# ORACLE BUSINESS INTELLIGENCE, ORACLE DATABASE, AND EXADATA INTEGRATION

## EXECUTIVE SUMMARY

Oracle business intelligence solutions are complete, open, and integrated.   Key components of Oracle business intelligence solutions include Oracle Business Intelligence Enterprise Edition 11g (OBIEE 11g), business intelligence applications, the Oracle database, and the Oracle Exadata Database Machine.   The openness of OBIEE 11g and the database are clearly established.   OBIEE 11g is often deployed for business intelligence when accessing data from a variety of popular databases.   The Oracle database is the most popular database under a variety of business intelligence tools from a variety of vendors, even where it is increasingly deployed on the Oracle Exadata Database Machine server and storage platform.

This paper summarizes the complete and integrated aspect of Oracle's strategy and describes where OBIEE 11g, the Oracle database, and the Oracle Exadata Database Machine have several key technical integration points.  Collectively, these integration and optimization points provide customers superior performance, faster time to value, and lower costs. From a broader standpoint, the technology products are also coming together to deliver end-to-end business intelligence applications footprints.  This paper will address both of these aspects of Oracle's complete and integrated strategy.

## A Thumbnail Description of the Key Components

Oracle offers an integrated solution across business intelligence applications, tools, database, and server and storage platform and provides a complete end-to-end solution from a single vendor as shown in the following illustration:
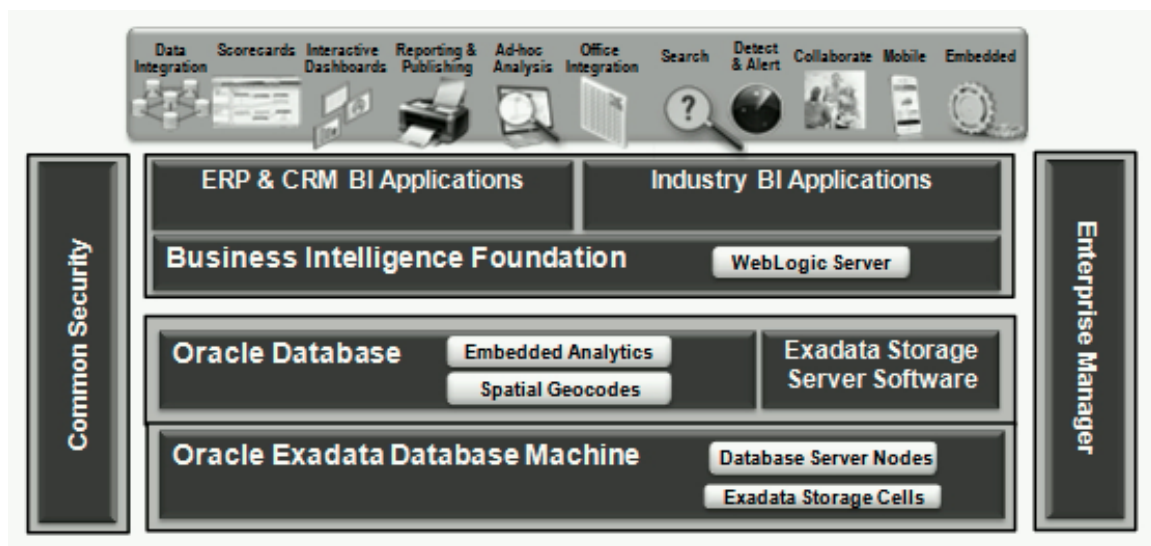


The key components, working our way up the solution stack, are as follows:

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### The Oracle Exadata Database Machine

Also referred to as the Sun Oracle Database Machine, the Oracle Exadata Database Machine consists of Sun database server nodes, Sun Exadata Storage Server Cells, and a high bandwidth InfiniBand network all packaged within single frames. The nodes, cells, and InfiniBand bandwidth are scaled in a pre-defined and balanced fashion. The Oracle Exadata Storage Server Software enables query processing typically handled in the Oracle database server nodes to occur in storage resulting in significant query performance improvement. The Database Machine is designed to scale for data warehousing and transaction processing applications and data sets into the hundreds of Terabytes (or more) and also serve as a database server and storage consolidation platform.

### Oracle Database Enterprise Edition 11g Release 2

Oracle's market leading database for data warehousing and transaction processing features an extensive number of query and analysis features and options including parallelization, static bitmaps, star-join techniques, materialized views, embedded SQL aggregation and analytic functions, embedded OLAP, and embedded data mining. The database also includes embedded extraction, transformation, and load (ETL) functions and extensive self-management and optimization through Enterprise Manager / Grid Control features and options.

### Oracle Business Intelligence Enterprise Edition 11g

Oracle's Business Intelligence offering is a middleware solution that includes the BI Server containing the Common Enterprise Information Model. The BI Server provides a centralized business model view, can serve as an advanced calculation and integration engine, and provides native database support for a variety of databases including Oracle. Front-end components in OBIEE 11g provide ad-hoc query and analyses, high fidelity reporting (BI Publisher), strategy and balanced scorecards, dashboards, and linkage to an action framework for automated detection and business processes. Additional integration is also provided to Microsoft Office, mobile devices and other Oracle middleware products such as WebCenter.

### Oracle Business Intelligence Applications for ERP and CRM

Oracle's Business Intelligence Applications provide pre-defined data models and key performance indicators that are displayed in pre-built reports for such areas as sales analytics, service and contact center analytics, marketing analytics, financial analytics, supply chain analytics, project analytics, and workforce (human resources) analytics. Pre-built ETL scripts are also available for common sources such as the Oracle E-Business Suite, PeopleSoft, JD Edwards, and Siebel CRM.

### Oracle Industry Business Intelligence / Analytics Applications

Specific data models and OBIEE pre-defined reports and analytics are available from Oracle for a variety of industries including communications, financial services, healthcare, retail, and utilities. Oracle is also working with a variety of systems integrator partners who offer such models and solutions built upon key Oracle technology components for business intelligence and data warehousing.

## Technical Integration Points

By design, the Oracle Exadata Database Machine is a tightly integrated Sun server, storage and Oracle database software solution. The Oracle Exadata Storage Server Software performs query offload processing in storage and is uniquely available for this platform. These smart scans greatly speed query performance while eliminating much of the need for indexing that was common practice by database administrators (DBAs) previously. The introduction of Flash technology as a Smart Flash Cache in the Database Machine enables further performance speed-up for a variety of workloads. In addition, the entire platform, including the Exadata Storage Server, is managed through Oracle's

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Enterprise Manager / Grid Control and supports hardware status alerting through Sun's Integrated Lights Out Management (ILOM) capabilities. There is an extensive library of Oracle technical whitepapers describing these concepts and integration points.

However, a question that is sometimes asked regards the level of integration between OBIEE 11g and the Oracle database given their open nature. The technical integration occurs in a number of ways.

### OBIEE 11g Query Request & Data Access Optimized for the Oracle Database

The BI Server component of OBIEE 11g supports the following database optimization techniques: intelligent query generation, intelligent function shipping, multi-pass analyses optimization, intelligent aggregate navigation, intelligent caching, and optimization where distributed data is accessed. Specific Oracle SQL optimization and capabilities are provided by the BI Server during SQL query generation. In contrast to third party BI tools that rely on ODBC connectivity, the SQL that OBIEE 11g generates uses the Oracle database's native call level interface (OCI) to communicate with it. OBIEE 11g performs extensive function shipping to the Oracle database to take advantage of optimizations within the database and query offload processing provided by Exadata. For example, the SQL that is generated takes advantage of the Oracle database's ability to handle full outer joins, hierarchical operators, UNION ALL, and SQL analytic functions, just to name a few. OCI support also enables transparent OBIEE 11g query failover to a stand-by Oracle database should the primary Oracle database platform fail in a highly available server configuration.

### OBIEE 11g Extended Support for Oracle Database Analytics Features

OBIEE 11g has integration with other extended Oracle database analytics capabilities. Data tied to spatial latitude and longitude, stored in the form as geocodes, can be queried and displayed in map views created by OBIEE 11g users. OBIEE 11g includes the Oracle MapViewer, a specialized tool for the display of spatial data in the Oracle database. This integration enables the creation and display of multilayered, highly interactive and animated maps within OBIEE dashboards and reports.

Given that Oracle's data mining and advanced analytics operate natively inside the Oracle Database, mining insights and predictions also remain inside the database so can be accessed by SQL queries from OBIEE 11g. Predictive model results can be called interactively using OBIEE 11g reports and dashboards. For example, OBIEE 11g might be used to review customer analytics of likely loyal and / or profitable customers sorted or filtered by gender, years as a customer, RFM (response, frequency, monetary), income, next-likely product to purchase, and other parameters. With Oracle, all the data mining and advanced analysis and results stay inside the database providing a simpler architecture, better security, better scalability and a single source of truth.

Another example of OBIEE 11g analytics capabilities tied to the Oracle database is the ability to generate queries against data residing in Oracle OLAP Option cubes. Business analyst have the ability to perform robust OLAP style analytics, including member selection, ragged hierarchy navigation, and pivot tables from the same interface used for relational query and analysis.

### OBIEE 11g Security Integration with the Oracle Database

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Given the database consolidations made possible by the Oracle database and Exadata, it should come as no surprise that providing advanced levels of security for diverse user communities is often desired. OBIEE 11g can leverage Oracle database security in several key ways that provide a much more manageable solution than a tools-centric security approach would provide. For example, the Virtual Private Database (VPD) support in the Oracle database restricts user access to data uniquely relevant to them within schema. OBIEE 11g is made aware of VPDs through the enterprise semantic layer in the BI Server and VPDs are respected by queries cached in the BI Server. Other security techniques include encryption of database data at the row and column level and data masking, all made possible since OBIEE 11g communicates with the database using OCI.

<u>System Management & Administration</u>

OBIEE 11g shares a common management framework, Enterprise Manager, with the Oracle database and Exadata. Similar to other Oracle platforms, Enterprise Manager is used to perform key management tasks for OBIEE 11g including performance monitoring, diagnostics, tuning, scale out and on-line clustering, and dynamic capacity management during the development, testing, and /or deployment process of the BI Server. This common management framework ensures that all elements of the business intelligence and data warehouse environment are optimized to work together to ensure the highest performance, scalability, reliability, and availability.

## Applications Footprints

A business intelligence solution is more than just the server, storage, database, and business intelligence tools technology. A deployed solution also includes a database data model deployed on the database server and metadata driven reports and ad-hoc query tools in the middle tier that make the infrastructure useful to business analysts. Oracle offers pre-defined solutions containing data models and business intelligence foundation metadata to address horizontal business areas (the ERP and CRM business intelligence applications) and for a variety of industries. The data models and reports generally serve as a starting point in deploying a complete solution for specific business and technical needs as modification is usually necessary. But, such starting points can greatly speed the initial deployment.

The ERP and CRM business intelligence analytics applications analytics data models are designed as star schema with conformed dimensions enabling queries across horizontal business areas. For example, a query might require data residing in the human resources and financial analytics schema to determine the costs associated with employees. Altogether, there are over 360 pre-defined metrics, over 30 dashboards, and over 200 reports defined. The models are supported on Oracle Database 11g Release 2 and RAC and have demonstrated excellent scalability in deployment on the Oracle Exadata Database Machine. Also included with these offerings is pre-defined ETL from over 3000 tables present in popular ERP and CRM data sources.

The industry enterprise data models are generally third normal form but such offerings also can include star schema and / or OLAP cubes for analytics. Just as with the ERP and CRM business intelligence applications, where analytics models are provided, sample reports and business intelligence metadata are included. As an example, the Oracle Retail Data Model Intelligent Warehouse offering includes over 1200 retail measures and key performance indicators, more than 15 OLAP cubes, and more than12 data mining models. Retail business areas such as store operations, point of sale, loss prevention, merchandising, order management, inventory, category management, workforce management, customer segmentation, and promotion effectiveness are addressed.

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## Future Directions

While Oracle remains firmly committed to providing open database and business intelligence solutions, you can also expect to see increasing levels of integration within the Oracle technology and applications solutions stack. As Larry Ellison, Oracle CEO, stated just after the Oracle acquisition of Sun was approved, "By having all of the pieces in the stack – from the silicon all the way up to the application, we'll be able to deliver systems that run faster, are fault-tolerant, are highly secure – much more secure, much more performance, much more cost-effective, much easier to use than we ever could have delivered by simply delivering components." Oracle is well positioned to deliver such complete and end-to-end business intelligence solutions given Oracle's array of data models and business intelligence tools, database, and Oracle Exadata Database Machine available for deployment. These solutions hold the promise of much faster time to value and more effective deployment while mitigating the risk of project failure.

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