Hochschule für Angewandte Wissenschaften Hamburg

Hamburg University of Applied Sciences

Optimizer / Statistiken / SQL / Performance

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Überblick Performance

1. HTTP Request / Netzwerk
2. Applikation Server / Java Klassen / Netzwerkanbindung
3. Optimizer / SQL Tuning
4. Datenmodellierung / Partitionierung / Indizes
5. Datenbanktuning
6. System / OS / VMware / Netzwerk / IO-Subsystem

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Applikation / Charakteristik der Anwendung

OLTP / Einzelsatzverarbeitung	Data Hub / ODS / Mischbetrieb	DWH / Massendatenverarbeitung
• Viele Anwender	• Viele Anwender bzw. Datenabnehmer	• Wenige Anwender
• Tausende Transaktionen pro Sekunde, sehr viele Ausführungen	• ETL Jobs, Reporting, OLTP, viele & anspruchsvolle Ausführungen	• ETL Jobs, Reporting, wenige anspruchsvolle Ausführungen
• Einzelnes Statement deutlich weniger als eine Sekunde	• Unterschiedliche lange Ausführungszeiten	• Einzelnes Statement kann Minuten, bzw. Stunden dauern
• Einzelsatzverarbeitung Row-by-row based Cursorverarbeitung Nested Loop	• Einzel- + Massenverarbeitung Row- + Set based Alle Aufrufarten NL + Hash-Join	• Massenverarbeitung Set based Direkter SQL Aufruf Merge-Join / Hash-Join
• Pro Ausführung werden kleine Datenmengen verarbeitet	• Pro Ausführung werden unterschiedl. große Datenmengen verarbeitet	• Pro Ausführung werden große Datenmengen verarbeitet
• B*-Tree Indizes! Single Read/Write I/O!	• Indizes! Single Read/Write I/O!	• Indizes? Single Read/Write I/O?
• Partitionierung? / Parallel Query?	• Partitionierung! / Parallel Query! IO-Durchsatz! Star-Datenmodell! Bitmap Indizes	• Partitionierung! / Parallel Query! Full Table Scan! IO-Durchsatz! Star-Datenmodell! Bitmap Indizes

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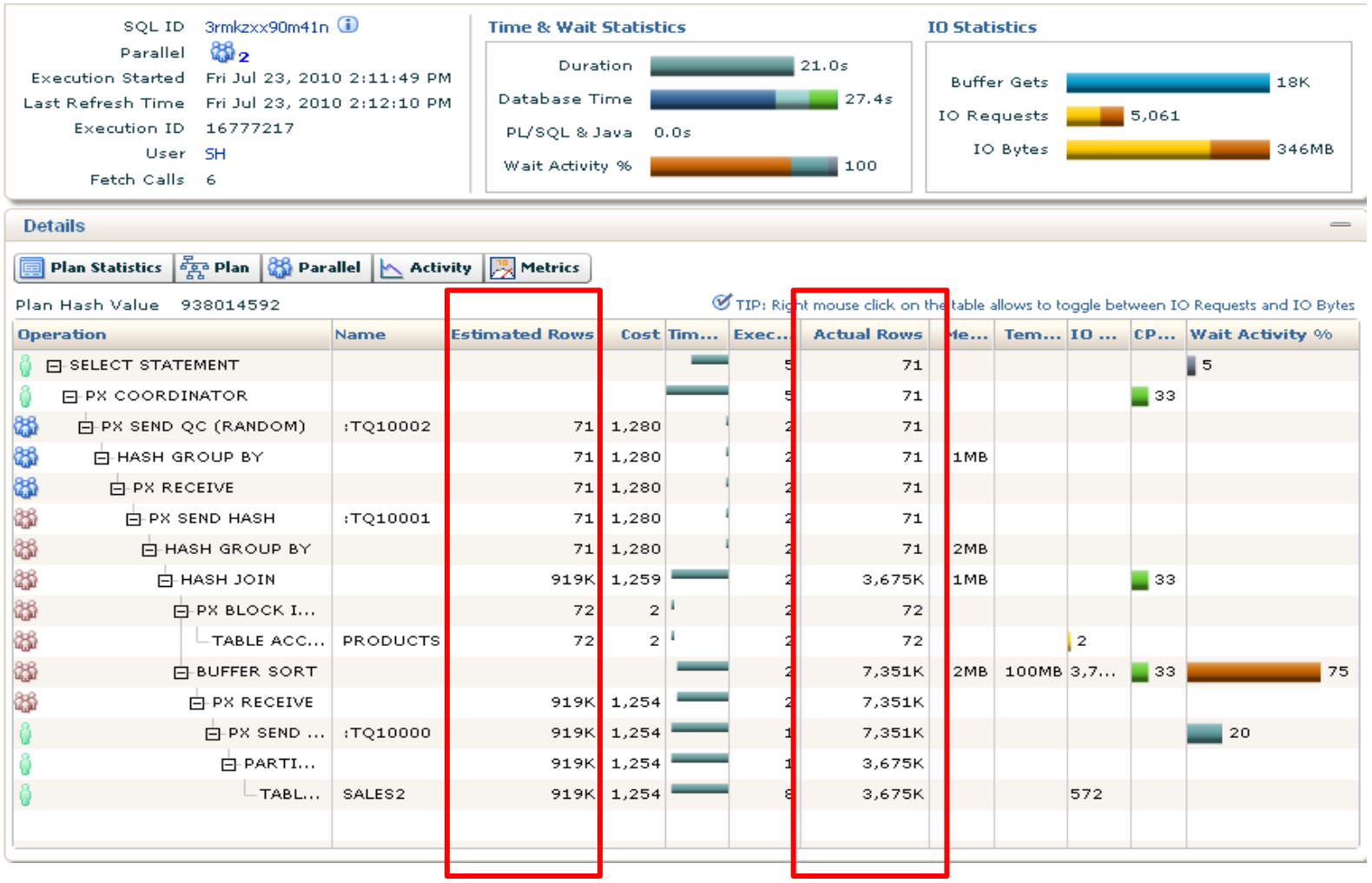
SQL Statements / Monitoring im EM Cloud Control

SQL Monitor

- Gibt einen exakten Überblick über laufende SQL Statements
- Execution Plan
- Anzahl gelesener Sätze
- Anzahl I/Os
- Wait Aktivitäten
- Parallele Verarbeitung
- Auch für Entwickler wichtig!



SQL ID	3rmkzxx90m41n
Parallel	2
Execution Started	Fri Jul 23, 2010 2:11:49 PM
Last Refresh Time	Fri Jul 23, 2010 2:12:10 PM
Execution ID	16777217
User	SH
Fetch Calls	6

Time & Wait Statistics

Duration	21.0s
Database Time	27.4s
PL/SQL & Java	0.0s
Wait Activity %	100

IO Statistics

Buffer Gets	18K
IO Requests	5,061
IO Bytes	346MB

Details

Plan Statistics | Plan | Parallel | Activity | Metrics

Plan Hash Value 938014592

TIP: Right mouse click on the table allows to toggle between IO Requests and IO Bytes

Operation	Name	Estimated Rows	Cost	Tim...	Exec...	Actual Rows	Me...	Tem...	IO ...	CP...	Wait Activity %
SELECT STATEMENT					5	71					5
PX COORDINATOR					5	71				33	
PX SEND QC (RANDOM)	:TQ10002	71	1,280		2	71					
HASH GROUP BY		71	1,280		2	71	1MB				
PX RECEIVE		71	1,280		2	71					
PX SEND HASH	:TQ10001	71	1,280		2	71					
HASH GROUP BY		71	1,280		2	71	2MB				
HASH JOIN		919K	1,259		2	3,675K	1MB			33	
PX BLOCK I...		72	2		2	72					
TABLE ACC...	PRODUCTS	72	2		2	72			2		
BUFFER SORT					2	7,351K	2MB	100MB	3,7...	33	75
PX RECEIVE		919K	1,254		2	7,351K					
PX SEND ...	:TQ10000	919K	1,254		1	7,351K					20
PARTI...		919K	1,254		1	3,675K					
TABL...	SALES2	919K	1,254		8	3,675K			572		

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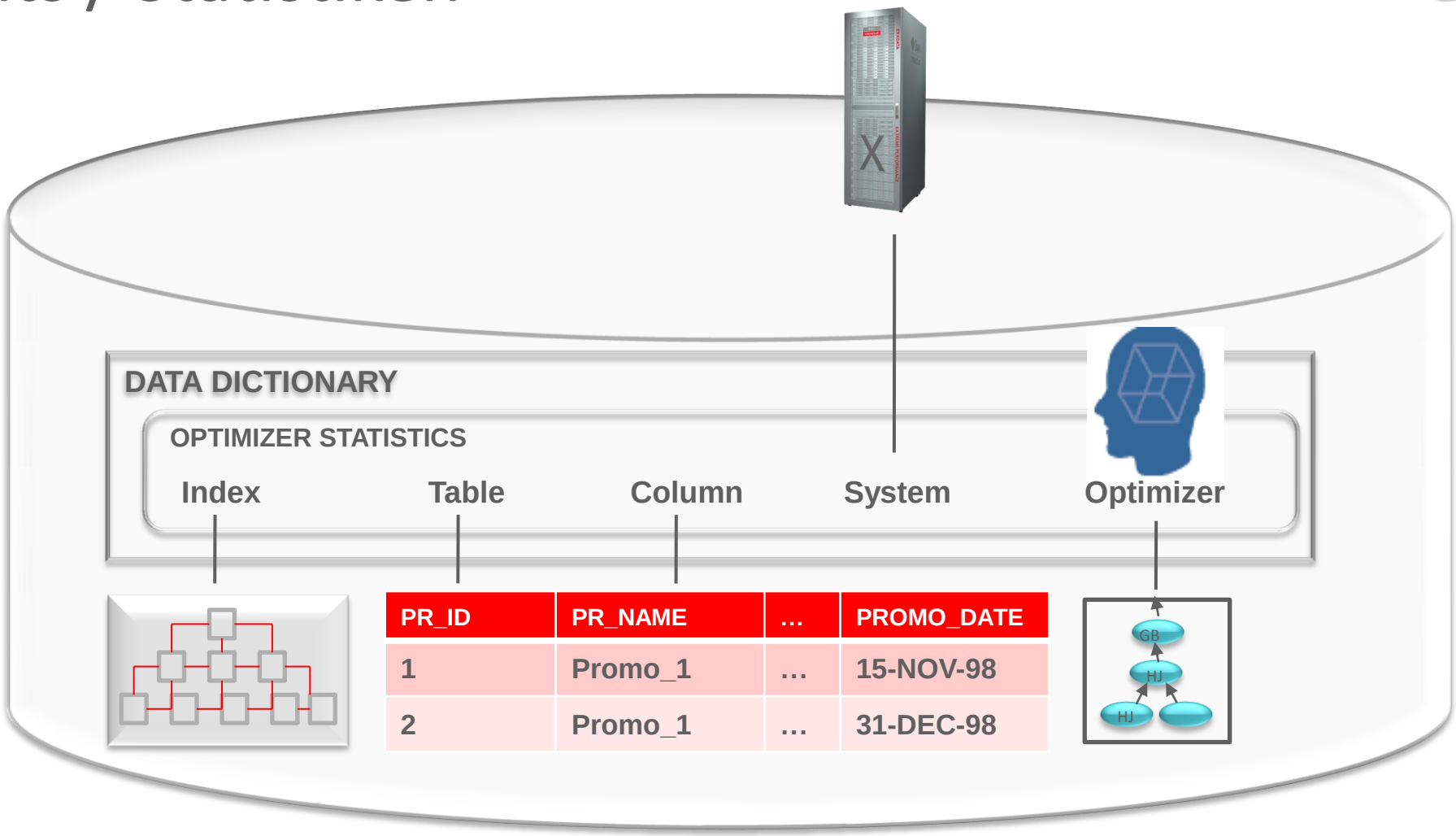
SQL Statements / Statistiken

Statistiken

- Tabellenstatistik
  - Größe
  - Anzahl Sätze
  - Satzlänge
- Spaltenstatistik
  - Kardinalität
  - Verteilung
  - Häufigkeit
- Indexstatistik
  - Indextiefe
  - Indexebenen
- Systemstatistiken
  - Anzahl CPUs
  - IO Durchsatz
  - Single Block Read



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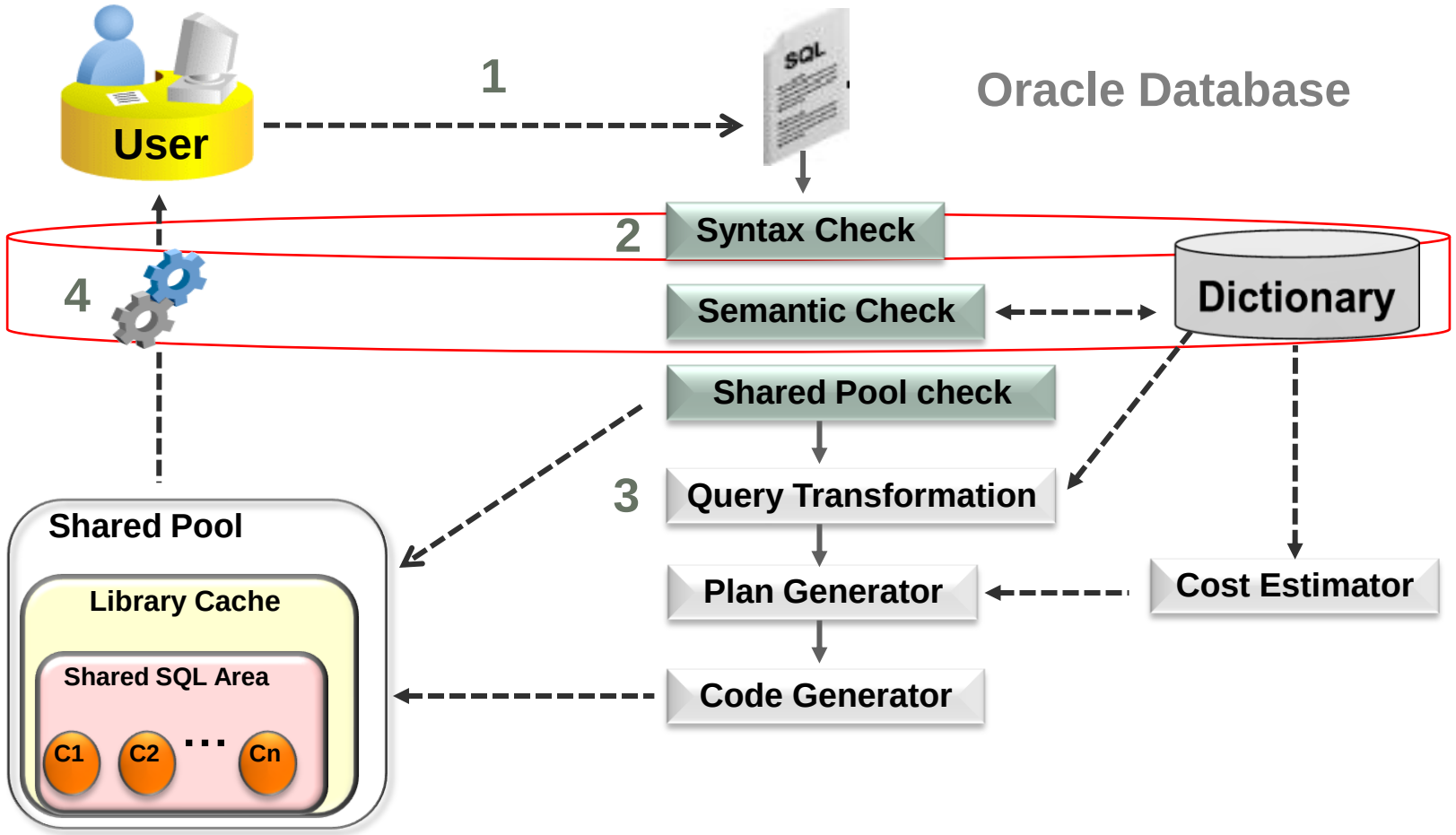
SQL Statements / Arbeitsweise des Optimizers

Optimizer / Execution Plan

1. Ein User setzt ein SQL Statement ab
2. Soft Parse: des Statements mit Hilfe des Dictionaries und des Shared Pools
3. Hard Parse: es wird mit Hilfe von Statistiken der beste Execution Plan gesucht und als ausführbarer Code in den Shared Pool geschrieben
4. Ausführung des Statements und senden des Ergebnisses an den User



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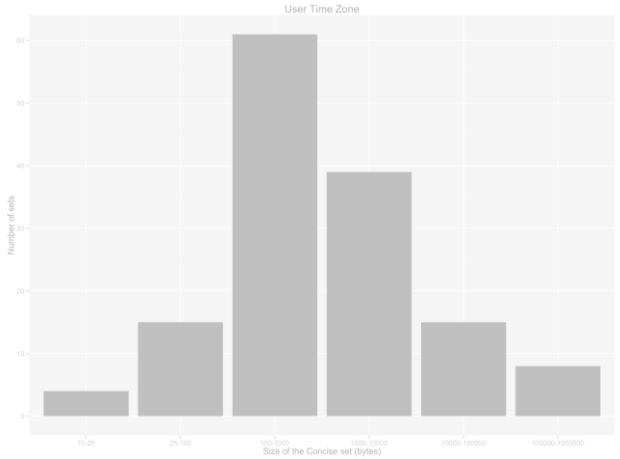
SQL Statements / Arbeitsweise des Optimizers

Optimizer / Execution Plan

- Kardinalität
  - Einschätzung der Selektivität / Kardinalität
  - Hohe Selektivität (Auftragsnummer), Geringe Selektivität (Geschlecht)
- Zugriffspfade
  - Bestimmung des Zugriffs auf die Daten
  - Full Table Scan, Index, Bitmap Index, Index Range Scan, …
- Join-Typ
  - Welche Join Art wurde verwendet
  - Nested Loop Join, Hash Join, Sort-Merge Join, Kartesisches Produkt
- Join-Reihenfolge
  - Bestimmung der Reihenfolge
  - Erst A mit B joinen, dann mit D, zuletzt mit C



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SQL Statements / Arbeitsweise des Optimizers


```
-------------------------------------------------------------------------------------------------------------------
| Id  | Operation                          | Name            | Rows  | Bytes | Cost (%CPU)| Time     | Pstart| Pstop |
-------------------------------------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT                   |                 |       |       |   709 (100)|          |       |       |
|   1 |  VIEW                              |                 |     4 |   156 |   709  (34)| 00:00:09 |       |       |
|   2 |   SORT GROUP BY                    |                 |     4 |   380 |   709  (34)| 00:00:09 |       |       |
|*  3 |    HASH JOIN                       |                 |     4 |   380 |   708  (34)| 00:00:09 |       |       |
|*  4 |     HASH JOIN                      |                 |     4 |   276 |   701  (34)| 00:00:09 |       |       |
|   5 |      PART JOIN FILTER CREATE       | :BF0000         |     4 |   156 |    35  (18)| 00:00:01 |       |       |
|   6 |       VIEW                         | VW_GBF_10       |     4 |   156 |    35  (18)| 00:00:01 |       |       |
|   7 |        HASH GROUP BY               |                 |     4 |   208 |    35  (18)| 00:00:01 |       |       |
|   8 |         PARTITION RANGE SINGLE     |                 |     4 |   208 |    34  (15)| 00:00:01 |    14 |    14 |
|   9 |          PARTITION HASH ALL        |                 |     4 |   208 |    34  (15)| 00:00:01 |     1 |   128 |
|* 10 |           TABLE ACCESS FULL        | TRANS_DETAIL    |     4 |   208 |    34  (15)| 00:00:01 |  1665 |  1792 |
|  11 |      PARTITION RANGE ALL           |                 |  130K |  3829K|   655  (34)| 00:00:08 |     1 |    16 |
|  12 |       PARTITION HASH JOIN-FILTER   |                 |  130K |  3829K|   655  (34)| 00:00:08 |:BF0000|:BF0000|
|  13 |        TABLE ACCESS FULL           | ACCOUNT_MASTER  |  130K |  3829K|   655  (34)| 00:00:08 |     1 |  2048 |
|  14 |  TABLE ACCESS FULL                 | PCODE_REF       |  1307 | 33982 |     6   (0)| 00:00:01 |       |       |
-------------------------------------------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------

   3 - access("A"."PCODE"="B"."PCODE")
   4 - access("A"."ACCT_NUM"="ITEM_2" AND "A"."CO_ID"="ITEM_1")
  10 - filter(("C"."ASOF_YYYYMM"=200102 AND "C"."TRAN_AMT"<2000000000))
```

Join-Typ

1

2

3

Pfad

Kardinalität

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SQL Statements / Access Paths

Access Path	Explanation
Full table scan	Reads all rows from table & filters out those that do not meet the where clause predicates. Used when no index, DOP set etc
Table access by Rowid	Rowid specifies the datafile & data block containing the row and the location of the row in that block. Used if rowid supplied by index or in where clause
Index unique scan	Only one row will be returned. Used when stmt contains a UNIQUE or a PRIMARY KEY constraint that guarantees that only a single row is accessed.
Index range scan	Accesses adjacent index entries returns ROWID values Used with equality on non-unique indexes or range predicate on unique index (<.>, between etc)
Index skip scan	Skips the leading edge of the index & uses the rest Advantageous if there are few distinct values in the leading column and many distinct values in the non-leading column
Full index scan	Processes all leaf blocks of an index, but only enough branch blocks to find 1st leaf block. Used when all necessary columns are in index & order by clause matches index struct or if sort merge join is done
Fast full index scan	Scans all blocks in index used to replace a FTS when all necessary columns are in the index. Using multi-block IO & can going parallel
Index joins	Hash join of several indexes that together contain all the table columns that are referenced in the query. Wont eliminate a sort operation
Bitmap indexes	uses a bitmap for key values and a mapping function that converts each bit position to a rowid. Can efficiently merge indexes that correspond to several conditions in a WHERE clause

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SQL Statements / Join Types

Access Path	Explanation
Nested Loops joins	For every row in the outer table, Oracle accesses all the rows in the inner table Useful when joining small subsets of data and there is an efficient way to access the second table (index look up)
Hash Joins	The smaller of two tables is scan and resulting rows are used to build a hash table on the join key in memory. The larger table is then scan, join column of the resulting rows are hashed and the values used to probing the hash table to find the matching rows. Useful for larger tables & if equality pred
Sort Merge joins	Consists of two steps: 1. Sort join operation: Both the inputs are sorted on the join key. 2. Merge join operation: The sorted lists are merged together. Useful when the join condition between two tables is an inequality condition
Cartesian Joins	Joins every row from one data source with every row from the other data source, creating the Cartesian Product of the two sets. Only good if tables are very small. Only choice if there is no join condition specified in query
Outer Joins	Returns all rows that satisfy the join condition and also returns all of the rows from the table without the (+) for which no rows from the other table satisfy the join condition

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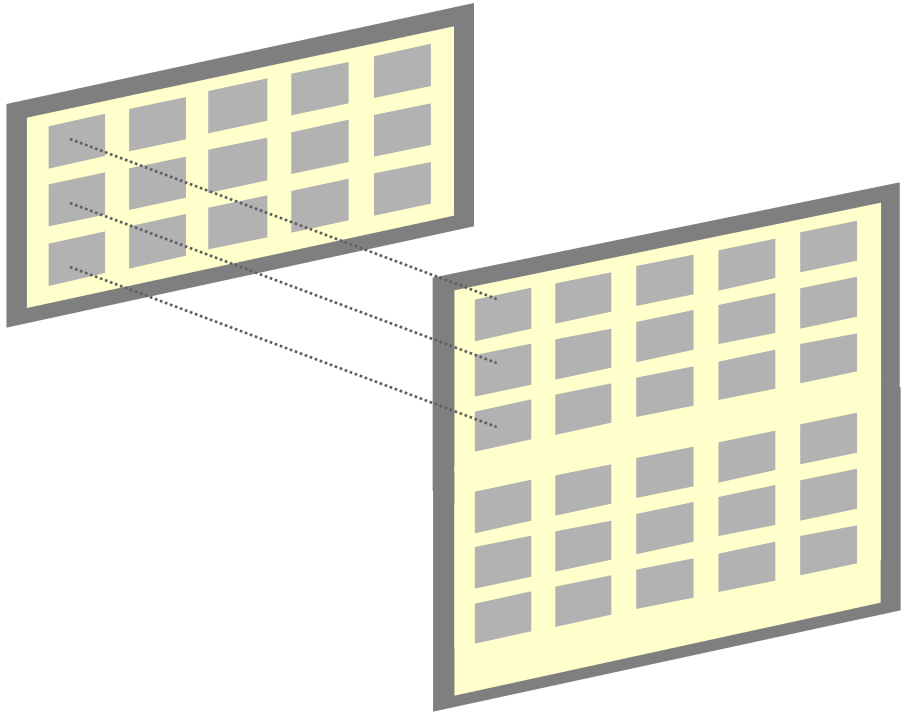
SQL Statements / Hash Join

- Für Batch Jobs / Massenverarbeitung
- Sinnvoll -> DWH
- Historie
  - Sort/Merge Joins (SMJ) und/oder
  - Nested Loop Joins nicht immer optimal

- Hash Join bietet ein Verfahren, das auch
- dann sehr effizient arbeitet, wenn keine
- Indizes vorhanden sind!



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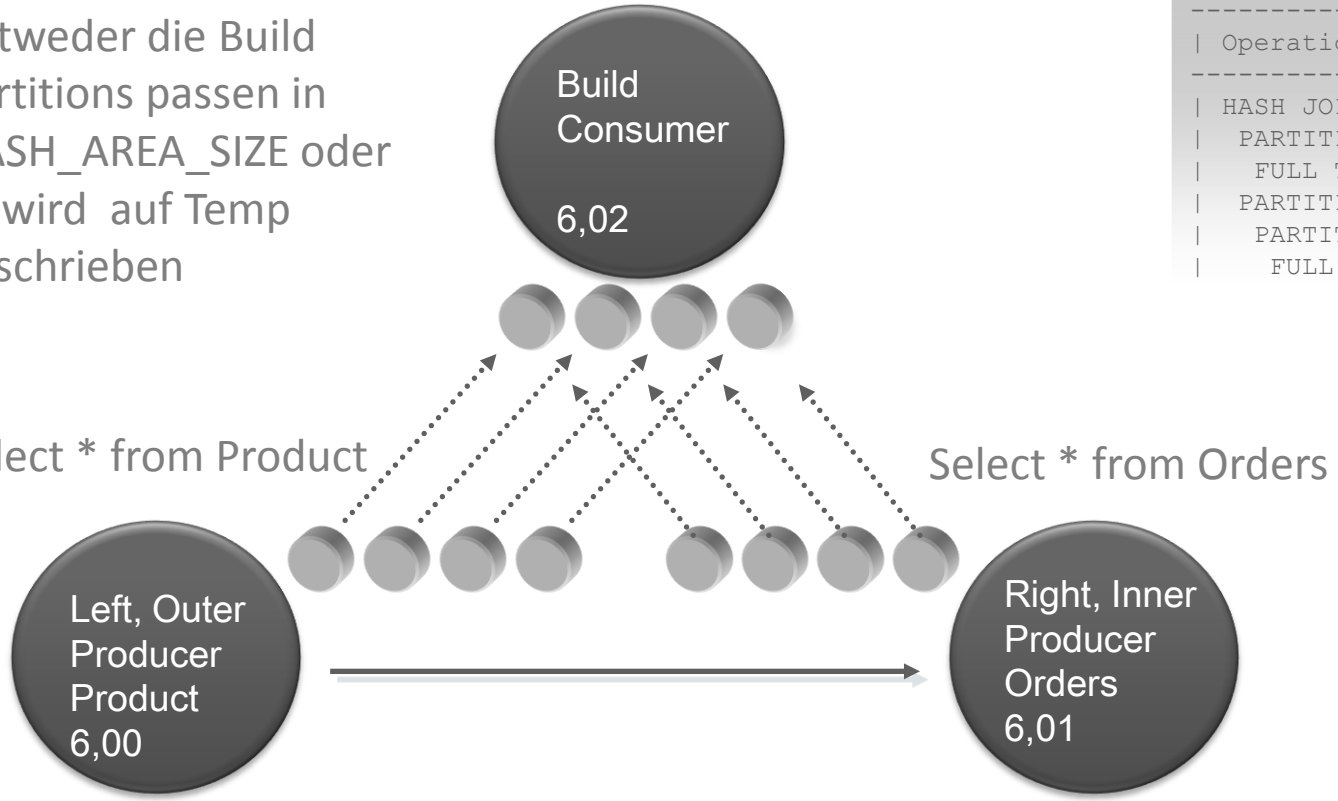
SQL Statements / Parallel Hash Join

Entweder die Build Partitions passen in HASH_AREA_SIZE oder es wird auf Temp geschrieben




```
-----------------------------------------------------------------
| Operation             |  Name    | TQ   | IN-OUT| PQ Dist |
-----------------------------------------------------------------
| HASH JOIN             |          |6,02  | PCWP  |         |
|  PARTITION HASH ALL   |          |6,02  | PCWP  |         |
|   FULL TABLE SCAN     | PRODUCT  |6,00  | P->P  |  HASH   |
|  PARTITION RANGE ALL  |          |6,02  | PCWP  |         |
|   PARTITION HASH ALL  |          |6,02  | PCWP  |         |
|    FULL TABLE SCAN    | ORDERS   |6,01  | P_>P  |  HASH   |
```

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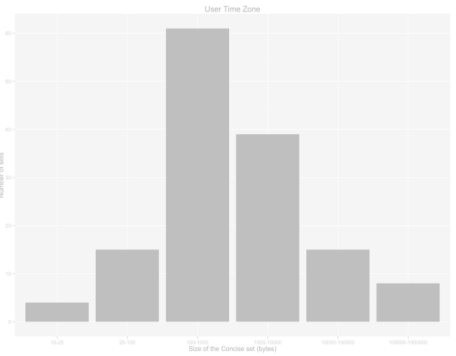
SQL Statements / Cardinality

Optimizer / Execution Plan

- Cardinality on the object and on the join level is determined by the optimizer to find the best execution plan
- For the optimizer that means number of rows returned by an operation
- The column ***ROWS*** in the execution plan or ***ESTIMATED ROWS*** in sql monitor shows this information
- Correct information is crucial for correct execution plans

- Cardinality feedback (object level):
  - optimizer estimates cardinality
  - actual rows processed are kept in row source tree
  - If estimations are wrong by factor 2 or more they are overwritten



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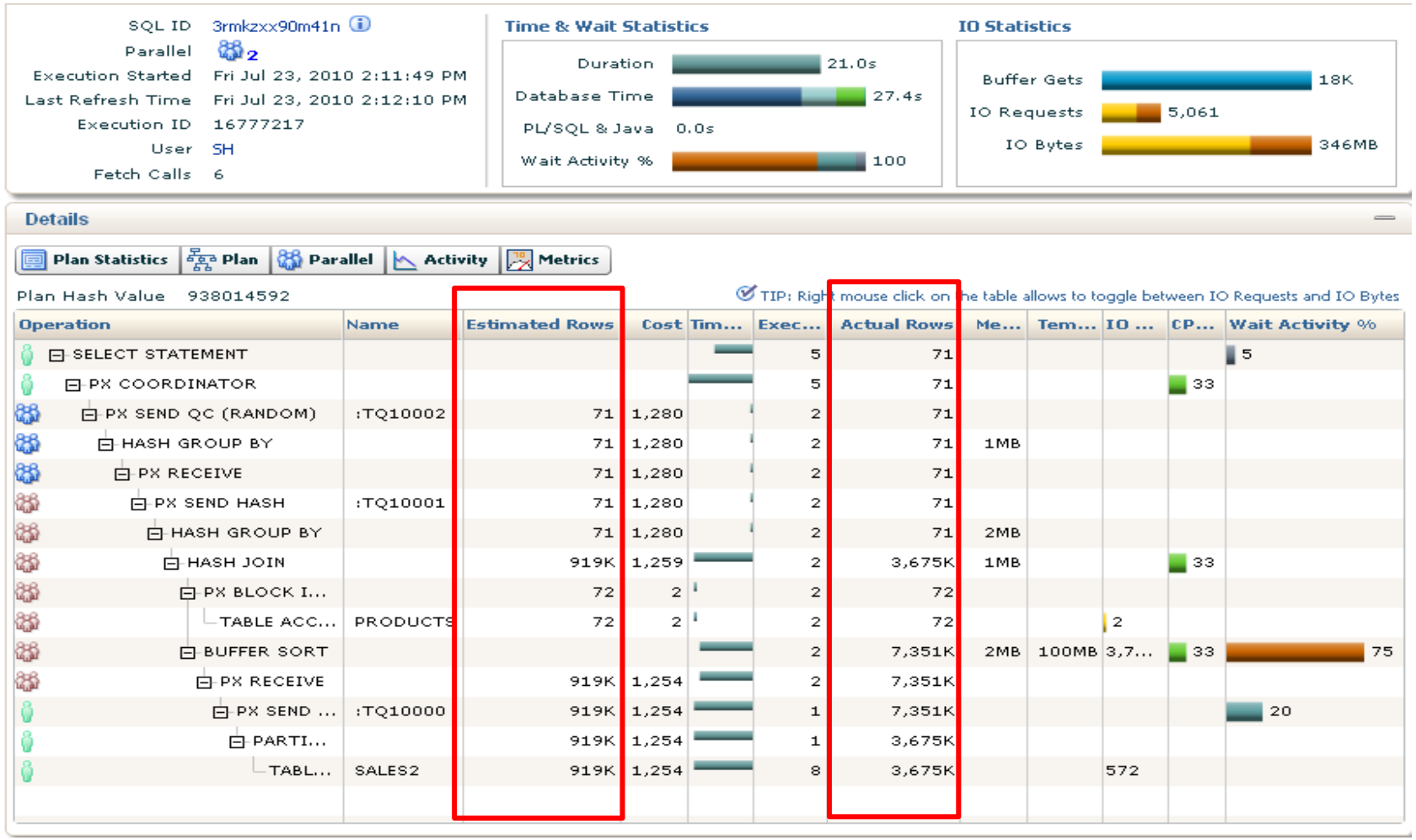
SQL Statements / Cardinality using EM



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Parallel	2
Execution Started	Fri Jul 23, 2010 2:11:49 PM
Last Refresh Time	Fri Jul 23, 2010 2:12:10 PM
Execution ID	16777217
User	SH
Fetch Calls	6

Time & Wait Statistics

Duration	21.0s
Database Time	27.4s
PL/SQL & Java	0.0s
Wait Activity %	100

IO Statistics

Buffer Gets	18K
IO Requests	5,061
IO Bytes	346MB

Details

Plan Statistics | Plan | Parallel | Activity | Metrics

Plan Hash Value 938014592

TIP: Right mouse click on the table allows to toggle between IO Requests and IO Bytes

Operation	Name	Estimated Rows	Cost	Tim...	Exec...	Actual Rows	Me...	Tem...	IO ...	CP...	Wait Activity %
SELECT STATEMENT					5	71					5
PX COORDINATOR					5	71				33	
PX SEND QC (RANDOM)	:TQ10002	71	1,280		2	71					
HASH GROUP BY		71	1,280		2	71	1MB				
PX RECEIVE		71	1,280		2	71					
PX SEND HASH	:TQ10001	71	1,280		2	71					
HASH GROUP BY		71	1,280		2	71	2MB				
HASH JOIN		919K	1,259		2	3,675K	1MB			33	
PX BLOCK I...		72	2		2	72					
TABLE ACC...	PRODUCTS	72	2		2	72			2		
BUFFER SORT					2	7,351K	2MB	100MB	3,7...	33	75
PX RECEIVE		919K	1,254		2	7,351K					
PX SEND ...	:TQ10000	919K	1,254		1	7,351K					20
PARTI...		919K	1,254		1	3,675K					
TABL...	SALES2	919K	1,254		8	3,675K			572		

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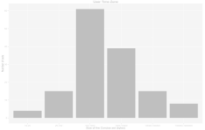
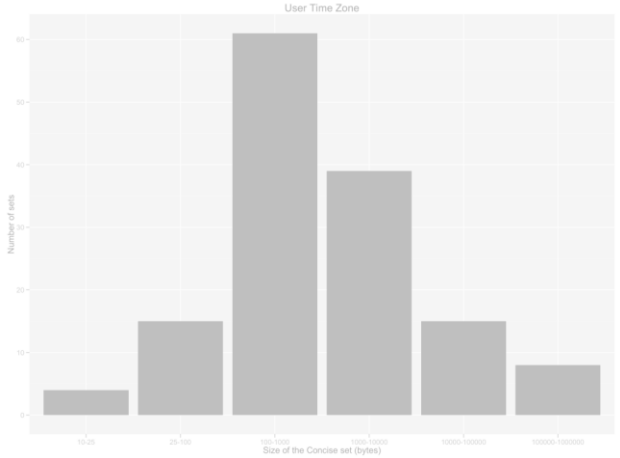
SQL Statements / Incorrect Cardinality



Optimizer / Execution Plan

- No statistics or stale statistics
- Data Skew
- Correlated single Table Predicates
- Multiple correlated Columns used in a Join
- Function wrapped Column
- Complicated Expression



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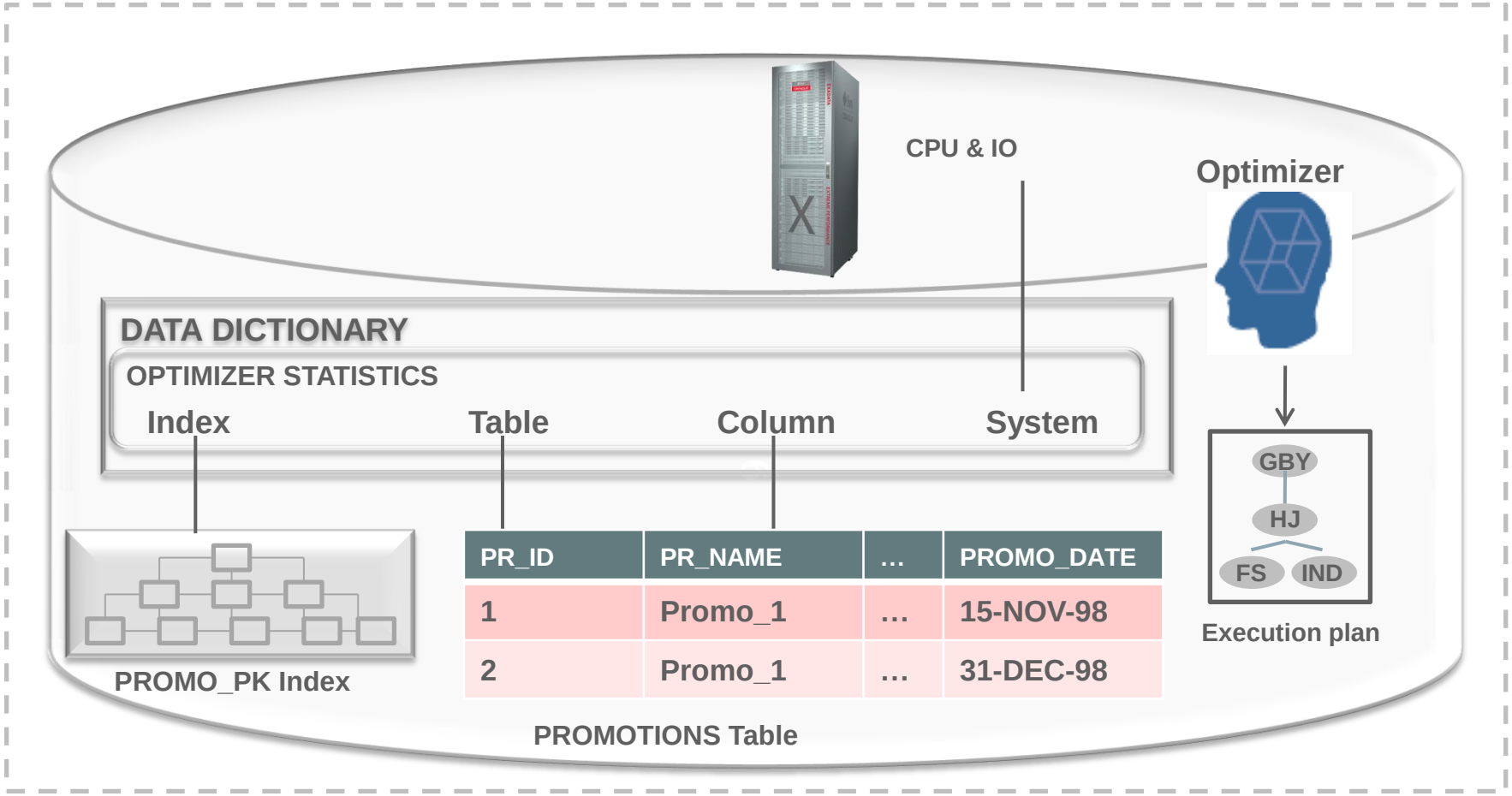
Optimizer Statistics



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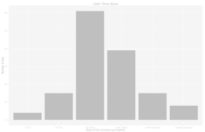
Optimizer Statistics / Stale Statistics



- Statistics are considered stale when 10% or more of the rows in the object have changed
  - Changes include, inserts, updates, deletes etc.
- Query dictionary to check if statistics are stale

SELECT table_name, stale_stats FROM user_tab_ statistics;

Table Name	Stale Statistics
Sales	NO
Customers	Yes
Product	-

No means stats are good

Yes means stats are stale

Null means no stats

Solution gather statistics

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Optimizer Statistics / No Statistics

```
PLAN_TABLE_OUTPUT
------------------------------------------------------------------------------------------
Plan hash value: 312224462

-------------------------------------------------------------------------------------------
| Id  | Operation           | Name    | Rows  | Bytes | Cost (%CPU)| Time     | Pstart| Pstop |
-------------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT    |         |  3844 |   326K|  1252   (1)| 00:00:16 |       |       |
|   1 |  PARTITION HASH ALL |         |  3844 |   326K|  1252   (1)| 00:00:16 |     1 |     8 |
|*  2 |   TABLE ACCESS FULL | SALES2  |  3844 |   326K|  1252   (1)| 00:00:16 |     1 |     8 |
-------------------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------

   2 - filter("CUST_ID">=5 AND "CUST_ID"<=30)

Note
-----
   - dynamic sampling used for this statement (level=2)
```

Solution gather statistics

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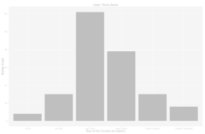
Optimizer Statistics / No Statistics – Dynamic Sampling



- Optimizer gathers statistics during parse operation
  - *alter system set optimizer_dynamic_sampling = 6;*
- Optimizer Dynamic Sampling (no joins):
  - *0 = off*
  - *2 = DEFAULT, tables without stats, 32 blocks*
  - *3 = level 2 + complex single predicates, 64 blocks*
  - *4 = even if table is analyzed, statistics are gathered*
  - *5 = level 4, 2x default blocks*
  - *6 = level 4, 4 x default blocks → PQ*
  - *7 = level 4, 8 x default blocks*
  - *8 = level 4, 32 x default blocks*
  - *9 = level 4, 128 x default blocks*
  - *10 = level 4, complete table*

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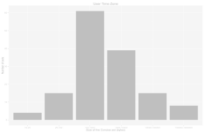
Optimizer Statistics / How to gather Statistics



- Analyze command is deprecated
- The GATHER_*_STATS procedure takes 13 parameters
  - ***Schema Name***
  - ***Table Name***
  - ***Partition Name***
  - ***…***
- Gather Statistics command should be simple
- From 11g onwards use default estimate_percent *AUTO_SAMPLE_SIZE*

```
SQL> BEGIN
  2  dbms_stats.gather_table_stats('SH','SALES');
  3  END;
  4  /

PL/SQL procedure successfully completed.
```

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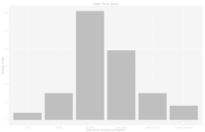
Optimizer Statistics / *AUTO_SAMPLE_SIZE*



Run Num	AUTO_SAMPLE_SIZE	10% SAMPLE	100% SAMPLE
1	00:02:21.86	00:02:31.56	00:08:24.10
2	00:02:38.11	00:02:49.49	00:07:38.25
3	00:02:39.31	00:02:38.55	00:07:37.83

Column Name	NDV with AUTO_SAMPLE_SIZE	NDV with 10% SAMPLE	NDV with 100% SAMPLE
C1	59852	31464	60351
C2	1270912	608544	1289760
C3	768384	359424	777942

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Optimizer Statistics / Example of Data Skew

SELECT * FROM HR.Employee WHERE Job_id = AD_VP;

NAME	ENUM	JOB
Kochhar	101	AD_VP
De Haan	102	AD_VP

HR Employee table

Last_name	Em_id	Job_id
SMITH	99	CLERK
ALLEN	7499	CLERK
WARD	2021	CLERK
KOCHHAR	101	AD_VP
De Haan	102	AD_VP
CLARK	7782	CLERK

Optimizer assumes even distribution

Cardinality estimate is $\frac{\text{NUM\_ROWS}}{\text{NDV}} = \frac{107}{19} = 6$

```
-------------------------------------------------------------------------------
| Id  | Operation          | Name      | Starts | E-Rows | A-Rows |   A-Time   |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT   |           |      1 |        |      2 |00:00:00.01 |
|*  1 |  TABLE ACCESS FULL | EMPLOYEES |      1 |      6 |      2 |00:00:00.01 |
-------------------------------------------------------------------------------
```

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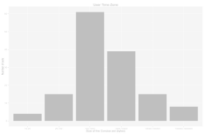
Optimizer Statistics / Solution: Histograms



EXEC DBMS_STATS.GATHER_TABLE_STATS('HR','EMPLOYEES',method_opt => 'FOR ALL COLUMNS SIZE SKEWONLY');

```
SELECT column_name
      , num_distinct
      , histogram
FROM user_tab_col_statistics
WHERE table_name =
      ' EMPLOYEES';
```

COLUMN_NAME	NUM_DISTINCT	HISTOGRAM
EMPLOYEE_ID	107	NONE
FIRST_NAME	91	NONE
LAST_NAME	102	NONE
EMAIL	107	NONE
PHONE_NUMBER	107	NONE
HIRE_DATE	98	NONE
JOB_ID	19	FREQUENCY
SALARY	58	NONE
COMMISSION_PCT	7	NONE
MANAGER_ID	18	FREQUENCY
DEPARTMENT_ID	11	FREQUENCY

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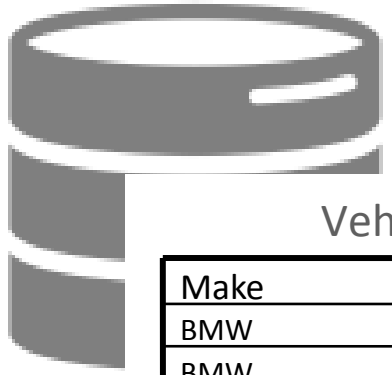
Optimizer Statistics / Multiple correlated Columns

SELECT … WHERE model = '530xi' and make = 'BMW';

Make	Model	Color
BMW	530xi	red
BMW	530xi	black
BMW	530xi	silver



Vehicles Table

Make	Model	Color
BMW	530xi	RED
BMW	530xi	BLACK
BMW	530xi	SILVER
PORSCHE	911	RED
MERC	SLK	RED
MERC	C320	SLIVER

Cardinality est. is ROWS (12) $* \frac{1}{\text{NDV C1 (3)}} * \frac{1}{\text{NDV C2 (4)}} = 1$

```
-----------------------------------------------------------------------
| Id  | Operation          | Name     | Starts | E-Rows | A-Rows |
-----------------------------------------------------------------------
|   0 | SELECT STATEMENT   |          |      1 |        |      1 |
|   1 |  SORT AGGREGATE    |          |      1 |      1 |      1 |
|*  2 |   TABLE ACCESS FULL| VEHICLES |      1 |      1 |      3 |
-----------------------------------------------------------------------
```

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Optimizer Statistics / Solution: Extended Statistics

Create extended statistics on the Model & Make columns

```
exec dbms_stats.gather_table_stats('DWH', 'VEHICLES', degree=>8,
method_opt=> 'for columns (MODEL, MAKE) size 256 ');
```

```
SELECT column_name
      , num_distinct
      , histogram
FROM user_tab_col_statistics
WHERE table_name = ' VEHICLES';
```

COLUMN_NAME	NUM_DISTINCT
MAKE	5
MODEL	9
COLOR	7
SYS_STU8OPK2S$PEWHARK2CP3#1F#G	9

New Column with system generated name

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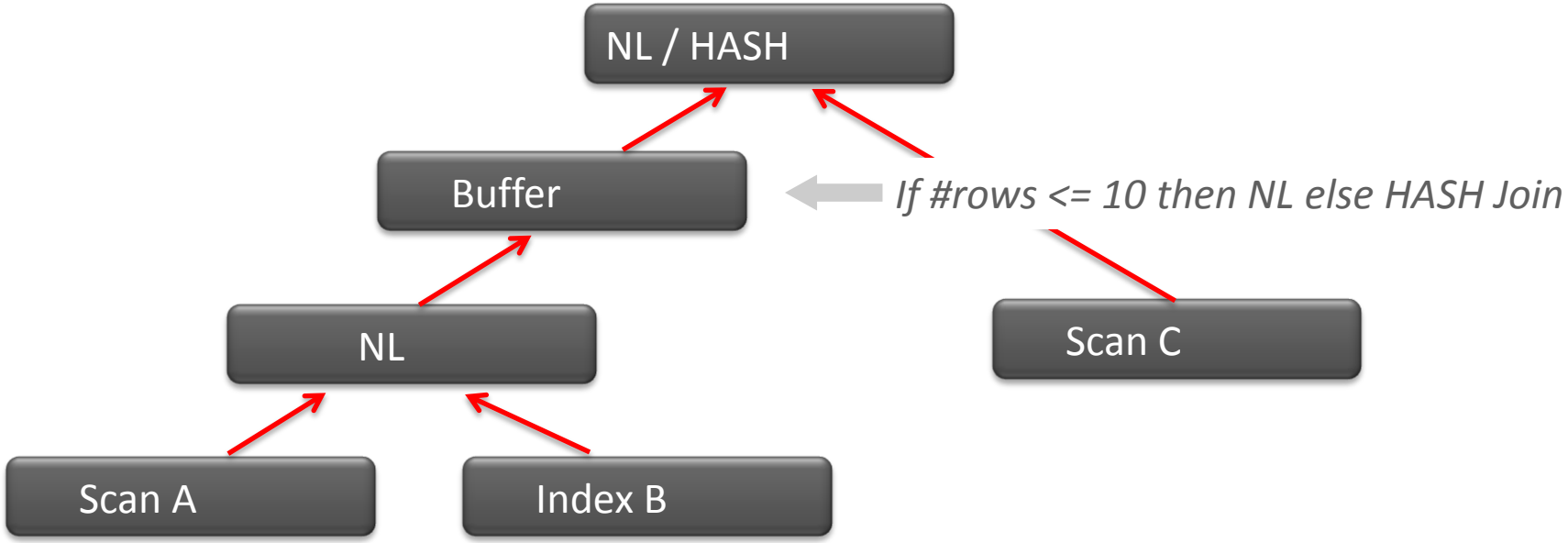
Optimizer Statistics / Solution: Adaptive Query Plan

- The optimizer in 12g checks the cardinality during execution
- Results are buffered before processed



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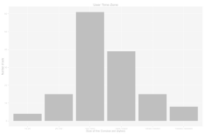
Optimizer Statistics / Solutions



Cause	Solution
Stale or missing statistics	DBMS_STATS
Data Skew	Create a histogram
Multiple single column predicates on a table	Create a column group using DBMS_STATS.CREATE_EXTENDED_STATS
Multiple columns used in a join	Create a column group using DBMS_STATS.CREATE_EXTENDED_STATS
Function wrapped column	Create statistics on the function wrapped column using DBMS_STATS.CREATE_EXTENDED_STATS
Complicated expression containing columns from multiple tables	Use dynamic sampling level 4 or higher

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ORACLE Enterprise Manager 11g
Database Control

Monitored SQL Executions

Active in last 2 hours

Refresh Manual Refresh

Status	Duration	SQL ID	User	Parallel	Database Time	IO Requests	Start	Ended	SQL Text
	6.0s	8wbxw9vvq98a7	DWH_DATA	64 8	57.2s	8513	9:27:10 AM		SELECT /*# QUERYL08 #*/ /*+ ORDERED USE_H
	1.2m	9fcpzwgsskxzd	DWH_DATA	64 8	25.9m	186K	9:21:17 AM	9:22:28 AM	SELECT /*+ ORDERED USE_HASH(t1) INDEX(t1) PUS
	7.0s	572fbaj0fdw2b	SYS		6.4s	222	9:17:25 AM	9:17:32 AM	select output from table(dbms_workload_repository.awr
	7.0s	572fbaj0fdw2b	SYS		6.8s	220	9:17:17 AM	9:17:24 AM	select output from table(dbms_workload_repository.awr
	7.0s	572fbaj0fdw2b	SYS		6.9s	232	9:17:09 AM	9:17:16 AM	select output from table(dbms_workload_repository.awr
	7.0s	572fbaj0fdw2b	SYS		7.2s	224	9:17:00 AM	9:17:07 AM	select output from table(dbms_workload_repository.awr
	7.0s	572fbaj0fdw2b	SYS		6.4s	213	9:16:52 AM	9:16:59 AM	select output from table(dbms_workload_repository.awr
	7.0s	572fbaj0fdw2b	SYS		6.6s	215	9:16:44 AM	9:16:51 AM	select output from table(dbms_workload_repository.awr
	7.0s	572fbaj0fdw2b	SYS		6.8s	265	9:16:36 AM	9:16:43 AM	select output from table(dbms_workload_repository.awr
	12.0s	572fbaj0fdw2b	SYS		11.0s	970	9:16:23 AM	9:16:35 AM	select output from table(dbms_workload_repository.awr
	7.0m	9fcpzwgsskxzd	DWH_DATA	64 8	2.2h	2374K	9:01:42 AM	9:08:39 AM	SELECT /*+ ORDERED USE_HASH(t1) INDEX(t1) PUS
	1.2m	6xr88j72tap5v	DWH_DATA	64 8	41.9m	73K	9:00:25 AM	9:01:37 AM	SELECT /*+ ORDERED USE_HASH(t1) INDEX(t1) PUS

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Oracle Enterprise Manager (...

Monitored SQL Execution Details

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Overview

SQL ID	8wbxw9vvq98a7
Parallel	64 8
Execution Started	Wed Apr 7, 2010 9:27:10 AM
Last Refresh Time	Wed Apr 7, 2010 9:29:04 AM
Execution ID	16777216
User	DWH_DATA
Fetch Calls	0

Time & Wait Statistics

Duration	2.0m
Database Time	29.6m
Wait Activity %	100
PL/SQL & Java	0.0s

IO Statistics

IO Requests	282K
IO Bytes	34G
Buffer Gets	137K
Cell Offload Efficiency	-96.08%

Details

Plan Statistics | Parallel | Activity

Plan Hash Value 233075956

TIP: Right mouse click on the table allows to toggle between IO Requests and IO Bytes

Operation	Name	Estimat...	Cost	Timeline(117s)	Exe...	Actu...	Mem...	Temp	IO Requests	Cell ...	CPU Activity %	Wait Activity %	Progress %
SELECT STATEMENT					129								
PX COORDINATOR					129								
PX SEND QC (RANDOM)	:TQ10012	1	726K										
HASH GROUP BY		1	726K										
PX RECEIVE		1	726K										
PX SEND HASH	:TQ10011	1	726K										
MERGE JOIN		1	726K										
SORT JOIN		1	726K										
PX RECEIVE		1	726K										
PX SEND BROADCAST	:TQ10010	1	726K										
HASH JOIN BUFFERED		1	726K										
PX RECEIVE		1	726K										
PX SEND HASH	:TQ10008	1	726K										
HASH JOIN		1	726K										
PX RECEIVE		1	726K										
PX SEND HA...	:TQ10007	1	726K		64								
HASH JOIN		1	726K		64		55G	44G	310K		44	90	
PX RECE...		1	726K		64	1074M					24	3.08	

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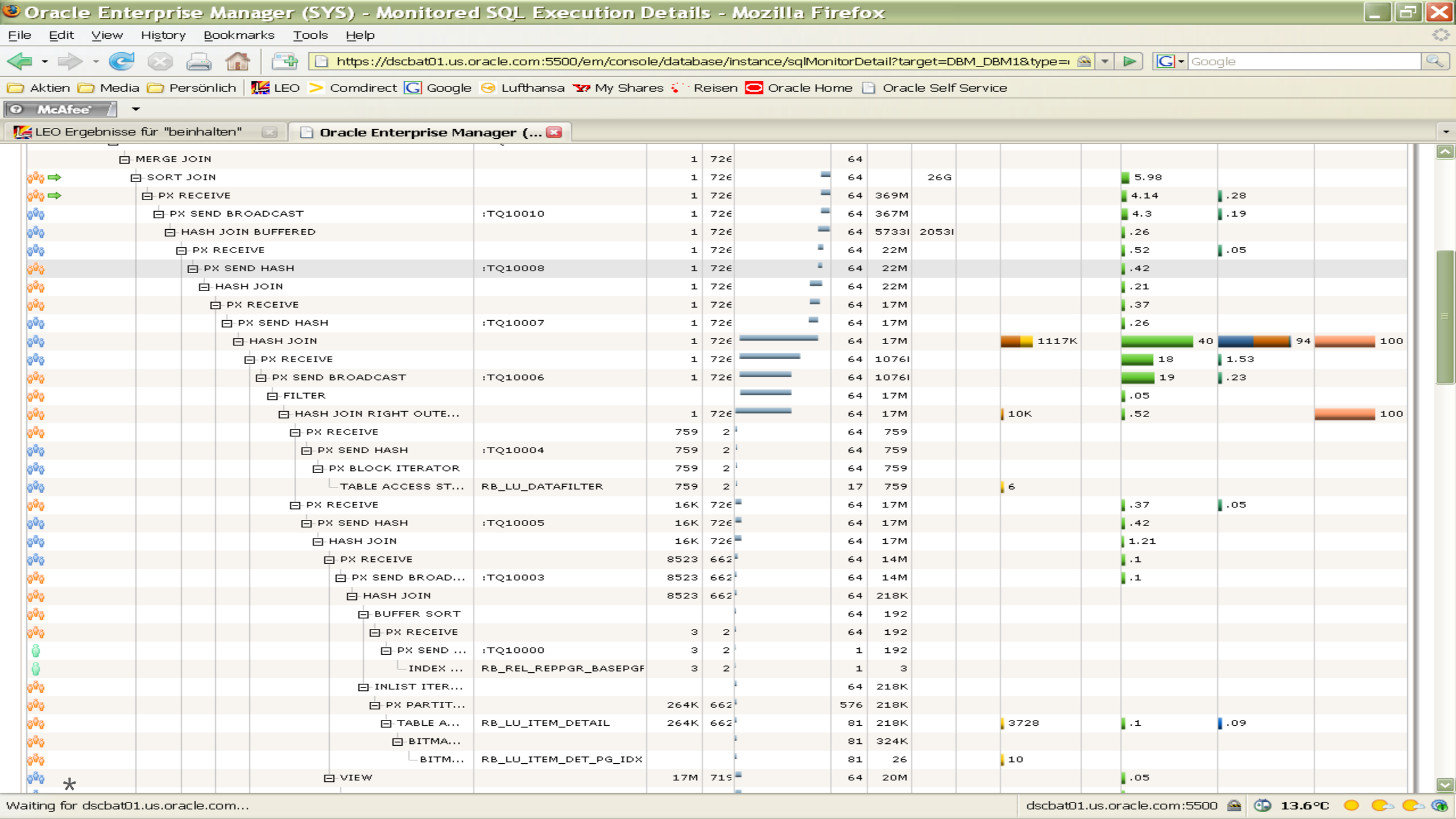
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MERGE JOIN 1 72€ 64
SORT JOIN 1 72€ 64 26G 5.98
PX RECEIVE 1 72€ 64 369M 4.14 .28
PX SEND BROADCAST :TQ10010 1 72€ 64 367M 4.3 .19
HASH JOIN BUFFERED 1 72€ 64 5733I 2053I .26
PX RECEIVE 1 72€ 64 22M .52 .05
PX SEND HASH :TQ10008 1 72€ 64 22M .42
HASH JOIN 1 72€ 64 22M .21
PX RECEIVE 1 72€ 64 17M .37
PX SEND HASH :TQ10007 1 72€ 64 17M .26
HASH JOIN 1 72€ 64 17M 1117K 40 94 100
PX RECEIVE 1 72€ 64 1076I 18 1.53
PX SEND BROADCAST :TQ10006 1 72€ 64 1076I 19 .23
FILTER 64 17M .05
HASH JOIN RIGHT OUTE... 1 72€ 64 17M 10K .52 100
PX RECEIVE 759 2 64 759
PX SEND HASH :TQ10004 759 2 64 759
PX BLOCK ITERATOR 759 2 64 759
TABLE ACCESS ST... RB_LU_DATAFILTER 759 2 17 759 6
PX RECEIVE 16K 72€ 64 17M .37 .05
PX SEND HASH :TQ10005 16K 72€ 64 17M .42
HASH JOIN 16K 72€ 64 17M 1.21
PX RECEIVE 8523 662 64 14M .1
PX SEND BROAD... :TQ10003 8523 662 64 14M .1
HASH JOIN 8523 662 64 218K
BUFFER SORT 64 192
PX RECEIVE 3 2 64 192
PX SEND ... :TQ10000 3 2 1 192
INDEX ... RB_REL_REPPGR_BASEPGF 3 2 1 3
INLIST ITER... 64 218K
PX PARTIT... 264K 662 576 218K
TABLE A... RB_LU_ITEM_DETAIL 264K 662 81 218K 3728 .1 .09
BITMA... 81 324K
BITM... RB_LU_ITEM_DET_PG_IDX 81 26 10
VIEW 17M 71€ 64 20M .05
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Database Control

Setup Preferences Help Logout
Cluster Database

Cluster Database: DBM > Database Instance: DBM_DBM1 > Monitored SQL Executions >

Logged in As SYS

Monitored SQL Execution Details

Save Mail View Report Refresh 10 seconds Stop Refresh

Overview

SQL ID	8wbxw9vvq98a7
Parallel	64 8
Execution Started	Wed Apr 7, 2010 9:27:10 AM
Last Refresh Time	Wed Apr 7, 2010 9:32:58 AM
Execution ID	16777216
User	DWH_DATA
Fetch Calls	0

Time & Wait Statistics

Duration	5.8m
Database Time	1.5h
Wait Activity %	100
PL/SQL & Java	0.0s

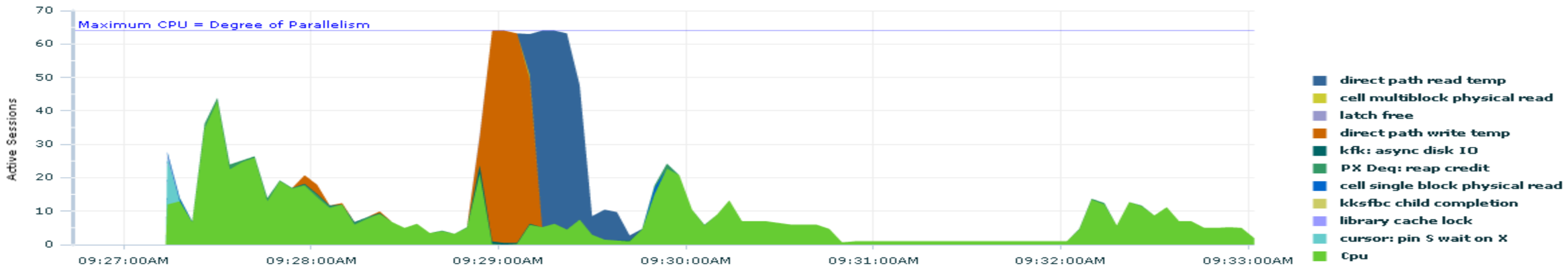
User I/O - 00:34:07 (38%)

IO Statistics

IO Requests	1145K
IO Bytes	140G
Buffer Gets	157K
Cell Offload Efficiency	-61.29%

Details

Plan Statistics | Parallel | Activity



Cluster | Database | Setup | Preferences | Help | Logout

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Database Control

Setup Preferences Help Logout
Cluster Database

Cluster Database: DBM > Database Instance: DBM_DBM1 > Monitored SQL Executions >

Logged in As SYS

Monitored SQL Execution Details

Save Mail View Report Refresh 10 seconds Stop Refresh

Overview

SQL ID	8wbxw9vvq98a7
Parallel	64
Execution Started	Wed Apr
Last Refresh Time	Wed Apr
Execution ID	167772
User	DWH_DA
Fetch Calls	0

Time & Wait Statistics

Duration 4.1m
SQL & Java 0.0s
1.4h
100

IO Statistics

IO Requests	684K
IO Bytes	165G
Buffer Gets	157K
Cell Offload Efficiency	-85.19%

SELECT /*# QUERYL08 #*/
/*+ ORDERED USE_HASH(t1) INDEX(t1)
PUSH_SUBQ NOREWRITE NO_MERGE USE_HASH(t2)
INDEX(t2.i) NO_INDEX(t2.i, rb_lu_item_det_pk)
USE_HASH(t4) USE_MERGE(t5) USE_HASH(t6)
USE_HASH(t8) *//*# 79795 #*/
'B' || t2.pg_featurevalue_26_id
PG_FeatureValue_26_1,
'B' || t3.repproductgroup_id repproductgroup_1,
'B' || t4.repchannel_id repchannel_1,
'r' || t5.elementrange_id price_eur_1,
'G' || 289198 country_1,
'G' || t6.elementgroup_id period_1,

SUM(t1.pd_sales_units*t1.pd_projection_factor)/1000
thsalesunits,

SUM(t1.pd_sales_units*t1.pd_projection_factor*t1.pd_
price_units_eur)/1000 thsalesvalueeur
FROM
DWH_RB.rb_rel_reppgr_basepgr t3,
DWH_RB.rb_lu_item_detail_v t2,
(
SELECT /*+ NO_MERGE USE_HASH(r) INDEX(f) */
f.project_id, f.project_type_id, f.period_id,
f.periodicity_id, f.outlet_id,
COALESCE(r.target_basechannel_id, f.basechannel_id)
basechannel_id, f.basechannel_id basechannel_orig_id,
f.country_channel_id, f.channel_id, f.country_id,
f.item_id, f.item_version_id, f.productgroup_id,
f.domain_productgroup_id, f.flg_status_id,
f.pd_price_units_eur, f.pd_price_units_eur_orig,
f.pd_delivered_price_eur, f.pd_delivered_price_eur_orig,
f.pd_stock_old_units, f.pd_stock_old_units_orig,
f.pd_sales_units, f.pd_sales_units_orig,
f.pd_purchase_units, f.pd_purchase_units_orig,
f.pd_stock_new_units, f.pd_stock_new_units_orig,
f.pd_rentals, f.pd_rentals_orig, f.pd_unit_factor,
f.pd_projection_factor, f.pd_distribution_factor,
f.pd_dis_weighting_factor, f.pd_set_factor_sales,
f.pd_set_factor_sales_orig, f.pd_set_factor_price,
f.pd_set_factor_price_orig, f.pd_bundle_price,

Details

Plan Statistics | Parallel

Plan Hash Value 233075956

TIP: Right mouse click on the table allows to toggle between IO Requests and IO Bytes

Operation	Esti...	C...	Timeline(247s)	E...	Ac...	Me...	Temp	IO Requ...	Ce...	CPU Activi...	Wait Activ...	Progress %
SELECT STATEMENT				129								
PX COORDINATOR				129						.08		
PX SEND QC (RANDO		TQ10012	1	726								
HASH GROUP BY			1	726								
PX RECEIVE			1	726								
PX SEND HASH		TQ10011	1	726		64						
MERGE JOIN			1	726		64						
SORT JOIN			1	726		64		2198	55G	241K	43	1.83
PX RECEI			1	726		64	996M				6.54	1.17
PX SEND		TQ10010	1	726		64	995M				6.65	.5
HASH			1	726		64	16M	1108			.34	
PX			1	726		64	22M				.08	
PX		TQ10008	1	726		64	22M				.23	
			1	726		64	22M				.57	
			1	726		64	17M				.11	
		TQ10007	1	726		64	17M				.2	
			1	726		64	17M			421K	18	92 100

* SQL Statements

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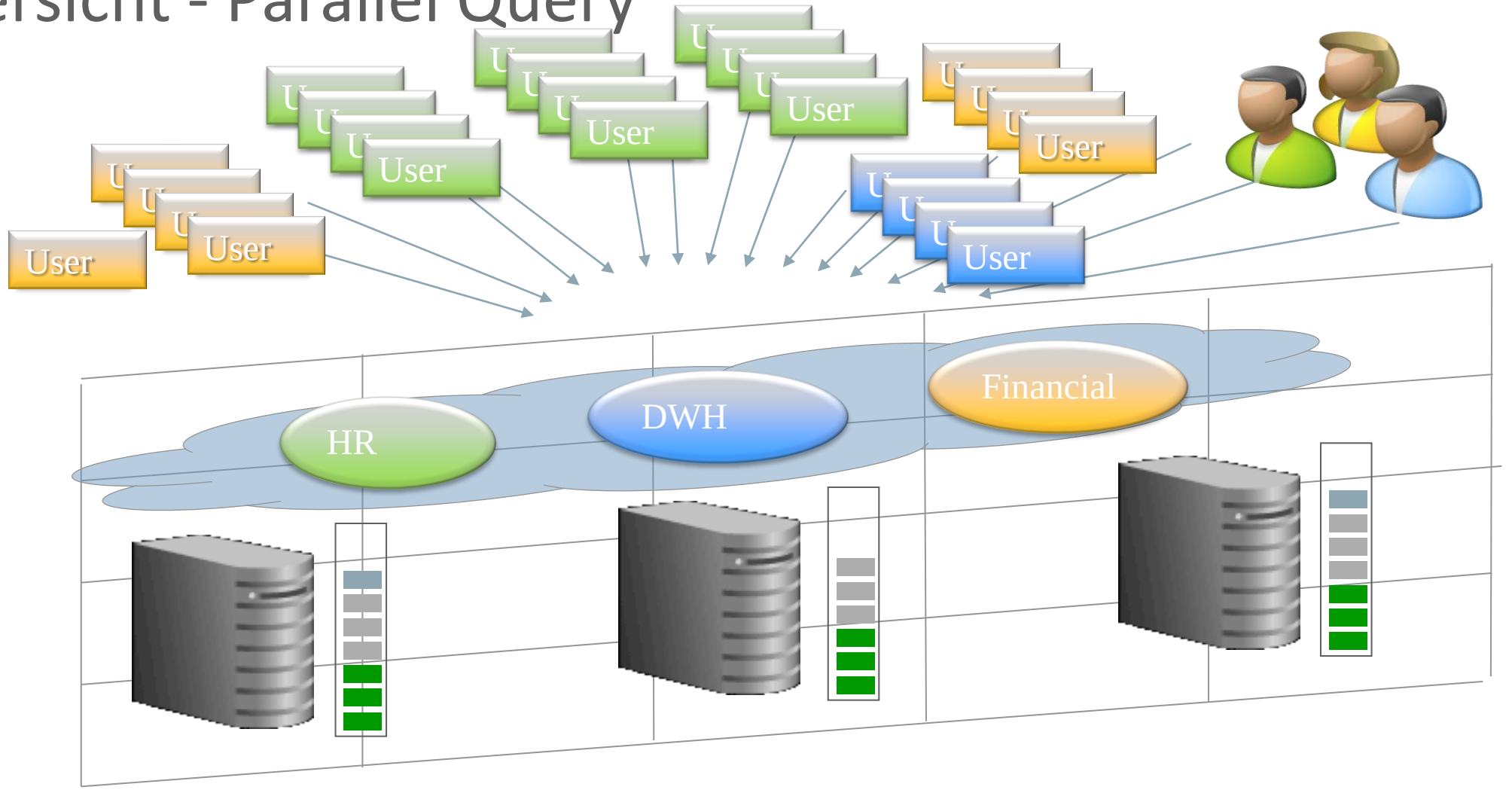
Übersicht - Parallel Query



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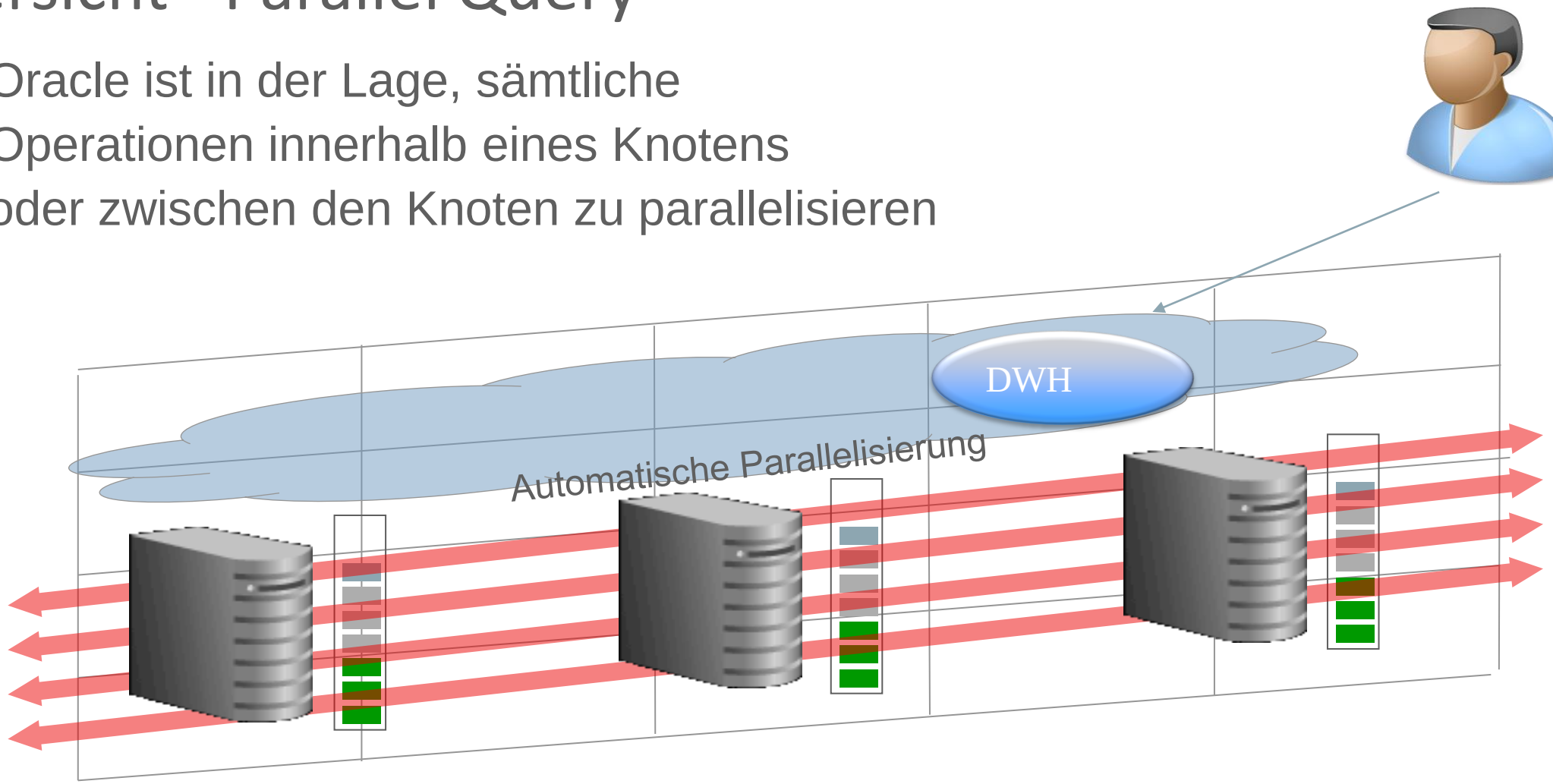
Übersicht - Parallel Query

Oracle ist in der Lage, sämtliche Operationen innerhalb eines Knotens oder zwischen den Knoten zu parallelisieren



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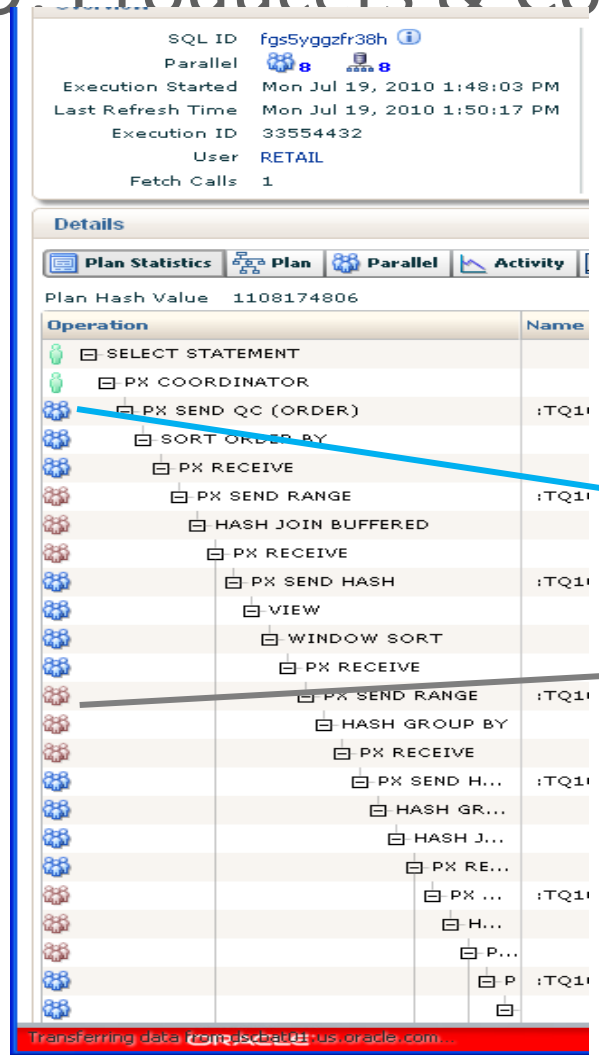
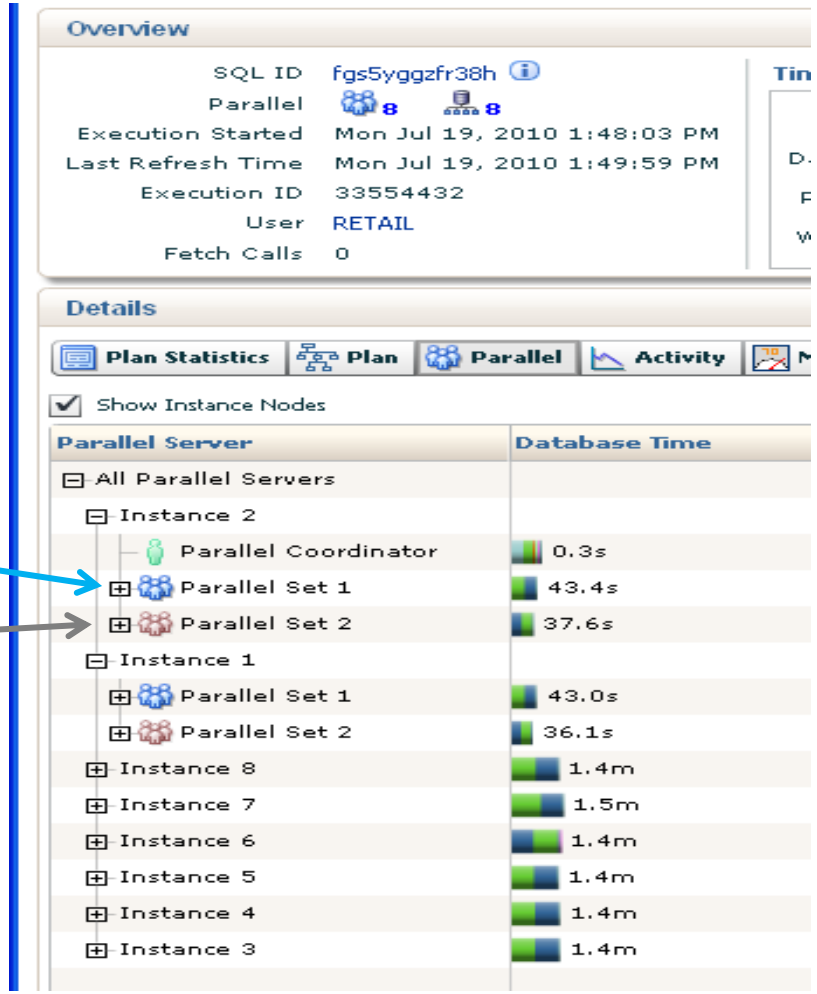
PQ: Producers & Consumers





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Monitored SQL Execution Details

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Overview

SQL ID	8wbxw9vvq98a7
Parallel	64 8
Execution Started	Wed Apr 7, 2010 9:27:10 AM
Last Refresh Time	Wed Apr 7, 2010 9:31:45 AM
Execution ID	16777216
User	DWH_DATA
Fetch Calls	0

Time & Wait Statistics

Duration	4.6m
Database Time	1.3h
Wait Activity %	100
PL/SQL & Java	0.0s

IO Statistics

IO Requests	1145K
IO Bytes	140G
Buffer Gets	157K
Cell Offload Efficiency	-61.29%

Details

Plan Statistics | Parallel | Activity

Show Instance Nodes

TIP: Right mouse click on the table allows to toggle between IO Requests and IO Bytes

Parallel Server	Database Time	Wait Activity %	IO Requests	Cell Offload ...	Buffer Gets
All Parallel Servers					
Instance 1					
Parallel Coordinator	0.4s				326
Parallel Set 1					
Parallel Server 9 (p000)	59.2s	1.39	17K	-63.93	309
Parallel Server 10 (p001)	1.0m	1.49	17K	-63.93	8529
Parallel Server 11 (p002)	1.2m	1.49	17K	-63.93	393
Parallel Server 12 (p003)	1.1m	1.44	17K	-63.93	7912
Parallel Server 13 (p004)	57.7s	1.39	17K	-63.93	2544
Parallel Server 14 (p005)	56.0s	1.35	17K	-63.93	313
Parallel Server 15 (p006)	57.0s	1.25	17K	-63.93	6701
Parallel Server 16 (p007)	59.4s	1.35	17K	-63.93	6593
Parallel Set 2	1.4m	.09	368		1290
Instance 2					
Parallel Set 1	8.2m	13	149K		13K
Parallel Set 2	52.7s	.46	3693		8738
Instance 8	9.1m	12	135K		34K
Instance 7	9.5m	12	137K		20K

Performance Zusammenfassung / Empfehlungen

Analyse	• Analyse des Gesamtsystems notwendig, bevor Maßnahmen ergriffen werden • Konzentrieren der Maßnahmen auf die Zeitfresser
Applikation	• Was für ein Typ ist die Applikation? OLTP, DWH, Mix • Nutzt die Applikation die Ressourcen der Datenbank und des Systems? • Monitoring der Applikation, nicht nur in der Datenbank
SQL Statements	• Möglichkeiten zur Analyse/Monitoring von SQL Statements • Erstellen von aktuellen Statistiken • Tuning von SQL Statements / optimaler Execution Plan / Parallel Query
Systemperformance	• Gute Zusammenarbeit aller beteiligten Abteilungen • Well Balanced System

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