

ORACLE DATABASE 11g RELEASE 2 FUNCTIONALITY CERTIFIED BY SAP

INTRODUCTION

Oracle Database 11g Release 2 Enterprise Edition delivers industry leading performance, scalability, security and reliability. Customers can choose either clustered or single-servers that run Windows, all major Linux distributions or any major vendor UNIX distributions. It provides comprehensive features to easily manage the most demanding transaction processing, business intelligence, and content management applications.

Oracle Database 11g 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 11g 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 11g Rel. 2 is not provided for earlier SAP releases (SAP R/3 3.11 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) 11g Release 2 occurred at the same time as the general release of Oracle Database 11g 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 11g 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 11g 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.

Index Compression

The Oracle Database provides a highly efficient technology for storing regular indexes in an efficient manner. For performance and throughput reasons almost every access to SAP data in the Oracle Database happens via indexes. Therefore indexes in the database are critical for the throughput of an SAP system. The more efficient indexes are stored in the database the more efficient the SAP application will run. By using index compression in the Oracle Database the performance of the SAP application will be improved. Queries may run three to four times faster using compressed indexes. Index compression will reduce the total disk space for the Oracle Database by up to 20%. The use of index compression in the Oracle Database for SAP Applications is described in **SAP Support Note 1109743** and fully integrated in the BR*Space utility of SAP.

Compressed Index Organized Tables

The Oracle Database provides another important and ideal technology for SAP applications. Many tables used by the SAP application have only a single unique index (primary key). These tables with a single unique index can be stored much more efficient in the Oracle Database by using compressed index organized tables (IOTs). By using compressed IOTs queries may run up to five times faster. Insert and Delete operations against compressed IOTs will perform up to twice as fast. The use of compressed IOTs will reduce the total disk space of the Oracle Database by up to 25%. The implementation of compressed IOTs provides the capability to keep single index tables entirely or almost entirely in-memory avoiding any disk IO and therefore providing extremely fast access to data in the Oracle Database.

The use of compressed IOTs in the Oracle Database for SAP Applications is described in more detail in **SAP Support Note 1856270**.

OLTP Table Compression

Oracle Database 11g 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'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 11g 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-of-line 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 10g Release 2. In Oracle Database 11g, 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).

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 11g 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 11g 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 11g, 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 sub-seconds 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 10g, the listed Oracle Database 11g 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 11g). SecureFiles improve dramatically the scalability of SAP applications running against Oracle Database 11g RAC but also Oracle Database 11g 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 11g, Oracle provided security features such as Column Encryption through Transparent Data Encryption (TDE) and Client Server (SAP Application Server) Network Encryption.

Additional Encryption

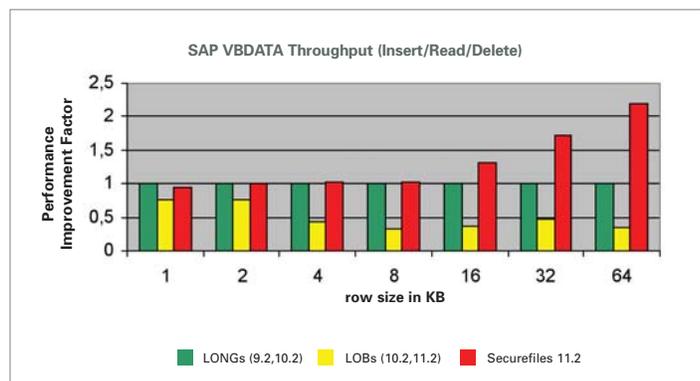
Advanced Security Option (ASO) within Oracle Database 11g includes RMAN Backup Encryption, so no one can read data from a (stolen) backup. In addition customers can easily encrypt export file with Oracle Data Pump unstructured LOB data with SecureFile Encryption.

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 11g 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 10g as well as Oracle Database 11g (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 11g Release 2 databases. The test results can be read in the newsletter <http://www.oracle.com/us/solutions/volume19-en-183572.pdf> on page 12.

Direct NFS

With Oracle Database 11g 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 11g, 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 11g 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 11g 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 new patches in addition. In other words, customers always need to install only one, the most current, SBP using MOPatch.

Oracle Database 12c for SAP customers directions

Oracle Database 12c will support SAP applications. More details will be available in the SAP Product Availability Matrix (PAM) Currently we are testing – among others:

Oracle Database 12c options and features for SAP.

- Multitenant Option
- Information Life Cycle Management/Automatic Data Optimization (ADO), requires Advanced Compression Option (ACO)
- Hybrid Columnar Compression (HCC)

