



IBM Software Group

SQL...Can't Live with it...Can't Live without it

An IBM System z Software Teleconference



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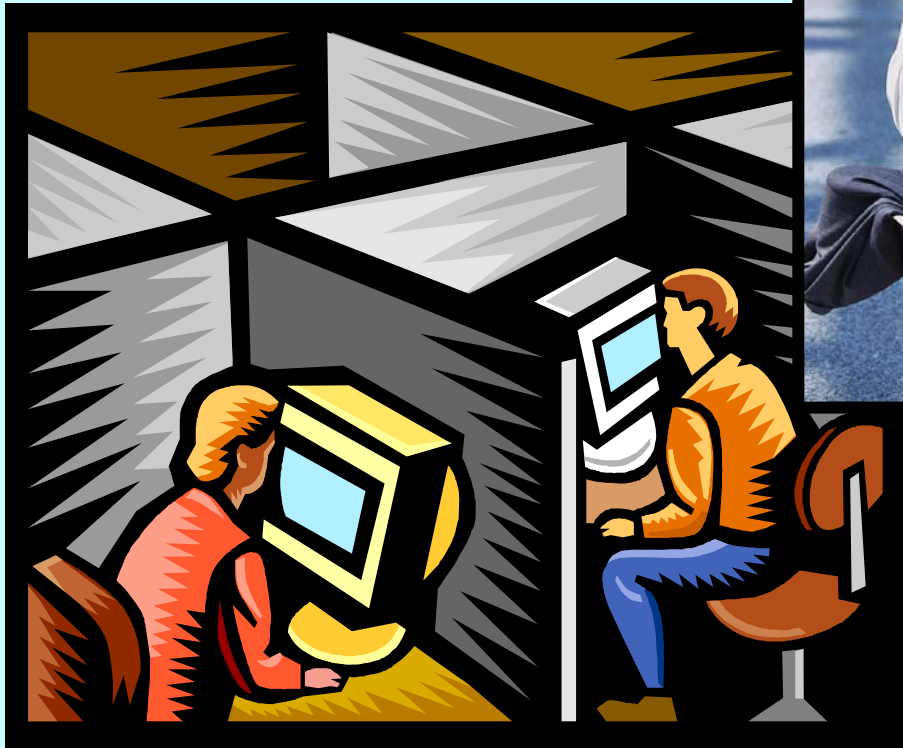
COMPUTER PROGRAMMING



COBOL
PL1
ASSEMBLER
RPG II



WHAT IS DIFFERENT?



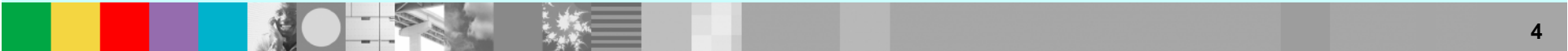
SQL
Java



STATIC vs DYNAMIC SQL

How the statements are coded

- STATIC
 - ▶ SQL statements are built into the program
 - ▶ Compile / Link Edit / Bind
 - ▶ DBRM
 - ▶ Plan / Package
- DYNAMIC
 - ▶ Keyed in by a user sitting at a terminal or embedded in host language
 - ▶ Assembled at execution time
 - ▶ Explicitly prepared



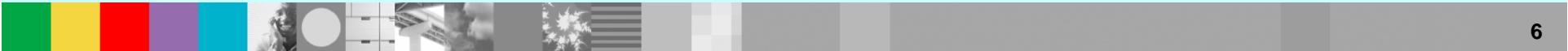
SQL

- Embedded Static SQL
 - ▶ SQL statements are included in the host language
 - EXEC SQL
 - #sql
 - ▶ Pre-compile, link-edit, and bind
 - ▶ Dynamic capabilities
 - Using host variables
 - Execute the same statement repetitively using different values
 - The statement itself is fixed
 - Each program using this method has its own statements
 - Each must have its own DBRM (bound)



SQL

- Embedded Dynamic SQL
 - ▶ PREPARE and EXECUTE
 - ▶ Pre-compile / link-edit / bind
 - ▶ The dynamic statements are prepared and executed when invoked at runtime
- Interactive Dynamic SQL
 - ▶ SPUFI
 - ▶ QMF
 - ▶ Report Writers



SQL

- Deferred Embedded Dynamic SQL
 - ▶ Used by DB2 private protocol to access remote data
 - ▶ Alias or use of 3 part name
 - DSNB.PROD.EMPLOYEE
 - ▶ SQL has characteristics of STATIC in that it is embedded and hard coded
 - ▶ SQL is like DYNAMIC because it is prepared at runtime prior to execution
 - ▶ No plans / packages on the target subsystem
 - ▶ Recommendation is to migrate from private protocol to DRDA
- DB2 processes SQL accessing declared temporary tables the same way it does using the private protocol



SQLJ - Java

- SQLJ – API for embedded static SQL in Java programs
- SQLJ translator – transforms SQL into calls for the runtime environment
- Profile files – used at execution time; can be used to create DBRM's
- Compile / Link-edit / Bind
- Dynamic
 - ▶ Uses host expressions (vs. host variables)
 - ▶ No syntax to handle dynamic SQL statements – rather use JDBC – the 'static' code acts as a dynamic SQL statement
 - Transparent to the user

CALLABLE INTERFACES

- ODBC – available for C and C++
 - ▶ Uses function calls
 - ▶ Does not require pre-compilation or binding
- JDBC – can access any relational data base
 - ▶ Uses function calls
 - ▶ Does not require pre-compilation or binding
- REXX
 - ▶ Uses RRS or CAF attach to connect to DB2
 - ▶ No pre-compilation
 - ▶ Comes with a pre-defined set of packages

STATIC vs DYNAMIC SQL vs Combined

By the way the statements are executed

- STATIC
 - ▶ Requires a DBRM (Database Request Module)
 - ▶ Statements are executed directly without preparation
- DYNAMIC
 - ▶ SQL statements have not been bound
 - ▶ No executable form of the statement exists
- COMBINED
 - ▶ Deferred embedded SQL
 - ▶ SQLJ coming in through JDBC interface



STATIC vs DYNAMIC SQL

▪ STATIC

- ▶ Performance
 - Non-uniformed distribution – the path chosen at bind time may be sub-optimal
- ▶ Authorization benefits
 - User needs EXECUTE privilege on plan / package
- ▶ Auditing
 - Code exists in source libraries
 - Easy to manage change management

▪ DYNAMIC

- ▶ Performance
 - Overhead of doing the prepare
 - Caching of SQL helps
 - If data is skewed, dynamic SQL may perform better
- ▶ Authorization
 - Users will need explicit authorizations on the object(s) (could use DYNAMICRULES(BIND) on embedded dynamic SQL)
 - Stored Procedure alternative
- ▶ Auditing – not possible to determine if the statement was modified before execution





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Identifying Problematic SQL using IBM DB2 Query Monitor for z/OS



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How Do You Find SQL To Tune?

- DB2 subsystem monitors
 - ▶ IBM Tivoli OMEGAMON XE for DB2 Performance Expert
 - ▶ IBM Tivoli OMEGAMON XE for DB2 Performance Monitor
 - ▶ ISV tools
- SQL activity trace
- SQL activity monitors
 - ▶ IBM DB2 Query Monitor for z/OS
 - ▶ ISV tools



About DB2 Query Monitor for z/OS

- What it is
 - ▶ An SQL statement monitor
 - Real-time and historical data
 - Low overhead
 - Traces ACCTG(1,3) and STATS(1,3,4)
 - Easy to use
 - Appropriate for DBAs and application programmers
 - A complementary tool to an existing DB2 subsystem monitor
- What it isn't
 - ▶ A DB2 subsystem monitor
 - ▶ A DB2 thread monitor
 - ▶ A post-processor of trace data

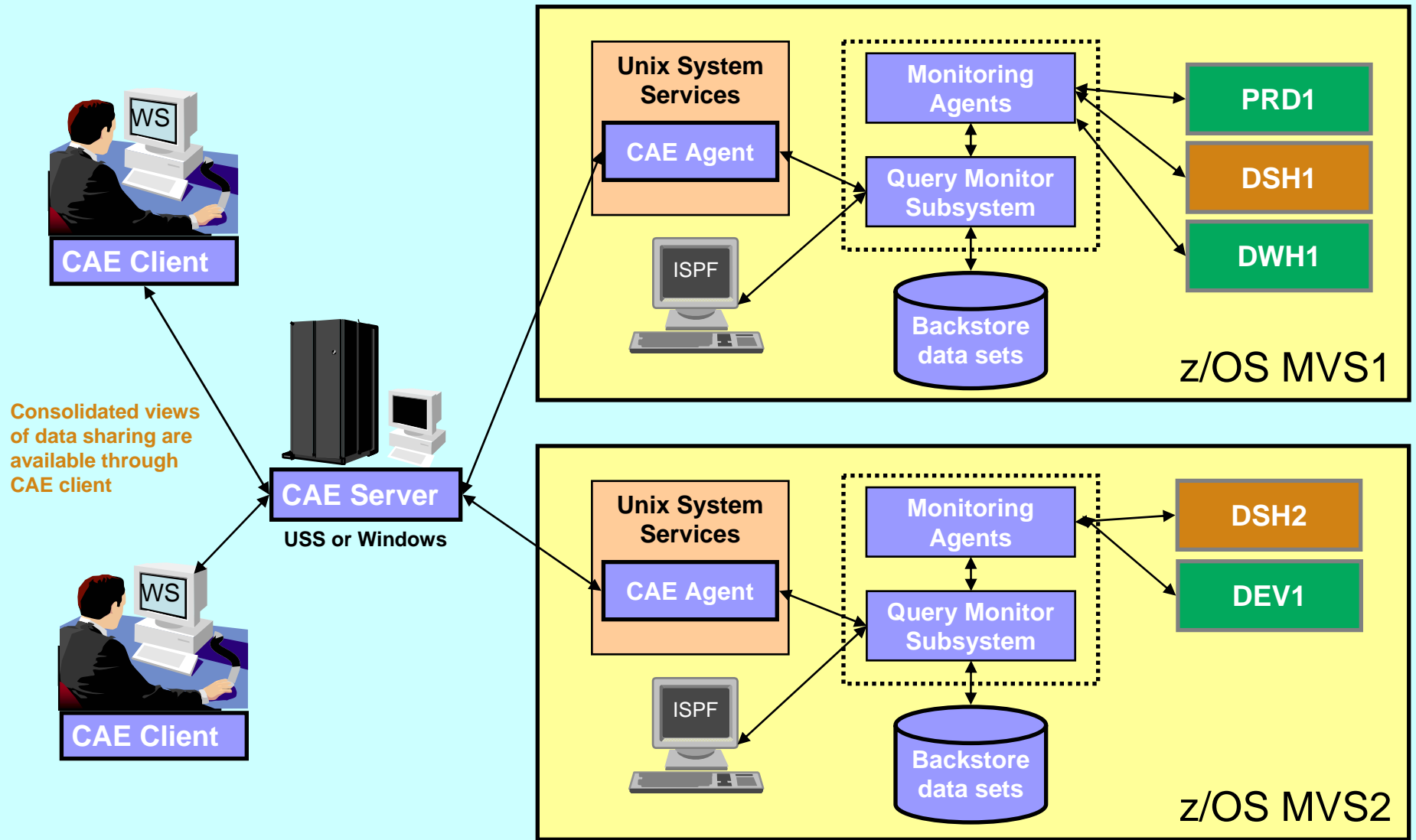


What Does Query Monitor Do?

- Enables quick and easy identification of problem SQL
 - ▶ View by plan, package, authid, SQL statement, etc.
 - ▶ Key metrics - CPU, elapsed time, GETPAGES
- Allows you to proactively manage DB2 resources
 - ▶ Exceptions and alerts by workload
 - ▶ Automated actions for alerts
- Allows you to react quickly and effectively to DB2 performance problems
 - ▶ ISPF, GUI and web interfaces



DB2QM – Architecture



DB2QM – Main Menu

```
IBM
2006/10/31 13:25:10 ---- IBM DB2 Query Monitor for z/OS ----
Option ==> m
DB2 QM Subsystem ID: DBQM (? to Select)           User: DBA560
                                                    Release: CQM V2R2M0
-----
U.  View Activity Summaries           N.  View SQLCODEs
A.  View Current Activity             C.  View DB2 Command Activity
E.  View Exceptions
M.  Work with Monitoring Agents       S.  Setup
P.  Work with Profiles                X.  Exit Query Monitor

Enter END command to return to ISPF.

M& a
```

- 'DBQM' is the name of our QM collector
- Use option 'M' to see the monitoring status of all DB2 subsystems on this LPAR
- Options 'U' and 'E' can be used to find problem SQL statements
- Option 'N' can be used to find SQL errors
- Option 'C' can be used to view all commands issued to monitored DB2 subsystems

DB2QM – Monitoring Status

```

IBM
2006/10/31 13:25:34 ----- DB2 QM Monitoring Status ----- Row 1 of 7
Option ==> Scroll ==> CSR
DB2 QM Subsystem DBQM
C:A-Activate,C-Change Profile,D-Deactivate,R-Refresh Profile,V-View Profile
-----
CMD SSID Active Monitored QM Version QM Subsystem Profile Name
- - - - -
- DSNB YES YES V220 DQMA DSNAPROF
v DSNB YES YES V220 DBQM DSNBPROF
= DSNB YES YES V220 DQMC DSNAPROF
- DSND YES NO
- DB1S YES NO
- DB2S NO NO
- DSNT YES NO
***** Bottom of Data *****
MA a

```

- Monitoring profiles may be dynamically changed or refreshed
- The monitoring agent may be dynamically activated and deactivated
- Use option 'V' to see the details of a monitoring profile
- Note: this is not a typical configuration – generally there will be 1 QM subsystem per LPAR

DB2QM – Monitoring Profile Summary

2006/10/31 13:27:04 ----- View Monitoring Profile ----- Row 1 of 10
 Option ==> Scroll ==> CSR
 Profile Name: DSNBPROF

C:V View

CMD	INCL\EXCL	SSID	Plan	Program	AUTHID	JOBNAME	CONN	CORRID
-	-	-	-	-	-	-	-	-
-	E	*	CQMPLAN1	*	*	*	*	*
-	E	*	DB2P*	*	*	*	*	*
-	E	*	FPE*	*	*	*	*	*
-	E	*	ANLPLAN	*	*	*	*	*
-	I	*	DSNREXX*	*	*	*	*	*
-	I	*	DIST*	*	*	*	*	*
-	I	*	TJHPGM*	*	*	*	*	*
▼	I	*	ADB*	*	*	*	*	*
=	I	*	*	*	DNET315	*	*	*
-	I	*	*	*	*	*	*	*

***** Bottom of Data *****

MA a

- Workload is assigned to the first matching line in the profile
- Use wildcarding, when possible, to limit number of entries to search
- Specify excludes first
- Specify a 'catchall' definition at end for unmatched workload

DB2QM – Monitoring Profile Detail (1)

```

----- View Profile Line for DSNBPROF -----
Option ==> _____ Scroll ==> CSR
More: +

INCLUDE/EXCLUDE      I      (I=Include, E=Exclude)
Disable Summary Reporting N      (Y/N)  Gather Host Variables Y      (Y/N)
DB2 Subsystem        *
Program Name         *
AUTHID               *
Connection ID        *
                     *
Workstation User     *
Workstation Trans    *
Workstation Name     *
Workload Name        Admin Tool
Exception CPU        00 : 00 : 02 . 000000
Exception Elapsed    00 : 00 : 03 . 000000
Exception Getpages   500
Exception SQL Calls  0

Press <PF7/PF8> to scroll for additional options.

```

- Definition lines can be used to exclude workloads from summary and exception reporting
- Host variables may be collected
- An 'and' condition is applied to filters, i.e. – all must match
- The workload name is shown on the exceptions display
- An 'or' condition is applied to thresholds
- A value of '0' means "don't test"

DB2QM – Monitoring Profile Detail (2)

```

----- View Profile Line for DSNBPROF -----
Option ==> _____ Scroll ==> CSR
More: - +

Exception Limit          50
Generate SQLCODE Exceptions Y (Y/N)
Exclude Exception SQLCODEs N (Y/N)
Alert CPU                00 : 00 : 00 . 000000
Alert Elapsed           00 : 00 : 00 . 000000
Alert Getpages          0
Alert SQL Calls         0
Generate SQLCODE Alerts Y (Y/N)
Exclude Alert SQLCODEs N (Y/N)
Exclude Summary SQLCODEs N (Y/N)
Override OPTKEYS        N (Y/N)
  OPTKEYS(TEXT)         N (Y/N)
  OPTKEYS(AUTHIDS)      N (Y/N)
  OPTKEYS(CORRID)       N (Y/N)
  OPTKEYS(CORRNAME)     N (Y/N)
  OPTKEYS(WSUSER)       N (Y/N)

Press <PF7/PF8> to scroll for additional options.

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```

- The exception limit should be a reasonable value to maintain low overhead for collection
- Alert thresholds should be higher than exceptions
- Alerts are sent to the CAE server
- Optional summarization can be controlled at the workload level via the OPTKEYS override

DB2QM – View Exceptions

- Exceptions are a good place to start looking for poor performing SQL

```
IBM
2006/10/31 17:58:43 ---- IBM DB2 Query Monitor for z/OS ----
Option ==> e
-----
DB2 QM Subsystem ID: DBQM (? to Select)           User: DBA560
                                                    Release: CQM V2R2M0
-----
U.  View Activity Summaries           N.  View SQLCODEs
A.  View Current Activity             C.  View DB2 Command Activity
E.  View Exceptions
M.  Work with Monitoring Agents       S.  Setup
P.  Work with Profiles               X.  Exit Query Monitor

Enter END command to return to ISPF.

MA a
```

DB2QM – Exceptions (1)

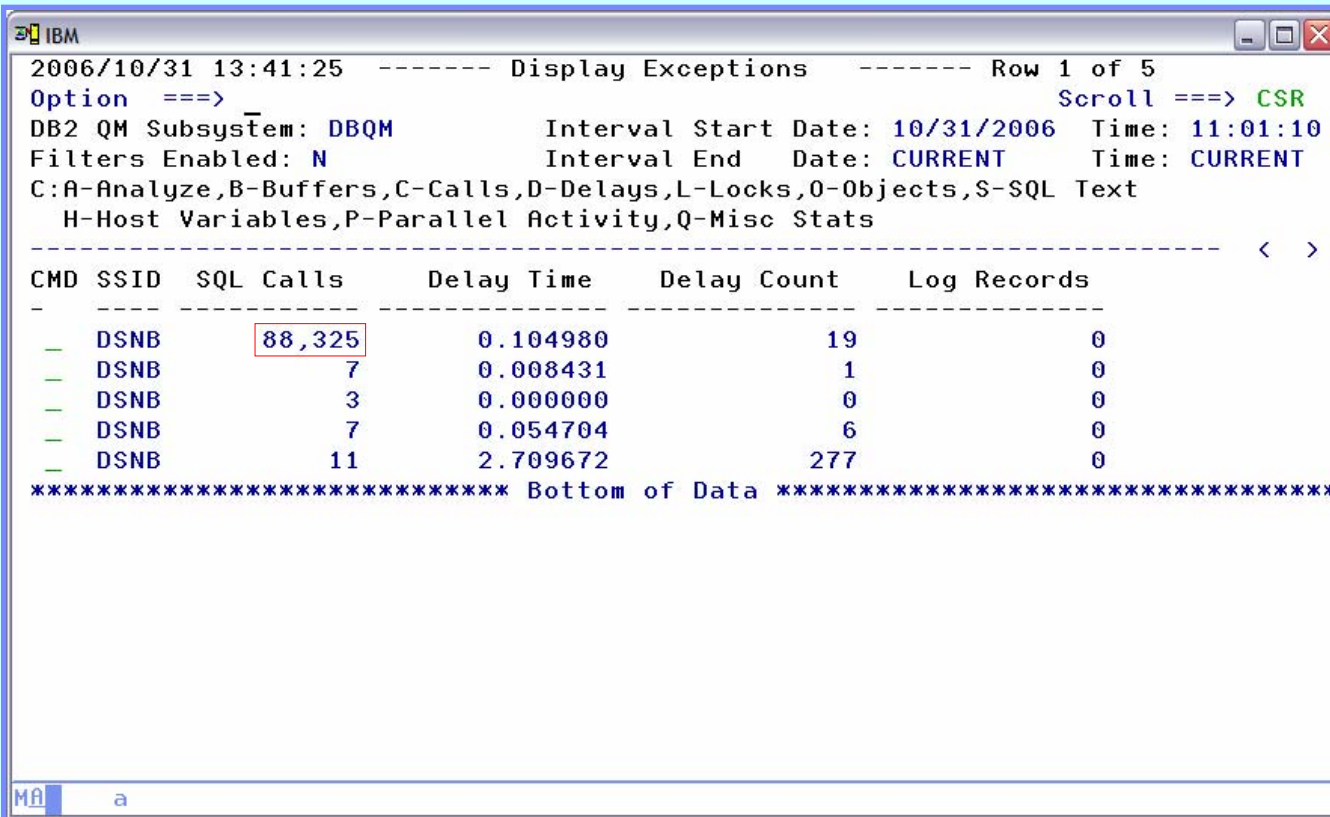
```

IBM
2006/10/31 13:40:47 ----- Display Exceptions ----- Row 1 of 5
Option ==>
DB2 QM Subsystem: DBQM          Interval Start Date: 10/31/2006   Time: 11:01:10
Filters Enabled: N              Interval End   Date: CURRENT       Time: CURRENT
C:A-Analyze,B-Buffers,C-Calls,D-Delays,L-Locks,O-Objects,S-SQL Text
  H-Host Variables,P-Parallel Activity,Q-Misc Stats
-----
CMD  SSID  Plan   Program  DB2 CPU Time   DB2 Elapsed   GETPAGES   SQLCODE
-----
-   DSNB  ADB    ADBMAIN   1.887607    2.157569      8,838      +100
-   DSNB  ADB    ADBMAIN   0.018129    0.020690      617        +100
-   DSNB  ADB    ADBMAIN   0.001336    0.001358       2         -601
-   DSNB  ADB    ADBMAIN   0.018585    0.063918      617        +100
-   DSNB  ADB    ADBMAIN   0.053786    2.772239      8,820      +100
***** Bottom of Data *****
MA  a

```

- One line is displayed per exception event
- Significant data is available to the right (PF11) and through drill-down commands
- The key performance indicators (CPU, elapsed, and GETPAGES) are displayed on the first panel
- The triggering threshold is displayed in an alternate color – the GETPAGES count (lines 1,2,4,5) is highlighted
- Filtering is available to limit displayed data by plan, package, authid, etc.

DB2QM – Exceptions (2)



2006/10/31 13:41:25 ----- Display Exceptions ----- Row 1 of 5
Option ==> _ Scroll ==> CSR
DB2 QM Subsystem: DBQM Interval Start Date: 10/31/2006 Time: 11:01:10
Filters Enabled: N Interval End Date: CURRENT Time: CURRENT
C:A-Analyze,B-Buffers,C-Calls,D-Delays,L-Locks,O-Objects,S-SQL Text
H-Host Variables,P-Parallel Activity,Q-Misc Stats

CMD	SSID	SQL Calls	Delay Time	Delay Count	Log Records
-	DSNB	88,325	0.104980	19	0
-	DSNB	7	0.008431	1	0
-	DSNB	3	0.000000	0	0
-	DSNB	7	0.054704	6	0
-	DSNB	11	2.709672	277	0

***** Bottom of Data *****

MA a

- Additional data is available as we scroll to the right
- The high number of SQL calls and high delay times of the first and last exception may be worthy of further investigation

DB2QM – Exceptions (3)

```

IBM
2006/10/31 13:42:23 ----- Display Exceptions ----- Row 1 of 5
Option ==> _ Scroll ==> CSR
DB2 QM Subsystem: DBQM Interval Start Date: 10/31/2006 Time: 11:01:10
Filters Enabled: N Interval End Date: CURRENT Time: CURRENT
C:A-Analyze,B-Buffers,C-Calls,D-Delays,L-Locks,O-Objects,S-SQL Text
H-Host Variables,P-Parallel Activity,Q-Misc Stats
----- < >
CMD SSID Jobname Conn Token Authid Req Site Corrid
-----
- DSNB DBA560 TSO 4877 DBA560 NDCDB202 DBA560
- DSNB DNET132 TSO 4866 DNET132 NDCDB202 DNET132
- DSNB DNET132 TSO 4866 DNET132 NDCDB202 DNET132
- DSNB DNET132 TSO 4866 DNET132 NDCDB202 DNET132
- DSNB APERKIN TSO 4784 APERKIN NDCDB202 APERKIN
***** Bottom of Data *****
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```

- Key data to identify the user that caused the exception is also available
- The workstation identifiers are available for distributed applications such as SAP and PeopleSoft by scrolling to the right

DB2QM – Exceptions (4)

```

IBM
2006/10/31 13:43:03 ----- Display Exceptions ----- Row 1 of 5
Option ==> Scroll ==> CSR
DB2 QM Subsystem: DBQM      Interval Start Date: 10/31/2006  Time: 11:01:10
Filters Enabled: N         Interval End Date: CURRENT      Time: CURRENT
C:A-Analyze,B-Buffers,C-Calls,D-Delays,L-Locks,O-Objects,S-SQL Text
H-Host Variables,P-Parallel Activity,Q-Misc Stats
-----
CMD SSID Workload      Start Time              End Time
-----
s DSNB Admin Tool     2006-10-31-13.39.58.970576 2006-10-31-13.40.09.903017
= DSNB Admin Tool     2006-10-31-13.31.39.321319 2006-10-31-13.31.39.417519
- DSNB Admin Tool     2006-10-31-13.31.39.125168 2006-10-31-13.31.39.126630
- DSNB Admin Tool     2006-10-31-13.29.11.203646 2006-10-31-13.29.11.390128
- DSNB Admin Tool     2006-10-31-11.22.12.373244 2006-10-31-11.22.15.187338
***** Bottom of Data *****

```

- Notice the workload name for each exception
- Let's use the 'S' line command to look at the SQL text of the statement with a high number of calls

DB2QM – SQL Text Display

```
IBM
2006/10/31 13:43:30 ---- Display SQL Statement Text ---- Row 1 of 2
Option ==> exp_ Scroll ==> CSR

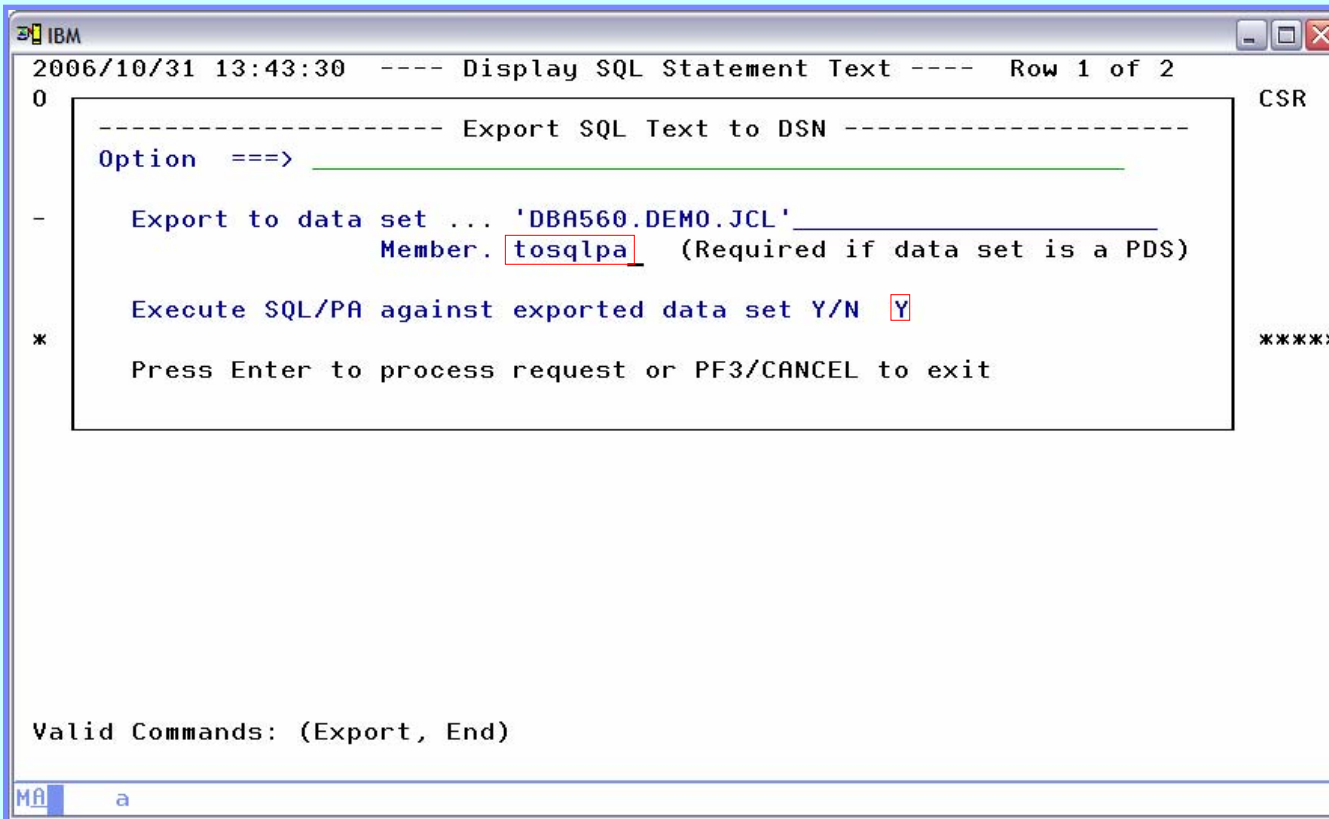
DB2 SSID: DSNB Plan: ADB DBRM: ADBMAIN Coll: ADBL
Cursor: C1 Section: 1
-----
SELECT *
FROM SYSIBM.SYSCOLUMNS
***** Bottom of Data *****

Valid Commands: (Export, End)

MA a
```

- Not a complex query – but the user probably didn't consider the amount of data they were requesting
- The 'Export' command may be used to save the query and optionally pass it to IBM DB2 SQL Performance Analyzer
- The complete text of the SQL statement is displayed – 32KB for V7 and 2MB for V8

DB2QM – Export SQL Text



```
IBM
2006/10/31 13:43:30 ---- Display SQL Statement Text ---- Row 1 of 2
0
----- Export SQL Text to DSN -----
Option ==> _____
-   Export to data set ... 'DBA560.DEMO.JCL' _____
    Member. tosqlpa (Required if data set is a PDS)
*   Execute SQL/PA against exported data set Y/N Y
    Press Enter to process request or PF3/CANCEL to exit
*****

Valid Commands: (Export, End)

MA a
```

- The export pop-up requests a location to store the SQL text, and whether or not to invoke SQL PA
- The 'A' line command may be used from the 'Display Exceptions' panel to directly invoke SQL PA without first exporting to a data set

DB2QM – View Objects Related to Exception

- We can drill-down to see detailed metrics related to buffer pools, delays, locks, etc.
- We can also look at the objects used by the query

```

IBM
2006/10/31 13:45:18 ----- Display Exceptions ----- Row 1 of 5
Option ==> Scroll ==> CSR
DB2 QM Subsystem: DBQM Interval Start Date: 10/31/2006 Time: 11:01:10
Filters Enabled: N Interval End Date: CURRENT Time: CURRENT
C:A-Analyze,B-Buffers,C-Calls,D-Delays,L-Locks,O-Objects,S-SQL Text
H-Host Variables,P-Parallel Activity,Q-Misc Stats
-----
CMD SSID Plan Program DB2 CPU Time DB2 Elapsed GETPAGES SQLCODE
-----
o DSNB ADB ADBMAIN 1.887607 2.157569 8,838 +100
= DSNB ADB ADBMAIN 0.018129 0.020690 617 +100
- DSNB ADB ADBMAIN 0.001336 0.001358 2 -601
- DSNB ADB ADBMAIN 0.018585 0.063918 617 +100
- DSNB ADB ADBMAIN 0.053786 2.772239 8,820 +100
***** Bottom of Data *****
    
```

DB2QM – Object Statistics

```

IBM
2006/10/31 13:45:32 ----- Object Statistics ----- Row 1 of 7
Option ==> Scroll ==> CSR
Filters enabled: N
DB2 SSID: DSNB Plan: ADB DBRM: ADBMAIN Coll: ADBL
Cursor: C1 Section: 1

C: B Buffer Pool Statistics
----->
CMD Creator Name Type Database BPool Pageset GETPAGES
----->
▼ SYSIBM DSNATX02 INDEX DSND06 BP0 DSNATX02 6
b SYSIBM SYSCOLUMNS TABLE DSND06 BP0 SYSDBASE 8,822
= SYSIBM SYSINDEXES TABLE DSND06 BP0 SYSDBASE 3
- SYSIBM SYSTABLESPACE TABLE DSND06 BP0 SYSDBASE 1
- SYSIBM DSNDX01 INDEX DSND06 BP0 DSNDX01 2
- SYSIBM SYSTABLES TABLE DSND06 BP0 SYSDBASE 2
- SYSIBM DSNDTX01 INDEX DSND06 BP0 DSNDTX01 2
***** Bottom of Data *****
MA a
    
```

- Tables and indexes related to the exception are displayed
- We can scroll to the right for more detail and use the 'B' line command to display buffer pool details for each object

DB2QM – Buffer Pool Statistics

- We now see the buffer pool statistics, for table SYSCOLUMNS, related to the query that triggered the exception

```

IBM
2006/10/31 13:45:47 ----- Buffer Pool Statistics ----- Row 1 of 16
Option ==> _____ Scroll ==> CSR

DB2 SSID: DSNB      Plan: ADB      DBRM: ADBMAIN   Coll: ADBL
                  Cursor: C1                      Section:      1
-----+-----
Buffer Pool: ALL
Buffer Pool Hit Ratio (%)          Total      Average
Hiper Pool Hit Ratio (%)          N/A        94.18
Get Page Requests                 8,822      0.09
Buffer Pages Updated              0          0.00
Synchronous Pages Read            5          0.00
Synchronous Pages Written         0          0.00
Sequential Prefetch Requests     273       0.00
List Prefetch Requests           0          0.00
Dynamic Prefetch Requests        0          0.00
Successful Hiper Pool Reads       0          0.00
Hiper Pool Read Failures         0          0.00
Successful Hiper Pool Writes     0          0.00
Unsuccessful Hiper Pool Writes   0          0.00
Async Pages Read                 508       0.00

Valid Commands: (End)
MA a

```


DB2QM – View Calls for an Exception

- The 'C' line command may be used to display statements by type
- Calls is an optional summary bucket controlled by the OPTKEYS setting

```

IBM
2006/10/31 13:46:25 ----- Display Exceptions ----- Row 1 of 5
Option ==> Scroll ==> CSR
DB2 QM Subsystem: DBQM Interval Start Date: 10/31/2006 Time: 11:01:10
Filters Enabled: N Interval End Date: CURRENT Time: CURRENT
C:A-Analyze,B-Buffers,C-Calls,D-Delays,L-Locks,O-Objects,S-SQL Text
H-Host Variables,P-Parallel Activity,Q-Misc Stats
-----
CMD SSID Plan Program DB2 CPU Time DB2 Elapsed GETPAGES SQLCODE
-----
c DSNB ADB ADBMAIN 1.887607 2.157569 8,838 +100
= DSNB ADB ADBMAIN 0.018129 0.020690 617 +100
- DSNB ADB ADBMAIN 0.001336 0.001358 2 -601
- DSNB ADB ADBMAIN 0.018585 0.063918 617 +100
- DSNB ADB ADBMAIN 0.053786 2.772239 8,820 +100
***** Bottom of Data *****
MA a
    
```


DB2QM – View Delays for a Call

```

IBM
2006/10/31 13:47:04 ----- Call Level Statistics ----- Row 1 of 5
Option ==> _____ Scroll ==> CSR

DB2 SSID: DSNB Plan: ADB DBRM: ADBMAIN Coll: ADBL
Cursor: C1 Section: 1
Filters Enabled: N

C:B-Buffers,C-SQLCA,D-Delays,L-Locks,H-Host Variables,S-Call Text
Q-Misc Stats
-----
CMD STMT# Call Type DB2 CPU Time DB2 Elapsed
-----
- 2,643 PREPARE 0.001721 0.002301
- 2,747 DESCRIBE 0.000009 0.000009
- 2,890 OPEN 0.000019 0.000019
d 2,902 FETCH 1.885848 2.155228
= 2,973 CLOSE 0.000009 0.000009
***** Bottom of Data *****
MA a
    
```

- Call level statistics allows us to view metrics related to the individual parts of a query
- Delays, locks and miscellaneous stats may be useful to diagnose performance issues

DB2QM – Delay Statistics (1)

- Delays elongate the elapsed time of a query and should be investigated

```

IBM
2006/10/31 13:47:21 ----- Delay Statistics ----- Row 1 of 30
Option ==> _____ Scroll ==> CSR

DB2 SSID: DSNB   Plan: ADB       DBRM: ADBMAIN   Coll: ADBL
                Cursor: C1          Section:      1
                Stmt: 2,902        Type: FETCH

-----+
Delay Event                Event Count    Delay Time
Lock or Latch Delays             0          0.00000
Synchronous I/O Delays           5          0.01181
  Database I/O Delays             5          0.01181
  Log Write I/O Delays            0          0.00000
Other Read Delays                14         0.09316
Other Write Delays                0          0.00000
Service Task Switch Delays       0          0.00000
Update Commit Delays             0          0.00000
Open/Close Delays                0          0.00000
SYSLGRNG Rec Delays              0          0.00000
EXT/DEL/DEF Delays               0          0.00000
Other Service Delays             0          0.00000
Archive Log Quiesce Delays       0          0.00000

Valid Commands: (End)

MA a

```

DB2QM – Lock Related Statistics (2)

```
IBM
2006/10/31 13:47:53 ----- Lock Related Statistics ----- Row 1 of 26
Option ==> _____ Scroll ==> CSR

DB2 SSID: DSNB      Plan: ADB          DBRM: ADBMAIN   Coll: ADBL
                  Cursor: C1             Section:      1
                  Stmt: 2,902           Type: FETCH

-----+
Lock Event                Event Count
Lock Deadlocks             0
Lock Suspensions           0
Lock Timeouts              0
Latch Suspensions          0
Other Suspensions          0
Lock Requests              6,857
Unlock Requests            6,857
Query Requests             0
Change Requests            0
Other Requests             0
Claim Requests             0
Claim Failures             0
Drain Requests             0

Valid Commands: (End)

MA a
```

- High lock requests should be investigated – be sure the isolation level requested is appropriate

DB2QM – Miscellaneous Statistics

```
IBM
2006/10/31 13:48:46 ----- Miscellaneous Statistics ----- Row 1 of 40
Option ==> _____ Scroll ==> CSR

DB2 SSID: DSNB      Plan: ADB      DBRM: ADBMAIN   Coll: ADBL
                  Cursor: C1          Section:      1
                  Stmt: 2,902      Type: FETCH

-----+
Event                Time/Count
Trigger Elapsed Time    0.000000
Trigger DB2 CPU Time    0.000000
UDF Application Elapsed Time 0.000000
UDF Application CPU Time 0.000000
UDF DB2 Elapsed Time    0.000000
UDF DB2 CPU Time        0.000000
SP Application Elapsed Time 0.000000
SP Application CPU Time 0.000000
SP DB2 Elapsed Time     0.000000
SP DB2 CPU Time         0.000000
RIDLIST Used           0
RIDLIST Failed - No Storage 0
RIDLIST Failed - Limit Exceeded 0

Valid Commands: (End)

MA a
```

- Miscellaneous statistics provide us with details on triggers, user-defined functions, stored procedures and more
- RIDLIST failures can have a significant impact on query performance and warrant further investigation

DB2QM – View Historical Data

- Historical data may be accessed by using PF4/PF6 or the 'INTV' primary command

```

IBM
2006/10/31 13:50:06 ----- Display Exceptions ----- Row 1 of 5
Option ==> intv Scroll ==> CSR
DB2 QM Subsystem: DBQM Interval Start Date: 10/31/2006 Time: 11:01:10
Filters Enabled: N Interval End Date: CURRENT Time: CURRENT
C:A-Analyze,B-Buffers,C-Calls,D-Delays,L-Locks,O-Objects,S-SQL Text
H-Host Variables,P-Parallel Activity,Q-Misc Stats
-----
CMD SSID Plan Program DB2 CPU Time DB2 Elapsed GETPAGES SQLCODE
-----
- DSNB ADB ADBMAIN 1.887607 2.157569 8,838 +100
- DSNB ADB ADBMAIN 0.018129 0.020690 617 +100
- DSNB ADB ADBMAIN 0.001336 0.001358 2 -601
- DSNB ADB ADBMAIN 0.018585 0.063918 617 +100
- DSNB ADB ADBMAIN 0.053786 2.772239 8,820 +100
***** Bottom of Data *****
MA a

```


DB2QM – Interval Selection of Historical Data

2006/10/31 13:50:47 Interval Selection Row 1 of 30
Option ==> Scroll ==> CSR

C:D-Datasets,S>Select Interval

CMD	AVAIL	START	END	INTERVAL NUMBER
S	YES	10/31/2006 - 11:01:10		6096
S	YES	10/31/2006 - 7:01:10	10/31/2006 - 11:01:10	6095
S	YES	10/31/2006 - 3:01:10	10/31/2006 - 7:01:10	6094
S	YES	10/30/2006 - 23:01:10	10/31/2006 - 3:01:10	6093
-	YES	10/30/2006 - 19:01:10	10/30/2006 - 23:01:10	6092
-	YES	10/30/2006 - 15:01:10	10/30/2006 - 19:01:10	6091
-	YES	10/30/2006 - 11:01:10	10/30/2006 - 15:01:10	6090
-	YES	10/30/2006 - 7:01:10	10/30/2006 - 11:01:10	6089
-	YES	10/30/2006 - 4:02:26	10/30/2006 - 7:01:10	6088
-	YES	10/30/2006 - 0:02:26	10/30/2006 - 4:02:26	6087
-	YES	10/29/2006 - 20:02:26	10/30/2006 - 0:02:26	6086
-	YES	10/29/2006 - 16:02:26	10/29/2006 - 20:02:26	6085
-	YES	10/29/2006 - 12:02:26	10/29/2006 - 16:02:26	6084
-	YES	10/29/2006 - 8:02:26	10/29/2006 - 12:02:26	6083
-	YES	10/29/2006 - 4:02:26	10/29/2006 - 8:02:26	6082
-	YES	10/29/2006 - 0:02:26	10/29/2006 - 4:02:26	6081

MA a

- The length of an interval and the number of intervals to keep is controlled by a start-up parameter
- Multiple intervals may be selected for viewing
- Data from the underlying VSAM data sets may be loaded into DB2 tables for analysis using SQL

DB2QM – Multiple Intervals Displayed

```

IBM
2006/10/31 13:51:23 ----- Display Exceptions ----- Row 1 of 8
Option ==> Scroll ==> CSR
DB2 QM Subsystem: DBQM Interval Start Date: 10/30/2006 Time: 23:01:10
Filters Enabled: N Interval End Date: CURRENT Time: CURRENT
C:A-Analyze,B-Buffers,C-Calls,D-Delays,L-Locks,O-Objects,S-SQL Text
H-Host Variables,P-Parallel Activity,Q-Misc Stats
-----
CMD SSID Plan Program DB2 CPU Time DB2 Elapsed GETPAGES SQLCODE
-----
- DSNB ADB ADBMAIN 1.887607 2.157569 8,838 +100
- DSNB ADB ADBMAIN 0.018129 0.020690 617 +100
- DSNB ADB ADBMAIN 0.001336 0.001358 2 -601
- DSNB ADB ADBMAIN 0.018585 0.063918 617 +100
- DSNB ADB ADBMAIN 0.053786 2.772239 8,820 +100
- DSNB ADB ADBMAIN 0.115398 2.944799 9,363 0
- DSNB ADB ADBMAIN 0.056781 2.600002 8,852 +100
- DSNB ADB ADBMAIN 0.005011 0.006137 357 -803
***** Bottom of Data *****
MA a
    
```

- We're now seeing data for the current and 3 previous intervals
- The 'CURRENT' primary command may be used to return to the current interval data

DB2QM – View Negative SQL Codes

```
IBM
2006/10/31 13:53:32 ---- IBM DB2 Query Monitor for z/OS ----
Option ==> n
DB2 QM Subsystem ID: DBQM (? to Select)          User: DBA560
                                                Release: CQM V2R2M0
-----
U.  View Activity Summaries
A.  View Current Activity
E.  View Exceptions
M.  Work with Monitoring Agents
P.  Work with Profiles
N.  View SQLCODEs
C.  View DB2 Command Activity
S.  Setup
X.  Exit Query Monitor

Enter END command to return to ISPF.

MA a
```

- Negative SQL codes may represent significant wasted resources and should be investigated
- Use option 'N' to view negative SQL codes
- The monitoring profile may be used to exclude the collection of SQL codes which represent common programming techniques – e.g., Singleton select (-811)

DB2QM – View SQL Code Details

```

IBM
2006/10/31 13:53:41 ----- DB2 QM SQL Code Summary ----- Row 1 of 3
Option ==> Scroll ==> CSR
DB2 QM Subsystem: DBQM          Interval Start Date: 10/31/2006   Time: 11:01:10
                               Interval End   Date: CURRENT       Time: CURRENT
Group by  S  (SQLCODE, AuthID, DBRM/Package, Plan)
           Specify "*" for no grouping
C: A-AUTHIDs, D-DBRMs/Packages, P-Plans, S-Select
-----
CMD  SQLCODE  Occurrences
-----
s  -204      1
=  -601      1
-  -30081    3
***** Bottom of Data *****

```

- Use 'Group by' option to view by code, user, etc.
- Start-up parameters limit the number of discrete codes captured per interval as well as the number of occurrences per code
- An '*' next to the occurrence count indicates the limit for capturing has been exceeded

DB2QM – View SQLCA

- Use the 'C' line command to view the SQL communications area

```
IBM
2006/10/31 13:54:01 --- DB2 QM SQL Code Detail Display --- Row 1 of 1
Option ==>
DB2 QM Subsystem: DBQM          Interval Start Date: 10/31/2006   Time: 11:01:10
                               Interval End   Date: CURRENT         Time: CURRENT
Detail data captured for SQLCODE: -204
C: C-SQLCA,S-SQL text
-----
CMD  SSID Plan      DBRM\Package  JOBNAME  STMT#  Collection ID  SECT#  AUTHID
-----
c   DSNB ADB       ADBMAIN      DBA560   2,643  ADBL          1     DBA560
***** Bottom of Data *****
MA a
```

DB2QM – SQLCA Display

- Examine the SQL error for potential training topics

```
IBM
2006/10/31 16:36:29 ----- SQLCA Display ----- Row 1 of 32
Option ==> _____ Scroll ==> CSR

DB2 SSID: DSNB      Plan: ADB          DBRM: ADBMAIN   Coll: ADBL
                  Cursor: C1          Section:      1
                  Stmt:  2,643       Type: PREPARE
-----+-----
DSNT408I  SQLCODE = -204, ERROR:  DBA560.EMP1 IS AN UNDEFINED NAME
DSNT418I  SQLSTATE  = 42704 SQLSTATE RETURN CODE
DSNT415I  SQLERRP   = DSNX0TL SQL PROCEDURE DETECTING ERROR
DSNT416I  SQLERRD   = -500  0  0  -1  0  0 SQL DIAGNOSTIC INFORMATION
DSNT416I  SQLERRD   = X'FFFFFFE0C' X'000000000' X'000000000'
                  X'FFFFFFFFF' X'000000000' X'000000000' SQL DIAGNOSTIC
                  INFORMATION

SQLCAID      SQLCA
SQLCABC      136
SQLCODE      -204
SQLERRML     11
SQLERRMC     DBA560.EMP1
SQLERRP      DSNX0TL

Valid Commands: (End)

MA a
```

DB2QM – View SQL Text

- Use the 'S' line command to view the SQL text

```
IBM
2006/10/31 13:54:37 --- DB2 QM SQL Code Detail Display --- Row 1 of 1
Option ==>
Scroll ==> CSR
DB2 QM Subsystem: DBQM Interval Start Date: 10/31/2006 Time: 11:01:10
Interval End Date: CURRENT Time: CURRENT
Detail data captured for SQLCODE: -204
C: C-SQLCA (S) SQL text
-----
CMD  SSID  Plan    DBRM\Package  JOBNAME  STMT#  Collection ID  SECT#  AUTHID
-----
s   DSNB  ADB     ADBMAIN      DBA560   2,643  ADBL          1     DBA560
***** Bottom of Data *****
MA a
```

DB2QM – SQL Text Display

- Examine the SQL text for potential training topics

```
IBM
2006/10/31 13:54:53 ---- Display SQL Statement Text ---- Row 1 of 2
Option ==> _____ Scroll ==> CSR

DB2 SSID: DSNB Plan: ADB DBRM: ADBMAIN Coll: ADBL
Cursor: C1 Section: 1
-----

SELECT *
FROM DBA560.EMP1
***** Bottom of Data *****

Valid Commands: (Export, End)

MA a
```

DB2QM – Java Client (1)

The screenshot displays the DB2 Query Monitor (DB2QMDEMO:administrator) Java client interface. The main window is titled "DB2 Query Monitor (DB2QMDEMO:administrator)" and contains several panes:

- Activity Browser:** Shows a tree view of the database structure, including Data Sharing Groups, Systems, and various users like MVSNA, DSNB, and User.
- Activity Summaries(Operational) : User(7 rows):** A table showing performance metrics for different users.

User	Calls	Elapsed	% Elapsed	Avg Elaps
APERKIN	1002	6:30.963	58.68	0
DB2PM	803207	4:26.141	39.94	0
DBA031	3478	6.014	0.90	0
DBA560	88343	2.167	0.33	0
DNET132	149	0.408	0.06	0
DNET467	483	0.066	0.01	0
KLTAILO	2431	0.513	0.08	0
- Details:** A pane showing various system properties and their values, such as Lock Deadlocks (0), Lock Suspensions (0), and Lock Requests (6881).
- Query Monitor:** A section for monitoring queries and alerts.
- Alert Browser:** A table of alerts with columns for Ack., Pri., Correlation, Exception Type, Sub., and System.

Ack.	Pri.	Correlation	Exception Type	Sub.	System
<input type="checkbox"/>	4		Application Coding Error		MVSA
<input type="checkbox"/>	3		General Sql Error		MVSA
<input type="checkbox"/>	4		Application Coding Error		MVSA
- Default Message Board (27):** A section showing 27 messages, with 27 unacknowledged. The status is "Ready".

- The Java client may be used as an alternative to the ISPF interface
- The Java client offers a message board for alerts
- Data from the various windows may be saved to a file on the workstation

DB2QM – Java Client (2)

DB2 Query Monitor (DB2QMDEMO:administrator)

File Edit View Tools Help

Activity Browser

Trees Details

Perspective: Activity Summaries(Operational)

Activity Summaries(Operational) : 1(2 rows)

Calls	Elapsed	% Elapsed	Avg Elapsed	CP
1	0.001	0.06	0.001	
88325	2.157	99.94	0.000	

Details

Locks Delays Buffer Pool
Misc Text General

```
SELECT *
FROM SYSIBM.SYSCOLUMNS
```

Query Monitor

Alert Browser Priority: [Icons]

Ack.	Pri.	Correlation	Exception Type	Sub.	System
<input type="checkbox"/>	4		Application Coding Error		MVSA
		A sql statement received SQL code -204, MessageTokens DBA560.EMP1			
<input type="checkbox"/>	3		General Sql Error		MVSA
		A sql statement received SQL code -401, MessageTokens			
<input type="checkbox"/>	4		Application Coding Error		MVSA
		A sql statement received SQL code -206, MessageTokens PHONE			

Application Coding Error: A sql statement received SQL code -204, MessageTokens DBA560.EMP1

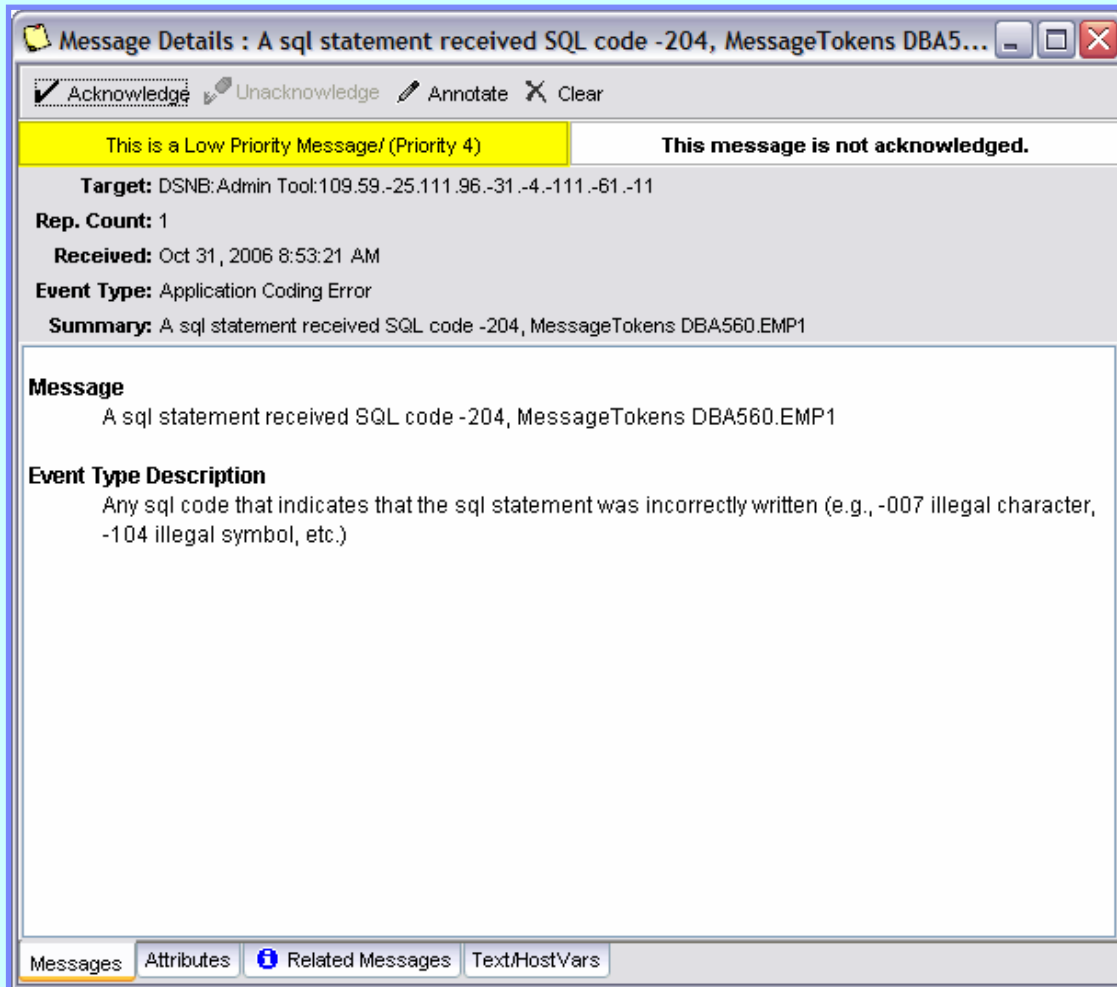
Default Message Board (27)

27 messages (27 unacknowledged) Ready.

➤ The data we saw earlier related to an exception is displayed at the top of the interface

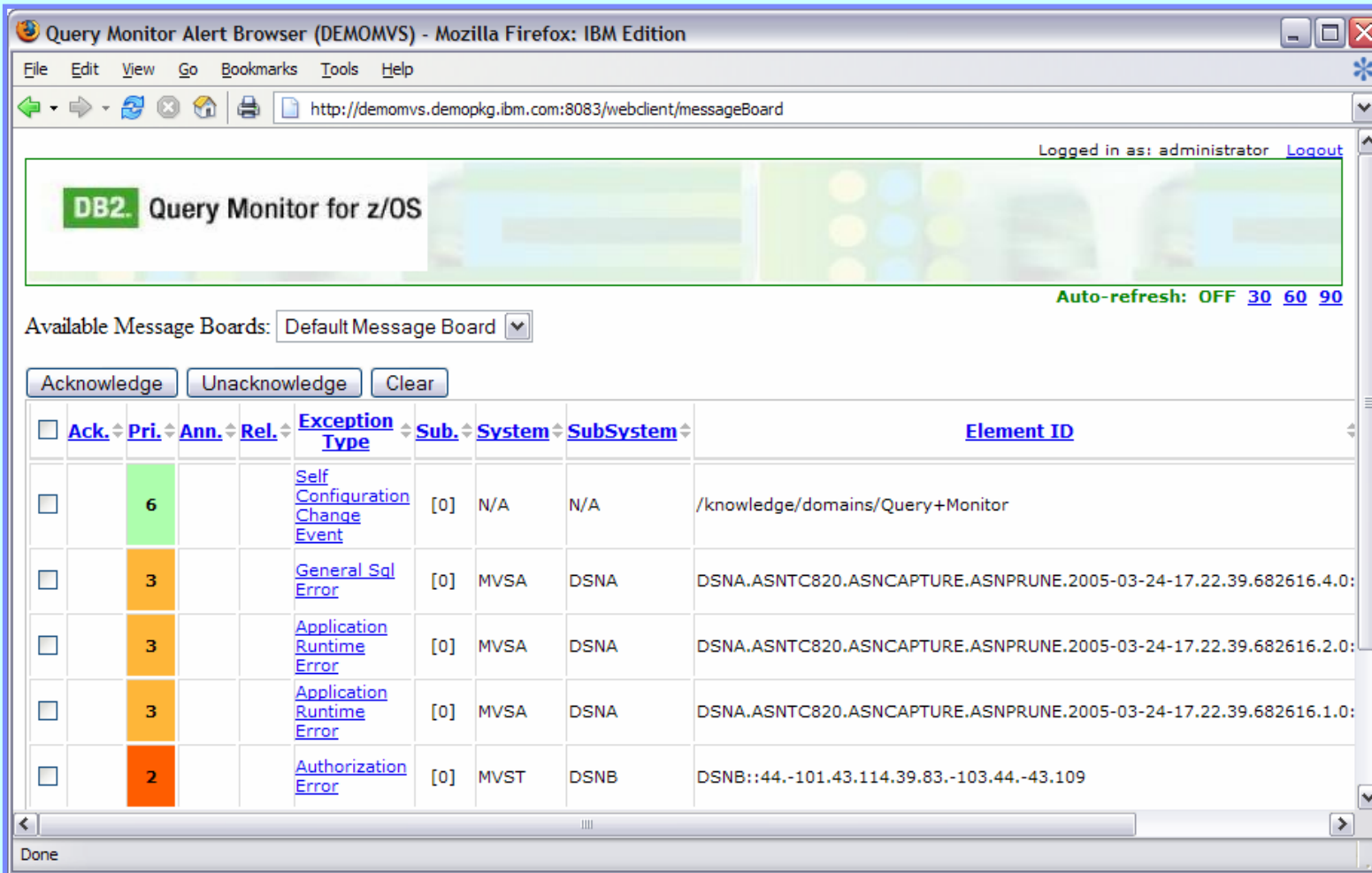
➤ The negative SQL error we investigated is displayed in the message board

DB2QM – Java Client / SQL Error Details



- Double-clicking on an event in the message board opens up a detail window – notice the tabs at the bottom for more details

DB2QM – Web-based Message Board



Query Monitor Alert Browser (DEMOMVS) - Mozilla Firefox: IBM Edition

File Edit View Go Bookmarks Tools Help

http://demomvs.demopkg.ibm.com:8083/webclient/messageBoard

Logged in as: administrator Logout

DB2 Query Monitor for z/OS

Auto-refresh: OFF 30 60 90

Available Message Boards: Default Message Board

Acknowledge Unacknowledge Clear

<input type="checkbox"/>	Ack	Pri	Ann	Rel	Exception Type	Sub	System	SubSystem	Element ID
<input type="checkbox"/>		6			Self Configuration Change Event	[0]	N/A	N/A	/knowledge/domains/Query+Monitor
<input type="checkbox"/>		3			General Sql Error	[0]	MVSA	DSNA	DSNA.ASNTC820.ASNCAPTURE.ASNPRUNE.2005-03-24-17.22.39.682616.4.0:
<input type="checkbox"/>		3			Application Runtime Error	[0]	MVSA	DSNA	DSNA.ASNTC820.ASNCAPTURE.ASNPRUNE.2005-03-24-17.22.39.682616.2.0:
<input type="checkbox"/>		3			Application Runtime Error	[0]	MVSA	DSNA	DSNA.ASNTC820.ASNCAPTURE.ASNPRUNE.2005-03-24-17.22.39.682616.1.0:
<input type="checkbox"/>		2			Authorization Error	[0]	MVST	DSNB	DSNB::44.-101.43.114.39.83.-103.44.-43.109

Done

- The message board may be accessed via a web browser
- Alerts go to the message board – exceptions do not
- Clicking on a hyperlink will display the details for the event
- Notice the auto-refresh option at the top right

DB2QM – View Summarized Data

```
IBM
2006/10/31 14:04:41 ---- IBM DB2 Query Monitor for z/OS ----
Option ==> u
-----
DB2 QM Subsystem ID: DBQM (? to Select)           User: DBA560
                                                    Release: CQM V2R2M0
-----
U. View Activity Summaries           N. View SQLCODEs
A. View Current Activity             C. View DB2 Command Activity
E. View Exceptions
M. Work with Monitoring Agents       S. Setup
P. Work with Profiles                X. Exit Query Monitor

Enter END command to return to ISPF.

MA a
```

- Summarized data does not show individual SQL statement executions, but may be a good way to find SQL statements that use a high amount of resources

DB2QM – Select Summary Level

```
IBM
2006/10/31 14:04:41 ---- IBM DB2 Query Monitor for z/OS ----
0
----- Select Summary Level -----
Option ==> r_
-- Operational --                -- Structural --
2) DB2                          5) DB2
P) Plan                          N) Database
(R) DBRM/Package                 F) Buffer Pool
U) AuthID                        G) Page Set

Enter END command to return to ISPF.
MA a
```

- Query Monitor summarizes data by subsystem, plan and package
- Summarization by AUTHID as well as object data collection is controlled by start-up and profile settings

DB2QM – Package Summary Display

- SQL text is available for summarized data
- Individual executions of an SQL statement cannot be seen in summarized data

```

IBM
2006/10/31 14:11:33 ----- Operational Summaries ----- Row 7 of 17
Option ==> Scroll ==> CSR
DB2 QM Subsystem: DBQM      Interval Start Date: 10/31/2006  Time: 11:01:10
Filters Enabled: N          Interval End Date: CURRENT      Time: CURRENT
DB2:      Plan:      Pgm:      Authid:
          Section:   Call:      Type:
          WSUser:    WSName:
          WSTran:    CorrID:
C:2-DB2,P-Plan,R-Pgm,U-Authid,I-Corr,T-Sect,C-Call,W-WSUser,M-WSName,N-WSTran
S-SQL,0-Objs,D-Delay,B-Buff,L-Lock,Q-Misc Stats,E-Exceptions,A-Curr Activity
----- -+>
CMD Program      Calls      Elapsed    %Elap     Avg Elapsed
-----
-  DGO@DATE        486288    18.240746  2.65     0.000037
-  DGO@PC1         27630     3:09.124634 27.49    0.006844
-  DGO@PC2        326034    1:10.657011 10.27    0.000216
-  DGO@PC4         11052     0.884513   0.12     0.000080
-  DGO@WR2C        6819      5.450529   0.79     0.000799
-  DSNAPCOL        308       0.055661   0.00     0.000180
-  DSNESM68         48        6:13.583172 54.31    7.782982
-  DSNUTILS        436       0.014088   0.00     0.000032
-  SQLC2E07         70        0.007108   0.00     0.000101
-  SYSSH200        5994      6.562168   0.95     0.001094
    
```

DB2QM – Sort Displayed Data

2006/10/31 14:11:44 ----- Operational Summaries ----- Row 7 of 17
 Option ==> **sort 4 d** Scroll ==> CSR
 DB2 QM Subsystem: DBQM Interval Start Date: 10/31/2006 Time: 11:01:10
 Filters Enabled: N Interval End Date: CURRENT Time: CURRENT
 DB2: Plan: Pgm: Authid:
 Section: Call: Type:
 WSUser: WSName:
 WSTran: CorrID:
 C:2-DB2,P-Plan,R-Pgm,U-Authid,I-Corr,T-Sect,C-Call,W-WSUser,M-WSName,N-WSTran
 S-SQL,O-Objs,D-Delay,B-Buff,L-Lock,Q-Misc Stats,E-Exceptions,A-Curr Activity
 <-+>

CMD	CPU	%CPU	Avg CPU	<%CPU>	DELAY	%DELAY
-	15.341325	6.21	0.000031	84.10	0.014004	0.00
-	2:50.115518	68.90	0.006156	89.94	0.000000	0.00
-	57.464661	23.27	0.000176	81.32	0.015797	0.00
-	0.774901	0.31	0.000070	87.60	0.000000	0.00
-	0.443061	0.17	0.000064	8.12	4.876660	1.25
-	0.031843	0.01	0.000103	57.20	0.021966	0.00
-	0.020559	0.00	0.000428	0.00	6:13.559602	96.33
-	0.013579	0.00	0.000031	96.38	0.000000	0.00
-	0.001678	0.00	0.000023	23.61	0.005326	0.00
-	0.475912	0.19	0.000079	7.25	6.050248	1.56

- Any panel may be sorted using the 'SORT' or 'CSORT' primary commands
- Sorting is based on column number – the 'CMD' column is column number 1
- Use 'CNUM' to toggle on/off column numbers

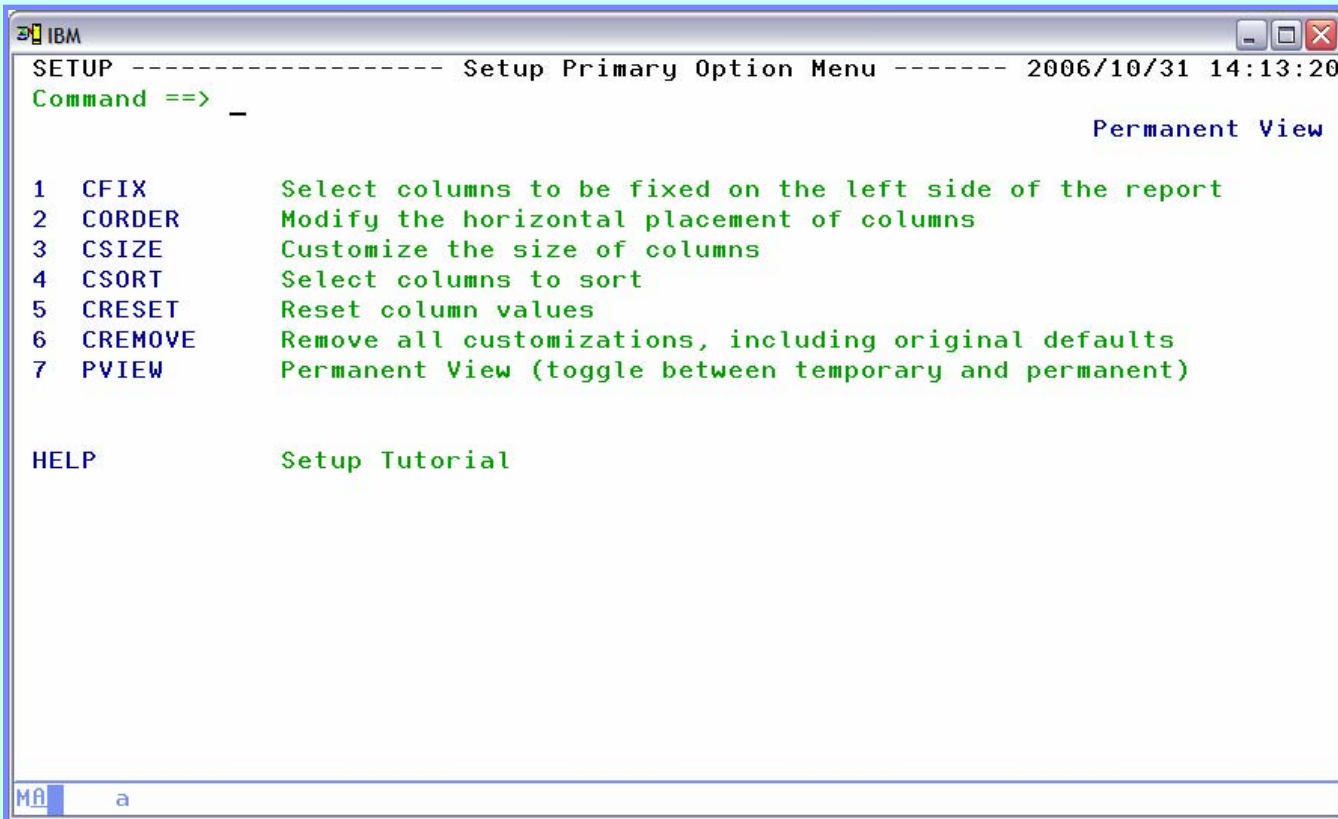
DB2QM – Manage Display Characteristics

- Use 'CSETUP' to change display attributes

```

IBM
2006/10/31 14:13:01 ----- Operational Summaries ----- Row 1 of 17
Option ==> csetup_ Scroll ==> CSR
DB2 QM Subsystem: DBQM Interval Start Date: 10/31/2006 Time: 11:01:10
Filters Enabled: N Interval End Date: CURRENT Time: CURRENT
DB2: Plan: Pgm: Authid:
      Section: Call: Type:
      WSUser: WSName:
      WStran: CorrID:
C:2-DB2,P-Plan,R-Pgm,U-Authid,I-Corr,T-Sect,C-Call,W-WSUser,M-WSName,N-WStran
S-SQL,0-Objs,D-Delay,B-Buff,L-Lock,Q-Misc Stats,E-Exceptions,A-Curr Activity
----- < +>
CMD CPU %CPU Avg CPU <%CPU> DELAY %DELAY
-----
- 2:52.336060 68.91 0.006157 89.91 0.000000 0.00
- 0.020559 0.00 0.000428 0.00 6:13.559602 96.29
- 58.216273 23.27 0.000176 81.26 0.015797 0.00
- 0.013755 0.00 0.000144 13.63 0.085816 0.02
- 0.032039 0.01 0.000138 36.03 0.053520 0.01
- 0.023534 0.00 0.000127 0.13 0.022139 0.00
- 0.031843 0.01 0.000103 57.20 0.021966 0.00
- 0.000329 0.00 0.000082 99.21 0.000000 0.00
- 0.477560 0.19 0.000079 7.26 6.056196 1.56
- 0.785055 0.31 0.000070 87.61 0.000000 0.00
    
```

DB2QM – Setup Options Menu



```
IBM
SETUP ----- Setup Primary Option Menu ----- 2006/10/31 14:13:20
Command ==> _
Permanent View

1 CFIX      Select columns to be fixed on the left side of the report
2 CORDER    Modify the horizontal placement of columns
3 CSIZE     Customize the size of columns
4 CSORT     Select columns to sort
5 CRESET    Reset column values
6 CREMOVE   Remove all customizations, including original defaults
7 PVIEW     Permanent View (toggle between temporary and permanent)

HELP       Setup Tutorial

MA a
```

- Options are stored in each user's ISPF profile data set
- Commands listed on this panel may be used as primary commands without first issuing 'CSETUP'

DB2QM – View Package SQL Text

- We've sorted the package summary to bring the highest average user of CPU to the top – we'll use the 'S' line command to view the SQL text

```

IBM
2006/10/31 14:13:33 ----- Operational Summaries ----- Row 1 of 17
Option ==> Scroll ==> CSR
DB2 QM Subsystem: DBQM      Interval Start Date: 10/31/2006  Time: 11:01:10
Filters Enabled: N          Interval End Date: CURRENT      Time: CURRENT
DB2:      Plan:      Pgm:      Authid:
          Section:   Call:      Type:
          WSUser:    WSName:
          WSTran:    CorRID:
C:2-DB2,P-Plan,R-Pgm,U-Authid,I-Corr,T-Sect,C-Call,W-WSUser,M-WSName,N-WSTran
S-SQL,0-Objs,D-Delay,B-Buff,L-Lock,Q-Misc Stats,E-Exceptions,A-Curr Activity
----- < +>
CMD      CPU      %CPU      Avg CPU <%CPU>      DELAY %DELAY
-----
s      2:52.336060 68.91      0.006157 89.91      0.000000 0.00
=      0.020559 0.00      0.000428 0.00      6:13.559602 96.29
-      58.216273 23.27      0.000176 81.26      0.015797 0.00
-      0.013755 0.00      0.000144 13.63      0.085816 0.02
-      0.032039 0.01      0.000138 36.03      0.053520 0.01
-      0.023534 0.00      0.000127 0.13      0.022139 0.00
-      0.031843 0.01      0.000103 57.20      0.021966 0.00
-      0.000329 0.00      0.000082 99.21      0.000000 0.00
-      0.477560 0.19      0.000079 7.26      6.056196 1.56
-      0.785055 0.31      0.000070 87.61      0.000000 0.00
    
```


DB2QM – View Full SQL Text

- Use the 'V' line command to see the entire SQL statement text

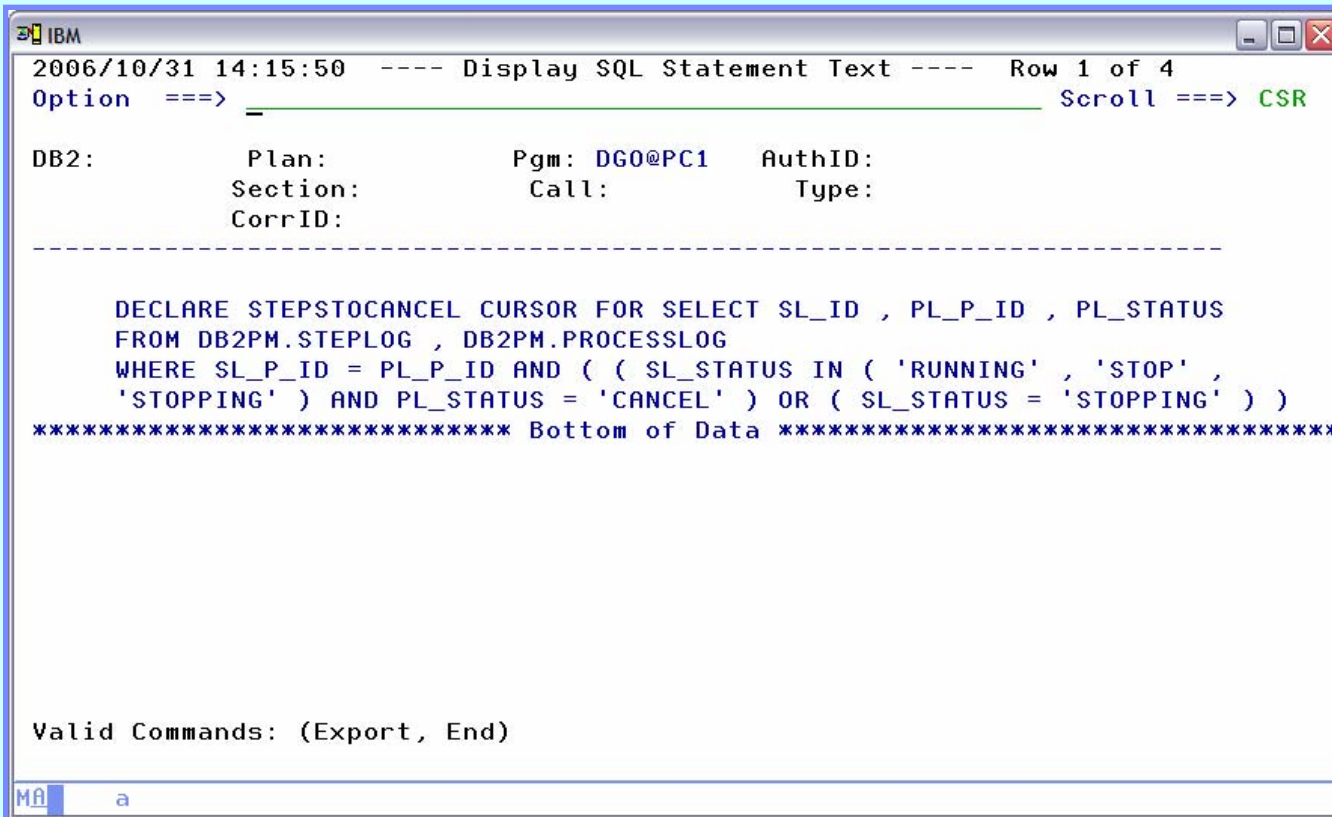
```

IBM
2006/10/31 14:15:08 ---- Activity by SQL Text ---- Row 1 of 5
Option ==>
DB2 QM Subsystem: DBQM          Interval Start Date: 10/31/2006   Time: 11:01:10
Filters Enabled: N              Interval End   Date: CURRENT       Time: CURRENT
DB2:      Plan:      Pgm: DGO@PC1   Authid:
        Section:    Call:      Type:
        WSUser:     WSName:
        WSTran:
CorrID:
C:0-0bjs,D-Delay,B-Buffer Pool,L-Lock,A-Analyze,V-View,Q-Misc Stats
-----
CMD SQL Text                                Calls DB2  Plan
-----
- SELECT P_SCHEDULE INTO : H : H FROM DB2P    1883 DSNB DB2PM
v DECLARE STEPSTOCANCEL CURSOR FOR SELECT     5649 DSNB DB2PM
- DECLARE ACTPROCEXEC CURSOR FOR SELECT P     5649 DSNB DB2PM
- DECLARE CANCELPROCEXEC CURSOR FOR SELEC    5649 DSNB DB2PM
- COMMIT                                       9415 DSNB DB2PM
***** Bottom of Data *****

```

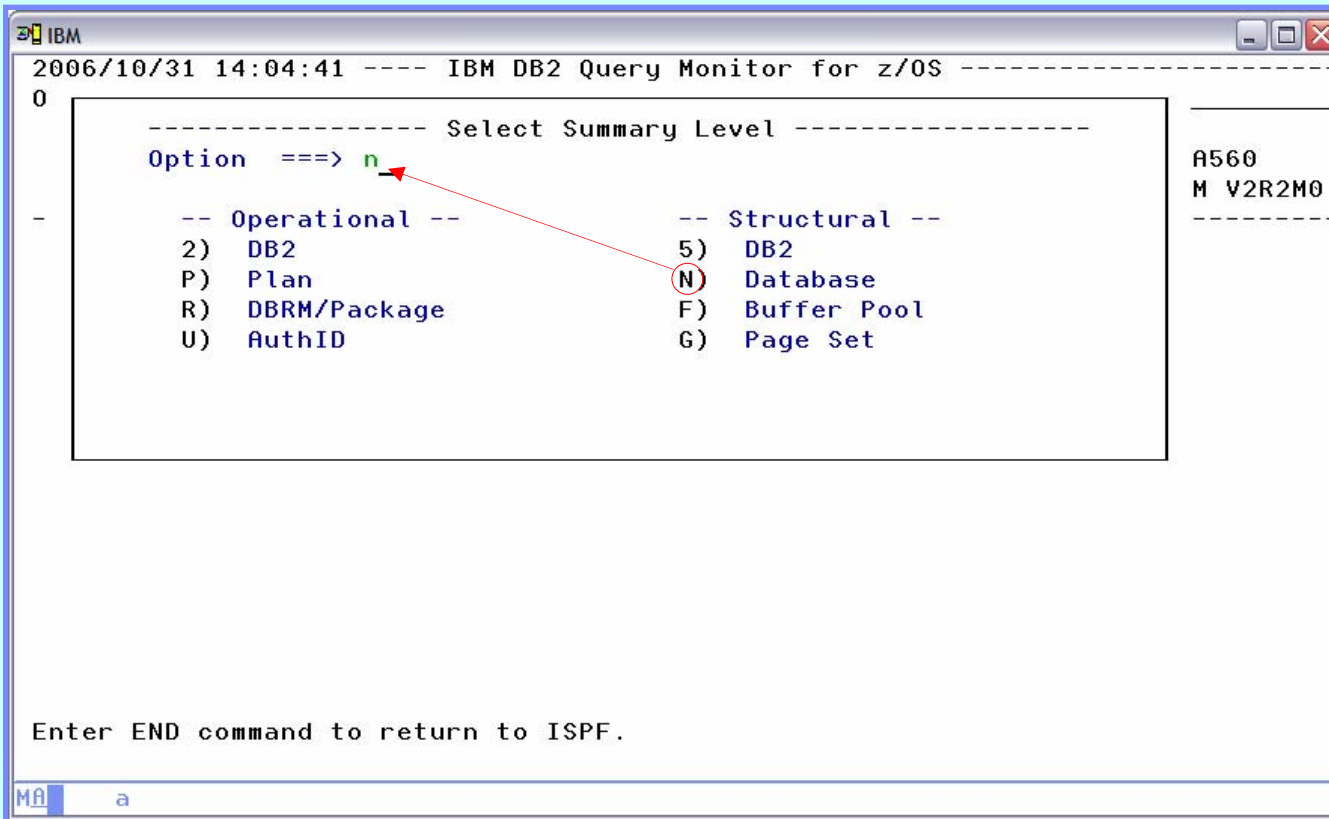
DB2QM – Full SQL Text Display

- Query Monitor will display the full 32K (V7) or 2MB (V8) of SQL text



```
IBM
2006/10/31 14:15:50 ---- Display SQL Statement Text ---- Row 1 of 4
Option ==> _____ Scroll ==> CSR
DB2:      Plan:      Pgm: DG0@PC1  AuthID:
          Section:   Call:      Type:
          CorrID:
-----
      DECLARE STEPSTOCANCEL CURSOR FOR SELECT SL_ID , PL_P_ID , PL_STATUS
      FROM DB2PM.STEPLLOG , DB2PM.PROCESSLOG
      WHERE SL_P_ID = PL_P_ID AND ( ( SL_STATUS IN ( 'RUNNING' , 'STOP' ,
      'STOPPING' ) AND PL_STATUS = 'CANCEL' ) OR ( SL_STATUS = 'STOPPING' ) )
      ***** Bottom of Data *****
Valid Commands: (Export, End)
MA a
```

DB2QM – View Database Summary Data



```
IBM
2006/10/31 14:04:41 ---- IBM DB2 Query Monitor for z/OS ----
0
----- Select Summary Level -----
Option ==> n
-- Operational --                -- Structural --
2) DB2                          5) DB2
P) Plan                          (N) Database
R) DBRM/Package                 F) Buffer Pool
U) AuthID                       G) Page Set

A560
M V2R2M0

Enter END command to return to ISPF.

MA a
```

- Structural data is collected based on start-up parameters
- Structural data may be more useful for tuning at the subsystem level, rather than the SQL statement level

DB2QM – View Object Detail

- At the object level we can drill down to get details on buffer pool, page set, and object details

```

IBM
2006/10/31 14:17:10 ----- Structural Summaries ----- Row 1 of 5
Option ==> Scroll ==> CSR
DB2 QM Subsystem: DBQM Interval Start Date: 10/31/2006 Time: 11:01:10
Filters Enabled: N Interval End Date: CURRENT Time: CURRENT
DB2: DBname: BPool: PageSet:
C:D-DB2,N-DataBase,B-Buffer Pool,P-Page set,0 Object Detail
-----
CMD Database GetPages Elapsed SyncRead SyncWrit SeqPftch LstPftch
-----
o DB2PM 578241 1.008725 0 0 0 0
= TEMPDB 2768 0.002757 0 0 0 0
- DSNDDB04 12 0.010533 4 0 4 0
- DSNDDB06 132262 8.787148 325 0 1114 8
- DSNDDB07 1311224 1.493610 1 0 5162 0
***** Bottom of Data *****
  
```

DB2QM – View Object Usage

2006/10/31 14:17:26.09 ----- Object Detail ----- Row 1 of 16
 Option ==> Scroll ==> CSR
 DB2 QM Subsystem: DBQM Interval Start Date: 10/31/2006 Time: 11:01:10
 Filters Enabled: N Interval End Date: CURRENT Time: CURRENT
 DB2: DBname: DB2PM BPool: Page set:
 C:U Usage,S-SQL

CMD	Type	Creator	Name	DataBase	BPool	PageSet	GetPages
-	TABLE	DB2PM	PROCESS	DB2PM	BP32K	PROCESS	5727
-	TABLE	DB2PM	STEP	DB2PM	BP32K	PROCESS	83996
-	INDEX	DB2PM	IX_PROCESSLOG	DB2PM	BP2	IXRP1C0B	3818
▼	INDEX	DB2PM	IX_PROCESS	DB2PM	BP2	IXRP1798	3818
u	TABLE	DB2PM	STEPLOG	DB2PM	BP32K	PROCESS	280623
=	TABLE	DB2PM	PROCESSLOG	DB2PM	BP32K	PROCESS	192809
-	INDEX	DB2PM	UIX_DB2A_SYSTEM	DB2PM	BP0	UIXRDB2A	588
-	TABLE	DB2PM	DB2C_APPLICATION	DB2PM	BP32K	ONLINE	196
-	INDEX	DB2PM	UIX_DB2C_SYSTEM	DB2PM	BP0	UIXRDB2C	2354
-	TABLE	DB2PM	DB2C_SYSTEM	DB2PM	BP32K	ONLINE	1374
-	INDEX	DB2PM	UIX_DB2CG_GATEWAY	DB2PM	BP0	UIXR1FRR	40
-	INDEX	DB2PM	IX_DB2C_GATEWAY	DB2PM	BP2	IXRDB2CR	40
-	TABLE	DB2PM	DB2C_GATEWAY	DB2PM	BP32K	ONLINE	2980
-	TABLE	DB2PM	VERSION	DB2PM	BP32K	PROCESS	80

MA a

- Tables and indexes are displayed in the object detail
- Drill down is limited to object usage, and SQL accessing objects

DB2QM – Object Usage Display

- Object usage allows us to determine the plans, packages and users that have accessed an object

```

IBM
2006/10/31 14:17:48.79 ----- Object Usage ----- Row 1 of 3
Option ==> _ Scroll ==> CSR
DB2 QM Subsystem: DBQM Interval Start Date: 10/31/2006 Time: 11:01:10
Filters Enabled: N Interval End Date: CURRENT Time: CURRENT
DB2: DBname: DB2PM BPool: BP32K Page set: PROCESS
Type: TABLE Creator: DB2PM Name: STEPLOG
----- >
PLAN PROGRAM USER CORRID WSUSER
-----
DB2PM DG0@PC2 DB2PM CXEGA03
DB2PM DG0@PC1 DB2PM CXEGA03
DB2PM DG0@PC4 DB2PM CXEGA03
***** Bottom of Data *****
MA a

```


DB2QM – View DB2 Command Activity

- Query Monitor captures all commands issued to DB2

```
IBM
2006/10/31 14:02:12 ---- IBM DB2 Query Monitor for z/OS ----
Option ==> c
-----
DB2 QM Subsystem ID: DBQM (? to Select)           User: DBA560
                                                    Release: CQM V2R2M0
-----
U.  View Activity Summaries           N.  View SQLCODEs
A.  View Current Activity             C.  View DB2 Command Activity
E.  View Exceptions
M.  Work with Monitoring Agents       S.  Setup
P.  Work with Profiles                X.  Exit Query Monitor

Enter END command to return to ISPF.

MA a
```


DB2QM – DB2 Commands Display

```

IBM
2006/10/31 14:04:04 ----- DB2 Command Activity ----- Row 22 of 28
Option ==> Scroll ==> CSR
DB2 QM Subsystem: DBQM Interval Start Date: 10/31/2006 Time: 11:01:10
Filters Enabled: N Interval End Date: CURRENT Time: CURRENT
-----
SSID JOBNAME AUTHID Command Timestamp Command Text
-----
DSNB APERKIN APERKIN 10/31/2006 - 11:35:00 -DIS UTIL(*)
DSNB APERKIN APERKIN 10/31/2006 - 11:34:55 -TERM UTIL(LOADCUST)
DSNB DSNBSPAS APERKIN 10/31/2006 - 11:35:30 -STOP TRACE(MON) TNO(13)
DSNB DSNBSPAS APERKIN 10/31/2006 - 11:35:30 -START TRACE(MON)
DSNB DBA560 DBA560 10/31/2006 - 14:03:23 -STO DATABASE(D560D71P)
DSNB DBA560 DBA560 10/31/2006 - 14:03:30 -DIS DB(D560D71P) SPACE(*) LIMIT(
DSNB DBA560 DBA560 10/31/2006 - 14:03:41 -STA DB(D560D71P) ACC(RW)
***** Bottom of Data *****
MA a

```

- Look for commands which could have an impact on user response, or perception of response
- Start trace commands could have a significant impact on subsystem performance

*Now that we know how
to find poorly performing SQL
let's see how we can make it better*





IBM Software Group

Optimizing the Performance of SQL with IBM Explain Tools



ON DEMAND BUSINESS™

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EXPLAIN SOLUTIONS FROM IBM

- Visual Explain
- DB2 SQL Performance Analyzer
- DB2 Path Checker



VISUAL EXPLAIN

- GUI interface for explaining SQL on various platforms including z/OS
- Feature of DB2
- Source of SQL
 - ▶ Key or cut and paste a SQL statement into the tool
 - ▶ Plan / Package
 - ▶ Existing entry in a PLAN_TABLE (retro explain)



VISUAL EXPLAIN – RETRO EXPLAIN

Click to display a graphical representation of the access path

Visual Explain

Subsystem Tools Plugin Properties Windows Help

Show Plan Table-DSNC

Statement View

All the rows are displayed. The number of rows is 2513.

QUERYNO	QBLOCKNO	APPLNAME	PROGNAME	PLANNO	METHOD	CREATOR	TNAME	TABNO	ACCESSTYPE	MATCHCOLS	AC
90000131	1		ANLMAIN	3	3			0		0	
90000133	1		ANLMAIN	1	0	DBA104	SS01TB01_DEPT	2	I	1	SY
90000133	1		ANLMAIN	2	1	DBA104	SS01TB02_EMP	1	I	1	DB
90000134	1		ANLMAIN	1	0	DBA104	SS01TB02_EMP	1	R	0	
90000135	1		ANLMAIN	1	0	DBA104	CANDIDATE	1	R	0	
90000135	1		ANLMAIN	2	1	DBA104	TEST_TAKEN	2	R	0	
90000135	1		ANLMAIN	3	3			0		0	
90000136	1		ANLMAIN	1	0	DBA104	CANDIDATE	1	R	0	
90000136	1		ANLMAIN	2	1	DBA104	TEST_TAKEN	2	R	0	
90000136	1		ANLMAIN	3	3			0		0	
90000137	1		ANLMAIN	1	0	DBA104	SS01TB01_DEPT	2	I	1	SY
90000137	1		ANLMAIN	2	1	DBA104	SS01TB02_EMP	1	I	1	DB
90000138	1		ANLMAIN	1	0	DBA104	SS01TB02_EMP	1	R	0	
0	1		SQLC2E07	1	0	DB2PMPDB	DB2PM_STAT_GENERAL	1	I	0	DB
0	1		SQLC2E07	2	3			0		0	
100000001	1		ANLPGM31	1	0	DBA104	CANDIDATE	1	R	0	
100000001	1		ANLPGM31	2	1	DBA104	TEST_TAKEN	2	R	0	
100000001	1		ANLPGM31	3	3			0		0	
100000002	1		ANLPGM31	1	0	DBA104	CANDIDATE	1	R	0	
100000002	1		ANLPGM31	2	1	DBA104	TEST_TAKEN	2	R	0	
100000002	1		ANLPGM31	3	3			0		0	
100000003	1		ANLPGM31	1	0	DBA104	SS01TB01_DEPT	2	I	1	SY
100000003	1		ANLPGM31	2	1	DBA104	SS01TB02_EMP	1	I	1	DB
100000004	1		ANLPGM31	1	0	DBA104	SS01TB02_EMP	1	R	0	

Tune S...

VISUAL EXPLAIN – GUI Access Path View

Visual Explain

Subsystem Tools Plugin Properties Windows Help

Tune SQL - DSN

File Access Plan Selected Action View

SQL Text Access Plan Execution Result Report Statistics Advisor

DB2 Platform: Z/OS DB2 Version: v8 Explain Time: 2006-10-31 13:44:24.36

query

Show attribute explanation Views: Cost estimati...

Name	Value
Type	SELECT
CPU Cost (ms)	5
CPU Cost (su)	115
Cost Category	A
Reason	
Timestamp	2006-10-31 13:44:24.36

Attribute explanation:
Type: Query type (SELECT, INSERT, UPDATE, DELETE, SELUPD, DELCUR, UPDCUR)

Save As... Print... Suggestions Help

Query Block 1

Access path

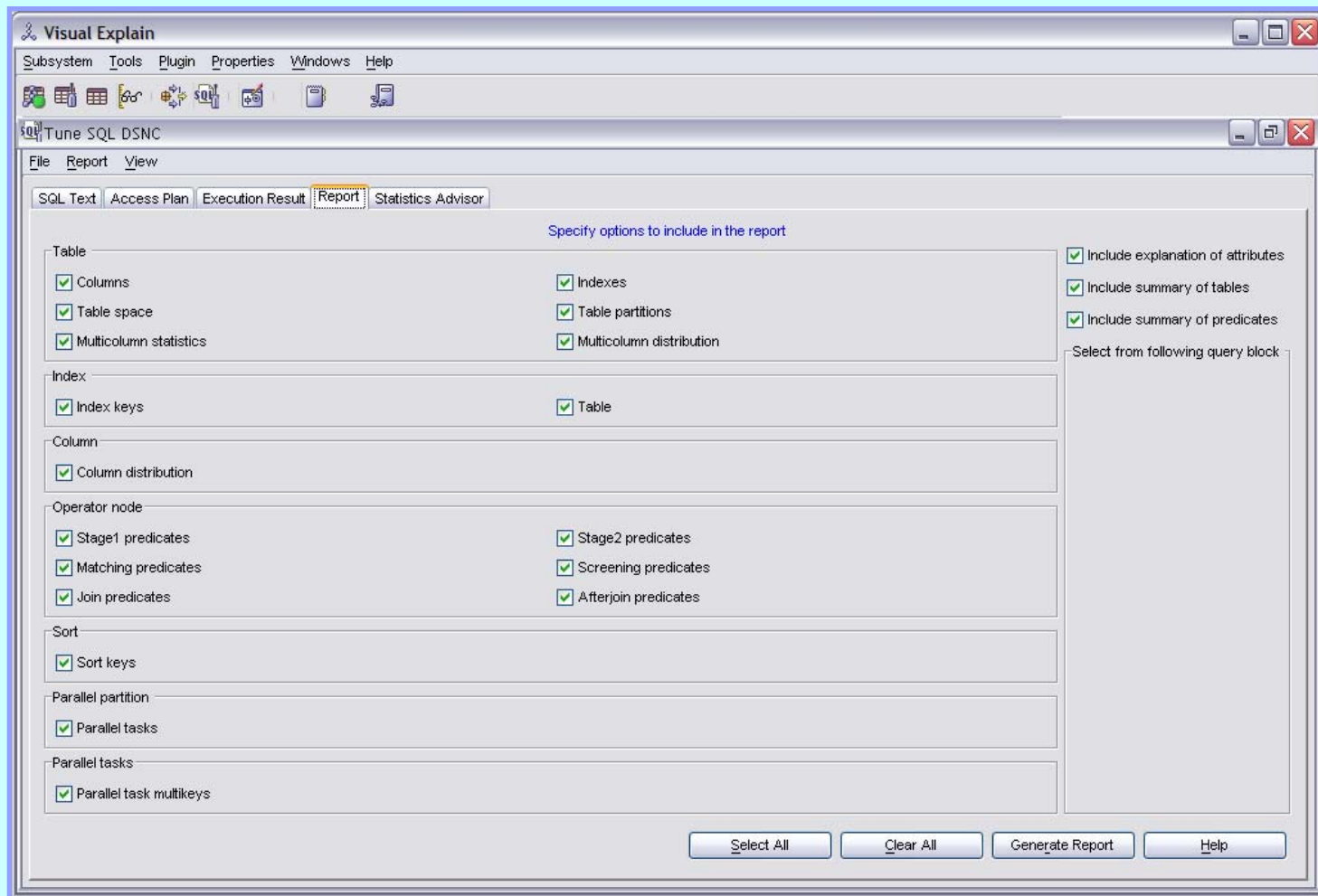
```

    graph TD
      Q[QUERY] --> QB1[QB1]
      QB1 --> NLJOIN[NLJOIN]
      NLJOIN --> F1[FETCH]
      NLJOIN --> F2[FETCH]
      F1 --> IXSCAN1[IXSCAN]
      IXSCAN1 --> XA01[XS01XA01  
25(default)]
      F1 --> TB01[GS01TB01_DEPT  
0]
      F2 --> IXSCAN2[IXSCAN]
      IXSCAN2 --> XA02[XS01XA02  
5]
      F2 --> TB02[GS01TB02_EMP  
54830]
    
```

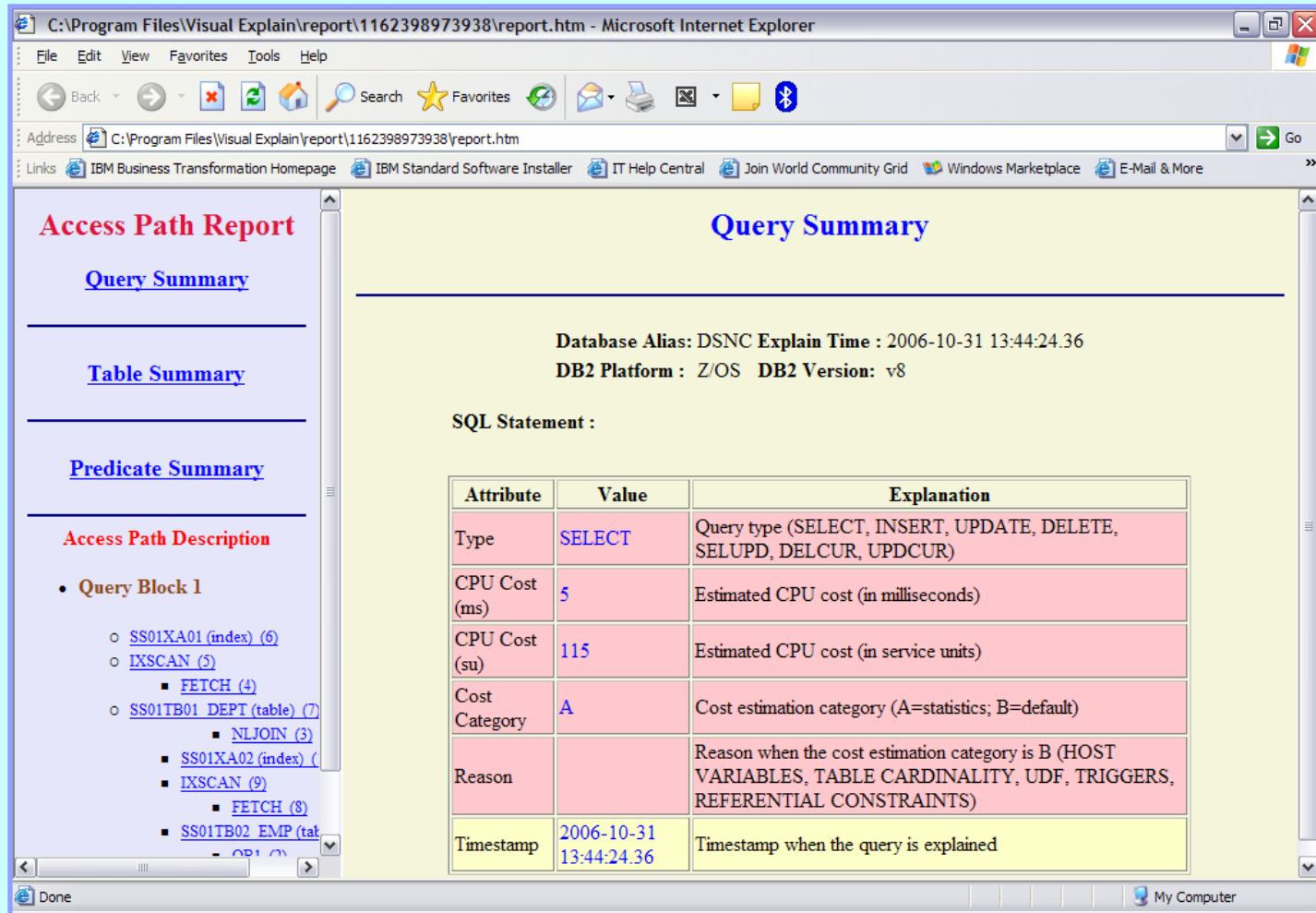
Cost



VISUAL EXPLAIN - Report Options



VISUAL EXPLAIN – Query Summary Report



Access Path Report

[Query Summary](#)

[Table Summary](#)

[Predicate Summary](#)

Access Path Description

- **Query Block 1**
 - [SS01XA01 \(index\) \(6\)](#)
 - [IXSCAN \(5\)](#)
 - [FETCH \(4\)](#)
 - [SS01TB01 DEPT \(table\) \(7\)](#)
 - [NLJOIN \(3\)](#)
 - [SS01XA02 \(index\) \(1\)](#)
 - [IXSCAN \(9\)](#)
 - [FETCH \(8\)](#)
 - [SS01TB02 EMP \(table\) \(1\)](#)
 - [OP1 \(1\)](#)

Query Summary

Database Alias: DSNCL Explain Time : 2006-10-31 13:44:24.36
DB2 Platform : Z/OS DB2 Version: v8

SQL Statement :

Attribute	Value	Explanation
Type	SELECT	Query type (SELECT, INSERT, UPDATE, DELETE, SELUPD, DELCUR, UPDCUR)
CPU Cost (ms)	5	Estimated CPU cost (in milliseconds)
CPU Cost (su)	115	Estimated CPU cost (in service units)
Cost Category	A	Cost estimation category (A=statistics; B=default)
Reason		Reason when the cost estimation category is B (HOST VARIABLES, TABLE CARDINALITY, UDF, TRIGGERS, REFERENTIAL CONSTRAINTS)
Timestamp	2006-10-31 13:44:24.36	Timestamp when the query is explained

VISUAL EXPLAIN – Predicate Summary Report

The screenshot shows a Microsoft Internet Explorer window displaying a report titled "Predicate Summary". The browser's address bar shows the file path: C:\Program Files\Visual Explain\report\1162399069078\report.htm. The report content is divided into a left-hand navigation pane and a main content area.

Left-hand navigation pane:

- Access Path Report** (highlighted in red)
- [Query Summary](#)
- [Table Summary](#)
- [Predicate Summary](#) (highlighted in blue)
- Access Path Description**
 - **Query Block 1**
 - [SS01XA01 \(index\) \(6\)](#)
 - [IXSCAN \(5\)](#)
 - [FETCH \(4\)](#)
 - [SS01TB01_DEPT \(table\) \(7\)](#)
 - [NLJOIN \(3\)](#)
 - [SS01XA02 \(index\) \(8\)](#)
 - [IXSCAN \(9\)](#)
 - [FETCH \(8\)](#)
 - [SS01TB02_EMP \(table\) \(10\)](#)

Main Content Area:

Predicate Summary

Predicate Number	Left-hand Side	Left-hand Side Column Cardinality	Predicate Type	Right-hand Side	Right-hand Side Column Cardinality	Filter Factor	Is Sargable	Is Join Predicate	Is After Join Predicate	Has parameter marker
1			AND			1	Y	N		N
2	DEPTNO	0	EQUAL	VALUE		0.04	Y	N		N
3	EMPNO	0	EQUAL	MGRNO	0	0.04	Y	Y		N

VISUAL EXPLAIN - Key in an SQL Statement

The screenshot shows the Visual Explain application window. The main area displays an SQL statement:

```
SELECT D.DEPT_NO, MIN(D.DEPT_NAME) AS DEPT_NAME,
       MIN(D.LOCATION) AS DEPT_LOCATION,
       SUM(E.SALARY) AS TOTAL_SALARY FROM
SSEMMWLH.GLWTDPT D, SSEMMWLH.GLWTEMP E WHERE
D.DEPT_NO = E.WORKDEPT AND
E.BONUS BETWEEN 0.00 AND 2000.00 GROUP BY
D.DEPT_NO;
```

Below the SQL statement, the 'Messages for Execution and Explain' section contains the following text:

```
The above query has been explained successfully with the
following warning :
1 Descriptor may be incomplete since no record is selected
from DSN_DETCOST_TABLE
```

At the bottom of the window, there are buttons for 'Explain with stored procedure', 'Explain', 'Execute', 'Analyze', and 'Help'. A yellow bracket on the right side of the SQL statement is labeled 'SQL', and another yellow bracket on the right side of the execution messages is labeled 'EXPLAIN EXECUTE ANALYZE'.

SQL

EXPLAIN
EXECUTE
ANALYZE



VISUAL EXPLAIN – Access Path Information

The screenshot shows the Visual Explain interface for a query. The main window displays an access plan diagram with the following structure:

```

    graph TD
      Q[QUERY] --> O[OBS]
      O --> MJ[MISJOIN]
      MJ --> WFS1[WFSCAN]
      MJ --> WFS2[WFSCAN]
      WFS1 --> WF1[WORK FILE]
      WFS2 --> WF2[WORK FILE]
      WF1 --> S1[SORT]
      WF2 --> S2[SORT]
      S1 --> TBS1[TBSCAN]
      S2 --> TBS2[TBSCAN]
      TBS1 --> GLW1[GLWTEMP 1048]
      TBS2 --> GLW2[GLWTDPT 80]
    
```

On the left side, there is a table with the following data:

Name	Value
Type	SELECT
CPU Cost (ms)	9
CPU Cost (su)	228
Cost Category	A
Reason	
Timestamp	2006-11-01 11:23:34.46

Below the table, the attribute explanation is shown:

Attribute explanation:
 Type: Query type (SELECT, INSERT, UPDATE, DELETE, SELUPD, DELCUR, UPDCUR)

VISUAL EXPLAIN – Query Summary Report

Access Path Report

- [Query Summary](#)
- [Table Summary](#)
- [Predicate Summary](#)

Access Path Description

- Query
 - [GLWTEMP \(table\) \(8\)](#)
 - [TBSCAN \(7\)](#)
 - [SORT \(6\)](#)
 - [WORK FILE \(5\)](#)
 - [WFSCAN \(4\)](#)
 - [MSJOIN \(3\)](#)
 - [GLWTDPT \(table\) \(13\)](#)
 - [TBSCAN \(12\)](#)
 - [SORT \(11\)](#)
 - [WORK FILE \(10\)](#)

Query Summary

Database Alias: DSN Explain Time : 2006-11-01 11:23:34.46
 DB2 Platform : Z/OS DB2 Version: v8

SQL Statement :

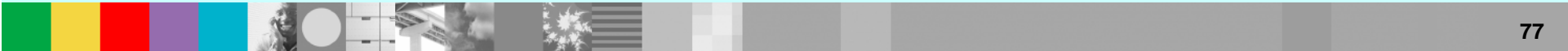
```
SELECT D.DEPT_NO, MIN(D.DEPT_NAME) AS DEPT_NAME, MIN(D.LOCATION) AS DEPT_LOCATION, SUM(E.SALARY) AS TOTAL_SALARY FROM SSEM/MWLH.GLWTDPT D, SSEM/MWLH.GLWTEMP E WHERE D.DEPT_NO = E.WORKDEPT AND E.BONUS BETWEEN 0.00 AND 2000.00 GROUP BY D.DEPT_NO;
```

Attribute	Value	Explanation
Type	SELECT	Query type (SELECT, INSERT, UPDATE, DELETE, SELUPD, DELCUR, UPDCUR)
CPU Cost (ms)	9	Estimated CPU cost (in milliseconds)
CPU Cost (su)	228	Estimated CPU cost (in service units)
Cost Category	A	Cost estimation category (A=statistics; B=default)
Reason		Reason when the cost estimation category is B (HOST VARIABLES, TABLE CARDINALITY, UDF, TRIGGERS, REFERENTIAL CONSTRAINTS)

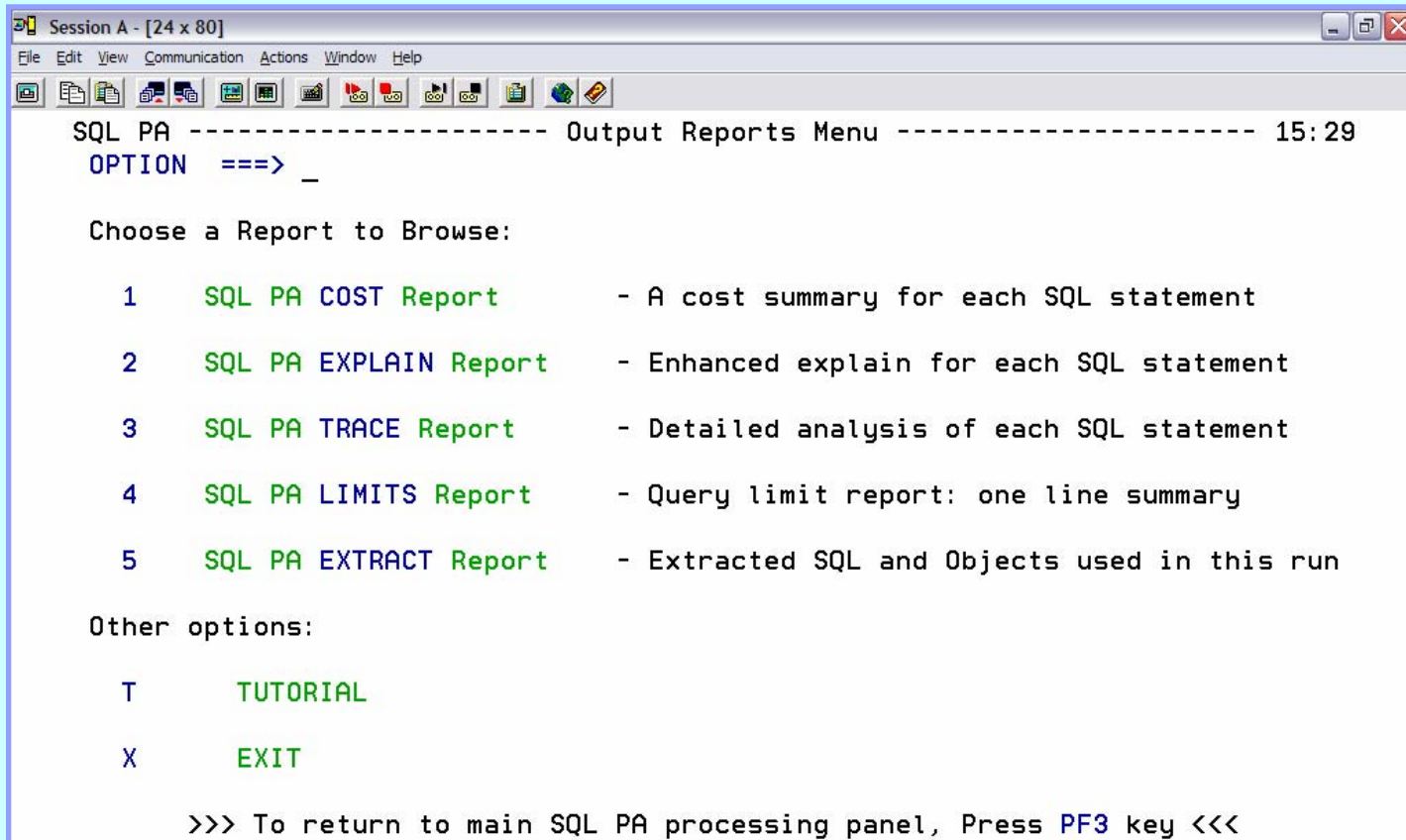


DB2 SQL PERFORMANCE ANALYZER

- Enhanced Explain Tool
- Can run
 - ▶ In BATCH, as normal z/OS job
 - ▶ In TSO, under ISPF Panel interface
- Input
 - ▶ Sequential data sets (PS)
 - ▶ Partitioned data set members (PDS)
 - ▶ DBRM library members (PO)
 - **Entire** DBRM Libraries, with member selectivity
 - ▶ In QMF, as a Governor Intercept
 - ▶ In **any** DB2 application, via a Stored Procedure call
- Produces a variety of reports



DB2 SQLPA Reports

A screenshot of a terminal window titled "Session A - [24 x 80]". The window shows the "Output Reports Menu" with a list of five report options and two other options. The options are: 1. SQL PA COST Report (A cost summary for each SQL statement), 2. SQL PA EXPLAIN Report (Enhanced explain for each SQL statement), 3. SQL PA TRACE Report (Detailed analysis of each SQL statement), 4. SQL PA LIMITS Report (Query limit report: one line summary), and 5. SQL PA EXTRACT Report (Extracted SQL and Objects used in this run). Other options include T TUTORIAL and X EXIT. At the bottom, it says ">>> To return to main SQL PA processing panel, Press PF3 key <<<".

```
Session A - [24 x 80]
File Edit View Communication Actions Window Help
SQL PA ----- Output Reports Menu ----- 15:29
OPTION ==> _

Choose a Report to Browse:

 1  SQL PA COST Report      - A cost summary for each SQL statement
 2  SQL PA EXPLAIN Report   - Enhanced explain for each SQL statement
 3  SQL PA TRACE Report     - Detailed analysis of each SQL statement
 4  SQL PA LIMITS Report    - Query limit report: one line summary
 5  SQL PA EXTRACT Report   - Extracted SQL and Objects used in this run

Other options:

T   TUTORIAL

X   EXIT

>>> To return to main SQL PA processing panel, Press PF3 key <<<
```

All reports are a forecast: what will be if the SQL is executed

What does DB2 SQLPA actually do ??

- It **forecasts** SQL performance:
 - Response Times
 - CPU Times
 - I/O Counts
- It **forecasts** the **COST** of the query, in terms of:
 - Charge Back (monetary, in national currency)
 - QUNITS TM (query service units)

SQL PA transforms Optimizer access paths into their real world costs



DB2 SQLPA - Cost Report

```

Session A - [24 x 80]
File Edit View Communication Actions Window Help
BROWSE -- DBA104.ANLCOST.LOG ----- Line 00000009 Col 001 080
Command ==> _____ Scroll ==> CSR

SELECT D.DEPT_NO, MIN(D.DEPT_NAME) AS DEPT_NAME, MIN(D.LOCATION) AS DEPT_LOCATI
FROM SSEMMWLH.GLWDPT D, SSEMMWLH.GLWTEMP E
WHERE D.DEPT_NO = E.WORKDEPT
AND E.BONUS BETWEEN 0.00
AND 2000.00
GROUP BY D.DEPT_NO

*-----*
* Query: 100000001 has been estimated by the DB2 Optimizer *
* to consume      0.00900 Seconds of central processing time *
* which is equivalent to      230 resource service units. *
* Estimated cost of CPU processing: $      0.0012 DOLLARS *
*-----*

ANLPGM31 ** Statistics ** Total statements examined =      1
          ** for this ** Good statements prepared =      1
          ** Parser run ** Bad statements w/errors =      0
    
```

Cost via

- 1) Elapse time
- 2) CPU time
- 3) I/O
- 4) Qunits
- 5) \$\$\$

What else does DB2 SQLPA do ??

- It provides an *Enhanced* EXPLAIN report:
 - Catalog Statistics
 - Access Path Information
 - RI Relationships
- It provides key **ADVICE** on each SQL statement:
 - Warnings and Alerts
 - Guidelines and Recommendations
 - Performance Notes and Good News

SQL PA teaches users how to write better SQL



DB2 SQLPA – Enhanced Explain Report

```

Session A - [24 x 80]
File Edit View Communication Actions Window Help
BROWSE -- DBA104.EXPLAIN ----- Line 00000102 Col 001 080
Command ==> _____ Scroll ==> CSR

TABLESPACE SCAN
-----
Creator: SSEMMWLH
Tabname: GLWTEMP

Detailed information about the
table space scan

Tablespace Scan was chosen on a partitioned tablespace with      4 parts
Version:  0 Table contains a total of:                          144 4K pages
Table Rows:                1048 Columns:   19 Rec Length:   138 bytes
Dssize:  0 GB Number of MQTs:  0 Log: Y Avg Row Length:   134 bytes
Type: T Lock Size: A TS Lock Mode: IS Lock Part: N Close Table: Y
Pages with rows: 25% Pct Compressed:  0% Max Rows: 255 Bpool: BP15
Encode: E CCSIDs are SBCS:   37 DBCS:    0 Mixed:    0 Volatile: N
The Correlation Name associated with this table is: E

Alternative Index
+++++
Creator: SSEMMWLH
Ix Name: GLWXEMP1

Vers:  0 Key Len:  36 Padded: N C-ed: N C-ing: Y CluRatio:  55.9160

```

DB2 SQLPA Enhanced Explain Report (2)

```

Session A - [24 x 80]
File Edit View Communication Actions Window Help
-----
BROWSE -- DBA104.EXPLAIN ----- Line 00000120 Col 001 080
Command ==> _____ Scroll ==> CSR
Creator: SSEMMWLH
Ix Name: GLWXEMP1

Vers: 0 Key Len: 36 Padded: N C-ed: N C-ing: Y CluRatio: 55.9160
Fullkey Card: 1048 Firstkey Card: 332
Type: 2 Nleaf Pages: 16 Nlevels: 2 Unique: U Key Cols: 3

Key Order Colcard Column Name
-----
1 A 332 LASTNAME
2 A 83 FIRSTNME
3 A 1048 EMP_NO

+-----+
ANL6052I *** NOTE:
This index is specified as "Not Padded", allowing storage of a
varying length index key. Padded indexes use blanks to fill out
their fixed length keys and are not eligible for Index Only scan.
"Not Padded" indexes do not blank fill CHAR and VARCHAR columns,
allowing greater flexibility and better use of storage, packing
more entries into a single Leaf page. Index Only access allowed.
+-----+

```

Example of a NOTE – regarding Non-padded indexes and their advantage

DB2 SQLPA Predicate Analysis Report

- Embedded in the Enhanced Explain Report
- Provides optimizer insights and **filter factors** for each predicate, even those generated by predicate transitive closure
- All PRED characteristics are provided: predicate type, stage 1 or 2, indexable, boolean term, used for join, generated by DB2, redundant, etc.

DB2 SQLPA - Predict Analysis Sample Output

```

Session A - [24 x 80]
File Edit View Communication Actions Window Help
-----
BROWSE -- DBA104.EXPLAIN ----- Line 00000275 Col 001 080
Command ==> _____ Scroll ==> CSR
Queryno: 100000001
Predicate Analysis
-----

Qblkno:    1 Predno:    1 Filter: 1.0000000 Type: AND      Join Pred? N
Stage 1? Y Boolean Term? Y Index Keyfield? N Redundant? N After Join? N
Added by PTC? N For Negation? N Literals:
Left Side --> ..... Tabno:  0 Blockno:  0 Predno:  2
Right Side -> ..... Tabno:  0 Blockno:  0 Predno:  3
Psuedo Text:
( CAST(D.DEPT_NO AS INTEGER)=E.WORKDEPT AND E.BONUS BETWEEN 0.00 AND 2000.00)..

Qblkno:    1 Predno:    2 Filter: 0.0125000 Type: EQUAL     Join Pred? Y
Stage 1? Y Boolean Term? Y Index Keyfield? Y Redundant? N After Join? N
Added by PTC? N For Negation? N Literals:
Left Side --> DEPT_NO..... Tabno:  1 Blockno:  1 Predno:  0
Right Side -> WORKDEPT..... Tabno:  2 Blockno:  1 Predno:  0
Psuedo Text:
CAST(D.DEPT_NO AS INTEGER)=E.WORKDEPT

Qblkno:    1 Predno:    3 Filter: 0.9973684 Type: BETWEEN  Join Pred? N
Stage 1? Y Boolean Term? Y Index Keyfield? N Redundant? N After Join? N
    
```

2

1

Does DB2 SQLPA do anything else ??

- It provides a detailed execution *“forecast”* report:
- Breaks down SQL by time spent in DB2 components
 - Wait Times and Bottlenecks, Path Lengths and I/O Types

...*for the serious ‘bits and bytes’ DBA*

Suitable for SQL Development, Tuning and Control



DB2 SQLPA – Trace Report

```

Session A - [24 x 80]
File Edit View Communication Actions Window Help
BROWSE -- DBA104 TRACE ----- Line 00000220 Col 001 080
CommaDisplay the number of rows & columns to be processed ==> CSR
+---
  The synchronous, prefetch, and asynchronous I/O's
Tablespace Scan is processed with 4 degrees of parallelism in group 1
Sequential Prefetch will be employed to access this table.
The prefetch will be done in 4 degrees using * CPU * parallelism.

```

Rows processed =	5	Percent table processed =	0.004000000		
Cols processed =	4	Boolean Filter from DB2 =	0.004000000		
Data pages read=	144	Indexed Leaf pages read =	0		
Sync Read I/Os =	2	Table =	2	Index =	0
Prefetch I/Os =	5	Table =	5	Index =	0
Async Wrt I/Os =	0	Table =	0	Index =	0
Get Page Calls =	173	SysIO =	11	LogIO =	0

```

Sync Read = 0.015000 Prefetch = 0.143000 Async Wrt = 0.000000
Get Pages = 0.415200 Systems = 0.147800 Log Write = 0.000000
Decompress= 0.000000 Compress = 0.000000 Hiperpool = 0.000000
Fetch Row = 0.014200 Lock/etc = 0.212325 Processes = 0.764521

```

MA a

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DB2 SQLPA – Trace Report (2)

```

Session A - [24 x 80]
File Edit View Communication Actions Window Help
----- Line 00000242 Col 001 080
BROWSE -- DBA104.TRACE -----
Command ==> _____ Scroll ==> CSR
Predicate =          2 Class 1 =          1.569046 Other 0/H =          0.143000

The DB2 Optimizer has provided a processing estimate of          9 Msec
equating to          230 system Service Units. The "Cost Category" is: A

A join of 2 tables has been detected. This was the first table access.
It collects          5 rows and          4 columns from          1 pages.

This table is accessed with 4 degrees of parallelism in group 1

Queryno: 100000001  Qblockno: 1  Planno: 1  MixOpSeq: 0
Summary -> CPU times, Class 1 time, Logical I/O, Physical I/O

The Total Cumulative Path Length for this query is          1.712046M Ins.
Resulting in a Total CPU Time of          0.01250 Seconds consumed overall.
DB2 will put Class 1 CPU Time of          0.01145 Seconds in SMF 101 record.
DB2 shows additional CPU Time of          0.00104 Seconds in SMF 100 record.
Estimated Total Logical I/O calls =          7 (excluding system) and
Estimated Total Physical I/O calls =          7 with Hit Ratio = 1.000.
Wait Time for Sync Read I/O =          0.04610 Prefetch I/O =          0.06901
Wait Time on Async Write I/O =          0.00000 Total IWAIT =          0.11511
Wait Time for VSAM Open/Close macros, Binding and Locking =          0.15866

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```

DB2 SQLPA - QLIMITS Report

- One line summary for each SQL statement evaluated
- Recap of costs
- Quick eye catcher for problem queries
- Can be sorted by any column on the report or combination thereof

DB2 SQLPA – QLIMITS Report

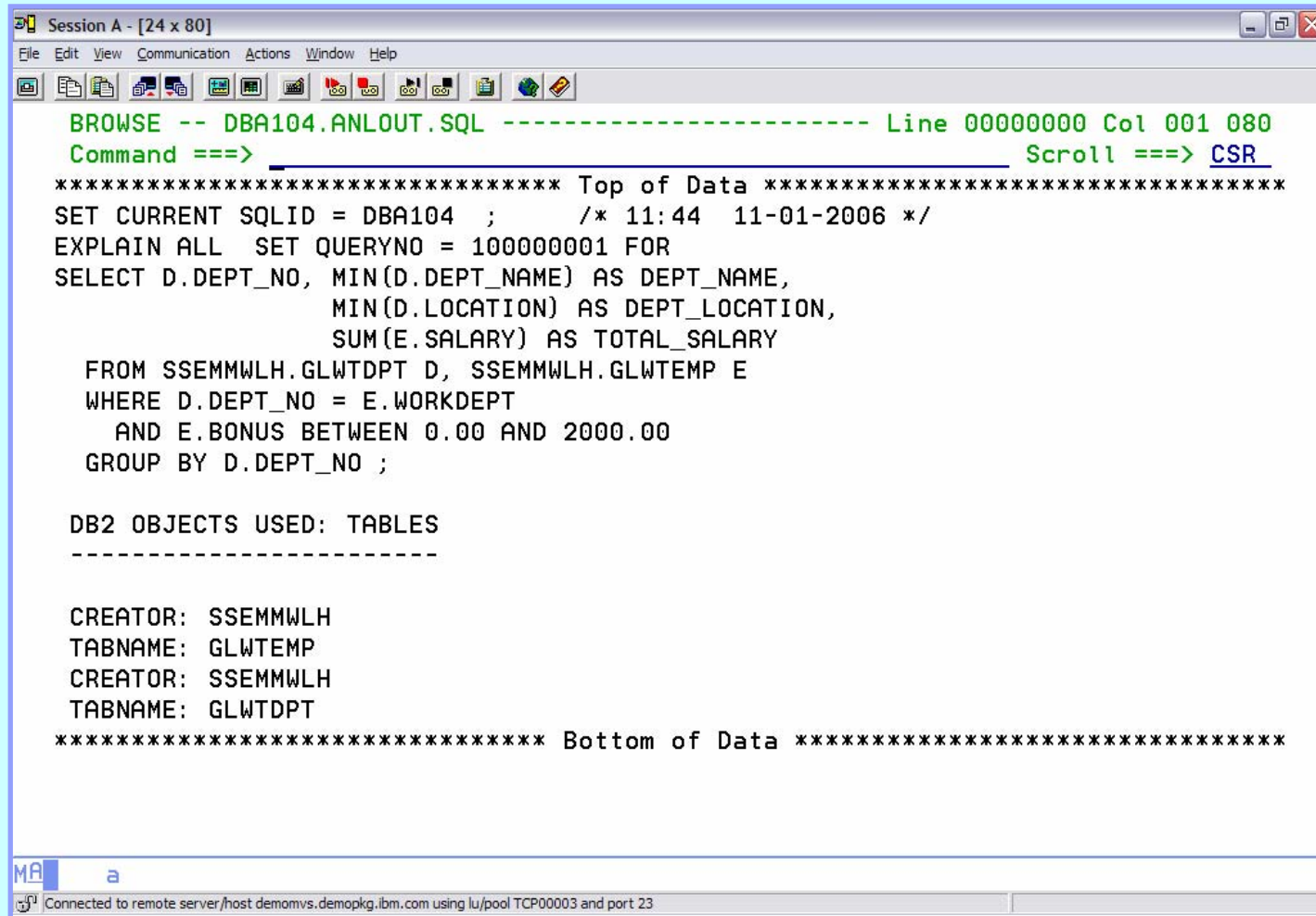
```

Session A - [24 x 80]
File Edit View Communication Actions Window Help
BROWSE -- DBA104.QLIMIT ----- Columns 001 072
Command ==> _____ Scroll ==> CSR
***** Top of Data *****
==MSG> -Warning- The UNDO command is not available until you change
==MSG> your edit profile using the command RECOVERY ON.
000001 15:57:27.844 SQL Performance Analyzer Versio
000002 10-30-2006 Query Limits Report Level
000003
000004 CEIQ$ Error Queryno Type CPU Time Elapsed Phys I/O Qunits
000005 --Y- 0 100000004 ST 0.61100 1.544 18 15654
000006 --- 0 100000003 ST 0.00500 0.313 15 115
000007 ----- 0 100000001 ST 0.00100 1.268 6299 5
000008 ----- 0 100000002 ST 0.00100 1.584 18830 4
***** Bottom of Data *****
    
```

Exceeded threshold

Type of statements: ST = SELECT, IT = INSERT, UE = UPDATE, DE = DELETE ...

DB2 SQLPA – Extract Report



```
Session A - [24 x 80]
File Edit View Communication Actions Window Help
BROWSE -- DBA104.ANLOUT.SQL ----- Line 00000000 Col 001 080
Command ==> _____ Scroll ==> CSR
***** Top of Data *****
SET CURRENT SQLID = DBA104 ; /* 11:44 11-01-2006 */
EXPLAIN ALL SET QUERYNO = 100000001 FOR
SELECT D.DEPT_NO, MIN(D.DEPT_NAME) AS DEPT_NAME,
        MIN(D.LOCATION) AS DEPT_LOCATION,
        SUM(E.SALARY) AS TOTAL_SALARY
FROM SSEMMLH.GLWTDPT D, SSEMMLH.GLWTEMP E
WHERE D.DEPT_NO = E.WORKDEPT
      AND E.BONUS BETWEEN 0.00 AND 2000.00
GROUP BY D.DEPT_NO ;

DB2 OBJECTS USED: TABLES
-----

CREATOR: SSEMMLH
TABNAME: GLWTEMP
CREATOR: SSEMMLH
TABNAME: GLWTDPT
***** Bottom of Data *****

MA a
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```


What can DB2 SQLPA do for you?

- Provide expert advice on how to improve your SQL
- Warn users of long running queries
- Illustrate the incremental components of cost
- Help fine tune design of DB2 queries and databases
- Help tune production SQL via DBRM scans
- Evaluate future production volume performance
- Preempt costly QMF Governor cancels
- Implement governing for *any* DB2 application

All of this is done without ever executing the SQL

How does DB2 SQLPA work?

- *Emulates and Invokes* the DB2 Optimizer
- *Analyzes* the Access Plan chosen by DB2
- *Estimates* the Execution Cost in the **Real World**

All of this is done without actually executing the SQL statements!



DB2 SQLPA - Parameter Driven

- User defined parameters
- System defined parameters
- Advisor Thresholds



DB2 SQLPA – User Defined Parameters

- Select which reports to produce (Cost and QLIMITS are mandatory)
- Control amount of detail displayed in reports
- Show or not show alternate indexes
- Consider MQT's when determining access path
- Display the objects being accessed
- Define the qualifier to be used for unqualified SQL
- Specify sort sequence for columns on QLIMITS report

DB2 SQLPA - Advisor Thresholds

- Specify whether or not to display the full message text
- Notified if an object has not had RUNSTATS run against it
- Flag
 - ▶ Table space scans
 - ▶ Non-matching index scans
 - ▶ When all partitions are scanned
- Specify a high water mark for
 - ▶ Number of matching index scans
 - ▶ Number of non-matching index scans
 - ▶ Number of table space scans
 - ▶ Acceptable number of tables to be included in a join
 - ▶ Acceptable number of items to be included in a LIST
 - ▶ Acceptable number of indexes to be updated



DB2 SQLPA - Example of an Alert

```

Session A - [24 x 80]
File Edit View Communication Actions Window Help
+-----+
BROWSE -- DBA104.EXPLAIN ----- Line 00000195 Col 001 080
Command ==> _____ Scroll ==> CSR
+-----+
|ANL5044W *** ALERT:
|Site requires notification when ALL TS PARTITIONS are scanned.
|-----+
Tablespace Scan is processed with 4 degrees of parallelism in group 1
Sequential Prefetch will be employed to access this table.
The prefetch will be done in 4 degrees using * CPU * parallelism.
A join of 2 tables has been detected. This was the first table access.
This table is accessed with 4 degree of parallelism in group 1
-----+
Queryno: 100000001 Qblockno: 1 Planno: 2 MixOpSeq: 0
Process ->
+-----+

```

MA a

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What factors are considered inside DB2 SQLPA?

- The influence of DB2 catalog statistics
- The types of predicates being processed
- The hardware and software configuration
- User and installation parameters
- Predicate filter factors
- Optimizer cost estimates
- DB2 current release level
- CPU Processor and DASD speeds

SQL PA has **minimal** catalog impact: access **once** for most objects, then store them internally



DB2 SQLPA - Catalog Statistics

- Statistics are an important ingredient in the optimizer's determination of the access path
- The gathering of statistics via RUNSTATS
 - ▶ Has no impact on static SQL until the next BIND
 - ▶ Impacts the performance of dynamic SQL immediately

DB2 SQL/PA Supports

Import of DB2 Catalog Statistics from one subsystem to another
(supports wildcarding)

Modification of table and index statistics for WHAT IF scenarios
(original statistics may be restored)



DB2 SQLPA - Collect Catalog Statistics

```

Session A - [24 x 80]
File Edit View Communication Actions Window Help
SQL PA ----- Collect Catalog Stats ----- 16:46
COMMAND ==>

*DB2 Subsystem ID.... ==> DSNC          ( DSN  or subsystem ID)

*DB2 Version "FROM".. ==> V8NFM         ( V8NFM | V8COM | V7R1 | V6R1)
*"TO" New DB2 Version ==> V8NFM         ( V8NFM | V8COM | V7R1 | V6R1)

Using DBA104.ANL310.SANLSTAT data set:

*SAVE input parms for later use in member ==> _          ( member name )
*WRITE output Catalog updates into member ==> -          ( member name )

(optional)
ROUTE this batch job to a different LPAR ==> N/A          ( /*ROUTE card )

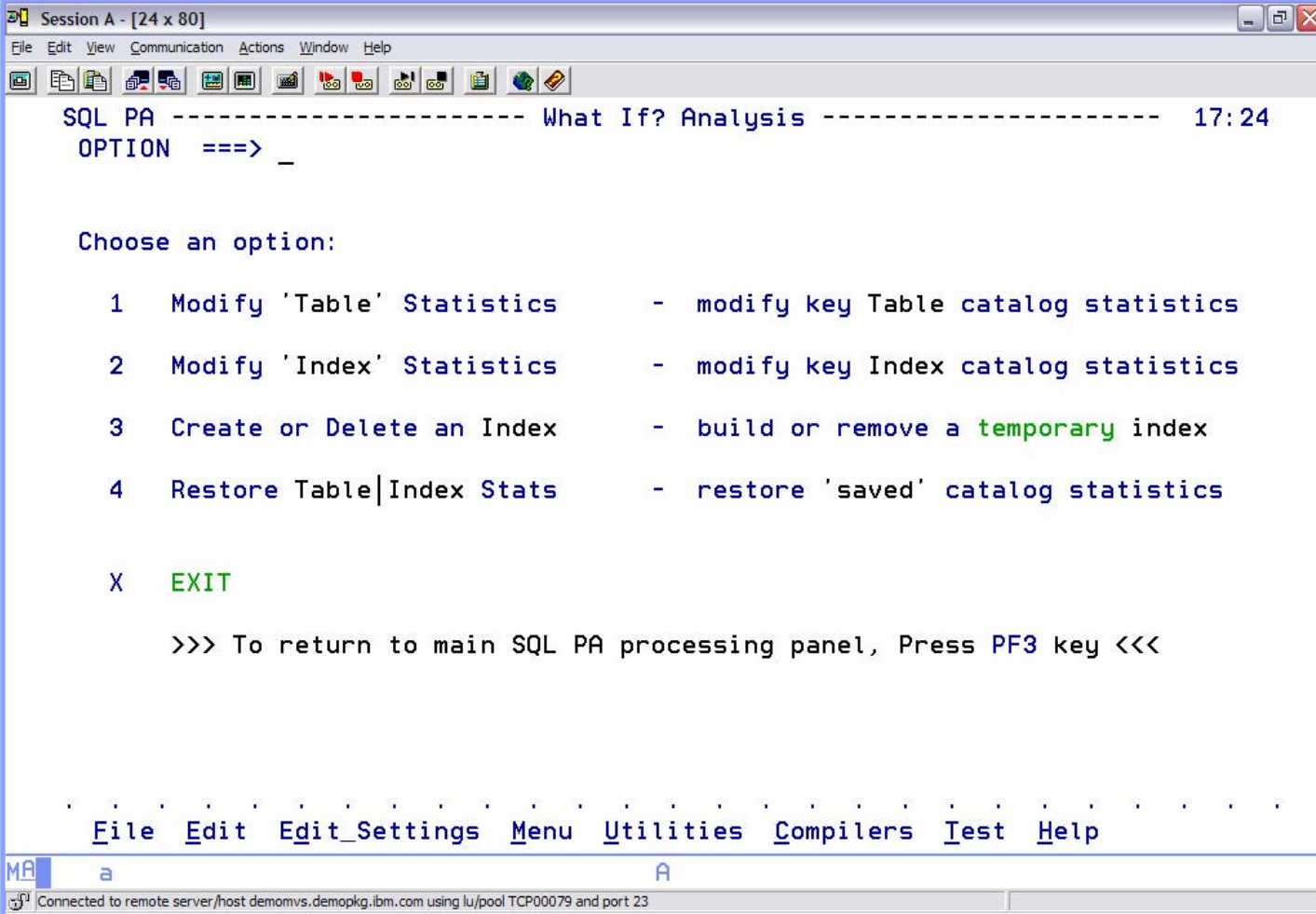
Specify global output target high level names:

*Target database name ==>                ( target database )
*Target creator name  ==>                ( target creator )

>>> Press PF3 or Enter to define collection parms, or PF12 to Exit <<<
Menu Functions Confirm Utilities Help
MA a
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```

DB2 SQLPA - WHAT IF



The screenshot shows a terminal window titled "Session A - [24 x 80]". The menu text is as follows:

```
SQL PA ----- What If? Analysis ----- 17:24
OPTION ==> _

Choose an option:

1  Modify 'Table' Statistics      -  modify key Table catalog statistics
2  Modify 'Index' Statistics      -  modify key Index catalog statistics
3  Create or Delete an Index     -  build or remove a temporary index
4  Restore Table|Index Stats     -  restore 'saved' catalog statistics

X  EXIT

>>> To return to main SQL PA processing panel, Press PF3 key <<<
```

At the bottom of the terminal, there is a menu bar with the following items: File, Edit, Edit_Settings, Menu, Utilities, Compilers, Test, Help. Below the menu bar, the characters "MA" and "a" are visible, along with a cursor. At the very bottom, a status bar indicates: "Connected to remote server/host demomvs.demopkg.ibm.com using lu/pool TCP00079 and port 23".

DB2 SQL/PA - WHAT IF

- **Modify catalog statistics**
 - ▶ Specify new values for **tables**
 - Number of rows (CARD)
 - Number of pages (NPAGES / NACTIVE)
 - % of the table space used by the table (PCTPAGES)
 - % of row compression (PCTROWCOMP)
 - ▶ Specify new values for **indexes**
 - Number of rows indexed by 1st column (FIRSTKEYCARD)
 - Number of rows indexed by all columns (FULLKEYCARD)
 - Size of the index (NLEAF / NLEVELS)
 - Cluster ratio (CLUSTERRATIO)



DB2 SQL/PA - WHAT IF

Create a new index

Maximum of 5 columns

DEFER YES

DEFINE NO

Able to delete the index after

evaluating it

```

Session A - [24 x 80]
File Edit View Communication Actions Window Help
SQL PA ----- Create Temporary Index ----- evaluating it 17:25
COMMAND ==>

*DB2 Subsystem ID... ==> DSNC          ( DSN or subsystem ID)
*DB2 Current Version ==> V8NFM        ( V8NFM | V8COM | V7R1 | V6R1)

>>place cursor on scrollable fields below, using PF10 (left) and PF11 (right)<<
ON
*Table Creator ==> DBA104             ( table creator ) >
*Table Name.... ==> GLWTEMP          ( table name ) >
CREATE
*Index Creator ==> DBA104             ( index creator ) >
*Index Name.... ==> GLWEEE           ( index name ) >

OR DELETE this index.... ==> NO      ( Delete THIS Index NO | YES)

Type over any values that you wish to change and then Enter or PF3:

UNIQUE ==> NO ( Yes | No ) WHERE NOT NULL ==> NO ( Yes | No )
CLOSE ==> NO ( Yes | No ) CLUSTER INDEX ==> NO ( Yes | No )

>>> Press PF3 or Enter to define the index keys, or PF12 to Exit <<<
File Edit Edit_Settings Menu Utilities Compilers Test Help
MA a A
Connected to remote server/host demomvs.demopkg.ibm.com using lu/pool TCP00079 and port 23
    
```

DB2 SQLPA - Retro Explain

- Ability to reexamine the old access path stored in a plan table

```
Session B - [24 x 80]
File Edit View Communication Actions Window Help

SQL PA ----- Retro Plan Explains ----- 14:46
COMMAND ==> _

Existing Plan Table Owner..... ==> DBA104   Owner of the "Plan Table"

Enter the Range of query numbers to Retro Explain, or ALL of them:

Starting Plan Query Number..... ==> ALL     Starting Queryno, or ALL
Terminating Plan Query No..... ==> 999999999 Ending Queryno, or 999999999

>>> To process, Press#Enter or PF3 key. To cancel, Press PF12 key<<<

MA b
Connected to remote server/host testmva.demopkg.ibm.com using lu/pool TCP00094 and port 23
hp business inkjet 1100 series on USB001
```

DB2 SQLPA - Easy Explain Feature

- Provides information about how DB2 accesses data for a given SQL statement – additional DB2 Catalog information
- Input
 - ▶ Plans / packages (DB2 Catalog)
 - ▶ Query number of previous explain operation (Plan table entry)
 - ▶ QMF
 - ▶ PDS
 - ▶ Sequential file
- Provides the ability to store results and compare old to new
- ISPF or batch
- Reports



DB2 SQLPA – EEE is Parameter Driven

Level of report
Source of input
SQL

```

Session A - [24 x 80]
File Edit View Communication Actions Window Help
SQL PA Edit ----- DBA104.JCL.SQLPA(JOIN03) - 01.01----- COLUMNS 000 000
COMMAND ==> _
***** ***** Top of Data *****
=NOTE= FOLLOWING IS A SHORT REFERENCE TO THE EEE STATEMENTS
=NOTE= PLEASE SEE EEE REFERENCE CARD FOR A COMPLETE SYNTAX|
=NOTE= ENTER YOUR EEE STATEMENTS AFTER THE NOTE| (USE 'RES' TO ERASE THE NOTE)
=NOTE= -----
=NOTE= LVL= 'DET', 'NOC', 'NOK', 'ALL', 'KEY', 'SQL' OR 'SUM'
=NOTE= PLN= PLAN NAME
=NOTE= PKG= PACKAGE NAME
=NOTE= QMF= QMF QUERY NAME (YOUR OWN OR A SHARED)
=NOTE= QNO= QUERY NUMBER (,OWNER= AUTHID OR 'USER')
=NOTE= SQL= EXPLAINABLE SQL STATEMENT TERMINATED BY A ';'
=NOTE= * ANY TEXT AS COMMENT (NOT SHOWN ON SUMMARY PAGE)
=NOTE= -- ANY TEXT AS COMMENT (SHOWN ON SUMMARY PAGE)
=NOTE= TOPA=ALL CAN BE ADDED TO ANY OF THESE COMMANDS
=NOTE= -----
=NOTE= FOLLOWING SUBCOMMAND CAN BE USED WITH PLN, PKG, QMF AND QNO:
=NOTE= -----
=NOTE= INDEX= 'YES', 'NO', 'ALL', OR 'TSCN'
=NOTE= -----
=NOTE= FOLLOWING SUBCOMMANDS CAN BE USED WITH PLN, AND PKG:
. . . . .
Menu Options View Uti _____

```

DB2 SQLPA – EEE Report

```

Session A - [24 x 80]
File Edit View Communication Actions Window Help
SQL PA Browse ----- SYS06305.T123614.RA000.DBA104.R0155076--- LINE 00000002
COMMAND ==> SCROLL ==> CSR
SQL-Statement to be EXPLAIN'ed:
=====
      SELECT D.DEPT_NO, MIN(D.DEPT_NAME) AS DEPT_NAME,
             MIN(D.LOCATION) AS DEPT_LOCATION,
             SUM(E.SALARY) AS TOTAL_SALARY
      FROM SSEMMWLH.GLWTDPT D, SSEMMWLH.GLWTEMP E
      WHERE D.DEPT_NO = E.WORKDEPT
             AND E.BONUS BETWEEN 0.00 AND 2000.00
      GROUP BY D.DEPT_NO;

                                           Page 1-001

Breakdown of EXPLAIN information for SQL-statement
=====
Location: NDCDB203                                DB2 sysid & rel.: DSNC 8.1
PLAN_TABLE Data:                                PLAN_TABLE Owner: DBA104
QueryNo:90000141, Acc. Type:  R, Plan No:  1, Table Name: GLWTEMP
Q Block No.:  1, Matchcols:  0, Tab. No:  2, - Owner: SSEMMWLH
Date: 2006-11-01, Plan:      , Method:  0, Index Name:
Time: 12:36:12.7, DBRM: Dyn.stmt, IdxOnly: No, - Owner:
TS Lockmode:  IS, Col.Func.:  , Prefetch:  S, Mult.Index:
Access Deg.:  -, Acc.PgrId:  -, JoinDeg:  -, Join PgrId:  -
. . . . .
  Menu  Options  View  Uti  _____
MA      a                                A
Connected to remote server/host demomvs.demopkg.ibm.com using lu/pool TCP00003 and port 23

```

DB2 SQLPA – EEE Report

```

Session A - [24 x 80]
File Edit View Communication Actions Window Help
SQL PA Browse ----- SYS06305.T123614.RA000.DBA104.R0155076--- LINE 00000012
COMMAND ==> SCROLL ==> CSR
Breakdown of EXPLAIN information for SQL-statement
=====
Location: NDCDB203 DB2 sysid & rel.: DSN8 8.1
PLAN_TABLE Data: PLAN_TABLE Owner: DBA104
QueryNo: 90000141, Acc. Type: R, Plan No: 1, Table Name: GLWTEMP
Q Block No.: 1, Matchcols: 0, Tab. No: 2, - Owner: SSEMMWLH
Date: 2006-11-01, Plan: , Method : 0, Index Name:
Time: 12:36:12.7, DBRM: Dyn.stmt, IdxOnly: No, - Owner:
TS Lockmode: IS, Col.Func.: , Prefetch: S, Mult.Index:
Access Deg.: -, Acc.PgrId: -, JoinDeg: -, Join PgrId: -
SortC PgrId: -, ParalMode: , PageRng: , CorrelName: E
SortN PgrId: -, MergeJoin: -, JoinTyp: , GroupMembr:
WhenOptimiz: Blnk, Qblock: SELECT, BindTim: 2006-11-01-12.36.12.790000
Opthint: , Hint: , Dir.Row: No , OptHint-ID: 3492
ParentQblk#: 0, Tab: Real Table
Encod: EBCDIC , SCCSID: 37, MCCSID: -2, DCCSID: -2
SortN Table: Unique: N, Join: N, Order By: N, Group By: N
SortC Table: Unique: N, Join: N, Order By: N, Group By: N
=====
Menu Options View Uti
MA a A
Connected to remote server/host demomvs.demopkg.ibm.com using lu/pool TCP00003 and port 23

```

DB2 SQLPA – EEE Report – Access Path

```

Session A - [24 x 80]
File Edit View Communication Actions Window Help
SQL PA Browse ----- SYS06305.T123614.RA000.DBA104.R0155076--- LINE 0000029
COMMAND ==> SCROLL ==> CSR
SortC Table: Unique: N, Join: N, Order By: N, Group By: N
-----

The Access Path Chosen by DB2 at 12:36:12 on 2006-11-01:
+-----+
| Table space scan - no index will be used
| A total of 108 pages with no rows will be read ( 7% of TS)
| Table/Index: SSEMMWLH.GLWTEMP/*none*
| Estimated number of TIMERONs: 1
| Processor cost: 9 msec. 228 SU. Cat: 'A'
| Standard sequential PREFETCH will be performed
| Query block SQL operation: SELECT
| Lock mode is Share Lock for the page
+-----+

Information for Table SSEMMWLH.GLWTEMP:
Table Rows:      1048, Columns :    19, RowLength:   138, Edit Proc.:
Pct. Pages:      25%, DBase id:   410, Tb Status:    X, ValidProc.:
Pages w/Rows:    36, Table id:    10, Auditing : None, TabCreator: DBA104
EncodingChar: EBCDIC, Rel.Cret:   V8, AvgRowLth:   134
. . . . .
Menu Options View Uti

```

MA a A

Connected to remote server /host demomvs.demopkg.ibm.com using lu/pool TCP00003 and port 23

DB2SQLPA – EEE Report – Available Index Info

```

Session A - [24 x 80]
File Edit View Communication Actions Window Help
SQL PA Browse ----- SYS06305.T123614.RA000.DBA104.R0155076--- LINE 00000056
COMMAND ==>                                     SCROLL ==> CSR
Information for ALL available indexes is requested by the user:

Information for Index SSEMMWLH.GLWXEMP1:
Full Key Card:      1048, Pages:      16, Levels:      2, ErRule: N, Clustering: Y
1'st Key Card:      332, Space: N/A K, Unique: Yes, ClRule: Y, Clustered: N
Cluster Ratio:      55%, PageSz: 4096, BfPool:BP16, DB.IXS: SSEMMWLH.GLWXEMP1
IndexType 1/2:      2, PiecSz:      0K, StatsTime: 2006-10-27-20.36.30.971394

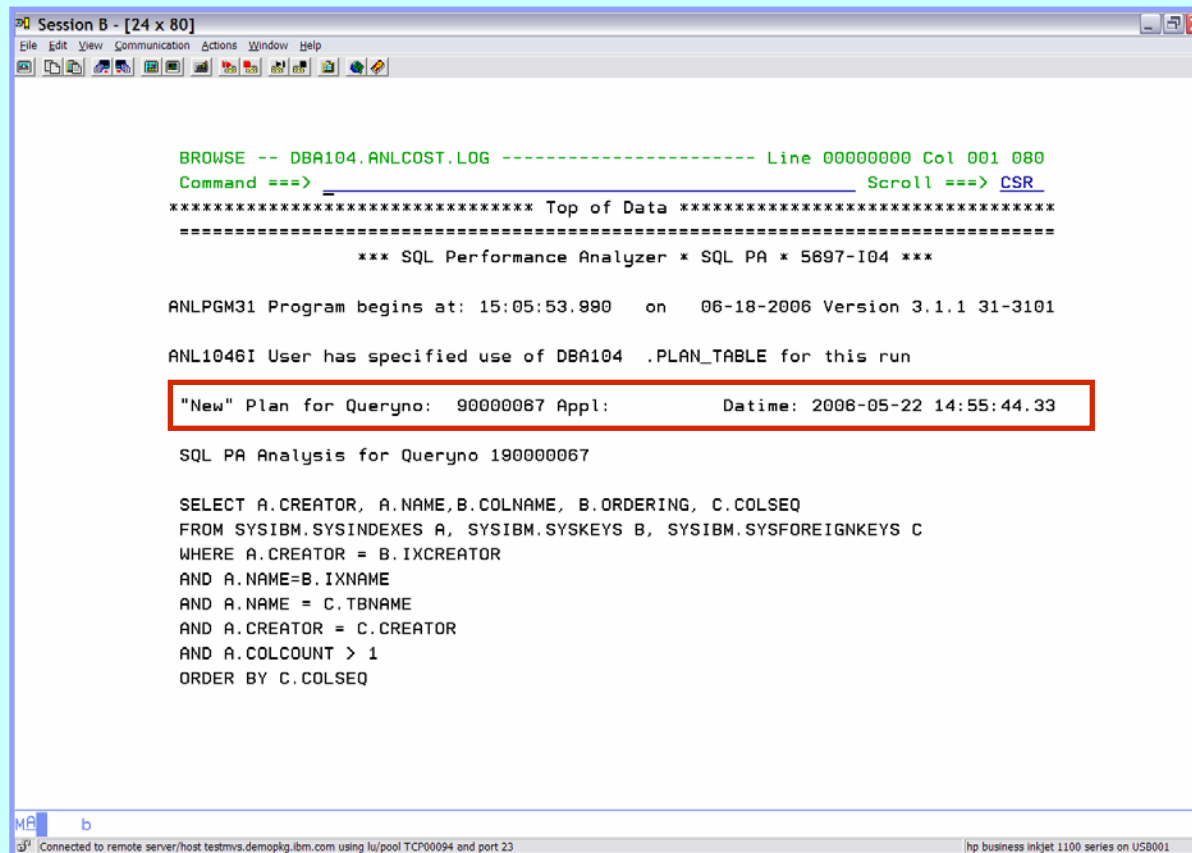
Key
No. Column Name      Col.Type Lng Null      Key
-----
1 LASTNAME           VARCHAR  20 No      332 Asc.  c'D...@@@. c'...@@@..
2 FIRSTNME           VARCHAR  12 No      83 Asc.  c'U...@@@. c'.....@@.
3 EMP_NO             INTEGER  4 No      1048 Asc.  x'80000003 x'80000427

Information for Index SSEMMWLH.GLWXEMP2:
Full Key Card:      80, Pages:      3, Levels:      2, ErRule: N, Clustering: N
1'st Key Card:      80, Space: N/A K, Unique: No, ClRule: Y, Clustered: N
Cluster Ratio:      12%, PageSz: 4096, BfPool:BP16, DB.IXS: SSEMMWLH.GLWXEMP2
IndexType 1/2:      2, PiecSz:      2G, StatsTime: 2006-10-27-20.36.14.075327

. . . . .
Menu Options View Uti | _____
MA a A
Connected to remote server/host demomvs.demopkg.ibm.com using lu/pool TCP00003 and port 23
    
```

DB2 SQLPA - Compare Old and New Plans

- Compare access paths and costs of SQL plans previously stored by Easy Explain in the EEE path tables with those of the current plan



```
Session B - [24 x 80]
File Edit View Communication Actions Window Help
BROWSE -- DBA104.ANLCOST.LOG ----- Line 00000000 Col 001 080
Command ==> _____ Scroll ==> CSR
***** Top of Data *****
*****
*** SQL Performance Analyzer * SQL PA * 5697-I04 ***

ANLPGM31 Program begins at: 15:05:53.990 on 06-18-2006 Version 3.1.1 31-3101

ANL1046I User has specified use of DBA104 .PLAN_TABLE for this run

"New" Plan for Queryno: 90000067 Appl:          Datime: 2006-05-22 14:55:44.33

SQL PA Analysis for Queryno 190000067

SELECT A.CREATOR, A.NAME, B.COLNAME, B.ORDERING, C.COLSEQ
FROM SYSIBM.SYSINDEXES A, SYSIBM.SYSKEYS B, SYSIBM.SYSFOREIGNKEYS C
WHERE A.CREATOR = B.IXCREATOR
AND A.NAME=B.IXNAME
AND A.NAME = C.TBNAME
AND A.CREATOR = C.CREATOR
AND A.COLCOUNT > 1
ORDER BY C.COLSEQ

MA b
Connected to remote server/host testmvs.demopkg.ibm.com using lu/pool TCP00094 and port 23
hp business inkjet 1100 series on US8001
```


RECAP DB2 SQL/PA

- DB2 SQL PA provides enhanced explain information for SQL statements
 - ▶ DB2 SQL PA
 - SQL input TSO, sequential files, DBRM, QMF
 - Output – multiple reports providing detailed explanation of access paths, provides warnings, alerts, guidelines, recommendations, ..
 - ▶ EEE Easy Explain
 - SQL input Plan, Package, DBRM, sequential file, QMF
 - Output – reports providing formatted explanation of access paths



DB2 PATH CHECKER

- Identifies potential access path changes
 - ▶ Determine if the access path will change and identify what the change is **before** doing the rebind
 - ▶ **Tune the application** to achieve a better access path before the rebind
- Used to avoid performance issues related to these changes
- Chooses course of action before changes affect DB2 production
- Helps DBAs to verify access path changes



DB2 PATH CHECKER – 3 Major Functions

- **REPORT** – generate an Access Report
 - ▶ Can view just the changed access paths
 - ▶ Or view all of the access paths
- **TEST** – explain access paths of a DBRM and compare to a previously explained access path
- **COMPARE** – compare the access paths after an explain has been done (ea. in their own plan table)



DB2 PATH CHECKER – REPORT Feature

- **Input: Plan Table**
 - ▶ Uses Creator-ID to determine the plan_table to read
 - ▶ If the corresponding plan table is not populated with the selected plan or package explain data, the program will return no information
- **3 Types of reports**
 - ▶ Summary Report (default) → SYSPRINT
 - ▶ Detail Report – EXPLAIN → SYSEXPLN
 - ▶ Directory Report - Summary of BIND and EXPLAIN Activity



DB2 PATH CHECKER – REPORT Output

```

Session B - [24 x 80]
File Edit View Communication Actions Window Help
-----
  Display Filter View Print Options Help
-----
SDSF OUTPUT DISPLAY IBM01R2 JOB01668 DSID 102 LINE 17 COLUMNS 01- 80
COMMAND INPUT ==> SCROLL ==> CSR
11 ACCESS PATH FOR COLLID - TESTCOLL .TEST01 SQL ID- OLD

IN QRYNO M CREATOR TNAME TBNO AC MC CREATOR ACCESSNAME
 327 0 PUBLIC SYSCOLUMNS 1 I 2 PUBLIC DSNDX01
CKP225I DSN_STATEMNT_TABLE ESTIMATED COST - EST SVC UNITS 139

IN QRYNO M CREATOR TNAME TBNO AC MC CREATOR ACCESSNAME
 334 0 PUBLIC SYSTABLES 1 I 1 PUBLIC DSNDTX01
CKP225I DSN_STATEMNT_TABLE ESTIMATED COST - EST SVC UNITS 138

CKP206I REPORT COMPLETE FOR PROGRAM = TEST01 VERSION = 2005-04-11-18.34.

11 ACCESS PATH FOR COLLID - TESTCOLL .TEST02 SQL ID- OLD
. . . . .
EDIT PUBLIC.CKPPTHCK.JCL(REPORTA) - 01.03 Columns 00001 00072
Command ==> Scroll ==> CSR
***** ***** Top of Data *****
MA b 04/021
Connected to remote server/host 151.213.121.35 using lu/pool SC0TCP05 and port 23
    
```

DB2 PATH CHECKER – REPORT Output (2)

```

Session B - [24 x 80]
File Edit View Communication Actions Window Help
-----
Display Filter View Print Options Help
-----
SDSF OUTPUT DISPLAY IBM01R2 JOB01668 DSID 102 LINE 17 COLUMNS 55- 134
COMMAND INPUT ==> SCROLL ==> CSR
ST01 SQL ID- OLD PLAN_TABLE - RUN DATE 2006/11/01

CREATOR ACCESSNAME IO SORTUJOG LK PF FN QBNO PLNO MXSQ MJN PG JN OP
PUBLIC DSNDX01 N NNNNNNNN IS L 1 1 0
UNITS 139

CREATOR ACCESSNAME IO SORTUJOG LK PF FN QBNO PLNO MXSQ MJN PG JN OP
PUBLIC DSNDTX01 N NNNNNNNN IS L 1 1 0
UNITS 138

ION = 2005-04-11-18.34.53.754785

ST02 SQL ID- OLD PLAN_TABLE - RUN DATE 2006/11/01
EDIT PUBLIC.CKPPTHCK.JCL(REPORTA) - 01.03 Columns 00001 00072
Command ==> Scroll ==> CSR
***** Top of Data *****
MA b 04/021
Connected to remote server/host 151.213.121.35 using lu/pool SCOTCP05 and port 23
    
```


DB2 PATH CHECKER – TEST Feature

- **Input:** DBRM
- TEST can be done WITHOUT binding the associate DBRM or package
- Examines each SQL statement (only those that can be explained)
- Performs an explain to determine the access path
- Compares the new access path to the existing access path (in the plan table)
- Generates a report to show the old and new access paths
 - ▶ Configure to show all statements
 - ▶ Or show only those that have changed



DB2 PATH CHECKER – TEST Output

```

Session B - [24 x 80]
File Edit View Communication Actions Window Help
-----
Display Filter View Print Options Help
-----
SDSF OUTPUT DISPLAY IBM01T2 JOB01673 DSID 102 LINE 99 COLUMNS 01- 80
COMMAND INPUT ==>
INS 330 0 SYSIBM SYSCOLUMNS 2 I 0 SYSIBM DSNDX01
INS 330 1 SYSIBM SYSTABLES 1 I 2 SYSIBM DSNDTX01
CKP223I DSN_STATEMNT_TABLE ESTIMATED COST CHANGE - NEW EST SVC UNITS 52

IN QRYNO M CREATOR TNAME TBNO AC MC CREATOR ACCESSNAME
INS 339 0 SYSIBM SYSTABLES 1 I 1 SYSIBM DSNDTX01
CKP223I DSN_STATEMNT_TABLE ESTIMATED COST CHANGE - NEW EST SVC UNITS 5

IN QRYNO M CREATOR TNAME TBNO AC MC CREATOR ACCESSNAME
INS 345 0 SYSIBM SYSINDEXES 1 M 0
INS 345 0 SYSIBM SYSINDEXES 1 MX 1 SYSIBM DSNDXX02
INS 345 0 SYSIBM SYSINDEXES 1 MX 1 SYSIBM DSNDXX01
INS 345 0 SYSIBM SYSINDEXES 1 MU 0
INS 345 1 SYSIBM SYSTABLES 2 I 2 SYSIBM DSNDTX01
CKP223I DSN_STATEMNT_TABLE ESTIMATED COST CHANGE - NEW EST SVC UNITS 13

EDIT PUBLIC.CKPPTHCK.JCL (TEST) - 01.08 Columns 00001 00072
Command ==> Scroll ==> CSR
***** Top of Data *****
MA b 04/021
Connected to remote server/host 151.213.121.35 using lu/pool SC0TCP05 and port 23
    
```

DB2 PATH CHECKER – COMPARE Feature

- The **COMPARE** Command contrast entries for Plans or Packages that exist in PLAN_TABLES
- Comparisons can be done within or between PLAN_TABLES
- The compared PLAN_TABLES can be within an SSID or on different SSIDs where DDF is available
- The default is to compare the most recent explain to the most recent previous entry
- Options are available to set the comparison to specific entries in the PLAN_TABLE



DB2 PATH CHECKER – TEST Output

```

-----
                        Changed Access Path
                        |
                        v
CSR
*****
CKP218I PROGRAM TEST01      HAS A CHANGED ACCESS PATH
QUERYNO                      327
OLD PROCSU                    139
NEW PROCSU                    209
COLLECTION                    TESTCOLLX
NEW VERSION                   2006-05-23-19.00.27.449848
OLD VERSION                   2005-04-11-18.34.53.754785
*****
CKP218I PROGRAM TEST02      HAS A NEW SQL STATEMENT
QUERYNO                      327
COLLECTION                    TESTCOLLX
NEW VERSION                   2005-04-11-18.35.13.673978
OLD VERSION                   2005-04-11-18.20.50.343441
*****
CKP218I PROGRAM TEST02      HAS A DELETED SQL STATEMENT
COLLECTION                    TESTCOLLX
NEW VERSION                   2005-04-11-18.35.13.673978
OLD VERSION                   2005-04-11-18.20.50.343441
*****

```

b A
 Connected to remote server/host 151.213.121.35 using lu/pool SC0TCP05 and port 23

DB2 PATH CHECKER - COMPARE Report

```

-----
                                                                    CSR
STATEMENT          327 THIS IS THE NEW ACCESS PATH.

STATEMENT#         327 DECLARE SELECT-1 CURSOR FOR SELECT NAME , TBNAME , COLNO ,
                    OLTYPE , LENGTH FROM SYSCOLUMNS WHERE TBNAME = : H

STEP              1  ACCESSES TABLE      PUBLIC .SYSCOLUMNS
                    USING A TABLESPACE SCAN.
                    THE ACCESS WILL USE SEQUENTIAL PREFETCH
                    THE INTENT LOCK FOR THE TABLE IS IS
                    THE TIMESTAMP FOR THIS EXPLAIN IS 2006102310560961
                    THE TABLE HAS              -1 ROWS OF      969 BYTES.
CKP220I DATA CHANGE FOR COLUMN ACESSTYPE      WAS      I
CKP220I DATA CHANGE FOR COLUMN MATCHCOLS      WAS      2
CKP220I DATA CHANGE FOR COLUMN ACCESSCREATOR  1 } WAS      PUBLIC
CKP220I DATA CHANGE FOR COLUMN ACCESSNAME     WAS      DSNDX01
CKP220I DATA CHANGE FOR COLUMN PREFETCH      WAS      L
CKP221I DATA CHANGE FOR COLUMN ACESSTYPE      IS NOW  }
CKP221I DATA CHANGE FOR COLUMN MATCHCOLS     IS NOW  } 2 0
CKP221I DATA CHANGE FOR COLUMN ACCESSCREATOR IS NOW  }
CKP221I DATA CHANGE FOR COLUMN ACCESSNAME    IS NOW  }
MA b A
Connected to remote server/host 151.213.121.35 using lu/pool SC0TCP05 and port 23
    
```



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