

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

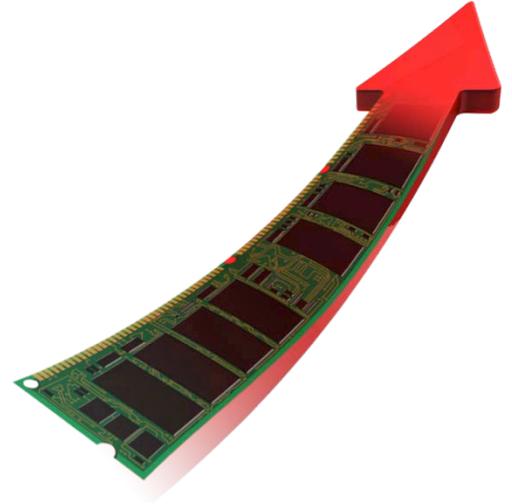
*Powering the Real-Time
Enterprise*



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

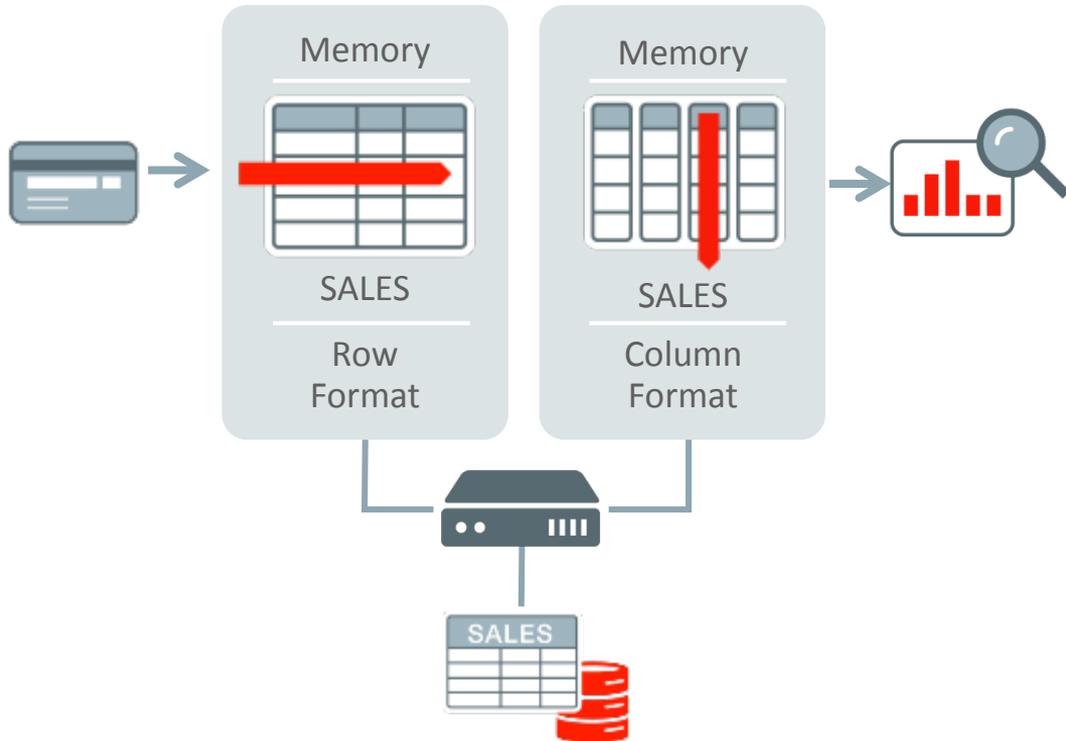
Column



- **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

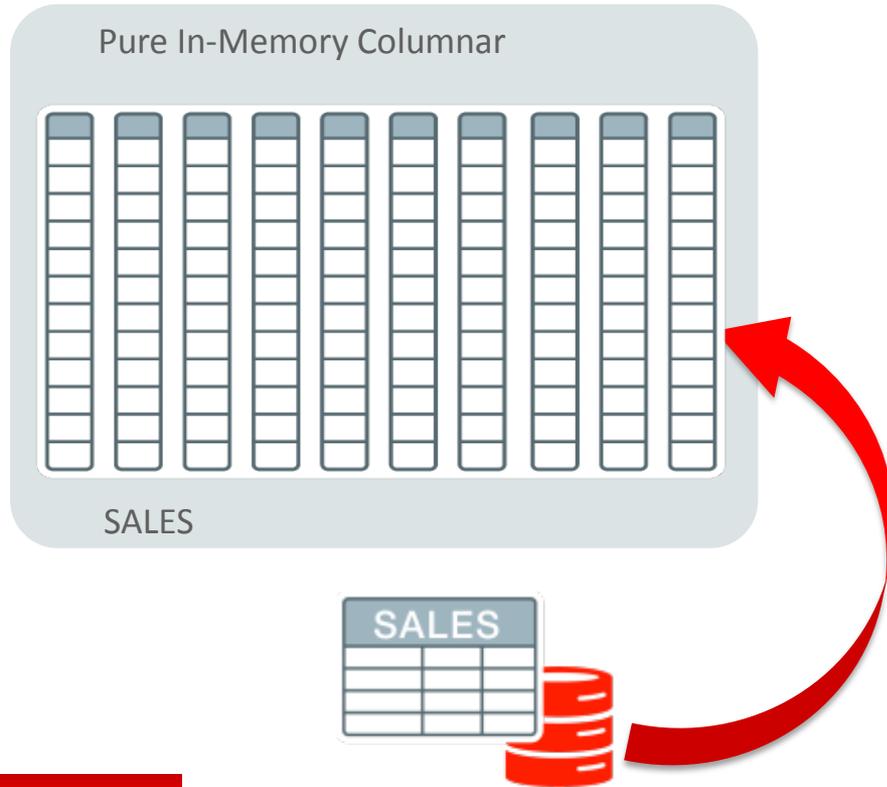


- **BOTH** row and column formats for same table
- Simultaneously active and transactionally consistent
- Analytics & reporting use new in-memory Column format
- OLTP uses proven row format

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

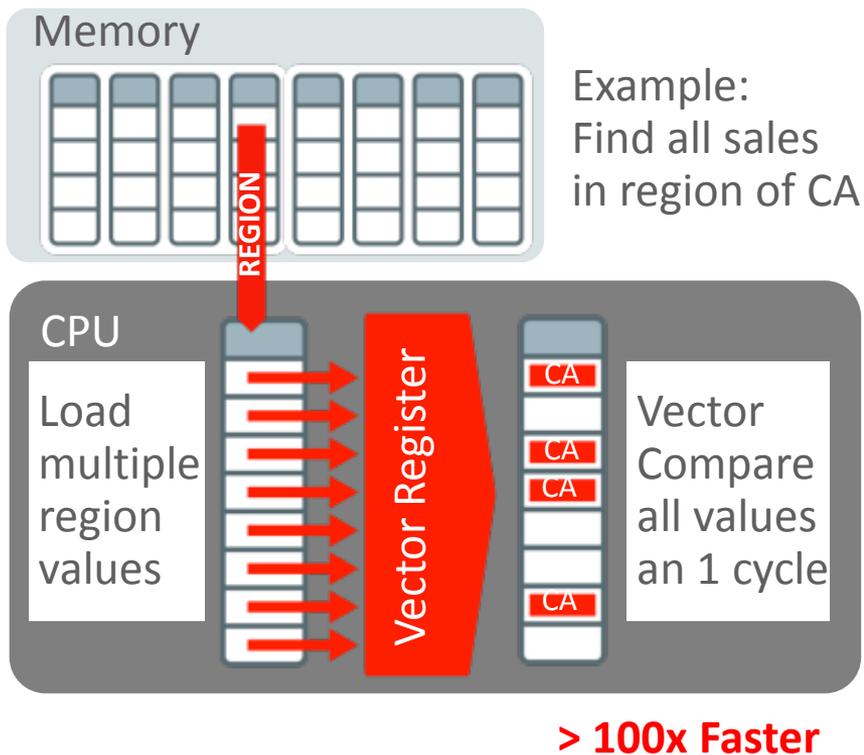
Arup Nanda
Enterprise Architect
Starwood Hotels and Resorts

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

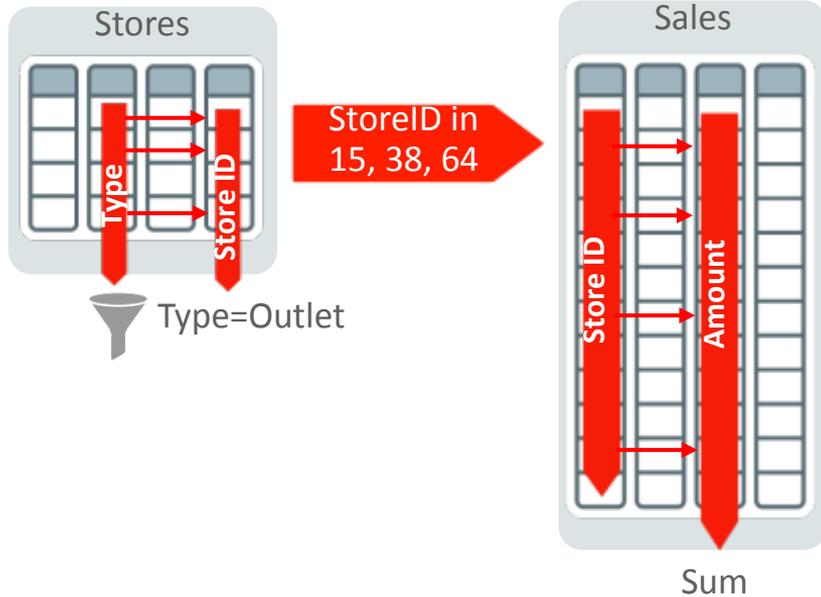
Orders of Magnitude Faster Analytic Data Scans



- 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

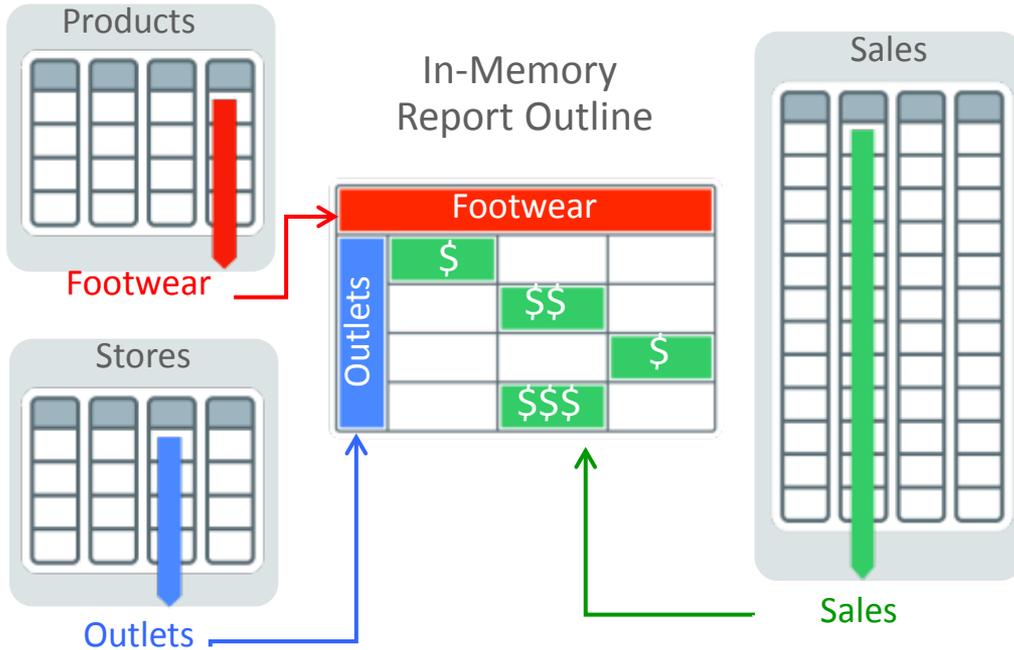
Example: Find total sales in outlet stores



- 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.”

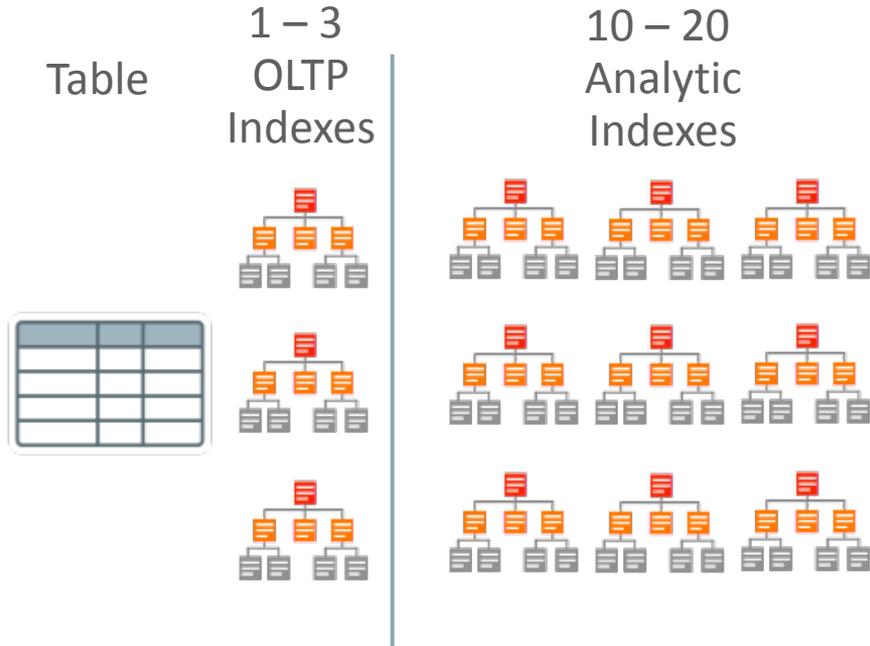
Liviu Horn

AVP Database Management
McKesson Health Solutions

McKESSON

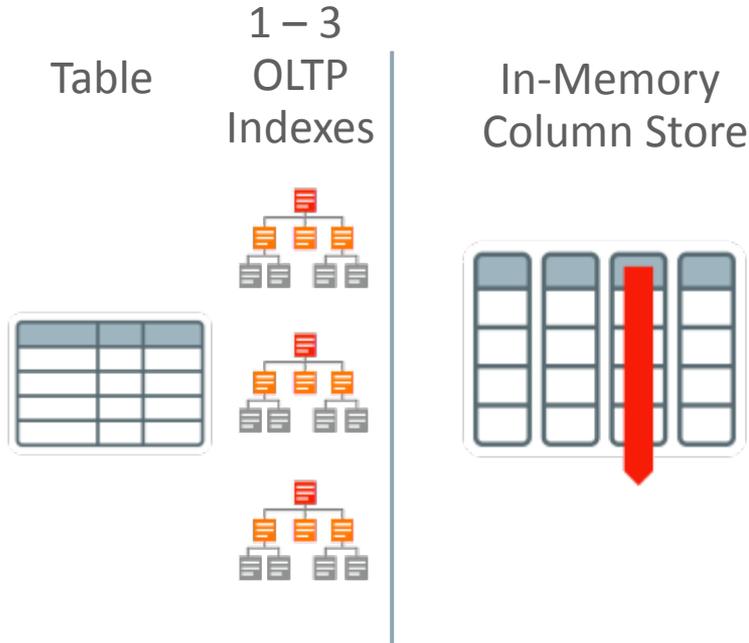
ORACLE

Complex OLTP is Slowed by Analytic Indexes

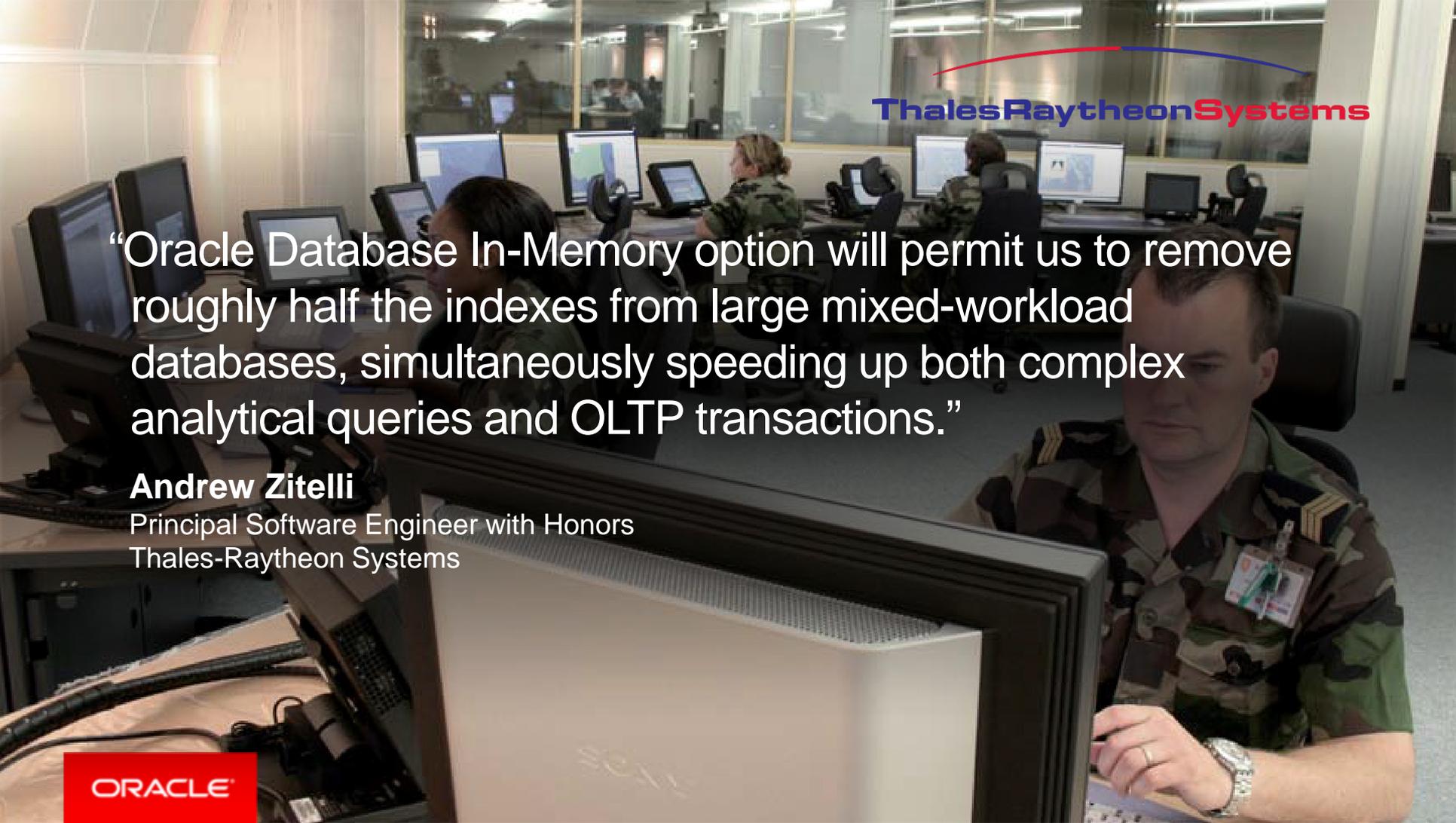


- Most Indexes in complex OLTP (e.g. ERP) databases are only used for analytic queries
- Inserting one row into a table requires updating 10-20 analytic indexes: **Slow!**
- Indexes only speed up predictable queries & reports

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

A control room with several operators in military uniforms working at computer workstations. The room is dimly lit, with the primary light source being the computer monitors. The operators are focused on their screens, which display various data and maps. The background shows a large window looking out onto a brightly lit area, possibly an airport or a large facility.

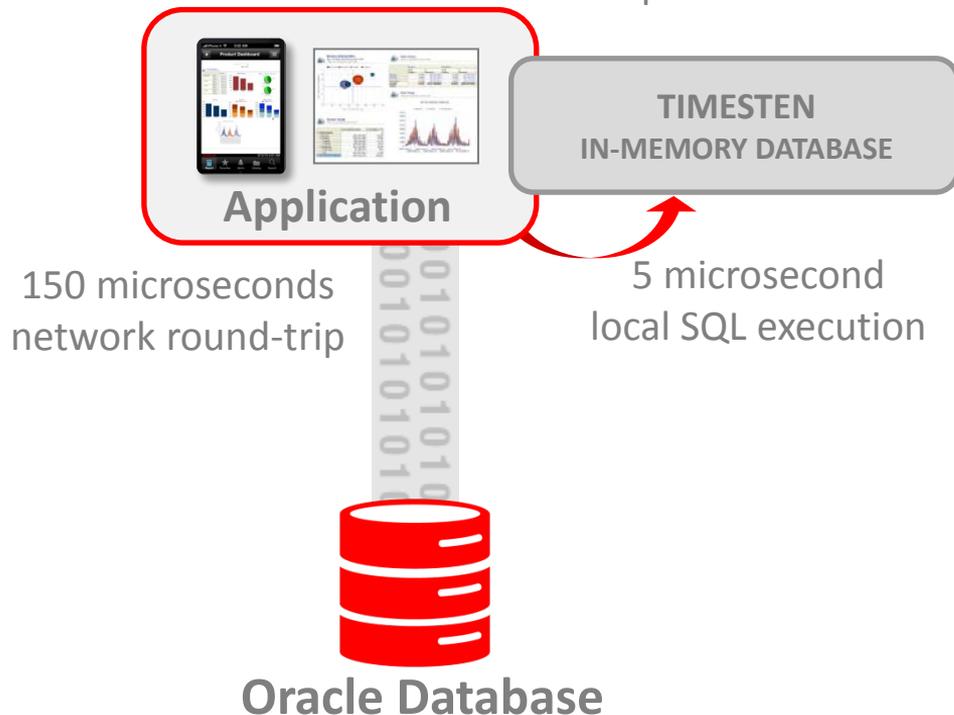
“Oracle Database In-Memory option will permit us to remove roughly half the indexes from large mixed-workload databases, simultaneously speeding up both complex analytical queries and OLTP transactions.”

Andrew Zitelli

Principal Software Engineer with Honors
Thales-Raytheon Systems

TimesTen for Latency-Critical OLTP Complementary In-Memory Technology

Same Address Space

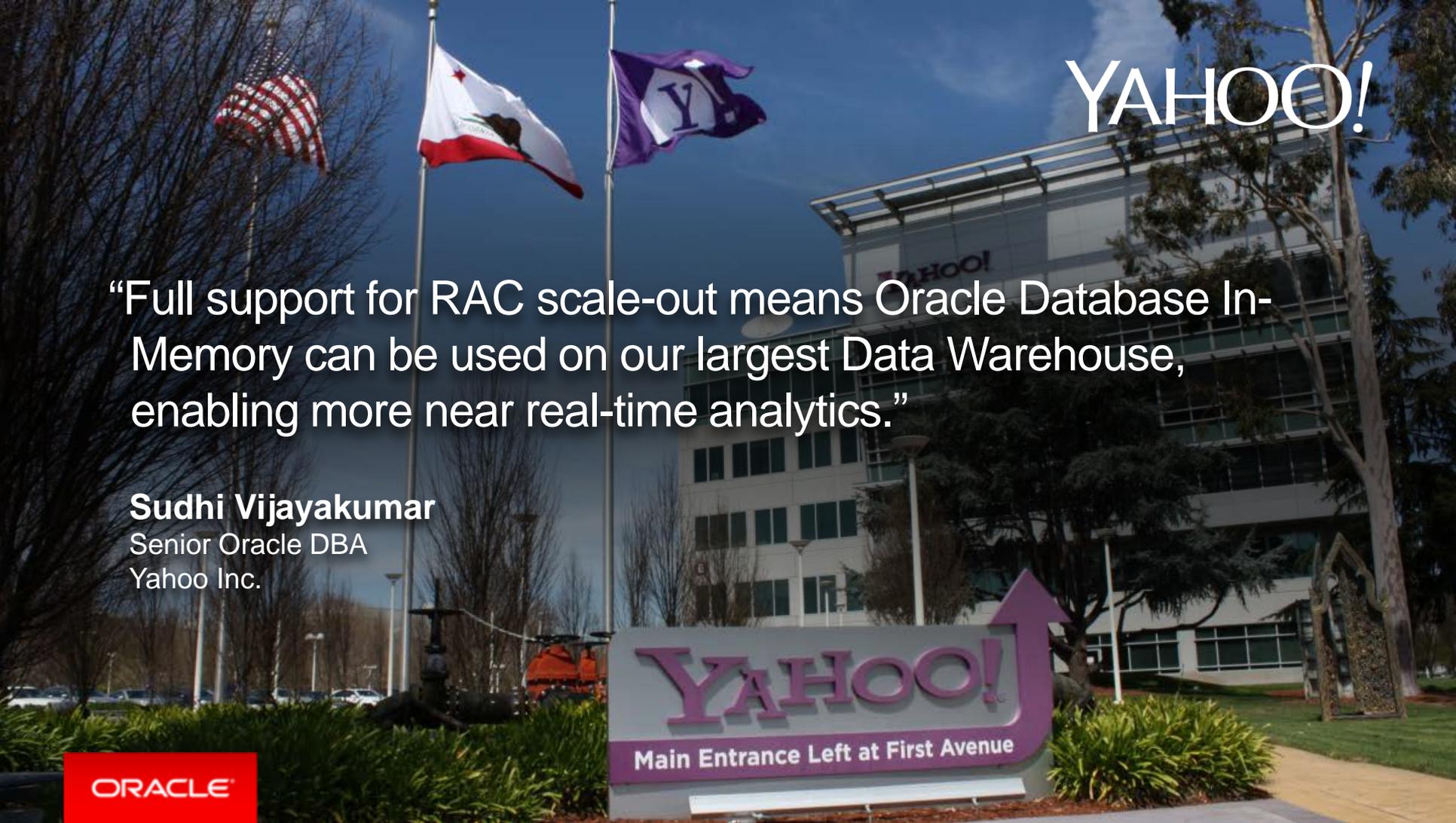


- Latency-Critical OLTP limited by network between application and database
- Phone call routing, stock trading
- TimesTen In-Memory Database is light-weight and ultra-fast
- Runs in application address space:
No Network
- **30x** faster latency-critical OLTP

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



A photograph of a modern, multi-story office building with a glass facade. In the foreground, three flagpoles stand against a clear blue sky. From left to right, they hold the United States flag, the Mexican flag, and a purple flag with a white 'Y' logo. In the bottom left corner, there is a red rectangular logo with the word 'ORACLE' in white. In the bottom right corner, there is a large purple arrow pointing upwards, containing the word 'YAHOO!' in white, with the text 'Main Entrance Left at First Avenue' below it.

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

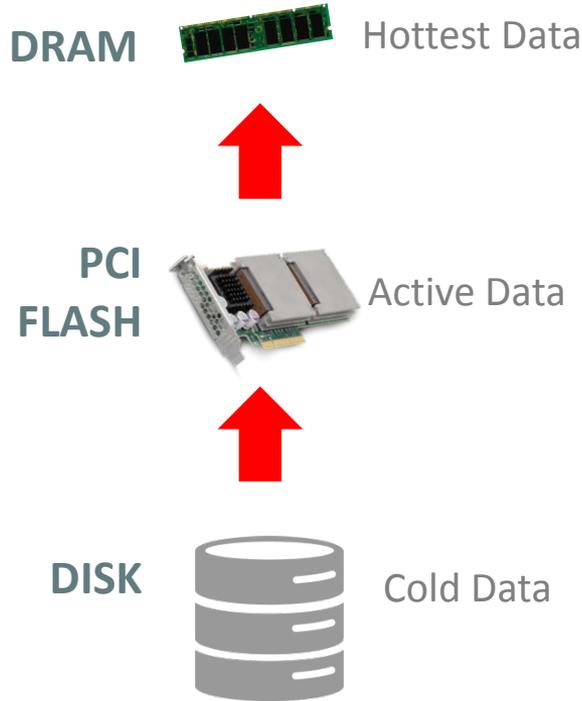
Yahoo Inc.

ORACLE

YAHOO!

Main Entrance Left at First Avenue

In-Memory Speed + Capacity of Low Cost Disk



- 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

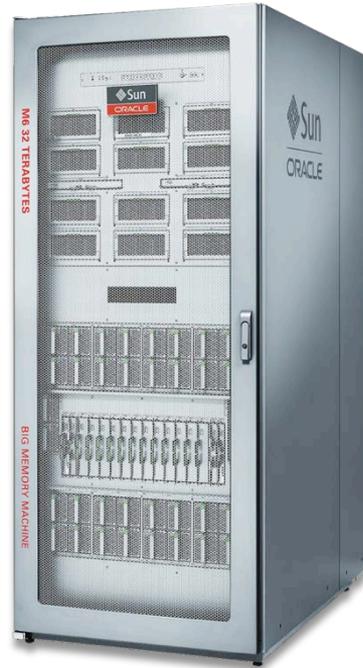
M6-32

Big Memory Machine

32 TB DRAM

32 Socket, 384 Cores

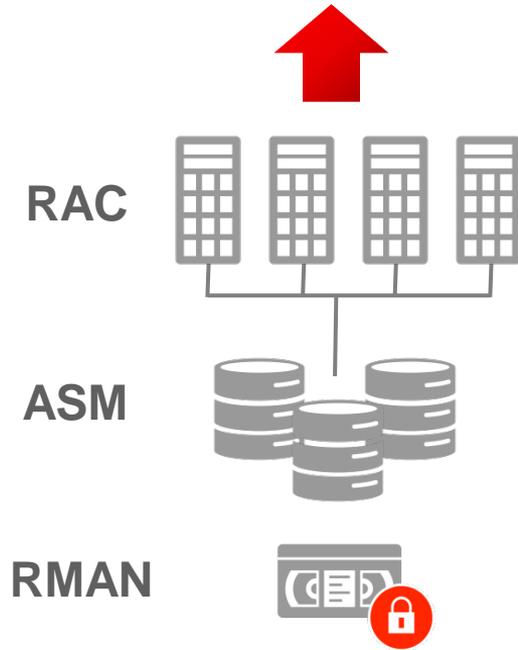
3 Terabyte/sec Bandwidth



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

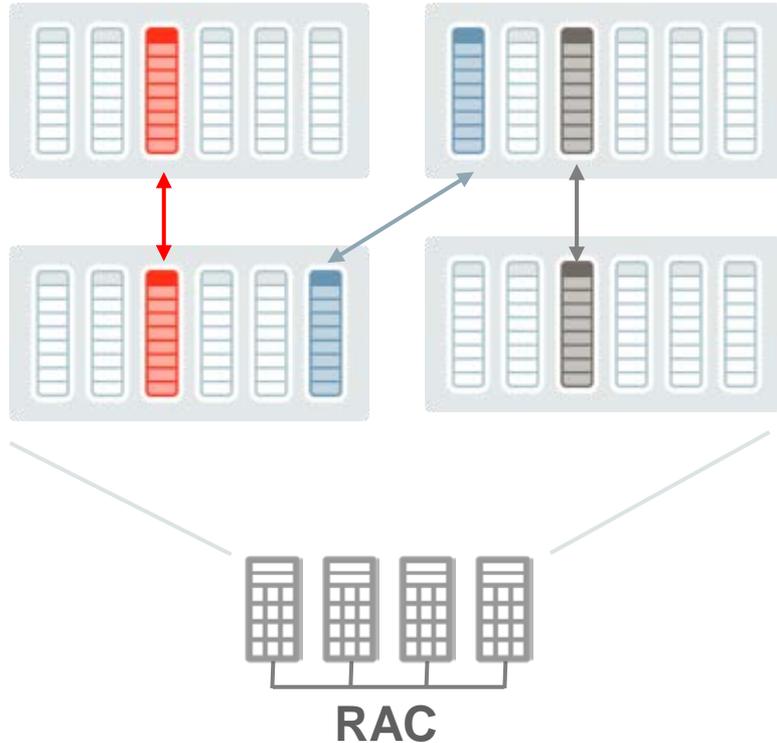
Oracle In-Memory: Industrial Strength Availability

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



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®

PEOPLESOFT

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



The Oracle logo, consisting of the word 'ORACLE' in white, uppercase, sans-serif font on a red rectangular background.

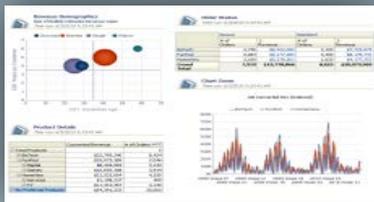
A photograph of a modern, multi-story office building with a curved facade and large glass windows. The building is primarily brick with a glass curtain wall section. The MicroStrategy logo is visible on the upper part of the building. The sky is blue with scattered white clouds.

“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



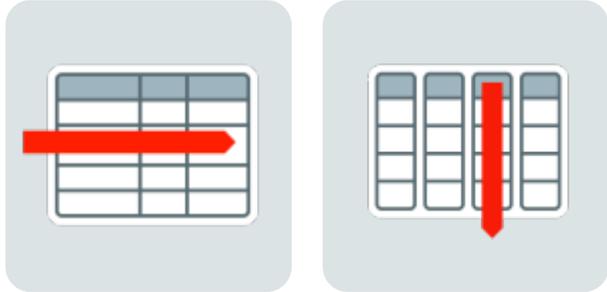
Oracle Applications



From Batch to
Real-Time

Oracle Database In-Memory

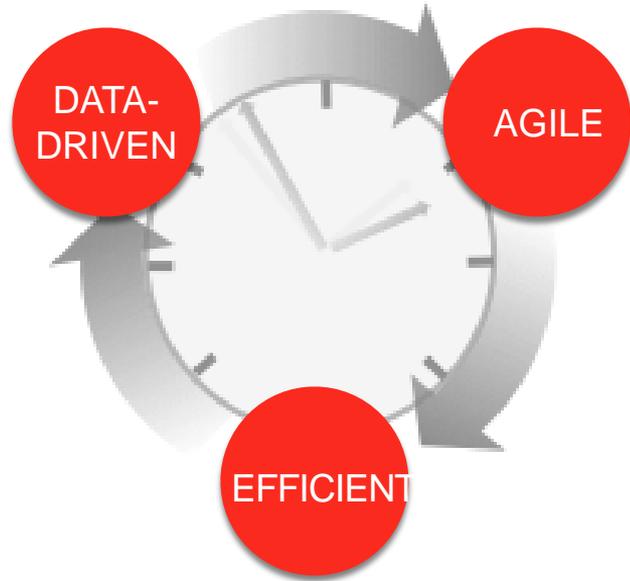
Keys to Real-Time Data Processing



- **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®