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ORACLE
Real Application Testing
(RAT)

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MÜNCHEN

WER BIN ICH ...

- **Freiberuflicher IT Consultant**
 - in der IT seit mehr als 25 Jahren
 - Studium Mathematik
- **IT Projekte im Bereich:**
 - Oracle-DB (Beratung/Administration/Performance)
 - Oracle Data Guard / Unified Directory (OUD)
 - Data Warehousing
 - UNIX/Linux/Windows/Cloud
 - RZ Infrastruktur Management
 - RZ Automation z. B. CA / Automic UC4 / Dollar Universe
 - DevOps Tätigkeiten
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AGENDA - RAT

- Lizenzierung
- Einführung
- Funktionsweise - Architektur
- Limitierungen
- Workload Capture
- Workload Replay
- Reporting und Monitoring
- Beispiel
- Zusammenfassung

ORACLE REAL APPLICATION TESTING

- **SQL Performance Analyzer (SPA)**
 - SQL Tuning Sets (STS)
 - SQL Tuning Advisor
 - SQL Plan Management
- **Database Replay**
 - Workload Capture
 - Workload Replay
 - Analysis und Reporting
- **Consolidated Database Replay**
- **Ab Oracle 19c Multitenant Unterstützung**

- Lizenzierung
- Special License Rights: Real Application Testing

<https://docs.oracle.com/en/database/oracle/oracle-database/19/dblic/Licensing-Information.html#GUID-75262092-CD86-4B30-A21B-92ECC1C2E130>

The full functionality of Oracle Real Application Testing is available only on Oracle Database 11g Release 1 or higher. Partial functionality of Oracle Real Application Testing is available to customers wishing to upgrade from Oracle9i Database Release 2 or Oracle Database 10g.

The functionality available on Oracle9i Database Release 2 is as follows:

- **Database Replay:** Only the Workload Capture feature is supported, and the captured workload may only be replayed only on Oracle Database 11g. This feature can be used only to facilitate upgrades from Oracle 9i Database Release 2 to Oracle Database 11g or higher.

The functionality available on Oracle Database 10g Release 2 is as follows:

- **Database Replay:** Only the Workload Capture feature is supported, and the captured workload may be replayed only on Oracle Database 11g. This feature can be used only to facilitate upgrades from Oracle Database 10g Release 2 to Oracle Database 11g.
- **SQL Performance Analyzer:** Only the Remote SQL Test Execute and SQL Capture into SQL Tuning Set features are supported. These features can be used only to facilitate upgrades from Oracle9i Database Release 2 and Oracle Database 10g Release 1 to Oracle Database 10g Release 2 or higher. When upgrading to Oracle Database 10g Release 2 from earlier releases (Oracle 9i Database or Oracle Database 10g Release 1), Oracle Database 11g is needed to remotely execute SQL on the target database (that is, Oracle Database 10g Release 2). Oracle Real Application Testing licensing is required for both systems, Oracle Database 10g Release 2 and Oracle Database 11g.

■ Lizenzierung

■ Special License Rights: Real Application Testing

<https://docs.oracle.com/en/database/oracle/oracle-database/19/dblic/Licensing-Information.html#GUID-75262092-CD86-4B30-A21B-92ECC1C2E130>

Feature / Option / Pack	XE	SE2	EE	EE-ES	DBCS SE	DBCS EE	DBCS EE-HP	DBCS EE-EP	ExaCS/C	Notes
Oracle Cloud Management Pack for Oracle Database	N	N	Y	Y	N	N	Y	Y	Y	EE and EE-ES: Extra cost option
Oracle Data Masking and Subsetting Pack	N	N	Y	Y	N	Y	Y	Y	Y	EE and EE-ES: Extra cost option
Oracle Database Lifecycle Management Pack for Oracle Database	N	N	Y	Y	N	N	Y	Y	Y	EE and EE-ES: Extra cost option
Oracle Diagnostics Pack	N	N	Y	Y	N	Y	Y	Y	Y	EE and EE-ES: Extra cost option
Oracle Tuning Pack	N	N	Y	Y	N	Y	Y	Y	Y	EE and EE-ES: Extra cost option, also requires Oracle Diagnostics Pack
Oracle Real Application Testing	N	N	Y	Y	N	Y	Y	Y	Y	EE and EE-ES: Extra cost option

WARUM TESTEN ... ?

- Neue Features
- Parameteränderungen
- Neue Hardware
- Benchmarking / Stresstest
- Kapazitätsplanung / Konsolidierung
- Strategiewechsel (Cloud)
- Kundenanforderung
- Kenne deinen Workload
- ...

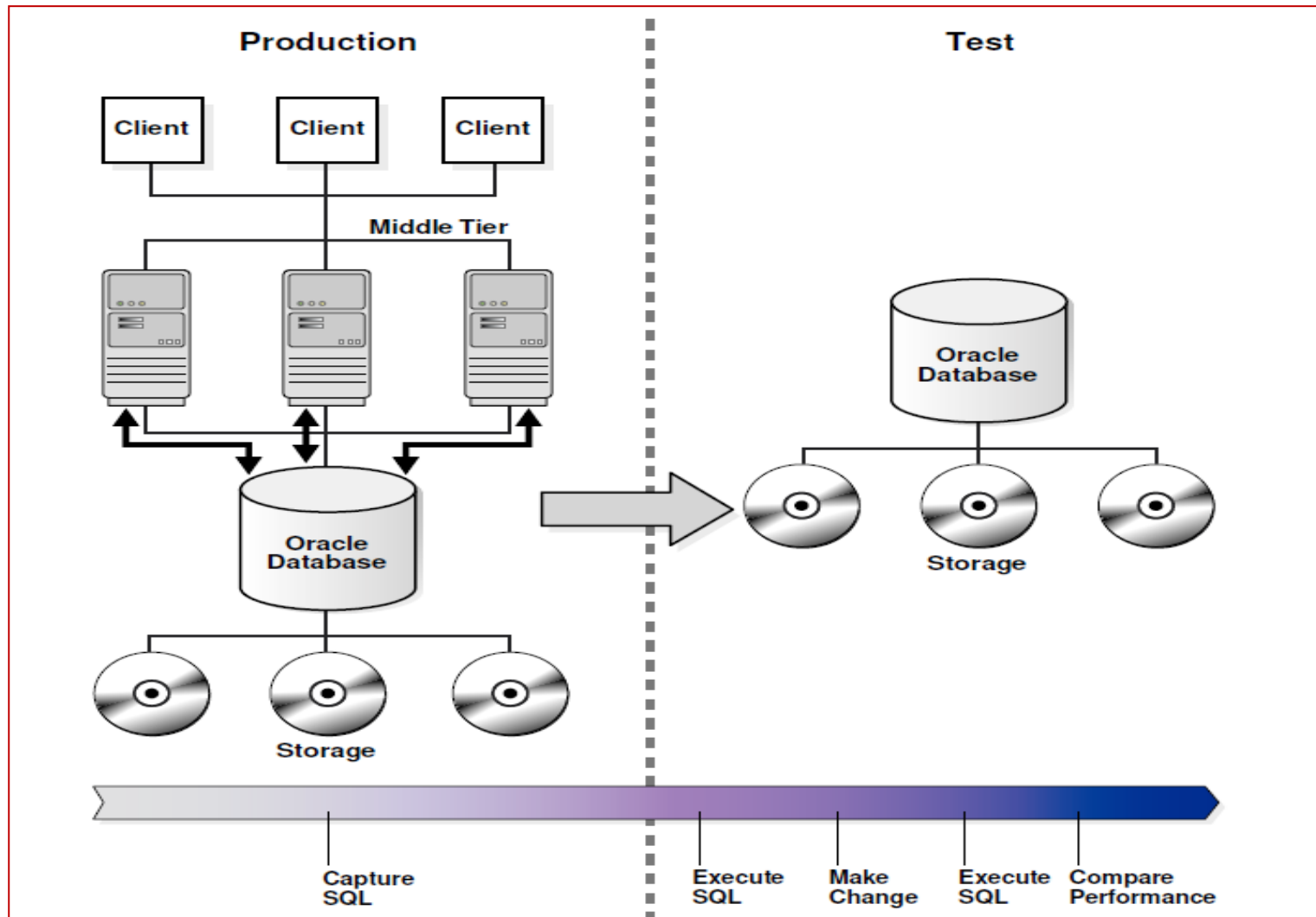
ANFORDERUNGEN

- Sicheren, zuverlässigen Systembetrieb
- Migrationen und Upgrades
 - planen und durchführen
- Regelmäßig Patches einspielen
- Neue Technologien
 - but never change a running system
- Risiken minimieren
- Performance

ZIELE

- Probleme frühzeitig erkennen
- Leistungsspektrum der Systemumgebung ermitteln
- Risiken minimieren
- Performanceprobleme **vor** Inbetriebnahme identifizieren
- Architektur und deren Komponenten unter realistischen Bedingungen prüfen

ARCHITEKTUR DATABASE REPLAY



Quelle: Oracle Testing Guide 19c

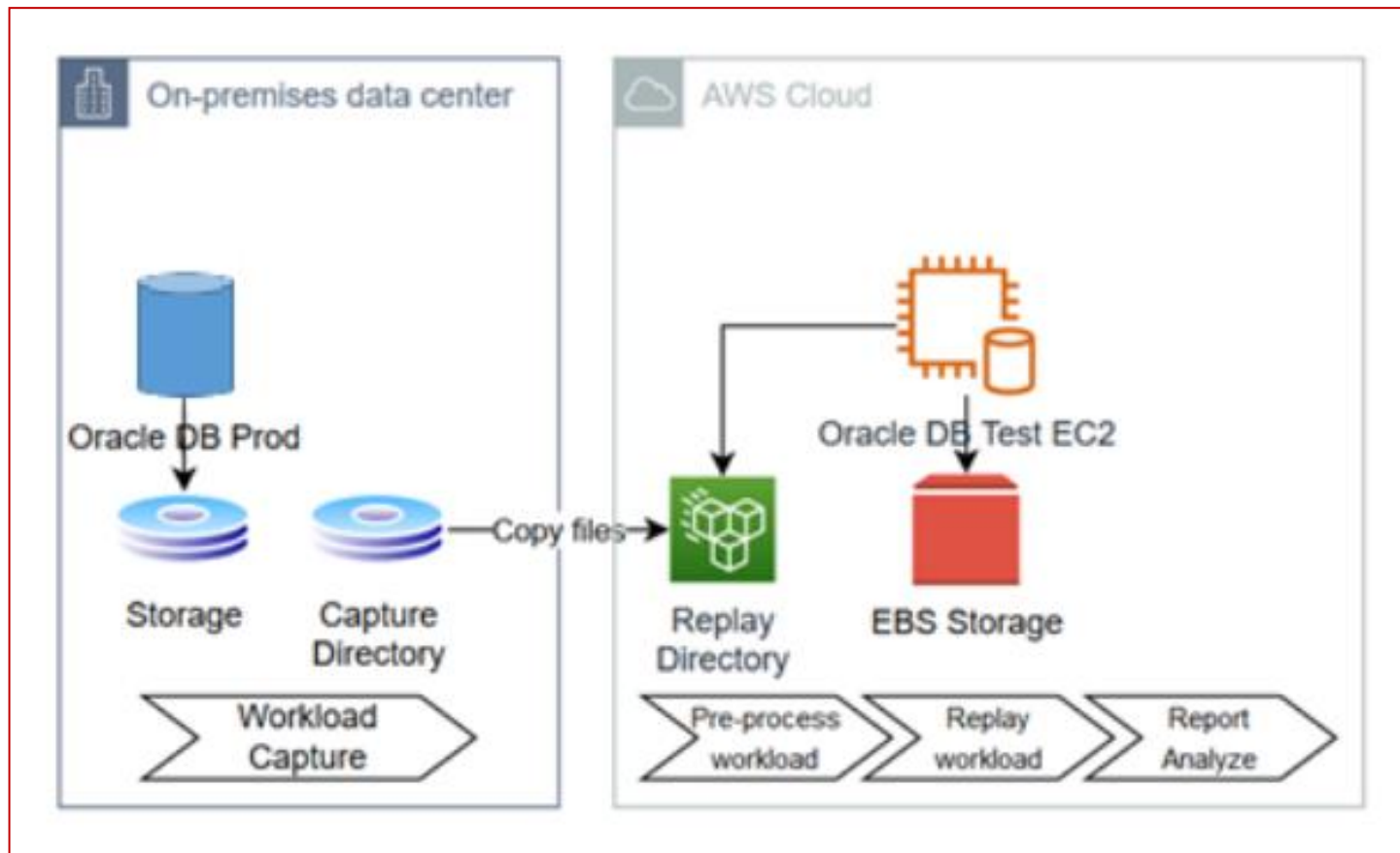
09/2022

Josef Lippert, IT Beratung

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ARCHITEKTUR DATABASE REPLAY – AWS CLOUD

<https://aws.amazon.com/de/blogs/database/use-oracle-real-application-testing-features-with-amazon-ec2/>



ARCHITEKTUR DATABASE REPLAY - OCI / AUTONOMOUS DATABASE

- Die aufgezeichneten Workloads von On-Premise und Cloud Datenbanken können nun auch auf Autonomous Datenbank-Instanzen abgespielt werden.
- <https://docs.oracle.com/en/cloud/paas/autonomous-database/adbsa/autonomous-real-application-testing.html#GUID-3D1B0F77-6D0F-4C3E-9EAA-BA3CE2552F56>

```
BEGIN
  DBMS_CLOUD_ADMIN.REPLAY_WORKLOAD (
    location_uri      => 'https://objectstorage.us-phoen
    credential_name => 'CRED_TEST',
    synchronization => TRUE,
    process_capture => TRUE);
END;
/
```

MULTITENANT UNTERSTÜTZUNG AB 19C

A workload capture can be enabled and a workload replay can be started at the pluggable database (PDB) level.

Before Oracle Database Release 19c, workload capture and replay were strictly for container database (CDB) administrators where capture and replay were started from CDB root. Starting with Oracle Database Release 19c, a workload capture can be enabled for the current pluggable database (PDB). A workload replay can also be started for the current PDB.

 Note:

Concurrent workload captures and replays are not supported at the PDB level.

Quelle: Oracle Testing Guide 19c

■ Oracle Testing Guide lesen

- Direct path load of data from external files using utilities such as SQL*Loader
- Non-PL/SQL based Advanced Queuing (AQ)
- Flashback queries
- Oracle Call Interface (OCI) based object navigations
- Non SQL-based object access
- Distributed transactions

Any distributed transactions that are captured will be replayed as local transactions.

- XA transactions

XA transactions are not captured or replayed. All local transactions are captured.

Quelle: Oracle Testing Guide 19c

SETUP CAPTURE SYSTEM (1)

- Passenden Zeitpunkt/Workload wählen
- Capture in CDB oder PDB
- Oracle Directory definieren
 - ausreichend Diskspace zur Verfügung stellen
- Capture-Filter hinzufügen
- Verschlüsselung der Daten erforderlich?
- Capture starten
- Workload starten
- Capture beenden
- AWR exportieren

SETUP CAPTURE SYSTEM (2)

■ Capture-Filter

Parameter	Description
<code>fname</code>	Name for the filter to be added. Can be used to delete the filter later if it is not required. (Mandatory)
<code>fattribute</code>	Specifies the attribute on which the filter needs to be applied (Mandatory). The possible values are: • <code>INSTANCE_NUMBER</code> - type <code>NUMBER</code> • <code>USER</code> - type <code>STRING</code> • <code>MODULE</code> - type <code>STRING</code> • <code>ACTION</code> - type <code>STRING</code> • <code>PROGRAM</code> - type <code>STRING</code> • <code>SERVICE</code> - type <code>STRING</code> • <code>PDB_NAME</code> - type <code>STRING</code>
<code>fvalue</code>	Specifies the value to which the given attribute should be equal to for the filter to be considered active. Wildcards like '%' are acceptable for all attributes that are of type <code>STRING</code> . This means that the filter for a <code>NUMBER</code> attribute is parsed as "attribute = value", with the filter for a <code>STRING</code> attribute parsed as "attribute like value" (Mandatory).

- Hintergrundprozesse + Scheduler Aktivitäten werden ignoriert

SETUP CAPTURE SYSTEM (3)

- create or replace directory RAT_WORKLOAD_DIR as '/home/RAT_workload/';
- exec dbms_workload_capture.ADD_FILTER('RAT_FILTER','USER','DOAG2022');
- exec dbms_workload_capture.DELETE_FILTER(<filter name>');
- SELECT * FROM cdb_workload_filters;
- exec dbms_workload_capture.start_capture('RAT_CAPTURE_1',
capture_sts => TRUE, die => 'RAT_WORKLOAD_DIR',
default_action=> 'EXCLUDE', encryption => ...);
- Workload erzeugen

SETUP CAPTURE SYSTEM (4)

- Workload erzeugen
- `exec dbms_workload_capture.finish_capture();`
- `select id, name, status, start_time, end_time, connects, dir_path, filters_used, duration_secs, capture_size from dba_workload_captures;`
- `exec DBMS_WORKLOAD_CAPTURE.EXPORT_AWR (<id>);`
 - manueller AWR Report:
`select id, AWR_BEGIN_SNAP, AWR_END_SNAP from dba_workload_captures;`
 - `@?/rdbms/admin/awrrpt.sql`
- Kopiere Workload-Verzeichnis zum Zielsystem

WORKLOAD PROCESSING (1)

- Replay in CDB oder PDB
- Oracle Directory definieren (Workload)
- AWR importieren
- Workload Analyzer ([wcr_cap_analysis.html](#))
- Process Capture
- Calibrate Clients
- Remap Connections
- Initialize Replay

WORKLOAD PROCESSING (2)

- Prepare Replay
- Start Workload Clients
- Start Replay
- Monitor Replay

- Nach Abschluss
 - Replay Report
 - Replay Vergleich

SETUP REPLAY SYSTEM (1)

- `wrc <connect> replaydir=/home/RAT_workload
CONNECTION_OVERRIDE=TRUE mode=get_tables`
- create or replace directory RAT_WORKLOAD_DIR as '/home/RAT_workload/';
- `select id, CAPTURE_ID, name,status, START_TIME, END_TIME,
DURATION_SECS, pdb_level, AWR_BEGIN SNAP, AWR_END SNAP,
AWR_EXPORTED, ERROR_MESSAGE from dba_workload_replays;`
- `select DBMS_WORKLOAD_CAPTURE.IMPORT_AWR (capture_id => <ID>,
staging_schema => <staging_schema>) FROM DUAL;`
- `exec DBMS_WORKLOAD_REPLAY.DELETE_REPLAY_INFO (replay_id =>
<ID>);`

SETUP REPLAY SYSTEM (2)

- Workload Analyzer

Real Application Testing: How to Run Workload Analyzer (Doc ID 1268920.1)

- Oracle Enterprise Manager

- `java -classpath`

```
$ORACLE_HOME/jdbc/lib/ojdbc8.jar:  
$ORACLE_HOME/rdbms/jlib/dbrowser.jar:  
$ORACLE_HOME/rdbms/jlib/dbanalyzer.jar:  
oracle.dbreplay.workload.checker.CaptureChecker
```

```
/home/RAT_workload
```

```
jdbc:oracle:thin:@//<server>/<database>
```

SETUP REPLAY SYSTEM (3)

- `select * from dba_workload_connection_map;`
- `exec dbms_workload_replay.remap_connection`
`(<capture_id>,<connection_id>,<replay_connection>);`
- `wrc system/<pwd>@vmware1/pdb2`
`replaydir=/home/RAT_workload mode=calibrate`
`CONNECTION_OVERRIDE=TRUE`

SETUP REPLAY SYSTEM (4)

- `wrc system/<pwd>@vmware1/pdb2`
`replaydir=/home/RAT_workload mode=calibrate`
`CONNECTION_OVERRIDE=TRUE`

```
Workload Replay Client: Release 21.3.0.0.0 - Production on Tue May 3 11:22:35 2022
```

```
Copyright (c) 1982, 2021, Oracle and/or its affiliates. All rights reserved.
```

```
Report for Workload in: /home/RAT_workload
```

```
-----
```

Recommendation:

Consider using at least 1 clients divided among 1 CPU(s)

You will need at least 3 MB of memory per client process.

If your machine(s) cannot match that number, consider using more clients.

Workload Characteristics:

- max concurrency: 1 sessions
- total number of sessions: 27

Assumptions:

- 1 client process per 100 concurrent sessions
- 4 client processes per CPU
- 256 KB of memory cache per concurrent session
- think time scale = 100
- connect time scale = 100
- synchronization = TRUE

SETUP REPLAY SYSTEM (5)

- `exec DBMS_WORKLOAD_REPLAY.PROCESS_CAPTURE (capture_dir => 'RAT_WORKLOAD_DIR');`
- `exec DBMS_WORKLOAD_REPLAY.INITIALIZE_REPLAY('RAT_REPLAY_1', 'RAT_WORKLOAD_DIR');`
- `exec dbms_workload_replay.prepare_replay(synchronization=>'SCN', ...);`
- `wrc <connect> replaydir=/home/RAT_workload
CONNECTION_OVERRIDE=TRUE`
- `exec DBMS_WORKLOAD_REPLAY.START_REPLAY;`
- `exec dbms_workload_replay.delete_replay_info(<ID>);`

MONITORING/AUSWERTUNG

- Oracle Enterprise Manager
- `select * from dba_workload_replays;`

ID	CAPTURE_ID	NAME	STATUS	START_TIME	END_TIME	DURATION_SECS	P	AWR_EXPORTED
1	1	RAT_REPLAY_0	COMPLETED	17.03.2022 13:25:57	17.03.2022 13:39:50	833	Y	NO
11	1	RAT_REPLAY_0	COMPLETED	18.03.2022 09:03:44	18.03.2022 09:26:14	1350	Y	NO
21	32	RAT_REPLAY_0	CANCELLED	18.03.2022 10:13:31	18.03.2022 10:17:36	245	Y	YES
31	42	RAT_REPLAY_0	COMPLETED	18.03.2022 10:24:54	18.03.2022 10:25:08	14	Y	YES
41	52	RAT_REPLAY_0	COMPLETED	18.03.2022 12:47:00	18.03.2022 12:47:02	2	Y	YES
51	61	RAT_REPLAY_1	COMPLETED	21.03.2022 07:57:28	21.03.2022 07:57:58	30	Y	YES
61	61	RAT_REPLAY_1	COMPLETED	21.03.2022 08:45:01	21.03.2022 08:45:31	30	Y	YES
62	61	RAT_REPLAY_2	COMPLETED	21.03.2022 08:52:12	21.03.2022 08:52:42	30	Y	YES
71	61	RAT_REPLAY_2	COMPLETED	21.03.2022 08:54:02	21.03.2022 08:54:32	30	Y	YES
81	61	RAT_REPLAY_2	COMPLETED	21.03.2022 08:55:56	21.03.2022 08:56:26	30	Y	YES
91	61	RAT_REPLAY_3	COMPLETED	21.03.2022 09:28:17	21.03.2022 09:28:46	29	Y	YES

MONITORING/AUSWERTUNG

- `select dbms_workload_replay.report(replay_id=>101,format=>'HTML') from dual ;`

DB Name	DB Id	Release	RAC	Replay Name	Replay Status
PDB2	3171504834	21.3.0.0.0	NO	RAT_REPLAY_4	COMPLETED

Replay Information		
Information	Replay	Capture
Name	RAT_REPLAY_4	RAT_CAPTURE_2
Status	COMPLETED	COMPLETED
Database Name	PDB2	PDB1
Database Version	21.3.0.0.0	21.3.0.0.0
Start Time	03-05-22 09:23:35	03-05-22 07:16:12
End Time	03-05-22 11:25:49	03-05-22 09:19:05
Duration	2 hours 2 minutes 14 seconds	2 hours 2 minutes 53 seconds
Directory Object	RAT_WORKLOAD_DIR	RAT_WORKLOAD_DIR
Directory Path	/home/RAT_workload/	/home/RAT_workload/
AWR DB Id	3171504834	
AWR Begin Snap Id	23	
AWR End Snap Id	24	
PL/SQL Mode	TOP_LEVEL	TOP_LEVEL
Encryption Algorithm		
Replay Directory Number	18583661	N/A
DB Replay Patch Info		

MONITORING/AUSWERTUNG

- `select dbms_workload_replay.report(replay_id=>101, format=>'HTML') from dual ;`

Replay Options

Option Name	Value
Synchronization	SCN
Connect Time	100%
Connect Time Auto Correct	YES
Think Time	100%
Think Time Auto Correct	TRUE
Query Only	N
Number of WRC Clients	1 (1 Completed, 0 Running)

Replay Statistics

Statistic	Replay	Capture
DB Time	9 minutes 41.67 seconds	9 minutes 16.82 seconds
PL/SQL DB Time	5.5 seconds	21.88 seconds
User calls	3150	3150
PL/SQL user calls	108	108
PL/SQL subcalls	N/A	0
Average Active Sessions	.08	.08
Capture Files	27	27
Finished Replay Sessions	27	27

MONITORING/AUSWERTUNG

- `select dbms_workload_replay.report(replay_id=>101,format=>'HTML') from dual ;`

Top Events

[\(-\) Hide](#)

Event	Instance ID	Total Wait Time
direct path write	1	10 seconds
enq: RO - fast object reuse	1	10 seconds
CPU	1	10 seconds

Top SQL with Top Events

[\(+\). Show](#)

[\(-\) Hide](#)

SQL ID	Instance ID	Event	Total Wait Time
6y55dxn24t86q	1	CPU	10 seconds
9pkpa7tczhkmn	1	enq: RO - fast object reuse	10 seconds
bd7aj5k4kg46a	1	direct path write	10 seconds

Top Service/Module

[\(+\). Show](#)

[\(-\) Hide](#)

Service	Module	Instance ID	Total Wait Time
NULL	KTSJ	1	10 seconds
PDB2	SQL*Plus	1	10 seconds
PDB2	sqlplus@vmware1 (TNS V1-V3)	1	10 seconds

Top Sessions with Top Events

[\(+\). Show](#)

[\(-\) Hide](#)

Session ID	Session Serial#	Instance ID	Event	Total Wait Time
17	31337	1	CPU	10 seconds
43	34888	1	direct path write	10 seconds
293	61392	1	enq: RO - fast object reuse	10 seconds

MONITORING/AUSWERTUNG

- select dbms_workload_replay.report(replay_id=>101,format=>'HTML') from dual:

Top Slowest Replay Sessions

(-) Hide

Delta	Session ID	Session Serial#	Instance ID	Filename	User Calls	Capture Elapsed	Replay Elapsed
8 seconds behind	291	55316	1	wcr_71pw0h0000003.rec	102	188	196
5 seconds behind	32	23691	1	wcr_71qurh0000008.rec	102	1172	1177
5 seconds behind	32	36600	1	wcr_71qf3h0000006.rec	102	768	773
4 seconds behind	21	9384	1	wcr_71rfrh000000h.rec	114	2099	2103
4 seconds behind	291	38653	1	wcr_71psch0000002.rec	102	73	77
4 seconds behind	291	56766	1	wcr_71pqfh0000000.rec	102	12	16
3 seconds behind	21	42196	1	wcr_71r9xh000000b.rec	102	1658	1661
3 seconds behind	21	49274	1	wcr_71rbzh000000c.rec	102	1724	1727
3 seconds behind	32	15201	1	wcr_71qdhh0000005.rec	102	748	751

Top Fastest Replay Sessions

(-) Hide

Delta	Session ID	Session Serial#	Instance ID	Filename	User Calls	Capture Elapsed	Replay Elapsed
18 seconds ahead	55	43523	1	wcr_71wu1h000000t.rec	138	7317	7299
17 seconds ahead	55	7197	1	wcr_71wv5h000000u.rec	138	7351	7334
15 seconds ahead	61	51819	1	wcr_71v72h000000s.rec	138	5685	5670
14 seconds ahead	61	56371	1	wcr_71v3xh000000r.rec	138	5591	5577
6 seconds ahead	21	57786	1	wcr_71t5kh000000q.rec	138	3589	3583
3 seconds ahead	32	8413	1	wcr_71swnh000000p.rec	138	3304	3301
2 seconds ahead	32	33705	1	wcr_71qu1h0000007.rec	102	1152	1150
1 seconds ahead	21	28320	1	wcr_71rtxh000000j.rec	126	2183	2182
1 seconds ahead	21	37928	1	wcr_71rfrh000000d.rec	114	1823	1822

WORKLOAD VERGLEICH (1)

- variable compare_result clob
- set pagesize 0 heading off long 100000 linesize 300
- begin

```
DBMS_WORKLOAD_REPLAY.COMPARE_PERIOD_REPORT(  
  replay_id1 => 101,  
  replay_id2 => 113,  
  format    => 'HTML',  
  result     => :compare_result);
```

end;

/

- spool compare_result.html
- print compare_result
- spool off

WORKLOAD VERGLEICH (2)

	1st Replay	2nd Replay
Capture/Replay name	RAT_REPLAY_4	RAT_REPLAY_5
Capture/Replay ID	101	113
Data Directory Name	RAT_WORKLOAD_DIR	RAT_WORKLOAD_DIR
Directory Path	/home/RAT_workload/	/home/RAT_workload/
PL/SQL Mode	TOP_LEVEL	TOP_LEVEL
Encryption Algorithm		

(-) Information About Databases

	1st Replay	2nd Replay
Database Name	CDB	CDB
Original Database ID	3171504834	3171504834
Version	21.0.0.0.0	21.0.0.0.0
Platform	Linux x86 64-bit	Linux x86 64-bit
Is It RAC?	NO	NO
Number of Instances	1	1

(-) Information About AWR and Time Periods

	1st Replay	2nd Replay
Start Time	2022-05-03 11:23:32	2022-05-03 13:59:25
End Time	2022-05-03 13:25:49	2022-05-03 16:01:48
Duration	2.04 hours	2.04 hours
AWR Database ID	3171504834	3171504834
AWR Start Snapshot ID	23	27
AWR End Snapshot ID	24	28

WORKLOAD VERGLEICH (3)

	Change in DB time	1st Replay total time	2nd Replay total time	1st Replay % of DB time	2nd Replay % of DB time
Database Time	1.36%	595.55 seconds	603.66 seconds	100	100
CPU Time	1.07%	396.28 seconds	400.5 seconds	66.54	66.35
User I/O Wait Time	N/A	0 seconds	0 seconds	0	0

(-) DB Time Distribution

Comparison Metric	Time Period1	Time Period2
Total Sample Count	570	560
Total DB Time	569.87944	545.72478
Total CPU Time	380	450
Total WAIT Time	189.87944	95.72478
Total IO Time	0	0
IO Request Count	0	0
Avg Time Per IO Request	00000000.00000	00000000.00000

(-) Wait Time Distribution

Time Period(1)			Time Period(2)		
Event(1)	Wait time(1)	Event Count(1)	Event(2)	Wait time(2)	Event Count(2)
log file switch (checkpoint incomplete),Configuration	99.87944	13	log file switch (checkpoint incomplete),Configuration	75.72478	7
enq: RO - fast object reuse,Application	70	415	enq: RO - fast object reuse,Application	10	2
log file switch completion,Configuration	10	10	log file switch completion,Configuration	10	9
log buffer space,Configuration	10	170			

WORKLOAD VERGLEICH (4)

(-) Common SQL By Total DB Time

SQL Text	Total DB Time(1)	Total DB Time(2)	DIFF(Total DB Time)
(+) update data_doag2022 set section = id1< /td>	191.79369	255.57072	-63.77703
(+) update data_doag2022 set id1 = 0	30	77.64205	-47.64205
(+) update data_doag2022 set id2 = id1	93.14299	72.51201	+20.63098
(+) insert into data_doag2022 (section, id1 , id2) select level, [...]	20	10	+10
(+) SELECT /*+ first_rows(1) */ sql_id, fo rce_matching_signatur [...]	10	20	-10
(+) delete from data_doag2022 where section = id1	84.94276	80	+4.94276

(-) Common Long Running SQL

SQL Text	Avg Res Time(1)	Max Res Time(1)	Min Res Time(1)	Median Res Time(1)	Avg Res Time(2)	Max Res Time(2)	Min Res Time(2)	Median Res Time(2)	DIFF(Avg Res Time)
(+) SELECT /*+ first_rows(1) */ sql_id, fo rce_matching_signatur [...]	1.265	1.265	1.265	1.265	1.97	2.049	1.89	1.9695	-.705
(+) update data_doag2022 set section = id1< /td>	1.881	3.265	.505	1.8445	2.477	4.128	.929	2.449	-.596
(+) update data_doag2022 set id2 = 0	2.405	3.984	.905	2.144	1.928	1.928	1.928	1.928	+4.77
(+) delete from data_doag2022 where section = id1	2.074	3.584	1.024	2.0445	1.618	3.569	.969	1.529	+4.56
(+) update data_doag2022 set id1 = 0	1.971	4.664	.505	.745	2.414	3.209	1.649	2.229	-.443
(+) insert into data_doag2022 (section, id1 , id2) select level, [...]	.885	1.025	.745	.885	1.008	1.008	1.008	1.008	-.123
(+) update data_doag2022 set id2 = id1	2.075	3.465	.425	2.2245	2.043	3.809	1.049	1.808	+0.32

WORKLOAD VERGLEICH (5)

(-) Top Sql By DB Time

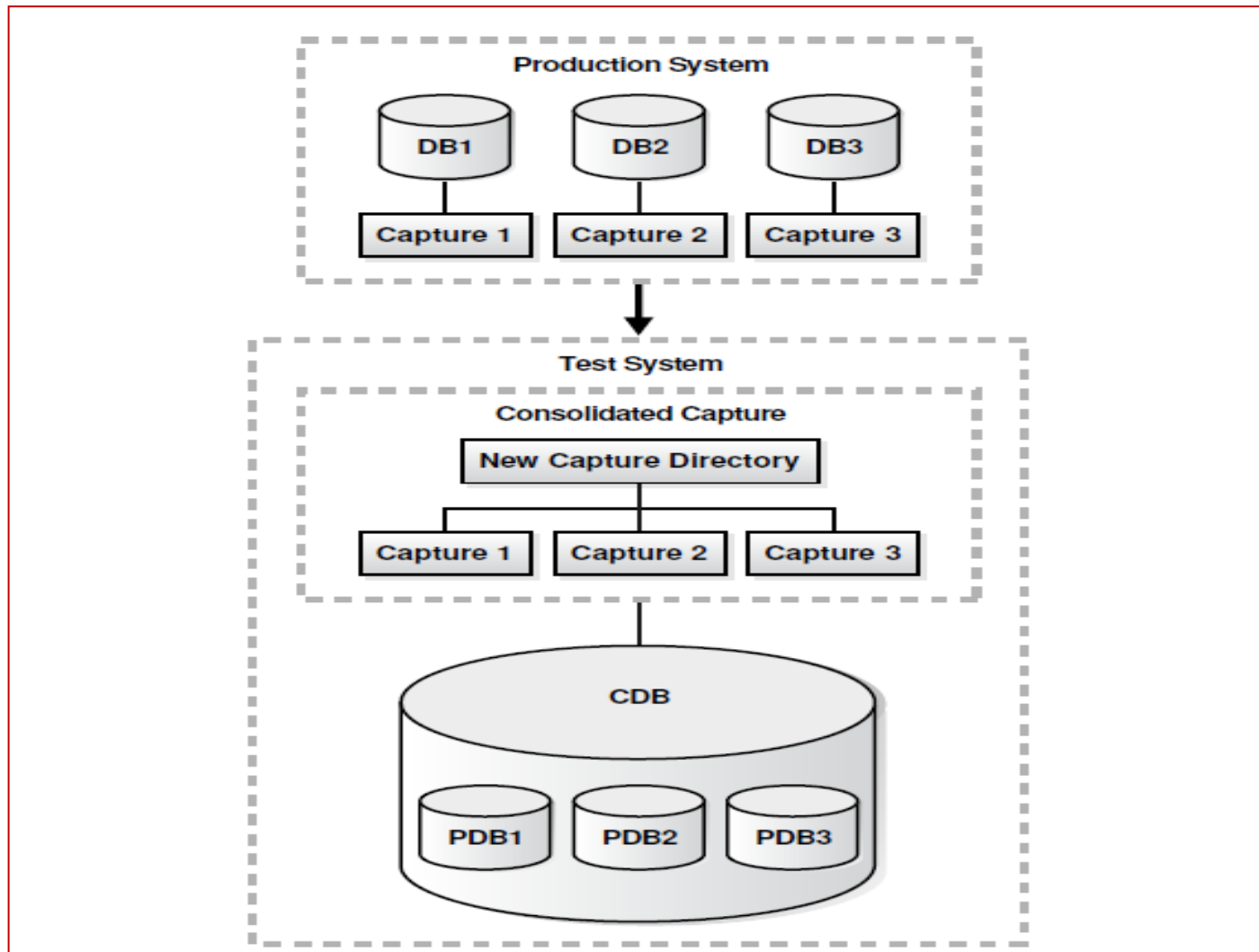
Time Period (1)

SQL Id(1)	SQL Text(1)	DB time(1)
ag55s7nh563r3	(+) update data_doag2022 set section = id1	191.79369
253avrd8vng7n	(+) update data_doag2022 set id2 = id1	93.14299
3bm2pqzsb1n5m	(+) delete from data_doag2022 where section = id1	84.94276
21n8zztd1wu1c	(+) update data_doag2022 set id2 = 0	70
90vpcn5p2chbm	(+) update data_doag2022 set id1 = 0	30
406w3fu083xjx	(+) insert into data_doag2022 (section, id1, id2) select level, [...]	20
64fxh1wgdmo4	(+) /* SQL Analyze(0) */ select /*+ full(t) no_parallel(t) n [...]	10
fn0stp00nzmj6	(+) SELECT /*+ first_rows(1) */ sql_id, for ce_matching_signatur [...]	10

Time Period (2)

SQL Id(2)	SQL Text(2)	DB time(2)
ag55s7nh563r3	(+) update data_doag2022 set section = id1	255.57072
3bm2pqzsb1n5m	(+) delete from data_doag2022 where section = id1	80
90vpcn5p2chbm	(+) update data_doag2022 set id1 = 0	77.64205
253avrd8vng7n	(+) update data_doag2022 set id2 = id1	72.51201
fn0stp00nzmj6	(+) SELECT /*+ first_rows(1) */ sql_id, for ce_matching_signatur [...]	20
ggh55rhz95kyj	(+) SELECT AUDIT_OPTION_TYPE, COUNT(DISTINCT POLICY_NAME) POL_CN [...]	10
406w3fu083xjx	(+) insert into data_doag2022 (section, id1, id2) select level, [...]	10

DATABASE REPLAY - KONSOLIDIERT



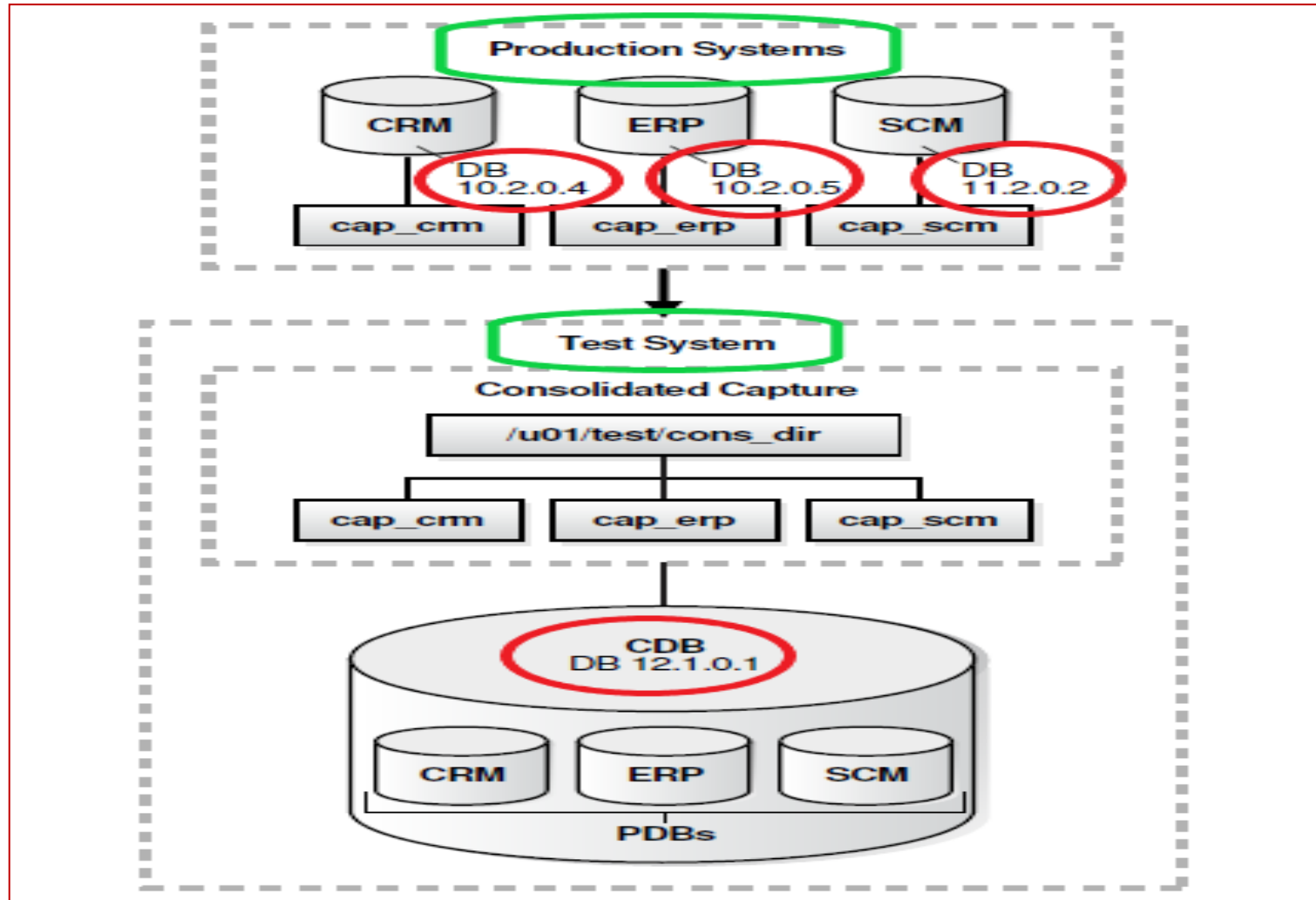
Quelle: Oracle Testing Guide 19c

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Quelle: Oracle Testing Guide 19c

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DATABASE REPLAY - KONSOLIDIERT

Compare Period Report: Consolidated Replay

[Collapse all sections](#)

Compare Attr	Capture "wrr-20120923-154838" with ID 61	Replay "cons_replay" with ID 85	Capture "wrr-20120924-000237" with ID 67	Replay "cons_replay" with ID 85	Capture "wrr-20120924-002300" with ID 70	Replay "cons_replay" with ID 85
Total Sample Count	2050	7490	1130	1600	1360	3280
Total DB Time	2519.88801	10164.33483	1784.11442	2212.95289	2368.00657	3720
Total CPU Time	2260	9130	1600	2050	2310	3580
Total WAIT Time	259.88801	1034.33483	184.11442	162.95289	58.00657	140
Total IO Time	10	770	40	10	40	100
IO Request Count	2924	329819	4473	3390	82366	42543
Avg Time Per IO Request	00000000.00342	00000000.00233	00000000.00894	00000000.00295	00000000.00049	00000000.00235

Quelle: Oracle Testing Guide 19c

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DATABASE REPLAY - KONSOLIDIERT

■ Zeitverschiebung innerhalb der aufgezeichneten Workloads

```
➤ EXEC DBMS_WORKLOAD_REPLAY.BEGIN_REPLAY_SCHEDULE ('align_peaks_schedule');  
➤ SELECT DBMS_WORKLOAD_REPLAY.ADD_CAPTURE ('SALES') FROM dual;  
➤ SELECT DBMS_WORKLOAD_REPLAY.ADD_CAPTURE ('CRM', 3600) FROM dual;  
➤ SELECT DBMS_WORKLOAD_REPLAY.ADD_CAPTURE ('DW', 1800) FROM dual;  
➤ EXEC DBMS_WORKLOAD_REPLAY.END_REPLAY_SCHEDULE;
```

■ Workload Unterteilung

```
➤ EXEC DBMS_WORKLOAD_REPLAY.GENERATE_CAPTURE_SUBSET  
('CAP_MONDAY', 'CAP_MON_2AM_8AM', 'mon_2am_8am_wkld', 0, TRUE, 21600,  
FALSE, 1);
```

■ Schema Remapping

```
➤ EXEC DBMS_WORKLOAD_REPLAY.SET_USER_MAPPING (2, 'sales_usr',  
'sales_usr_2');
```

ORACLE SUPPORT NOTES (1)

- Primary Note for Real Application Testing
(Doc ID 1464274.1)
- Real Application Testing
Best Practices (Doc ID 1535885.1)
- Database Capture and Replay
Common Errors and Reasons
(Doc ID 463263.1)
- How to Setup and Run a Database Testing
Replay in an Oracle Multitenant
Environment (Doc ID 1937920.1)

ORACLE SUPPORT NOTES (2)

- Real Application Testing: How to Run Workload Analyzer (Doc ID 1268920.1)
- Real Application Testing: Database Capture FAQ (Doc ID 1920275.1)
- Real Application Testing: Database Replay FAQ (Doc ID 2204090.1)
- Real Application Testing (RAT): Recommended Technical Papers (Doc ID 1546337.1)

ZUSAMMENFASSUNG - RAT

- Eigene Lizenz erforderlich
- RAT besteht aus den Komponenten
 - SQL Performance Analyzer (SPA)
 - DB Capture / Replay
 - Analyse und Reporting
 - Bedienung via PL/SQL und/oder OEM
- PDB Unterstützung ab 19c
- Auswirkungen von Upgrades, Patches, Migrationen vorab erkennen
- Workload konsolidierter DBs erproben

Danke für Ihre Aufmerksamkeit!

Fragen ...