Preventing Bad SQLs in the Cloud

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Longtime DBA

“

DBA
Developer should have taken care of this.

Developer
Why isn’t the DBA aware of this problem?

Manager
DBA will review all queries and approve them.

”

We have been running this SQL for ages.

Never had a problem.

Until Now.

Why Good SQLs Go Bad …

- Missing, Incomplete or Inaccurate Statistics
- Improper or Lack of Indexing
- Bad Syntax
  - `WHERE COL1+20 = COL2`
  - `WHERE UPPER(COL1) = 'XYZ'`

Why Good SQLs Go Bad

- High Demand for Data Buffers
- Bind peeking
- Upgrades, patches.

Solutions …

- Adding or Correcting Indexing
  - Index Absent
  - Proper Index- B-tree? Bitmap? Unique?
- Rewriting the SQL
  - e.g. `col1+10=:v1` becomes `col1=:v1-10`
  - Nested Loop to Hash Join

Solutions

- Reduce I/O
  - Materialized Views
  - Partitioning
- Collect Accurate Statistics
- Put Hints
- Create Outlines.

Challenges …

- Tough to determine why plans go bad, at least quickly
- Requires development skills
  - Not typical DBA skills
- Volume of statements to tune
- Time
  - Almost always reactive
  - Do it *now*. Under pressure!

Challenges

- Not in the loop for application deployment
- Code can't be changed, i.e. no hints
- Lack of Testing
  - Time
  - Resources.

Added Challenge in Cloud

- Shared Infrastructure
  - Resource Manager
- DevOps: Continuous Deployment
  - A moving target

SQL Profile

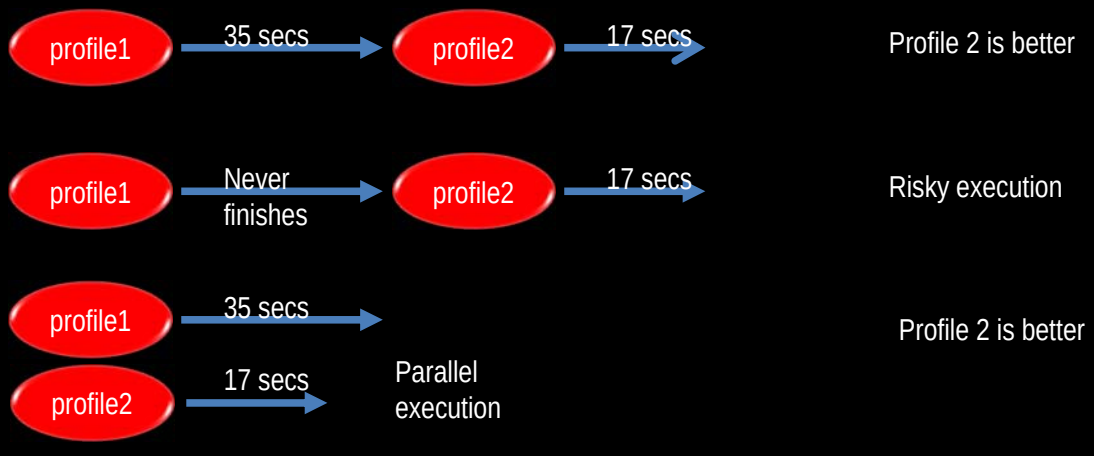
Hints are *automatically* added to queries

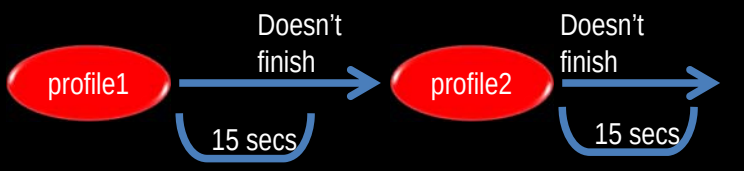
Gives more information about the accessed objects, data, etc.

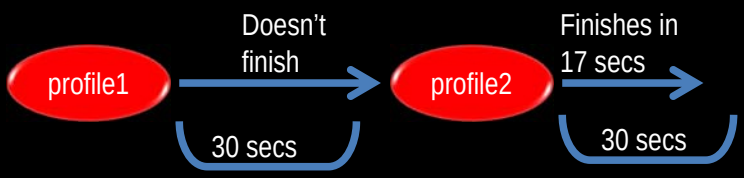
Different from SQL Plan Management Baselines

```
<outline_data>
   <hint><![CDATA[BEGIN_OUTLINE_DATA]]></hint>
   <hint><![CDATA[IGNORE_OPTIM_EMBEDDED_HINTS]]></hint>
   <hint><![CDATA[OPTIMIZER_FEATURES_ENABLE('11.2.0.3')]]></hint>
   <hint><![CDATA[DB_VERSION('11.2.0.3')]]></hint>
   <hint><![CDATA[OPT_PARAM('optimizer_dynamic_sampling' 7)]]></hint>
   <hint><![CDATA[ALL_ROWS]]></hint>
   <hint><![CDATA[OUTLINE_LEAF(@"SEL$2")]]></hint>
   <hint><![CDATA[OUTLINE_LEAF(@"SEL$1")]]></hint>
   <hint><![CDATA[NO_ACCESS(@"SEL$1" "from$_subquery$_001"@"SEL$1")]]></hint>
   <hint><![CDATA[INDEX_RS_ASC(@"SEL$2" "CH"@"SEL$2" ("T1"."COL1" "T1"."COL2"
"T1"."COL3"))]]></hint>
   <hint><![CDATA[OPT_ESTIMATE(@"SEL$1", TABLE, "T"@"SEL$1",
SCALE_ROWS=0.15")]]></hint>
```


How Oracle Selects a Profile





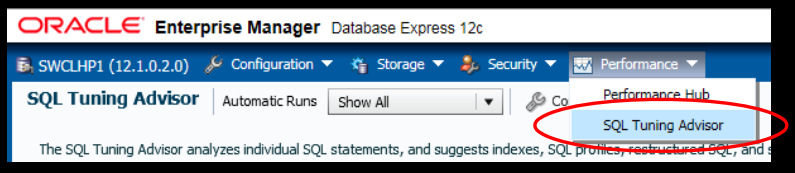


Adding SQL Profiles?

- SQL Tuning Advisor
  - A built-in tool for SQL Tuning
  - Can suggest alternatives, some pretty good.

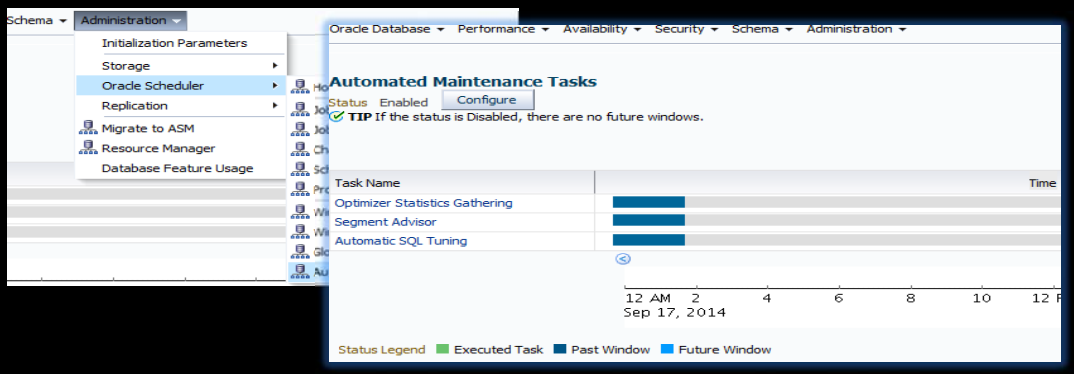
- STA Suggests:
  - Indexes
  - Rewriting
  - Materialized Views
  - Partitioning
  - Statistics
  - SQL Profiles
  - Baselines

STA from EM Express



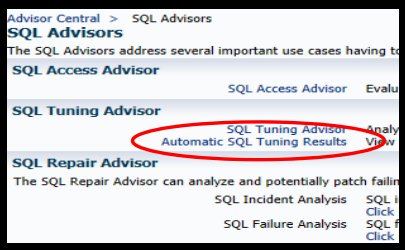
SQL Tuning Advisor

- From Top Menu -> Administration -> Oracle Scheduler -> Automated Maintenance Tasks

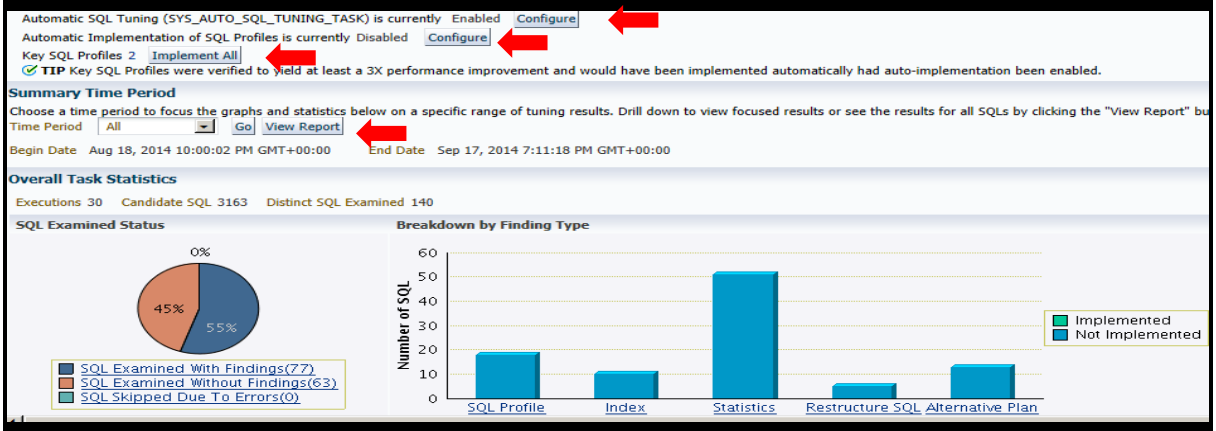


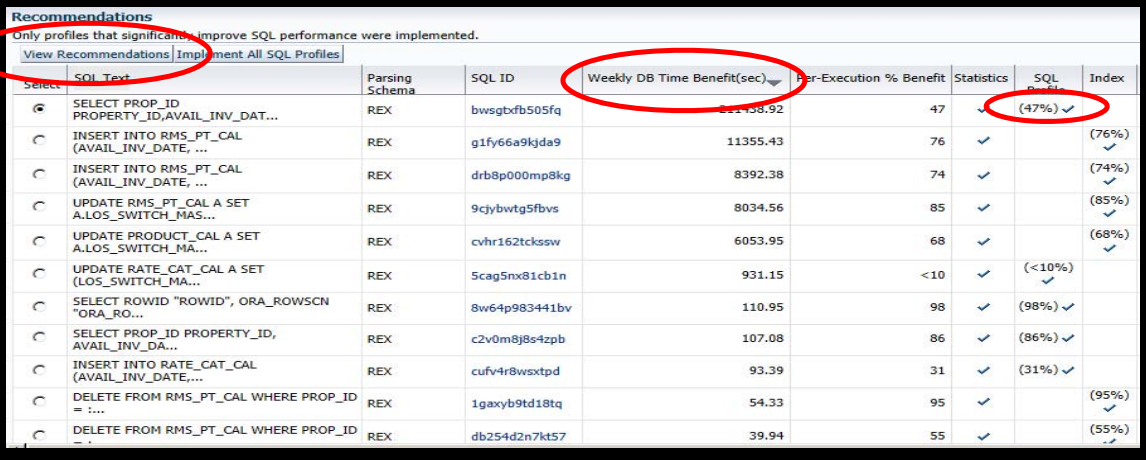
Automatic

- Automatic since Oracle 11g
- Or, from Top Menu -> Performance -> Advisor Home -> SQL Advisors



Automatic SQL Tuning





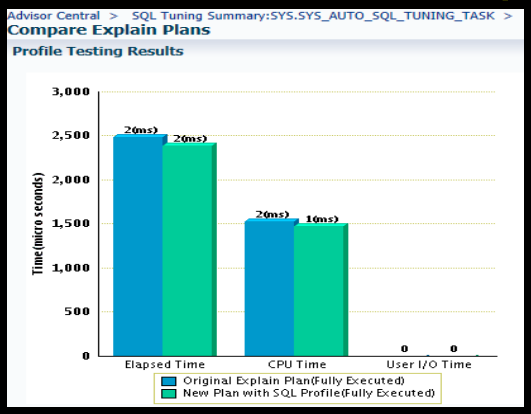
Select	SQL Text	Parsing Schema	SQL ID	Weekly DB Time Benefit(sec)	Per-Execution % Benefit	Statistics	SQL Profile	Index
◉	SELECT PROP_ID PROPERTY_ID,AVAIL_INV_DAT...	REX	bwsgtxfb505fq	211438.92	47	✓	(47%) ✓	
○	INSERT INTO RMS_PT_CAL (AVAIL_INV_DATE, ...	REX	g1fy66a9kjda9	11355.43	76	✓		(76%) ✓
○	INSERT INTO RMS_PT_CAL (AVAIL_INV_DATE, ...	REX	drb8p000mp8kg	8392.38	74	✓		(74%) ✓
○	UPDATE RMS_PT_CAL A SET A.LOS_SWITCH_MAS...	REX	9cjybwtg5fbvs	8034.56	85	✓		(85%) ✓
○	UPDATE PRODUCT_CAL A SET A.LOS_SWITCH_MA...	REX	cvhr162tckssw	6053.95	68	✓		(68%) ✓
○	UPDATE RATE_CAT_CAL A SET (LOS_SWITCH_MA...	REX	5cag5nx81cb1n	931.15	<10	✓	(<10%) ✓	
○	SELECT ROWID "ROWID", ORA_ROWSCN "ORA_RO...	REX	8w64p983441bv	110.95	98	✓	(98%) ✓	
○	SELECT PROP_ID PROPERTY_ID, AVAIL_INV_DA...	REX	c2v0m8j8s4zpb	107.08	86	✓	(86%) ✓	
○	INSERT INTO RATE_CAT_CAL (AVAIL_INV_DATE,...	REX	cufv4r8wsxtpd	93.39	31	✓	(31%) ✓	
○	DELETE FROM RMS_PT_CAL WHERE PROP_ID = :...	REX	1gaxyb9td18tq	54.33	95	✓		(95%) ✓
○	DELETE FROM RMS_PT_CAL WHERE PROP_ID	REX	db254d2n7kt57	39.94	55	✓		(55%) ✓

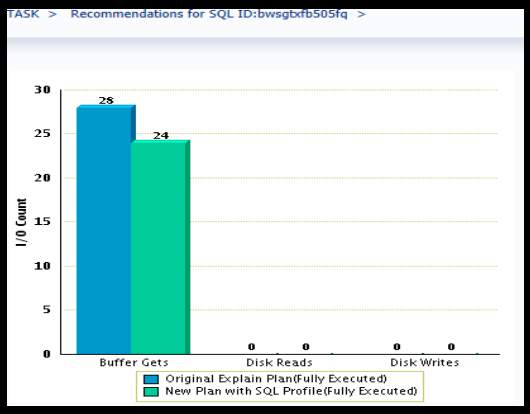
SQL Profile	A potentially better execution plan was found for this statement.
Alternative Plans	Some alternative execution plans for this statement were found by searching the system's real-time and historical performance data.

Shows the comparison of plans before and after SQL Profile

The SQL profile was not automatically created because its benefit could not be verified.	47.84		
Creating a plan baseline for the plan with the best elapsed time will prevent the Oracle optimizer from selecting a plan with worse performance.			

Enhancement Comparison





Compare Plans

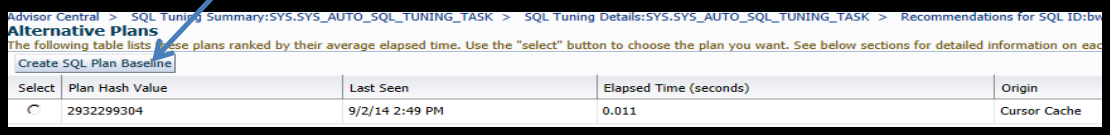
Operation	Line ID	Object
SELECT STATEMENT	0	
SORT GROUP BY		
FILTER		
FILTER		
NESTED LOOPS		
HASH JOIN		
PARTITION RANGE ITERATOR		

Order	Rows	Bytes	Cost	Time	CPU Cost	I/O Cost
27		0.162	23	1	39,814,568	21
26		0.162	23	1	39,814,568	21
25						
23						
22		0.162	22	1	20,091,796	21
20		0.307	22	1	20,087,996	21
3		0.024	6	1	201,168	6
2		0.024	6	1	201,168	6

Shows that the plan steps are different as a result of SQL Profile

Alternative Plans

Creates a BASELINE



Why only Profiles in Auto?

- Setup is quick
  - e.g. building an index takes time
- SQL does not need to change
- Testing localized to SQL only—effective
- Don't like it? Easily undone.
- Can be private, using SQL Tune Category.

More on Auto Profiles

- Default Behavior:
  - Uses MAINTENANCE_WINDOW_GROUP
  - SQL profiles are generated but not implemented

You can configure:

- If, when, how long
- Resources allowed to use
- If profiles are automatically accepted
- How many profiles it implements

To Prevent Bad SQLs in the Cloud…

… configure Auto SQL Apply

Risks?

Profiles could be worse.

Rewards?

Bad SQLs can be prevented in Cloud

Mitigation available

SQL Profiles -vs- Baselines

SQL Profiles	Baselines
Reactive	Proactive
Bad plan. Fix applied	Good Plan. Plan Fixed
Works by storing additional information about cardinality	Works by storing the plan. Cardinality is not the primary factor
Provides additional data to Optimizer	Helps Optimizer to choose from choices
No specific plan	Only the set of plans
When data changes are dramatic, better	When data changes are dramatic, difficult
One execution is enough to generate profile	More than one execution is required
Can still be valid if the access structures change	May not be valid when access structures change

Don't Like GUI?

- Package DBMS_SQLTUNE Functions

Function	Description
CREATE_TUNING_TASK	Creates a tuning task • For a single SQL, a group of SQLs • For SQL text, or SQL_ID • From an SQL Tuning Set
EXECUTE_TUNING_TASK	Executes the task • The parameters are defined here
REPORT_TUNING_TASK	Reports the findings
SCRIPT_TUNING_TASK	Implement the results. Creates a script to be implemented by SQL*Plus

Non-GUI Auto

- Package DBMS_AUTO_SQLTUNE

Function	Description
SET_AUTO_TUNING_TASK_PARAMETER	Change the default parameters
EXECUTE_AUTO_TUNING_TASK	Executes the task • The parameters are defined here
REPORT_AUTO_TUNING_TASK	Reports the findings

Sources for Tuning Set

All functions are in DBMS_SQLTUNE package

Source	How to Get from it
Shared pool	SELECT_CURSOR_CACHE ()
From AWR Repository	SELECT_WORKLOAD_REPOSITORY ()
Oracle Trace Files	SELECT_SQL_TRACE ()
SQL Performance Analyzer task comparison results	SELECT_SQLPA_TASK ()
Another SQL Tuning Set	SELECT_SQLSET ()

Realtime SQL Monitoring

- From SQL Menu, Plan
  - Automatically monitors long running SQL
  - Shows the statistics and resources consumed at each step of the plan.
  - Shows actual cardinality at each step, helps resolve problems with poor cardinality estimates

Realtime SQL Monitoring

- Exposes monitoring statistics
  - Plan operation level
  - Parallel Execution level
  - I/O, CPU, memory, network
  - Exadata Smart Scans

Very Useful Tool: Active Reports

Active Reports without EM

- Built-In Functions Returning Report as CLOB
  - SQL Details `dbms_perf.report_session`
  - SQL Monitor `dbms_sqltune.report_sql_monitor_list`
  - SQL Perf Analyzer `dbms_sqlpa.report_analysis_task`
  - Performance Hub `dbms_perf.report_perfhub`

Active Reports in SQL Example

```
set pages 0 linesize 32767 trimspool on
set long 1000000 longchunksize 10000000
spool rep.html
select dbms_perf.report_perfhub (is_realtime=>1,
type=>'active') from dual;
```


Takeaways

- Enable SQL Tuning Advisor to run automatically
- Enable automatic application of SQL Profiles
- Check recommendations and apply them from one screen
  - In small databases, may want to enable automatic application of profiles
- Use Realtime Monitoring to find out issues at specific steps
- Generate Active Reports to explain database issues

Q&A

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