Disaster Recovery and Zero Failover using Oracle Dataguard

Kiran Chavan¹ Abhijeet Sutar² Prof Sudhakar Jadhav³

¹,²,³ Lokmanya Tilak College of Engineering, Mumbai University, Navi-Mumbai, Maharashtra, India

Abstract— Data Guard is most of the useful technique for high availability, disaster recovery and protection. Data Guard are providing high availability of your database because when your primary database is fails due To Some bugs(error) the Data Guard can switch to any standby database. The Standby database is Take Place Of primary database, so the availability of the database is high. This paper will study these changes and will see how active Data Guard is providing high availability with offloading workload to one or more standby databases and providing the opportunity to query real time data in Standby databases. Our approach is based on changing the parameters of TNS file and prevent the users to reconnect to Primary database again and again after Primary system failure.

Key words: Oracle Data Guard, Database, Disaster Recovery, Switchover, Failover

I. INTRODUCTION TO ORACLE DATA GUARD

Oracle Data Guard is one of the software solutions provided by Oracle Corporation to maximize high availability of Oracle databases. Oracle Data Guard maintains one or many secondary databases as alternatives to the primary production database. Oracle Data Guard ensures high availability, data protection, and disaster recovery for enterprise data.

Data Guard can switch any standby database to the production role, minimizing the downtime associated with the outage. Data Guard can be used with traditional backup, restoration, and cluster techniques to provide a high level of data protection and data availability.

Data Guard maintains these standby databases as copies of the production database.

Then, if the production database becomes unavailable because of a planned or an unplanned outage, With Data Guard, administrators can optionally improve production database performance by offloading resource-intensive backup and reporting operations to standby systems. [5]

II. OVERVIEW OF ORACLE DATA GUARD

Data Guard is basically a ship redo and then apply redo, as you know redo is the information needed to recover a database transaction. A production database referred to as a primary database transmits redo to one or more independent replicas referred to as standby databases.

Standby databases are in a continuous state of recovery, validating and applying redo to maintain synchronization with the primary database. A standby database will also automatically resynchronize if it becomes temporary disconnected to the primary due to power outages, network problems etc.

Fig. 1: Architecture of Oracle Data Guard

III. BENEFITS OF DATA GUARD

Data Guard Provide following benefits:

1) Ease of use
2) Fast, Automatic Failover
3) Improve Production Performance
4) Flexibility in data protection
5) Automatic Gap detection and resolution
6) Centralized management scheme
7) Integrated with Oracle database
8) Maximum Data Availability
9) Complete Data Protection.
10) Efficient Utilization of System Resources

Data guard ensures maximum availability by performing Switchover and Failover Operations. Standby database provides complete data protection by backup operation and efficiently utilization by performing backup, restoration tasks. Number of available standby databases allows flexibility in system protection. [3]

IV. FEATURES OF DATA GUARD

A. Minimize Data Loss during Failover:

One of the statements that are not well known, but introduced in Oracle 11gR2 is the flush of the redo.

For Oracle Data Guard a flush of the redo in case of a fail over can be very useful. If this statement is successful executed the last redo is applied on the standby and there will be no data loss.
B. Minimize Human Efforts:
Primary Database is failed so it switches to standby the database this operation performs automatically there is no Human Interaction.

V. DATA GUARD MODES
Oracle Data Guard can operate in 3 different modes:

A. Maximum Protection:
Transactions are not allowed to commit until all redo data are written to the online redo logs and propagated to at least one synchronized secondary database. If for any reason, the primary database cannot propagate its redo stream to one secondary database, the primary will shut down to ensure maximum protection mode.[2]

B. Maximum Performance (Default):
Transactions are not allowed to commit as soon as the redo are written to the online redo logs. The redo stream is asynchronously propagated to the secondary databases to ensure maximum performance mode.[2]

C. Maximum Availability:
This protection mode provides the highest level of data protection that is possible without compromising the availability of a primary database. Transactions do not commit until all redo data needed to recover those transactions has been written to the online redo log and to at least one synchronized standby database. If the primary database cannot write its redo stream to at least one synchronized standby database, it operates as if it were in maximum performance mode to preserve primary database availability until it is again able to write its redo stream to a synchronized standby database.[2]

VI. DATA GUARD WORKING

A. Failover:
If the primary database is not available the standby database can be activated as a primary database using the following statements.
SQL> ALTER DATABASE RECOVER MANAGED STANDBY DATABASE FINISH;
SQL> ALTER DATABASE ACTIVATE STANDBY DATABASE;
Since the standby database is now the primary database it should be backed up. [6]

B. Switchover:
A database can be in one of two mutually exclusive modes (primary or standby). These roles can be altered at runtime without loss of data or resetting of redo logs. This process is known as a Switchover. [9]
Steps for Switchover from Primary to Standby Database:
1) On Standby Database:
   1) Step 1:
   SQL> SELECT SWITCHOVER_STATUS FROM V$DATABASE;
   SWITCHOVER_STATUS
   -----------------
   TO_PRIMARY

2) Step 2:
   SQL> ALTER DATABASE COMMIT TO SWITCHOVER TO PRIMARY WITH SESSION SHUTDOWN;
   1) On New Standby Database:
   SQL> ALTER DATABASE RECOVER MANAGED STANDBY DATABASE USING CURRENT LOGFILE DISCONNECT FROM SESSION;

C. Log Shipping and Apply Services Options:
1) Step 1:
   SQL> SELECT SWITCHOVER_STATUS FROM V$DATABASE;
   SWITCHOVER_STATUS
   -----------------
   TO STANDBY
   1 row selected
   2) Step 2:- Initiate The Switchover On The Primary Database
   SQL> ALTER DATABASE COMMIT TO SWITCHOVER TO PHYSICAL STANDBY WITH SESSION SHUTDOWN;
   3) Step 3:
   SQL> SHUTDOWN ABORT;
   4) Step 4:
   SQL> STARTUP MOUNT;

D. Delayed Apply:
When a primary database is open and active transactions are in progress, redo log data is generated and shipped to standby sites. It is possible to delay the application of redo data already received at one or more standby databases. The ability to delay the application of changes to standby databases enables not only the protection of production data from data center disasters, but also provides a window of protection from user errors or corruption. [1]

E. Automatic Resynchronization:
Oracle Data Guard can smoothly handle network connectivity problems that temporarily disconnect the standby database from the primary database. In this case, transactions are captured locally at the primary database until a standby is available. When connectivity to the standby is re-established, the accumulated logs are automatically shipped to the standby, until the standby has resynchronized with the primary and all archive gaps are resolved. Oracle Data Guard supports both physical standby and logical standby sites. [3]

VII. DATA GUARD BROKER
The Data Guard broker is a distributed management framework that automates the creation, maintenance, and monitoring of Data Guard configurations. You can use either the Oracle Enterprise Manager graphical user interface (GUI) or the Data Guard [3]
Command-line interface (DGMGRL) to:
1) Create and enable Data Guard configurations, including setting up redo transport
2) Services and apply services
3) Manage and monitor Data Guard configurations that contain Oracle RAC primary or standby databases
4) Manage an entire Data Guard configuration from any system in the configuration.

A. Implementing Observer Configuration and Changing Parameters of Client TNS:

1) Client Connectivity:

B. Client TNS File:

VIII. FINAL RESULTS

A. Performing Failover:

To check that your standby database is working properly but the primary database is not working properly so it switches to standby database and now standby database become a primary database. After Recover your Primary database you can also switch over to the standby database to the primary database.

IX. TYPES OF STANDBY DATABASES

A. Physical Standby Database:

In Physical Standby Database, when the primary database transactions generate redo entries, a redo apply process keeps up the secondary databases with the exact block copies of the primary database. Archived redo log are transferred from the primary database to the standby database and are directly applied. Once you create the physical standby database and set up redo transport services, you may want to verify database modifications are being successfully transmitted from the primary database to the standby database. To see that redo data is being received on the standby database, you should first identify the existing archived redo log files on
the standby database, force a log switch and archive a few online redo log files on the primary database, and then check the standby database again.

**B. Logical Standby Database:**

SQL apply processes read the redo and convert it to SQL transactions. These are then applied to the secondary database. From the archive logs, SQL statements are captured and only these statements are applied on the standby database. Organization and structure of the data can be different. Organization and structure of the data can be different. The logical standby database is kept synchronized with the primary database through SQL Apply, which transforms the data in the redo received from the primary database into SQL statements and then executes the SQL statements on the standby database. The logical standby database is kept synchronized with the primary database through SQL Apply, which transforms the data in the redo received from the primary database into SQL statements and then executes the SQL statements on the standby database. A logical standby database can be used for other business purposes in addition to disaster recovery requirements. This allows users to access a logical standby database for queries and reporting purposes at any time. Also, using a logical standby database, you can upgrade Oracle Database software and patch sets with almost no downtime. Thus, a logical standby database can be used concurrently for data protection, reporting, and database upgrades.

**Fig. 7: Primary Database and Standby Database**

**X. CONCLUSION**

Data Guard Redo Apply is the simplest, fastest and most reliable solution for maintaining an independent, synchronized physical replica of the Oracle Database for HA/DR.

**A. Data Guard:**

1) Supports both High Availability (with Zero Data Loss and/or Automatic Failover) and Disaster Recovery.
2) Provides unique levels of data protection and availability and is the only DR technology able to support the very high transaction volumes driven by Exadata.
3) Data Guard is more efficient than any Data management tool exist till now because other tools require much more manual interaction

**XI. ACKNOWLEDGEMENT**

We would like to acknowledge our parents and our professor from Lokmanya Tilak College of Engineering, Prof Sudhakar Jadhav. Because of their guidance and knowledge in this area, we could complete this research paper successfully with ease.

**REFERENCE**