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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

<table>
<thead>
<tr>
<th>In-Memory Capacity Increased</th>
<th>In-Memory Cost Decreased</th>
<th>In-Memory Significantly Faster</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002 256MB/DIMM</td>
<td>2002 $0.2/MB</td>
<td>HDD 5ms response</td>
</tr>
<tr>
<td>2012 16GB/DIMM</td>
<td>2012 $0.009/MB</td>
<td>D-RAM 100ns response</td>
</tr>
</tbody>
</table>

64X More Capacity  25X Cheaper  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

<table>
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<th>For Business Analytics</th>
<th>For Transaction Processing</th>
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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?

### 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?

### 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?

### 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

### 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

### Components
- Endeca Information Discovery
- Hyperion Planning & Budgeting
- OBI In-Memory Analytics
- Endeca In-Memory MDEX Server
- Essbase In-Memory OLAP
- Times Ten In-Memory DBMS

### Specifications
- 1 TB DRAM, 40 Intel Cores
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

• 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
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

1 or More Data Sources → ETL Data Load → Essbase → Oracle BI

High Performance Multi-Dimensional OLAP
✓ On-line, Rapid Cube Building: Essbase In-Memory
✓ Fast Cube Rebuild and Aggregation: Fast Reads/Updates
✓ Scalable Forecasting and What-if Analysis: Essbase Scenario Modeling
✓ Fast, Scalable User Experience: Essbase In-Memory Query Acceleration
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
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
Customer Results

**Nykredit**
- Largest mortgage provider in Denmark, major private bond issuer in Europe
- 1700 Power Analytics Users; 50 Terabytes Data; Superfast Adhoc Query Performance
- **35X to 70X** faster with Exadata + Exalytics

**Polk**
- Supplies automotive industry with market intelligence “PolkInsight”
- Need highly interactive dashboards and visualizations for global analyst community
- **> 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
- 1500 Power Users using Packaged Analytic Applications across the organization
- **5X** faster to develop; **5X** faster performance; **50X** faster than custom reports

**SAVVIS**
- Large cloud infrastructure services company
- Need highly interactive visualizations for large numbers of individual analyst data sets
- **30X** faster response time – on par with desktop tools

**Global CPG Company**
- Global consumer pre-packaged foods company
- 2000+ users needing Daily Planning & Budgeting Cycles and Management Reporting
- **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

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# Oracle Exalytics

Oracle Exalytics is significantly better than SAP HANA

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<th>Exalytics</th>
<th>SAP HANA</th>
<th>Hana’s Limitations</th>
</tr>
</thead>
</table>
| Operational Reporting  | ![Circle]  | ![Half Circle] | Limited Data Sources with Sybase Replication Server  
Limited support of 3rd normal form within Business Objects |
| Data Mart              | ![Circle]  | ![Half Circle] | No Parallel Query (Scale-Out) or NUMA (Scale-Up) Support  
Limited & Non-Standard SQL |
| Data Warehouse         | ![Circle]  | ![Half Circle] | 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 | ![Circle]  | ![Half Circle] | Limited Write Performance to update aggregates due to compressed, in-memory columnar storage |
| Planning & Budgeting   | ![Circle]  | ![Half Circle] | Layers of aggregates in SAP BW impact planning on BW on Hana  
Limited write performance with columnar storage; |
| Unstructured Discovery | ![Circle]  | ![Half Circle] | No unstructured data support in Hana  
No discovery capabilities across unstructured & structured |
| Packaged Apps & BI Tools | ![Circle]  | ![Half Circle] | 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

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

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<td>Hardware: 1TB RAM</td>
<td>$135,000</td>
<td>$362,474*</td>
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<tr>
<td>In-Memory Database Software for 1TB RAM</td>
<td>$690,000</td>
<td>$3,750,000**</td>
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* IBM 7143-H2x + 7143-H3x Upgrade Option ** HANA Enterprise Edition
Summary
Oracle Exalytics

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