Ex 12:

Oracle Database 12c Replication – Part 2

Oracle Goldengate 12C Configurations & Demoes

By David Itshak

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http://www.sqlserver.co.il/?cat=940
OGG 12C Installation & Configurations & Demoes

By David Yitzhak

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Agenda

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• Install OGG V12.1.2.1.0 for Oracle on Windows 2012 R2 (64-bit) with OUI
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Agenda

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  • Create Wallet and CREDENTIALSTORE
  • Using the Oracle GoldenGate TranData Option.

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Agenda

- Generating Data and Testing Replication
  - Generating INSERTs
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Prerequisites

- Download software from
  - The **Oracle Technology Network (OTN)** website – By Version
  - Oracle Software Delivery Cloud (e-delivery) – By Part number
- I will demonstrate installation of OGG version:
  1. Linux Red Hat 6.5
  2. Windows 2012 R2 SP1
Install OGG V12.1.2.1.0 for Oracle on Windows 2012 R2 (64-bit) with OUI

- Extract V49540-01.zip

- Run
  ```
  C:\temp\V49540\ggs_Windows_x64_shiphome\Disk1\setup.exe
  ```
Install OGG V12.1.2.1.0 on Windows

- Extract V49540-01.zip

- Run

- C:\temp\V49540\ggs_Windows_x64_shiphome\Disk1\setup.exe
Install OGG V12.1.2.1.0 on Windows

Software Location: C:\oracle\product\12.1.2\oggcore_1
Database Location: C:\oracle\product\12.1.0\dbhome_1
Manager Port: 7809
Install OGG V12.1.2.1.0 on Windows
Install OGG V12.1.2.1.0 Win 64-bit
Install OGG V12.1.2.1.0 Linux Red Hat 64-bit

• Unpack Media

```bash
export ORACLE_SID ORACLE_BASE ORACLE_HOME PATH LD_LIBRARY_PATH
$ unzip V40146-01.zip
Archive: V40146-01.zip
creating: fbo_ggs_Linux_x64_shiphome/
creating: fbo_ggs_Linux_x64_shiphome/Disk1/
creating: fbo_ggs_Linux_x64_shiphome/Disk1/install/
```

• Enable X server and OUI

1. As root user:
   ```bash
   [root@dbserver ]$ xhost +
   access control disabled, clients can connect from any host
   ```

2. As oracle user, set the DISPLAY environment variable

   ```bash
   [oracle@dbserver ]$ su - oracle
   [oracle@dbserver ]$export DISPLAY=:0.0
   ```
Run installer

```
$ cd fbo_ggs_Linux_x64_shiphome/Disk1
$ ./runInstaller
```

Click Install on Summary Screen

Installation Progress

Install OGG V12.1.2.1.0 Linux
On successful *installation*

Troubleshoot with OUI log:

Preparing to launch Oracle Universal Installer from /tmp/OralInstall2015-02-01_04-13-31PM. Please wait ..... You can find the log of this install session at: /u01/app/oraInventory/logs/installActions2015-08-01_04-15-171PM. log
Install OGG V12.1.2.1.0 Linux

- Make sure LD_LIBRARY_PATH is correctly set before launching GGSCI in ~/.bashrc
- export LD_LIBRARY_PATH=${ORACLE_HOME}/lib:$LD_LIBRARY_PATH
- source ~/.bashrc
Install OGG V12.1.2.1.0 Linux

- Change directory to OGG software dir (/u01/app/oracle/product/ogg) and launch ggsci.
- Enter the info mgr command to verify that the manager is running.

```bash
cd $GG_HOME
ggsci
```

Oracle GoldenGate Command Interpreter for Oracle
Version 12.1.2.0.0 17185003 OGGCORE_12.1.2.0.0 PLATFORMS_130924.1316_FBO
Linux, x64, 64bit (optimized), Oracle 12c on Sep 25 2013 02:33:54
Operating system character set identified as UTF-8.
Copyright (C) 1995, 2013, Oracle and/or its affiliates. All rights reserved.

GGSCI > info all
<table>
<thead>
<tr>
<th>Program</th>
<th>Status</th>
<th>Group</th>
<th>Lag at Chkpt</th>
<th>Time Since Chkpt</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANAGER</td>
<td>RUNNING</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GGSCI > exit
Silent Installation

- Use oggcore.rsp template response file in installation software

`./runInstaller -silent -nowait -responseFile /u01/app/oracle/product/12.1.2/stage/fbo_ggs_Linux_x64_shiphome/Disk1/response/oggcore.rsp`
Subdirectories

- Automatically created in OGG home
- Can be moved to a storage area network (SAN). Example in RAC where software installed on each node.

**BR**

- Contains all checkpoint files for the bounded recovery – feature of Extract process checkpoint.
- Ensures efficient recovery after Extract process stops planned or unplanned, no matter how many open (uncommitted) transactions when extract stopped.
- Contents of the directory can grow large, deepens on BRINTERVAL parameter.
- File format: `<br><sequence number>..<file extension>.
- For Oracle RAC, ensure br subdirectory is mounted on a shared filesystem.
Subdirectories : dirchk

- Default location for checkpoint files created by the Extract Replicat that provide data persistence of read/write operations.
- Filename format : `<group name><sequence number>.<file extension>`.
- A processing group :
  - ✓ Extract /Replicat process
  - ✓ parameter file,
  - ✓ checkpoint file,
  - ✓ any other files associated with the process.
- Group name up to 8 characters (including nonalphanumeric).
- File extension : cpe for Extract checkpoint files or cpr for Replicat checkpoint files.
- For Oracle RAC, ensure dirchk subdirectory is mounted on a shared filesystem.
Subdirectories
dircrd
- Default location for Credential Store - new security features of OGG 12c (cwallet.sso)
- Discard files of extracts, pumps (E00.dsc, P015.dsc)

dirsq1
- The dirsq1 subdirectory is the default location for SQL scripts.

dirtmp
- Default location for OGG process temporary files that "swap out" data related to large transactions that exceed the allocated cache size.
- Best practice: Use its own disk to reduce the I/O contention.

dirwlt
- Default location for wallet files that support all new security features of OGG12c.
- For Oracle RAC ensure that the dirwlt subdir is mounted on shared filesystem.
Subdirectories

**dirprm**
- Default location for the GoldenGate parameter for OGG process groups or utilities. ASCII files are edited by GGSCI utility or directly.
- Filename format is `<group name/user-defined name>.prm` or `mgr.prm`.

**dirrpt**
- Default location for report ASCII files created by Extract, Replicat, and Manager processes.
- Report statistical information running process.
- When a process abends, the file is updated automatically.
- To get obtain process statistics on the fly, use REPORT in GGSCI.
- The filename format is `<group name><sequence number>.rpt`.

**dirsml**
- Default location for SQL scripts.
**Subdirectories**

**Dirdat**

- Default dir for trail files and extract files created by all the Extract processes. Trail files are processed by Replicat process, application, or utility.
- The filename format: `<prefix> <sequence number>.
- Prefix must be two alphanumeric characters specified during the Extract creation or the Replicat creation.
- Typical prefix names are: sa, sb, sc, and so on for 1st, 2nd, and 3rd trail files on the source and ta, tb, tc, and so on for the 1st, 2nd, and 3rd trail files on the target.
- 6 digit sequential number is automatically appended to each file prefix for each new trail file created.
- Extract trail file names is a user-defined name and has no sequence number.
- Default size of trail files is 100 MB. Trail files can be purged periodically by OGG.

![File Directory Table]

<table>
<thead>
<tr>
<th>Name</th>
<th>Size (KB)</th>
<th>Last modified</th>
<th>Owner</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>ez000000</td>
<td>74,533</td>
<td>2015-10-28 06:58</td>
<td>oracle</td>
<td>oinstall</td>
</tr>
<tr>
<td>ez000001</td>
<td>21,554</td>
<td>2015-11-03 08:47</td>
<td>oracle</td>
<td>oinstall</td>
</tr>
<tr>
<td>ez000002</td>
<td>9,519</td>
<td>2015-11-03 15:53</td>
<td>oracle</td>
<td>oinstall</td>
</tr>
<tr>
<td>f4000000</td>
<td>9,588</td>
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<td>oracle</td>
<td>oinstall</td>
</tr>
<tr>
<td>f4000001</td>
<td>0</td>
<td>2015-10-20 09:10</td>
<td>oracle</td>
<td>oinstall</td>
</tr>
<tr>
<td>f4000002</td>
<td>1</td>
<td>2015-10-20 09:10</td>
<td>oracle</td>
<td>oinstall</td>
</tr>
<tr>
<td>f8000000</td>
<td>0</td>
<td>2015-10-20 09:10</td>
<td>oracle</td>
<td>oinstall</td>
</tr>
<tr>
<td>f8000001</td>
<td>0</td>
<td>2015-10-20 09:10</td>
<td>oracle</td>
<td>oinstall</td>
</tr>
<tr>
<td>f8000002</td>
<td>0</td>
<td>2015-10-20 09:10</td>
<td>oracle</td>
<td>oinstall</td>
</tr>
<tr>
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<td>2015-10-20 09:11</td>
<td>oracle</td>
<td>oinstall</td>
</tr>
<tr>
<td>f8000004</td>
<td>0</td>
<td>2015-10-20 09:11</td>
<td>oracle</td>
<td>oinstall</td>
</tr>
<tr>
<td>f8000005</td>
<td>0</td>
<td>2015-10-20 09:11</td>
<td>oracle</td>
<td>oinstall</td>
</tr>
<tr>
<td>f8000006</td>
<td>0</td>
<td>2015-10-20 09:11</td>
<td>oracle</td>
<td>oinstall</td>
</tr>
<tr>
<td>f8000007</td>
<td>0</td>
<td>2015-10-20 09:11</td>
<td>oracle</td>
<td>oinstall</td>
</tr>
<tr>
<td>f8000008</td>
<td>0</td>
<td>2015-10-20 09:11</td>
<td>oracle</td>
<td>oinstall</td>
</tr>
</tbody>
</table>
Subdirectories

dirdef

- Store data definitions files created by DEFGEN utility.
  - ASCII files contain the source or target data definitions used in a heterogeneous synchronization environment.
  - The filename format is user-defined and specified explicitly in the DEFGEN parameter file.

1. defgen parameter file hrdefs.prm:
   defsfile ./dirdef/RHREMD1.defs
   USERID GGER@sourcedb, PASSWORD userpw
   TABLE HR.::*;

2. Next generate the data definitions with defgen command:
   defgen paramfile dirprm/hrdefs.prm

3. Last step tell OGG that you’re using a defgen file and no longer ASSUMETARGETDEFS parameter because the source and target tables are different.
   --AssumeTargetDefs
   SourceDefs dirdef/RHREMD1.defs
Subdirectories dirpcs

- Default location for process status files.
- created only when a process is running.
- file shows: program, process name, the port, and \ process ID.
- Format is <group name>.<file extension>.
- File extension is pce for Extract, pcr for Replicat, or pcm for Manager processes.
12c container database (CDB) Environment

Oracle Database Enterprise Edition 12.1.0.2.0
CDB ORACLE_SID = OGG12
PDB ORACLE_SID = PDB1
Create entry for PDB In source and target DB in tnsnames.ora in

$ORACLE_HOME/network/admin/tnsnames.ora:

```
PDB1 =
  (DESCRIPTION =
   (ADDRESS = (PROTOCOL = TCP)(HOST = ORASRV1)(PORT = 1521))
   (CONNECT_DATA =
     (SERVER = DEDICATED)
     (SERVICE_NAME = PDB1)
   )
  )
```
Create entry for PDB in source and target DB in tsnames.ora in

$ORACLE_HOME/network/admin/tlistener.ora

To pervert error like:

ORA-12560: TNS:protocol adapter error:

```
SID_LIST_LISTENER =
  (SID_LIST =
    (SID_DESC =
      (SID_NAME = CLRExtProc)
      (ORACLE_HOME = c:\oracle\product\12.1.0\dbhome_1)
      (PROGRAM = extproc)
      (ENVS = "EXTPROC_DLLS=ONLY:c:\oracle\product\12.1.0\dbhome_1\bin\oraclr12.dll")
    )
    (SID_DESC =
      (SID_NAME = PDB1)
      (ORACLE_HOME = c:\oracle\product\12.1.0\dbhome_1)
    )
  )
```

```
LISTENER =
  (DESCRIPTION_LIST =
    (DESCRIPTION =
      (ADDRESS = (PROTOCOL = TCP)(HOST = ORASRV1)(PORT = 1521))
      (ADDRESS = (PROTOCOL = IPC)(KEY = EXTPROC1521))
    )
  )
```
Create startup trigger for PDB

- Ensure that PDB will start automatically when CDP start, using startup triggers. You can do it from SQL Developer 4.1 interface as follows.

- IF PDB is not open it

```
ALTER PLUGGABLE DATABASE PDB1 OPEN READ WRITE;
```
CREATE OR REPLACE TRIGGER open_pdb_PDB1 AFTER STARTUP ON DATABASE BEGIN
EXECUTE IMMEDIATE 'ALTER PLUGGABLE DATABASE PDB1 OPEN READ WRITE'; END open_pdb_PDB1;

Create startup trigger for PDB
Preparing 12c CDB for OGG

Enable archive log mode

archive log list
shutdown immediate
startup mount
alter database archivelog;
alter database open;
alter pluggable database pdb1 open;
archive log list

Preparing 12c CDB for OGG

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Enable archive log mode

archive log list
shutdown immediate
startup mount
alter database archivelog;
alter database open;
alter pluggable database pdb1 open;
archive log list
Enabling supplemental logging

- Set FORCE LOGGING feature at DB level to override any NOLOGGING operation, which ensures all changed data is written to the redo logs.

- For bidirectional replication, you need to enable supplemental logging on both the source and the target DBs.

- Force the logging of the full before and after images: store the state of the data before and after an UPDATE transaction, which are written to the DB redo logs.

- DB must be configured for supplemental logging on primary key columns as a minimum.

  ALTER DATABASE ADD SUPPLEMENTAL LOG DATA;
  ALTER DATABASE FORCE LOGGING;
  ALTER SYSTEM SWITCH LOGFILE;
  SELECT SUPPLEMENTAL_LOG_DATA_MIN FROM V$DATABASE;
  -- Results should be YES.
  SELECT log_mode, force_logging, supplemental_log_data_min FROM v$database;

- Enabling supplemental logging
Create OGG Admin user

- As sysdba create common user C##OGG_ADMIN.
- DBMS_GOLDENGGATE_AUTH package, we grant C##OGG_ADMIN user access to all database containers so OGG can mine the redo logs for all.
- For simplicity I gave OGG_ADMIN DBA and CDB_DBA role.
- Refer to OGG Docs for minimum individual roles and privileges required.

-- USER SQL
CREATE USER C##OGG_ADMIN IDENTIFIED BY Aa1234 DEFAULT TABLESPACE "USERS";

-- ROLES
GRANT DBA TO C##OGG_ADMIN CONTAINER=ALL;
-- Optional
GRANT "CDB_DBA" TO C##OGG_ADMIN;

-- SYSTEM PRIVILEGES
GRANT CREATE SESSION TO C##OGG_ADMIN;

execute
   dbms_goldengate_auth.grant_admin_privilege('C##OGG_ADMIN',container=>'all')
Create OGG Admin user

- Must also grant the DBA role but with the container=all option

```
GRANT DBA TO C##OGG_ADMIN CONTAINER=ALL;
```

- Otherwise Extract process against Oracle 12c CDB will give the following error:

OGG-06203 Failed to switch to catalog PDB1. OCI Error ORA-01031: insufficient privileges SQL ALTER SESSION SET CONTAINER=PDB1 (status = 1031), SQL <ALTER SESSION SET CONTAINER=PDB1>.
ON Source server on PDB1 Create tablespaces SRCDATA to host the replication source database objects.

set ORACLE_SID=PDB1

sqlplus /nolog

conn /@PDB1 as sysdba

cREATE TABLESPACE srcdata DATAFILE 'C:\oracle\oradata\OGG12\srcdata01.dbf'
SIZE 50M AUTOEXTEND ON EXTENT MANAGEMENT LOCAL UNIFORM SIZE 256K;
ON Source server on PDB1 Create tablespaces SRCDATA to host the replication source database objects.

set ORACLE_SID=PDB1

sqlplus /nolog

conn /@PDB1 as sysdba

cREATE TABLESPACE srcdata DATAFILE 'C:\oracle\oradata\OGG12\srcdata01.dbf'

SIZE 50M AUTOEXTEND ON EXTENT MANAGEMENT LOCAL UNIFORM SIZE 256K;
Create OGGSRC user on source server with tablespace SRCDATA.

Create OGGTRG on target server with default tablespace TRGDATA.

These two users only need the CONNECT and RESOURCE privileges.

Oracle 12c removed the unlimited quota privilege from the RESOURCE role, so you must now grant quota unlimited to the user.

These two users only need the CONNECT and RESOURCE privileges. Oracle 12c removed the unlimited quota privilege from the RESOURCE role, so you must now grant quota unlimited to the user.
Demo: Create OGGSRC user and OGGTRG user

-- Source DB :
set ORACLE_SID=PDB1
sqlplus /nolog
conn /@PDB1 as sysdba
create user OGGSRC identified by Welcome1 default tablespace SRCDATA temporary tablespace TEMP;
grant CONNECT,RESOURCE to OGGSRC;
alter user OGGSRC quota unlimited on SRCDATA;

-- Target DB :
set ORACLE_SID=PDB1
sqlplus /nolog
conn /@PDB1 as sysdba
create user OGGTRG identified by Welcome1 default tablespace TRGDATA temporary tablespace TEMP;
alter user OGGTRG quota unlimited on TRGDATA;
grant CONNECT,RESOURCE to OGGTRG;
Enabling the Flashback Query

- To maintain a read-consistent row image for a specific time or SCN OGG 12c uses Flashback Query to obtain all the values:
  - User-defined types
  - Nested tables
  - XMLType objects

- Set UNDO_RETENTION parameter is set to 86400 seconds (24 hours). It is the Oracle recommended:

  ALTER SYSTEM SET UNDO_RETENTION=86400 SCOPE=BOTH;
  GRANT FLASHBACK ANY TABLE TO C##OGG_ADMIN;
Configuring OGG Manager Process.

- Edit parameter file for manager
  - ✓ Linux: `$GG_HOME\dirprm\mgr.prm` (/u01/app/oracle/product/golden_gate/dirprm/)
  - ✓ Win: `C:\oracle\product\12.1.2\oggcore_1\dirprm`
- Use gedit or vi on Linux. Notepad on windows.

GGSCI > set editor gedit
GGSCI > edit param mgr

- Or directly for example via MobaXterm
OGG Manager Process parameters

DynamicPortList 20000-20099
• Specify TCP/IP ports available to the manager process

PurgeOldExtracts dirdat/*, UseCheckpoints, MinKeepDays 7
• Purge the old extracts

AUTOSTART ER *
• Start one or more Extract and Replicat processes automatically when Manager starts.
• ER Restarts Extract and Replicat automatically

AUTORESTART ER *, RETRIES 20, WAITSECONDS 15, RESETMINUTES 60
• AUTORESTART tries restarting any OGG processes after they fail. To reduce the time it takes OGG processes to restart after a role transition, Oracle recommends setting the maximum number of retries to 20 and the wait time between each retry to 15 seconds within a one hour time period
OGG Manager Process parameters

LAGINFOMINUTES 0
LAGREPORTMINUTES 15
• Measure between transaction was committed on source DB to time it is committed on the target DB:
• LAGINFOMINUTES writes an informational message to log at the frequency specified by LAGREPORTMINUTES

DOWNREPORTMINUTES 15
DOWNCRITICAL
• Use the DOWNCRITICAL parameter to include processes that abended or stopped normally in the report that is generated by the DOWNREPORT parameter

LAGINFOMINUTES 0
LAGREPORTMINUTES 15
• Measure between transaction was committed on source DB to time it is committed on the target DB.
• lag information is written to OGG error log every minute.
• LAGINFOMINUTES writes an informational message to log at the frequency specified by LAGREPORTMINUTES
GLOBALS file

- specify parameters that apply to the entire OGG instance.

**Location:**
1. Linux: $GG_HOME : /u01/app/oracle/product/golden_gate/
2. Win: C:\oracle\product\12.1.2\oggcore_1

**Edit Global file:** Use gedit or vi on Linux  Notepad on windows  
1. Edit GLOBALS from GGSCI
   cd $GG_HOME  
ggsci  
GGSCI > set editor gedit  
GGSCI > EDIT PARAMS ./GLOBALS

2. Directly. Example via MobaXterm
Start OGG Manager

- By default OGG manager will not start.

- Linux: Change directory to OGG Home:
  
  ```bash
  $ export GG_HOME=/u01/app/oracle/product/12.1.2/ogg
  cd $GG_HOME
  ```

- Windows: from cmd:
  
  ```bash
  C:\oracle\product\12.1.2\oggcore_1\ggsci.exe
  ```

- Run GGSCI and check manager status:
  
  GGSCI > start manager
  
  GGSCI > info all
To avoid storing passwords in clear text in the various Extract and Replicat parameter files, in OGG 12C you can store encrypted credentials in the wallet credential store and refer them through an alias, rather than the combination username/password.

```bash
-- C:\oracle\product\12.1.2\oggcore_1\ggsci.exe
GGSCI 1> start manager
Manager started.
GGSCI 2> info all

<table>
<thead>
<tr>
<th>Program</th>
<th>Status</th>
<th>Group</th>
<th>Lag at Chkpt</th>
<th>Time Since Chkpt</th>
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<td>MANAGER</td>
<td>RUNNING</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GGSCI 3> OPEN WALLET

ERROR: Wallet was not found in filesystem: 'dirwlt\cwallet.sso'.

GGSCI 4> CREATE WALLET

Created wallet at location 'dirwlt'.
Opened wallet at location 'dirwlt'.

GGSCI 5> ADD CREDENTIALSTORE

Credential store created in .\dircrd\.
Create Wallet and CREDENTIALSTORE

GGSCI 6> ALTER CREDENTIALSTORE ADD USER C##OGG_ADMIN@PDB1 ALIAS OGG_ADMIN domain admin
Password:

Credential store in .\dircrd\ altered.

GGSCI 7> info CREDENTIALSTORE DOMAIN admin

Reading from .\dircrd\:
Domain: admin

   Alias: OGG_ADMIN
   Userid: C##OGG_ADMIN@PDB1

• Make sure the Oracle GoldenGate user can connect to the Oracle database using a credential alias

GGSCI 8> DBLOGIN USERIDALIAS OGG_ADMIN  DOMAIN admin
Successfully logged into database PDB1.
Create Wallet and CREDENTIALSTORE

Oracle GoldenGate Command Interpreter for Oracle

GGSCI <managername> 1> start manager
Manager started.

GGSCI <managername> 2> info all
Program Status Group Lag at Chkpt Time Since Chkpt
MANAGER RUNNING

GGSCI <managername> 3> OPEN WALLET
ERROR: Wallet was not found in filesystem: 'dirwlt\cwallet.sso'.

GGSCI <managername> 4> CREATE WALLET
Created wallet at location 'dirwlt'.
Opened wallet at location 'dirwlt'.

GGSCI <managername> 5> ADD CREDENTIALSTORE
Credential store created in .\dircrd.\

GGSCI <dudl2orasrv1> 6> ALTER CREDENTIALSTORE ADD USER \#OGG_ADMIN@PDB1 ALIAS OGG_ADMIN domain admin
Password:
Credential store in .\dircrd\ altered.

GGSCI <managername> 7> info CREDENTIALSTORE DOMAIN admin
Reading from .\dircrd:\
Domain: admin
   Alias: OGG_ADMIN
   UserId: CH#OGG_ADMIN@PDB1

GGSCI <managername> 8> DBLOGIN USERID ALIAS OGG_ADMIN DOMAIN admin
Successfully logged into database PDB1.

GGSCI <managername> as CH#OGG_ADMIN@ogg12/PDB1> 9> -
Using the OGG TranData Option

ADD TRANDATA
• Use ADD TRANDATA to enable Oracle OGG to acquire the transaction information that it needs from the transaction records.
• Before using this command, use the DBLOGIN command to establish a database connection.
• Add supplemental logging at the table level and create the integrated extract.
• Note – for 12c Multitenant Container databases we have to use Integrated Extracts in place of Classic Extracts.
• To add trandata we need to be connected to the individual pluggable database and not the root container. In this case the PDB is PDP1.

ALLCOLS Valid for Oracle
• Enables the unconditional supplemental logging of all of the key and non-key columns of the table. This option enables the logging of the keys required to compute dependencies, plus all other columns for use in filtering, conflict resolution, or other purposes.

• Configure OGG in order to add supplemental log data to source tables with the GGSCI ADD TRANDATA command:

✓ Connect to the pluggable database PDB1 as a privileged user that has been granted the DBA role.
✓ we log in as the OGG_ADMIN user from GGSCI. OGG_ADMIN has been created on the pluggable database:
Using the OGG TranData Option

Successfully logged into database.

GGSCI (omm) 9> Add TranData OGGSRC.*   ALLCOLS

TRANDATA for scheduling columns has been added on table 'OGGSRC.ECONOMIC_ENTITY'.TRANDATA for all columns has been added on table 'OGGSRC.ECONOMIC_ENTITY'.
Logging of supplemental redo data enabled for table OGGSRC.GDP_BY_YEAR.
TRANDATA for scheduling columns has been added on table 'OGGSRC.GDP_BY_YEAR'.TRANDATA for all columns has been added on table 'OGGSRC.GDP_BY_YEAR'.
Logging of supplemental redo data enabled for table OGGSRC.GDP_GROWTH_BY_YEAR.
TRANDATA for scheduling columns has been added on table 'OGGSRC.GDP_GROWTH_BY_YEAR'.TRANDATA for all columns has been added on table 'OGGSRC.GDP_GROWTH_BY_YEAR'.

GGSCI (omm) 10> Info TranData OGGSRC.*

Logging of supplemental redo log data is enabled for table OGGSRC.ECONOMIC_ENTITY.
Columns supplementally logged for table OGGSRC.ECONOMIC_ENTITY: ALL.

Logging of supplemental redo log data is enabled for table OGGSRC.GDP_BY_YEAR.
Columns supplementally logged for table OGGSRC.GDP_BY_YEAR: ALL.

Logging of supplemental redo log data is enabled for table OGGSRC.GDP_GROWTH_BY_YEAR.
Columns supplementally logged for table OGGSRC.GDP_GROWTH_BY_YEAR: ALL.
Next Demo Configuration Summary

- Configuring Integrated Extract and Integrated Replicat Using OGG 12c

<table>
<thead>
<tr>
<th>Role</th>
<th>Process</th>
<th>Process Group Name</th>
<th>Parameter Filename</th>
<th>Trail Filename Prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source/Target</td>
<td>Manager</td>
<td>MGR</td>
<td>mgr.prm</td>
<td>N/A</td>
</tr>
<tr>
<td>Source</td>
<td>Extract</td>
<td>einta</td>
<td>Einta.prm</td>
<td>/dirdat/in</td>
</tr>
<tr>
<td></td>
<td>Extract (data pump)</td>
<td>pinta</td>
<td>Pinta.prm</td>
<td>/dirdat/in (local)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>/dirdat/pn (remote)</td>
</tr>
<tr>
<td>Target</td>
<td>Replicat</td>
<td>rinta</td>
<td>Rinta.prm</td>
<td>/dirdat/pn</td>
</tr>
</tbody>
</table>

- Specifies the relationship between the system's role, database server, the CDB name, the PDB name and the schema table

<table>
<thead>
<tr>
<th>Role</th>
<th>Database Server Hostname</th>
<th>Container Database Name</th>
<th>Pluggable Database Name</th>
<th>Schema Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>12c Source</td>
<td>orasrv1</td>
<td>OGG12</td>
<td>PDB1</td>
<td>oggsrc</td>
</tr>
<tr>
<td>12c Source</td>
<td>orasrv2</td>
<td>OGG12</td>
<td>PDB1</td>
<td>oggtrg</td>
</tr>
</tbody>
</table>
The capture Process

- Create Extract parameter file.
- The `<group name>`.prm file is implicitly created in the dirprm subdirectory by:
  
  \texttt{GGSCI > edit param einta Extract einta}

- Capture process scans DB online or archived redo logs for committed transactions.
- OGG can access the ASM disk groups by a new OCI API that scans the logs in the fast recovery area (FRA) from the database server, if Oracle uses ASM.

- The basic:
  - The Extract group name
  - The Extract mode of operation (for example, integrated capture)
  - The Oracle Database System ID (ORACLE_SID), if not using the USERIDALIAS
  - The source DB OGG admin user login credentials
  - The source trail file path and prefix
  - The source table names
1. Configuring the Primary Integrated Extract on the Oracle source schema

- Select the GGSCI_SRC window to create the primary Extract parameter file. Path/filename.ext will be dirprm/einta.prm.

```
GGSCI > edit param einta Extract einta
SETENV (ORACLE_SID='ogg12') UserIdAlias ogg_user TranlogOptions
IntegratedParams (max_sga_size 256)
Exttrail ./dirdat/in
LOGALLSUPCOLS
UPDATERECORDFORMAT COMPACT
SOURCECATALOG pdb1
Table OGGSRC.*;
```

- LOGALLSUPCOLS: This supports integrated Replicat and the Oracle GoldenGate conflict detection and resolution feature
- UPDATERECORDFORMAT: This combines the before and after images of the UPDATE operation to a single record in the GoldenGate trail
- SOURCECATALOG: This specifies the Oracle 12c pluggable database

Save the parameter file and leave the editor.
1. Configuring the Primary Integrated Extract on the Oracle source schema

**LOGALLSUPCOLS and UPDATERECORDFORMAT**

- Integrated Replicat, requires the source extract parameter file to contain these new parameters introduced in 12c.

**LOGALLSUPCOLS**

- LOGALLSUPCOLS causes Extract to do the following with these supplementally logged columns:
  - Automatically includes in the trail record the before image for UPDATE operations.
  - Automatically includes in the trail record the before image of all supplementally logged columns for both UPDATE and DELETE operations.

**UPDATERECORDFORMAT**

- This combines the before and after images of the UPDATE operation to a single record in the GoldenGate trail.
- When 2 records are generated for an update to a single row, it incurs additional disk I/O and processing for both Extract and Replicat. If supplemental logging is enabled on all columns, the unmodified columns may be repeated in both the before and after records. The overall size of the trail is larger, as well. This overhead is reduced by using UPDATERECORDFORMAT COMPACT.

**SOURCECATALOG**

Specifies the Oracle 12c pluggable DB
1. Configuring the Primary Integrated Extract on the Oracle source schema

- Login to the database, register the Integrated Extract and create the Extract group and the local Extract trail file.

```
GGSCI > DBLOGIN USERIDALIAS OGG_ADMIN  DOMAIN admin
Successfully logged into database.
GGSCI > register extract einta database Extract EINTA CONTAINER(PDB1) 
successfully registered with database at SCN 1905933.
GGSCI > add extract einta, integrated tranlog, begin now
EXTRACT added.
GGSCI > add exttrail ./dirdat/in, extract einta, megabytes 10
EXTTRAIL added.
```

- Your SCN will be different. The Megabytes 10 is optional. The default is 100 Megabytes.
- The primary Extract has been created and configured, but not started. Leave GGSCI running for the next step
Creating the capture process

• GGSCI command string includes the TRANLOG keyword. This tells GoldenGate to extract data from the source database's online redo logs.
• BEGIN NOW option tells OGG to start data replication immediately when the capture process is started.

```
GGSCI > add extract einta, integrated tranlog, begin now
```

• In a RAC environment, THREADS parameter of ADD EXTRACT command must be set to the number of database instances.
  1. Default is 1 for a single instance database.
  2. Note this is not required for the integrated capture mode of operation, as the integration allows OGG to obtain the necessary configuration information directly from the database.

• Next step is to define the local trail for the Extract group process. The following GGSCI command string specifies a local trail with the in prefix.
• Each trail file associated with the einta Extract process group will be a maximum of 100 MB in size, which is the default:

```
GGSCI > add exttrail ./dirdat/in, extract einta, megabytes 10
```
Registering the capture process in a 12c container database

- Newly created Extract process group must be registered with the source database to enable integrated capture mode.

```
GGSCI > DBLOGIN USERIDALIAS OGG_ADMIN  DOMAIN admin
Successfully logged into database.
GGSCI > register extract einta database Extract EINTA  CONTAINER(PDB1)
successfully registered with database at SCN 1905933.
```

- Extract-registered starting point is defined with System Change Number (SCN), causing data replication to begin from the last committed transaction as of SCN 1905933.
2. Configuring the Data Pump

• Create the secondary Extract (data pump) parameter file.

```
GGSCI > Edit Param pinta Extract pinta

SETENV (ORACLE_SID='ogg12')

DBLOGIN USERIDALIAS OGG_ADMIN DOMAINT admin

rmthost orasrv2 mgrport 7909 rmttrail ./dirdat/pn

SOURCECATALOG pdb1

table OGGSRC.*;
```

• Save the file leaving the editor. You can check your work by entering View Param pinta any time.
• Create the data pump group and the remote Extract trail file.`

```
GGSCI > add extract pinta, exttrailsource ./dirdat/in

EXTRACT added.

GGSCI > add rmttrail ./dirdat/pn, extract pinta, megabytes 10

RMTTRAIL added.
```

• The Megabytes 10 is optional. The default is 100 Megabytes.
• The data pump reads from the local trail file in and writes to the remote trail file pn. The remote trail file that will be created will be named dirdat/pn000000, then when that one fills up the next will be dirdat/pn000001, then dirdat/pn000002, and so on.
• The secondary Extract has been created and configured, but not started. Leave GGSCI running for the next step.
The data pump process

- Extract group that runs on source DB server and sends changed data to the target system. The basic configuration:
  1. The data pump name
  2. The target hostname
  3. The source database and login alias
  4. The target trail file path and prefix
  5. The Manager TCP/IP port number
  6. The source table name

- The data pump configuration for the Oracle 11g database is the same, apart from the absence of the SOURCECATALOG parameter.

```
GGSCI > Edit Param pinta Extract pinta
SETENV (ORACLE_SID='ogg12')
DBLOGIN USERIDALIAS OGG_ADMIN  DOMAIN admin
rmthost orasrv2 mgrport 7909 rmttrail ./dirdat/pn
SOURCECATALOG pdb1
table OGGSRC.*;
```

- Before starting the capture process, ensuring that the Extract trail prefix is specified. We also need to add the remote trail, which includes the prefix.

```
GGSCI > add extract pinta, exttrailsource ./dirdat/in
EXTRACT added.
GGSCI > add rmttrail ./dirdat/pn, extract pinta, megabytes 10
RMTTRAIL added.
```
3. Starting the Primary Extract and the Data

- Start the two Extract processes Einta and Pinta.
  
<table>
<thead>
<tr>
<th>Program</th>
<th>Status</th>
<th>Group</th>
<th>Lag at Chkpt</th>
<th>Time Since Chkpt</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANAGER</td>
<td>RUNNING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXTRACT</td>
<td>STARTING</td>
<td>EINTA</td>
<td>00:00:00</td>
<td>20:43:37</td>
</tr>
<tr>
<td>EXTRACT</td>
<td>RUNNING</td>
<td>PINTA</td>
<td>00:00:00</td>
<td>00:00:03</td>
</tr>
</tbody>
</table>

- Enter the Info All command to assess the status of the two Extract processes. It is not unusual for the Integrated Extract to take a few seconds to start. In this case, the status for the Integrated Extract is STARTING.

<table>
<thead>
<tr>
<th>Program</th>
<th>Status</th>
<th>Group</th>
<th>Lag at Chkpt</th>
<th>Time Since Chkpt</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANAGER</td>
<td>RUNNING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXTRACT</td>
<td>STARTING</td>
<td>EINTA</td>
<td>00:00:00</td>
<td>20:43:41</td>
</tr>
<tr>
<td>EXTRACT</td>
<td>RUNNING</td>
<td>PINTA</td>
<td>00:00:00</td>
<td>00:00:07</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Program</th>
<th>Status</th>
<th>Group</th>
<th>Lag at Chkpt</th>
<th>Time Since Chkpt</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANAGER</td>
<td>RUNNING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXTRACT</td>
<td>RUNNING</td>
<td>EINTA</td>
<td>20:44:16</td>
<td>00:00:01</td>
</tr>
<tr>
<td>EXTRACT</td>
<td>RUNNING</td>
<td>PINTA</td>
<td>00:00:00</td>
<td>00:00:03</td>
</tr>
</tbody>
</table>
4. Creating OGG admin user on the target PDB DB

- Ogg requires a dedicated user to apply the replicated data to the target database.
- OGG admin user does not need to be created in the root container of the Oracle 12c db.
- Log in to the pluggable database as SYSDBA and create the GGADMIN user:

```sql
SQL> ALTER SESSION SET CONTAINER =PDB1
Session altered
SQL> create user ogg_admin identified by xxxxx default tablespace users;
User created;
SQL> grant DBA to ogg_admin ;
Grant succeeded ;
SQL> execute dbms_streams_auth.grant_admin_privilege('ggadmin');
PL/SQL procedure successfully completed ;
```

- For integrated Replicat, the OGG_ADMIN user must be granted the necessary privileges through the dbms_goldengate_auth.grant_admin_privilege procedure.
- For an Oracle 11g target DB OGG admin creation is the same, except that we do not log in to the DB.
4. Creating OGG admin user on the target PDB DB

- Now we can add the login credentials to the Credential Store.
  
  ```
  GGSCI > Alter CredentialStore Add User ogg_admin @pdb1 Password xxxx Alias ogg_admin
  Credential store in ./dircrd/ altered.
  GGSCI > Info CredentialStore
  Reading from ./dircrd/:
  Domain: OracleGoldenGate
  Alias: ogg_user
  Userid: ogguser@ogg12 GGSCI
  ```

- Make sure the Oracle OGG user can connect to the Oracle database using a credential alias

  ```
  GGSCI > DBLogin UserIDAlias ogg_admin
  Successfully logged into database
  ```
5. Configuring Data Delivery Using Integrated Replicat

- When the replication target is a database, data delivery is accomplished by a Replicat process.
- Simulates replication between 2 schemas (oggsrc, replication source and oggtrg, the replication target)
- On target server:
  
  GGSCI > Edit Param rinta
  Replicat rinta
  SETENV(ORACLE_SID='PDB1')
  DBOPTIONS INTEGRATEDPARAMS(parallelism 6)
  USERIDALIAS tgtdb DOMAIN admin
  AssumeTargetDefs
  DiscardFile ./dirrpt/rpdw.dsc,
  Purge UserIdAlias ogg_user
  Map PDB1.oggsrc.*, PDB1.target oggtrg.*;

- Leave the editor saving the file rinta.prm.
- DBOPTIONS INTEGRATEDPARAMS(parallelism 6) for this Integrated Replicat, min number of parallel apply processes will be 6.
The apply process

- OGG 12c, the new terminology for the Replicat process
- Apply process reads the target trail files, converts OGG *Logical Change Records* (LCR) to DML or DDL, and applies all the changes to target DB.
- For Oracle 12c pluggable DB targets, integrated Replicat process cannot connect to Oracle 12c DB root container. It must connect directly to the specific pluggable database.

Basic configuration consists of:
- The Replicat group name
- The Replicat mode of operation (for example, integrated apply)
- The target DB OGG admin user login credentials or USERIDALIAS if using the Credential Store
- Target trail file path and prefix
- Discarded data file (data records that suffer an error during apply)
- Mapping information between the source table and the target table
5. Configuring Data Delivery Using Integrated Replicat

- Connect to the database and add the Replicat rinta, connecting it to the Exttrail ./dirdat/pn

  GGSCI > DBlogin UserIdAlias ogg_user
  Successfully logged into database.

  GGSCI > Add Replicat rinta Integrated exttrail ./dirdat/pn
  REPLICAT (Integrated) added.

  GGSCI > Start Replicat rinta
  Sending START request to MANAGER ... 
  REPLICAT RINTA starting

  GGSCI > info all
  Program Status Group Lag at Chkpt Time Since Chkpt
  MANAGER RUNNING
  REPLICAT RUNNING RINTA 00:00:00 00:00:39 GGSCI
6. Obtaining Information About All Processes: Target

- To display more information about the rinta Replicat process you can enter the command `Info rinta`.

  ```
  GGSCI (kati:~) > Info rinta
  REPPLICAT RINTA  Last Started 2014-02-03 22:34  Status RUNNING
  INTEGRATED
  Checkpoint Lag    00:00:00 (updated 00:00:04 ago)
  Process ID        50022
  Log Read Checkpoint File ./dirdat/pn000000
  First Record RBA 0
  ```

- The output specifies that rinta is an Integrated Replicat process. You can also enter "Info rinta, Detail" to display the most detailed information.

- In all cases, the Status should be **RUNNING**, and the time since the last update or checkpoint should be under 10 seconds.

  ```
  GGSCI (kati:~) > Info rinta, Detail
  REPPLICAT RINTA  Last Started 2014-02-03 22:34  Status RUNNING
  INTEGRATED
  Checkpoint Lag    00:00:00 (updated 00:00:01 ago)
  Process ID        50022
  Log Read Checkpoint File ./dirdat/pn000000
  First Record RBA 0

  INTEGRATED Replicat
  DBLOGIN Provided, inbound server name is OGG$RINTA in ATTACHED state

  Current Log BSN value: <NULL>

  Extract Source         Begin          End
  ./dirdat/pn000000     * Initialized * First Record
  ./dirdat/pn000000     * Initialized * First Record
  ./dirdat/pn000000     * Initialized * First Record

  Current directory     /u01/app/oracle/product/ogg_trg
  Report file           /u01/app/oracle/product/ogg_trg/dirrpt/RINTA.rpt
  Parameter file        /u01/app/oracle/product/ogg_trg/dirprm/rinta.prm
  Checkpoint file       /u01/app/oracle/product/ogg_trg/dirchk/RINTA.cpr
  Process file          /u01/app/oracle/product/ogg_trg/dirpcs/RINTA.pcr
  Error log             /u01/app/oracle/product/ogg_trg/ggserr.log
  ```
6. Obtaining Information About All Processes: Target

- rinta Replicat process is "Integrated," Oracle DB knows about it.
- Several OGG views defined in DB data dictionary which can be queried to display information about Oracle OGG queues and processes. Connect as sysdba on target to query data dictionary tables.

```
SQL> connect / as sysdba
Connected.

SQL> column replicat_name format a30
SQL> column server_name format a30

SQL> select replicat_name,server_name from DBA_GOLDENGATE_INBOUND;

REPLICAT_NAME       SERVER_NAME
--------------------------------------
RINTA                OGG$RINTA

SQL> column apply_name format a30
SQL> column queue_name format a30

SQL> select apply_name,queue_name from DBA_APPLY;

APPLY_NAME       QUEUE_NAME
------------------------
OGG$RINTA         OGGQ$RINTA
```
6. Obtaining Information About All Processes: Target

SQL> select apply_name, state from V$GG_APPLY_COORDINATOR;

<table>
<thead>
<tr>
<th>APPLY_NAME</th>
<th>STATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>OGG$RINTA</td>
<td>IDLE</td>
</tr>
</tbody>
</table>

• Note: Because we had configured PARALLELISM to be 6 via the DBOPTIONS INTEGRATEDPARAMS(parallelism 6) in the replicat parameter file, we will see 6 apply server processes which are ready to run.

• At this stage they are IDLE and have not received or applied any messages or LCRs.

SQL> select server_id, TOTAL_MESSAGES_APPLIED from V$GG_APPLY_SERVER 2 where apply_name='OGG$RINTA';

<table>
<thead>
<tr>
<th>SERVER_ID</th>
<th>TOTAL_MESSAGES_APPLIED</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

6 rows selected.
6. Obtaining Information About All Processes: Source

- Display information about all processes on the replication source instance. Display summary information:

<table>
<thead>
<tr>
<th>Program</th>
<th>Status</th>
<th>Group</th>
<th>Lag at Chkpt</th>
<th>Time Since Chkpt</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANAGER</td>
<td>RUNNING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXTRACT</td>
<td>RUNNING</td>
<td>EINTA</td>
<td>00:00:05</td>
<td>00:00:01</td>
</tr>
<tr>
<td>EXTRACT</td>
<td>RUNNING</td>
<td>PINTA</td>
<td>00:00:00</td>
<td>00:00:05</td>
</tr>
</tbody>
</table>

- Display detailed information

<table>
<thead>
<tr>
<th>Program</th>
<th>Group</th>
<th>Last Started</th>
<th>Status</th>
<th>Checkpoint Lag</th>
<th>Process ID</th>
<th>Log Read Checkpoint</th>
<th>First Record</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXTRACT</td>
<td>EINTA</td>
<td>2014-02-03 21:51</td>
<td>RUNNING</td>
<td>00:00:05 (updated 00:00:05 ago)</td>
<td>49304</td>
<td>Oracle Integrated Redo Logs</td>
<td>RBA 1429</td>
</tr>
<tr>
<td>EXTRACT</td>
<td>PINTA</td>
<td>2014-02-03 21:51</td>
<td>RUNNING</td>
<td>00:00:00 (updated 00:00:08 ago)</td>
<td>49316</td>
<td>File ./dirdat/in000000</td>
<td></td>
</tr>
</tbody>
</table>
6. Obtaining Information About All Processes: Source

- Display even more detailed information: > Info Extract *, Detail
- Everything should show a status of **RUNNING**. The source tables are still empty. No data has flowed yet, nothing has replicated yet.

---

**GGSCI (Display current)> Info Extract *, Detail**

<table>
<thead>
<tr>
<th>EXTRACT</th>
<th>EINTA</th>
<th>Last Started: 2014-02-03 21:51</th>
<th>Status: RUNNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checkpoint</td>
<td>Lag</td>
<td>00:00:06 (updated 00:00:04 ago)</td>
<td></td>
</tr>
<tr>
<td>Process ID</td>
<td></td>
<td>49304</td>
<td></td>
</tr>
<tr>
<td>Log Read Checkpoint</td>
<td>Oracle Integrated Redo Logs</td>
<td>2014-02-03 23:59:24</td>
<td>SCN 0.2032590 (2032590)</td>
</tr>
</tbody>
</table>

**Target Extract Trails:**

<table>
<thead>
<tr>
<th>Trail Name</th>
<th>Segno</th>
<th>RBA</th>
<th>Max MB</th>
<th>Trail Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>./dirdat/in</td>
<td></td>
<td>0</td>
<td>1429</td>
<td>10 EXTTRAIL</td>
</tr>
</tbody>
</table>

**Integrated Extract outbound server first scn: 0.1905933 (1905933)**

<table>
<thead>
<tr>
<th>Extract Source</th>
<th>Begin</th>
<th>End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Available</td>
<td>2014-02-03 01:07</td>
<td>2014-02-03 23:59</td>
</tr>
<tr>
<td>Not Available</td>
<td>* Initialized * 2014-02-03 01:07</td>
<td></td>
</tr>
</tbody>
</table>

**Current directory**

/u01/app/oracle/product/ogg_src

**Report file**

/u01/app/oracle/product/ogg_src/dirrpt/EINTA.rpt

**Parameter file**

/u01/app/oracle/product/ogg_src/dirprm/einta.prm

**Checkpoint file**

/u01/app/oracle/product/ogg_src/dirchk/EINTA.cpe

**Process file**

/u01/app/oracle/product/ogg_src/dircos/EINTA.pcc

**Error log**

/u01/app/oracle/product/ogg_src/ggserr.log

---

**EXTRACT PINTA**

<table>
<thead>
<tr>
<th>Checkpoint</th>
<th>Lag</th>
<th>00:00:00 (updated 00:00:07 ago)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process ID</td>
<td></td>
<td>49316</td>
</tr>
<tr>
<td>Log Read Checkpoint</td>
<td>File . ./dirdat/in000000</td>
<td>First Record RBA 1429</td>
</tr>
</tbody>
</table>
7. Generating INSERTs

- Launch sqlplus, connecting to Oracle DB as OGGSRC.
  Execute the gdp_by_year_2008.sql script, then compute the number of rows in the table GDP_BY_YEAR.

```sql
[oracle@localhost ]$ sqlplus oggsrc/Welcome1@PDB1

SQL*Plus: Release 12.1.0.1.0 Production on Tue Feb 4 00:11:22 2014
Copyright (c) 1982, 2013, Oracle. All rights reserved.
Last Successful login time: Mon Feb 03 2014 23:21:44 +11:00
Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real Application Testing options

SQL> @gdp_by_year_2008.sql
1 row created.
1 row created.
... many lines omitted for clarity ...
1 row created.
Commit complete.

SQL> select count(*) from gdp_by_year;
       COUNT(*)
----------
        235
```
7. Generating INSERTs

- Verify that the rows were inserted into the table in the replication target schema (oggtrg.)

  SQL> show user
  USER is "OGGTRG"

  SQL> select count(*) from gdp_by_year;
  |
  |
  |
  |
  |
  | COUNT(*)
  |
  |
  |
  |
  |
  235

- Verify that the source GGSCI Extract processes are still running on source.
- If the Status says **ABENDED**, then check the process reports to see what the error was. Use command "**view report einta**" or "**view report pinta**" to find out what happened to the Extract group.

```
GGSCI (example> ) > Info All

<table>
<thead>
<tr>
<th>Program</th>
<th>Status</th>
<th>Group</th>
<th>Lag at Chkpt</th>
<th>Time Since Chkpt</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANAGER</td>
<td>RUNNING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXTRACT</td>
<td>RUNNING</td>
<td>EINTA</td>
<td>00:00:06</td>
<td>00:00:01</td>
</tr>
<tr>
<td>EXTRACT</td>
<td>RUNNING</td>
<td>PINTA</td>
<td>00:00:00</td>
<td>00:00:07</td>
</tr>
</tbody>
</table>
```
7. Generating INSERTs

- Use the **Stats** command to request the Extract processes EINTA and PINTA to display to the screen statistics about their run so far:

```
GGSCI (host01.example.com) > Stats einta

Sending STATS request to EXTRACT EINTA ...

Start of Statistics at 2014-02-04 00:28:42.

Output to ./dirdat/in:

Extracting from OGGSRC.GDP_BY_YEAR to OGGSRC.GDP_BY_YEAR:

*** Total statistics since 2014-02-04 00:12:26 ***

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total inserts</td>
<td>235.00</td>
</tr>
<tr>
<td>Total updates</td>
<td>0.00</td>
</tr>
<tr>
<td>Total deletes</td>
<td>0.00</td>
</tr>
<tr>
<td>Total discards</td>
<td>0.00</td>
</tr>
<tr>
<td>Total operations</td>
<td>235.00</td>
</tr>
</tbody>
</table>

*** Daily statistics since 2014-02-04 00:12:26 ***

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total inserts</td>
<td>235.00</td>
</tr>
<tr>
<td>Total updates</td>
<td>0.00</td>
</tr>
<tr>
<td>Total deletes</td>
<td>0.00</td>
</tr>
<tr>
<td>Total discards</td>
<td>0.00</td>
</tr>
<tr>
<td>Total operations</td>
<td>235.00</td>
</tr>
</tbody>
</table>

*** Hourly statistics since 2014-02-04 00:12:26 ***

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total inserts</td>
<td>235.00</td>
</tr>
<tr>
<td>Total updates</td>
<td>0.00</td>
</tr>
<tr>
<td>Total deletes</td>
<td>0.00</td>
</tr>
<tr>
<td>Total discards</td>
<td>0.00</td>
</tr>
<tr>
<td>Total operations</td>
<td>235.00</td>
</tr>
</tbody>
</table>

*** Latest statistics since 2014-02-04 00:12:26 ***

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total inserts</td>
<td>235.00</td>
</tr>
<tr>
<td>Total updates</td>
<td>0.00</td>
</tr>
<tr>
<td>Total deletes</td>
<td>0.00</td>
</tr>
<tr>
<td>Total discards</td>
<td>0.00</td>
</tr>
</tbody>
</table>
7. Generating INSERTs

- Use the `Stats` command to request the Extract processes EINTA and PINTA to display to the screen statistics about their run so far:

```
GGSCI (HDS1421:0) > Stats pinta
Sending STATS request to EXTRACT PINTA ...
Output to ./dirdat/pn:
Extracting from OGGSRC.GDP_BY_YEAR to OGGSRC.GDP_BY_YEAR:

*** Total statistics since 2014-02-04 00:12:34 ***
  Total inserts         235.00
  Total updates         0.00
  Total deletes         0.00
  Total discards        0.00
  Total operations      235.00

*** Daily statistics since 2014-02-04 00:12:34 ***
  Total inserts         235.00
  Total updates         0.00
  Total deletes         0.00
  Total discards        0.00
  Total operations      235.00

*** Hourly statistics since 2014-02-04 00:12:34 ***
  Total inserts         235.00
  Total updates         0.00
  Total deletes         0.00
  Total discards        0.00
  Total operations      235.00

*** Latest statistics since 2014-02-04 00:12:34 ***
  Total inserts         235.00
  Total updates         0.00
  Total deletes         0.00
  Total discards        0.00
  Total operations      235.00

End of Statistics.
```
7. Generating INSERTs

- Verify that the target GGSCI Integrated Replicat process is still running.
- If the Status says **ABENDED**, then check the process reports to see what the error was. You should use the command **view report rinta** to find out what happened to the Replicat group.

<table>
<thead>
<tr>
<th>Program</th>
<th>Status</th>
<th>Group</th>
<th>Lag at Chkpt</th>
<th>Time Since Chkpt</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANAGER</td>
<td>RUNNING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REPLICAT</td>
<td>RUNNING</td>
<td>RINTA</td>
<td>00:00:00</td>
<td>00:00:05</td>
</tr>
</tbody>
</table>

- Use the **Stats** command to request the Replicat process RINTA to display to the screen statistics about its run so far.
8. Generating UPDATEs/ DELETEs

- In the ECONOMIC_ENTITY table all economic entities which are not single countries, like "East Asia Less Japan" or "Other Western Europe" are listed as "N/A" in the CONTINENT column. Change "N/A" to "Not a continent".

```sql
SQL> UPDATE ECONOMIC_ENTITY set CONTINENT = 'Not a continent' WHERE CONTINENT = 'N/A';
36 rows updated.
SQL> DELETE FROM GDP_BY_YEAR where GDP_YEAR=2008;
235 rows deleted.
SQL> commit;
Commit complete.
```

- Use the Stats command to request the Extract processes EINTA and PINTA to display to the screen statistics about their run so far.

```sql
OGSCI > Stats einta
Sending STATS request to EXTRACT EINTA ...
Start of Statistics at 2014-02-04 00:49:37.
Output to ./dirdat/in:
Extracting from OGGSEC.GDP_BY_YEAR to OGGSEC.GDP_BY_YEAR:

*** Total statistics since 2014-02-04 00:12:26 ***
  Total inserts          235.00
  Total updates          0.00
  Total deletes          235.00
  Total discards         0.00
  Total operations       470.00

*** Daily statistics since 2014-02-04 00:12:26 ***
  Total inserts          235.00
  Total updates          0.00
  Total deletes          235.00
  Total discards         0.00
  Total operations       470.00

*** Hourly statistics since 2014-02-04 00:12:26 ***
  Total inserts          235.00
  Total updates          0.00
  Total deletes          235.00
  Total discards         0.00
  Total operations       470.00

*** Latest statistics since 2014-02-04 00:12:26 ***
  Total inserts          235.00
  Total updates          0.00
  Total deletes          235.00
  Total discards         0.00
  Total operations       470.00

Extracting from OGGSEC.ECONOMIC_ENTITY to OGGSEC.ECONOMIC_ENTITY:

*** Total statistics since 2014-02-04 00:12:26 ***
  Total inserts          0.00
  Total updates          0.00
  Total deletes          0.00
  Total discards         0.00
  Total operations       36.00

*** Daily statistics since 2014-02-04 00:12:26 ***
  Total inserts          0.00
  Total updates          0.00
  Total deletes          0.00
  Total discards         0.00
  Total operations       36.00
```
8. Generating UPDATEs/DELETEs

- Verify that the target GGSCI Integrated Replicat process is still running

<table>
<thead>
<tr>
<th>Program</th>
<th>Status</th>
<th>Group</th>
<th>Lag at Chkpt</th>
<th>Time Since Chkpt</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANAGER</td>
<td>RUNNING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REPLICAT</td>
<td>RUNNING</td>
<td>RINTA</td>
<td>00:00:00</td>
<td>00:00:00</td>
</tr>
</tbody>
</table>

- If the Status says **ABENDED**, then check the process reports to see what the error was. You should use the command **view report rinta** to find out what happened to the Replicat group

- Use the **Stats** command to request the Replicat process RINTA to display to the screen statistics about its run so far
• DML changes from the hub itself will be routed to all spokes.

• DML changes from a spoke will be routed and applied at the hub and forwarded to all other spokes except of the spoke, where the DML change was originally initiated using (tag functionality).

• DML changes are bidirectionally replicated.

• It works with the classic integrated Extract and not with integrated Extract (tag functionality)- In our labs :

---

**Demo: Hub & Spoke Configurations**
**peer-to-peer environment- Implementation**

- One extract capture process at each DB site.
- \(<n-1>\) extract pump processes that points to the other DB.
- \(<n-1>\) Replicat processes at each DB site that applies the DML-changes from each of the other \(<n-1>\) sites
## Configuration Comparison

<table>
<thead>
<tr>
<th></th>
<th>Peer-to-Peer</th>
<th>Hub &amp; Spoke</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Creating Environment</strong></td>
<td>$O(n^2)$</td>
<td>$O(2n)$ !</td>
</tr>
<tr>
<td><strong>Adding Node</strong></td>
<td>$O(2*n)$</td>
<td>$O(2)$ !</td>
</tr>
<tr>
<td><strong>Point of failure</strong></td>
<td>No single point.</td>
<td>Hub must be high available. A single point of failure. combination of RAC &amp; Data Guard or a &quot;Double Hub &amp; Spoke&quot;</td>
</tr>
<tr>
<td><strong>No of Processes</strong></td>
<td>Every sides has many processes</td>
<td>3 processes at the spokes</td>
</tr>
</tbody>
</table>
## Demo: Hub & Spoke Configurations

<table>
<thead>
<tr>
<th>Process</th>
<th>Hub</th>
<th>Spoke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extract</td>
<td>• one process</td>
<td>• one process</td>
</tr>
<tr>
<td>(capture)</td>
<td>• No TRANLOGOPTION EXCLUDEUSER</td>
<td>• TRANLOGOPTION EXCLUDEUSER</td>
</tr>
<tr>
<td></td>
<td>• Additional TOKEN for TXN Username</td>
<td></td>
</tr>
<tr>
<td>Extract</td>
<td>• (&lt;n&gt;) process (for each spoke)</td>
<td>• one simple process</td>
</tr>
<tr>
<td>(pump)</td>
<td>• FILTER on TXN Username</td>
<td></td>
</tr>
<tr>
<td>Replicat</td>
<td>• (&lt;n&gt;) simple processes used by the specific OGG_ADMIN(&lt;n&gt;)</td>
<td>• one simple process</td>
</tr>
<tr>
<td></td>
<td>user</td>
<td></td>
</tr>
</tbody>
</table>
Spoke Configurations: Replicat

At each Spoke, there is exactly one OGG_ADMIN user (called OGG_ADMIN or OGG_ADMIN_<n> where <n> represents the spoke number (1, 2, 3, ..).

At each spoke, there is only one Replicat process that applies DML changes coming from the hub.

```c
/*R1.prm */
1  REPPLICAT R1
2  -- Replicate process from spoke 1 to hub
3  4  -- Source and target are identical
5  ASSUMETARGETDEFS
6  7  AllowDupTargetMap
8  9  -- connect to the target db
10 SETENV (ORACLE_HOME ="/u01/app/oracle/product/11.2.0/db_1")
11 SETENV (ORACLE_SID  ="GISDB")
12 UserID OGG_ADMIN_1, Password xxxxxx
13 14 15 16  REFERROR (DEFAULT, DISCARD)
17  REFERROR (DEFAULT2, EXCEPTION)
18 19 20  DISCARDFILE ./discrd/R1.dsc, APPEND, MEGABYTES 100
21 22  DiscardRollover at 22:30
23 24  25  -- Call to exception handler macro
26  Include ./dirprm/SH.mac
27  Include ./dirprm/SCOTT.mac
28 29  -- Valid for Extract and Replicat
30  -- truncates is only allowed from hub
31  GETTRUNCATES
32  -- Ignore truncates from spoke
33  -- IGNORETRUNCATES
34 35 36 MAPEXCLUDE IAF_OPR_A.MD*
37 MAPEXCLUDE IAF_TRN_A.MD*
38 39  MAP IAF_OPR_A.*, TARGET IAF_OPR_A.*;
40 MAP IAF_OPR_A.*, FILTER (@GETENV('LASTERR', 'DBERRNUM') <> 0), #exception_SH();
41 42 MAP IAF_TRN_A.*, TARGET IAF_TRN_A.*;
43 MAP IAF_TRN_A.*, FILTER (@GETENV('LASTERR', 'DBERRNUM') <> 0), #exception_SCOTT();
```
Spoke Configurations : Extract

- At each spoke, there is exactly one extract process that captures the changes.
- Changes originally coming from the spoke (or changes from other spokes that are forwarded by the hub), are not captured.
- TRANLOGOPTION EXCLUDEUSER OGG_ADMIN_<n> option.
- Effectively blocking the GGS_ADMIN user on the target system (the user associated with the Replicat process).
- Changes arriving and applied at a spoke are at the final destination. Those DML changes will not be processed anymore. The spoke is an “end-point
Spoke Configurations : Extract

-- File Name : E1.prm
extract E1

-- This is needed, if you have more than one instance:
SETENV (ORACLE_HOME ="/u01/app/oracle/product/11.2.0/db_1")
SETENV (ORACLE_SID ="GISDB")
UserID OGG_ADMIN_1 Password xxxxx

DISCARDFILE ./dircrd/E1.dsc, APPEND, MEGABYTES 100

DiscardRollover at 22:30

ReportCount Every 30 Minutes, Rate

extrtrail ./dirdat/eA

TRANLOGOPTIONS EXCLUDEUSER OGG_ADMIN_1

TABLEEXCLUDE * MD* *
TABLEEXCLUDE * DB_CONFIG
TABLEEXCLUDE * FLIGHT_QUEUE
TABLEEXCLUDE * MENIFA_QUEUE
TABLEEXCLUDE * LOGGED_USERS
TABLEEXCLUDE * GG_EXCEPTIONS
TABLEEXCLUDE * LOCK_ENTITY

TABLE SCOTT.*;
TABLE SH.*;
Spoke Configurations : Pump

• At each spoke, there is exactly one Extract pump process that routes DML changes from the spoke to the hub.

• Because the information was already filtered with the TRANLOGOPTION USEREXCLUDE at the Extract capture process, there is no need for a filter within the Extract pump from the spokes

```plaintext
*P1.prm

1 -- file name : P1.prm
2 -- Data pump from Spoke 1 to hub
3 EXTRACT P1
4
5 -- this is needed, if you have more than one instance:
6 SETENV (ORACLE_HOME="/u01/app/oracle/product/11.2.0/db_1")
7 SETENV (ORACLE_SID="GISDB")
8 UserID OGG_ADMIN_1 Password xxxx
9
10 DISCARDFILE ./dircrd/P1.dsc, APPEND, MEGABYTES 100
11
12 DiscardRollover at 22:30
13
14 RmtHost 22.85.94.60, MgrPort 7809, Compress
15 rmttrail ./dirdat/rA
16
17 TABLE SCOTT.*;
18 TABLE SH.*;
19
```
Hub Configurations: Extract E00

- At the hub, the number of OGG_ADMIN users (called OGG_ADMIN or OGG_ADMIN_<0n>), where 0 represents the hub and <n> represents the spoke number (01, 02, 03, ..).
- At the hub, N Replicat processes for each spoke <n> managed by the specific OGG_ADMIN_<0n> user that applies DML changes coming from the specific spoke:
  - OGG_ADMIN_1 will manage the R01 process coming from spoke #1
  - OGG_ADMIN_2 will manage the R02 process coming from spoke #2
  ...  
  - OGG_ADMIN_9 will manage the R09 process coming from spoke #9
- At the hub, there is exactly one extract process that captures all the changes by the OGG_ADMIN_0 user. There is no filter in here. Having only one Extract capture process will minimize any resource utilization on the hub database.
- DML Changes from the hub database as a local transaction will be captured.
- Any applied DML change initially performed at any spoke will be captured at the hub. The hub is no “end-point”, it forwards DML changes from any spoke.
• **TOKENS** is valid for TABLE.

• Use **TOKENS** to define a user token and associate it with data. Tokens enable you to extract and store data within the user token area of a trail record header.

• **USERNAME** (Oracle) Returns the Oracle user name of the database user that committed the last transaction.
Hub Configurations: Pump P01, P02 ... P0<n>

- **STRFIND**: Use the `@STRFIND` function to determine the position of a string within a string column or else return zero if the string is not found.
- **FILTER**: Selects records based on a numeric value. FILTER provides more flexibility than WHERE.
Hub Configurations: Replicat R01,R02 ...R0<n>

```plaintext
1 REPICALT R01
2   -- Replicate process from spoke 1 to hub
3
4   -- Source and target are identical
5 ASSUMETARGETDEFS
6
7   -- connect to the target db
8 SETENV (ORACLE_HOME ="/u01/app/oracle/product/11.2.0/db_1")
9 SETENV (ORACLE_SID ="GISDB")
10 UserID OGG_ADMIN_1, Password xxxx
11
12 AllowDupTargetMap
13
14
15 REPERROR (DEFAULT, DISCARD)
16 REPERROR (DEFAULT2, EXCEPTION)
17
18
19 DISCARDFILE ./dircrd/R01.dsc, APPEND, MEGABYTES 100
20
21 DiscardRollover at 22:30
22
23 ReportCount Every 30 Minutes, Rate
24
25   -- Call to exception handler macro
26 Include ./dirprm/exception_IAF_OPR_A.mac
27 Include ./dirprm/exception_IAF_TRN_A.mac
28
29  -- Valid For Extract and Replicat
30  -- truncates is only allowed from hub
31  -- GETTRUNCATES
32  -- Ignore truncates from spoke
33  IGNORETRUNCATES
34
35 MAPEXCLUDE SCOTT.MD*
36
37 MAP SCOTT.*, SCOTT.*;
38 MAP SCOTT.*, FILTER (@GETENV('LASTERR', 'DBERRNUM') <> 0), #exception_SCOTT();
39
40 MAP SH.*, SH.*;
41 MAP SH.*, FILTER (@GETENV('LASTERR', 'DBERRNUM') <> 0), #exception_SH();
42
```
setup_hub.oby script

-- Script name: setup_hub.oby
-- Description:
-- Create the hub.
-- Run this script on hub as follows:
-- $ cd $GG_HOME
-- $ ggsci
-- GGSCI > obey diroby/setup_hub.oby

-- Connect to the target db in any case for new reruns
DBLogin UserID OGG_ADMIN_0, Password xxxxx

-- Kill and delete all extracts and repload processes.
stop er *
KILL extract E*
delete extract E*
KILL extract P*
delete extract P*
KILL replicat R*
delete replicat R*

-- Delete checkpoint table if exists
delete checkpointtable!

-- Configure the hub by running sqlplus using sh. Use the following when using DBFS:
-- sh sqlplus /nolog @/oracle/dbfs_direct/FS1/golden_gate/dirsq1/Create_GG_Admin_On_Hub.sql

-- Configure the hub by running sqlplus using sh. Use the following when not using DBFS:
sh sqlplus /nolog @/u01/app/oracle/product/golden_gate/dirsq1/Create_GG_Admin_On_Hub.sql
-- GLOBALS file
-- =============
-- specify parameters that apply to the entire OGG instance
-- 1. CHECKPOIN'TABLE
-- For classic mode first step to configure Change Data Delivery (CDD) is the creation of a Checkpoint table.
-- Optional but recommends
-- Enables the checkpoint to be included within Replicat's transaction, ensuring complete recovery from all failure scenarios.
-- For Integrated mode, the Checkpoint table is not required and should not be created

-- 2. Fine-grained Performance Monitoring
-- New GoldenGate Extended Metrics
-- Access to Monitoring Point through Restful Web Services
-- http://<hostname>:<mgr_port>/mpointsx
-- Real-time insight into GoldenGate client programs
-- Requires ENABLEMONITORING in GLOBALS

sh echo CheckpointTable OGG_ADMIN_0.OGGCHKPT > /u01/app/oracle/product/golden_gate/GLOBALS
sh echo ENABLEMONITORING >> /u01/app/oracle/product/golden_gate/GLOBALS

stop mgr

-- Delete previous report files, discard files checkpoint files and trail files
SHELL rm $GG_HOME/dirppt/*.rpt
SHELL rm $GG_HOME/dircrd/*.dsc
SHELL rm $GG_HOME/dirchk/*
SHELL rm $GG_HOME/dirdat/*

-- Clean Gg error log
SHELL echo # > $GG_HOME/ggserr.log

start mgr

-- connect to the target db
DBlogin userid OGG_ADMIN_0, Password Admin01
Add CheckpointTable
setup_hub.oby script

-- Give all permissions on Checkpoint Table to OGG_ADMIN_1 ... OGG_ADMIN_n on hub

-- Configure the hub by running sqlplus using sh. Use the following when using DBFS:
    sh sqlplus /nolog @/oracle/dbfs_direct/FS1/golden_gate/dirsq/dirsq/grant_permission_on_chkt_tbl_on_hub.sql

-- Configure the hub by running sqlplus using sh. Use the following when not using DBFS:
    sh sqlplus /nolog @/u01/app/oracle/product/golden_gate/dirsq/dirsq/grant_permission_on_chkt_tbl_on_hub.sql

stop mgr
start mgr
DBLogin UserID OGG_ADMIN_0, Password xxxx
Info CheckpointTable
Set Editor vi

-- ADD SCHEMATRANDATA schema ALLCOLS
-- logs all supported key and non-key columns for all current and future tables in the schema for conflict resolution

ADD SCHEMATRANDATA SCOTT ALLCOLS
ADD SCHEMATRANDATA SH ALLCOLS

Add TranData SCOTT.*
Add TranData SH.*

-- Determine whether supplemental logging is enabled, and to show the names of columns that are being logged supplementally.
INFO TRANDATA SCOTT.*
INFO TRANDATA SH.*
-- 1. Extract Capture
--
-- 1.1 Hub
--
add extract E00, tranlog, begin now
add extrail ./dirdat/eZ, extract E00, Megabytes 100

-- 2. Extract Pump
--
-- 2.1 Hub
--
add extract P01, extrailsourse ./dirdat/eZ
add rmtrail ./dirdat/aZ, extract P01, Megabytes 100
add extract P02, extrailsourse ./dirdat/eZ
add rmtrail ./dirdat/bZ, extract P02, Megabytes 100
add extract P03, extrailsourse ./dirdat/eZ
add rmtrail ./dirdat/cZ, extract P03, Megabytes 100

-- 3. Replicats
--
-- 3.1 Hub
--
add replicat R01, extrail ./dirdat/rA
add replicat R02, extrail ./dirdat/rB
add replicat R03, extrail ./dirdat/rC

-- 4. Start processes
--

start er *
-- Sleep and then issue several info all because processes can be in status starting
pause 10
info all
info all
info all
Automatic startup of GG

Start_GG.sh:

```bash
#!/bin/bash
cd /u01/app/oracle/product/golden_gate
./ggsci << EOF
OBEY /u01/app/oracle/product/golden_gate/diroby/start_GG.oby
EOF
```

```
-- On spoke<n> use OGG_ADMIN_<n> where n is 1,2,3 ..
-- On hub use OGG_ADMIN_0
DBLogin UserID OGG_ADMIN_0, Password Admin01
Start Mgr
Info Mgr
Info CheckpointTable
Set Editor notepad

start mgr
DBLogin UserID OGG_ADMIN_0, Password xxxxxxxxxxxx
Info CheckpointTable
Set Editor vi

--Start processes
start er *
-- Sleep and then issue several info all because processes can be in status starting .
pause 20
info all
info all
info all
info all
info all
```