

Oracle GoldenGate 12c: Troubleshooting and Tuning

Student Guide

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Introduction



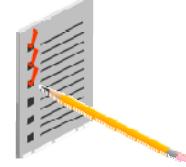
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Course Goals

After completing this course, you should be able to use Oracle GoldenGate replication to perform the following tasks with Oracle (12c) and non-Oracle target and source databases:

- Gather evidence to help troubleshoot problems.
- Use troubleshooting tools.
- Describe solutions for the most common problems.
- Monitor and tune performance of Classic Extract and Classic Replicat groups.
- Monitor and tune performance of Integrated Extract and Integrated Replicat groups (Oracle 11.2.0.4 and later).



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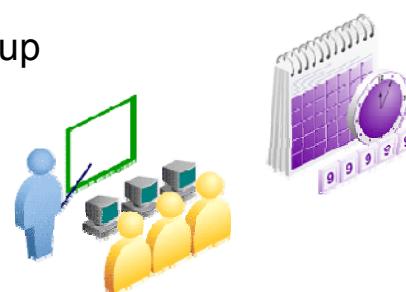
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This course uses a combination of instructor-led presentations, classroom discussions, and hands-on practices to provide real-world experience in solving typical problems in Oracle GoldenGate (sometimes abbreviated as “OGG”).

The practices in this course use `obey` files and shell scripts to intentionally inject problems into your Oracle GoldenGate practice environment. You then diagnose and address these problems.

Agenda: Day 1

- Lessons
 1. Introduction
 2. Gathering Evidence
 3. Tools
 4. Basic Problems and Process Startup Problems
- Practices
 2. Gathering Evidence
 3. Examining the Evidence
 4. Solving Cases: The Stubborn Startup



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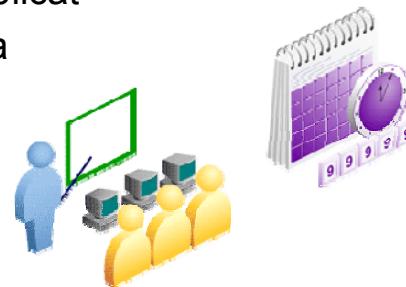
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On the first day, you look at the process of gathering information that helps you understand your Oracle GoldenGate application. You learn about useful GGSCI commands, reports, and files that tell you about errors and give you information about the state of Oracle GoldenGate processes.

After you better understand the available tools that you can use and the information that you can gather to analyze and solve problems, the focus moves to solving typical problems, such as slow or abended startups of processes and problems in extracting activities.

Agenda: Day 2

- Review of Day 1
- Lessons
 - 5. Extraction Problems
 - 6. Replication Problems
 - 7. Missed Transactions
- Practices
 - 5. Solving Cases: The Troublesome Extract
 - 6. Solving Cases: The Rebellious Replicat
 - 7. Solving Cases: The Dissimilar Data



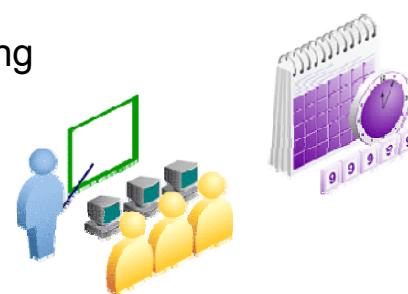
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On the second day, you continue to focus on problem solving. The discussions and hands-on practices cover a variety of typical problems, such as incorrect security, database connection issues, and missed transactions.

Agenda: Day 3

- Review of Day 2
- Lessons
 - 8. Mapping and Synchronization Problems
 - 9. SQLLEXEC, File Maintenance, and Other Problems
 - 10. Classic Performance Tuning
- Practices
 - 8. Solving Cases: The Mangled Mapping
 - 9. Solving Cases: The Filled Files
 - 10. Solving Cases: Performance Tuning



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On the third day, you concentrate on troubleshooting problems with mismatched data, incorrect mapping, and full files.

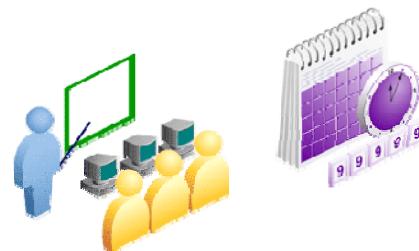
You learn about performance tuning by identifying areas that could be performing better.

You also learn about methods to monitor your system and gather lag and other statistics. You then learn how to identify and eliminate bottlenecks in your system.

Finally, you learn techniques that help you tune the Classic Extract and Classic Replicat processes for better performance.

Agenda: Day 4

- Review of Day 3
- Lessons
 - 11. Integrated Performance Tuning
 - 12. Integrated Capture and Delivery Troubleshooting
- Practices
 - 11. Configuring Integrated Extract and Integrated Replicat; Accessing GoldenGate V\$ Views for Tuning
 - 12. Installing and Using the Troubleshooting Facility Provided by Oracle GoldenGate



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On the fourth day, you concentrate on the recently introduced OGG features called *Integrated Extract* (available since Oracle Database release 11.2.0.3) and *Integrated Replicat* (available since Oracle Database release 11.2.0.4).

The practices include setting up a complete replication configuration by using Integrated Capture and Integrated Replicat, using the V\$ GoldenGate views to assess replication performance, and installing the Streams Performance Advisor (UTL_SPADV) and the Oracle GoldenGate health check (ICRHC) script. These utilities are used with the latest version of the Automatic Workload Repository (AWR) that has been enhanced to include performance statistics that are specific to Oracle GoldenGate.

Summary

In this lesson, you should have learned about the following:

- Course goals and objectives
- Tentative course agenda



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Gathering Evidence

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Objectives

After completing this lesson, you should be able to:

- Use the GGSCI commands to view:
 - Processing status
 - Events
 - Errors
 - Checkpoints
- View Oracle GoldenGate reports and logs:
 - Process reports
 - Error log
 - Discard file
 - System logs



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Roadmap

- GGSCI commands
 - Processing status
 - Events
 - Errors
 - Checkpoints
- Oracle GoldenGate reports and logs



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GGSCI Commands

The GGSCI commands display basic processing status, events, errors, and checkpoints:

```
GGSCI> Send <group>, Status  
GGSCI> Send <group>, ShowTrans  
GGSCI> Stats <group>  
GGSCI> Info All  
GGSCI> Info <group>, Detail
```



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- **Send <group>, Status:** Shows the current processing status. The status includes the read and write checkpoints for a group. It also shows if the group is at the end of the file (EOF) or if the group is not running.
- **Send <group>, ShowTrans:** Shows the redo logs that are needed for the recovery checkpoint and can show open transactions including the XID, Redo Thread, Start Time, SCN, Redo Log Sequence Number, Redo Relative Byte Address, and Status
- **Stats <group>:** Shows information about operations processed
- **Info All:** Shows the status and lag for all Manager, Extract, and Replicat processes on the System
- **Info <group>, Detail:** Shows the process status, data source, checkpoints, lag, working directory, and files containing processing information

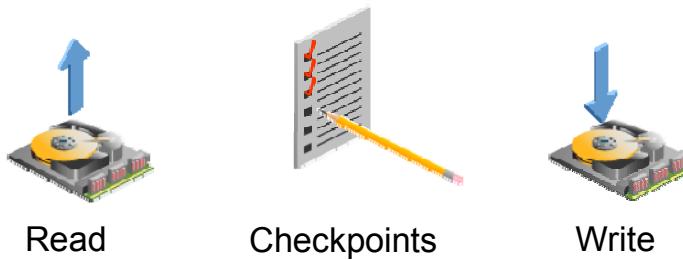
The following is sample Info command output (some redo logs are purposely omitted due to space constraints).

```
GGSCI> Info ext_ctg1, Detail
EXTRACT EXT_CTG1 Last Started 2014-03-16 11:10 Status ABENDED
Checkpoint Lag 00:00:00 (updated 444:20:28 ago)
Log Read Checkpoint Oracle Redo Logs
2014-03-22 23:20:39 Seqno 794, RBA 8919040
Target Extract Trails:
Remote Trail Name Seqno RBA Max MB
./dirdat/vv 0 25380 5
Extract Source Begin End
/u01/app/oracle/oradata/orcl/REDO01.LOG 2014-03-16 05:55 2014-03-22
23:20
/u01/app/oracle/oradata/orcl/REDO01.LOG 2014-03-15 15:11 2014-03-16
05:55
/u01/app/oracle/oradata/orcl/REDO01.LOG * Initialized * 2014-03-15
15:11
/u01/app/oracle/oradata/orcl/REDO01.LOG 2005-03-15 14:27 2014-03-15
15:10
Not Available 2014-03-13 10:53 2014-03-13 10:53
Not Available * Initialized * 2014-03-13 10:53
Current directory
/home/oracle/OGG_S
Report file /home/oracle/OGG_S/dirrpt/EXT_CTG1.rpt
Parameter file /home/oracle/OGG_S/dirprm/EXT_CTG1.prm
Checkpoint file /home/oracle/OGG_S/dircchk/EXT_CTG1.chk
Process file /home/oracle/OGG_S/dirrpcs/EXT_CTG1.pce
Error log /home/oracle/OGG_S/ggserr.log
Oracle
```

Viewing Checkpoint Details

The Info ShowCh command displays detailed checkpoint information in the Extract file, including:

- **Read checkpoints:** Checkpoints in the data source (transaction log or trail file)
- **Write checkpoints:** Where Extract writes to the trail



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- **Read checkpoints:** Checkpoints in the data source (transaction log or trail file), including:
 - **Starting checkpoint:** Starting position in the data source
 - **Recovery checkpoint:** Position in the data source of the oldest uncommitted transaction. This is required for recovery.
 - **Current checkpoint:** Position in the data source of the last record read by the Extract. This should match the Log Read checkpoint in the basic Info Extract command without options.
- **Write checkpoints:** Where Extract writes to the trail
- **Current checkpoint:** The position in the trail or trails, including a sequence number and relative byte address

Viewing Checkpoint Details

```
GGSCI > Info Extract ext_1a, ShowCh
EXTRACT EXT_1A Last Started 2014-03-11 11:11 Status RUNNING
Checkpoint Lag           00:00:14 (updated 00:00:00 ago)
Log Read Checkpoint     Oracle Redo Logs
                           2014-03-11 11:29:28 Seqno 46, RBA 3757568
Current Checkpoint Detail:
Read Checkpoint #1
  Oracle Redo Log
    Startup Checkpoint (starting position in the data source) :
      Sequence #: 46
      RBA: 2858000
      Timestamp: 2014-03-11 11:11:29.000000
      Redo File: /u01/app/oracle/oradata/orcl/REDO02.LOG
    Recovery Checkpoint (position of oldest unprocessed transaction in the data
    source) :
      Sequence #: 46
      RBA: 3756952
      Timestamp: 2014-03-11 11:29:21.000000
      Redo File: /u01/app/oracle/oradata/orcl/REDO02.LOG
  Current Checkpoint (position of last record read in the data source) :
    Sequence #: 46
    RBA: 3757568
    Timestamp: 2014-03-11 11:29:28.000000
    Redo File: /u01/app/oracle/oradata/orcl/REDO02.LOG
```



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This slide shows the Read portion of the read/write information. The information continues in the next slide.

Viewing Checkpoint Details

Example of ShowCh for Extract (continued):

```
:  
Continued..  
:  
Write Checkpoint #1  
GGS Log Trail  
Current Checkpoint (current write position):  
    Sequence #: 2  
    RBA: 2348478  
    Timestamp: 2014-03-11 11:29:42.608000  
    Extract Trail: ./dirdat/vv  
    Timestamp: 2014-03-11 11:11:29.000000
```



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This slide shows the Write portion of the read/write information.

Viewing Checkpoint Details

Fields in Replicat checkpoint detail for Info ShowCh:

- Startup checkpoint:
 - Is the position in the trail where Replicat began reading when it was started
 - Comprises the trail file sequence #, rba, time stamp, and relative path name of the trail
- Current checkpoint:
 - Is the position of the last record that was read by Replicat.
 - Should match the Log Read checkpoint statistic shown in the summary and in the basic Info Extract command without options



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The Header, File Information, Configuration, and Status statistics at the end of the ShowCh display are for use by Oracle GoldenGate support specialists. These statistics contain internal information that is useful in the resolution of a support case.

Header:

```
Version = 2
Record Source = A
Type = 1
# Input Checkpoints = 1
# Output Checkpoints = 0
```

File Information:

```
Block Size = 2048
Max Blocks = 100
Record Length = 2048
Current Offset = 0
```

Configuration:

```
Data Source = 0  
Transaction Integrity = -1  
Task Type = 0
```

Status:

```
Start Time = 2014-03-12 13:10:13  
Last Update Time = 2014-03-07 21:23:31  
Stop Status = A  
Last Result = 400
```

Viewing Checkpoint Details

Example of ShowCh for Replicat:

```
GGSCI (SYSB) 9> Info Replicat orarep, ShowCh
REPLICAT ORAREP           Last Started 2014-03-15 16:16 Status RUNNING
Checkpoint Lag             00:00:00 (updated 00:00:03 ago)
Log Read Checkpoint       File ./DIRDAT/PP000012
                           2014-03-15 15:46:18.000000 RBA 3234370
Current Checkpoint Detail:
Read Checkpoint #1
GGS Log Trail
Startup Checkpoint(starting position in the data source):
  Sequence #: 12
  RBA: 3142345
  Timestamp: 2014-03-15 15:46:18
  Extract Trail: ./dirdat/vv
Current Checkpoint (position of last record read in the data):
  Sequence #: 12
  RBA: 3234370
  Timestamp: 2014-03-15 15:46:18
  Extract Trail: ./dirdat/vv
```



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Viewing Status and Events

Oracle Management Pack for Oracle GoldenGate includes:

- Oracle GoldenGate Director:
 - Most GGSCI information is also available through Oracle GoldenGate Director Client.
 - A subset can be viewed with Oracle GoldenGate Director Web.
 - Oracle GoldenGate Director provides an intuitive, graphical way to monitor the configuration and health of the Oracle GoldenGate network.
 - Includes SMTP alert notification
- Oracle GoldenGate Monitor:
 - Provides monitoring only and no configuration
 - Supports SNMP and SMTP notifications



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One of the advantages of using Oracle GoldenGate Director is that it can monitor multiple Extracts and Replicats more easily.

Alert notifications represent another advantage. Note that the `from system` name cannot contain spaces.

Roadmap

- GGSCI commands
- Oracle GoldenGate reports and logs
 - Process reports
 - Error log
 - Discard file
 - System logs



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Process Report

Each Extract, Replicat, and Manager has its own report file that shows:

- A banner with startup time
- Parameters that are in use
- Table and column mapping
- Database and environmental information
- Runtime messages and errors

The Process report provides initial clues, such as:

- Invalid or out-of-order parameters
- Data mapping errors

You can:

- View Process reports using `View Report <group>` in GGSCI
- Use a single click to view the next or previous historical reports



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Parameter Errors

The following are examples of the types of parameter errors that can occur:

- The parameter is not valid for the type of process.
- The parameter syntax is not correct.
- The ordering of the parameters is not correct. For example, certain parameters must come before a MAP statement or after a database login.

Viewing the Report File

View the file name with `Info <group> Detail` in GGSCI. The default location is the `dirrpt` directory in the Oracle GoldenGate home location. Only the last 10 reports are kept, and the number of reports is not configurable. Old reports are kept with active reports. You may need to go back to them if the Oracle GoldenGate environment is large. Old reports are numbered 0 through 9.

Process Report: Sample

```
***** Running with the following parameters*****
SourceIsFile
UserID "ggs", Password "*****"
RmtHost sys1, MgrPort 8040
RmtFile /home/ggsora/dirdat/owner.tcustord.dat, Purge
Table tcustord;

Processing table TCUSTORD
***** Run Time Statistics*****
Report at 2014-03-13 11:07:36 (activity since 2014-03-13
11:07:31)
Output to /home/ggsora/dirdat/owner.tcustord.dat:

From Table TCUSTORD:
#      inserts:      2
#      updates:       0
#      deletes:       0
#      discards:      0
```



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This slide is an example of a process report file with no errors.

Best Practices

- Do not add parameters to the parameter file unless they are specifically needed. Adding a parameter may slow processing.
- Comment the parameter file by including the reason that an additional parameter is being added. This can be helpful if there are support issues.

Process Report Not Created

What if a process abends before generating a report?

- Run the process from the OS command shell and not from GGSCI.
 - Messages are output to the terminal if ReportFile is not included.
 - Syntax:

```
{extract|replicat} paramfile <param_file_path>.prm
```
 - Example:

```
Shell> ./extract paramfile ./dirprm/extctg.prm
```
- Use the StartupValidationDelay Manager parameter.
 - This sets the delay time for the Manager to validate process status.



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Windows Example

If DLLs are missing, the process does not create a report. Running the process from the command shell generates a window with the name of the missing DLL.

StartupValidationDelay

Use StartupValidationDelay to set a delay time (in seconds or centiseconds) after which Manager validates the status of a process started with the Start Extract or Start Replicat command. If a process is not running after the specified delay time, an error message is displayed at the GGSCI prompt. This parameter accounts for processes that fail before they can generate an error message (for example, when there is not enough memory to launch the processes). Startup validation makes GoldenGate users aware of such failures.

Example

```
StartupValidationDelayCsecs 10
```

On UNIX systems, look for a file named `core` in the Oracle GoldenGate home directory. On z/OS and OS390, look for a file that begins with `CEEDUMP` followed by a time stamp. A support technician will probably want to look at the file.

Event (Error) Log

- Oracle GoldenGate Event Log lists show:
 - A history of GGSCI commands
 - Processes that started and stopped
 - Errors that occurred
 - Informational messages
- The Event Log also shows events leading to an error. For example, you might discover one of the following:
 - Someone stopped a process.
 - A process failed to make a TCP/IP or database connection.
 - A process could not open a file.
- Use one of the following to view the Event Log:
 - A standard text editor or a shell command
 - The GGSCI command `view GGSEVT`
 - Oracle GoldenGate Monitor or Director



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The log's name is `ggserr.log` and it is located in the root Oracle GoldenGate directory. You can also locate the file by using the `Info Extract <group>, Detail` command. The location of the `ggserr.log` file is listed with the other Oracle GoldenGate working directories:

```
GGSCI> Info Extract oraext, Detail
EXTRACT ORAEXT           Last Started 2014-03-28 10:45 Status STOPPED
Checkpoint Lag            00:00:00 (updated 161:55:17 ago)
Log Read Checkpoint      File u01/app/oracle/oradata/orcl/REDO03.LOG
                           2014-03-29 17:55:57 Seqno 34, RBA 104843776
<some contents deliberately omitted>
Current directory          /home/oracle/OGG_T/
Report file                /home/oracle/OGG_T/dirrpt\ORAEXT.rpt
Parameter file              /home/oracle/OGG_T/dirprm\ORAEXT.prm
Checkpoint file             /home/oracle/OGG_T/dircchk\ORAEXT.cpe
Process file                /home/oracle/OGG_T/dirpcs\ORAEXT.pce
Error log                  /home/oracle/OGG_T/ggserr.log
```

Event Log Maintenance: Best Practices

- Saving the event file under another name provides history that may be valuable to the support staff.
- Renaming the event file causes the program to create a new one.
- When running Manager:
 - **Windows:** Because it has a lock on it, the event file cannot be renamed if the Manager is running.
 - **Linux:** You can mv (rename) the file while it is running, and the Manager continues to write to the existing file with the new name (such as `ggserr.log.backup3`). When you stop the Manager, it writes the last two closing entries:

```
2012-11-26 08:56:01 INFO OGG-00963 Oracle GoldenGate Manager for Oracle, mgr.prm: Command received from GGSCI on host ogg.example.com:48652 (STOP).
```

```
2012-11-26 08:56:01 WARNING OGG-00938 Oracle GoldenGate Manager for Oracle, mgr.prm: Manager is stopping at user request.
```

Then a new file is created with the default name of `ggserr.log` with the first entry:

```
2012-11-26 08:56:01 INFO OGG-00987 Oracle GoldenGate Command Interpreter for Oracle: GGSCI command (oracle): stop mgr.
```

When you restart the Manager, all new event entries go to the new file with the default name. Note that the three “stop” messages all have the same time stamp.

Event Log: Sample

```
2014-03-08 11:20:56 GGS INFO 301 Oracle GoldenGate Manager for Oracle,
mgr.prm: Command received from GUI (START GGSCI).
2014-03-08 11:20:56 GGS INFO 302 Oracle GoldenGate Manager for Oracle,
mgr.prm: Manager started GGSCI process on port 7840.
2014-03-08 11:21:31 GGS INFO 301 Oracle GoldenGate Manager for Oracle,
mgr.prm: Command received from GUI (START GGSCI).
2014-03-08 11:21:31 GGS INFO 302 Oracle GoldenGate Manager for Oracle,
mgr.prm: Manager started GGSCI process on port 7841.
2014-03-08 11:24:15 GGS INFO 301 Oracle GoldenGate Manager for Oracle,
mgr.prm: Command received from GUI (START GGSCI).
2014-03-08 11:24:15 GGS INFO 302 Oracle GoldenGate Manager for Oracle,
mgr.prm: Manager started GGSCI process on port 7842.
2014-03-08 11:24:16 GGS INFO 399 Oracle GoldenGate Command Interpreter
for Oracle: GGSCI command (ggs): add extract extcust tranlog, begin now.
2014-03-08 11:30:19 GGS INFO 399 Oracle GoldenGate Command Interpreter
for Oracle: GGSCI command (ggs): add rmttrail /home/ggs, extract ggs
```

Note: Error messages can have different numbers and layouts for different platforms and versions.



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Filtering the Log for Errors

Because the file can become quite large, you may want to parse the file for errors or commands only, as in the following example:

```
$ more ggserr.log | grep ERROR
```

The preceding filter shows only errors:

```
Shell>cat ggserr.log | grep ERROR
2014-03-13 10:48:28 GGS ERROR 112 GoldenGate Capture for
Oracle, EXT_CTG1.prm:
    Could not create /home/oracle/OGG_T/dirdat/g1000000 (error
2, No such file or directory).
```

Other ways to read and filter this data:

- **Notepad and WordPad:** Use the FIND capability and SAVE AS to make a copy of the file.
- **vi:** Find a string by pressing the Esc key (to enter command mode) and then entering /<string>. Press Enter to find the first string, and then press the N key to find the next one.

You can also download the log by using Oracle Management Pack for Oracle GoldenGate: Monitor or Director.

Discard File

A discard file:

- Is created if the `DiscardFile <file_name>` parameter is used in the Extract or Replicat parameter file
- Is created when Extract or Replicat has a problem with the record that it is processing
- Contains column-level details for operations that the process cannot handle
- Is usually used for Replicat to log operations that cannot be reconstructed or applied
- Can help you resolve data-mapping issues



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The location of the discard file is set in either the Extract parameter file or the Replicat parameter file by using the `DiscardFile` parameter:

```
DiscardFile /home/oracle/OGG_T/dirrpt/discard.txt, <option>
```

Options are the following:

- **Append**: Adds new content to old content in an existing file
- **Purge**: Purges an existing file before writing new content
- **Megabytes <n>**: Sets the maximum size of the file (default is 1 MB)

It is recommended that you include the `DiscardFile` parameter to facilitate troubleshooting.

GoldenGate processes in OGG 12c automatically generate a discard file with default values whenever a process is started with the `START` command through GGSCI. However, if you currently specify the `DISCARDFILE` parameter in your parameter files, those specifications remain valid. If you did not specify `DISCARDROLLOVER` along with `DISCARDFILE`, however, your discard file will roll over automatically every time the process starts. This automatic rollover behavior contradicts the `DISCARDFILE [APPEND/PURGE]` option because the new default is to roll over.

Discard File: Sample

```
Current time: 2014-03-09 08:59:22
Discarded record from action ABEND on error 1
ORA-00001: unique constraint (TARGET.EMP5E_PRIMARY_KEY)
violated
Aborting transaction beginning at seqno 1 rba 321270
error at seqno 1 rba 321270
Problem replicating SOURCE.EMP5E to TARGET.EMP5E
Error (1) occurred with insert record (target format)...
*
EMPNO = 150277
ENAME = MARTIN
JOB = SALESMAN
MGR = 7698
HIREDATE = 1981-09-28 00:00:00
SAL = 1250.00
COMM = 5521.00
DEPTNO = 3
*
```



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The discard file reports information such as:

- Database error message
- Trail-file sequence number
- RBA address in the trail file
- Column-level details of the discarded Oracle operation

System Logs

Oracle GoldenGate writes operating system-level errors to the Event Viewer (in Windows) or to the syslog (in UNIX).

- **Windows:** Use the ADDEVENTS option of the INSTALL program to add generic GoldenGate events to the Event Manager.

```
Shell> install addevents
```

- **UNIX:** System log is enabled by default.
- For more specific messages, copy category.dll and ggsmsg.dll from the Oracle GoldenGate directory to the SYSTEM32\ directory.
- These errors also appear in the Event Log.



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The more specific Windows error messages include the Oracle GoldenGate username and process, the parameter file name, and the error text.

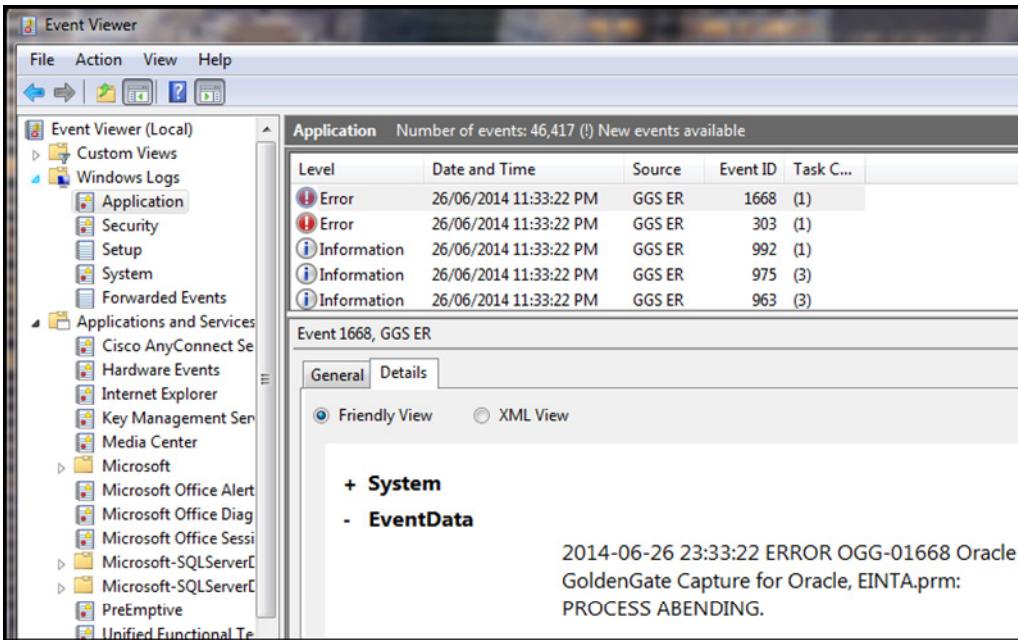
- **Windows:** GoldenGate writes errors that are generated at the operating system level to the Event Viewer. GoldenGate messaging to the Event Viewer is disabled by default. To enable GoldenGate messaging in Windows, run the `install` program with the `addevents` option.
- **UNIX:** GoldenGate writes errors that are generated at the operating system level to the syslog. GoldenGate messaging to the syslog is enabled by default in UNIX.

Note: See the system documentation for more information about these logs.

Additional Event-Monitoring Tools

Event messages that are created by Collector and Replicat on supported operating systems can be captured and sent to the Event Management Service (EMS) on NonStop systems. The EMS enables centralized viewing of GoldenGate messages across platforms.

Windows Event Viewer: Sample



The UNIX system log is similar.

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To view the Event Viewer:

1. Open the Windows control panel by selecting Start > Control Panel.
2. Double-click **Administrative Tools**.
3. Double-click **Event Viewer**.

Practice 2 Overview: Gathering Evidence

The practices for this lesson cover the following topics:

- Becoming familiar with your Oracle environment
- Finding clues in information commands
- Checking the files for more evidence



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Quiz

GGSCI commands can be used to display:

- a. Processing status
- b. Statistics (information about operations processed)
- c. Lag for processes in the system
- d. All of the above



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Answer: d

Quiz

Oracle GoldenGate writes operating system-level errors to the:

- a. Discard file
- b. System log
- c. Event log
- d. Process report



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Answer: b

Summary

In this lesson, you should have learned how to:

- Use GGSCI commands to view:
 - Processing status
 - Events
 - Errors
 - Checkpoints
- View Oracle GoldenGate reports and logs:
 - Process reports
 - Error log
 - Discard file
 - System logs



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3 Tools

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Objectives

After completing this lesson, you should be able to use the following Oracle GoldenGate troubleshooting tools:

- Knowledge Documents
- Documentation
- `ShowSyntax` parameter
- `logdump` utility



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Tools: Overview

GoldenGate self-help tools include:

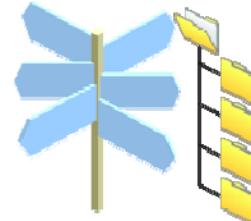
- Knowledge documents
 - Maintained by experts and accessible from My Oracle Support
- Documentation
 - Configuration instructions and descriptions of Oracle GoldenGate errors, commands, parameters, and functions
- **ShowSyntax** parameter
 - Shows Replicat SQL statements
- **logdump** utility
 - Tool for viewing and analyzing Oracle GoldenGate trails
- **Trace** and **TlTrace** parameters
 - Debugging feature to detect bottlenecks
- Oracle GoldenGate Veridata
 - High-speed solution to compare tables



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Roadmap

- Knowledge documents
 - Web-based
- Documentation
- ShowSyntax parameter
- logdump utility



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Knowledge Documents

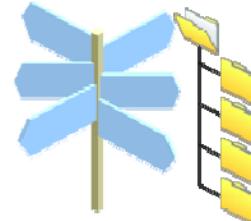
- Go to My Oracle Support (<http://support.oracle.com>):
 - New users must register for an account with a Customer Support Identifier (Support ID) and must be approved by their Customer User Administrator (CUA).
- The customer portal enables you to search knowledge documents about known issues:
 - Enter GoldenGate as the product.



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Roadmap

- Knowledge documents
- Documentation
 - HTML
 - PDF
- ShowSyntax parameter
- logdump utility



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Oracle GoldenGate Documentation

Oracle GoldenGate:

- *Installation and Setup Guides*
- *Windows and UNIX Administrator's Guide*
- *Windows and UNIX Reference Guide*
- *Windows and UNIX Troubleshooting and Tuning Guide*
- *Release Notes*
- *Error Messages Guide*

Download or view this documentation from the following location:

<http://www.oracle.com/technetwork/middleware/goldengate/documentation/index.html>

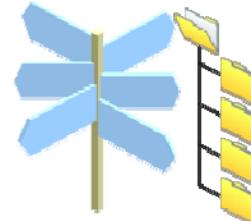


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- **Oracle GoldenGate Installation and Setup Guides:** Provide an installation guide and setup guide for each database that is supported by Oracle GoldenGate. Each guide includes database-specific configuration information.
 - **Oracle GoldenGate Windows and UNIX Administrator's Guide:** Introduces Oracle GoldenGate components and explains how to plan for, configure, and implement Oracle GoldenGate on Windows and UNIX platforms
 - **Oracle GoldenGate Windows and UNIX Reference Guide:** Provides detailed information about Oracle GoldenGate parameters, commands, and functions for the Windows and UNIX platforms
 - **Oracle GoldenGate Windows and UNIX Troubleshooting and Tuning Guide:** Provides suggestions for improving the performance of Oracle GoldenGate in different situations; also provides solutions to common problems
 - **Oracle GoldenGate for Windows and UNIX Error Messages Guide:** Contains a list of the OGG-0xxxx message numbers, descriptions, causes, and suggested actions to remedy problems.
- Note:** As a general rule, messages may appear as WARNING when, in fact, they cause a process to abort.

Roadmap

- Knowledge documents
- Documentation
- ShowSyntax parameter
- logdump utility



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ShowSyntax Parameter: Overview

- With this parameter, Replicat displays SQL DML statements before executing them.
- ShowSyntax helps you diagnose failed operations such as the following:
 - The WHERE clause may be using a non-indexed column.
 - A row may be locked by another process.
 - There may be no value for the SET clause.



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When you use ShowSyntax for the first time, use it only with guidance from an Oracle support analyst. It is a debugging parameter and can cause unwanted results if it is used improperly.

- It requires manual intervention, so all automated processing of statements is suspended.
- It slows down processing and can cause processing backups and latency.

This parameter is recommended for use in a test environment; create duplicates of your groups and tables so you do not affect the production environment.

Important: This parameter is valid only for Replicat from the OS prompt, and not from inside GGSCI.

ShowSyntax Parameter: Usage

- Parameters that must be used with ShowSyntax:
 - NoDynSQL
 - NoBinaryChars

Note: Each must be on a line by itself, before ShowSyntax.

- Start Replicat from the command shell in the home directory.
 - Do not specify a report file. The output must go to screen.

```
Shell> ./replicat paramfile dirprm/<replicat_name>.prm
```

- The first SQL statement is displayed with some prompts.
- In Oracle GoldenGate 12c, ShowSyntax now works with dynamic SQL.



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Remove (comment out) ShowSyntax, NoBinaryChars, and NoDynSQL when finished.

In releases prior to Oracle GoldenGate 12c, ShowSyntax required the use of other parameters including NoBinaryChars and NoDynSQL.

In Oracle GoldenGate 12c, by default, Replicat does not show LOB data or other data types that are treated as a LOB by the database or by Oracle GoldenGate, whether or not the data is bound in SQL. Examples include LOB, XML, and UDT data types. Instead, Replicat shows a data identifier (for example, <LOB data>) . To display this type of data, specify the INCLUDELOB option of ShowSyntax. If the column data is not bound in a SQL statement, Replicat does not show the data even when INCLUDELOB is used.

NoBinaryChars is an undocumented parameter that causes Oracle GoldenGate to treat binary data as a null-terminated string.

NoDynSQL causes Replicat to use literal SQL statements instead of dynamic SQL, as in the following examples:

- Statement without NoDynSQL: UPDATE <table> WHERE ID = :B
- Statement with NoDynSQL: UPDATE <table>...WHERE ID = '1234'

Instead of using bind variables, NoDynSQL creates the statements each time.

ShowSyntax Parameter: Output

```
*****
**
Run Time Messages
*****
**
Opened trail file ./dirdat/aa000000 at 2014-02-09 13:38:35
MAP resolved (entry ODS.SCUSTMER):
MAP ODS.SCUSTMER, TARGET ODS.TCUSTMER, SQLEXEC (ID sel_tcust,
QUERY "SELECT city from ODS.TCUSTMER WHERE cust_code = 'ABC'",
NOPARAMS), colmap (cust_code = cust_code, name = name, city =
@getval (sel_tcust.city), state = state), REPERROR (1403,
EXCEPTION), REPERROR (0001, EXCEPTION);
Using the following key columns for target table ODS.TCUSTMER:
CUST_CODE.
INSERT INTO "ODS"."TCUSTMER" ("CUST_CODE", "NAME", "STATE")
VALUES
('WILL','BG SOFTWARE CO.','WA')
Statement length: 101
(S)top display, (K)eep displaying (default):
```



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Prompts

- **K=Keep Displaying:** This is the default. To execute the current statement and display the next. Even though K is the default, you still have to type K to make it do something. Just pressing Enter is not enough.
- **S=Stop Display:** To resume normal processing and stop printing SQL statements to screen

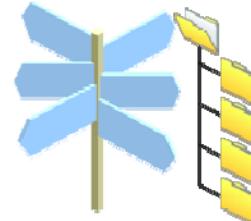
In this example, the literal SQL statement that Replicat delivers to the target database is displayed. These statements can be used with an Oracle explain plan to determine if the database will use indexes to access the data. Sometimes a full-table scan, that is, not using an index, can cause a performance lag.

Note: To know for sure if the lack of an index is a good thing or a bad thing, see one of the following Oracle University courses:

- *Oracle SQL Tuning for Developers* (D73549GC10)
- *Oracle Database 11g: SQL Tuning Workshop Ed 2* (D52163GC20)

Roadmap

- Knowledge documents
- Documentation
- ShowSyntax parameter
- logdump utility



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logdump Utility: Overview

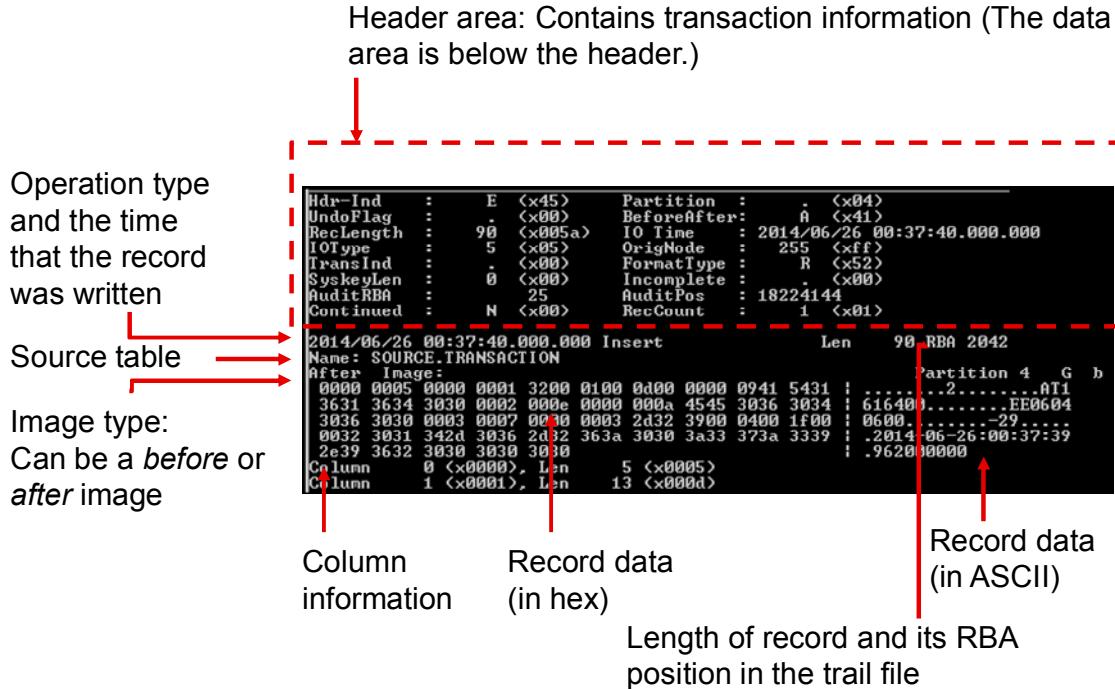
- With `logdump`, you can:
 - Search for, filter, view, and save data that is stored in an Oracle GoldenGate trail or extract file
 - Save part of a trail to another trail file
 - Edit and reuse a history of numbered `logdump` command lines
- Use `logdump` only if you need to view data in the Oracle GoldenGate trail files.



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Note: For detailed information about using `logdump`, see the *Oracle GoldenGate Windows and UNIX Troubleshooting and Tuning Guide*.

logdump Utility: Record Components



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Oracle GoldenGate trail files are unstructured. The Oracle GoldenGate record header provides metadata of the data contained in the record and includes the following information:

- Operation type (such as an insert, update, or delete)
- Before or after indicator for updates
- Transaction information (such as the transaction group and commit time stamp)

The data area of the Oracle GoldenGate record contains the following:

- Time that the change was written to the GoldenGate file
- Type of database operation
- Length of the record
- Relative byte address in the GoldenGate file
- Table name
- Change data in hex and ASCII format

If before images are configured to be captured (for example, to enable a procedure to compare before values in the WHERE clause), a before image also appears in the record.

logdump Utility: Header Fields

- Hdr-Ind
 - Should always be E, indicating that the record was created by Extract. Any other value indicates invalid data.
- UndoFlag
 - (NonStop) This is set when extracting aborted transactions from the TMF trail.
- RecLength
 - The length (in bytes) of the record buffer
- IOType
 - The type of operation represented by the record. The most common types are 3 (delete), 5 (insert), 10 (update), 15 (compressed update), and 116 (LOB).



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Hdr-Ind

This should always be a value of E, indicating that the record was created by the Extract process. Any other value indicates invalid data.

UndoFlag

Normally, UndoFlag is set to 0. But if the record is the backout of a previously successful operation, UndoFlag is set to 1. An undo that is performed by the disc process because of a constraint violation is not marked as an undo.

RecLength

This is always 28 KB. The data portion accommodates up to 24 KB of data (excluding LONG, LOB, and UDT data), plus four for internal indicators. Extract abends when the length of the data being written exceeds 24 KB. Update operations are most affected by this. In addition to writing the after image of the updated columns to the record, GoldenGate also must write the following for use in locating the target row:

- For updated rows that have a defined key, a substitute key defined with a KeyCols clause, or a unique index, Extract sends the before image of the key or indexed columns.
- For updated rows without a unique identifier, Extract sends the entire before image of the row.

The combined size of a before image (or key/index image) and the after image cannot exceed 24 KB.

The 24 KB limit does not include the full size of VARCHAR2 and LOB/LONG/XML columns. It includes only a specific number of bytes. GoldenGate stores a database change record in two segments in the trail file: the base segment and the LOB segment. The base segment stores all of the basic data types (such as CHAR, NUMBER, DATE, and so on) and reserves space for the following types (if any of these columns exist):

- The first 200 bytes of each VARCHAR2
- The first 8000 bytes of each BLOB/LONG RAW
- The first 4000 bytes of each XML/CLOB/LONG

The LOB segment stores the rest of a VARCHAR2 or LOB/LONG/XML column—namely, the part that could not fit into the base segment. As many LOB segments as are needed are created in 2000-byte chunks that follow the base segment in the trail. (Exception: If a VARCHAR2 is part of the primary key, the whole VARCHAR2 is stored in the base segment, regardless of its size.)

It is the base segment that has the size limitation of 24 KB. To prevent data from exceeding that size, GoldenGate sums the defined length of each column in a table (excluding any VARCHAR2 or LOB/LONG/XML), the assumption being that at least some rows will reach the defined lengths. That sum is reduced by the fixed amount of space reserved for VARCHAR2s (200 bytes each), BLOB/LONG RAWs (8000 bytes each), and XML/CLOB/LONGs (4000 bytes each). An additional 2 bytes per column are allocated to internal GoldenGate identifiers.

Note: The preceding information is from Technical Services ticket 4426.

IOType

For a list of record types, see the Logdump chapter of the *Oracle GoldenGate Windows and UNIX Reference Guide*, or issue the `Show RecType logdump` command.

Note: this IOT is not to be confused with database index-organized tables (IOT).

logdump Utility: Header Fields

- TransInd
 - The position of the record in the current transaction, with the following values:
 - 0: The first record in the transaction
 - 1: Neither the first record nor the last record in the transaction
 - 2: The last record in the transaction
 - 3: The only record in the transaction
- SysKeyLen
 - (NonStop) The length of the system key (4 bytes or 8 bytes) if the source is a NonStop file and has a system key



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logdump Utility: Header Fields

- AuditRBA
 - For Oracle, this is the sequence number of the data source (redo log).
- Continued
 - For Windows and UNIX, this identifies a BLOB segment.
 - BLOBS that are too large to fit within one record are stored across multiple records.
 - Y = BLOB segment; N = not a BLOB segment
- Partition
 - This depends on the record type.
 - For NonStop BulkIO records, this indicates the number of the source partition where the bulk operation was performed.
 - For nonbulk operations, the partition is either 0 or 4.



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AuditRBA

For some data sources, such as NonStop, this is the relative byte address of the commit record. In this case, all records in a transaction will have the same relative byte address. The sum of IO Time + AuditRBA uniquely identifies data for that transaction.

Partition

Partition tells GoldenGate the NonStop source partition to which the data was originally written. Replicat uses the Partition field to determine the name of the target partition. The file name in the record header is always the name of the primary partition. Valid values for BulkIO records are 0 through 15. For nonbulk operations, the partition can be either 0 or 4, with 4 indicating that the data is in FieldComp format.

logdump Utility: Header Fields

- **BeforeAfter**
 - `BeforeAfter` identifies whether the record is a before (B) or after (A) image of an update operation.
 - Inserts are always after images; deletes are always before images.
- **IO Time**
 - Time stamp of the commit record
 - All records in a transaction have the same commit time stamp.
- **OrigNode**
 - (NonStop) Node number of the system where the data was extracted
 - Other database records have 0 here.



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BeforeAfter

If the primary key is part of the update, both a before image and an after image are saved. `IOTYPE` is 115 (primary key update).

IO Time

The time stamp uses local system time (based on GMT). If the transaction comes in over TCP/IP, the Server Collector checks the time; if the time differs from the local CPU clock, the Server Collector makes an adjustment. This adjustment can be suppressed by using `NoTCPSourceTimer`.

OrigNode

Each system in a NonStop cluster has a unique node number. Node numbers can range from 0 through 255. For records other than NonStop in origin, `OrigNode` is 0.

logdump Utility: Header Fields

- FormatType
 - Identifies whether the data was read from the transaction log or fetched from the database:
 - F: Fetched from database
 - R: Readable in transaction log
- Incomplete
 - Is no longer used
- AuditPos
 - Identifies the position of the Extract process in the transaction log
 - For an Oracle database, this is the relative byte address in the redo log.
- RecCount
 - When Windows and UNIX LOB data is divided into 2 KB chunks to be written to the GoldenGate file, RecCount is used to reassemble the chunks.



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When you use the “Extract to File” initial load method from an Oracle database with SOURCEISTABLE and either EXTFILE or RMTFILE, the FormatType shows R rather than F.

Using logdump: Open

To open a trail file:

1. Determine the trail file to view (usually shown in the error message).
2. Run the logdump program from the Oracle GoldenGate home directory.
3. Open the file:

Syntax:

```
Logdump > Open <file_name>
```

Example:

```
Logdump > Open /home/ggs/dirdat/rt000000
```



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Using logdump

To set up the view:

- View record header with the data.

Logdump > **GHdr On**

- Add column information.

Logdump > **Detail On**

- Add hex and ASCII data values to the column list.

Logdump > **Detail Data**

- Control how much record data is displayed.

Logdump > **RecLen 280**



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Detail Data

Including column data can add significantly to the size of the displayed record if the table has many columns.

RecLen

Use RecLen to control how much of the record data is displayed. You can use RecLen to control the amount of scrolling that must be done when records are large, while still showing enough data to evaluate the record. Data beyond the specified length is truncated.

UserToken

You can also choose to view user tokens. By default, the name of the token and its length are displayed. Use the UserToken Detail option to show the actual token data.

Using logdump: ScanFor

To go to the first record and to move from one record to another in sequence:

```
Logdump > Pos 0
Logdump > Next (or just enter N)
```

To position at an approximate starting point and locate the next good header record:

```
Logdump > Pos <approximate_location>
Logdump > ScanForHeader (or just enter sfh)
```



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Results from ScanForHeader

Hdr-Ind : E (x45)	Partition : . (x00)
UndoFlag : . (x00)	BeforeAfter: A (x41)
RecLength : 66 (x0042)	IO Time : 2011/02/10 17:46:09.181
IOType : 5 (x05)	OrigNode : 108 (x6c)
TransInd : . (x00)	FormatType : F (x46)
SyskeyLen : 0 (x00)	Incomplete : . (x00)
AuditRBA : 126445880	AuditPos : 0

2014/02/10 17:46:09.181 Insert	Len 66	Log	RBA 0
Name: TCUSTORD			
After Image:		Partition	0
5749 4C4C 3139 3934 2D30 392D	WILL1994-09-30:15:33		
3A30 3043 4152 2020 2020 2020	:00CAR		
0000 3031 3735 3230 3030 0000	..01752000..000003..		
0000 0000 0064d		

Using logdump: ScanFor

To scan for the end of a transaction:

```
Logdump > ScanForEndTransaction
Hdr-Ind      : E (x45) Partition : . (x00)
UndoFlag     : . (x00) BeforeAfter: A (x41)
RecLength    : 66 (x0042) IO Time: 2014/02/10 17:46:09.181
IOType       : 5 (x05) OrigNode : 108 (x6c)
TransInd   : . (x02) FormatType : F (x46)
SyskeyLen   : 0 (x00) Incomplete : . (x00)
AuditRBA    : 126445880 AuditPos : 0

2014/02/10 17:46:09.181 Insert          Len 66 Log RBA 0
Name: TCUSTORD
After Image:                                     Partition 0
5749 4C4C 3139 3934 2D30 392D | WILL1994-09-30:15:33
3A30 3043 4152 2020 2020 2020 | :00CAR .....
0000 3031 3735 3230 3030 0000 | ..01752000..000003..
0000 0000 0064 | .....d
```

Last operation in
the transaction

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ScanForEndTransaction

Use `ScanForEndTransaction` (or `sfet`) to scan for a record in an Oracle GoldenGate trail with a transaction indicator (`TransInd`) of `x02`. Other indicators can be the following:

- `x00`: First statement in the transaction
- `x01`: Statement in the middle of the transaction
- `x02`: Last statement in the transaction

When an `x02` indicator is found, enter `n` again; `logdump` displays the first record of the next transaction. You can also find the beginning of the next transaction by using the `ScanForNextTrans` command.

TransInd

Examining `TransInd` can help you determine if records are corrupted. For example, if you see an `x02` end-of-transaction record, and if the next record is either `x01` or `x02`, there is a record missing from the transaction (the first operation was lost). This indicates that the trail was overwritten. You can determine whether this is true by looking at the `IO Time` field to see if there are unusual time differences (maybe the next record is older than the previous one rather than newer). Also, the `AuditPos` and `AuditRBA` in the next record could reflect an unexpected result (perhaps an earlier position in the file instead of the expected later position).

Using logdump: Filter

To filter on a table name:

```
Logdump > Filter Include Filename HR.SALES
Logdump > Filter Match All
Logdump > N

Hdr-Ind          : E (x45)      Partition : . (x00)
UndoFlag         : . (x00)      BeforeAfter: A (x41)
RecLength        : 56 (x0038)    IO Time : 2014/01/30 15:56:40.814
IOType           : 5 (x05)      OrigNode : 108 (x6c)
TransInd         : . (x01)      FormatType : F (x46)
SyskeyLen        : 0 (x00)      Incomplete : . (x00)
AuditRBA         : 105974056

2014/02/03 15:56:40.814 Insert    Len 56          Log RBA 1230
Name: HR.SALES                           Partition 0
After Image:
3220 2020 4A61 6D65 7320 2020 2020 4A6F 686E 736F | 2 James Johnso
6E20 2020 2020 2020 2020 2020 4368 6F75 6472 | n Choudr
616E 7420 2020 2020 2020 2020 4C41 | LA
Filtering suppressed 18 records
```

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Filter is case sensitive. Enter table names as they appear in the source database. They will appear in the trail record in the same case in which they appear in the database. If the source database is not case sensitive, names are converted by Oracle GoldenGate to uppercase before writing them to the trail, and you then use uppercase in your filter specification.

- **Match All:** Is required only if there are multiple filter criteria and you want the filter to match all of them
- **Match Any:** Applies the filter if the criteria match any of the multiple filters

Using logdump: Hex

To locate a hex data value:

```

Logdump > Filter Inc Hex /68656C20/
Logdump > Pos 0
Logdump > N

Hdr-Ind      : E (x45)          Partition : . (x00)
UndoFlag     : . (x00)          BeforeAfter: B (x42)
RecLength    : 56 (x0038)        IO Time   : 2014/01/30 16:22:14.205
IOType       : 3 (x03)          OrigNode  : 108 (x6c)
TransInd     : . (x01)          FormatType: F (x46)
SyskeyLen    : 0 (x00)          Incomplete: . (x00)
AuditRBA     : 109406324

2014/01/30 16:22:14.205 Delete   Len          Log RBA 424
File: TCUSTMER Partition 0

Before Image:
3620 2020 4A61 6D65 7320 2020 2020 2020 4A6F 6861 736F | 6 James Johnso
6E20 2020 2020 2020 2020 2020 4574 6865 6C20 | n Ethel
2020 2020 2020 2020 2020 2020 4C41 | LA

Filtering suppressed 545 records

```

Found hex string

If more data was showing, you could see ASCII values.

Shows number of records suppressed by filtering

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Filter provides many options. For a complete reference, see the logdump documentation in the Oracle GoldenGate documentation set.

Use the RecLen command to specify the amount of data that is displayed.

Using logdump: Position

To position (go to) a specific RBA in the file:

```
Logdump > Pos 1148  
Current position set to RBA 1148  
Logdump > N
```

(Displays the record located at that RBA)

To go to the first record in the file:

```
Logdump > Pos First  
Current position set to RBA 0  
Logdump > N
```



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The position of each record is noted in the record header in the `AuditPos` field.

When there is an error, the RBA is usually listed in the message.

Note: There is also a `logdump` command named `ScanForRBA`, which searches based on the transaction RBA. This is not the command to use when searching for an RBA in the trail. Instead, use the `Pos` command to get to an RBA in a trail file.

Using logdump: Count

To count the records in a trail file:

```
Logdump > Count

LogTrail /ggs/dirdat/rt000000 has 4828 records
Total Data Bytes           334802
    Avg Bytes/Record 69
Delete                      900
Insert                      3902
FieldComp                   26
Before Images                900
After Images                 3928

Average of 25 Transactions
Bytes/Trans ..... 22661
Records/Trans ... 193
Files/Trans ..... 8
```

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Without options, the Count display shows the following:

- The RBA where the count began
- Number of records in the file as of the RBA where the count began
- Total number of data bytes and average number of bytes per record
- Information about the operation types
- Information about the transactions

With options, you can view count information for each table and specify how the count is generated:

- **Detail:** Produces a summary count plus a count for each table or file that was processed by Extract. The information includes the total and average numbers of data bytes, as well as information about the operations on the table.
- **START [TIME] <time_string>:** Begins the count with the first record written at the specified time
- **END [TIME] <time_string>:** Stops the count with the last record written at the specified time

- **INT [ERVAL] <minutes>**: Displays statistics for total bytes, average bytes, and the number of each type of operation that occurred within a specified interval of time (in minutes), and then displays the totals for those statistics
- **LOG <wildcard>**: Produces a count for multiple trail or extract files that are specified with a wildcard character (*)
- **FILE <specification>**: Specifies the count to be generated for the specified table or group of tables designated with a wildcard character (*)

Using logdump: Count

To count the records in a trail file (continued):

```
:  
(Continued)  
:  
TCUSTMER  
Total Data Bytes          105624  
    Avg Bytes/Record       55  
Delete                   300  
Insert                   1578  
FieldComp                12  
Before Images             300  
After Images              1590
```



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Reasons to use Count to obtain statistics:

- The statistics in GGSCI show statistics from the process startup. They are reset if restarted.
- You can determine the most heavily updated tables.
- You can go back in time to old trails.

Using logdump: Count

To count the records in a trail file (continued):

TCUSTORD	
Total Data Bytes	229178
Avg Bytes/Record	78
Delete	600
Insert	2324
FieldComp	14
Before Images	600
After Images	233



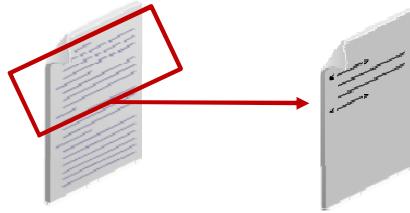
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Because Count did not filter on table, each table's count is shown.

Using logdump: Save

To save some or all records to a new trail file:

```
Logdump > Save /home/oracle/save/sv000005 10 records  
or ...  
Logdump > Save /home/oracle/save/sv000005
```



To close the current file and open the next file in the trail:

```
Logdump > NextTrail
```

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Saving Records

Use **Save** to write a subset of the records to a new trail or Extract file.

- By saving a subset to a new file, you can work with a smaller file that is easier to debug.
- Saving to another file also enables you to extract valid records that can be processed by GoldenGate, while excluding records that may be causing errors.

To set the version of the trail or file (to an old or a new format), use the **TrailFormat** command. **Note:** Including the ! symbol (exclamation point) overwrites an existing file of the same name.

- **<n> records | <n> bytes**: Specifies either a number of records or a number of data bytes to write to the new file. This is taken forward from the current position in the file.
- **NoComment**: Suppresses the leading and trailing comment records that are usually placed by Logdump in the new file.
- **OldFormat | NewFormat**: Writes the data in either the current trail format (NewFormat, which is the default) or the format that was used for GoldenGate versions 6.0 and earlier (OldFormat)

Using logdump: Environment

To see the current logdump environment:

```
Logdump > Env
```

Shows features that are enabled (such as filter and header views) and environment information (such as current trail and position)



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Sample env Output

```
Current Volume: /home/ggs
LogTrail: /home/ggs/dirdat/rt000000
Trail Format: New
End of File: 33876
Current Position: 428
Next Position: 535
Last Modtime: 2014/02/25 08:14:26.000.000
Display RecLen: 140
Logtrail Filter: On
Show Ghdr: On
Detail: Data
```

HeaderToken: On
UserToken: On
Trans History: 3 Transactions, Records 100, Bytes 100000
LargeBlock I/O: On, Blocksize 57344
Local System: BigEndian
Logtrail Data: BigEndian/ASCII
Logtrail Header: ASCII
Dump: ASCII
Timeoffset: LOCAL
Scan Notify Interval: 10000 records, Scrolling On

Using logdump : Logging

To keep a log of your session:

```
Logdump > log to MySession.txt
```

To stop logging:

```
Logdump > log stop
```

To write text to the log:

```
Logdump > writelog "Customer name is ABC Company"
```



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Getting logdump Help and Exiting

To get help:

```
Logdump > Help
```

Note: logdump utility information is available in the *Oracle GoldenGate Troubleshooting and Tuning Guide*.

To exit logdump, use either of the following:

```
Logdump > Exit
```

```
Logdump > Quit
```



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logdump Help: Sample

The following is an excerpt from the help output:

```
FC  [<num> | <string>]          - Edit previous command
HISTORY                      - List previous commands
OPEN | FROM <filename>        - Open a Log file
RECORD | REC                  - Display audit record
NEXT [ <count> ]              - Display next data record
SKIP [ <count> ]              - Skip down <count> records
COUNT                        - Count the records in the file
[START[time] <timestr>,<br/>
[END[time] <timestr>,<br/>
[INT[erval] <minutes>,<br/>
[LOG[trail] <wildcard-template>,<br/>
[FILE <wildcard-template>,<br/>
[DETAIL <timestr> format is [yy]yy-mm-dd] [hh[:mm][:ss]] ]
```

POSITION [<rba> FIRST]	- Set position in file
RecLEN [<size>]	- Sets max output length
EXIT QUIT	- Exit the program
FILES FI DIR	- Display filenames
ENV	- Show current settings

Other Useful logdump Commands

- CD | Volume
- Decrypt On|Off
- ScanForRBA (sfr)
- ScanForTime (sfts)
- ScanForType (sft)
- Skip
- Time
- TimeOffset
- X



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- **CD | Volume:** Sets the default folder, directory, or saved volume
- **Decrypt:** Decrypts an encrypted trail
- **ScanForRBA (sfr):** Scans for the record at a relative byte address specified by the AuditRBA field of the record header
- **ScanForTime (sfts):** Scans for a record that contains a specific time stamp. The time stamp is contained in the IO_Time field of the record header.

- **ScanForType (sft)**: Scans for the next record of the specified type
- **Skip**: Skips a specified number of records
- **Time**: Displays the current time in local and GMT formats
- **TimeOffset**: Sets the `logdump` time format (local, GMT, or a GMT offset)
- **x**: Executes a shell command and then returns to the `logdump` prompt

Other Useful logdump Commands

To find tables that have long-running transactions, heavy volume, LOB data, or other transactions that interrupt normal processing:

- Use the `TransHist` command to set the size of the table in bytes (200 max).
- Use either `TransRecLimit` or `TransByteLimit` to set a lower boundary for what is considered a normal-sized transaction.
- Use the `Count` command to display statistics about transaction size.
- Use the `logdump Position <RBA>` command to go to each RBA listed in the `Count` output. This gives you the name of the table that generated the transaction.



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Using `TransHist`

Transactions are tracked in descending order (according to the total number of bytes) to help you do the following:

- Determine whether the environment generates large transactions.
- Identify the relative size of those transactions.

When the history table is full, the smallest transaction is removed to enable a larger transaction to be added to the list.

Other Useful logdump Commands

Use the Count command to view statistics that are tracked with TransHist.

- The output appears at the end of the Count statistics.
- Transaction size information is reported when logdump finishes scanning the files:

```
Transactions with at least 100 records or 100000 bytes
2014/02/01 09:31:24.000.000 00:00:00.000, Seq 0, RBA 13101
    Bytes/Trans ..... 1168167
    Records/Trans ... 1001
    Files/Trans ..... 1
2014/02/01 09:31:35.000.000 00:00:11.000, Seq 0, RBA 1205292
    Bytes/Trans ..... 1168167
    Records/Trans ... 1001
    Files/Trans ..... 1
2014/02/01 09:31:41.000.000 00:00:06.000, Seq 0, RBA 2397483
    Bytes/Trans ..... 1168167
    Records/Trans ... 1001
    Files/Trans ..... 1
2014/02/01 09:42:36.000.000 00:10:55.000, Seq 0, RBA 3589674
    Bytes/Trans ..... 373736
    Records/Trans ... 3014
    Files/Trans ..... 1S
```



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In the screenshot, the first line (`Transactions with at least 100 records or 100000 bytes`) indicates that the size boundary was set to the default of 100 operations or 100 KB. The defaults can be changed with the `TransByteLimit` and `TransRecLimit` parameters.

`TransRecLimit` and `TransByteLimit` prevent normal-sized transactions from being tracked in the transaction table specified with the `TransHist` command. Setting a boundary reduces the amount of data that is stored and, consequently, the amount of data that must be reviewed when troubleshooting.

- `TransRecLimit <n>`: Sets a lower boundary for the number of records in a transaction. It should be set to represent a normal-sized transaction for the environment that is being evaluated with logdump.
- `TransByteLimit <n>`: Sets a lower boundary for the number of bytes in a transaction. It should be set to represent a normal-sized transaction for the environment that is being evaluated with logdump .

logdump Filtering

Filter capabilities include:

```

FILTER INCLUDE | EXCLUDE] <options>
<options> are
    RecTYPE <type number | type name>
    STRING [BOTH] /<text>/ [<column range>]
    HEX <hex string> [<column range>]
    TransID <transaction identifier>
    FILENAME <filename template>
    STARTTIME <date-time string>
    ENDTIME <date-time string>
    TransIND [<comparison>] <nn>
    RecLEN [<comparison>] <nn>
    AUDITRBA [<comparison>] <nnnnnnnn>
<column range> is <start column>:<end column> e.g.
0:231
<comparison> is one of =, ==, !=, <>, <, >, <=, >= EQ,
GT, LE, GE, LE, NE

```



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Adding a filter to your search criteria is one of the best features of logdump . Here are some additional filter options:

```

FILTER SHOW
FILTER ENABLE | ON - Enable filtering
FILTER DISABLE | OFF - Disable filtering
FILTER CLEAR [ <filterid> | <ALL> ]
FILTER MATCH ANY | ALL
FILTER [INCLUDE | EXCLUDE] <options>
<options> are
    RecTYPE <type number | type name>
    STRING [BOTH] /<text>/ [<column range>]
    HEX <hex string> [<column range>]
    TransID <TMF transaction identifier>
    FILENAME <filename template>
    PROCESS <processname template>

```

```
INT16 <16-bit integer>
INT32 <32-bit integer>
INT64 <64-bit integer>
STARTTIME <date-time string>
ENDTIME <date-time string>
SYSKEY [<comparison>] <32/64-bit syskey>
TransIND [<comparison>] <nn>
UNDOFLAG [<comparison>] <nn>
RecLEN [<comparison>] <nn>
AUDITRBA [<comparison>] <nnnnnnnn>
ANSINAME <ansi table name>

<filterid>
    RecTYPE, STRING, HEX, TransID, FILENAME, PROCESS, INT16,
    INT32, INT64, RBA, STARTTIME, ENDTIME
    TransIND, UNDOFLAG, RecLEN, AUDITRBA, ANSINAME

<column range>
    <start column>:<end column> e.g. 0:231

<comparison>
    =, ==, !=, <>, <, >, <=, >= EQ, GT, LE, GE, LE, NE
X <program> [string] - Execute <program>
```

```
TransHist nnnn          - Set size of transaction history
TransRecLimit nnnn       - Set low record count threshold
TransByteLimit nnnn      - Set low byte count threshold
LOG {STOP} | { [TO] <filename> } - Write a session log
BEGIN <date-time>        - Set next read position using a time stamp
SAVE <savefilename> [!] <options> - Write data to a savefile
<options> are:
nnn RECORDS | nnn BYTES
[NOCOMMENT] - suppress the header/trailer recs
[OLDFORMAT] - force oldformat records
[NEWFORMAT] - force newformat records
[EXT ( <pri>, <sec> [,<max>] )] - Savefile Extent sizes on NSK
[MEGabytes <nnnn>] - For extent size calculation
```

USERTOKEN OFF		on		detail	- show user token info
HEADERTOKEN OFF		on		detail	- show header token info
GGSTOKEN OFF		on		detail	- show GGS token info
ASCIIHEADER ON		off			- toggle header charset
EBCDICHEADER on		OFF			- toggle header charset
ASCIIDATA ON		on			- toggle user data charset
EBCDICDATA on		OFF			- toggle user data charset
ASCIIDUMP ON		off			- toggle charset for hex/ascii display
EBCDICDUMP on		OFF			- toggle charset for hex/ascii display
TRAILFORMAT old		new			- force trail type

Quiz

What should you do if you want to have SQL DML statements displayed before executing them?

- a. Enable the ShowSyntax parameter.
- b. Execute the ScanForRBA command.
- c. Execute the Detail On command.
- d. None of the above



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Answer: a

Practice 3 Overview: Examining the Evidence

The practices in this lesson cover the use of the following:

- ShowSyntax
- logdump



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Summary

In this lesson, you should have learned how to use the following Oracle GoldenGate troubleshooting tools:

- Knowledge documents
- Documentation
- ShowSyntax parameter
- Logdump utility



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Basic Problems and Process Startup Problems

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Objectives

After completing this lesson, you should be able to troubleshoot:

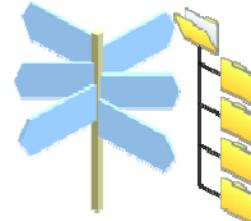
- Basic problems
- Process startup problems



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Roadmap

- Basic problems
 - Example 1
 - Example 2
- Process startup problems



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Basic Troubleshooting: Example 1 (Slide 1 of 2)

This is an example of how to use GGSCI commands, process Reports, and the error log to determine why a process (in this case, Extract) failed.

- The status command returns the following:

```
GGSCI > Status Extract *
EXTRACT GGEEXT: ABENDED
```

- The View Report shows:

```
ERROR: Could not read full block (2048 bytes) from
checkpoint file /home/ggs/dirchk/DIRCAP.cpe
```

This indicates that Extract could not read from the checkpoint file, which it must do to determine the processing startup point.



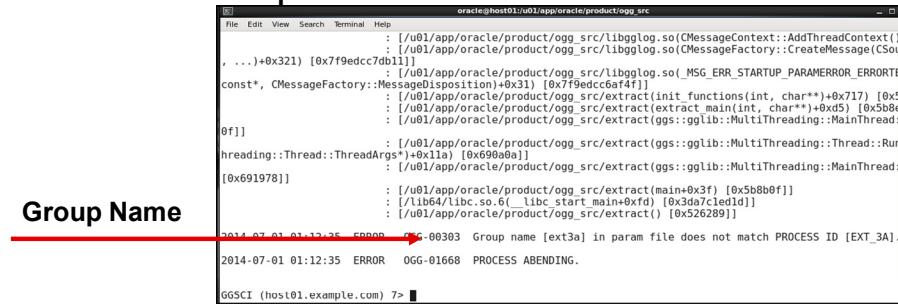
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Basic Troubleshooting: Example 1 (Slide 2 of 2)

- Note the group name in the error message:
 - The name differs from the group name because the underscore is missing.
- Check the name that is recorded for Extract in the parameter file.

Solution:

- Make sure that the name of the group matches the name that is recorded in the parameter file.



The screenshot shows a terminal window with the following text:

```
oracle@host01:/u01/app/oracle/product/ogg_src
[...]
: [/u01/app/oracle/product/ogg_src/libogglog.so!CMessagelContext::AddThreadContext()]
: [/u01/app/oracle/product/ogg_src/libogglog.so!CMessagelFactory::CreateMessage(CSOU
, ...)+0x321] [0x7f9edcc7db11]
: [/u01/app/oracle/product/ogg_src/libogglog.so!_MSG_ER_STARTUP_PARAMERROR_ERRORT
const*, CMessageFactory::MessageDlSpecPosition]+0x31] [0x7f9edcc8a411]
: [/u01/app/oracle/product/ogg_src/extract(init_functions(int, char**)+0x717) [0x5
: [/u01/app/oracle/product/ogg_src/extract(extract_main(int, char**)+0xd5) [0x5b8e
: [/u01/app/oracle/product/ogg_src/extract(ggs::gplib::MultiThreading::MainThread:
Ofj)]
: [/u01/app/oracle/product/ogg_src/extract(ggs::gplib::MultiThreading::Thread::Run
hreading::Thread::ThreadArgs)+0x1a] [0x699a8a]
: [/u01/app/oracle/product/ogg_src/extract(ggs::gplib::MultiThreading::MainThread:
[0x691978]]
: [/u01/app/oracle/product/ogg_src/extract(main+0x3f) [0x5bb8b0f]
: [/lib64/libc.so.6(_libc_start_main+0xfd) [0x3da7c1ed1d]
: [/u01/app/oracle/product/ogg_src/extract() [0x526289]]]

2014-07-01 01:12:35 FDR00P 00303 Group name [ext3a] in param file does not match PROCESS ID [EXT_3A].
2014-07-01 01:12:35 ERROR OGG-01668 PROCESS ABENDING.

GGSCI (host01.example.com) 7> ■
```

A red line highlights the word "Group" in the error message line: "Group name [ext3a] in param file does not match PROCESS ID [EXT_3A]."

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Basic Troubleshooting: Example 2 (Slide 1 of 2)

You can also diagnose a failed process in the following situation:

- The Status command indicates that Extract is down.
- View Report indicates a permission problem.
- Checking the error log shows the following:

```
GGSCI 1> View ggsevt
2014-03-27 16:38:15 GGS INFO 301 Oracle GoldenGate
Manager for Oracle, mgr.prm: Command received from GGSCI on
host 192.168.103.115 (START EXTRACT GGEXT).
2014-03-27 16:38:15 GGS INFO 310 Oracle GoldenGate
Capture for Oracle, ggext.prm: EXTRACT GGEXT starting.
2014-03-27 16:38:17 GGS ERROR 501 Oracle GoldenGate
Capture for Oracle, ggext.prm: Extract read, error 13
(Permission denied) opening redo log
/newrdbms/oracle/ora920/arch/0001_0000000758.arc for sequence
758.
2014-03-27 16:38:17 GGS ERROR 190 Oracle GoldenGate
Capture for Oracle, ggext.prm: PROCESS ABENDING.
```



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In this case, permission to open the redo log was denied. Check the read permissions for the file.

Basic Troubleshooting: Example 2 (Slide 2 of 2)

Error 501 indicates that the Extract user does not have permission to read the checkpoint file and the redo logs.

Solution

1. Contact the system administrator to grant the Extract user read permission for those files, or create another user with the correct permissions (and update the parameter file accordingly).
2. Stop Manager, exit GGSCI, and exit the terminal session.
3. After permission is granted, you can start the processes again from a new session.



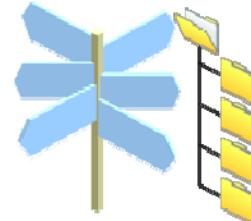
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Why is it necessary to stop the Manager process?

Because file permissions are picked up when a process starts, you must stop and restart Manager to pick up the new permissions.

Roadmap

- Basic
- Process startup problems
 - Reports
 - Operating system
 - Permissions
 - Database



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Startup Problems: Overview

What should you do if a process fails?

- View the process report:
 - View Report <group>
 - You can also use Oracle GoldenGate Director to view the report.
- The report shows basic troubleshooting information:
 - Parameters that are used
 - Tables that are mapped
 - Key-column information
 - Specific details about the error



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Startup Problems: Oracle GoldenGate Configuration (Slide 1 of 5)

Was the correct Oracle GoldenGate build installed?

- OGG software is specific to:
 - OS
 - Hardware
 - Database

Oracle GoldenGate Certification Matrix 12c (12.1.2.0.*)				
This document covers the following product releases for Oracle GoldenGate: - Oracle GoldenGate 12c (12.1.2.0.0, 12.1.2.0.1) - Oracle GoldenGate Director 12c (12.1.2.0.0, 12.1.2.0.1)				
Oracle GoldenGate				
Product	Release	Processor Type	OS Version	OS Update Type
Oracle GoldenGate	12.1.2.0.1+	Linux x86-64	Oracle Linux 5	Update Level
Oracle GoldenGate	12.1.2.0.1+	Linux x86-64	Oracle Linux 5	Update Level
Oracle GoldenGate	12.1.2.0.1+	Linux x86-64	Oracle Linux 6	Update Level
Oracle GoldenGate	12.1.2.0.1+	Linux x86-64	Oracle Linux 6	Update Level
Oracle GoldenGate	12.1.2.0.1+	Linux x86-64	Red Hat Enterprise Linux 5	Update Level
Oracle GoldenGate	12.1.2.0.1+	Linux x86-64	Red Hat Enterprise Linux 5	Update Level
Oracle GoldenGate	12.1.2.0.1+	Linux x86-64	Red Hat Enterprise Linux 6	Update Level
Oracle GoldenGate	12.1.2.0.1+	Linux x86-64	Red Hat Enterprise Linux 6	Update Level

- The screenshot lists examples of combinations for which Oracle GoldenGate provides builds.



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To determine the Oracle GoldenGate version, change to the Oracle GoldenGate home directory and issue the following command from the OS shell:

```
ggsci -v
```

Note

1. Find the Certification matrix of supported combinations of hardware and OS on the following page:
<http://www.oracle.com/technetwork/middleware/ias/downloads/fusion-certification-100350.html>
2. Search for "System Requirements and Supported Platforms for Oracle Fusion Middleware 12c (12.1.2) (xls)" and then click the xls link to download the Excel spreadsheet.

Startup Problems: Oracle GoldenGate Configuration (Slide 2 of 5)

Did you use the CheckParams parameter and forget to remove it?

- This causes the process to stop after it verifies the parameter syntax.
- View the process report for syntax errors. Then fix the errors and remove CheckParams.



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CheckParams can be positioned anywhere in the parameter file. It is simple and safe to use because it does not process data.

CheckParams does not check every option for each parameter to make sure it is *logically* correct. Instead, it checks that each parameter is only *syntactically* correct.

For example, it can verify that the ExtTrail or RmtTrail statement is correct, but it does not verify that the specified trail file is consistent with the checkpoint file entry, or that an Extract trail matches a Replicat trail.

Note: CheckParams is not effective when you have dynamic resolution of wildcards. In this case, syntax checking does not pick up the metadata for the wildcarded tables at startup. It is unable to check column mapping, WHERE statements, and other column-level syntax that might cause problems later.

Startup Problems: Oracle GoldenGate Configuration (Slide 3 of 5)

- Is the database running?
- Is Manager running?
- Does the group exist?
 - Use Info All to view all processes and groups on the system.
 - Is the group name spelled wrong?
- Does a trail or extract file exist?
 - If not, Extract cannot write its initial checkpoint, and Replicat has no data source to read.
 - Use the Detail option with Info Extract <group> or with Info Replicat <group> to see if a trail or file exists.



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For a process group to be started, the database and Manager must be running. Many initial errors are configuration errors.

Startup Problems: Oracle GoldenGate Configuration (Slide 4 of 5)

- Is the parameter file missing?
 - Check for the file in the Oracle GoldenGate `dirprm/` subdirectory.
 - The file must have the same name as the group.
 - Check the case of the name. If you copied the file from Windows to UNIX, the case might be wrong; it should be all lowercase.
 - If the file is not there, did you store it somewhere else?
 - To store a parameter file elsewhere (not recommended), use the `PARAMS` argument with `Add Extract` or `Alter Extract`.
- Is the parameter file inaccessible?
 - Verify that the process user has the permissions to open the file.



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Startup Problems: Oracle GoldenGate Configuration (Slide 5 of 5)

Additional potential problems with the parameter file:

- Are all required parameters present?
- Are parameters listed in logical order?
 - Parameters are processed in the order in which they are listed; some parameters must precede others.
- Is the parameter syntax correct?
 - Oracle GoldenGate reports syntax problems in the process report (usually as a “bad parameter” error).
 - Use the `CheckParams` parameter to verify syntax. This parameter writes to the report file and then stops the process.
 - Remove `CheckParams` when the process stops.



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Required Extract Parameters

Depending on the database type, the following parameters are required:

```
Extract <group_name>
SourceDB <data_source>
UserID <ID>, Password <pswd>
RmtHost <hostname>, MgrPort <port>
RmtTrail <trail_name> | ExtTrail <trail_name> | RmtFile
<filename> |
ExtFile <filename>
Table <table_name>
```

Parameter Ordering: Examples

- **RmtHost must precede RmtTrail:** A host name must be qualified before a file name can be qualified.
- **UserID must precede TABLE:** GoldenGate must log in to the database before it can process table information.

Table or Map must be listed after the global and specific parameters that apply to it.

Note: See the Oracle GoldenGate reference guide for complete syntax information for these parameters.

Common Issues

- The Table and Map parameters must end with a semicolon.
- In the syntax, a comma must be followed by a space.
- When using the ColMap parameter, be sure to include all commas, quotation marks, and parentheses.
- If "userid" and "pswd" are enclosed in double quotation marks, they might be case sensitive in some databases.

Startup Problems: Operating System

- Does the error report a missing UNIX library?
 - Issue the `env` command and make sure that `LD_LIBRARY_PATH` and `PATH` are correct.
 - Set the correct library path names in the startup files also:
 - `.profile` and `.dtprofile` in the Oracle GoldenGate home directory
 - Use UNIX `ldd` to list the required dynamic objects.
- Does the error indicate that the function stack should be increased?
 - You have exceeded the memory that stores arguments supplied to and from Oracle GoldenGate functions.
 - To increase the allocated memory, use the `FunctionStackSize` parameter.



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`LD_LIBRARY_PATH`: Example

```
LD_LIBRARY_PATH=/rdbms/oracle/ora9202i/64/lib:/rdbms/oracle/ora9202i
/64/rdbms/lib:/rdbms/oracle/ora9202i/64/lib32:/rdbms/oracle/ora9202i
/64/rdbms/lib32:/usr/lib:/usr/ccs/lib:/usr/uclib:/usr/local/perl/li
b:/home/user1/veridata1.0.1/veridata/server
```

Note: Do not add Oracle GoldenGate to the `PATH` because this will allow GGSCI to be started from any location. Because the startup location becomes the default for GGSCI activities, GGSCI will not be able to find checkpoint and executable files. GGSCI should be run only from the Oracle GoldenGate home directory.

The `FunctionStackSize` parameter (for Extract and Replicat) can adversely affect Oracle GoldenGate performance.

Startup Problems: Permissions

- Extract and Replicat users require the following permissions:
 - Read and write for files in the Oracle GoldenGate directory
 - Read for the transaction and archive logs
- If you receive a file-access error such as Bad parameter: Group name invalid, the process cannot open the checkpoint file.
 - Issue Info * to view the group name.
 - Issue View Params <group>.
 - Make sure that the group name from Info * matches the group name in the Extract or Replicat parameter.
 - Check for permission issues.



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Startup Problems: Database Login

Does the Oracle GoldenGate database login fail?

- Was a database user created for the process? Was it created with the correct permissions?
- Are the database user and password specified with UserID?
- If a data source is required at login, is it specified with SourceDB or TargetDB?
- Could the database password have changed?
 - Connect from outside GoldenGate (for example, with SQL*Plus) to verify the validity of the password that Oracle GoldenGate uses.
- (Oracle Database) Are the ORACLE_SID and ORACLE_HOME system variables set to the instance name in the Oracle GoldenGate user profile?



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See the database-specific chapters in the operations guide for required database permissions.

Examples

- Required Extract permissions include the ability to create a session and to select from the system catalog and dictionary tables. Additional required Replicat permissions include data manipulation language (DML) privileges.
- If database passwords change frequently, you can specify operating system-level authentication with the UserID parameter.

To check Oracle Database environment variables, use the following:

```
env | grep ORA
```

This filters out all the other information that would be shown by using the env command. Note that some environment variables, such as SID, are case sensitive.

It is possible to set environment variables directly in the Extract or Replicat parameter file, as in the following example: SETENV (ORACLE_SID='ogg12c').

Verify that the redefined environment variable identifies the required database.

Startup Problems: Slow Startup

Do you have a very large number of tables?

- If you are using wildcard names, use the `WildcardResolve Dynamic` parameter.
- Use the `DynamicResolution` parameter to add a table's attributes to the object record the first time its object ID enters the transaction log.
 - This parameter defers the building of metadata for other tables until activity occurs.



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Startup Problem: Example

When Extract or Replicat starts, it queries the database for table attributes and builds an object record. When Oracle GoldenGate analyzes a large volume of tables, it takes a long time and seems to be stalled.

Use `WildcardResolve`

If wildcards are being used for table names, you can use the `WildcardResolve` parameter with the `Dynamic` option. Source tables that satisfy wildcard definitions are resolved each time the wildcard rule is satisfied (instead of all together at startup).

Best Practice

You should use `DynamicResolution` when Extract is configured for a large number of tables.

Quiz

Suppose that your process stops immediately after it verifies the parameter syntax. What is the most likely reason?

- a. The CheckParams parameter is enabled.
- b. Oracle GoldenGate reports syntax problems.
- c. The database user was created for the process with incorrect permissions
- d. The group name is spelled wrong.



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Answer: a

Practice 4 Overview: The Stubborn Startup

The practices for this lesson cover the solving of:

- Extract startup problems
- Replicat startup problems



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Summary

In this lesson, you should have learned how to troubleshoot:

- Basic problems
- Process startup problems



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Extraction Problems

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Objectives

After completing this lesson, you should be able to troubleshoot the following types of Extraction problems:

- Extract is slow.
- Extract abends.
- Data pump abends.



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Extract Is Slow (Slide 1 of 3)

Is tracing enabled?

- Tracing makes Extract slower.
- Check for Trace/Trace2 or TLTrace parameters in the PRM file. Disable those parameters unless they are required by a support case.
- Activity Logging (described in Knowledge Doc 1204284.1) may be slowing down the processes and creating dump files.

Potential bug

Deprecated

Are there numerous columns in the tables?

- When tables have more columns, operations take longer because Extract has to process more information.
 - This is normal and cannot be avoided.



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TLTrace traces the transaction log extraction activity.

Note: TLTRACE has been deprecated in Oracle GoldenGate 11.1.1.0.0.

Trace and Trace2 capture Extract or Replicat processing information to help reveal processing bottlenecks.

- Trace provides step-by-step processing information.
- Trace2 helps identify the code segments on which Extract or Replicat is spending the most time.

Several new tracing methods (Activity Logging) have been introduced with version 11g.

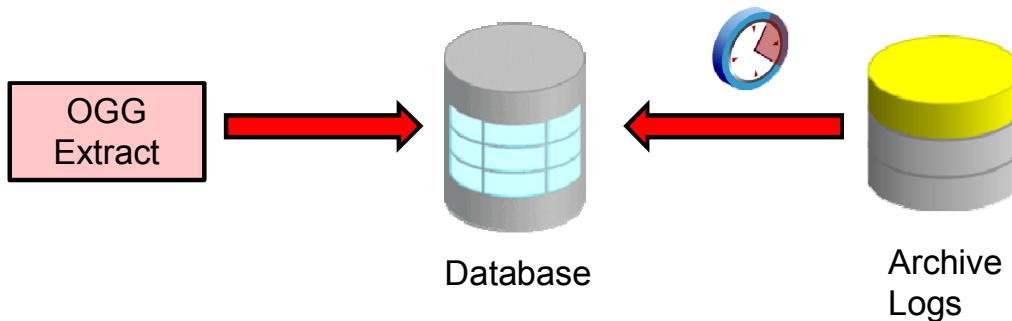
These are outlined in support document 1204284.1. Activity Logging is documented not in the regular PDFs but only in the knowledge (support) documents.

TRACE and TRACE2 are still supported, but bug 10098571 exists in early version 11g and is fixed in V 11.1.1.0.4_001. The workaround is documented in support document 1204235.1.

Extract Is Slow (Slide 2 of 3)

- Is Extract waiting for an archive log?
- Can Extract locate the archive logs?
- Is the slowness due to low volume?

You can find additional help for improving Extract performance in the performance-tuning section of this course.



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- Is Extract waiting for an archive log?
 - If Extract is restarted when there is a long-running transaction, it may need to read many old logs that have already been processed.
- Can Extract locate the archive logs?
 - If the archives are not in the default Oracle Database location, use the `AltArchiveLogDest <path_name>` Extract parameter to specify the alternative location.
- Is the slowness due to low volume?
 - If there are only 100 transactions being generated per second, the maximum speed is 100 transactions per second.

For Oracle tables, query the `v$transaction` table to see if there are open transactions.

Extract Is Slow (Slide 3 of 3)

Extract can be slow when there are numerous large transactions and when tables contain many LOBs.

- If necessary, use the CacheMgr parameter (with the assistance of Oracle Technical Support) to control the virtual memory and temporary disk space that are available for caching uncommitted transaction data.
- To view the CacheMgr settings, issue a View Report command for the Extract.



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When to Adjust CacheMgr

The memory manager generates statistics that can be viewed with the Send Extract command when used with the CacheMgr option. The statistics show the size of the memory pool, the paging frequency, the size of the transactions, and other information that creates a system profile.

Based on this profile, you might need to make adjustments to the memory cache if you see performance problems that appear to be related to file caching. The first step is to modify the CacheSize and CachePageOutSize parameters. You might need to use a higher or lower cache size, a larger or smaller page size, or a combination of both, based on the size and type of transactions that are being generated. You might also need to adjust the initial memory allocation with the CacheBufferSize option.

Syntax

```
CacheMgr {  
  [, CacheSize <size>]  
  [, CacheBufferSize <size>]  
  [, CacheDirectory <path> [<size> [, ...]]]  
  [, CachePageOutSize <size>]  
}
```

- **CacheSize <size>**: Sets a soft limit for the amount of virtual memory (cache size) that is available for caching transaction data. On 64-bit systems, the default is 64 GB. On 32-bit systems, the cache size is determined dynamically by the cache manager. The value can be specified in bytes, and it can also be specified in gigabytes, megabytes, or kilobytes in any of the following forms:
GB | MB | KB | G | M | K | gb | mb | kb | g | m | k
- **CacheBufferSize <size>**: This was deprecated in version 11.2 and defaults to 64 KB. In earlier releases, CacheBufferSize <size> controlled the size of the initial memory buffer that was allocated from the global pool to a cached transaction. CacheBufferSize had to be set to the expected size of the majority of transactions. To determine the size of the transactions, see the statistics returned with the `Send Extract` command when used with the `CacheMgr` option. Specify the value in powers of 2; values that are not supplied in powers of 2 are rounded to the closest power of 2. The default size is relative to the size of the global virtual memory pool (see `CacheSize`) and is adjusted at startup accordingly. The value can be specified in bytes, and it can also be specified in gigabytes, megabytes, or kilobytes in any of the following forms:
GB | MB | KB | G | M | K | gb | mb | kb | g | m | k
- **CacheDirectory <path> [<size>]** : Specifies the name of the directory to which Oracle GoldenGate temporarily writes transaction data to disk when the soft limit set by `CacheSize` is reached. The default without this parameter is the `dirtmp/` subdirectory of the Oracle GoldenGate installation directory. The directory must be on its own file system. If Oracle GoldenGate has its own file system, it can be in that file system.

- **<path>**: A fully qualified directory name
- **<size>**: Sets a maximum amount of disk space that can be allocated to the specified directory. There is no default. Its limitations are those of the file system itself, such as the maximum file size or the number of files. Do not use this option unless you must constrain the Oracle GoldenGate swap space because of resource limitations. Allowing unrestricted disk space permits the memory manager to manage memory with fewer system calls. You can specify more than one directory, but each directory must be on a different file system. The value can be specified in bytes, and it can also be specified in gigabytes, megabytes, or kilobytes in any of the following forms:

GB | MB | KB | G | M | K | gb | mb | kb | g | m | k

- **CachePageOutSize <size>**: Sets a threshold above which data from a transaction can be paged to a disk if needed. Even if this threshold is reached for a transaction, however, paging occurs only if it is needed to avoid using system overhead unnecessarily. The default is 2 MB; avoid using values below 1 MB. The value can be specified in bytes, and it can also be specified in gigabytes, megabytes, or kilobytes in any of the following forms:

GB | MB | KB | G | M | K | gb | mb | kb | g | m | k

Suppose that all transactions have 1 MB of data and that the cache size is 3 GB. You would need 3,000 concurrent transactions before paging occurs. If you believe there are performance problems on the system, changing this parameter might help.

Example

CacheMgr

CacheBufferSize 64KB, &

CacheSize 4GB, &

CacheDirectory /ggs/dirtemp, CacheDirectory /ggs2/dirtemp 256GB, &

CachePageOutSize 4MB

Extract Abends (Slide 1 of 3)

- Is Extract unable to open the transaction logs?
 - Check to see if the disk is full. If it is not full, the Extract user may not have read permissions on the files.
- After permissions are granted, perform the following steps:
 1. Stop Manager.
 2. Exit GGSCI.
 3. Close the terminal session.
 4. Start the processes again from a new session.
- Is an archive log missing?
 - Restore the archive log that is specified in the error message in the report file (and subsequent archive logs).



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Using Archive Logs

Extract reads the archive logs when an online log is not available. If Extract is shut down for any length of time, the records that it needs on restart were probably archived away. On startup, Extract searches for the missing data. When the log cannot be found, Extract abends. Extract should never be stopped intentionally—at least not for long. If it is stopped either intentionally or otherwise, make certain that archives are available all the way back to the time of failure. If the length of time during which Extract was down is exceptionally long, you might find it more practical to resynchronize the tables rather than wait for Extract to go through the archives and catch up.

If the naming of the archive logs is changed, Oracle GoldenGate may not be able to find them because Oracle GoldenGate simply increments the number and looks for the next archive.

It is possible to prevent missing archive log errors by enabling an Extract group in classic capture mode to work with Oracle Recovery Manager (RMAN) to retain the logs that Extract needs for recovery.

Consider the following example:

```
GGSCI> Register Extract <group> LogRetention
```

This example creates an underlying Oracle Streams capture process that is dedicated to the Extract group and is used only for log retention. The Streams capture process has a similar name.

Extract Abends (Slide 2 of 3)

Does Extract return connection errors?

- A typical TCP/IP error is 4127 connection refused.
- This error indicates that the target Manager or server process is not running, or that Extract is pointed to the wrong TCP/IP address or the wrong Manager port number.
- Connection errors can indicate Collector security violations, full file system errors, or system/GoldenGate configuration errors.
 - Use View GGSEVT to check for these errors.



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When checking the network, make sure that the source can communicate with the target:

```
ping <hostname>
```

The following command displays the network routing table:

```
netstat -r
```

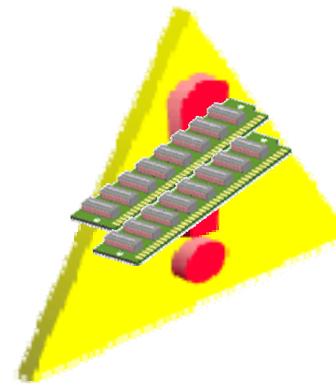
When checking if the Extract is pointing to the wrong address or port, do the following:

- Use Info Mgr to view the port number specified for the target Manager.
- Check the RmtHost Extract parameter.
 - If the parameter is a host name, make sure that the domain name server (DNS) can resolve it.
 - If the parameter is an IP address, verify it.
 - MgrPort must match the port number that is shown by Info Mgr.

Extract Abends (Slide 3 of 3)

Does the error indicate that maximum RAM was reached? The process abends if maximum memory is reached.

- Limit the transaction size to minimize temporary memory requirements and latency and to improve performance.
- If necessary, use the CacheMgr parameter (with the assistance of Oracle Technical Support) to control virtual memory and temporary disk space.



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Data Pump Abends (Slide 1 of 4)

Does the data pump abend with error number 509
(Incompatible record)?

```
"2014-03-02 15:45:22 GGS ERROR 509 GoldenGate Delivery  
for Oracle, ORAPMP.prm: Extract read, Incompatible  
record in ./dirdat/JD000000, rba 5287 (getting  
header) ."
```

If so, the inbound trail record's headers are not aligned.



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For more information about Error 509, see the “Replicat Abends with Error 509” section in the lesson titled “Replication Problems.”

Data Pump Abends (Slide 2 of 4)

Diagnosis

- Have you stopped, re-added, and restarted the primary Extract or data pump without resetting the data pump's read position in the local trail?

Solution

- Change the data pump's read position in the local trail so that it starts processing the record after the last record that is written to the remote trail. This ensures that no operations are missed.



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If the suggested diagnosis and solution do not work, look for a `debug509.txt` file in the root Oracle GoldenGate directory and send it to Oracle Technical Support.

Sample `debug509.txt` File

```
cur_extract_file: /d05/ggs/dirdat/rt000000
file_rba: 903
cur_block_rba: 0
first position: -1,-1
records processed: 0
cur_block_bytes: 8487
etr.rec.cur_pos: 0,903
etr.i.buf_len: 8487
etr.i.remaining_len: 8487
current eof: 9390
last_good_rba: -1
```

```
etr.i.buf contents:  
0: 3800 0AFF FF00 0000 0000 0000 0000 3900 8.....9.  
16: 04FF FF00 0000 3A00 0AFF FF00 0000 0000 .....  
<contents of buffer purposely deleted>  
etr.i.buf_ptr contents:  
0: 3800 0AFF FF00 0000 0000 0000 0000 3900 8.....9.  
16: 04FF FF00 0000 3A00 0AFF FF00 0000 0000 .....  
<contents of buffer purposely deleted>  
cur_block_ptr contents:  
0: 3800 0AFF FF00 0000 0000 0000 0000 3900 8.....9.  
16: 04FF FF00 0000 3A00 0AFF FF00 0000 0000 .....  
<contents of buffer purposely deleted>  
contents starting at position 0
```

```
0: 4700 0079 4800 0031 4504 0041 001C 0FFF G..yH..1E. A
16: 02FF 2679 FFFF 7AFF 0000 0000 04FF 0C10 ..&y...z....
<contents of buffer purposely deleted>
*** ET TRACE INFO ***
ITEM #1
event: ET_get_rec
hdr_len: 0
data_len: 0
buf_len: 8487
remaining_len: 8487
result: 101
cur_pos: 0,903
next_pos: 0,903
hdr (0):
0: 0000 0000 0000 0000 0000 0000 0000 0000 .....
16: 0000 0000 0000 0000 0000 0000 0000 0000 .....
<contents of buffer purposely deleted>
```

```
data (0):
buf (8487):
0: 3800 0AFF FF00 0000 0000 0000 0000 3900 8.....9.
16: 04FF FF00 0000 3A00 0AFF FF00 0000 0000 ..... .
<contents of buffer purposely deleted>
buf_ptr (8487):
0: 3800 0AFF FF00 0000 0000 0000 0000 3900 8.....9.
16: 04FF FF00 0000 3A00 0AFF FF00 0000 0000 ..... : .
<contents of buffer purposely deleted>
ITEM #2
event: ET_get_rec
hdr_len: 0
data_len: 0
buf_len: 8487
remaining_len: 8487
result: 101
cur_pos: 0,903
```

```
next_pos: 0,903
hdr (0):
0: 0000 0000 0000 0000 0000 0000 0000 0000 .....
16: 0000 0000 0000 0000 0000 0000 0000 0000 .....
<contents of buffer purposely deleted>
<items purposely deleted>
```

Data Pump Abends (Slide 3 of 4)

Have the source tables been changed?

- Is the Extract abending due to data manipulation?
 - The source table definition was changed before all captured data was sent.
 - A mismatch was caused by the new metadata.
- You must stop the processes before changing the DDL.

When you change the DDL, refer to the *Oracle GoldenGate Windows and UNIX Administrator's Guide* for help.



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Data Pump Abends (Slide 4 of 4)

- Are you using a data pump in pass-through mode?
 - If so, you cannot use data filtering, conversion, or other manipulation.
- Does the parameter file include UserID or SourceDB parameters?
 - If there is no database access, these parameters should not be used.
- Are you combining pass-through for some tables and normal processing for other tables?
 - Non-pass-through tables:
 - The system must have a database, and database login parameters are needed.
 - A source definitions file is required if filtering is used.
 - A target definitions file is required for column mapping or conversion.



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The following are examples of messages that you might see if the data pump abends because of data manipulation:

2014-03-10 14:41:29 GGS ERROR 101 COLMAP option cannot be used with PASSTHRU parameter.

2014-03-10 14:41:29 GGS ERROR 190 PROCESS ABENDING.

2014-03-10 14:42:04 GGS ERROR 101 WHERE option cannot be used with PASSTHRU parameter.

2014-03-10 14:42:04 GGS ERROR 190 PROCESS ABENDING.

2014-03-10 14:44:41 GGS ERROR 101 FILTER option cannot be used with PASSTHRU parameter.

2014-03-10 14:44:41 GGS ERROR 190 PROCESS ABENDING.

Use PassthruMessages or NoPassthruMessages to control whether messages for tables that are being processed in pass-through mode are written to the Extract report file. If the PassthruMessages parameter is used, messages similar to the following are written:

"PASSTHRU mapping resolved for source table <table_name>"

Quiz

Connection errors can indicate security violations, full file system errors, or system configuration errors. Which of the following should you use to troubleshoot such errors?

- a. Enable the Trace parameter in the parameter file.
- b. Execute the Info Mgr command.
- c. Execute the View GGSEVT command.
- d. All of the above



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Answer: c

Practice 5 Overview: The Troublesome Extract

The practices for this lesson cover the following topics:

- Solving user problems
- Solving connection problems



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Summary

In this lesson, you should have learned how to troubleshoot the following types of Extraction problems:

- Extract is slow.
- Extract abends.
- Data pump abends.



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6 Replication Problems

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Objectives

After completing this lesson, you should be able to troubleshoot Replicat:

- When it is not moving
- When it abends



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Replicat Is Not Moving

Does Stats Replicat return no statistics? Do successive Info Replicat [, ShowCh] commands indicate that the Replicat read checkpoint is not moving?

- If so, note the trail name and ensure that Replicat is reading the trail to which Extract is writing.
- If it is not the correct trail, issue Alter Replicat to read the correct trail.

Additional reasons for Replicat not moving (or moving too slowly) are covered in the lesson titled “Classic Performance Tuning.”



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It is very easy to mistype a trail name. For example, you might omit a backward slash in the path name.

To create a trail:

```
Add {ExtTrail | RmtTrail} <trailname>, Extract <group>
```

To alter Replicat:

```
Alter Replicat <group>, ExtTrail <trail> [, Begin <start_point>]
```

Instead of (or in addition to) altering Replicat, you can change RmtTrail or ExtTrail in the Extract parameter file, depending on where the mistake was.

Note: For details about syntax, see the *Oracle GoldenGate Windows and UNIX Reference Guide*.

Replicat Abends: Example 1

Is Replicat unable to locate a trail?

- Issue `Info Extract <group>` and note the trail name.
- Make sure that the trail was created:
 1. Issue `Info RmtTrail *` (or `Info ExtTrail *` if local).
 2. Create the trail (if necessary).
 3. Issue `Alter Replicat` to read that trail.

Is Replicat unable to open a trail file?

- Verify that the Replicat user has read and write permissions on trail files.



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You can confirm a trail's existence by looking in the `dirdat` directory of the Oracle GoldenGate home location. You should see the same information that is shown by `Info Extract` and `Info RmtTrail`, and the same information that is specified with `RmtTrail` when you view the Extract parameter file.

Replicat Abends: Example 2

- Was Add TranData issued for each table?
- This command activates supplemental logging, as in the following example of a Replicat error:

```
Missing one or more key fields in update
Aborting transaction beginning at seqno 0 rba 10008
error at seqno 0 rba 10008
Problem replicating HR.EMPLOYEE to HR.EMPLOYEE
Mapping problem with compressed update record (target
format)..
*
CUST_CODE =
NAME = George Washington
```

CUST_CODE (primary key) is
NULL but should not be.



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In this example of a Replicat discard file, the CUST_CODE column was not updated and therefore has a NULL value because supplemental logging using the Add TranData command was not used.

For Oracle databases, you have the option of using Add SchemaTranData. This command does not work on non-Oracle databases.

Replicat Abends with Error 509 (Slide 1 of 7)

Did Replicat return an error 509 (“Incompatible record”)?

```
"2014-03-27 15:45:22 GGS ERROR 509 Oracle GoldenGate  
Delivery for Oracle, ORAREP.prm: Extract read,  
Incompatible record in ./DIRDAT/JD000000, rba 5287  
gettingheader) . "
```

This means the data is either corrupt or written in a format other than the standard Oracle GoldenGate format. This occurs in the following situations:

- The data becomes corrupted while in transit from the source system to the target system.
- You have used FORMATASCII, FORMATSQ_L, or FORMATXML as parameters for the Extract, because Replicat does not understand those formats.



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“Incompatible record” errors may also occur due to misconfiguration of the trail files that are sent from the source to the target system when the Extract is configured to overwrite existing trail files. Two Extract processes writing to the same trail file can overwrite records in the trail file, thus causing an error 509.

Replicat Abends with Error 509 (Slide 2 of 7)

Diagnosis:

- Did you recently run an initial load?
 - Check the Extract that was used during the load.
 - Did it use FormatASCII, FormatSQL, or FormatXML?
- Have you stopped, re-added, and restarted the primary Extract or data pump (if any) without resetting the trail read position?
 - If you have done this, alter the Replicat's read position in the trail so that it starts reading after the last record is written.



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Replicat Abends with Error 509 (Slide 3 of 7)

Did a data pump crash before it could update its checkpoint file after the data was flushed to the trail?

- On restart, it rewrites some of the records (overlaying records in the existing trail). But the records that it rewrites do not exactly match the previous records.
- The data from the start of the rewrite might be (but probably is not) the same as the data that Replicat has processed.
- If the data is not the same, Replicat might be stuck in the middle of a record that could actually be the end of a previous record (before the rewrite).



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Replicat Abends with Error 509 (Slide 4 of 7)

Use logdump to check the trail:

- Issue the Open <path_name> command to open the sequence number shown in the error, as in this example:
Logdump> Open /home/goldengate/dirdat/rt000000
- If a complete record is followed by an incomplete record, the incomplete record will be overwritten, as in the following examples:
 - Extract is configured to overwrite an existing trail.
 - Two Extracts were configured to write to the same trail.
- Use the Pos command and relative byte address (RBA) in the error to look at the time stamps of records before and after that position:
 - If later records have earlier time stamps, they overwrote the trail.



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Suppose that, instead of reading the complete record starting with the beginning of a header (as Replicat expects), Replicat starts somewhere in the middle. Here are two possible reasons for this problem:

- The group may have been dropped and re-created by using the same trail name, causing the new Extract to start writing at trail 0 again and thus overwriting what is already there.
- The parameter file for one group may have been copied as the basis for the second group, but trail names (and possibly other names) were not changed for the second group.

When a trail is corrupted in this way, a debug509.txt file is created in the root Oracle GoldenGate directory. Contact Oracle Support and send the file, or search the knowledge documents for more information.

Replicat Abends with Error 509 (Slide 5 of 7)

To recover from an overwritten trail:

- Using Pos and ScanForHeader in logdump, try to determine the time and RBA when Extract started to overwrite the data. A time gap usually reveals this position.
- If you cannot find the gap, position Replicat to the RBA of a record with a commit time stamp a few minutes before the timestamp of the record near the RBA where Replicat abended:

```
GGSCI> Alter Replicat <group>, ExtRBA <earlier_point_in_trail>
```

- Consider adding HandleCollisions and running Replicat until it is past the RBA where it abended.
 - Set HandleCollisions in the Map statements of specific tables.



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Data integrity issues may still exist. If the target tables had triggers that inserted additional rows in another table, extra data might result. Remember to disable HandleCollisions after your troubleshooting session.

Replicat Abends with Error 509 (Slide 6 of 7)

If there is just one bad record and you have analyzed the reason, you can choose to skip the record:

- Add the `RestartCollisions` Replicat parameter.
 - This is used to handle duplicate or missing operations.
- To skip the bad record, do the following:
 1. Set the `GroupTransOps` and `MaxTransOps` parameters to 1 to commit after each operation.
 2. Restart Replicat and let it fail on that transaction.
 3. Use `Logdump ScanForHeader` to determine the RBA of the next good record.
 4. Alter Replicat to start at that record:

GGSCI> **Alter Replicat <group>, ExtRBA <rba>**
 5. Comment out (or remove) `GroupTransOps`/`MaxTransOps`.
 6. Restart Replicat.



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Use `RestartCollisions` to enable `HandleCollisions` until the first checkpoint is finished. After the first checkpoint is finished, `RestartCollisions` is turned off.

Replicat Abends with Error 509 (Slide 7 of 7)

If you look at the root cause and find that the trail is not recoverable, you may need to resynchronize the data:

- Do not reuse the old trails. Use new trails instead.
- Contact Oracle Technical Support before you start this process.



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Move the old trail files to a temporary location. You might need them later, or a support engineer might need to see them.

Replicat Abends: Diagnosis

Diagnostic questions:

- Are you using trail encryption?
- Are the Replicat transactions large?
- Has there been a change to a source table definition?



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- Are you using trail encryption?
 - If you specified `EncryptTrail` for Extract, make sure that `DecryptTrail` is specified for Replicat.
 - Otherwise, the still-encrypted data is interpreted as a bad record and GoldenGate error 160 is returned.
- Are the Replicat transactions large?
 - If the target is unable to handle large transactions, Replicat abends with a memory error.
 - Try the `MaxTransOps` parameter to split Replicat transactions into smaller ones.
- Has there been a change to a source table definition?
 - If so, use `defgen` to create a new source definitions file.
 - Then transfer the file to the target.

Replicat Abends: Diagnosis

Does the error message recommend AllowNoOpUpdates?

- Is the Replicat Set clause missing a target column name to use when processing an update?
 - Does the source table have a column that does not exist in the target?
 - Or was a column excluded from replication?
- Did an update set a column to the same value as the current one?
 - Oracle Database does not log the new value because it did not change. But GoldenGate extracts the update because the primary key was logged.
 - Replicat fails because there is no column value for its Set clause.



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Sample error message:

An update has been encountered where all the fields being mapped are key fields. To allow this to be processed as an ignored no-operation add the parameter AllowNoOpUpdates to the parameter file.

If an update sets a column value equal to itself, you can enable AllowNoOpUpdates to ignore the operation without data loss (and with no effect on the target table).

Note: When AllowNoOpUpdates is used, the statistics reported by Replicat will show that an update was made, but the database will not be updated.

Replicat Abends: Example 3

You cannot use `AllowNoOpUpdates` in the following situations:

- The target has more primary or unique columns than the source.
- There is an update to a non-key/index source column that is part of the target key/index.

Different key definitions on source and target can cause data integrity issues.

- It is *not* safe to enable `AllowNoOpUpdates`.
- Instead, define appropriate key columns on the target table.
- Tables must be resynchronized if replication has been running on them.



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Examples

- The source has columns A, B, C, and D.
- The key is column A.
- The target has the same columns.
- Columns A and B are the key.

The following might happen: The source application updates column B so that the update image has only column A (the key) and column B (the changed column). On the target, however, because both columns A and B are the key columns, there is no column for Replicat's `Set` clause.

Preventing Replicat from Exiting

If Replicat abends on certain errors but you do not want it to specify error-handling rules with the RepError parameter, do the following:

- Use one RepError statement to set the default.
- Use other RepError statements to handle specific errors differently.

Example

Ignore duplicate-record errors but abend in other cases.



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Responses to errors:

- **Abend:** Roll back the transaction and abend.
- **Discard:** Send to the discard file.
- **Exception:** Apply the operation to an exception Map statement.
- **Ignore:** Ignore the operation.
- **Retryop:** Retry the operation a specified number of times.
- **Transabort:** Abort the whole transaction and try again.

Example 1

The following example demonstrates how to abort processing for most errors while ignoring duplicate-record errors.

```
RepError (Default, ABEND)
```

```
RepError (-1, IGNORE)
```

Example 2

The following example invokes an exceptions Map statement that is created to handle errors on the account table. Errors on the product table cause Replicat to abend because an exceptions Map statement was not defined.

```
RepError (Default, Exception)
RepError (Default2, Abend)
Map sales.product, Target sales.product;
Map sales.account, Target sales.account;
InsertAllRecords
Map sales.account, Target sales.account_exception,
ExceptionsOnly,
ColMap (account_no = account_no,
optype = @GETENV ("lasterr", "optype"),
dberr = @GETENV ("lasterr", "dberrnum"),
dberrmsg = @GETENV ("lasterr", "dberrmsg"));
```

Example 3

The following example applies error rules for the first Map statement and then restores the default of ABEND to the second Map statement:

```
RepError (-1, IGNORE)
Map sales.product, Target sales.product;
RepError Reset
Map sales.account, Target sales.account;
```

Quiz

Which of the following issues can prevent the Replicat process from advancing? (Choose all that apply.)

- a. The trail name is incorrect.
- b. The Extract name is incorrect.
- c. Stats Replicat must be run.



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Answer: a

Quiz

Which Oracle GoldenGate utility can be used to help troubleshoot issues with Error 509?

- a. CONVCHK utility
- b. logdump utility
- c. reverse utility



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Answer: b

Practice 6 Overview: The Rebellious Replicat

The practices for this lesson cover the following topics:

- Solving Replicat problems
- Solving trail file problems



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Summary

In this lesson, you should have learned how to troubleshoot Replicat:

- When it is not moving
- When it abends



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Missed Transactions

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Objectives

After completing this lesson, you should be able to troubleshoot missed transactions involving issues such as the following:

- Tables that are not properly specified
- A missing Add TranData command
- Direct loads that are not working
- LOB data that is not replicating



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Transactions Not Being Processed (Slide 1 of 5)

Are the affected tables properly specified?

- Verify that the tables were included in the Table and Map statements.
- Check the syntax: Best practice requires using fully qualified names (`owner.table`) for both Table and Map.
- Be careful about using 'single quotes' for object names because, in some databases, this implies that they are case sensitive.



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Verifying Table and Map

The name used in the Table Extract parameter is written to the trail record header, and Replicat expects an exact match in the source portion of the Replicat Map statement. Otherwise, nothing is replicated.

Transactions Not Being Processed (Slide 2 of 5)

- Was the Add TranData command issued for each table?
This activates supplemental logging.
- Here is an example of a Replicat error:

```
Missing one or more key fields in update
Aborting transaction beginning at seqno 0 rba 10008
error at seqno 0 rba 10008
Problem replicating HR.EMPLOYEE to HR.EMPLOYEE
Mapping problem with compressed update record (target
format)..
*
CUST_CODE = CUST_CODE (primary key) is
NULL but should not be.
NAME = George Washington
```



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If appropriate, you can use Add SchemaTranData instead of Add TranData.

Add SchemaTranData is used to enable schema-level supplemental logging for Oracle tables. It acts on all of the current and *future tables* in a given schema to automatically log a superset of available keys that Oracle GoldenGate needs for row identification.

Note: Suppose you have two tables named mytable1 and mytable2 that are both in myschema. You use a mixture of Add SchemaTranData myschema and Add TranData myschema.mytable2 in the same schema, and you then try to see which tables are tracking transaction data. As a result, Info Trandata myschema.* reports that "Logging of supplemental redo log data is disabled for table myschema.mytable1" when, in fact, the logging is enabled because of SchemaTranData (at least with the same end result).

Transactions Not Being Processed (Slide 3 of 5)

Are the transactions coming out of the source system properly?

- If no operations are being added to the trail for the affected tables, the problem is in the source.
- Check this problem by using one of the following:
 - Send Extract <group>, Report to see the number of operations that Extract is processing for the affected tables
 - Count in logdump to see if there are any records in the trail for the affected tables



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After the initial implementation of Oracle GoldenGate, a common problem is that a new table is added and the user forgets to include the Add TranData or Add SchemaTranData option.

Transactions Not Being Processed (Slide 4 of 5)

Did you recently run a direct load?

- Did you use the same parameter file for your load and online groups?
 - After the load, alter the appropriate parameters from the load configuration to suit the online configuration.
 - Avoid the common mistake of using the `RmtFile` for the load, or forgetting to change it to `RmtTrail` for the online group.
- Solution:
 1. Stop Extract.
 2. Edit the parameter file to fix or add parameters.
 3. Add the remote trail with `Add RmtTrail` in GGSCI (if you have not already done so).
 4. Start Extract.



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Transactions Not Being Processed (Slide 5 of 5)

Are LOBs not being captured?

- For LOBs to be captured in Oracle 8*i* and later versions of Oracle Database, the other columns in the row must be modified in the same transaction.
- Solution: Write a stored procedure to set a column value equal to itself.



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Note: Oracle 8*i* is not supported with GoldenGate 12c.

Including Missed Transactions

After running Add TranData or setting data capture changes, do the following:

- To include missed operations in the target table, resynchronize the source and target tables (discussed earlier).
- To skip the missed operations:
 - Stop Replicat:

```
GGSCI> Stop Replicat <group>
```

- Close the current trail file and open a new one:

```
GGSCI> Send Extract <group> Rollover
```

```
GGSCI> Alter Replicat <group>,ExtSeqNo <nnnn>,ExtRBA 0
```

- Point Replicat to the new file:

<nnnn> is the sequence number of the new file.

Start Replicat to start processing from the new file:

```
GGSCI> Start Replicat <group>
```



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Quiz

What must be done for each table that is added after the initial implementation of Oracle GoldenGate?

- a. Oracle GoldenGate must be stopped and restarted.
- b. The database must be stopped and restarted.
- c. The Add TranData command must be executed.
- d. Nothing needs to be done. Oracle GoldenGate automatically detects the new table and begins collecting data.



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Answer: c

In addition, `Add SchemaTranData` picks up new tables automatically.

Practice Overview 7: The Dissimilar Data

The practices for this lesson cover the following topics:

- Solving mismatch problems
- Handling errors



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Summary

In this lesson, you should have learned how to troubleshoot missed transactions involving issues such as the following:

- Tables that are not properly specified
- A missing Add TranData command
- Direct loads that are not working
- LOB data that is not replicating



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Mapping and Synchronization Problems

8

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Objectives

After completing this lesson, you should be able to troubleshoot the following:

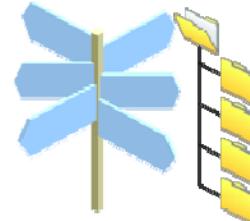
- Mapping problems, including:
 - Failed fetching from source data
 - Table and column names that do not match in the source and target databases
- Synchronization problems, including:
 - Out-of-sync rows
 - DML on target tables
 - Tables without keys
 - Different character sets



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Roadmap

- Mapping problems
 - Failed fetching from source data
 - Table and column names that do not match in the source and the target databases
- Synchronization problems

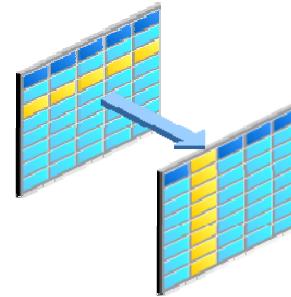


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Mapping Problems: Overview

- Table and column mapping can be complex. It is a common cause of errors or unexpected results.
- The process report shows where data-mapping errors occurs.
- Issue `View Report <group>` or use Oracle GoldenGate Director to view the report.



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Mapping Problems: Source Fetch Fails

Is Extract returning fetch-related errors?

Check for the following:

- Was the row containing the data deleted?
- Has the undo retention expired?
 - If so, the read-consistent image that Extract needs is gone and a snapshot-too-old message is returned.
 - The Extract `FetchOptions NoUseSnapshot` parameter tells Extract to fetch from the *table* rather than from the undo segments.
 - After Extract has passed the affected record, remove this parameter so that Extract goes back to the undo segments.
 - If possible, increase the amount of time that Oracle Database keeps information in the undo segments.



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`FetchOptions` is an Extract parameter that controls certain aspects of the way that Oracle GoldenGate fetches data. The `UseSnapshot | NoUseSnapshot` option is valid only for Oracle databases.

- **UseSnapshot** : (the default) Causes Extract to use the Flashback Query mechanism to fetch data that is required to reconstruct operations containing LOB data, user-defined data types, nested tables, and XML type records from the undo tablespace
- **NoUseSnapshot** : Causes Extract to fetch the required data from the source table

Note: For more information about how Oracle GoldenGate fetches data from Oracle Database, see the *Oracle GoldenGate Windows and UNIX Administrator's Guide*.

Certain DDL operations that alter the structure of a table (such as a table truncate) can also cause fetch errors.

Mapping Problems: Source Fetch Fails

Are you using the `NoUseLatestVersion` parameter for `FetchOptions`?

- If so, Oracle GoldenGate cannot default to fetching from the table when the undo record is not available.
- Extract abends unless error-handling options are set with the `NoUseLatestVersion` parameter.



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The `UseLatestVersion` | `NoUseLatestVersion` option is valid only for Oracle Databases. Use it with `UseSnapshot`.

- **`UseLatestVersion`:** (the default) Causes Extract to fetch data from the source table if it cannot fetch from the undo tablespace
- **`NoUseLatestVersion`:** Causes Extract to ignore the condition if the snapshot fetch fails and then to continue processing

To provide an alternate action if a snapshot fetch does not succeed, use the `MissingRow` option. If fetched data is available but cannot be merged with the redo data, Extract exits.

Mapping Problems: Table and Column Names

Do the source and target tables exist in both databases?

- Are they specified correctly in the Table or Map statement?
 - Ensure that names are fully qualified (schema.table).

Do table and column names contain only supported characters?

- Are any column names within double quotes?
 - If so, they will be interpreted as literals. You can change this behavior with the NoANSISQLQuotes parameter.
- Are there unnecessary white spaces?
 - Although this is tolerated, it may cause problems due to inconsistency.



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Note: For details about requirements for table and column names, see the Table and Map documentation in the *Oracle GoldenGate Windows and UNIX Reference Guide*.

You may need to perform a global substitution to replace words that are reserved in a specific database.

Oracle GoldenGate now treats strings that are in single quotes as literals. Oracle GoldenGate has supported double-quoted object names since version 11.2 but did not fully implement the rule of single quotes for literals until version 12. Supporting double quotes for object names and single quotes for literals brings Oracle GoldenGate into compliance with SQL-92 rules.

The change to default SQL-92 rules affects literals in parameter files (including OBEY files), SQLEXEC clauses, token values, conversion functions, user exits, and GGSCI commands. It also affects literal strings in the DESC options of the ADD commands.

For More Information

- See the *Oracle GoldenGate Windows and UNIX Reference Guide* to determine whether single or double quotes are now required for the parameters that you are using.
- See *Oracle GoldenGate: Upgrading Oracle GoldenGate for Windows and UNIX* for information about your options for converting parameter files to use the new naming convention or retain the existing one.

Mapping Problems: Definitions

- Did you create a source definition file and place it in the target system?
- Is the file referenced correctly with the SourceDefs Replicat parameter?
- If you are using the file with Extract, did you use the TargetDefs parameter?
- Are source columns mapped to target columns of a similar data type?
- Do WHERE clauses compare different data types?
- Are source and target columns of different sizes?



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- **Are source columns mapped to target columns of a similar data type?**
If source columns are mapped to target columns of a different data type, use a column-conversion function in the mapping statement. This prevents “mismatched data type” errors.
- **Do WHERE clauses compare different data types?**
It would be an unrealistic WHERE comparison, for example, to test a numeric column against an alphanumeric value.
- **Are source and target columns of different sizes?**
If source and target columns are of different sizes, Oracle GoldenGate truncates or rounds target data if the target column is smaller than the source column.

Mapping Problems: Column-Missing Error

Are you using KeyCols?

- Are the specified columns being logged to the transaction log or to the GoldenGate log table?
 - Enable logging of the columns, or use Add TranData with the Cols option (Oracle databases only) .
- Are you using both source and target KeyCols?
 - Corresponding source and target columns must match.
- Did you include any existing primary-key or unique-index columns in the KeyCols definition?
 - A best practice is to include existing keys or unique columns in KeyCols.



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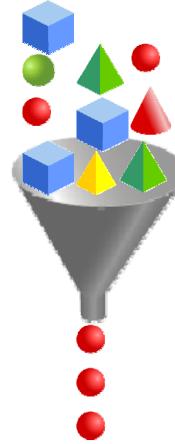
Mapping Problems: Column-Missing Error

Did the error occur on a filter or function? (This indicates that data is missing from the transaction record.)

- Try to filter on key columns, or do one of the following:
 - Enable logging of required columns.
 - Use `FetchCols` or `FetchColsExcept` in the `Table` statement.

Are you using valid filter or comparison elements?

- For example, `Filter` takes a numeric value, and `WHERE` takes a string but not arithmetic operators or floating-point numbers.

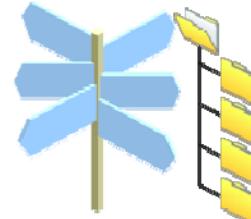


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Roadmap

- Mapping problems
- Synchronization problems
 - Out-of-sync rows
 - DML on target tables
 - Tables without keys
 - Different character sets
 - Resynchronizing



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Synchronization Problems: Testing for Out-of-Sync Rows

Use Oracle GoldenGate Veridata to compare source data with target data:

- Locate and report data discrepancies.
- Determine which tables are out of sync, how many rows are affected, and what the column values are.
- Use Veridata on active source tables while replication is active.
- Use options to customize and filter the comparisons.

The user interface is either the command-line interface or the Oracle GoldenGate Veridata web GUI.



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Synchronization Problems: Oracle GoldenGate Veridata Web GUI

Run / Execute Job

Run Configuration

Job: Job1 Description: Financials

Job Profile: Retrieve Compare Pair List

All

Filter list by:

Sales

Select	Previous Comparison Status	Row Partitions	Previous Run Duration	Compare Pair Name	Previous Number Rows Compared	Previous Number Rows Out-Of-Sync	Previous With Errors	Previous Comparison Reports
<input checked="" type="checkbox"/>	(<input type="radio"/>)	[...]	00:00:00	COMPOSITE_KEY_TABLE=COMPOSITE_KEY_TABLE	0	0	0	
<input checked="" type="checkbox"/>	(<input type="radio"/>)	[...]	00:00:00	DIFFERENT_COLUMN_TYPES_TABLE=DIFFERENT_COLUMN_TYPES_TABLE	0	0	0	
<input checked="" type="checkbox"/>	(<input type="radio"/>)	[...]	00:00:00	DIFFERENT_PK_SIZE_TABLE=DIFFERENT_PK_SIZE_TABLE	0	0	0	
<input checked="" type="checkbox"/>	(<input type="radio"/>)	[...]	00:00:00	DUMMY_TABLE=DUMMY_TABLE	0	0	0	
<input checked="" type="checkbox"/>	(<input type="radio"/>)	[...]	00:00:00	FAKE_DUMMY_TABLE=FAKE_DUMMY_TABLE	0	0	0	
<input checked="" type="checkbox"/>	(<input type="radio"/>)	[...]	00:00:00	KEYLESS_TABLE=KEYLESS_TABLE	0	0	0	
<input checked="" type="checkbox"/>	(<input type="radio"/>)	[...]	00:00:00	ONLY_SOURCE_WITH_PK_TABLE=ONLY_SOURCE_WITH_PK_TABLE	0	0	0	

Show 10 Items per page

Override Run Options
Command Line To Be Used: vericom.exe -job Job1

Configure Run Options

Run

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This is the Veridata list page that displays and runs comparisons of source-target compare pairs. It provides complete online help for user assistance.

Synchronization Problems: Causes of Out-of-Sync Data

Data discrepancies can happen for a variety of reasons.

- The following discrepancies are out of the control of users and Oracle GoldenGate:
 - User-input errors
 - Application bugs
 - System failures
 - Disk corruption
- The user can control the following discrepancies :
 - DML on target tables (outside replication)
 - Tables without keys
 - Character sets
 - Different table structure or primary key on source and target



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Character-set discrepancies can occur when the Oracle `NLS_LANG` parameter is not set.

Synchronization Problems: DML on Target Tables

Are transactional applications running on the target?

- Unless you write a CDR routine, OGG does not verify target row data before replicating changes. It verifies only that the source and target keys match.
- Changes to target tables outside of Replicat cause data discrepancies or errors.

Are there triggers on target tables?

- Triggered operations are replicated from the source.
- If target triggers reproduce the same operations, they can cause errors.
- Disable triggers, alter them to ignore the Replicat user, or use SQLLEXEC to disable them during processing by issuing the appropriate database command.



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Problems Caused by Triggers: Example

Suppose that the trigger is set to delete B when deleting A. So two operations—delete A and delete B—are sent to Replicat. If the trigger is set on both the source and the target, the delete A operation on the target will trigger delete B, and the delete B operation will fail.

Conflict Detection and Resolution (CDR): This is a feature of the Map statement used in bidirectional replication to automatically handle data conflict due to latency.

Disabling triggers: You can use the DBOptions SuppressTriggers parameter option to disable triggers for the Replicat database user session.

Note: Triggers that affect tables *outside* the Oracle GoldenGate replication environment are permissible.

Synchronization Problems: Tables Without Keys

Do any target tables lack primary keys or unique indexes?

- If they do, Oracle GoldenGate will use all columns as a key.
- The Replicat process may erroneously update multiple rows if they contain identical data.
- Use the DBOptions LimitRows parameter to prevent this from happening.



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LimitRows | NoLimitRows

These DBOptions options are valid for Replicat in Oracle databases and in Sybase.

LimitRows prevents multiple rows from being updated or deleted by the same Replicat SQL statement when the target table does not have a primary or unique key. Depending on whether a WHERE clause already exists, LimitRows alters the WHERE clause that is used by Replicat by adding either of the following clauses:

```
WHERE ROWNUM = 1  
AND ROWNUM = 1
```

The alteration is applied only if the table has no unique key.

LimitRows is the default. NoLimitRows permits multiple rows to be updated or deleted by the same Replicat SQL statement. This option does not work when you are using the Oracle Call Interface (OCI).

LimitRows and NoLimitRows apply globally to all Map statements in a parameter file.

Synchronization Problems: Character Sets in Oracle Databases

Are the source and target character sets different? If they are different, the extended ASCII will not synchronize correctly. If you are using Oracle GoldenGate versions prior to 12c, do the following:

- Check the `NLS_LANG` environment variable on the source and target databases.
 - The target `NLS_LANG` must be set to accommodate the character set of the source database.
 - The character sets must match, or the character set of the target database must be a superset of the character set of the source database (for example, Unicode).
- This behavior has changed with OGG 12c. The conversion of the source character set to an Oracle target character set is now performed by Replicat instead of OCI.



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If your client applications use different character sets, the database character set must be a superset of the character sets of the client applications. For example, for redo log reading Extract, `NLS_LANG` must match the source database character set. For Replicat, `NLS_LANG` must match the character set in the trail file it is reading from. `NLS_LANG` does not affect regular data pump Extracts.

In this configuration, every character is represented in conversions from a client character set to the database character set. Unicode can solve most of these problems, but you need to configure the database this way from the start.

Set `NLS_LANG` either through the operating system or in the Extract parameter file, as in the following example:

```
SETENV (NLS_LANG = "AMERICAN_AMERICA.AL32UTF8")
```

In Oracle GoldenGate 12c, where the conversion of the source character is performed by Replicat rather than by the Oracle Call Interface (OCI), the requirement to set `NLS_LANG` on the target to support conversion has been eliminated. See the list of supported Oracle character sets in *Administering Oracle GoldenGate for Windows and UNIX*.

Note: For more information, see the *Oracle Database Globalization Support Guide*.

Synchronization Problems: Different Structures or Keys

- Are the problems with specific tables only?
- Are the source and target table structures different?
 - If they are different, you must run `defgen` to create a new definitions file.
 - If they are not different, you must apply the same structure to the target.
- Do source and target tables have different primary keys?
 - If the key columns are different, use the `KeyCols` option of `Table` and `Map` to define columns as keys.



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- **Data-definitions file:** Required if you are synchronizing source and target tables that have different data definitions. The data-definitions file enables accurate conversion from one format to another.
- **Source-definitions file:** Required if you are configuring column mapping or transformation to be performed on the target system. The source-definitions file contains the definitions of the source tables and is transferred to the target system. The Replicat process uses the definitions in this file to perform the conversions.
- **Target-definitions file:** Required if you are configuring column mapping or transformation to be performed on the source system. The target-definitions file contains the definitions of the target tables and is transferred to the source system. The Extract process uses the definitions in this file to perform the conversions.

For more information about creating a data-definitions file, see the *Oracle GoldenGate Windows and UNIX Administrator's Guide*.

Synchronization Problems: Resynchronizing

To resynchronize an out-of-sync table:

1. Comment out the table in the Replicat parameter file:

```
GGSCI> Edit Param <group1>
```

2. Stop Replicat and start it again so that it continues for unaffected tables:

```
GGSCI> Stop Replicat <group1>
GGSCI> Start Replicat <group1>
```

3. Record the time stamp on the source system.
4. Copy the source data for the affected tables, but try to resolve any long-running transactions before making the copy.
5. Import the copy to the target table.



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It is important to resolve long-running transactions before making the copy. The reason is that transactions that are open while the copy is being made will not be reflected in it.

Synchronization Problems: Resynchronizing

6. Create a new Replicat group for the out-of-sync table, using Begin and the source time stamp that you recorded earlier and using the existing trail for ExtTrail:

```
GGSCI> Add Replicat <group2>, ExtTrail  
<existing_trail>, Begin <yyyy-mm-dd hh:mm:ss>
```

7. Create the parameter file so that it includes HandleCollisions.
8. Start the new Replicat:

```
GGSCI> Start Replicat <group2>
```

9. View the new Replicat's lag until it shows At EOF, no more records to process:

```
GGSCI> Send Replicat <group2>, GetLag
```



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Synchronization Problems: Resynchronizing

10. Turn off HandleCollisions in the new Replicat:

```
GGSCI> Send Replicat <group> NoHandleCollisions
```

11. Edit the parameter file to comment out or remove HandleCollisions if you bounce the process later.
12. The next steps merge the table back with the other tables so that only one Replicat group is needed.
13. Stop Extract:

```
GGSCI> Stop Extract <group>
```

14. View both Replicats' lag until you see EOF again:

```
GGSCI> Send Replicat <group1>, GetLag  
GGSCI> Send Replicat <group2>, GetLag
```

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Synchronization Problems: Resynchronizing

15. Stop both Replicats.
16. Uncomment the resynced table in the original Replicat parameter file:

```
GGSCI> Edit Param <group1>
```

17. Start Extract.
18. Start the original Replicat:

```
GGSCI> Start Replicat <group1>
```

19. Delete the new Replicat that you created:

```
GGSCI> Delete Replicat <group2>
```



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Quiz

In what circumstances do you use the KeyCols parameter?

- a. In addition to the primary key
- b. In addition to the unique index
- c. To define a substitute primary key



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Answer: c

Quiz

Which file is required if you are configuring column mapping or transformation on the target system only?

- a. Extract parameter file
- b. Source-definitions file
- c. Target-definitions file
- d. Replicat parameter file



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Answer: b

Practice 8 Overview: The Mangled Mapping

The practice for this lesson covers solving mapping problems.



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Summary

In this lesson, you should have learned how to troubleshoot the following:

- Mapping problems, including:
 - Failed fetching from source data
 - Table and column names that do not match in the source and target databases
- Synchronization problems, including:
 - Out-of-sync rows
 - DML on target tables
 - Tables without keys
 - Different character sets



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SQL*EXEC, File-Maintenance, and Other Problems

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Objectives

After completing this lesson, you should be able to troubleshoot the following:

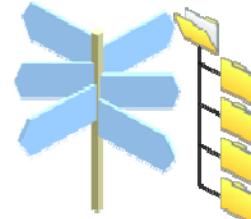
- SQLLEXEC problems
- File-maintenance problems
- Other problems, including:
 - Time differences
 - Unusable indexes
 - Too many open cursors



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Roadmap

- SQLEXEC problems
 - SQL not executing
 - Tracing
- File maintenance problems
- Other problems



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SQLEXEC Problems: SQL Does Not Execute

- Does the user who is specified with the UserID parameter have database permissions to call and execute procedures and commands?
- Are you trying to use input or output parameters for a SQLEXEC statement at the root of a parameter file?
 - Parameters can be used only for SQLEXEC statements that are in a Table or Map statement.



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Using SQLEXEC

To implement database commands, stored procedures, and queries, use the SQLEXEC parameter. This parameter can be used as a:

- Clause of a Table or Map statement
- Stand-alone parameter at the root level of the Extract or Replicat parameter file

Executing SQLEXEC in a Table or Map Statement

When used in a Table or Map statement, SQLEXEC can pass and accept parameters. It can be used for procedures and queries, but not for database commands.

SQLEXEC Problems: SQL Does Not Execute

Does parameter resolution result in a column-missing error?

- Is the referenced column being logged to a transaction log?
 - Enable logging or (with Oracle Database) use `Add TranData` with the `Cols` option.
- Is the map-level stored procedure supposed to execute more than once?
 - You must use the `ID <logical_name>` option.
- Is the SQL in the `SQLEXEC` statement supposed to synchronize a source row with multiple target rows?
 - Set the `EXEC` option to `SourceRow` so that it executes for each source-row operation.

To prevent a process from exiting on `SQLEXEC` errors, specify error handling with the `Error` option.



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A column that is not a key cannot be captured without the `Add TranData Cols` option.

SQLEXEC Problems: Tracing SQLEXEC Problems

Use the Trace option of SQLEXEC to research problems.

- There are two choices:
 - All writes input and output parameters to the discard file. This is the default.
 - Error writes the input and output parameters to the discard file only after a SQL error occurs.
- The discard file shows the parameters that are passed.
The report file shows the number of attempts.



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SQLEXEC Problems: Tracing SQLEXEC Problems

Parameter file:

```
Map MASTER.INTERACTION_ATTR_VALUES ,
  Target MASTER.INTERACTION_ATTR_VALUES,
  SQLEXEC (SPNAME ggs_conflict_rule,
            ID ggs_interaction_attr_values,
  PARAMS (LMS_TABLE = "INTERACTION_ATTR_VALUES",
           KEY1 = interaction_attribute_value_id,
           KEY2 = attribute_value_seq),
           ERROR RAISE, TRACE ALL) ;
```



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Use the SPNAME clause to execute a stored procedure in a Table or Map statement:

```
SQLEXEC (SPNAME <sp_name>,
          [ID <logical_name>]
          {, PARAMS <param_spec> | NOPARAMS}
          [, <option>] [, ...]
        )
```

- **<sp_name>**: Specifies the name of the procedure to execute
- **ID <logical_name>**: Defines a logical name for the procedure. Use this option to execute the procedure multiple times in a Map statement. Up to 20 stored procedures can be executed for each Map statement. This option is not required when a procedure is executed only once.
- **PARAMS <param_spec> | NOPARAMS**: These options define whether the procedure accepts parameters. You must select one of these options.
- **<param_spec>**: Defines input parameters and the source of the input

- *<option>*: Represents one of the following options that can be used alone or with other options to control the effects of the stored procedure:
AFTERFILTER | BEFOREFILTER
ALLPARAMS
DBOP
ERROR
EXEC
MaxVARCHARLEN
PARAMBUFSIZE
TRACE

SQLEXEC Problems: Tracing SQLEXEC Problems

Discard file:

```
Input parameter values...
    LMS_TABLE: INTERACTION_ATTR_VALUES
    KEY1: 2818249
    KEY2: 1
```

Report file:

```
From Table MASTER.INTERACTION_ATTR_VALUES to
MASTER.INTERACTION_ATTR_VALUES:
    # inserts: 0
    # updates: 0
    # deletes: 0
    # discards: 1
Stored procedure GGS_INTERACTION_ATTR_VALUES:
    attempts: 2
    successful: 0
```



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SQLEXEC Problems: Tracing SQLEXEC Problems

Using ID with stored procedures:

```
Map <source_schema>.demotab2,
Target <target_schema>.demotab2,
    SQLEXEC(SPNAME getzip, ID lookup1,
    PARAMS (v_city = resicity), ERROR RAISE),
    SQLEXEC(SPNAME getzip, ID lookup2,
    PARAMS (v_city = workcity), ERROR RAISE),
    ColMap (UseDefaults,
        id = empid,
        fname = first_name,
        lname = last_name,
        dept = department,
        residence_zip = lookup1.zip,
        work_zip = lookup2.zip,
        resi_city = resicity,
        work_city = workcity);
```



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In the example shown in the slide, SQLEXEC is called multiple times for the same Map parameter. ID is used to determine which stored procedure is referenced.

Without stored procedures, the code might look similar to the following:

```
Map <source_schema>.demotab1, Target <target_schema>.demotab1,
SQLEXEC ( ID lookup1, query " Select birthcity from lookup_tab
            where id = v_id " ,
            PARAMS (v_id = id), ERROR RAISE),
SQLEXEC ( ID lookup2, query " Select workcity from lookup_tab
            where id = v_id " ,
            PARAMS (v_id = id), ERROR RAISE)
            ColMap (UseDefaults,
                id = empid,
                fname = first_name,
                lname = last_name,
                dept = department,
                birth_city = lookup1.birthcity,
                work_city = lookup2.workcity);
```

SQLEXEC Problems: Tracing SQLEXEC Problems

Using ID with BEFOREFILTER:

```
Map      <source_schema>.demotab8,
Target   <target_schema>.demotab8,
SQLEXEC  (ID lookup, query "Select salary from lookup_tab
           where id = v_id" ,
PARAMS   (v_id = id)), ERROR RAISE, BEFOREFILTER),
FILTER   (lookup.salary > 5000),
ColMap   (usedefaults,
           id = empid,
           fname = first_name,
           lname = last_name,
           dept = department,
           salary = lookup.salary);
```

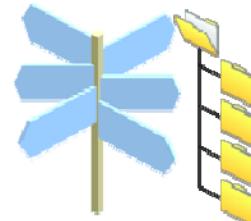


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In the example shown in the slide, ID is used to alias a query that can then be referenced to “return” salary from the lookup_tab table and assign that value to the salary column in the demotab8 table.

Roadmap

- SQLEXEC problems
- File maintenance problems
 - Discard file
 - Trail file
 - Report file
- Other problems

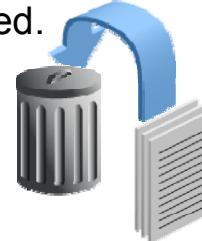


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File-Maintenance Problems: Discard File Is Not Created

- Did you use the DiscardFile parameter to specify a location for the discard file?
 - Prior to OGG 12c, discard files were not created by default.
 - In OGG 12c, the behavior changes: The discard files are now created by default.
- Are you looking in the right directory?
 - Check the DiscardFile parameter for the location.
- Could it be a security issue?
 - Whoever wrote the last discard file might have a security level that does not allow a new one to be created.



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Syntax

```
DiscardFile <filename>
[, Append | Purge]
[, MaxBytes <n> | Megabytes <n> ]
```

If you do not specify the location, Oracle GoldenGate creates the discard file in the `dir rpt`/subdirectory of the Oracle GoldenGate installation directory.

Best Practice

Always specify a discard file. It may be needed to resolve support issues.

File-Maintenance Problems: Discard File Is Too Big

Can you resolve the problem that is causing operations to accumulate?

- If you can tolerate the errors, you can control the discard file size with the following parameters:
 - **DiscardRollover**
 - **MaxDiscardRecs**
 - **Purge option of DiscardFile**
 - **Megabytes option of DiscardFile**
 - **MaxBytes option of DiscardFile**



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You must periodically monitor the size of the discard file depending on the maximum values that you have set.

- **DiscardRollover:** Specifies parameters for aging the file
- **MaxDiscardRecs:** Limits the number of errors written to the file
- **Purge option of DiscardFile:** Purges the file before writing new content
- **Megabytes option of DiscardFile:** Sets a different maximum file size in megabytes. The default is 1.
- **MaxBytes option of DiscardFile:** Sets the maximum file size in bytes. The valid range is from 1 through 2147488646. The default is 1000000 (1 MB).

File-Maintenance Problems: Trail File Delays

Is it a local trail?

- If a local trail is not being processed, check for TCP/IP issues that can delay transfer of data across the network.

Is it a remote trail?

- If a remote trail is not being processed, is Replicat running and processing data?
 - If Replicat is performing as usual, it might be processing a large transaction.

Is the trail not rolling over?

- View the file size field with `Info ExtTrail *` or `Info RmtTrail *` to check the file size that was specified when the trail was created.
 - The file size may not have reached the maximum value.
- Change the file size: `Alter ExtTrail | RmtTrail`.



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Trail files should be sized so that they can be maintained. The maximum size is 2 GB. However, 500 MB is the recommended upper limit for ease of maintenance

File-Maintenance Problems: Trail Files Are Not Being Purged

Are you using `PurgeOldExtracts` to manage the trail?

- You should use it as a Manager parameter with the `UseCheckpoints` option.
- Verify that the Manager user has the authority to purge trail files.
- Use `Send Manager GetPurgeOldExtracts` to review settings.
 - Verify that the `PurgeOldExtracts` options are used correctly.
 - A `MIN` option may be retaining the files for too long.

Is there an obsolete Replicat group pointing to the trail?

- Delete the group with `Delete Replicat <group>` so that checkpoint records are deleted, which allows Manager to purge the files. Files are not purged if another process is reading them.



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Options for `Send Manager`

Syntax:

```
Send Manager  
[ChildStatus [DEBUG]]  
[GetPortInfo [DETAIL]]  
[GetPurgeOldExtracts]  
[TracePurgeOldExtracts]
```

GetPurgeOldExtracts: Displays current trail-maintenance rules, as specified by the `PurgeOldExtracts` parameter in the Manager parameter file

TracePurgeOldExtracts: Displays current rules for trail maintenance, as specified by the PurgeOldExtracts parameter, as well as information such as the trail sequence number, the number of hours since the file was modified, and the oldest checkpoint

Note: For details about using PurgeOldExtracts, see the *Oracle GoldenGate Windows and UNIX Reference Guide*.

Example

Send Manager GetPurgeOldExtracts results in output similar to the following:

PurgeOldExtracts Rules

Fileset	MinHours	MinFiles	UseCP
/home/GGS/DIRDAT/EXTTRAIL/P4/*	0	1	Y
/home/GGS/DIRDAT/EXTTRAIL/P2/*	0	1	Y
/home/GGS/DIRDAT/EXTTRAIL/P1/*	0	1	Y
/home/GGS/DIRDAT/EXTTRAIL/P4/*	0	1	Y
/home/GGS/DIRDAT/EXTTRAIL/P2/*	0	1	Y
/home/GGS/DIRDAT/EXTTRAIL/P1/*	0	1	Y

OK

Extract Trails

Filename	Oldest_Checkpt_Seqno	IsTable	IsVamTwoPhaseCommit
/home/GGS/DIRDAT/RT 8 0 0			
/home/GGS/DIRDAT/REPTRAIL/P1/RT	18	0	0
/home/GGS/DIRDAT/REPTRAIL/P2/RT	18	0	0
/home/GGS/DIRDAT/REPTRAIL/P4/RT	18	0	0

File-Maintenance Problems: Trail Files Are Purged Too Soon

Are multiple Replicats, or a Replicat and a data pump, reading from the same trail? If so, are you using `PurgeOldExtracts` for Extract or Replicat instead of using it for Manager?

- `PurgeOldExtracts` should be used for Manager only.
- Use the `UseCheckpoints` option so that a purge is done only after all processes are finished with a file (as indicated by checkpoints).
- You can specify `MIN` options to keep a file for a specific amount of time, regardless of checkpoints.



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Best Practice

Define trail maintenance for Manager so that there are rules to ensure that trails needed by another process are not purged.

File-Maintenance Problems: Report File Is Too Big

Are you using macros?

- Are you using CmdTrace?
 - CmdTrace causes the inclusion of macro-expansion steps in the report.
 - The DETAIL option writes even more data.
 - Disable CmdTrace to reduce the report size.
- Are you using List?
 - To reduce the report size, use the NoList option to disable the listing of macros.

To control the report size, set an aging schedule with the ReportRollover parameter.



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ReportRollover

Use ReportRollover to define when the current report file is aged and a new one is created. Old reports are renamed in the following format:

```
<group_name><n>.rpt
```

In this syntax, *<group name>* is the name of the Extract or Replicat group and *<n>* is a number that is incremented by 1 whenever a new file is created (for example, myext0.rpt, myext1.rpt, myext2.rpt, and so on).

Note: Before the first report is overwritten, you should back it up and save it. It contains information that might be needed by Oracle Support.

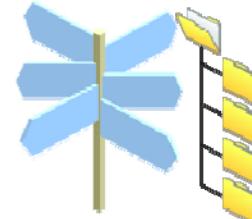
Syntax

```
ReportRollover  
{AT <hh:mi> |  
ON <day> |  
AT <hh:mi> ON <day>}
```

- **AT <hh:mi>** specifies the time of day at which to age the file:
 - hh is based on a 24-hour clock and accepts values of 1 through 28.
 - mi accepts values from 00 through 59 .
- **ON <day>** specifies the day of the week on which to age the file:
 - Valid values are SUNDAY, MONDAY, TUESDAY, WEDNESDAY, THURSDAY, FRIDAY, and SATURDAY. They are not case sensitive.

Roadmap

- SQLEXEC problems
- File maintenance problems
- Other problems
 - Time differences
 - Unusable indexes
 - Too many open cursors



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Other Problems: Time Differences

Are time stamps inaccurate?

- Oracle GoldenGate records are extracted in GMT (Greenwich Mean Time).
- Source and target CPU clocks might differ.
 - If the time does not look right, check the system clock.
- For low-volume systems, lag is determined by flush time more than by process time.
- The server may make adjustments to the GGS header commit time stamp based on CPU clock differences.
 - Use `NoTCPSourceTimer` to suppress any adjustments to the commit time stamp in the header.



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Using GMT is reliable in any time zone (regardless of changes due to Daylight Saving Time) without sequence problems.

`TCPSourceTimer` and `NoTCPSourceTimer` are Extract parameters that are used to control the adjustment of the time stamps of records that are transferred to target systems. They are global parameters and apply to all `TABLE` statements in the Extract parameter file.

`TCPSourceTimer`, which is the default, adjusts time stamps so that you can calculate an accurate synchronization lag when source and target system clocks reflect different times.

Other Problems: Indexes Are Unusable

Did you run a bulk load?

- This is an Oracle Database issue when you use the BULKLOAD parameter during an initial bulk load into an Oracle Database version 9.2.0.5 database.
- The cause is a known Oracle issue that arises after an upgrade from Oracle Database version 9.2.0.4 to version 9.2.0.5, but it does not occur after upgrades from version 9.2.0.1.
- Resolution: Run the `catcio.sql` script. (For more information, see My Oracle Support solution 8644544.)
- It is a best practice to rebuild the indexes.



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If an index becomes unusable, you should rebuild it to correct the problem.

Too Many Open Cursors

Has the maximum number of `OPEN_CURSORS` been reached?

- GoldenGate maintains cursors for:
 - Extract queries that fetch data.
 - Replicat caching of SQL statements.These processes can also use other cursors, such as those that are needed for `SQLEXEC` operations
- `MaxFetchStatements` and `MaxSQLStatements` are the two parameters that control cursor allocation.
- Reducing the number of GoldenGate cursors can affect performance because GoldenGate then needs to age more statements.



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- **MaxFetchStatements:** Extract parameter that controls the maximum allowable number of prepared queries that can be used by Extract to fetch row data from an Oracle source database. Extract may need to fetch data directly from a table or from the undo tablespace (in Oracle 9*i* Database and later versions). The fetched data is used when not enough information is available to construct a logical SQL statement from a transaction log record.
- **MaxSQLStatements:** Replicat parameter that is used when you use the `DYNSQL` parameter. It controls the number of prepared SQL statements that can be used by Replicat in regular processing mode as well as when `BATCHSQL` is enabled. The value of this parameter determines the number of open cursors that Replicat maintains. Ensure that the database can support the number of cursors that are specified with `MaxSQLStatements`, in addition to the cursors that are used by other applications and processes. Before changing this parameter, you should contact Oracle Support.

Other Problems: INFO Command Shows Incorrect Status

Does INFO show that a process is running when the process is not actually running?

- Did the system crash before this occurred?
 - Oracle GoldenGate considers a process to be RUNNING when it has an orphan file (a .pce or .pcr file on dirpcs for this group).
 - In a mounted file system (for example, NFS or NAS), locks on the files may not be released after a system crash.
- Because this is usually caused by an operating-system bug, you should first ask the system administrator to investigate.



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Quiz

What is a DiscardFile *not* used for?

- a. As a file to which Extract writes rejected record data
- b. As a file to which Replicat writes rejected record data
- c. For replacing a trail file on the target system



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Answer: c

Practice 9 Overview: The Filled Files

The practice for this lesson covers solving trail maintenance issues.



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Summary

In this lesson, you should have learned how to troubleshoot the following:

- SQLLEXEC problems
- File-maintenance problems
- Other problems, including:
 - Time differences
 - Indexes unusable
 - Too many open cursors



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10

Classic Performance Tuning

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Objectives

After completing this lesson, you should be able to:

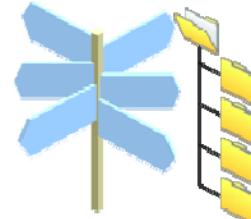
- Identify the causes of slow startups
- Monitor lag and statistics
- Tune Manager
- Identify network and disk bottlenecks
- Tune Extract
- Tune Replicat



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Roadmap

- Startup speed
 - Building object records
 - Wildcards
- Monitoring lag and statistics
- Bottlenecks
- Manager
- Classic Extract
- Classic Replicat



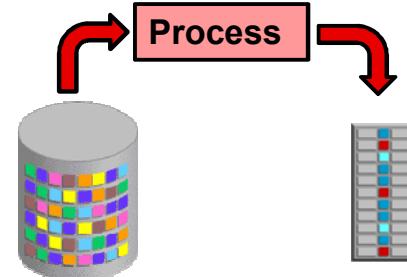
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Startup Speed: Building the Object Record

Problem

- When a process starts, it queries the database system tables to retrieve table metadata and builds a structure in the memory.
- Analyzing many tables takes time.



Solution

- The `DynamicResolution` parameter adds the tables' attributes to the object record the first time its object ID enters the transaction log.
- This defers record building for other tables until any activity occurs, thus speeding up startup.

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`DynamicResolution` is an Extract and Replicat parameter that causes the object record to be built one table at a time, instead of all at once when a process starts.

A table's attributes are added to the record the first time its object ID enters the transaction log, which occurs with the first extracted transaction on that table. Record building for other tables is deferred until activity occurs.

`DynamicResolution` is the same as `WildcardResolve Dynamic`.

`NoDynamicResolution` causes the object record to be built at startup.

This option is not supported for Teradata.

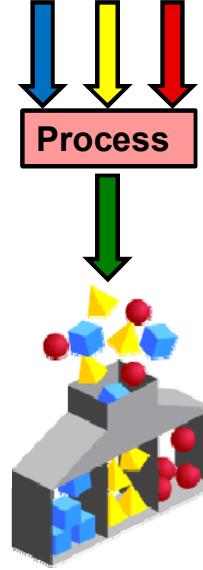
Syntax:

```
DynamicResolution
```

Startup Speed: Building the Object Record

Explicit:

- HR . DEPTS 
- HR . EMPS



Wildcards:

- HR . AREA*
- Resolves to HR . AREA51 
- SALES.*
- Resolves to SALES . 1999
- Resolves to SALES . 2000 
- Resolves to SALES . 2001

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You can have fully qualified object names, or names with wildcards. You cannot use a wildcard as part of the schema name.

When building the object record:

- An array is created in memory to hold the metadata
- Information for explicitly named tables (for example, HR . EMP) is added at startup
- Resolving wildcarded tables (for example, HR . *) can cause slow startup but reduces problems later
- DynamicResolution builds out the columns only when a table is used
- You use immediate resolution for initial loads that use SourceIsTable with wildcards. Otherwise, SourceIsTable does not resolve.

Startup Speed: Resolving Wildcards

When you have a large number of tables in wildcarded Table or Map statements, the way wildcards are resolved affects performance.

Solution

- You must expand Wildcards to create lists of included tables.
- Control when this happens by using the following setting:
WildcardResolve [Immediate | Dynamic | Both]
- Use the `WildcardResolve Dynamic` option in the parameter file to speed startup.
 - Source tables that satisfy wildcard definitions are resolved each time the wildcard rule is satisfied, instead of all at once at startup.



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With `WildcardResolve Immediate`, source tables that satisfy the wildcard definition are processed at startup.

With `WildcardResolve Dynamic`, source tables that satisfy the wildcard definition are resolved each time the wildcard rule is satisfied. Do not use this option. Instead, use the `Both` option in the following situations:

- The `SourceIsTable` is specified.
- Some source tables are specified with wildcards while others are specified with explicit names.

`WildcardResolve Both` combines `Dynamic` resolution and `Immediate` resolution.

Source tables that are defined by name are processed at startup (`Immediate`).

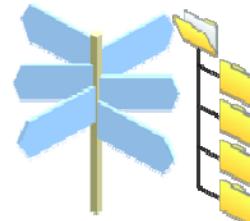
Wildcarded source tables are processed when GoldenGate receives the first operation on them (`Dynamic`). This allows new source tables (that satisfy the wildcard) to be added after processing starts.

Syntax:

```
WildcardResolve Dynamic
```

Roadmap

- Startup speed
- Monitoring lag and statistics
 - Lag
 - Statistics
- Bottlenecks
- Manager
- Classic Extract
- Classic Replicat



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Monitoring: Overview

Low volume and too much lag indicate that Oracle GoldenGate may need tuning.

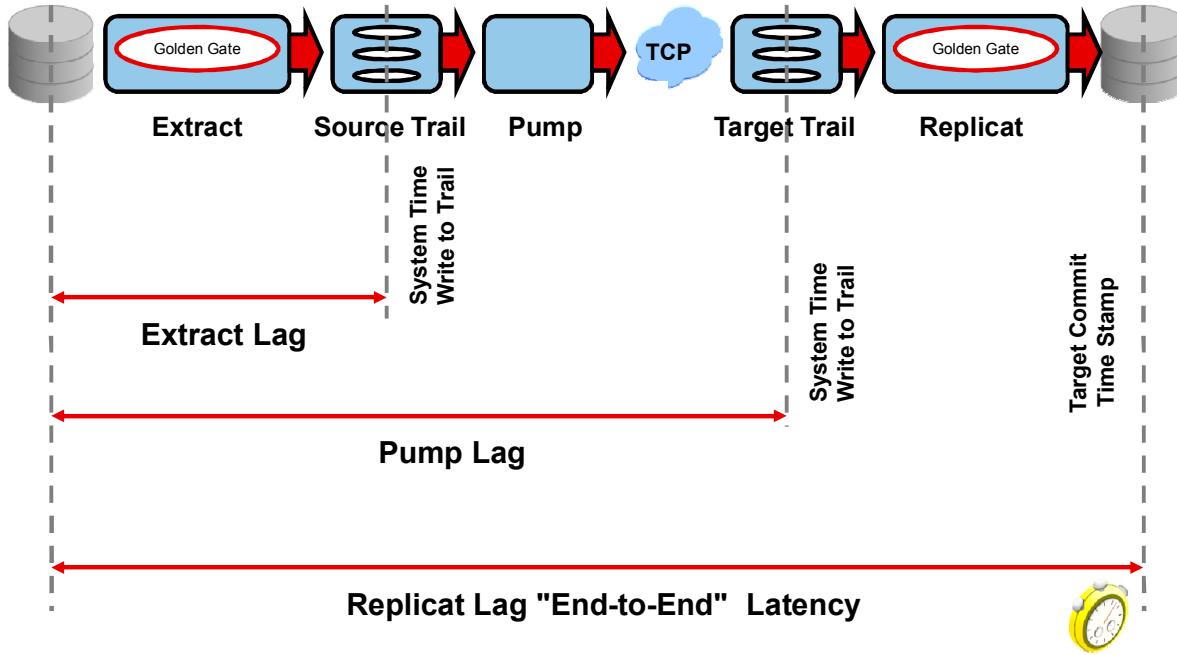
- Regularly monitor lag and processing volume of extraction and replication.
 - Continuous excess lag usually indicates a bottleneck in one or both processes.
- Compare Extract's processing volume with Replicat's volume.
 - Extract is usually faster because Replicat must construct and apply SQL statements. In time, you should learn whether the difference is normal or whether it indicates that tuning is required.



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Look for lag that remains constant or is growing, as opposed to occasional spikes. Lag can indicate an error condition (which is covered in the lesson titled “Mapping and Synchronization Problems”) or a normal condition that requires only tuning.

Monitoring: What Is Lag?



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- **Lag:** Is the *Extract lag* in the diagram in the slide. It is the difference in time between when a change record is processed by Extract (written to the trail) and when the time stamp of that record is committed in the target database.
- **Latency:** Is the *Replicat lag* in the diagram. It is the difference in time between when a change is made to source data and when that change is reflected in the target data.

Monitoring: Lag Time Differences

Is the lag report inaccurate?

- Lag is always accurate in absolute terms, but it may appear to be inaccurate because of differences in the system time on the source and target machines.
- Use the `TCPSourceTimer` parameter to reflect a more accurate lag result.



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If you are using a user token that refers to `GGHEADER` or `COMMITTIMESTAMP` of the `@GETENV` column-conversion function, you should not use `NoTCPSourceTimer` to retain the original time stamp value. If you do use `NoTCPSourceTimer`, the actual time stamp stored in the trail header is adjusted when `TCPSourceTimer` is on.

Monitoring: Checking Lag Statistics

To view lag, use the Send or Lag commands:

```
GGSCI> Send {Extract|Replicat} {<group/wildcard>},  
GetLag
```

Or...

```
GGSCI> Lag {Extract| Replicat|ER} {<group/wildcard>}
```

You can also use the Info, Detail command to view lag:

- Is not as accurate as the Send and Lag commands
- Provides additional information such as checkpoint positions, process status, and working directories

```
GGSCI> Info {Extract|Replicat|ER} {<group/wildcard>},  
Detail
```



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Examples

```
GGSCI 12> Lag Replicat *
```

Sending GETLAG request to REPLICAT ORAREP...

No records yet processed.

At EOF, no more records to process.

```
Sending GETLAG request to REPLICAT REPORA2...
```

Last record lag: 7 seconds.

At EOF, no more records to process.

GGSCI 13> **Lag ER ***

Sending GETLAG request to EXTRACT ORAEXT2...
Last record lag: 1 second.
At EOF, no more records to process.

Sending GETLAG request to REPLICAT ORAREP...
No records yet processed.
At EOF, no more records to process.

Sending GETLAG request to REPLICAT REPORA2...
Last record lag: 7 seconds.
At EOF, no more records to process

Monitoring: Controlling How Lag Is Reported

Manager parameters control how lag is checked and reported.

- `LagReportMinutes` and `LagReportHours` specify the interval at which Manager checks for Extract and Replicat lag
- `LagCriticalSeconds`, `LagCriticalMinutes`, and `LagCriticalHours` specify a “critical” lag threshold that forces a warning message to the error log when reached.
- `LagInfoSeconds`, `LagInfoMinutes`, and `LagInfoHours` specify how often to report lag information to the error log.



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`LagCritical` parameter syntax (Manager parameter file):

```
LagCriticalSection <seconds> | LagCriticalMinutes <minutes>  
| LagCriticalHours <hours>
```

`LagReport` parameter syntax (Manager parameter file):

```
LagReportMinutes <minutes> | LagReportHours <hours>
```

`LagInfo` parameter syntax (Manager parameter file):

```
LagInfoSeconds <seconds> | LagInfoMinutes <minutes> |  
LagInfoHours <hours>
```

The `LagCritical` setting affects all Extract and Replicat processes on the local system.

`LagInfo`: Value of zero (0) forces a message at the frequency specified with `LagReportMinutes` or `LagReportHours`. If the lag is greater than the value specified with one of the `LagCritical` parameters, Manager reports the lag as critical; otherwise, it reports the lag as an informational message.

The shorter interval for monitoring lag at initial implementation can be lengthened after the system is up.

Monitoring: Checking Volume Statistics

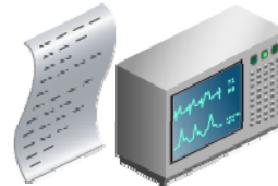
You can check volume statistics by doing the following:

- Using Report or ReportCount parameters
- Using the Stats command
- Generating reports on demand with commands:

```
GGSCI> Send [ Extract | Replicat ] <group>, Report
```

- Viewing reports and the history of reports:

```
GGSCI> View Report <group>
GGSCI> View Report <group>[n]
GGSCI> View Report <filename>
```



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Monitoring: Using the Report parameter

- The Report parameter generates report statistics.
- The results are printed to the report file.
- You can schedule the counts at regular intervals or on specific days of the week at specific times of the day.

Syntax:

```
:  
Report {At <hh:mi> / On <day> / At <hh:mi> On <day>}  
:
```



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Report is valid for Extract and Replicat.

Use Report to specify when Extract or Replicat generates interim runtime statistics in a process report. The statistics are added to the existing report. By default, runtime statistics are displayed at the end of a run unless you intentionally kill the process.

The statistics for Report are carried over from the previous report. For example, if the process performed 10 million inserts one day and 20 million the next, and if a report is generated at 3:00 each day, the first report would show the first 10 million inserts, and the second report would show those inserts *plus* the current day's 20 million inserts, for a total of 30 million.

To reset the statistics when a new report is generated, use the StatOptions parameter with the ResetReportStats option.

Monitoring: Using ReportCount

- The ReportCount parameter generates a count of the records that have been processed since Extract or Replicat started.
- The results are printed to the report file.
- You can schedule the counts at regular intervals or after a specific number of records.

Syntax:

```
:  
ReportCount [Every] <count>  
{Records | Seconds | Minutes | Hours} [, Rate]  
:
```



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Records | Seconds | Minutes | Hours: The unit of measure for <count>, in terms of records, is seconds, minutes, or hours.

Rate: Reports the number of operations per second and the change in rate as a measurement of performance. The “rate” statistic is the total number of records divided by the total time elapsed since the process started. The “delta” statistic is the number of records since the last report divided by the time since the last report.

Note: The calculations are done using microsecond time granularity. The time intervals are shown without fractional seconds, and the rate values are shown as whole numbers.

The best results are obtained using Minutes or Hours and Rate.

Monitoring: Using the Stats Command

- To view the volume of records being processed, with an option to filter by table name, use the Stats command:

```
GGSCI> Stats {Extract|Replicat|ER}  
      {<group/wildcard>} [Table <name/wildcard>]
```

- The basic Stats command shows the number of processed operations by type for each table.
 - Statistics are shown for the following periods:
 - Since the process started
 - By the hour
 - By the day
 - The latest statistics



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Using the Stats Command: Example

This example is for Extract. These statistics are repeated for each table but are omitted from the example for all tables except one (due to space constraints).

```
GGSCI > Stats Extract oraext  
Sending Stats request to EXTRACT ORAEXT...  
Start of Statistics at 2014-03-08 16:94:38.  
Output to /home/goldengate802/dirdat/xx:  
Extracting from HR.EMPLOYEES to HR.EMPLOYEES:  
  
*** Total statistics since 2014-03-08 16:35:05 ***  
Total inserts          704.00  
Total updates          0.00  
Total deletes          160.00  
Total discards         0.00  
Total operations       864.00
```

```
*** Daily statistics since 2014-03-08 16:35:05 ***
      Total inserts 704.00
      Total updates 0.00
      Total deletes 160.00
      Total discards 0.00
      Total operations 864.00
*** Hourly statistics since 2014-03-08 16:35:05 ***
      Total inserts 704.00
      Total updates 0.00
      Total deletes 160.00
      Total discards 0.00
      Total operations 864.00
*** Latest statistics since 2014-03-08 16:35:05 ***
      Total inserts 704.00
      Total updates 0.00
      Total deletes 160.00
      Total discards 0.00
      Total operations 864.00
```

Monitoring: Using the Stats Command

Stats <option> enables filtering of the information:

```
Stats {Extract|Replicat|ER} {<group/wildcard>},  
      <option>
```

- View processing rate (instead of absolute numbers):

```
ReportRate {Hr|Min|Sec}
```

- View summary of operations for a table since startup:

```
TotalsOnly <table>
```

- Limit output to one or more statistics:

```
{Total | Daily | Hourly | Latest}
```

- Clear all filters that were set with previous options:

```
Reset
```



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Stats...ReportRate

```
*** Latest statistics since 2014-03-08 16:35:05 ***  
      Total inserts/hour:      718.39  
      Total updates/hour:      0.00  
      Total deletes/hour:      0.00  
      Total discards/hour:     0.00  
      Total operations/hour:   718.39
```

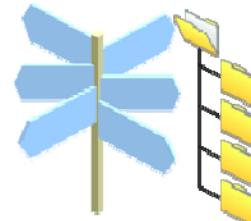
```
Stats...TotalsOnly <table>
  Start of Statistics at 2014-03-08 17:06:93.
  Output to /home/goldengate802/dirdat/xx:
  Cumulative totals for specified table(s):
  *** Total statistics since 2006-03-08 16:35:05 ***
    Total inserts 352.00
    Total updates 0.00
    Total deletes 0.00
    Total discards 0.00
    Total operations 352.00
    Stats...TotalsOnly <table>
  *** Daily statistics since 2014-03-08 16:35:05 ***
    Total inserts 352.00
    Total updates 0.00
    Total deletes 0.00
    Total discards 0.00
    Total operations 352.00
  Extracting from HR.LOCATIONS to HR.LOCATIONS:
  *** Latest statistics since 2014-03-08 16:35:05 ***
    No database operations have been performed.
```

Stats...LATEST

```
Start of Statistics at 2014-03-08 17:18:23.  
Output to /home/goldengate802/dirdat/xx:  
Extracting from HR.EMPLOYEES to HR.EMPLOYEES:  
*** Latest statistics since 2006-03-08 16:35:05 ***  
      Total inserts      704.00  
      Total updates       0.00  
      Total deletes      160.00  
      Total discards       0.00  
      Total operations   864.00  
Extracting from HR.DEPARTMENTS to HR.DEPARTMENTS:  
*** Latest statistics since 2006-03-08 16:35:05 ***  
      Total inserts      352.00  
      Total updates       0.00  
      Total deletes       0.00  
      Total discards       0.00  
      Total operations   352.00
```

Roadmap

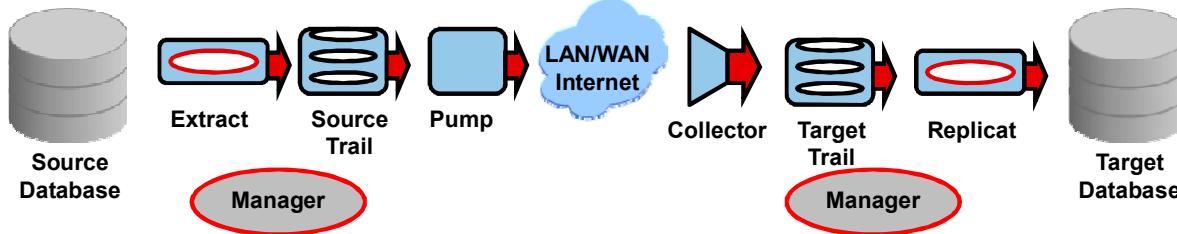
- Startup speed
- Monitoring lag and statistics
- Bottlenecks
 - Identification
 - Checkpoints
 - Network
 - Disks
- Manager
- Classic Extract
- Classic Replicat



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Identifying Bottlenecks



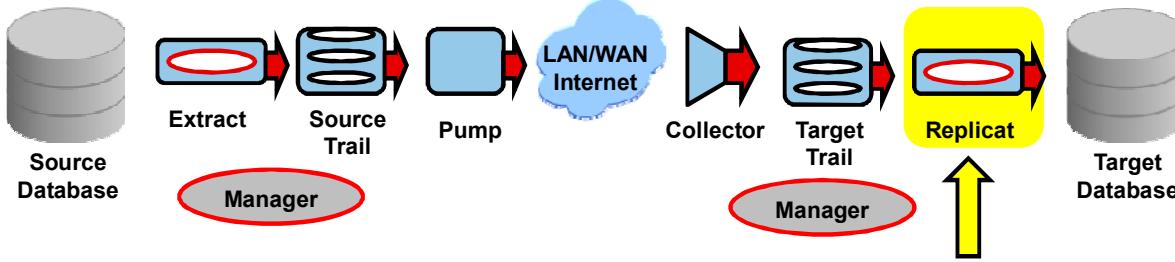
First, determine if there is a bottleneck.

- Monitor lag by working from the target back to the source.

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Identifying Bottlenecks: Replicat Lag



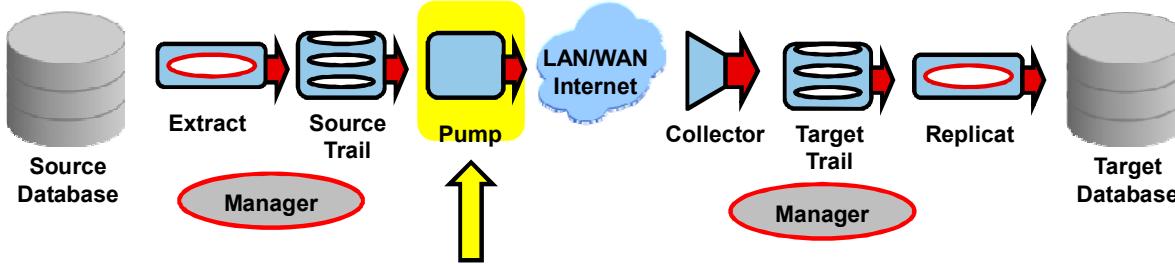
First, determine if there is a bottleneck.

- Monitor lag by working from the target back to the source.
 - If the lag (latency) in Replicat is acceptable, all is well.

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Identifying Bottlenecks: Pump Lag



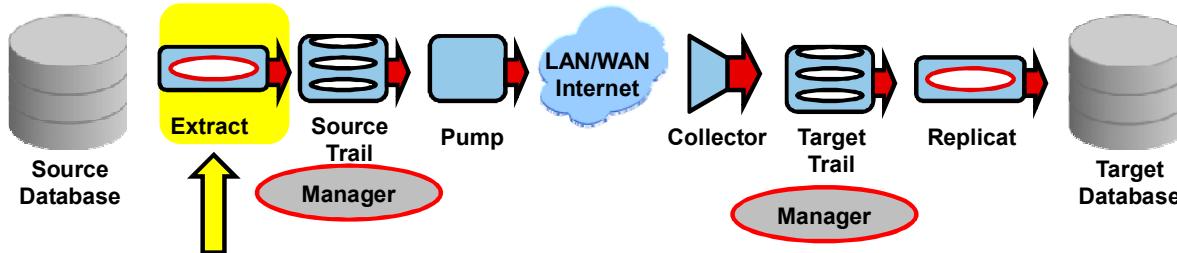
First, determine if there is a bottleneck.

- Monitor lag by working from the target back to the source.
 - If the lag (latency) in Replicat is acceptable, all is well.
 - If there is lag in Replicat, check for lag in the pump.

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Identifying Bottlenecks: Extract Lag



First, determine if there is a bottleneck.

- Monitor lag by working from the target back to the source.
 - If the lag (latency) in Replicat is acceptable, all is well.
 - If there is lag in Replicat, check for lag in the pump.
 - If there is lag in the pump, check for lag in Extract.
 - If there is lag in Extract, start there.
- Throughput statistics are also useful for identifying potential bottlenecks.

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Bottlenecks: Determining Lag (Latency)

- Lag calculation:

```
lag = current_time - operation_time_stamp, where:  
Operation_time_stamp =  
transaction_commit_time_stamp
```

 - When sending data over a network, the operation's time stamp is adjusted by default for system clock differences.
- Determining lag by using GGSCI:
 - Lag command, or GetLag option of the Send command:
 - Shows the current lag at the time the command is issued
 - Info command:
 - Shows the checkpoint lag, which is the lag at the time of the last checkpoint
- Some users monitor lag by injecting “heartbeat” records into the data stream.



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See the description of TCPSourceTimer/NoTCPSourceTimer in *Oracle GoldenGate Windows and UNIX Reference Guide* for information about operation time stamp adjustment over a network.

Lag/GetLag command syntax in GGSCI:

```
Lag {Extract | Replicat | ER {<group | wildcard>}}  
Send {Extract | Replicat | ER {<group | wildcard>}}, GetLag
```

Info command syntax in GGSCI:

```
Info {Extract | Replicat | ER {<group | wildcard>}}
```

Bottlenecks: Determining Lag by Looking at Checkpoints

- To view the Extract checkpoint in the trail, issue this command:

```
GGSCI> Info Extract <group>, ShowCh
```
- Look at the Output checkpoint statistic.
 - Extract is having trouble sending data across the network if:
 - The number of output checkpoints is not incremental (indicated by the numerical value assigned to each one)
 - It is increasing too slowly
 - If you use a data pump on the source system, issuing Info Extract for both processes (primary and pump) shows that:
 - The primary Extract's checkpoints are moving because the Extract writes to a local trail
 - The pump's checkpoints are not being incremented because the data pump Extract writes to a remote trail



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Output Checkpoint Statistic

```
Output Checkpoint #10
  GGS Log Trail
  Next Checkpoint:
  Sequence #: 0
  RBA: 32516
  Time stamp: 2014-03-08 16:03:03.333000
  Is File?: 0
  Extract Trail: /home/goldengate802/dirdat/xx
```

Bottlenecks: Determining Lag by Looking at Checkpoints

- Issue Info Extract and Info Replicat with the Detail option:

```
GGSCI> Info Extract <group>, Detail
GGSCI> Info Replicat <group>, Detail
```
- If Replicat is running and there are no problems with the trail files, compare Extract's write point with Replicat's read point.
 - Info Replicat may show continued processing up to the last record written to the trail file (the read RBA continues increasing). Then Replicat stops because no more records arrive across the network.
 - The primary Extract continues writing to the local trail files until it reaches the last one in the sequence. Then, because it is no longer able to checkpoint, it abends.



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Checkpoint Comparison

From Info Extract:

```
Remote Trail Name Seqno RBA Max MB
/home/gg802/dirdat/xx 1 3251 10
```

From Info Replicat:

```
Log Read Checkpoint File /home/GG802/DIRDAT/XX000001
2014-03-08 16:91:58.000000 RBA 260128
```

Bottlenecks: Monitoring Lag (Latency)

- Manager can also be configured to monitor lags and report any thresholds that are exceeded.
- Is lag always an indicator of a performance problem?
 - Were any of the processes stopped for maintenance or for other reasons?
 - Consider a large batch transaction with 1 million operations.
 - Continuous excessive lag does indicate a bottleneck.



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Handling Large Transactions

- GoldenGate Capture will buffer large transactions until the transaction is committed to preserve commit order in the output trail (queue).
- If it takes a few minutes to output the transaction, the lag for the last records that are output will reflect the length of time it takes to output the entire transaction.
- After the large transaction is completely processed, the lag should quickly return to normal levels.

Bottlenecks: Measuring Throughput

In addition to lag, throughput statistics can help isolate bottlenecks.

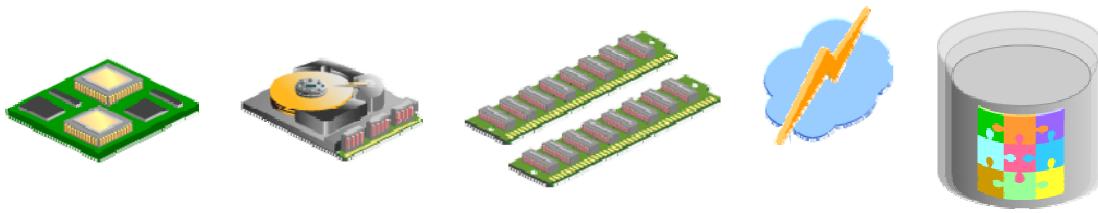
- ReportCount
 - This parameter outputs record counts to the report file at predefined intervals.
 - The Rate option shows the cumulative rate since process startup, as well as the delta from the prior interval.
 - Rate fluctuations can help identify bottlenecks.
- Stats
 - Retrieves point-in-time throughput statistics
 - Can be reset to measure specific intervals



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Bottlenecks: Finding the Cause

After using lag and throughput information to identify the potential bottleneck, you must determine the *reason* that the process or resource is causing a bottleneck.



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Possible bottleneck sites:

- CPU
- Disk I/O
- Memory or paging
- Network
- Database access

Bottlenecks: Uncovering a Network Bottleneck

- To check the network's health, use a network diagnostic tool or contact your network administrator.
 - If the problem is within the network itself, wait for the problem to be resolved and then see if GoldenGate's performance improves.
- If the network is performing as designed, check the following:
 - What is the per-process bandwidth?
 - Has Extract used its share of bandwidth?
 - If Extract has used its share, the solutions offered in the following slides can help.



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Bottlenecks: Network Bottleneck Solution

- If you are running one Extract process, try splitting the processing among multiple groups to gain bandwidth.
 - You can also use multiple data pumps. This helps reduce the chance that Extract will abend if the network is unreliable and goes down intermittently for short periods.
- Try increasing the value of the `FlushSecs` Extract parameter or the value of the `RmtHost` parameter's `TCPFlushBytes` option.
 - Both of these parameters control the point at which Extract flushes data from its buffer to the target (based on a time or size threshold).
- Try increasing the value of the `TCPBufSize` option of `RmtHost`.



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Tables with referential integrity to one another should be processed by the same process group.

An increased value for the `FlushSecs` or `TCPFlushBytes` parameters might allow more efficient use of the network, but the benefit must be balanced with the risk of increased latency of the target data if activity on the source is low and the buffer has not been flushed.

TCP Parameters

`TCPFlushBytes` and `TCPBufSize` should be used only for online processes and not for initial load configurations. Work with your network administrator to find a suitable value for `TCPBufSize`.

`TCPBufSize` in `RmtHost` controls the size of the TCP socket buffer. The default is 30,000 bytes. But modern network configurations usually support larger buffers, which can help with network utilization.

You can use the following formula as a guideline for further experimentation to determine the optimum buffer size for your network. First, use the ping command from the operating system's command shell to obtain the average round-trip time (RTT):

```
/home/ggs> ping ggsoftware.com
Pinging ggsoftware.com [192.168.116.171] with 32 bytes of data:
Reply from 192.168.116.171: bytes=32 time=31ms TTL=56
Reply from 192.168.116.171: bytes=32 time=61ms TTL=56
Reply from 192.168.116.171: bytes=32 time=32ms TTL=56
Reply from 192.168.116.171: bytes=32 time=39ms TTL=56
Ping statistics for 192.168.116.171:
    Packets: Sent = 9, Received = 9, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 31ms, Maximum = 61ms, Average = 39ms
```

Multiply that value by the network bandwidth. For example, if the RTT is 0.08 seconds and the bandwidth is 100 Mbps (megabits per second), the optimum buffer size is calculated as follows:

$$0.08 \times 100\text{Mbps} = 8 \text{ Mbps}$$

Divide the result by 8 to determine the number of bytes (there are eight bits to a byte). For example, the preceding sample result translates to 1 MB per second; therefore, you would set TCPBufSize to a value of 1000000 (as specified in bytes).

Note: The maximum socket buffer size (for non-Windows systems) is usually limited by default. Ask your system administrator to increase the default value on the source and target systems so that Oracle GoldenGate can increase the buffer size configured with TCPBufSize.

Performance improvements are seen only when the target Oracle GoldenGate version is 8.0.9 or later. For more information, see the *Oracle GoldenGate Windows and UNIX Reference Guide*.

Bottlenecks: Network Bottleneck Solution

To prevent Extract from abending if the network goes down for a short period, you can change the Extract CacheMgr settings (with assistance from Oracle Support).

- This parameter controls the amount of memory that Extract uses to hold transactions.
- When more memory is allocated to Extract, longer network outages can be tolerated.



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Bottlenecks: Disk Reads

Performance can be affected by reads of the transaction logs or trail files.

Solution

- `EOFDelay` and `EOFDelayCSecs` control how often Extract reads transaction logs or the trail files (if a data pump is used).
- `EOFDelay` and `EOFDelayCSecs` control how often Replicat reads the trail files.
- Increasing the parameter value reduces read frequency and thus reduces overhead.
- `EOFDelay` of five seconds reduces contention with the log writer and enables Extract to read full buffers.



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`EOFDelay` parameter syntax (Extract and Replicat parameter file):

- `EOFDelay <seconds>`
- `EOFDelayCSecs <centiseconds>`

The default is 1 second.

You can also use `ThreadOptions EOFDelayMs` to specify how long the Extract process delays after it reaches the logical end of a redo log before searching for more data to process. The default is 250 milliseconds. Increasing the value can increase the lag between the time when the changes are made to the source tables and when they are applied to the target tables.

Note: Depending on how high you set these parameters, target latency may increase.

Bottlenecks: Disk Reads Solutions

- Ensure that Extract has optimal transaction log access.
 - Make sure that archive logs are on a separate disk.
 - If the database uses multiple online logs, make sure that each log is on its own disk.
- Configure Extract to use separate threads for “producer” and “consumer” (currently available for Oracle databases only).



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For Oracle databases, high log-write sync times are an indicator of disk contention on the logs.

The `Threads 1` option can be used to enable the “producer” thread to read concurrently with the “consumer” in an Oracle Database non-RAC environment.

The `Threads 1` command syntax in GGSCI is as follows:

```
Add Extract {group}, TranLog, Threads 1, Begin Now
```

Note: This configuration should be used only when necessary. It might require additional memory for the process.

Bottlenecks: Disk Writes

Performance can be affected by writes to trail files when persisting captured data or forcing checkpoints.

Solution

- At the OS level, look for I/O waits on disk subsystems containing the trails.
 - Put the trails on the fastest disk controller that is available.
- Check the RAID configuration.
 - Because Oracle GoldenGate writes data sequentially, RAID 0+1 (striping and mirroring) is a better choice than RAID-5, which uses checksums that slow down I/O and are not necessary for these types of files.



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Bottlenecks: Disk Writes

If disk I/O cannot be improved at the system level, you can do the following:

- **Adjust CheckpointSecs for Extract or Replicat.**
 - Each checkpoint requires a flush of all buffers and a sync to disk, so you should decrease the checkpoint frequency of the affected process.
- **Use GroupTransOps for Replicat.**
 - This controls how many operations are grouped into one transaction and reduces the number of checkpoints
- **Use CompressDeletes and CompressUpdates.**
 - This significantly reduces trail size.



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GroupTransOps

Because Replicat writes a checkpoint after it commits a transaction, increasing GroupTransOps reduces the number of checkpoints that are required. The benefits of using this parameter must be weighed against the fact that more data must be reprocessed if the process fails. This can increase the latency of target data, so you should avoid setting GroupTransOps to an arbitrarily high number.

CompressDeletes Extract Parameter

CompressDeletes/NoCompressDeletes :

- Writes only the key column data to the trail
- Is enabled by default
- Can be specified globally or at the Map/Table level

Bottlenecks: Disk Writes

Is Extract writing multiple trails?

- Use one or more data pumps to decouple writes.
- Use multiple processes to write in parallel (rather than round robin).

Adjust FlushSecs to make sure that each write is for a full buffer.

- You should also consider buffer size.



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CompressUpdates **Extract Parameter**

CompressUpdates writes only the key-column data plus the changed column values to the trail. This parameter is more important for databases in which the transaction log contains the entire row image:

- **Oracle Database:** Only changed columns
- **DB2, SQL Server, Sybase, SQL/MX, Teradata:** All columns

The CompressUpdates parameter is not supported on NSK, but GetNETCHANGES can be used if AUDITCompress is not enabled for the audit log.

FlushSecs Parameter Syntax (Extract and Replicat Parameter Files)

FlushSecs <seconds>

FlushCSecs <centiseconds>

- FlushSecs defaults to 1 second.
- Consider buffer size as well. The default is 30000 bytes.
- This parameter does not usually have a significant impact.

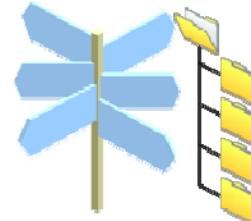
CheckpointSecs Parameter Syntax (Extract and Replicat Parameter Files)

CheckpointSecs <seconds>

- CheckpointSecs defaults to 10 seconds.
- This parameter does not usually have a significant impact unless it is set too low.

Roadmap

- Startup speed
- Monitoring lag and statistics
- Bottlenecks
- Manager
- Classic Extract
- Classic Replicat

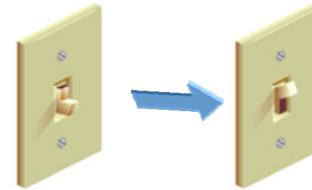


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Tuning Manager

- You can tune Manager to restart processes that terminate abnormally.
- Manager ensures that processing starts again promptly without user intervention after a problem is fixed.
- Use the AutoRestart Manager parameter.
- Other Manager parameters for controlling the start of processes include:
 - Autostart
 - BootDelayMinutes



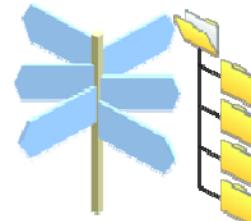
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- **AutoRestart:** If the database goes down, for example, autorestarting ensures that GoldenGate processes start again after recovery. You can use multiple AutoRestart statements for different processes to set startup rules and retry attempts.
- **Autostart:** Starts processes when Manager starts. It can be useful at system boot time to start data synchronization immediately.
- **BootDelayMinutes:** Delays Manager start-of-processing activities for Windows systems. This is useful during system startup (for example, when database services must be started before you start Oracle GoldenGate processes).

Roadmap

- Startup speed
- Monitoring lag and statistics
- Bottlenecks
- Manager
- Classic Extract
 - Logs
 - Data pump
- Classic Replicat



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Tuning Extract: Filtering and Conversion

Data filtering and data conversion can cause performance degradation because extra work is required.

Solution

- Use Replicat or a data pump to perform filtering and conversion.
 - This leaves Extract free to keep up with transaction log volume.
 - The pump or Replicat can be stopped and started to make configuration changes when needed, with less risk of missing transaction data.
- Use parallel pumps or Replicats.
 - Use them for different tables to accelerate processing.
 - Use them for different target systems.
- Less-optimal solution: Divide filtering and conversion work between Extract and Replicat.



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Tables that have referential integrity to one another should be kept in the same process group.

To remove the overhead from the source system, you can use data pumps on an intermediate system or the target system. However, this may not be the best option when the data pump is performing filtering because it means that more data is sent over the network. (Data is sent before it is filtered.)

Tuning Extract: Database Fetching

When data must be fetched, Extract's performance is affected because data that is fetched uses native calls.

Solution

- Identify tables that generate fetches, generate long transactions, or use SQL procedures that fetch data.
 - Separate them into one or more Extract groups.
 - Keep tables with relational constraints to each other in the same group.
- You may need multiple Extract groups for each large table with a heavy LOB volume .
 - Use the `@RANGE` function to divide the load in a safe and scalable manner.
- Using multiple Extracts requires multiple trails.
 - Use one data pump (if one is currently defined) and one Replicat for each Extract.



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Fetches are required, for example, when an operation involves LOB data or when the values are not present in the transaction log. In addition, long columns, user-defined types, and XML types can cause fetches. If rows in a transaction are updated multiple times, Extract slows down if data must be fetched from the undo space. Fetching requires that Oracle Database do more work to scan for the correct snapshot.

Isolating problem tables prevents them from slowing down extraction for the rest of the tables.

Use the following Oracle Database query to check for LOB data types:

```
SELECT owner, table_name, column_name
FROM dba_tab_columns
WHERE data_type IN ('CLOB', 'BLOB');
```

Use the following Oracle Database query to check for outstanding transactions:

```
set pagesize 95
col rbs_seg format a8
col username format a10
col machine format a25
col 'OBJ FL BLK ROW' format a20
col OBJECT_NAME format a35
col owner format a15
set linesize 200
col program format a20
SELECT tb.owner, tb.object_name, vs.username, vs.program,
       vs.machine, vt.used_ublk, vt.start_time,
       TO_CHAR(SYSDATE, 'MM-DD-YYYY HH24:MI:SS'), vs.ROW_WAIT_OBJ#,
       vs.sid, vs.serial#
FROM v$transaction vt, v$session vs, dba_objects tb
WHERE vt.addr = vs.taddr AND vs.ROW_WAIT_OBJ# = tb.object_ID
ORDER BY start_time;
```

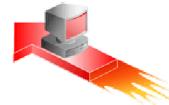
Tuning Extract: Log Reads

When Oracle GoldenGate captures from the transaction logs, I/O bottlenecks can occur because Extract is reading—and the database is writing to—the same files.

- This is more noticeable when multiple Extracts read the same logs.

Solution

- Faster drives and controller
 - A faster I/O system results in faster Extract and Oracle log writer transaction processing.
- Check whether the logs are on RAID-5 devices.
 - RAID 0+1 is recommended.



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RAID-5 performs checksums on every block that is written. This is fine for random access, but it is not a good choice for high levels of continuous I/O. Oracle makes the following recommendation (this information is an excerpt from Oracle Technology Network):

What are the differences between RAID-5 and RAID 0+1? Which implementation is better? RAID-5 means both data and parity information are striped across a number of disk drives, and the parity information usually requires an additional 10% to 25% of storage capacity (to protect the actual data). RAID-5 is usually good for read-intensive applications but not for write-intensive applications. RAID 0+1 means the data is striped across a set of disk drives, and the entire set of disks is mirrored. So there are always two sets of data or an additional 100% of storage capacity (to protect the actual data).

Both RAID-5 and RAID 0+1 protect the data from a disk failure. RAID 0+1 usually provides better overall performance than RAID-5, but it costs more than RAID-5.

Note: For more information, see the appropriate documentation or search related websites.

Tuning Extract: Databases

- Adjusting cursors
 - Extract maintains cursors for SQLLEXEC operations and for queries that fetch data.
 - If Extract does not have enough cursors, it must age more statements.
 - To adjust the number of cursors that Extract can open, use the MaxFetchStatements parameter.
- Preventing the search for archive logs
 - Windows file management makes Extract read archived logs faster than it reads online logs. So, by default, Extract searches for archived logs.
 - If archive logging is not enabled, use the TranLogOptions NoOpenArchiveImmediate option to prevent Extract from searching for nonexistent archives.



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When using MaxFetchStatements, you might also need to adjust the number of open cursors that are permitted at the database level.

With archive logs in Windows, Extract uses the online log if it does not find the data it needs in an archive log.

Tuning Extract: Data Pump

Pass-through mode

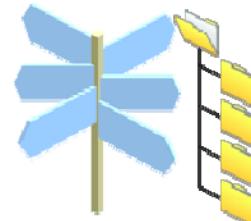
- Choose this mode if no conversion or filtering is used. It is faster because it bypasses the functionality that looks up table definitions.
 - Use the `Passthru` parameter in the pump's parameter file.
 - Omit the `SourceDB`, `USERID`, and `Password` parameters.
- You can use a pass-through pump on the following:
 - The source
 - An intermediary system that has no database
- To combine pass-through mode with normal processing, toggle the `Passthru` parameter with `NoPassthru`.
 - One parameter will remain in effect for subsequent Map statements and trails until the other is encountered.



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Roadmap

- Startup speed
- Monitoring lag and statistics
- Bottlenecks
- Manager
- Classic Extract
- **Classic Replicat**
 - Dividing the load
 - Transaction type
 - Database



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Tuning Classic Replicat: Dividing the Load

Replication is a single-threaded process that applies operations one at a time by using regular SQL. As a result, it can cause a performance bottleneck.

Solution

- Divide the load into multiple Replicat groups that work in parallel.
- Try splitting the load by schema.
- You might need more groups to isolate tables in a schema.
 - Use logdump's TransHist and Count commands to find tables with long-running transactions, heavy volume, LOB data, or other transactions that interrupt normal processing.
 - Keep tables with relational constraints in the same group.
 - Try using a different group for each table.



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- Use TransHist to set the size of the history table that tracks transaction size.
- Use either TransRecLimit or TransByteLimit to set a boundary for what is considered a normal-sized transaction.
- Use the Count command to display statistics on transaction size:

```
Transactions with at least 100 records or 100000 bytes  
2014/02/01 04:31:29.000.000 00:00:00.000, Seq 0, RBA 13101  
Bytes/Trans ..... 1168167  
Records/Trans ... 1001  
Files/Trans ..... 1  
2014/02/01 04:31:35.000.000 00:00:11.000, Seq 0, RBA  
1205292  
Bytes/Trans ..... 1168167  
Records/Trans ... 1001  
Files/Trans ..... 1
```

- Use Position <RBA> to see which table each of those transactions is for.

The number of supported groups depends on the available memory resources on the system. Each Extract and Replicat process needs approximately 25 MB to 55 MB of memory (or more) depending on the size of the transactions and the number of concurrent transactions.

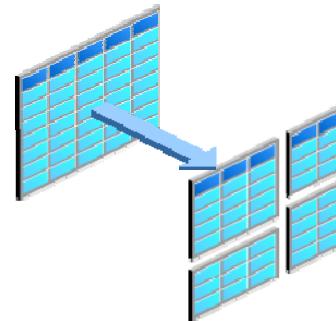
Caution: If you split one table among multiple Replicats, you cannot do DDL replication on that table. You can do only DML replication.

Tuning Classic Replicat: Dividing the Load

You can split a table among multiple groups to perform row operations in parallel.

The @RANGE function:

- Is an easy, safe, and scalable way to divide rows among different processing groups
- Preserves data integrity by guaranteeing that the same row is always processed by the same group



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Use the @RANGE function in a Filter clause to divide the processing workload into multiple groups of data while guaranteeing that the same row is always processed by the same process.

@RANGE computes a hash value of all the columns specified. If no columns are specified, it computes a hash value of the primary key columns of the source table. Oracle GoldenGate adjusts the total number of ranges to optimize the even distribution across the number of specified ranges.

Because any column (and not just the primary key) can be specified, rows in tables with relational constraints to each other should be grouped into the same process or trail to preserve referential integrity.

Using Extract to calculate the ranges is more efficient than using Replicat. Calculating ranges on the target side requires Replicat to read through the whole trail to find the data to meet each range specification.

Note: The new Integrated Replicat that is available with Oracle GoldenGate 12c makes this technique no longer necessary. The @RANGE function should be used with non-Oracle RDBMS databases only.

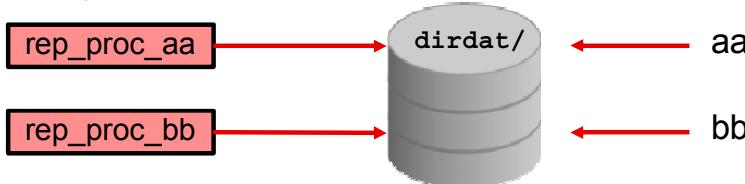
Tuning Classic Replicat: Dividing the Load

Extract is more efficient than Replicat for @Range.

- Configure different trails with the @Range function for Extract.
 - The ordering in the parameter file should look like this:

```
RmtTrail /ggs/dirdat/aa  
Table fin.account, Filter (@RANGE (1, 2));  
RmtTrail /ggs/dirdat/bb  
Table fin.account, Filter (@RANGE (2, 2));
```

- Configure a Replicat process for each of the trails.



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In the following example, the replication workload is divided into three ranges (between three Replicat processes) based on the ID column of the source ACCT table:

- Replicat group 1 parameter file:
Map sales.acct, Target sales.acct, Filter (@RANGE (1, 3, ID));
- Replicat group 2 parameter file:
Map sales.acct, Target sales.acct, Filter (@RANGE (2, 3, ID));
- Replicat group 3 parameter file:
Map sales.acct, Target sales.acct, Filter (@RANGE (3, 3, ID));

Note: For more information about using @RANGE, see the Oracle GoldenGate Windows and UNIX Reference Guide.

Tuning Classic Replicat: Full Table Scans

Target tables without primary keys or unique indexes cause Replicat to use all of the columns in its WHERE clause. This results in a full table scan.

Solution

- If you do not have a primary key or unique index, specify a nonunique index with the KeyCols clause to use as a key.
- In Table and Map statements, use the following syntax to add the KeyCols clause:

— Extract:

```
Table <source_table>,
KeyCols (<column> [, <column>, <column>, ...]);
```

— Replicat:

```
Map <source_table>, Target <target_table>,
KeyCols (<column> [, <column>, <column>, ...]);
```



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Follow these rules:

- To avoid errors, make sure the key contains unique values.
- The column values must be logged to the transaction log or GoldenGate log table (depending on your GoldenGate configuration). For Oracle Database tables using log-based extraction, you can use the GGSCI command Add TranData with the COLS option to set the logging mechanism to include those columns. Otherwise, you can enable logging through the database.
- On the target system, create an index on those columns.

Extract example:

```
Table hr.emp, KeyCols (FIRST_NAME, LAST_NAME, DOB, ID_NO);
```

Replicat example:

```
Map hr.emp, Target hr.emp2,
KeyCols (FIRST_NAME, LAST_NAME, DOB, ID_NO);
```

Tuning Classic Replicat: Transaction Type

Most transactions are small in size, which causes Replicat to commit more frequently and incurs higher disk I/O for checkpoints.

Solution

- Try using the `GroupTransOps` parameter, which does the following:
 - Increases the number of operations in a target transaction
 - Causes Replicat to checkpoint less frequently, which reduces trail I/O
- Try using the `BatchSQL` parameter, which does the following:
 - Batches similar SQL statements into arrays
 - Applies arrays in a single operation, instead of immediately applying each statement



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- **GroupTransOps:** Sets a minimum for the number of records in a transaction. If that value is reached before the commit from the last transaction in the group is received, Replicat waits for the commit before committing its own transaction. Because Extract sends only committed transactions to the target, transactions can be grouped without having to account for source rollbacks.
- **BatchSQL:** Batches together operations containing the same table, operation type, and column list. Each type of statement is prepared once, cached, and then executed many times by using different bind variables. `BatchSQL` can improve performance when row changes are small (about 100 bytes per change). After 5,000 bytes per minute, the benefits diminish.

Note: For more information about `GroupTransOps` and `BatchSQL`, see the *Oracle GoldenGate Windows and UNIX Reference Guide*.

Tuning Classic Replicat: Transaction Type

Large transactions:

- Large transactions are normally handled by Replicat as fast as any other transaction, because operations are applied as they are read from the trail.
- However, the target database may not be configured to handle large transactions.

Solution

- Use the MaxTransOps Replicat parameter to split large source transactions into smaller ones on the target database.
- Example: You can split one million deletes from the source into target transactions of 10,000 deletes with one commit each.



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Tuning Classic Replicat: Checkpoint Frequency

Whenever Replicat writes a checkpoint, it incurs disk I/O.

- Frequent checkpoints speed recovery. But this reduces performance because data is written to the disk more frequently.
- To view Replicat's checkpoints, use the following:

```
GGSCI> Info Replicat <group>, ShowCh
```

Solution

- Decrease the checkpoint frequency by increasing the value of the CheckpointSecs Replicat parameter.
- **Caution:** Doing this can increase the amount of data that must be reprocessed from the trail if Replicat abends, which in turn can increase target latency until Replicat catches up to a normal lag again.



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As a general rule, you should change CheckpointSecs only after consulting Oracle Support.

Tuning Classic Replicat: Database

Replicat uses regular SQL, so its performance partially depends on the performance of the target database and the type of SQL being applied (inserts versus updates or deletes).

- Try using `MaxSQLStatements` to increase cursor allocation:
 - Replicat maintains cursors for caching SQL statements and other uses, such as `SQLExec` operations.
 - If there are not enough cursors, Replicat must age more statements.
- Disk issues can affect replication:
 - Check the system logs and I/O statistics.



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Tuning Classic Replicat: Database

Excessive block fragmentation slows the application of Replicat's SQL statements:

- Reorganize heavily fragmented tables (if possible).
- Then stop and start Replicat to register the new object ID.

Stale database statistics can affect performance as Replicat adds rows to tables:

- Generate new statistics to ensure the use of appropriate execution plans.
- Because stale database statistics can affect replication, you should check the system logs and I/O statistics.



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Quiz

Which parameter can give a more accurate time when you are looking at lag statistics?

- a. DynamicResolution
- b. TCPSourceTimer
- c. CacheMgr



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Answer: b

Quiz

To determine if there is a bottleneck, you begin by monitoring lag. You do this by working from the target back to the source.

- a. True
- b. False



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Answer: a

Quiz

Which two components of GoldenGate are the best choices to perform data filtering and data conversion?

- a. Extract
- b. Data Pump Extract
- c. Local Trail
- d. Remote Trail
- e. Replicat



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Answer: b, e

Practice 10 Overview: Performance Tuning

The practice for this lesson covers tuning Replicat.



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Summary

In this lesson, you should have learned how to:

- Identify the causes of slow startups
- Monitor lag and statistics
- Tune Manager
- Identify network and disk bottlenecks
- Tune Extract
- Tune Replicat



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11

Integrated Performance Tuning

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Objectives

After completing this lesson, you should be able to:

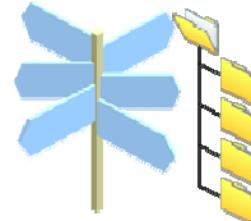
- Describe the architecture and advantages of the new integrated capture mode
- Describe the architecture and advantages of the new integrated delivery mode
- Use the new database views holding configuration information and real-time Oracle GoldenGate statistics to assess and tune data extraction and delivery



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Roadmap

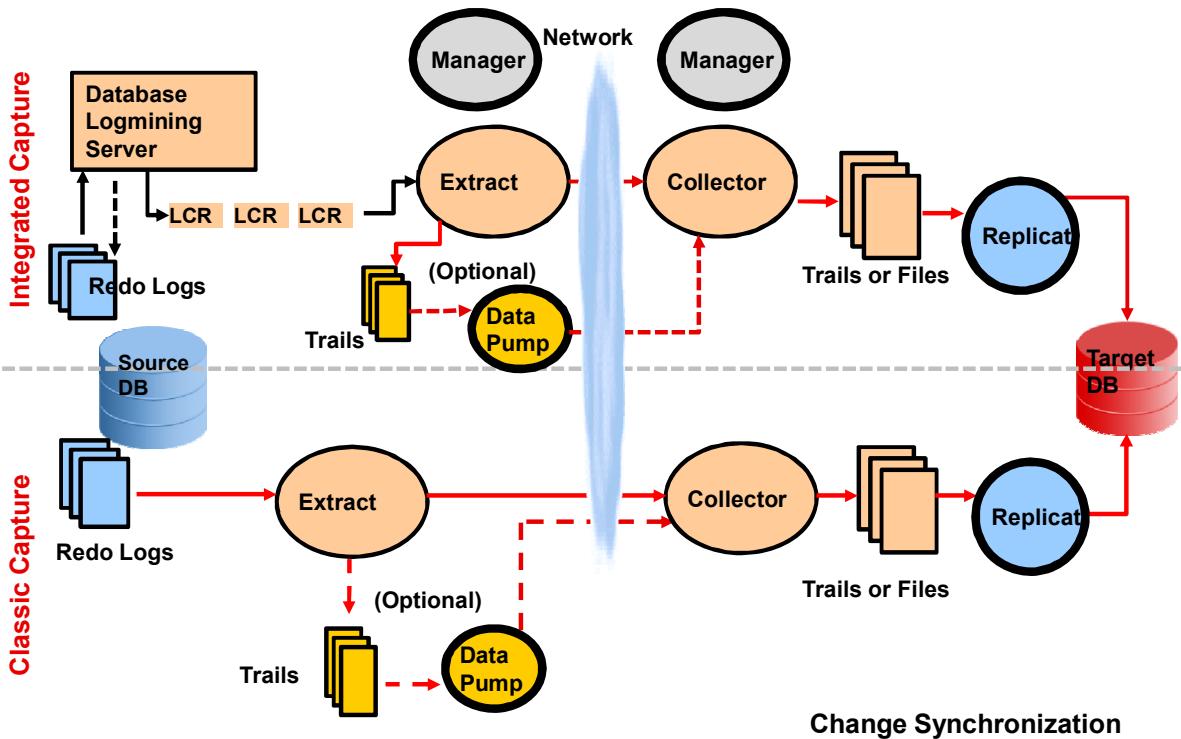
- Integrated capture mode
 - Architecture and advantages
- Integrated delivery mode
- Database views for the integrated Replication environment



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Integrated Capture: Architecture



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The diagram shows how the new integrated capture architecture (top half of the slide) differs from the classic capture architecture (bottom half of the slide.)

Integrated Capture: Architecture

In integrated capture mode, the Oracle GoldenGate Extract process interacts directly with a database logmining server.

Integrated capture:

- Receives data changes in the form of logical change records (LCRs)
- Supports more data and storage types than classic capture and is more transparent
 - More data types can be read directly from the redo log file rather than by accessing the source tables. The same applies to compressed storage.
- Enables faster filtering of tables
- Does not require a special setup for RAC, ASM, or TDE



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Integrated capture uses the database logmining server to access the Oracle redo stream, with the benefit of being able to automatically switch between different copies of archive logs or different mirrored versions of online logs.

When integrated capture is used, the following parameters become obsolete:

- THREADS (RAC integration)
- ASMUSER, ASMBUFSIZE, and DBLOGREADER (ASM integration)
- DECRYPTPASSWORD (TDE/TSE integration)

Integrated Capture: Architecture

Integrated capture (continued):

- Handles point-in-time recovery and RAC integration more efficiently
- Features integrated log management
 - Oracle Recovery Manager (RMAN) automatically retains the archive logs that Extract needs.
- Is the only mode that fully supports capture from a multitenant container database (Oracle RDBMS 12c)
 - One Extract can mine multiple pluggable databases in a multitenant container database.
- Captures DDL asynchronously through the logmining server in Oracle RDBMS 11.2.0.4 (and later)
 - Does not require special triggers or other database objects



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Integrated Capture: Deployment Options

- **Local deployment:** The source database and the mining database are the same.
 - You deploy the logmining server to the source database.
 - Because integrated capture is fully integrated with the database, this mode does not require special database setup.
- **Downstream deployment:** The source and mining databases are different databases.
 - You create the logmining server at the downstream database.
 - You configure redo transport at the source database to ship the redo logs to the downstream mining database for capture at that location.



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In “downstream mode,” an additional computer is used as a standby collector of redo logs (or archived redo logs), which offloads the replication overhead to a computer that is not involved with OLTP production.

- You can configure a small downstream logmining database, because the data coming from the replication source is not stored (not even temporarily) in the downstream database.
- You need an Oracle instance to run the internal log processing module only when you create LCR entries that are published to the integrated Extract process.

Integrated Capture: Syntax

- The database release must be at least 11.2.0.3 with the 1411356.1 patchset.
- The database must be running in archivelog mode, and each Extract group process must be registered with the logmining database by using the GGSCI REGISTER command.
- GGSCI now supports the ADD EXTRACT command with the INTEGRATED TRANLOG clause. To configure an integrated capture Extract group, you first register the extract group with the source database:

```
GGSCI> REGISTER EXTRACT <group> DATABASE
2012-05-19 12:28:40 INFO OGG-02003 Extract <group>
successfully registered with database at SCN <SCN #>.
```



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In GGSCI, you must connect to the database before issuing the REGISTER EXTRACT command.

The Extract group parameter set has been extended to include TRANLOGOPTIONS INTEGRATEDPARAMS to enable integrated capture.

Integrated Capture: Syntax

In the parameter file, set the values for INTEGRATEDPARAMS:

```
TRANLOGOPTIONS INTEGRATEDPARAMS (max_sga_size 200, &
parallelism 3)
```

INTEGRATEDPARAMS supports three options:

- max_sga_size
- parallelism
- downstream_real_time_mine

In GGSCI, start the new Extract group:

```
GGSCI> ADD EXTRACT <group>, INTEGRATED TRANLOG, BEGIN
NOW
```



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Best practices require that the names of Extract (including data pumps) and Replicat groups end with a letter and never with a number. The reason is that Oracle GoldenGate internally appends numbers to Extract and Replicat names. To avoid problems that can occur while performing low-level troubleshooting, always end the Extract and Replicat names with letters.

- **max_sga_size**: A positive integer that specifies (in megabytes) the amount of SGA memory that is used by the database logmining server. The default is 1 GB if the streams_pool_size parameter is greater than 1 GB; otherwise, it is 75% of streams_pool_size.
- **parallelism**: A positive integer that specifies the number of processes of the logmining server
- **downstream_real_time_mine**: Specifies whether integrated capture mines a downstream mining database in real-time mode. If it is set to Y, the logmining server uses redo logs. If it is set to N, the logmining server uses the archived logs.

Integrated Capture: Syntax

If you use integrated Extract with integrated Replicat in an Oracle RDBMS 12c environment, you must specify two additional parameters in the Extract parameter file:

- LOGALLSUPCOLS causes Extract to do the following with the supplementally logged columns:
 - Automatically include in the trail record the before image for UPDATE operations.
 - Automatically include in the trail record the before image of all supplementally logged columns for both UPDATE and DELETE operations.
- UPDATERECORDFORMAT
 - If supplemental logging is enabled on all columns, the unmodified columns may be repeated in both the before image and the after image. UPDATERECORDFORMAT COMPACT reduces the overhead.



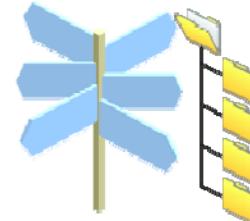
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You can configure integrated capture at the replication source database and use classic Replicat for data delivery at the target database. This type of configuration is the norm in a heterogeneous environment when the source database is an Oracle RDBMS and the target database is different.

When you use both integrated capture and integrated delivery, you must configure the LOGALLSUPCOLS and UPDATERECORDFORMAT parameters.

Roadmap

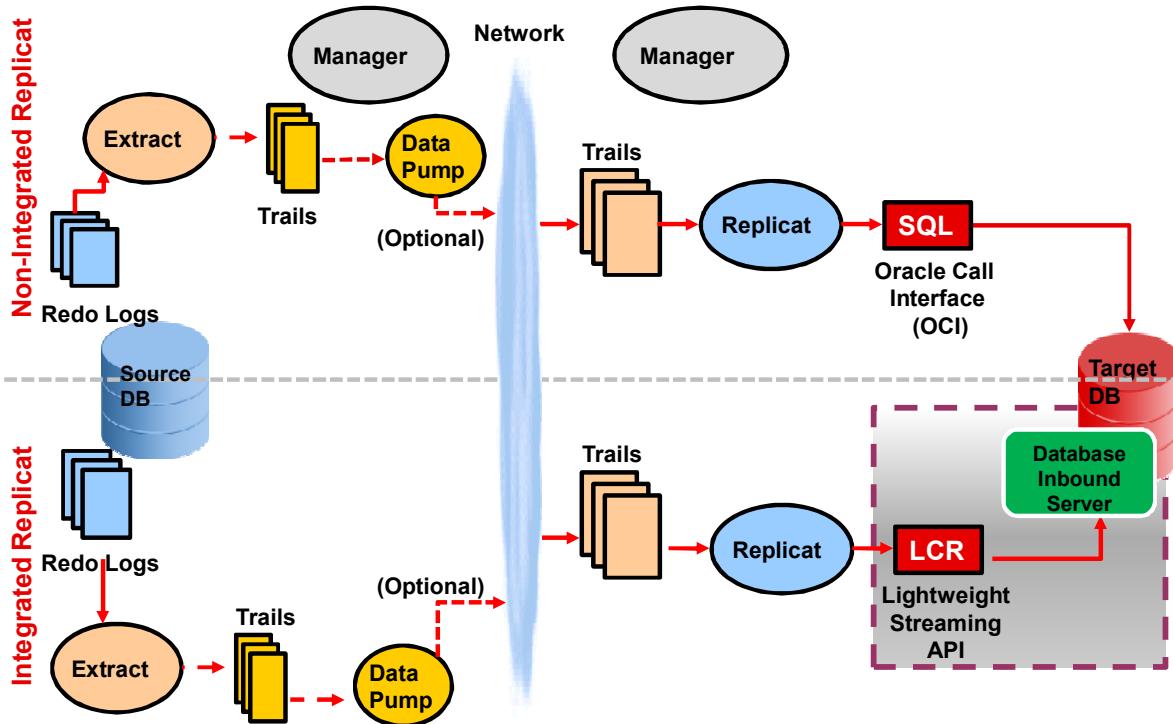
- Integrated capture
- Integrated delivery
 - Architecture and advantages
- Database views for the integrated Replication environment



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Integrated Replicat: Architecture



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The diagram shows how the new integrated Replicat architecture (bottom half of the slide) differs from classic Replicat architecture (top half of the slide.)

Integrated Replicat: Architecture

Integrated delivery (also known as “integrated apply” or “integrated Replicat”):

- Is available only with Oracle Database releases starting with 11.2.0.4
- Leverages database parallel apply servers via the inbound server for automatic, dependency-aware parallel apply
- Causes only minimal changes to Replicat configuration
- Has a single Replicat, so that @RANGE, THREAD, or other manual partitioning is not necessary



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Integrated Delivery

- Uses a streaming protocol with asynchronous processing
- Applies source transactions in parallel based on dependencies between transactions
- Performs automatic tuning of parallelism based on the workload
- Detects and resolves conflicts by using:
 - GoldenGate CDR, REPERROR, and HANDLECOLLISIONS
 - Oracle Streams conflict resolution and error handlers
 - Replicat for retry and failure processing of redirected, unhandled errors
- Provides fine-grained filtering with session redo tags such as cycle prevention in bidirectional replication



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Integrated delivery uses the streaming protocol to avoid roundtrip times for applying SQL.

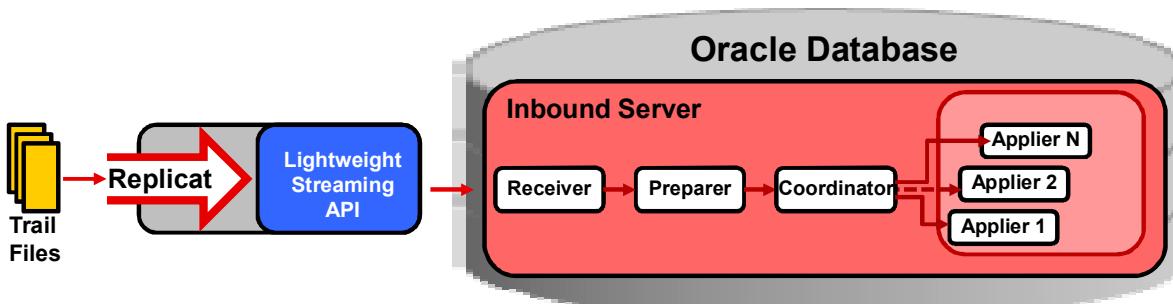
Key column constraints (PK, UI, FK) model the dependencies in the database.

GoldenGate conflict detection and resolution, REPERROR handling, and HANDLECOLLISIONS are configured in the Replicat parameter file: the inbound server performs these tasks.

Oracle Streams updates conflict resolution and the DML or error handlers that are configured in Oracle Database.

Redo tags can be configured to prevent replication cycles. This assumes that you are using integrated extract to exclude the tagged changes.

Integrated Delivery in Detail



Replicat

- Reads the trail file
- Constructs LCRs
- Transmits LCRs to Oracle Database via the lightweight streaming API

Inbound Server (Database Apply Process)

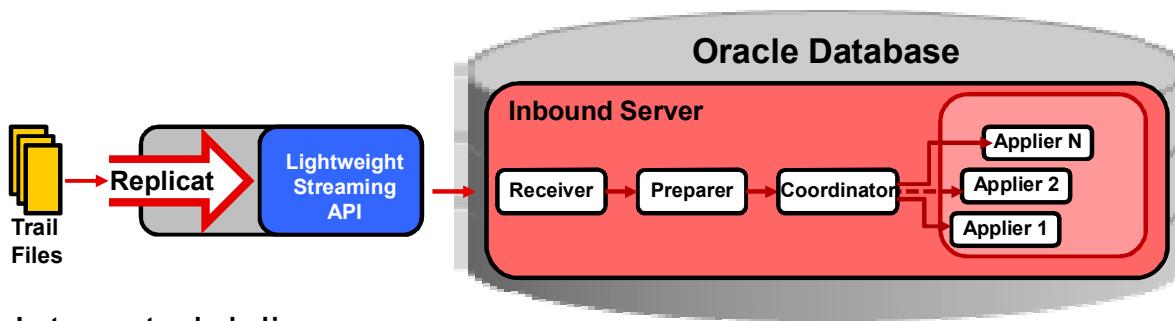
- **Receiver:** Reads LCRs
- **Preparer:** Computes transaction dependencies
- **Coordinator:** Coordinates transactions and maintains the order between applier processes
- **Applier:** Performs changes for assigned transactions, including conflict detection and error handling

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- The receiver is responsible for grouping transactions and sorting them in order of dependency.
- The coordinator coordinates the transactions to be applied (and maintains applier processes in the correct order).
- The appliers perform changes for assigned transactions, including conflict detection and error handling.
- The Oracle database maintains statistics for each applier (apply server) process, including table statistics.

Streaming Protocol: Asynchronous Processing



Integrated delivery:

- Uses one open connection to deliver multiple transactions
- Uses time-based asynchronous ACK to minimize roundtrips
- Uses separate processes for receiving and execution
- Processes each execution immediately
- Handles mixed workloads (inserts, updates, deletes) across multiple tables and schemas without roundtrips

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Parallel Apply: Reasons to Use Dependency Computation and Scheduling

If you ignore dependencies between transactions when applying transactions in parallel, you will encounter the following problems:

- Spurious ORA-1403 errors (no data found)
- Deadlocks
- Slowdowns: You must stop and restart apply.

Because certain application constraints transcend referential integrity, you must respect the commit order of transactions that do not depend on each other.



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If you apply transactions in parallel and disregard dependencies, an apply process will incur the risk of updating or deleting a row that does not exist yet, because the insert transaction has not yet been applied. In more complex scenarios, transactions can cause deadlocks due to their interdependencies.

Even when you do not violate strict referential integrity, applications sometimes rely on a temporal sequence of operations which, if they are not followed, can introduce spurious bugs. For example, an account balance can become negative (with consequences for the customer) if a larger deposit transaction is applied after a smaller, withdrawal transaction that is large enough to cause a negative balance.

Parallel Apply Processing

- Dependency scheduling is based on primary key, unique index, and foreign key constraints in the target database.
 - Supplemental logging at the source is required for these columns.
 - The trail file must record these columns.
- You can configure the ordering of transaction commit in apply by using `COMMIT_SERIALIZATION`:
 - **FULL**: Commits transactions in the same order in which they are committed in the source database
 - **DEPENDENT_TRANSACTIONS**: Commits dependent transactions in the correct dependency order



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Dependency-Aware Apply: Source Database Logging

- The source database can be an Oracle or non-Oracle database.
- Supplemental logging requirements:
 - For Oracle GoldenGate version 12.1.2, ADD TRANDATA and ADD SCHEMATRANDATA provide appropriate logging by default.
 - For Oracle GoldenGate versions 11.1.1 and 11.2.1 with an Oracle source database, configure ADD TRANDATA logging for the unique index and foreign key constraint columns (as defined at the target) by using the COLS clause.
 - For Oracle GoldenGate versions 11.1.1 and 11.2.1 with non-Oracle source databases, ADD TRANDATA provides all columns by default. No additional supplemental logging is required.



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Dependency-Aware Apply: Trail File Logging

Integrated Replicat works with any trail file as input. You must use the following parameters in the Extract parameter file:

- For Oracle GoldenGate version 12.1.2:
`LOGALLSUPCOLS` and `UPDATERECORDFORMAT COMPACT`
- For Oracle GoldenGate versions 11.1.1 and 11.2.1 or non-Oracle source databases:
`GETUPDATEBEFORE`s and `NOCOMPRESSDELETE`S
- For all trail files produced by integrated Extract:
`LOGALLSUPCOLS` and `UPDATERECORDFORMAT COMPACT`



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Use the `GETUPDATEBEFORE`s and `IGNOREUPDATEBEFORE`s parameters to determine whether the before images of the columns in the `UPDATE` operations are included in the records that are processed by Oracle GoldenGate. Before images contain column details that existed before a row has been updated.

Use the `GETUPDATEBEFORE`s parameter in the following situations:

- In the Extract parameter file to extract before images from the data source
- In the Replicat parameter file to include before images in a Replicat operation

You can compare before images with after images to identify the net results of a transaction or to perform other delta calculations.

Use the `COMPRESSDELETE`s and `NOCOMPRESSDELETE`s parameters to control the way columns are written to the trail record for `DELETE` operations.

You can use `COMPRESSDELETE`s and `NOCOMPRESSDELETE`s for all `TABLE` statements in the parameter file, or you can use them as on-off switches for individual `TABLE` statements.

Workload-Based Autotuning

Workload-based autotuning measures the throughput (the number of LCRs processed) and adds or subtracts an apply server to increase throughput past a threshold.

Parameters:

- **PARALLELISM**: Minimum number of apply servers; default = 4
- **MAX_PARALLELISM**: Maximum number of apply servers; default = 30
- **PARALLELISM_INTERVAL**: Number of seconds between autotune computations; default = 5
- **PARALLELISM=MAX_PARALLELISM**: Disables autotuning
- **PARALLELISM=1**: Results in no parallelism and no autotuning



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The apply Coordinator process is responsible for autotuning. When deciding whether to add or remove an apply server, the coordinator assesses whether adding or removing an apply server in the last iteration was helpful (that is, if it increased throughput past a certain threshold). If it was helpful, the Coordinator process tries to either increase or decrease the number of apply servers by a value of 1.

If throughput is about the same (for $X + 1$ and $X - 1$ apply servers), the preference is for fewer apply servers ($X - 1$) to conserve resources.

Autotune Parallelism

- Unnecessary appliers are marked as INACTIVE.
 - You can reactivate them quickly if necessary.
 - Appliers that remain inactive for more than five minutes are removed.
- Oracle Database maintains runtime information related to autotuning:
 - In the `V$GG_APPLY_COORDINATOR` view, the `ACTIVE_SERVER_COUNT` column shows the number of currently active apply servers.
 - Inactive apply servers (appliers) have the `INACTIVE` state in the `V$GG_APPLY_SERVER` view.



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Direct Replicat (OCI) Processing

Replicat handles some changes directly:

- DDL
- SQLEXEC, External Message Interface (EMI) protocol actions, and user exits
- Data types that are not currently supported by the inbound server



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Data definition language (DDL) commands are currently applied by classic Replicat.

Stored procedures are handled through the OCI interface as well as the Oracle GoldenGate user exits.

The Messaging Gateway processing messages conforming to the EMI protocol specifications require classic Replicat handling.

ADT (Abstract Data Type) is a user-defined data type (also referred to as UDT). The integrated Replicat inbound server is currently unable to handle ADTs.

Direct Replicat Processing

For unhandled errors, integrated Replicat reverts to classic Replicat for error handling, which does the following:

- Stores an error placeholder in the error queue
(Note: LCRs are not stored in the error queue.)
- Repositions to the marker in the trail file and retries the transaction(s)
- If the transaction is successfully applied, returns control to the inbound server and deletes the error
- If the transaction is not successfully applied, stops the inbound server and abends



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BATCHSQL Support

BATCHSQL is supported via the inbound server.

- Parallelism for BATCHSQL is supported.
 - Use BATCHTRANSOPS to tune batch size.
 - The default value for BATCHTRANSOPS for the inbound server is 50.
 - If the apply WAIT for DEPENDENCY is high, tune BATCHTRANSOPS downward.
- When there is an error in BATCHSQL:
 - The batched transaction is rolled back
 - Apply is in normal mode via the inbound server



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SQLEXEC in Integrated Delivery

- SQLEXEC from the TABLE or MAP statement is performed directly by Replicat (not by the inbound server).
- When SQLEXEC applies to the entire Replicat process, you can configure the inbound server to perform SQLEXEC with the Replicat parameter:
 - DBOPTIONS INTEGRATEDPARAMS (GLOBALSQLEXEC <block>)
 - <block> is a PL/SQL block to be performed by the inbound server.



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Bidirectional Replication

You can configure integrated Replicat to tag its changes in the redo.

- Use the following tag to avoid cycling in bidirectional replication:
 - SETTAG 00
 - Example: DBOPTIONS SETTAG 00 in the Replicat parameter file
- If you are replicating DDL in a bidirectional configuration, set the following:
 - DDLOPTIONS NOTAG
 - DDLOPTIONS UPDATEMETADATA
- Use the following tag to avoid capturing changes made by Replicat in integrated Extract:
 - TRANLOGOPTIONS EXCLUDETAG 00



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The tag is a RAW (16) value. It is used to avoid an endless loop while replicating data in a bidirectional configuration.

For this mechanism to work properly, the Extract parameter file must include the TRANLOGOPTIONS EXCLUDETAG clause and the Replicat parameter file must include the DBOPTIONS SETTAG clause.

Integrated Replicat: Syntax

You can set values for INTEGRATEDPARAMS in the parameter file:

```
DBOPTIONS INTEGRATEDPARAMS (parallelism 6)
```

In GGSCI, connect to the target database:

```
GGSCI> DBlogin UserIdAlias <user alias>
```

Alternatively, you can use the following:

```
GGSCI> DBlogin UserId <user>, Password <password>
```

Add the Replicat and specify it as an integrated Replicat:

```
GGSCI> Add Replicat <group> Integrated exttrail <trail>
REPLICAT (Integrated) added.
```

Start the newly configured integrated Replicat:

```
GGSCI> Start Replicat <group>
Sending START request to MANAGER ...
REPLICAT <group> starting
```



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Several parameters are available to the INTEGRATEDPARAMS option to fine tune the integrated Replicat. The most important are:

- **MAX_PARALLELISM**: Limits the number of apply servers that can be used with heavy loads
- **EAGER_SIZE**: Sets a threshold for the size of a transaction (in number of LCRs) beyond which Oracle GoldenGate starts applying data before the commit record is received
- **PARALLELISM**: Sets the minimum number of apply servers that can be used under normal conditions. Setting PARALLELISM to 1 disables apply parallelism, and transactions are applied with a single apply server process. The default for Oracle GoldenGate is 4.
- **COMMIT_SERIALIZATION**: Controls the order in which applied transactions are committed. The default for Oracle GoldenGate is DEPENDENT_TRANSACTIONS.

Note: For a complete list of all available parameters, see *Oracle GoldenGate Installing and Configuring Oracle GoldenGate for Oracle Database 12c (12.1.2)*.

Changes to Replicat Parameters

- MAXTRANSOPS and TRACETABLE are not supported.
- TRACE and TRACE2 are effective only for Replicat and not for the Inbound Server.
- SHOWSYNTAX
 - Has no interactive aspects in integrated Replicat mode
 - Enables SQLTRACE for inbound server processes
 - Tracing appears in the apply server database trace files (*_as*.trc).
- GROUPTRANSOPS
 - Effective only with Parallelism = 1
 - If specified in the parameter file, the value is passed to the inbound server.



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Quiz

Integrated delivery works only with trail files that are produced by integrated capture.

- a. True
- b. False



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Answer: b

Quiz

Which syntax is used to avoid an endless replication loop in a bidirectional configuration?

- a. Replicat: DBOPTIONS TAG 00 Extract:
TRANLOGOPTIONS NOTAG 00
- b. Replicat: DBOPTIONS SETTAG 00 Extract:
TRANLOGOPTIONS NOTAG 00
- c. Replicat: DBOPTIONS SETTAG 00 Extract:
TRANLOGOPTIONS EXCLUDETAG 00



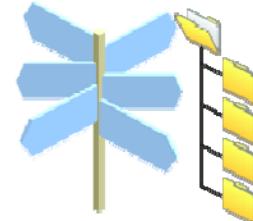
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Answer: c

Roadmap

- Integrated capture
- Integrated delivery
- Database views for the integrated Replication environment



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Oracle GoldenGate Database Views

- Configuration
 - DBA_GOLDENGATE_PRIVILEGES
 - DBA_GOLDENGATE_INBOUND
 - DBA_GG_INBOUND_PROGRESS
 - DBA_APPLY, DBA_APPLY_PARAMETERS
 - _ Parameters are configured by Replicat at runtime.
- Runtime
 - V\$GG_APPLY_RECEIVER
 - V\$GG_APPLY_READER
 - V\$GG_APPLY_COORDINATOR
 - V\$GG_APPLY_SERVER
 - V\$GOLDENGATE_TABLE_STATS



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- **V\$GG_APPLY_RECEIVER:** Displays information about the message receiver of the Replicat process. The values are reset to zero when the database (or instance in an Oracle Real Application Clusters [Oracle RAC] environment) restarts and when the Replicat process is stopped.
- **V\$GG_APPLY_READER:** Displays information about each GoldenGate apply reader. The apply reader is a process which reads (dequeues) messages from the queue, computes message dependencies, and builds transactions. It passes the transactions to the coordinator in commit order for assignment to the apply servers.
- **V\$GG_APPLY_COORDINATOR:** Displays information about each GoldenGate apply process coordinator. The coordinator for an apply process gets transactions from the apply process reader and transfers them to the apply servers.
- **V\$GG_APPLY_SERVER:** Displays information about each GoldenGate apply server and its activities. An apply server receives messages from the apply coordinator for an apply process. For each message received, an apply server either applies the message or sends the message to the appropriate apply handler.
- **V\$GOLDENGATE_TABLE_STATS:** Displays table statistics for all the tables that are used by each Oracle GoldenGate apply server

Practice 11 Overview: Integrated Performance Tuning

The practice for this lesson covers the following topics:

- Configuring an integrated Extract and a data pump
- Configuring an integrated Replicat
- Generating data on the source schema and verifying that replication is occurring
- Gathering performance statistics from GoldenGate v\$ views



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Summary

In this lesson, you should have learned how to:

- Describe the architecture and advantages of the new integrated capture mode
- Describe the architecture and advantages of the new integrated delivery mode
- Use the new database views holding configuration information and real-time Oracle GoldenGate statistics to assess and tune data extraction and delivery



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Integrated Capture and Delivery Troubleshooting

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Objectives

After completing this lesson, you should be able to:

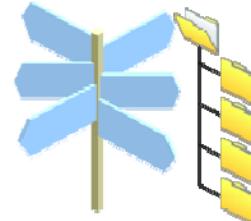
- Use the troubleshooting aids and tools for integrated capture and integrated delivery
- Monitor and analyze replication performance by using the UTL_SPADV utility
- Use the healthcheck scripts
- Generate and analyze the new Oracle Database AWR report



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Roadmap

- Integrated capture and delivery troubleshooting aids
- UTL_SPADV PL/SQL package
- Healthcheck scripts
- Oracle Database enhanced AWR report



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Troubleshooting Aids

For troubleshooting and performance, the new Oracle GoldenGate features (integrated Extract and integrated Replicat) are supported by three facilities:

- UTL_SPADV PL/SQL package
- Healthcheck scripts
 - Three different versions: Oracle RDBMS versions 11.2.0.3, 11.2.0.4, and 12.1
- Enhanced AWR report, which now includes information that is specific to Oracle GoldenGate



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Troubleshooting Aids: Where to Find Them

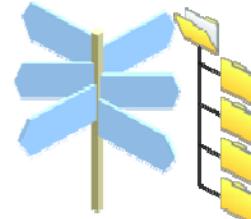
- The UTL_SPADV performance advisor package (`utlspadv.sql`) is shipped with the Oracle Database software.
 - Find it in `$ORACLE_HOME/rdbms/admin`.
- The healthcheck script can be downloaded from the Oracle Support site.
 - My Oracle Support (MOS) article 1448324.1
- The AWR facility is shipped with the Oracle Database software.
 - In Oracle Database 11.2.0.4, the Oracle GoldenGate information is found in the “Streams” section.
 - In Oracle Database 12.1.0.1, the Oracle GoldenGate section is called “Replication Statistics (GoldenGate, Xstream).”



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Roadmap

- Integrated capture and delivery troubleshooting aids
- UTL_SPADV PL/SQL package
- Healthcheck scripts
- Oracle Database enhanced AWR report



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Streams Performance Advisor UTL_SPADV Package

This package must be deployed in the Oracle GoldenGate administrator account.

- It requires DBA privileges.

```
SQL> @?/rdbms/admin/utlspadv.sql
```

Use UTL_SPADV to start monitoring:

```
SQL> exec utl_spadv.start_monitoring;
```

Stop monitoring:

```
SQL> exec utl_spadv.stop_monitoring;
```

Generate performance advisor report:

```
SQL> exec utl_spadv.show_stats_html;  
Or  
SQL> exec utl_spadv.show_stats;
```

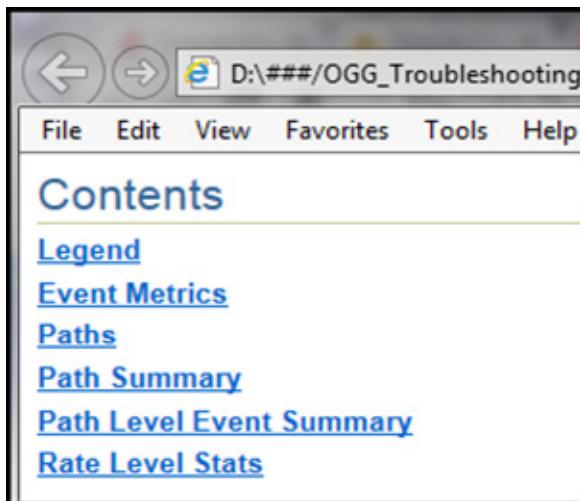


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The UTL_SPADV report in text format can be used like the equivalent of a “top” UNIX utility, if it is wrapped in a loop (perhaps run from a shell.) Used in this manner, the UTL_SPADV report can be left running in a terminal shell. You should refresh it periodically to give immediate feedback on performance issues that you are investigating.

UTL_SPADV Report

The report generated by the UTL_SPADV utility is divided into six sections. For example, in HTML output mode, the top part of the report contains six links. Each link positions your browser at the beginning of the section that is indicated by the link:



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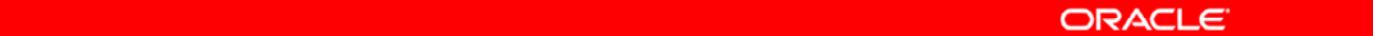
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UTL_SPADV Performance Metrics

Four main performance metrics are used to rank the efficiency of each replication component throughout the UTL_SPADV report:

- IDLE%
- FLWCTRL%
- TOPEVENT
- TOPEVENT%

Event Metrics	
Metric	Description
IDLE%	Percent of time in the run, spent waiting on upstream component
FLWCTRL%	Percent of time in the run, spent waiting on downstream component
TOPEVENT	Non-idle, Non-flwctrl Event which occupies most of run time
TOPEVENT%	Percent of time in the run, spent on Topevent

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UTL_SPADV Replication Paths

The UTL_SPADV report divides replication into “paths”:

- Path 1 refers to data capture.
- Path 2 refers to data delivery.

PATHS		
Path 1		
Component	Name	Database
CAPTURE	OGG\$CAP_EINTA	OGG12C
Q	"OGGUSER"."OGG\$Q_EINTA"	OGG12C
EXTRACT	EINTA	OGG12C

Path 2		
Component	Name	Database
REPLICAT	RINTA	OGG12C
Q	"OGGUSER"."OGG\$RINTA"	OGG12C
APPLY	OGG\$RINTA	OGG12C



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For each path, the UTL_SPADV report provides a path-level summary that provides details about the following:

- Average number of capture messages per second
- Average capture latency
- Average number of apply transactions per second
- Average number of apply messages per second
- Average apply latency

UTL_SPADV Replication Component Analysis

It is possible to access detailed statistics for each replication component across the two paths. The Path Level Event Summary displays each component as a link. If you click the component-level link (LMR,LMP,LMB, and so on), you access the statistics for the selected component.

Path Id	Component	Topevent 1	% Topevent 1	Topevent 2	% Topevent 2	Topevent 3	% Topevent 3	% Bottleneck
1	LMR	CPU + Wait for CPU	3.61					0.
1	LMP(2)	CPU + Wait for CPU	5.29					0.
1	LMB	CPU + Wait for CPU	4.02					0.
1	CP	CPU + Wait for CPU	2.91	LogMiner client: transaction	1.59	log file sync	1.59	0.
1	Q							0.
1	EXTRACT	CPU + Wait for CPU	2.91	LogMiner client: transaction	1.59	log file sync	1.59	0.
2	REPLICAT	SQL*Net more data from client	78.67					260.
2	Q							260.
2	APR	CPU + Wait for CPU	4.2					0.
2	APC	CPU + Wait for CPU	7.94					0.
2	APS(31)	CPU + Wait for CPU	5.58	buffer busy waits	4.76			0.



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LMR	LogMiner Reader
LMP	LogMiner Preparer
LMB	LogMiner Builder
CP	Capture Process
Q	Queue
Extract	Extract component
Replicat	Replicat component
APR	Apply Reader
APC	Apply Coordinator
APS	Apply Slave

UTL_SPADV Component Statistics Details

Performance metrics are provided for each replication component. The wait event analysis details the three most relevant waits as both an absolute value and a percentage.

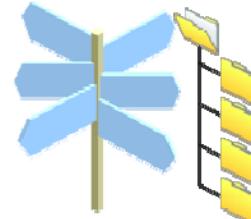
COMPONENT LEVEL STATS EXTRACT										
Path Id	Run Id	Run time	Throughput	Rate 2	Latency	% Idle	% Flwctrl	% Topevent 1	Topevent 1	
1	11	29-MAY-2014 00:46:17	0	0	4	97.8	.3	1.93	CPU + Wait for CPU	
1	12	29-MAY-2014 00:47:19	4369	1023768	0	96.8	0.	3.17	CPU + Wait for CPU	
COMPONENT LEVEL STATS REPLICAT										
Path Id	Run Id	Run time	Throughput	Rate 2	Latency	% Idle	% Flwctrl	% Topevent 1	Topevent 1	
2	11	29-MAY-2014 00:46:17	0	0		19.3	0.	79.42	SQL*Net more data from client	
2	12	29-MAY-2014 00:47:19	54	7823		17.5	0.	80.95	SQL*Net more data from client	
2	13	29-MAY-2014 00:48:20	1084	227573		14.5	0.	83.87	SQL*Net more data from client	



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Roadmap

- Integrated capture and delivery troubleshooting aids
- UTL_SPADV PL/SQL package
- Healthcheck scripts
- Oracle Database enhanced AWR report



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Oracle GoldenGate Healthcheck Script

See MOS article 1448324.1 on the Oracle Support site.

- There are three different scripts:
 - Integrated capture healthcheck script for Oracle Database 11.2.0.3. This script supports integrated Extract only.
 - Integrated capture and integrated Replicat healthcheck script for Oracle Database 11.2.0.4
 - Integrated capture and integrated Replicat healthcheck script for Oracle Database 12.1.0.1.
 - The scripts for Oracle Database versions 11.2.4 and 12.1.0.1 support both integrated Extract and integrated Replicat.
- You must execute the healthcheck script in every database where either integrated Extract or integrated Replicat is configured.



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MOS article URL

<https://support.oracle.com/oip/faces/secure/km/DocumentDisplay.jspx?id=1448324.1&h=Y>

- Healthcheck script for Oracle Database 11.2.0.3: `ichc_11203.sql`
- Healthcheck script for Oracle Database 11.2.0.4: `icrhc_11204.sql`
- Healthcheck script for Oracle Database 12.1.0.1: `icrhc_12101.sql`

ICHC is an abbreviation for “integrated capture healthcheck.” Integrated Replicat is not supported by Oracle Database 11.2.0.3, so the healthcheck script is named ICHC.

Integrated Replicat support began with the release of Oracle Database 11.2.0.4, which is why the abbreviation is now ICRHC, with the "R" indicating that the script now performs healthchecks on integrated Replicat as well as on integrated capture.

Oracle GoldenGate Healthcheck Script

The healthcheck script must be run as sysdba so it can access some structures that are visible only to sys.

- The output format changed starting with Oracle Database release 11.2.0.4 compared to the script in release 11.2.0.3. Since release 11.2.0.4, the most relevant information appears at the top of the report.
- The output can be in HTML format (the default and the format preferred by Oracle Support) or in plain ASCII text.
- The script can be run repeatedly to check for slowdowns in replication performance.



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Oracle GoldenGate Healthcheck Script

As the report is generated, the output below the header will show links to the following main sections:

- **Configuration:** Generic information for the database configuration affecting integrated processes
- **Extract:** Information that is relevant to the defined integrated Extract processes
- **Replicat:** Information that is relevant to the defined integrated Replicat processes
- **Analysis:** Tests that are performed by the healthcheck script to confirm the sanity of your installation
- **Statistics:** Statistics for those elements of integrated capture and Replicat that are enabled



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Below the links to the five sections, there is a new section called Summary that quickly shows your configuration and the potential problems that may be affecting your installation.

Important: It is a good practice to start checking this Summary section because it reports key messages about environmental problems.

Oracle GoldenGate Healthcheck Script

Each of the five sections is divided into subsections. If you select HTML output, the links enable you to access relevant information quickly.

Oracle GoldenGate Integrated Extract/Replicat Health Check (v3.1.17) for OGG12C

Configuration: [Database Queue Administrators Bundle](#)

Extract: [Configuration Capture Statistics](#)

Replicat: [Configuration Apply Statistics](#)

Analysis: [History Notifications Objects Checks Performance Wait Analysis Topology](#)

Statistics: [Statistics Queue Capture Apply Apply Errors](#)

The healthcheck script provides configuration information (static by nature) and rapidly changing, near-real-time performance statistics, such as detailed wait-event analysis.



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By comparing different ICRHC output, you can verify that your IC or IR component is flowing properly or is stuck. To find out if an enabled IC or IR component is processing properly, you must check its state (in the Statistics section), but remember that this state is specific to the moment when the query issued by the healthcheck report was run. Therefore, a process state may change immediately after the healthcheck query is run.

Note: It is a good practice to run the healthcheck report repeatedly at short intervals when you suspect that an IC or IR component is not processing optimally.

Replication Statistics

The healthcheck script generates replication statistics:

++ GOLDENGATE CAPTURE STATISTICS ++														
SYSDATE	Capture Process Number	Capture Name	Startup Timestamp	Session ID	Session Serial Number	State	Last State Change Time	Redo Entries Scanned	Total LCRs Enqueued	Streams Pool Used MB	Streams Pool Allocated MB	Redo Mined MB	SCN at Startup	
2014-05-29 01:26:10	TNS	OGGSCAP_EI_NTA	2014-05-27 23:51:46	12	13	WAITING FOR TRANS ACTION	2014-05-29 01:26:09	7274642	6243740	7	255	4344	1976076	
++ APPLY Reader Statistics ++														
Apply Name	Captured or User-Enqueued L	Process	STATE	Total Messages Dequeued	Total Messages Spilled	SGA Used MB	SGA Allocated MB	Oldest Transaction	Total LCRs with Dependencies	Total LCRs with WM Dependency	Total in-Memory LCRs			
OGGSRINTA	Captured LCRS	AS01	IDLE	2382983	0	28	30	30.13.2029	2430	0	1			
Apply Name	Apply Reader Latency (Seconds)		Dequeued Message Creation Timestamp			Dequeue Timestamp		DEQUEUED_POSITION						
OGGSRINTA	9		01:25:51 05:29			01:26:00 05:29		5356330						



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In the data capture section, you can review details and statistics related to integrated capture and associated LogMiner sessions.

In the data delivery section, you can find detailed information about apply reader, component, and defined server processes. You can check the total number of transactions processed, which transactions are being processed, and what transaction each server is applying.

Configuration Information

The healthcheck script excels at verifying all aspects of replication: data capture, data delivery, and all of the queues and replication components between capture and delivery.

It reports erroneous or inconsistent parameter settings. The sections that describe apply errors and replication errors in queues are especially useful.

++ APPLY PROCESS PARAMETERS ++			
Apply Name	Parameter Name	Parameter Value	Usr Set
OGG\$RINTA	ALLOW_DUPLICATE_ROWS	Y	YES
OGG\$RINTA	CDGRANULARITY	ROW	YES
OGG\$RINTA	MAX_PARALLELISM	30	YES
OGG\$RINTA	PARALLELISM	6	YES
OGG\$RINTA	PRESERVE_ENCRYPTION	N	YES
OGG\$RINTA	SUPPRESSTRIGGERS	Y	YES



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In the configuration section of the report, you can identify the extract processes that are registered in the database. It is possible to determine whether an Oracle GoldenGate extract process is currently attached to the database or not.

An Extract process has one of three statuses:

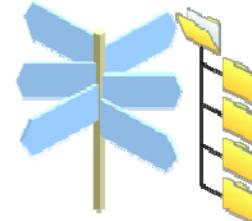
- **ATTACHED:** Integrated capture process is up and attached to the GoldenGate extract process.
- **DETACHED:** Integrated capture process is waiting for the GoldenGate extract process to be started.
- **ABORTED:** Integrated capture process has aborted because the associated GoldenGate extract process has abended.

Similarly, when a Replicat is defined as INTEGRATED, an apply process is created on the database. Replicat processes can be linked to their associated apply process. You can observe the status of the link, which is one of the following:

- **ATTACHED:** Associated apply process is up and attached to the GoldenGate Replicat process.
- **DETACHED:** Associated apply process is waiting for the GoldenGate Replicat process to be started.
- **ABORTED:** Associated apply process has aborted because the associated GoldenGate Replicat process has abended.

Roadmap

- Integrated capture and delivery troubleshooting aids
- UTL_SPADV PL/SQL package
- Healthcheck scripts
- Oracle Database enhanced AWR report



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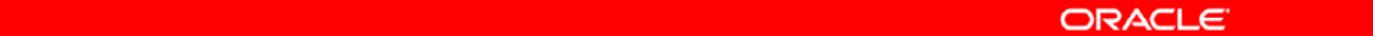
Oracle Database Enhanced AWR Report

Automatic Workload Repository (AWR) is a good starting point for identifying general database performance issues. AWR provides the initial indicators to help you locate problems with integrated Extract and integrated Replicat.

AWR has been enhanced and now contains a specific section for Oracle GoldenGate statistics.

Report Details

- [Report Summary](#)
- [Time Model Statistics](#)
- [Operating System Statistics](#)
- [Wait Events](#)
- [Service Statistics](#)
- [SQL Statistics](#)
- [Instance Activity Statistics](#)
- [IO Stats](#)
- [Advisory Statistics](#)
- [Wait Stats](#)
- [Undo Statistics](#)
- [Latch Statistics](#)
- [Segment Statistics](#)
- [Dictionary Cache Statistics](#)
- [Library Cache Statistics](#)
- [Memory Statistics](#)
- [Replication Statistics \(GoldenGate, XStream\)](#)
- [Streams Statistics](#)
- [Shared Server Statistics](#)

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Oracle GoldenGate Replication Statistics

If you click Replication Statistics (GoldenGate, XStreams), you go directly to the portion of the AWR report that shows detailed statistics about replication.

Replication Statistics (GoldenGate, XStream)

- [Replication System Resource Usage](#)
- [Replication SGA Usage](#)
- [GoldenGate Capture](#)
- [GoldenGate Capture Rate](#)
- [GoldenGate Apply Reader](#)
- [GoldenGate Apply Coordinator](#)
- [GoldenGate Apply Server](#)
- [GoldenGate Apply Coordinator Rate](#)
- [GoldenGate Apply Reader and Server Rate](#)
- [Table Statistics by DML Operations](#)
- [Table Statistics by Conflict Resolutions](#)
- [Replication Large Transaction Statistics](#)
- [Replication Long Running Transaction Statistics](#)

A good starting point to assess the overall performance of your replication system is the section titled Replication System Resource Usage.



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Replication Performance at a Glance

Replication System Resource Usage:

- System resource usage of GoldenGate/XStream processes is aggregated by Session Type and Session Module.
- Data is ordered by absolute value of '%Diff' column of CPU Time in descending order, followed by Session Type and Session Module in ascending order.
- CPU and I/O time columns are displayed in seconds.

Replication System Resource Usage										
Session Type	Session Module	CPU Time (sec)			User I/O Time (sec)			System I/O Time (sec)		
		1st	2nd	%Diff	1st	2nd	%Diff	1st	2nd	%Diff
Apply Server	GoldenGate	0.03	255.27	850,800.00	0.00	0.08	100.00	0.00	0.00	0.00
Apply Receiver	GoldenGate	0.03	7.99	26,533.33	0.00	0.00	0.00	0.00	0.00	0.00
Capture	GoldenGate	0.83	27.43	3,204.82	0.00	0.00	0.00	0.00	0.00	0.00
Apply Reader	GoldenGate	0.49	13.48	2,651.02	0.00	0.00	0.00	0.00	0.00	0.00
Logminer Reader	GoldenGate	2.21	28.86	1,205.88	0.00	0.01	100.00	0.50	0.41	-18.00
Logminer Preparer	GoldenGate	3.33	40.94	1,129.43	0.09	0.00	-100.00	0.00	0.00	0.00
Logminer Builder	GoldenGate	3.79	27.76	632.45	0.12	0.00	-100.00	0.00	0.00	0.00
Apply Coordinator	GoldenGate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



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On this page, you see a breakdown by replication component. If your replication configuration has performance problems, this is the page on which you will probably be alerted about a replication component that is using a disproportionate amount of resources.

Analyzing Data Capture

The GoldenGate Capture section provides statistics about the database capture processes:

- Data is cumulative from the most recent instance startup for each interval.
- A capture name prefixed with a * indicates a process that was (re-)started between the Begin and End snapshots.
- Columns suffixed with K,M,G,T, and P are in multiples of 1000.
- Ordered by absolute value of %Diff column of captured messages in descending order, followed by Extract Name and Capture Name in ascending order

GoldenGate Capture																			Redo Mined(B)			Redo Sent(B)						
Extract Name	Capture Name	Captured Messages			Enqueued Messages			Lag Change			Rule Time (sec)			Enqueue Time (sec)			Redo Wait Time (sec)			Pause Time (sec)			Redo Mined(B)			Redo Sent(B)		
		1st	2nd	%Diff	1st	2nd	%Diff	1st	2nd	%Diff	1st	2nd	%Diff	1st	2nd	%Diff	1st	2nd	%Diff	1st	2nd	%Diff	1st	2nd	%Diff	1st	2nd	%Diff
ENTA	OGG\$CAP_ENTA	12.8K	810K	6,212.56	8862	692.4K	7,893.70	0.00	1.00	100.00	0.00	0.00	0.00	0.19	8.58	4,415.79	0.00	0.00	0.00	0.00	0.00	0.00	105.7M	476.6M	350.83	1.5M	163.6M	10,631.28



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Oracle GoldenGate Apply Reader Statistics

The GoldenGate Apply Reader section provides useful statistics on the apply readers configured in your database.

- Data is cumulative from the most recent instance startup for each interval.
- An apply name prefixed with a * indicates a process that was (re-)started between the Begin and End snapshots.
- Columns suffixed with K,M,G,T, and P are in multiples of 1000.
- The Lag(s) column displays the lag (in seconds) of the most recently captured message.
- Ordered by Replicat Name and Apply Name in ascending order

GoldenGate Apply Reader							
Replicat Name	Apply Name	Reader Dequeue Msgs			Reader Lag Change		
		1st	2nd	%Diff	1st	2nd	%Diff
RINTA	OGGSRINTA	0	350.2K	100.00	0.00	-1.00	100.00



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Apply Server and Apply Coordinator Statistics

- Wait Deps% refers to the percentage of transactions that must wait for other transactions due to dependency.
- Wait Commit% refers to the percentage of transactions that must wait due to source transaction commit ordering.
- Columns suffixed with K,M,G,T,P are in multiples of 1000.
- Ordered by absolute value of %Diff column of Txns Received in descending order, followed by Replicat Name and Apply Name in ascending order

GoldenGate Apply Coordinator																						
Replicat Name	Apply Name	Txns Received			Txns Applied			Txns Rolled Back			Wait Deps%			Wait Commit%			Unassigned Complete Txn			Total Errors		
		1st	2nd	%Diff	1st	2nd	%Diff	1st	2nd	%Diff	1st	2nd	%Diff	1st	2nd	%Diff	1st	2nd	%Diff	1st	2nd	%Diff
RINTA	OGG\$RINTA	0	111.3K	100.00	0	111.3K	100.00	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0.00	0	0	0.00	

GoldenGate Apply Server																			
Replicat Name	Apply Name	Server LCRs Applied			Server Apply Time(s)			Server Dequeue Time(s)			Total LCRs Retried			Total Txn Retried					
		1st	2nd	%Diff	1st	2nd	%Diff	1st	2nd	%Diff	1st	2nd	%Diff	1st	2nd	%Diff	1st	2nd	%Diff
RINTA	OGG\$RINTA	0	350.2K	100.00	0.00	42.09	100.00	0.00	0.21	100.00	0	0	0.00	0	0	0.00	0	0	0.00

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DML Operations

The AWR report also displays a very useful section in which each DML operation that affects replication objects is ranked according to metrics such as the following:

- Total DML operations
- Total inserts, updates, and deletes
- Successful conflict detection resolutions
- Failed conflict detection resolutions
- Replication errors
- Number of handled collisions

Table Statistics by DML Operations

Apply Name	Session Module	Table Name	Total DML Ops		Total Inserts		Total Updates		Total Deletes		CDR Successful		CDR Failed		RepError Count		Handled Collisions	
			1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
OGGSRNTA	GoldenGate	TARGET.ACCOUNT	111.3K	0	0	111.3K	0	0	0	0	0	0	0	0	0	0	0	0
OGGSRNTA	GoldenGate	TARGET.EXCEPTION	16.3K	16.3K	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OGGSRNTA	GoldenGate	TARGET.TRANSACTION	111.3K	111.3K	0	0	0	0	0	0	0	0	0	0	0	0	0	0



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In this section, you can learn whether a specific object is generating too many conflicts (perhaps the CDR rules are incorrect). You can also learn whether a replication object is showing an abnormal number of DML operations, which can be a symptom of unexpected traffic or more serious problems.

Quiz

The healthcheck (ICRHC) script is shipped with the Oracle Database software and is available in the ?/rdbms/admin directory.

- a. True
- b. False



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Answer: b

Quiz

The UTL_SPADV utility provides advice for integrated capture only. To get feedback about integrated Replicat issues, you must use the healthcheck (ICRHC) report.

- a. True
- b. False



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Answer: b

Quiz

The AWR report provides detailed statistical information about both classic and integrated Extract and Replicat.

- a. True
- b. False



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Answer: b

Practice 12 Overview: Integrated Capture and Delivery Troubleshooting

The practices in this lesson cover the following topics:

- Enabling the capture of AWR snapshots
- Running the UTL_SPADV package and interpreting its output
- Running the healthcheck script and assessing its output
- Generating AWR reports and analyzing the results



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Summary

In this lesson, you should have learned how to:

- Use the troubleshooting aids and tools for integrated capture and integrated delivery
- Monitor and analyze replication performance by using the UTL_SPADV utility
- Use the healthcheck scripts
- Generate and analyze the new Oracle Database AWR report



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