Oracle Database 11g Replay: The In-built Recorder for Real Application Testing

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Introduction

Oracle Database 11g introduced a new feature "Database Replay" which helps in performing Real Application testing. This feature allows the database/system administrator to simulate actual production workload to test the impact of infrastructure and database level changes on test server. Database Replay can be used to assess the impact of any system changes such as below:

- o   Database upgrades, patches, parameter, schema changes,
- o   Configuration changes such as conversion from a single instance to RAC,
- o   Storage, network, interconnect changes,
- o   Operating system, hardware migrations, patches, upgrades, parameter changes,

Database replay captures a workload on the production system with negligible performance overheads and replays it on a test system with the exact timing, concurrency, and transaction characteristics of the original workload. This makes possible complete assessment of the impact of the change. Extensive analysis and reporting (AWR , ADDM report and DB Replay Report) is provided to help identify any potential problems, such as new errors encountered and performance divergences.

Need for Database Replay

Lower testing cost

DBAs and System administrators can have a test infrastructure to test their changes without the overhead of having to duplicate the infrastructure. Database Replay does not have set up overhead to recreate a middle-tier or a web server tier or build test scripts. Thus, DBAs and system administrators can test and upgrade the infrastructure components as the changes have been truly tested and validated using production scenarios.

Faster deployment

Database Replay does not require DBA to spend a lot of time in getting functional knowledge of the application for developing test scripts. With Database Replay, DBAs have a full production workload available to test and rollout any change. This reduces application testing cycles and brings significant cost savings to business.

Overview of Oracle 11G Database Replay

Oracle 11G Database Replay allows the database administrator to capture the full production workload and then recreate the same in the test environment.

Workload Capture tracks and captures all external database requests and writes the data into a binary file called capture file.

Workload Processing is the step where the capture files are converted into replay files. Replay files contain all the necessary metadata needed for replaying the workload. This is the most resource intensive task and should be performed on a non-production server. Once the replay files are created, they can be reused any number of times without having to reprocess the workload.

Workload Replay is performed through the replay client which processes the replay files and submits the load / calls to the database with the exact timing and concurrency that it has recorded in the original system.

Analysis and Reporting allows to generate detailed analysis of the capture and replay. All errors encountered during replay are reported. Any divergence in rows and basic comparisons between the capture and replay are shown in "Replay and Capture" report. Besides, AWR, ADDM can be used for detailed analysis and diagnostics.

Database Replay Phases

Workload Capture

The database are tracked and stored in binary files on file system, called capture files. These files contain all relevant information about the call needed for replay such as SQL text, bind values, SCN, etc.

1)   Backup production Database so we can restore database on test environment on same SCN level of database to minimize data divergence.

2)   Add/remove filter
By default, all user sessions are recorded during workload capture. You can use workload filters to specify which user sessions to include in or exclude from the workload.

3)   Create directory make sure enough space is there to hold the capture files.

4)   Capture workload using OEM or dbms packages. The following shows the production capture process using OEM.

Workload Processing

Once the workload has been captured, the information in the capture files has to be processed preferably on the test system. This processing transforms the captured data and creates all necessary metadata needed for replaying the workload.

Database Instance: infTEST > Database Replay >   Logged in As SYS
Preprocess Captured Workload

Cancel   Preprocess Workload

Directory
Select a directory object that contains a captured workload.

* Directory Object DB_REPLAY_CAPTURE   Create Directory Object

▼ **Capture Summary**

Name	PROD_CAPTURE	Captured Data Size (MB)	2.04
Status	Completed	Duration (hh:mm:ss)	00:39:15
Directory Object	DB_REPLAY_CAPTURE	Start Time	Feb 25, 2008 11:34:00 PM CST
Database Name	INFPROD	End Time	Feb 26, 2008 12:13:15 AM CST
Capture Database Version	11.1.0.6.0	Start SCN	1016530
DBID	530026227	End SCN	1355413
Capture Error Code	0	Preprocessed Database Version	11.1.0.6.0
Capture Error Message	None		

```
SQL> BEGIN
  2    DBMS_WORKLOAD_REPLAY.process_capture('DB_REPLAY_CAPTURE');
  3    END;
  4  /

PL/SQL procedure successfully completed.
```

Workload Replay

1)   Restore database backup taken to test system and start the test database.

2)   Initialize and Prepare replay.

3)   Start clients and begin Replay.

Database Instance: infTEST > Database Replay >   Logged in As SYS
View Workload Replay: REPLAY-infTEST-20080226021803

OK

Status Completed

▼ **Summary**

Replay Name	REPLAY-infTEST-20080226021803	Capture Name	PROD_CAPTURE
Directory Object	DB_REPLAY_CAPTURE	Duration (hh:mm:ss)	00:39:28
Database Name	INFTEST	Prepare Time	Feb 26, 2008 2:20:59 AM CST
DBID	106506683	Start Time	Feb 26, 2008 2:26:45 AM CST
Replay Error Code	N/A	End Time	Feb 26, 2008 3:06:13 AM CST
Replay Error Message	None		

Workload Profile | Connection Mappings | Replay Parameters | Report

Network Time (hh:mm:ss) 00:13:29   Clients 1
Think Time (hh:mm:ss) 06:44:47   Clients Finished 1

Elapsed Time Comparison

Assessing the Replay

The Elapsed Time Comparison chart shows how much time the replayed workload has taken to accomplish the same amount of work as captured.

When the Replay bar is shorter than the Capture bar then the replay environment is processing the workload faster than the capture environment.

The divergence table gives information about both the data and error discrepancies between the replay and capture environments, which can be used as a measure of the replay quality.

Legend: ▯ Replay Elapsed ▮ Capture Elapsed ▯ Not Yet Replayed

Analysis and Reporting

The Database Capture and Replay report indicates if any system change will affect the system performance. There are 3 types of divergence reports, namely Data divergence, Error divergence and Performance divergence.

DB Replay Report for REPLAY-infTEST-20080226021803

DB Name	DB Id	Release	RAC	Replay Name	Replay Status
INFTEST	106506683	11.1.0.6.0	NO	REPLAY-infTEST-20080226021803	COMPLETED

Replay Information

Information	Replay	Capture
Name	REPLAY-infTEST-20080226021803	PROD_CAPTURE
Status	COMPLETED	COMPLETED
Database Name	INFTEST	INFPROD
Database Version	11.1.0.6.0	11.1.0.6.0
Start Time	26-FEB-08 02:26:45	25-FEB-08 23:34:00
End Time	26-FEB-08 03:06:13	26-FEB-08 00:13:15
Duration	39 minutes 28 seconds	39 minutes 15 seconds
Directory Object	DB_REPLAY_CAPTURE	DB_REPLAY_CAPTURE
Directory Path	c:\capture	c:\capture

Replay Options

Option Name	Value
Synchronization	TRUE
Connect Time	100%
Think Time	100%
Think Time Auto Correct	TRUE
Number of WRC Clients	1 (1 Completed, 0 Running)

Replay Statistics

Statistic	Replay	Capture
DB Time	85.718 seconds	6138.611 seconds
Average Active Sessions	.04	2.61
User calls	9023	9023
Network Time	809.451 seconds	
Think Time	24286.554 seconds	

CONCLUSION

Database Replay provides Real Application Testing which helps organizations to lower their testing costs. It removes the dependency of preparing scripts to generate production workload. It gives DBAs and system administrators an easy-to-deploy solution for testing and rolling out system changes with reduced hardware and software costs.