

The Oracle logo is displayed in white text on a red background.

Maximum Application Availability with Oracle Database 12c

Oracle Development



Problems to Solve

Maximum Application Availability

Upon Database Outage Four Problems Confront Applications

1. Hang
2. Error Handling
3. Outcome of In-Flight Work
4. Resubmission of In-Flight Work

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Current Situation

HA Mechanisms and Limitations

✓ Hang

- Fast Application Notification (FAN) / Fast Connection Failover
- Error Handling? **Not fully formalized**
 - If “**Connection not valid**” then Application gets a New one
- In-Flight Work? **Lost!**
- Resubmission of In-Flight Work? **N/A!**

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New Concepts

Recoverable Error: *is_recoverable* attribute; no need to maintain own list of

error codes (e.g., ora-1033, ora-1034, ora-xxx)
i.e., JDBC throws *SQLRecoverableException*

Logical Transaction ID: to obtain COMMIT outcome

Reliable Commit Outcome: outcome upon a recoverable error.

Database Request: Unit of work submitted by the application

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Database Request

Unit of Work

- PoolDataSource pds = GetPoolDataSource();
- Connection conn = getConnection(pds);
- PreparedStatement pstmt = ...
 - ...
 - SQL, PL/SQL, local calls, RPC
 - ...
- conn.commit();
- conn.close();

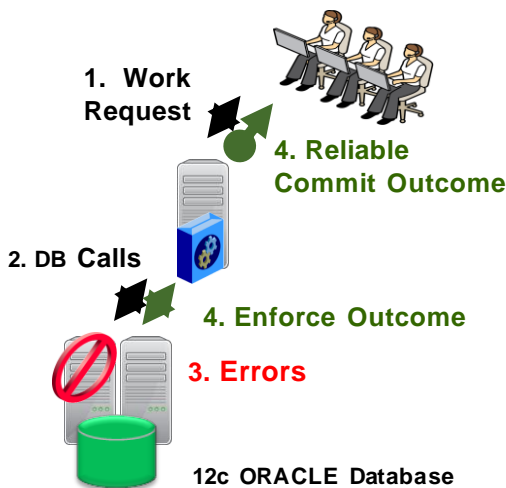
Request Begins

Request Body
Usually ends with **COMMIT**

Request Ends

Transaction Guard

Preserve & Retrieve COMMIT Outcome



- Transaction Guard allows applications to deal correctly with failures
- Without Transaction Guard, retry can cause logical corruption
- Application Continuity uses Transaction Guard
- Can be used independently via JDBC-thin, OCI/OCPI, ODP.NET

Transaction Guard

Broad driver support in first release

- Commit Models
 - Local TXN
 - Auto-commit, Commit on Success
 - Commit embedded in PL/SQL
 - DDL, DCL, Parallel DDL
 - Remote, Distributed
- Exclusions
 - XA
 - R/W DBLinks from Active Data Guard or Read Only

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Transaction Guard

Typical usage

- Database session outage
 - **FAN & FCF** abort dead session FAST
 - Application receives an error
- If **“recoverable error”** then
 - Get last LTXID from dead session
 - Obtain new database session
 - **Get transaction status**
DBMS_APP_CONT.GET_LTXID_OUTCOME with last LTXID

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Transaction Guard

Configuration

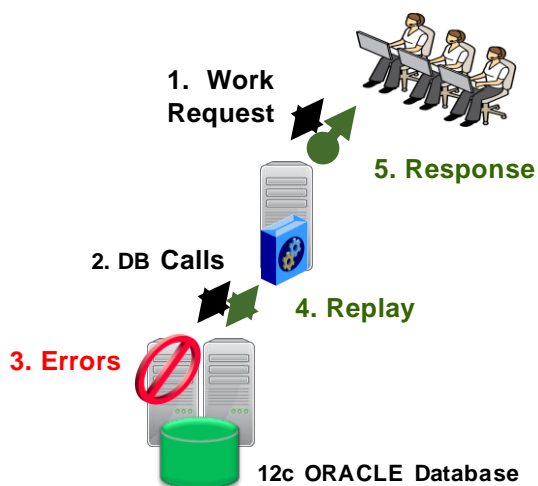
- On Service
 - COMMIT_OUTCOME
 - Values – TRUE and FALSE
 - Default – FALSE
 - Applies to new sessions
 - RETENTION_TIMEOUT
 - Units – seconds
 - Default – 24 hours (86400)
 - Maximum value – 30 days (2592000)

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Application Continuity

End to End Solution: Masks Outages When Successful



- Replays in-flight work on recoverable errors
- Masks many hardware, software, network, storage errors and outages when successful
- Improves end user experience

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Phases in Application Continuity

1-Capture	2-Reconnect	3-Replay
<ul style="list-style-type: none"> Keeps track of database requests Decides what can / cannot be replayed Holds original calls with binds and validation 	<ul style="list-style-type: none"> Checks request has replay enabled Handles timeouts Creates a new connection Validates target database Uses Transaction Guard to enforce last commit 	<ul style="list-style-type: none"> Replays held calls Verifies that user visible results match original Continues request if replay is successful

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Exclusions

Replay Disabled

Global	Request	Target Database
<ul style="list-style-type: none"> Do not use default database service Excludes XA Excludes Java deprecated concrete classes 	<ul style="list-style-type: none"> Restricted calls <ul style="list-style-type: none"> Alter System Alter Database Not supported for Active Data Guard with read/write database links 	<ul style="list-style-type: none"> Does not support: <ul style="list-style-type: none"> Logical Standby Golden Gate

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AC – Application Assessment

Decide	What to do
Request Boundaries	Mark request boundaries, if not using Oracle Pools
Side Effects	Use disable API if a request has a call that should not be replayed
Mutable Functions	Grant keeping mutable values
Callbacks	Register a callback for apps that change state outside requests. For WebLogic and UCP labels – do nothing.
JDBC Concrete Classes	Replace deprecated concrete classes with Java interfaces

Disabling Replay

- Use `disableReplay` API for requests that should not be replayed.
- Make a conscious decision to replay external actions**

e.g. Autonomous Transactions

UTL_HTTP

UTL_URL

UTL_FILE

UTL_FILE_TRANSFER

UTL_SMPT

UTL_TCP

UTL_MAIL

DBMS_PIPE

DBMS_ALERT



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Configure JDBC Replay Data Source

- Configure the new Replay Data Source in the property file (or in the thin JDBC app)

Use new 12.1

```
replay_datasource=oracle.jdbc.replay.OracleDataSourceImpl
```

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Server Configuration - Service

- Set the service attributes:
 - `FAILOVER_TYPE = TRANSACTION` for using Application Continuity
- Review the service attributes:
 - `COMMIT_OUTCOME = TRUE` for Transaction Guard
 - `REPLAY_INITIATION_TIMEOUT = 300` after which replay is canceled
 - `FAILOVER_RETRIES = 60` for the number of connection retries for each replay attempt
 - `FAILOVER_DELAY = 3` for delay in seconds between connection retries
 - `AQ_HA_NOTIFICATIONS = TRUE` for FAN

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Server Configuration - Mutables

GRANT [KEEP DATE TIME | KEEP SYSGUID].. [to USER]

- REVOKE [KEEP DATE TIME | KEEP SYSGUID][from USER]
- GRANT KEEP SEQUENCE.. [to USER] on [sequence object];
- REVOKE KEEP SEQUENCE [from USER] on [sequence object];
- If owned, ALTER SEQUENCE.. [sequence object] [KEEP|NOKEEP];
CREATE SEQUENCE.. [sequence object] [KEEP|NOKEEP];

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