

Oracle Redo Logs and Archive Logs

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1. Introduction

What are Redo Logs?

Redo Logs are special files in Oracle Database that record all changes made to the database. They capture every SQL statement that modifies data (INSERT, UPDATE, DELETE, DDL operations) before these changes are written to the datafiles. The primary purpose of redo logs is to ensure database recovery in case of instance failure or media failure.

Every Oracle Database must have at least two redo log groups. The database writes to redo logs in a circular manner - once a redo log group fills up, the database switches to the next group and continues recording changes.

What are Archive Logs?

Archive Logs are copies of redo log files that have been filled and switched. When a redo log group becomes full and the database switches to the next group, the old group is archived (copied) to a designated location. This process is called archiving and only occurs when the database is in ARCHIVELOG mode.

Archive logs serve as permanent records of all database changes and are essential for performing point-in-time recovery, disaster recovery, and maintaining a complete transaction history.

2. Relationship Between Redo Logs and Archive Logs

The relationship between redo logs and archive logs follows a sequential lifecycle:

Redo Log Lifecycle:

1. A new redo log group is created and begins recording database changes
2. The redo log fills up over time as more transactions occur
3. When full, a log switch occurs - the database moves to the next redo log group
4. The filled redo log is either archived or overwritten depending on the database mode

Key Relationships:

- Redo logs are temporary and cyclical; archive logs are permanent records
- Archive logs are created FROM redo logs during the archiving process
- In NOARCHIVELOG mode, redo logs are overwritten after a log switch (no archive logs created)
- In ARCHIVELOG mode, redo logs are archived before being overwritten
- Archive logs provide protection that redo logs alone cannot offer
- Together, they form the complete recovery strategy for Oracle Database

Circular Redo Log Mechanism:

Redo Log Group 1 → Redo Log Group 2 → Redo Log Group 3 →

(fills)

(fills)

(fills)

↓

↓

↓

Archive Log 1

Archive Log 2

Archive Log 3

↓

Cycle repeats

3. Enabling Archive Logs

Prerequisites

- Database must have at least two redo log groups
- Sufficient disk space for archive logs
- Proper directory structure with appropriate permissions

Steps to Enable ARCHIVELOG Mode

Step 1: Shut down the database

```
SHUTDOWN IMMEDIATE;
```

Step 2: Start the database in mount mode

```
STARTUP MOUNT;
```

Step 3: Enable ARCHIVELOG mode

```
ALTER DATABASE ARCHIVELOG;
```

Step 4: Open the database

```
ALTER DATABASE OPEN;
```

Configuring Archive Log Destination

Step 1: Determine current archive destination

```
SHOW PARAMETER db_recovery_file_dest;
```

Step 2: Set the archive destination (if not already configured)

```
ALTER SYSTEM SET db_recovery_file_dest='/u01/archive' SCOPE=BOTH;
```

Or configure with initialization parameters:

```
ALTER SYSTEM SET log_archive_dest_1='LOCATION=/u01/archive  
VALID_FOR=(ALL_LOGFILES,ALL_ROLES) DB_UNIQUE_NAME=prod' SCOPE=BOTH;
```

Step 3: Create the archive directory and verify permissions

```
mkdir -p /u01/archive  
chown oracle:dba /u01/archive  
chmod 755 /u01/archive
```

Configuring Multiple Archive Destinations

For high availability, configure multiple archive destinations:

```
ALTER SYSTEM SET log_archive_dest_1='LOCATION=/u01/archive  
VALID_FOR=(ALL_LOGFILES,ALL_ROLES)' SCOPE=BOTH;  
ALTER SYSTEM SET log_archive_dest_2='LOCATION=/u02/archive  
VALID_FOR=(ALL_LOGFILES,ALL_ROLES)' SCOPE=BOTH;
```

4. Validating Archive Log Configuration

Verify ARCHIVELOG Mode is Enabled

ARCHIVE LOG LIST;

Expected Output:

| | |
|-----------------------------------|--------------|
| Database log mode | Archive Mode |
| Automatic archival | Enabled |
| Archive destination | /u01/archive |
| Oldest online log sequence number | 100 |
| Next log sequence number | 105 |
| Current log sequence number | 105 |

Check Database Mode with SQL Query

SELECT LOG_MODE FROM v\$database;

Should return: ARCHIVELOG or NOARCHIVELOG

Verify Archive Destination Configuration

SHOW PARAMETER db_recovery_file_dest;

SHOW PARAMETER log_archive_dest;

Check Current Redo Log Groups

```
SELECT GROUP#, SEQUENCE#, BYTES, MEMBERS, STATUS
FROM v$log
ORDER BY GROUP#;
```

Status explanations:

- CURRENT : Currently being written to
- ACTIVE : Required for crash recovery but not being written to
- INACTIVE : Not needed for crash recovery and can be archived
- UNUSED : Not yet used

Monitor Archive Log Generation

```
SELECT THREAD#, SEQUENCE#, FIRST_CHANGE#, NEXT_CHANGE#,
ARCHIVED, STATUS, NAME
FROM v$log_history
ORDER BY COMPLETION_TIME DESC
FETCH FIRST 20 ROWS ONLY;
```

Check Archive Log Disk Space

```
SELECT NAME, SPACE_LIMIT, SPACE_USED, SPACE_RECLAIMABLE
FROM v$recovery_file_dest;
```

5. Importance and Benefits of Redo and Archive Logs

Redo Logs - Importance

- **Instance Recovery:** Redo logs enable automatic recovery from instance failures. When the database crashes and restarts, Oracle uses redo logs to replay all committed transactions that were not written to datafiles.
- **Data Consistency:** Redo logs ensure the database maintains consistency during recovery operations by providing a complete record of all changes.
- **ACID Compliance:** They support the Atomic and Durable properties of ACID transactions.
- **Crash Prevention:** Help prevent data loss during unexpected shutdown or system failures.

Archive Logs - Importance

- **Complete Recovery:** Archive logs enable point-in-time recovery, allowing restoration to any point in time since archiving began.
- **Disaster Recovery:** Provide the foundation for robust disaster recovery strategies and geographic redundancy.
- **Data Protection:** Offer long-term protection and auditability of database changes.
- **Regulatory Compliance:** Meet requirements for data retention and historical audit trails.
- **Data Replication:** Essential for setting up Data Guard, Streams, and other replication solutions.

Key Benefits

Data Loss Prevention:

- Redo logs prevent immediate data loss during instance failures
- Archive logs provide recovery options for media failures and logical errors
- Combined, they create a complete safety net against data loss

Business Continuity:

- Enable rapid recovery minimizing downtime
- Support failover and disaster recovery strategies
- Reduce business impact of unexpected outages

Flexibility:

- Point-in-time recovery allows restoration to specific moments
- Supports multiple recovery strategies (full, partial, selective)
- Enables recovery from logical errors and corruption

Auditability and Compliance:

- Complete transaction history for audit purposes
- Meet regulatory requirements for data retention
- Support forensic analysis of database changes

Performance Optimization:

- Enable efficient incremental backups
- Support log-based replication with minimal overhead
- Allow tuning of recovery parameters based on business needs

6. Operational Considerations

Redo Log Sizing

Too Small : Causes frequent log switches, increasing I/O and CPU overhead
Too Large : Increases recovery time and memory consumption

Recommendation: Size redo log groups so they fill every 15-30 minutes under normal load.

Check current sizing:

```
SELECT GROUP#, BYTES/1024/1024 as SIZE_MB FROM v$log;
```

Archive Log Management

Enable space management:

```
ALTER SYSTEM SET db_recovery_file_dest_size=100G;
```

Monitor archive log growth:

```
SELECT COUNT(*) as ARCHIVE_COUNT,  
       ROUND(SUM(BLOCKS*BLOCK_SIZE)/1024/1024/1024, 2) as SIZE_GB  
FROM v$archived_log;
```

Backup Strategy

- Archive logs should be backed up regularly
- Do not rely on archive destination as sole backup
- Implement retention policies based on recovery requirements
- Test recovery procedures regularly

7. Troubleshooting Common Issues

Archive Log Destination Full

Error: "ORA-19809: limit exceeded for recovery files"

Solution:

1. Increase destination size: ALTER SYSTEM SET db_recovery_file_dest_size=200G;
2. Backup and delete old archive logs
3. Add additional destination: ALTER SYSTEM SET log_archive_dest_2=...

Archive Process Stuck

Check status:

```
SELECT PROCESS, STATUS, SEQUENCE# FROM v$archive_processes;
```

Restart if needed:

```
ALTER SYSTEM ARCHIVE LOG START;
```

Missing Archive Logs

Check sequence gaps:

```
SELECT SEQUENCE# FROM v$archived_log WHERE STATUS='A'  
ORDER BY SEQUENCE#;
```

8. Best Practices

1. Always run in **ARCHIVELOG mode** for production databases
2. **Configure multiple archive destinations** for redundancy
3. **Monitor archive log disk space** and set up alerts
4. **Regularly test recovery procedures** using archive logs
5. **Implement proper retention policies** based on recovery objectives
6. **Back up archive logs** as part of overall backup strategy
7. **Size redo logs appropriately** for your workload
8. **Document recovery procedures** and recovery point objectives (RPO)
9. **Use flashback features** in conjunction with archive logs for logical recovery
10. **Maintain adequate disk space** - recommendation is 3-4x datafile size for archives

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