Oracle GoldenGate 12c: Conflict Detection and Resolution
What is it and how to use it

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Submit an Abstract: http://www.enkitec.com/e4/submit-an-abstract
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- Database-as-a-Service
- Oracle Applications on Engineered Systems
- Cloud-based solutions leveraging Engineered Systems
Agenda

• Oracle GoldenGate 12c Architecture
• Conflict Management
• Examples
• Statistics
• Summary
Capture: committed transactions are captured (and can be filtered) as they occur by reading the transaction logs. As of V.11.2.1, GoldenGate offers two options for capture for Oracle: Classic & Integrated Capture.

Trail: stages and queues data for routing.

Pump: distributes data for routing to target(s).

Route: data is compressed, encrypted for routing to target(s).

Delivery: applies data with transaction integrity. New with GoldenGate 12c, Integrated Delivery.
Capture: committed transactions are captured (and can be filtered) as they occur by reading the transaction logs. As of V.11.2.1, GoldenGate offers two options for capture for Oracle; Classic & Integrated Capture.

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Capture Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trail Files Pump Delivery Trial Bi-directional
Oracle GoldenGate 12c
Conflict Management

• All most all Active/Active systems will have a form of conflict
• Conflicts happen due to at least one row is modified on more than one system with difference data
• Common Situations:
  1. Row already exists (Inserts)
  2. Row does not exist (deletes)
  3. Values in row already changed (updates)
Conflict Management

Example - Financial Institution: Active/Active

<table>
<thead>
<tr>
<th>ACCTINFO</th>
<th>Capture</th>
<th>Trail Files</th>
<th>Pump</th>
<th>Delivery</th>
<th>Trail Files</th>
<th>Capture</th>
<th>Trail Files</th>
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<tbody>
<tr>
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<td>CHANGE_TS</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ACCTINFO</th>
<th>Delivery</th>
<th>Trail Files</th>
<th>Pump</th>
<th>Capture</th>
<th>Trail Files</th>
</tr>
</thead>
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<td>ID (PK)</td>
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</tr>
<tr>
<td>NAME</td>
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<td>ADDRESS</td>
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<tr>
<td>CHANGE_TS</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

AcctInfo Table: General details related to bank accounts between San Francisco and Atlanta
Conflict Management
Example - Financial Institution: Active/Active

Note: Tables should be able to identify when a record has been changes.
Conflict Management

Conflicts Supported

Basic Resolution for conflicts within GoldenGate environment:

- **INSERT**
  - Uniqueness conflict for INSERT

- **UPDATE**
  - conflict for “No Data Found” when row exists (before image diffs)
  - conflict for “No Data Found” when row does not exists

- **DELETE**
  - conflict for “No Data Found” when row exists (before image diffs)
  - conflict for “No Data Found” when row does not exists
Conflict Management

Supported Data Types

Data Types that can be compared are supported:

- NUMERIC
- DATE
- TIMESTAMP
- CHAR/NCHAR
- VARCHAR/NVARCHAR

Typically these data types are used with parameters like COMPARECOLS, GETBEFORECOLS, and in resolution parameters using RESOLVECONFLICT ([USEMIN] | [USEMAX])
Conflict Management
Before and After Images

<table>
<thead>
<tr>
<th>ACCTINFO</th>
<th>BEFORE</th>
<th>AFTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID (PK)</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>NAME</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>ADDRESS</td>
<td>96 Smith Rd</td>
<td>96 Smith Rd</td>
</tr>
<tr>
<td>CITY</td>
<td>Atlanta</td>
<td>Atlanta</td>
</tr>
<tr>
<td>BALANCE</td>
<td>1500</td>
<td>1550</td>
</tr>
<tr>
<td>CHANGE_TS</td>
<td>2014-10-29 00:00:00 AM</td>
<td>2014-10-30 13:32:05 PM</td>
</tr>
</tbody>
</table>

- Transaction logs are needed for recovery
- Before Images
  - Deletes and Updates
- After Images
  - Inserts and Updates

Note: LogDump utility is useful for reading trail files to identify before/after images.
Conflict Management

Requirements - Environment

Full before image of each record

Transactional Data

GGSCI> dblogin user <gg user> password <password>
GGSCI> add trandata SFAA.ACCTINFO, allcols

Behind the scene:

SQL> ALTER TABLE SFAA.ACCTINFO ADD SUPPLEMENTAL LOG GROUP GGS_94879(id, name, address, city, balance, change_ts) ALWAYS;

Note: System generated log group names can be located in DBA_LOG_GROUPS
Conflict Management

Requirements - Environment

- Sequences need to be unique on each system
  - Use starting value and increment by number of systems
  - Applies to existing sequences and identity columns
Conflict Management

Requirements - Extract

• **LOGALLSUPCOLS**
  Extract captures before images for UPDATE operations
  Extract captures before images of supplemental logged columns for both UPDATE and DELETE operations

• **GETBEFORECOLS**
  Ensures certain columns are logged
  - GETBEFOREUPDATES (DB2 only)
  - TABLE option in extract
    - GETBEFORECOLS (ON UPDATE ALL, ON DELETE ALL)
Conflict Management
Requirements - Extract

- TRANSLOGOPTION EXCLUDETAG
  - Tag supplied to transaction as it is extracted to prevent receiving replicat from trying to send it back to source
    - Classic/Integrated Extract (primary or pump)
  - Tag can be any number/letter [0-9 A-Z]

Example:
TRANSLOGOPTION EXCLUDETAG 0294
Conflict Management
Requirements - Replicat

- REPERROR
  Used to control how Replicat responds to errors

Default:
  REPERROR(default, abend)

For CDR:
  REPERROR(default, exception)
  REPERROR(default2, [ abend | discard ])
  REPERROR(-1, exception)
Conflict Management

Requirements - Replicat

- COMPARECOLS
  Used by Replicat to detect and resolve update/delete conflicts

- RESOLVECONFLICT
  Used by Replicat in bi-directional-multi-master to handle conflicts for DML operations

Example:

MAP SFAA.ACCTINFO, TARGET ATLAA.ACCTINFO,
  COMPARECOLS (ON UPDATE ALL, ON DELETE ALL),
  RESOLVECONFLICT (INSERTROWEXISTS, (DEFAULT, USEMAX(CHANGE_TS)));
Oracle GoldenGate 12c
Resolve Conflict Parameter
Conflict Management
Requirements - Exceptions

• Exception Table[s]
  • User defined
  • Used for troubleshooting or handling errors
  • Referenced in REPERROR and MAP parameters
  • Best if defined through macros
Conflict Management

Beware

**BATCHSQL**

- Increases apply performance of Replicat by organizing similar SQL statements and apply them at an accelerated rate.

- CDR is not performed in this mode

- Replicat reverts, as needed, to help resolve conflict
  1. GROUPTRANSOPS
  2. Single-transaction mode
Example 1 – Insert Row Exists

<table>
<thead>
<tr>
<th>ACCTINFO</th>
<th>SF</th>
<th>ATL</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>944</td>
<td>944</td>
</tr>
<tr>
<td>NAME</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>ADDRESS</td>
<td>55 5th Street</td>
<td>55 5th Street</td>
</tr>
<tr>
<td>CITY</td>
<td>Smyrna</td>
<td>Smyrna</td>
</tr>
<tr>
<td>BALANCE</td>
<td>1100</td>
<td>1200</td>
</tr>
<tr>
<td>CHANGE_TS</td>
<td>31-OCT-14 10.40.36.000000000 PM</td>
<td>31-OCT-14 10.40.40.000000000 PM</td>
</tr>
</tbody>
</table>

MAP SFAA.ACCTINFO, TARGET ATLAA.ACCTINFO,
COMPARECOLS (ON UPDATE ALL, ON DELETE ALL),
RESOLVECONFLICT (INSERTROWEXISTS, (DEFAULT, USEMAX(CHANGE_TS)));

- Violates the unique constraint on the target
Conflict Management

Example 2 – Update Row Exists

<table>
<thead>
<tr>
<th>ACCTINFO</th>
<th>BEFORE</th>
<th>AFTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>944</td>
<td>944</td>
</tr>
<tr>
<td>NAME</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>ADDRESS</td>
<td>55 5th Street</td>
<td>55 5th Street</td>
</tr>
<tr>
<td>CITY</td>
<td>Symrna</td>
<td>Symrna</td>
</tr>
<tr>
<td>BALANCE</td>
<td>1150</td>
<td>1100</td>
</tr>
<tr>
<td>CHANGE_TS</td>
<td>31-OCT-14</td>
<td>31-OCT-14</td>
</tr>
<tr>
<td></td>
<td>10.40.36.000000000 PM</td>
<td>10.40.40.000000000 PM</td>
</tr>
</tbody>
</table>

**UPDATEROWEXISTS**
- Updated row exists on target side
- One or more columns have a before image different from current value

MAP SFAA.ACCTINFO, TARGET ATLAA.ACCTINFO, COMPARECOLS (ON UPDATE ALL, ON DELETE ALL), RESOLVECONFLICT (UPDATEROWEXISTS, (DEFAULT, USEMIN(CHANGE_TS)));
Conflict Management

Example 3 – Delete Row

MAP SFAA.ACCTINFO, TARGET ATLAA.ACCTINFO,
COMPARECOLS (ON UPDATE ALL, ON DELETE ALL),
RESOLVECONFLICT (DELETEROWMISSING, (DEFAULT, [ DISCARD | IGNORE ]));

<table>
<thead>
<tr>
<th>ACCTINFO</th>
<th>SF</th>
<th>ATL</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>944</td>
<td>null</td>
</tr>
<tr>
<td>NAME</td>
<td>32</td>
<td>null</td>
</tr>
<tr>
<td>ADDRESS</td>
<td>55 5th Street</td>
<td>null</td>
</tr>
<tr>
<td>CITY</td>
<td>Symrna</td>
<td>null</td>
</tr>
<tr>
<td>BALANCE</td>
<td>1100</td>
<td>null</td>
</tr>
<tr>
<td>CHANGE_TS</td>
<td>31-OCT-14 10.40.36.000000000 PM</td>
<td>null</td>
</tr>
</tbody>
</table>

DELETEROWMISSING
- Deleted row does not exist on target
Conflict Management

Statistics

Replicating from ATLAA.ACCTINFO to SFAA.ACCTINFO:

*** Total statistics since 2014-11-02 00:30:43 ***

- Total inserts: 719.00
- Total updates: 93.00
- Total deletes: 524.00
- Total discards: 0.00
- Total operations: 1336.00
- Total CDR conflicts: 377.00
- CDR resolutions succeeded: 377.00
- CDR INSERTROWEXISTS conflicts: 257.00
- CDR UPDATEROWEXISTS conflicts: 93.00
- CDR DELETEROWMISSING conflicts: 27.00
Example Extract Parameter File

-- CHECKPARAMS
EXTRACT EXTAA
USERID <gg user>, PASSWORD <pwd>
TRANLOGOPTIONS DBLOGREADER
TRANLOGOPTIONS EXCLUDETAG 0294
SETENV (ORACLE_HOME="/u01/app/oracle/product/12.1.0/db12cr1")
SETENV (ORACLE_SID="oragg")
WARNLONGTRANS 10m, CHECKINTERVAL 5m
LOGALLSUPCOLS
EXTTRAIL ./dirdat/la
WILDCARDRESOLVE IMMEDIATE

TABLE SFAA.ACCTINFO, GETBEFORECOLS(ON UPDATE ALL, ON DELETE ALL);
Example Replicat Parameter File

-- CHECKPARAMS
REPLICAT REPAB
SETENV (ORACLE_HOME="/u01/app/oracle/product/12.1.0/db12cr1")
SETENV (ORACLE_SID="oragg")
USERID ggate, PASSWORD <pwd>
DISCARDFILE ./dirrpt/REPAB.discard APPEND MEGABYTES 100
REPERROR (default, exception)
REPERROR (default2, abend)
ASSUMETARGETDEFS
WILDCARDRESOLVE IMMEDIATE
INCLUDE ./dirmac/exceptions.mac

MAP ATLAA.ACCTINFO, target SFAA.ACCTINFO,
   COMPARCECOLS (ON UPDATE ALL, ON DELETE ALL),
   RESOLVECONFLICT (insertrowexists, (default, usemax(change_ts))),
   RESOLVECONFLICT (updaterowexists, (default, usemin(change_ts))),
   RESOLVECONFLICT (deleterowmissing, (default, discard));

map ATLAA.ACCTINFO, #exception_handler(ggate);
Conflict Management

Summary

• Architecture

• Conflict Management
  • Parameters Required

• Examples
  • INSERTROWEXISTING
  • UPDATEROWEXISTING
  • DELETEROWMISSING

• Statistics
Contact Info

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