Deep Dive into Automating Oracle GoldenGate using the New Microservices

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Oracle GoldenGate provides low-impact capture, routing, transformation, and delivery of database transactions across homogeneous and heterogeneous environments in real-time with no distance limitations.

* The most popular enterprise integration tool in history

Supports Databases, Big Data and NoSQL:
Agenda

1. New GoldenGate Microservices Architecture
2. Automating and Embedding GoldenGate
New GoldenGate Microservices Architecture

Simplifies large scale and cloud deployments

• GoldenGate components as micro services with comprehensive RESTful interfaces.

• Enables remote and secure configuration, administration, and monitoring capabilities.

• Enables Applications to embed, automate, and orchestrate GoldenGate.
New Services Architecture for Cloud and Large-scale Deployments
Administration, Distribution, Receiver, Metrics Services with RESTful Service Interfaces
New GoldenGate Microservices

• Administration Service
  – Replaces GGSCI and Manager with a single administration service for managing replication processes

• Multi-threaded Distribution Service
  – Replaces multiple source-side Extract Pumps with a single instance service.
  – Lightweight filtering only (no transformations)

• Multi-threaded Receiver Service
  – Replaces the multiple discrete target-side Server/Collectors with a single instance service

• Performance Metrics Service
  – New service for monitoring metrics related to a particular deployment
  – Also available in the traditional architecture

• Service Manager
  – New service for managing multiple deployments on a local host
Administer GoldenGate with Variety of Clients
Command Line, Browsers, Programmatic RESTful Interfaces

AdminClient
Browsers
PLSQL
Scripts & Interpreters
Anything via Service IF

Service Interface

HTTPS

Metrics Server
Distribution Server
Admin Server
Service Manager
Receiver Server

Trail Files
Extract

Replicat

Trail Files
REST based clients for Remote and Secure GoldenGate Administration

- Use browser to administer and monitor GoldenGate
- Each service has an embedded HTML5 app

```
OGG (not connected) > CONNECT https://kgz.us.oracle.com:9000 DEPLOYMENT demo AS admin PASSWORD ***
OGG (https://localhost:9000 demo) > DBLOGIN USER IDALIAS gg_2 DOMAIN OracleGoldenGate
Successfully logged into database.
OGG (https://localhost:9000 demo) > ADD EXTRACT e001 INTEGRATED TRANLOG BEGIN NOW
OGG (https://localhost:9000 demo) > REGISTER EXTRACT e001 DATABASE
2016-09-16T01:13:33Z INFO  OGG-02003 Extract e001 successfully registered with database at SCN 1155176.
OGG (https://localhost:9000 demo) > ADD EXTRAIL ah EXTRACT e001
2016-09-16T01:13:34Z INFO  OGG-08100 EXTRAIL added.
OGG (https://localhost:9000 demo) > START EXTRACT e001
2016-09-16T01:13:34Z INFO  OGG-00975 EXTRACTEDBA starting
2016-09-16T01:13:34Z INFO  OGG-15428 EXTRACTEDBA started
```

- Thin Command Line client - similar to GGSCI
- Connect and administer local and remote deployments
Example RESTful Service Call to Create Extract
Single Call to create, update parameter file, register, and start integrated Extract

POST  https://xyz.us.oracle.com:9101/services/v2/processes/extracts/e001

JSON Payload:

```
{
  "$schema": "ogg:extract",
  "credentials": {
    "domain": "OracleGoldenGate",
    "alias": "gg1"
  },
  "config": [
    "-- Parameter file for primary extract: e001",
    "extract e001",
    "useridalias gg1",
    "extrtrail aa, format release 12.3",
    "tranlogoptions excludetag +",
    "eofdelaycsecs 10",
    "table u1.*",
    ""
  ],
  "status": "running",
  "source": {
    "tranlogs": "integrated"
  },
  "registration": {
    "csn": "0.0",
    "share": true
  },
  "targets": [
    {
      "name": "aa"
    }
  ]
}
```
Security Model

Standard TLS/SSL based authentication and Client Authorization

Client Authorization

- Identity via SSL user certificates or via username/password
  - Integrate with SSO configured in proxy/middleware.

- Roles
  - Security User
  - Administrator
  - Operator
  - User
WebSockets -- Default Data Communication Protocol

Industry standard HTTP(S) initiated full-duplex streaming protocol

- SSL based security
- Can seamlessly traverse through HTTP forward/reverse proxy servers
Allows Applications to Embed and Automate GoldenGate

Easily build self-service applications which automates GoldenGate

REST calls to configure, administer, and monitor GoldenGate

Catalog of RESTful APIs are available for all services
GoldenGate Automated in Oracle Database Sharding

**N-way active-active replication automatically set up**

- Automatic creation of replication processes
  - Extracts, Replicats, Distribution Paths
  - Automatic CDR for resolving conflicts
- Replication topology is automatically reconfigured upon sharding changes
Sharding - Automatic Oracle GoldenGate Configuration

1. Define replication topology

GDSCTL > create shardcatalog .... -repl OGG ....

GDSCTL> add shardgroup ..shgrp1 -repfactor 3

GDSCTL>add shard -shardgroup shgrp1....
  gg_service host01:9000/deploy1 ....
GDSCTL>add shard -shardgroup shgrp1.... -
  gg_service host02:9000/deploy1
GDSCTL>add shard -shardgroup shgrp1.... -
  gg_service host03:9000/deploy1
  ....
  ....
GDSCTL>DEPLOY
Sharding - Automatic Oracle GoldenGate Configuration

1. Define replication topology
2. Send command to shards
3. https
4. Setup replication
5. Update status

OGG sharding orchestration logic issues REST calls to setup GoldenGate replication

GDSCTL > DEPLOY

Shard Catalog

Shards
Program Agenda

1. New GoldenGate Microservices Architecture
2. Automating and Embedding GoldenGate
Set up Replication using simple PL/SQL buildings blocks

Database

PL/SQL Procedures

- one_way_replication
- create_extract
- create_replicat
- create_distpath
- ....
- gg_send_request

HTTPS

GoldenGate Services

Note: We plan to publish example building blocks on OTN
SEND_GG_REQUEST
Uses UTL_HTTP to make REST calls

```sql
procedure send_gg_request
    ( gg_uri     IN  varchar2,
      verb       IN  varchar2,
      payload    IN  varchar2,
      resp_code  OUT number,
      resp_text  OUT NOCOPY varchar2
    )
```

- URI of GoldenGate Service Endpoint: https://<gghost>:9001/services/v2/processes/extracts/e001
- HTML Verb: POST, PATCH, DELETE, GET
- Payload: JSON object specifying the replication process
- Response_Code: 200 (OK), 201 (CREATED), ...
- Response_Text: <detailed Response from Service>
Procedures to create GoldenGate Processes

```sql
procedure create_[extract|replicat]
    ( [ext|rep]_name    IN  varchar2,
      adminsrv_uri    IN  varchar2,
      db_credentials  IN  varchar2,
      [ext|rep]_trail  IN  varchar2,
      [ext|rep]_params IN  varchar2 )
```

```sql
procedure create_distpath
    ( path_name    IN  varchar2,
      ds_uri       IN  varchar2,
      src_trail    IN  varchar2,
      rs_uri       IN  varchar2,
      tgt_trail    IN  varchar2 )
```
Orchestration Procedure to setup One-way Replication

Customize as needed

```
procedure one_way_replication

(db_src varchar2,
gg_src varchar2,
gg_trg varchar2,
,db_trg varchar2,
tables varchar2,
,instatiation varchar2 [YES|NO],
,auto_CDR varchar2 [YES|NO])
```

Generate ER process names
Generate Trail file names

```
create_extract
create_distpath
create_replicat
```

Database Utilities
```
DBMS_DATAPUMP
DBMS_FILE_TRANSFER
DBMS_TTS
```

```
DBMS_GOLDENGATE_ADM
ADD_AUTO_CDR(...)
```

Requires DB 12.2+ & OGG 12.3
Setup One Way Replication

- Orchestration Package
- Database export/import to instantiate target
- Databases and Goldengate Services are up

BEGIN
  add_oneway_replication(
    db_src        => 'REPDB01',
    gg_src        => 'GG_Inst01',
    gg_trg        => 'GG_Inst02',
    db_trg        => 'REPDB02',
    tables        => 'HR.EMP',
    instantiation => 'YES',
    auto_CDR      => 'NO'
  );
END;
Create and Start Integrated Extract

1. Creating Extract
2. Creating Distribution Path
3. Datapump Export
4. Datapump Import
5. Creating Replicat

```
POST HTTPS://gg_src:8001/....
```

```json
{
  "config": [  
    "Extract E01AA",
    "ExtTrail et",
    "UseridAlias gg_src",
    "Table HR.EMP;"
  ],
  "source": {
    "tranlogs": "integrated"
  },
  "credentials": {
    "alias": "gg_src"
  },
  "registration": "default",
  "begin": "now",
  "targets": [
    {
      "name": "et"
    }
  ]
}
```
Create and Start Distribution Path

1. Creating Extract
2. Creating Distribution Path
3. Datapump Export
4. Datapump Import
5. Creating Replicat

POST HTTPS://gg_src:8002/....

```json
{
   "$schema": "ogg:distPath",
   "name": "AAtoAB",
   "description": "distPath1",
   "source": {
      "uri": "trail://ggsource:8002/dirdat/et"
   },
   "target": {
      "uri": "ogg://ggtarget:9003/dirdat/rt"
   },
   "begin": {
      "sequence": 0,
      "offset": 0
   },
   "status": "running"
}
```
Datapump Export

1. Creating Extract
2. Creating Distribution Path
3. **Datapump Export**
4. Datapump Import
5. Creating Replicat

---

**Datapump Export (EXPDP)**

```sql
v_dp_handle:=dbms_datapump.open
dbms_datapump.add_file
...
dbms_datapump.set_parameter
dbms_datapump.metadata_filter
dbms_datapump.start_job
dbms_datapump.detach
```
Datapump Import

1. Creating Extract
2. Creating Distribution Path
3. Datapump Export
4. Datapump Import
5. Creating Replicat

Orchestration Database

Datapump Import (IMPDP)

```sql
v_dp_handle := dbms_datapump.open
dbms_datapump.add_file
...
dbms_datapump.set_parameter
dbms_datapump.metadata_filter
dbms_datapump.start_job
dbms_datapump.detach
```

REPDB01  Extract  IMPDP  DBlk

GoldenGate Services

REPDB02

GoldenGate Services
Create and Start Replicat to complete setup

GoldenGate instantiation SCN features automatically filters pre-instantiation changes

1. Creating Extract
2. Creating Distribution Path
3. Datapump Export
4. Datapump Import
5. Creating Replicat

```
POST HTTPS://gg_trg:9001/....
{
  "config" : [ 
    { "Replicat" : "R01BA", 
      "UseridAlias" : "ggadmin", 
      "Map" : "HR.EMP", 
      "Target" : "HR.EMP;" 
    },
    "source" : { 
      "name" : "rt" 
    },
    "credentials" : { 
      "alias" : "gg_trg" 
    },
    "checkpoint" : { 
      "table" : "ggadmin.ckpt" 
    }
  ]
}
```
Setup Bidirectional Active-Active Replication from PL/SQL

Using the same high level building block

BEGIN
    add_oneway_replication(
        db_src => 'REPDB01',
        gg_src => 'GG_Inst01',
        gg_trg => 'GG_Inst02',
        db_trg => 'REPDB02',
        tables => 'HR.EMP',
        instantiation => 'YES',
        auto_CDR => 'YES'
    );
END;

BEGIN
    add_oneway_replication(
        db_src => 'REPDB02',
        gg_src => 'GG_Inst02',
        gg_trg => 'GG_Inst01',
        db_trg => 'REPDB01',
        tables => 'HR.EMP',
        instantiation => 'NO',
        auto_CDR => 'YES'
    );
END;
Hub & Spoke Configuration
Two calls for every Hub/Spoke pair

BEGIN
  add_oneway_replication
  (db_src      => 'HUB',
   ,gg_src     => 'GG.Inst_HUB',
   ,gg_trg     => 'GG.Inst_01',
   ,db_trg     => 'Spoke01',
   ,tables     => 'HR.EMP',
   ,instantiation => 'YES',
   ,auto_CDR   => 'YES'
  );
END;

BEGIN
  add_oneway_replication
  (db_src      => 'Spoke01',
   ,gg_src     => 'GG.Inst_01',
   ,gg_trg     => 'GG.Inst_HUB',
   ,db_trg     => 'HUB',
   ,tables     => 'HR.EMP',
   ,instantiation => 'NO',
   ,auto_CDR   => 'YES'
  );
END;
Global Replication Catalog

Keep Track of Replication Deployments

- Control Replication Environments in replication catalog
- Create, modify or remove Replication Topologies from this catalog table
- Can manage replication with DML to table
  - Have a DML trigger execute the PL/SQL replication orchestration logic

<table>
<thead>
<tr>
<th>Source Database</th>
<th>Extract</th>
<th>Dist Path</th>
<th>Replicat</th>
<th>Target Database</th>
</tr>
</thead>
<tbody>
<tr>
<td>REPDB01</td>
<td>E01AB</td>
<td>A_to_B</td>
<td>R01BA</td>
<td>REPDB02</td>
</tr>
<tr>
<td>REPDB01</td>
<td>E02AC</td>
<td>A_to_C</td>
<td>R01CA</td>
<td>REPDB03</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

DML Trigger
Orchestration
Logic

HTTPS
POST
PATCH
DELETE

GoldenGate
Services

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Monitor Replication from the Database
Retrieve information about Replication environments

- Use GET RESTful calls
- Check status, warnings/errors (if any), throughput, lag, ...

<table>
<thead>
<tr>
<th>Source Database</th>
<th>Extract</th>
<th>Dist Path</th>
<th>Replicat</th>
<th>Target Database</th>
<th>Status</th>
<th>LAG [s]</th>
<th>Throughput [Changes/s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>REPDB01</td>
<td>E01AB</td>
<td>A_to_B</td>
<td>R01BA</td>
<td>REPDB02</td>
<td>OK</td>
<td>1.8</td>
<td>54,673</td>
</tr>
<tr>
<td>REPDB01</td>
<td>E02AC</td>
<td>A_to_C</td>
<td>R01CA</td>
<td>REPDB03</td>
<td>OK</td>
<td>1.8</td>
<td>78,924</td>
</tr>
<tr>
<td>……</td>
<td>……</td>
<td>……</td>
<td>……</td>
<td>……</td>
<td>……</td>
<td>……</td>
<td>……</td>
</tr>
</tbody>
</table>
Easy Orchestration with New GoldenGate Microservices

Classic Architecture

✗ Combination of scripts
  – Shell Scripts, SQL scripts, ...
  – Obey Files, Parameter Files,...

✗ Requires OS access to DB hosts
  – Not secure

GoldenGate Microservices

✔ Simple and secure REST calls for all GoldenGate operations
New GoldenGate Microservices Architecture
Simplifies large scale and cloud deployments

• GoldenGate components as micro services with comprehensive RESTful interfaces.

• Enables remote and secure configuration, administration, and monitoring capabilities.

• Enables Applications to embed, automate, and orchestrate GoldenGate.
Additional sessions and Demos

Sunday, October 1
- Lift and Shift Workloads to Cloud with Oracle Data Integration Platform Cloud [SUN6653]
- Data Movement between On-Prem, Fusion ERP Cloud, Fusion HCM Cloud and Salesforce [SUN7286]
- Accelerate Migration to Cloud Infrastructure with Data Integration Platform [SUN6896]

Monday, October 2
- Oracle Data Integration Platform Strategy and Roadmap [CON6646]
- Filling Your Data Lake with Potable Data, Using Data Integration [CON5465]
- GoldenGate: Deep Dive into Automating OGG using the new Microservices [CON6569]
- Oracle Data Integration Platform: Foundation for Cloud Integration [CON6650]
- Oracle Data Integration Platform Empowers Enterprise Grade Big Data Solutions [CON6893]
- Oracle Data Integration Platform Cloud Deep Dive [CON6651]
- Oracle GoldenGate Cloud Service: Real-Time Data Replication in the Cloud [HOL7715]

Tuesday, October 3
- Oracle Data Integrator Product Update and Strategy [CON6654]
- Oracle Enterprise Data Quality: Product Overview and Roadmap [CON6656]
- Accelerate Cloud On-Boarding Using Oracle GoldenGate Cloud Service [CON6894]
- Oracle Enterprise Data Quality for All Types of Data [HOL7653]
- Oracle Data Integration Platform: a Cornerstone for Big Data [CON6655]
- GoldenGate: MAA and Best Practices for Oracle GoldenGate Microservices [CON6570]
- Oracle GoldenGate Product Update and Strategy [CON6897]

Wednesday, October 4
- A Practical Path to Enterprise Data Governance with Enterprise Data Quality [CON6657]
- Oracle Data Integrator and Oracle GoldenGate for Big Data [HOL7708]
- Introduction to Oracle Data Integration Platform Cloud [HOL7673]
- An Enterprise Databus: GoldenGate in the Cloud Working with Kafka and Spark [CON6895]
- GoldenGate: Best Practices & Deep Dive on OGG 12.3 Microservices at Cloud [CON6568]
- Oracle GoldenGate for Big Data [CON6898]
- Oracle Data Integration Platform Cloud Service Governance Edition [CON6652]
- Oracle Sharding: Linear Scalability, Extreme Availability, and Geo-Distribution [CON6673]