

# Managing Oracle GoldenGate

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# Introduction

## About Myself

- Oracle DBA
- GoldenGate Admin

## Instructor

- UCSD
- George Washington University
- Other IT Institutes

## Presented

- IOUG – RAC Best Practices & Tuning
- IOUG – Data Guard Best Practices and Tuning

# VST Oracle Articles

Master GoldenGate & Oracle 12c Database

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- **Introduction to GoldenGate**
- GoldenGate Architecture
- Basic Configuration
- Selecting and Filtering Data
- BatchSQL, Compression, Encryption
- DDL Replication
- Performance Tuning
- GoldenGate 12c New Features

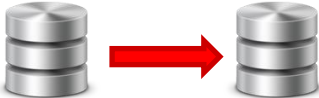
# Introduction to GoldenGate

- What is GoldenGate?
  - Replication mechanism
  - Reads from Redo logs or Archive logs
- What is the history and future?
  - Purchased by Oracle
  - Dependable – Used by Banks, etc..
  - Replacement for Oracle Streams

# Topologies

- Uni-directional
- Bi-Directional
- Peer to Peer
- Broadcast
- Consolidation
- Data Distribution

**Unidirectional  
Query Offloading  
Zero - Downtime Migration**



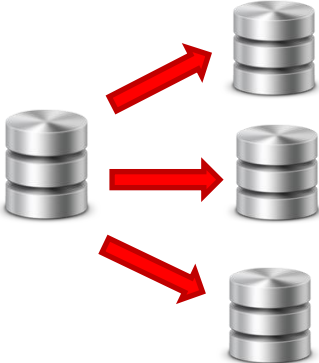
**Bi - Directional  
Hot Standby or  
Active - Active for  
HA**



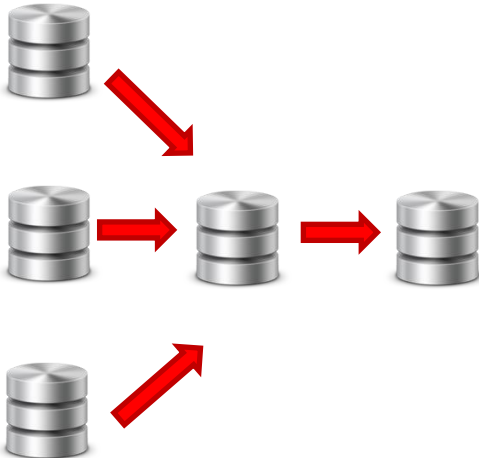
**Peer - to - Peer  
Load Balancing  
Multi - Master**



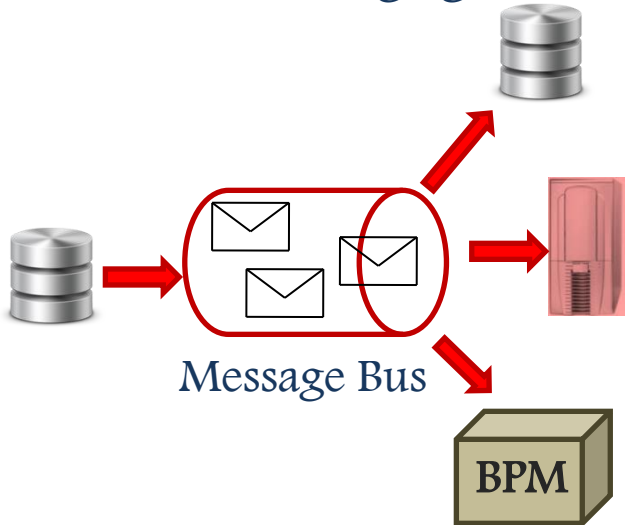
**Broadcast  
Data Distribution**



**Integration Consolidation  
Data Warehouse**



**Data Distribution  
Via Messaging**



# Unidirectional

## Query Offloading - Zero - Downtime Migration

- Simplest, basic config
- Two database servers
- DDL or DML Captured on source
- Data replicated from source to target
- Called **Active-Passive** configuration.





# Bi-Directional

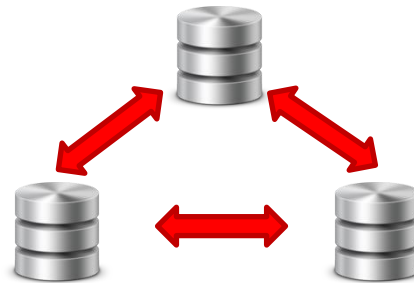
Hot Standby or Active – Active for HA

- **Active-Active** configuration
- Requires two DB's
- Supports both DDL and DML
- Provides High availability
- Allows transactional load Balancing



## Peer – to – Peer

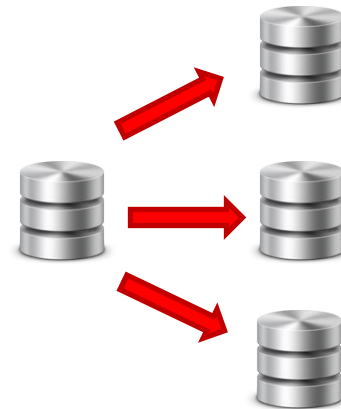
- More than two systems
- Connected through Bi-Directional config
- Data replicated from source's to ALL DB's



# Broadcast

## Data Distribution

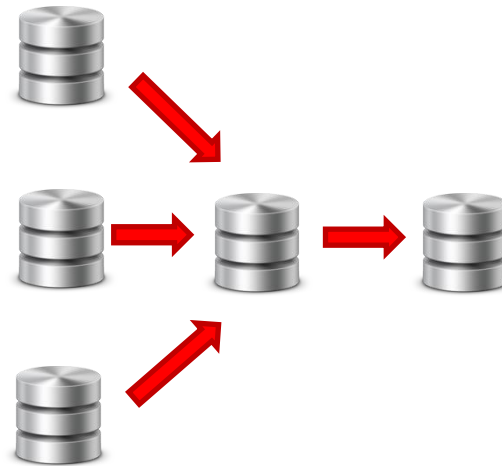
- One Source, many targets
- For Live reporting site
- For Backups
- One source, many target DB's



# Integration Consolidation

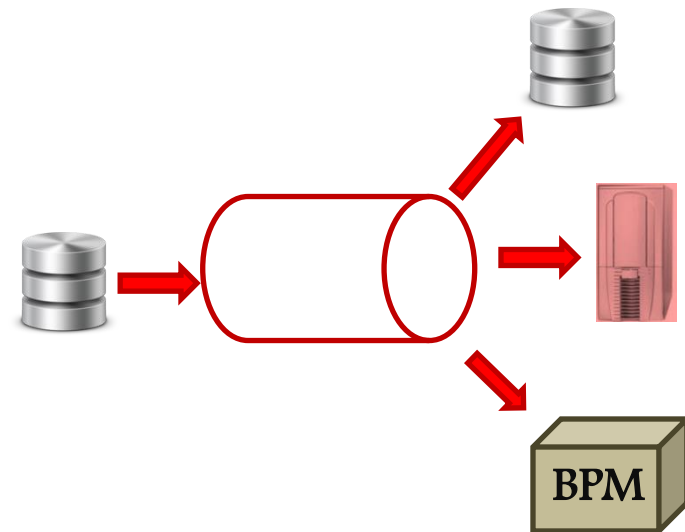
## Data Warehouse

- Multiple Source, one target
- Data replicated from multiple source DB's to central DB
- Synchronize data from multiple DB's to single target



# Data Distribution

- Also known as Cascading
- Data replicated from
  - One source to one
  - Or Multiple Database servers
- Most powerful configuration
- Considered a complex setup



# Replication

DML – on by Default

DDL – Needs to be enabled

- Introduction
- **GoldenGate Architecture**
- Basic Configuration
- Selecting and Filtering Data
- BatchSQL, Compression, Encryption
- DDL Replication
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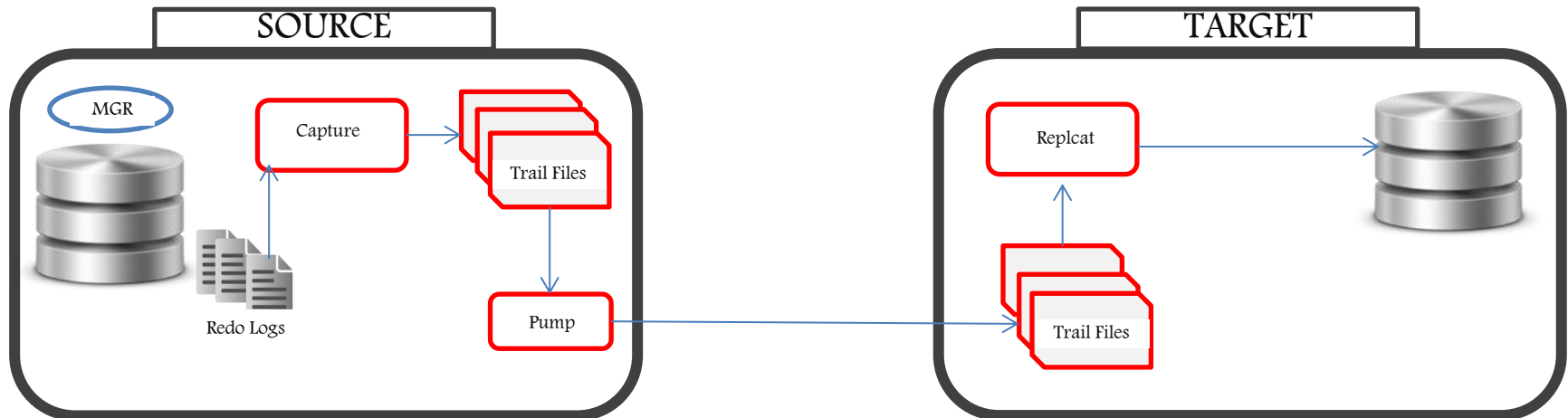
# Architecture

Components include:

- Manager
- Extract/Capture(traditional vs Integrated)
- Pump
- Replicate

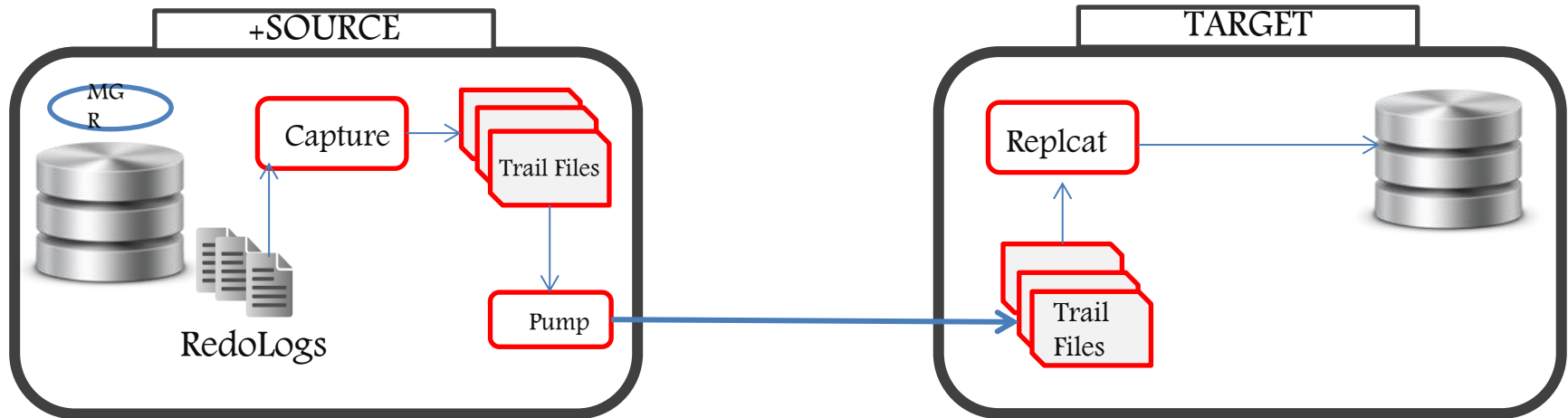


# MGR



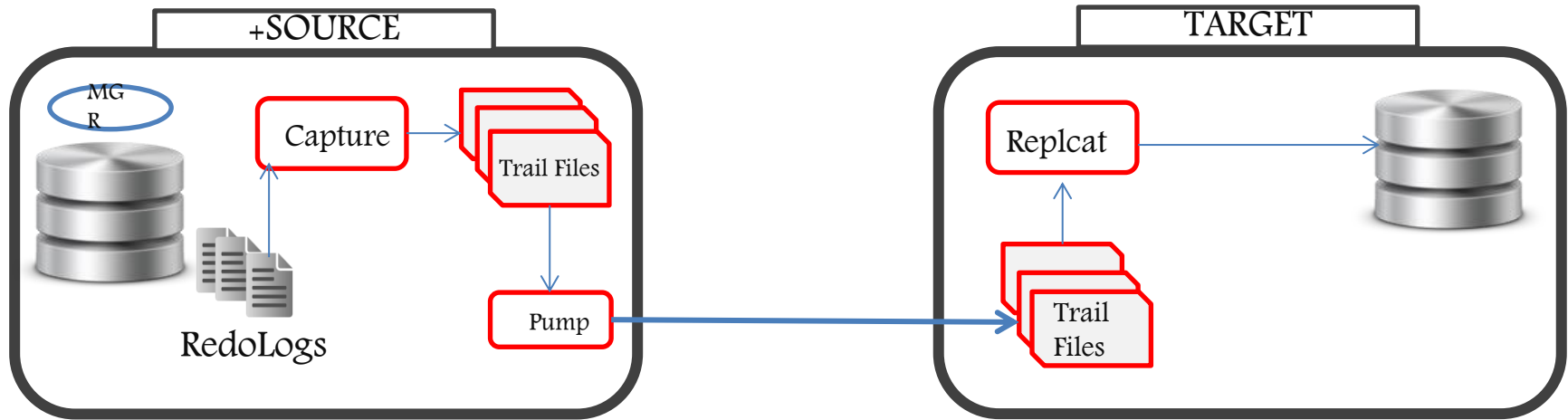
- Running before configuring processes
- Purges trail files
- Autostart processes
- Restarts failed
- One manager per GoldenGate home

## EXTRACT



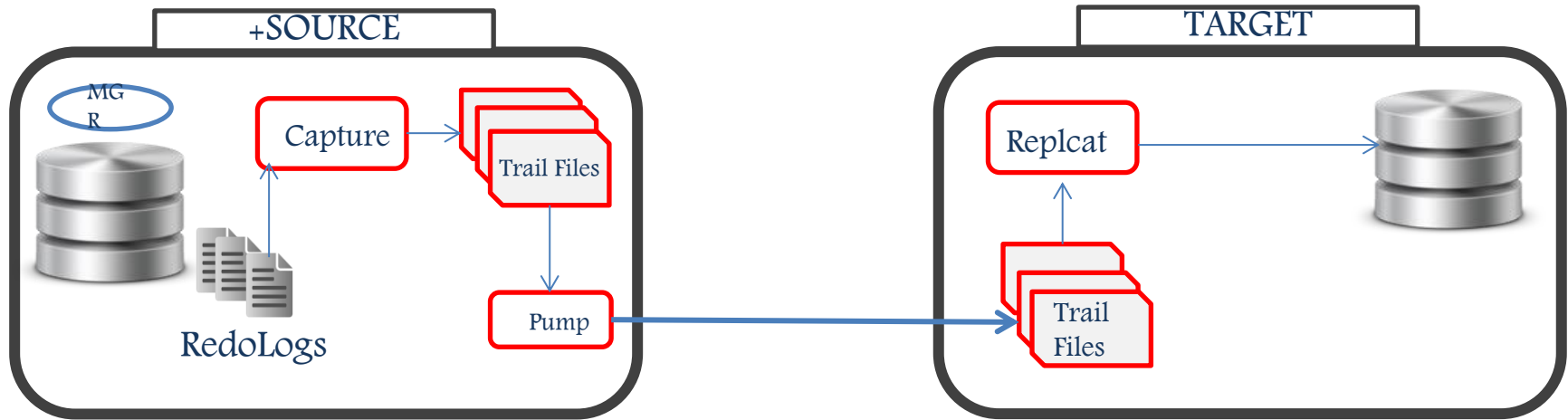
- Read Redo logs, Archive logs
- Extracts DML and DDL transactions
- Writes committed data to trail file
- Writes uncommitted data to dirtmp (disk)
- Can be Encrypted

# PUMP



- Also an extract process
- Optional in the GG setup
- Copies trail files to target system
- PASSTHRU for performance

# REPLICAT



- Also called Apply process
- End point of data delivery chain
- Reads trail files generated by Pump
- Replcat converts data into SQL INSERT
- Applies data changes to target DB

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# Installation

- Download GG software
- Unzip file
- Start GGSCI
- Run “Create Subdirs” command
- Configure/Start Manager process

# Pre-Requisites

- User with proper privs
- Logging to Capture KEY value changes

## On Source DB

- Database level
- Object Level

# Configure Extract

- Change Capture keeps track of transactional changes
- Configuration steps:
  - Configure Extract
  - Start Extract
  - Initial Load
  - Configure Pump
  - Start Pump



# Configure Extract

- Extract Parameter file
- Add Extract process
  - “ADD EXTRACT” with “TRANLOG “option
- TRANLOG option reads online Redologs
- Add Trail Files to Extract process
  - ADD EXTTRAIL

```
ADD EXTRACT E_SRC, TRANLOG, BEGIN NOW
```

```
ADD EXTTRAIL ./dirdat/ST, EXTRACT E_SRC, megabytes 50
```

# Configure INTEGRATED Extract

- Add Extract Parameter file
- Add Extract process
  - “ADD INTEGRATED EXTRACT” with “TRANLOG “option
- TRANLOG option reads online Redologs
- Add Trail Files to Extract process
- ADD EXTTRAIL

```
ADD INTEGRATED EXTRACT E_SRC, TRANLOG, BEGIN NOW  
ADD EXTTRAIL ./dirdat/ST, EXTRACT E_SRC, megabytes 50
```

# Initial Load

- `impdp gg_admin_wh DIRECTORY=ENT_BI_DIR NETWORK_LINK=sdna schemas=pay_eng remap_schema=pay_eng:na_pay_eng REMAP_TABLESPACE=SYSTEM:OD_DATA INCLUDE=TABLE/TABLE_DATA, TABLE/PROCACT_INSTANCE, TABLE/TABLE, TABLE/CONSTRAINT, TABLE/INDEX, TABLE/COMMENT, TABLE/CONSTRAINT, TABLE/STATISTICS FLASHBACK_SCN=7288654023027;`
- CTAS
- Database/Clone Recovery

## Handling ORA-1555 SnapShot Too OLD

- `DBMS_PARALLEL_EXECUTE`

# Configure Pump

- Create Pump Parameter file
- Add Pump process
- Start Pump Process

# Configure Replicat

- Create Replicat Parameter file
- Add Replicat process
  - “ADD REPLICAT” command with “EXTRAIL” parameter
- Associate Replicat with Trail file
  - `ADD REPLICAT R_SRC, EXTTRAIL ./DIRDAT/TT, CHECKPOINTTABLE GGS_CHECKPOINT, BEGIN NOW`
- Start Replicat Process

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# Data Mapping and Manipulation

- Selection, Mapping & Manipulation performed
  - TABLE & MAP parameters
- Data Integrated between source and target
  - Selection of records and columns
  - Selection & converting operations
  - Mapping different columns
  - Transforming data
  - Testing
  - Use of tokens

- Used for simple filtering of data
- Used with MAP or TABLE statement
- Functions compatible with “WHERE” clause
  - @present: Checks presence of column in data
  - @absent: Checks the absence of column
  - @null: Checks for Null data in data record

MAP SOURCE.EMP, TARGET TARGET.EMP, & WHERE (AMOUNT = @PRESENT  
AND AMOUNT <> @NULL);



## FILTER clause

- Evaluates complex data selection
- Select rows & columns with specific operations
- Built-in functions can be used
- Used with MAP or TABLE statements

```
TABLE SOURCE.EMP, FILTER (ON UPDATE, ON DELETE, AMOUNT > 1000);
```

# Filter Functions

- **COMPUTE**: It is used for the calculations

```
TABLE SOURCE.EMP, FILTER (@COMPUTE(SAL) > 10000);
```

- **STRFIND**: Used for string comparison within row data

```
TABLE SOURCE.EMP, FILTER (@STRFIND(City,"NEW") > 0);
```

# RANGE Function

- Data divided implicitly based on Range
- Parallel replication
- Maintains data integrity
- Cannot be used if PK Updates performed

```
MAP SOURCE.EMP, TARGET TARGET.EMP, FILTER (@RANGE (1, 2, ID));
```

```
MAP SOURCE.EMP, TARGET TARGETEMP, FILTER (@RANGE (2, 2, ID));
```

# Other Functions

- **BINARY:** Maintains binary data in character column
- **BINTOHEX:** Converts binary strings to hexadecimal
- **GETENV:** Returns environment information
- **GETVAL:** Used to get input for SP for FILTER or COLMAP clause.
- **TOKEN:** Capture token data from Trail Record Header

# SQLEXEC

- Enables GG processes to run SQL queries or SP
- Runs DB command
- GG User must have Execute privs

# SQLEXEC With Query

- Performs LOOKUP operation
- @GETVAL captures data

```
MAP SOURCE.EMP, TARGET TARGET.EMP, &  
SQLEXEC (ID LOOKUP_EMP, &  
QUERY "SELECT EMP_NAME FROM EMP  
WHERE EMP_CODE = :IN_PARAM", &  
PARAMS (IN_PARAM = EMP_CODE)), &  
COLMAP (NEW_ID = ID, & NEW_NAME = @GETVAL (LOOKUP_EMP.OUT_PARAM));
```

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# BATCHSQL

- Used by Replicat
- Similar SQL statements organized into batches
- Supports Initial load & data change capture
- Enhances performance of Replicat
- Each batch applied at once



- Referential integrity is preserved
- *SQL statements are:*
  - *parsed, cached at once and retained in memory*
  - *Executed again for numerous subsequent executions*
- The MAXSQLSTATEMENTS parameter controls number of statements cached

# Data Compression

- Performed at the network layer
- Decompressed automatically at target by collector
- Used in Extract or Pump

EXTRACT P\_SRC

PASSTHRU

RMTHOST 192.168.xx, MGRPORT 7809, COMPRESS

# Trail File Encryption

- Uses 256 key byte substitution
- Data of Trail or Extract automatically decrypted by the Pump or Replicat Process
- Use ENCRYPTTRAIL or DECRYPTTRAIL

```
ENCRYPTTRAIL
```

```
RMTTRAIL ./dirdat/ST
```

```
TABLE SOURCE.EMP;
```

# Encryption

- Security feature of OGG
- Used for
  - Data Encryption: It includes
    - Message Encryption
    - Trail file Encryption
  - Password Encryption

# Message Encryption

- Uses Blowfish, a symmetric 64-bit block cipher to encrypt
- Message decrypted automatically at target by collector
- ENCRYPT and KEYNAME parameters with RMTHOST

RMTHOST 192.168.1xx, MGRPORT 7809, ENCRYPT BLOWFISH, KEYNAME Key1

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# DDL Replication

- Trigger based
- Run script on source
- Enabled on target by default
- DDL Replication independent of DML

## Supported Objects

- Clusters
- Tables
- Triggers
- Functions
- Tablespaces
- Types
- Indexes
- Roles
- Views
- Packages
- Sequences
- Materialized views
- Procedure
- Synonyms
- Users

## Supported Operations

- Create
- Alter
- Drop
- Rename
- Grant
- Revoke



## DDL Parameters

- Set in Extract and Replicate
- Enables DDL support
- Filter includes or excludes DDL operations
- Include or exclude DDL operations based on
  - Scope
  - Object type
  - Operation type
  - Object name

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# Scope

## MAPPED

- Base object specified in Table or Map statement.
- Operations like Create, Alter, Drop, Rename, Grant & Revoke.
- Objects include Table, Trigger, Materialized view, Trigger etc

## UNMAPPED

Table or Map statement is missing for base objects

## OTHER

- Applied to target with same object & owner name as source  
e.g. Create User, Create Role, Alter tablespace

## ALL

- INCLUDE or EXCLUDE to DDL operations of all scopes  
e.g. DDL INCLUDE MAPPED EXCLUDE UNMAPPED

## Object type

- Used to specify object with INCLUDE or EXCLUDE  
DDL INCLUDE OBJTYPE 'INDEX'

## Operation type

- Used to specify operations with INCLUDE or EXCLUDE  
DDL INCLUDE OPTYPE CREATE

## Object name

- Used to specify objects with INCLUDE or EXCLUDE  
DDL INCLUDE OBJNAME "Employee"

# DDL Options

- To add additional options & functionality
- Important Options like
  - ADDTRANDATA
  - GETAPPLOPS | IGNOREAPPLOPS
  - GETREPLICATES | IGNOREREPLICATE
  - PASSWORD ENCRYPTKEY
  - UPDATEMETADATA

## ADDTRANDATA

- Valid for extract only
- Used to enable or update supplemental logging for the new Tables or Altered Tables

## GETAPPLOPS | IGNOREAPPLOPS

- Valid for extract only
- Used to include or ignore local DDL operations
- Used to control DDL in active-active Bi-directional configuration

## GETREPLICATES | IGNOREREPLICATES

- Valid for extract only
- Used to include or ignore replicated DDL operations

# Parallel Processing / Load Balancing

- Divide tables into multiple Extracts/replicats
- Enhance throughput of the transactions
- Reduce lag times

- Parallel processes greater on target
- Tables with referential constraints in same group
- Maximum three Replicat use same Rmttrail
- Replicat paired with own Trail file & extract process



# Splitting Large Tables

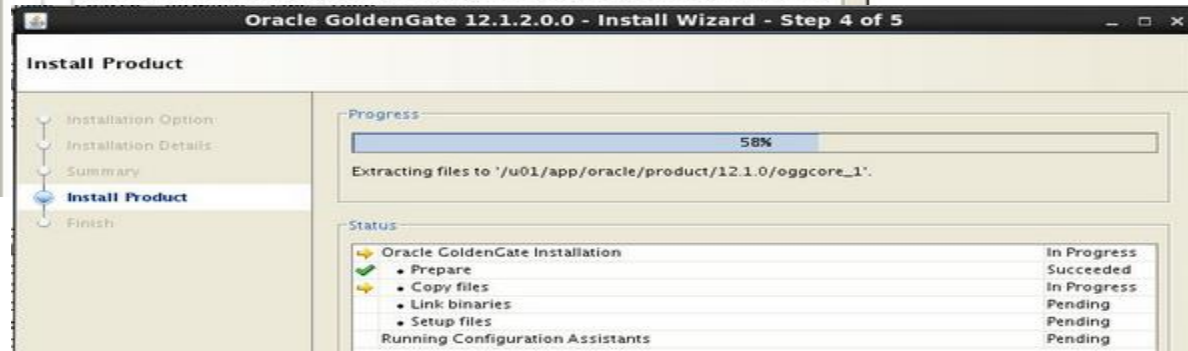
- Split large tables with high data change rate
- @Range function can be used in Data Pump and Replicat processes
- Splits transaction data across parallel Extracts

```
MAP SOURCE.EMP, TARGET TARGET.EMP, FILTER (@RANGE (1, 2, ID));
```

```
MAP SOURCE.EMP, TARGET TARGETEMP, FILTER (@RANGE (2, 2, ID));
```

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# OUI Installation



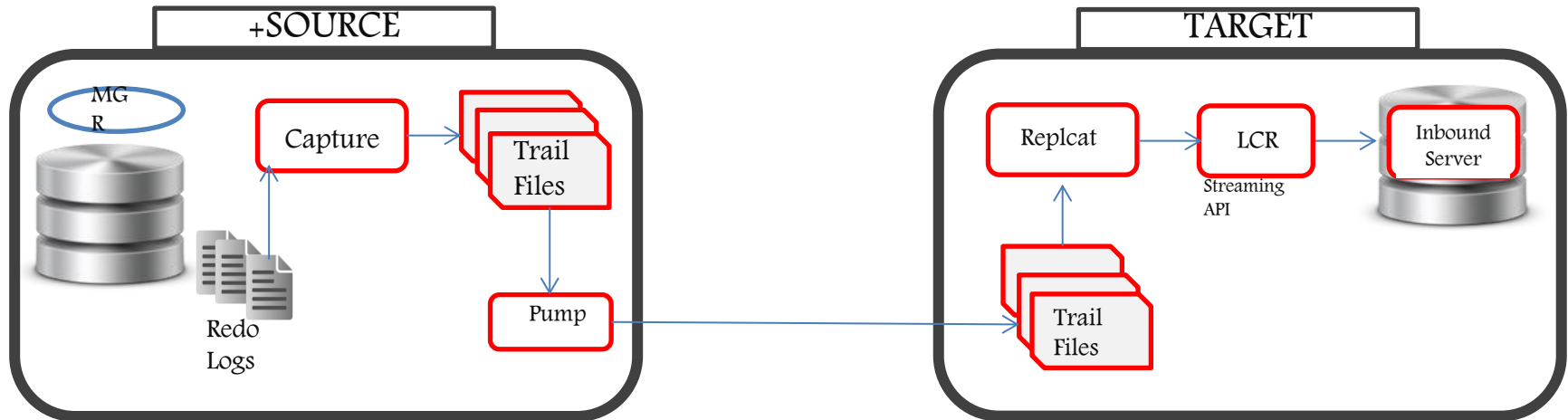
# Support for Multitenant Database

- Three-part Object naming
- Defined at Container (CDB) level not PDB

# Trigger-less DDL replication

- Native DDL Capture
- Additional DDL support
- No Setup required

# Integrated Replicat



- Uses Logical Change Records (LCR's)
- Parameters
  - INTEGRATED
  - DBOPTIONS INTEGRATEDPARAMS

# Coordinated Replicat

- Improves Performance
- Used with Classical Apply
- Replaces RANGE functionality
- Manual Setup no longer required
- Multithreaded Parallel process
- Params
  - COORDINATED
  - SYNCHRONIZE REPLICAT

# Security

- Trail file & Network Encryption
- Wallet and master key authentication
- Credential store
  - Username
  - Password



# Miscellaneous

## Download FusionWare

- [Metalink: Patches and Updates](#)
- <https://edelivery.oracle.com>

## GG Document on OTN

- <http://docs.oracle.com/goldengate/1212/gg-winux/index.html>
- <http://www.oracle.com/technetwork/middleware/goldengate/documentation/index.html>

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Thank You.

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