

ORACLE®

Safe Harbor Statement

The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, and timing of any features or functionality described for Oracle's products remains at the sole discretion of Oracle.

ORACLE®

Oracle Database In-Memory Option

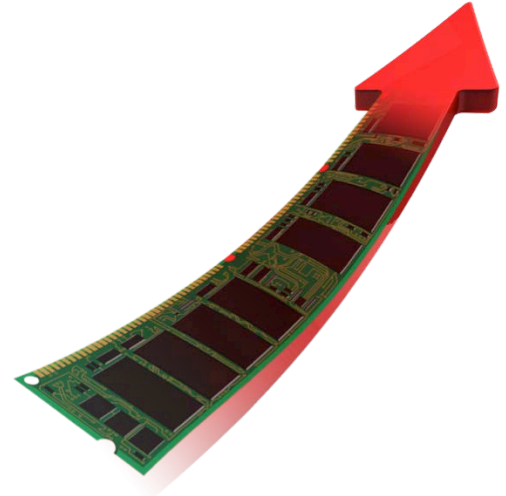
*Powering the Real-Time
Enterprise*



Available July 2014

Oracle Database 12c In-Memory Option Goals

- **100x** Faster Queries: Real-Time Analytics
 - Instantaneous Queries on OLTP Database **or** Data Warehouse
- Faster Mixed Workload OLTP
- **Transparent:** no application changes
 - Simple to Implement



Row Format Databases vs. Column Format Databases

Row



- **Transactions** run faster on row format
 - Example: Insert or query a sales order
 - Fast processing few rows, many columns

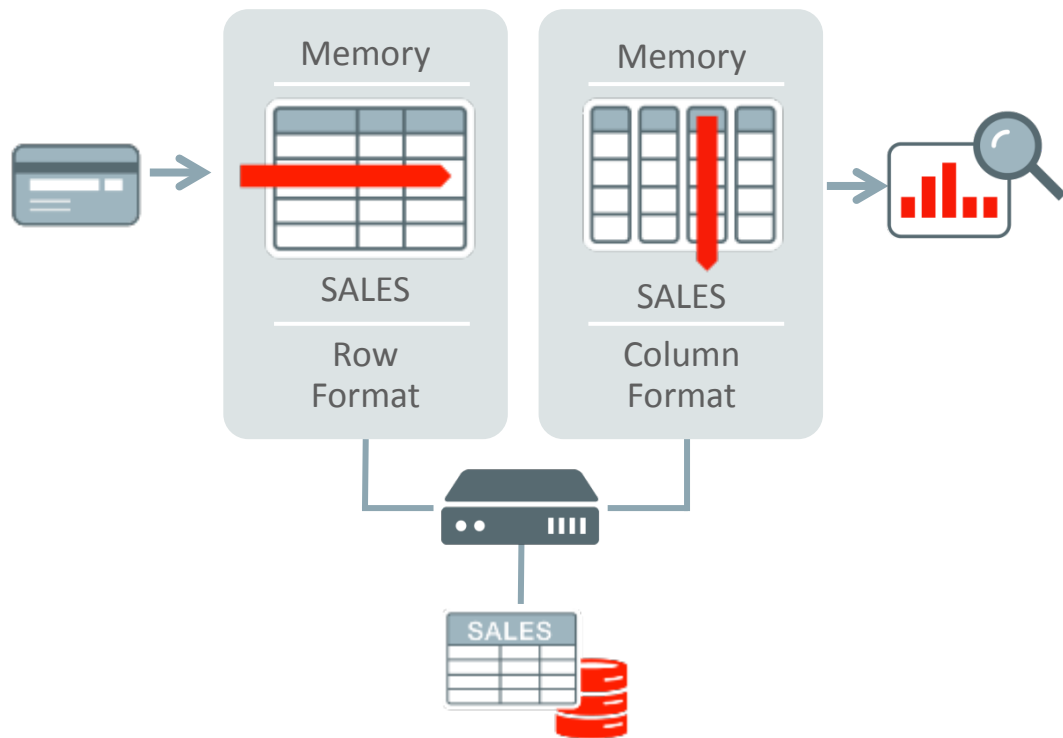
Column



- **Analytics** run faster on column format
 - Example : Report on sales totals by region
 - Fast accessing few columns, many rows

Until Now Must Choose One Format and Suffer Tradeoffs

Breakthrough: Dual Format Database

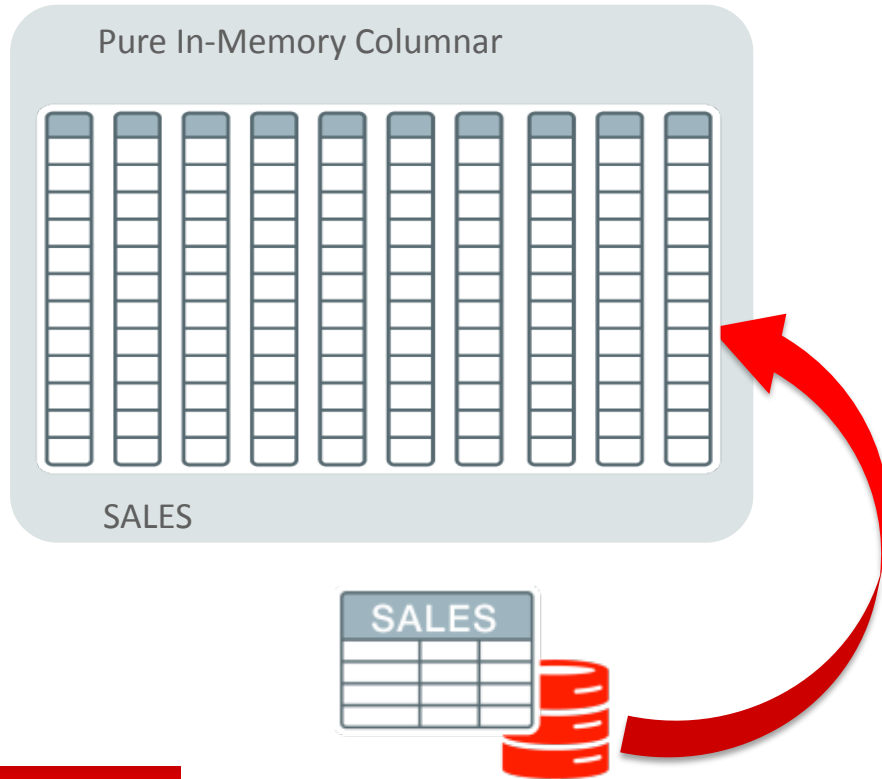


- **BOTH** row and column formats for same table
- Simultaneously active and transactionally consistent
- Analytics & reporting use new in-memory Column format
- OLTP uses proven row format

“Now we can run time-sensitive analytical queries directly against our OLTP database. This is something we wouldn’t have dreamt of earlier.”

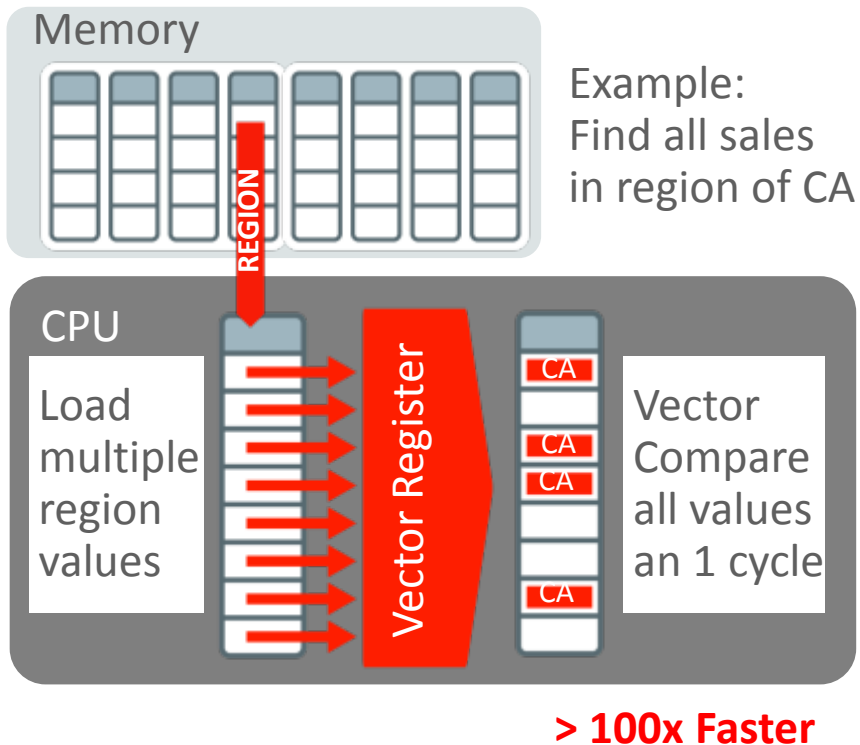
Arup Nanda
Enterprise Architect
Starwood Hotels and Resorts

Oracle In-Memory Columnar Technology



- Pure in-memory column format
 - Not persistent, and no logging
 - Quick to change data: fast OLTP
- 2x to 20x compression
- Enabled at table or partition level
- Available on all hardware platforms

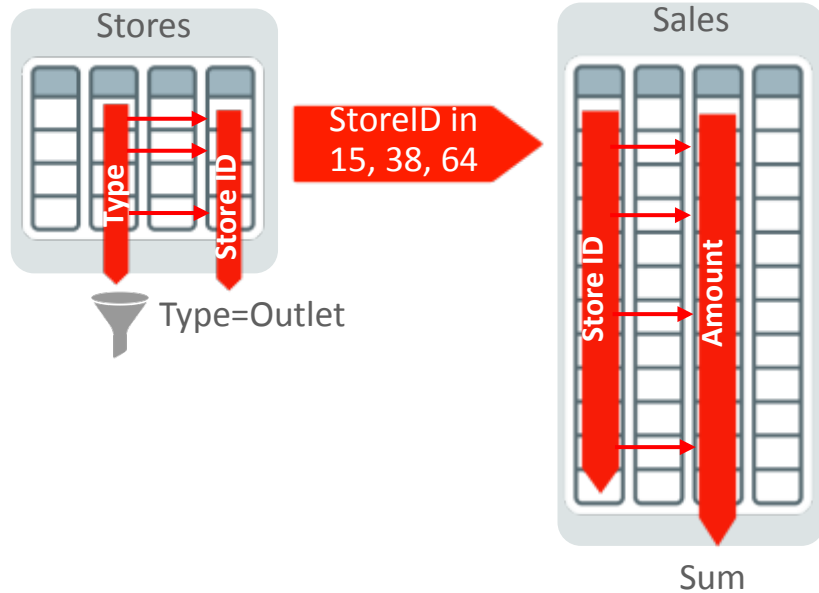
Orders of Magnitude Faster Analytic Data Scans



- Each CPU core scans local in-memory columns
- Scans use super fast SIMD vector instructions
 - Originally designed for graphics & science
- **Billions of rows/sec** scan rate per CPU core
 - Row format is millions/sec

Joining and Combining Data Also Dramatically Faster

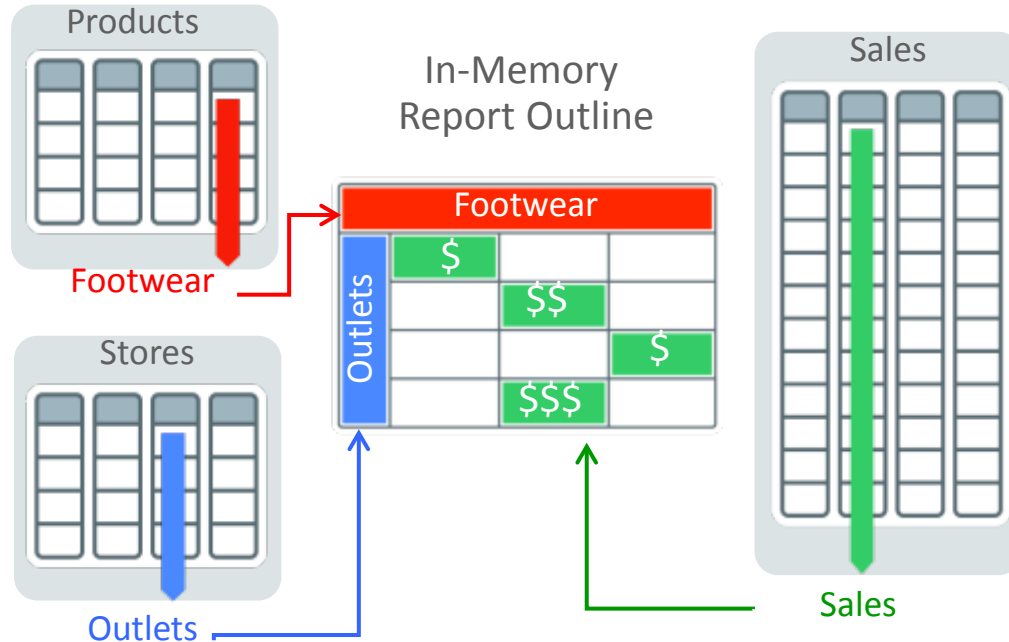
Example: Find total sales in outlet stores




- Converts joins of data in multiple tables into fast column scans
- Joins tables **10x** faster

Generates Reports Instantly

Example: Report sales of footwear in outlet stores



- Dynamically creates in-memory report outline
- Then report outline filled-in during fast fact scan
- Reports run much faster without predefined cubes



“Oracle Database In-Memory is a game changer for OLTP, DW, and mixed workloads. It dramatically improves the performance of all types of analytical queries.”

Liviu Horn

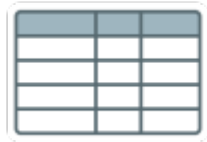
AVP Database Management
McKesson Health Solutions

McKESSON

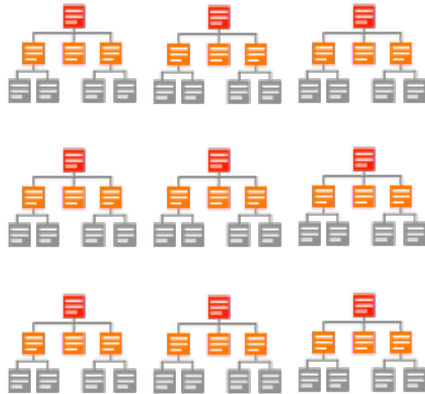
ORACLE

Complex OLTP is Slowed by Analytic Indexes

Table
1 – 3
OLTP
Indexes

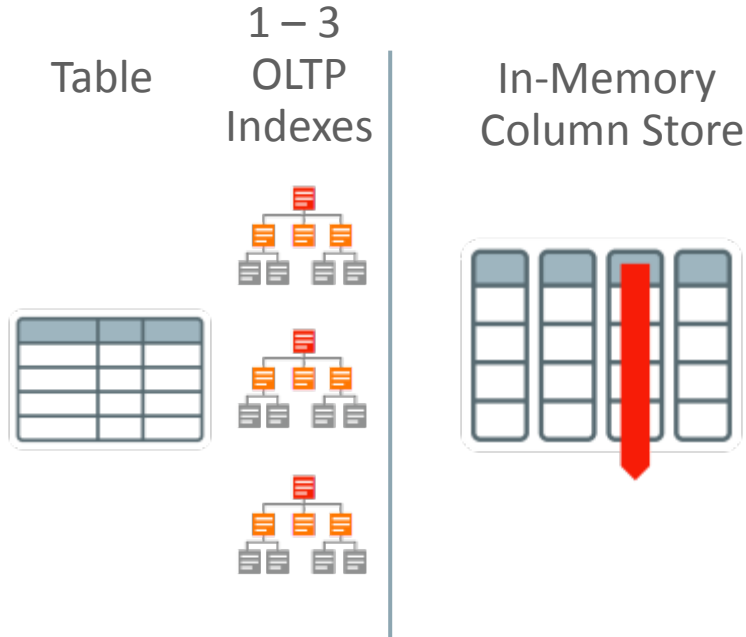


10 – 20
Analytic
Indexes

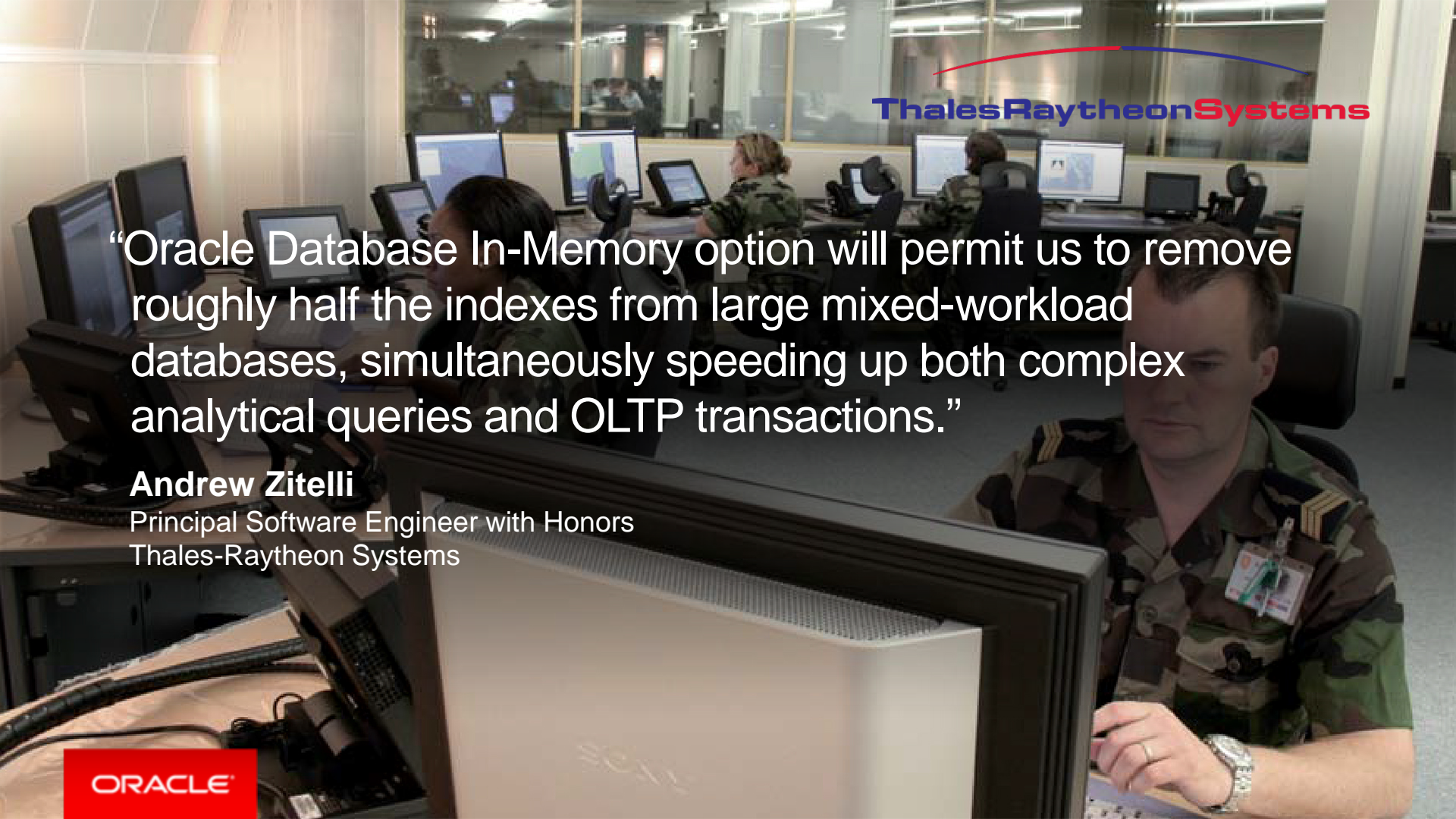


- Most Indexes in complex OLTP (e.g. ERP) databases are only used for analytic queries
- Inserting one row into a table requires updating 10-20 analytic indexes: **Slow!**
- Indexes only speed up predictable queries & reports

Column Store Replaces Analytic Indexes



- Fast analytics on any columns
 - Better for unpredictable analytics
 - Less tuning & administration
- Column Store not persistent so update cost is much lower
 - OLTP & batch run faster

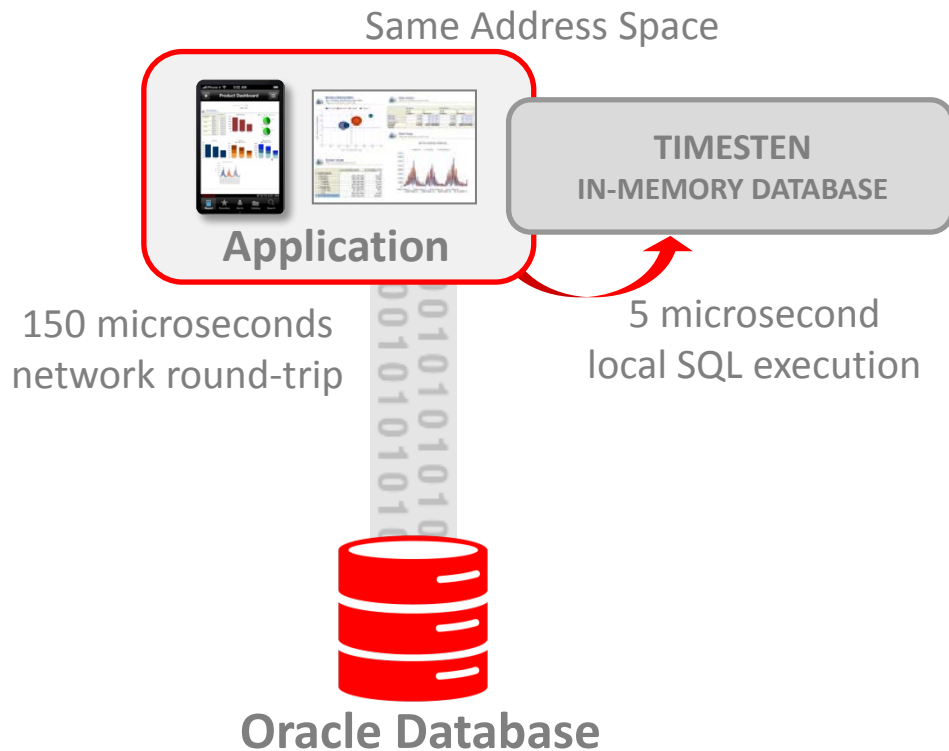


“Oracle Database In-Memory option will permit us to remove roughly half the indexes from large mixed-workload databases, simultaneously speeding up both complex analytical queries and OLTP transactions.”

Andrew Zitelli

Principal Software Engineer with Honors
Thales-Raytheon Systems

TimesTen for Latency-Critical OLTP Complementary In-Memory Technology



- Latency-Critical OLTP limited by network between application and database
 - Phone call routing, stock trading
- TimesTen In-Memory Database is light-weight and ultra-fast
 - Runs in application address space:
No Network
 - **30x** faster latency-critical OLTP

Scale-Out In-Memory Database to Any Size

- Scale-Out across servers to grow memory and CPUs
- In-Memory **queries parallelized** across servers to access local column data
- **Direct-to-wire** InfiniBand protocol speeds messaging



The background image shows a modern multi-story office building with large glass windows. In the foreground, there are three flagpoles with flags: the American flag, the Mexican flag, and a purple Yahoo! flag. A large purple sign with the word 'YAHOO!' and an upward-pointing arrow is visible, with the text 'Main Entrance Left at First Avenue' below it. The sky is blue with some clouds.

YAHOO!

“Full support for RAC scale-out means Oracle Database In-Memory can be used on our largest Data Warehouse, enabling more near real-time analytics.”

Sudhi Vijayakumar

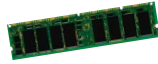
Senior Oracle DBA
Yahoo Inc.

ORACLE®

In-Memory Speed + Capacity of Low Cost Disk



DRAM



Hottest Data



PCI
FLASH



Active Data



DISK



Cold Data

- Size not limited by memory
- Data transparently accessed across tiers
- Each tier has specialized algorithms & compression
- **Speed** of DRAM
- **I/Os** of Flash
- **Cost** of Disk

Scale-Up for Maximum In-Memory Performance

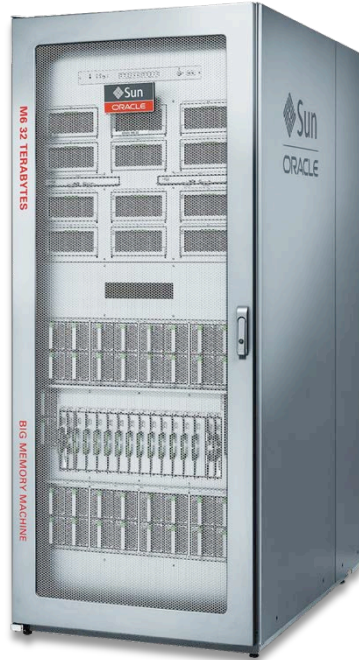
M6-32

Big Memory Machine

32 TB DRAM

32 Socket, 384 Cores

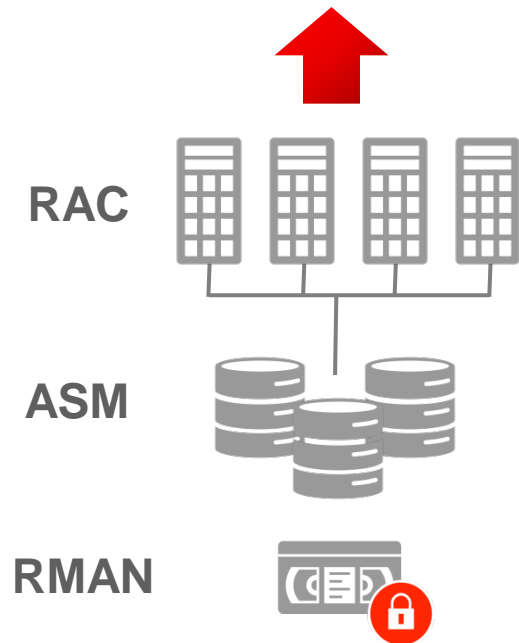
3 Terabyte/sec Bandwidth



- Scale-Up on large SMPs
- SMP scaling removes overhead of distributing queries across servers
- Memory interconnect far faster than any network

Oracle In-Memory: Industrial Strength Availability

Data Guard & GoldenGate



- Pure In-Memory format does not change Oracle's storage format, logging, backup, recovery, etc.
- All Oracle's proven availability technologies work transparently
- **Protection from all failures**
 - Node, site, corruption, human error, etc.

Oracle Database In-Memory: Unique Fault Tolerance



- Similar to storage mirroring
- Duplicate in-memory columns on another node
 - Enabled per table/partition
 - Application transparent
- Downtime eliminated by using duplicate after failure

“Downtime is extremely costly for our business. Oracle’s In-Memory architecture takes the right approach to balancing real-time speed with continuous availability.”

Jens-Christian Pokolm

Analyst IT-DB Architecture & Engineering
Postbank Systems AG

DER BRIEFKASTEN
FÜRS PAKET.

DHL

Oracle In-Memory: Simple to Implement

1. Configure Memory Capacity

- `inmemory_size = XXX GB`

2. Configure tables or partitions to be in memory

- `alter table | partition ... inmemory;`

3. Drop analytic indexes to speed up OLTP



“In terms of how easy the in-memory option was to use, it was actually almost boring. It just worked - just turn it on, select the tables, nothing else to do.”

Mark Rittman
Chief Technical Officer
Rittman Mead

rittmanmead



DELIVERED INTELLIGENCE

ORACLE®

Oracle In-Memory Requires Zero Application Changes

Full Functionality

- No restrictions on SQL

Easy to Implement

- No migration of data

Fully Compatible

- All existing applications run unchanged

Fully Multitenant

- Oracle In-Memory is Cloud Ready

ORACLE®
E-BUSINESS SUITE


ORACLE®
FUSION APPLICATIONS

ORACLE®
JD EDWARDS

ORACLE®
PEOPLESFT

ORACLE®
SIEBEL

Uniquely Achieves All In-Memory Benefits With No Application Changes



“Oracle Database In-Memory made our slowest financial queries faster out-of-the box; then we dropped indexes and things just got faster.”


Evan Goldberg

Co-Founder, Chairman, CTO

NetSuite Inc. **Ecommerce**



ORACLE

A low-angle photograph of a modern, multi-story office building with a curved facade and large glass windows. The building is primarily red brick with grey metal framing around the windows. The MicroStrategy logo is visible on the upper part of the building. The sky is blue with scattered white clouds.

“The combination of MicroStrategy with Oracle Database In-Memory will enable dramatically better and faster decision-making for our customers.”

Paul Zolfaghari
President
MicroStrategy Inc.

MicroStrategy

ORACLE®



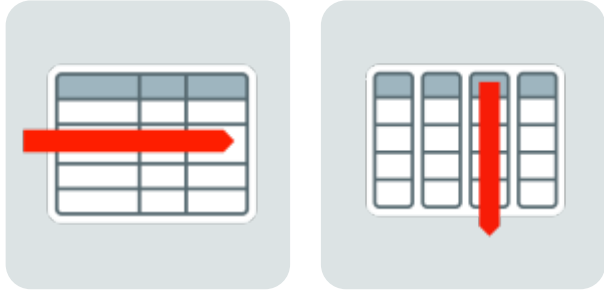
Oracle Applications



Oracle Database In-Memory

From Batch to
Real-Time

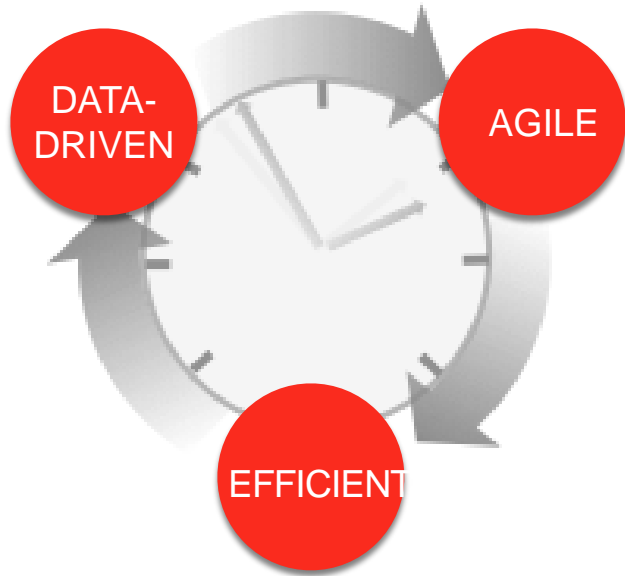
Keys to Real-Time Data Processing



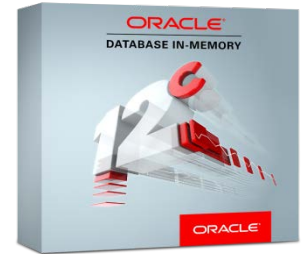
- **Process data in database not application**
- **Process sets of rows using SQL**
 - Row by row processing is slow and cannot be parallelized
- **Enable in-memory column format**
- **Enable parallel SQL**
 - Memory removes storage bottlenecks enabling highly parallel SQL

Summary: Oracle Database In-Memory

Powering the Real-Time Enterprise



- **Extreme Performance: Analytics & OLTP**
- **Extreme Scale-Out & Scale-Up**
- **Extreme Availability**
- **Extreme Simplicity**



ORACLE®

DATABASE IN-MEMORY



ORACLE®

ORACLE®

Hardware and Software **Engineered to Work Together**

ORACLE®