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Tuning RMAN Backup Performance

Objectives

After completing this lesson, you should be able to:

- Interpret the RMAN message output
- Apply best-practice tuning principles
- Diagnose RMAN performance issues

Is There a Problem?

- Know the performance of each of your components.
- Analyze the read and process steps by using the `BACKUP VALIDATE` command.
- Analyze the read and process steps by using the `RESTORE VALIDATE` command.

Diagnosing Performance Bottlenecks

1. Query the `EFFECTIVE_BYTES_PER_SECOND` column in `V$BACKUP_ASYNC_IO` or `V$BACKUP_SYNC_IO` for the `AGGREGATE` row.
2. If the value in `EFFECTIVE_BYTES_PER_SECOND` < storage media throughput, execute the `BACKUP VALIDATE` command to obtain additional information.

Diagnosing Performance Bottlenecks: Read Phase

- If `BACKUP VALIDATE` time ~= actual backup time, the read phase is the likely bottleneck.
- Implement appropriate RMAN multiplexing and buffer usage guidelines.

Is There a “Write” Problem?

To analyze a write process to disk:

- Create a data file on the disk and time the operation
- Invoke the write by calling the `DBMS_BACKUP_RESTORE.SETPARMS` function

Diagnosing Performance Bottlenecks: Write or Copy Phase

- If `BACKUP VALIDATE` time is less than the actual backup time, buffer copy or write to storage is the likely bottleneck.
- Implement backup compression and encryption guidelines:
  - Verify that uncompressed backup performance scales properly, as channels are added.
  - Use the `LOW` or `MEDIUM` setting.
  - Use the `AES128` encryption algorithm.
- If tape backup, check media management (MML) settings:
  - TCP/IP buffer size
  - Media management client/server buffer size
  - Client/socket timeout
  - Media server hardware, connectivity to tape
  - Enable tape compression (but not RMAN compression)

Using Dynamic Views to Diagnose RMAN Performance

Use the following views to determine where RMAN backup and restore operations are encountering performance issues:

View	Use
V$SESSION_LONGOPS	Monitoring the progress of backups and restore jobs
V$BACKUP_SYNC_IO	Identifying bottlenecks Determining whether the tape is streaming when the I/O is synchronous Viewing detailed progress of backup jobs
V$BACKUP_ASYNC_IO	Identifying bottlenecks Determining the rate of asynchronous I/O

Monitoring RMAN Job Progress

Monitor the progress of backup and restore operations by querying V$SESSION_LONGOPS.

```
SQL> SELECT SID,SERIAL#,CONTEXT,SOFAR,TOTALWORK,
  2  ROUND(SOFAR/TOTALWORK*100,2) "%_COMPLETE"
  3  FROM V$SESSION_LONGOPS
  4  WHERE OPNAME LIKE 'RMAN%'
  5  AND OPNAME NOT LIKE '%aggregate%'
  6  AND TOTALWORK != 0
  7  AND SOFAR <> TOTALWORK;

SID SERIAL# CONTEXT   SOFAR TOTALWORK %_COMPLETE
--- ------- ------- ------- --------- ----------
 13      75       1    9470     15360      61.65
 12      81       1   15871     28160      56.36
```


Identifying Backup and Restore Bottlenecks

- The following views can be used to determine the source of bottlenecks and to view backup job progress:
  - V$BACKUP_SYNC_IO
  - V$BACKUP_ASYNC_IO

Asynchronous I/O Bottlenecks

- Use V$BACKUP_ASYNC_IO to monitor asynchronous I/O.
- The file that has the largest ratio of LONG_WAITS to IO_COUNT is probably the bottleneck.
  - IO_COUNT: Number of I/Os performed on the file
  - LONG_WAITS: Number of times the backup/restore process directed the OS to wait until I/O was complete
- Wait times should be zero to avoid bottlenecks.
  - SHORT_WAIT_TIME_TOTAL
  - LONG_WAIT_TIME_TOTAL

Synchronous I/O Bottlenecks

- Synchronous I/O is considered to be a bottleneck.
- Query the DISCRETE_BYTES_PER_SECOND column from V$BACKUP_SYNC_IO to view the I/O rate.
  - Compare this rate with the device's maximum rate.
  - If the rate is lower than what the device specifies, this is a tuning opportunity.

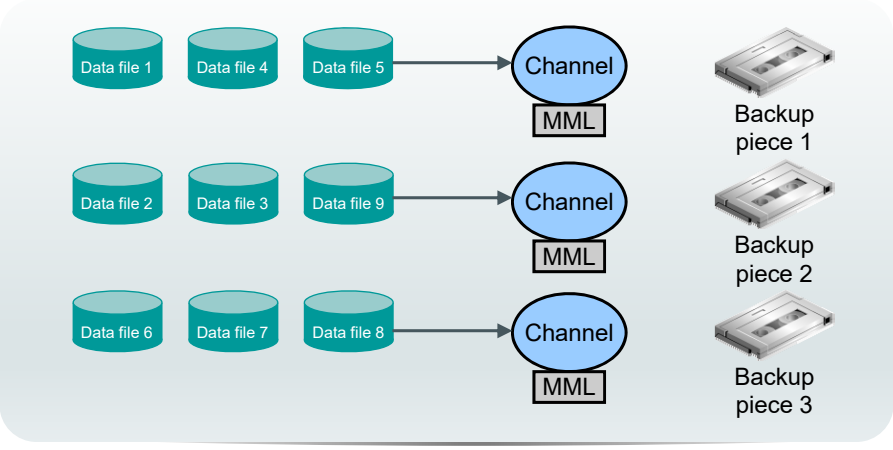
Tuning RMAN Backup Performance

To tune RMAN backup performance, perform the following steps:

1. Remove `RATE` settings from configured and allocated channels.
2. Set the `DBWR_IO_SLAVES` parameter if you use synchronous disk I/O.
3. Set the `LARGE_POOL_SIZE` initialization parameter.
4. Tune the RMAN read, write, and copy phases.

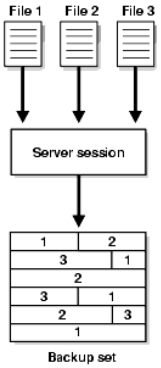
Parallelization of Backup Sets

For performance, allocate multiple channels and assign files to specific channels.



RMAN Multiplexing

- Multiplexing level: Maximum number of files read by one channel, at any time, during backup
  - Min (`MAXOPENFILES`, `FILESPERSET`)
  - Default for `MAXOPENFILES` is 8.
  - Default for `FILESPERSET` default is 64.
- `MAXOPENFILES` determines the number and size of input buffers.
  - All buffers allocated from PGA, unless disk or tape I/O slaves, are enabled.



RMAN Multiplexing

- For reads:

Multiplexing Level	Allocation Rule
Level <= 4	1 MB buffers are allocated so that the total buffer size for all input files is 16 MB.
4 < Level <= 8	512 KB are allocated so that the total buffer size for all files is less than 16 MB.
Level > 8	RMAN allocates four 128 KB disk buffers per channel for each file so that the total size is 512 KB per channel for each file.

- For writes, each channel is allocated four output buffers of 1 MB each.

Summary

In this lesson, you should have learned how to:

- Interpret the RMAN message output
- Apply best-practice tuning principles
- Diagnose RMAN performance issues

Practice Overview

- Monitoring an RMAN Backup Job