

# Oracle OpenWorld 2019

SAN FRANCISCO

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# Zero Downtime for Java Applications: What's New, Use cases and Solutions

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## Safe Harbor

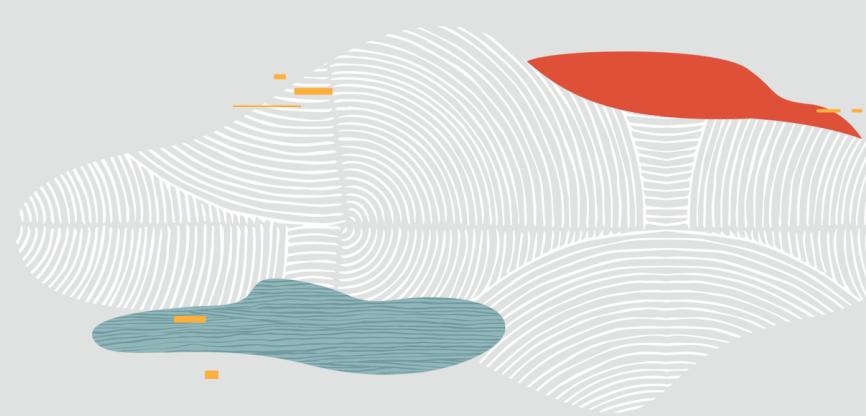
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# Agenda

- 1 Announcement
- 2 Building Blocks of Continuous Availability
- 3 Transparent Application Continuity (TAC) – Planned/Unplanned
- 4 Transparent Application Continuity with ATP-D
- 5 Questions

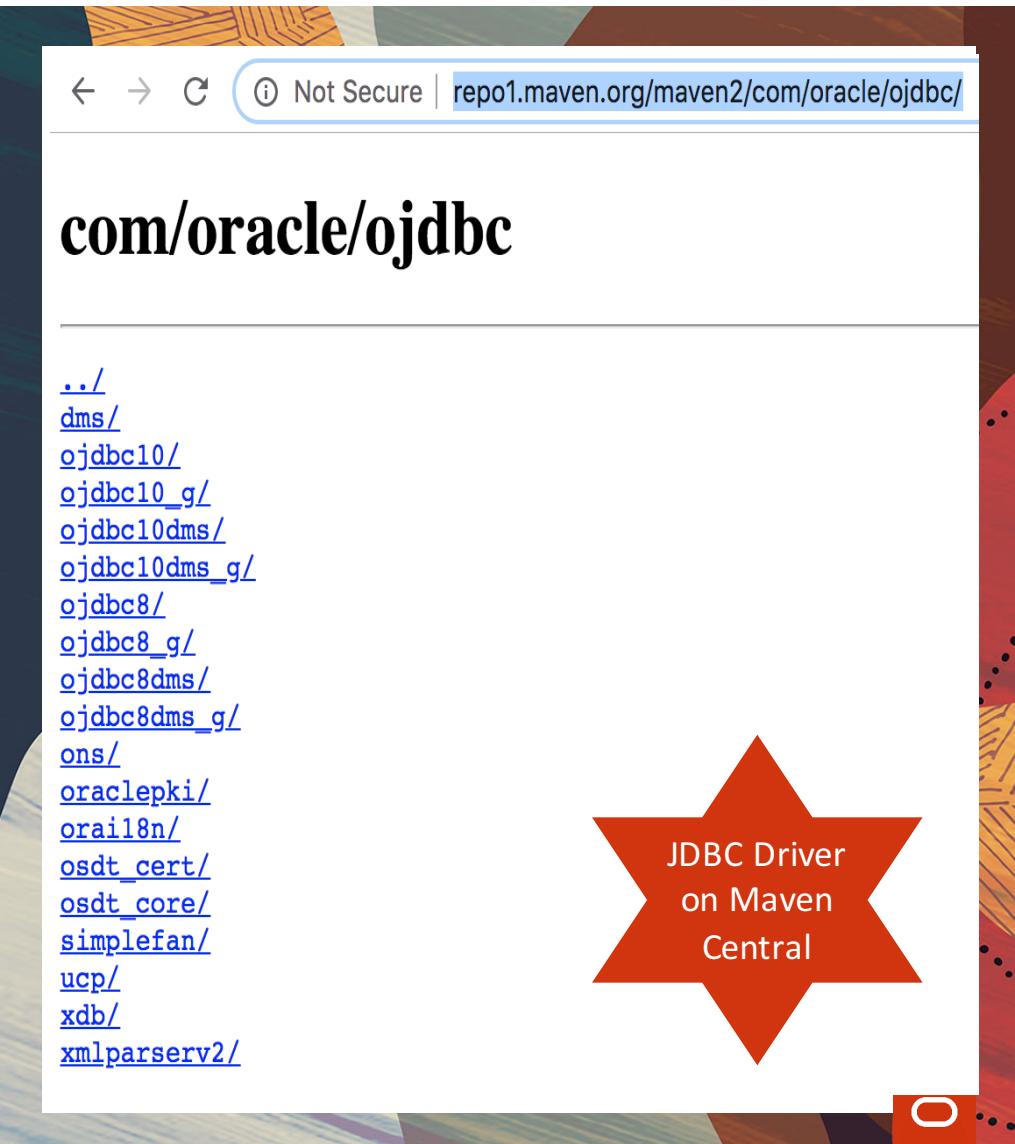


## 19.3 JDBC drivers & some companion jars on Central Maven

<https://repo1.maven.org/maven2/com/oracle/ojdbc/>

```
<groupId>com.oracle.ojdbc</groupId>
<artifactId>ojdbc8</artifactId>
<version>19.3.0.0</version>
```

Older releases will be available later



# Building Blocks of continuous availability

- Application side
  - Universal Connection Pool (UCP)
  - Recommended connection URL
  - Fast Application Notification (FAN)
  - Request Boundaries
  - Transparent Application Continuity (TAC)
- Database Server side
  - MAA Architecture: RAC / ADG /DG
  - Use Database Services

# UCP with other Java-based Application Servers

```
<Context docBase="ATPWebApp" path="/ATPWebApp"
  reloadable="true" source="org.eclipse.jst.jee.server:samplejdbcpage">

  <Resource name="tomcat/UCP_atp" auth="Container"
    factory="oracle.ucp.jdbc.PoolDataSourceImpl"
    type="oracle.ucp.jdbc.PoolDataSource"
    description="UCP Pool in Tomcat"
    connectionFactoryClassName="oracle.jdbc.pool.OracleDataSource"
    minPoolSize="5"
    maxPoolSize="50"
    initialPoolSize="15"
    user="hr"
    password="hr"
    url="jdbc:oracle:thin:@databasename_medium?TNS_ADMIN=/Users/test/lib"
  />

</Context>
```

- IBM WebSphere
- IBM Liberty
- Apache Tomcat
- NEC WebOTX
- Red Hat WildFly (JBoss)
- Hibernate
- Spring
- custom

# Recommended Connection String

All drivers 12.2

```
alias =(DESCRIPTION =
  (CONNECT_TIMEOUT=90) (RETRY_COUNT=20)(RETRY_DELAY=3)
  (TRANSPORT_CONNECT_TIMEOUT=3)
  (ADDRESS_LIST =
    (LOAD_BALANCE=on)
    ( ADDRESS = (PROTOCOL = TCP)(HOST=primary-scan)(PORT=1521)))
  (ADDRESS_LIST =
    (LOAD_BALANCE=on)
    ( ADDRESS = (PROTOCOL = TCP)(HOST=secondary-scan)(PORT=1521)))
  (CONNECT_DATA=(SERVICE_NAME = gold-cloud)))
```

Automatic Retries

Configure Once  
in LDAP or  
tnsnames.ora

No reliance on DNS

**ALWAYS** use a service that is NOT DB/PDB name

# Concept: Fast Application Notification (FAN)

- The FAN allows applications to be notified instantaneously of Oracle Database events
- Supported FAN events are mentioned below
  - **Node Events**: Node Down, Public Network Down
  - **Instance Events**: Instance Down, Instance Up
  - **Service Events**: Service member Down, Service member Up, Service Down, Service Up
  - **Database Events**: Database Down, Database Up
- The Universal Connection Pool (UCP) and JDBC driver support FAN (Without any application changes)

# Sample FAN event

- SERVICE DOWN

- VERSION=1.0 **event\_type=SERVICE**

service=testy\_pdb\_srv.us.oracle.com database=testy  
db\_domain=us.oracle.com host=rachost\_723 **status=down**  
reason=USER timestamp=2019-01-21 19:25:52 timezone=-08:00

# Concept: Request Boundaries

UCP 12c+, Java Standard (JDK9+), Transparent Application Continuity (TAC)

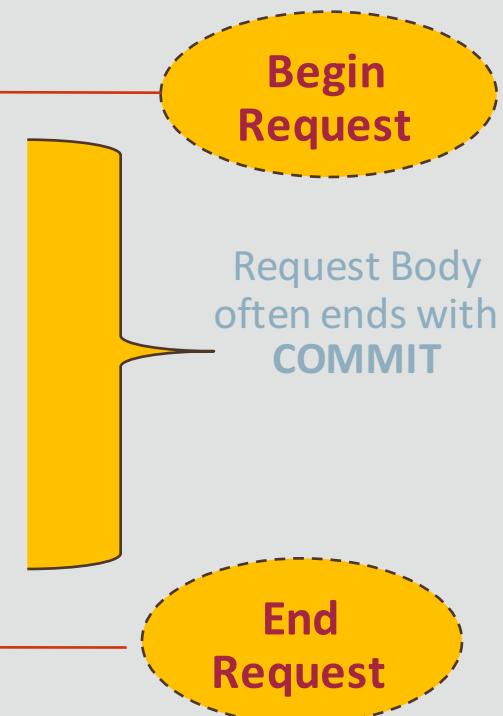
```
PoolDataSource pds = GetPoolDataSource();  
Connection conn = pds.getConnection(); ←  
PreparedStatement pstmt = ...
```

...

SQL, PL/SQL, local calls, RPC

...

```
conn.commit();  
conn.close(); ←
```



# Application Continuity Explained

## Normal Operation

Client marks requests: explicit and **implicit**.

Server **tracks session state**, decides which calls to replay, **disables side effects**.

Directed, client holds original calls, their inputs, and **validation data**.

## Failover Phase 1: Reconnect

Checks replay is enabled

Verifies timeliness

Creates new connection

Checks target database is legal for replay

Uses Transaction Guard to guarantee commit outcome

## Failover Phase 2: Replay

Restores and **verifies the session state**

Replays held calls, restores mutables **automatically**

Ensures results, **states**, messages match original.

On success, returns control to application

# Evolution of Application Continuity (AC)

## 18c

Transparent Application Continuity (TAC) in the JDBC driver

- Transparent in most cases
- Detects & reports implicit request boundaries to the server
  - `oracle.jdbc.enableImplicitRequest` to turn off
- Handles state signature at runtime and replay
- Support for concrete classes

## 19c

- Implicitly starts requests using Java standard APIs on fresh connections
- **TAC is ON by default on ATP-D**
  - Use TP and TPURGENT for TAC
- Full session parameters restored, use `FAILOVER_RESTORE` on server side

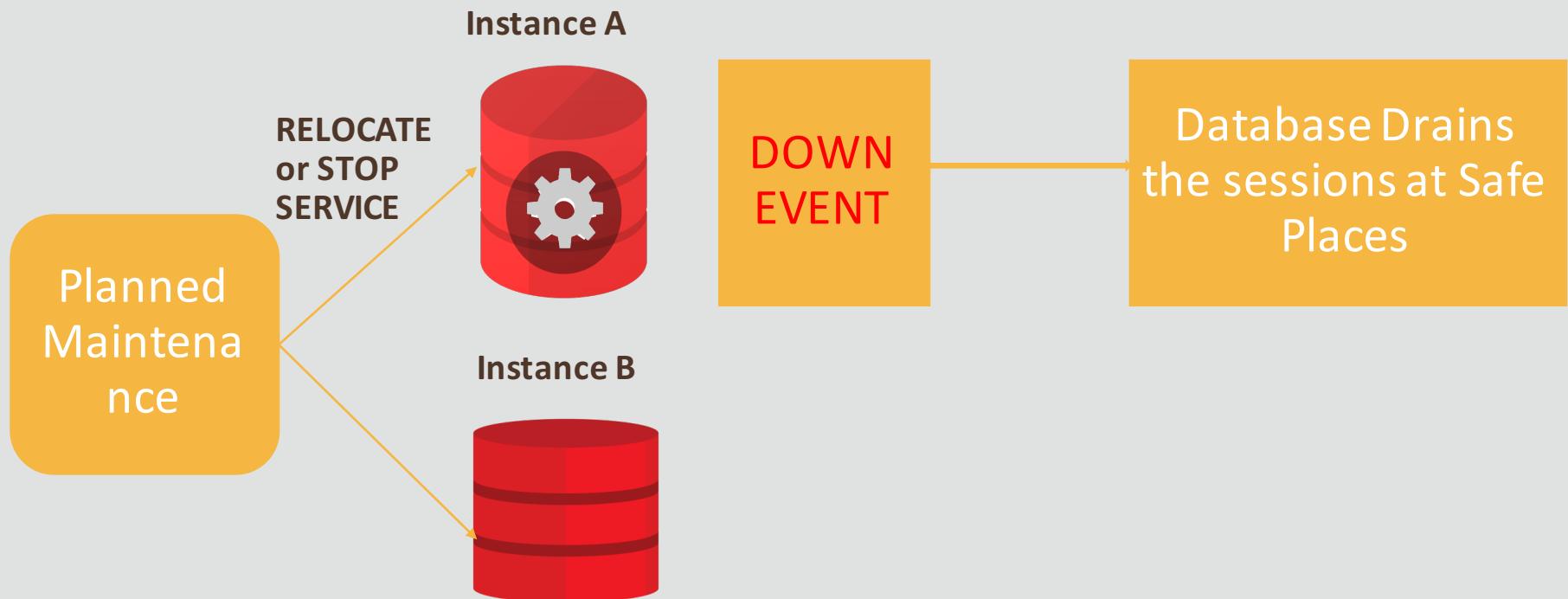
## 20c

- MODP (Modifiable Parameters) state coverage for both TAC and AC
- TAC template and overflow support
- Server has "planned failover"

# AC support for concrete classes

- The 18.3 JDBC driver supports the following concrete classes with Application Continuity
  - oracle.sql.CLOB,
  - oracle.sql.NCLOB
  - oracle.sql.BLOB
  - oracle.sql.BFILE
  - oracle.sql.STRUCT
  - oracle.sql.REF
  - oracle.sql.ARRAY
- NOT SUPPORTED datatypes
  - oracle.sql.OPAQUE and oracle.sql.ANYDATA

# Planned maintenance - Draining



# Planned Node Maintenance with JDBC

DB 12.2 JDBC driver (`ojdbc8.jar`)

- Driver closes the database sessions at a “Safe Place” (See connection validation options)
- Application must use one of the **safe draining methods** (next slide)
- Requires `simplefan.jar` and `ons.jar` in the classpath

# Tip: Enable Connection Tests for Application Servers

Application Server	Test Name	Connection Test to DB
Oracle WebLogic – Generic and Multi data sources	TestConnectionsOnReserve TestConnectionsOnCreate	isUsable() SQL – SELECT 1 FROM DUAL
Oracle WebLogic Active GridLink	Embedded	isUsable()
IBM WebSphere	PreTest Connections	SQL – SELECT 1 FROM DUAL
RedHat WildFly (JBoss)	Check-valid-connection-sql	SQL – SELECT COUNT(*) FROM DUAL
Apache Tomcat	TestOnBorrow TestOnRelease	SQL – SELECT 1 FROM DUAL

# Planned Node Maintenance

Java Requirements (Add these in the classpath)

- Option A: DB 12.2 + ucp.jar
- Option B: DB 12.2 + ojdbc8.jar
- Option C: DB 12.2 + ons.jar + simplefan.jar if not using UCP

# Transparency for all Outages



**Planned Maintenance**  
Patches  
Repairs  
Upgrades  
Changes



**Unplanned Outages**



**Unpredictable Response & Throughput**



**Site Disasters**



**Data Corruption**



**Human Errors**

# Solutions for handling Unplanned Outage

- Use UCP with replay datasource
  - `oracle.jdbc.replay.OracleDataSourceImpl`
- Use APIs to check the AC statistics
  - `OracleDataSource.getReplayStatistics(StatisticsReportType)`
  - `OracleDataSource.getReplayStatistics()`
- For server side settings, refer to the whitepaper or AC documentation

# Best Practices for handling Unplanned Outage

- Return connections to the pool
  - Check out and check in when the DB work is complete
  - Allows AC to embed request boundaries at safe places
- Enable JDBC Statement caching
  - `ods.setImplicitCachingEnabled(true);`
  - `(OracleConnection) conn).setStatementCacheSize(10);`
  - Disable the statement caching provided by the app servers (WLS, Tomcat etc.,)
- Align Application and Server Timeouts
  - `oracle.jdbc.ReadTimeout` and `HTTP_REQUEST_TIMEOUT` should be higher than detection and recovery timers on the server side

# High Availability with ATP-D

- Transparent Application Continuity is enabled by default on ATP-D
  - Use `tpurgent` or `tpurgent_tls` services
- Use the replay datasource (`oracle.jdbc.replay.OracleDataSourceImpl`)
- Set the ONS configuration on the client side
  - `onsConfiguration="nodes=<ATPDhost>:6200\nwalletfile=/net/host/path/ons wallet"`
- Make sure to have `ons.jar` and `simplefan.jar` on the classpath
- Increase the connection timeouts and `retry_count` and `retry_delay`
- RAC Rolling restart will handle everything on the server side

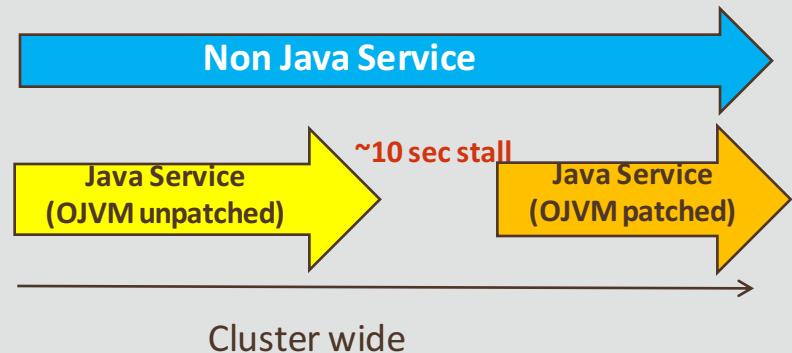


# Transparent Application Continuity with ATP-D (DEMO)

# OJVM Rolling Upgrade- Planned Maintenance -overview

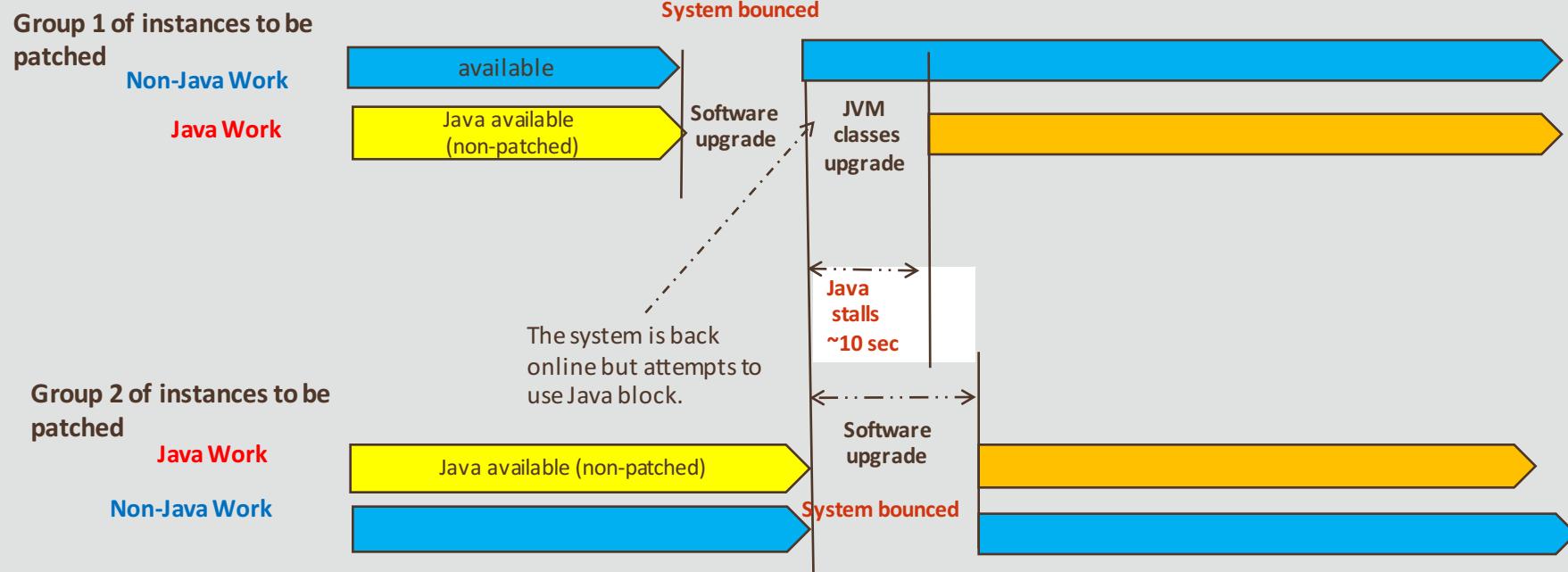
DB 18.4: OJVM Patching will be RAC Rolling

- No functional change
- Single PSU for both DB and OJVM
- Non-Java service available all time (at least one instance)
- Java service available all time, except ~10 sec brown-out
- No error reported during brown-out
- CDB/PDBs supported (may incur longer brown-out)
- Looking into back-porting to 11.2 and 12.1 (plan not finalized)
- White paper + MOS Note



# OJVM Rolling Upgrade- Planned Maintenance - Workflow

- 2 or more groups of instances targeted for upgrade
  - JVM classes upgrade -> once per database or CDB
  - Software upgrade -> each instance



# Thank You

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## Oracle JDBC and UCP

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