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# Oracle Exalytics

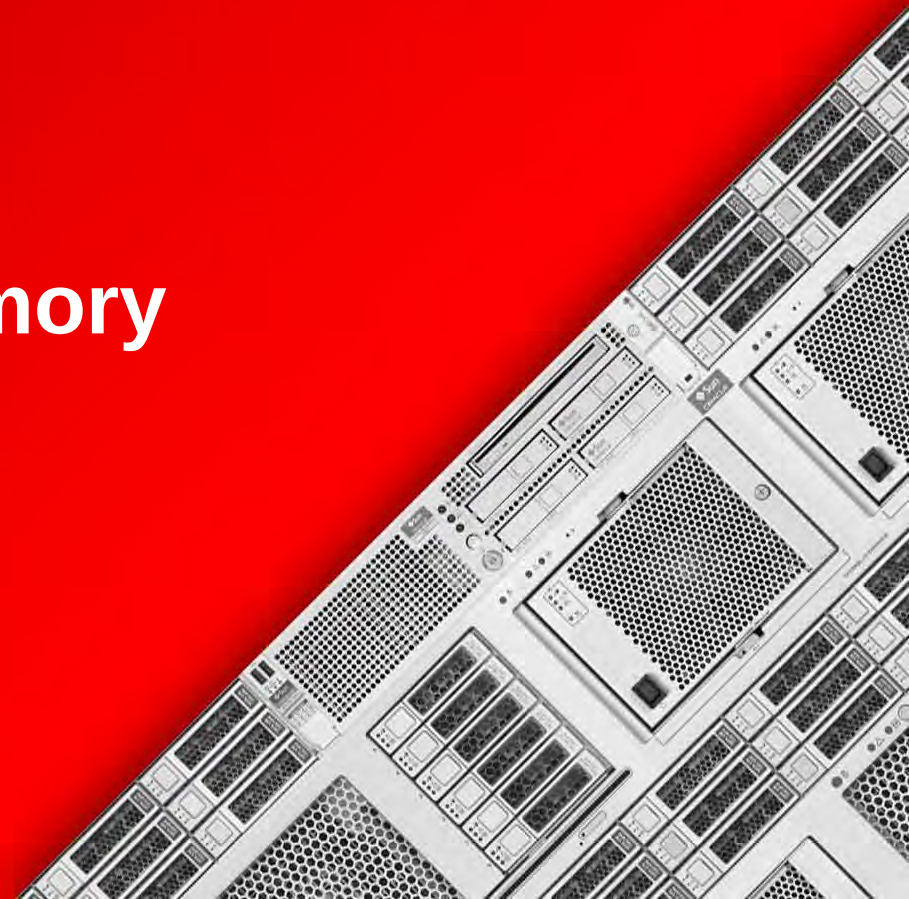
Thomas Kurian
Executive Vice President

# Oracle Exalytics

## Summary

- In-Memory Analytics has made rapid advances
  - Memory is Faster, Cheaper, and has More Capacity Today
- Oracle has the most mature & best In-Memory Technology
  - For Transaction Processing, Business Analytics, and Unstructured Information Processing
- Oracle Exalytics is a complete In-Memory Analytics System
  - Operational Reporting, R-OLAP, M-OLAP, Planning & Budgeting, Unstructured Information Discovery
- Oracle Exalytics is being adopted rapidly by customers
  - Most Complete Solution, Analytics Speed, Better Business Intelligence, Lower Cost
- Oracle Exalytics solves these problems better than competitors
  - More complete & mature solution, solves analytics problems better, & much cheaper than competitors
- In-Memory DBMS will not replace many or all relational DBMS
  - Competitor's DBMS in particular has many architectural & functional limitations

# Understanding In-Memory Computing



# Why In-Memory?

## Memory is Faster, Cheaper, & has more Capacity Today

| In-Memory Capacity Increased | |
|---|---|
| 2002 | 256MB/DIMM |
| 2012 | 16GB/DIMM |

**64X More Capacity**

| In-Memory Cost Decreased | |
|---|---|
| 2002 | $0.2/MB |
| 2012 | $0.009/MB |

**25X Cheaper**

| In-Memory Significantly Faster | |
|---|---|
| HDD | 5ms response |
| D-RAM | 100ns response |

**50,000X Faster**

Faster Analysis, Faster Reporting, Faster Planning
Better Interactivity, Better Visualizations, Better Intelligence
More Users, More Data, More Calculations

# In-Memory Database

## Requirements for Transaction Processing & Business Analytics

| Requirement | For Business Analytics | For Transaction Processing |
|---|---|---|
| In-Memory Data Caching | ✓ | ✓ |
| In-Memory Columnar Storage | ✓ | ✓ |
| In-Memory Row & Column Compression | ✓ | ✓ |
| In-Memory Indexes | ✓ | ✓ |
| In-Memory Query Optimizer (Predictability) | ✓ | ✓ |
| In-Memory NUMA Support (Scale Up) | ✓ | ✓ |
| In-Memory Parallel Query (Scale Out) | ✓ | |
| In-Memory Aggregates & Result Sets | ✓ | |
| In-Memory Analytic Functions | ✓ | |
| In-Memory Unstructured Data | ✓ | ✓ |
| High Performance Writes/Updates | ✓ | ✓ |
| Data Persistence on Disk | | ✓ |
| Transactional Integrity/Correctness | | ✓ |
| Multi-Version Concurrency | | ✓ |

# In-Memory Business Analytics

## 5 Types of Analytics Problems

- Operational Reporting: Report on information in real time
  - Which customer orders will be affected by delays in my NYC warehouse today?
- Relational Query & Analysis: Analyze information in real time
  - How many of these customers had late deliveries this year & what is their current sales pipeline?
- Online Analytic Processing: Across many dimensions in real time
  - Summarize # of orders, key customers, & revenue impact in each sales VP, SVP, EVP's territory?
- Planning: Compare information to their financial plans and budgets
  - How does revenue shortfall affect operational budgets & what happens if I expedite the top 5?
- Information Discovery: Identify patterns in unstructured information
  - Have the customers who are affected by delays complained on social media about my delays?

# In-Memory Business Analytics

## 5 Types of Analytics Problems

**Operational Reporting**

OLTP Operational Data Store

**Query & Analysis**

OLTP Warehouse or Data Mart

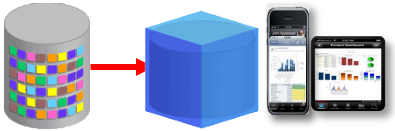
**Multi-dimensional OLAP**

OLTP OLAP

**Planning & Budgeting**

OLTP Planning System

**Unstructured Information Discovery**



Warehouse Unstructured Analytics

# In-Memory Business Analytics

## Each Type of Problem has different Performance Requirements

### Operational Reporting

1. How fresh is the data in my ODS?
2. How fast is my response time to queries?

### Query & Analysis

1. How fresh is the data in my warehouse or mart?
2. How fast is my response time to user queries?
3. How does it scale as I add users & data?

### Multi-dimensional OLAP

1. How fresh is the data in my OLAP Cubes?
2. How quickly can I re-build aggregates?
3. How fast is query response time & how does it scale?

### Planning & Budgeting

1. How quickly can I re-calculate budgets up my hierarchy?
2. How quickly can I model what-if scenarios?
3. How fast can I generate management reports?

### Unstructured Information Discovery

1. How quickly do I add structure to unstructured data?
2. How fast do I refresh the search index?
3. How quickly & effectively do I guide users to specific patterns in the information?

# In-Memory Business Analytics

## Each Problem has different Performance Requirements

### Operational Reporting

**Fast Data Movement**
**Fast Query Response Time**

### Query & Analysis

**Fast Data Movement**
**Fast Query Response**
**Fast Aggregates & View Refresh**
**User & Data Scalability**

### Multi-dimensional OLAP

**Fast, On-Line Cube Builds**
**Fast Query & Aggregate Calculation**
**Fast Scenario Modeling (Updates)**
**User & Data Scalability**

### Planning & Budgeting

**Fast Plan Re-computation**
**Fast Forecasting (Updates)**
**Fast Aggregation & Reporting**
**User & Data Scalability**

### Unstructured Information Discovery

**Fast Search Index Re-computation**
**Fast Query & Guided Navigation**

# Oracle Exalytics – Product Overview

# Oracle Exalytics In-Memory Machine

**Endeca Information Discovery**

**Hyperion Planning & Budgeting**

**OBI In-Memory Analytics**

**Endeca In-Memory MDEX Server**

**Essbase In-Memory OLAP**

**Times Ten In-Memory DBMS**

**1 TB DRAM, 40 Intel Cores**


## Unique Features

- ✓ In-Memory Query & Analysis
- ✓ In-Memory Multi-Dimensional OLAP
- ✓ In-Memory Reporting
- ✓ In-Memory Planning & Budgeting
- ✓ Runs Packaged Applications without modification
- ✓ Works with ANY Oracle & Non-Oracle Data Source
- ✓ Superfast optimizations with Oracle Exadata

## Benefits

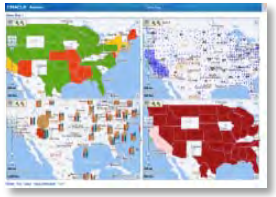
- ✓ Superfast, Interactive Visual Analysis
- ✓ Faster Planning & Budgeting with Richer Models
- ✓ Quick to Deploy, Supports More Users
- ✓ Faster, Cheaper, Better Analytics

# Oracle Exalytics Hardware

- Memory
  - 1 TB D-RAM
- Compute
  - 4 Intel® Xeon® E7-4870, 40 cores total
- Networking
  - 40 Gbps InfiniBand – 2 ports
  - 10 Gbps Ethernet – 2 ports
  - 8 Gbps FibreChannel – 2 ports
  - 1 Gbps Ethernet – 4 ports
- Storage
  - 3.6 TB HDD Capacity
- Operating System
  - Linux

# Oracle BI Foundation

## Powerful In-Memory Query & Analysis



- Scorecards
- Query & Analysis
- Dashboards
- Reporting
- Mobile
- Office & Outlook


- In-Memory Optimizations
  - In-Memory R-OLAP, In-Memory Reporting
  - Latency Reduction: 8-10X faster response time
  - Scalability Improvements: 2-4X more users
- Data Federation Capabilities
  - Consistent calculations across data from many sources
  - Supports 100s of Sources including SAP BW (MOLAP + ROLAP)
- Summary Advisor
  - Heuristic Adaptive In-Memory Cache
  - Automatically identify ‘hot data’ and caches it
  - Maintain and tune cache as usage changes
- Super Fast Parallel Query Execution
  - Query, Metadata, Dashboard Caching
  - Multi-Pass Calculations

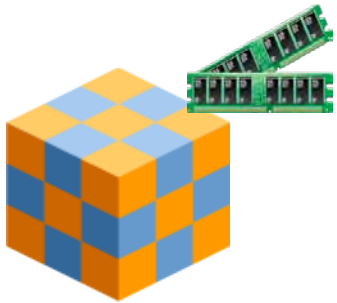
# TimesTen In-Memory Database

## Powerful In-Memory Transactional & Analytics DBMS

- The Leading In-memory Database
  - Fully Persistent (Updates) & Highly Available
  - Proven in mission critical deployments
  - Used by 1000s of Companies TODAY
- New Analytical Functions
  - Grouping Operators: CUBE, ROLLUP, GROUPING SETS
  - WITH Clause
  - Analytic Functions: RANK, DENSE_RANK, SUM, AVG, ORDER BY NULLS FIRST|LAST
- New In-Memory Enhancements
  - Enhanced Data & Result Set Caching
  - Fast Refresh of Aggregates & Views
  - New Columnar Storage
  - New Columnar Compression: 5-10X capacity increase
- Standard SQL/ODBC/JDBC Interfaces

# Essbase In-Memory M-OLAP

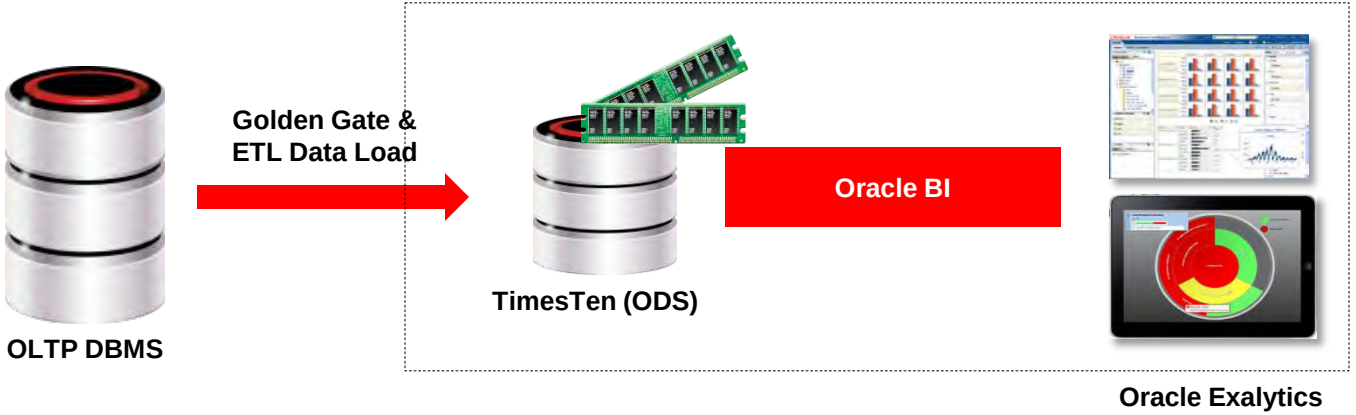
## Powerful In-Memory M-OLAP & Planning Engine



- The Leading Multi-Dimensional OLAP Server
  - Fully Persistent (Updates) & Highly Available
  - Proven in mission critical deployments
  - Used by 1000s of Companies TODAY
- Fast Data Feed
  - Online Trickle Feed of Data
  - Online Cube Merge
- New In-Memory Optimizations
  - Interactive and batch calculations (128 threads/calc)
  - Parallel Data Load & Data Export
  - Fast/Parallel Cube Re-build
  - Fast/Aggregate Computation
  - Super Fast OLAP query execution
- Standard MDX Interface
  - Runs hundreds of packaged applications with no change

# Oracle Exalytics

## Operational Reporting

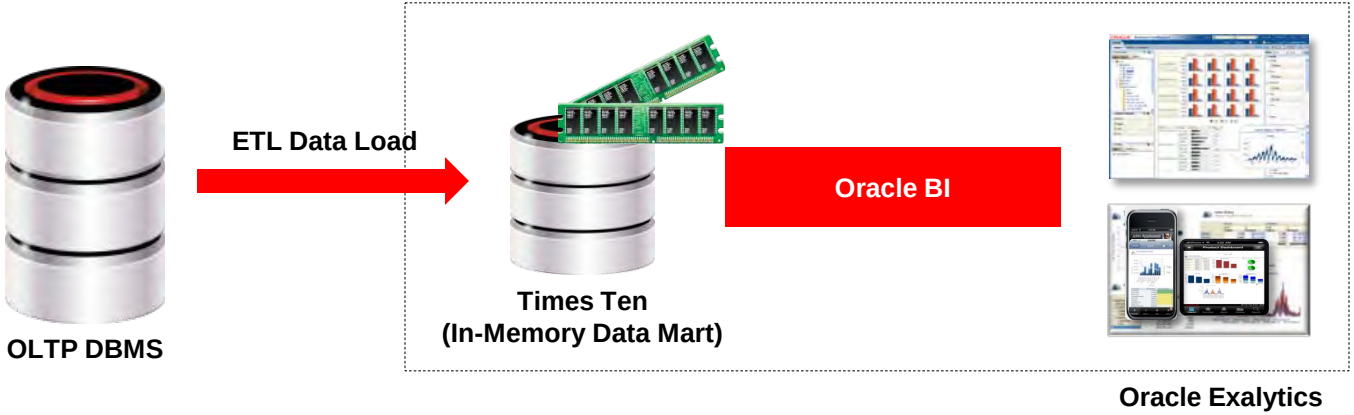



### High Performance Operational Reporting

- ✓ Super Fast Data Refresh: Golden Gate for Transaction Replication
- ✓ Super Fast Query Performance: In-Memory Pre-Cached Queries, Results, Views
- ✓ Fast Aggregates & View Refresh: In-Memory Optimizations in Times Ten
- ✓ Excellent User Scalability: Highly Scalable Parallel Query in Oracle BI & Times Ten

# Oracle Exalytics

## Query & Analysis: In-Memory Data Marts

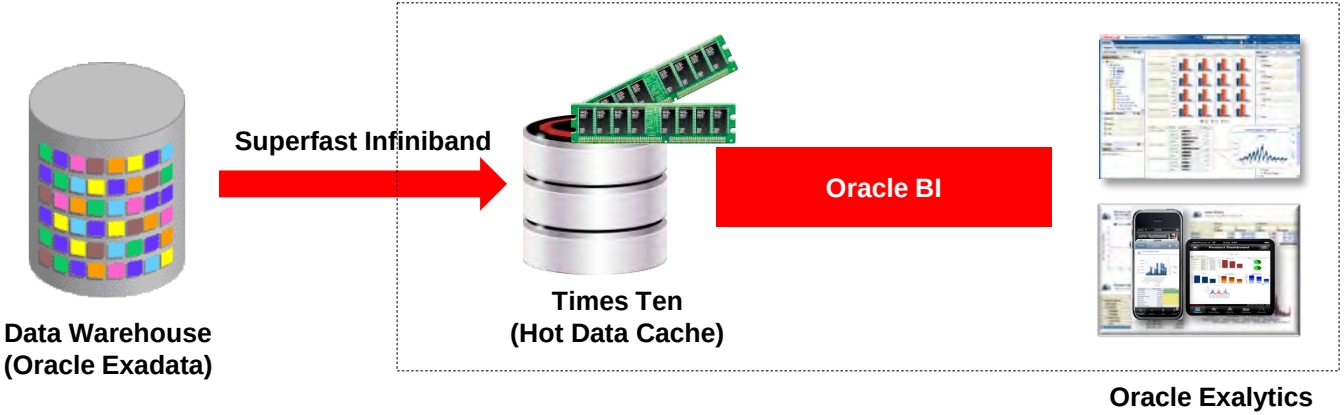



### High Performance Query and Analysis for Data Marts

- ✓ Identifying Hot Data to Cache in Mart: Oracle BI Summary Advisory
- ✓ High Capacity In-Memory Storage: Columnar Compression & Storage
- ✓ Fast Aggregates & View Refresh: In-Memory Optimizations in Times Ten
- ✓ Fast Query Response & Excellent Scalability: Oracle BI In-Memory

# Oracle Exalytics

## Query & Analysis: Enterprise Warehouse with Oracle Exadata

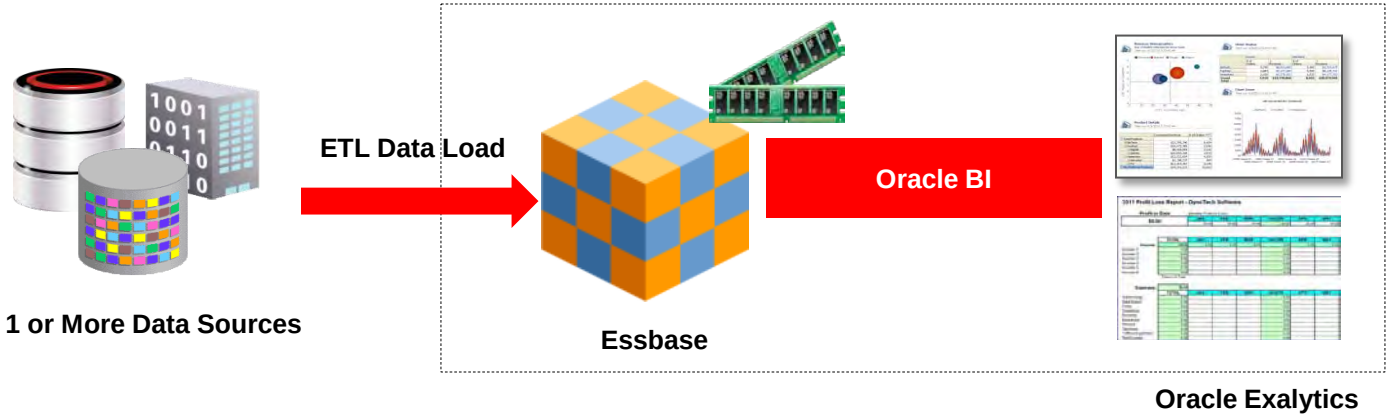



### High Performance Query and Analysis for Data Warehouses

- ✓ Fast Query and Analysis: Automatically move ‘Hot’ Data into Times Ten Cache
- ✓ Fast Aggregates & View Refresh: In-Memory Optimizations in Times Ten
- ✓ Better User Scalability: Parallel Processing in Oracle BI, Times Ten, and Exadata
- ✓ Data Scalability: ‘Hot’ Data in Times Ten, All Data in Exadata, Columnar Compression

# Oracle Exalytics

## Multi-Dimensional OLAP

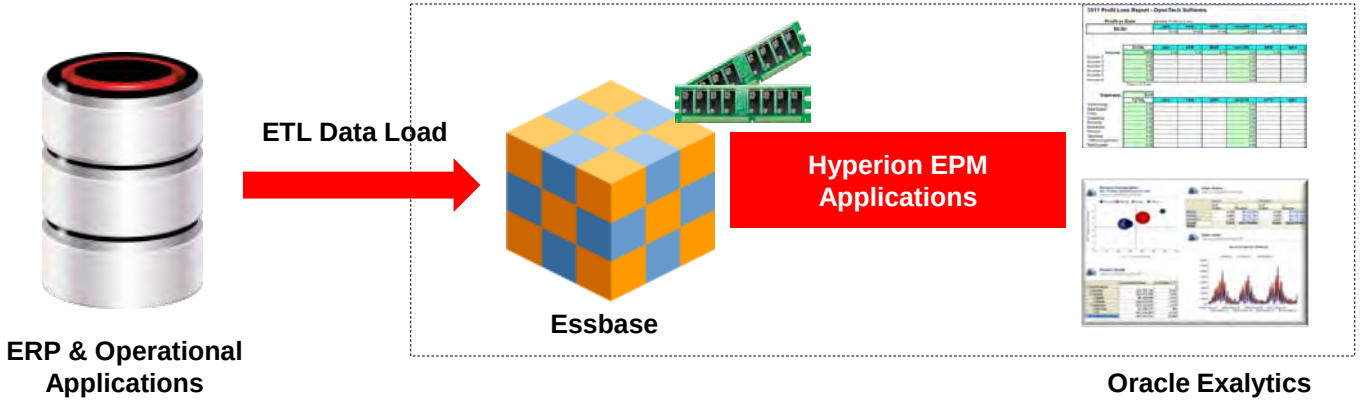



### High Performance Multi-Dimensional OLAP

- ✓ On-line, Rapid Cube Building: Essbase In-Memory
- ✓ Fast Cube Rebuild and Aggregation:  Fast Writes/Updates
- ✓ Scalable Forecasting and What-if Analysis: Essbase Scenario Modeling
- ✓ Fast, Scalable User Experience: Essbase In-Memory Query Acceleration

# Oracle Exalytics

## Planning & Budgeting

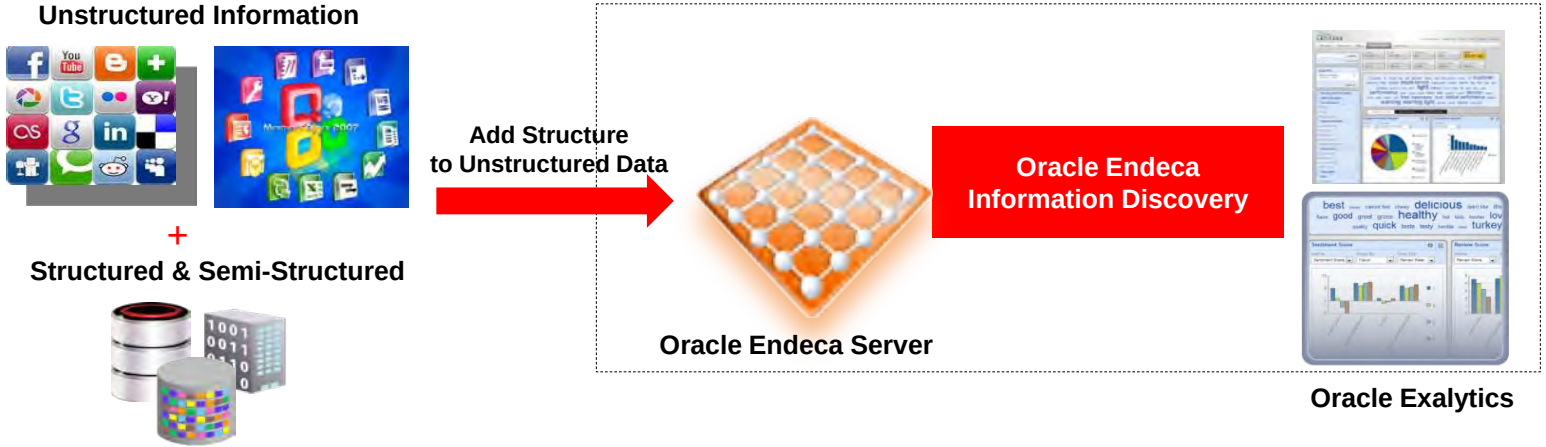



### High Performance Planning & Budgeting

- ✓ Fast Plan Updates & Incremental Aggregation: Fast Block Writes
- ✓ Broader Scenario Modeling and Better Forecasting: Non-Layered Aggregates
- ✓ Highly Interactive Planning User Experience: Essbase In-Memory Acceleration
- ✓ Fast and Scalable Management Reporting: High Speed In-Memory Aggregates

# Oracle Exalytics

## Unstructured Information Discovery




### Interactive Discovery on Unstructured Information

- ✓ Rapid Ingestion of Unstructured Data: Oracle Endeca Server
- ✓ Rapidly Adding Structure to Unstructured Data: Oracle Endeca Server
- ✓ Fast Query Response: Oracle Endeca In-Memory Parallel Query
- ✓ Fast Changing Information: Rapid In-Memory Search Index Re-build

# Oracle Exalytics

## Packaged Applications Support

### Packaged Business Intelligence Applications


| Sales | Service & Contact Center | Marketing | Order Management | Supply Chain | Financials | Human Resources |
|---|---|---|---|---|---|---|

### Packaged Performance Management Applications

| Financial Modeling | Financial Planning & Budgeting | Operational Planning | Statutory Reporting | Metrics & Scorecards |
|---|---|---|---|---|

# Oracle Exalytics

## Customer Results

| | |
|---|---|
| Nykredit | • Largest mortgage provider in Denmark, major private bond issuer in Europe<br>• 1700 Power Analytics Users; 50 Terabytes Data; Superfast Adhoc Query Performance<br>• **35X to 70X** faster with Exadata + Exalytics |
| Polk | • Supplies automotive industry with market intelligence "*PolkInsight*"<br>• Need highly interactive dashboards and visualizations for global analyst community<br>• **> 10X** faster on average and up to **100X** faster in specific cases |
| Key Energy Services | • Large oilfield services company with about ~860 rigs deployed around the world<br>• 1500 Power Users using Packaged Analytic Applications across the organization<br>• **5X** faster to develop; **5X** faster performance; **50X** faster than custom reports |
| SAVVIS | • Large cloud infrastructure services company<br>• Need highly interactive visualizations for large numbers of individual analyst data sets<br>• **30X** faster response time – on par with **desktop tools** |
| Global CPG Company | • Global consumer pre-packaged foods company<br>• 2000+ users needing Daily Planning & Budgeting Cycles and Management Reporting<br>• **6X** faster cycle time - **4 hours** down from more than **24 hours** |

# Competitive Comparisons

# What are limitations of pure In-Memory DBMS?

In-Memory is NOT a panacea for all DBMS

- Transaction Processing
  - Updates/Writes need to be stored on disk for High Availability or Durability
  - If Writes done to Disk, Sophisticated Clustering required to share data across Nodes
- Data Warehousing (Scale-Up)
  - For DBMS > 2-4 TB, need more than 1 TB of D-RAM which requires 8 Socket NUMA X86
  - Very few DBMS implement NUMA with high performance & scalability
  - Very expensive to buy many servers to fit large DBMS 100% in-memory
- Data Mart (Scale-Out)
  - Parallel Query critical to get User & Query Scalability across multi-cores
  - Sophisticated Query Optimizer required to provide Predictable Query Performance
- M-OLAP & Planning/Budgeting
  - Write Performance critical to update aggregates and calculations
  - In-Memory Columnar Compression & Storage can impact write performance

# Oracle Exalytics

## Oracle TimesTen is significantly better than SAP HANA

| Requirement | Oracle Times Ten | SAP HANA |
|---|---|---|
| In-Memory Data Caching | ✓ | ✓ |
| In-Memory Columnar Storage | ✓ | ✓ |
| In-Memory Row & Column Compression | ✓ | Column Only |
| In-Memory Indexes | ✓ | |
| In-Memory Query Optimizer (Predictability) | ✓ | |
| In-Memory NUMA Support (Scale Up) | ✓ | |
| In-Memory Parallel Query (Scale Out) | ✓ | |
| In-Memory Aggregates & Result Sets | ✓ | |
| In-Memory Analytic Functions | ✓ | |
| In-Memory Unstructured Data | ✓ | |
| High Performance Writes/Updates | ✓ | |
| Data Persistence on Disk | ✓ | ✓ |
| Transactional Integrity/Correctness | ✓ | ? |
| Multi-Version Concurrency | ✓ | ? |

# Oracle Exalytics

## Oracle Exalytics is significantly better than SAP HANA

| | Exalytics | SAP HANA | Hana's Limitations |
|---|---|---|---|
| Operational Reporting |  |  | Limited Data Sources with Sybase Replication Server<br>Limited support of 3rd normal form within Business Objects |
| Data Mart |  |  | No Parallel Query (Scale-Out) or NUMA (Scale-Up) Support<br>Limited & Non-Standard SQL |
| Data Warehouse |  |  | Theoretically Possible but Practically far too expensive above 2-4 TB to put all data in memory; no graceful mechanism for disk storage |
| Multi-dimensional OLAP |  |  | Limited Write Performance to update aggregates due to compressed, in-memory columnar storage |
| Planning & Budgeting |  |  | Layers of aggregates in SAP BW impact planning on BW on Hana<br>Limited write performance with columnar storage; |
| Unstructured Discovery |  |  | No unstructured data support in Hana<br>No discovery capabilities across unstructured & structured |
| Packaged Apps & BI Tools |  |  | All Packaged Oracle Analytic Applications, Packaged EPM Applications, and any BI Tool works with Exalytics; Hana only works with SAP Tools |

# Oracle Exalytics

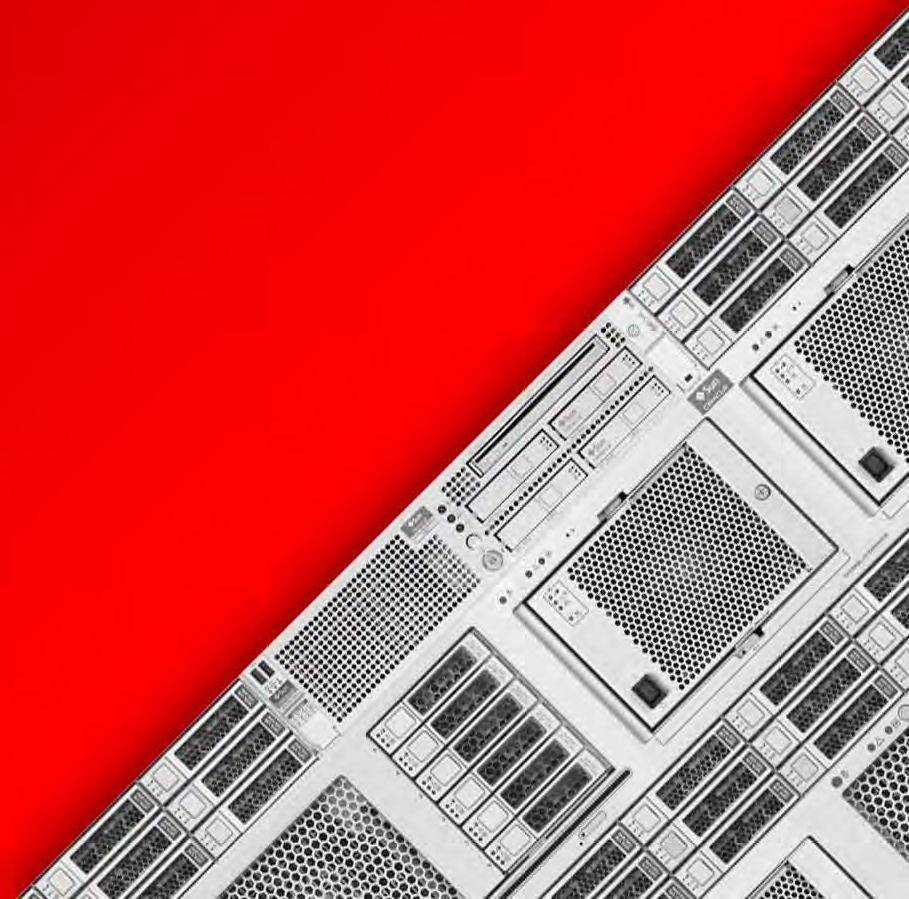
## Oracle Exalytics is significantly cheaper than SAP HANA

| | Oracle Exalytics | SAP HANA + IBM Hardware | Comparison |
|---|---|---|---|
| **In-Memory Data Mart**<br>512GB compressed data<br>1TB memory | **$825,000** | **$4,112,474** | Hana is **5X** more expensive |
| **In-Memory Analytics for Enterprise DW**<br>20 TB compressed data<br>40TB memory | **$2,499,000**<br>1 Exalytics + 1 Exadata. | **$126,548,960**<br>40 Size L servers required to hold all data in-memory | Hana is **50X** more expensive |

| Pricing | Oracle Exalytics | SAP HANA + IBM Hardware |
|---|---|---|
| Hardware: 1TB RAM | $135,000 | $362,474* |
| In-Memory Database Software for 1TB RAM | $690,000 | $3,750,000** |

* IBM 7143-H2x + 7143-H3x Upgrade Option ** HANA Enterprise Edition

# Summary



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