CON4758: Next-Generation Scale: How T-Mobile Uses Oracle TimesTen In-Memory Database

Sam Drake
Architect, Oracle TimesTen In-Memory Database

Pradeep Rathnalla
Sr. Manager Customer Information, T-Mobile

Magesh Janarthanan
Principal Engineer, T-Mobile US
Agenda

• Introducing TimesTen
  - Sam

• T-Mobile’s Customer Information Caching Journey
  Pradeep and Magesh

• Questions - All
Agenda

- Introducing TimesTen
  - Sam

- T-Mobile’s Customer Information Caching Journey
  - Pradeep and Magesh

- Questions - All
Safe Harbor

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, timing, and pricing of any features or functionality described for Oracle's products may change and remains at the sole discretion of Oracle Corporation.

Statements in this presentation relating to Oracle’s future plans, expectations, beliefs, intentions and prospects are “forward-looking statements” and are subject to material risks and uncertainties. A detailed discussion of these factors and other risks that affect our business is contained in Oracle’s Securities and Exchange Commission (SEC) filings, including our most recent reports on Form 10-K and Form 10-Q under the heading “Risk Factors.” These filings are available on the SEC's website or on Oracle’s website at http://www.oracle.com/investor. All information in this presentation is current as of September 2019 and Oracle undertakes no duty to update any statement in light of new information or future events.
How do you **build** a service?

- Books say …
  - Three tier model
    - Web servers interact with users
    - Application servers implement business logic
    - Database remembers everything
  - Simple!
How does your service **perform**?

- Web servers
- Application servers
- Database

**Busy**

**Melting**
How do you **scale** your service?

- Hyperscale applications are harder
- Adding more web servers: easy
- Adding more app servers: easy
- How about a much bigger database?
How is your response time?

- Every request goes over the network
- Twice
- Networks are slow
How do you **cache** data?

- **Great!**
  - Take some load off the database
  - Reduce network traffic
  - Improve response time

- **Not great!**
  - Two sets of code to access the same data?
  - Two different data models?
  - How do you keep the cache up to date?

- **Would be Awesome:**
  - A readable cache that looks like the database
How do you capture data?

- Some applications have high ingest rates
- Must capture data persistently
- Even if the database is down
- Even if the data is *bursty*
- Would be awesome:
  - A writable cache that looks like the database
Oracle TimesTen In-Memory Database

Relational Database
- Pure in-memory
- ACID compliant
- Standard SQL and PL/SQL
- Entire database in DRAM

Extremely Fast
- Microseconds response time
- Hundreds of millions of transactions per second throughput
- Transparent scale out to dozens of hosts

Fully Persistent
- Database and transaction logs persisted to flash / disk

Highly Available
- Active – standby and multi-master replication
- Parallel replication for very high throughput
- High Availability and Disaster Recovery
- K-safety

Used by thousands of companies around the world for over 20 years
How do you use TimesTen?

*With the same skills you already have*

- TimesTen is a database
- Full transaction semantics
- Standard database APIs
- SQL
- PL/SQL
- Oracle compatible datatypes
- Sophisticated ability to sync data to/from Oracle Database (optional)
TimesTen as the **database of record**

- Example: Prepaid mobile billing

- *TimesTen runs more than a billion mobile phones around the world*

- Ultra high transaction volume
  - Every phone call
  - Every text message

- Very low response times
TimesTen as a writable cache

- Example: Realtime fraud detection
- Post office scans every envelope in real time
  - Looking for fraudulently photocopied stamps
- Huge transaction volumes
  - Over a million per second at peak
- Ultra short response time
  - Reroute letter while it’s still in the sorting machine
- Data ultimately sent to Oracle Database for long-term storage
TimesTen as a read only cache

- Example: eBay
  - Cache of all user data
  - Capable of 140 billion queries per day

- Example: T-Mobile
Agenda

- Introducing TimesTen
  - Sam

- T-Mobile’s Customer Information Caching Journey
  - Pradeep and Magesh

- Questions - All
T-Mobile
Customer Information - Caching Journey

PACE Powered by TimesTen

Pradeep Rathnala Sr Manager, Customer Information

Magesh Kumar Janarthanathan Principal Engineer

PRODUCT & TECHNOLOGY

Customer Information Domain

T-Mobile®
ABOUT T-MOBILE

- T-Mobile US is the third largest wireless carrier in the United States. T-Mobile US provides wireless voice and data services in the United States, Puerto Rico and the U.S. Virgin Islands under the T-Mobile and Metro by T-Mobile brands.
- As America's Un-carrier, T-Mobile US, Inc. is redefining the way consumers and businesses buy wireless services through leading product and service innovation.
- NASDAQ traded public company – TMUS
- Based in Bellevue, Washington

Q2 2019 Highlights:
- 1.8M total net adds – 25th consecutive quarter with more than 1 million net adds
- Record-low branded postpaid phone churn of 0.78% in Q1 2019, down 17 bps YoY
WE REPRESENT..

Oracle Product Components:
- Oracle Siebel UCM
- Oracle TimesTen
- Oracle Enterprise DQ
- Oracle Watchlist Screening
- Oracle Database
- Oracle Data Integrator
- Oracle Goldengate
- Oracle Active Data Guard

Customer Information Domain

Customer Hub

T-Mobile

Postpaid

Inbound Events

Per Day

5.2 MM

Commits /Day

400 MM

150 +

Capability APIs

30 TB

Database Size

99.996%

Availability

Domain Facts

112 MM

Subscribers

380 MM

Prospects

10.2 MM

Lookup Calls per Day

50 - 800

Milli sec

Avg SLA

5.2 MM

Inbound Events Per Day

Part of Products & Technology responsible for:
- Customer & Prospect Lifecycle Management
- Customer Experience
- Credit, Fraud, Risk & Compliance
- Preferences

Oracle Goldengate

Oracle Active Data Guard

Oracle Database

Oracle Data Integrator

Oracle Watchlist Screening

Oracle Enterprise DQ

Oracle TimesTen

Oracle Siebel UCM

We Represent...
OUR PROBLEM STATEMENT

We were challenged with:

- SLA consistency amidst growing customer base
- Lack of application-level cache for COTS
- Need for in-memory data caching for microservice architectures
- Increased number of API consumers for customer data
- Interface to modernized customer experience platform in web and social channels
- Necessity to support critical-experience APIs
- Handling high concurrency
- Database hotspots
Our Cache Journey

RDBMS Options
NoSQL Options
Research Products in Market
Product Identification

Cloud Assessment (AWS)
Load tests
Proof of Concept
Use Case Evaluation
Evaluation

Hardware Specification
Recommendations
Sizing
Product RoadMap
Product Team Review

Production Readiness Review
Testing (Functional + Performance)
Monitoring/Alerts & Dashboard
High Availability
NPE / Production Build
Setup & Configurations
Implementation

April 2019

Assessment
Hardware Requirements
License Assessment
Product Support
Success Stories
Published Benchmarks

Comparison
Response Time
Stability
Compatibility with our product stack
Cost (Implementation + Ops)

Procurement
Business Justification
Funding
Domain Roadmap alignment

Realization
Faster time to market
Customer Experience
Exceptional Performance

T-Mobile
OUR SOLUTION

On-Prem Cloud Platform

API Gateway

Web Partners

Care

Retail

SIVR

Social Media

Consumers / Channels

Sources

Billing

Comm...

Credit

Finance

Order

TFB

Event Framework

Kafka

RabbitMQ

Transaction CRM

Transactions

SOURCES

PCF

Event Framework

JMS

Kafka

RabbitMQ

API Gateway

On-Prem Cloud Platform

Pivotal Cloud Foundry

Read / Write Cache

Oracle Timesten

Oracle

T-Mobile Confidential
WHY TIMESTEN?

- Extreme read/write speed/performance (Microseconds Response Time)
- Failover and high availability
- Supports transactional data cache
- Supports reference data cache
- Support for relational data model
- Data replication
- Cloud native
- Available client frameworks for quick development
- Configurable retention policies
- Native primary data source (oracle DB) compatibility
**TimesTen Specification**

**GRID1**
- Active
- **H/W Specification**: HPE DL560 Gen10 8180M @2.5 GHz, 112 Core
- 4TB PCIe NVMe
- 4TB DDR4 DRAM

**GRID2**
- Active
- **H/W Specification**: HPE DL380 Gen10 8180 @2.5 GHz, 56 Core
- 3TB PCIe NVMe
- 1.5TB DDR4 DRAM

**GRID1**
- StandBy

**GRID2**
- StandBy

---

**FAST Facts**

- **23** Cache Groups
- **1.1 Billion** Cached Records
- **1.3TB** Active Cache Size
- **10.2 MM** Requests /Day
- **21MM** Load Speed Per Second
- **99.96 %** Cache Hit Ratio

An illustrative high Available environment IDD.
Capability Benchmarks

API SLA

<table>
<thead>
<tr>
<th>Capability</th>
<th>Without TimesTen</th>
<th>With TimesTen</th>
</tr>
</thead>
<tbody>
<tr>
<td>CustomerBridging</td>
<td>20X</td>
<td>20X</td>
</tr>
<tr>
<td>BillPaymentKiosk</td>
<td>28X</td>
<td>28X</td>
</tr>
<tr>
<td>Accountautopay</td>
<td>22X</td>
<td>22X</td>
</tr>
<tr>
<td>Customereligibilitycheck</td>
<td>5X</td>
<td>5X</td>
</tr>
<tr>
<td>TEXconnectedcustomerassig...</td>
<td>24X</td>
<td>24X</td>
</tr>
<tr>
<td>TEXAssignmentlookup</td>
<td>24X</td>
<td>24X</td>
</tr>
<tr>
<td>BankCustomerProfile</td>
<td></td>
<td>40X</td>
</tr>
<tr>
<td>CustomerPrescreen</td>
<td></td>
<td>20X</td>
</tr>
</tbody>
</table>

Response Time (Millisec)

[Graph showing performance improvements for various capabilities]
REALIZED BENEFITS

FAST RESPONSE TIME
5 - 50x IMPROVEMENT

ALWAYS ON
SEAMLESS SWITCHOVER

HIGH THROUGHPUT
STABLE UP TO 5x LOADS
NEXT STEPS

- Migrate to ScaleOut based on readiness of Application Cache feature. Working with Product Team to the rollout of Application Cache in ScaleOut
  - Scalability Benefits
- Implement Use cases to Integrate GraphQL with TimesTen. Working with Product team for release of adapter for Node.js
LET’S TALK
ARE YOU WITH US?

T-Mobile®
THE UN-CARRIER®
TimesTen Sessions This Week

- CON4759: Oracle Data Caching: An eBay perspective
  Moscone South
  Room 152C
  11:15 Wednesday

- Come see us at the Demogrounds!
  Moscone South
  Booth ODB-015
Oracle TimesTen

The World’s Fastest OLTP Database