



Oracle OpenWorld 2019

SAN FRANCISCO



ORACLE

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

Sam Drake

Architect, Oracle TimesTen In-Memory Database

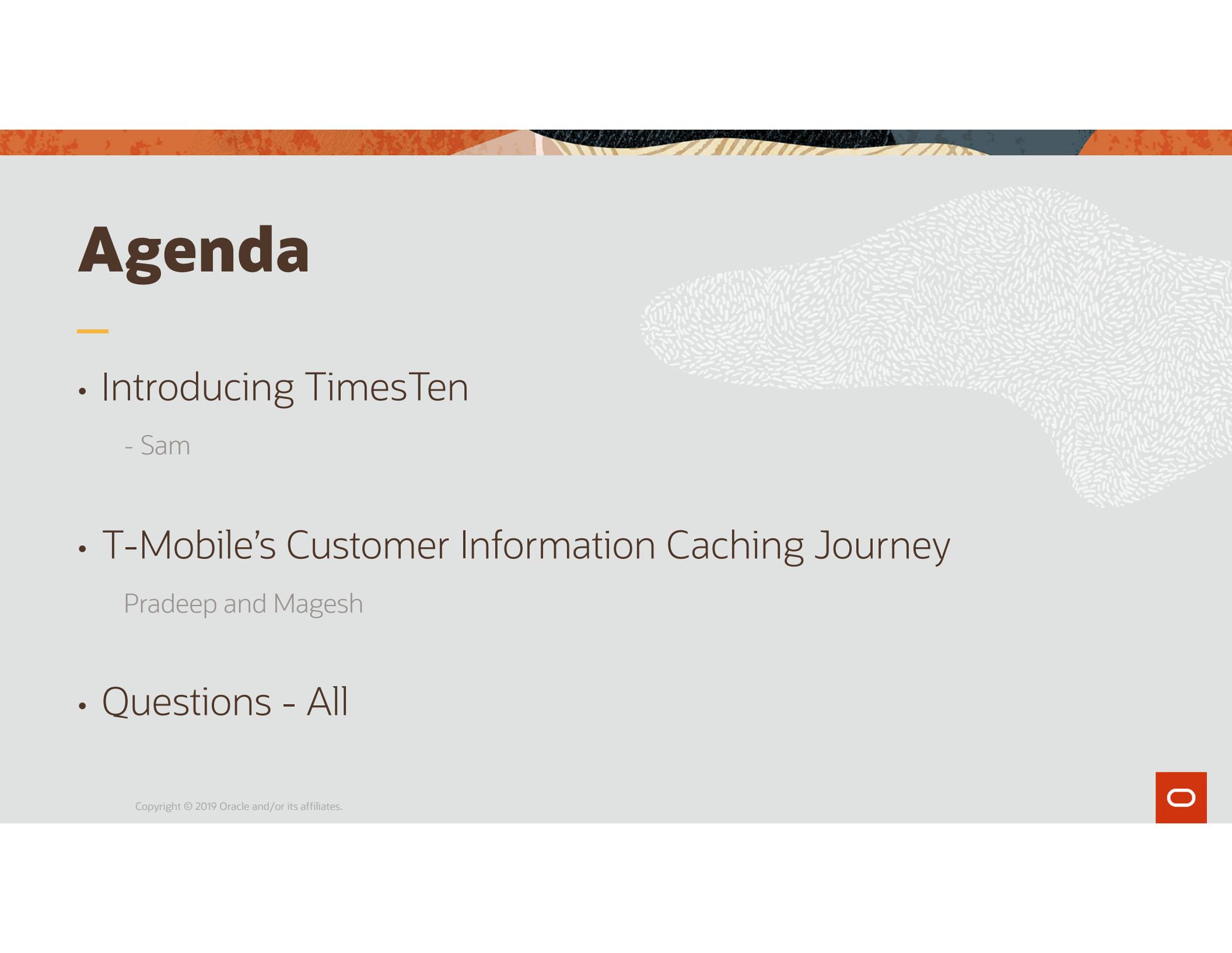
Pradeep Rathnala

Sr. Manager Customer Information, T-Mobile

Magesh Janarthanan

Principal Engineer, T-Mobile US

Agenda



- Introducing TimesTen

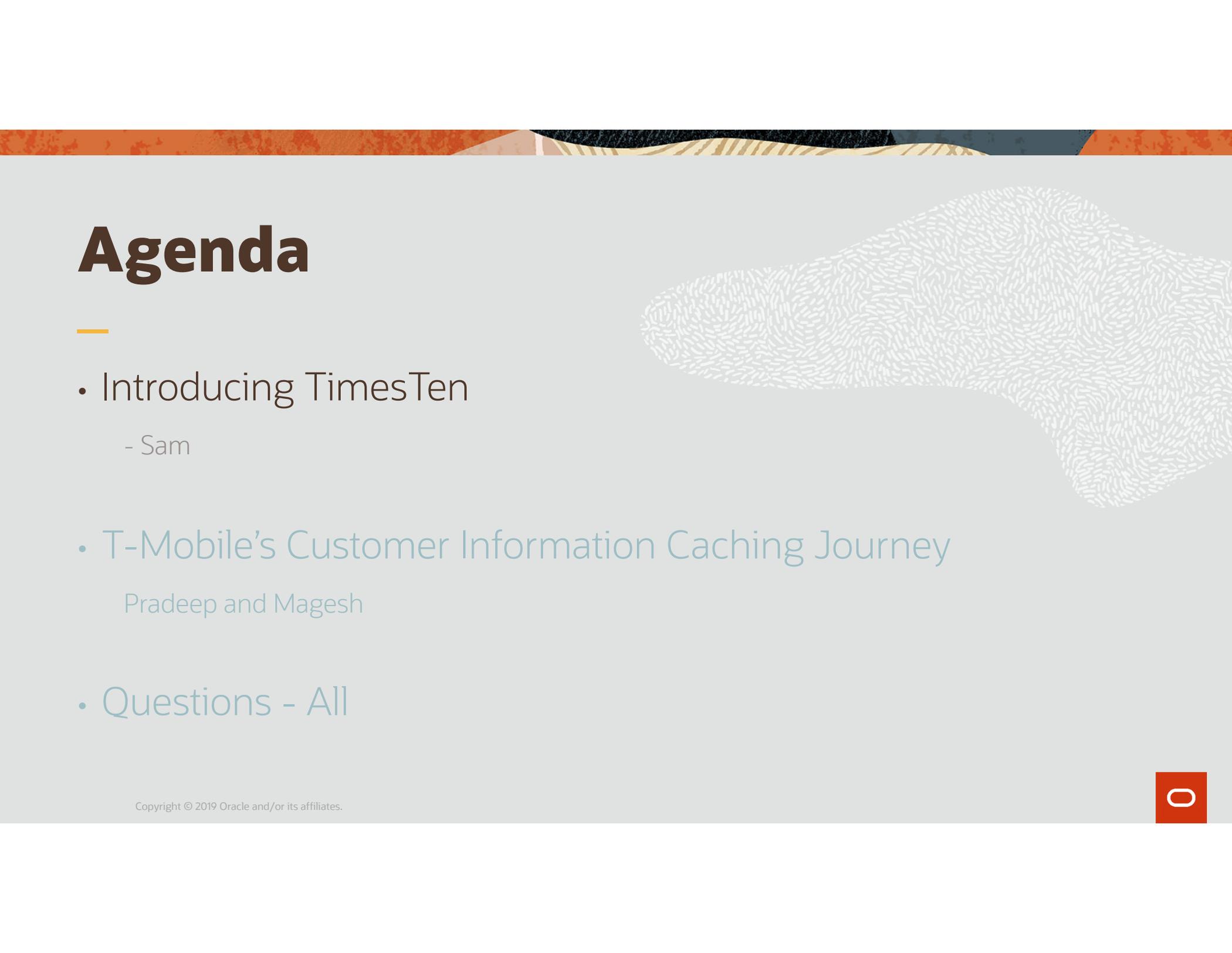
- Sam

- T-Mobile's Customer Information Caching Journey

Pradeep and Magesh

- Questions - All

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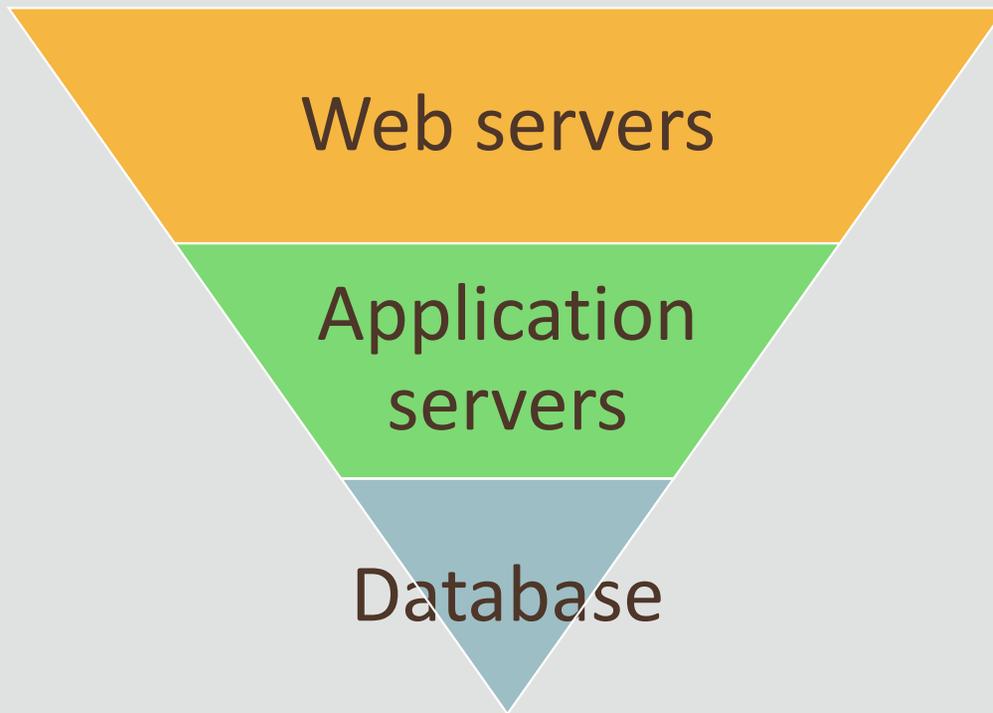
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Safe Harbor

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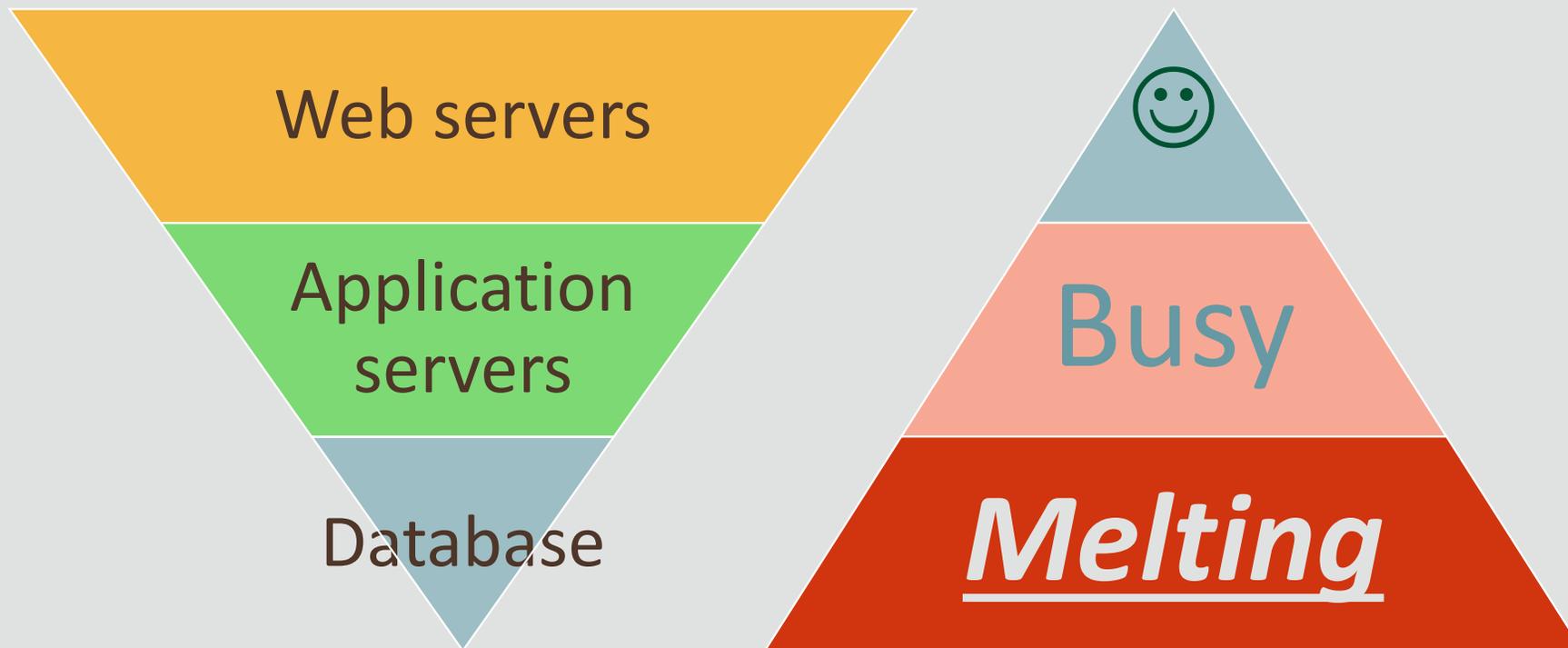
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How do you **build** a service?



- Books say ...
- Three tier model
 - Web servers interact with users
 - Application servers implement business logic
 - Database remembers everything
- Simple!

How does your service perform?



How do you **scale** your service?

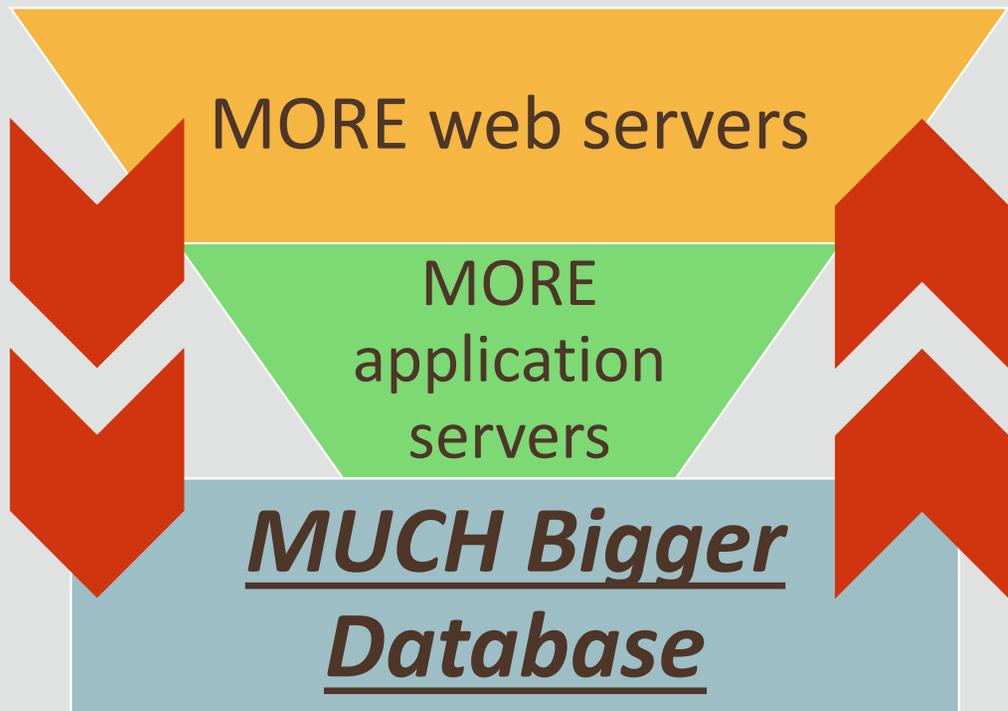
MORE web servers

MORE
application
servers

MUCH Bigger
Database

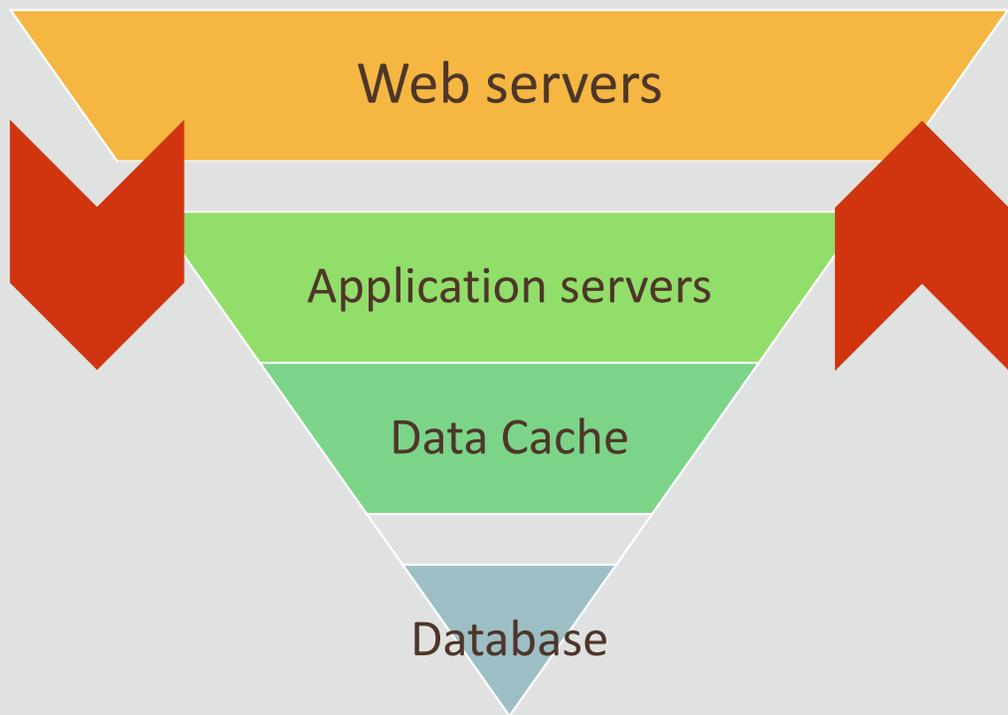
- Hyperscale applications are harder
- Adding more web servers: easy
- Adding more app servers: easy
- **How about a much bigger database?**

How is your **response time**?



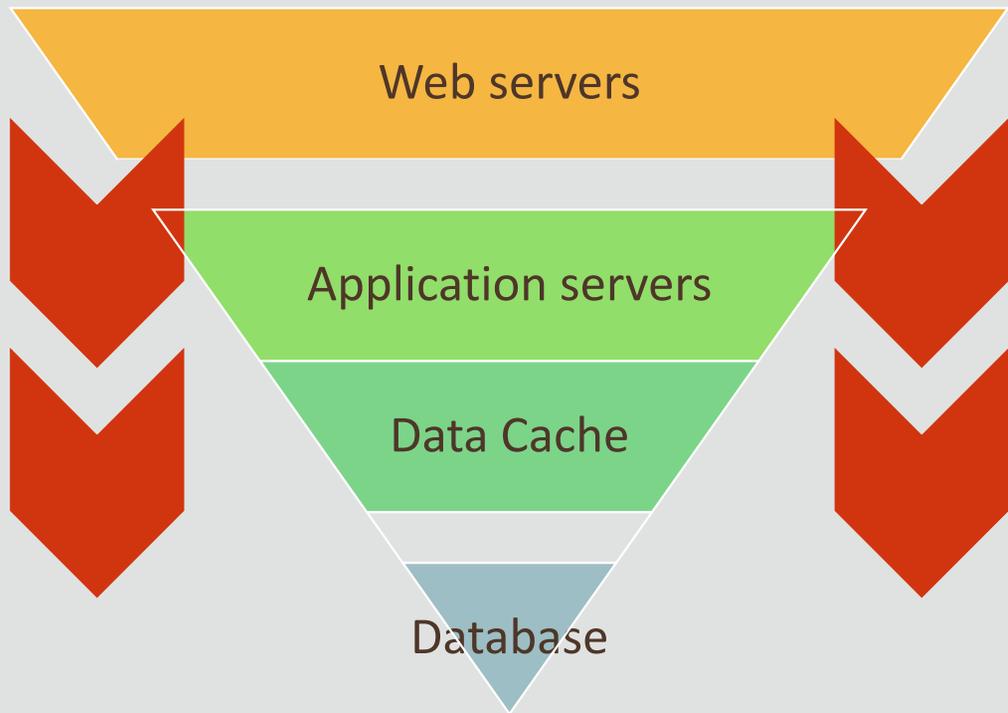
- Every request goes over the network
- Twice
- Networks are slow

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

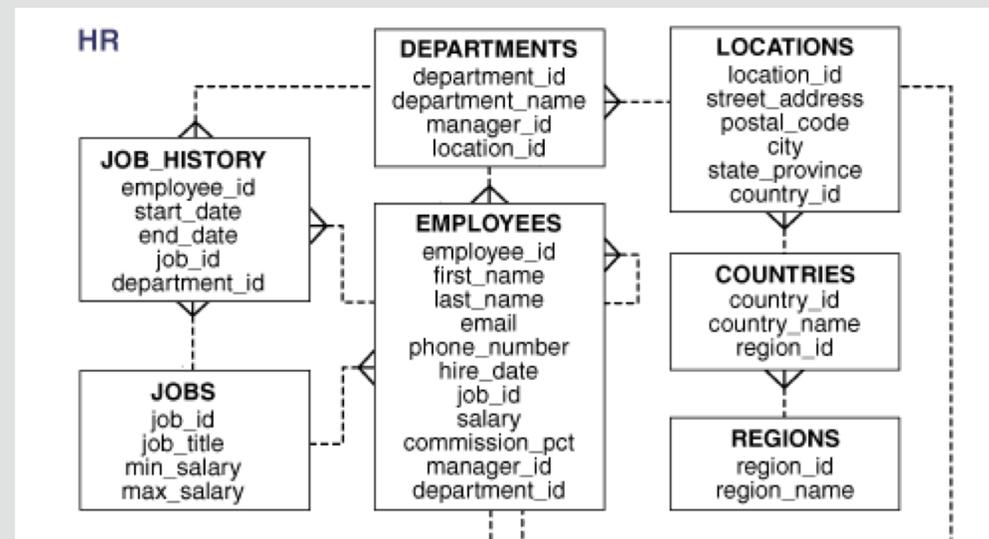
Active – standby and
multi-master replication
Parallel replication for
very high throughput
High Availability and
Disaster Recovery
K-safety

*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

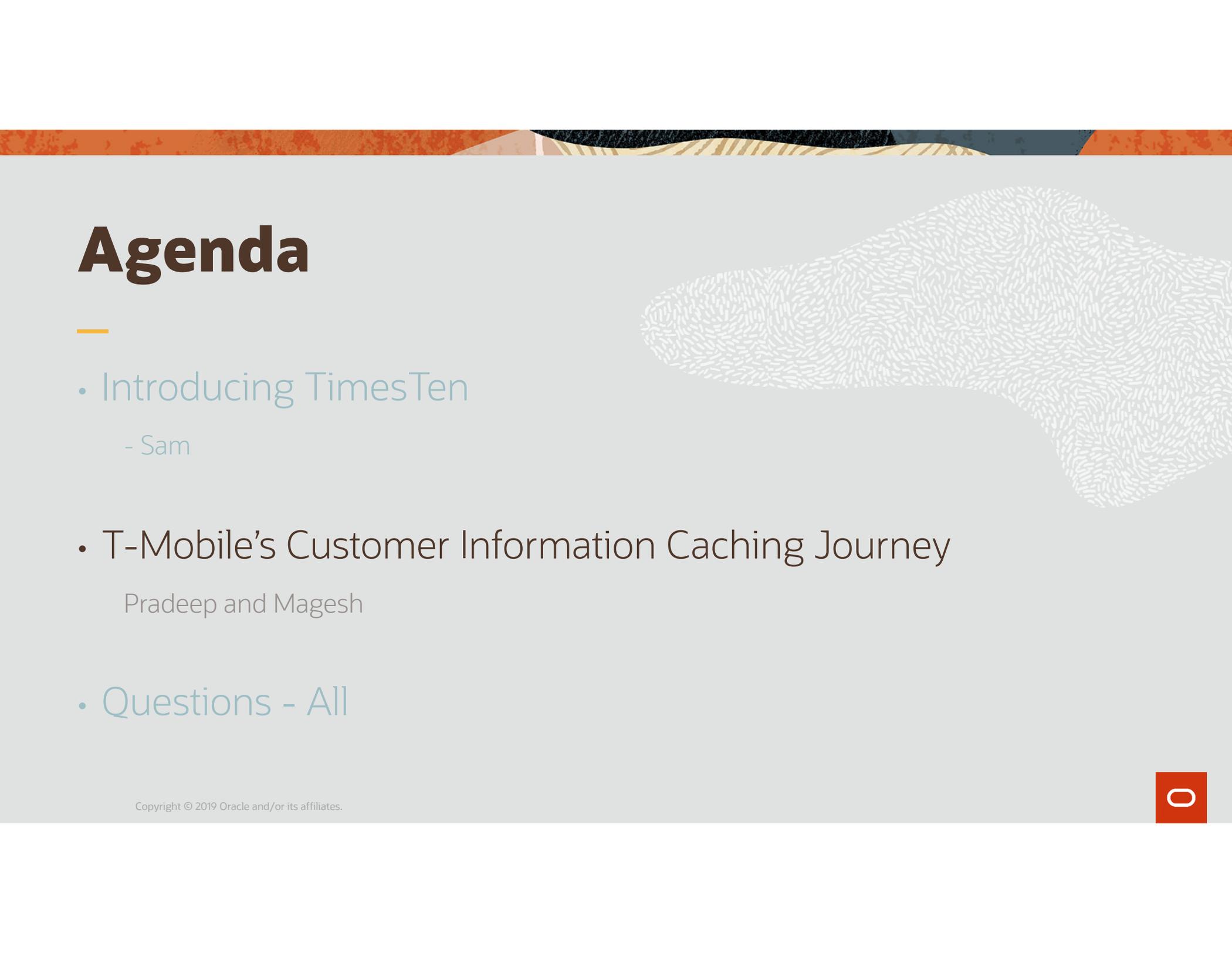
- Example: Realtime fraud detection
- Post office scans every envelope in real time
 - Looking for fraudulently photocopied stamps
- Huge transaction volumes
 - Over a million per second at peak
- Ultra short response time
 - Reroute letter *while it's still in the sorting machine*
- Data ultimately 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



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- Questions - All



T-Mobile

Customer Information - Caching Journey

PACE Powered by TimesTen

Pradeep Rathnala Sr Manager, Customer

Information

Magesh Kumar Janarthanan 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



UN-CARRIER MOVES



**SIMPLE CHOICE &
MOBILE WITHOUT BORDERS**
MARCH 2013



**SIMPLE
GLOBAL**
OCTOBER 2013



**LIFETIME
COVERAGE
GUARANTEE**
JUNE 2014



**Wi-Fi
UNLEASHED**
SEPTEMBER 2014



**UN-CARRIER
FOR BUSINESS**
MARCH 2015



#GETTHANKED
JUNE 2016



**TAXES & FEES
INCLUDED**
JANUARY 2017



**TEAM OF
EXPERTS**
AUGUST 2018



**JUMP! &
JUMP! ON
DEMAND**
JULY 2013



**CARRIER
FREEDOM**
JANUARY 2014



**MUSIC
FREEDOM**
JUNE 2014



**DATA
STASH**
DECEMBER 2014



BINGE ON
NOVEMBER 2015



T-MOBILE ONE
AUGUST 2016



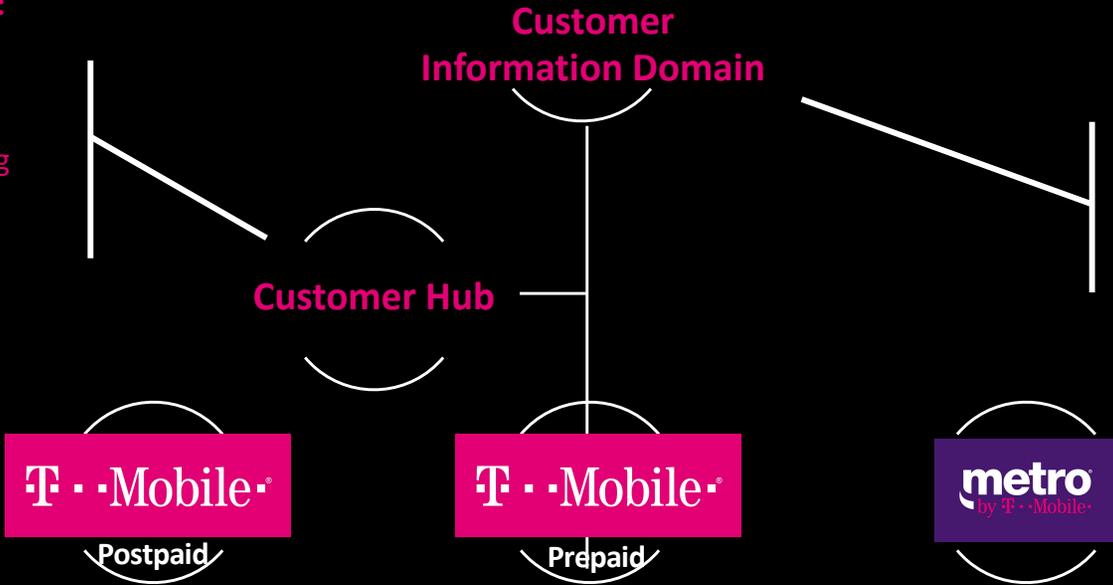
NETFLIX ON US
SEPTEMBER 2017

WE REPRESENT..

PRODUCT & TECHNOLOGY

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



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

Domain Facts								
112 MM	380 MM	10.2 MM	50 - 800	5.2 MM	400 MM	150 +	30 TB	99.996%
Subscribers	Prospects	Lookup Calls per Day	Milli sec Avg SLA	Inbound Events Per Day	Commits /Day	Capability APIs	Database Size	Availability

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

PRODUCT & TECHNOLOGY

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

Sept
2019

Assessment

Hardware Requirements
License Assessment
Product Support
Success Stories
Published Benchmarks

Comparison

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

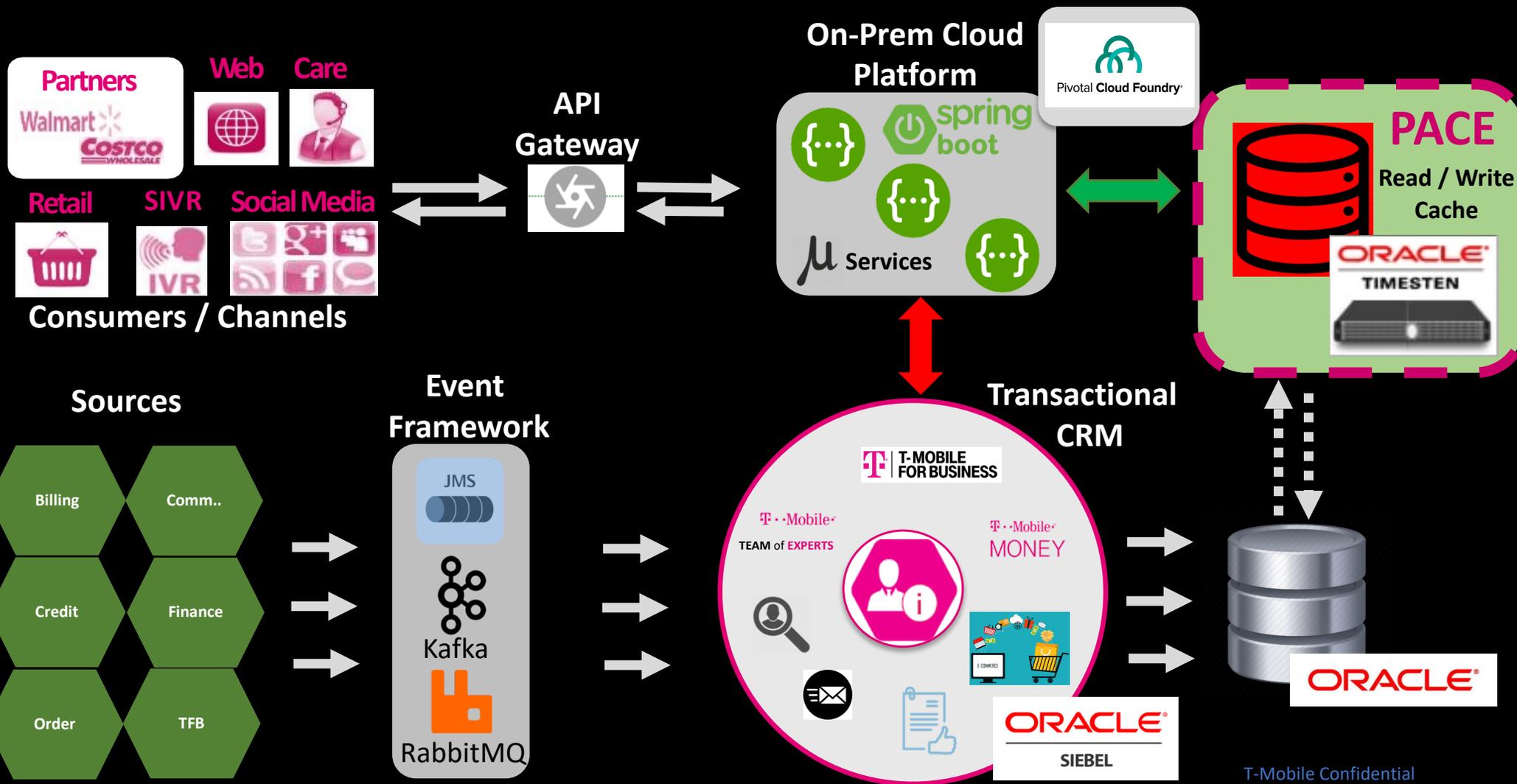
Procurement

Business Justification
Funding
Domain Roadmap alignment

Realization

Faster time to market
Customer Experience
Exceptional Performance

OUR SOLUTION



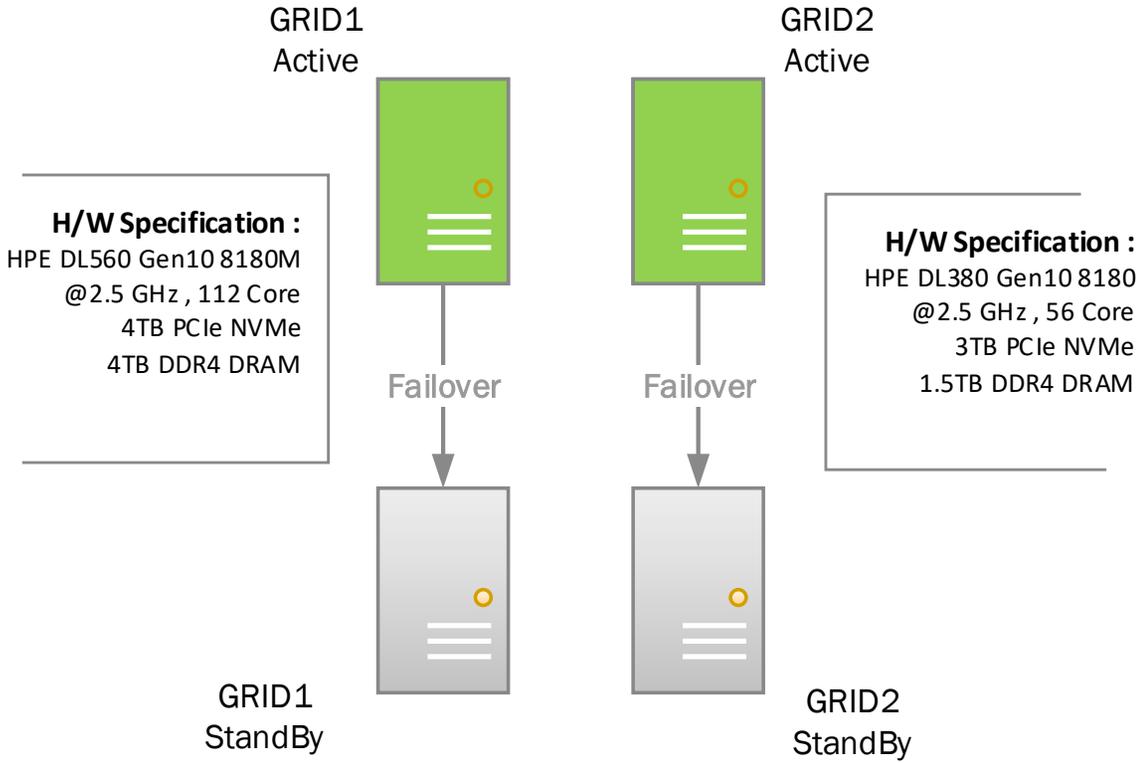
WHY TIMESTEN?

- 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

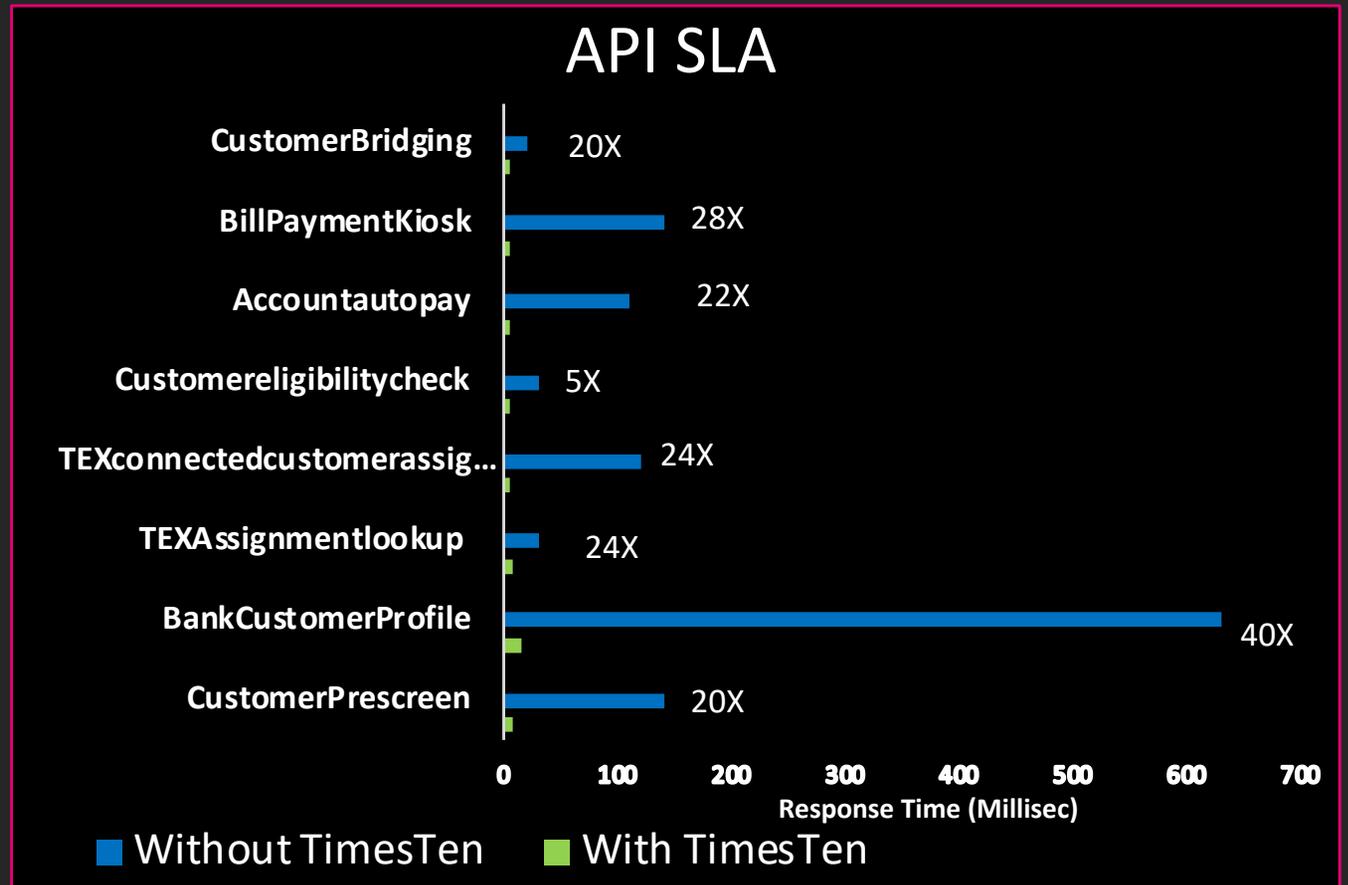
TimesTen Specification

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

An illustrative high Available environment IDD.



Capability Benchmarks



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

T-Mobile®

ARE
YOU
WITH
US?TM

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