

Database tools for developers

Jacek Wojcieszuk, IT-DM

Database Developers' Workshop

July 8th, 2008



- Most useful tools:
 - SQL*Plus
 - Benthic
 - SQL Developer
 - JDeveloper
 - Session Manager
 - Weekly reports
- Typical use-cases:
 - My query is slow
 - My application is slower than it used to
 - My DML statement got stuck



Most useful tools



SQL*Plus

- SQL*Plus is the primary tool to access an Oracle database
 - You can be sure to find it wherever Oracle software is installed
- It is a traditional line-mode tool to execute SQL:
 - Scripting and formatting facilities
 - Can generate quite good reports
 - Some SQL optimization functionality
- But
 - Formatting the output is not an easy task
 - No command history on Unix
 - Use rlwrap tool to make SQL*Plus more user friendly
<https://twiki.cern.ch/twiki/bin/view/PSSGroup/RIWrap>

Setting up SQL*plus

- To start using SQL*Plus from lxplus run:
 - For tcsh:
`source /afs/cern.ch/project/oracle/script/setoraenv.csh -s client ver`
 - For bash:
`source afs/cern.ch/project/oracle/script/setoraenv.sh -s client_ver`
- Some useful formatting commands:
 - `set linesize xxx` – number of characters per line
 - `set pagesize xxx` – number of rows per page
 - `col column_name for ...` – specified the way contents of the column are printed e.g:
`col name for a50; col salary for 9999.99`
 - `set long xxx` – number of characters printed for LOB columns
- If you create login.sql script, it will be run automatically when you connect with SQL*Plus
 - Use SQLPATH environment variable to indicate the patch to your SQL scripts.

- SQL*Plus can be used for SQL debugging purposes. It can provide information on:
 - Actual query execution plan
 - Query execution statistics
- **SET AUTOTRACE TRACEONLY**
- Comprehensive SQL*Plus documentation can be found here: <http://oracle-documentation.web.cern.ch/oracle-documentation/10gr2doc/server.102/b14357/toc.htm>

DM Example

```
SQL> set autotrace traceonly
```

```
SQL> var :b1 number;
```

```
SQL> exec :b1 := 3423
```

```
SQL> SELECT file_state FROM lcg_fts_prod.t_file
      WHERE file_id = :B1;
```

Id	Operation	Name	Rows	Bytes	Cost (%CPU)	Time
0	SELECT STATEMENT		1	11	1 (0)	00:00:01
1	TABLE ACCESS BY INDEX ROWID	T_FILE	1	11	1 (0)	00:00:01
* 2	INDEX UNIQUE SCAN	FILE_FILE_ID_PK	1		0 (0)	00:00:01

Predicate Information (identified by operation id):

```
2 - access("FILE_ID"<=TO_NUMBER(:B1))
```

Statistics

```

1 recursive calls
0 db block gets
1 consistent gets
1 physical reads
0 redo size
279 bytes sent via SQL*Net to client
385 bytes received via SQL*Net from client
1 SQL*Net roundtrips to/from client
0 sorts (memory)
0 sorts (disk)
0 rows processed

```

Query execution statistics

Statistics	Meaning
Recursive calls	number of SQL statements executed on behalf of the query
Db block gets, consistent gets	number of blocks read from the cache
Physical reads	number of physical reads from datafiles into the cache
Redo size	Total amount of redo generated
Bytes sent/received via SQL*Net to/from client	amount of data sent between the client to the server
SQL*Net roundtrips to/from client	total number of messages exchanged between the client and the server
Sorts (memory)	sorts done in the sessions memory
Sorts (disk)	sorts done on disk (in the temporary tablespace)
Rows processed	number of rows modified or returned by executed SQL statement



DM

Benthic

- Benthic applications provide GUI for writing queries, running scripts, developing PL/SQL code and browsing schema objects
 - Benthic Golden is a querying and scripting tool
 - Benthic PLEdit is PL/SQL code editor
 - Benthic GoldView is a schema structure browser
- Benthic is available for Windows OS only
- Benthic can be downloaded from <http://www.benthicsoftware.com>
- It is commercial software, the license keys are located at DFS, can be used by anybody on the CERN site





Benthic Golden

- Benthic Golden is an ad-hoc query and SQL scripting tool:
 - Allows editing and running multiple scripts simultaneously
 - Supports SQL*Plus variable prompting, bind variables and calling external scripts with parameter passing.
 - Supports SQL*Plus specific command EXEC, DESC and CONNECT.
 - Provides script and statement's timing
 - Provides access to query execution plans
 - Contains various export/import options.
 - Allows editing of single table result sets
 - Supports colored syntax highlighting
 - Includes SQL builder tool – to quickly assemble desired SQL statement



DM

Benthic PLEdit

- Benthic PLEdit facilitates editing and compiling of PL/SQL code modules (stored procedures, functions, packages, triggers)
 - Supports editing of multiple modules simultaneously
 - Simplifies resolving compilation errors
 - Supports colored syntax highlighting
 - Includes SQL builder – for easier assembly of PL/SQL blocks
 - Includes some stored PL/SQL code management tools
 - Shows dependencies visually
 - Misses PL/SQL debugger



Benthic GoldView

- GoldView is a schema structure browser
 - Offers a fast and easy way to find an information about the objects in a schema
 - It is a read-only tool
- Displays objects in all accessible schemas
- Shows detailed information on tables, views, triggers, indexes, synonyms, sequences, types and code modules
- Shows structure, keys, constraints, stored code, DDL and more!

DM

Benthic

The screenshot displays the Benthic Software Golden interface. The main window shows a SQL query in the editor and its results in a table. The query is:

```
select * from employees where first_name like 'C%'  
or department_id in (select department_id from departments where department_name like 'A%')
```

The results table shows 7 records:

#	EMPLOYEE_ID	FIRST_NAME	LAST_NAME	EMAIL	PHONE_NUMBER	HIRE_DATE	JOB_ID
1	200	Jennifer	Whalen	JWHALEN	515.123.4444	09/17/1987 00:00:00	AD_ASST
2	205	Shelley	Higgins	SHIGGINS	515.123.8080	06/07/1994 00:00:00	AC_MGR
3	206	William	Gietz	WGIEZT	515.123.8181	06/07/1994 00:00:00	AC_ACCOUNT
4	142	Curtis	Davies	CDAVIES	650.121.2994	01/29/1997 00:00:00	ST_CLERK
5	153	Christopher	Olsen	COLSEN	011.44.1344.498718	03/30/1998 00:00:00	SA_REP
6	162	Clara	Vishney	CVISHNEY	011.44.1346.129268	11/11/1997 00:00:00	SA_REP
7	179	Charles	Johnson	CJOHNSON	011.44.1644.429262	01/04/2000 00:00:00	SA_REP

The interface also shows a schema browser on the right with a tree view of tables and views. The status bar at the bottom indicates "Object resolved to: TABLE HR.EMPLOYEES" and "Selected 7 records".





Oracle SQL Developer

- Oracle SQL Developer is a powerful GUI for database interaction and development. It has all the Benthic functionality and in addition:
 - Visual Query builder
 - Full PL/SQL debugging
 - Required DEBUG CONNECT SESSION and DEBUG ANY PROCEDURE privs
 - Pre-defined and user-defined reports
 - Full integration with CVS and Subversion
 - Integrated tool for migrating data from 3rd party database engines like MySQL, Microsoft SQL Server, Sybase Adaptive Server, or Microsoft Access
- Oracle SQL Developer is a Java-based application so it is fully portable between different platforms
- **It is a free tool**, can be downloaded from <http://otn.oracle.com>

DM

SQL Developer

The screenshot displays the Oracle SQL Developer application window. The main window title is "Oracle SQL Developer". The menu bar includes File, Edit, View, Navigate, Run, Source, Versioning, Migration, Tools, and Help. The toolbar contains various icons for file operations and execution. The left-hand side features a "Data Dictionary Reports" tree with categories like About Your Database, All Objects, Application Express, ASH and AWR, Charts, Database Administration, Data Dictionary, Jobs, PL/Sql, and Security. Below this is a "Stack" window showing subroutines: HR.ADD_JOB_HISTORY and HR.ANONYMOUS_BLOCK. The main workspace is titled "Enter SQL Statement:" and contains the following SQL query:

```
select * from employees e, departments d where e.department_id=d.department_id and d.department_name like :1;
```

 Below the query editor, the "Results" window shows a table with 10 columns: EMPLOYEE_ID, FIRST_NAME, LAST_NAME, EMAIL, PHONE_NUMBER, HIRE_DATE, JOB_ID, SALARY, COMMISSION_PCT, MANAGER_ID, and DEPARTMENT_ID. The table contains three rows of data. The status bar at the bottom indicates "All Rows Fetched: 3". The Windows taskbar at the bottom shows the Start button, taskbar icons for Microsoft PowerPoint, SQL Developer 1.5, Oracle SQL Developer, and Command Prompt, along with the system tray showing the time as 2:48 PM.

EMPLOYEE_ID	FIRST_NAME	LAST_NAME	EMAIL	PHONE_NUMBER	HIRE_DATE	JOB_ID	SALARY	COMMISSION_PCT	MANAGER_ID	DEPARTMENT_ID
1	Jennifer	Whalen	JWHALEN	515.123.4444	17-SEP-87	AD_ASST	4400	(null)	101	101
2	Shelley	Higgins	SHIGGINS	515.123.8080	07-JUN-94	AC_MGR	12000	(null)	101	101
3	William	Gietz	WGIEZT	515.123.8181	07-JUN-94	AC_ACCOUNT	8300	(null)	205	101





JDeveloper

- Complete and integrated Java, XML and Web Services development environment
 - Build/debug/tune/deploy
 - Full J2EE 1.4 and EJB 3.0 support (as of 10.1.3)
- Very good integration with Oracle Database Server
 - Very similar functionality to what SQL Developer offers
- Good integration with several application servers (Oracle AS, JBoss, Tomcat, WebLogic)
- JDeveloper is a Java-based application



DM

JDeveloper

- Wizards to create your Servlets, JSP, EJB, WEB Services, XML...
- WYSIWYG editor for web pages
- UML diagrammer
- Support for Open Source projects like Junit, Apache Ant, Struts
- Support for CVS
- And all the functionality of SQL Developer
- ... and much more

DM

JDeveloper

The screenshot displays the Oracle JDeveloper IDE interface. The main window shows a SQL worksheet with the following query:

```
select * from employees where first_name like 'C%'  
or department_id in (select department_id from departments where department_name like 'A%')
```

Below the query, the "Explain Plan Results" table is visible:

Operation	Optimizer	Cost	Cardinality	Bytes	Partition Start	Partiti
SELECT STATEMENT	ALL_ROWS	3	11	748		
FILTER						
TABLE ACCESS(FULL) HR.EMPLOYEES	ANALYZED	3	107	7276		
TABLE ACCESS(BY INDEX ROWID) HR.DEPARTMENTS	ANALYZED	1	1	16		
INDEX(UNIQUE SCAN) HR.DEPT_ID_PK	ANALYZED	0	1			

The left sidebar shows a project tree with a "Tables" folder containing COUNTRIES, DEPARTMENTS, EMPLOYEES, JOB_HISTORY, and JOBS. The bottom status bar shows the connection "jdev.cm:HR@testdb_hr:TABLE".





Session Manager

- Home-grown tool to monitor and manage applications' database sessions:

<https://twiki.cern.ch/twiki/bin/view/PSSGroup/SessionsManager>

- Installed and configured for all development, integration and production databases
- Offers a convenient way to:
 - Check who is connected
 - See database sessions' details
 - Check what sessions are doing/waiting for
 - Investigate on locking conditions
 - Kill problematic sessions

Session Manager > Physics Databases > IT-PSS > CERN

List of sessions

The session marked in red is the session used by this application you -normally- do not need to bother about it.
The sessions marked in green are the active sessions.

#	kill	Inst	SID	Oracle username	Server PID	CPU	CPU time	Process time	Process size	Wait Event	Wait Time	Client username	Logon time	Client mo
1	<input type="checkbox"/>	2	824	JWOJCIES	972	%			MB	SQL*Net message from client	11643	oracle@itrac412.cern.ch/956	11:59:09 07/JUL/2008	-SQL*Plus-
2	<input type="checkbox"/>	1	833	JWOJCIES	15776	0.0%	00:00:00	03:13:49	139MB	enq: TX - row lock contention	11616	oracle@itrac411.cern.ch/15754	12:00:27 07/JUL/2008	-SQL*Plus-
3	<input type="checkbox"/>	1	802	JWOJCIES	7284	20.0%	00:00:00	00:01	141MB	PX Deq: Execute Reply	0	oracle@itapp18.cern.ch/12864	15:14:16 07/JUL/2008	-httpd@itapp1 (TNS V1-V3)-
4	<input type="checkbox"/>	2	784	JWOJCIES	22284	%			MB	PX Deq: resp credit	0	oracle@itapp18.cern.ch/22284	15:14:17 07/JUL/2008	-httpd@itapp1 (TNS V1-V3)-
5	<input type="checkbox"/>	1	802	JWOJCIES	24016	1.1%	10:08:25	38-05:02:57	151MB	PX Deq: Execution Msg	2	oracle@itapp18.cern.ch/24016	15:14:17 07/JUL/2008	-httpd@itapp1 (TNS V1-V3)-

[Kill: ALL your sessions]

[List: YOUR sessions | ALL sessions]

Find: session Next Previous Highlight all Match case

Done oraweb.cern.ch

DM

Weekly reports

- Another home-grown tool
- Provides aggregated information on applications' activity
 - Top resource consumers
 - Hourly applications' activity stats
- Signalizes potential problems
 - Repeting queries without bind variables
 - Expiring/expired passwords
 - Invalid objects
 - Failing jobs
 - Fragmented tables
 - Connection errors



Typical use-cases

My query is slow

- SQL*Plus

- Connect to the database

- Enable autotrace

```
set autotrace traceonly
```

- Run the query:

- **keep bind variables**

- Study the execution plan, look for costly steps:

- TABLE ACCESS FULL usually means missing index

- MERGE JOIN CARTESIAN usually means missing WHERE predicates

- INDEX FULL SCAN operations also should be avoided

- Check for existing indices and create missing ones:

```
select * from user_ind_columns where  
table_name='name_of_the_table';
```


My query is slow (2)

- Check if object statistics were collected recently, if not collect them:

```
select table_name, last_analyzed from
  user_tables where
    table_name='name_of_the_table';
select index_name, last_analyzed from
  user_indexes where table_name='
  name_of_the_table';
exec dbms_stats.gather_table_stats(user,
  'name_of_the_table')
exec dbms_stats.gather_index_stats(user, '
  name_of_the_index')
```

- Review query execution statistics returned by autotrace:
 - Pay special attention to 'recursive calls', 'physical reads', 'SQL*Net roundtrips' and 'sorts (disk)'
- Or do the same with SQL Developer or Benthic

My application is slower than it used to be

- If the application runs on a shared database have a look at the Weekly Report:
 - Check the load generated by your and other applications
 - Check the number of sessions
 - Compare with the previous Weekly Reports
- Check when application objects were last analyzed
 - Collect statistics if needed:

```
exec dbms_stats.gather_schema_stats(null)
```
- Check if there were any recent changes of the schema and objects:

```
select object_name, object_type, created,  
last_ddl_time from user_objects where  
created > sysdate - 5 or last_ddl_time > sysdate -  
5;
```
- Review execution plans of most important queries



DM

My DML statement got stuck

- This most likely means wait for resources locked by other sessions
 - Go to the Session Manager
 - Find the session keeping resource your DML is waiting for
 - Either commit, rollback or kill the blocking session
 - Review the application to avoid similar problems in the future.



DM

```
for(tp = m; tp < m + n; tp++)  
    if(tp > second-  
        busyTPools.p  
  
// Reap child pr  
pid_t pid;  
while ((pid = w  
if(!beGraceful)  
// on a SIGINT  
return; }  
  
// now loop wait  
while(busyTPool  
sleep(1); // S  
for(unsigned i  
if(busyTPools  
// it's idle no  
busyTPools  
else  
i++  
}
```

Q&A

