ORACLE

Oracle In-Memory Database Cache Overview

Simon Law
Product Manager

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.
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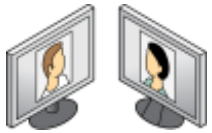
Enabling The Real-Time World

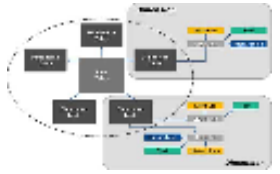
Authorization, Online Charging, Location-Based Services

eCommerce, Personalization, Real-Time Ad Serving



Market Data, Market Events, Order Matching, Trading

Real-Time Data Mart



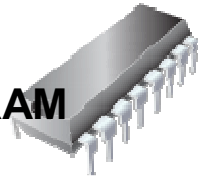
Real-Time Applications

Instantly Responsive / Highly Scalable / Always-On

Mainstream 64-bit Processors

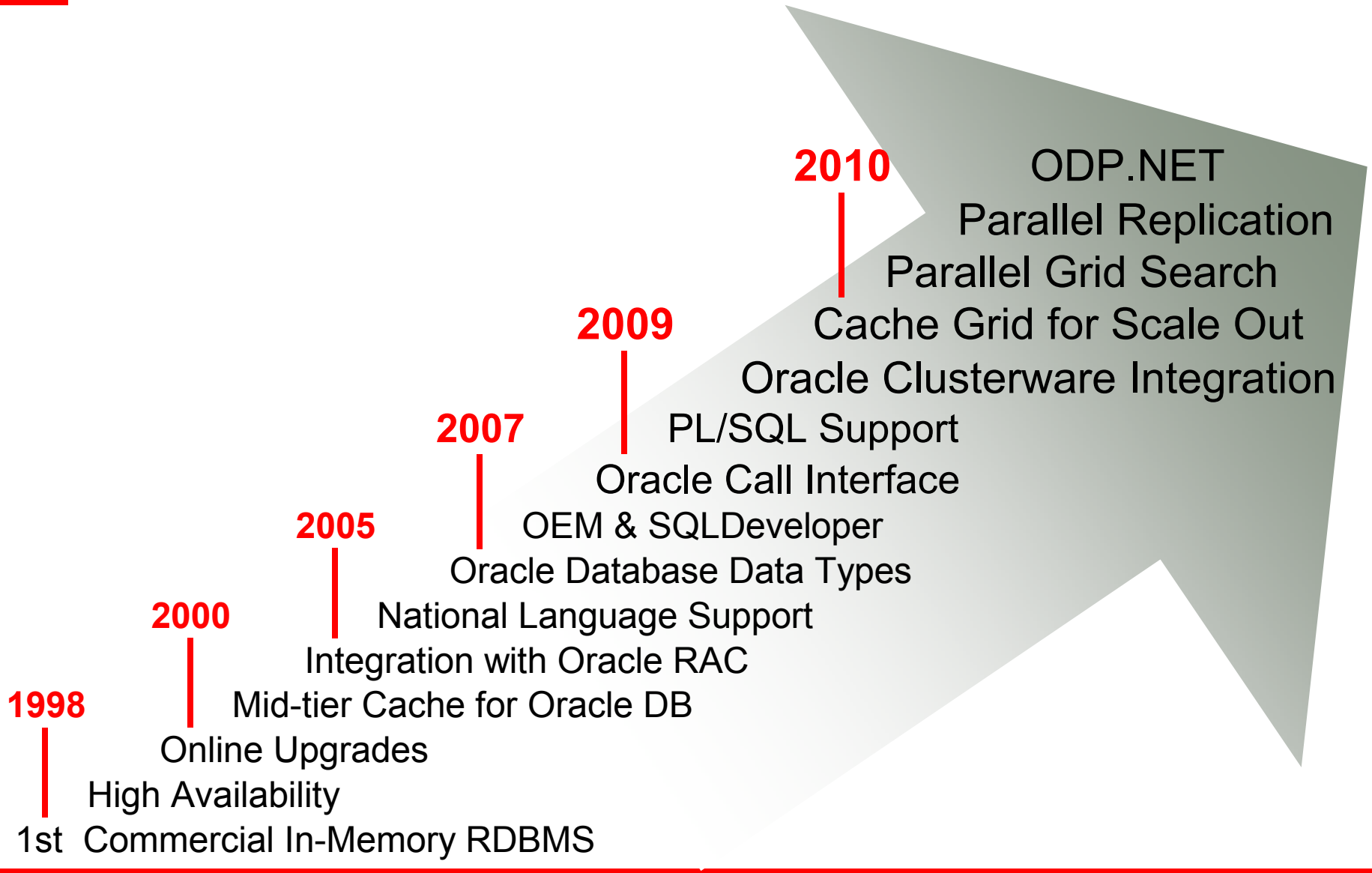
Fast Networks

Large Capacity RAM



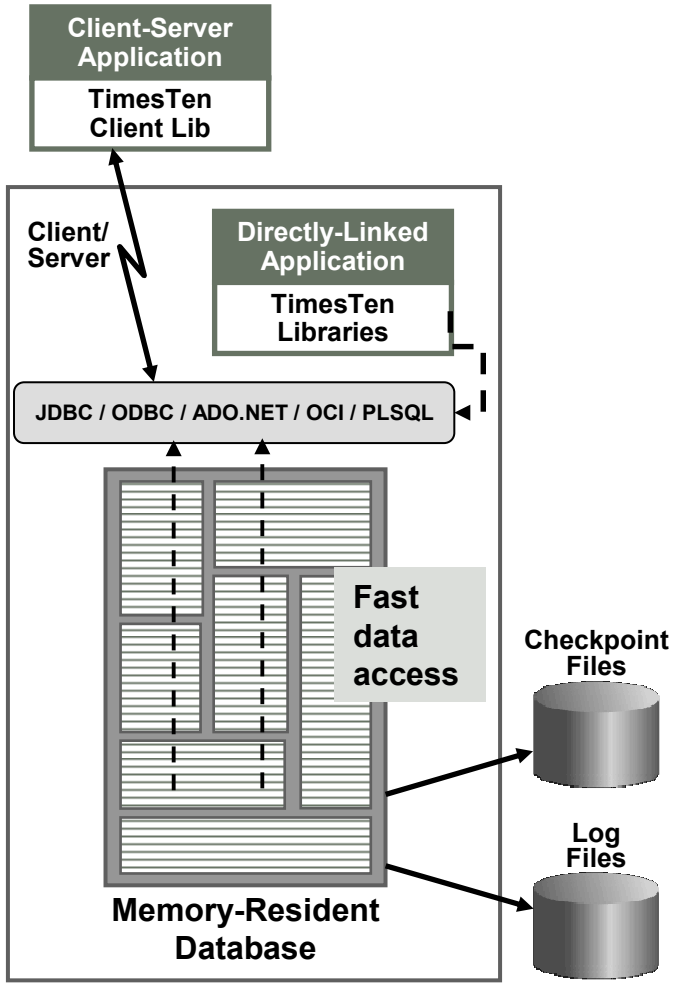
Key Enabling Technology

TimesTen Evolution



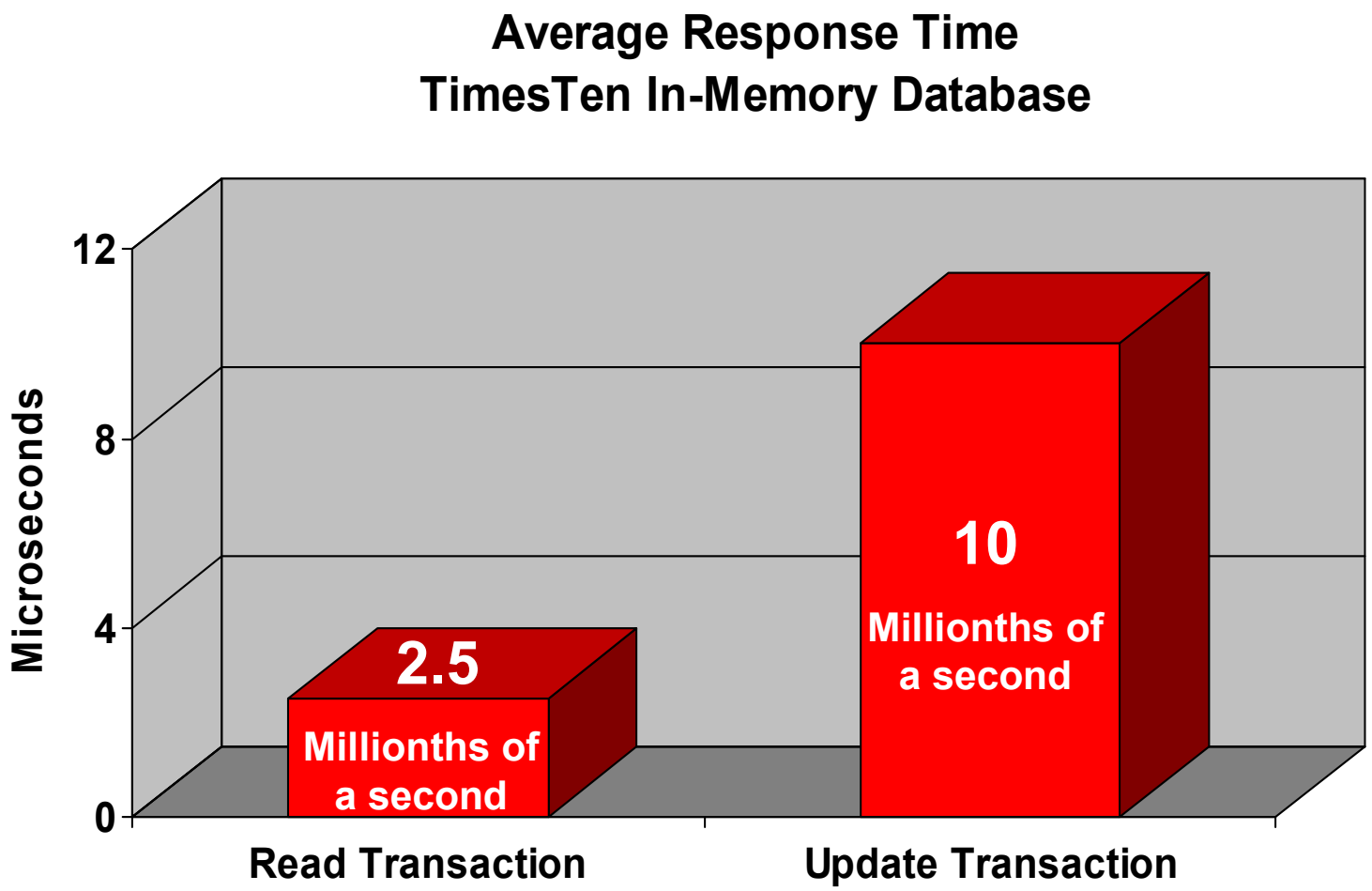
Oracle TimesTen In-Memory Database

Memory-Optimized Relational Database



- In-memory RDBMS
  - Optimized for memory structures
- Exceptional performance
  - Low latency response time
  - High throughput
  - Embeddable
- Persistent and durable
  - Transactions and checkpoints persisted to disk storage
- Standard SQL and PL/SQL
  - JDBC, ODBC, ADO.NET, OCI, Pro*C
  - Compatible with Oracle Database

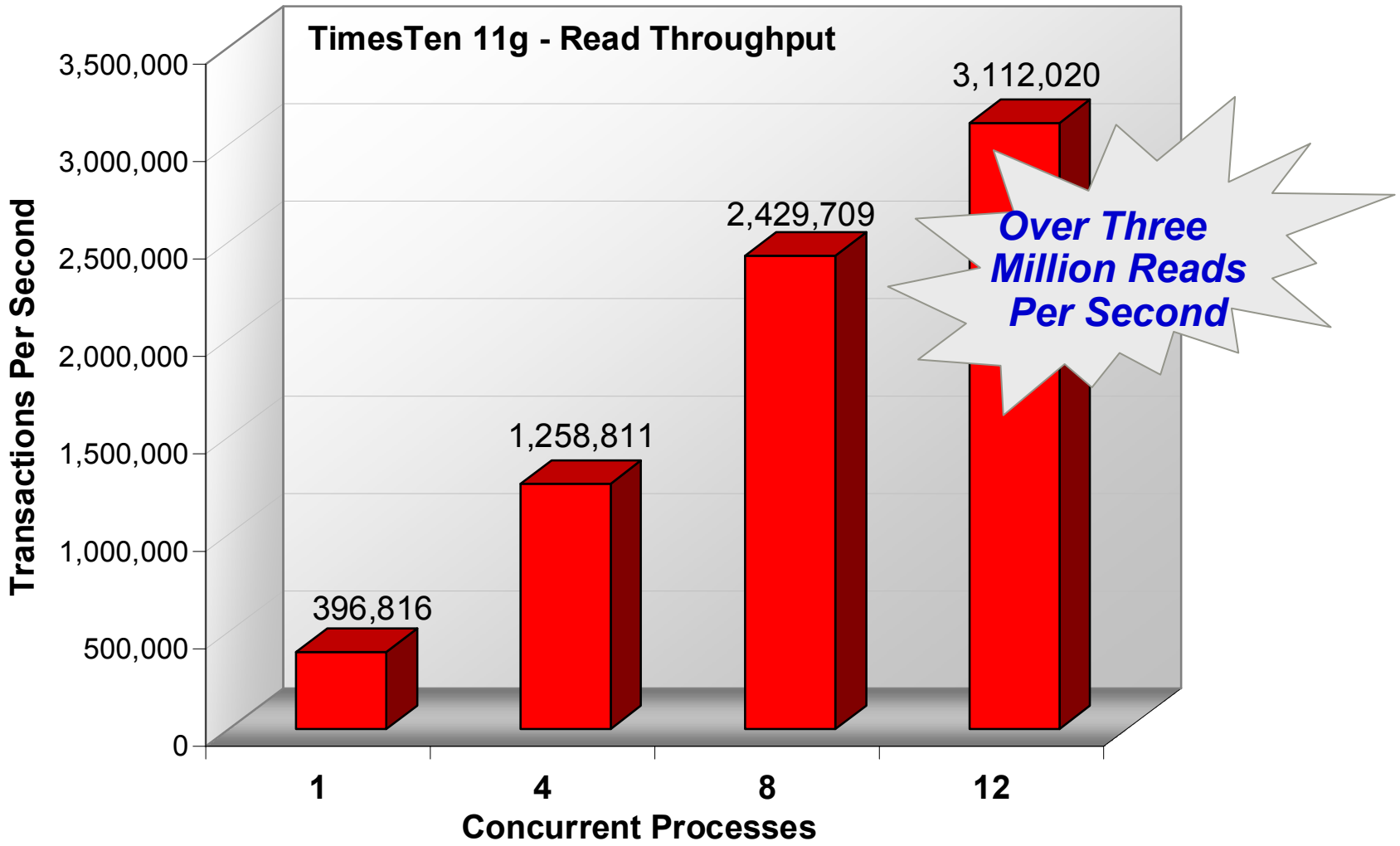
Lightning Fast Response Time



Oracle TimesTen In-Memory Database 11g – Intel Xeon 5670, 2 CPUs, 6 cores/CPU – Solaris 10

TimesTen 11g – Read Throughput Scaling

Scale Up on Multi-Processor / Multi-Core Hardware

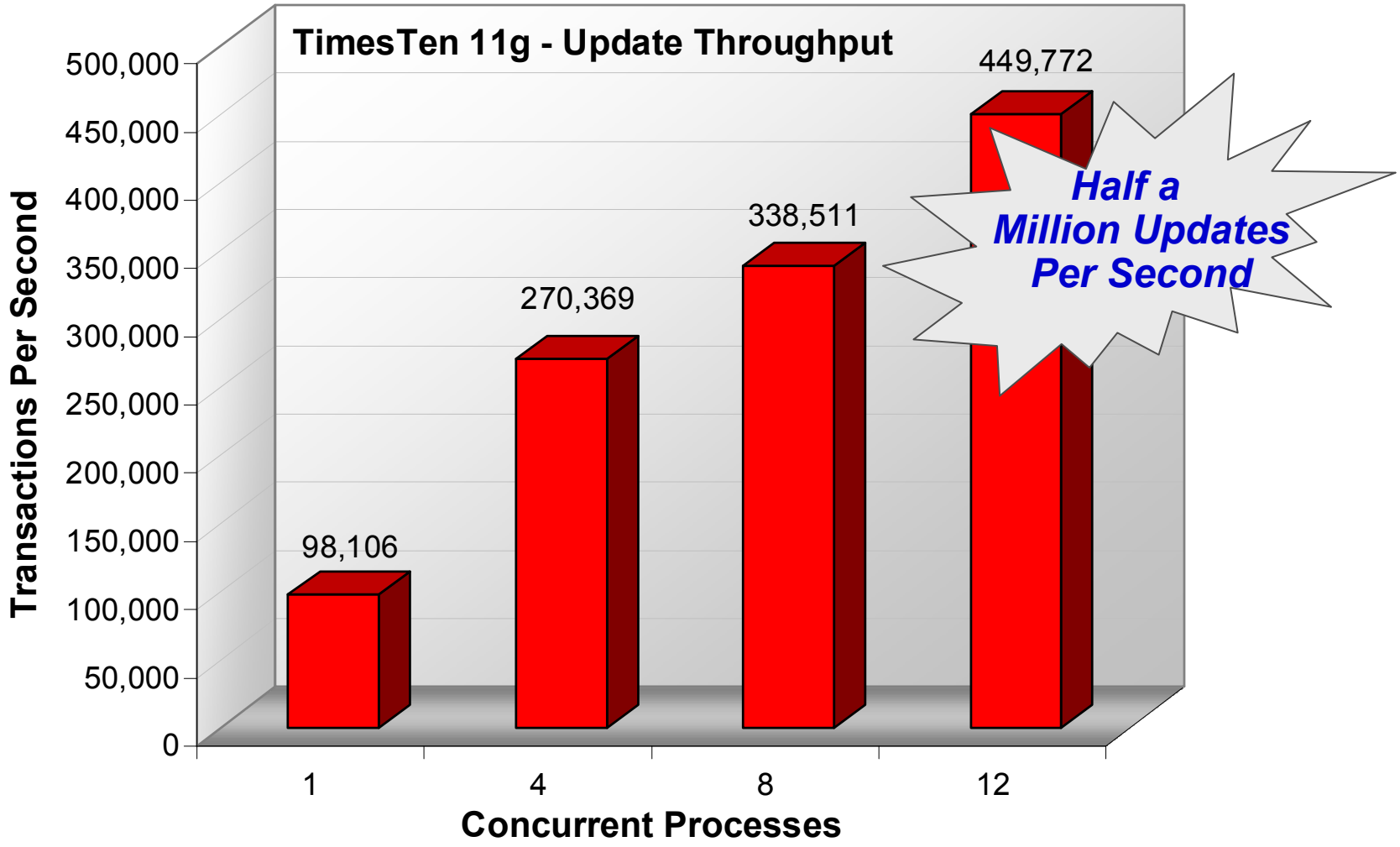


ORACLE

Oracle TimesTen In-Memory Database 11g, Sun Fire 4270 M2, Dual 6-Core Intel Xeon 5670 (2.93 GHz) on Solaris 10

TimesTen 11g – Write Throughput Scaling

Scale Up on Multi-Processor / Multi-Core Hardware

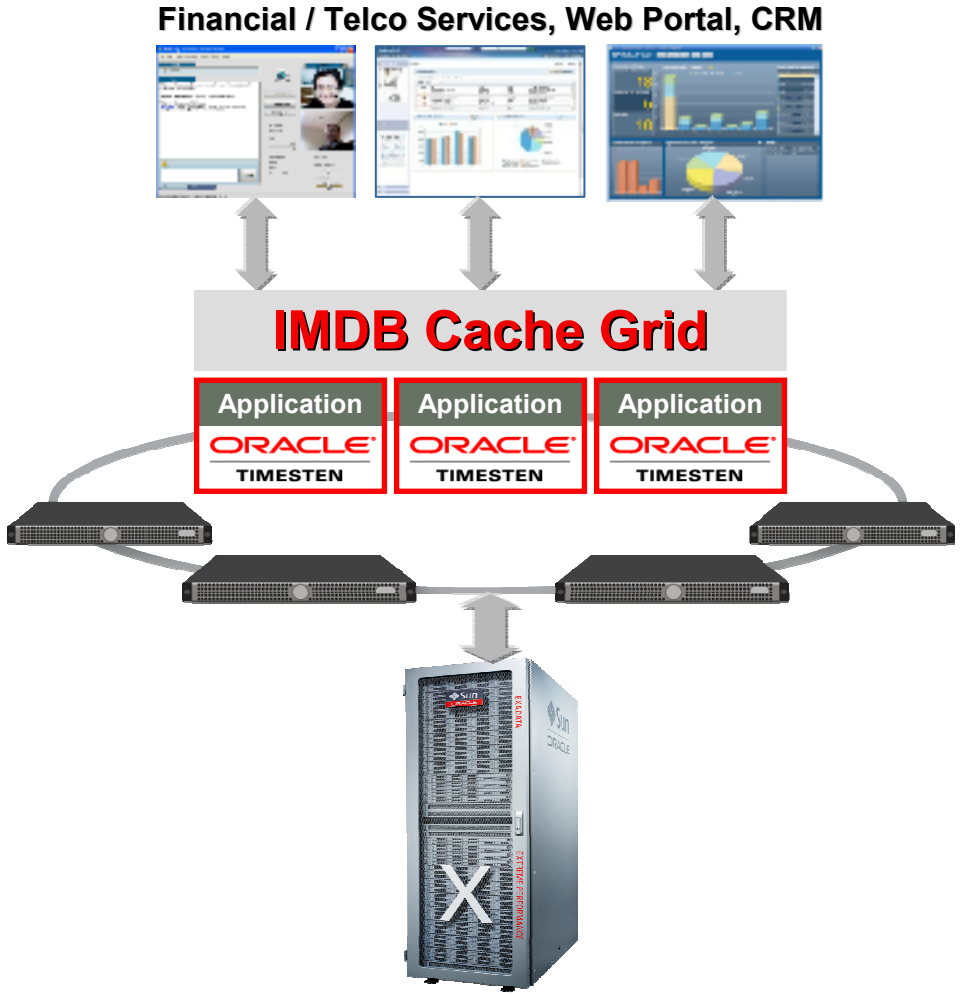


Oracle TimesTen In-Memory Database 11g, Sun Fire 4270 M2, Dual 6-Core Intel Xeon 5670 (2.93 GHz) on Solaris 10

TimesTen In-Memory Database Demo

Oracle In-Memory Database Cache

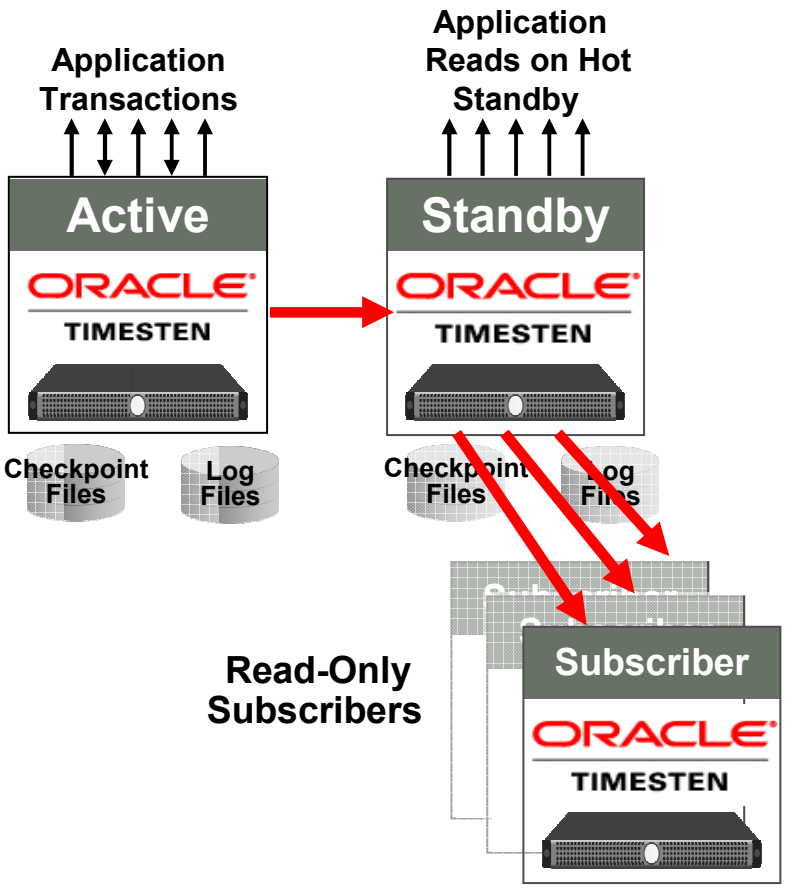
Accelerates Oracle Database Applications



- Runs in the middle-tier
- Caches subset of Oracle DB
- Full featured in-memory RDBMS with standard SQL and PL/SQL
- Accelerates applications with micro-second response time
- Scale up on SMP
- Scale out on commodity hardware
- Read/write caching
- Cached data pre-loaded or loaded on demand
- Automatic synchronization with Oracle DB
- Built-in high availability

Persistence and Real-Time Replication

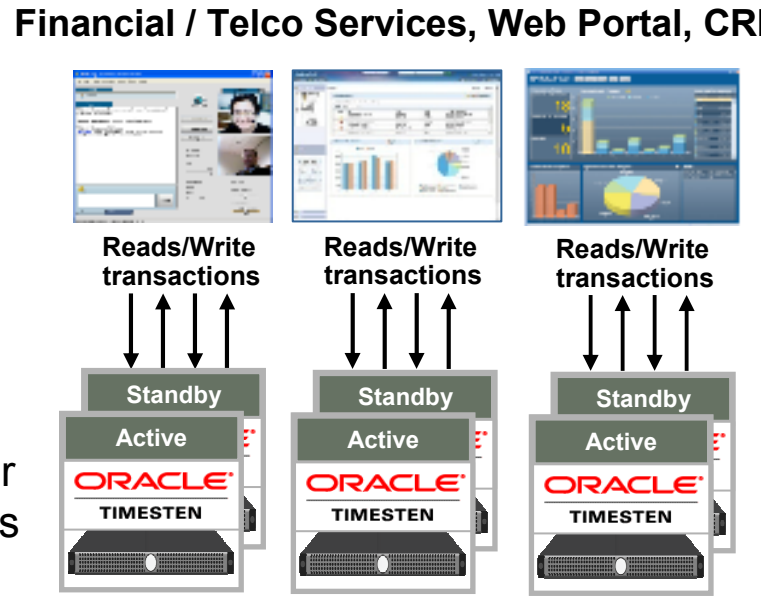
High Availability, Low-Latency, On-Line Upgrades



- Real-time transactional replication
- High performance
  - Asynchronous and Synchronous
- Multiple topologies, including
  - Active Standby Pair
  - Optional read-only subscribers
- Robust and reliable
  - LAN and WAN configurations
  - Data compression
- Online upgrades → zero downtime

TimesTen In-Memory Database

In-memory RDBMS for real-time applications

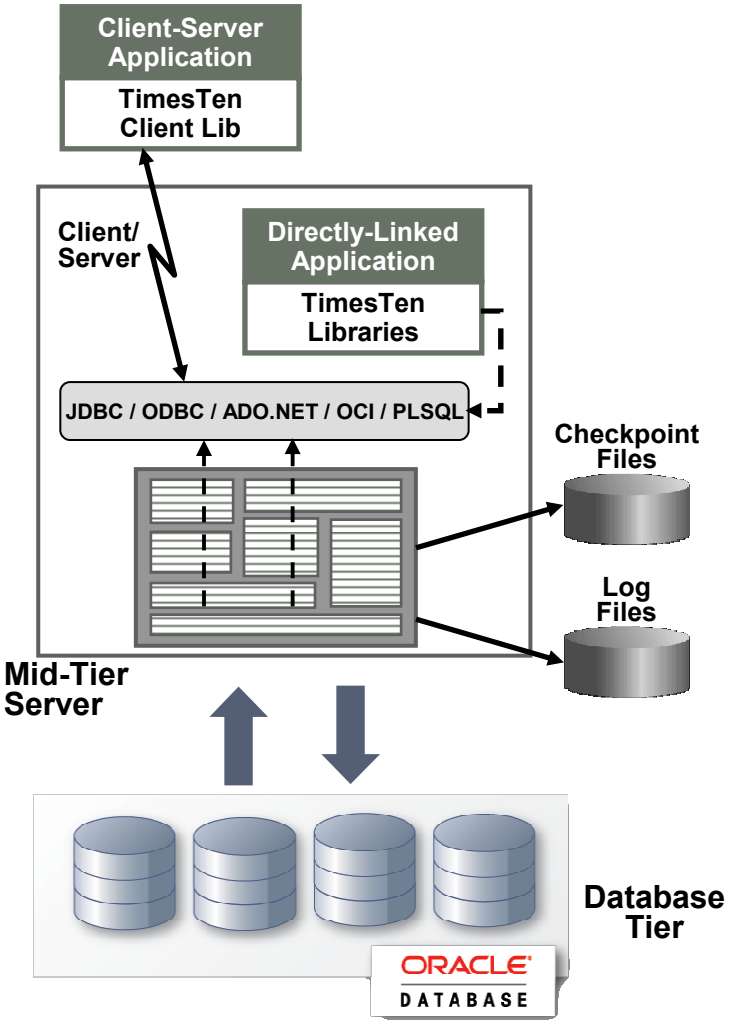


- Deployed in mid-tier
- Exceptional performance
  - Low latency response time
- Scalability
  - Grow with the application
- High availability
  - Fast replication
- Minimal changes to the applications
  - Standard SQL, no rewrite
  - Leverage existing skill sets

What If .. you already have an existing Oracle Database?

How to enable your application to use the in-memory technology?

Oracle In-Memory Database Cache

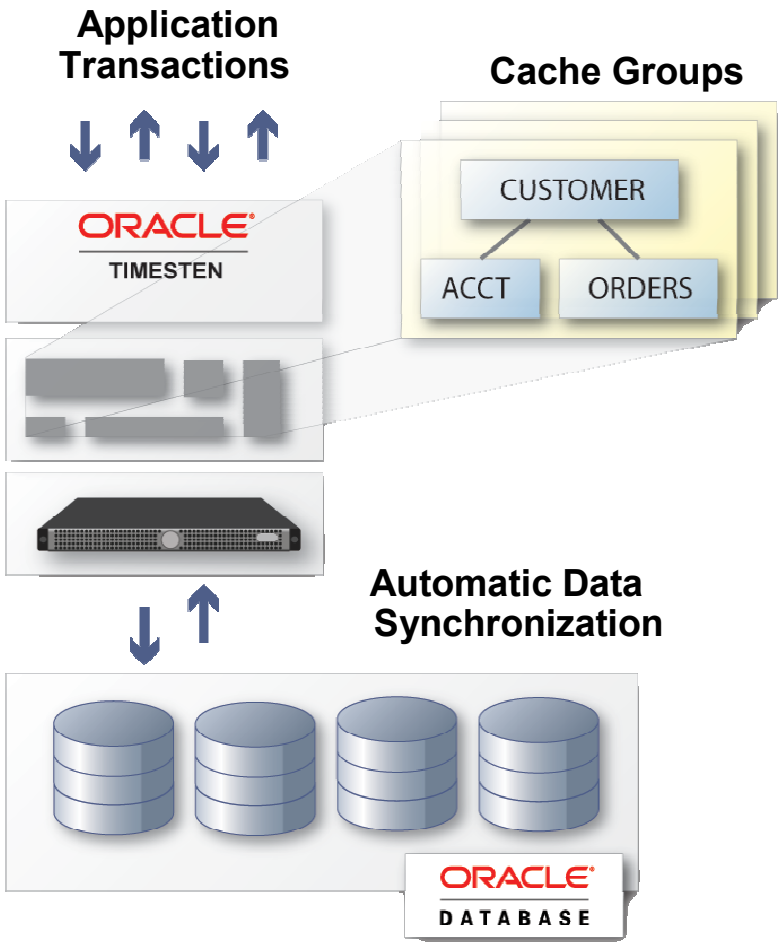


- Cache subset of Oracle Database tables in TimesTen
- Applications access cache tables like regular relational tables
  - Standard SQL with JDBC, ODP.NET, ODBC, OCI, Pro*C, PL/SQL
- Read-only and read/write cache tables
  - Transactions with ACID properties
  - Persistent and durable
- Automatic data synchronization with the Oracle database

* Direct-linked = In-process

In-Memory Database Cache

Flexible Cache Group Configurations



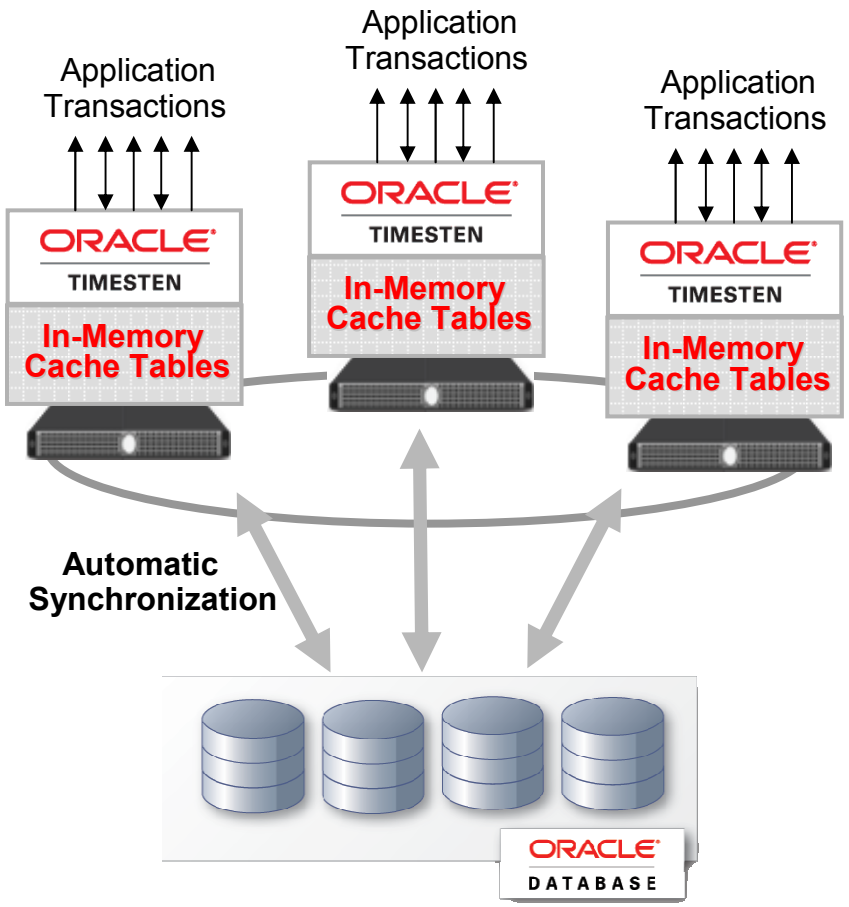
- ***Cache Group*** describes the data in the Oracle database to cache
- Groups of related tables
  - All or subset of rows and columns
  - Defined via SQL clause

```
CREATE CACHE GROUP
FROM   owner.tab1 (col1, col2),
       owner.tab2 (col1, col4)
...
WHERE <predicate>
```

- Cache tables are regular database tables in TimesTen
  - Joins/search, insert/update/delete

Read-Write Cache

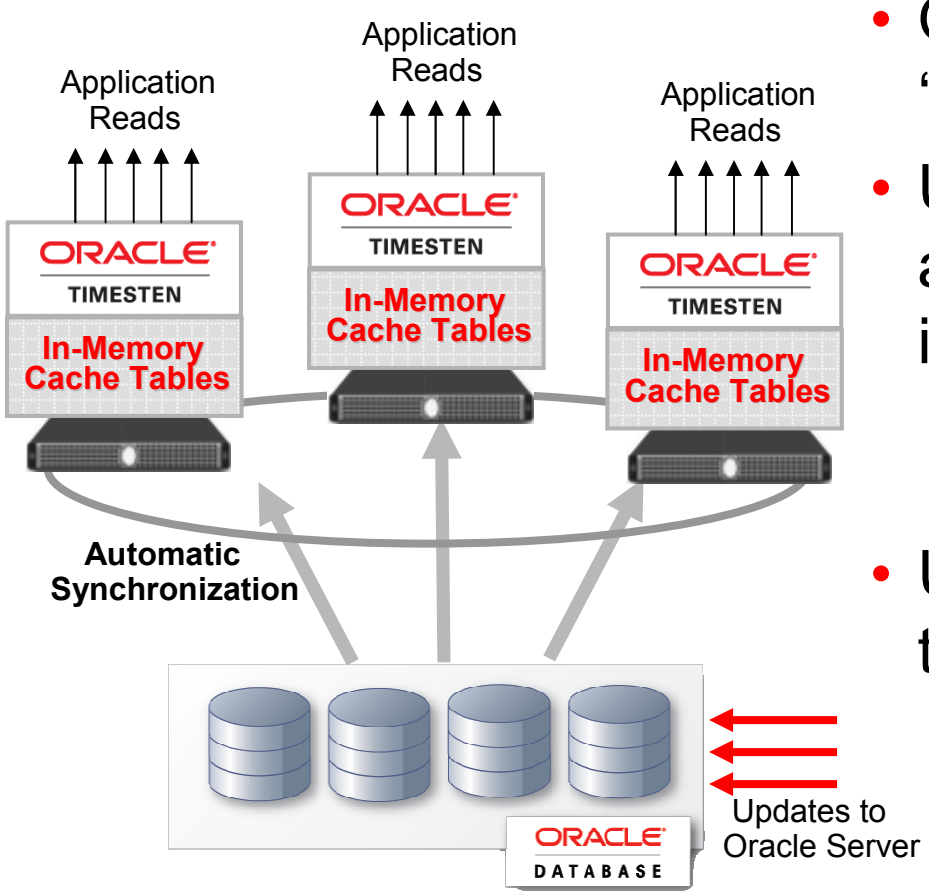
With Transactional Consistency



- TimesTen database is the 'master'
- Transactions executed in TimesTen
- Committed transactions write-through to Oracle database
  - Asynchronous write-through yields better response time and throughput

Read-only Cache

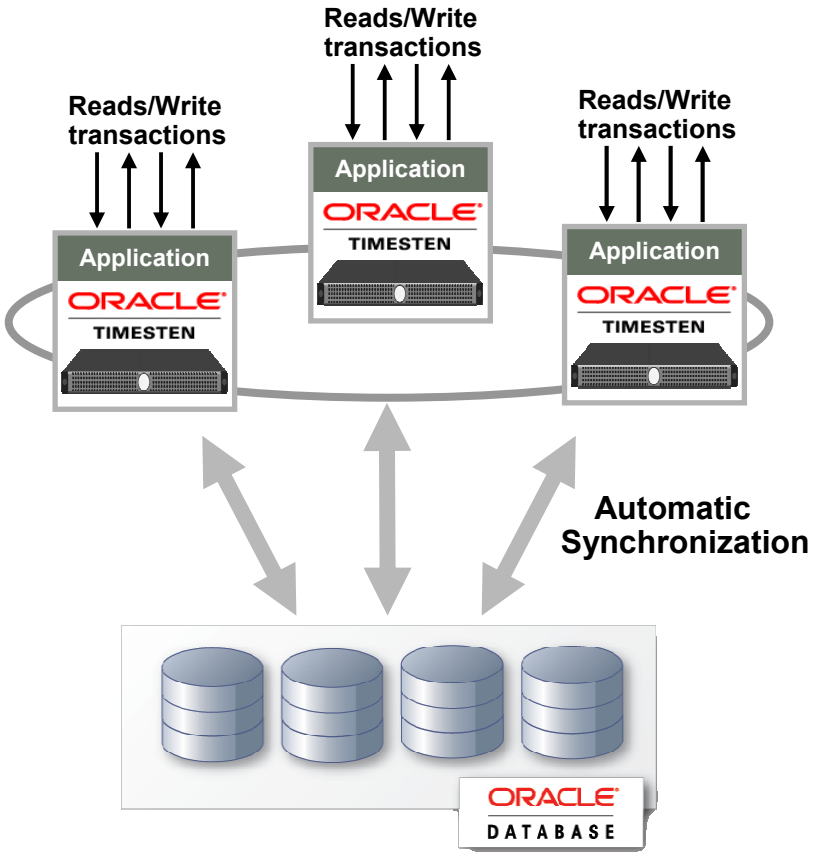
For Frequently Queried Data



- Oracle database is the 'master'
- Updates in Oracle automatically refreshed to the in-memory cache tables
  - Refresh frequency (interval) configurable
- Updates to read-only cache tables disallowed
  - May use pass-through to directly update the Oracle database

Globally Shared Caches

Horizontal Scaling on Commodity Hardware



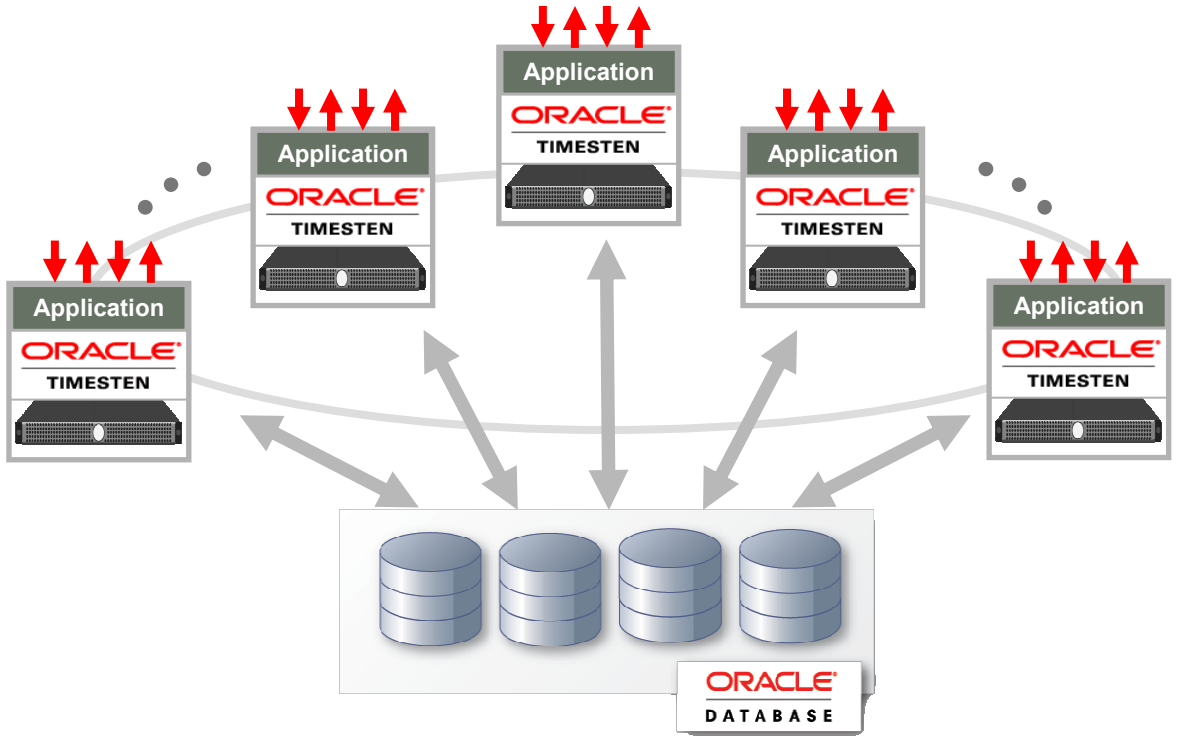
- Location transparency
  - Content of *all* cache nodes available at *each* node
- On-demand cache loads
- Usage-driven, adaptive redistribution of cached data
- Distributed parallel searches
- Transactional consistency
- Peer-to-peer communication
- Automatic synchronization with Oracle Database

Flexible Caching Options

- Different caches may all coexist
  - Pre-loaded read-only cache
  - Pre-loaded read-write cache
  - Dynamic read-write cache
  - Sliding window cache
- Flexible In-memory database caching
  - Locality optimized for consistent response time
  - Globally shared across all nodes for application transparency
  - Scale-out horizontally with processing capacity
- Transactional consistency across cache nodes and synchronization with Oracle Database

Online Addition/Removal of Cache Grid Members

Incremental Scalability

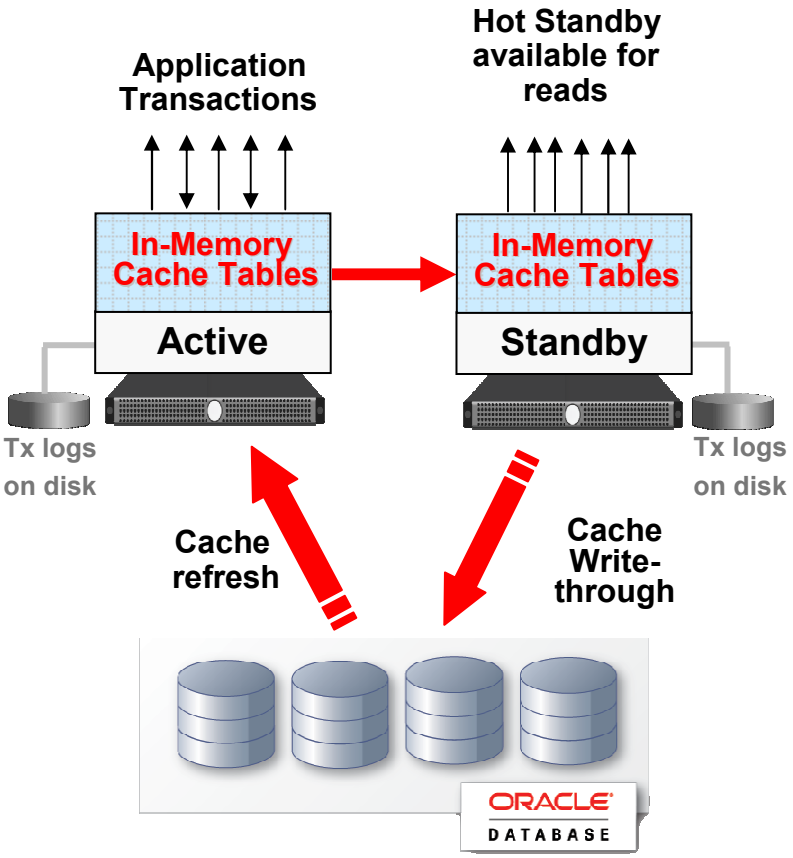


- On-demand addition/ removal of cache nodes to accommodate
  - Memory capacity needs
  - Computation capacity needs

In-Memory Database Cache Demo

High Availability and Maximum Availability

Read-write and Read-only Cache Replication



- Read-write caching
  - Execute transactions on Active
  - Replicate committed transactions to Standby
  - Propagate committed transactions to Oracle database
- Read-only caching
  - Refresh committed transactions from Oracle database to Active
- Application continues even when connection to Oracle database is down

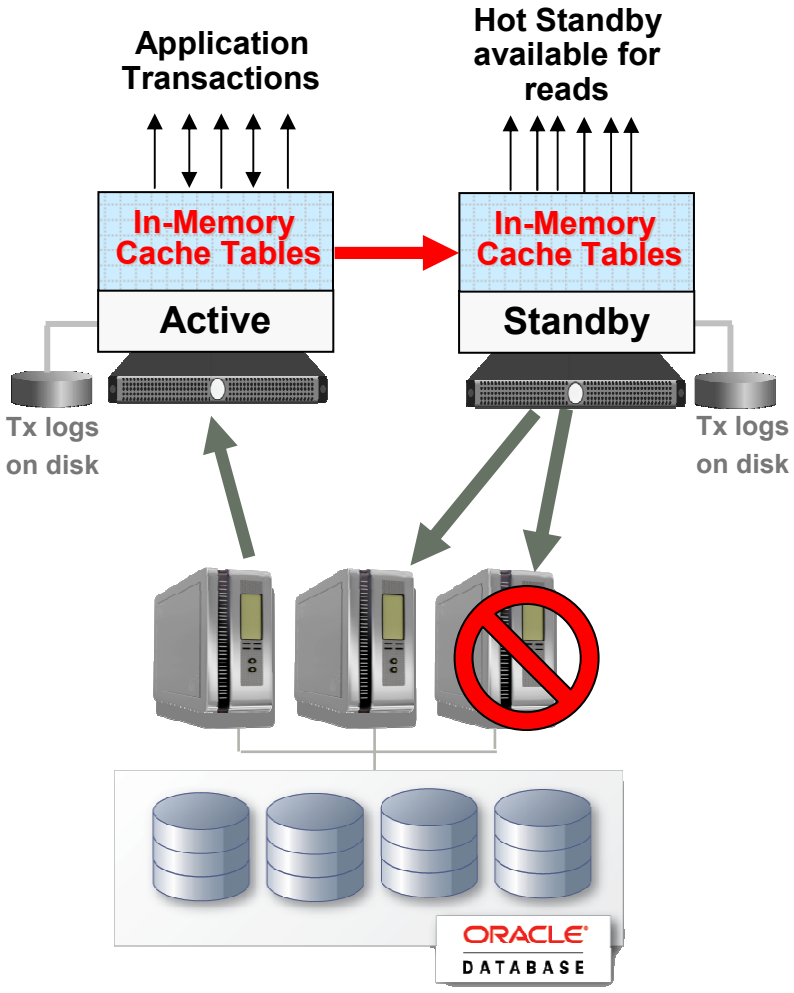
Automatic Client Connection Failover

- Available for Client / Server connections
  - Configurable by the application
- Automatic connection failover
  - When TimesTen database failovers to Standby server
- Automatic re-connect application to the new Active server
  - Connection handle is preserved
- Connection failover notification (like TAF)
  - Available if subscribed

Integration with Oracle RAC

Cross-tier High Availability

- Automatic recovery from Oracle Database RAC node failures using TAF and FAN
  - Automatic reconnection to the cluster
  - Automatic resumption of data refresh from Oracle to TimesTen
  - Automatic resumption transaction propagation from TimesTen to Oracle
  - No loss of transactions

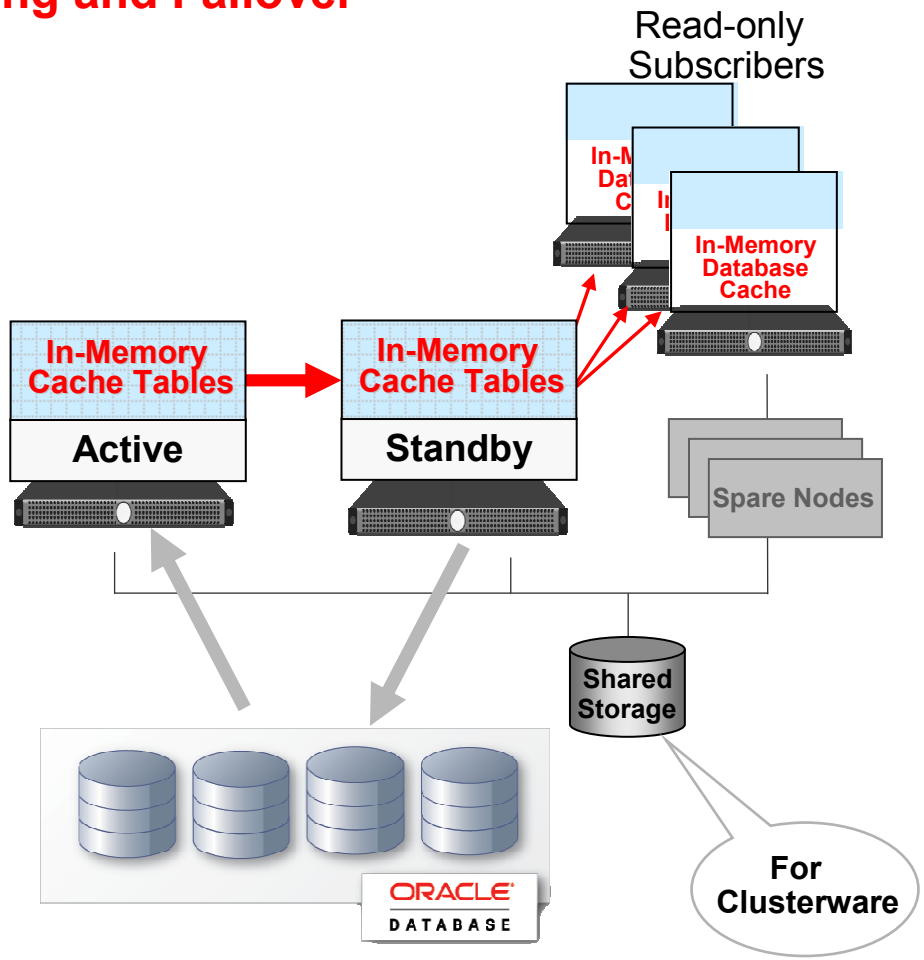


Integration with Oracle Clusterware

Automated Management, Monitoring and Failover

Oracle Clusterware

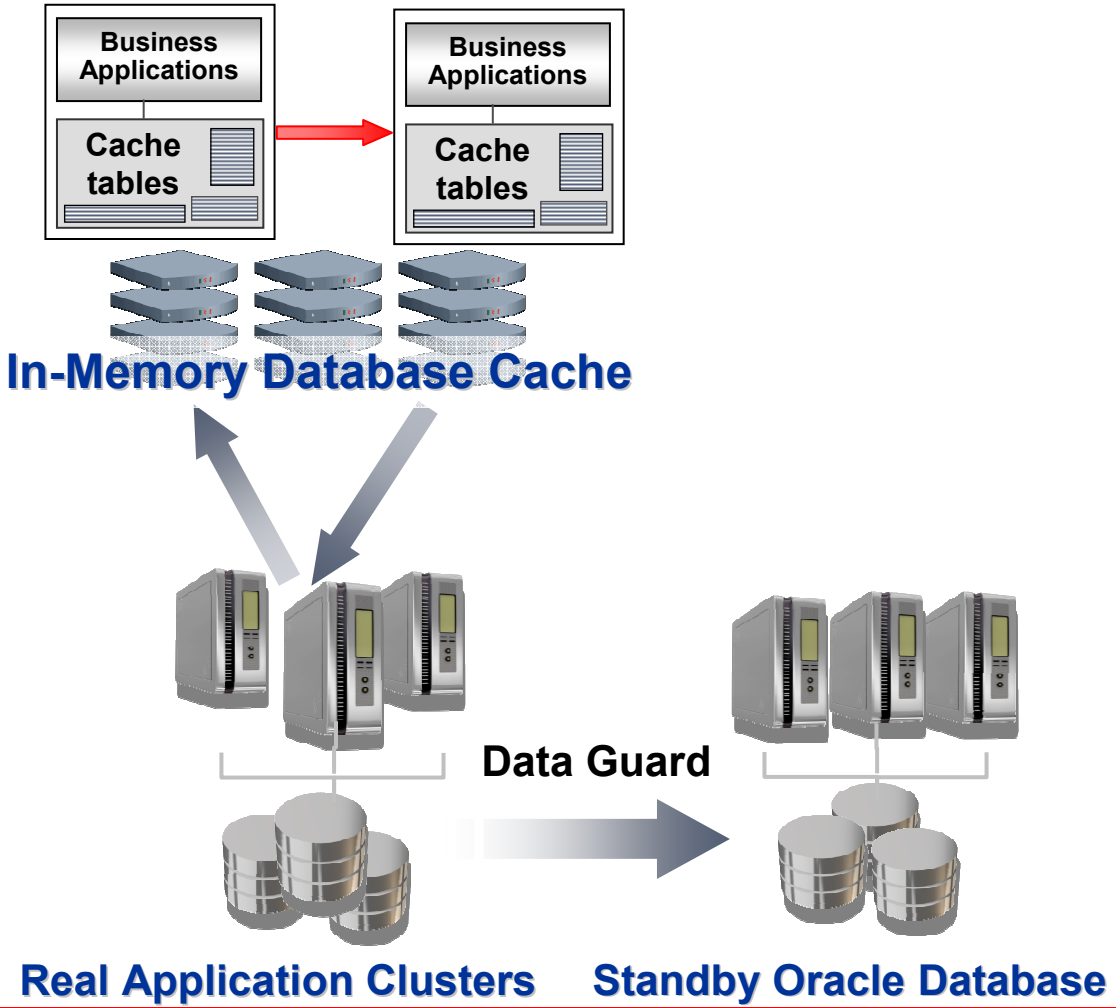
- Manages TimesTen / IMDB Cache processes
- Monitors and detects failure of
  - Nodes
  - TimesTen / IMDB Cache processes
  - Applications
- Manages automatic failover and assignment of new roles
- Recovers automatically, including provisioning of spare nodes



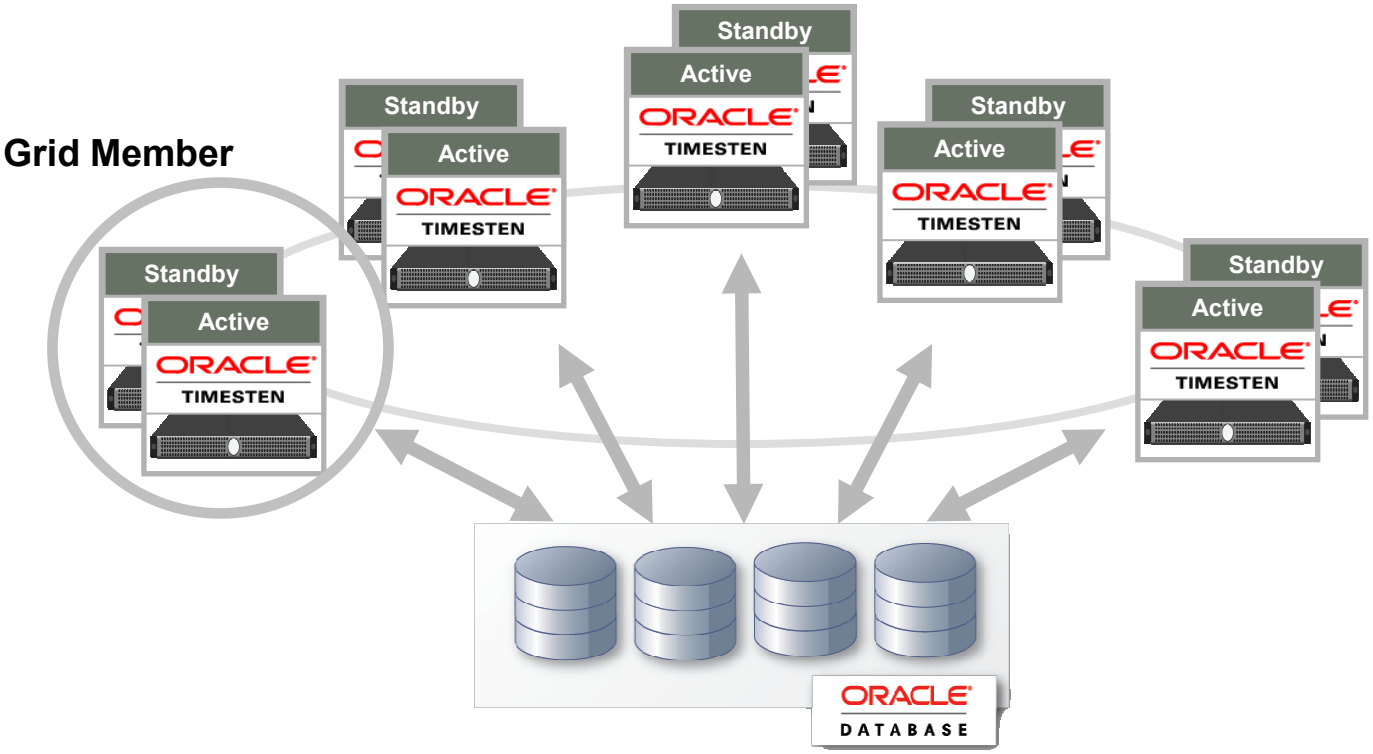
Integration with Oracle Data Guard

Oracle Maximum Availability Architecture

- Support Data Guard synchronous physical standby
  - Failover
  - Switchover
  - Rolling upgrade



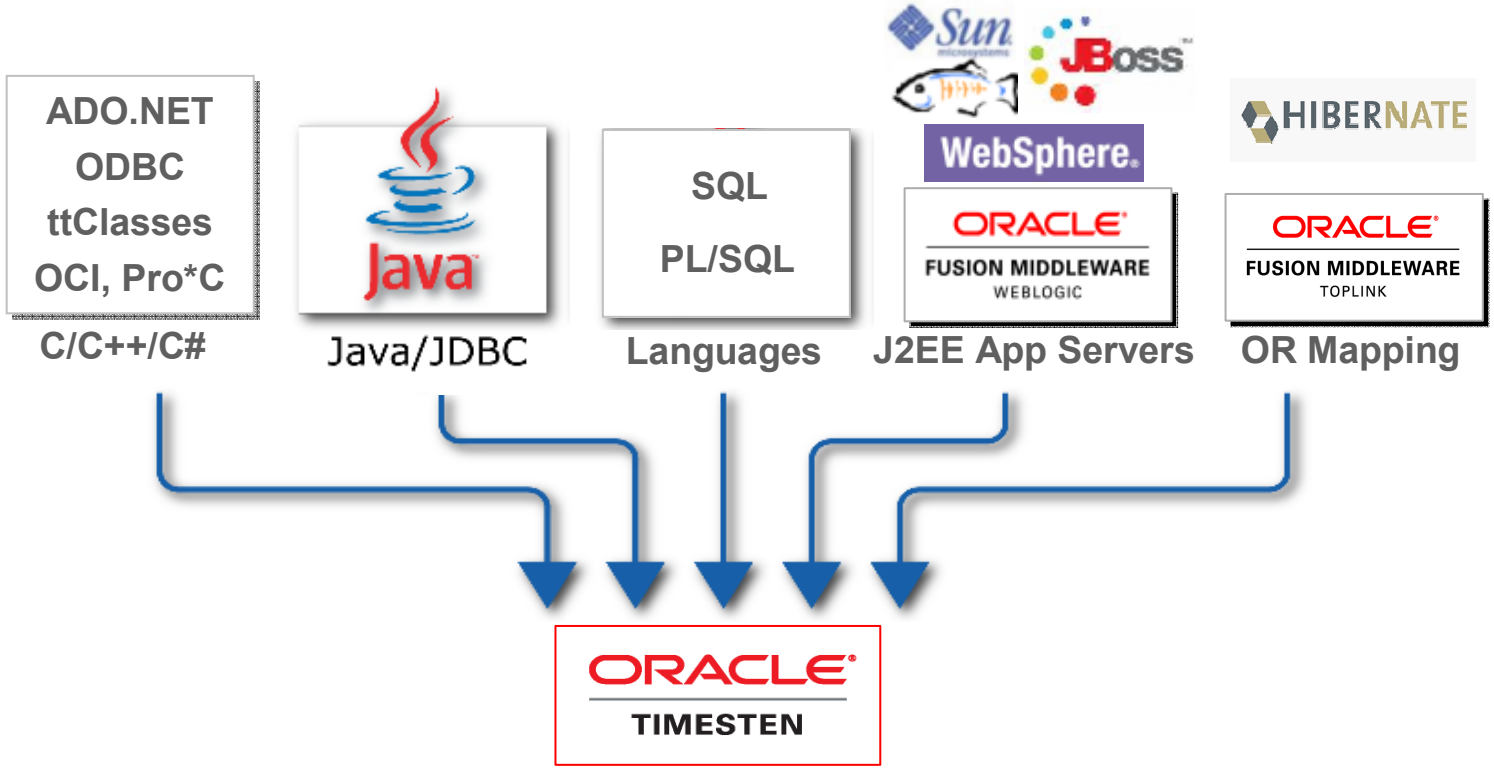
Built-In High Availability for In-Memory Cache Grid



- Integration with Oracle Clusterware for automated failover and recovery
- Grid Members are fail safe
- Cache Grid is resilient to Grid Member failures

APIs and Tools

Application Development



Leverage existing developer skill sets and application infrastructure

No rewrite

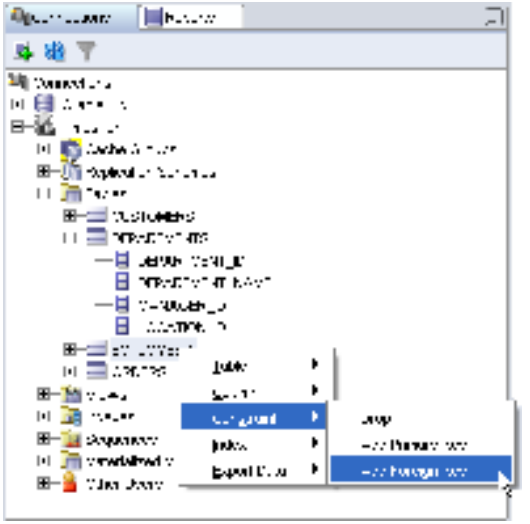
Minimal Application Changes

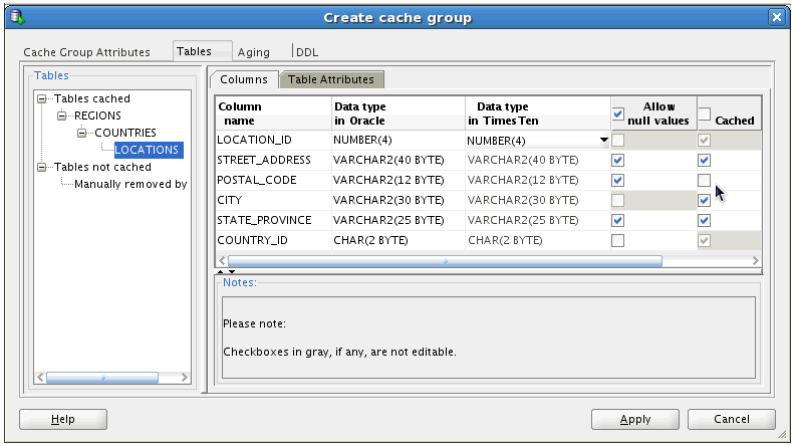
PL/SQL, Java, OCI, ODBC, ODP.NET, Pro*C Standard Interfaces

- C/C++ support
  - Standard ODBC interface
- Java support
  - Standard JDBC interface
- Oracle APIs: OCI, ODP.NET, Pro*C/C++ support
  - Identical API signatures as used for the Oracle Database
  - Subset of functions
- PL/SQL support
  - PL/SQL engine implemented inside TimesTen database
  - Same Oracle PL/SQL language; subset of packages
- Minimal application changes
  - Extremely fast response time and high throughput

TimesTen Support in SQL Developer 3.0

- Browse, Edit, Create, Alter TimesTen database objects
- Create, Drop, Alter cache groups
- Load, Unload, Flush, Refresh cache data
- Develop PL/SQL procedures, functions, and packages
- Show SQL execution plans, update table and column statistics
- Access SQL Worksheet for ad-hoc queries, execute TimesTen built-in procedures and *ttIsql* commands
- Concurrent access to cache data in TimesTen and Oracle Database

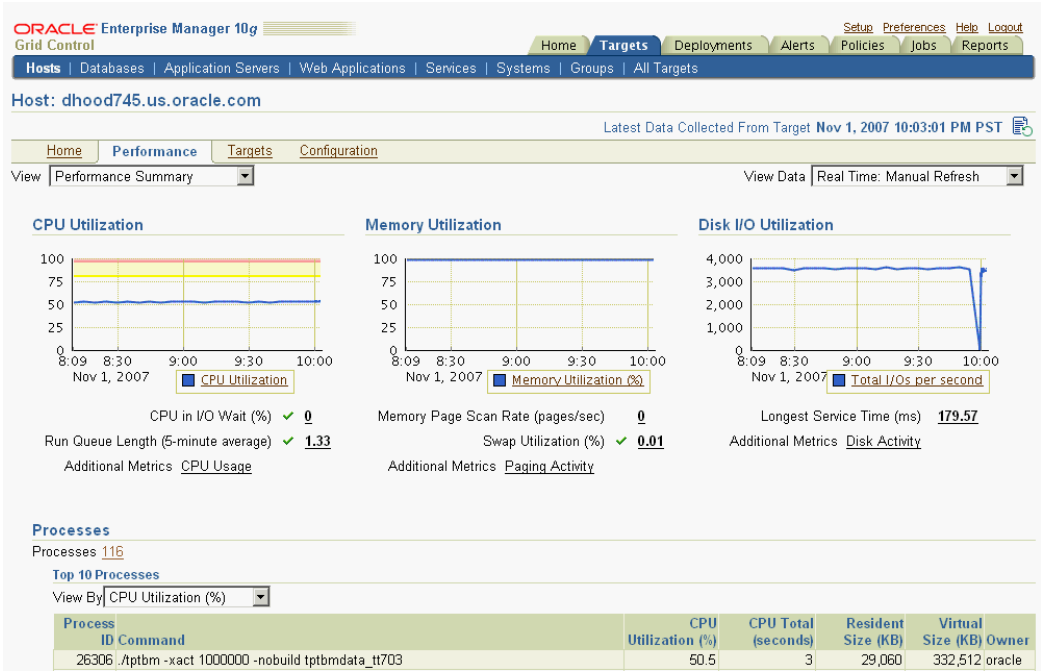




TimesTen System Monitoring Tool

An Oracle Enterprise Manager Plug-In

- Monitor key performance metrics
- User defined thresholds for alerts and notifications
- Out-of-the-box reports for TimesTen metrics
- Create custom reports with graphical report wizard
- Low overhead



Top Reasons Customers Selected TimesTen

- Respond to real-time events
  Response time measured in microseconds
- Provide consistent level of responsiveness
  Bounded response time
- Handle large workloads even during peak hours
  High volume transaction and event processing
- Provide continuous, uninterrupted service
  High availability, online upgrades
- Ability to leverage existing applications with minimal changes to application code and interfaces
  Standard SQL/relational model, standard APIs, caching from Oracle Database and automatic synchronization with Oracle Database

For More Information

TimesTen Product Center on OTN:

http://www.oracle.com/technology/products/timesten

- Technology white papers
- Quick Start Guide and tutorials
- Discussion Forum
- And more..


Q&A


ORACLE®