

Oracle Exalytics: Engineered for Speed-of-Thought Analytics

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One of the biggest product announcements at 2011's Oracle OpenWorld user conference was Oracle Exalytics In-Memory Machine, the latest addition to the "Exa"-branded suite of Oracle-Sun engineered software-hardware systems.

Analytics is all about gaining insights from the data for better decision making. However, the vision of delivering fast, interactive, insightful analytics has remained elusive for most organizations. Most enterprise IT organizations continue to struggle to deliver actionable analytics due to time-sensitive, sprawling requirements and ever tightening budgets. The issue is further exasperated by the fact that most enterprise analytics solutions require dealing with a number of hardware, software, storage and networking vendors and precious resources are wasted integrating the hardware and software components to deliver a complete analytical solution.

Oracle Exalytics Business Intelligence Machine is the world's first engineered system specifically designed to deliver high performance analysis, modeling and planning. Built using industry-standard hardware, market-leading business intelligence software and in-memory database technology, Oracle Exalytics is an optimized system that delivers answers to all your business questions with unmatched speed, intelligence, simplicity and manageability.

Keywords: *engineered system, Business Intelligence, analytics, OLAP, architecture*

1 Introduction

The primary design principle of Oracle Exalytics is to enable fast and easy ad hoc analysis across large end-user communities using an in-memory processing engine. Speed of thought and instant response are the hallmarks of its functionality, making it highly applicable to a range of ad hoc, what-if analysis and forecasting and realtime planning applications.

The in-memory capabilities are key to enabling what Oracle calls a highly interactive and visual analytic experience for end users. Oracle claims that Exalytics introduces a new user interface designed to handle end-user queries "at the speed of thought." Peeling away the marketing speak, this means the product is designed to trawl through dense data sets (regardless of query, location, and device type and including desktops, laptops, tablets, and even smartphones) and provide results

almost instantaneously. Oracle claims that the algorithmic speed of the system means it can respond to queries as they are being typed – which is, in many ways, similar to how Google offers suggested searches based on a partially typed phrase [1].

What exactly is Oracle Exalytics? It is the latest addition to Oracle's "Exa"-branded family of pre-engineered software-hardware systems – in which the company integrates its software on its own hardware. Now that Oracle has its own line of hardware (through the acquisition of Sun), it appears to have fully embraced the "engineered systems" model as a way to sell both hardware and software while maintaining higher margins. Oracle Exalytics' immediate "engineered" siblings currently include the Exalogic Elastic Cloud middleware machine, the Exadata Database Machine, and the Oracle SPARC

SuperCluster T4-4 general-purpose servers [2].

2 Oracle Exalytics Architecture

Although Oracle Exalytics is a new product, the architecture is built on several existing Oracle products (Figure 1): parallelized versions of its TimesTen in-memory database and Oracle Essbase OLAP Server (a specialized in-memory version), together with an optimized version of the Oracle BI Foundation Suite (OBI EE 11g for standard

enterprise-grade BI query, analysis, reporting, dashboarding, and other visualizations). Most, if not all, of these software products have been modified to run in-parallel and in-memory data-processing architectures. All of these combine to deliver query optimization, complex multidimensional analysis and planning calculations, and enterprise-wide BI scale, respectively, through a revamped user interface that is designed for “speed-of-thought” analytics [1],[3].

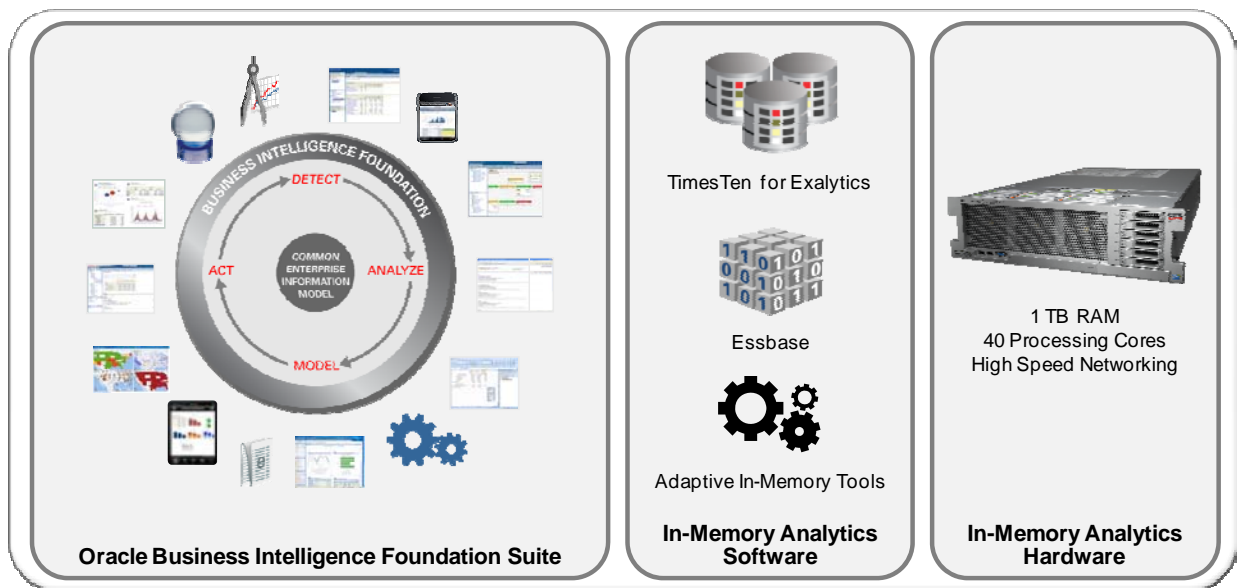


Figure 1. Oracle Exalytics Components

The Oracle Exalytics hardware is delivered in units of a single 3RU rack-mountable server that is optimally configured for in-memory analytics for business intelligence workloads. Multiple Oracle Exalytics machines can be clustered together to expand available memory capacity and to provide high availability. Oracle Exalytics includes powerful compute capacity, abundant memory, and fast networking options and is capable of direct attached storage options.

Oracle Exalytics is powered by four Intel Xeon® E7-4800 series processors and features high-speed interconnect technology between processors and I/O. Each processor supports 10 compute

cores providing a total of 40 cores for computation. The compute power is matched with 1TB of memory to provide sufficient capacity for in-memory analytics.

A high-performance business intelligence system requires fast connectivity to data warehouses, operational systems and other data sources. Besides, high-speed network connectivity is also required to create clusters which deliver high availability, load balancing and disaster recovery. Oracle Exalytics provides the following network interfaces to support the above requirements[1]:

- *InfiniBand*: Two quad-data rate (QDR) 40 GB/s InfiniBand ports

are available with each machine expressly for Oracle Exadata (only database machine that provides extreme performance for both data warehousing and online transaction processing (OLTP) applications) connectivity. When connected to Oracle Exadata, Oracle Exalytics becomes an integral part of the Oracle Exadata private InfiniBand network and has high-speed, low latency access to the database servers. When multiple Oracle Exalytics machines are clustered together, the InfiniBand fabric also serves as the high-speed cluster interconnect.

- *10 GB Ethernet*: Two 10 GB/s Ethernet ports are available for connecting to enterprise data sources and for client access.
- *1 GB Ethernet*: Four 1 GB/s Ethernet ports are available for client access.
- *Dedicated Integrated Lights Out Management (ILOM)*: Ethernet port for complete remote management.

All network interfaces support failover and can be used to setup a cluster without a single point of failure. Oracle Exalytics also includes redundant hot-swappable power supplies and fans.

Oracle Exalytics includes a high-performance direct attached storage system including a high-performance RAID HBA and 3.6TBs of raw disk capacity. Optionally, clusters of Oracle Exalytics machines can leverage network attached storage for storing shared metadata and configuration data.

3 Oracle Exalytics Software

Oracle Exalytics runs the Oracle Business Intelligence Foundation along with Oracle TimesTen In-Memory Database for Exalytics. Both BI Foundation and TimesTen In-Memory Database for Exalytics have been specifically enhanced to work together and have been optimized to

provide exclusive features on Oracle Exalytics hardware [1].

The *Oracle Business Intelligence Foundation* delivers the most complete, open, and integrated business intelligence platform on the market today. The Oracle BI Foundation provides comprehensive and complete capabilities for business intelligence, including enterprise reporting, dashboards, ad hoc analysis, multi-dimensional OLAP, scorecards, and predictive analytics on an integrated platform.

The Oracle BI Foundation includes the industry's best-in-class server technology for relational and multi-dimensional analysis and delivers rich end user experience that includes visualization, collaboration, alerts and notifications, search and mobile access.

Oracle TimesTen In-Memory Database (TimesTen) is a proven memory-optimized full-featured relational database with persistence. TimesTen stores all its data in memory optimized data structures and supports query algorithms specifically designed for in-memory processing. Using the familiar SQL programming interfaces, TimesTen provides real-time data management that delivers blazing-fast response times, and very high throughput for a variety of workloads.

Oracle TimesTen In-Memory Database for Exalytics, based on Oracle TimesTen In-Memory Database, has been specifically enhanced for analytical processing at in-memory speeds.

Oracle TimesTen In-Memory Database for Exalytics supports columnar compression that reduces the memory footprint for in-memory data. Compression ratios of 5X are practical and help expand in-memory capacity. Analytic algorithms are designed to operate directly on compressed data, thus further speeding up the in-memory analytics queries.

Oracle Essbase is the industry leading multi-dimensional OLAP Server for analytic applications. For Oracle Exalytics, Oracle Essbase has a number of optimizations for in-memory operation including

improvements to overall storage layer performance, enhancements to parallel operations, enhanced MDX syntax and a high performance MDX query engine. The Exalytics enhancements to Oracle Essbase provide up to 16X faster query execution as well as up to 6X reduction in write-back and calculation operations, including batch processes.

These enhancements are particularly important for advanced use cases such as planning and forecasting, providing faster cycle times and supporting more number of users than ever before.

Oracle Exalytics includes two in-memory analytics engines that provide the analytics capability - Oracle TimesTen *In-Memory* Database for Exalytics and Oracle Essbase with in-memory optimizations for Exalytics. These two data management engines are leveraged in the following four techniques to provide high performance in-memory analytics for a wide variety of business intelligence usage scenarios at workgroup, departmental and enterprise scale. These are:

- In-Memory Data Replication
- In-Memory Adaptive Data Mart
- In-Memory Intelligent Result Cache
- In-Memory Cubes

The Oracle Exalytics Business Intelligence Machine also supports *clustering* to provide scalability and high availability. It supports both active-active and active-passive configurations. A cluster configuration also can be configured to pool the available memory resources to accommodate larger data sets in-memory.

4. The Complementary Roles of Oracle Exalytics and Oracle Exadata

The Oracle Exadata Database Machine [4] is the only database machine that provides extreme performance for both data warehousing and online transaction processing (OLTP) applications, making it the ideal platform for consolidating onto grids or private clouds. It is a complete package of servers, storage, networking, and software that is massively scalable, secure, and redundant. With Oracle Exadata Database Machine, customers can reduce IT costs through consolidation, manage more data on multiple compression tiers, improve performance of all applications, and make better business decisions in real time.

Oracle Exalytics complements Oracle Exadata's (Figure 2) high performance query processing capabilities by delivering best in class user experience for analytical workloads including reporting, dashboards, ad-hoc and OLAP. Oracle Exalytics has been designed from the ground-up to be complementary to Oracle Exadata. Starting from the network interfaces, protocols to middleware to database interaction, Oracle Exalytics provides the best overall cost of ownership when connected to Oracle Exadata. Oracle Exalytics comes with pre-configured and pre-tested options to get the best performance, and the lowest Total Cost of Ownership (TCO) without extensive tuning with Oracle Exadata.

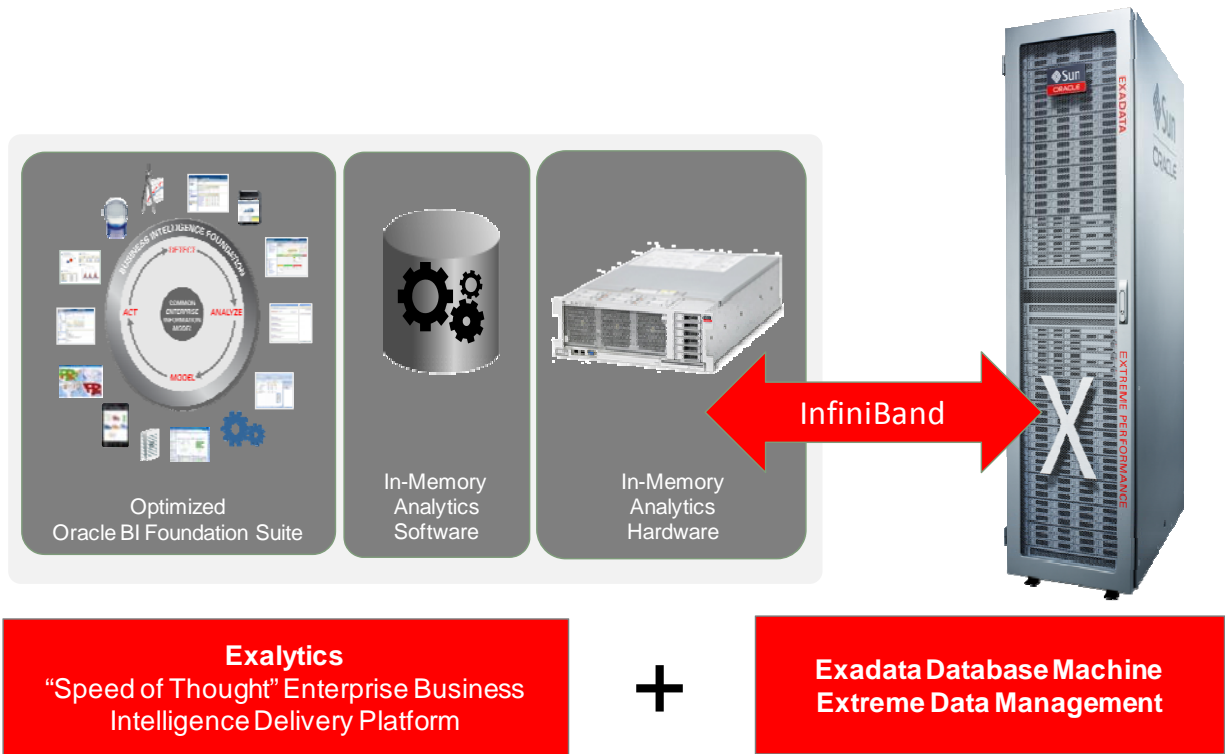


Figure 2. Complementary Roles of Oracle Exalytics and Oracle Exadata

The following figure illustrates key software supported in the Oracle Exadata Database Machine hosting a datawarehouse and the

Oracle Exalytics Business Intelligence Machine hosting the BI components.

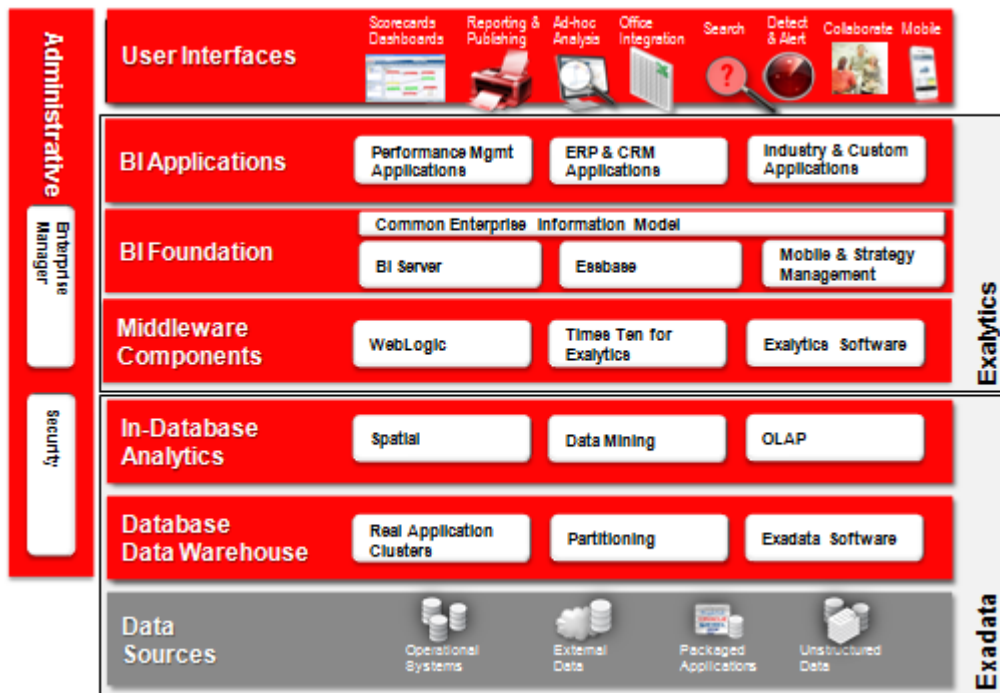


Figure 3. Key software supported in the Oracle Exadata and Exalytics

The Oracle Exalytics BI machine supports optimum SQL generation for Oracle

Exadata. For large analytics deployments where the data warehouse can't entirely fit

into Oracle Exalytics in-memory cache, Oracle Exalytics deployments can benefit by leveraging Oracle Exadata's massively parallel processing and extreme performance capabilities.

In addition, Oracle Exalytics can use Oracle Exadata as an extension to its in-memory cache/data mart. Such a configuration boosts the capacity of the in-memory cache/data mart and is especially suited for providing uniform responsiveness over large federated deployments.

5 Conclusions

Exalytics bundles in some mature and well-established technologies, and is the latest part of Oracle's strategy to parallelize its entire data processing stack. In fact, all of the new "Exa"-branded Oracle-engineered systems are parallelized configurations of servers, networks, and storage, while the software is a virtual machine, operating system, database, and middleware.

Data warehousing servers and BI servers have different roles and each provide value in a completing a business intelligence infrastructure. In the past, organizations have faced tradeoffs when trying to put together optimal configurations of the back-end and middle-tier components. Vendors often oversold the value of the individual components when they have offered only

one side of the equation. Now, the Oracle Exalytics Business Intelligence Machine and the Oracle Exadata Database Machine can be deployed together to provide the optimal end-to-end footprint to fulfill the needs of both IT and the LOBs, with support across the entire footprint coming from a single vendor.

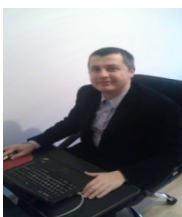
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