

ORACLE®

# Oracle GoldenGate 12c for Oracle Database 12c

Jagdev Dhillon  
Vice President

Nick Wagner  
Product Manager

**ORACLE**



# Safe Harbor Statement

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

# Program Agenda

- 1 Oracle GoldenGate 12.1.2 Review
- 2 Oracle GoldenGate 12.1.2.1 New Features
- 3 Streams to GoldenGate Conversions
- 4 Q&A

# Oracle GoldenGate 12c Enhancements

Area	Enhancements
Oracle Integration	Support for Oracle Multitenant, Integrated Replicat for automatic dependency-aware apply, integration with Data Guard for auto-restart of GG components after failover
Improved Ease of Use	Simpler configuration of DDL replication, Coordinated Replicat for all databases to allow for better, simpler scalability
Enhanced Security	Integration with Oracle Credential Store for database authentication
Enhanced Heterogeneity	New capabilities for replication for MySQL, SQL Server, Sybase, Teradata, and DB2.
Cloud Ready	Capture from and delivery to the Cloud, both Cloud to Cloud and on-premises to cloud

# Oracle GoldenGate 12c Generic Enhancements

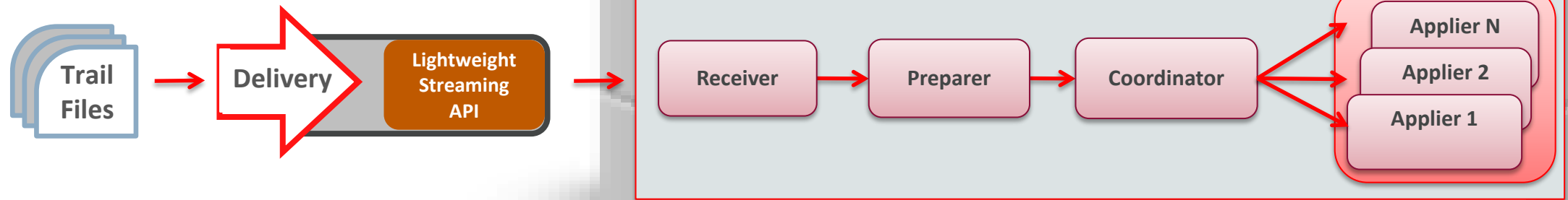
- DDL Trigger is no longer needed
  - Works with Oracle 11.2.0.4 and up and requires Integrated Extract
  - Works with Oracle Standard Edition as well as Enterprise Edition
- DISCARDFILE now has defaults, and no longer needs to be specified for each Replicat
- Improved Schema Wildcard resolution within the parameter files
  - Only captures first TABLE parameter for SCOTT.EMP DML  
TABLE SCOTT.EMP, COLMAP(...);  
TABLE \*.EMP;
- Oracle 12c Expanded Data Type Support
  - Support for VARCHAR2 / NVARCHAR2 / RAW MAX options (32k length)

# Integrated Replicat

- Integrated Replicat for Oracle target databases only
  - 11.2.0.4 and 12c (12.1.+)
- Leverages database parallel apply servers for automatic dependency aware parallel apply
- Minimal changes to replicat configuration
  - Single replicat parameter file for all tables
  - No split transaction semantics

# Integrated Replicat

## Architecture Diagram



### Delivery

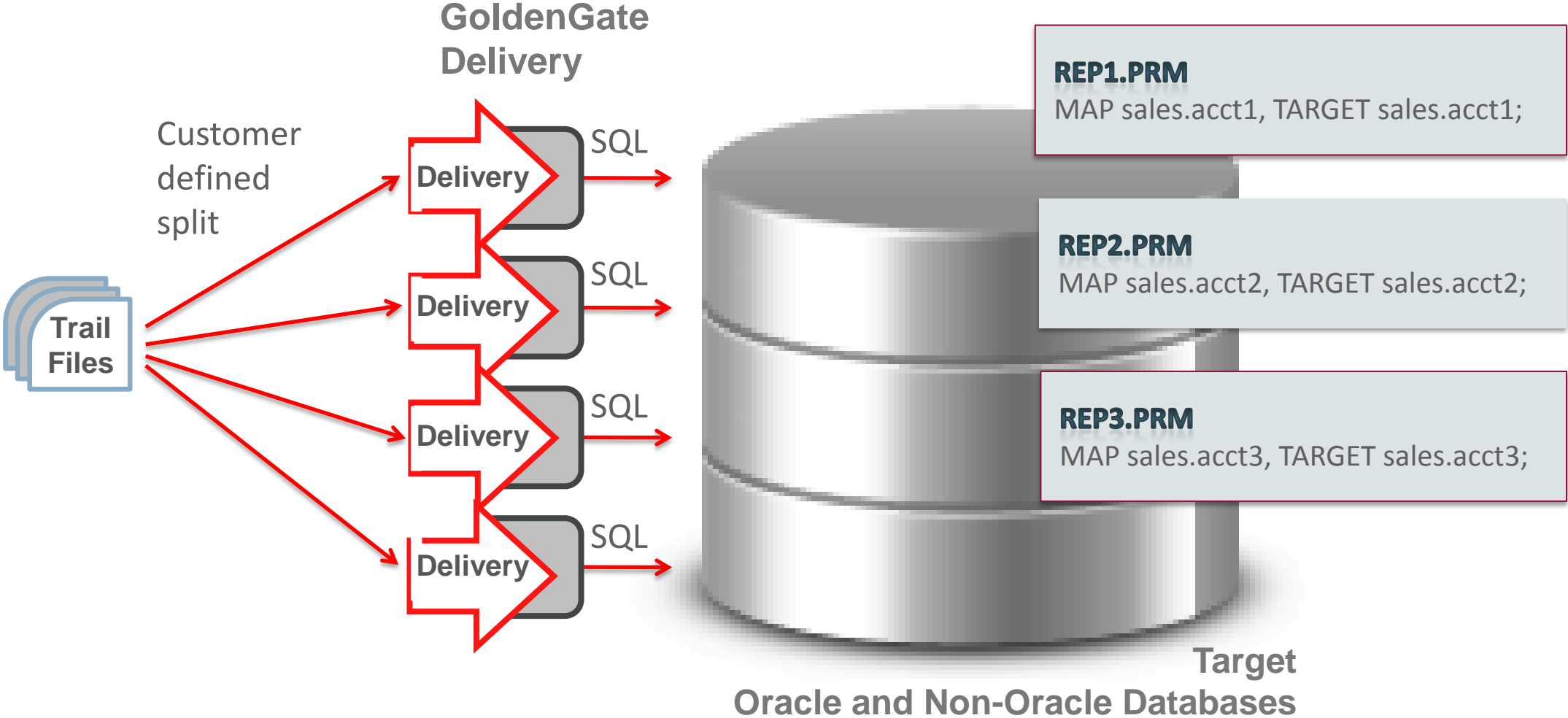
- Reads the trail file
- Constructs logical change records (LCRs)
- Transmits LCRs to Oracle Database via the Lightweight Streaming API

### Inbound Server (Database Apply Process)

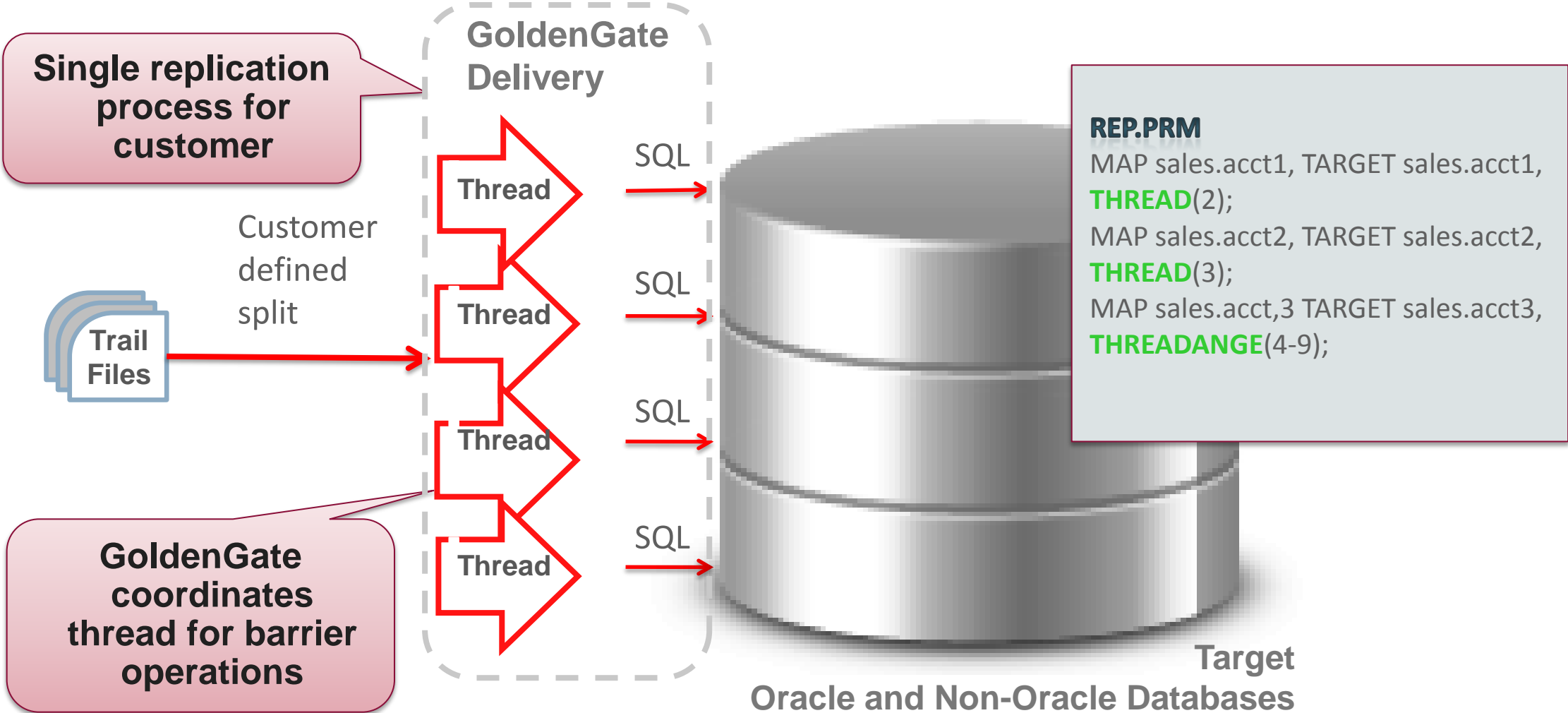
- **Receiver:** Reads LCRs
- **Preparer:** Computes the dependencies between the transactions (primary key, unique indexes, foreign key) , grouping transactions and sorting in dependency order.
- **Coordinator:** Coordinates transactions, maintains the order between applier processes.
- **Applier:** Performs changes for assigned transactions, including conflict detection and error handling.



# Prior to OGG 12c - High Volume Replication



# Coordinated Delivery for Non-Oracle Databases



# Key Concepts

## Coordinated vs. Integrated Replicat

	Coordinated Replicat	Integrated Replicat
Thread management	User Specified	Automatic based on foreign keys and unique identifiers
Maintain Commit Boundaries	Single Thread only	Fully Maintained
Database Support	All databases	Oracle 11.2.0.4 and 12c
SQL Execution	Done by the OGG Replicat process	Execution is done in the database server

# Credential Store/Oracle Wallet

- Oracle Wallet and Credential Store functionality now built into the Oracle GoldenGate Installation
- Credential Store for storing usernames and passwords
- Once a credential has been added to the wallet
  - Remove USERID, MININGDBUSERID, etc
  - Replace with USERIDALIAS, MININGDBUSERIDALIAS, etc

# HA Features for GoldenGate in 12.1.2

- Oracle Active Data Guard and Oracle GoldenGate High-Availability Best Practices [CON7715]
  - Tuesday, Sep 30, 10:45 AM - 11:30 AM- Moscone South – 308
- Full Integration with ASYNC FSFO
  - GoldenGate can now safely follow bounded data-loss failovers
  - Support enabled in Integrated Extract with the addition of the following parameter:  
TRANLOGOPTIONS HANDLEDLFAILOVER
    - Works for Oracle DB 11g and 12c
- Full integration with Oracle's XAG
  - XAG allows you to register a GoldenGate instance to improve HA
  - XAG provides increased availability in the face a loss of an instance or Primary database

# Program Agenda

- 1 Oracle GoldenGate 12.1.2 Review
- 2 Oracle GoldenGate 12.1.2.1 New Features
- 3 Streams to GoldenGate Conversions
- 4 Q&A

# 12.1.2.1 Major Enhancements

- Capture Enhancements
  - Integrated Extract Enhancements
  - Certification for Oracle 12.1.0.2 and In-Memory Database (IMDB)
  - Support for Capturing from ADG Standby database
- Integrated Delivery Enhancements
  - Dependency Aware Batching
  - DDL and DML Handlers
  - Error Queue Support
- Support for multiple Editions (Edition Based Redefinition)
- Column Level Character Set Support
- SOCKS 5 Support

# 12.1.2.1 Capture Enhancements

## Integrated Extract Specific Enhancements

- Continues to support Oracle SE and EE databases
- Improved Startup Performance and Scalability (shared mining dictionary)
- Tagged transaction can be excluded for Active-Active replication
  - EXCLUDETAG
- Create Table As Select... can be applied as DDL + DML rather than DDL
  - TRANLOGOPTIONS GETCTASDML
- Added redo log capture for ANYDATA and UDTs
  - TRANLOGOPTIONS USENATIVEOBSUPPORT
- Support for Edition Based Redefinition and multiple editions



## 12.1.2.1 Capture Enhancements

Classic Extract can now capture from an ADG Standby database

- Extract can be configured to run on the Standby Database
- Configuration on the Primary database
  - Setup DDL capture (optional)
  - Configure Supplemental log data
- Configuration on the Standby database
  - USERID Parameter points to the Primary database (USERID username@primary )
  - Set TRANLOGOPTIONS MINEFROMACTIVEDG

# 12.1.2.1 Capture Enhancements.

## Shared Logminer Dictionary

- REGISTER EXTRACT ecap DATABASE
- REGISTER EXTRACT ename DATABASE SHARE ecap
  - Ename is created as a “clone” of ecap
  - 2<sup>nd</sup> extract (ename) uses same internal dictionary as ecap
    - Fast start of 2<sup>nd</sup> extract (no dictionary processing required)
    - Single extract does dictionary maintenance
- REGISTER EXTRACT eother DATABASE SCN startatscn SHARE ecap
  - SCN parameter meaning is different when combined with SHARE

# 12.1.2.1 Capture Enhancements

## EXCLUDETAG Functionality

- TRANLOGOPTIONS EXCLUDETAG takes a single string value, but allows multiple lines to specify multiple tags
- Extend EXCLUDETAG to exclude any tagged operation
  - EXCLUDETAG +
  - Similar to Streams is\_null\_tag setting.
- Filtering of tagged transactions can be done in the Extract pump and REPLICAT

# 12.1.2.1 Integrated Delivery Enhancements

## Dependency-Aware Batching for Integrated Replicat

- Through the use of INTEGRATEDPARAMS BATCHSQL\_MODE
  - Controls the ordering of transactions in BATCHSQL mode
  - Options:
    - SEQUENTIAL – transaction batched in sequential order
    - DEPENDENT – Dependency grouping, schedule when no active dependencies
    - DEPENDENT\_EAGER – dependency grouping but allow scheduling when there are active dependencies
  - Default is DEPENDENT for Oracle 12.1.0.2
  - Requires new OGG/RDBMS bundled patch (bp2) but not available for 11.2.0.4.
    - Without patch, default is SEQUENTIAL
- COMMIT\_SERIALIZATION=FULL sets BATCHSQL\_MODE=SEQUENTIAL

# 12.1.2.1 Integrated Delivery Enhancements

## Integrated Replicat Apply Handler Configuration

- Uses the same package calls to set up as Streams does
  - DBMS\_APPLY\_ADM package
    - DML: Set\_dml\_handler or Add\_stmt\_handler
    - DDL: Alter\_apply
  - The scope of handler is dependent on the configuration
    - Per Table , Per Operation (Ins/Upd/Del)
    - It is associated with the Inbound Server (Integrated Replicat process inside the database)
    - Operations processed by the DML/DDL handler will not be applied by the Replicat
- Integrated Replicat needs to be stopped and restarted when adding or removing handlers.

# 12.1.2.1 Integrated Delivery Enhancements

## PL/SQL Update Handler on DEMO.ORDERS table

```
BEGIN
DBMS_APPLY_ADM.SET_DML_HANDLER(
object_name => ""DEMO"."ORDERS"",
object_type => 'TABLE',
operation_name => 'UPDATE',
error_handler => FALSE, ## if FALSE, then the handler replaces normal apply processing,
                        ## if TRUE, then the handler is only executed on error.
user_procedure => 'DEMO.ORDERS_DML_HANDLER',
apply_database_link => NULL,
apply_name => NULL); ## If NULL, then handler is used for ALL apply & inbound servers
END;
/
```

# 12.1.2.1 Integrated Delivery Enhancements

## Statement DML Handlers

- Statement DML handlers are up to 4x faster than procedural DML handlers
  - Statement DML handlers should be used to replace SQLEXEC in the Replicat when possible
- Easy to Use
  - SQL statements, rather than PL/SQL procedures
  - DBMS\_APPLY\_ADM.ADD\_STMT\_HANDLER
    - Creates handler with SQL statement AND
    - Registers to Apply process
  - DBMS\_STREAMS\_HANDLER\_ADM package procedures
    - Create or Drop handler
    - Add or Remove statements to/from handler
    - Register with apply

# 12.1.2.1 Integrated Delivery Enhancements

## Enable Error Queue Handling

- In older versions of OGG, if an error occurs it falls back and lets the Replicat retry the operation. If the OGG retry fails it abends
- Allow DBMS\_Apply\_Adm.Execute\_Error capability for Integrated Replicat to retry operations in the error queue. Handles whether is message is added to the error queue.
  - DBOPTIONS \_NO\_DISABLE\_ON\_RETRY\_ERROR
    - Allow OGG to retry, but if OGG fails, continue processing. If OGG successfully applies transaction, OGG deletes error from queue. Default behavior.
  - DBOPTIONS \_NO\_DISABLE\_OR\_RETRY\_ERROR
    - Disable OGG retry and continue processing, recommended with COMMIT\_SERIALIZATION=FULL



# 12.1.2.1 Integrated Delivery Enhancements

## Managing Apply Errors

The screenshot displays the Oracle Enterprise Manager interface for a GoldenGate Apply process. The main heading is "View Details: OGG\$RORCL\_3 - GoldenGate Apply (apply)". Below this, there are tabs for "Overview", "Configurations", "Rules", and "Statistics". The "Overview" tab is active, showing a "General" section with status information (Status: up, Apply User: GGADM, Purpose: GoldenGate Apply, Apply Tag: 076079) and a "State" section (Reader: IDLE, Coordinator: IDLE, Server: IDLE(12)).

An "Errors" section is visible, indicating "Transaction Errors 1" and "Apply Errors: Error Number n/a Error Message n/a". Below this, there are buttons for "Retry Transaction", "Delete", "Retry all Transactions", and "Delete All".

A table of errors is displayed below the buttons, highlighted with a red border. The table has columns for "Transaction ID", "Message", "Error", and "Objects". The error details are as follows:

Select	Transaction ID		Source Database	Commit SCN	Message		Error			Objects				View Error LCRs	
	Local	Source			Number	Count	Number	Message	Error Type	Owner	Name	Primary Key	Operation		
<input type="checkbox"/>	10.15.89	9.27.2515	NULL	0	1	1	1	ORA-00001: unique constraint (.) violated	ORA-0000		DEMO	ORDERS		INSERT	

# 12.1.2.1 Integrated Delivery Enhancements

## Managing Apply Errors

The screenshot displays the Oracle Enterprise Manager (SYSMAN) interface in a Mozilla Firefox browser window. The page title is "Compare Values: OGG\$RORCL\_3". The breadcrumb navigation shows: Manage Replication > View Apply Details > View Error LCRs > Compare Values: OGG\$RORCL\_3. The main heading is "Compare Values: OGG\$RORCL\_3". Below the heading, an error message is displayed: "Error ORA-00001: unique constraint (.) violated ORA-00001: unique constraint (DEMO.SYS\_C004972) violated".

Column Name	Column Type	Old Value	New Value	Current Value
STATUS	SYS.VARCHAR2		PENDING	MakeItFail
ORDER_NUMBER	SYS.VARCHAR2		1008	1008
DELIVERY_DATE	SYS.DATE		19-SEP-2014 06:57:11	19-SEP-2014 18:55:37
PART_NUMBER	SYS.VARCHAR2		789	9999

**TIPS**

- Old Value shows the old column value in the row LCR. This is the column value for the row before the DML change.
- New Value shows the new column value in the row LCR. This is the column value for the row after the DML change.
- Current Value shows the column value in the row at the destination database. This is the row that will be modified by the row LCR when the apply process applies the change.

# 12.1.2.1 Integrated Delivery Enhancements

## Edition Based Redefinition

- DDL Replication now supports CREATE/DROP EDITION
  - Replicat will grant the user permission to use if it exists on target
- Extract will capture the EDITION NAME owner
- Replicat will switch session to the EDITION owner before applying DDL
- DDL operations on editions can be filtered as well
  - DDL INCLUDE ALL, EXCLUDE OBJTYPE EDITION

## 12.1.2.1 Major Enhancements

- Support for Column Level Character Sets
  - For cases where a table has column(s) with a character set that is different from the database character set.
  - Use SOURCECHARSET to enable this functionality
    - In MAP / TABLE statements use CHARSET to use your own settings
    - In DEFGEN use COLCHARSET to use your own settings

# 12.1.2.1 Major Enhancements

- Enhanced Cloud support

- SOCKS v5 Support

- SOCKet Secure is a protocol that supports routing between client and server
    - Allows authentication
    - SOCKS can encrypt all traffic between client and server
    - Alternative to VPN for cloud to on-premise or vice-versa

- New parameter SOCKSPROXY

- SOCKSPROXY host:port, [PROXYCSALIAS <alias> [, PROXYCSDOMAIN domain]]

# 12.1.2.1 Major Enhancements

- Enhanced Cloud support

- Example for sending trail data from on-premise to cloud.

- GoldenGate installed on cloud-server.oracle.com with manager port 9000
- Firewall only allows incoming connections on SSH port.

- Use SSH as SOCKS proxy server on-premise

- `ssh -i ssh-key -N -f -D 1080 cloud-user@cloud-server.oracle.com`
- Port 1080 is the client port that will route to an OGG installation on cloud-server.oracle.com

- Extract Parameter file:

- `RMTHOST cloud-server.oracle.com, MGRPORT 9000, SOCKSPROXY localhost:1080`

# Program Agenda

- 1 Oracle GoldenGate 12.1.2 Review
- 2 Oracle GoldenGate 12.1.2.1 New Features
- 3 Streams to GoldenGate Conversions
- 4 Q&A

# Streams to Oracle GoldenGate Conversion Utility

## MOS 1912338.1 Oracle Streams to Oracle GoldenGate Conversion

- Streams is now deprecated (as of Oracle 12c)
- Designed to help existing Streams users convert their replication into Oracle GoldenGate replication.
  - The streams2ogg tool will generate the appropriate GoldenGate 12c configuration files allowing for an easier way to migrate the Streams implementation into a GoldenGate implementation.
- This tool will help
  - Eliminate manual conversion errors
  - Minimize the GoldenGate learning curve for Streams customers
  - Implement GoldenGate best practices



# Streams to Oracle GoldenGate Conversion Utility

## MOS 1912338.1 Oracle Streams to Oracle GoldenGate Conversion

- The streams2ogg migration tool is run at the database level
  - connecting to the Streams Administrator schema
  - Load and execute the streams2ogg package
  - Oracle GoldenGate Parameter files are produced
- OGG configuration files can be generated to run on a different database or machine to allowing for testing and platform migrations.

### NOTE:

This tool does not provide the environment or process for switching from Streams over to your GoldenGate implementation. And does not support complete conversion of the CDC (Change Data Capture) feature of Oracle DB. Ideally suited for environments where the source and target object structure is the same.

# Streams2ogg

## MOS 1912338.1 Oracle Streams to Oracle GoldenGate Conversion

- Database package streams2ogg
  - Download from MOS Doc ID [1912338.1](#)
- Load package as Streams Administrator and answer 2 questions
  - @streams2ogg
  - Name of Oracle GoldenGate administrator schema
  - Name of staging directory for storing the generated files
- Run procedure from Streams Administrator schema using either:
  - exec streams2ogg.main
  - exec streams2ogg.customize (if performing customizations)
- All generated files will be in the staging directory.

# Streams2ogg Files Generated

File Name	Description
<i>ecapname.prm</i>	Extract file name based on <i>capture name</i>
<i>pcapname.prm</i>	Pump file name based on <i>capture name/propagation name</i>
<i>rappname.prm</i>	Replicat file name based on <i>apply name</i>
<i>mgr.prm</i>	Manager file name - contains PORT number, other OGG mgr Best Practice parameters (These are not based on Streams configuration)
<i>handlers.sql</i>	Sql script to configure Streams handlers after replicat process is registered (does not include handler code)
<i>streams2ogg.trc</i>	Debug/Trace file – always generated
<i>streams2ogg.rpt</i>	Report file – always generated

# Streams2ogg Files Generated (continued)

File Name	Description
ggconfig.oby	GGSCI obey file to create extract, pump, replicat processes
ggconfig2.oby	GGSCI obey file to create additional extract processes based on first extract SCN
ggconfig_trandata.oby	GGSCI obey file to configure database supplemental logging
create_subdirectories.sh	Shell script to generate directory structure under the trail file storage directory
reg_extract.sh	Helper shell script for ggconfig2.oby OGG 12.1.2.0 Register extract... SCN option
watch.sh, watch.sql watch_status.sql	Helper shell and sql script for ggconfig2.oby for OGG 12.1.2.1 Register extract...SHARE option watch_status.sql can be used to get status of capture initialization
ogg_name_map.csv	Comma-separated name/value pairs for customizing streams2ogg file generation

# Streams2ogg Post Execution Steps

## MOS 1912338.1 Oracle Streams to Oracle GoldenGate Conversion

- Parameter files and obey files need to be edited
  - Choose method to login: dblogin or dbloginalias
  - For dblogin, set password
- Pump parameter file also needs to identify the host name for the RMTHOST command
  - If PORT number is changed in mgr.port, modify port number in pump file, too.
- wait.sh script needs sqlplus login password

# Program Agenda

- 1 Oracle GoldenGate 12.1.2 Review
- 2 Oracle GoldenGate 12.1.2.1 New Features
- 3 Streams to GoldenGate Conversions
- 4 Q&A

# **Hardware and Software Engineered to Work Together**

ORACLE®