How to Interpret the "SQL ordered by Physical Reads (UnOptimized)" Section in AWR Reports (11.2 onwards) for Smart Flash Cache Database (Doc ID 1466035.1)

APPLIES TO:

Oracle Database - Enterprise Edition - Version 11.2.0.1 and later
Oracle Database Cloud Schema Service - Version N/A and later
Oracle Database Exadata Cloud Machine - Version N/A and later
Oracle Cloud Infrastructure - Database Service - Version N/A and later
Oracle Database Backup Service - Version N/A and later
Information in this document applies to any platform.

GOAL

This document describes the 'SQL ordered by Physical Reads (UnOptimized)' section in AWR reports from Oracle 11.2 onwards and explains how to interpret certain sections.

SOLUTION

 An example of the 'SQL ordered by Physical Reads (UnOptimized)' section would look similar to the following:

SQL ordered by Physical Reads (UnOptimized)

- UnOptimized Read Reqs = Physical Read Reqts - Optimized Read Reqs
- %Opt - Optimized Reads as percentage of SQL Read Requests
- %Total - UnOptimized Read Reqs as a percentage of Total UnOptimized Read Reqs
- Total Physical Read Requests: 3,438,206
- Captured SQL account for 88.8% of Total
- Total UnOptimized Read Requests: 3,438,206
- Captured SQL account for 88.8% of Total
- Total Optimized Read Requests: 1
- Captured SQL account for 0.0% of Total

UnOptimized Read Reqs	Physical Read Reqs	Executions	UnOptimized Reqs per Exec	%Opt	%Total	SQL Id	SQL Module	SQL T
1,072,693	1,072,693	4	268,173.25	0.00	31.20	a94vs7s7k2xx0	SQL*Plus	DECLARE OUT NUMBER; V_E
1,064,970	1,064,970	3	354,990.00	0.00	30.97	6bsa26gr5mp2k	SQL*Plus	INSERT /*+ a INTO FIRE...
771,242	771,242	1	771,242.00	0.00	22.43	ftja941kjtrxj	SQL*Plus	DECLARE OUT NUMBER; V_E
....	...	...	...	...	...	...	...	...
63,381	63,381	2	31,690.50	0.00	1.84	bha3g79j51261	SQL*Plus	INSERT INTO FIREWALL_XF(
61,362	61,362	2	30,681.00	0.00	1.78	f0tqq0h3aqsn0	SQL*Plus	SELECT TRUNC(EVENT E...
59,921	59,921	11	5,447.36	0.00	1.74	6zbw6ctdmd9d8	DBMS_SCHEDULER	/* SQL Analyz MERGE ...
37,168	37,168	1	37,168.00	0.00	1.08	frurkbv3y3acd	SQL*Plus	INSERT INTO

| | | | | | | | | FIREWALL_NO |

What are 'Optimized Read Reqs'?

Optimized Read Requests are read requests that are satisfied from the Smart Flash Cache (or the Smart Flash Cache in OracleExadata V2).

> Note that despite same name, concept and use of 'Smart Flash Cache' in Exadata V2 is different from 'Smart Flash Cache' in Database Smart Flash Cache.

Read requests that are satisfied from the Smart Flash Cache are termed 'optimized' since they are returned much faster than requests from disk (the implemention uses solid state device (SSD) technology). Additionally, read requests accessing Storage Indexes using smart scans in Oracle Exadata V2 (and significantly reducing I/O operations) also fall under the category 'optimized read requests' since they avoid reading blocks that do not contain relevant data.

In database systems where 'Optimized Read Requests' are not present, UnOptimized Read Reqs will be equal to Physical Read Reqs (I/O requests satisfied from disk). In this case columns 'UnOptimized Read Reqs' and 'Physical Read Reqs' will display the same values and column '%Opt' will display zero (as seen in extract from AWR report above).

> Note that the 'Physical Read Reqs' column in the 'SQL ordered by Physical Reads (UnOptimized)' section is the number of I/O requests and not the number of blocks returned. Be careful not to confuse these with the Physical Reads statistics from the AWR section 'SQL ordered by Reads', which counts database blocks read from the disk not actual I/Os (a single I/O operation may return many blocks from disk).

If you look at the example 'SQL ordered by Reads' section below from same AWR report for database not using smart cache, notice the physical reads:

SQL ordered by Reads

- %Total - Physical Reads as a percentage of Total Disk Reads
- %CPU - CPU Time as a percentage of Elapsed Time
- %IO - User I/O Time as a percentage of Elapsed Time
- Total Disk Reads: 8,414,054
- Captured SQL account for 98.3% of Total

Physical Reads	Executions	Reads per Exec	%Total	Elapsed Time (s)	%CPU	%IO	SQL Id	SQL Module	SQI
3,308,102	1	3,308,102.00	39.32	2,250.65	15.30	85.62	59v4zh1ac3v2a	DBMS_SCHEDULER	DECLARE job BINARY_INTE(
...	...	...	....	...	...	...	...	...	...
910,228	2	455,114.00	10.82	116.02	66.64	12.31	f0tqq0h3aqsn0	SQL*Plus	SELECT TRUN('hh') E...
772,465	1	772,465.00	9.18	3,536.45	25.41	70.20	ftja941kjtrxj	SQL*Plus	DECLARE OUT V_ERROR...
681,649	0		8.10	3,598.62	1.29	99.21	6mcpb06rctk0x	DBMS_SCHEDULER	call dbms_space.a
654,542	1	654,542.00	7.78	3,166.37	26.57	68.47	9cdjzp9sv9tqh	SQL*Plus	INSERT INTO FIREWALL_XF(
391,516	317	1,235.07	4.65	3,564.33	0.89	99.56	8szmwam7fysa3	DBMS_SCHEDULER	insert into wri$_adv_objs
...	...	...	...	...	...	...	...	...	...

To tune high physical reads for non smart cache sql,please review following:

Document 232443.1 How to Identify Resource Intensive SQL to Tune

Note the difference between 'Physical Reads' in the 'SQL ordered by Reads' and the 'Physical Read Reqs' in the 'SQL ordered by Physical Reads (UnOptimized)' section above for the SQL with "SQL_ID=f0tqq0h3aqsn0" from same AWR report in the comparison below:

SQL ordered by Physical Reads (UnOptimized)

UnOptimized Read Reqs	Physical Read Reqs	Executions	UnOptimized Reqs per Exec	%Opt	%Total	SQL Id	SQL Module	SQL Text
1,072,693	1,072,693	4	268,173.25					DECLARE OUTPUT NUMBER; ERROR...
1,064,970	1,064,970	3	354,990.					SERT /*+ append */ INTO RE...
771,242	771,242	1	771,242.00					ECLARE OUTPUT NUMBER; ERROR...
....	...	..	...	...	...	...	...	...
63,381	63,381	2	31,690.50	0.00	1.84	bha3g79j51261	SQL*Plus	INSERT INTO FIREWALL_XFORM_TEM...
61,362	61,362	2	30,681.00	0.00	1.78	f0tqq0h3aqsn0	SQL*Plus	SELECT TRUNC(EVENT_DT, 'hh') E...
59,921	59,921	11	5,447.36	0.00	1.74	6zbw6ctdmd9d8	DBMS_SCHEDULER	/* SQL Analyze(8, 1) */ MERGE ...
37,168	37,168	1	37,168.00	0.00	1.08	frurkbv3y3acd	SQL*Plus	INSERT INTO FIREWALL_NODE (ID,...

In the 'SQL ordered by Physical Reads (UnOptimized)' section, 'Physical Read Reqs' is the number of I/O requests NOT the number of blocks

SQL ordered by Reads

Physical Reads	Executions	Reads per Exec	%Total	Elapsed Time (s)	%CPU	%IO	SQL Id	SQL Module	SQL Text
3,308,102	1	3,308,102.00	39.32	2,250.65	15.30	85.62	59v4zh1ac3v2a	DBMS_SCHEDULER	DECLARE job BINARY_INTEGER := ...
...	...	...	....	...	...	...	...	...	...
910,228	2	455,114.00	10.82	116.02	66.64	12.31	f0tqq0h3aqsn0	SQL*Plus	SELECT TRUNC(EVENT_DT, 'hh') E...
772,465	1	772,465.00	9.18	3,536.45	25.41	70.20	ftja941kjtrxj	SQL*Plus	DECLARE OUTPUT NUMBER; V_ERROR...
681,649	0				.29	99.21	6mcpb06rctk0x	DBMS_SCHEDULER	call dbms_space.auto_space_adv...
654,542	1	6			.57	68.47	9cdjzp9sv9tqh	SQL*Plus	INSERT INTO FIREWALL_XFORM(REC...
391,516	317				.89	99.56	8szmwam7fysa3	DBMS_SCHEDULER	insert into wri$_adv_objspace_...
...	...	...	...	...	...	...	...	...	...

Physical Reads in the 'SQL ordered by Reads' section is actual Blocks not I/Os

For more details on configuring the Smart Flash Cache see:

Oracle® Database Administrator's Guide
11g Release 2 (11.2)
Part Number E25494-02
Configuring Database Smart Flash Cache
http://docs.oracle.com/cd/E11882_01/server.112/e25494/memory.htm#BABHEDBH

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