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Performance analysis of Oracle databases with Panorama

Peter Ramm, OSP Dresden

June 2021

Otto Group Solution Provider (OSP) GmbH

Founded:
March 1991

Parent company:
OTTO Group

Locations:
Dresden, Hamburg, Burgkunstadt, Madrid, Taipeh, Bangkok

Number of employees:
Ca. 300

Managing directors:
Dr. Stefan Borsutzky, Norbert Gödicke, Jens Gruhl

Website:
https://www.osp.de

About me

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Peter Ramm

Team lead for strategic-technical consulting at OSP Dresden

> 30 years of history in IT projects

Main focus:

- Development of OLTP systems based on Oracle databases
- From architecture consulting up to trouble shooting
- Performance optimization of existing systems

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Factors influencing performance in DB usage

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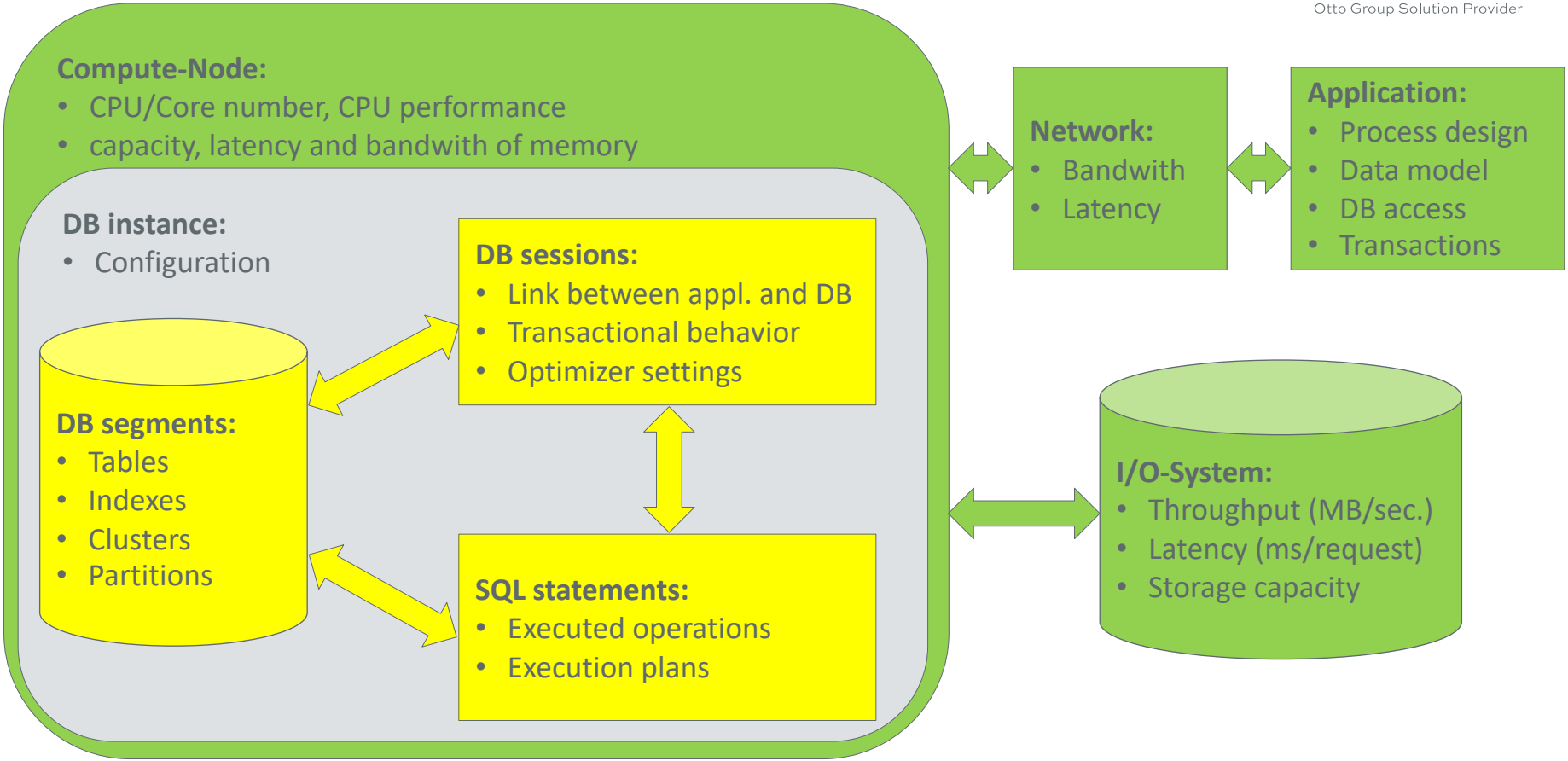

Agenda

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- Presentation of the used tool "Panorama
- Top/down analysis of session activities
- Executed SQL statements with detail analysis
- Segment statistics: Recording of characteristic values for objects (tables, indexes ...)
- Capacity and utilization of CPU, memory and I/O system, configuration of the instance
- Dragnet investigation: Systematic scan of the system for performance antipatterns

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Panorama for Oracle databases

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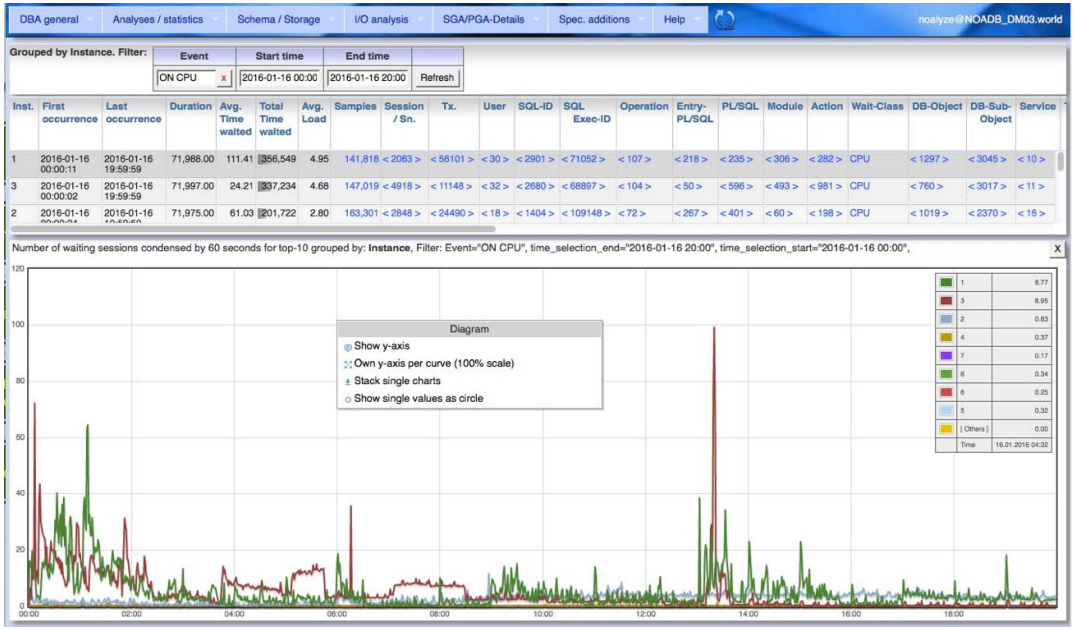
Free available tool for performance analysis of Oracle DB

Based on AWR data or Panorama‘s own sampling (also with Standard Edition or without Diagnostics Pack)

Docker image or self-booting war file

Panorama accesses your DB on a read-only basis and does not install any PL/SQL objects of its own. So you can test the functions without any risk.



Description of Panorama incl. download link : https://rammpeter.github.io/panorama.html
Oracle performance analysis blog : https://rammpeter.blogspot.com
Various slides on the use of Panorama : https://www.slideshare.net/PeterRamm1

Panorama for Oracle: Motivation

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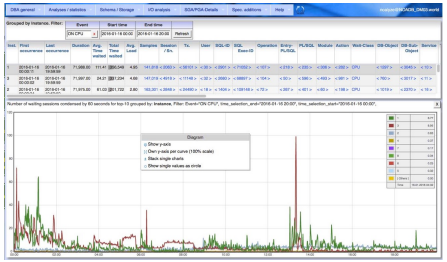
Focus on:

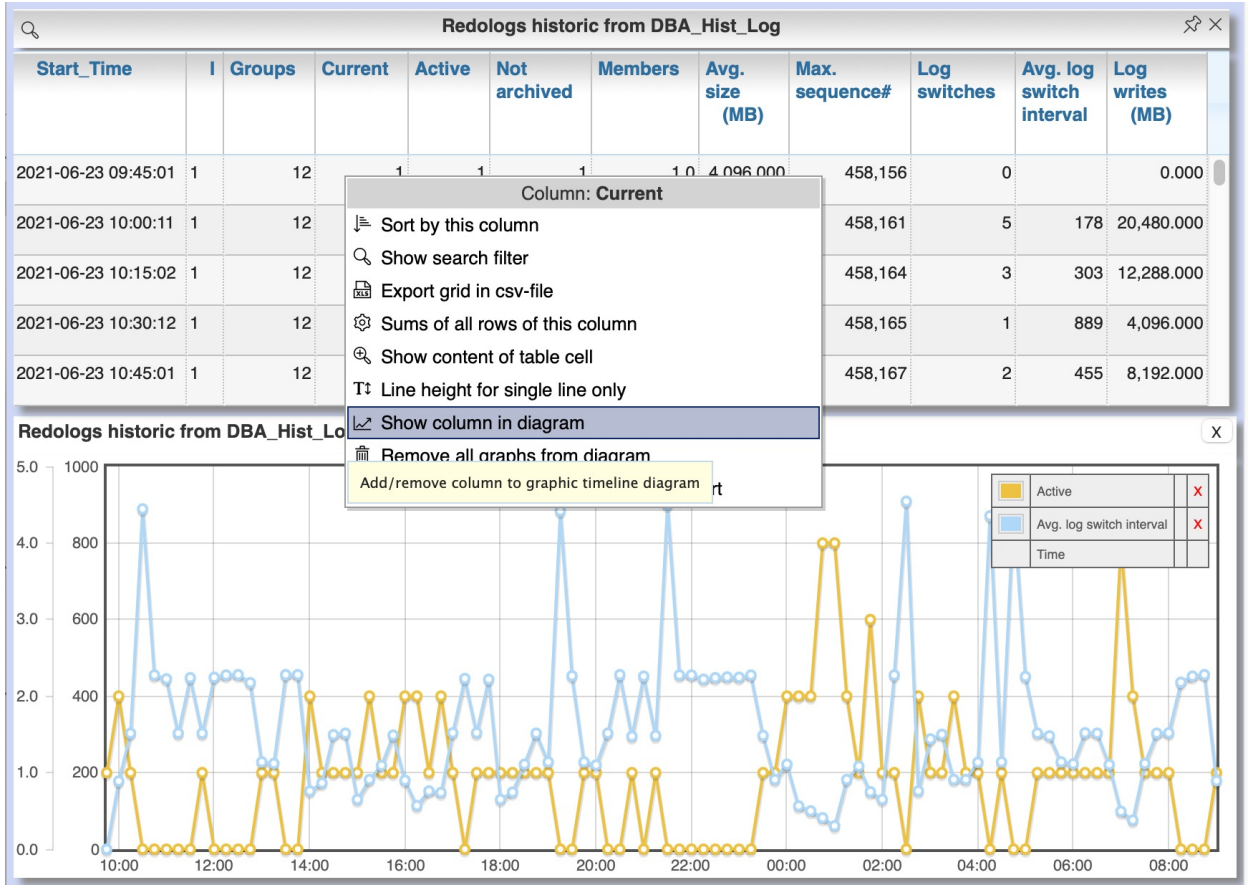
- Preparation of complex interrelationships of DB without deep insider knowledge
- Support of an analysis workflow by linking the individual steps on web GUI as an alternative to loving collection of individual SQL scripts
- Drilldown in root cause identification starting from concrete problem points
- Offline analysis with time distance to the problem under investigation
- Lowering the barriers to actually getting to the bottom of problems in detail



Differentiation from other established monitoring tools :

- Panorama does not claim to cover all facets of monitoring and visualization of Oracle DB internals
- Functions usually found inclusion in Panorama when they are:
  - not or only insufficiently offered by the established tools
  - Existing tools are not accessible for normal users (e.g. because of costs)
- A useful application is not instead of, but in combination with e.g. EM Cloud Control etc.

Forms of presentation



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Workflow in browser page continuously downwards

Results usually as tables

Time-related values can generally also be displayed as graphs by showing/hiding columns of the tables

Visualization in graphs via context menu (right mouse button)

Environment variable PANORAMA_LOG_LEVEL=debug shows executed SQLs on console

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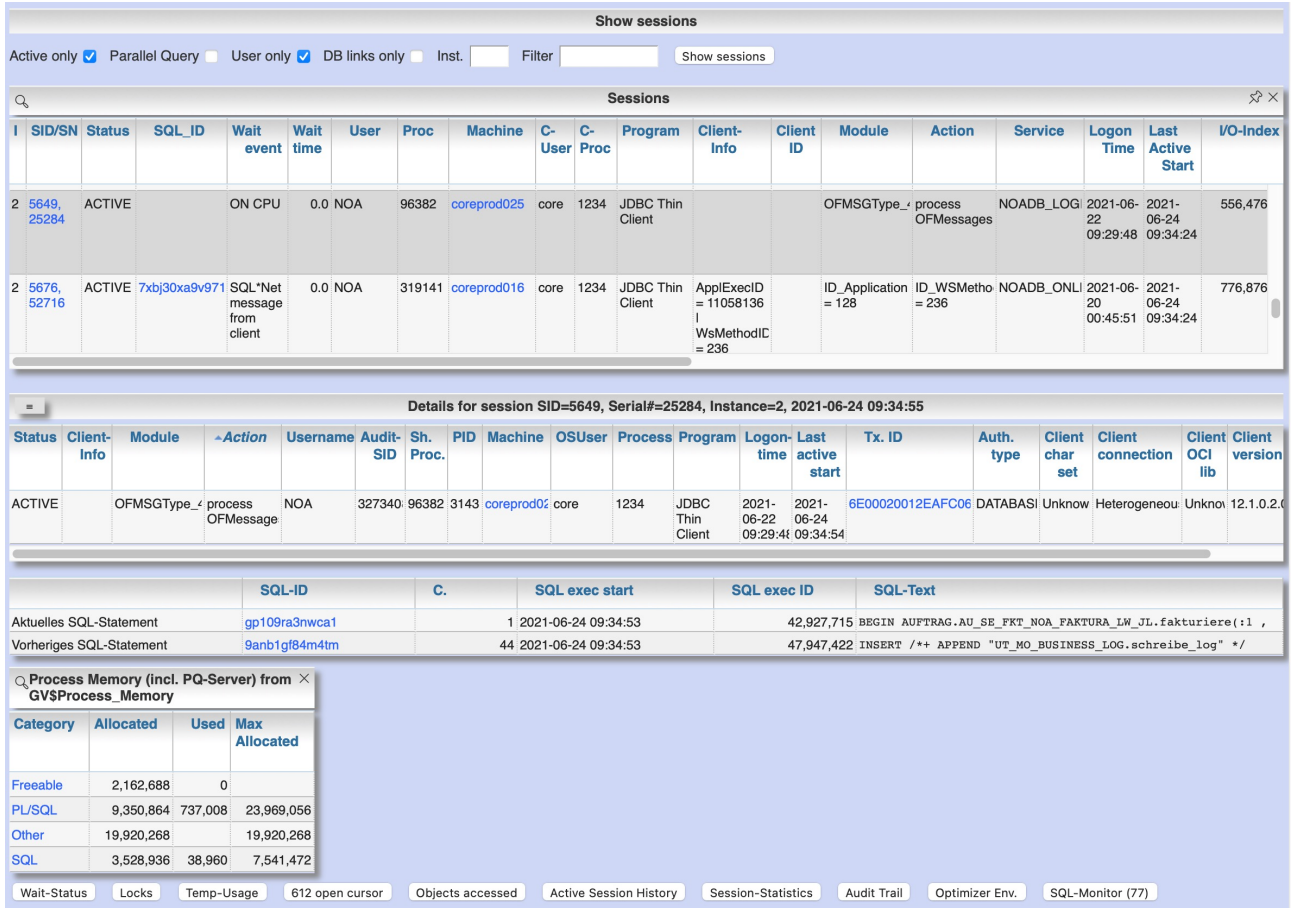
Sessions currently connected to DB

Menu: „DBA general“ / „sessions“



Listing of DB sessions with optional filter and drilldown into session and SQL details

Filter and sort sessions by several criterias

Retrospective analysis of the workload

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- Evaluating and analyzing the workload of interest of a DB is rarely possible live
- Usually an escalation occurs more or less delayed to the triggering event
- The past cannot be inferred from the current load situation of a DB

- Some information about executed SQLs can be found out from the SGA (v$SQL ...) as well as e.g. via StatsPack

Oracle's builtin solution: "Active Workload Repository" (AWR) and "Active Session History" (ASH)

- Historization of various operating states out of the box
- AWR: recording at hourly intervals with retention for 7 days (customizable)
- ASH: Recording of active sessions every second with condensation to 10 seconds
- Available only for Enterprise Edition with additional licensing of the "Oracle Diagnostics Pack“
- Caution: Also accessible without license but access means license violation

And what about Standard Edition or without Diagnostics Pack?

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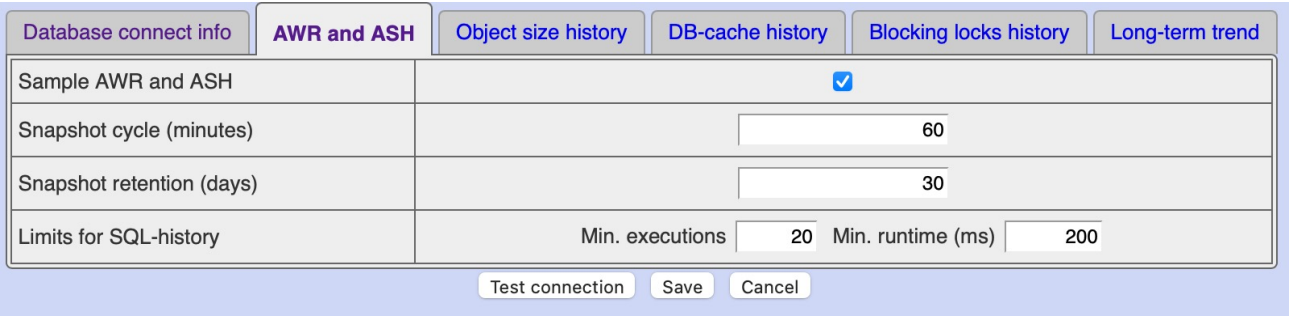
Panorama provides its own recording of the workload (Panorama-Sampler):

- Structurally identical to Oracle's AWR and ASH tables
- Usable without EE / Diagnostics Pack also for Standard Edition or Express Edition
- Recording in tables in local schema of DB
- Panorama transparently uses either AWR data or its own workload recording
- Other sampler functions not included in AWR :
  - Cache usage history, history of object sizes, blocking locks, long-term trend of usage

- Integrated in Panorama
- Activate recording via GUI
- Unlimited number of observed DB instances



More details about Panorama-Sampler: https://rammpeter.github.io/panorama_sampler.html

Range of functions of the Panorama-Sampler

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For the following AWR views with history recording there is an equivalent in the Panorama-Sampler :

gv$Active_Session_History
DBA_Hist_Active_Sess_History
DBA_Hist_Cache_Advice
DBA_Hist_Datafile
DBA_Hist_Enqueue_Stat
DBA_Hist_FileStatXS
DBA_Hist_IOStat_Detail
DBA_Hist_IOStat_Filetype
DBA_Hist_Log
DBA_Hist_Memory_Resize_Ops
DBA_Hist_OSStat
DBA_Hist_OSStat_Name
DBA_Hist_Parameter
DBA_Hist_PGAStat
DBA_Hist_Process_Mem_Summary
DBA_Hist_Resource_Limit
DBA_Hist_Seg_Stat
DBA_Hist_Service_Name
DBA_Hist_Snapshot
DBA_Hist_SQL_Bind
DBA_Hist_SQL_Plan
DBA_Hist_SQLStat
DBA_Hist_SQLText
DBA_Hist_StatName
DBA_Hist_Sysmetric_History
DBA_Hist_Sysmetric_Summary
DBA_Hist_System_Event
DBA_Hist_SysStat
DBA_Hist_Tablespace
DBA_Hist_Tempfile
DBA_Hist_TempStatXS
DBA_Hist_TopLevelCall_Name
DBA_Hist_UndoStat
DBA_Hist_WR_Control

Why leave traces for analysis

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The escalation of technical problems usually takes place with a certain latency.
Standard query: Process XY ran last night 3 x as long as usual! Why?

Example: The application works with Java JEE application server and session pooling:

- For each transaction, a DB session is again randomly fetched from the pool
- With regard to the OLTP character of the system, transactions are very short
- A process scales in parallel using a variable number of DB sessions

How should the traces in the database history be assigned to the business process here?

Extremely helpful for retrospective analysis is the tagging of DB sessions with business context information about the process at the beginning of a transaction.

Setting the context info is done by executing the PL/SQL function :
DBMS_Application_Info.Set_Module(<Module>, <Action>)

This info is recorded with in various tracks of the DB and allows later the assignment of the DB activities to the triggering process via module and action.

Active Session History

Menu "Analyses/statistics“ / „Session Waits“ / „Historic“

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- For me the biggest step in the analysis functions of the Oracle DB
- Introduced with Oracle 10g, strongly extended in 11g, still somewhat in 12c
- Historization of the data of all active sessions of the DB from V$Session ++
- Storage per second in SGA memory, query via view V$Active_Session_History
- Persistence of every 10th second in the cycle of AWR snapshots in AWR table, query via view DBA_Hist_Active_Sess_History
- Stored in AWR table analogous to other AWR data, default 7 days
- This database can be used to reconstruct the operating conditions of the DB very precisely, even after a long period of time.

Usage requires Enterprise Edition plus licensing of 'Diagnostics Pack' option

Active Session History

Menu "Analyses/statistics“ / „Session Waits“ / „Historic“

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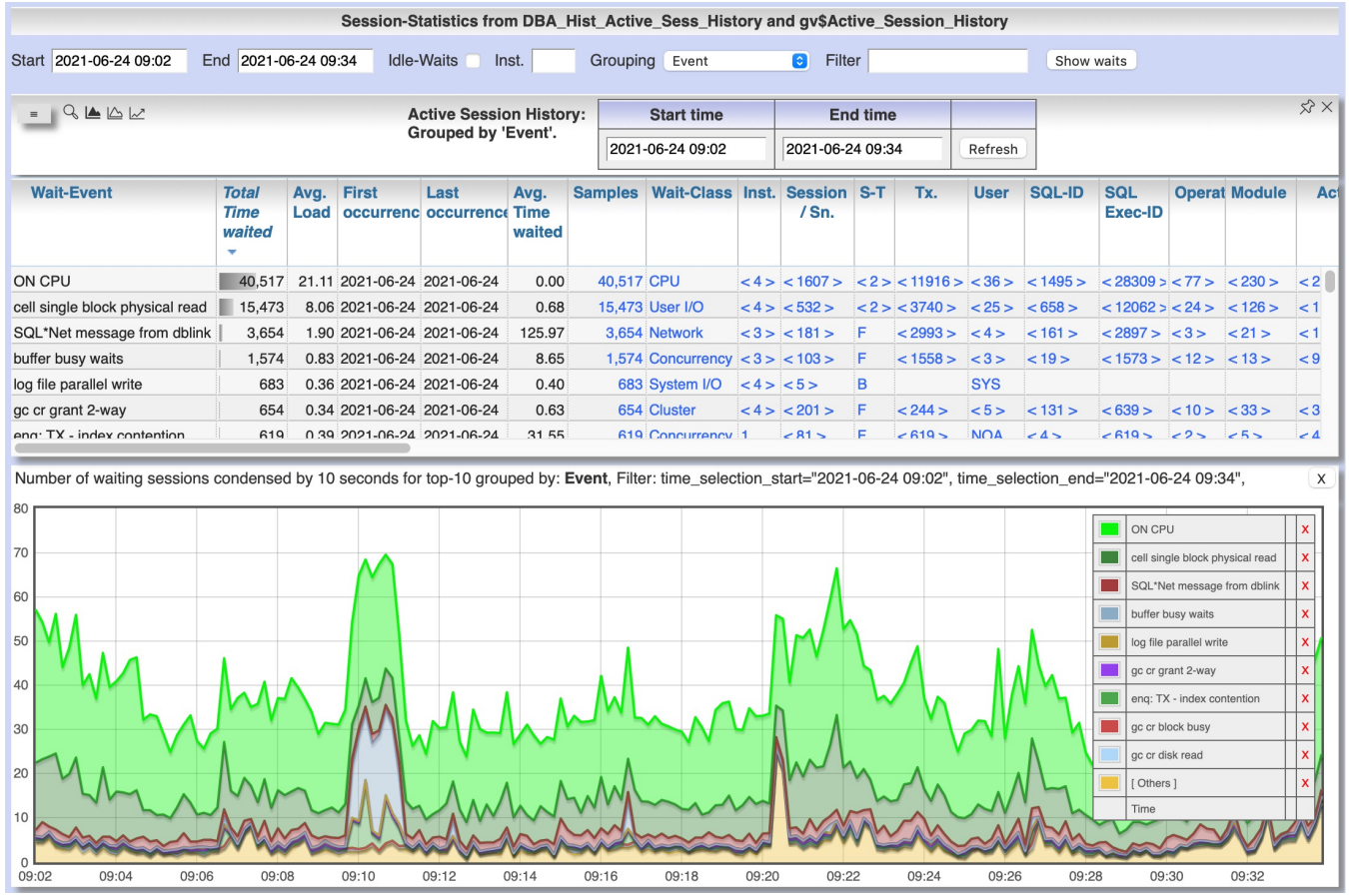

- Select period and entry grouping
- Successive drilldown according to various criteria
- „< xxx>“shows number of different values of the category column in current selection
- Click on „< xxx>“groups the values of the current row according to this category in another table
- Drill down to individual ASH sample records

ASH: Retrospective analysis of blocking locks

Menu “DBA general“ / „DB-Locks“ / „Blocking locks historic from ASH“

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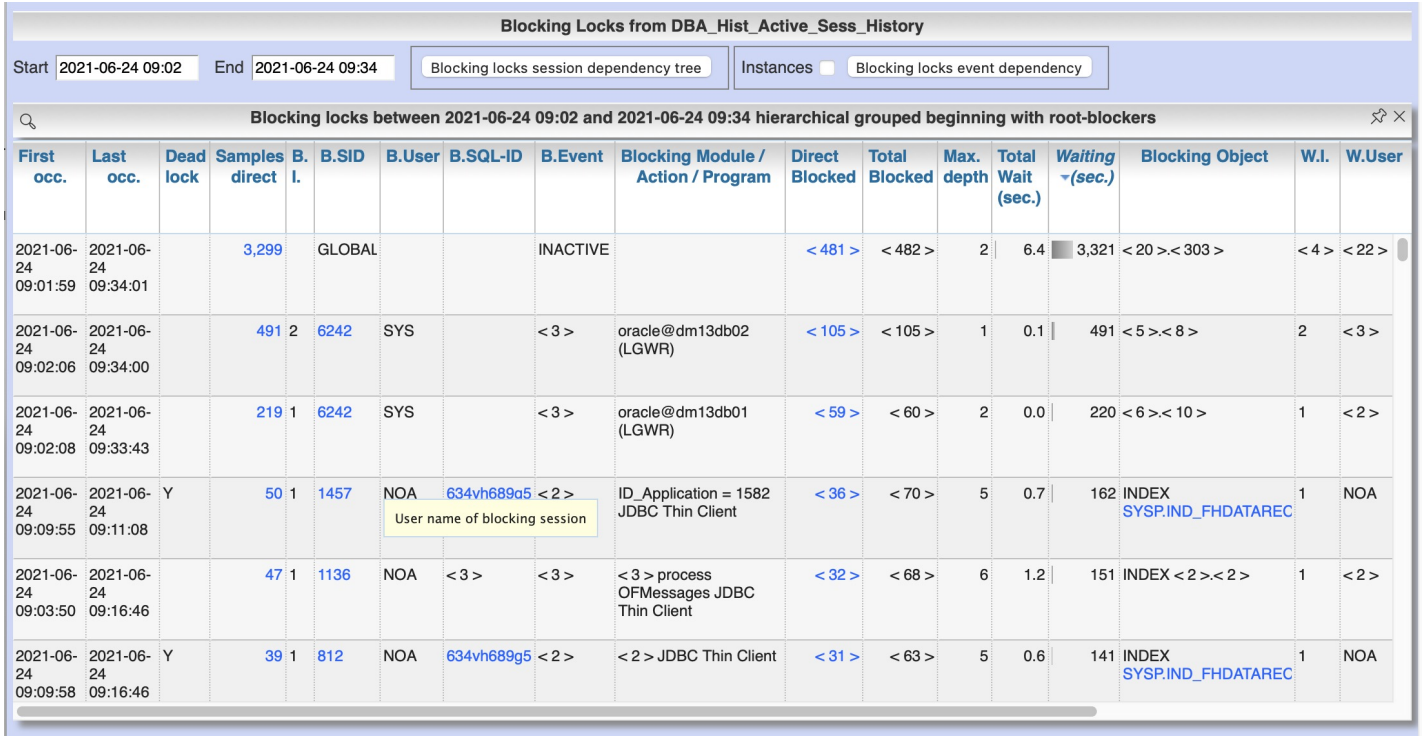

Blocking Locks from DBA_Hist_Active_Sess_History

Start 2021-06-24 09:02 End 2021-06-24 09:34 | Blocking locks session dependency tree | Instances | Blocking locks event dependency

Blocking locks between 2021-06-24 09:02 and 2021-06-24 09:34 hierarchical grouped beginning with root-blockers

First occ.	Last occ.	Dead lock	Samples direct	B. I.	B.SID	B.User	B.SQL-ID	B.Event	Blocking Module / Action / Program	Direct Blocked	Total Blocked	Max. depth	Total Wait (sec.)	Waiting (sec.)	Blocking Object	W.I.	W.User
2021-06-24 09:01:59	2021-06-24 09:34:01		3,299		GLOBAL			INACTIVE		< 481 >	< 482 >	2	6.4	3,321	< 20 >.< 303 >	< 4 >	< 22 >
2021-06-24 09:02:06	2021-06-24 09:34:00		491	2	6242	SYS		< 3 >	oracle@dm13db02 (LGWR)	< 105 >	< 105 >	1	0.1	491	< 5 >.< 8 >	2	< 3 >
2021-06-24 09:02:08	2021-06-24 09:33:43		219	1	6242	SYS		< 3 >	oracle@dm13db01 (LGWR)	< 59 >	< 60 >	2	0.0	220	< 6 >.< 10 >	1	< 2 >
2021-06-24 09:09:55	2021-06-24 09:11:08	Y	50	1	1457	NOA	634vh689g5	< 2 >	ID_Application = 1582 JDBC Thin Client	< 36 >	< 70 >	5	0.7	162	INDEX SYSP.IND_FHDATAREC	1	NOA
2021-06-24 09:03:50	2021-06-24 09:16:46		47	1	1136	NOA	< 3 >	< 3 >	< 3 > process OFMessages JDBC Thin Client	< 32 >	< 68 >	6	1.2	151	INDEX < 2 >.< 2 >	1	< 2 >
2021-06-24 09:09:58	2021-06-24 09:16:46	Y	39	1	812	NOA	634vh689g5	< 2 >	< 2 > JDBC Thin Client	< 31 >	< 63 >	5	0.6	141	INDEX SYSP.IND_FHDATAREC	1	NOA

User name of blocking session

- Shows one line per blocking cascade triggering session (root blocker)
- Sorted by waiting time of all directly or indirectly blocked sessions
- Drilldown in:
  - Blocked sessions
  - ASH of blocking session
  - ASH of blocked sessions
  - Blocking objekt down to the primary key value of the record

ASH: Retrospective analysis of TEMP users

Menu “Schema / Storage“ / „ TEMP-usage“ / „Historic from ASH“

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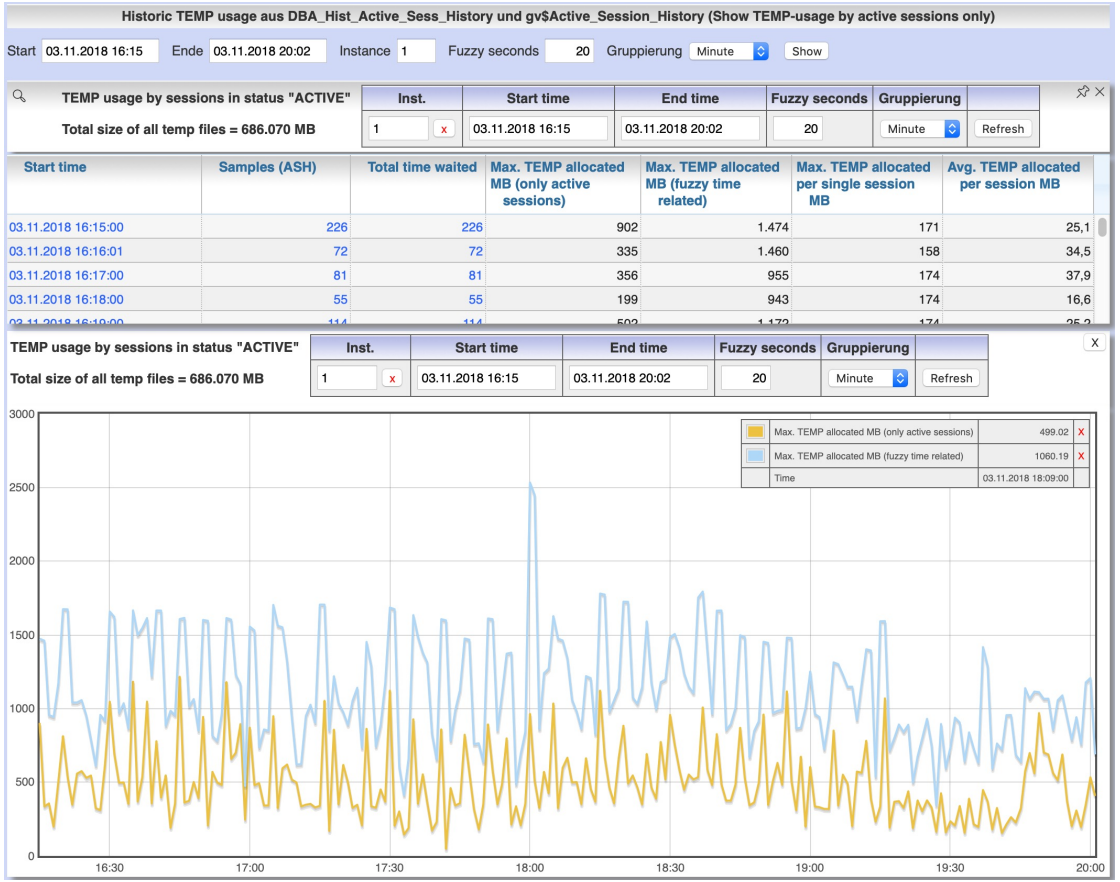

Detection of the users of TEMP tablespace including the cause of a possible "unable to extend temp segment“

- Display of TEMP usage over time in diagram
- Determine the relevant point in time
- Change to ASH analysis to determine specific sessions by TEMP consumption at that time

See also: Blog post on the topic

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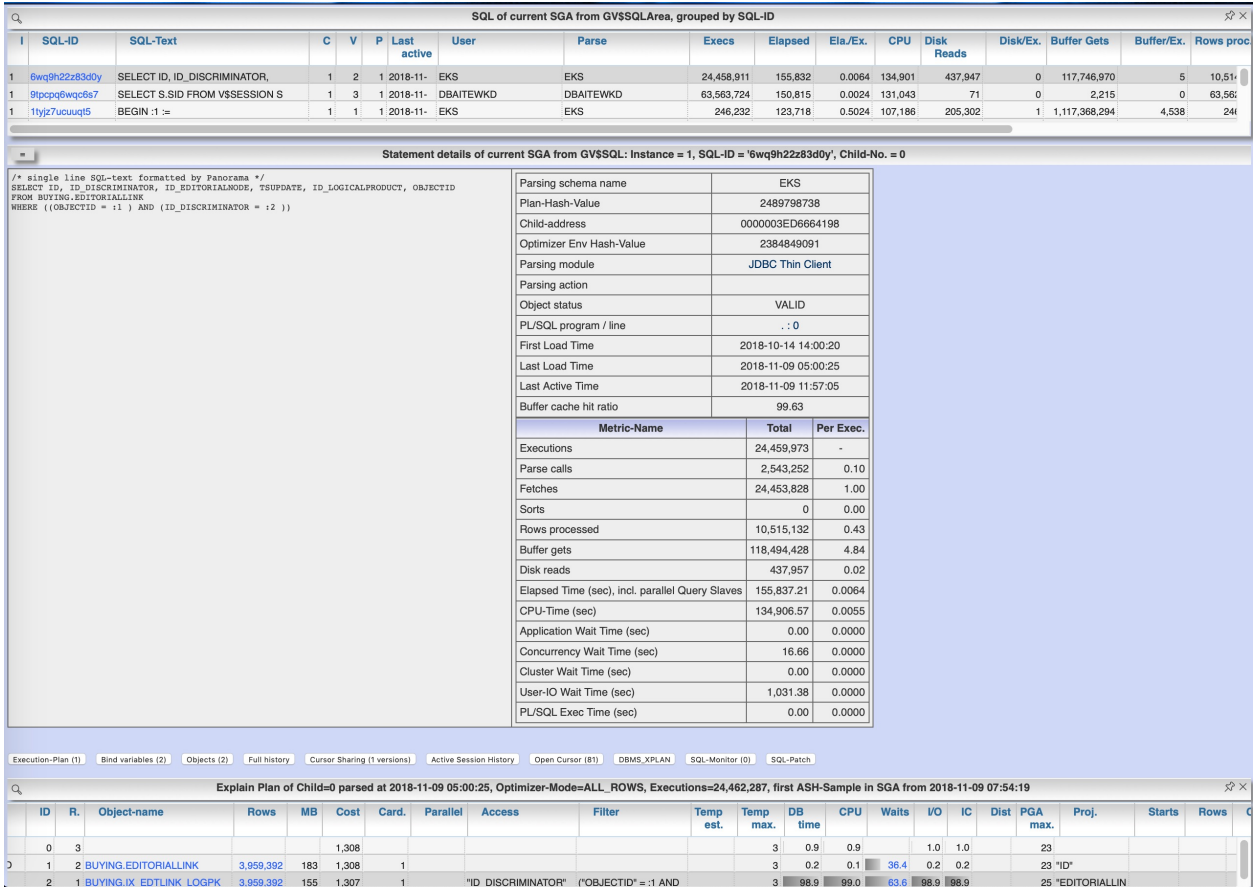
SQL History

Menüu “SGA/PGA Details“ / „SQL-Area“ / ..



Evaluation of the SQLs currently in SGA as well as the history from AWR

Listing of SQLs sorted by various criteria

Details per SQL incl.

- Execution plan
- Bind variables
- Child cursors
- Full history of all AWR snapshots of SQL
- Reasons for multiple cursors
- SQL monitor recordings
- Create baseline / SQL patch

SQL statement details: Execution plan

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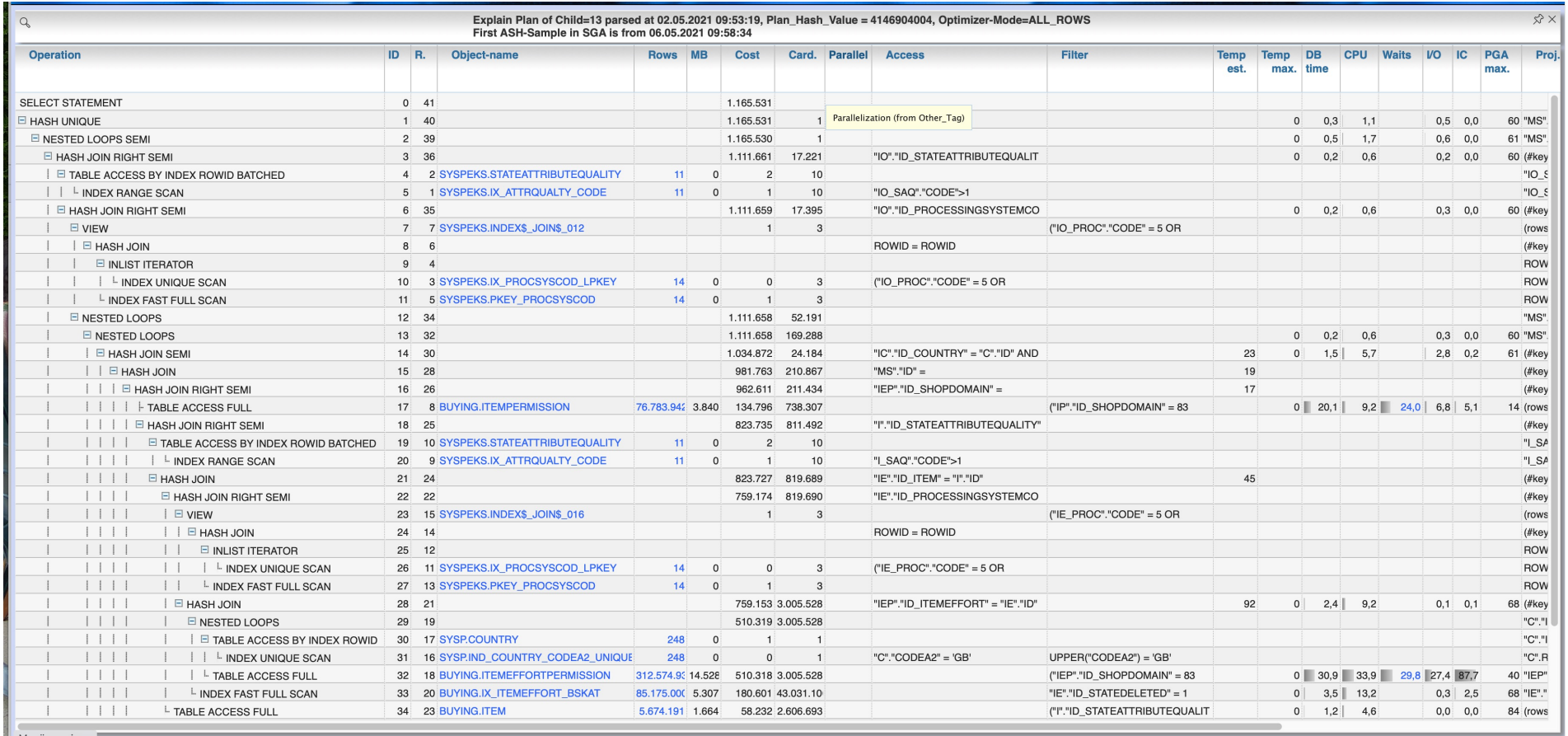

Explain Plan of Child=13 parsed at 02.05.2021 09:53:19, Plan_Hash_Value = 4146904004, Optimizer-Mode=ALL_ROWS
First ASH-Sample in SGA is from 06.05.2021 09:58:34

Operation	ID	R.	Object-name	Rows	MB	Cost	Card.	Parallel	Access	Filter	Temp est.	Temp max.	DB time	CPU	Waits	I/O	IC	PGA max.	Proj.
SELECT STATEMENT	0	41				1.165.531													
HASH UNIQUE	1	40				1.165.531	1					0	0,3	1,1		0,5	0,0	60	"MS"
NESTED LOOPS SEMI	2	39				1.165.530	1					0	0,5	1,7		0,6	0,0	61	"MS"
HASH JOIN RIGHT SEMI	3	36				1.111.661	17.221		"IO"."ID_STATEATTRIBUTEQUALIT			0	0,2	0,6		0,2	0,0	60	(#key
TABLE ACCESS BY INDEX ROWID BATCHED	4	2	SYSPEKS.STATEATTRIBUTEQUALITY	11	0	2	10												"IO_S
INDEX RANGE SCAN	5	1	SYSPEKS.IX_ATTRQUALTY_CODE	11	0	1	10		"IO_SAQ"."CODE">1										"IO_S
HASH JOIN RIGHT SEMI	6	35				1.111.659	17.395		"IO"."ID_PROCESSINGSYSTEMCO			0	0,2	0,6		0,3	0,0	60	(#key
VIEW	7	7	SYSPEKS.INDEX$_JOIN$_012			1	3			("IO_PROC"."CODE" = 5 OR									(rows
HASH JOIN	8	6							ROWID = ROWID										(#key
INLIST ITERATOR	9	4																	ROW
INDEX UNIQUE SCAN	10	3	SYSPEKS.IX_PROCSYSCOD_LPKEY	14	0	0	3		("IO_PROC"."CODE" = 5 OR										ROW
INDEX FAST FULL SCAN	11	5	SYSPEKS.PKEY_PROCSYSCOD	14	0	1	3												ROW
NESTED LOOPS	12	34				1.111.658	52.191												"MS"
NESTED LOOPS	13	32				1.111.658	169.288					0	0,2	0,6		0,3	0,0	60	"MS"
HASH JOIN SEMI	14	30				1.034.872	24.184		"IC"."ID_COUNTRY" = "C"."ID" AND		23	0	1,5	5,7		2,8	0,2	61	(#key
HASH JOIN	15	28				981.763	210.867		"MS"."ID" =		19								(#key
HASH JOIN RIGHT SEMI	16	26				962.611	211.434		"IEP"."ID_SHOPDOMAIN" =		17								(#key
TABLE ACCESS FULL	17	8	BUYING.ITEMPERMISSION	76.783.942	3.840	134.796	738.307			("IP"."ID_SHOPDOMAIN" = 83		0	20,1	9,2	24,0	6,8	5,1	14	(rows
HASH JOIN RIGHT SEMI	18	25				823.735	811.492		"I"."ID_STATEATTRIBUTEQUALITY"										(#key
TABLE ACCESS BY INDEX ROWID BATCHED	19	10	SYSPEKS.STATEATTRIBUTEQUALITY	11	0	2	10												"I_SA
INDEX RANGE SCAN	20	9	SYSPEKS.IX_ATTRQUALTY_CODE	11	0	1	10		"I_SAQ"."CODE">1										"I_SA
HASH JOIN	21	24				823.727	819.689		"IE"."ID_ITEM" = "I"."ID"		45								(#key
HASH JOIN RIGHT SEMI	22	22				759.174	819.690		"IE"."ID_PROCESSINGSYSTEMCO										(#key
VIEW	23	15	SYSPEKS.INDEX$_JOIN$_016			1	3			("IE_PROC"."CODE" = 5 OR									(rows
HASH JOIN	24	14							ROWID = ROWID										(#key
INLIST ITERATOR	25	12																	ROW
INDEX UNIQUE SCAN	26	11	SYSPEKS.IX_PROCSYSCOD_LPKEY	14	0	0	3		("IE_PROC"."CODE" = 5 OR										ROW
INDEX FAST FULL SCAN	27	13	SYSPEKS.PKEY_PROCSYSCOD	14	0	1	3												ROW
HASH JOIN	28	21				759.153	3.005.528		"IEP"."ID_ITEMEFFORT" = "IE"."ID"		92	0	2,4	9,2		0,1	0,1	68	(#key
NESTED LOOPS	29	19				510.319	3.005.528												"C"."I
TABLE ACCESS BY INDEX ROWID	30	17	SYSP.COUNTRY	248	0	1	1												"C"."I
INDEX UNIQUE SCAN	31	16	SYSP.IND_COUNTRY_CODEA2_UNIQUE	248	0	0	1		"C"."CODEA2" = 'GB'	UPPER("CODEA2") = 'GB'									"C".R
TABLE ACCESS FULL	32	18	BUYING.ITEMEFFORTPERMISSION	312.574.93	14.528	510.318	3.005.528			("IEP"."ID_SHOPDOMAIN" = 83		0	30,9	33,9	29,8	27,4	87,7	40	"IEP"
INDEX FAST FULL SCAN	33	20	BUYING.IX_ITEMEFFORT_BSKAT	85.175.000	5.307	180.601	43.031.10			"IE"."ID_STATEDELETED" = 1		0	3,5	13,2		0,3	2,5	68	"IE"."I
TABLE ACCESS FULL	34	23	BUYING.ITEM	5.674.191	1.664	58.232	2.606.693			("I"."ID_STATEATTRIBUTEQUALIT		0	1,2	4,6		0,0	0,0	84	(rows

Parallelization (from Other_Tag)

SQL statement details : AWR history

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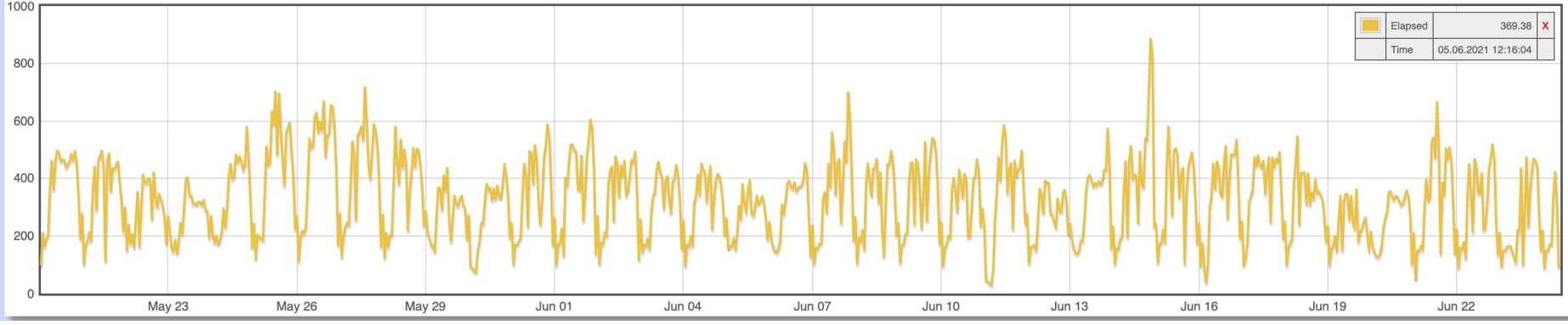
Historic snapshots from DBA_Hist_SQLStat for SQL-ID = 'apq66m3gj4uwg' Instance = 2

Instance 2 Schema NOA Start 2021-05-20 01:15 End 2021-06-24 10:15 Grouping Hour Refresh

Start	First occurrence	Last occurrence	Plans	Plan hash value	Envs.	Opt. env hash value	Execs	Elapsed	Ela. / Ex.	Ela. / Row	CPU	App.	Con.	Clu.	I/O	PL/ SQL	Disk Reads	Disk / Ex.	ms / Disk Read	Hit Ratio	Buffer Gets	Buffer / Ex.	Buffer / Row	Rows proc.	Rows / Ex.	Parses
2021-06-24 10:00:00	2021-06-24 10:00:07	2021-06-24 10:15:03	1	2238303688	1	1683692210	421,968	100	0.0002	0	50	0	1	0	23	24	60,196	0.143	0.37	97.14	2,104,214	4.99	5.06	416,068	0.99	0
2021-06-24 09:00:00	2021-06-24 09:45:31	2021-06-24 10:00:07	1	2238303688	1	1683692210	410,333	93	0.0002	0	49	0	1	0	18	23	58,468	0.142	0.31	97.14	2,046,823	4.99	5.05	405,085	0.99	1
2021-06-24 08:00:00	2021-06-24 08:00:19	2021-06-24 09:00:16	1	2238303688	1	1683692210	1,279,603	315	0.0002	0	166	0	2	0	70	75	210,311	0.164	0.33	96.71	6,386,473	4.99	5.04	1,267,592	0.99	15
2021-06-24 07:00:00	2021-06-24 07:00:10	2021-06-24 08:00:19	1	2238303688	1	1683692210	1,775,193	422	0.0002	0	207	0	3	0	103	97	279,368	0.157	0.37	96.85	8,868,559	5.00	5.02	1,767,650	1.00	1

Historic snapshots from DBA_Hist_SQLStat for SQL-ID = 'apq66m3gj4uwg' Instance = 2

Instance 2 Schema NOA Start 2021-05-20 01:15 End 2021-06-24 10:15 Grouping Hour Refresh



SQL statement details : SQL-Monitor

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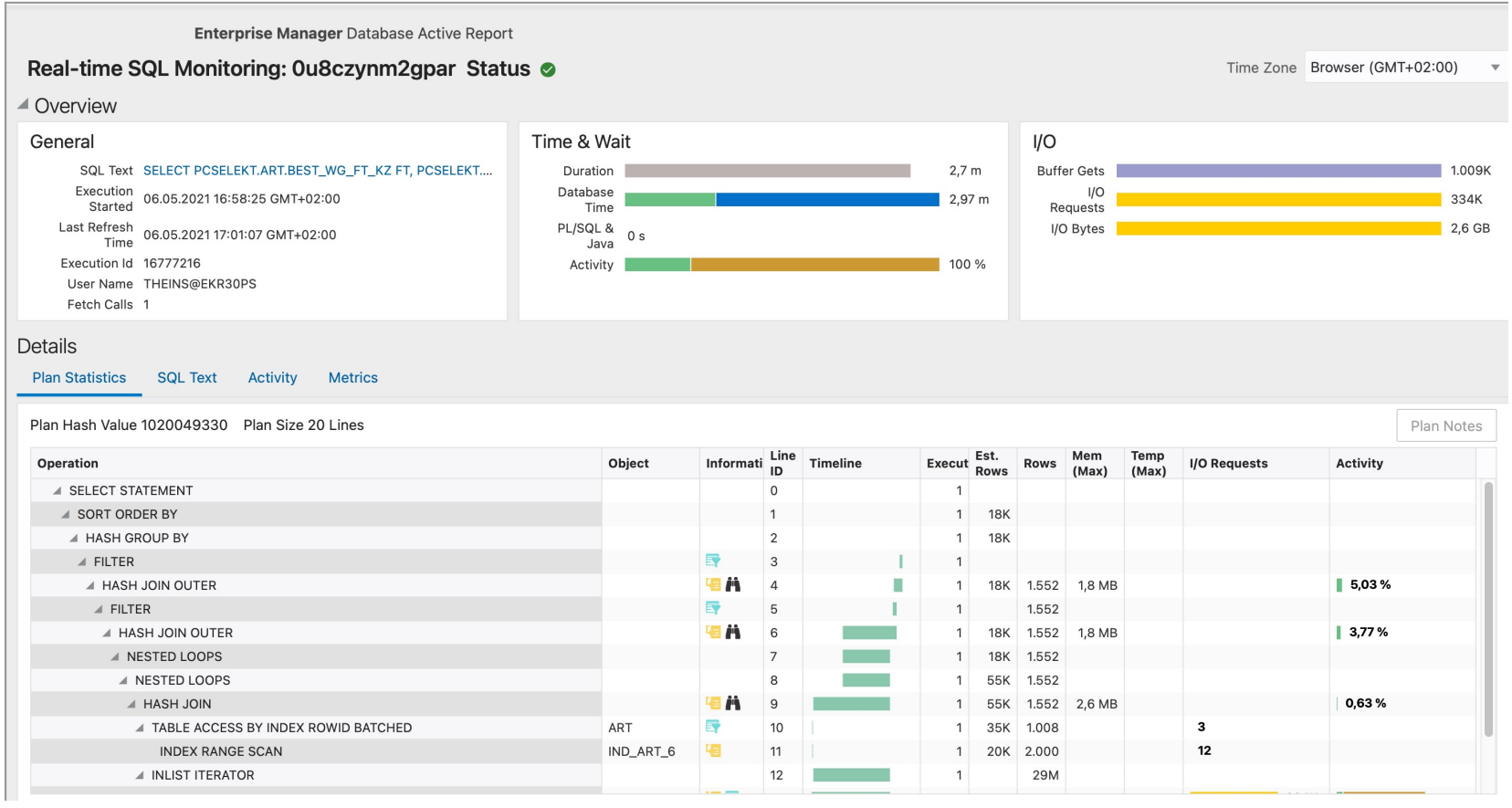


Enterprise Manager Database Active Report

Real-time SQL Monitoring: 0u8czynm2gpar Status

Time Zone: Browser (GMT+02:00)

Overview

General

SQL Text	SELECT PCSELEKT.ART.BEST_WG_FT_KZ FT, PCSELEKT....
Execution Started	06.05.2021 16:58:25 GMT+02:00
Last Refresh Time	06.05.2021 17:01:07 GMT+02:00
Execution Id	16777216
User Name	THEINS@EKR30PS
Fetch Calls	1

Time & Wait

Duration	2,7 m
Database Time	2,97 m
PL/SQL & Java	0 s
Activity	100 %

I/O

Buffer Gets	1.009K
I/O Requests	334K
I/O Bytes	2,6 GB

Details

Plan Statistics | SQL Text | Activity | Metrics

Plan Hash Value 1020049330 Plan Size 20 Lines

Plan Notes

Operation	Object	Informati	Line ID	Timeline	Execut	Est. Rows	Rows	Mem (Max)	Temp (Max)	I/O Requests	Activity
SELECT STATEMENT			0		1						
SORT ORDER BY			1		1	18K					
HASH GROUP BY			2		1	18K					
FILTER			3		1						
HASH JOIN OUTER			4		1	18K	1.552	1,8 MB			5,03 %
FILTER			5		1		1.552				
HASH JOIN OUTER			6		1	18K	1.552	1,8 MB			3,77 %
NESTED LOOPS			7		1	18K	1.552				
NESTED LOOPS			8		1	55K	1.552				
HASH JOIN			9		1	55K	1.552	2,6 MB			0,63 %
TABLE ACCESS BY INDEX ROWID BATCHED	ART		10		1	35K	1.008			3	
INDEX RANGE SCAN	IND_ART_6		11		1	20K	2.000			12	
INLIST ITERATOR			12		1		29M				

SQL statement details : Plan stability

Menu “SGA/PGA Details“ / „SQL plan management“

Otto Group Solution Provider

SQL plan management directives

SQL profiles (15) | SQL plan baselines (32) | Stored outlines (0) | SQL translations (0) | SQL patches (0)

SQL profiles from DBA_SQL_Profiles

Name	Categor	Created	Last modified	Description	Type	Status	Force matching	*Usages in SGA*	Usages in history	SQL
coe_7g7nxtsc978z3_118057973	DEFAULT	28.02.202(16:25:54	28.02.2020 16:25:54	coe 7g7nxtsc978z3 1180579734 16845058284648096774 16845058284648096774	MANUAL	ENABLED	NO	1	1	SELECT ITEMCMP_ID, ITEMCMPTYPE
SYS_SQLPROF_0171e44aea53	DEFAULT	05.05.202(12:04:07	05.05.2020 12:04:07		MANUAL	ENABLED	NO			INSERT INTO temp_ottoint WITH
SYS_SQLPROF_0171bb184c61	DEFAULT	27.04.202(12:04:24	27.04.2020 12:04:24		MANUAL	ENABLED	NO			SELECT A.BEST_WG_FT_KZ FT,
SYS_SQLPROF_014932983b35	DEFAULT	18.02.202(15:02:05	18.02.2020 15:02:05		MANUAL	ENABLED	NO			SELECT TL.ID ,TL.LOGTYPE ,GETI

Existence per SQL and as overview :

- SQL-Profiles
- SQL Plan Baselines
- Stored Outlines
- SQL-Translations
- SQL-Patches

For executed SQLs generation of PL/SQL snippets for creation of directives :

- SQL plan baselines: Pinning based on already existing plans via plan hash value
- SQL patches: Injecting optimizer hints into unmodified SQL statements
- SQL translations: Complete replacement of SQL text for statements unchanged in application

Agenda

OSP
Otto Group Solution Provider

- Presentation of the used tool "Panorama
- Top/down analysis of session activities
- Executed SQL statements with detail analysis
- Segment statistics: Recording of characteristic values for objects (tables, indexes ...)
- Capacity and utilization of CPU, memory and I/O system, configuration of the instance
- Dragnet investigation: Systematic scan of the system for performance antipatterns

Structure info of tables, indexes, packages etc.

Menu: „Schema/Storage“ / „ Describe object“

Otto Group Solution Provider

Describe database object

Object-Owner: cust | Object-Name: Customer | Object-Type: [Alle] | Describe

Description of TABLE CUST.CUSTOMER

Company dependent customer

Komprimierung reduziert Footprint auf 60%

Columns of TABLE CUST.CUSTOMER

Col.Name	Type	Prec.	Sc.	N.	Def.	Distinct	Nulls	Avg. Len.	Density	Buckets	Histogram	Comments	LOB segment	EQ	EQJ	NEQ
ID	NUMBER	9	0	N		68.305.085	0	7	0,0000	1	NONE	Primary Key		24.729	84.737	0
ID_COMPANY	NUMBER	4	0	N		59	0	3	0,0000	59	FREQUENCY	Company to		48.698	37.917	0
ID_PERSON	NUMBER	9	0	N		68.305.085	0	7	0,0000	1	NONE	Person that		9.015	26.073	0
CREATIONDATE	DATE			N		43.819.008	0	8	0,0000	254	HYBRID	Date of		5.626	192	78
ID_LOCALE	NUMBER	4	0	N		13	0	3	0,0000	13	FREQUENCY	Locale		7.318	4.971	0
CUSTNO	VARCHAR2	10 Chars		N		39.424.000	0	10	0,0000	254	HYBRID	Company		12.343	1.714	0
CANCELLATIONDATE	DATE			Y		96.240	64.013.335	2	0,0000	254	HYBRID	Date when		7.322	0	0
ORDERCOUNTER	NUMBER	6	0	Y		2.533	12.500.973	3	0,0000	254	TOP-	Comments		119	0	0
LASTONLINEUPD	DATE			Y		46.915.584	7.174.628	8	0,0000	1	NONE	Letzte				
ID_SHOPDOMAIN	NUMBER	4	0	Y		88	44.031.316	3	0,0114	1	NONE	ShopDomain,				

Attributes of TABLE CUST.CUSTOMER

TS	Pct Free	Init. Trans	Initial extent (KB)	Rows	Size (MB) Table	Size (MB) Total	Extents	Blocks	Empty	Avg. Space	Chained	RowLen	Dg.	Cache	Part.	Sub-Part.	Created	La
DATA02	10	8		68.305.085	4.659,75	18.598,94	598	596.448	0	0	0	56	1	N	2	0	08.03.2015 00:42:45	05. 08

6 Indexes | 1 Primary Key | 2 Check Constraints | 4 References from | 85 References to | 12 Triggers | 129 Dependencies | 49 Grants | DBMS_METADATA | DB-Cache

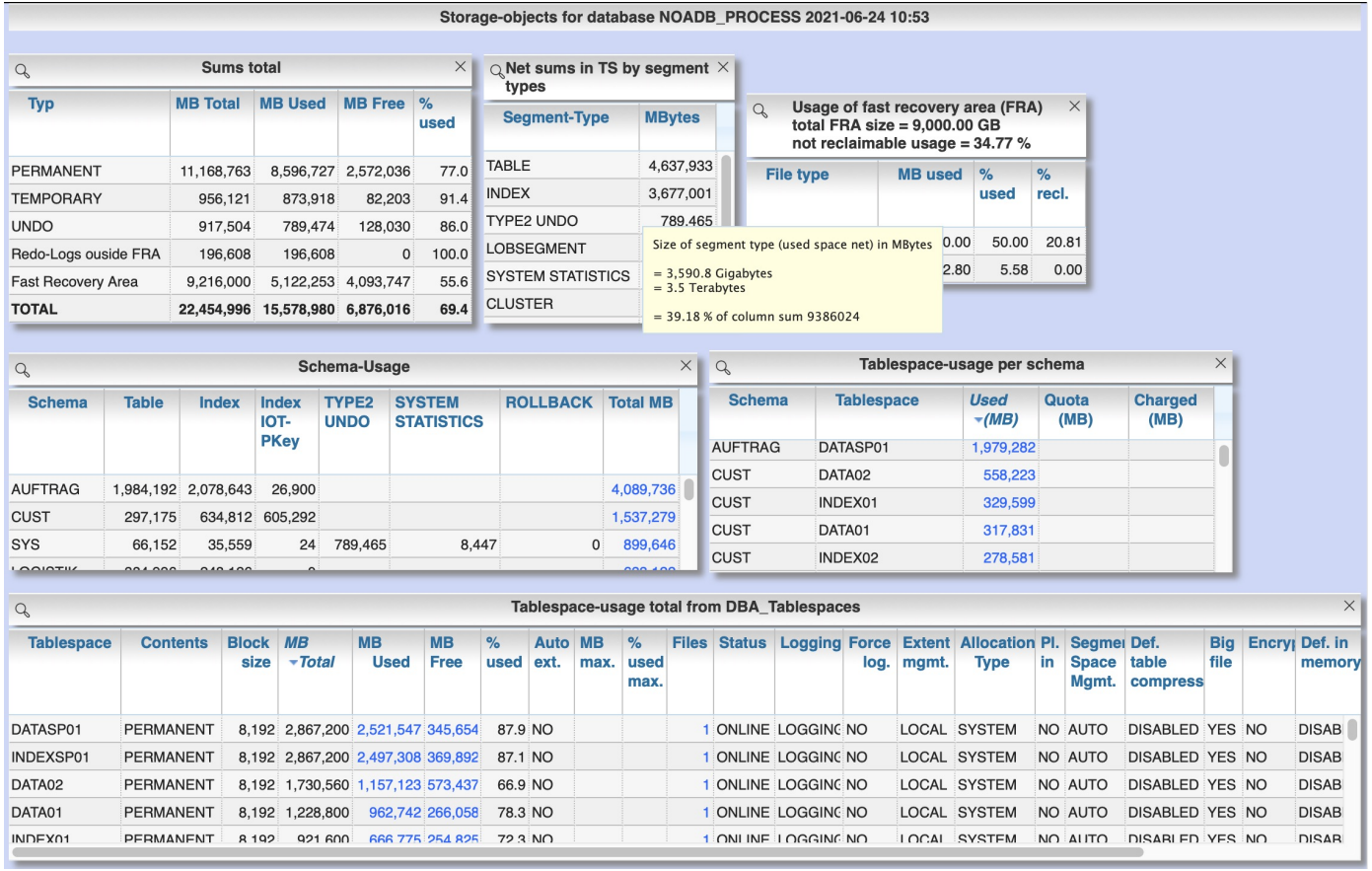
Sessions accessing | SQLs | Active Session History | Segment statistics | Size evolution

Detailed info on DB objects with drilldown into structures, accesses, dependencies, etc.

Storage usage overview

Menu: „Schema/Storage“ / „Disk storage summary“

Otto Group Solution Provider



Storage-objects for database NOADB_PROCESS 2021-06-24 10:53

Sums total

Typ	MB Total	MB Used	MB Free	% used
PERMANENT	11,168,763	8,596,727	2,572,036	77.0
TEMPORARY	956,121	873,918	82,203	91.4
UNDO	917,504	789,474	128,030	86.0
Redo-Logs ouside FRA	196,608	196,608	0	100.0
Fast Recovery Area	9,216,000	5,122,253	4,093,747	55.6
TOTAL	**22,454,996**	**15,578,980**	**6,876,016**	**69.4**

Net sums in TS by segment types

Segment-Type	MBytes
TABLE	4,637,933
INDEX	3,677,001
TYPE2 UNDO	789,465
LOBSEGMENT	
SYSTEM STATISTICS	
CLUSTER	

Size of segment type (used space net) in MBytes

= 3,590.8 Gigabytes
= 3.5 Terabytes

= 39.18 % of column sum 9386024

Usage of fast recovery area (FRA)
total FRA size = 9,000.00 GB
not reclaimable usage = 34.77 %

File type	MB used	% used	% recl.
		0.00	50.00	20.81
		2.80	5.58	0.00

Schema-Usage

Schema	Table	Index	Index IOT-PKey	TYPE2 UNDO	SYSTEM STATISTICS	ROLLBACK	Total MB
AUFTRAG	1,984,192	2,078,643	26,900				4,089,736
CUST	297,175	634,812	605,292				1,537,279
SYS	66,152	35,559	24	789,465	8,447	0	899,646

Tablespace-usage per schema

Schema	Tablespace	Used (MB)	Quota (MB)	Charged (MB)
AUFTRAG	DATASP01	1,979,282		
CUST	DATA02	558,223		
CUST	INDEX01	329,599		
CUST	DATA01	317,831		
CUST	INDEX02	278,581		

Tablespace-usage total from DBA_Tablespaces

Tablespace	Contents	Block size	MB Total	MB Used	MB Free	% used	Auto ext.	MB max.	% used max.	Files	Status	Logging	Force log.	Extent mgmt.	Allocation Type	Pl. in	Segmei Space Mgmt.	Def. table compress	Big file	Encryp	Def. in memory
DATASP01	PERMANENT	8,192	2,867,200	2,521,547	345,654	87.9	NO			1	ONLINE	LOGGINC	NO	LOCAL	SYSTEM	NO	AUTO	DISABLED	YES	NO	DISAB
INDEXSP01	PERMANENT	8,192	2,867,200	2,497,308	369,892	87.1	NO			1	ONLINE	LOGGINC	NO	LOCAL	SYSTEM	NO	AUTO	DISABLED	YES	NO	DISAB
DATA02	PERMANENT	8,192	1,730,560	1,157,123	573,437	66.9	NO			1	ONLINE	LOGGINC	NO	LOCAL	SYSTEM	NO	AUTO	DISABLED	YES	NO	DISAB
DATA01	PERMANENT	8,192	1,228,800	962,742	266,058	78.3	NO			1	ONLINE	LOGGINC	NO	LOCAL	SYSTEM	NO	AUTO	DISABLED	YES	NO	DISAB
INDEX01	PERMANENT	8,192	921,600	666,775	254,825	72.3	NO			1	ONLINE	LOGGINC	NO	LOCAL	SYSTEM	NO	AUTO	DISABLED	YES	NO	DISAB

- Storage usage by types, schemas, tablespaces
- Drill down to objects and partitions
- Calculation of the space to be released by reorganization
- Representation of the real available storage under consideration of fragmentation

Segment statistiks

Menu „Analyses / statistics“ / „Segment statistics “

Otto Group Solution Provider

Historic segment statistics from DBA_Hist_Seg_Stat

Start 2021-06-22 09:02 End 2021-06-24 13:02 Inst. Part. Objekt-Name Show

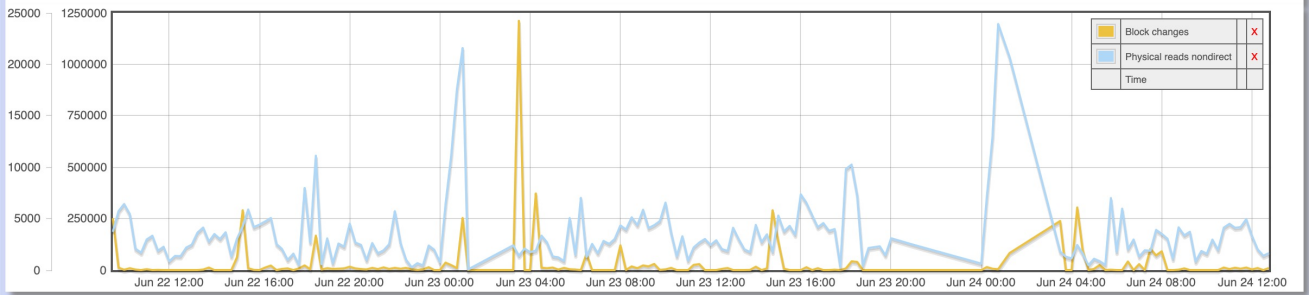
Segment statistics from DBA_Hist_Seg_Stat, from 2021-06-22 09:02 until 2021-06-24 13:02

I	Object	SQLs	Num Rows	Object size (MB)	Time waited	Avg. Time waited	AWR snaps.	Logical reads	Buffer busy waits	Block changes	Physical reads nondirect	Physical reads direct	Physical writes nondirect	Physical writes direct	ITL	Row lock waits	GC buf bus wai
1	ITM . ITEMEFFORT	5,670	47,546,070	7,202.44	105,830	69.22	174	665,658,976	66	103,136	31,143,264	77,469,497	84,582	0	0	0	2(
1	AUFTRAG . AU_ABSTIMMZAHL	76	10,355,730	868.00	90,570	0.55	12	56,060,672	0	0	755,641	0	0	0	0	0	
2	AUFTRAG . AU_FORDERUNG_OP	333	2,629,259,559	469,960.19	64,110	16.78	188	23,628,943,488	2,310	11,699,37(	177,878,30:	0	1,496,337	0	0	8	
1	MOMAIN . CUSTORDER	972	15,014,599	3,107.94	61,760	5.09	208	10,963,614,400	19,955	33,929,53(	11,226,208	7,534,762,6(	414,706	0	0	0	4(

Segment statistics from DBA_Hist_Seg_Stat, Inst_ID=1, from 2021-06-22 09:02 until 2021-06-24 13:02 for 'ITM.ITEMEFFORT'

Time	Logical reads	Buffer busy waits	Block changes	Physical reads nondirect	Physical reads direct	Physical writes nondirect	Physical writes direct	ITL	Row lock waits	Global cache buffer busy waits	GC CR blocks received	GC CU blocks received	Space used (MB)	Space allocated (MB)	Full table scans
2021-06-22 09:30:08	1,262,816	1	5,040	185,821	0	3,577	0	0	0	2,367	214,573	111,598	0.00	0.00	0
2021-06-22 09:45:18	2,979,728	0	224	286,916	662,030	109	0	0	0	723	422,481	238,813	0.00	0.00	106
2021-06-22 10:00:09	3,125,232	0	32	321,033	662,158	28	0	0	0	679	484,729	263,542	0.00	0.00	106

Segment statistics from DBA_Hist_Seg_Stat, Inst_ID=1, from 2021-06-22 09:02 until 2021-06-24 13:02 for 'ITM.ITEMEFFORT'



Characteristic values per table/index for period

Sortable according to individual characteristic values

Evolution over time within the period

Agenda

OSP
Otto Group Solution Provider

- Presentation of the used tool "Panorama
- Top/down analysis of session activities
- Executed SQL statements with detail analysis
- Segment statistics: Recording of characteristic values for objects (tables, indexes ...)
- Capacity and utilization of CPU, memory and I/O system, configuration of the instance
- Dragnet investigation: Systematic scan of the system for performance antipatterns

OS statistics for CPU and memory

Menu: „Analyses/statistics“ / „ OS statistics“

Otto Group Solution Provider

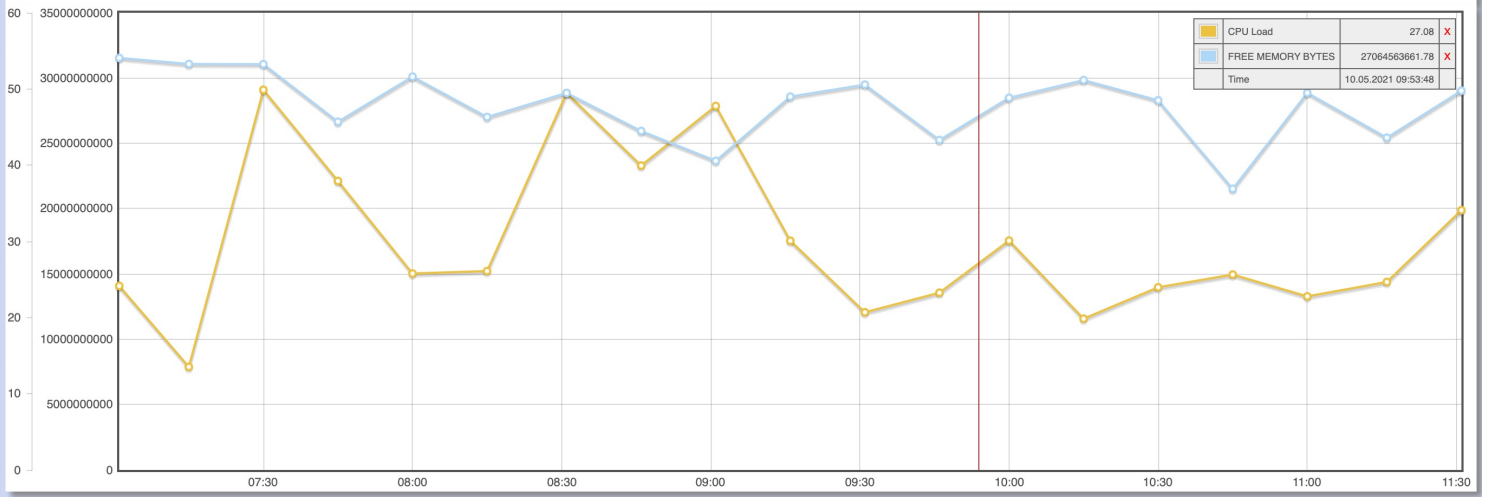
Historic operation system statistics from DBA_Hist_OSStat

Start 10.05.2021 06:52 Ende 10.05.2021 11:52 Instance Show OS statistics

Historic operating system statistics from 10.05.2021 06:52 until 10.05.2021 11:52

Time	CPU Load	BUSY TIME	FREE MEMORY BYTES	GLOBAL RECEIVE SIZE MAX	GLOBAL SEND SIZE MAX	IDLE TIME	INACTIVE MEMORY BYTES	IOWAIT TIME	LOAD	NICE TIME	NUM CPU CORES	NUM CPU SOCKETS	NUM CPUS	PHYSICAL MEMORY BYTES	RSRC MGR CPU WAIT TIME	SWAP FREE BYTES	SYS TIME	TCP RECEIVE SIZE DEFAULT	TCP RECE SIZE
10.05.2021 07:01:00	24,15	653.205	31.545.610.240	4.194.304	1.048.576	2.025.931	3.871.301.632	118.552	9	0	32	32	32	404.962.127.872	0	18.248.622.080	55.159	87.380	6
10.05.2021 07:15:00	13,53	392.015	31.081.197.568	4.194.304	1.048.576	2.486.826	3.892.752.384	91.704	12	0	32	32	32	404.962.127.872	0	18.248.622.080	37.629	87.380	6
10.05.2021	49.89	1.446.097	31.066.476.544	4.194.304	1.048.576	1.410.474	3.894.341.632	613.955	35	0	32	32	32	404.962.127.872	0	18.248.622.080	231.545	87.380	6

Historic operating system statistics from 10.05.2021 06:52 until 10.05.2021 11:52

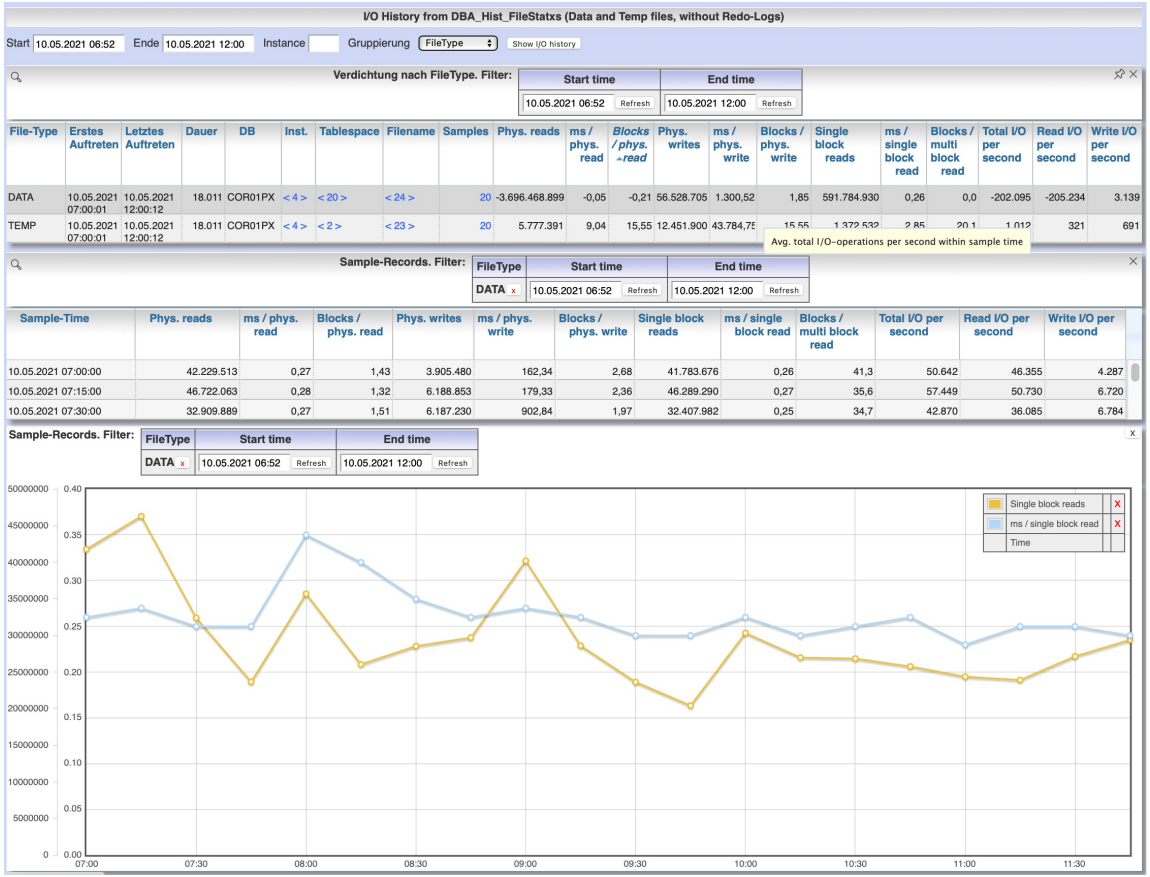


- Number of CPUs/Cores
- Total CPU load of the machine
- Totlal physical memory
- Available physicle memory
- Available swap space
- History in resolution of the AWR cycle

I/O-statistics

Menu: „I/O-Analysis“ / „I/O history by files“

Otto Group Solution Provider



- Three sources for I/O history from AWR
- Recording of various characteristic values
- different grouping by file types up to file names

- The third source DBA_Hist_Filestatxs is no longer filled by AWR as of 18c

Memory configuration

Menu: „SGA/PGA details“ / „SGA memory“ / „SGA components“

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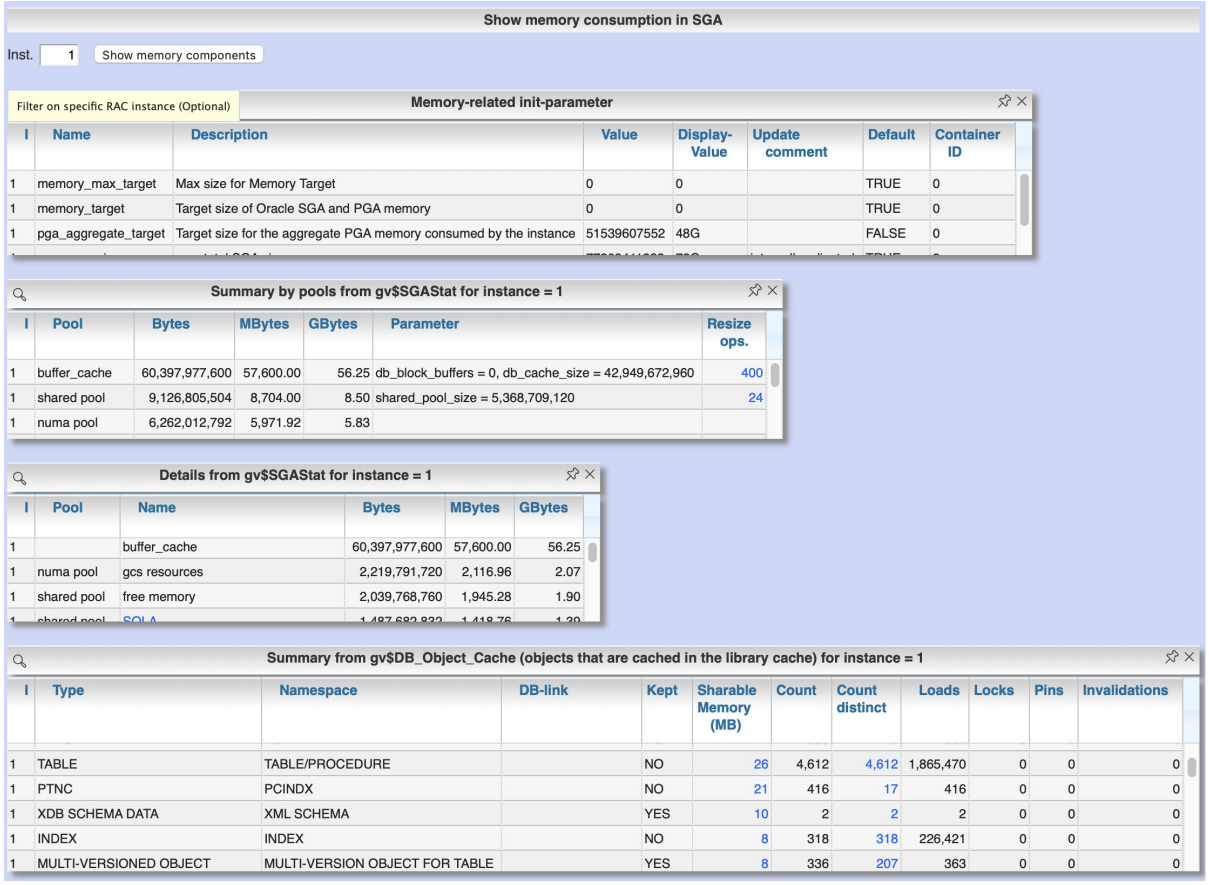

Show memory consumption in SGA

Inst. 1 Show memory components

Filter on specific RAC instance (Optional)

Memory-related init-parameter

I	Name	Description	Value	Display-Value	Update comment	Default	Container ID
1	memory_max_target	Max size for Memory Target	0	0		TRUE	0
1	memory_target	Target size of Oracle SGA and PGA memory	0	0		TRUE	0
1	pga_aggregate_target	Target size for the aggregate PGA memory consumed by the instance	51539607552	48G		FALSE	0

Summary by pools from gv$SGAStat for instance = 1

I	Pool	Bytes	MBytes	GBytes	Parameter	Resize ops.
1	buffer_cache	60,397,977,600	57,600.00	56.25	db_block_buffers = 0, db_cache_size = 42,949,672,960	400
1	shared pool	9,126,805,504	8,704.00	8.50	shared_pool_size = 5,368,709,120	24
1	numa pool	6,262,012,792	5,971.92	5.83		

Details from gv$SGAStat for instance = 1

I	Pool	Name	Bytes	MBytes	GBytes
1		buffer_cache	60,397,977,600	57,600.00	56.25
1	numa pool	gcs resources	2,219,791,720	2,116.96	2.07
1	shared pool	free memory	2,039,768,760	1,945.28	1.90
1	shared pool	SQLA	1,487,682,832	1,418.76	1.39

Summary from gv$DB_Object_Cache (objects that are cached in the library cache) for instance = 1

I	Type	Namespace	DB-link	Kept	Sharable Memory (MB)	Count	Count distinct	Loads	Locks	Pins	Invalidations
1	TABLE	TABLE/PROCEDURE		NO	26	4,612	4,612	1,865,470	0	0	0
1	PTNC	PCINDX		NO	21	416	17	416	0	0	0
1	XDB SCHEMA DATA	XML SCHEMA		YES	10	2	2	2	0	0	0
1	INDEX	INDEX		NO	8	318	318	226,421	0	0	0
1	MULTI-VERSIONED OBJECT	MULTI-VERSION OBJECT FOR TABLE		YES	8	336	207	363	0	0	0

This view shows :

- Dynamic allocation of physical memory to components
- Control of the distribution through manual specifications of minimum sizes

Optimization target is usually use of SGA memory for DB cache or inMemory store

Usage of DB cache by objekts

Menu: „SGA/PGA details“ / „DB-Cache “ / „DB-Cache usage current“

OSP
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DB-cache usage

Inst. 1 Part. Show cache content

DB-cache usage: Instance=1, 2021-06-25 09:31:52

Summary

Status	Size (MB)	Blocks	%
read	0.094	12	0.00
free	17.039	2,181	0.03
scur	41,424.984	5,302,398	79.86
pi	109.703	14,042	0.21
xcur	6,834.234	874,782	13.17
cr	3,488.398	446,515	6.72

Details

Name	Type	Tablename	SQLs	Size (MB)	Blocks	%	Dirty	cr	pi	read	scur	xcur	F.Read	F.V
WHR . IX_WHACCOUNT_NUNIQ	INDEX	WHR.WAREHOUSEACCOUNT	71	3,631.305	464,807	6.94	684	9,663	17	0	450,437	4,690	0	
MOMAIN . CUSTORDER	TABLE PARTITION		164	2,492.648	319,059	4.77	2,966	15,120	0	0	286,196	17,743	0	
CUST . IX_CSTBLCONST_CRTSTATID	INDEX PARTITION	CUST.CUSTBLOCKCONSEQU	0	2,327.625	297,936	4.45	6	4	2	0	296,192	1,738	0	
WHR . WAREHOUSEACCOUNT	TABLE		74	2,181.133	279,185	4.17	5,867	5,828	40	0	266,619	6,698	0	
AUFTRAG . IX_AU_GP_KONT_GPKAG	INDEX	AUFTRAG.AU_GP_KONTO	22	2,022.016	258,818	3.87	0	6	0	0	258,812	0	0	
ITM . ITEMEFFORT	TABLE PARTITION		140	1,873.781	239,844	3.58	2	119,263	0	1	120,573	7	0	
JOURNAL . OFMESSAGE	TABLE SUBPARTITION		18,720	1,687.500	216,000	3.23	3,839	13,273	604	0	190,688	11,435	0	
SYS . FGA_LOG$	TABLE		12	1,652.164	211,477	3.16	6	285	0	0	205,453	5,739	0	
ITM . EMREPLICATIONLOG	TABLE PARTITION		72	1,114.563	142,664	2.13	667	2,830	367	0	115,807	23,660	0	

Use of DB cache by tables and indexes.

- Ensure that the DB cache is really used for business-relevant objects
- Detect suboptimal SQLs that bring objects with low business relevance to the top of the LRU list

History of DB cache by objects

Menu: „SGA/PGA details“ / „DB-Cache “ / „DB-Cache usage historic“

Otto Group Solution Provider

DB-cache usage historic

Max. result count 100 Start 10.05.2021 00:00 Ende 10.05.2021 06:45 Instance Partitions Show

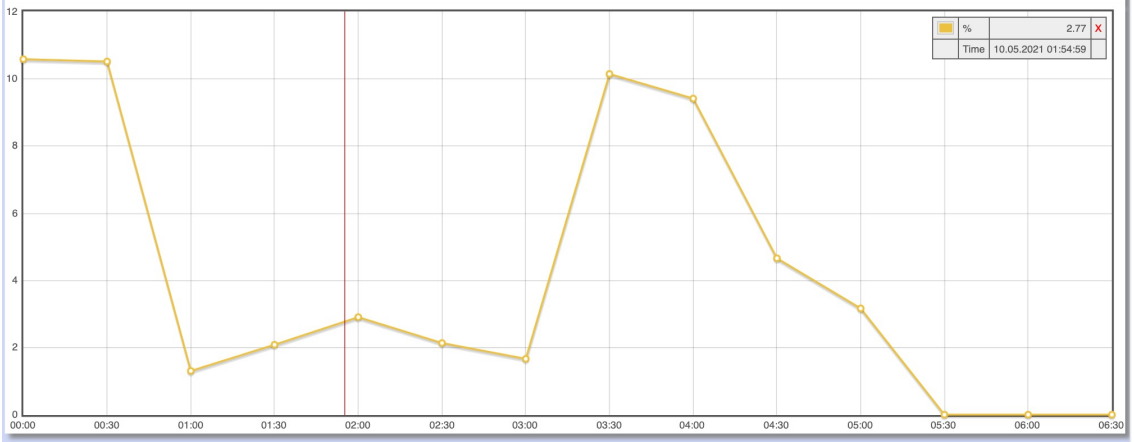
DB-cache usage between 10.05.2021 00:00 and 10.05.2021 06:45

I	Name	Weighted index	Avg. %	Avg. Blocks	Min. Blocks	Max. Blocks	Avg. Dirty	Min. Dirty	Max. Dirty	Samples	SQLs
1	[unknown].TS=UNDOTBS1	25.591.197	7,08	1.827.943	65.161	5.310.615	252.725	1.325	693.404	14	Show SQLs
1	buying.BIDEMANDESTIMATION	15.138.702	4,19	1.081.336	3.078	2.740.011	16.888	0	50.714	14	Show SQLs
1	einkauf.ART_PROM	12.655.833	3,50	903.988	316.307	2.118.340	1	0	6	14	Show SQLs
1	einkauf.ART_GR	11.783.938	3,26	841.710	230.924	1.861.573	47	0	209	14	Show SQLs

DB-cache usage BUYING.BIDEMANDESTIMATION between 10.05.2021 00:00 and 10.05.2021 06:45 Instance=1

Timestamp	Blocks	%	Dirty
10.05.2021 00:00:00	2.740.011	10,58	0
10.05.2021 00:30:00	2.724.555	10,51	0
10.05.2021 01:00:00	335.688	1,31	48.163
10.05.2021 01:30:00	538.960	2,09	50.714
10.05.2021 02:00:00	753.101	2,91	47.865

DB-cache usage BUYING.BIDEMANDESTIMATION between 10.05.2021 00:00 and 10.05.2021 06:45 Instance=1



Use of DB cache by tables and indexes in a period of the past.

- Data source is the Panorama-Sampler, not AWR
- Time course of DB cache usage per object

Forecast when changing the DB cache size

Menü: „SGA/PGA Details“ / „DB-cache “ / „DB-cache advice “

Otto Group Solution Provider

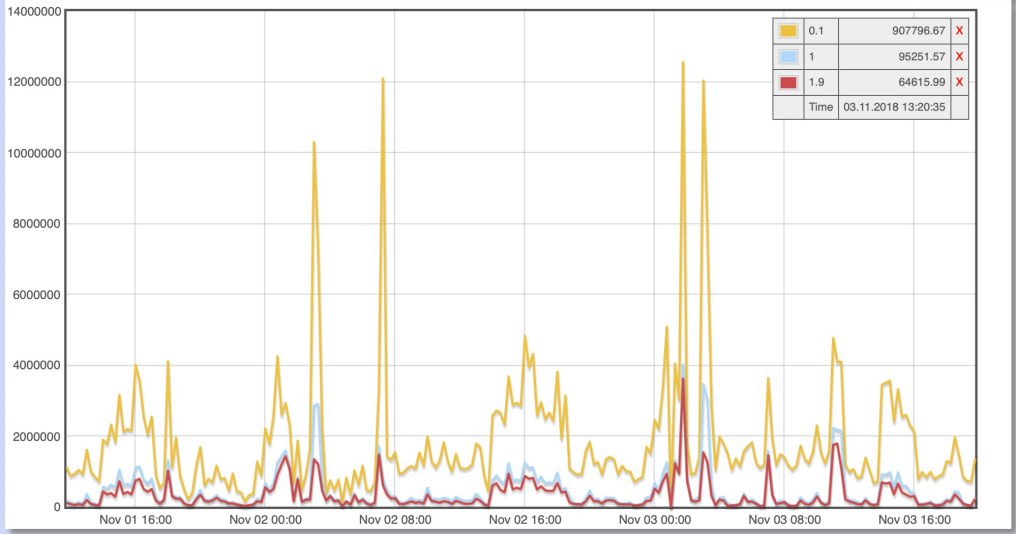
Historic DB-cache advice from DBA_Hist_DB_Cache_Advice

Start 01.11.2018 11:39 Ende 03.11.2018 20:02 Instance 1 Show

Estimated number of read requests if size of DB buffer cache is changed with factor x

	0.7	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9
54	221.843	202.931	188.383	168.107	155.953	148.503	138.023	125.239	122.366	119.871	113.121	111.138	109.777
42	177.549	133.739	128.205	124.862	114.165	102.925	99.728	96.950	93.998	81.801	76.721	75.395	73.239
36	136.021	127.653	106.612	86.631	83.768	81.838	79.392	72.946	69.767	59.895	51.927	50.354	48.116
00	180.118	168.879	149.520	129.184	125.957	122.218	103.441	102.197	99.858	79.844	75.690	73.367	71.256
40	148.905	115.622	99.992	93.183	89.115	79.991	67.211	65.203	62.889	61.286	59.419	51.368	50.544

Estimated number of read requests if size of DB buffer cache is changed with factor x



Predicting the change in the number of I/O read requests when increasing/decreasing the DB cache at specific times.

- 1 = values for current Cache-Size
- 0.1 = Prediction for reducing cache to 10%
- 1.8 = Prediction for increasing cache by 80%

Configuration of the redo logs: Actual state

Menü: „DBA general“ / „ Redologs“ / „Current“

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Redo-Logfiles from GV$LOG at 19.10.2018 08:13:05

Instance	Group	Size (MB)	Status	Start timestamp	Members	Archived	Log switch interval
1	1	200,00	CURRENT	18.10.2018 10:36:38	1	NO	
1	3	200,00	INACTIVE	15.10.2018 07:47:04	1	NO	269.374
1	2	200,00	INACTIVE	14.10.2018 23:15:10	1	NO	30.714

This picture shows the default configuration after installing an Oracle DB.

Unfortunately, this is also often the case in production systems..

Problem points :

- With only 3 redo log groups, there is a latent danger of "cannot switch redo log file" after the current log file has been written to full by the logwriter process.
  Until a free redo log file is available again, all commit operations are stopped. (GAU for OLTP systems)
- 200 MB default size can be much too small
  (Optimization target > 10 seconds between log switches)

Redo logs utilization in history

Menü: „DBA general“ / „ Redologs“ / „Historic“

Historic redo log info from DBA_Hist_Log

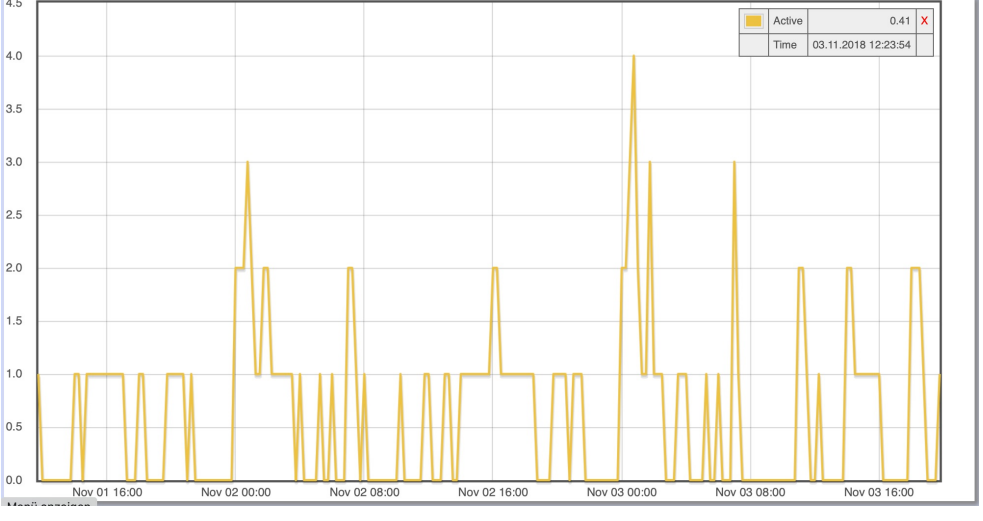
Start 01.11.2018 11:39 Ende 03.11.2018 20:02 Instance 1 Show redo log info

Redologs historic from DBA_Hist_Log

Start_Time	I	Groups	Current	Active	Not archived	Members	Avg. size (MB)	Max. sequence#	Log switches	Avg. log switch interval	Log writes (MB)
01.11.2018 11:45:09	1	12	1	1	1	1,0	4.096,000	144.905	0		0,000
01.11.2018 12:00:02	1	12	1	0	1	1,0	4.096,000	144.907	2	450	8.192,000
01.11.2018 12:15:02	1	12	1	0	1	1,0	4.096,000	144.908	1	902	4.096,000
01.11.2018	1	12	1	0	1	1,0	4.096,000	144.909	1	901	4.096,000

Redologs historic from DBA_Hist_Log

Average time in seconds between log switches for this time period



Evaluation of the utilization of the redo logs in the AWR cycle.

- Current + Active should normally never reach the number of available redo log groups
- Cross check also via alert.log with search for "cannot allocate new log" to detect possible problems within the AWR cycles
- This blog post describes the problem in detail

Agenda

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- Presentation of the used tool "Panorama
- Top/down analysis of session activities
- Executed SQL statements with detail analysis
- Segment statistics: Recording of characteristic values for objects (tables, indexes ...)
- Capacity and utilization of CPU, memory and I/O system, configuration of the instance
- Dragnet investigation: Systematic scan of the system for performance antipatterns

Dragnet investigation of performance antipatterns

Menü „Spec.additions“ / „ Dragnet investigation“

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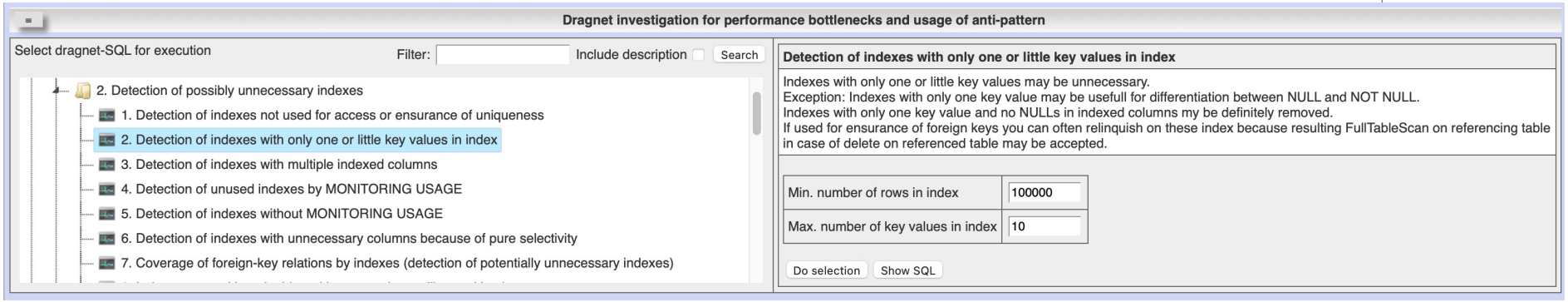

Performance optimization: reactive event-driven or preventive?

Motivation

- Detection of all further occurrences of a once analyzed problem in the system
- Solutions as simple as possible to implement without interfering with architecture and design
- Fixing identified easy-to-solve issues system-wide instead of step-by-step after escalation
- Convenient embedding in further analysis workflow

Extensible with custom queries, further details in this blog post

Example: Unused and unnecessary indexes

Menü „Spec.additions“ / „Dragnet investigation“: Point 1.2.4

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Detection of the use of indexes by SQL statements

- ALTER INDEX xxx MONITORING USAGE activates logging of index usage by SQL
- This allows a clear statement: Index has never been used since x days in 1st-level SQL
- Restriction: Recursive accesses to the index when checking a foreign key are not logged here.

For continuous monitoring of the usage state of indexes, cyclic execution of a script is recommended :

- Reactivation of the index monitoring after x days if a usage of the index was detected
- So that detection from when a previously active index is no longer used
- Execution of ALTER INDEX xxx MONITORING USAGE leads to invalidation of all cursors using this index and thus to load peaks when parsing again. This can be critical in high traffic OLTP systems.
- Therefore reactivation per ALTER INDEX xxx MONITORING USAGE only for indices which are currently not included in execution plans of the SGA
- Blog post contains the PL/SQL script for cyclic reactivation of the monitoring state as well as SQL queries

Conclusion: Automated detection of dispensable indexes is feasible.

Non-Unique indexes without foreign key and without usage for x days can be removed securely.

Final word

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Panorama only has read-only access to the database and does not require its own PL/SQL objects.

So you can test and understand the functions without any risk.
Feel free to try it out.

Tip:
Started with environment variable "PANORAMA_LOG_LEVEL= debug" all SQL statements executed by Panorama are logged in the original in the log output of the Panorama server.

Description incl. Download link:	https://rammpeter.github.io/panorama.html
Docker image	https://hub.docker.com/r/rammpeter/panorama
Blog on the subject:	https://rammpeter.blogspot.com

Thank you for your interest

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