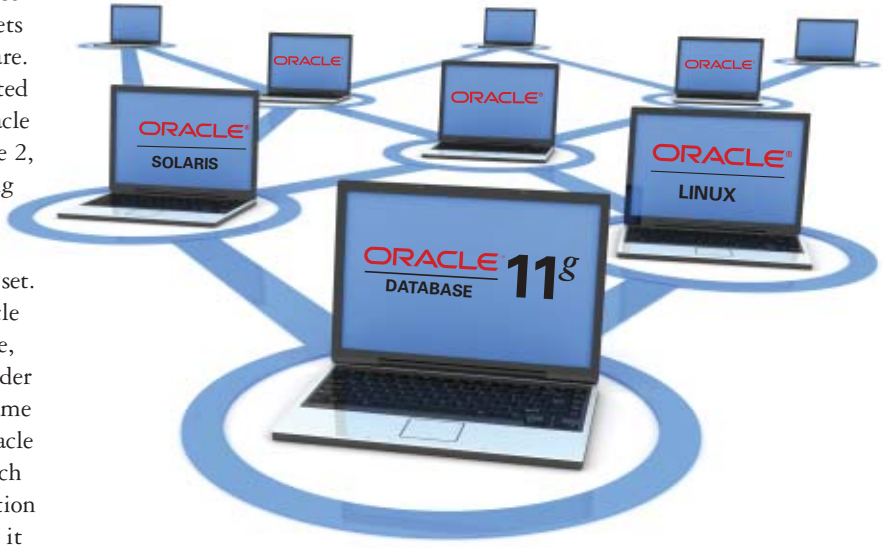
Out-of-place Upgrade

Starting with the first patch set for Oracle Database 11*g* Release 2 (11.2.0.2), Oracle Database patch sets are full installations of the Oracle Database software. In past releases, Oracle Database patch sets consisted of a set of files that replaced files in an existing Oracle home. Beginning with Oracle Database 11*g* Release 2, patch sets are full installations that replace existing installations.

This is Oracle's recommended way to apply a patch set. You install the patch set into a new, separate Oracle home location. After you install the patch upgrade, you then migrate the Oracle Database from the older Oracle home. The patch set upgrade is now the same process to upgrade from one version to another. Oracle recommends that you perform an out-of-place patch set upgrade, because this patch set application option requires much less downtime, and is safer because it does not require patching an ORACLE_HOME that is already being used in production. However, you must ensure that you have sufficient free disk space to accommodate two Oracle home directories at the same time (for more information check SAP note 1524205).

SAP Bundle Patches (SBP)

Oracle database patches for UNIX-platforms are now delivered in form of so-called SAP Bundle Patches (SBP) as of Oracle Database Rel. 10.2.0.4. SBPs are based on Oracle Patch Set Updates (PSUs) that are proactive cumulative patches containing recommended bug fixes and Critical Patch Updates (CPU) that are released on a regular and predictable schedule. A SAP Bundle Patch consists of Current Patch Set Update (PSU), SAP specific necessary Single-and Merge-Patches which are not contained in the PSU, current SAP specific Optimizer-Merge-Patch, README.html: installation manual for SBP, bugs_fixed.html: list of patches contained in SBP. SBPs are cumulative and the current one contain all previous patches and then nes patches in addition. In other words, customers always need to install only one, the most current, SBP using MOPatch.

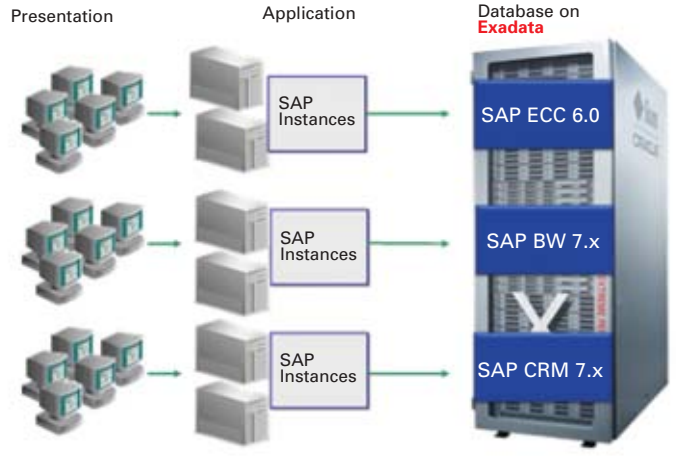


ORACLE EXADATA MACHINE FOR SAP CUSTOMERS

Oracle Exadata Database Machine was certified by SAP on June 10, 2011 and can be used with SAP NetWeaver 7.0 or higher including all SAP products which are based on SAP NetWeaver 7.x such as SAP ERP 6.0, SAP BW 7.x, SAP CRM 7.x etc. (for a complete list check the SAP Product Availability Matrix: http://www.service.sap.com/PAM).

The Oracle Exadata Database Machine is an easy to deploy solution for hosting the Oracle Database that delivers the highest available levels of database performance. **The Exadata Database Machine is a "cloud in a box" 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 (i.e. SAP ERP 6.0), Business Warehouse (i.e. SAP BW 7.x) 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.

SAP Application with Oracle Exadata Database Machine



SAP customers can easily migrate their database to Exadata that **runs SAP applications unchanged**. The migration to Exadata (DB server on either Oracle Linux or Oracle Solaris) is smooth and is not more than a homogeneous or heterogeneous OS platform migration depending on the source platform the database is running on today. The migration can be done either online or offline depending on the source platform and the migration tool (R3Load, RMAN duplicate database, RMAN transportable tablespaces or O2O/Triple-O) as well. For more details see http://www.sdn.sap.com/irj/sdn/ora and scroll down to "Oracle Exadata".

The advantages of Exadata for SAP customers are obvious since it's transparent to the application, runs on proven technology such as Oracle 11.2, RAC, etc, eliminates systems integration trial-and-error, relies on existing personnel and skills, performs database queries much faster (large and complex Infocubes, queries, or transactions that show a large amount of time spent in the database), less administration time, simpler patching, and greater uptime. Exadata provides High availability and disaster recovery out-of-the-box and highly proven at SAP customers, it helps to consolidate platforms and database, thus reduce power and cooling consumption. Last but not least Oracle Exadata relies on Single vendor, bundled OS and RDBMS patch sets – ends the Multi vendor nightmare.

SAP customers migrating to Exadata will have a 3-tier architecture with SAP instances running on separate servers and not on the database servers.
This flexible three tier architecture allows for any combination of hardware and operating systems running the SAP instances to be used with the Oracle Exadata Database Machine. For instance you can run SAP Application servers on AIX, HP-UX, Linux or any other SAP certified platform against the Oracle Exadata Database Machine. This flexibility allows an easy introduction of the Oracle Exadata Database Machine into existing SAP environments the SAP layer is unchanged.

Additionally to the database instances running on the database servers, customers can make SAP central services high available on the database nodes through SAPCTL based on Oracle Clusterware, but only if the SAP system is UNICODE. If a separate cluster other than the database cluster is already used for the SAP Central Services then it is recommended to continue to use this separate cluster for the SAP Central Services when deploying the Oracle Exadata Database Machine. Last but not least, BR*Tools are supported to run on Exadata database servers as well.

To prepare Exadata nodes for the database migration, customers can use SAPinst (see SAP note 1619343) to generate the prerequisites for the Oracle Exadata database instance that among other things create users, groups, oracle client software, SAP kernel executables and BR*Tools.

The migration methods of the database are described in the paper "Using SAP NetWeaver with the Oracle Exadata Database Machine: A Best Practices Guide". See (www.scn.sap.com/community/oracle then scroll down to "Oracle Exadata"). The pure database migration to Exadata actually does not differ from the migration to ASM (Automatic Storage Management file system) already described in detail.

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 a "cloud in a box" composed of database servers.
The Exadata Storage Server is an integral component of the Exadata Database Machine. Extreme performance is delivered by several unique features of the product. Exadata storage provides database aware storage services, such as the ability to offload database processing from the database server to storage, and provides this while being transparent to SQL processing and database applications. Hence just the data requested by the application is returned rather than all the data in the queried tables. Exadata Smart Flash Cache dramatically accelerates Oracle Database processing by speeding I/O operations. The Flash provides intelligent caching of database objects to avoid physical I/O operations and speeds database logging.

The Oracle Database on the Database Machine is the first Flash enabled database. Exadata storage provides an advanced compression technology, Hybrid Columnar Compression, that typically provides 10x, and higher, levels of data compression. Exadata compression boosts the effective data transfer by an order of magnitude. The Oracle Exadata Database Machine is the world's most secure database machine. Building on the superior security capabilities of the Oracle Database, the Exadata storage provides the ability to query fully encrypted databases with near zero overhead at hundreds of gigabytes per second. The combination of these, and many other, features of the product are the basis of the outstanding performance of the Exadata Database Machine.

The Exadata Database Machine has also been designed to work with, or independently of, the Oracle Exalogic Elastic Cloud. The combination of Exadata and Exalogic is a complete hardware and software engineered solution that delivers high-performance for all enterprise applications including Oracle E-Business Suite, Siebel, PeopleSoft and SAP applications.

The foundation of the Exadata family of products is the Oracle Exadata Database Machine (Database Machine). The Database Machine is a complete and fully integrated database system that includes all the components to quickly and easily deploy any enterprise database delivering the best performance. The Exadata Storage Server (Exadata storage or Exadata cells) is used as the storage for the Oracle Database in the Database Machine. It runs the Exadata Storage Server Software that provides the unique and powerful Exadata technology including Smart Scan, Smart Flash Cache, Smart Flash Logging, IO Resource Manager, Storage Indexes and Hybrid Columnar Compression. The Exadata Storage Expansion Rack is a fast and simple means to grow the Exadata storage capacity and bandwidth of an existing Database Machine or SPARC SuperCluster deployment.

The Database Machine is a pre-configured system ready to be turned on day one, taking significant integration work, cost and time out of the database deployment process. Since it is a well known configuration Oracle Support is very familiar with how to service the system resulting in a superior support experience with the system. The benefit of a common infrastructure to deploy a database for any application, whether OLTP, OLAP, a mix of the two, or as a platform for consolidation of several databases, creates tremendous opportunities for efficiencies in the datacenter. It is truly a "cloud in box".

Exadata Database Machine

There are two versions of Exadata Database Machine. The Exadata Database Machine X2-2 expands from 2 twelve-core database servers with 192 GB of memory and 3 Exadata Storage Servers to 8 twelve-core database servers with 1,152 GB of memory and 14 Exadata Storage Servers, all in a single rack. The Exadata Database Machine X2-8 is comprised of 2 eighty-core database servers with 4 TB of memory and 14 Exadata Storage Servers, in a single rack. The X2-2 provides a convenient entry point in to the Exadata Database Machine family with the largest degree of expandability in a single rack. The X2-8 is for large deployments with larger memory requirements or for consolidating multiple databases on to a single system. Both versions run the Oracle Database 11*g* Release 2 database software.

Each model of the Database Machine X2-2 can grow in capacity and power, ensuring a smooth upgrade path, as processing requirements grow. An online field upgrade from the Quarter Rack to the Half Rack and from the Half Rack to Full Rack can be easily performed by Oracle personnel.
While an Exadata Database Machine is an extremely powerful system, a building-block approach is used that allows Exadata Database Machines to scale to almost any size. Multiple Database Machine X2-2 systems can be connected using the InfiniBand fabric in the system to form a larger single system image configuration. Multiple Exadata Database Machine X2-8 racks can similarly be connected. This capability is done by connecting InfiniBand cables between the racks as all the InfiniBand infrastructure (switches and port cabling) is designed to provide this growth option. Up to 8 racks can be connected by simply connecting the InfiniBand cables. Larger configurations can be built with additional InfiniBand switches. Any combination of X2-2 Full and Half Racks can be connected. Quarter racks can be inter-connected with other racks in two circumstances. Two Quarter Racks can be inter-connected to each other or one Quarter Rack can be connected to any combination of Full and Half Racks. The inherent capability of the Exadata Database Machine to grow enables the support of the largest databases any application would require.

Exadata Storage Server

The Exadata Storage Server runs the Exadata Storage Server Software and provides the unique and powerful Exadata software technology of the Database Machine including Smart Scan, Smart Flash Cache, Smart Flash Logging, IO Resource Manager, Storage Indexes and Hybrid Columnar Compression. The hardware components of the Exadata Storage Server (also referred to as an Exadata cell) were carefully chosen to match the needs of high performance database processing. The Exadata software is optimized to take the best possible advantage of the hardware components and Oracle Database. Each Exadata cell delivers outstanding I/O performance and bandwidth to the database. The CPU cores in the Exadata Storage Server are dedicated to providing features such as Smart Scan SQL processing that is done in the Exadata storage. Building on the high security capabilities in every Oracle Database, the Exadata storage provides the ability to query fully encrypted databases with near zero overhead at hundreds of gigabytes per second. This is done by moving decryption processing from software into the Exadata Storage Server hardware. The Oracle software and the Intel 5600 processors used in the Exadata Storage Server provide Advanced Encryption Standard (AES) support enabling this.

Exadata Smart Flash Cache

Each Exadata cell comes with 384 GB of Exadata Smart Flash Cache. This means in the Database Machine X2-8 and Full Rack X2-2 there is 5.3 TB of Flash – larger than most databases. This solid state storage delivers dramatic performance advantages with Exadata storage. It provides a ten-fold improvement in response time for reads over regular disk; a hundred-fold improvement in IOPS for reads over regular disk; and is a less expensive higher capacity alternative to memory. Overall it delivers a ten-fold increase performing a blended average of read and write operations.

One of the key enablers of Exadata's extreme performance is the Exadata Smart Flash Cache hardware and the intelligent Oracle Exadata Storage Server Software that drives it. The Exadata Smart Flash Cache feature of the Exadata Storage Server Software intelligently caches database objects in flash memory, replacing slow, mechanical I/O operations to disk with very rapid flash memory operations. The Exadata Storage Server Software also provides the Exadata Smart Flash Logging feature to speed database log I/O. Exadata Smart Flash Cache is one of the essential technologies of the Oracle Exadata Database Machine that enables the processing of up to 1.5 million random I/O operations per second (IOPS), and the scanning of data within Exadata storage at up to 75 GB/second

Exadata Storage Capacity, Performance, Bandwidth and IOPS

The Oracle Exadata Storage Servers comes with either twelve 600 GB 15,000 RPM High Performance SAS disks or twelve 3 TB 7,200 RPM High Capacity SAS disks. The High Performance SAS disk based Exadata Storage Servers provide up to 3.25 TB of uncompressed useable capacity, and up to 1.8 GB/-second of raw data bandwidth. The High Capacity SAS disk based Exadata Storage Servers provide up to 16 TB of uncompressed useable capacity, and up to 1.3 GB/second of raw data bandwidth. When stored in compressed format, the amount of user data and the amount of data bandwidth delivered by each cell significantly increases.

The performance that each cell delivers is extremely high due to the Exadata Smart Flash Cache. The Exadata software can simultaneously scan from Flash and disk to maximize bandwidth. The automated caching within Flash enables each Exadata cell to deliver up to 5.4 GB/second bandwidth and 125,000 database achievable, often increases up to ten times, or more. This represents a significant improvement over traditional storage devices used with the Oracle Database.

Enterprise Manager Support for Exadata Database Machine

Oracle Enterprise Manager Cloud Control 12c uses a holistic approach to manage the Exadata Database Machine and provides comprehensive lifecycle management from monitoring to management and ongoing maintenance for the entire engineered system.

Integrated System Monitoring

Oracle Enterprise Manager provides comprehensive monitoring and notifications to enable administrators to proactively detect and respond to problems with Oracle Exadata Data Machine and its software and hardware components. Administrators can easily adjust these monitoring settings to suit the needs of their datacenter environment. When notified of these alerts, administrators can easily view the history of alerts and associated performance metrics of the problem component, such as the network performance of an InfiniBand port or the disk activity of an Exadata storage cell, to identify the root cause of the problem. With direct connectivity into the hardware components of Exadata, Oracle Enterprise Manager can alert administrators to hardware-related faults and log service requests automatically through integration with Oracle Automatic Service Requests (ASR) for immediate review by Oracle Support.

Problems that would have required a combination of database, system and storage administrators to detect in traditional systems can now be diagnosed in minutes because of integrated systems monitoring for the entire Exadata Database Machine.

ORACLE EXADATA START UP PACK FOR SAP CUSTOMERS

An integrated approach to enable rapid results

Oracle Engineered Systems deliver extreme performance through pre-integrated technology. In order to realize the rapid time-to-production benefits that this can bring, customers need to ensure that they are able to address the requirements in an optimal way.

The Oracle Exadata Start-Up Pack for SAP customers delivers an integrated service package and product expertise to ensure an optimized and planned deployment of an Oracle Exadata system. Oracle's service experts deliver a suite of services that begins with strategic architectural design and planning. Oracle then installs and configures the system according to Oracle best practices. Oracle support engineers provide supportability reviews throughout pre-production as customers execute the architectural design plans. Once in production, Oracle provides quarterly patch especially for SAP customers, deployments across the entire Oracle Exadata stack for one year.

Start Up Advisory Service

The Oracle Exadata Start-Up Advisory Service provides an exceptional level of implementation assurance. Our teams of experts work closely with customers' organizations to help them to deliver the best overall Quality of Service by building a strategic plan that ensures mission critical applications meet the performance and operational needs of the customer's business. Providing assessments, planning and recommendations, Oracle delivers the fundamental guidance needed to minimize project and deployment risks while accelerating operational readiness for the Oracle Exadata platform. Oracle's Exadata Start-Up Advisory Service is the first step to a well-executed implementation, and is tailored to customer business requirements, time to value objectives, and long-term strategic vision.

The service provides current state assessment of key areas essential for a successful Oracle Exadata deployment. In addition, a gap analysis of assessment against Oracle best practices is provided, along with documented recommendations that cover implementation, migration strategies and change management across both people and business processes.

Production Support Readiness

Oracle's Service Delivery Managers and Oracle Engineers will proactively support project objectives, coordinating both the Oracle and client project teams and overseeing the Oracle Exadata installation and go-live process. Governance meetings are conducted to review key best practices, so as to ensure supportability, and report on all Oracle, customer, and partner pre-production activities.

Leveraging the outputs of the Oracle Exadata Start-Up Advisory Service, Oracle engineers deliver the detail and recommendations to keep customers on a seamless path to a successful deployment and ongoing production support. Key technical areas that are reviewed include configuration, data migration, kind of migration method (SAP's R3LOAD, RMAN, Transportable Tablespaces, O2O (Oracle DB to Oracle DB migration) or Triple-O (Oracle to Oracle Online database migration, based on SAP Note 1508271), patch planning, and production support readiness.

Exadata Installation Service

The Oracle Exadata Installation Service provides comprehensive hardware system installation to shorten time to deployment. Oracle system implementations combine highly trained engineers with proven, standardized installation methodologies along with best practices, tools and technology for all installations.

Exadata Configuration Service

Guided by the Start Up Advisory outputs, the Oracle Exadata Configuration Service delivers complete Oracle Database configuration based on Oracle best practices. Oracle engineers cover all aspects of the required configuration and patching across the Oracle Exadata storage servers and software, database servers, shared storage, and database patches. Using well-documented processes, Oracle Exadata experts configure login and network addresses, create cell disks, and configure logins and network addresses. All configuration settings are documented and delivered to the customer IT team during the post installation procedures. Activities include installation of licensed Oracle Database, configuration of database servers and shared storage to support Oracle Real Application Clusters, running verification tests, and documenting configuration and maintenance procedures.

Quarterly Patch Deployment Service

The Oracle Exadata Quarterly Patch Deployment Service delivers a proactive patch deployment process to ensure each customer's Oracle Exadata for SAP machine is optimally maintained. Oracle delivers a special patch only for SAP customers (SAP Note 1591389) Oracle performs a high-level check of the system's configuration profile to identify known configuration issues. Oracle support experts then generate a standardized report of findings, based on Oracle's recommended best practices. Oracle implements the required updates, once per quarter for one year, in a unified and proactive manner across all system components including firmware, Oracle Enterprise (remark, so far as I knoe the new name is OL "only Oracle Linux) Linux or Solaris, and other Oracle software installed on the Oracle Exadata machine. Customers retain the flexibility to apply additional configuration and patches as needed between the planned deployments of this service.

Optimising Time to Production

Proper planning, installation, deployment and support of Oracle Exadata are critical to optimizing system performance. By utilizing the Oracle Exadata Start-Up Pack integrated solutions and personalized expertise, customers can ensure the ongoing system stability and the performance expected of the technology—right from the start.

Oracle service professionals deliver the thought leadership, technical expertise, tools, and best practices to help ensure a smooth and highly optimized Oracle Exadata production implementation. Customers get the right expertise at the right time to help mitigate risk and to maximize the value of their technology investments.

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GLENCORE EMBRACES ORACLE EXADATA AS THE TECHNOLOGY OF THE FUTURE

"As a leading integrated commodities producer and marketer, we need to source, process, refine, transport, store, finance and supply materials needed by industries around the world. Consequently, each decision related to performance maximization becomes more critical and complex, particularly in today's outlook. Oracle Exadata is the best solution to ensure optimal performance and fully integrated platform that will support our company's fast growing pace and success story."

– CYRIL REOL,
CIO, Glencore International plc.

Customer Success Story

Glencore is a leading producer and marketer of commodity products, predominantly in the supply of metals, minerals, energy and agricultural products. It operates 24 hours a day, 7 days a week, supported by a global network of 50 offices in 40 countries throughout Europe, North, Central and South America, the CIS, Asia, Australia, Africa and the Middle East. Over 2,800 people work in its marketing division, while over 54,800 people are directly or indirectly employed in industrial operations.

In today's globalization, success or failure depends largely on capacity to make the right decision based on the latest information available. A commodity marketer has to understand the political uncertainties, risks specific to a particular production region, changes in weather conditions that may affect delivery of goods, market volatility on supply/demand, amongst hundreds of unpredictable changes.

In order to respond to all these challenges, Glencore has established a solid backbone of trading and risk management platforms, and reporting databases, which allows a dynamic decision making process in its globally distributed business. More than 200 different IT solutions are operating on a daily basis, with the highest level of transactional integration possible, particularly for its corporate data warehouse and global accounting.

A significant part of these key solutions are hosted in Glencore's headquarter in Baar, Switzerland.

As a leading and innovative company, Glencore IT has always had a culture for performance. The reason is obvious: by allowing early adoption of technologies that bring a true competitive advantage IT is enabling business opportunities. In that respect, Glencore embraced Oracle Exadata platform as a new foundation for company data warehouse and global SAP programs.

Two projects, one goal: maximum availability for mission-critical business

"We considered Oracle Exadata solution before it gets fully certified on SAP ECC 6.0, enabling a leading edge solution to support a major accounting program change but certification was an essential prerequisite for our company" recalled Sveto Putincanin, Head of IT Engineering and Operations.

Back in July 2011, Glencore decided to proceed with an evaluation of Oracle Exadata Database Machine with assistance from Tradeware AG, an Oracle Platinum Partner based in Switzerland.

After reviewing Oracle Exadata core features and capabilities through a Proof of Concept (benefiting from a quarter-rack infrastructure environment for that purpose), Glencore was convinced that Oracle's new system represented the way of the future. Decision was made to upgrade its global data warehouse environment – plus underlying data feed processes – as the new SAP-based global financial solution to Oracle Exadata Database Machine.

Phase 1

The first phase of the Exadata roll-out project was to upgrade Glencore data warehouse environment. A major performance gain was identified, especially in terms of I/O, and due to the high system load. Before considering any migration, Glencore thoroughly tested the platform using an Exadata system which was provisioned by its partner Tradeware. Because the preparation work was crucial, Glencore was able to leverage Oracle GoldenGate with limited issues. It has performed the necessary upgrade tasks of Oracle Database from 10*g* to 11*g*.

"Any benchmark in terms of performance between the new Oracle Exadata and our previous Oracle environment would be impressive" added Sveto Putincanin.

The major improvement is about the generation of business reports that users urgently need to market commodities. In the past, some reports were generated overnight due to the volume of data retrieved and processed; now, it appears on the decision maker screens in less than an hour.

"This is very valuable in our competitive industry which depends heavily on market information and how you can anticipate change. Being able to quantify and correlate any technical improvement with the Glencore overall financial performance is quite difficult. Nevertheless, I consider that we have today a key component for future successes" commented Cyril Reol.

This first deployment fulfilled all Glencore's expectations placed in Oracle Exadata Database Machine. The underlying components harmonized together perfectly and particularly increase performance on the I/O side. As a matter of fact, Glencore no longer need to ensure the interoperability of the server, operating system, firmware, storage and other heterogeneous components. Key complexity was visibly reduced, greatly simplifying system operation.

Oracle Exadata also drastically reduced the number of systems that had to be administered. It replaced many production, testing and development machines along with the adequate SAN environment.

"We saved on resources as well, particularly as the platform only needs to be administered by one team instead of four previously. It will clearly pay off in all our subsequent activities" said Sveto Putincanin.

Phase 2

SAP Financial & Controlling solution on Exadata

Since Glencore was an early adopter, the Walldorf-based Oracle team helped to deploy the first SAP FI/CO environment on Oracle Exadata in Switzerland, as a second step for Glencore. The Oracle experts supported the Glencore team throughout the entire process – from planning, conceptual design, infrastructure sizing to production startup – to ensure that no issue might delay this critical program go-live.

Glencore's ambitious new Global Accounting Program – based on SAP FI/CO – aimed to streamline its accounting and financial processes worldwide and across all commodity divisions. It was initially deployed in Baar, Switzerland for its global Metal, Minerals and Coal marketing businesses. Afterwards, the project will be continue across other operations, covering Oil and Gas divisions in UK, US and Singapore, plus Agricultural business in The Netherlands.

As the Global Accounting Program was launched prior to Oracle announcement about Exadata, Glencore IT had to catch-up quickly during the project and decided to migrate the Test environment first. Afterwards, Glencore completed the remaining environments and went live on SAP FI/CO based on Oracle Exadata Database Machine in January 2012.

"We highly valued Oracle's support. Their employees had the required expertise to select the perfect hardware for our requirements and prepare meticulously for go-live. While there were a few stressful moments for everyone in the project, we went live very smoothly for an early adopter project" said Sveto Putincanin.

"We now have a SAP-certified solution and a single provider supplying the operational support for all its components. Additionally, we can administer and further develop our IT infrastructure more efficiently thanks to the Oracle Exadata solution, making our team even more effective in the future"

Challenges

- Being able to make the right decision based on the latest information available; Glencore, as a leading producer and marketer for commodity products, is operating globally and requiring high-performance solutions.
- Managing the underlying risks to introduce a major technology change while ensuring daily support, best performance and availability for business-critical requirements.
- Identifying eligible applications/projects that would benefit the most of Oracle Exadata improvements; Glencore selected its data warehouse and new SAP FI/CO program.
- Finding the right partner(s) that would fit into the company culture and support a smooth transitioning to Oracle Exadata; Glencore established a partnership with Tradeware and Oracle in that respect.
- Minimizing the infrastructure's complexity to ensure efficient system operations and to optimize support processes, making its operational team even more effective.

Solution

- A Proof of Concept, supported by Oracle partner Tradeware AG, confirms that the new IT environment based on Oracle Exadata could deliver the expected performance and reduce the complexity inherent to heterogeneous infrastructures.
- Oracle Exadata Database Machine in conjunction with Oracle Real Application Clusters and Oracle Advanced Compression forms the foundation for a successful architecture.
- Leveraging Oracle GoldenGate to eliminate performance bottlenecks and to ensure a smooth migration of a complex data warehouse environment.

Achievements

- Users can now more quickly access the reports they urgently need to market their products. Reports that used to be generated overnight now appear on the user's screen within an hour.
- Global Accounting Program to streamline all Glencore accounting and financial processes went successfully live in January 2012, supported by Oracle Exadata experts as part of the Early Adopter Program.
- A seamless interoperability of the hardware and software components is achieved by the placement into service of the SAP-certified Oracle Exadata environment.
- System operation is much simpler overall since the server, operating system, firmware, storage and all necessary components are perfectly fitted.
- Glencore saved on daily support resources and only need one administration team instead of four previously.

Why Oracle?

As a fast-growing, successful company, Glencore consistently relies on the latest technologies to improve its competitive edge. Oracle has long numbered among the company's strategic partners; it relies on many Oracle products in addition to its database. Oracle Real Application Clusters, for example, efficiently ensures high availability, while Oracle Advanced Compression optimizes storage resources.

Oracle's solution represents the future high-performance platform for mission-critical applications and offers incomparable performance, availability and administrative efficiency particularly as it dramatically simplifies the complexity of heterogeneous infrastructure.

Implementation Process

A careful and comprehensive Proof of Concept of the Exadata technology helps to establish the surroundings for successful projects. Glencore was able to upgrade a global data warehouse largely on its own and to deploy SAP FI/CO in association with Oracle experts as part of the Early Adopter Program.

Partner Involvement

Tradeware AG is a leading provider of IT infrastructure with server, storage, software and archive solutions. It has worked with leading technology vendors for many years, giving it the experience needed to implement IT infrastructure solutions. As an Oracle technology partner, Thalwil-based Tradeware has Switzerland's only Exadata Competence Center with its own Exadata Database Machine. The Oracle Platinum Partner allows customers to test their applicaions and compare the performance of various platforms on this system.

Glencore has been working with Tradeware for years, mainly because of its extensive capabilities: "Tradeware fully understands our business and technology requirements, knows the key people at our company and knows what really matters for us. Tradeware was supportive to offer their Exadata machine during a Proof of Concept, which gave this project an extra push," said Sveto Putincanin.

Tradeware AG was given the "EMEA Exadata Partner of the Year" award at Oracle Open World 2011 in San Francisco in recognition of its outstanding contributions.

GLENCORE

Keywords:

Oracle Customer Success Story, Glencore International AG, Oracle Exadata Database Machine X2-2 HC Half Rack, Oracle Exadata Database Machine X2-2 HC Quarter Rack, Oracle Database 11*g* Release 2, Enterprise Edition, Oracle Real Application Clusters, Oracle Advanced Compression, Oracle GoldenGate, Commodity Trading, Tradeware AG, High Availability, High Performance.

Customer and Partner Information

Customer Name: Glencore International plc

Customer Revenue: US$ 186 billion (2011-provisional)

Customer URL: www.glencore.com

Customer Headquarters: Baar, Switzerland

Industry: Integrated Commodities Producer and Marketer

Employees: 54,800

Partner Name for Oracle.com Search: Tradeware AG

Go to Market Products :

- Oracle Exadata Database Machine X2-2 HC Half Rack
- Oracle Exadata Database Machine X2-2 HC Quarter Rack
- Oracle Database 11*g* Release 2, Enterprise Edition
- Oracle Real Application Clusters
- Oracle Advanced Compression
- Oracle GoldenGate

Region: EMEA

Country: Switzerland

ORACLE
EXADATA

"The Oracle Exadata Database Machine delivered all the improvements we had hoped for. Having this kind of system just inspires a sense of trust and confidence."

– IT GROUP HEAD

ORACLE DATABASE MACHINE: THE KEY TO TAKING SAP USE TO THE NEXT LEVEL

Industry: Automotive, Electronics

Oracle products and services:
- Oracle Exadata Database Machine
- 2 quarter racks
- Oracle Database 11.2.02
- Oracle Advanced Customer Support Service (ACS)

Key benefits:
- Future-oriented infrastructure with innovative technologies,
- increased performance,
- decreased complexity,
- high availability,
- resource savings,
- high scalability and flexibility

SAP:
- ERP ECC 6.0 (with GTS and EPP), NetWeaver BW, CRM, HCM, SCM

Other infrastructure components:
- HP and IBM server/storage

This innovative, successful firm prides itself on developing in-house capabilities in many aspects of its business – including IT. From applications to infrastructure, the IT team has amassed vast experience and profound technological expertise over the years.

Oracle databases, for example, have been humming productively away at the electronics firm for several decades. Indeed, the predecessor of SAP's standard software already ran on Oracle. When they switched to R/3 in 2001, it also deployed Oracle as its preferred database management system.

Today, over 40 SAP systems (testing, quality assurance and production systems with 3,500 concurrent users in total) perform their duties together with Oracle Database 11*g*. Many non-SAP applications (PLM, asset management, BDE/BME) run on Oracle Database 11*g* as well. In addition, the multinational corporation has long relied on Oracle's Advanced Customer Support Services (ACS). And since the end of January 2012, the customer has been reaping the benefits of the Oracle Exadata Database Machine, a one-of-a-kind appliance and out-of-the-box solution with innovative, perfectly matched hardware and software.

To the Database Machine via Oracle Advanced Customer Services (ACS)

"We devote a lot of resources to keeping our systems running smoothly for SAP application use, especially for SAP BW. In many cases, this consists of constantly tuning the systems to maximize overall performance," explained Group Lead IT.

This had been a hot topic of discussion between the IT team and Oracle ACS experts – and the subject of several proposed solutions. Finally, the ACS specialists suggested the Oracle Exadata Database Machine in the spring of 2011 and gave a presentation in July.

According to the ERP expert, "We loved the Oracle Exadata Database Machine from the start. It was clear that Oracle's out-of-the-box solution could greatly optimize our SAP activities, not just in terms of performance, but also in terms of minimizing the resources tied up in system tuning, which we were very keen to do."

Though the expectations were high, Oracle Exadata delivered all the hoped-for improvements in BW and CRM use from the very first day. Plus, not only was the implementation of two X2-2 Exadata quarter racks (with Oracle Database 11*g* and Oracle Enterprise Linux) completely painless, it was also completed very quickly: in slightly more than three weeks.

ECC6.0 on Exadata after BW and CRM

The IT team and Oracle ACS joined forces to systematically carry out an Exadata implementation project plan; Oracle SAP specialists were brought in as needed. After installing and checking the hardware, the partners got to work on the main step in the project: setting up the 4.5 TB Oracle Exadata Database Machine as the standby database for NetWeaver BW and CRM. This took less than two days, which left plenty of time for testing.

Once the preparations were complete, the team "pulled the lever" and switched the BW and CRM database infrastructure over to the Exadata Database Machine. The Exadata standby database had become the production database. As IT Group Lead recalled, "Everything went off painlessly, just as planned. Exadata has been our sole SAP database layer for BW and CRM since January 29."

The Exadata appliance replaced an HP DL580 (database) server (with SUSE Linux) and an EVA8100 storage system (including 4 Gb SAN system), which have been redeployed elsewhere in the company. The customer is already planning to move ERP ECC6.0 (including GTS) over to Exadata to improve performance even more.

The benefits are enormous

The advantages and improvements offered by Oracle Exadata represent a giant leap forward that has delivered countless benefits for the company.

"We can make massive reductions in system tuning, which has been a real boon. Between Exadata's excellent performance and the way in which the data is prepared, we have essentially eliminated the need to tune our systems for BW use. For example, we no longer have to analyze certain reports or statements and create additional indexes. That lets us put our resources to more productive uses," noted the IT expert.

Also, the customer has reported enormous improvements in overall BW performance. But it saw entirely new benefits, too. "We can now generate BW reports that were simply unheard of in our pre-Exadata days," said the SAP application expert. "And that's a great thing. Not just for us in IT, but also for people in the user departments, whose satisfaction with BW has risen enormously. Exadata has unlocked an entirely new dimension of the application for them." Before Exadata, many large reports could not be generated because they would time out after reaching the ten-minute mark set by the customer.

The reports and queries have obviously seen improvements as well – quite dramatic ones, in some cases. According to the company's measurements, some queries (including revenue queries) are up to 14 times faster with Exadata than the previous database environment.

Reduction of complexity

When the IT Group Lead says that the Oracle Exadata Database Machine "just inspires a sense of trust and confidence," he is obviously referring to improvements in system tuning and performance. However, he has another issue in mind, too: "reduction of complexity" or, to put it another way, "patch risk reduction."

"Whenever you patch a conventional SAP database environment, you have to look out for compatibility conflicts between components." A database server patch, for example, may require the switch or storage system to have a particular patch version. Managing all these patches can be extremely complicated. "Exadata, by contrast, is an out-of-the-box solution with perfectly matched and tested components. It doesn't require time-consuming patching, which drastically reduces and simplifies our workload," explained the IT expert.

Next, the customer plans to switch ERP ECC-6.0 (including GTS, 5 TB) over to Exadata. The company expects to see additional benefits from this move. Tests have already shown that data can be loaded from the ERP system to the database much faster with the Oracle Exadata Database Machine. That will give an additional fillip to performance and, by extension, user satisfaction.

If necessary, the Exadata system can scale up easily and painlessly: The quarter racks can be upgraded to half racks, full racks or multi-racks. Will the automotive customer use one of these options? Only time will tell, but it certainly seems possible. After all, in the medium term, they plan to supply application services to its sites in China and the United States from Germany.

Selected queries with and without Oracle Exadata Database

Query	Time old System (sec)	Time EXA (sec)	Factor	CPU Time old	CPU Time EXA	Physical Reads old	Physical Reads EXA
ZPCA_M02/ZCO_PCAM02_100	2.206 37Min	164 2Min40Sec	13	602	146	22.669.277	22.669.225
ZPCA_M02/ZCO_PCAM02_100	6.261 1h44Min	433 7Min	14	1577	313	65.636.143	63.786.358

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DATABASE CONSOLIDATION ON ORACLE EXADATA DATABASE MACHINE

– KONRAD HÄFELI,
Senior Technology Manager, Trivadis AG

This article outlines the general approach and actual experience of a telco company, which chose to use Exadata as its new strategic Oracle Database server platform. Specifically, it examines the consolidation of a large number of databases in the new environment together with the options considered and the chosen approaches.

Introduction

Much has been written about the evaluation of the Oracle Exadata Database Machine as a strategic database server platform, so it is not discussed any further in this report. The main motivations described by my client (a large company in the telco industry) were as follows:

- Planned replacement of storage systems
- Existing standby systems did not offer same performance as primary systems
- Standby systems were no longer adequate
- Planned introduction of Oracle 11*g* Release 2
- Existing backup infrastructure and processes too complex
- Energy consumption no longer acceptable by modern standards
- A number of pending platform consolidations
- Desired reduction in license costs.

The standard setup of Oracle ACS (Advanced Customer Services) is also well known and I described the migration of a database with Oracle GoldenGate (near zero downtime migration) to the "untouched" Database Machine in a presentation at the last DOAG conference. In this article, I will examine the issues that must be considered when using the technology as a consolidation platform.

Starting Situation and Target Platform

The data to be consolidated consisted of around 50 databases, ranging in size from 100 GB to several terabytes. Various versions were represented, mainly Oracle 10.2.0.4; most of the databases were single-instance but there were also some RAC databases. The infrastructure is operated on an application basis by two teams who work closely on database management. For the most part, availability is assured by means of a failover cluster configuration; a Veritas stretched cluster is divided between two data centers located 3 km apart. The existing RAC configuration is combined into a maximum availability architecture (MAA) system with Dataguard.
The sizing of the Exadata platform was supported by Trivadis Configuration Manager (TVD-ConfMan™). KPIs were defined and measured for all the existing systems and then compared with the performance-relevant figures for Exadata. It became clear that a half-rack configuration would be sufficient to handle the existing load and provide sufficient reserves for the planned new databases. The availability requirements of the telco sector (24/365) also necessitated an MAA configuration (a half-rack in each data center, 80 km apart).

Possible Approaches and Evaluation

If all the database infrastructures were combined and operated by a single team in a new, horizontal organization, the application-based division of the databases could be disregarded. However, the question must be posed as to whether to consider the two extreme variants:

- 1:1 migration, i.e. a new database on Exadata for every old one

The first variant makes no use of the synergies and potential of the available RAC infrastructure:

- High or maximum service availability
- Scale-out option
- Reduction in resources for memory, background processes, and number of tablespaces

The following definition was formulated as a general basis for consolidation on an (Exadata) RAC infrastructure:

1. All applications are only connected by database service names and are no longer linked to the physical database or the database name.
2. The applications are able to withstand a brief disconnection and re-establish the connection (through Oracle Net Configuration and the handling of the Oracle connections).

The first requirement allows for an abstraction of data access, so the physical location of the data is unimportant. The second requirement ensures that the relocation of the database services over the RAC nodes (and potentially the MAA nodes) does not cause applications to crash.

Description of Concept:

The objective is to consolidate the existing data, by topic, on the four nodes of the Exadata half-rack in as few databases as possible. Access to the data is abstracted by database service names. All topic-based databases have instances running on every node, but the application services for a database only ever run on one node and high availability is maintained by service failover. In this way, services are distributed between the nodes to balance the load on the system.

Benefits:

By consolidating the databases it is possible to eliminate existing database links. A specific database service is highly available because failover can take place on a launched instance. Potential cache fusion issues are avoided because the various connections to the same data are not created over different instances (there is no scale-out by default, as most applications are not RAC-aware). It is very straightforward to achieve good load distribution due to the granularity of the database service.

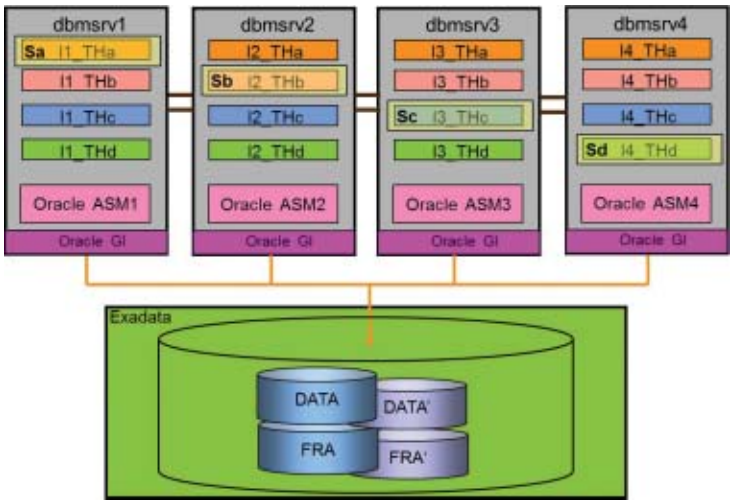


Figure 1: Schematic representation of Exadata database consolidation on database services

Figure 1 shows, in summarized form, the redundant data in the Exadata storage cells and above it the four database nodes with Oracle Grid Infrastructure (cluster layer), the ASM instances (per server), and the various databases consolidated by topic (TH[a-d]). The diagram shows four databases, each with one instance (I[1-4]) per node, over which the database services (S[a-d]) are distributed.

An Exadata platform does not provide the disaster redundancy offered by the old concept with a stretched cluster. For this reason, a maximum availability architecture (MAA) is defined in the new concept. With the help of Dataguard (Redo Log Transport and Apply), this provides a database safeguard that can launch and run the defined services in the event of an error. Active Dataguard also makes it possible to offer read-only services on the standby databases, thus taking the load off the transaction-oriented (primary) system.

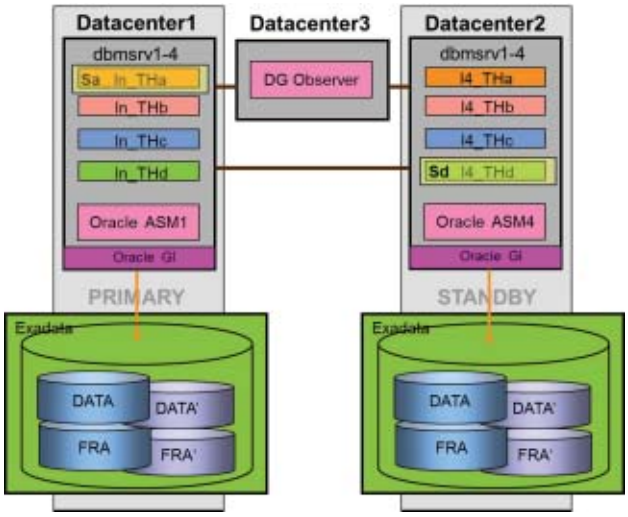


Figure 2: Schematic representation of Exadata MAA configuration

Figure *2* shows the two data centers, which host the databases alternately or in combined operation in primary and standby mode. Monitoring could take place in a third data center in which a Dataguard Observer is configured. This would implement failover from the primary site to the standby site in the event of an error.

Implementation of Consolidation

The databases should be consolidated in line with the following criteria:

- Relationships between data
  - Same application family
  - Shared data (replacement of database links)
- Explicit data separation
  - Separation due to independence requirements
  - Concentration risk
- Security
  - Sensitive data
  - Schema requires high privileges
- Availability
  - Multi-instance database
  - Single-instance database
  - Dataguard
  - Dataguard protection level
- RDBMS version
  - Major / minor releases
  - Patch / patch set.

To implement the consolidation it was necessary first of all to draw up a list of consolidation criteria and to evaluate them for each individual database. Initially structured in the form of a matrix, the list proved however to be very cumbersome, as the different criteria were sometimes mutually exclusive and it was necessary to query them with many different application, platform, and service managers, as well as others. Unsurprisingly, most of those concerned saw more risks than benefits in the database consolidation. Coordinating the various activities across much of the complex functional structure of a telco company was, in fact, very difficult and called for an influential project sponsor.

The in-depth consolidation questionnaire covered the following main areas:

- Technical information about each database (name, version, size, resource consumption)
- Application information about each database (name, type of application, type of database access, availability and security requirements)
- Operating information (backup, monitoring, data file system type, batch jobs)
- Responsibilities (manager, team, DBA, supplier)
- Test / integration environment (setup type, test data, scaling)
- Information about the migration scenario (versions, adaptations, costs of adaptation, suitability for consolidation).

Once the collected data had been evaluated (note that not all the information could be obtained for all projects within an expedient time), the following breakdown and prioritization was drawn up:

- Implementation of all new database resource queries on the new platform
- Migration of a few non-critical databases as “quick wins” to build experience in migration and operation
- Identification of time-critical databases and application of project manager focus to ensure they are consolidated on time.

Actual Experience

The fast pace of innovation in the company demanded that the consolidation platform be implemented quickly.

The following tasks had to be completed first:

- Naming concepts for databases, instances, and services
- Development of template scripts for the creation of standardized databases
- Development of scripts for the configuration of databases and services in the cluster
- Concept and implementation of resource management (Exadata IORM, DBRM)
- Implementation of backup concept
- Implementation of monitoring concept.

The anxiety of the application managers and operators prior to the consolidation of their data in one database was somewhat greater than expected. This resistance was largely due to concerns that surrendering existing privileges would result in more work and that dependence on less stable systems would mean reduced availability. Simplifying the consolidation task somewhat by migrating the trickiest databases gave users confidence in the functionality of the platform, which means they may well be willing to consolidate the database schema with others at a later stage.

It was not until the system went into productive operation that the benefits of the MAA configuration became obvious. Switching over from one data center to another allowed large system patches to be implemented with no risk. The second system also proved very useful when technical issues arose (including disk failure and replacement of the motherboard), which in some cases were not easy to resolve. The transfer of services to a second system allowed the hardware to be replaced without load.
It is important, when operating an Exadata platform, to work closely with the Oracle support team, who provide rapid and expert solutions, particularly for Exadata service requests. The platform – both software and hardware – demands focused life-cycle management, including troubleshooting for unforeseen issues.

Naturally, the question of costs for consolidation projects such as this is becoming increasingly important. The company had plenty of experience with licenses, and of course it was able to negotiate effectively with Oracle as an early adopter of the Exadata technology. After the not inconsiderable setup work, the workload involved in operation was certainly less compared with the conventional platform. If the DBA has some familiarity with the operating system or network and is willing to perform this task under instruction, he/she can maintain an Exadata platform after setup.

Much more could be said about function and utilization with the Exadata Database Machine as a consolidated database server, and the author will be pleased to answer any questions.

I wish you every success as you put Trivadis know-how into practice.

– Konrad Häfeli,
Senior Technology Manager
Trivadis AG, Bern

Download from www.trivadis.com:

http://www.trivadis.com/uploads/tx_cabagdownloadarea/Konrad_Haefeli_OracleGoldenGate_DB-Migration-auf-Exadata-mit-Fallback_NOV2010.pdf

ORACLE EXALOGIC ELASTIC CLOUD CERTIFIED FOR SAP NETWEAVER 7

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

Oracle Exalogic is the Engineered System for running middleware and packaged applications, capable of virtually unlimited scale, unbeatable performance, and previously unimagined management simplicity. It follows Oracle's Engineered Systems philosophy (similar to Exadata) of integrating all components of a system at the factory level providing a highly standardized, optimized and integrated solution that minimizes risk while maximizing performance and reliability.

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

The power of Engineered Systems such as Exadata and Exalogic show 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.

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 delivers outstanding I/O and SQL processing performance for online transaction processing (OLTP), data warehousing (DW) and consolidation of mixed workloads.

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.

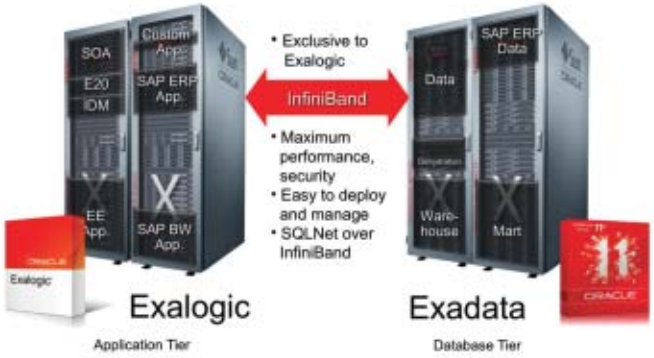
The InfiniBand fabric that spans Exalogic and Exadata components provides the following key ways of simplifying and accelerating SAP NetWeaver installations running on Exalogic:

- 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.[1] While detailed SAP performance data is not yet available, we expect

[1] 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 (http://www.oracle.com/us/products/database/sap-exadata-wp-409603.pdf).



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:
See Oracle White Paper: Oracle Exalogic Elastic Cloud: A Brief Introduction http://www.oracle.com/us/products/middleware/exalogic-wp-173449.pdf

- 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

– SAP SRM 2005 / 2007 / 7.x

– SAP SCM 2005 / 2007 / 7.x

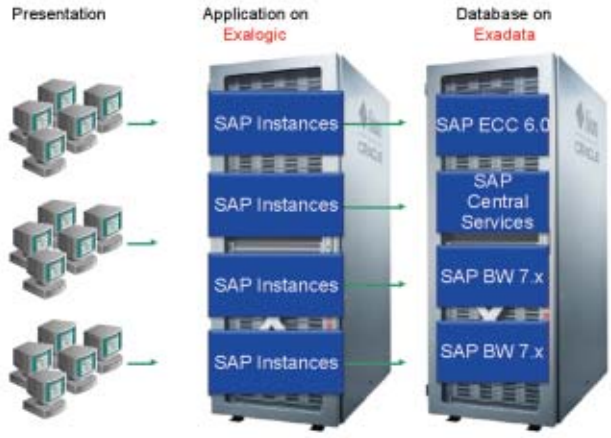
– SAP Oil & Gas 2005 / 6.x

– 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 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 (http://www.oracle.com/us/products/database/sap-exadata-wp-409603.pdf).

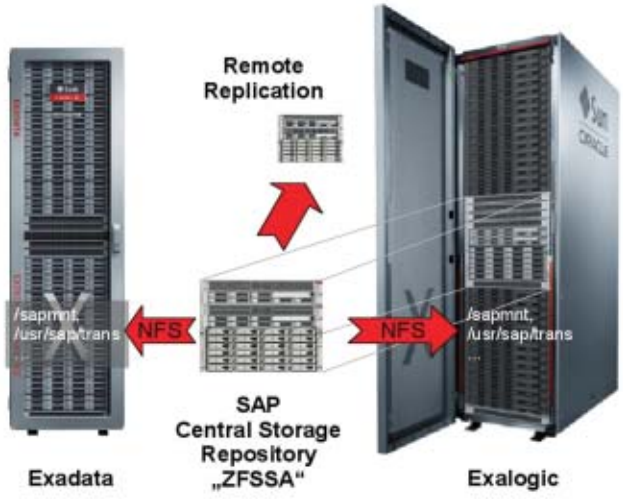
- Only Unicode installations of the SAP Software are supported.
- As of this time, only Oracle Exalogic X2-2 models are supported.
- As of this time, only Oracle Linux is supported as the operating system on the Oracle Exalogic Elastic Cloud server nodes. The minimum release is Oracle Linux 5 Update 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 a later date.

- The minimum supported Oracle Database Release is 11*g* 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

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.

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 also leverages 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.

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 Availabillity 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.

Especially in consolidation scenarios, where Exalogic is used as a platform for hosting WebLogic, Oracle and other applications, the recent certification of SAP for Exalogic allows the consolidation of SAP dev, test and production environments onto Exalogic as well, maximizing the utilization of Exalogic compute nodes.

Furthermore, environments that are especially sensitive to network latency can greatly benefit from Exalogic's direct Infiniband connection to Exadata as a way of minimizing network latency by a factor of 10 while maximizing bandwidth by a factor of 4.

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.

More information can be found at the following sources:

- SAP Note 1617188
- Oracle White Paper: Running SAP NetWeaver on the Oracle Exalogic Elastic Cloud (http://www.oracle.com/us/products/middleware/netweaver-on-exalogic-489027.pdf)
- Oracle White Paper: Using SAP NetWeaver with the Oracle Exadata Database Machine.(http://www.oracle.com-/us/products/database/sap-exadata-wp-409603.pdf).

ORACLE CLOUD FILE SYSTEM FOR SAP

Oracle Automatic Storage Management (ASM) and ASM Cluster File System (ACFS) available for SAP customers

Managing All Data in the Cloud

Oracle Cloud File System is tightly integrated with the Automatic Storage Management features of the Oracle Database. Together they deliver one solution for managing all business data, application binaries and personal data in a cloud infrastructure. Oracle customers will benefit from a single integrated solution instead of dealing with the complexities of managing different software layers from different vendors. It eliminates the need for 3rd party volume managers and file systems.

Oracle Cloud File System that compliments Automatic Storage Management for Oracle Databases is certified by SAP as of Oracle version 11.2.0.2 for Oracle Single Instance and Oracle Real Application Clusters (Oracle RAC).

Starting with 11*g* (11.2.0.2) Oracle Cloud File System is the preferred storage platform for SAP systems running on Oracle Real Application Clusters (RAC), as well as SAP systems running on a single Oracle Database. SAP customers are now able to use Oracle Cloud File System to manage ALL data: Oracle Database files, Oracle Clusterware files and non-structured general purpose data such as Oracle and SAP kernel binaries, external files, and text files.

Oracle Cloud File System can help to reduce costs, minimize the administration effort, and increase the availability of the SAP systems of all those customers who have been using Oracle single instance and Oracle Real Application Clusters (RAC) for SAP on the various platforms and using the underlying shared cluster file systems, required by Oracle RAC.

The Oracle Cloud File System comprises the following features: Oracle Automatic Storage Management Cluster File System and Oracle Automatic Storage Management Dynamic Volume Manager. These three main parts of Oracle Cloud File System create an integrated foundation for database and general purpose files as well as an infrastructure for cluster and single node server configurations. The Oracle Grid Infrastructure simplifies and streamlines management of volumes, file systems and cluster configurations, therefore eliminating the need for multiple 3rd party software layers, complexity and cost.

Complexity and cost can be reduced enormously for SAP customers using Oracle RAC by using SAPCTL (SAP Control) starting by Oracle Database Rel. 10.2 Clusterware and higher, making SAP services highly available and eliminating the need of 3rd party software.

Overview of Automatic Storage Management (ASM)

Oracle ASM is a volume manager and a file system for Oracle database files that supports single-instance Oracle Database and Oracle Real Application Clusters configurations. **Oracle ASM is Oracle's recommended storage management solution for SAP on Oracle RAC and Oracle single instance that provides an alternative to conventional volume managers, file systems, and raw devices**.

Oracle ASM lowers the Oracle database storage total cost of ownership and increases storage utilization while improving performance and availability over traditional file system and volume management solutions. Oracle ASM is easier to manage than conventional file systems, has the performance of raw volumes, and is tightly integrated with the Oracle Database forming the foundation of a storage grid for Oracle. Additionally, Oracle ASM eliminates the need for 3rd party volume managers and file systems for managing the Oracle database files.

Oracle ASM uses disk groups to store data files; an Oracle ASM disk group is a collection of disks that Oracle ASM manages as a unit. Within a disk group, Oracle ASM exposes a file system interface for Oracle database files. The content of files that are stored in a

disk group is evenly distributed to eliminate hot spots and to provide uniform performance across the disks. The performance is comparable to the performance of raw devices.

You can add or remove disks from a disk group while a database continues to access files from the disk group. When you add or remove disks from a disk group, Oracle ASM automatically redistributes the file contents and eliminates the need for downtime when redistributing the content.

The Oracle ASM volume manager functionality provides flexible server-based mirroring options. The Oracle ASM normal and high redundancy disk groups enable two-way and three-way mirroring respectively. Oracle ASM files can coexist with other storage management options such as raw disks and third-party file systems. This capability simplifies the integration of Oracle ASM into pre-existing environments.

Overview of Oracle ASM Cluster File System (ACFS)

Prior to Oracle Database 11*g* Release 2, Oracle ASM was a volume manager and a file system for Oracle database files only. Now, Oracle customers can benefit from a single integrated solution instead of acting as the systems integrator and dealing with the complexities of integrating different software layers from different vendors in house. Oracle ASM, Oracle ACFS, Oracle ADVM snapshot are tightly integrated with the Oracle Database, Oracle RAC, Clusterware and other Oracle technologies and presents a comprehensive and well tested solution for SAP customers running the Oracle Database.

Oracle Automatic Storage Management Cluster File System is a multi-platform, scalable file system, and storage management technology that extends Oracle Automatic Storage Management functionality to support customer files maintained outside of the Oracle Database. Oracle ACFS is tightly coupled with Oracle Clusterware technology, participating directly in Clusterware cluster membership state transitions and in Oracle Clusterware resource-based high availability (HA) management. In addition, Oracle installation, configuration, verification, and management tools have been updated to support Oracle ACFS.

Oracle ACFS can be accessed and managed using native operating system file system tools and standard application programming interfaces (APIs). Oracle ACFS can be configured and managed using Oracle Enterprise Management tools. Oracle ACFS can be accessed using industry standard Network Attached Storage (NAS) File Access Protocols: Network File System (NFS) and Common Internet File System (CIFS).

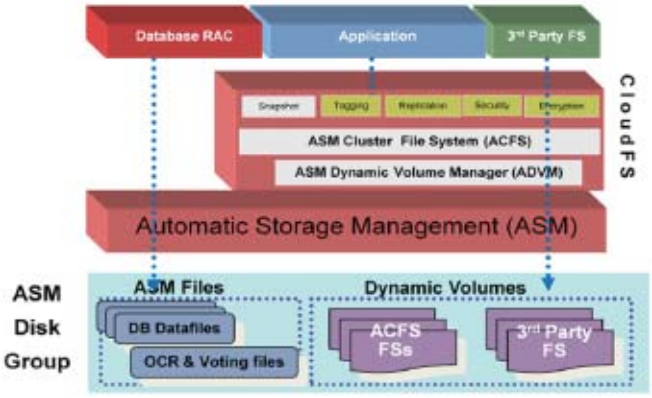


Figure 1

An Oracle ACFS file system is a layer on Oracle ASM and is configured with Oracle ASM storage, as shown in *Figure 1.* Oracle ACFS leverages Oracle ASM functionality that enables:

- Oracle ACFS dynamic file system resizing
- Maximized performance through direct access to Oracle ASM disk group storage
- Balanced distribution of Oracle ACFS across Oracle ASM disk group storage for increased I/O parallelism
- Data reliability through Oracle ASM mirroring protection mechanisms

Overview of Oracle ASM Dynamic Volume Manager (ADVM)

Oracle ASM Dynamic Volume Manager (Oracle ADVM) provides volume management services and a standard disk device driver interface to clients. File systems and other disk-based applications send I/O requests to Oracle ADVM volume devices as they would to other storage devices on a vendor operating system.

An Oracle ADVM volume device is constructed from an Oracle ASM dynamic volume. One or more Oracle ADVM volume devices may be configured within each Oracle ASM disk group. The Oracle ADVM Driver maps I/O requests against an Oracle ADVM volume device to blocks in a corresponding Oracle ASM dynamic volume and disk set located within an Oracle ASM disk group. An Oracle ADVM volume device exports Oracle ASM volume manager features and ensures that volume mirrors remain consistent in the face of abnormal system shutdowns, Oracle ASM instance failures, or system failures.

Oracle ADVM extends Oracle ASM by providing a disk driver interface to Oracle ASM storage allocated as Oracle ASM volume files. You can use Oracle ADVM to create virtual disks that contain file systems. These file systems contained on Oracle ASM volumes are able to support files beyond Oracle database files, such as executable files, report files, trace files, alert logs, and other application data files. Because Oracle ADVM volumes are actually Oracle ASM files, they require the same administrative privileges as the Oracle ASM files.

Oracle Automatic Storage Management Cluster File System (Oracle ACFS) is layered on Oracle ASM through the Oracle ADVM interface. With the addition of the Oracle ADVM, Oracle ASM becomes a complete storage solution of user data for both database and non-database file needs.

Moving SAP databases to Oracle Database 11*g* Release 2 ASM

SAP customers can now move their databases to ASM, the preferred storage platform for SAP systems running on RAC and single instance.
Customers can migrate their current file systems to ASM/ACFS/ADVM in a smooth way based on the best practices published on http://www.oracle.com/sap, http://www.sdn.sap.com/irj/sdn/ora and SAP Note 1550133. Based on these white papers the migration can be briefly described as follow:

- Oracle ASM Disk Groups configuration
- Oracle Grid Infrastructure installation
- Oracle Database 11*g* Release 2 and first patch set (11.2.0.2) installation
- Configuration of Source and Target system
- Online database migration through RMAN using "duplicate from active database" in case the OS platform does not change or if the source and target system have the same ENDIAN
- Off line database migration thorough RMAN using "transportable tablespaces" or export/import or Triple O based on Oracle GoldenGate if the platform changes (can also be used for homogeneous migration)
- For more information about the migration process, check the white papers mentioned above

BR*Tools support for Oracle ASM and Exadata

SAP provides the tools BRBACKUP, BRARCHIVE, BRRESTORE, BRRECOVER, BRSPACE, BRCONNECT, and BRTOOLS to manage and protect the data in your Oracle database.

The BR*Tools have been enhanced to support Oracle Automatic Storage Management (ASM) and cover among other:

- Backup, restore, recovery
- Database instance, space and segment management
- Database statistics, database check, database reorg

For more information check the sap notes:
- 1627541 – BR*Tools support for Oracle ASM and Exadata
- 1598594 – BR*Tools configuration for Oracle installations under 'oracle.'

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ORACLE'S ENGINEERED SYSTEMS FOR SAP: ORACLE INFRASTRUCTURE OPTIMIZES SAP LANDSCAPES

SAP landscapes are growing in complexity, with servers, storage, networking, operating systems, and database and middleware all needing to be ordered, configured, installed, tested, and maintained on an ongoing basis. This can turn ERP deployment and expansion into a lengthy and complex process. In addition, keeping SAP landscapes up to date through patching, updating software, and adding hardware requires a lot of skilled manpower and training. Oracle's engineered systems for SAP are designed to help savvy IT managers deploy more services faster on a streamlined infrastructure that costs less to run.

Oracle's Engineered Systems for SAP

For more than 24 years, companies have trusted their business-critical SAP environments to state-of-the-art Oracle software. Today, Oracle's integrated infrastructure stack — consisting of servers and storage, operating systems, database software, middleware, networking, and built-in virtualization features — is optimized to deliver agility and performance to SAP applications. Now this integrated stack is available as a family of Engineered Systems that are pre-integrated, pre-tested, and pre-configured to simplify data center operations, ensure fast and easy SAP infrastructure deployment, and accelerate business innovation.

Oracle Exadata Database Machine

Designed to deliver extreme performance to data warehousing, OLTP, and mixed-load database applications, the Oracle Exadata Database Machine is ready to perform out of the box. The system is pre-configured with all necessary software—Oracle Database, Oracle Database Real Application Clusters (RAC), Oracle Grid Infrastructure, and Oracle Exadata storage management and administration software—and Oracle database and storage servers are pre-cabled in racks using Infiniband and Ethernet switches. The complete Oracle Exadata package arrives pre-integrated and pre-tested, and can save weeks and sometimes months off time to deployment.

Highly optimized for database use and purpose-built for database consolidation, the core of the Oracle Exadata Database Machine is the Oracle Database 11*g* software and Oracle Exadata Storage Servers and Software. These storage servers overcome the limitations of conventional storage with a massively-parallel architecture to dramatically increase data bandwidth between the database server and storage. In addition, innovative Exadata technologies, such as Exadata Smart Scan, Exadata Smart Flash Cache, and Hybrid Columnar Compression, accelerate database processing and speed I/O operations for SAP applications.

As the SAP central services (message and enqueue server) and the database can run on the same machine, high availability comes out-of-the-box with the system; the massively scalable, secure, and redundant Oracle Exadata Database Machine is SAP certified and supported, and provides an ideal database-as-a-service platform for SAP applications. Improved application performance, effortless workload management, greater datacenter efficiency, and faster time-to-deployment enable enterprises to make better business decisions in real time and at less cost.

Oracle Exalogic Elastic Cloud

Oracle Exalogic Elastic Cloud is the first engineered system specifically designed to be a foundation for secure, mission-critical, private clouds. Delivering virtually unlimited scalability, unbeatable performance, and previously unimagined management simplicity, the Oracle Exalogic Elastic Cloud is an ideal platform for applications—from small-scale departmental applications to the largest and most demanding ERP applications. Balanced for compute-intensive workloads, each pre-assembled, pre-configured Exalogic system contains fully-integrated, hot-swappable x86 compute nodes, a high-performance ZFS Storage Appliance, and high-bandwidth interconnect fabric and switches.

An extremely fast, high-throughput interconnect connects all systems together to create a single large computer with extreme scalability, elasticity, and redundancy. The system exploits the I/O fabric, delivering performance results that are ten times faster than standard application server configurations. Thousands of applications with differing security, reliability, performance, and service-level requirements can run on a single Exalogic system, making it an ideal platform for SAP applications consolidation. In addition, it forms the foundation of an ideal special-purpose system when used in combination with an Oracle Exadata Database Machine running Oracle Database.

Oracle SPARC SuperCluster

SPARC SuperCluster T4-4 combines Oracle innovation—the computing power of Oracle's next-generation SPARC T4 servers, the performance and scalability of Oracle Solaris 11, the optimized database performance of Oracle Database 11*g* and Exadata storage, and the accelerated middleware processing of the Oracle Exalogic Elastic Cloud—into a general-purpose engineered system that provides high availability for enterprise SAP applications. Multiple databases and applications can run on a single system and take advantage of fast improvements for data compression, queries, OLTP response time, and Java middleware performance.

The Oracle SPARC SuperCluster is well suited as an SAP general-purpose system with SAP central instances, central services and database software installed together on the system. Because the system is pre-tested and ready to run, organizations can deploy SAP services in days rather than months. Consolidated SAP applications can run on a mix of Oracle Solaris 10 and Oracle Solaris 11 via Oracle's integrated virtualization technologies. In addition, the Oracle SPARC SuperCluster is SAP certified and supported, and is also offered as an Oracle Optimized Solution for SAP that includes deployment best practices, ongoing full-stack and patch testing, and more.

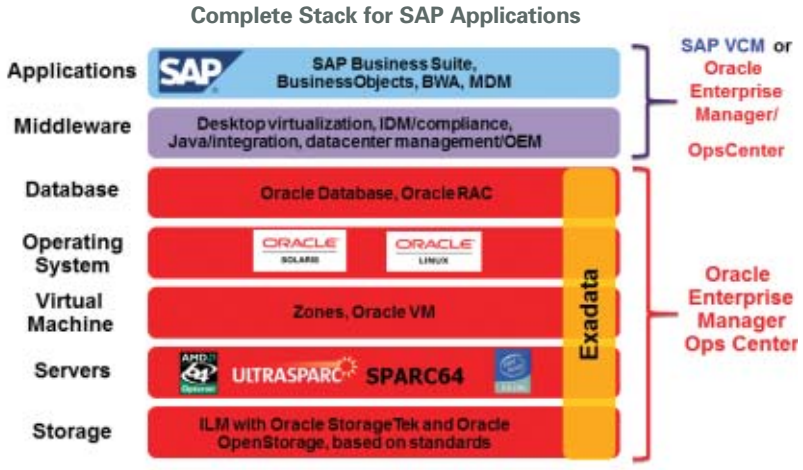
Oracle Database Appliance

The Oracle Database Appliance is a fully redundant, integrated database appliance—software, servers, storage, and networking—that offers one-button installation, patching, and diagnostics. A complete Oracle RAC database cluster in a box, it ships with Oracle Database Enterprise Edition 11*g* and Oracle Real Application Clusters or Oracle RAC One Node already installed to support highly available database services for SAP applications. Maintenance is easy: a single patch handles all firmware and software in one operation, using an Oracle-tested patch engineered specifically for the appliance. With the ability to consolidate databases up to 4 TB in size, it is ideal for midsize companies and departmental systems. Certification and full support for SAP is expected in the second half of 2012.

Conclusion

Built and tuned to run business-critical applications with extreme requirements for network bandwidth, access, and data growth, Oracle's engineered systems provide a number of options for optimizing SAP infrastructure and improving operation. Deploying one or more Oracle engineered systems within an SAP landscape results in more solid infrastructure, increased performance, greater efficiency and utilization, simplified management through application and database consolidation, and improved total cost of ownership.

PROVIDING A COMPLETE IT INFRASTRUCTURE STACK TO RUN SAP APPLICATIONS EVEN BETTER



Oracle's complete, open, and integrated product strategy provides flexibility and choice to our customers across their IT infrastructure. Now, with Sun server, storage, operating system, and virtualization technology, database and middleware and management tools, Oracle is the only vendor able to offer a complete technology stack in which every layer is integrated to work together as a single system. Oracle's open architecture and multiple operating-system options gives our customers unmatched benefits, including excellent system availability, scalability, energy efficiency, leading performance, and low total cost of ownership.

ORACLE SUN STORAGE

Oracle's Sun storage offers the industry's broadest portfolio of high-performance, cost effective, and easy to manage storage solutions. These products optimize performance, maximize data protection, and reduce the cost of ownership for Oracle databases, applications, and heterogeneous environments.

Sun Flash Storage

Turbocharge database applications, improve business response times, and increase productivity using Oracle's Sun Flash products across a full range of blade, rackmount and scalable server products.

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Turbocharge database applications, improve business response times, and increase productivity using Oracle's Sun Flash products across a full range of blade, rackmount and scalable server products.

Sun Disk Storage

Oracle's Sun storage fibre channel arrays provide mission-critical, tier-1 storage that scales in every dimension. Tailor performance profiles to site and application specific needs to achieve higher application performance while reducing power, space, and cooling requirements

NAS Storage

Sun ZFS Storage Appliances deliver enterprise-class NAS capabilities with industry-leading performance, efficiency, cost-effectiveness and ease of use coupled with unique Oracle software integration.

SAN Storage

Oracle's Pillar Axiom storage systems deliver fast, dependable performance for databases, applications, and heterogeneous mission critical environments with unique scalability and quality of service capabilities.

Sun Unified Storage (OpenStorage)

Oracle's Sun Unified Storage systems combine an innovative storage architecture and file system with storage analytics and management technologies to deliver leadership performance and value.

StorageTek Tape Storage

As the volume and value of data grows beyond online resources and backup windows, Oracle's proven Storage Tek tape and library solutions help you manage complexity, control costs, and deliver on service level agreements.

Sun Storage Software

Oracle's comprehensive suite of storage software efficiently manages data growth, optimizes storage hardware investments, and reduces the cost and complexity of storage management.

Sun Storage Networking

Oracle's comprehensive suite of storage software efficiently manages data growth, optimizes storage hardware investments, and reduces the cost and complexity of storage management.

ORACLE SUN SERVERS

Oracle's complete portfolio of mission-critical servers are engineered to deliver record-breaking performance, simplified management, and cost-saving efficiencies. Our systems are optimized to run Oracle Solaris, Oracle Linux, Oracle VM, and other leading operating and virtualization platforms with greater performance and efficiency.

Sun x86 Servers

Oracle is the only company that can offer tightly integrated x86 clustered systems from applications to disk. Oracle uses best-of-breed components to greatly simplify the deployment, management, and support of your IT infrastructure and to deliver unmatched performance and scalability.

Sun Blade Servers

Oracle's Sun Blade modular systems integrate robust x86 and SPARC-based servers, storage, and advanced networking capabilities to support a complex and dynamic mix of IT workloads. Controlled by a single system management interface, the balanced architecture of the **Sun Blade 6000 chassis** provides an open, standards-based infrastructure for virtualization and consolidation, as well as enterprise cloud deployments.

Sun SPARC Enterprise Servers

Oracle's Sun SPARC Enterprise servers running Oracle Solaris are ideal for mission-critical applications that require best-in-class availability, scalability, and manageability. The Sun SPARC Enterprise server family includes systems designed for optimal performance on all application tiers, from highly concurrent web applications to complex enterprise applications and data warehouses.

Sun SPARC Enterprise servers are designed to meet the needs of complex, multi-tier applications and are available in two series: The Sun SPARC Enterprise T-Series with chip multithreading (CMT) technology for highly concurrent applications, and the Sun SPARC Enterprise M-Series for complex processing requiring mainframe-class capacity and availability.

Sun Networking Products

Oracle's Ethernet, InfiniBand, and Fibre Channel products provide advanced network capabilities and serve as the foundation for increasing productivity, lowering your ownership costs, and delivering new business services.

VIRTUALIZATION

Only Oracle offers the industry's most comprehensive desktop-to-datacenter virtualization solutions portfolio that can virtualize and manage your full hardware and software stack, from applications to disk. Virtualization offers cost savings through consolidation and lower energy, facility, and labor costs. Oracle's virtualization solutions provide these benefits and much more, including:

- Highly optimized and integrated hardware and software virtualization solutions
- Integrated management from applications to disk
- Easier and faster deployment of software
- Greater IT efficiency, agility, and flexibility

Backed by Oracle's world-class support organization, customers now have a comprehensive, enterprise-class portfolio of virtualization solutions across the stack.

Server Virtualization
Oracle VM Server for x64

Oracle VM is server virtualization software that fully supports both Oracle and non-Oracle applications, and delivers more efficient performance. Backed by Oracle's world-class support organization, customers now have a single point of enterprise-class support for their entire virtualization environments, including Oracle Database, Fusion Middleware, Applications, and Linux, which are certified with Oracle VM.

Oracle VM Server for SPARC

Oracle VM Server for SPARC (previously called Sun Logical Domains) provides highly efficient, enterprise-class virtualization capabilities for Sun SPARC Enterprise servers with Chip Multithreading (CMT) technology. Unlike other virtualization technologies, Oracle VM Server for SPARC allows you to create up to 128 virtual servers on one system to take advantage of the massive thread scale offered by the CMT architecture. And all this capability is available at no additional cost.

OS virtualization with Solaris Zones allows you to maintain the one-application-per-server deployment model while simultaneously sharing hardware resources. An integral part of the Solaris Operating System, Solaris Zones isolate software applications and services using flexible, software defined boundaries and allows many private execution environments to be created within a single instance of the Solaris 10 OS. Each environment has its own identity, separate from the underlying hardware, so it behaves as if it's running on its own system making consolidation simple, safe, and secure.

Safely consolidate multiple applications onto one system and increase your utili-zation rates with the advanced functionality of Solaris 11. Run Solaris 8, Solaris 9 and Solaris 10 applications in Zones on the latest systems and save on power, space, cooling, administrative, and support costs.

Desktop Virtualization

- Oracle Virtual Desktop Infrastructure (VDI)
- Oracle Secure Global Desktop
- Sun Ray
- Oracle VM VirtualBox

Storage Virtualization

- Oracle Sun Storage Virtualization
- Oracle Automatic Storage Management
- Oracle VM Storage Connect

OPERATING SYSTEMS – ORACLE SOLARIS

Oracle Solaris is the #1 enterprise OS for datacenters, developers, and service providers. Oracle Solaris provides industry-leading **performance and scalability**. Oracle Solaris is designed to provide superior performance and scalability. It optimizes the system CPU, memory, I/O, and network resources for a broad range of mission-critical workloads.

The proven **reliability** of Oracle Solaris gives customers built-in fault tolerance through features such as ZFS, DTrace and Predictive Self Healing. Oracle Solaris enables customers to increase system and service availability while reducing infrastructure costs and risk. Oracle Solaris offers the most complete range of reliability features and delivers data center reliability on systems ranging from a single processor to hundreds of processors and cores. See separate article on Oracle Solaris benefits for SAP customers page 14.

ORACLE LINUX

Oracle Linux combined with **Oracle's Unbreakable Enterprice Kernel** brings the latest Linux innovations to market, delivering extreme performance, advanced scalability, and reliability for enterprise applications. The combination is:

- **Fast**—Delivers more than 75 percent performance gain in OLTP performance tests over a Red Hat 5 Compatible Kernel; 200 percent speedup of Infiniband messaging; 137 percent faster solid state disk access
- **Modern**—Optimized for large servers; improved power management and energy efficiency; fine grained CPU and memory resource control; derived from the stable 2.6.32 mainline Linux kernel
- **Reliable**—Supports the Data Integrity Extensions and T10 Protection Information Model, improves application uptime
- **Optimized for Oracle**—Built and tested to run Oracle hardware, databases, and middleware. Recommended for all enterprise applications

ORACLE DATABASE FOR SAP

Oracle Database 11*g* Release 2 Enterprise Edition delivers industry leading performance, scalability, security and reliability on a choice of clustered or single-servers running Windows, Linux, and UNIX. It provides comprehensive features to easily manage the most demanding transaction processing, business intelligence, and content management applications. Oracle Database 11*g* Release 2 Enterprise Edition comes with a wide **range of options** to extend the world's #1 database to help grow your business and meet your users' performance, security and availability service level expectations.

ORACLE
SOLARIS

SAP on Oracle Database 11*g* Release 2

SAP supports Oracle Database 11*g* Release 2 for SAP products based on SAP Kernel 6.40, 7.x and higher. Oracle Database 11*g* (single instance) and Oracle Real Application Clusters 11g for SAP are available for the major UNIX platforms (Solaris, HP-UX, and AIX), Linux, and Windows – as listed with details regarding the OS versions in **SAP Note 1398634**. The SAP release of Oracle Real Application Clusters 11*g* occurs at the same time as the general release of Oracle Database 11*g* in the SAP environ- ment. For information about Oracle RAC support, see **SAP Note 527843**. It contains important details about the released RAC configurations.
Oracle Database 11*g* Release 2 Enterprise Edition delivers industry leading performance, scalability, security and reliability on a choice of clustered or single-servers running Windows, Linux and UNIX. Customers who want to implement the new features provided by Oracle Database 11*g* Release 2 and Real Application Clusters 11*g* can find detailed information in a series of technical white papers as well as in technical skill workshops offered by Oracle Services and Support for SAP.

MIDDLEWARE AND SYSTEMS MANAGEMENT

Security and Identity Management

Both Solaris features plus Oracle middleware tools help SAP customers to run their environment safe and secure, provision users and services and prevent risk from daily IT operations. Some examples are: Meet stringent access-control demands — Provide the strong mandatory access controls required by governments and financial institutions using Oracle Solaris.

Trusted Extensions

- **Validate system security** — Verify the integrity of your system using Oracle Solaris Secure Execution and file verification features
- **Delegate appropriate privileges** — Reduce risk by granting only the privileges needed with user and process rights management
- **Simplify administration** — Use the open standardsbased Oracle Solaris cryptographic and key management frameworks for file and network encryption
- Ensure strong defenses — Protect your system against attack using the Secure By Default networking profile, IP Filter firewall, TCP Wrappers and IPsec/IKE

Oracle Identity Management 11*g* enables customers to efficiently comply with regulatory requirements, secure critical applications and sensitive data, and lower operational costs. Using the most complete and best-in-class suite of identity management solutions available, enterprises can manage the entire user identity life cycle across all enterprise resources — both within and beyond the firewall. Oracle Waveset, the former Sun IDM product, is integrated and works together with SAP BO Access Control to provide an end-to-end security and governance and risk solution for SAP customers.

IT MANAGEMENT

Oracle Enterprise Manager 11g helps IT organizations achieve an ROI of 149% for their IT management investments while also helping them to reduce customer-reported IT issues by as much as 80%.
Oracle Sun has integrated Oracle's Enterprise Manager Ops Center with SAP Adaptive Computing Controller (ACC) and thus lets SAP customers deploy and configure their SAP landscape on Oracle Sun IT layers more easily.

Efficiently Manage Your Sun Hardware with Ops Center

Oracle Enterprise Manager Ops Center is the most comprehensive solution for managing physical and virtual Sun infrastructure, including Sun servers, Solaris operating systems, and Solaris and SPARC virtualization technologies. It also provides management for Linux operating systems from Oracle, Red Hat, and SUSE.
With its rich lifecycle management capabilities and built-in automation, Ops Center dramatically improves the efficiency of IT operations while reducing system downtime. Ops Center's world-class configuration and patch management capabilities ensure that systems stay accurate and up to date, providing greater security and compliance in the data center.

ANNOUNCING SPARC SUPERCLUSTER OPTIMIZED SOLUTION FOR SAP CUSTOMERS

As you can see below, there is now a family of engineered systems and appliances for SAP customers. On the right, you see the purpose built systems, with Exadata designed to run the Oracle database, and Exalogic designed to run Web and Application servers for SAP customers who have heterogeneous environments or legacy applications.

The smaller appliance next to both systems on the left is the Oracle Database Appliance (ODA), designed to run databases up to 2 TB with minimal administrational effort.

Oracle Database Appliance (ODA)

SPARC SuperCluster

Oracle Exadata

In the middle, you can see the youngest member of the family: The general purpose SPARC Super-Cluster runs the Oracle parallel database, the application or web server and Oracle EM management software, and all your enterprise applications. This is especially suited for SAP customers who need a multi-purpose system, with not only SAP installed but additional enterprise applications, or having multi-tiered applications to consolidate and virtualize within their Datacenter.

SPARC SuperCluster offers SAP customers with SPARC-based systems a very smooth upgrade path. Or, it can give customers running SAP on older hardware from HP and IBM a powerful system to deploy SAP applications for lower cost and with much better performance while also providing a management system for the entire stack.

The Oracle SPARC SuperCluster T4-4 is a general purpose engineered solution for running SAP applications next to a wide range of complementary enterprise applications with the highest levels of performance and mission critical reliability. The SPARC SuperCluster T4-4 utilizes high performance software from Oracle Exadata and Oracle Exalogic combined with new SPARC T4-4 servers, Oracle Exadata Storage Servers, ZFS Storage Appliance, InfiniBand technology, and Oracle Solaris 11.

The full capabilities of Oracle Exadata along with Exadata Storage Servers are integrated into SPARC SuperCluster T4-4. Exadata Storage Servers are optimized for Oracle Database 11*g* R2 operations and will provide outstanding performance for both transaction-based and decision support SAP workloads. An optional external storage rack can be configured for additional performance and capacity.
The new SPARC T4 processor delivers a 5x improvement in single thread performance over the previous generation along with on-chip crypto acceleration providing enhanced data security and privacy without the performance penalty.

Three key benefits that SPARC SuperCluster delivers are: Extreme Performance, Lower TCO, and leading Datacenter Consolidation capabilities.

Extreme Performance:

- Realize performance benefits of up to 10x for query, data compression and OLTP response time
- Based on SPARC T4-4 servers which to date have set 10 world record benchmarks
- Utilizes Exadata storage cells delivering 10x – 50x performance improvement

Lower TCO

- An integrated system that dramatically reduces costs and downtime, and provides customers with a more easily managed infrastructure.
- Reduces storage requirements by compressing data
- Easily deployed into your existing SAP environment, leveraging your current systems environment

Datacenter Consolidation

- Consolidate a wide range of SAP workloads on to a single SPARC SuperCluster
- Integrated hardware and software designed for maximum uptime
- Runs Solaris 10 and 11, multiple databases, multiple application tiers

More information:

For more information, please visit
http://www.oracle.com/us/solutions/sap/infrastructure/ index.html
or
http://www.oracle.com/us/corporate/features/sparc-supercluster-t4-4-489157.html

http://scn.sap.com/community/oracle-solaris

Note 1693680 – Running SAP Software on Oracle SPARC SuperCluster
Note 1696570 – Oracle SPARC SuperCluster: Patches for 11.2.0.3
Note 1696716 – Creating a modified Solaris kernel medium

"The new system environment with Oracle Sun infrastructure components is the ideal tool to help build on our position as a leading healthcare provider and efficiently support our business processes with flexible, future-proof and high-performance IT."

– PHIL PEPLOW,
Head of IT Service Delivery and Infrastructure,
Spire Healthcare.

Complete IT infrastructure for SAP rollout project – Oracle 11*g* Database, Sun T4 / M5000 servers and Pillar Axiom 600 storage systems

SPIRE HEALTHCARE: TOWARD A NEW FUTURE WITH ORACLE SUN SYSTEMS

Spire Healthcare
http://www.spirehealthcare.com/

Industry:
Healthcare

Workforce:
7,600

Oracle Sun products and services:

- Oracle Database 11.2.01
- Sun Server
  T4-1 and T4-2
  M5000
- Storage
  Pillar Axiom 600

Key benefits:

- Future-oriented infrastructure with innovative technologies,
- high availability,
- cost savings,
- increased performance,
- decreased complexity,
- high scalability and flexibility

SAP:

- ERP ECC 6.0
- Netweaver PI
- IS-H/IS-Med
- BW and BI
- Risk Management
- EWM

Spire Healthcare is a leading provider of private healthcare, with 37 private hospitals throughout the UK. The company is built on a proud heritage of over 25 years experience of running successful private hospitals. The company employs over 7,600 people nationwide and for Spire Healthcare, it's more than just treating patients, it's about looking after people.

To fulfill this mission, Spire Healthcare needs a reliable IT infrastructure that will serve it well not only now, but in the future. The healthcare provider's application environment fulfilled its purpose for years, but there came a point where it was no longer future-proof. Just over two years ago, the incumbent application manufacturer for the main patient administration system announced that the system would only be supported until the end of March 2014.

Spire Healthcare was forced to look around for a new application solution and replace the existing system landscape with a new one. "After a long evaluation process we chose SAP in conjunction with infrastructure components from Oracle Sun," says Head of IT Service Delivery and Infrastructure, Phil Peplow.

Oracle Sun: the one-stop shop

Spire Healthcare applied the following key criteria to their market research before selecting Oracle Sun: a flexible and easy-to-use system, high availability, optimum value for money, high performance on the basis of state-of-the-art technologies, and optimum compatibility with SAP applications.

The company also preferred to source all infrastructure components from the same provider, including the necessary support. "The package comprising the Oracle database, Sun servers and Pillar Axiom storage systems was the best solution and the best platform for our SAP setup," says Peplow.

Sophisticated system landscape

When the new environment goes live later this year, Spire Healthcare will have a modern high-performance IT infrastructure that fully satisfies current and future requirements with regard to application usage. The Oracle Sun infrastructure will run the industry solutions IS-H/IS-Med, ECC6.0, BW and BI, Extended Warehouse Management, Risk Management, and Netweaver Process Integration. All the company's hospitals will be mapped to the central system.

A total of eight T4-1 and T4-2 Sun servers and two M5000 servers are used for the various applications in the production system. Those systems run Solaris as a standard Operating System that creates a reliable, secure and scalable platform, including virtulization and performance on enterprise level with no extra cost. Solaris ZFS is used on two Pillar Axiom 600 storage systems which offers a number of benefits, like high performance and unlimited capacity, flash-aware, tiered storage pools and built-in services including deduplication, encryption, replication and compression. The primary data management tool is Oracle 11*g* with its key capabilities as RAC, ASM, DataGuard, Flash Back, Compression, BR-Tools, and so on. The system landscape is designed as a clustered environment based on Solaris Cluster, which provides specific agents for both SAP applications and Oracle DB that both guarantees high stability and availability and delivers optimum load/power distribution.

The chosen system design, based on Oracle Sun technologies, also enables Spire Healthcare to handle a certain degree of surplus capacity or overload – without having to upgrade the existing hardware. Should it become necessary at any point to extend the environment, for example in response to changing business requirements, this can be accomplished without a problem.

Best equipped for now and later

"The new system environment with Oracle Sun infrastructure components is the ideal tool to help build on our position as a leading healthcare provider and efficiently support our business processes with flexible, future-proof and high-performance IT," says Peplow.

In the restructuring of its IT setup, Spire Healthcare received support from Oracle, SAP and IT service partners Steam and Common Management Solutions. The new system environment will also replace various siloed solutions. A number of non-SAP systems that are still needed are being integrated into the new environment, including a separate workflow solution, a HR system, and highly specialized industry-specific solutions.

The new system environment was designed for a total capacity of around 12 TB. In the first year, it is reckoned that the database will amount to around 4 TB. For backup and restore purposes, Spire Healthcare plans to use the Oracle Dataguard solution. The benefits of using DataGuard include a standby database that can also be used for read-write, reporting, testing, or during backups, reducing the load on the primary database; backup is completely transparent to SAP applications; if the primary database becomes unavailable, the standby database can easily assume the primary role. The system environment will be operated in London, where Spire Healthcare has two data centers.

Production environment

2 x Sun M5000 systems, each with 4 Sparc 2.66 quad core processors, 64 GB of memory. These systems are clustered and support the ECC DB layer.

Standardized on 2 x T4-2 systems for the ECC application
2 x Sun T4-2 systems for the EWM application and the database, the DB is clustered.
2 x Sun T4-2 systems for the BW application and the database, the DB is clustered.
2 x Sun T4-2 systems for the PI application and the database, the DB is clustered.
2 x Sun T4-1 systems for a sandpit cluster pair.

Storage
2 x Pillar Axiom 600 systems each with 1 brick of SSD and 4 bricks of 15K FC drives, just like the database storage systems.

"After a long evaluation process we chose SAP in conjunction with infrastructure components from Oracle Sun."

– Phil Peplow,
Head of IT Service Delivery and Infrastructure, Spire Healthcare.

SAP ON ORACLE SOLARIS

The Oracle Solaris Operating System

The Oracle Solaris Operating System – supported on over 1000 x86 and SPARC platforms – delivers the performance, stability and security our customers demand. With thousands of applications available on Solaris, one OS can span your entire enterprise: the Web tier, the data warehouse, and the most demanding technical applications. Moving to Solaris 10 is easy, whether you're upgrading from an older Solaris release or migrating from another OS. Oracle Sun and SAP have worked together since 1993 to provide a scalable, reliable, secure, flexible, and open computing infrastructure for customers around the globe. Over time, our joint efforts have paid off, helping Sun to consistently achieve many SAP Sales and Distribution standard application benchmark world records. Sun has 15 years of experience in scaling the OS to support throughput workloads. SAP leverages the scalability and performance of Solaris, whether on a 72-CPU SMP server, a 32-thread CoolThreads server, or a grid of x64 servers. With Solaris Containers, you can securely consolidate applications and increase the utilization of system resources by up to 80%. Solaris ZFS enables file systems to grow dynamically to virtually any size. All these features running on Sun servers create a powerful, efficient environment that can quickly scale and adapt to changes in demand or business processes.

Increase Business Efficiency, Lower Costs

Enterprises are under tremendous pressure to do more with less: roll out new business services faster, fit more servers into the same space, and comply with new regulations — all while budgets are shrinking and headcount is frozen.

Lowering TCO

Server consolidation with Solaris results in substantial reductions in total cost of ownership (TCO). Such information is always more meaningful if it is specific to your installation, and Oracle has TCO tools that can help you calculate the cost of your current infrastructure as well as the TCO of a consolidated infrastructure. Such server consolidations range from replacing 9 servers to as many as 20 servers with a single server (see table for sample savings based on real-world configurations). A free onsite data center assessment is available.

2 IBM p595, 24 CPUs
High-availability requirements
2 HP Superdome Itanium 2,
80.000 SAPS, 2x EMC CLARiiON
CX4 model 240, VxVM, VxFS
14 HP servers (different types, PA-RISC)
2 Sun M8000, 12 4 Core CPUs
2 Sun B6000 with 12 x64 Blades
(4 4-core 32GB) and 4 CMT blades
(1 T2 8-core 32GB)
2 Sun X4600, 90320 SAPS, 256 GB,
2x Sun StorageTek 7410,
Solaris ZFS
2 Sun X4600, 2 Sun M3000
23% lower operating costs than current configuration;
35% lower investment than proposed IBM P6 solution
89% savings in energy and cooling
87% savings in hardware maintenance
100% savings Veritas software license
ROI within 6 months
76% savings in energy and cooling,
HW maintenance not considered,
ROI within 2 years

Sample TCO Savings with Sun Server Consolidations

When TCO comparisons take into account costs for years 1 through 3 rather than year 1 only, Solaris wins over other options such as Linux that might appear low-cost but come with additional administration and licensing costs. The value-added features of Solaris coupled with its cross-hardware compatibility make its TCO very competitive indeed. When companies find themselves at an inflection point in SAP deployment, needing to squeeze the most value from existing SAP seats and licenses, server consolidation is an important way forward. In this context, it makes sense to consider Solaris for the following reasons:

Solaris' platform compatibility means that it runs on everything from laptops to high-end servers. Deploy Solaris on low-cost systems to achieve high-performance and stability. Having one operating system run on various computing platforms significantly reduces administration cost.

Virtualization is free

Solaris Containers are the only virtualization option currently supported by both Oracle and SAP (Oracle supports running in Oracle VM and in Solaris Containers; SAP supports running in VM ware and in Solaris Containers). Examine case studies regarding Containers for further details about the enterprise benefits of free virtualization using Solaris Containers.

Solaris is green

Green IT offers sustainability, energy and cost savings, and compliance with emerging regulations.

360-degree support for running SAP

Having a single source for support is also a compelling value proposition for enterprise data centers. If problems arise, calling Oracle Sun will solve the problem. Oracle Sun's role as an SAP Global Technology Partner, the Solaris Lab for SAP, and the Oracle Solution Center in Walldorf as well as SAP-certified migration consultants highlight Oracle's commitment to supporting SAP customers.

Less stress

Some advantages of Solaris are less easily quantified. In today's economy, businesses need a painless solution that solves problems and reduces stress. Solaris offers proven and unparalleled stability. Solaris' TCO is low in part because it needs so little administration and administering Solaris (for example patch management) is much easier than administering Linux. It just works.

Flexibility and agility

Cutting-edge technology features open the way for changing business processes and business network transformation. ZFS, virtualization, DTrace, network virtualization, identity management and many other capabilities make Solaris and Oracle software the ideal solutions for the changing business landscape.

Compliance and security

Support for and integration with SAP GRC as well as robust secure as configured OS-level security are important enterprise considerations.

Low TCO

Solaris, though often thought of in the context of high-end RISC servers, is included with Sun servers. For customers facing challenging business and technical requirements such as lowering costs, simplifying system administration, and maintaining high service levels, the Oracle Solaris operating system is the ideal choice. Only Solaris' innovative, built-in features deliver:

Reliability

- **Availability** — Predictive Self Healing provides both hardware and software resiliency with automatic predictive component retirement, software restart, and live upgrade of the OS and applications, as well as simplified service administration that reduces opportunities for errors
- **Data Integrity** — Oracle Solaris ZFS, an advanced file system, provides unmatched data integrity, automated error correction, and integrated data services that include unlimited snapshots and file compression
- **DTrace** — DTrace Analytics provide safe, live observability from the lowest level of the kernel to high-level application constructs, allowing you to optimize performance and quickly solve issues in production environments

Performance/Scalability

- **Optimization** — Solaris is optimized for the latest SPARC, Intel, and AMD processor technologies, high performance flexible networking, encryption acceleration, and memory allocation
- **Efficient Consolidation** — Oracle Solaris Containers provide built-in, high-performance and flexible virtualization on any system, allowing for highly efficient consolidation, relocation and replication of application environments. P2V capabilities make it fast and easy to rehost existing Oracle Solaris 8 and 9 applications onto Oracle's latest modern Sun SPARC servers

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Security

Oracle Solaris security, including Solaris Trusted Extensions, provides the separability and control required by governments and financial institutions without sacrificing hardware and application compatibility.

Runs Oracle 10x Faster*

The World's Fastest Database Machine

- Hardware by Sun
- Software by Oracle

*But you have to be willing to spend 50% less on hardware.

ORACLE®

10x faster based on comparing Oracle data warehouses on customer systems vs. Oracle Exadata Database Machines. Potential savings based on total hardware costs. Oracle Database and options licenses not included. Actual results and savings may vary.

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RUN DEMANDING SAP SOLUTIONS THAT DELIVER GREATER PERFORMANCE WITH ORACLE SOLARIS 11 PLATFORMS

Deploying SAP Business Suite on Oracle Solaris 11 platforms offers unparalleled enterprise-class functionality as well as performance, density, and energy efficiency. The unique features of Oracle Solaris 11 running on Oracle servers enable IT managers to reduce costs while improving service levels and security for business-critical SAP solutions.

Enterprises around the globe rely on SAP applications to support many different critical business functions. To provide organizations with global, around-the-clock, secure, agile, and highly available solutions, full-featured SAP software requires a powerful and flexible, yet cost-effective infrastructure on which to run.

Oracle Solaris 11 provides the platform to help enterprises achieve that infrastructure. Containing a number of innovative features, Oracle Solaris 11 is the most advanced operating system on the planet. Indeed, the Oracle Solaris operating system typically leads with new features that are subsequently introduced in other vendors' operating systems months or years later.

Highlights

- **Increase flexibility**
  Leverage the powerful virtualization features of Oracle Solaris 11 platforms for greater flexibility and scalability.
- **Reduce management costs**
  Deploy a single operating system across all back-end SAP tiers and consolidate and dynamically manage resources.
- **Enhance security**
  Protect against security breaches with the secure execution, root as role, and user and process rights management features of Oracle Solaris 11.
- **Optimize SAP application performance**
  Realize scalability and performance gains with an operating system optimized for Oracle servers.

Optimize Resource Utilization

Many data centers still contain numerous older servers, each running one or two applications to ensure isolation. A traditional deployment model for SAP applications in the past, this scenario limits scalability, agility, and flexibility and results in underutilized servers within a sprawling, complex, and costly infrastructure.

Engineered to solve the most challenging issues faced when deploying and managing a modern data center infrastructure, Oracle Solaris 11 is the first and only fully virtualized operating system. Secure, built-in virtualization services enable system, network, and data storage resources to be consolidated and used optimally for greater data center efficiency at no extra cost.

Increase Server Efficiency

Oracle Solaris server virtualization securely divides systems into smaller virtual servers, enabling administrators to place more applications on a single system. Because virtualization and resource control features are integrated into the kernel, IT organizations do not have to deploy add-on solutions that contribute layers of complexity and overhead. Instead, SAP instances can be virtualized, drawing from an underlying pool of dynamically managed system resources. This increases server utilization, enables more work to be completed faster, and adds the agility and flexibility required for demanding workloads.

Share Network Resources

Many SAP implementations are global, with users accessing applications over the network. As a result, network resources can become a bottleneck if not properly allocated. Oracle Solaris 11 offers network virtualization features that enable SAP applications to share networking resources. In the same way that systems are virtualized into smaller servers, network resources can be virtualized so that more applications can utilize them simultaneously.

These features are extended to Oracle Solaris Zones, enabling virtually unlimited numbers of virtual servers to share one physical network interface. By allocating network capacity to different zones, network transmissions can be run in parallel. Administrators can manage bandwidth and CPU allocations for each zone separately. The result is maximized throughput, decreased latency, and improved performance, particularly as the network load increases.

Handle Growing Volumes of Data

The lack of flexibility in traditional file systems makes it difficult to accommodate growing data volumes. Increasing the size of a typical file system requires administrators to backup the existing file system, create a new, larger file system, and restore the backup on the resized system. Oracle Solaris 11 eliminates this administrative obstacle by using Oracle Solaris ZFS as its default file system.

In Oracle Solaris ZFS, virtual storage pools decouple the file system from physical storage in the same way that virtual memory abstracts the address space from physical memory. Space is shared dynamically between multiple file systems from a single storage pool and is parceled out from the pool as file systems request it. As a result, storage is allocated without interrupting services, providing new levels of flexibility, availability, performance, and virtually unlimited scalability.

Leverage the Superior Performance Shown in SAP and Oracle Benchmarks[1]

As feature-rich SAP applications continue to gain new functionality, and demand for new features increases, additional compute power and memory, faster I/O, and better networking capabilities are needed in order to utilize application enhancements. Oracle Solaris is ideal for applications that require high-performance systems, massive threading, and large memory addressing capabilities at an attractive price point.

Recent SAP benchmarks demonstrate the high performance and scalability of SAP applications running on Oracle Solaris. In October 2011, Oracle announced a world-record result on the SAP SD Standard Application Benchmark utilizing Oracle Database 11*g*

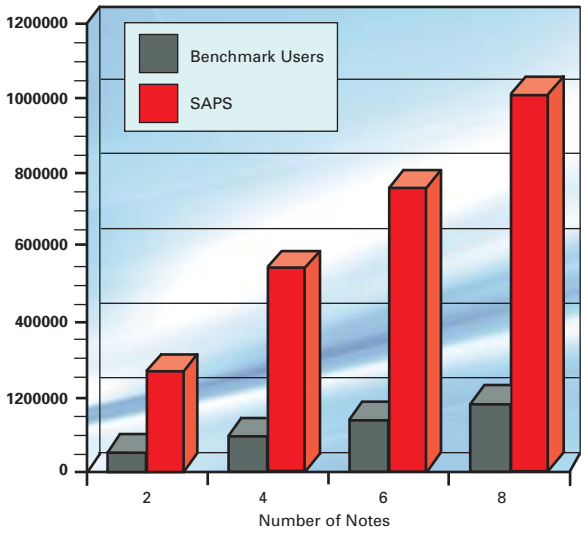

Figure 1. Running SAP applications on Oracle Solaris platforms delivers virtually linear scalability.

Oracle Real Application Clusters (RAC) running on Oracle Solaris 10 and Oracle Sun Fire X4800 M2 servers. The result was 180,000 SAP SD users and, for the first time on any SAP SD benchmark, more than 1 million SAPS, using the SAP SD Standard Parallel Application Benchmark. The configuration was replicated to create up to eight Oracle RAC nodes that delivered the outstanding performance results shown in Figure 1.

When measured with two-, four-, six-, and eight-node configurations, Oracle Database with Oracle RAC running on Oracle Sun Fire X4800 M2 servers shows an extraordinary 90 percent scalability, while maintaining superior performance and availability. Oracle's scale-out technology delivers both world-leading performance and virtually linear scalability from small to large systems.

Reduce Costs with Flexible, Scalable, Easy-to-Manage Systems

IT managers continue to explore all possible ways to reduce operating expenses, and Oracle platforms can help this effort. Oracle servers are extremely energy efficient, utilizing features within the architecture to create systems that produce significantly less heat,

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require less cooling, and draw less power per thread than other systems in the same class. The latest generation of Oracle servers adapt to application behavior by automatically adjusting processing power to deliver optimum performance and scaling energy use to the workload. As a result, running Oracle Solaris 11 on Oracle's SPARC or x86 processor-based servers creates a scalable, power- and energy-efficient platform that delivers flexibility, manageability, security, and reliability without breaking IT budgets.

Oracle Solaris binary compatibility enables IT managers to deploy and scale a single operating system across the enterprise— on desktops, blades, rackmount, and large-scale servers. SAP environments can take advantage of this compatibility by eliminating multiple operating systems within the SAP landscape. This approach streamlines administrative tasks and puts an end to the need for IT staff with multiple operating system skill sets.

The multicore-aware Oracle Solaris Zones enable secure consolidation of applications and help increase the utilization of system resources by up to 80 percent. In addition, Oracle Enterprise Manager OpsCenter manages virtualization running on top of Oracle Solaris, enabling applications to run on a dynamically managed pool of resources. These consolidated, dynamically-managed resources can be leveraged to reduce the number of servers used to run databases, lowering licensing costs. The result is a cost-efficient environment that can quickly scale and adapt to changes in demand or business processes.

Rely on Enhanced Security

As more employees, customers, suppliers, and partners access the collaborative environment enabled by SAP NetWeaver the need for security increases. Governmental regulations requiring ensured data integrity and security create additional burdens. Oracle intrinsically understands this challenge and continues its longtime commitment to building security into the operating system, with features such as secure execution, user and process rights management, and an integrated firewall. Indeed, a number of improvements and new security features in Oracle Solaris 11 enable security administrators to minimize and harden the environment to an even greater degree than ever before.

In traditional environments, users or applications with root access can make major changes to the system and SAP applications, either inadvertently or deliberately. With Oracle Solaris 11, administrators can secure the system by granting fine-grained privileges to users and applications, giving them the minimal access rights needed to perform specific tasks. In addition, the root user account is defined as a role, and only users with appropriate privileges can assume that role. Any changes made are traceable to users, providing greater security and accountability.

Increase Availability

More organizations need their SAP environments to be available 24x7 to remain competitive. This uptime requirement requires IT staff to carefully select platforms for rock solid reliability and availability.

Oracle servers have hot-swappable, redundant components to help reduce downtime due to hardware failures. In addition, the Oracle Solaris 11 operating system provides a number of features designed to help keep systems up and running. Operators can quickly debug performance issues and systemic problems and use Predictive Self Healing to diagnose, isolate, and recover from many hardware and application failures.

In addition, high availability and disaster recovery are possible with Oracle Real Application Clusters, or with Oracle Solaris Cluster and Oracle Solaris Cluster Geographic Edition.

Reduce Planned Downtime

Maintenance windows for SAP backups and upgrades are shrinking as organizations increasingly depend on their SAP applications for vital decision support. Planned downtime can be minimized by virtualizing servers and using Oracle Solaris ZFS. In addition, snapshots can be used to clone, roll back or recreate a file system on the same or another system. Writeable snapshots, known as clones, are ideal for storing private copies of shared data. Snapshots and clones are extremely useful to SAP administrators for system refreshes or copies, QA, test and development operations, or backups.

With a full line of SPARC and x86 processor-based systems—all running Oracle Solaris 11—Oracle platforms can help enterprises take advantage of the best technology to handle multitier enterprise SAP workloads.

(1) The SAP SD-Parallel standard application benchmark performed on September 26, 2011, by Oracle in Burlington, MA, USA, has been certified with the following data: 49,860 SAP SD-Parallel benchmark users. 0.91 seconds average dialog response time, 5,481,670 fully processed order line items per hour, 16,445,000 dialog steps per hour, 274,080 SAPS, 0.010 seconds/0.030 seconds average database request time (dialog/update). CPU utilization of servers, 91% (node 1 active: 88%, node 2 active: 94%). Server configuration: 2 Sun Fire X4800 servers each with 8 processors / 80 cores / 160 threads, Intel Xeon Processor E7-8870, 2.40 GHz, 64 KB L1 cache and 256 KB L2 cache per core, 30 MB L3 cache per processor, 512 GB main memory, Solaris 10 operating system, Oracle Database 11*g* Release 2 with Oracle Real Application Clusters, and SAP enhancement package 4 for SAP ERP 6.0. Certification Number: 2011040.

(2) The SAP SD-Parallel standard application benchmark performed on September 26, 2011, by Oracle in Burlington, MA, USA, has been certified with the following data: 94,736 SAP SD-Parallel benchmark users, 0.41 seconds average dialog response time, 10,921,000 fully processed order line items per hour. 32,763,000 dialog steps per hour. 546,050 SAPS, 0.010 seconds/0.041 seconds average database request time (dialog/update). CPU utilization of servers, 93% (node 1 active: 89%, node 2 active: 94%, node 3 active: 94%, node 4 active: 94%). Server configuration: 4 Sun Fire X4800 servers each with 8 processors / 80 cores / 160 threads, Intel Xeon Processor E7-8870, 2.40 GHz, 64 KB L1 cache and 256 KB L2 cache per core, 30 MB L3 cache per processor, 512 GB main memory, Solaris 10 operating system, Oracle Database 11*g* Release 2 with Oracle Real Application Clusters, and SAP enhancement package 4 for SAP ERP 6.0. Certification Number: 011039.

(3) The SAP SD-Parallel standard application benchmark performed on September 20, 2011, by Oracle in Burlington, MA, has been certified with the following data: 137,904 SAP SD-Parallel benchmark users 0.81 seconds average dialog response time, 15,309,330 fully processed order line items per hour, 45,928,000 dialog steps per hour, 765,470 SAPS, 0.009 seconds/0.045 seconds average database request time (dialog/update). CPU utilization of servers, 89% (node 1 active: 85%, node 2 active: 90%, node 3 active: 86%, node 4 active: 86%, node 5 active: 92%, node 6 active: 92%). Server configuration: 6 Sun Fire X4800 servers each with 8 processors / 80 cores / 160 threads, Intel Xeon Processor E7-8870, 2.40 GHz, 64 KB L1 cache and 256 KB L2 cache per core, 30 MB L3 cache per processor, 512 GB main memory, Solaris 10 operating system, Oracle Database 11*g* Release 2 with Oracle Real Application Clusters, and SAP enhancement package 4 for SAP ERP 6.0. Certification Number: 2011038.

(4) The SAP SD-Parallel standard application benchmark performed on September 5, 2011, by Oracle in Burlington, MA, has been certified with the following data: 180,000 SAP SD-Parallel benchmark users (overall world-record result on SAP SD benchmark) 0.63 seconds average dialog response time, 20,327,670 fully processed order line items per hour, 60,983,000 dialog steps per hour, 1,016,380 SAPS, 0.010 seconds/0.055 seconds average database request time (dialog/update). CPU utilization of servers, 89% (node 1 active: 85%, node 2 active: 89%, node 3 active: 90%, node 4 active: 90%, node 5 active: 90%, node 6 active: 89%, node 7 active: 89%, node 8 active: 90%). Server configuration: 8 Sun Fire X4800 servers each with 8 processors / 80 cores / 160 threads, Intel Xeon Processor E7-8870, 2.40 GHz, 64 KB L1 cache and 256 KB L2 cache per core, 30 MB L3 cache per processor, 512 GB main memory, Solaris 10 operating system, Oracle Database 11*g* Release 2 with Oracle Real Application Clusters, and SAP enhancement package 4 for SAP ERP 6.0. Certification Number: 2011037. Source: SAP, www.sap.com/benchmark

ORACLE DEMONSTRATES A PROOF OF VALUE AS A SERVICE FOR SAP CUSTOMERS

Introduction

Oracle has developed a Proof of Value as a Service (POVaaS) that leverages Oracle Cloud solutions to rapidly build and deploy production-ready images on Oracle Exadata, Exalogic. The POVaaS environment was created to demonstrate all elements of a data center infrastructure.

Key components of the POVaaS infrastructure include Oracle Linux, Oracle VM, OVM Manager, Oracle VM Templates, Oracle Enterprise Manager, Oracle RAC, Automatic Storage Management (ASM) and Cloud (Grid) Infrastructure. Numerous packaged applications such as SAP ERP ECC, Oracle E-Business Suite, Oracle Siebel CRM and Industry Applications are available to run on top of this infrastructure.

Customers may leverage this service in the Oracle Solution Center to evaluate Oracle solutions for their requirements and more specifically quantify the benefits or Oracle Engineered Systems.

This document describes how Oracle has deployed POVaaS for SAP.

Key Components of the POVaaS Infrastructure

Oracle Linux: Oracle Linux brings the latest Linux innovations to market, delivering extreme performance, advanced scalability, and reliability for enterprise applications. Oracle's Unbreakable Enterprise Kernel is a fast, modern, reliable Linux kernel that is optimized for enterprise software and hardware. It is the default kernel in Oracle Linux 5.6 and Oracle Linux 6. Oracle recommends the use of Oracle Linux with the Unbreakable Enterprise Kernel for all enterprise applications.

More information on SAP software support for Oracle Linux see SAP Note 1565179.

Oracle VM: Oracle VM Templates provide an innovative approach to deploying a fully configured software stack by offering pre-installed and pre-configured software images. Use of Oracle VM Templates eliminates the installation and configuration costs, and reduces the ongoing maintenance costs helping organizations achieve faster time to market and lower cost of operations. Oracle VM Templates for many Oracle products are available for download, including Oracle Linux, Oracle Solaris, Oracle Database, Fusion Middleware, and many more. POVaaS leverages and enhances OVM Templates with specific functions for Oracle Engineered Systems.

Oracle VM Manager: Oracle VM Manager is a web-based centralized management console. Through VM Manager Oracle VM servers are configured in a pool and connected through shared storage to offering features such as online secure live migration and high availability. If a physical server in a pool fails then virtual machines automatically get restarted on a different server within a given pool. There is support for gold images or OVM Templates that can be used to create new virtual machines. Oracle VM Manager is designed to handle many server pools and many more virtual machines per pool.

Oracle Enterprise Manager: Oracle Enterprise Manager 12c is Oracle's solution for enterprise cloud. The most important capabilities leveraged to deploy the POVaaS include:

- A centralized role-based console "Cloud Control" which is designed to support a lifecycle view of private and hybrid cloud management that spans infrastructure, database, middleware and applications environments.
- Customizable, role-based self service provisioning portal and service catalog capable of spanning physical and virtual infrastructure and public cloud services, as well as database, middleware and application environments.
- Template based provisioning and configuration control enabled by the Oracle Virtual Assembly Builder product that is designed to speed development and maintenance of full stack cloud service provisioning templates.
- New application to disk management capabilities for Oracle Applications and Oracle Engineered Systems, such as Exadata and Exalogic.

POVaaS Methodology

POVaaS methodology orchestrates these components in a comprehensive set of processes. This will ensure a secure and repeatable way of creating and managing different environments. VM instances are created in a cloud environment that can be deployed in three configurations:

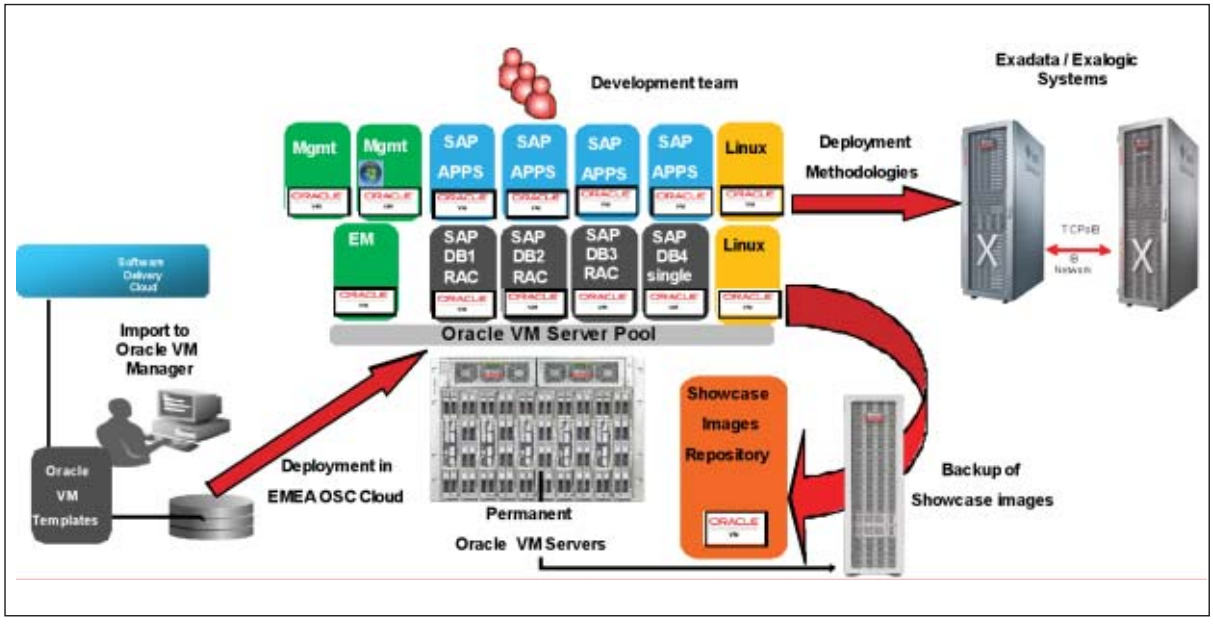
1) all virtual servers

2) virtual servers and Exadata / Exalogic

3) all Exadata / Exalogic

The picture below provides an overview of the POVaaS Methodology.

POVaaS Methodology with SAP



Production Showcases Features for SAP

Production Showcases for SAP are created using the POVaaS Methodology. Standard SAP Showcases can be deployed as is or customized with customer data. This document describes standard Showcases based on SAP ECC 6.0 and highlighting performance, manageability, high availability and disaster recovery.

Performance

SAP Load Generator SGEN is used to demonstrate SAP performance on Oracle Exadata. Performance data about execution time, CPU load, memory consumption and disk storage I/O will be monitored and recorded with Oracle Enterprise Manager and AWR reports. Results can be compared with customer baseline data.

High Availability

SAP transaction SU02 will be used to demonstrate continuous user transactions during a failure within the infrastructure. Failover to another Exadata compute node will be completely transparent while running SAP user transaction.

Disaster Recovery

SAP transaction will be used to continuously insert rows in a custom table. During a disaster recovery scenario that includes the entire loss of the primary production environment the transaction will continue on the stand-by database after startup. All changes on the database will be applied on the stand-by database with zero data loss.

System Management

Oracle Enterprise Manager and SAP management tools (ST04, DBACockpit, BRTools) are used to demonstrate SAP system management on Oracle Exadata and Exalogic. SAP configuration files, file system structure and typical maintenance tasks are all managed during system life cycle.

Customer specific Proof of Value

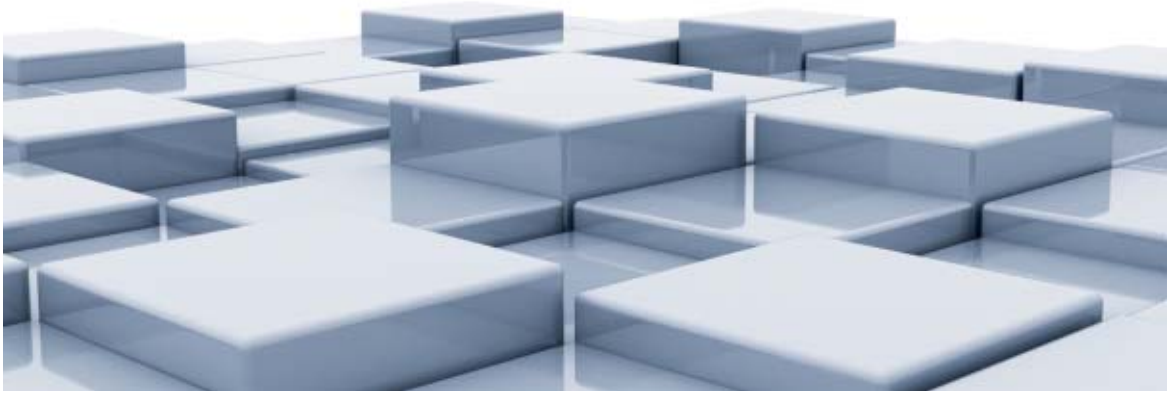
The POVaaS methodology and infrastructure simplifiy custom POVs as well. The flexibility and design of the environment enables re-building and deploying custom SAP instances for specific testing purposes. This includes database migration from any platform to Oracle Linux and extreme performance test runs on Exadata with selected SAP transactions.

Summary

Whether the requirement be a performance or high availability test or simulating a custom deployment the POVaaS methodology is a powerful mechanism for streamlining the process of evaluating Oracle infrastructure solutions including Exadata/Exalogic and other Engineered Systems for SAP implementations.

Contact:

Please contact the Oracle-SAP CC for more information.
Email: saponoracle_de@oracle.com
Internet: http://www.oracle.com/sap



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"The optimizations we hoped to achieve with ASM have been fully implemented. The Oracle Automatic Storage Management solution delivers tangible benefits in SAP system operations, including major time savings in the setup of our disaster systems, which translates into cost savings."

– CHRISTIAN DUSCHL,
SAP System Operations Team Leader,

Stadtwerke Muenchen GmbH
www.swm.de

Industry:
Utility/Public Sector

Turnover:
€ 3.8 billion (2010)

Workforce:
Around 7,500

Oracle products and services:
- Oracle Database 11*g* Release 2
- Oracle 11*g* RAC for SAP
- Oracle ASM/ACFS

Applications:
- ECC6.0 with add-on IS-U/CCS 6.04, PI 7.01,
- Public Transport
- Database hardware: 3 X Fujitsu
- Primergy RX600, Storage EMC (VMAX)

STADTWERKE MUENCHEN: USING ORACLE AUTOMATIC STORAGE MANAGEMENT (ASM) FOR SAP DELIVERS MULTIPLE BENEFITS

Stadtwerke Muenchen (SWM), Munich's municipal utilities company, is one of the largest energy and infrastructure companies in Germany. Over one million private households, SMEs and business clients benefit from the services provided by SWM on a daily basis. For decades, SWM has provided energy (electricity, natural gas, district heating) for the Bavarian capital in a safe and environmentally benign way. Among other things, the SWM development push for renewable energy and the push for eco-friendly district heating are an example to other districts. Furthermore, SWM supplies the megacity with fresh drinking water from the Bavarian Voralpenland – one of the best in Europe – and with 18 indoor and outdoor swimming pools they operate one of the most modern bathing environments in Germany. The MVG transport subsidiary is responsible for the underground, bus and tram systems and therefore a significant pillar in Munich's public transport network. SWM employs around 7,500 staff and in the 2010 fiscal year turnover reached around 3.8 billion euros. Further information is available at: www.swm.de/en

As the backbone of the business, the IT infrastructure performs an essential task and is designed for round-the-clock operation. It is vital that this infrastructure offers high stability and availability. Stadtwerke Muenchen also gives high priority to safety of investment, operating efficiency, cost-effectiveness and security.

It was with these priorities in mind that Stadtwerke Muenchen decided, nearly four years ago, to use Oracle Real Application Clusters (RAC) with SAP (ECC 6.0 with IS-U add-on for the utilities industry) in its productive systems. This reorientation, based on the Oracle RAC database clustering technology, proved to be an excellent choice. Indeed, SWM has been using Oracle solutions in a non-SAP environment for a number of years.

Since then, the organization has not only upgraded from Oracle Real Application Clusters 10*g* Release 2 to Oracle RAC 11*g* Release 2 for SAP (including an upgrade to the Microsoft Windows 2008 operating system platform), but has also realized a pilot project to implement Oracle Automatic Storage Management (ASM)/Oracle Cloud File System (ASM Cluster File System). Oracle ASM enabled Stadtwerke Muenchen to achieve several optimization objectives in its SAP operations in one fell swoop.

No Changes Except the Storage Environment

SWM opted to introduce Oracle ASM/ACFS with the utilities add-on to its IT infrastructure for one main reason: "As we were so impressed with the Oracle storage management platform in a non-SAP environment, we wanted to exploit ASM for SAP use too," says Christian Duschl, SAP System Operations Team Leader.

To implement ASM/ACFS, the utility company was supported by the Oracle Technology Center and the Oracle-SAP joint development team in Walldorf. Oracle not only helped SWM with the planning and rollout of ASM/ACFS, but also the implementation of a modified operating system concept, including documentation for ASM system operations.

SWM Systems Engineer Manfred Fischer explains, "It was specified in the project plan that implementing ASM/ACFS should not involve any significant changes to the SAP IT infrastructure – except in the storage environment, where the databases are actually operated. We also didn't intend to install any new or additional storage systems."

Prior to the introduction of ASM/ACFS, SWM was already using an IT infrastructure based on a stretched cluster model with two connected data centers, RZ1 and RZ2, with disaster systems, located around 20 kilometers (12.4 miles) apart. The core components of the database system environment include Oracle Real Application Clusters 11g Release 2 for SAP (3 nodes), Fujitsu Primergy RX600 (FlexFrame; MS Windows OS), EMC storage systems (VMAX, NFS shares), and a redundant network/redundant EMC connection. In terms of applications there are basically three systems (classic, delivery and network) with three databases (**3.1 TB, 3.4 TB and 3.1 TB** net, not including disaster systems). The operating system at application server level is SUSE Linux. In total there are some 1,800 users working with the SWM SAP application environment.

ASM: Superior Storage Management

One of the main objectives of the ASM/ACFS rollout was "to replace active-passive RAC with active-active RAC and storage use in our stretched cluster," says Fischer.

The reconfiguration of the EMC storage environment therefore focused on the rearrangement of the disks in RZ1 and RZ2 on the basis of ASM/-ACFS with ASM disk groups and the use of preferred read failure groups. ASM combines multiple hard disks into a disk group, which can have different redundancy levels. There are also different types of disk groups: ORC, VOTE, and ACFS.

At Stadtwerke Muenchen, ASM disk groups were set up and configured at both data centers in the stretched cluster, each assigned to particular failure groups. With ASM, the original is safely stored and a copy is made in the failure groups using raw devices. Should a storage problem occur at either of the two data centers, or should one data center fail completely, SWM can fall back on complete copies of the data in the active storage environment in the other data center.

This availability setup is also useful for maintenance purposes. "With ASM we were able to dispense the EMC-SRDF protocol, which transferred data between the active and passive storage environments. We also replaced OCFS with the ASM Cluster File System," Fischer adds.

In order to decide which data center should keep operating in the event of a disaster, should there be a breakdown in communication between RZ1 and RZ2, a control instance was set up at a third location in Munich, named RZ3. This OpenFiler system (filer for iSCSI) is connected to all three RAC nodes within the stretched cluster.

"With ASM we can operate our stretched cluster efficiently and with high stability across two sites, and with true active-active architecture."

– Manfred Fischer, Systems Engineer SWM Stadtwerke Munich

Beneficial New Solution

"The optimizations we hoped to achieve with ASM have been fully implemented. The Oracle storage management solution delivers tangible benefits in SAP system operations, including major time savings in the setup of our disaster systems, which translates into cost savings," says Duschl.

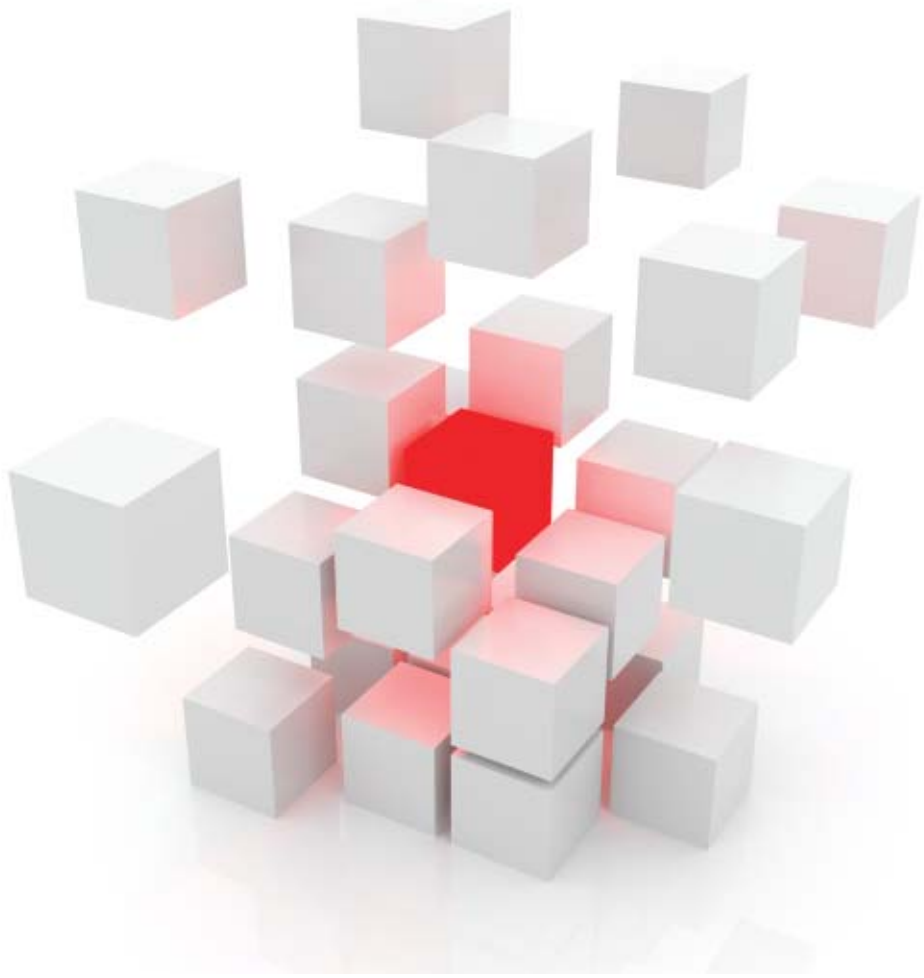
"With ASM we can operate our stretched cluster efficiently and with high stability across two sites, and with true active-active architecture," adds Fischer.

With Oracle ASM, SWM can perform maintenance on the storage system without causing application downtime. The new system operating environment with ASM also covers for the potential failure of one data center, storage system or database node. **Test- and consolidation systems** can also be re-established quickly with the help of hardware mirroring. Experience has shown that at SWM, Oracle ASM has reduced the time required to produce **a test- and consolidation systems** –a task performed every three to four months– from 16 hours to just one hour.

"BR*Tools fully support managing database files on Oracle ASM and provide all important backup/restore capabilities as well as initiated backups supporting the EMC clone method."

"As we were so impressed with the Oracle storage management platform in a non-SAP environment, we wanted to exploit ASM for SAP use too,"

– Christian Duschl, SAP System Operations Team Leader.



Only Oracle Database 11*g* Release 2 provides for SAP customers

	Oracle	other DBs
Fully integrated, platform independent active-active clustering solution for both SAP and database through RAC and Clusterware/SAPCTL	✓	–
Enhanced Add COLUMN Functionality	✓	–
High Performance NAS Storage through Direct NFS	✓	–
Online Patching	✓	–
Real Application Testing Option	✓	–
Updatable Standby Database	✓	–
RMAN Backup Compression, RMAN Backup Encryption	✓	–
SecureFile out-of-line LOB data compression	✓	–
Deferred Segments Creations	✓	–
Disk-Based Bitmap Indexes	✓	–
Tablespace Encryption	✓	–
Data Guard Secure Network Transport	✓	–
Database Vault	✓	–
Automatic Workload Repository (AWR)	✓	–

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SAP ON ORACLE 11*g* REAL APPLICATION CLUSTERS (RAC)

Astelit LLC Leverages World-Class Database Architecture for Expanding Mobile Communications IT Infrastructure

Astelit

Oracle Customer:
Astelit LLC

Location:
Kiev, Ukraine

Industry:
Communications

Employees:
More than 1,000

Annual Revenue:
$100 to $500 Million

Partner:
Citia

Astelit LLC was established in 2005 as the third GSM (Global System for Mobile Communication) operator in Ukraine. The company's vision is to become a single-source provider of communication services. Its mobile network, life:), serves 8.7 million subscribers (96.9% of the Ukrainian population as of the second quarter 2011), operates 10 life:) customer service centers, and 212 exclusive shops in 108 Ukraine cities. In addition, life:) subscribers can order life:) services through 117 branded points-of-sale and 47,382 GSM and nonGSM sales points throughout Ukraine. The company was the first in Ukraine to offer its customers enhanced data GSM environment-based (EDGE-based) high-speed data transfer services.

Within the first eight months of its operations in Ukraine, life:) added one million subscribers to its customer base. In late 2005, Wireless Intelligence, the market analyst managing the global database of mobile market information, acknowledged life:) as the fastest growing mobile communications operator worldwide in terms of subscribers. In 2006, Astelit became the first Ukrainian company to receive a prestigious international business award—The Stevie® Awards, considered by the New York Post to be the business world's Oscar Award—for outperforming competitors from all over the world to win the distinction of "Best Overall Company."

Astelit's main challenge was minimizing the impact of site disasters, such as node failures that could compromise business continuity—a critical requirement for a business that relies on the constant availability of information to establish mobile communications and bill correctly. In addition, Astelit wanted to centralize database management and enhance performance.

Astelit overhauled its database infrastructure with Oracle Database 11g Enterprise Edition. The company also deployed Oracle Real Application Clusters 11g with Oracle Data Guard 11*g* to implement an efficient disaster recovery solution that reduces the time required to recover from a primary site disaster to less than five minutes. Finally, it installed a host of other Oracle solutions to automate application tuning, decrease query and reporting time, and reduce software costs.

Challenges

A word from Astelit LLC

"We selected Oracle because it offers the best choice to deploy world-class telecommunication services, ensuring the highest possible availability of mission-critical information. Oracle truly enables us to fulfill our mission of adding value to the lives of our customers and building long-term customer relationships." – Yaroslav Mihaliuk, IT Infrastructure Operations Division Manager, Astelit LLC

- Ensure business continuity by minimizing the impact of a primary site disaster—such as business-critical failures of database nodes—that required from one hour to a few days to rectify
- Establish database management as well as real-time database monitoring and notifications to enable proactive support and mitigate the risk of system failures
- Automate software management for Astelit's numerous database installations to enhance database performance
- Ensure data access is based on employee roles, so that customer service operators and other employees have access only to a specific set of subscriber data, based on their job function

- Provide a high level of availability to expand Astelit's mobile communications infrastructure, as needed.

Solutions

Oracle Product and Services

- Oracle Database Enterprise Edition 11*g*
- Oracle Real Application Clusters 11*g*
- Oracle Active Data Guard 11*g*
- Oracle Configuration Management Pack 11*g*
- Oracle Enterprise Manager 11*g*
- Oracle Diagnostics Pack 11*g*
- Oracle Tuning Pack 11*g*
- Oracle Partitioning 11*g*

- Implemented Oracle Database 11*g* Enterprise Edition as a single source to manage all of the company's data—including 45 database instances with a total volume of 500 terabytes of information—with high efficiency
- Leveraged Oracle Real Application Clusters 11*g* in the combination with Oracle Active Data Guard 11*g* to establish business continuity with an efficient disaster recovery solution that reduces the time to recover from a primary site disaster—such as a mobile communications node failure—from hours or days to less than five minutes
- Used Oracle Partitioning 11*g* to subdivide tables, indexes, and index-organized tables of each Oracle database for more efficient usage to decrease query and reporting times
- Leveraged Oracle Diagnostics Pack 11*g* and Oracle Tuning Pack 11*g* to modify database parameters to comply with performance requirements, while automating the complex and time-consuming task of application tuning
- Utilized Oracle Active Data Guard 11*g* to achieve real-time replication regardless of data type, workload profile, or transaction throughput by offloading read-only workload from the company's production database
- Established online monitoring for all databases with Oracle Enterprise Manager 11*g* to enable proactive support and prevent most alarms from being raised in Astelit's mobile communications network
- Acquired complete control of software inventory changes with Oracle Configuration Management Pack 11*g* to minimize risks, reduce problem resolution time, and lower software costs
- Enhanced availability and scalability of database layer services with Oracle Real Application Clusters 11*g* to enable Astelit to grow its mobile communications infrastructure as needed—such as adding service numbers during a promotional campaign—to improve the quality of service
- Used Oracle Enterprise Manager 11*g* Grid Control to provide end-to-end monitoring across the entire spectrum of business transactions, with the ability to diagnose and remediate problems at any level of the company's database infrastructure.

"We immediately got noticeable results from Oracle Advanced Compression. And all results are obtained without decreasing performance of the most important business processes. So the DB size reduced by 56 TB to 40 TB (-29 percent) and the monthly growth reduced by 1.5 TB to 900 GB (-40 percent)."

– ANTONIO EVANGELISTA,
Information and Communication Technology
Enel, Italy

Italy's largest Power Company Enel optimizes one of the greatest SAP IS-U Installation on Oracle Database 11*g* Release 2 with Advanced Compression

INCREASED MANAGEABILITY, REDUCED SIZE

Enel
http://www.enel.it

Industry:
Utility

Workforce:
76.000

Oracle Products:
Oracle 11.2.01 for SAP;
Size 56 TB before Advanced Compression

Key Benefits:
Reduction in storage, optimized management, cost savings, significant database size reduction, reduced backuptime, enabling future growth

SAP:
ERP ECC 6.0 (IS-U),
Different modules active

Infrastructure:
DB OS AIX (5.3). DB Application Servers SUSE 10 Linux

Enel is Italy's largest power company, and Europe's second listed utility by installed capacity. It is an integrated player which produces, distributes and sells electricity and gas.
The Enel Group has a presence in 40 countries over 4 continents, has about 96,000 MW of net installed capacity and sells power and gas to around 61 million customers. Enel is also the second-largest Italian operator in the natural gas market, with approximately 3.1 million customers. In 2010, Enel posted revenues of more than 73 billion euros As of June 30th, 2011, the Group has over 76,000 employees and operates a wide range of hydroelectric, thermoelectric, nuclear, geothermal, wind-power, photovoltaic and other renewables' plants.

Enel has one of the greatest SAP IS-U installations on Oracle database. The system is dedicated to bill Italian free market energy customers; it produces on average 24 million a year electricity bills and 16 million a year gas bills. The system has over 3.9 million active contracts related to the electricity market segment and more than 3.1 million active gas contracts. The number of defined users in production instance is over 6,800.

Solving Disadvantages

Because of the exponential increases in data volume at Enel in recent years it has become imperative to employ more efficient ways of storing and managing data. At least the database size grew over 56 TB, with a growth of over 1.5 TB a month. The objects that contribute to the large size of the database include: the total sizes of the tables (39.0 TB) and indexes (11.1 TB) plus the tablespaces (23.0 TB), partitioned tables (14.8 TB), partitioned index (1.2 TB), unpartitioned table (2.2 TB) and unpartitioned index (3.8 TB). Mr. Antonio Evangelista at Enel says, "problems related to the size of these objects are evident".

He states, that especially the large tablespaces can have significant disadvantages. If reclaiming disk space (e.g. after archiving or deletion) or change the tablespace structure this requires a tablespace reorganization. A tablespace reorganization of a very large tablespace takes a significant amount of time, uses a lot of system resources and requires, at least temporarily, significant additional space. Also in case of online backups (without RMAN) the whole tablespace has to be put into backup mode while the backup is running. This results in significantly increased redo log generation. Finally there is a risk of running into the maximum number of datafiles per tablespace. "Therefore it is usually advantageous to keep the tablespace sizes at an acceptable level, but that depends on factors like available additional disk space and available time window", Mr. Evangelista remarks.

Enel started a project to achieve basically two goals. First reorganizing database objects in an efficient way, second reducing the size of the database. With these goals, Enel will get different benefits: smaller amount of storage needed, performance improvement, ability to better perform management activities, reduction in backup times and reduction in time realignment for Disaster Recovery environment.

In general rapid increase in data volumes have put enterprise IT infrastructures under severe pressure – from a cost, performance, scalability, and manageability perspective. Efficient ways of storing and managing data are needed to meet the growing demands of large systems; database compression is an important technique to reduce storage needs. Even prior to Oracle Database 11*g*, Oracle had already been a world leader in storage efficiency for customer data. Oracle's database size is generally significantly smaller than other databases because of the key attributes of Oracle's data representation on disk.

Advanced Compression – The Solution

Enel tested Oracle 11*g* Advanced Compression and decided to use it as quick as possible. As Mr. Evangelista says, "Oracle Database 11*g* Advanced Compression provides storage reduction through compression of all data types. It also provides performance improvements in several cases as compressed blocks result in more data being moved per I/O. It further improves memory efficiency as Oracle database keeps data compressed in memory".

From the standpoint of Enel the most important benefits gained using data compression are:

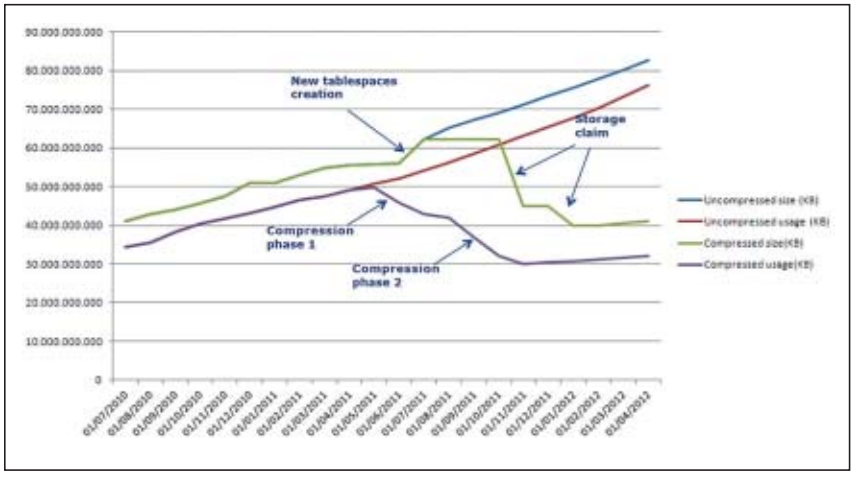
- large reduction in storage across all environments such as production, standby, test, development, backup, etc;
- improved memory efficiency as data remains compressed in memory;
- minimal or no performance impact on DML operations because of performance optimized compression technology;
- faster queries in many cases, because of improved I/O and memory efficiency;
- better network bandwidth utilization and
- application transparency – no application changes required.

Before Enel implemented Oracle Advanced Compression, first they needed to fix several project steps, They identified the critical objects and created new ASSM tablespaces. The next step was reorganizing objects with data compression in the new tablespaces and deleting empty tablespaces. After this the specialists at Enel moved datafiles between filesystems and removed empty filesystems. After this, Enel plans to test Oracle Database 11*g* Advanced Compression on performance system for 3 months followed by implementation in production for 6 months.

Enel defined some rules to identify and operate on the critical objects. For example, potentially critical objects are all tables and indexes greater than 1TB or creating a dedicated tablespace for each object greater than 2 TB (sum of the table and related indexes), but both tables and indexes can be put into the same tablespace. The remaining "small" tables can remain in a "collective" tablespace and all newly created tablespaces are in ASSM.

"Oracle Database 11*g* Advanced Compression provides storage reduction through compression of all data types"

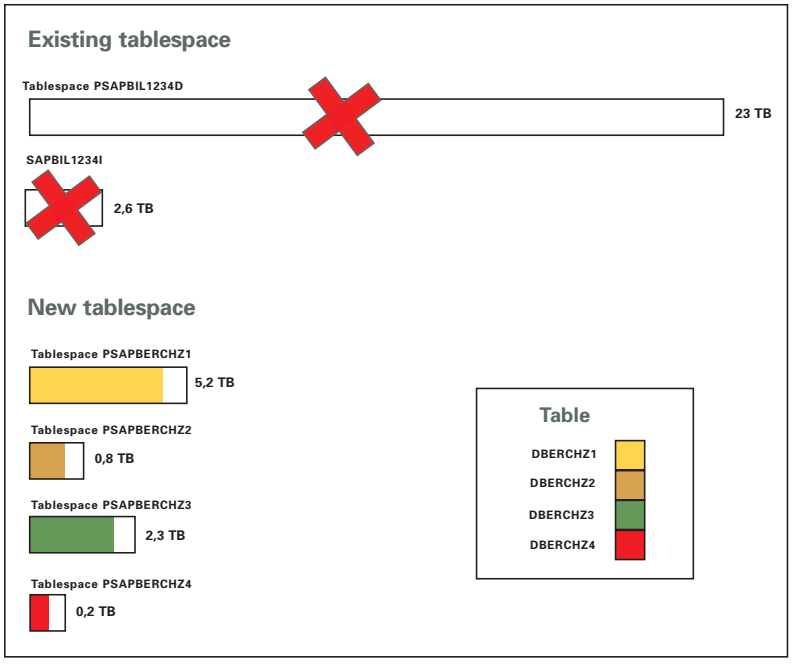
– Antonio Evangelista, Information and Communication Technology Enel, Italia



Database Growth after Compression

The project plan specifies, in the compress execution, all activities are performed using the standard SAP utilities included in BR Space tool. Also all reorganization activities are made online, without decreasing any performance to daily online and batch activities. The parallelization level during the compression activities is different for each object.

From the storage point of view, Enel prefers the following approach: when deleting tablespaces, the datafiles are also deleted. Generally datafiles are distributed in filesystems in sparse mode. So, to free up the entire disks, it is necessary to rearrange the data remaining on the filesystems (moving datafiles from one filesystem to another) and then to delete all the empty filesystems on a physical disk. "After that remove a disk from a volume group and finally get a saving", explains Mr Evangelista.



Existing Tables and new Tables in a graphical View

Before – after: Not a little Change

Using Oracle 11*g* Advanced Compression "we immediately got noticeable results from Oracle Advanced Compression. And all results were obtained without decreasing performance of the most important business processes. So the DB size at Enel was reduced by 56 TB to 40 TB (-29 percent) and the monthly growth was reduced by 1.5 TB to 900 GB (-40 percent). Also backup duration was reduced by 28 to 20 hours (-29 percent)", says Mr. Evangelista. Other results not immediately visible: increased manageability of the instance, reduced size for other related instances (DR, test and performances environments) and global cost reduction due to the storage savings.

Regarding a few details after the compression activities, there are some differences in the larger objects presented at the beginning of this project: Table named DBERCHZ1 was reduced in size down to 3.3 TB from 14.8 TB after Advanced Compression. Another Table named DBERCHZ2 was reduced from 1.8 TB to 378 GB. A third Table went from 5.7 TB uncompressed to 790 GB compressed. "That's maybe not a little change", Mr. Antonio Evangelista says.

Enel plans to further reduce the size of the database for their SAP Version ECC 6.0 that is running the database on AIX 5.3 and the Application Servers running Linux SUSE 10. The database tables and indexes compression activities are still under way in the production environment. The company needs to partition and compress the largest non-partitioned table shown in the initial scenario. Following the upgrade from Oracle 11.2.01 to 11.2.0.2, Enel will start the compression related to objects containing lob segments (securefile compression). The goal is to reduce the database size by a further 30 percent goal already achieved in the performance environment.

"Our aim with Oracle Database 11*g* Advanced Compression was to reduce database storage volume for SAP use by at least 50 % and thereby achieve substantial cost reductions. We not only achieved our optimization targets, we surpassed them."

– SVEN LAERUM,
Project Manager & BI Expert,
Heidelberger Druckmaschinen AG (Heidelberg)

Heidelberger Druckmaschinen AG
www.heidelberg.com

Industry:
Print Media Industry

Workforce:
15,800

Oracle Products:
Oracle 11.2.01 (10.2.04) for SAP DB size system Service Point before Advanced Compression 1.4 TB

Key Benefits:
Space savings, cost savings, database size reduction, better performance

SAP:
ERP ECC,
HCM/HR, SRM, SMC, APO, PM, SM, Netweaver BW and others

Infrastructure:
HP servers with HP-UX, EVA storage (hosted infrastructure)

56 % reduction in database storage – substantial cost savings

ORACLE DATABASE 11*g* ADVANCED COMPRESSION AT HEIDELBERGER DRUCKMASCHINEN AG: A POWERFUL TOOL FOR LONG-TERM ENHANCED EFFICIENCY EXCEEDING EXPECTATIONS

Heidelberger Druckmaschinen AG (Heidelberg) is the world's leading service and solution provider in the print media industry. In addition to offering a wide range of digital and sheet-fed offset printing solutions, the company manufactures complex precision-machined parts and assemblies. All over the globe, the Heidelberg name is synonymous with world-leading technology, quality, and an awareness of the customer's needs. The company's core business is the complete process and value-added chain in sheet-fed offset printing, covering formats of 35 x 50 cm to 120 x 160 cm, as well as digital printing solutions and consumables. Production to order, primarily for customers in other engineering sectors and the energy industry, also represents a growing line of business. Sales in 2010/2011 amounted to € 2.629 billion. As at 31 March 2011, the Heidelberg Group employed some 15 800 people, including 600 trainees.

Continuous optimization process

As you would expect, the company is reliant on its global IT systems for day-to-day operations – be it for R&D, financial management, production, sales, or customer service. For almost 20 years Heidelberg has trusted in Oracle Database, a vital component of its IT setup in conjunction with the SAP software. The company is continually seeking to optimize the efficiency and effectiveness of its IT environment, for example by outsourcing SAP system operation to a hosting provider and implementing consolidation projects to optimize the SAP system setup.

Naturally enough, Heidelberg's attentions soon turned to the optimization potential offered by Oracle Database 11*g*. There are plenty of reasons to choose Oracle Database 11*g* Advanced Compression to enhance database storage efficiency: "When we talked to Oracle we were immediately impressed by the disk space savings that can be achieved with Advanced Compression. The Oracle technology can slash database storage volume by around 50%, which means signif-icant cost savings. And the time and workload involved are relatively modest," says Sven Laerum, Project Manager & BI Expert at Heidelberger Druckmaschinen AG.

Careful planning with support from Oracle

Oracle Database 11*g* Advanced Compression was put through its paces in a proof-of-concept feasibility test to see if it could deliver Heidelberg's requirement of at least a 50% reduction in disk space. The target system was an existing SAP line including various applications and with more than 7,000 users. The service management system, known as ServicePoint, is used by Heidelberg's global service division.

"The test in the integration environment showed that the target could be exceeded and the actual optimization, including preparation and corrections, could be implemented in a short space of time," says Laerum.

Before compression with Oracle Database 11*g* Advanced Compression, the database on the ServicePoint integration system was a little over 1.4 TB. The features used included Index Compression, Table Compression, Secure Files Compression and Deferred Segment Creation. Following the successful test phase, Heidelberg gave the go-ahead for Oracle Database 11*g* Advanced Compression to be implemented on the ServicePoint productive system.

Optimization with Advanced Compression a complete success

Heidelberg was more than satisfied with the results. "The project was a complete success. We not only achieved our optimization targets, we surpassed them. The results are clear to see, not only in terms of database storage volume, but in terms of tangible cost savings too," says Laerum, adding: "Oracle did an incredible job throughout the project, dealing efficiently with any minor issues as they arose."

A before and after analysis reveals that Oracle Database 11*g* Advanced Compression reduced overall database storage volume by an impressive 56%, from around 1.42 GB to around 622.6 MB. A breakdown by feature shows that Index Compression delivered a reduction of 52%, Table Compression 60%, Secure Files 70%, and Deferred Segment Creation 100%.

Performance was also enhanced, with one special report taking 4 hours and 12 minutes before Oracle Database 11*g* Advanced Compression and just 56 minutes after. Another was reduced from 16.9 minutes to a mere 1.5 minutes.

By opting for Oracle Database11*g* Advanced Compression, Heidelberg achieved significant cost savings. "The bottom line is that we saved an annual five-figure sum on this system alone with Oracle technology. It's a powerful tool for long-term enhanced efficiency and substantial cost savings in IT," says Laerum.

"When we talked to Oracle we were immediately impressed by the disk space savings that can be achieved with Advanced Compression. The Oracle technology can slash database storage volume by around 50 %, which means significant cost savings."

– Sven Laerum,
Project Manager & BI Expert, Heidelberger Druckmaschinen (AG) (Heidelberg)

Oracle Database 11*g* Advanced Compression at Heidelberger Druckmaschinen AG (ServicePoint system) – the results at a glance

Item	Result
DB Disc Space Savings (overall)	56%
Index Compression (already available with 10*g*)	52%
Table Compression	60%
Migration of DB Elements of Type LOB to new "Secure File"	70%
Usage of Deferred Segment Creation (empty tables and indices don't use DB space until they are filled)	100% (Volume 1.2 GB)

HOW DELL MIGRATED FROM SUSE LINUX TO ORACLE LINUX

How Dell planned and implemented the migration, including key conversion issues and an overview of their transition process.

Switching the underlying operating system on a single server is not trivial. Neither is dealing with the related conversion and compatibility issues. Imagine what's involved in switching the operating system on thousands of servers spread globally across an enterprise, like Dell just did.

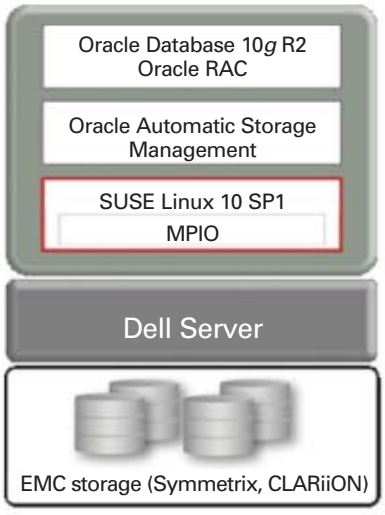
In June of 2010, Dell made the decision to migrate 1,700 systems from SUSE Linux to Oracle Linux, while leaving the hardware and application layers unchanged. Standardization across the Linux platforms helped make this large-scale conversion possible. The majority of the site-specific operating system and application configuration could simply be backed up and restored directly on the new operating system. Configuration changes were minimal and most could be automated, easing the administration effort required and helping achieve a reliable and consistent transition procedure.

Dell's Deployment Environment

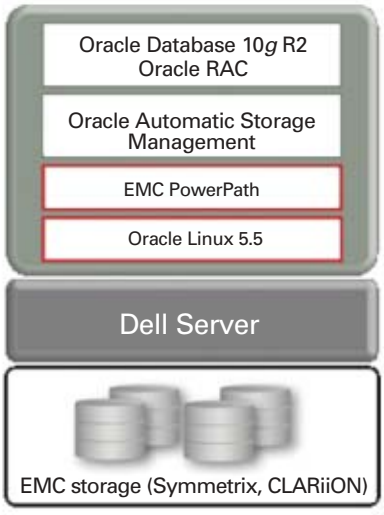
Dell had approximately 1,700 physical systems running SUSE Linux at the start of this migration process. These systems, geographically dispersed around the world, used a mix of eighth-generation (Dell PowerEdge 2850 and 2950 servers) and newer Dell hardware. Fibre Channel SAN storage comprised EMC Symmetrix and CLARiiON devices. The software environment included SUSE Linux 10 Service Pack 1 with multipath I/O (MPIO), Oracle Database 10*g* Release 2, Oracle Real Application Clusters (Oracle RAC), and Oracle Automatic Storage Management, as shown in *Figure 1*.

Figure 1. **Dell's Deployment Environment Before and After Migration to Oracle Linux**

The migration primarily involved the operating system moving from SUSE Linux 10 to Oracle Linux 5.5. The same physical server and storage hardware was retained during the migration. Similarly, the Oracle software remained unchanged after the migration. An additional change for Dell was a switch from SUSE Linux's built-in multipath I/O support to EMC PowerPath for automated data path management. (**Note:** the actual conversion from MPIO to PowerPath is tangential to the operating system migration and is beyond the scope of this document.)



Before migration



After migration

Figure 1.

This migration process also served as a time for Dell to re-evaluate its servers running SUSE Linux to determine whether the applications running on these servers could be decommissioned or deployed on an existing MegaGrid environment instead. Dell uses 16-node racks, each capable of hosting 300 databases, for their MegaGrid deployment. In some cases, there was sufficient capacity on an existing MegaGrid infrastructure, and the applications and databases could be migrated to the grid and the SUSE Linux server powered down and decommissioned. This consolidation provided savings in power, cooling, and reduced space requirements. In other cases where consolidation wasn't feasible, the SUSE Linux system was migrated to Oracle Linux, using the processes described in this document.

Migration Process

Given the scale of the migration, planning and automation were essential to the project's success. Aik Zu Shyong, in Core Engineering at Dell, reflects: "We put significant focus on engineering the operating system conversion to make sure we could deliver a simple, reliable, and repeatable automated process. Additionally, by designing the migration to be done in-place instead of using a much slower and cost-prohibitive replacement method, we were able to further reduce downtime and save data center space."

Dell's migration process included three main steps: preparation, reimaging the operating system, and postinstallation configuration. First, in the preparation step, Dell saved the existing environment's configuration and safely shut down the applications and database. Next, they reimaged the operating system from SUSE Linux 10 to Oracle Linux 5.5. After the reimaging was completed, the postinstallation steps were used to configure the new environment and restore the previous data.

Preparation

The following preinstallation steps were used by Dell to prepare for their migration from SUSE Linux to Oracle Linux.

1. **First, Dell created a scratch area to save the various configuration files.** For compatibility with the Oracle Linux operating system, Dell created an ext3 file system—not a ReiserFS file system, the default for SUSE Linux 10—and documented the location of this scratch file system for use after the migration. Dell used a spare volume on the attached Fibre Channel storage device or a secondary drive on the machine, depending on the system configuration, to store the files.

   The size of the scratch area varied with the specific system configuration, and it was based on the largest piece of data that needed to be backed up: the `ORACLE_HOME` directory. Sufficient space was reserved to hold this directory plus the various system configuration files that needed to be backed up.

   Next, Dell shut down applications and services on the system and disabled the init.d processes. Dell followed the Oracle-recommended shutdown order to stop the Oracle Database, Oracle Automatic Storage Management, applications running on the cluster nodes, and Cluster Ready Services (CRS). The `chkconfig` command was used to disable running services:

2. **# chkconfig *service_name* off**

1. For Dell's migration, the class of service of the system being migrated affected the shutdown procedure. For non-critical systems, a system maintenance window was requested and the entire cluster was shut down, migrated to Oracle Linux, and then restarted. For systems running business-critical applications, a complete shutdown of services was avoided. In these instances, rolling upgrades were employed. Services were transitioned off a selected cluster node to another node in the cluster, and that selected node was migrated to Oracle Linux. Then, that cluster node was restarted and rejoined the cluster. This process was repeated until all nodes in the cluster had been upgraded.

   Note: Although Oracle does not support heterogeneous Oracle RAC clusters, Dell experienced no issues during the transition with nodes running SUSE Linux interoperating with nodes running Oracle Linux. This mixed OS configuration was used only during the migration process, however, and not during normal system operation.

2. **Dell confirmed file systems were not in use**
   Dell used the lsof command to list any open files and make sure any NFS mounts were not in use. They also confirmed the `ORACLE_HOME` directory was free from resource utilization.

3. `# lsof`
4.
5. **Dell archived the relevant operating system configuration files and directories**

Dell converted MPIO to PowerPath

Dell chose to convert from SUSE Linux's built-in MPIO support to EMC PowerPath for automated data path management, because this was the Dell standard for other non-SUSE Linux systems. Using EMC PowerPath also made it easier to copy over LUN mappings after the conversion.

A custom script was written by EMC to perform the conversion from MPIO to PowerPath. Details of this conversion step are beyond the scope of this paper. Readers are referred to EMC or their storage provider for more information on converting data path management, if needed. **Dell archived the Oracle-specific configuration information.**

Similar to the operating system configuration files, Dell stored these Oracle-specific configuration files on a spare volume on the attached Fibre Channel storage device or on a secondary drive on the machine. *Table 1* lists the Oracle-specific configuration files that Dell saved in preparation for the migration to Oracle Linux.

Reimage the Operating System

After configuration information was saved and all essential services were moved to backup servers, the system was ready to have the new Oracle Linux operating system installed. The kickstart installation method was used to automatically perform the installation of the Oracle Linux 5.5 operating system across the network. Using kickstart helped ensure quick, efficient, and consistent operating system installations on the client systems.

The standard kickstart configuration and installation were employed, with a central kickstart server on the network used for the installations. ISO images for Oracle Linux 5.5 were copied to Dell's regional imaging server and made available over the network. A kickstart configuration file was created that specified kickstart options and the packages to be installed.

Table 1. Oracle-Specific Configuration

Archive Step	Comments
Profiles for `oracle` and `svcgrid` users	`.profile` files for `oracle` and `svcgrid` users (Note: Oracle Linux files are named `.bash_profile`)
LUN mapping info	`/u02` (this directory contained the symbolic links for the LUN mappings in the SUSE Linux environment)
Oracle Inventory Pointer (`oraInst.loc`) and `oratab` files	`/etc/oraInst.loc, /etc/oratab`
Oracle inventory file (`oraInventory`)	`/etc/oracle/oraInventory`
OCR file	`/etc/oracle/ocr.loc`
SSH trusted key for `oracle` user	`~oracle/.ssh/*`
Database-specific kernel settings	`/etc/sysctl.conf`
Home directory of `oracle` user	Site-specific; `/home/oracle` for Dell configurations
Home directory of Oracle software (`ORACLE_BASE`)	Site-specific; `/u01/app/oracle` for Dell configurations

7. **Finally, Dell created a backup image of the saved configuration files using the tar utility.**

The client machine was booted using a USB flash drive, and the kickstart configuration file was downloaded. Installation proceeded automatically and was completed without requiring user intervention.

Caution: Make sure that the installation process does not erase the backup disk, which is used to store the archived system information. Dell's kickstart process specifically touched only the `/dev/sda` disk, leaving `/dev/sdb` available for safely archiving the backup information.

Postinstallation

The following key steps were part of the postinstallation process in Dell's migration to Oracle Linux

Dell restored/converted the operating system configuration files from SUSE Linux to Oracle Linux

Dell restored the operating system configuration information that was saved (see Table 1) to enable the transition from SUSE Linux to Oracle Linux. The majority of the configuration files could be restored directly from the backup copy and did not require any conversion. The settings that were not directly restored include the following:

Ioscheduler information

Because the `grub.conf` file is different for Oracle Linux, the equivalent SUSE Linux file could not be copied directly. Instead, an entry for the preferred ioscheduler was added to the new Oracle Linux `/boot/grub/grub.conf` configuration file, for example:

```
kernel KERNEL_PARAMETERS elevator=deadline
```

Password information

Because the SUSE Linux environment used Blowfish and the new Oracle Linux environment used MD5 cryptographic hash functions, the encrypted password information in the `/etc/passwd` and `/etc/shadow` files could not be copied directly. Instead, the passwords for the few local user accounts (for example, the `oracle` user) were manually restored.

Host keys for ssh

After installing the new Oracle Linux operating system, the host keys returned by the ssh daemon changed. Therefore, new known_hosts key files, needed for ssh client access, were regenerated for the hosts in the cluster.

Note:

While Dell chose to generate new client keys, it would also be possible to restore the old host keys from backup.

Network bonding configuration

SUSE Linux directly loads the bonding kernel modules through `ifcfg-bondN` configuration files. In contrast, Oracle Linux uses the `/etc/modprobe-conf` file to load the bonding kernel module and its options. Therefore, entries were added to the new Oracle Linux `/etc/modprobe.conf` file to load the bonding kernel modules and set options, for example:

```
alias bond0 bonding
options bond0 mode=active-back-up miimon=100 downdelay=100 updelay=200
```

Both SUSE Linux and Oracle Linux store the network device information in `ifcfg-bondN` and `ethN` files. However, SUSE Linux stores these files in the `/etc/sysconfig/network` directory, and Oracle Linux uses the `/etc/sysconfig/-network-scripts` directory.

Table 2 shows an example `ifcfg-bondN` file for both the previous SUSE Linux environment and the new Oracle Linux environment.

Table 2. Example `ifcfg-bondN` Files

SUSE Linux	Oracle Linux
/etc/sysconfig/network/ifcfg-bond1	/etc/sysconfig/network-scripts/ifcfg-bond0
DEVICE=bond1 BOOTPROTO='static' BROADCAST='192.168.255.255' IPADDR='192.168.0.190' NETMASK='255.255.0.0' NETWORK='192.168.0.0' REMOTE_IPADDR='' MTU='' STARTMODE='onboot' BONDING_MASTER='yes' BONDING_SLAVE_0='eth2' BONDING_SLAVE_1='eth3' BONDING_MODULE_OPTS='mode=active-backup miimon=100 downdelay=100 updelay=200'	DEVICE=bond0 BOOTPROTO=none ONBOOT=yes IPADDR='192.168.0.190' NETMASK=255.255.0.0 NETWORK=192.168.0.0 USERCTL=no

Table 3 shows an example `ifcfg-eth2` file for both the previous SUSE Linux environment and the new Oracle Linux environment.

Table 3. Example `ifcfg-bondN` Files

SUSE Linux	Oracle Linux
/etc/sysconfig/network/ifcfg-eth2	/etc/sysconfig/network-scripts/ifcfg-eth2
DEVICE=eth2 STARTMODE='onboot' BOOTPROTO='none' MASTER='bond1' SLAVE='yes'	DEVICE=eth2 HWADDR=00:15:17:97:CD:4E BOOTPROTO=none ONBOOT=yes MASTER=bond0 SLAVE=yes USERCTL=no

Refer to the Oracle Linux system administration documentation for more complete details on setting up network bonding on an Oracle Linux system.

3. **Dell restored the Oracle configuration settings and files**
Dell restored the Oracle-specific configuration information that was saved (see Table 1 in previous section) to enable transition from SUSE Linux to Oracle Linux. Like the operating system configuration files, the majority of the Oracle-specific configuration files were able to be restored directly from the backup copy and did not require any conversion. The two exceptions were the profile files and the Oracle startup scripts in the `inittab` file.

Profile files. SUSE Linux uses a `.profile` file, and Oracle Linux uses a `.bash_profile` file. Therefore, the `.profile` files for the `oracle` and `svcgrid` users were copied to `.bash_profile` files in the new Oracle Linux environment.

The `inittab` file. The `inittab` file is different for the two operating systems. Therefore, entries for the three startup scripts for Oracle software were copied into the new `inittab` file rather than directly copying the `inittab` file in its entirety.

The three relevant lines in the original SUSE Linux `inittab` file—entries for the Event Manager daemon (`evmd`), Oracle Cluster Services Synchronization daemon (`cssd`), and Cluster Ready Services daemon (`crsd`)—were copied from the archived file and added to the end of new Oracle Linux `inittab` file, for example:

```
# Run xdm in runlevel 5
x:5:respawn:/etc/X11/prefdm -nodaemon
h1:35:respawn:/etc/init.d/init.evmd run
>/dev/null
2>&1 </dev/null h2:35:respawn:/etc/in-
it.d/init.cssd fatal
>/dev/null 2>&1 </dev/null h3:35:res-
pawn:/etc/init.d/init.crsd run
>/dev/null
2>&1 </dev/null
```

Dell rebooted the server

Dell then restarted the database and confirmed operation. In addition, third-party software products were also verified.

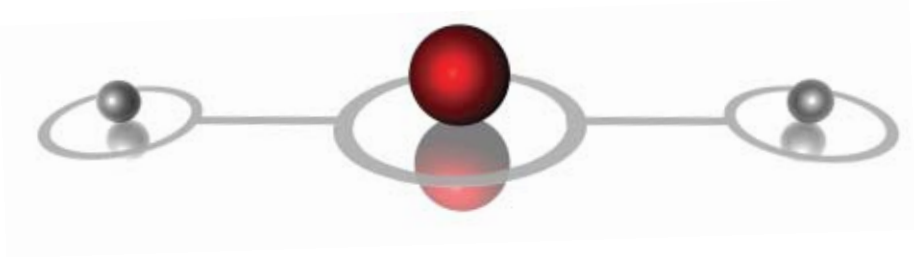
Note:
As a best practice, the Oracle product executables might need be relinked after installing the new operating system. For more information, refer to How to Relink Oracle Software on Unix [ID 131321.1] on My Oracle Support (requires a valid Customer Support Identifier [CSI] to view).

Final Thoughts

Migrating 1,700 servers from SUSE Linux to Oracle Linux was an aggressive IT decision, one deemed necessary by Dell to gain better stability and support, easier administration, and lower costs. Extracting the underlying operating system layer and replacing it, while leaving the application layer intact, was possible only because of standardization across the Linux platforms. The bulk of the site-specific operating system configuration could simply be backed up and restored directly on the new operating system. Similarly, Oracle Database and other applications required only minor configuration changes to transition from SUSE Linux to Oracle Linux.

At the time this document was written in December of 2011, Dell was approximately halfway through the migration process, with an anticipated June 2012 completion date. Careful planning before starting the migration to itemize the needed site-specific configuration files and identify the files that required conversion was key to Dell's success. Automation via scripts and kickstart installations, plus attention to detail via checklists during the actual conversion process, reduced risk and provided consistency during the migration process.

Dell is confident that the decision to migrate these servers from SUSE Linux to Oracle Linux was the right decision for their business. According to Jon Senger, Enterprise Architect at Dell, "We took a risk doing a migration of such a large scale with such a challenging infrastructure, but it's really paid off. Not only do we lower our TCO for the environment, but since we have been able to standardize on Oracle Linux, we have achieved the stability and support that our customers demand."



FEMSA INTEGRATES IT MANAGEMENT AND IMPLEMENTS 160 NEW DATABASES TO SUPPORT EXPANDING OPERATIONS

Fomento Económico Mexicano
S.A.B. de C.V. (FEMSA)
Mexico City, Mexico

Industry:

Consumer Goods

Annual Revenue:

US$15.1 billion

Employees:

100,000

Oracle Products & Services:

- Oracle Database Enterprise Edition
- Oracle Grid Control
- Oracle Partitioning
- Oracle Advanced Compression

Implementor:

Oracle Advanced Customer Services

Fomento Economico Mexicano S.A.B. de C.V. (FEMSA), a leader in the Latin American beverage industry, conducts operations through three subholding companies, including Coca-Cola FEMSA, S.A.B. de C.V. (Coca-Cola FEMSA), which is the world's largest public Coca-Cola bottler in terms of sales. This unit serves 215 million consumers in nine countries – Mexico, Guatemala, Nicaragua, Costa Rica, Panama, Venezuela, Colombia, Brazil, and Argentina – and has 31 bottling plants serving 1.6 million businesses, offering 100 beverage brands, including Coca-Cola, Sprite, Fanta, Nestea, and Minute Maid. Another subholding company, CEMSA Comercio, S.A. de C.V. (FEMSA Comercio), owns and operates the more than 8000 stores in the OXXO chain in Mexico and Colombia. The company's third unit, FEMSA Cerveza, specializes in beer and owns 20% of Heineken stock.

Challenges

- Support the shared services environment—data center infrastructure operation and administration, storage and networking, for the company's various beverage business units
- Identify IT issues quickly and efficiently to minimize infrastructure-related problems and maintain uninterrupted daily beverage sales and distribution operations
- Improve the performance, functionality, and maintenance of existing databases and implement new databases to keep up with the company's rapidly growing transaction levels

Solution

- Implemented Oracle Grid Control and Oracle Database with Oracle Advanced Customer Services for comprehensive IT environment management and a holistic view of the organization
- Used Oracle Grid Control to improve infrastructure management and visibility into the company's business units
- Installed 160 new databases, in addition to the 20 already installed, to efficiently manage 25 terabytes of information from bottling, distribution, sales, and packaging areas
- Ensured the scalability needed to process 500,000 daily purchase orders from retailers, enabling accurate and on-time fulfillment
- Cut data storage costs by reducing the size of the packaging database by 40% and the size of the human resources database by 50% using Oracle Advanced Compression

"By Implementing Oracle Grid Control, we have a comprehensive holistic view of all aspects of our system—from administration, to support, to maintenance. We are functioning at high capacity and providing a high level of satisfaction, achieving levels that only Oracle Database can provide."

– Pedro Francisco Elizalde Pérez, Director of Infrastructure Operations, Fomento Económico Mexicano S.A.B. de C.V. (FEMSA)

FEMSA INCREASES THE PRODUCTIVITY OF ITS DATABASE ADMINISTRATORS BY 500%

Challenges

- Train the company's database administration (DBA) team how to ensure high availability for large volumes of data from distribution, brands, and beverage sales
- Detect and quickly resolve database performance problems to ensure continuity of regional business operations
- Provide for DBAs' transfer of knowledge and practical skills

Solution

- Worked with Oracle Advanced Customer Services to train DBAs on Oracle Database for improved information availability, visibility, and efficiency
- Executed Oracle Advanced Customer Services' 10-month knowledge transfer plan, significantly expanding proficiency and efficiency in managing FEMSA's databases
- Reduced DBA learning curve from up to three years to at most, nine months
- Increased IT team productivity by 500%, using only three DBAs to manage 180 installed databases
- Acquired knowledge needed to integrate existing enterprise resource planning and database platforms with the advice of Oracle Advanced Customer Services and the Excellence Center for SAP, increasing system efficiency and accuracy.

"Oracle Advanced Customer Services adapted to our needs. The transfer of knowledge and skills enabled us to make great gains in system performance and achieve a 500% increase in DBA productivity."

– Pedro Francisco Elizalde Pérez, Director of Infrastructure Operations, Fomento Económico Mexicano S.A.B. de C.V. (FEMSA)

ACCLIMATION DELIVERS FULL UPGRADE SERVICES TO SAP ON ORACLE CUSTOMERS

Acclimation Pty Ltd is a private company located in Melbourne, Victoria, Australia, and focuses on delivery of Oracle and SAP consulting services as well as complementary products. Founded in 2008, Acclimation has achieved a well honored reputation, two SAP mentors are the heart of Acclimation. Acclimation has won the "Demo Jam" Award for innovation at the SAP TechEd 2010 conference in Las Vegas.

Acclimation – the Oracle experts in the SAP world – passionate about innovation without disruption.

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Acclimation has expertise in integration and middleware technologies to ensure that investments in SAP are seamlessly and reliably integrated with other systems, technologies and custom applications within the enterprise.

From solution design and delivery, installations and upgrades, application development or modification and ongoing support and administration Acclimation offers complete assistance.

As to the Oracle offerings, Acclimation is specialized on SAP and as many SAP customers utilize Oracle Acclimation has made it their business to understand how best to utilize Oracle features. To this end Acclimation does SAP related Oracle installations, upgrades, migrations, tuning, thus Oracle database optimization, anything that will help Acclimation's clients optimize their environment, resources, their SAP Application Lifecycle Management processes and reduce their support costs with efficient Oracle database operational procedures.

SAP customers need a cost effective and low risk capability to upgrade Oracle databases and keep them running efficiently. In order to achieve operational excellence and competitive advantage, they need a trusted adviser to help to embrace and exploit new Oracle Database 11*g* functionality whilst keeping an eye on the future maintainability of the SAP software on the most popular database of the world. The Acclimation Innovation Center for Oracle helps those customers to use Oracle Database 11*g* and to increase their agility.

Oracle Services for SAP customers delivered by Acclimation comprise:

- Oracle Real Application Testing (RAT) to reduce the impact of software upgrades by introducing a repeatable and testing process
- Upgrade to Oracle 11.2.0.2 (Patchset 3 - Dec 2011). This special version of the Oracle database engine includes complimentary access to the Oracle Advanced Compression Option (ACO)
- Compression of large Tables and Indexes without SAP Application outage. Compression rates of up 75% can often be achieved without risk as compression is now fully supported and integrated into brtools 7.20
- The deployment of Oracle Grid Control 12c can help to further optimize database operations. The Consolidation Planning feature can be used to unlock more cost savings
- For the larger SAP NetWeaver BW Customer, Oracle Partitioning represents another cost effective performance improvement option.
- As Backup times for large databases become critical, the introduction of Incremental Backups using Oracle Recovery Manager (RMAN) represents a safe and cost effective process to reduce backup times by up to 90% without introducing additional risk
- Once the more progressive customer realizes how much saving can be enjoyed without disruption and risk – this is now time to consolidate and save. The Oracle Exadata X2 Machine represents the ultimate performance boost an SAP customer could wish for. Full SAP support for the Exadata X2 Machine is outlined in SAP Note 1590515

Minimizing risk during the Oracle upgrade

The goal of the Oracle Database upgrade phase is typically limited to the minimal effort required to install the new software while doing no harm to the productive application.

In order to deploy some cost reduction features whilst minimizing the risk involved in the upgrade, Acclimation propose that all SAP customers consider the use of Oracle Real Application Testing (RAT).

Oracle RAT provides the ability to accurately rerun actual production workloads, including online user and batch workloads, in test environments. Oracle RAT enables to test the Oracle upgrade (and other system changes) by recreating production workloads on the Test systems.

The Acclimation SAP Basis Team can arrange in depth pre-sales technical assistance to help understand and prioritize some of the new Oracle Database 11.2 cost reduction features in various phases:

Phase 1:
Specialist advice for the Oracle upgrade and unlocking benefit

Aimed at clients who would like to prepare for an Oracle upgrade across a complex SAP landscape. Expert advice about how to minimize downtime, which new Oracle Database 11.2 features to unlock first and how to calculate dollar savings on investments in new Oracle Database 11.2 features.

Phase 2:
Creation of detailed Oracle Database 11*g* upgrade procedure documents

Aimed at clients who are too busy to collate and download the latest SAP Notes and Oracle bug fix information. This service will result in a comprehensive how-to upgrade to Oracle Database 11.2.0.2 guide which can be used to run the customer's own Oracle Database 11.2 with minimized risk.

Phase 3:
Performing the Oracle Database 11.2 Oracle upgrade

Aimed at clients who do not have local Oracle expertise or the time to perform the upgrade themselves. This service can also be used to improve the Oracle skills of local Basis Administration staff.

Phase 4:
Testing the Oracle Database 11*g* upgrade

Aimed at safeguarding the Oracle upgrade process and reducing risk by performing professional performance testing. Acclimation can help to exploit the customer's investment in the Oracle database software.

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DELTA CONSULTING

Delta Consulting, Inc. is a SAP-focused consultancy offering extensive SAP consulting services and Software components for it's SAP customer base. Delta has a deep rooted belief that the successful implementation of an SAP solution involves much more than installing software – it requires the integration of people, processes and technology. Our extensive SAP expertise and multi-disciplinary business backgrounds makes Delta consultants uniquely qualified to effectively deliver a broad range of SAP solutions.

As a certified SAP Services Partner for over 11 years and a member of the Oracle Preferred Partner Program (OPP), Delta Consulting is pleased to announce its selection by Oracle to extend its agreement to provide support services for Oracle Real Application Clusters (RAC). Using SAP with Oracle RAC offers a unique solution for SAP customers already running Oracle by providing them with a total solution that provides high availability and scalability. Our team includes highly skilled and experienced Oracle DBAs who are trained and certified in SAP basis administration.

Oracle Database 11*g* is the highly scalable and reliable database for mission critical SAP solutions. Our commitment and focus on this technology enables Delta Consulting to bring the best practices for migrating an existing SAP installation from a single instance Oracle database to a multiple instance Oracle RAC cluster database configuration.

Services to be provided by Delta Consulting include:

- RAC Implementations
- Database Migrations
- Tuning and Performance Optimization
- Backup/Recovery and Hot Standby Solutions

Over two-thirds of all mid-sitze to high-end SAP customers run their applications on Oracle. With SAP's endorsement and certification of Oracle Database 11*g*, the motivation to implement RAC include:

- Higher Availability
  - New Requirements
  - Maintenance window negotiation
  - More and more work places rely on SAP ERP
- More Flexibility
  - Dynamical growth by adding servers
  - Better reuse of equipment
- Cost Savings
  - Buy cheaper servers (scale out)
  - Reduce maintenance costs

Want to increase the ROI on your existing SAP system? Working with Delta Consulting, we can help you explore areas where you can leverage industry best practices and make current processing even more efficient. We offer a wide array to help you take advantage of your SAP investment.

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Toll Free: 1-888-461-5553
Phone: 1-610-558-1730
E-mail: info@go-delta.com
Website: www.go-delta.com

Delta

For additional information regarding Delta Consulting, please visit our website at www.go-delta.com or contact: Jack Tomb, Partner at 610-558-1730.

SUPPORT FOR ORACLE "RESOURCE MANAGER" OPENS NEW HORIZONS OF PRODUCTIVITY FOR SAP USERS

All4it Group

- For additional information regarding All4it, please visit our website at **www.All4it.com** or contact Olivier Lambert at **+33 6 08 73 09 92**

"Resource Manager" is the native scheduler of Oracle server resources. It helps balance the resources between different applications and different servers (in the RAC case).
With a simple implementation, it allows you to create rules in case of use of several SAP instances on the same physical server. This way, you can also use Resource Manager to explicitly allocate CPU resources to the multiple workloads or applications that are sharing the database. For example, you can prioritize a « qualification » landscape against a « development » one. So you can configure CPU allocations and limits for each application in a consolidated database, and therefore automatically manage case of overflow of one over the other.

It allows also you to define safeguard in case of malfunction of a component, or a transaction ...Using Oracle Database Resource Manager, you can ensure that your database's CPU load is always healthy, thus avoiding all of these problems.

A detailed white paper on the implementation and support with SAP is available at the following address:

http://www.oracle.com/technetwork/database/focus-areas/performance/resource-manager-twp-133705.pdf

"Customer case 1": Managing multiple instances of SAP/R3 databases on a single server

Background

The Customer currently uses the physical partitioning technology offered by the IBM pSeries to manage its various test, qualification and production instances.

Although Oracle recognizes physical partitioning by the IBM pSeries, this means that the Customer1 must satisfy the minimum processing requirements of each partition created.

Technology alternatives

Fortunately, Oracle (and SAP, thanks to certification through ALL4IT) provides an alternative to this problem, which is supported by SAP.

1. Oracle single-instance approach

Currently, the following process is applied for each SAP environment:

- Install Oracle distribution medium (ONE ORACLE_HOME)
- Create an instance (e.g. "SID")
- Install on "SAPR3" schema in the "SID" instance

However, SAP now supports multiple schemas. In other words, it is possible to have one Oracle installation and a single instance for the QBR, DBR, QBX and QBY schemas.

Advantages:

- Saves disk space
- Saves Oracle licenses

Disadvantages:

- Bigger database and therefore more cumbersome to use (although TBS exports are possible)
- Resources can no longer be distributed among SAP schemas. It is therefore no longer possible to allocate more or less capacity to a particular instance.

Valid Releases				
Software Component	**Release**	**From Release**	**To Release**	**and Subsequent**
KRNL32NUC	7.10	7.10	7.20	
KRNL32UC	7.10	7.10	7.20	
KRNL64NUC	7.10	7.10	7.20	
KRNL64UC	7.10	7.10	7.20	
KERNEL	71	7.10	7.11	
KERNEL	72	7.20	7.20	

Valid Releases	
Number	**Short Text**
105047	Support for Oracle functions in the SAP environment

Resource Manager provides a solution to this last problem (see SAP Note 1589924 and annexes). It offers the possibility of defining priority groups and assigning them resource plans (I/O, CPU, number of system calls).

SAP applications can be assigned to groups by a different method: name of Oracle user, name of client (Application Server), name of program. There are now functions available to define the calibration.

Resource plans can be dynamically modified as required, offering added flexibility of use.

Annexes: Software Requirements

- SAP Kernel 7.10 or higher
- Oracle 11.2.0.2 or higher (Enterprise Edition)
- SAP Bundle Patch April 2011 (SAP_112021_201104_*.zip) or higher

Customer case °2 : Limitation of resources for certain SAP/R3 transactions

History and Impacts

Use of transaction SE16N by some users for activities linked to post-startup of Norauto project.

Impacts: Negative impact on other processes due to heavy utilization of CPU capacity (> 30 %); restriction called for.
Action: Implement Resource Manager for module SAPLSE16N to limit CPU consumption to 10 %.

Summary

Limitation of CPU utilization for SE16N processes as requested. Return to previous functioning for other processes. No other impacts noted.

Remarks

The use of Resource Manager was also proposed when logistical requests were implemented via the transaction SQVI, but tests failed to confirm its necessity.

Notes

If you want to know more about these two cases, or more information about implementing Resource Manager with SAP, please contact All4it France bienvenue@all4it.com.

ORACLE ADVANCED CUSTOMER SERVICES FOR SAP

Database Services for SAP Environments

Oracle Support for SAP

A key attribute to the deep customer focused partnership with SAP, is SAP's requirement for a permanent onsite technical staff. These "Centers of Expertise" staff SAP's Oracle Development Level Support queue and provide immediate assistance for a wide range of activities ranging from critical issue support to "production down" outage situations. The Centers, located in Walldorf, Tokyo and Palo Alto, also assist SAP customers with a wide range of proactive support in areas such as management of increasing data volumes, performance optimization, setup of high availability solutions and data exchange between the SAP system and other Oracle databases. The SAP-Oracle integrated support model draws from over 20 years of close-in collaboration and delivers a highly responsive and anticipatory level of service.

Oracle Direct Customer Support Through Advanced Customer Services

In addition to the integrated support with SAP, many customers choose to engage Oracle Support directly to help achieve even greater performance and ROI from their SAP-Oracle configured environment. These services are available through Oracle's Advanced Customer Services (ACS) organization. Advanced Customer Services experts deliver personalized services directly to customers worldwide to maximize performance and increase productivity for all Oracle systems.

"SAP works in partnership with Oracle to provide quality system support. Many of our joint customers however, require even higher levels of support for their database environments to leverage maximum Oracle capabilities. Our annualized services take support to the next level", explains Larry Abramson, Senior Vice President, Oracle Advanced Customer Services.

The services provide for three levels of annualized operational support, Assisted Services Engagements and onsite Technical Skill Workshops. As SAP certifies new versions of Oracle databases, as with Oracle Database 11*g*, that deliver greater speed, scalability and reduced IT costs, Oracle Advanced Customer Services has the expertise and certifications to help customers adopt and leverage this technology for SAP applications. In addition, onsite assistance in deploying and leveraging Oracle database features such as Database Vault, Data Guard, Partitioning and RAC is available to ensure proper configuration and set ups with SAP application requirements. All Advanced Customer Services Database Services for SAP Environments are delivered by Oracle experts who are skilled in maximizing Oracle technology contributions to overall system performance, stability and recoverability.

Oracle with SAP Expert Guidance Tailored to Your Business

Database Services for SAP Environments offers three levels of annualized services that can be combined with engagements and workshops to meet your specific needs.

Advanced Support Assistance – facilitates and expedites service requests through a single point of contact. Your Service Delivery Manager (SDM) ensures that the right people and organizations are aligned with meaningful action plans resulting in more efficient and effective issue resolution.

Business Critical Assistance – combines service request resolution with proactive advice and assistance tailored to your specific operations and projects. Your SDM coordinates the efforts of a team of engineers who develop background capabilities on your company and your IT goals, and then assist with ensuring a successful outcome for each of your projects.

Solution Support Center – offers our most comprehensive service, with a team of focused engineers that are deeply aware of your environment, operations and projects. This focused team of engineers is available to you through a direct access hotline to provide assistance for critical Service Requests and a range of proactive services including assessments and root cause analysis.

Oracle/SAP- Oriented Workshops and Engagements

To build your IT staff's capabilities and confidence in optimizing the Oracle database in a SAP environment, our workshops are created and delivered by specialists who know how SAP applications interact with Oracle databases. With the content drawn from a long history of technical partnership with SAP, Oracle Advanced Customer Services provides the following Technical Skill Workshops:

- Fundamentals of Oracle database for SAP ERP (Level I)
- Oracle Advanced Performance Tuning for SAP ERP (Level II)
- Oracle Expert for SAP (Level III)
- Oracle Database 11*g* for SAP Business Suite Technical Skills Workshop
- Oracle Database Administration for SAP Business Intelligence
- Oracle Real Application Clusters for SAP
- SAP ERP ABAP Tuning with Oracle Database Platform

In addition to established portfolio of workshops, a new workshop, **Oracle Security for SAP ERP Customers** is now available on request.

Designed to help customers deal more effectively with external and internal compliance and security requirements, the workshop focuses on how to leverage the Oracle database features to safeguard their deployments at the database level. Key areas include: database-user security, auditing, network security, Transparent Data Encryption and Oracle Database Vault.

To further enhance the value, these Technical Skill Workshops can be modified and enhanced to help ensure alignment with your specific situation and goals. Technical Skill Workshops are specific to your company and are scheduled based on availability.

Many customers find that deep Oracle and SAP experience and expertise is necessary to improve database performance and system stability, when upgrading or moving the database or when leveraging Oracle database features.

Our most popular engagements include:

- Database Health Check
- Database Partitioning
- SAP ERP Administration Concepts
- Review and Proof of Concepts
- Hot Standby/Data Guard Implementation
- Backup/Restore/Recovery
- RAC Setup Assistance
- HW Migration "O2O"/Oracle (Advanced Customer Services as Provider)
- HW Migration Assistance "O2O" Packages (Advanced Customer Services as Assistance)
- Database Migration Assistance
- Database Reorganizations

With Advanced Customer Services Database Services for SAP Environments, you enjoy a preferred relationship with Oracle subject-matter experts, IT professionals, and developers to maximize the value of your Oracle environment.

Database Healthcheck/Performance Analysis

Performance is a primary key to success in the introduction and operation of a SAP system for all SAP customers. Our specially trained staff, not only knows the Oracle database in detail, but is also trained in the intricacies of Oracle in a SAP environment. Both at the beginning of a deployment and at regular intervals over the application life-cycle, Database Healthchecks can ensure proper configuration and tuning for optimum performance.

High Availability / Backup Concepts

Unavailability of the SAP system leads to catastrophic problems for most customers, both logistically and financially. In order to minimize the risk of unplanned downtime in a mission critical environment, IT organizations must pro actively plan for failover and recoverability. Oracle database products enable different approaches, such as hardware clusters, mirror technologies, standby databases, RAC and Data Guard. Oracle Advanced Customer Services can advise on the comparative advantages and disadvantages of these different approaches as it applies to your particular situation and, of course, assist with the implementation of the chosen solution.

Oracle RAC Enablement for SAP

The "Real Application Clusters" (RAC) option enables the distribution of your database instance across different servers, or nodes. This offers new possibilities in the area of high availability of an Oracle database system, and also provides greater flexibility in the dimensioning and scalability of system resources. Oracle Advanced Customer Services provides professional services, in the areas of planning, technical workshops and implementation, to assist you with enabling RAC for your SAP environments.

Database Migration Services for SAP

The majority of all SAP ERP installations run on an Oracle database. The Oracle Advanced Customer Services for SAP group is certified by SAP for database migrations and can assist companies who wish to migrate their SAP Business Suite installation from a non-Oracle database to Oracle. A much valued aspect of Oracle's migration services is the deep familiarity of the change from a DBA perspective. Oracle Advanced Customer Services can assist your staff in executing a migration plan while familiarizing them with the new database operations.

Oracle Partitioning for SAP Customers

Oracle Partitioning is an option to Oracle Database 10*g* Enterprise Edition (also along with Oracle Database 11*g* certification). At a technical level, Oracle Partitioning allows tables and indexes within a database to be subdivided into smaller pieces. Oracle can "partition" a table by ranges of values, so for example, the data for Jan 1, 2010 through Jan 31, 2010 can reside in its own partition. Oracle can also partition a table by a list of values, so, for example, North American data is in one partition, while the European data is in another partition. Partitioning is a critical feature for managing large databases.

Partitioning is the feature that allows a database to scale for very large datasets while maintaining consistent performance, without an unduly in-creased need for hardware resources or administrative efforts. Oracle Partitioning is embedded into the core database engine and supported by Oracle's administrative tools.

From a SAP application perspective, partitioning is completely transparent. Thus, no changes need to be made to the application or to the SQL statements in order to use partitioning. Partitioning for SAP has been supported since SAP Release 4.6C (see SAP Note 742243) for the SAP Kernel 6.20.

Oracle Database 11*g*

With the many new capabilities and enhancements of Oracle Database 11*g*, such as Advanced Compression, DirectNFS, Secure-files and Online Patching, enthusiasm and advanced demand continues to build for fast deployment. In addition, Database Vault is certified by SAP for supportability.

Advanced Customer Services stands ready to advise and assist SAP users in efficiently and smoothly upgrading to Oracle Database 11*g* in line with SAP supportability requirements. Technical workshops are in development to help your IT staff become aware and comfortable in deploying and supporting the many features of Oracle Database 11*g*.

Whether through our ongoing support and partnership with SAP, or directly with your IT organization, Oracle Advanced Customer Services deliver personalized services with deep experience operating with SAP applications. For further information please contact us:
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A NEW HOME FOR YOUR DATA
ORACLE DATABASE MIGRATION TECHNOLOGIES

Summary

The term "database migration" can mean different things in SAP environments. On the one hand, you may want to keep the hardware as well as the operating system of your database server machine, but replace the database provided by vendor X with that provided by vendor Y. This is what SAP calls a heterogeneous copy, and this is not what we want to discuss in this article. On the other hand, you may want to upgrade your existing hardware and/or change the operating system of your database server machine, but keep the database. Copying the existing database from legacy hardware to a new Exadata machine is one, but not the only example why you may need to perform such an operation. This is what SAP calls a homogeneous copy, and this is precisely the subject of the following discussions.

Even if it is clear that "migration" is to be understood in the sense of "homogeneous copy", there are still several options and therefore many decisions to be taken. The most important one is related to this question: If you move to a new house, do you really put all your effort into building an exact copy of the old one, or do you rather try to avoid your previous mistakes and construct a better one? That is why part I of this article discusses the difference between a migration strategy based on file copies (reproduction of the old house) and a strategy based on data export and import (construction of a new and more comfortable home).

Part II presents compression, partitioning, and encryption as optional Oracle features that can help build a better home – one that is more comfortable for the data as well as for the administrator. What these features have in common is the need to reorganize existing data. Whether you just switch on compression, or partitioning, or encryption, these features will change Oracle's behavior as far as new data are concerned, but will not have any effect on existing data. However, a migration based on data export and import is precisely a database reorganization. So why not bundle the activities? Why perform two, three or four reorganizations, if one is sufficient?

Part III, finally, explains yet another choice to be made. The strategy based on data export and import comes in two main flavors. One is called offline migration, which means that the Oracle database (and therefore the whole SAP system) is down while the migration is performed. The other one is called online migration. It is more complex. But it requires almost no downtime, even if your database is a very large one.

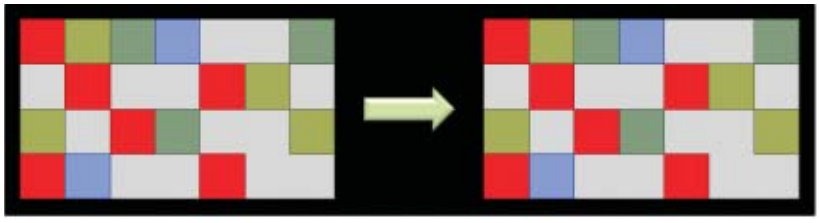


Figure 1a: Database migration using a method based on operating system files. The database is not reorganized, and it needs to be prepared for use of new features after migration.

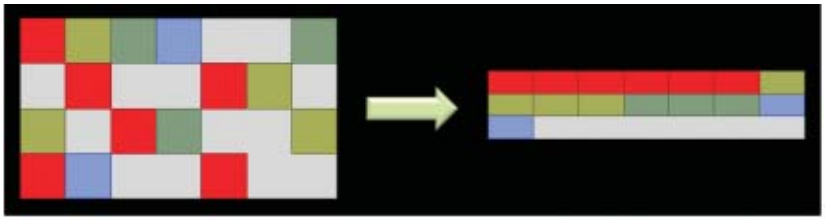


Figure 1b: Database migration using a method based on database objects. The database is reorganized implicitly, and it can be configured for immediate use of new features.

Part I: Database Migration in Context

SAP System Copies

As "migration" is such a fuzzy word, SAP prefers the term "system copy". Whatever the goal of your project is, and whichever method you choose – somehow you copy the data from a source database to a destination database. As, in this context, we are not

interested in modifications of the hardware and/or the operating system used to run the SAP applications, it can be said that a *heterogeneous system copy* is a migra-tion that moves the data from a database provided by one vendor to a database provided by a different vendor, whereas in the case of a *homogeneous system copy* the database vendor remains the same, but the data are moved to a different hardware/operating system platform. As stated in the summary, this article discusses only strategies for homogeneous system copies.

But there is yet another distinction to be made, because there are two kinds of system copies. In the first case, your plan is to run two independent SAP on Oracle systems in the future. To accomplish this, you create a copy of an existing Oracle database, start a new SAP instance and connect it to the new database, but nevertheless you keep the old system up and running. A typical example for this procedure is the creation of a test or training system in addition to (but based on) the existing production system. In other words, this kind of system copy means *database cloning*. In the second case, the idea is to create a copy of the database and make it part of a new SAP system, but to stop the old system as soon as it is clear that the new system runs without issues. Only this can be called *migration*.

The distinction between cloning and migration is important. If you need a clone, you need an exact copy of the database. There is no point in optimizing the test database (unless you want to test possible optimizations). However, the very goal of a migration (e.g. migration to a new hardware platform) is improvement (e.g. performance improvement), and therefore optimization of the database can help achieve even better results.

Database Migration Options

From an operating system perspective, a database is nothing but a set of files. Therefore the simplest migration strategy would be to *copy those files* from the source to the target storage using operating system commands. However, this approach has severe limitations. First, operating system and file system must be the same on source and target system. Second, this operation can only be performed, if the Oracle database (and therefore the SAP system) is down.

If Oracle Recovery Manager (RMAN) is used in combination with the file copy approach, additional migration options are available. The first additional option is based on Oracle's *Transportable Tablespace technology*. The basic steps are: (1) Create a new database consisting of all tablespaces that the database system itself needs (SYSTEM, SYSAUX, UNDO, TEMP). This is going to be the target database. (2) Use RMAN's data file conversion feature to copy (file system to Oracle ASM) and convert (big endian to little endian) all data files from all tablespaces that contain SAP-owned objects. (3) Plug-in the transported tablespaces into the newly created database. – As in this approach RMAN converts the data files according to the target requirements, the benefit is that source and target database can run on different operating systems and storage platforms. The disadvantage however is that it requires system downtime.

The second migration option that RMAN adds to a simple file copy is known as *duplicate from active database*, because it is based on RMAN's DUPLICATE DATABASE command. As the name suggests, this operation can be performed, even if the source database is up and running, which is certainly its most important benefit. From an operating system perspective, source and target are not required to be identical, however the supported combinations of source and target platforms are somewhat more limited than in the transportable tablespace case. (For details see the Oracle white paper "Moving your SAP Database to Oracle Automatic Storage Management 11*g* Release 2. A Best Practices Guide"). An additional requirement is that source and target database must be on Oracle Database version 11.2.0.2 or higher.

All this means that you have several options to choose from. Nevertheless, all strategies based on the file copy approach have one disadvantage in common: File copy does not change the structure of the files. File copy (with or without RMAN) copies all data from source to destination, and that is what you want it to do. But file copy copies the problems and issues as well. If your database files are fragmented, i.e. contain many small and empty fragments, because rows had been deleted or archived and the database has not been reorganized for a long time, then the new file (the file copied to the target system) has the same old fragmentation problem (see figure 1a). To

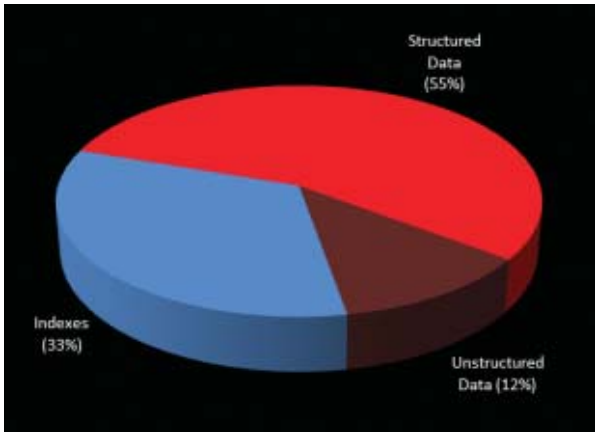


Figure 2a: Typical Oracle database used for SAP ERP (uncompressed).

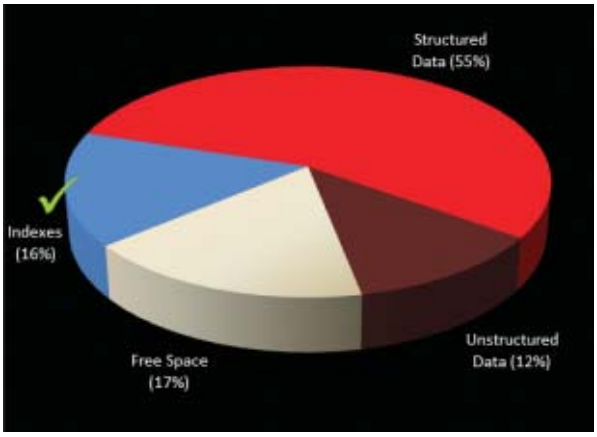


Figure 2b: Implementation of Oracle Index Key Compression.

come back to the comparison already used in the summary: If in your old home you had a broken chair and a dirty wall, you start with a broken chair and a dirty wall in your new home as well.

That is exactly why there is yet another, completely different migration approach. If, from en operating system perspective, the database is just a set of files, from a database perspective it is a set of database objects (mainly tables and indexes) containing data. On the database level, therefore, it is possible to provide tools that do not copy files, but data. Generally speaking, such a process consists of four main steps:

- A new, empty database (the target database) is created. This time, however, the new database does not only consist of those tablespaces that are required by the database system. All user tablespaces (in this case: all tablespaces for SAP data) are created as well. The new tablespace structure may or may not be equal to the old one.
- All tables are created (as empty tables) in the new database. This can be done, even in large databases with many tables, by generating SQL scripts in the source database and then running them in the target database.
- The data are moved from the source tables to the target tables.
- Finally the required indexes are created in the target database.

Two major benefits of this approach are obvious: (1) As the data transport relies on a database-to-database communication, it is completely independent of the underlying operating system and storage platforms. Any combination of source and target platform is possible. (2) As data are inserted into empty tables and indexes are recreated, the database is implicitly optimized. It is not uncommon that the target database needs 20-25% less disk space than the source database.

However, there is a third benefit. You can really build a new home for your data, with a different room structure, different furniture, and walls painted differently. This means: In the new database, you can make use of Oracle features that you had not been implemented in the old database (see figure 1b). And you can make use of them immediately. One example is data compression. Whereas, if you rely on the file copy approach, you need to copy the files first and then implement compression, the export/import approach allows you to combine everything in one single step. Because data that had been exported from an uncompressed database can be directly imported into a compressed database, you just create tables and indexes in the target database with the COMPRESS flag – and that's it.

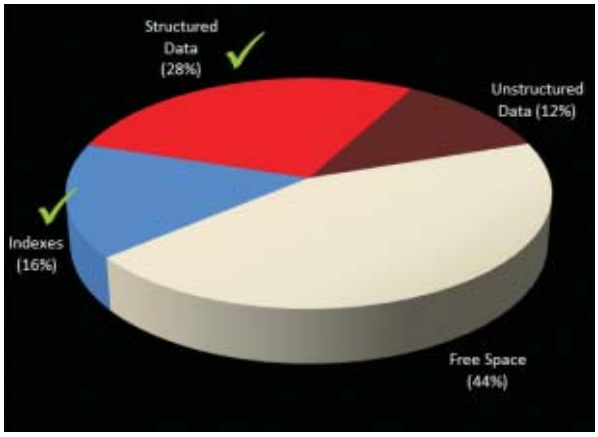


Figure 2c: Implementation of Oracle OLTP Table Compression for structured table data.

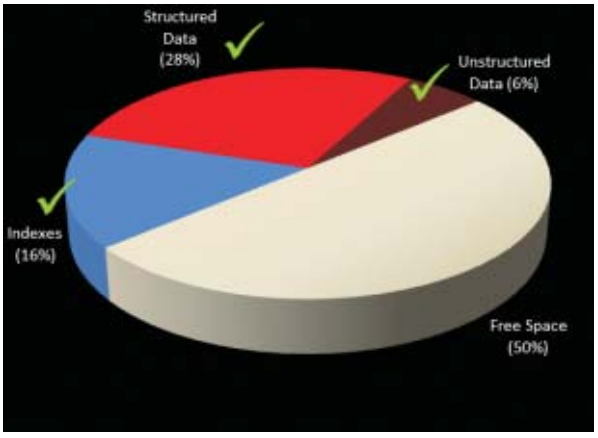


Figure 2d: Implementation of Oracle SecureFiles Compression for unstructured table data.

As in the file copy case, there are several ways to make this strategy happen. Especially for SAP on Oracle environments, Oracle provides two methods. One is called Oracle to Oracle ("O2O" or "O2O Classic"), the other one Oracle to Oracle Online ("Triple O") database migration. Both are much more than just a combination of data export and import. They rely on a combination of technologies that make them as fast, flexible, and reliable as possible. As their names suggest, the main difference is that O2O requires the system to be shut down as long as the migration takes, whereas Triple O needs almost no downtime. Details are discussed in part III of this article.

Part II: Optional Database Features

If you decide to rely on an export/import-based migration approach (O2O or Triple O) instead of a file-copy-based approach, you can configure the target database for immediate use of new Oracle features. But which features should you consider? Generally speaking: all features that require a database reorganization. If you want to change, say the parallelism used to access data, that changes the way how Oracle works with the data (in this case: the number of processes), but not the data themselves. But if you want to compress your data (and that means: new as well as existing data), you need to rebuild tables and indexes. And because O2O and Triple O rebuild the database anyway, it makes sense to consider, whether or not you want to combine migration and compression in one single step.

But there are more Oracle features that require a reorganization of all or some database objects. In SAP environments, the most important ones are partitioning and encryption. Therefore part II of this article discusses compression, partitioning and encryption in SAP environments.

Can you combine migration, compression, partitioning, and encryption in one single step? Yes, you can. Do you really want to do this? Well, it is up to you to make this decision. All Oracle can do and has done is to give you the flexibility, so you really have a choice and you can make a decision. You can do it in one step, or in four steps, or do something in between.

Compression

What is simply called "compression", is actually a comprehensive set of compression capabilities. Not all of them are relevant for database migration projects. Those that are, are index and table data compression. Figure 2 shows a typical implementation strategy, based on an Oracle database that is part of an SAP ERP system. 33% of the allocated disk space are used for indexes, 67% are used for tables, and the table data must be divided into structured and unstructured data (see figure 2a).

For historical reasons most customers start, and SAP still recommends to start with Index Key Compression, if compression is implemented in an existing database. In migration projects based on O2O or Triple O however, the sequence must be changed, as indexes are created after tables. Index Key Compression saves disk space by eliminating repeating values in the leaf blocks of B*Tree indexes (see figure 2b). Bitmap indexes, used in SAP BW, are already "compressed", so they cannot be compressed again.

The term "structured table data" means that information which consists of several items (e.g. first name, last name, city, zip code, etc.) is stored in separate table columns. Therefore the different items can be recognized by database tools such as SQL*Plus. Structured table data can be compressed using Oracle's Table Compression, which – again for historical reasons – is also called *OLTP Data Compression*. This does not mean that *only* data used in OLTP (e.g. SAP ERP) systems can be compressed. Exactly the opposite: It means that, unlike its predecessor (data compression in Oracle Database 10*g*), data compression in Oracle Database 11*g* cannot only be implemented in OLAP systems (e.g. SAP BW), but in OLTP systems as *well*. Leaving aside history, OLTP Table Compression can be implemented in *all* SAP systems. Similar to Index Key Compression, Table Data Compression saves disk space by eliminating repeating values (see figure 2c).

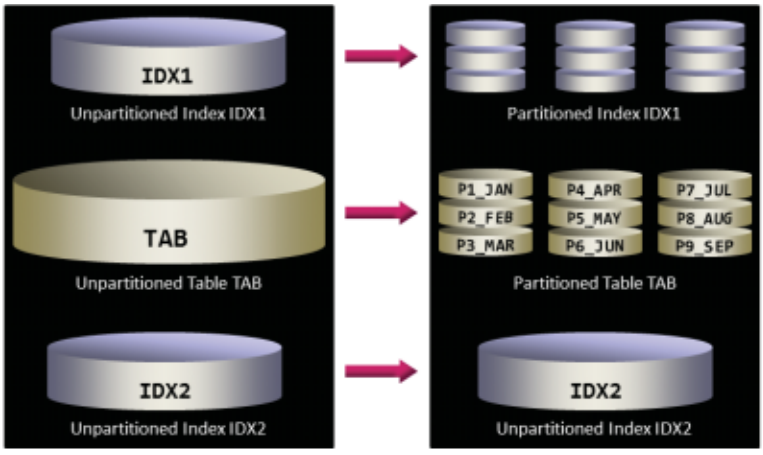


Figure 3: Oracle table and index partitioning.

The term "unstructured table data", then, means that information which consists of several items is *not* stored in separate table columns, but in one single column only. A typical example would be a PDF file stored in a database table. Unstructured data occur in SAP systems as well, because SAP applications sometimes bundle data sets and store them as one single value, which means that SAP applications can recognize the individual items, but the Oracle database and Oracle tools cannot. In Oracle Database versions prior to 11*g* these data had been stored in LONG or LOB columns. However, LONG as well as LOB values cannot be compressed. Therefore Oracle Database 11*g* comes with a new data type, called SecureFiles, which can be compressed, and that is why compression of unstructured table data is called *SecureFiles Compression*. Strictly speaking, this is the only case of compression, as Index Key and OLTP Data Compression just store data in a different (more efficient) format, whereas SecureFiles Compression is similar to what a ZIP utility does (see figure 2d).

Lab tests and customer results prove that by combining these three compression capabilities the disk space needed for your database can be reduced by 50% or more. This comparison assumes that the database was completely reorganized before compression. If the source database is fragmented, disk space savings will be considerably higher.

Lab tests and customer results also show that – contrary to most expectations – compression has no negative impact on database performance. Again the opposite is true: In most cases customers have seen performance improvements, as compression reduces I/O and improves the buffer hit ratio (SGA).

Partitioning

The basic idea of partitioning is very simple: group rows of a "table" based on the value(s) in one (or more) column(s) and store the distinct groups as "sub-tables" (see figure 3).

That rows can be grouped "based on the value(s)" in one or more column(s) is a very generic statement. Oracle provides many possible strategies to do exactly that. The strategies which are most important in SAP environments are called list and range partitioning.

SAP OLAP (BW)	SAP OLTP (e.g. ERP)
All types of partitioning are supported	All types of partitioning are supported
Range partitioning used by default	Partitioning not used by default
Same set of tables can be partitioned in all systems	Best candidates need to be selected for every system
Standard solution (part of installation)	SAP provides Partitioning Engine (see SAP Note 1333328)
	Oracle Support & Services for SAP can be engaged

Table 1: Oracle table/index partitioning and SAP applications

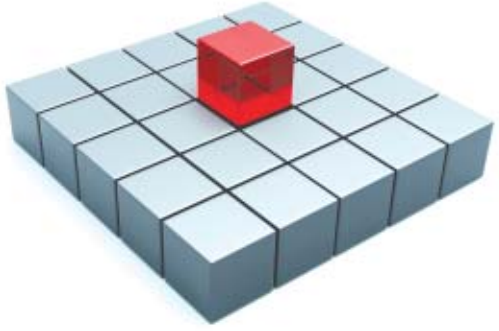
In order to implement list partitioning, a list of values has to be established which explicitly mentions every single value (example: countries, locations). In order to implement range partitioning, it is sufficient to define ranges by stating a start and end (example: January 1-31, February 1-28, etc.).

Oracle does not only support table partitioning, but also index partitioning. So database designers can group the rows in a table or the entries in index (leaf) blocks and store the results as virtual subsets called "partitions." Nevertheless, the table or the index can still be accessed as one single object, if this is necessary. Depending on application needs, an index on a table can be partitioned ("local index"), but can as well remain unpartitioned ("global index"). If multiple indexes on a table exist – a situation which is rather normal in SAP systems–, some of them can be local, some global.

The main benefit of table and index partitioning for users is improved performance. The technical reason for this performance improvement is called "partition pruning". Let us suppose a table partitioned by month and an application that wants to generate a monthly report based on this table. Receiving the request, the Oracle database will immediately realize that all partitions which need to be considered are located in one single partition, and therefore it will scan this partition only. This reduces I/O, memory usage and CPU workload dramatically, and therefore customers almost always see a performance improvement by a factor of 5, 10, or even more.

The main benefit for administrators is the fact that partitions can be managed individually and independently. If a table consists of 90% historical and 10% active data, and if partitioning was used to separate historical and active data, it is rather likely that administrative procedures such as daily backup or reorganization can be restricted to the partitions containing active data, whereas procedures such as archiving can be performed on very few historical partitions. This reduces unnecessary workload as well as the time needed for these jobs. Moreover, partitions can be created, dropped, or merged independently and online, so no additional maintenance downtime is required

Many years ago, SAP realized the benefits, and in particular the performance improvements provided by table and index partitioning. Therefore, Oracle Partitioning is supported by SAP for SAP BW systems as well as OLTP systems such as SAP ERP (see table 1).



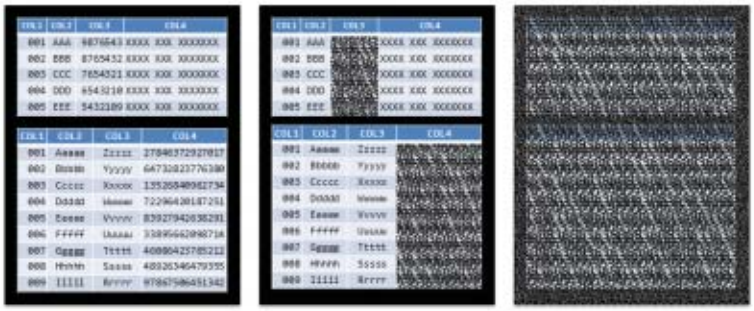


Figure 4: Unencrypted tablespace, use of column encryption, and use of tablespace encryption.

However, there is a difference. For SAP BW, Oracle Partitioning is not only supported, but also implemented. This means that the questions as to which tables should be partitioned and how, are already answered by SAP, that partitioning is implemented during the installation and configuration process, and that partition management tools are provided by SAP. This can be done, because the answer to the question, which tables should be partitioned and how, is the same for all SAP BW systems. In contrast, Oracle Partitioning for SAP ERP is supported, but there is no default implementation provided by SAP. It is easy now, to guess the reason: the answer to the question which tables should be partitioned and how is not the same for all customers and all systems.

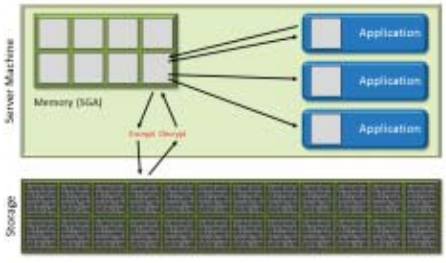


Figure 5: Column encryption and data access

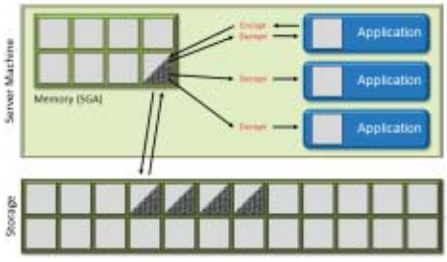


Figure 6: Tablespace encryption and data access

However, with SAP ERP databases reaching a size of 10, 20 or 30 Terabytes (in some cases even more) and 90% of the data located in a handful of giant tables, there was an urgent need for a solution. This solution, which was developed over several years, consists of 2 parts: a partitioning method provided by Oracle and a management interface provided by SAP, which is called the "SAP Partitioning Engine."

However, in Oracle to Oracle migration projects the SAP Partitioning Engine is not needed. O2O and Triple O are actually more flexible and more powerful. They can generate customized migration scripts which create partitioned tables and indexes in the target database. They do not only support range partitioning, but also list partitioning (based on the column "MANDT"). And they provide enhanced partitioning support (e.g. subpartitioning).

Encryption

Oracle provides many security features which can be used in SAP environments (for an overview see the article "Oracle Database Security for SAP Applications" in this volume). Most of them (Database Vault, Network as well as Backup Encryption) can be implemented without changes to the data in the database, i.e. without the need to rebuild tables and indexes. The only exception is Transparent Data Encryption, a feature designed to encrypt data in the production database.

Transparent Data Encryption comes in two flavors. The first one, which had already been available in Oracle Database 10*g*, is called Column Encryption, because you select just a few of the many SAP tables, or even individual columns of these tables that contain sensitive data and encrypt them. Everything else remains unencrypted. The second one, called Tablespace Encryption, is new in Oracle Database 11*g*. It allows you to encrypt complete tablespaces, which may contain hundreds, thousands, or tens of thousands of tables – you don't care (see figure 4).

This sounds as if the difference between these two encryption types was just the number of tables or the amount of data to be encrypted. The reality is that column encryption and tablespace encryption are based on completely different approaches (see figures 5 and 6).

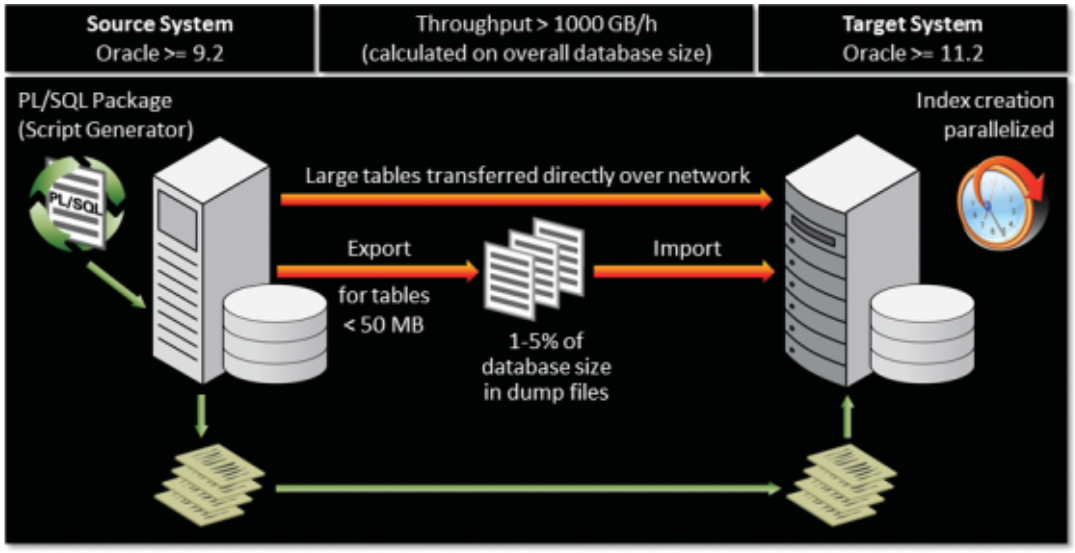


Figure 7: Oracle to Oracle ("O2O") database migration technology overview

If column encryption is used, database blocks that contain at least some encrypted data are transferred to the database cache (SGA) and stored in the cache in exactly the same format as on disk. This means that applications that want to read those data can find them in the SGA, but still in encrypted format. And this, in turn, means that every single application (or rather every single Oracle server process receiving a read request from an application) needs to decrypt the data. Time and again. It is clear that this causes a certain CPU overhead and slows down the system, unless only very few columns had been selected for encryption and are accessed rarely.

Tablespace encryption is based on the idea that the goal of encryption is to prevent attackers from reading database using some kind of editor. As long as data are stored on disks or tapes, they are unsecure, because disks and tapes can be stolen. However, when they enter the database server, they are protected, because the database server machine is like a castle or a town protected by a wall. Therefore it is sufficient to decrypt data once, when they enter the machine (i.e. when they are read from disk and before they are stored in memory), and encrypt them again, when they leave the machine (i.e. when they are written to disk). All applications, then, find unencrypted data in the SGA and can immediately work with them.

Considering that a physical read operation can be followed by tens, hundreds, or even thousands of in-memory accesses by applications, it is clear that this new approach reduces CPU overhead and negative performance impacts dramatically. That the hardware encryption feature provided by some of the recent CPUs can be used for tablespace encryption (but not for column encryption), is an additional plus. It means that tablespace encryption finally comes with almost no CPU overhead.

Part III: Oracle to Oracle Migration Methods

Oracle-to-Oracle Offline ("O2O") Migration Method

The O2O database migration method was developed by Oracle ACS services, to offer customers, having a very large database, a fast, smooth and reliable migration method. This method offers a migration speed of more than 1 TB/hour and reduces the efforts which must be spent for configuring and testing of the migration.

O2O supports all operating systems on which SAP products are certified. Because O2O is operating system independent, it can be used to perform homogenous and heterogeneous system copies.

The advantage of this method is that, you can combine the operating system change with multiple options to get the most out of the migration:

- With O2O it is possible to combine a platform migration with a release upgrade. The migration method supports every combination of Unix, Windows or Linux on the source and target system. So, you can migrate an existing Oracle 10.2 database on HP-UX to an Exadata Solaris database
- It is possible to upgrade directly to a higher database release. Currently with the O2O method direct database migrations are possible between different Oracle versions. So it is possible to upgrade directly from Oracle 9*i* to Oracle 11*g* by using O2O. You also do not need the most current patch set of the lower Oracle release to run the migration
- As part of the database migration, the whole database is reorganized. This can free up a significant amount of space within tables and indexes
- The tablespace layout can be changed to the new SAP standard or to a customer's customized one. It is also possible to move single tables and indexes to separate tablespaces or to merge them into existing or new ones. This allows you to unify the SAP landscape by using a default tablespace name like "PSAPSR3" in all SAP systems
- The SAP schema name can be changed, for instance to "SAPSR3", to unify the SAP landscape
- The number of data files and mount points can be significantly reduced, by either optimizing the tablespace layout or the size of the data files and file systems.
- Tablespaces are created with LMTS and ASSM.
- The method creates the appropriate scripts to create either a database using normal files systems or a database using ASM or Exadata file systems
- Data files will be converted from file system to Oracle ASM. The method provides you with the needed scripts to create the database and the tablespaces automatically
- LOB or LONG data types can be converted to SecureFiles (11.2 only). SecureFiles will also be compressed, if possible.
- You can compress the indexes on the target database by using Oracle index compression. The compression calculation is executed as described in SAP Note 1109743. The correct index compression for each index is determined automatically.
- You can compress tables on the target system. The compression will compress all SAP tables as recommended in SAP Note 1431296.

The downtime needed to migrate a database with the O2O method is dependent on the database size, the included database objects (SAP cluster tables, partitioned tables) and the available hardware resources (CPU, Memory, Storage, Network). Up to 1TB/hour is possible.

Although O2O was originally developed to perform database migrations, it can be an interesting method to perform a simple database upgrade, because you can implement all new database features you want into a single step:

- Database upgrade directly from 9*i* or 10*g* to 11*g*. There is no need for a special database release on the source, which can save additional time, because you don't need to patch the current database release before you perform the upgrade.
- Reorganization of the complete database to free up unused space.
- Implementation of index and table compression, which will result in a 50% smaller database size.

O2O Technology

The O2O method is based on the following steps: (see figure 7)

1. Prepare the source system, by defining the needed Oracle directories on the file system and load the into the source system. To hold the scripts on the file system, only a few MB are needed, typically less than 50 MB.
2. Define the basic conditions for the migration, e.g. definition of the setup for the target database (ASM configuration, usage of table and index compression, or other database features). The PL/SQL package is then executed to generate the needed migration scripts. A typical package run will take 30 – 60 minutes on a SAP system.

3. Creation of an empty target database, either with the provided scripts generated by the PL/SQL package or with your own scripts
4. After the scripts are created they are copied to the target system, to run the database migration itself. To run the migration process a program named "scheduler" is available, which runs all needed migration scripts in the correct order and also controls the correct execution of each script. Using this scheduler you have full control over the migration. This includes the possibility to restart failed scripts or to set it to "Done". The scheduler is written in ksh and runs on all Unix or Linux operating systems. It's also possible to run the scheduling software on a remote machine, e.g. if Windows is used on source or target.
   The throughput depends on the available hardware on the source and target machine. In best cases you can build up the target database with more than 1 TB/ hour. Typically the throughput will be on average between 250 GB/hour and 500 GB/hour. To achieve this throughput, different migration methods are used for the database tables. Based on the table size and datatype (e.g. SAP cluster tables), the best migration for the particular tables is chosen to achieve the best migration performance.
   Typically most of the data is transferred directly over the network, not using a dumpfile for the migration. This saves space on the file system. To verify the migration, source and target databases are compared on object level (based on the object name) to ensure the correctness of the migration. In a second step, all tables on source and target are compared based on the number of rows. So at the end of the migration you can prove the correctness of the migration based on object and row level.
5. Once the migration is completed the post SAP migration tasks can be started. The systems are fully supported by SAP as mentioned in SAP note # 1508271

The O2O method is developed and maintained by the Oracle ACS service in Walldorf Germany. O2O is available either as an ACS service or can also be used directly by customers.

Oracle-to-Oracle Online ("Triple O") Migration Method

If the downtime requirements cannot be fulfilled with the O2O offline method, you can use as an alternative the Triple-O method. The first step, estimate the downtime available for the technical database migra-

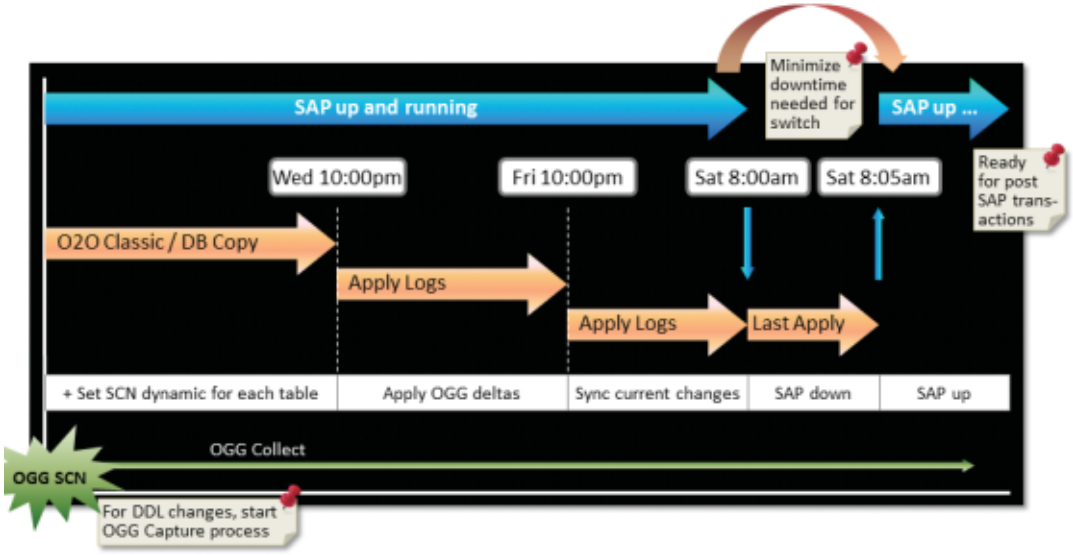


Figure 8: Oracle to Oracle Online ("Triple O") database migration technology overview

tion. During this period of downtime not only the database migration must be performed, but in case of a heterogeneous system copy, user acceptance tests, interface tests and post-SAP migration tasks must be performed. As a result, the real available downtime for the technical database migration is much shorter than the application downtime.

So the Triple-O method was developed to reduce the technical database migration time to a minimum. Typically the required downtime for the database migration is between 30-60 minutes, independent from the database size. On customer request the source and target database can be compared based on the row count after the migration is completed to ensure the correctness of the online migration.

Triple-O Technology

Triple-O Technology is a real online migration of the database. It uses GoldenGate software for the online synchronisation of the changes and modifies the O2O version, to perform a consistent initial database load. GoldenGate reads the online redo log or the archive log of the database and extracts DDL and DML changes, recorded in the redo log of the database. GoldenGate transforms the physical changes from the redo log file into a general description, which is operating system and database release independent, and saves these changes into trail files. The volume of the trail files is typically 30% - 50% of the redo log volume. To use GoldenGate supplemental logging must be enabled on the database.

The GoldenGate trail files are sent to the target database server, either with GoldenGate, using a network connection, or by providing the trail files via NFS to the target system. On the target side the trails files are read by apply processes, which execute native SQL statements, generated out of the contents of the trail file on the target system. So each DML is transformed into the appropriate insert, update or delete command. Also, allowing the use of GoldenGate for heterogeneous system copies as well.

It's possible to start or stop an online migration at any time. There is no downtime needed for the start or the stop of the migration. Furthermore the migration method doesn't need any special database patches, nor a special database patch level. Triple-O runs on any 9*i,* 10*g* or 11*g* version and supports DML and DDL changes. So there are no limitations (e.g. transport stop) on the usage of the SAP system during the migration. All operations can be performed as usual. Both, R/3 and BW systems are fully supported.

Because GoldenGate is operating system independent, also heterogeneous database migrations are supported. The minimum Oracle release on the source is 9.2. Direct database upgrades to 10*g* and 11*g* are possible. When using Triple-O, you can make use of all features listed for the O2O method. So the basic configuration is very similar between O2O and Triple-O. Beside the migration scripts, for Triple-O, the GoldenGate configuration scripts will be generated automatically.

The online migration is running in a very similar way, as the previously described O2O migration. A PL/SQL package is loaded into the database, and creates all necessary scripts, to perform the online migration. Instead of running the migration scripts offline (SAP is down), these scripts are now executed, while SAP is up and running. To allow a consistent export of the data, Oracle flashback capabilities are used. This allows on one side a consistent export of the tables to a specific SCN (System Change Number), on the other side it's possible to configure the GoldenGate processes for each table to the table specific SCN, to guarantee an error free apply. The fetch of an individual SCN for each table and the update of the GoldenGate configuration files is executed by the scheduler software, which runs the migration.

One challenge in an online migration is handling the additional load generated by the GoldenGate processes and the initial data load. Very often the current hardware on the source system is outdated and already fully used by the current application load. So it's not possible to add additional load on the system, without harming the production. To allow an online migration, even under these circumstances, it's possible to run a downstream capture of the GoldenGate processes. In such a configuration the archive files from the production system are analysed and extracted on a different server. This server is not required to have the same OS but only the same endian byte order. So it's possible to process database archive files from HP-UX, AIX and Sun Solaris (big endian) and Linux, Windows (little endian) cross-platform.

Therefore it's possible to run the GoldenGate processes on different hardware, to unload the productive environment and preserve the resources on the production system.

If any conflicts exist handling the initial data unload on the productive system, a shadow database can be used instead. So it's possible to run a Triple-o migration completely outside of the productive systems, which allows us to perform an online migration even on old and outdated hardware.

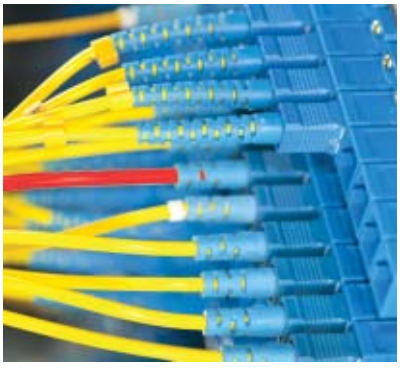
GoldenGate can be configured in many different ways in order to support very large databases with a huge system load. To increase the capabilities to process a larger redo log volume, up to 34 GoldenGate processes can be defined. Each process gets a number of tables to extract the DML and DDL changes of these tables. The PL/SQL package will perform a load distribution, based on the recorded DML changes in the database for each table. It's possible to configure up to 34 processes for the redo log extraction. One GoldenGate extract process is capable of handling up to 1 TB of redo within 24 hours.

In general, the apply on the target system requires more process than to extract the redo log file. Typically for a normal SAP system 5 – 10 apply processes are needed. For large BW systems more than 20 apply processes could be needed. To allow a maximum flexibility for the GoldenGate configuration, for each extract process up to 34 apply processes can be defined. Once again, the assigned tables in each extract are assigned to the number of defined apply processes by performing a work load balancing. So, with 2 tier architectures more than 1000 apply processes would be possible.

The typical project plan for an online migration generally has the following phases (see figure 8):

1. Prepare the migration, generate migration scripts.
2. Start the GoldenGate processes to record the database changes either on the productive system or downstream on a different server. The recorded changes, listed in the trail files are sent over the network to the target machine, where they are stored in the file system.
3. Run the SCN-based initial data load either from the productive server or from a shadow database. During the initial load the database changes are recorded permanently to the GoldenGate trail files. The duration of the initial load depends on the database size and the number of jobs which can be executed in parallel to unload the database. Typically the unload is completed within 48 hours.
4. Once the initial load is completed the apply processes on the target machine are started. Because the apply couldn't be started as long as the initial data load is running a time gap between the source and the target system will now exist, which must be closed to bring both systems into sync.
5. Now, there must be enough time to close the time gap between the source and target database. The needed time depends on the number of changes which have to apply, the kind of operations which have to be apply, the number of apply processes and the performance of the target system.
6. If the time gap between source and target system is closed, both systems can run in parallel up to the final switch.

Typically an online migration starts 5 days before the final switch. But if needed the migration can start more than a week before, to have enough time for all needed activities.



Triple-O for Datacenter Migration

Very often systems must be transferred between data centres. This can be due to a data centre consolidation, or is needed when the provider is changed. In this case it's very likely that there exists only a limited network connection between the database centres, which doesn't provide the necessary band width to run the initial data load and the GoldenGate processes in parallel. To run a full database load over a network at least a one Gigabyte connection is needed. For WAN connections typically 100 Megabit or even less is available. In this case it's still possible to run a full online migration, with the above mentioned minimum downtime between 30-60 minutes. To achieve this, the following approach is used:

1. Prepare the migration, generate migration scripts
2. Start the GoldenGate processes to record the database changes either on the productive system or downstream on a different server. The recorded changes, listed in the trail files are sent over the network to the target machine, where they are stored in the file system. To optimize the usage of the network band width, the GoldenGate transfer can be compressed by a factor of approximately 5-7.
3. Run the SCN-based initial data unload either from the productive server or from a shadow database. To save the band width the database is dumped out to a NAS server in multiple dump files. With a single NAS device you can achieve a throughput of 150 GB/h.
4. Once the initial unload is completed, the NAS device is detached from the source system and transported to the target data centre.
5. The NAS device is attached to the target system and the target database is loaded from the NAS device.
6. Once the initial load is completed, the applies on the target machine are started.
7. Now, there must be enough time to close the time gap between the source and target database. The time needed depends on the number of changes which have to be apply, the kind of operations which have to be applied, the number of apply processes and the performance of the target system.
8. If the time gap between the source and target system is closed, both systems can run in parallel up to the final switch.

Using this approach it's possible to migrate databases between date centres, which are connected only by a limited network connection.

Using the enhanced configuration option for GoldenGate (downstream capturing, usage of a shadow database for the initial database load) even very large databases with very critical performance can be migrated with a minimum downtime. The online migrations are performed without creating additional downtime during a larger migration project, so migration costs are reduced.

KEY INFORMATION ABOUT ORACLE SUN IT INFRASTRUCTURE FOR SAP (STORAGE, SYSTEMS, OS, VIRTUALIZATION, AND MANAGEMENT)

Some key literature (Solution Briefs, Data Sheets and White Papers) can be found at oracle.com/sap

http://www.oracle.com/technetwork/systems/index.html
http://www.oracle.com/technetwork/server-storage/solaris/overview/index.html
http://www.oracle.com/us/solutions/sap/infrastructure/index.html

Here you can find the following and download additional documents:

Overview:

- Oracle's Full Line of Integrated Sun Servers and Storage Systems
- Oracle Infrastructure Solutions for SAP Applications
- Oracle's Platform for SAP Solutions
- Oracle's IT Infrastructure for Optimizing SAP Environments

Solaris:

- Oracle Solaris 10
- Oracle Solaris 10: Performance Advantages
- The Role of Solaris 10 in Support of SAP Enterprise Applications
- Performance and Efficiency for SAP Solutions: Oracle Solaris 10 on Intel Xeon-Based Servers
- Leveraging the Power of Oracle Solaris 10 on Intel Xeon Processors for SAP Solutions
- Minimizing Downtime in SAP Environments
- Deploying SAP NetWeaver Master Data Management on Oracle Solaris Containers

Storage:

- Better Storage Solutions with Oracle's Sun ZFS Storage Appliance for SAP
- Oracle Sun Storage 7000 Unified Storage Systems and XML-Based Archiving for SAP Systems

Systems/Servers:

- Oracle's Full Line of Integrated Sun Servers and Storage Systems
- Sun SPARC T5440 Server
- Configuring SAP Business Objects for Scalability and Performance on Oracle Systems

Virtualization:

- Oracle Virtualization Technologies and the SAP NetWeaver Adaptive Computing Controller
- SAP ERP in the Cloud, Using Oracle Infrastructure Technologies
- Minimizing Planned Downtime of SAP Systems with the Virtualization Technologies in Oracle Solaris 10
- Minimizing Downtime in SAP Environments

Other:

- SAP BWA on Oracle's Sun Systems
- Oracle Sun Systems for SAP Mid-Sized Businesses

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For Oracle Solaris and latest DB Notes please see: service.sap.com

Note Number	Note Title	DB Version
Overview: Feature Support		
105047	Support for Oracle Functions in the SAP Environments	All DB Versions
720886	Oracle Database 10*g* Integration into the SAP Environment	Oracle DB 10*g*
828268	Oracle Database 10*g* – New Functions	Oracle DB 10*g*
1398634	Oracle Database 11*g* Integration in SAP Environment	Oracle DB 11*g*
1426979	SecureFiles – The New Way to Store LOB Data	Oracle DB 11*g*
1430669	BR*Tools support for Oracle 11*g*	Oracle DB 11*g*
1431800	Oracle 11.2 Central Technical Note	Oracle DB 11*g*
1434131	Oracle Database 11.2 for SAP versions	Oracle DB 11*g*
Overview: License & Maintenance information		
581312	Oracle Database Licensing Restrictions	All DB Versions
740897	Oracle License Scope & Required Oracle Options	All DB Versions
1028068	Required Oracle Options for DBA Cockpit	All DB Versions
1110995	Extended Maintenance for Oracle Version 10.2	Oracle DB 10*g*
1339724	Oracle 10.2 Extended Support	Oracle DB 10*g*
1654734	Extended Support contract required for 10.2.0.5 PSU and SBP	Oracle DB 10*g*
DB Option: Compression (+ Disc Space)		
1109743	Use of Index Key Compression for Oracle Databases	All DB Versions
1289494	FAQ Oracle Compression	All DB Versions
1431296	LOB Conversion and Table Compression with BRSPACE 7.20	Oracle DB 11*g*
1436352	Advanced Compression for SAP Systems	Oracle DB 11*g*
1464156	Support for Index Compression in BRSPACE 7.20	All DB Versions
1583303	Deferred Segment Creation	Oracle DB 11*g*
DB Option: Partitioning		
742243	General Table Partitioning	All DB Versions
859841	Deinstallation of Oracle Partitioning Option (SAP BW)	All DB Versions
1333328	Partitioning Engine for Oracle	All DB Versions
DB Option: Real Application Clusters (RAC)		
527843	Oracle RAC Support in the SAP Environment	All DB Versions
1550133	Automatic Storage Management (ASM)	Oracle DB 11*g*
DB Option: Real Application Testing (RAT)		
1426980	The Real Application Testing Option	Oracle DB 11*g*
DB Option: Security		
973450	Advanced Security – Network Encryption	All DB Versions
974876	Advanced Security – Transparent Data Encryption	All DB Versions
1324684	Advanced Security – Backup Encryption	All DB Versions
1355140	Using Oracle Database Vault in an SAP Environment	All DB Versions
1597194	Installing Oracle Database Vault in an SAP Environment	Oracle DB 11*g*
1502374	Database Vault for SAP Policy Scripts	Oracle DB 11*g*

Note Number	Note Title	DB Version
DB Administration: Tools		
355770	Oracle Enterprise Manager Database Control	All DB Versions
386413	Oracle Enterprise Manager (OEM) in the SAP Environment	All DB Versions
1589924	SAP Workload Management via Oracle Resource Manager	Oracle DB 11*g*
DB Administration: Backup & Recovery		
937492	Oracle Flashback FAQ	All DB Versions
966117	Oracle Flashback Database Technology	All DB Versions
**Exadata	Exalogic**	
1590515	SAP Software and Oracle Exadata	Oracle DB 11*g*
1617188	SAP Software and Oracle Exalogic	Oracle DB 11*g*
1619343	SAPinst for Oracle Exadata on Oracle Linux and Solaris X86	Oracle DB 11*g*
OS Platforms: General		
1508271	Oracle to Oracle Online Migration ("Triple O")	All DB Versions
1565179	SAP Software and Oracle Linux	Oracle DB 11*g*
1567511	Oracle Linux 5.x SAP installation and Upgrade	Oracle DB 11*g*
1575609	Future HP-UX Support	All DB Versions
OS Platforms: Virtualization		
1002461	Support of IBM Dynamic LPAR and Micropartitioning	All DB Versions
1173954	Support of Oracle for VMware	All DB Versions
1426182	Support of Oracle Database for XEN and KVM	All DB Versions
Technical Details: Installation, Upgrade, Patches		
1431751	Quick Reference for ADRCI and ADR	Oracle DB 11*g*
1431793	Upgrade Scripts	Oracle DB 11*g*
1431794	Instant Client	Oracle DB 11*g*
1431795	Patches/Patch Collections	Oracle DB 11*g*
1431796	Troubleshooting the Software Installation	Oracle DB 11*g*
1431797	Troubleshooting the Database Upgrade	Oracle DB 11*g*
1431798	Database Parameter Settings	Oracle DB 11*g*
1431799	Current Patch Set	Oracle DB 11*g*

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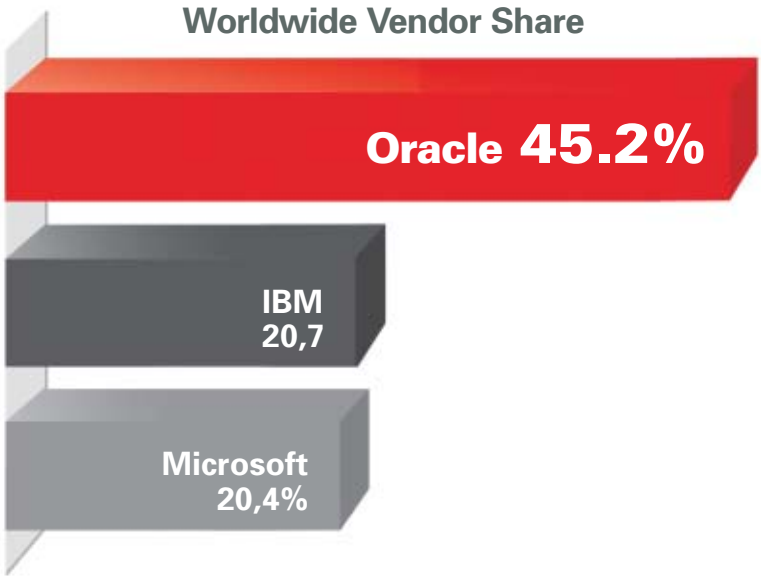

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