Fachhochschule Nordwestschweiz
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Execution Plans

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Was ist ein Execution Plan?

- Execution Plan = Ausführungsplan = Query Evaluation Plan (QEP)
  - Abfolge von Einzelschritten, die zur Ausführung eines SQL-Befehls benötigt werden
  - Wird vom Query Optimizer während der Parse-Phase ermittelt

- Der Optimizer trifft verschiedene Entscheidungen:
  - In welcher Reihenfolge werden die Tabellen gelesen?
  - Mit welchen Methoden werden die Tabellen gejoined?
  - Wie wird auf die einzelnen Tabellen zugegriffen (Full Table Scan / Indexzugriff)?

- In diesem Kapitel werden folgende Fragen beantwortet:
  - Wie können Execution Plans in Oracle bzw. SQL Developer angezeigt werden?
  - Wie werden Execution Plans gelesen?

ANZEIGEN VON EXECUTION PLANS

EXPLAIN PLAN / DBMS_XPLAN.DISPLAY

Execution Plan, der vom Optimizer zum Parse-Zeitpunkt ermittelt wird

```
EXPLAIN PLAN FOR SELECT * FROM emp WHERE deptno = 10 ORDER BY ename;

SELECT * FROM table(dbms_xplan.display);

Plan hash value: 150391907

------------------------------------------------------------------------------
| Id | Operation          | Name | Rows | Bytes | Cost (%CPU)| Time     |
------------------------------------------------------------------------------
|  0 | SELECT STATEMENT   |      |    3 |   114 |     4  (25)| 00:00:01 |
|  1 |  SORT ORDER BY     |      |    3 |   114 |     4  (25)| 00:00:01 |
|* 2 |   TABLE ACCESS FULL| EMP  |    3 |   114 |     3   (0)| 00:00:01 |
------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------
   2 - filter("DEPTNO"=10)
```

DBMS_XPLAN.DISPLAY_CURSOR

Execution Plan nach der Ausführung des SQL-Befehls

Enthält Informationen aus Dynamic Performance Views

- v$sql_plan
- v$sql_plan_statistics
- v$sql_workarea
- v$sql_plan_statistics_all

```
SELECT /*+ gather_plan_statistics */ c.first_name, c.last_name, a.zip_code, a.city
  FROM customers c
  JOIN addresses a ON (a.cust_id = c.id)
  JOIN orders o ON (o.cust_id = c.id)
 WHERE a.city = 'Berlin'
   AND o.order_date > TRUNC(SYSDATE, 'MONTH');

SELECT * FROM TABLE(dbms_xplan.display_cursor(format => 'IOSTATS LAST'));
```

DBMS_XPLAN.DISPLAY_CURSOR

```
SQL_ID  cggk4twx2kjkg, child number 2
-------------------------------------
Plan hash value: 1470961219
```

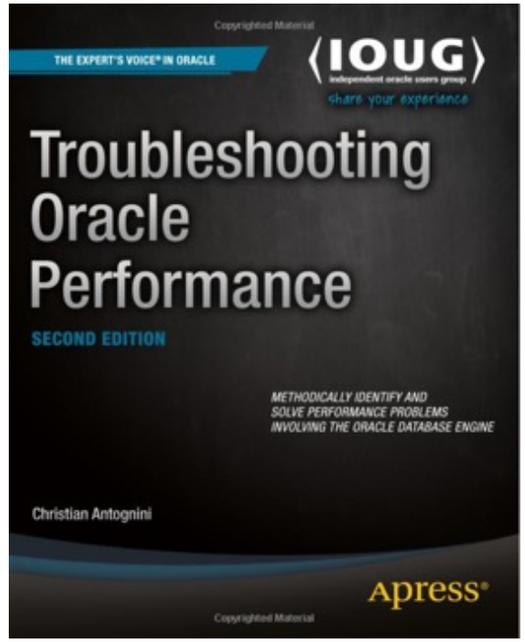
Zusätzliche Laufzeit-Informationen

```
-----------------------------------------------------------------------------------------------------
| Id  | Operation            | Name      | Starts | E-Rows | A-Rows |   A-Time   | Buffers |
-----------------------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT     |           |      1 |        |      2 |00:00:00.01 |    1073 |
|*  1 |  HASH JOIN           |           |      1 |      6 |      2 |00:00:00.01 |    1073 |
|*  2 |   HASH JOIN          |           |      1 |    127 |    136 |00:00:00.01 |     467 |
|*  3 |    TABLE ACCESS FULL| ADDRESSES |      1 |    127 |    136 |00:00:00.01 |     247 |
|   4 |    TABLE ACCESS FULL| CUSTOMERS |      1 |  16332 |  16332 |00:00:00.01 |     219 |
|*  5 |   TABLE ACCESS FULL | ORDERS    |      1 |    711 |    655 |00:00:00.01 |     605 |
-----------------------------------------------------------------------------------------------------

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

   1 - access("O"."CUST_ID"="C"."ID")
   2 - access("A"."CUST_ID"="C"."ID")
   3 - filter("A"."CITY"='Berlin')
   5 - filter("O"."ORDER_DATE">TRUNC(SYSDATE@!,'fmmonth'))
```

Weitere Informationen

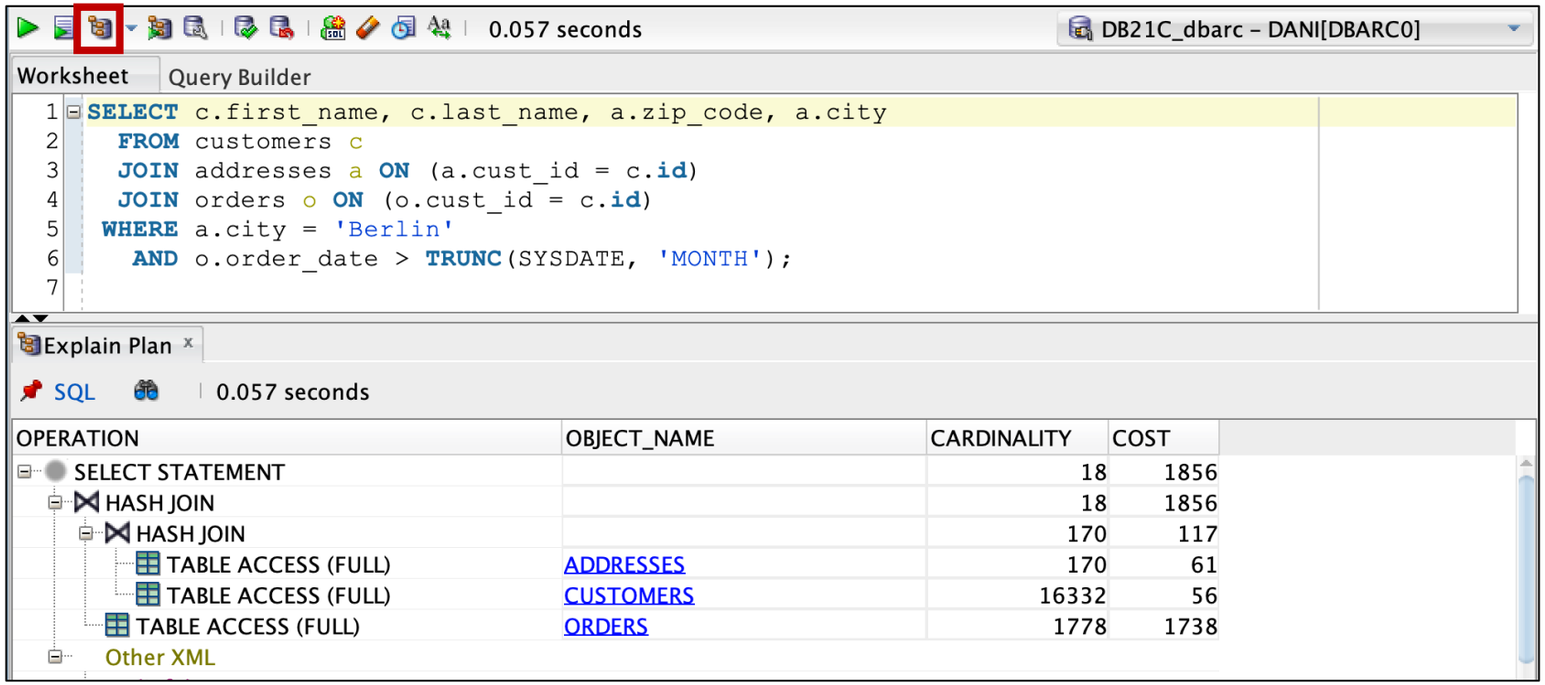
- SQL Tuning Guide, Part III Query Execution Plans
  https://docs.oracle.com/en/database/oracle/oracle-database/21/tgsql/query-execution-plans.html
- PL/SQL Packages and Types Reference, DBMS_XPLAN
  https://docs.oracle.com/en/database/oracle/oracle-database/21/arpls/DBMS_XPLAN.html

- Christian Antognini: **Troubleshooting Oracle Performance**
  Chapter 10: Execution Plans
  Apress; 2nd edition (2014), ISBN 978-1430257585



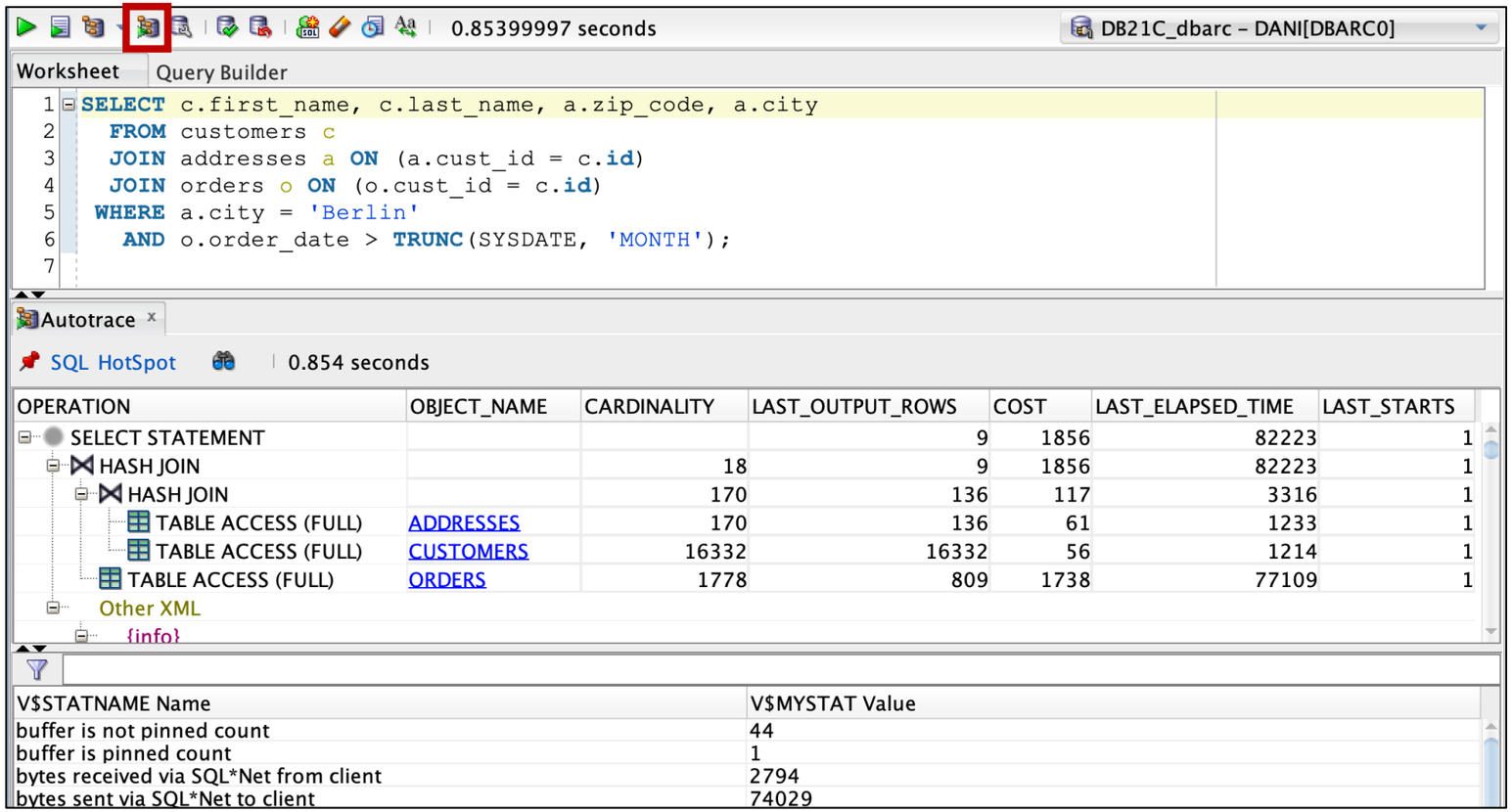
SQL Developer: Explain Plan

Explain Plan… (F10), entspricht dbms_xplan.display



SQL Developer: Autotrace

Autotrace… (F6), entspricht dbms_xplan.display_cursor

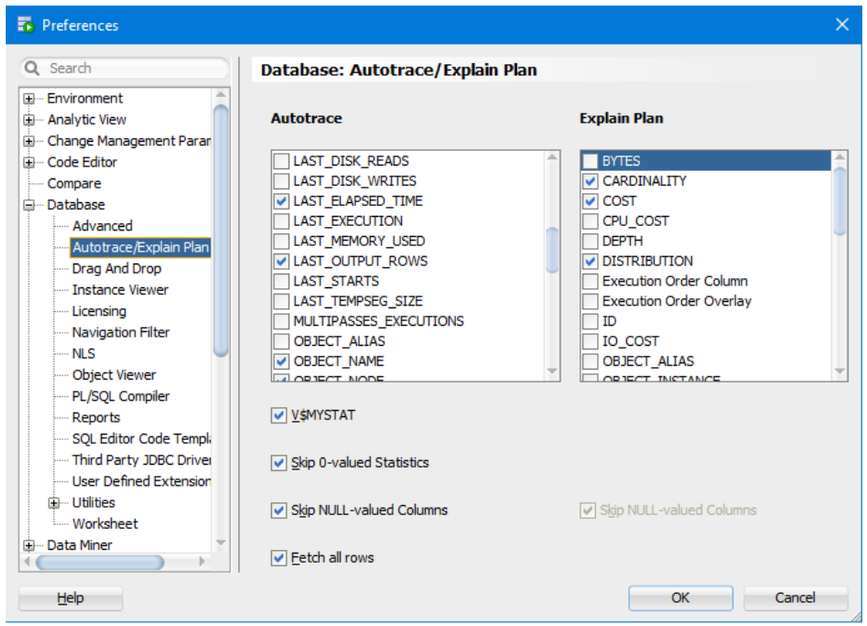


SQL Developer Konfiguration

- Für Autotrace wird SELECT_CATALOG_ROLE benötigt

```
GRANT SELECT_CATALOG_ROLE TO dbarc0;
```

- Konfiguration von zusätzlichen Attributen (z.B. LAST_OUTPUT_ROWS)



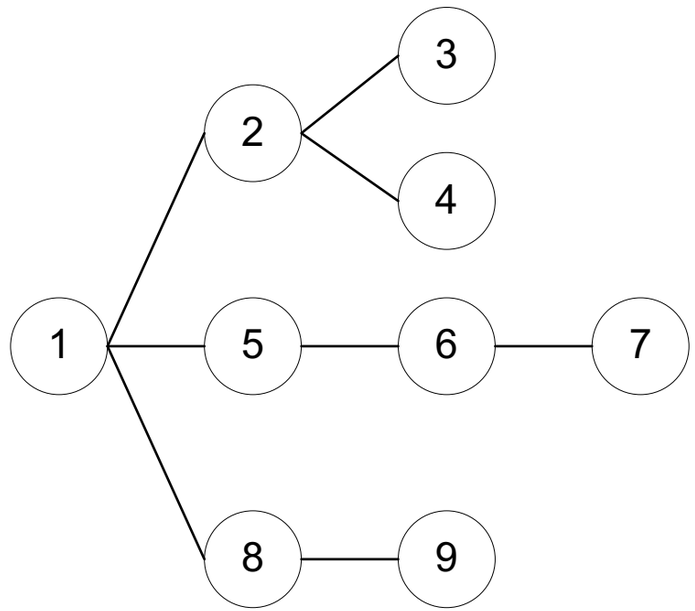
LESEN VON EXECUTION PLANS

Wie wird ein Execution Plan gelesen?

Als hierarchische Baum-Darstellung (Parent-Child)

- Von innen nach aussen
- Auf der gleichen Stufe von oben nach unten

```
-------------------------------------
| Id | Operation                    |
-------------------------------------
9.| 1 | UPDATE                       |
3.| 2 |  NESTED LOOPS                |
1.|* 3 |   TABLE ACCESS FULL         |
2.|* 4 |   INDEX UNIQUE SCAN         |
6.| 5 |  SORT AGGREGATE              |
5.| 6 |   TABLE ACCESS BY INDEX ROWID|
4.|* 7 |    INDEX RANGE SCAN         |
8.| 8 |  TABLE ACCESS BY INDEX ROWID |
7.|* 9 |   INDEX UNIQUE SCAN         |
-------------------------------------
```



E-Rows und A-Rows

- **E-Rows:** Vom Optimizer geschätze Anzahl Rows während der Parse-Phase
  - SQL Developer: CARDINALITY
- **A-Rows:** Tatsächliche Anzahl Rows während der Ausführung des SQL-Befehls
  - SQL Developer: LAST_OUTPUT_ROWS

```
-----------------------------------------------------------------------------------------------
| Id  | Operation           | Name      | Starts | E-Rows | A-Rows |   A-Time   | Buffers |
-----------------------------------------------------------------------------------------------
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-----------------------------------------------------------------------------------------------
```