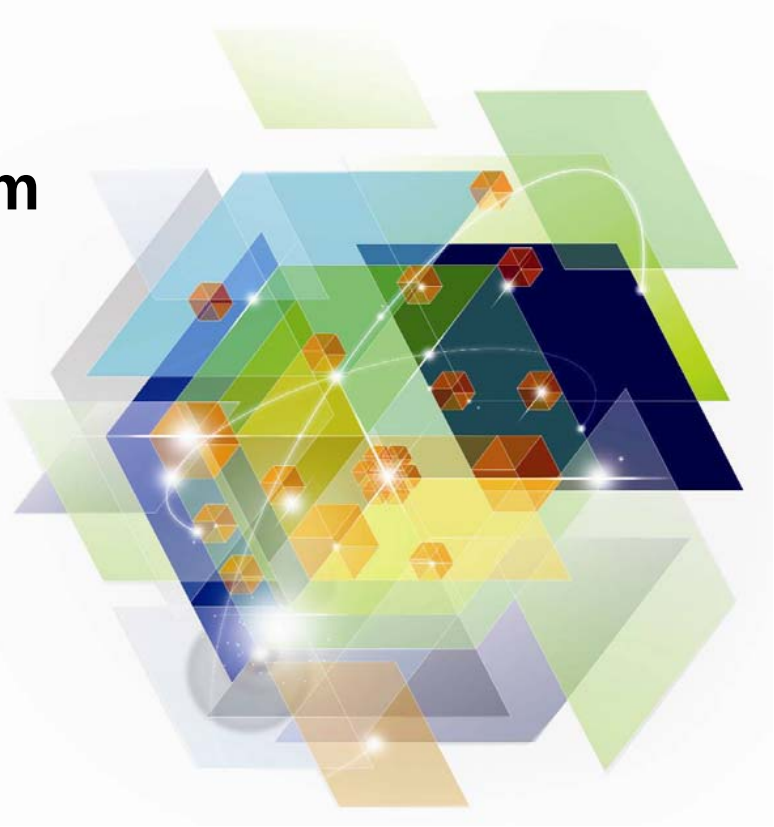
IBM System z Technology Summit

Migrating to DB2 10 - Get maximum CPU benefit with minimum impact



Presenter Name

Title

We all want to gain the benefits of DB2 10…

DB2 10 for z/OS: Out-of-the-Box Savings

Up to 20% CPU reductions for transactions, queries, and batch

- Out-of-the-box CPU reductions of 5-10% for traditional workloads
- Out-of-the box CPU reductions of up to 20% for new workloads
- Up to additional 10% CPU savings using new functions

Scales with less complexity and cost

- 5-10x more concurrent users – up to 20,000 per subsystem
- Significant scale-up capabilities in addition to existing scale-out support
- Consolidate to fewer LPARs and subsystems

Improved operational efficiencies and lower ac n cost

- Automatic diagnostics, tuning, and compression

Even better performance

- Elapsed time improvement for small LOBS and

…But the need to rebind is a concern

- **Why are rebinds so scary? The perception that:**
  - Rebinding requires a lot of CPU
  - Rebinding is a tedious and arduous task
  - Rebinding is costly
  - Rebinding will regress SQL performance

“To REBIND or NOT to REBIND”
… is that the question?

- The question should be, “WHEN to rebind?”
- …or “How can I perform necessary rebinds in a controlled and confident manner?”

Migration steps for ensuring best performance

1. Establish Key Performance Indicators and performance baseline
2. Manage packages that will have automatic rebinds
3. Identify packages that will have improved access path performance
4. Use triage techniques to manage problematic access paths
5. Handle remaining access path performance problems with SQL tuning tool
6. Re-examine Key Performance Indicators after migration

Access Path Analysis using DB2 Path Checker for z/OS

The need for version-to-version binds

- V7 to V8 requires a rebind to move from 31-bit mode to 64-bit mode
- V8, V9, and V10 have SPROC disabled with the migration and need a rebind to restore SPROC
- Falling back with Plan Management keeps the SPROC functionality
- Version Level Optimization requires a rebind
- Running packages bound in previous versions incur additional DB2 overhead

Automatic rebinds

- A V7 to V8 Migration will automatically rebind any package that has not been rebound since V3
- A V8 to V9 Migration will automatically rebind any package that has not been rebound since V4
- A V9 to V10 Migration will automatically rebind any package that has not been rebound since V5
- If you rebind at your current level rebinds will not be automatic

Bind / rebind strategies

- Many sites have a “no rebind” policy
- This policy is challenged by V2V necessities
- Many sites do not have EXPLAINs for every package
- An assessment of your business risks is required
- This is the time to find a V2V rebind solution

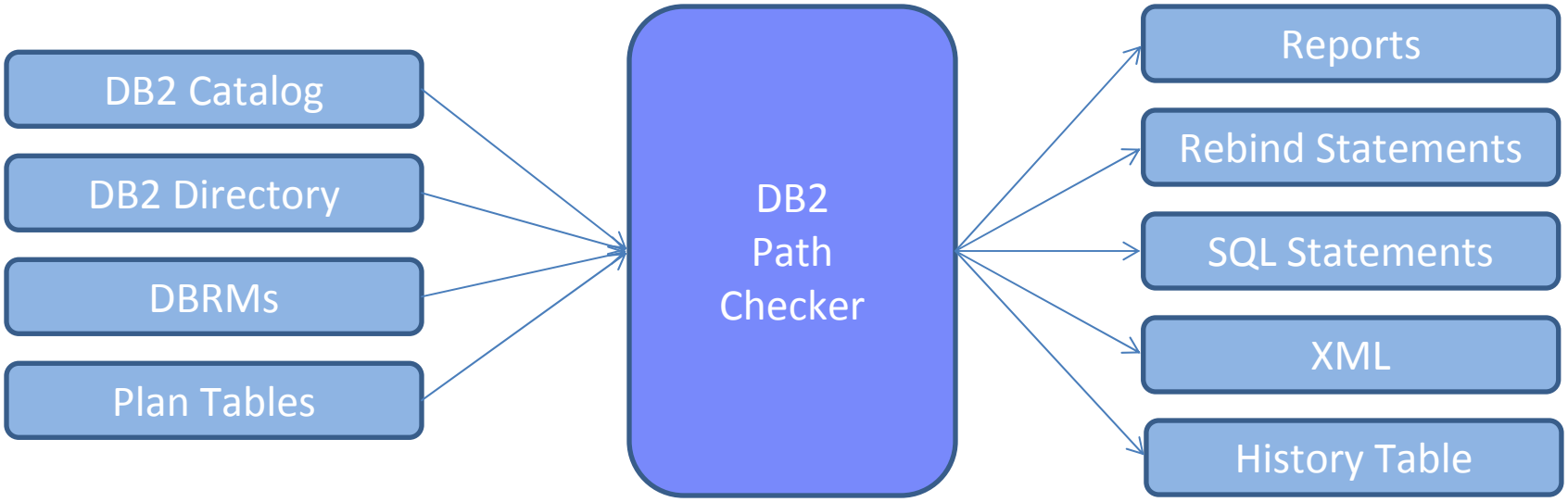
V2V migrations with DB2 Path Checker

- Use the DSNTIJPA job to size the automatic rebind exposure
- Use our first analysis query to create Path Checker TEST commands to recreate Plan Table entries where they are missing. Missing means no cost data as well as Plan Table data.
- Use our Path Checker TEST procedure to create rebind commands for packages that will not have any access path changes
- Use our second analysis query to create Path Checker TEST commands for packages that were rebound before a given date

V2V migrations with DB2 Path Checker

- **Example jobs are provided that will**
  - Identify and provide rebind cards for packages that will not have an access path change
  - Identify and provide rebind cards for packages that will have improved access paths
  - Iteratively walk you through the process by incrementing the amount of CPU increase
  - After the migration identify and removed rebind cards for packages where nothing will change

DB2 Path Checker inputs & outputs



DB2 Path Checker – first analysis

```
SELECT DISTINCT 'EXPLAIN DBRM '
  CONCAT RTRIM(NAME) CONCAT ' TO PACKAGE '
  CONCAT RTRIM(COLLID) CONCAT '.* IN P390I.PLAN_TABLE '
  FROM SYSIBM.SYSPACKAGE A
     WHERE CREATOR = 'P390H' AND VALID = 'Y'
    AND OPERATIVE = 'Y'
    AND NOT EXISTS (SELECT 1 FROM P390H.PLAN_TABLE B
                       WHERE A.COLLID = B.COLLID
                       AND A.NAME = B.PROGNAME
                       AND A.VERSION = B.VERSION );
```

You get a DB2 Path Checker EXPLAIN TO command for every package that does not have a plan table entry

Running these commands will give you an entry for the missing data in your target PLAN_TABLE and DSN_STATEMENT_TABLE

Build on success

- Are your packages organized by collection ID or package name, or random event?
- Find an application area that is willing to work with you
- Follow the next steps to identify those packages that will not change access paths and those that will improve with access path change

Find packages that will not change

- Path Checker 4.1 can identify without rebinding those packages that will not have access path changes
- Because the access path does not change you are paying the cost of that access path regardless of the cost entry in the plan table
- These rebinds are as safe as they can get

SYSCHG report sample

```
PCK218I PROGRAM TEST01    HAS A CHANGED ACCESS PATH
        QUERYNO 327
        OLD PROCSU 209
        NEW PROCSU 139
        COLLECTION TESTCOLL
        NEW VERSION 2005-04-11-18.34.53.754785
        OLD VERSION 2005-04-11-18.20.42.913225
PCK217I TOTAL DBRMS COMPARED 1
PCK217I TOTAL STATEMENTS COMPARED 2
PCK217I TOTAL ACCESS PATH CHANGES 1
PCK217I TOTAL ACCESS PATH SAME 1
PCK217I TOTAL NEW SQL STATEMENTS 0
PCK217I TOTAL DELETED SQL STATEMENTS 0
PCK217I TOTAL DSN_STATEMNT COST INCR 0
```

Status check

- We have now rebound 60% to 80% of your packages
- We now want to identify those packages that will have improved access path performance
- We will do the second analysis

DB2 Path Checker – second analysis

```
-- SELECT BIND DATE OLDER THAN ...
-- CHANGE CPUPCT nn ITERATIVELY
 SELECT DISTINCT 'TEST DBRM  '
   CONCAT RTRIM(NAME) CONCAT ' AS PACKAGE '
   CONCAT RTRIM(COLLID) CONCAT '.* '
   CONCAT ' IN TRAIN01.PLAN_TABLE '
   FROM SYSIBM.SYSPACKAGE A
   WHERE OWNER = 'TRAIN01'
     AND COLLID = 'TST01COLLX'
     AND TIMESTAMP < '2009-09-04-14.24.34.593683';
```

You get a DB2 Path Checker TEST command for every package bound before the timestamp value

Example Path Checker input

```
OPTIONS CPUPCT 00 CATALOGSQL
CONNECT TO GT8G
SET CURRENT SQLID = 'PUBLIC'
--TEST COMMANDS ARE FROM 2ND ANALYSIS QUERY
TEST DBRM  TEST01 AS PACKAGE TST01COLLX.* IN
TRAIN01.PLAN_TABLE
TEST DBRM  TEST02 AS PACKAGE TST01COLLX.*  IN
TRAIN01.PLAN_TABLE
```

Results

- **CPUPCT 00 does not generate rebind cards for packages whose cost increases past zero so you get**
  - Rebind cards in RBINDOUT for everything that has a lower cost.
  - Rebind cards in PBINDOUT for everything else
- **You have now rebound an additional 5% to 10% of your packages**

Iteration

- Repeat the last SPUFI to select TEST commands before the rebinds that completed
- Increase the CPUPCT 00 by 05
- Repeat the process until you feel the CPU percentage is approaching your limit
- Examine using the triage techniques

DB2 Path Checker triage

- SYSCHG DD will provide a list of access path changes by SQL statement and the costs and reasons
- Cost is represented in MSUs and CPU. If you are changing CPU types use the MSUs as the best reflection of change
- SYSCHG data can be written to a HIST_TABLE and examined by SPUFI

DB2 Path Checker triage - 1

- **Look for inner and outer table join changes first, as these are the most common**
  - Usually this means a change in DB2 STATS between the original bind and the present bind
  - Use Optim Query Workload Tuner Statistics Advisor

DB2 Path Checker triage - 2

- **Change in MATCHCOLS either up or down**
  - Again this is likely a change in Statistics
  - Use Optim Query Workload Tuner Statistics Advisor
  - MATCHCOLS cannot be change with a DB2 Hint
  - The DB2 Hint will be accepted but simply ignore the input

DB2 Path Checker triage - 3

- **The older the bind the more likely the access path is to change**
  - This is more likely with complex SQL
  - The older the bind, the more likely the change will look more costly
  - Remember the original cost data was at the time of the original bind. Has the amount of data increased?

DB2 Path Checker triage - 4

- **The reason we did the easy stuff first was**
  - To gain credibility
  - To have time to work on the more challenging problems.
  - Some of these cannot be fixed

DB2 Path Checker triage - 5

- **You will find SQL that has coding tricks to get a specific access path.**
- **You will find SQL that would perform better if written to take advantage of present technology.**
  - Document these, do not rebind unless you have to, and send them back through your management to be corrected

Cost contrasts between DB2 versions

- **If the COST value goes up by 50% or higher then something has changed**
  - The stats are different
  - The buffer pool setup is different
  - The indexes are different
  - Access path definitions have changed

V2V - production systems

- Access path most likely change
- Check order of tables in joins
- Check point-by-point plan table columns
- Most access path changes are for the better
- Have a hint strategy
- Hinting back to an old access path will most likely give performance stability

IBM tools with explain functionality

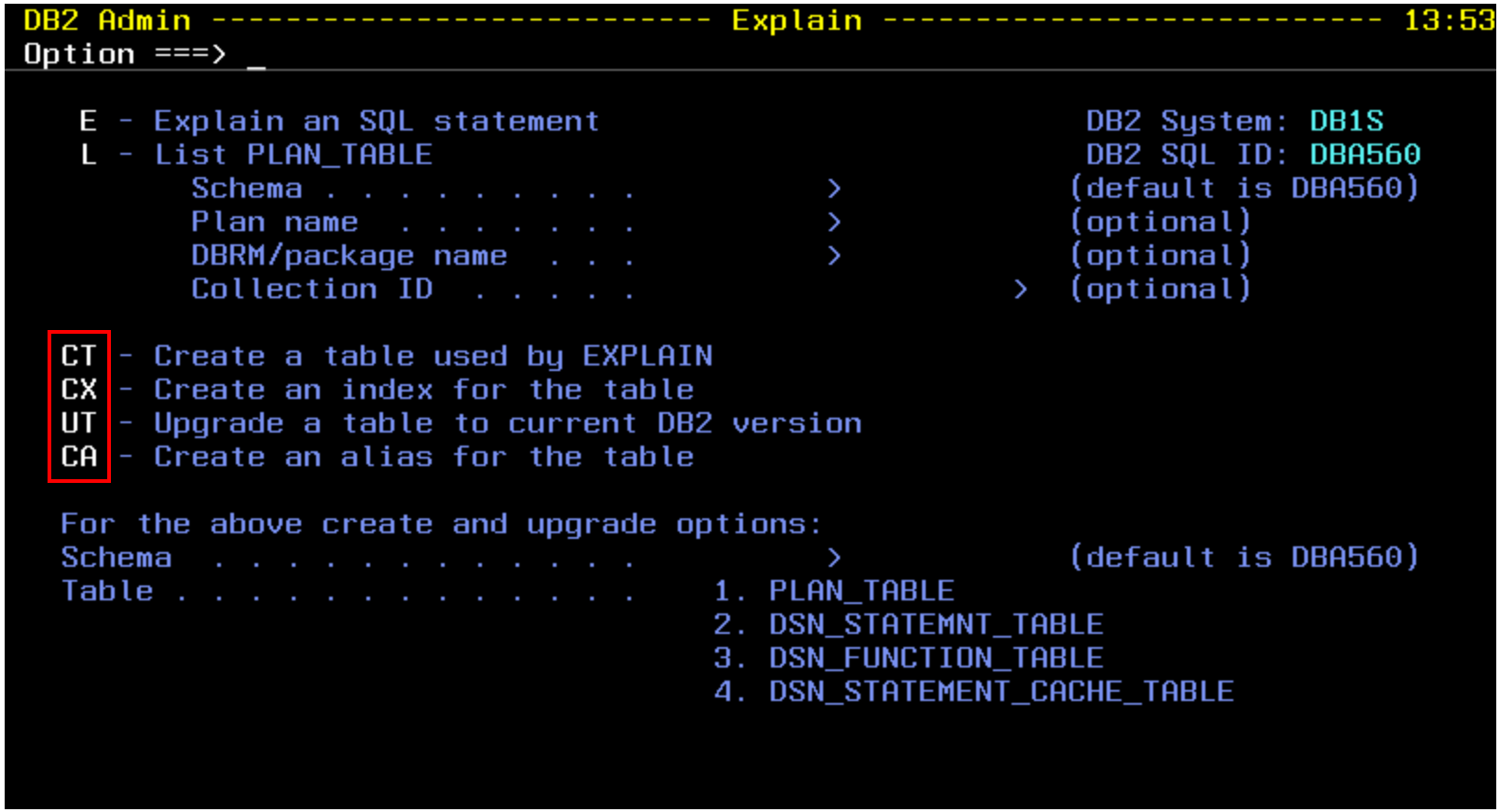
- DB2 Administration Tool for z/OS
- DB2 SQL Performance Analyzer for z/OS
- Optim Query Workload Tuner
- Data Studio

DB2 Administration Tool for z/OS

- **Comprehensive administration functions**
  - Catalog navigation
  - Reverse engineering
  - Advanced DBA actions – alterations, migrations, etc.
- **Explain functions**
  - Create and upgrade explain tables
  - Simple ad-hoc explain of SQL statement
  - Interpret plan table data
  - Migrate statistics

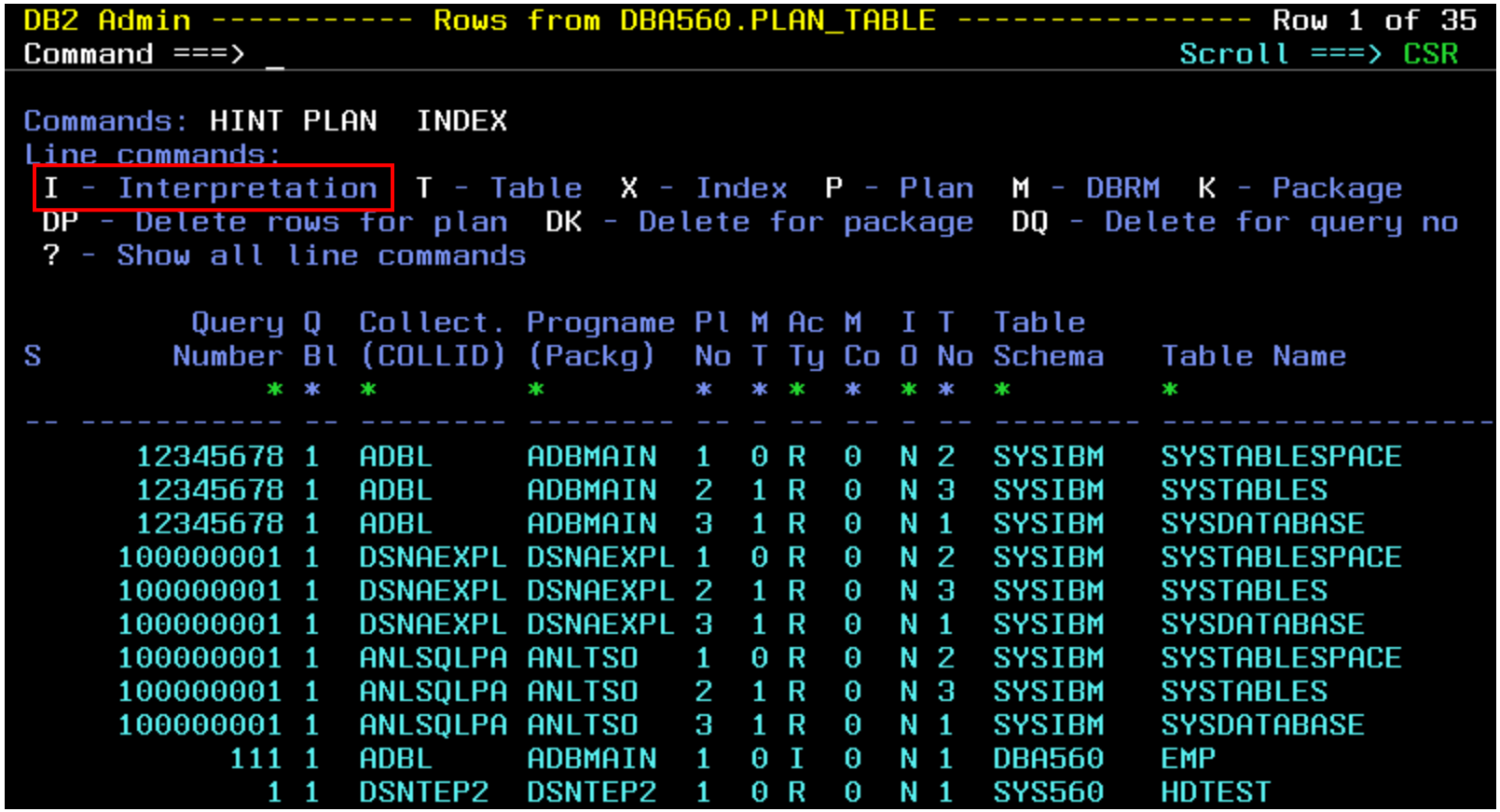
DB2 Administration Tool – explain options

Create or upgrade plan tables to DB2 10



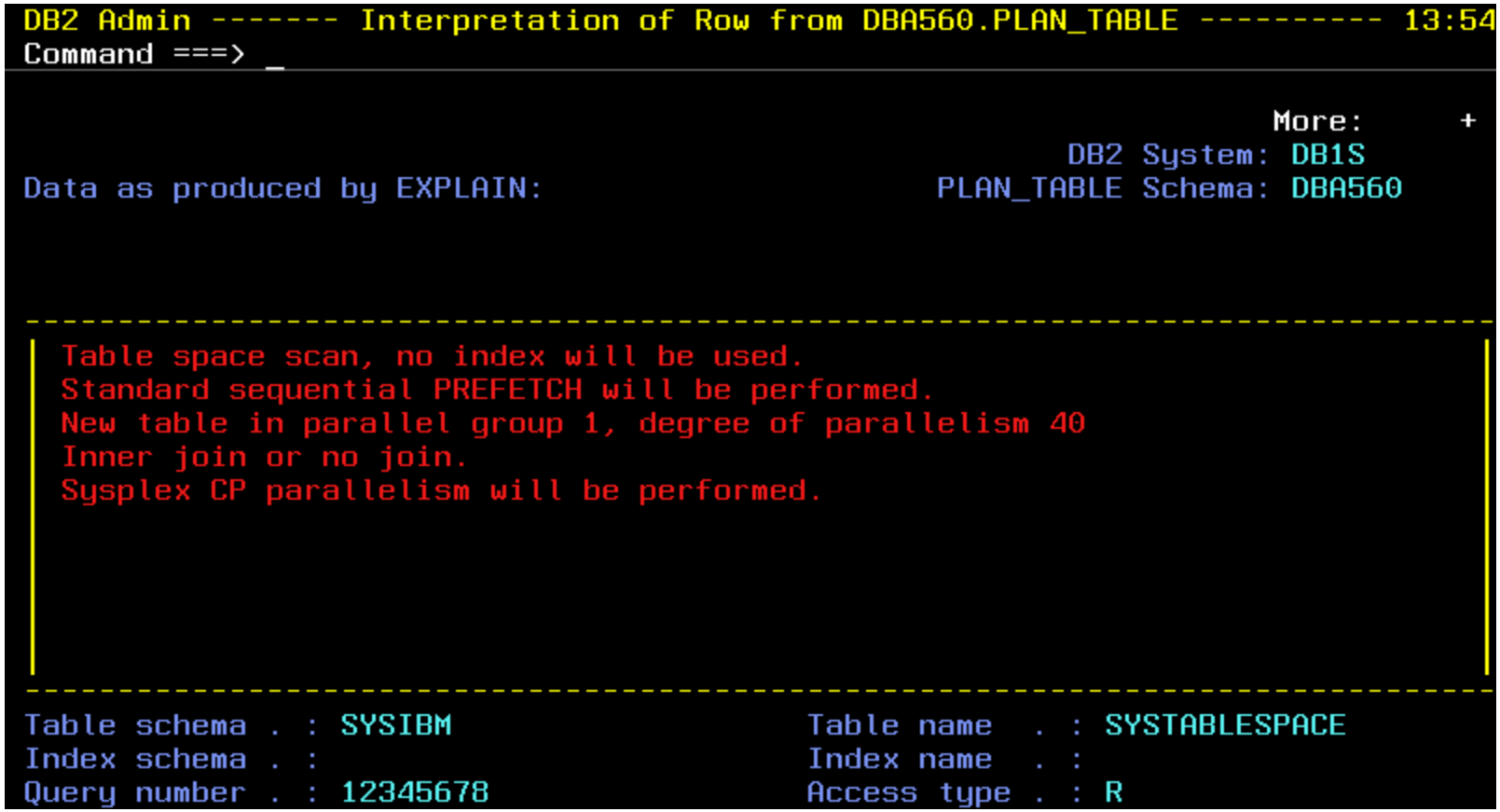
DB2 Administration Tool – plan table view

View plan table – also available from package display



DB2 Administration Tool – interpret explain

Basic access path information at object level

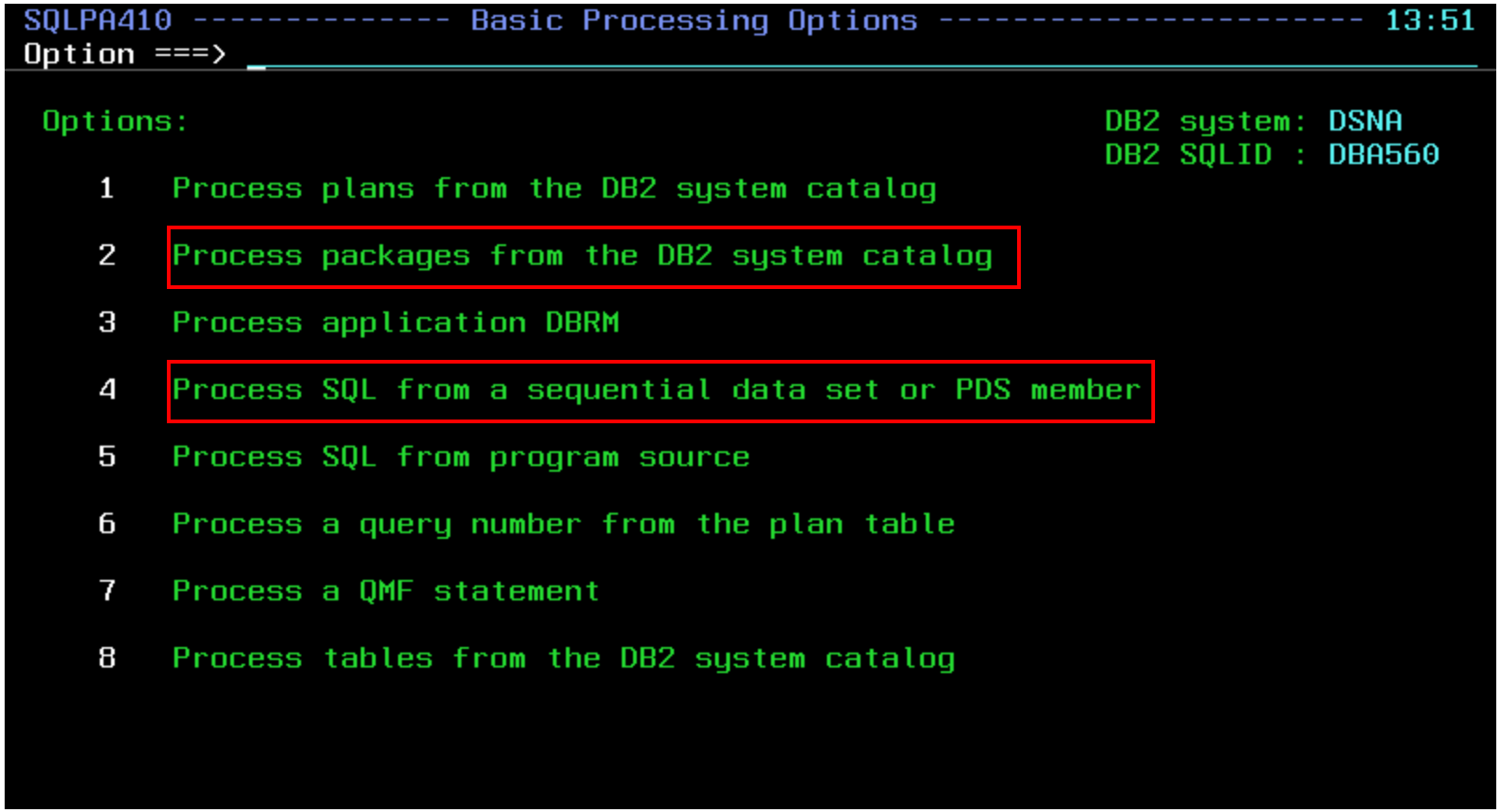


DB2 SQL Performance Analyzer for z/OS

- **SQL tuning tool**
  - Provides expert advice in detailed recommendations
  - Variety of input sources
    - Catalog
    - Program source
    - Text files
    - And more…
  - ISPF and batch SQL analysis
  - Invoke from other IBM tools
    - DB2 Path Checker
    - OMEGAMON XE for DB2 Performance Expert
    - DB2 Query Monitor
    - DB2 Administration Tool

DB2 SQL PA - options

Choose input source – option 4 to read SQL file from DB2 Path Checker



DB2 SQL PA – explain packages

Choose package identified in DB2 Path Checker by collection and name

```
SQLPA410 ------------------ Process Packages --------------------------- 13:57
Command ===> _____________________________________________ Scroll ===> CSR

 Commands:   EXPLAIN SQL TABLES                    DB2 system: DSNA
                                                   DB2 SQLID : DBA560
 Enter the package information:
  *Collection ID . . . ANLSQLPA_____________   >
  *Package name. . . . ANLS*________________   >
   Version ID  . . . . _____________________   >
   Current degree  . . 1__ (1 or Any)
   Generations . . . . 1_______
   Force . . . . . . . N  (Y or N)
 Statements accessing the following table:
   Table owner . . . . _____________________   >
   Table name. . . . . _____________________   >
 Range of statements:
   Beginning QUERYNO . _________
   Ending QUERYNO. . . _________
 Location
   Remote location . . _____________________   >
*Compare the old package to the new package? N (Y or N)

 (An * indicates a required field.)
```

DB2 SQL PA – explain from text input

Choose SQL input file created by DB2 Path Checker

```
SQLPA410 ------------------- Process SQL ------------------------------ 13:57
Command ===> _____________________________________________ Scroll ===> CSR

 Commands:  EXPLAIN  SQL  TABLES  EDIT                 DB2 system: DSNA
                                                       DB2 SQLID : DBA560
 Enter the input data set name:

  *Data set name. . . 'DBA560.DEMO.SQL(SQLDEMO)'

 Enter optional parameters:

   Table qualifier . . ____________________  >
   Synonym creator . . ________
   Current degree. . . 1__  (1 or Any)

 (An * indicates a required field.)
```

DB2 SQL PA – query limits report

Establish thresholds and focus on high-cost SQL

```
SQLPA410---------------------- Query Limits Report ------------------ Row 1 of 4
Command ==> _____________________________________________ Scroll ===> CSR

                                                      DB2 system: DSNA
Commands:  PR - PRINT                                 DB2 SQLID : DBA560
                                                      Time . . .: 13:59
Line commands:
 C - Cost Report  E - Explain Report  S - SQL  T - Trace Report  R - EEE Report
 W - What-if?
                              Stmt CPU        Elapsed    Physical
S CEIQ$  Error  Query No      Type Time       Time       I/O      QUNITS    Cost
- -----  ------ --------      ---- ---------- ---------- -------- --------- -------
_ ---Y-  0      100000003     NB   0.00800    0.194      6        412       0.0018
_ ---Y-  0      100000004     ST   0.00700    0.018      1        349       0.0016
_ -----  0      100000001     UE   0.00400    0.633      6        189       0.0009
_ -----  0      100000002     ST   0.00300    0.005      1        153       0.0007
******************************** Bottom of data ********************************
```

DB2 SQL PA – report sample - 1

Evaluate tuning advice – guidelines, recommendations, warnings…

```
EDIT ----- DBA560.ANL410.EXP------------------------------ COLUMNS 00001 00072
COMMAND ===> _                                              SCROLL ===> CSR
000516
000517  SQL PA Analysis for Queryno 100000003
000518
000519  SELECT NAME, NTABLES, PARTITIONS, SEGSIZE
000520  FROM SYSIBM.SYSTABLESPACE
000521  WHERE CREATOR = 'SYSIBM'
000522  AND NAME IN (
000523  SELECT TSNAME
000524  FROM SYSIBM.SYSTABLES
000525  WHERE PARENTS > 0
000526  OR CHILDREN > 0)
000527
000528  Queryno:  100000003 QBlk:  1 Pln:  1 Mix:  0 Prnt QBlk:  0 Prnt Pln:  0
000529  Process ->
000530
000531   +----------------------- Queryno 100000003 ----------------------+
000532   |ANL7002I *** GUIDELINE:                                         |
000533   |This plan step has not selected any Sequential|List Prefetch I/O.|
000534   |If the SQL processes just a few rows that is OK, but if many rows|
000535   |are involved, you can help promote Sequential Detection by both  |
000536   |accessing the data in sequential order (presort?) and by binding |
000537   |with Release (Deallocate) to avoid resetting counters at Commit. |
```

DB2 SQL PA – report sample - 2

Examine access path and table / index statistics

```
EDIT ----- DBA560.ANL410.EXP------------------------------ COLUMNS 00001 00072
COMMAND ===>                                                 SCROLL ===> CSR
000570  RANDOM NONMATCH IX SCAN
000571  ----------------------
000572  IX Creator: SYSIBM
000573  Index Name: DSNDSX01
000574
000575  Vers:   1 Key Len:   -1 Padded: N  C-ed: N C-ing: Y CluRatio:  62.0000
000576  Fullkey card:                  391 Firstkey card:                   28
000577  Type: 2  Nleaf pages:            4 Nlevels:  2 Unique: P  PRIMARY KEY
000578   0 of  2 columns are matched  Close:  N  Lock mode:  IS  Bpool: BP0
000579  Ex Type:   Key Target Cnt:  0 Unique Cnt:  0 Compress: N Owner Typ:
000580  Sparse index: - Hash overflow: -
000581
000582  Key      Column Name          Type    Len ODNPGMH  Colcard  Dist# Hist#
000583  ------------------------------------------------------------------------
000584    1 DBNAME                  VARCHAR    24 ANN----       28     10     0
000585    2 NAME                    VARCHAR    24 ANN----      276      0     0
000586
000587   +---------------------- Queryno 100000003 ----------------------+
000588   |ANL6052I *** NOTE:                                             |
000589   |This index is specified as "Not Padded", allowing storage of a |
000590   |varying length index key. Padded indexes use blanks to fill out|
000591   |their fixed length keys and are not eligible for Index Only scan.|
```

DB2 SQL PA – report sample - 3

Examine related tables for problems – e.g., missing index on column

```
EDIT ----- DBA560.ANL410.EXP------------------------------ COLUMNS 00001 00072
COMMAND ===>                                                 SCROLL ===> CSR
000298
000299  Table is a Parent to SYSIBM  .SYSRELS              in Relation: DSNDT@DR
000300  Primary key has  2 columns and Delete rule is: CASCADE
000301
000302  Table is a Parent to SYSIBM  .SYSTABSTATS_HIST    in Relation: DSNTT@HB
000303  Primary key has  2 columns and Delete rule is: CASCADE
000304
000305  Table is a Parent to SYSIBM  .SYSTABCONST         in Relation: DSNDT@CN
000306  Primary key has  2 columns and Delete rule is: CASCADE
000307
000308  Table is a Parent to SYSIBM  .SYSCONSTDEP         in Relation: DSNDT@CC
000309  Primary key has  2 columns and Delete rule is: CASCADE
000310
000311  Table is a Parent to SYSIBM  .SYSCHECKS           in Relation: DSNDT@SC
000312  Primary key has  2 columns and Delete rule is: CASCADE
000313
000314  Table is a Parent to SYSIBM  .SYSTABLES_HIST      in Relation: DSNDT@HD
000315  Primary key has  2 columns and Delete rule is: CASCADE
000316
000317  Table is a Parent to SYSIBM  .SYSTRIGGERS         in Relation: DSNDT@OT
000318  Primary key has  2 columns and Delete rule is: CASCADE
000319
```

Performance Analysis with OMEGAMON XE for DB2 Performance Expert

The role of performance monitoring

- **Monitoring tools help to identify your migration return on investment (ROI)**
- **Monitoring tools can help identify missed migration opportunities**
  - i.e. new DB2 capabilities
- **Monitoring tools capture data necessary for analysis of performance regression**

OMEGAMON XE for DB2 Performance Expert

- **Version 5.1 is required to monitor DB2 10**
  - There is no support for DB2 10 in OM PE V410/V420 – not even toleration
  - OMEGAMON XE for DB2 Performance Expert / Performance Monitor 5.1 supports DB2 8, 9, and 10
  - Buffer Pool Analyzer (included in OM PE) supports DB2 8, 9, and 10 as well
- **Customers should move to OM PE (or PM) 5.1 prior to beginning their DB2 10 migration**

Managing the migration to DB2 10

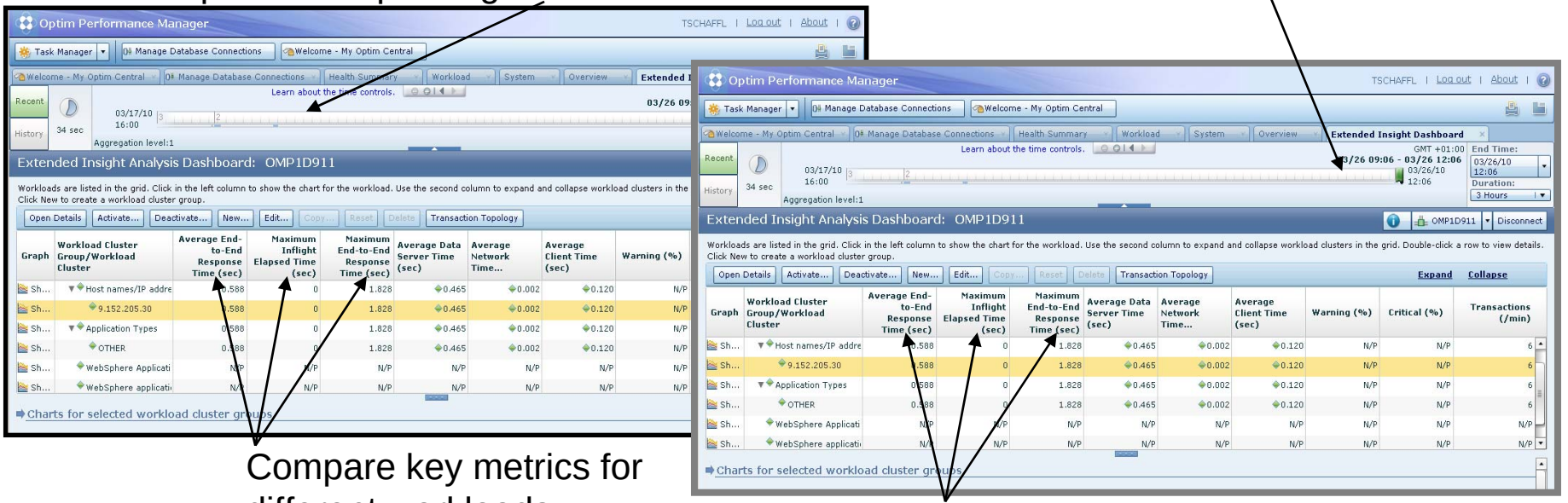
- **Identify Key Performance Indicators (KPIs), e.g.**
  - Elapsed time
  - In-DB2 CPU time
  - other
- **Identify critical business applications**
- **Baseline KPIs for critical business applications prior to migration**
- **Leverage the OMEGAMON 5.1 batch reporter with (optional) upload to PDB (Performance Database) running with DB2 9**
- **Applications which access DB2 on z/OS via DRDA using JCC, CLI, .Net can take advantage of Extended Insight and the repository database to store and compare average response time metrics**

Using Extended Insight to compare before and after

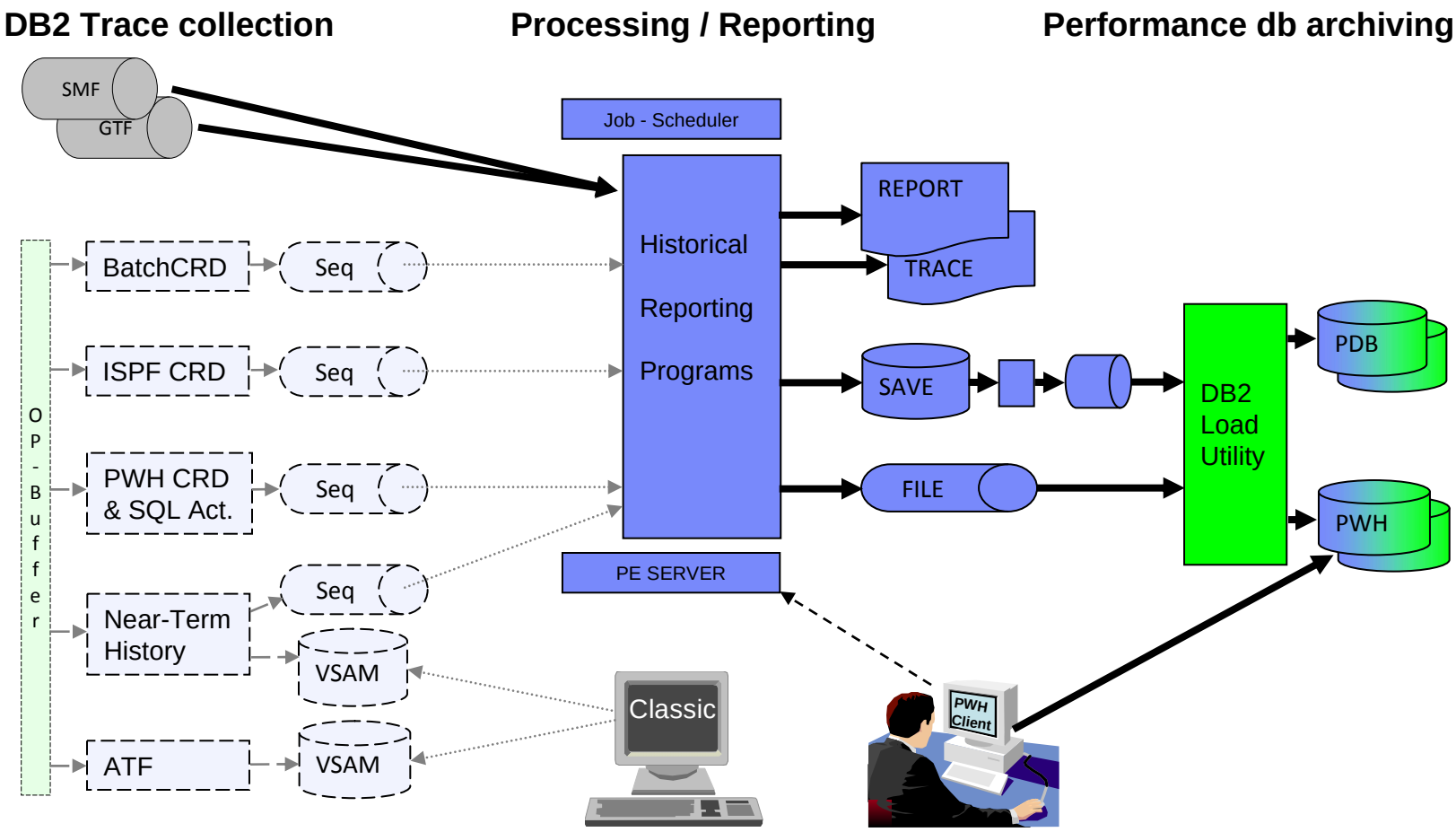
- **Note: as there is currently no side-by-side comparison for multiples point-in-time, open multiple web-consoles each with the appropriate time-period for analysis selected.**

Select time period A – pre-migration

Select time period B – post-migration



Analyzing application performance - PDB



Capture metrics before and after migration

- **STATISTICS reports/metrics identify potential DB2 system problems**
- **ACCOUNTING reports/metrics identify potential application problems**
- **There are metrics in DB2 10 that don’t exist in DB2 9**
- **Use the lowest common denominator**
- **While certain metrics exist only in DB2 10, they can provide insight not previously available even if you can’t compare the DB2 9 and 10 metrics side by side.**

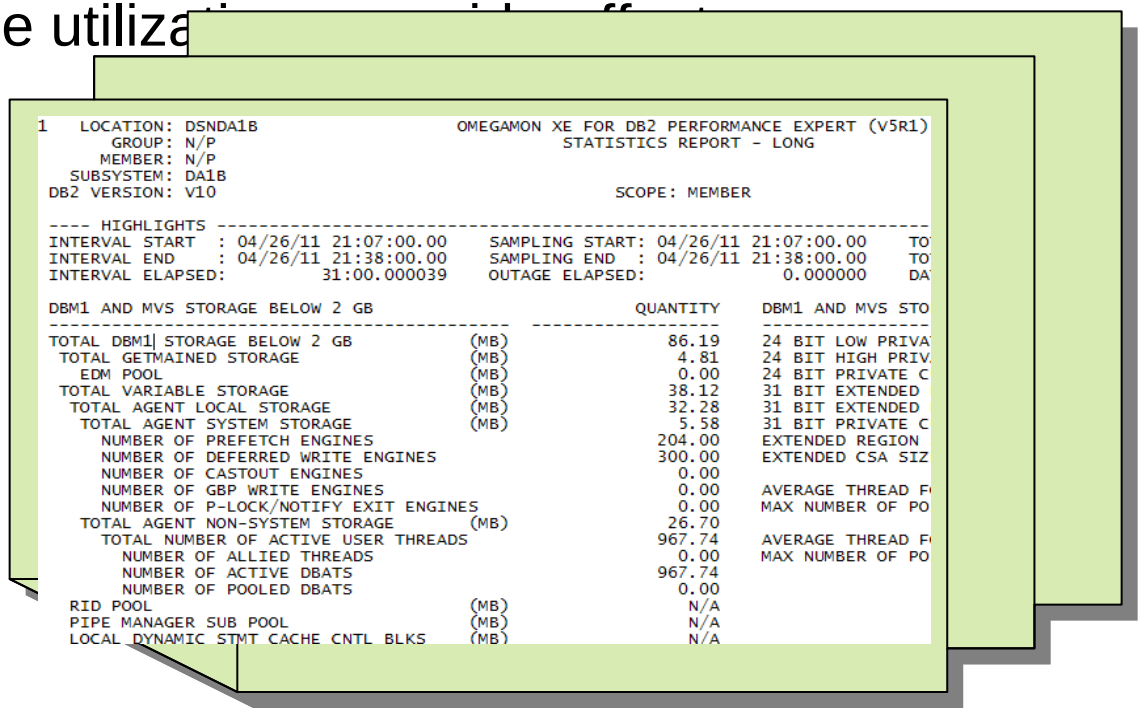
Key areas to evaluate

⑩Statistics reports

- IFCID 225 / DB2 for z/OS Storage – "`STATISTICS REPORT - LONG`"

☑ Expect to see storage relief in the DBM1 address space

☑ Monitor real storage utiliza



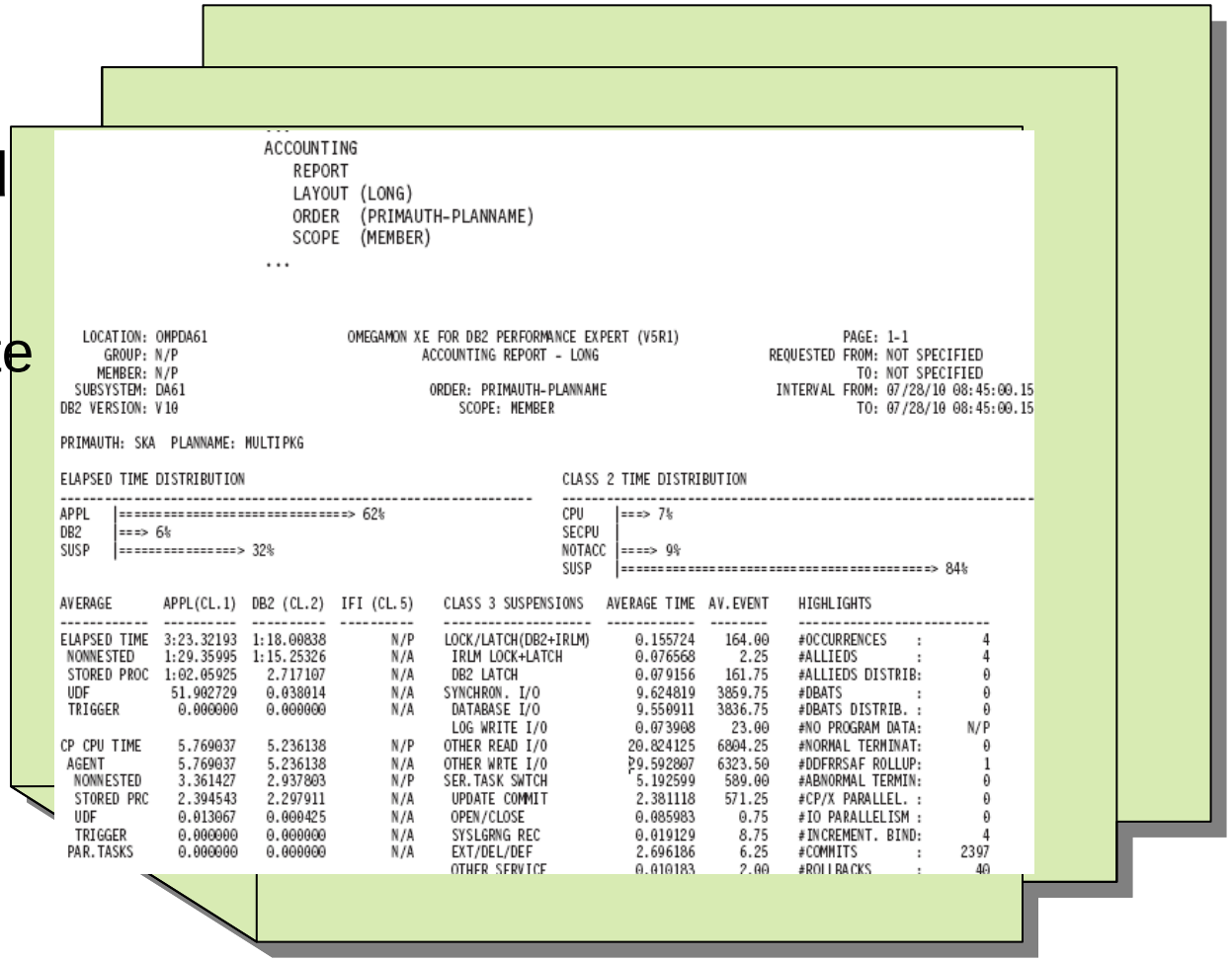
```
1   LOCATION: DSNDA1B                    OMEGAMON XE FOR DB2 PERFORMANCE EXPERT (V5R1)
      GROUP: N/P                                    STATISTICS REPORT - LONG
     MEMBER: N/P
  SUBSYSTEM: DA1B
 DB2 VERSION: V10                                        SCOPE: MEMBER

---- HIGHLIGHTS ------------------------------------------------------------------------
INTERVAL START  : 04/26/11 21:07:00.00    SAMPLING START: 04/26/11 21:07:00.00    TO
INTERVAL END    : 04/26/11 21:38:00.00    SAMPLING END  : 04/26/11 21:38:00.00    TO
INTERVAL ELAPSED:         31:00.000039    OUTAGE ELAPSED:           0.000000    DA

DBM1 AND MVS STORAGE BELOW 2 GB                              QUANTITY    DBM1 AND MVS STO
-------------------------------------------  ------------------------  ----------------
TOTAL DBM1 STORAGE BELOW 2 GB          (MB)                    86.19    24 BIT LOW PRIVA
 TOTAL GETMAINED STORAGE               (MB)                     4.81    24 BIT HIGH PRIV
   EDM POOL                            (MB)                     0.00    24 BIT PRIVATE C
 TOTAL VARIABLE STORAGE                (MB)                    38.12    31 BIT EXTENDED
  TOTAL AGENT LOCAL STORAGE            (MB)                    32.28    31 BIT EXTENDED
   TOTAL AGENT SYSTEM STORAGE          (MB)                     5.58    31 BIT PRIVATE C
     NUMBER OF PREFETCH ENGINES                                204.00    EXTENDED REGION
     NUMBER OF DEFERRED WRITE ENGINES                          300.00    EXTENDED CSA SIZ
     NUMBER OF CASTOUT ENGINES                                   0.00
     NUMBER OF GBP WRITE ENGINES                                 0.00    AVERAGE THREAD F
     NUMBER OF P-LOCK/NOTIFY EXIT ENGINES                        0.00    MAX NUMBER OF PO
   TOTAL AGENT NON-SYSTEM STORAGE        (MB)                    26.70
     TOTAL NUMBER OF ACTIVE USER THREADS                       967.74    AVERAGE THREAD F
       NUMBER OF ALLIED THREADS                                  0.00    MAX NUMBER OF PO
       NUMBER OF ACTIVE DBATS                                  967.74
       NUMBER OF POOLED DBATS                                    0.00
  RID POOL                             (MB)                      N/A
  PIPE MANAGER SUB POOL                (MB)                      N/A
  LOCAL DYNAMIC STMT CACHE CNTL BLKS   (MB)                      N/A
```

Key areas to evaluate

⑩Application (i.e. Accounting) reports - "ACCOUNTING REPORT – LONG"

☑Evaluate Lock and Latch wait times

- There are separate counters for: DB2 Lock, IRLM, and DB2 latch wait



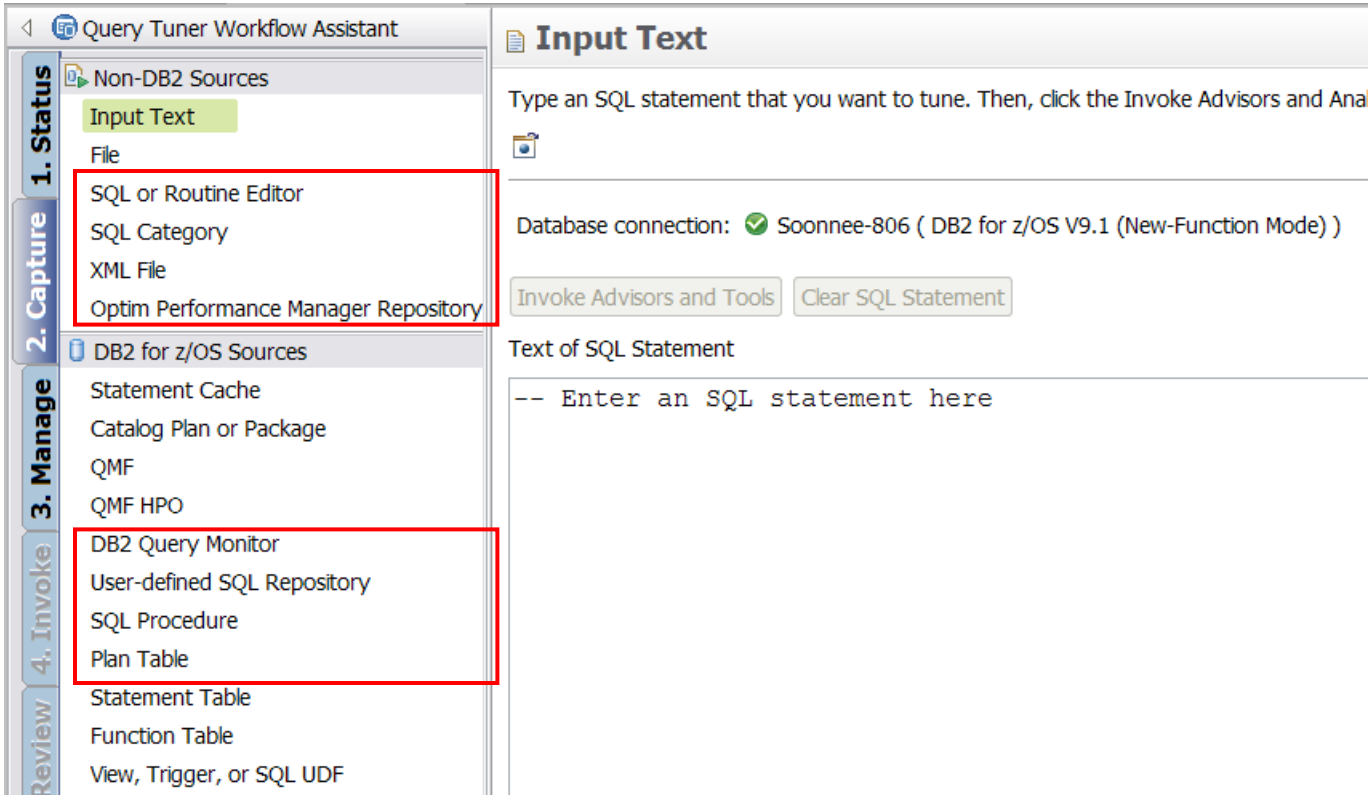
```
...
ACCOUNTING
   REPORT
   LAYOUT (LONG)
   ORDER  (PRIMAUTH-PLANNAME)
   SCOPE  (MEMBER)
...
```

```
   LOCATION: OMPDA61                OMEGAMON XE FOR DB2 PERFORMANCE EXPERT (V5R1)                PAGE: 1-1
     GROUP: N/P                                ACCOUNTING REPORT - LONG                REQUESTED FROM: NOT SPECIFIED
    MEMBER: N/P                                                                                 TO: NOT SPECIFIED
  SUBSYSTEM: DA61                            ORDER: PRIMAUTH-PLANNAME                 INTERVAL FROM: 07/28/10 08:45:00.15
DB2 VERSION: V10                               SCOPE: MEMBER                                    TO: 07/28/10 08:45:00.15

PRIMAUTH: SKA  PLANNAME: MULTIPKG

ELAPSED TIME DISTRIBUTION                                        CLASS 2 TIME DISTRIBUTION
-------------------------------------------------------------    ------------------------------------------------------------
APPL   |==============================> 62%                     CPU    |===> 7%
DB2    |===> 6%                                                 SECPU  |
SUSP   |================> 32%                                   NOTACC |====> 9%
                                                                 SUSP   |========================================> 84%

AVERAGE      APPL(CL.1)  DB2 (CL.2)  IFI (CL.5)   CLASS 3 SUSPENSIONS   AVERAGE TIME  AV.EVENT   HIGHLIGHTS
-----------  ----------  ----------  ----------   -------------------   ------------  --------   --------------------------
ELAPSED TIME  3:23.32193  1:18.00838         N/P   LOCK/LATCH(DB2+IRLM)      0.155724    164.00   #OCCURRENCES    :        4
 NONNESTED    1:29.35995  1:15.25326         N/A    IRLM LOCK+LATCH          0.076568      2.25   #ALLIEDS        :        4
 STORED PROC  1:02.05925    2.717107         N/A    DB2 LATCH                0.079156    161.75   #ALLIEDS DISTRIB:        0
 UDF           51.902729   0.038014         N/A   SYNCHRON. I/O             9.624819   3859.75   #DBATS          :        0
 TRIGGER        0.000000   0.000000         N/A    DATABASE I/O             9.550911   3836.75   #DBATS DISTRIB. :        0
                                                    LOG WRITE I/O            0.073908     23.00   #NO PROGRAM DATA:      N/P
CP CPU TIME     5.769037   5.236138         N/P   OTHER READ I/O           20.824125   6804.25   #NORMAL TERMINAT:        0
 AGENT          5.769037   5.236138         N/A   OTHER WRTE I/O           29.592807   6323.50   #DDFRRSAF ROLLUP:        1
  NONNESTED     3.361427   2.937803         N/P   SER.TASK SWTCH            5.192599    589.00   #ABNORMAL TERMIN:        0
  STORED PRC    2.394543   2.297911         N/A    UPDATE COMMIT            2.381118    571.25   #CP/X PARALLEL. :        0
  UDF           0.013067   0.000425         N/A    OPEN/CLOSE               0.085983      0.75   #IO PARALLELISM :        0
  TRIGGER       0.000000   0.000000         N/A    SYSLGRNG REC             0.019129      8.75   #INCREMENT. BIND:        4
PAR.TASKS       0.000000   0.000000         N/A    EXT/DEL/DEF              2.696186      6.25   #COMMITS        :     2397
                                                    OTHER SERVICE            0.010183      2.00   #ROLLBACKS      :       40
```

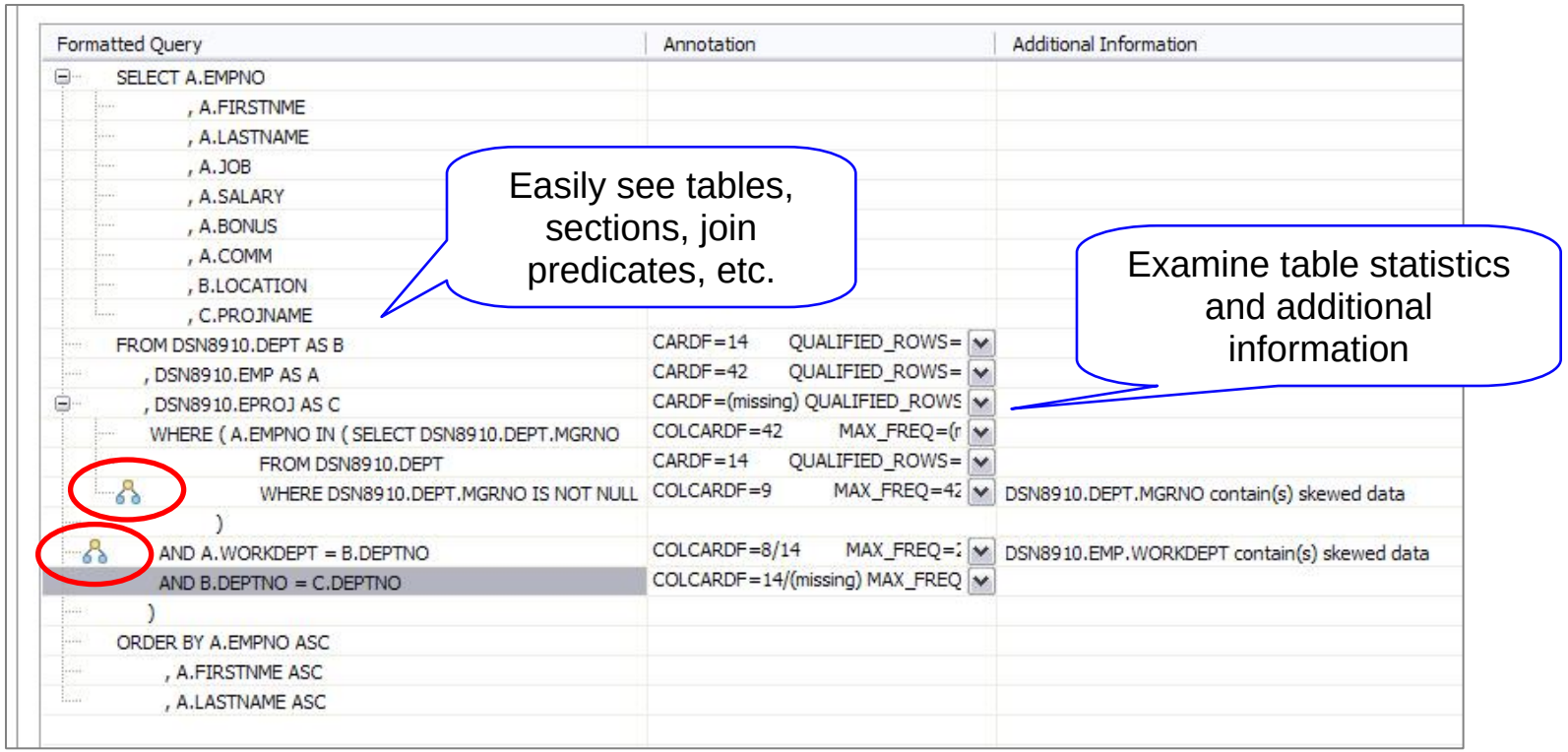
Optimizing Performance with Optim Query Workload Tuner

Capturing Workloads from Various Sources

- New SQL sources: OPM repository, DB2 Query Monitor, User-defined SQL Repository (typically used by other monitoring tools)
- Improved capture capability: Routine Editor, SQL procedure, SQL UDF, a limited set of PLAN tables…
- New in capture from Routine Editor: local variable substitution (into typed parameter marker)



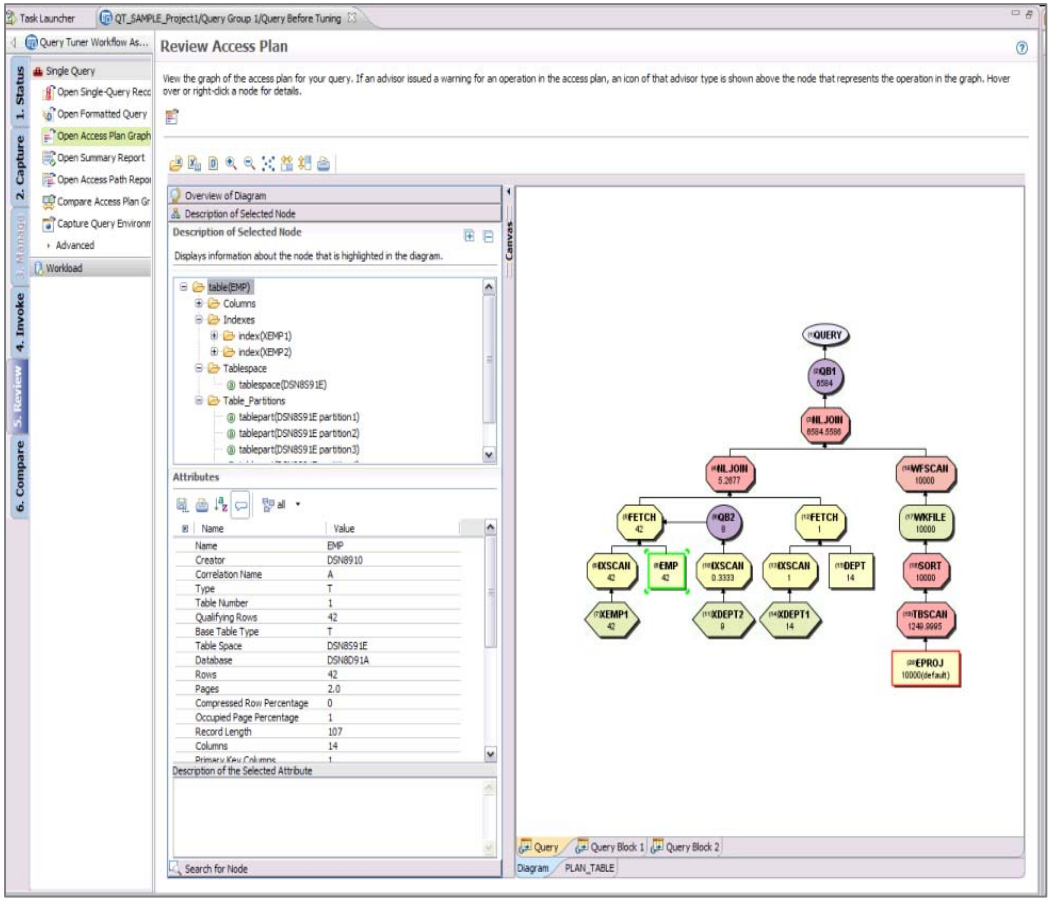
Visualize queries and costs to speed analysis



- **Accelerate analysis, reduce downtime**
  - Spot human errors
  - Identify where filtering should occur

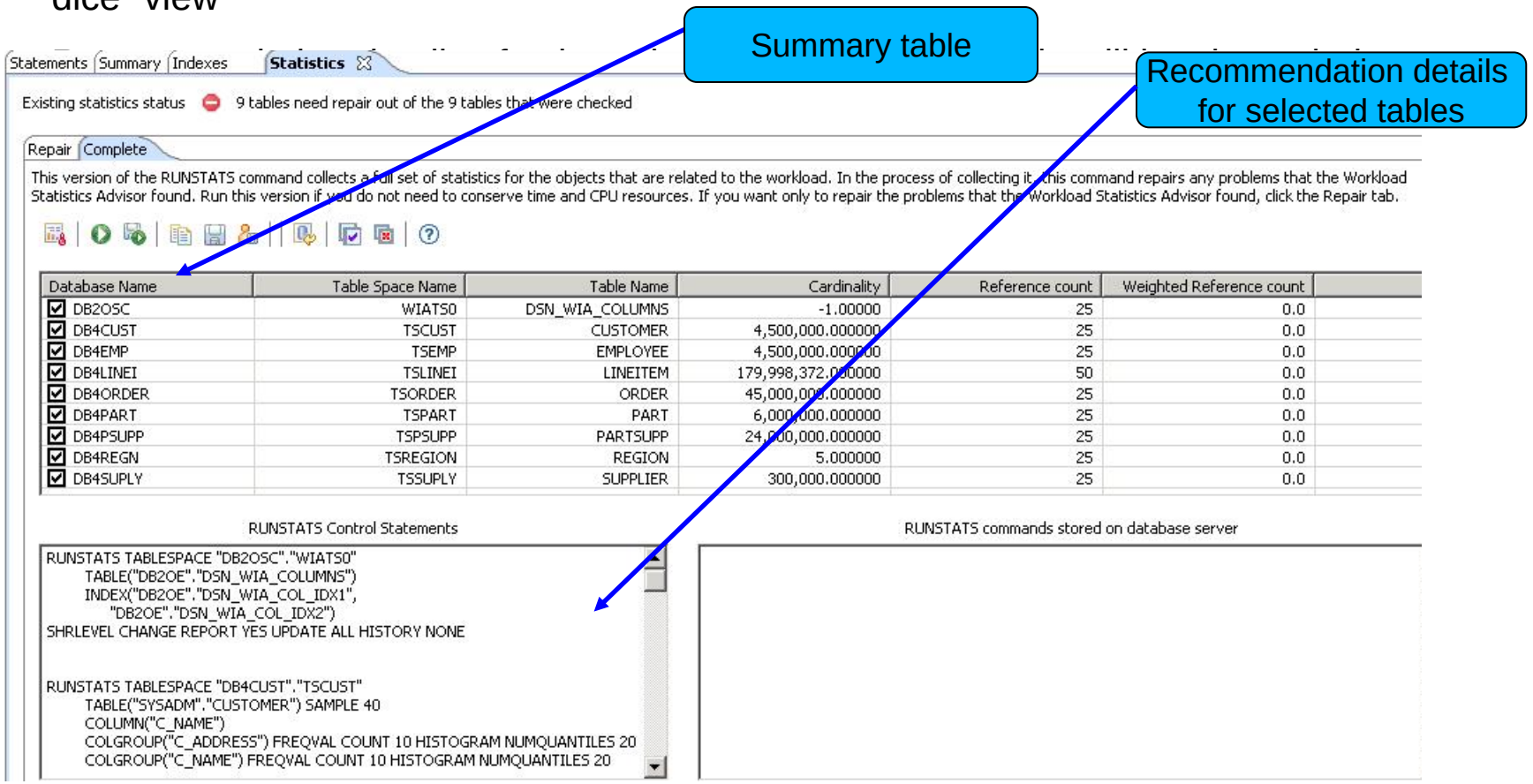
Expert-enabled query tuning out of the box

- **Identify query candidates from numerous sources**
  - DB2 catalog
  - Dynamic statement cache
  - Development Studio hot spots
  - Query or performance monitors
- **Facilitate analysis with new GUI**
  - Query formatting
  - Access path visualization and annotation
- **Get expert tuning advice**
  - Improve statistics quality



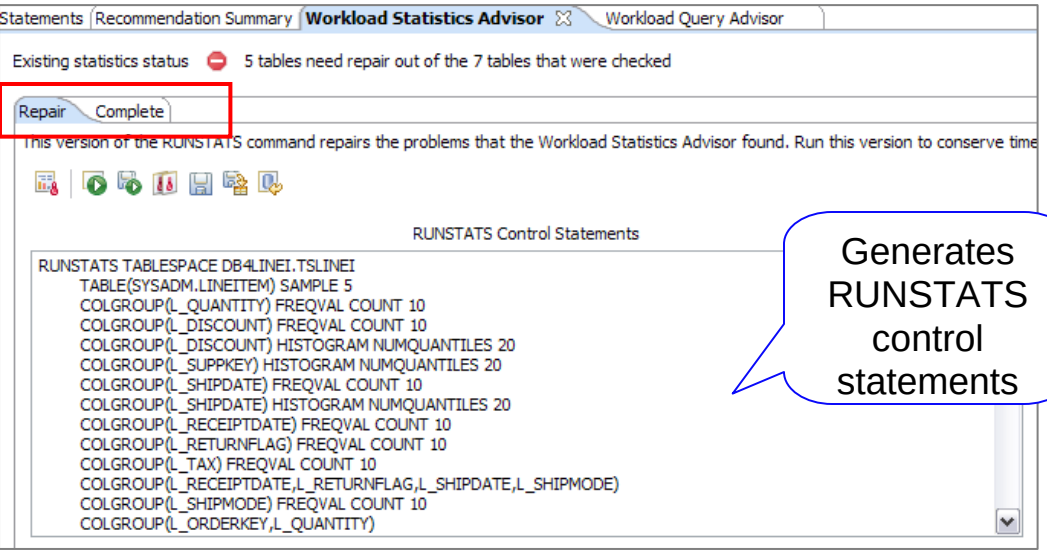
Workload Statistics Advisor Improvement

- Summary table lists all tables that have recommendations, allowing “slice and dice” view

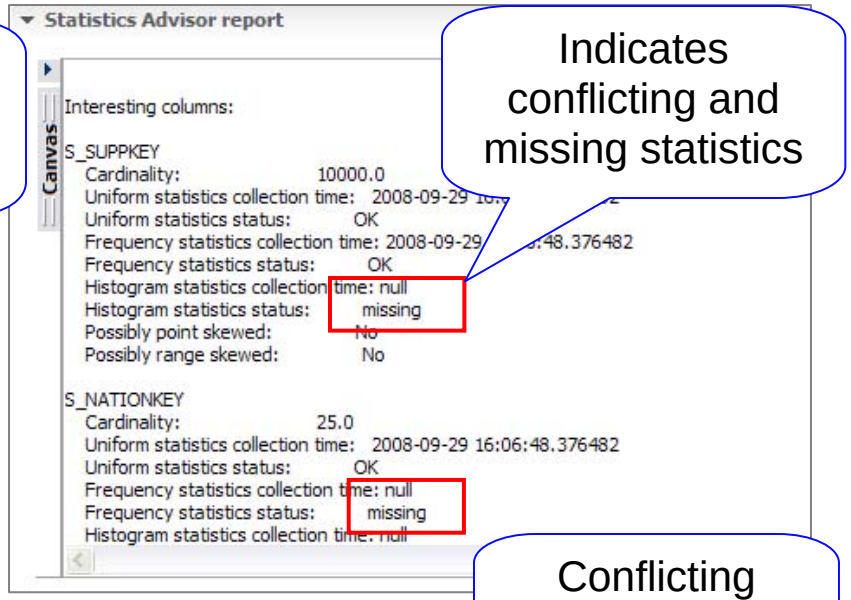


Improve statistics quality and collection

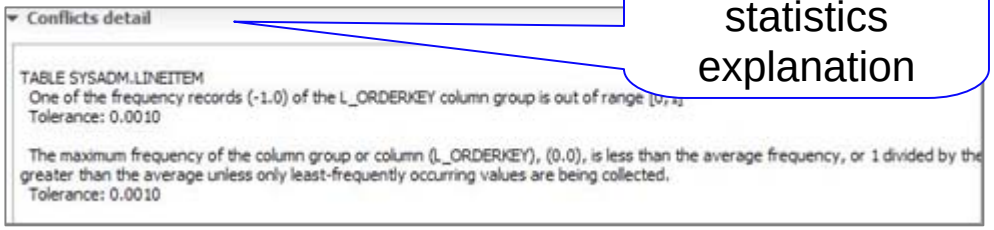
- Provides advice on
  - Missing statistics
  - Conflicting statistics
  - Out-of-date statistics



Generates RUNSTATS control statements



Indicates conflicting and missing statistics

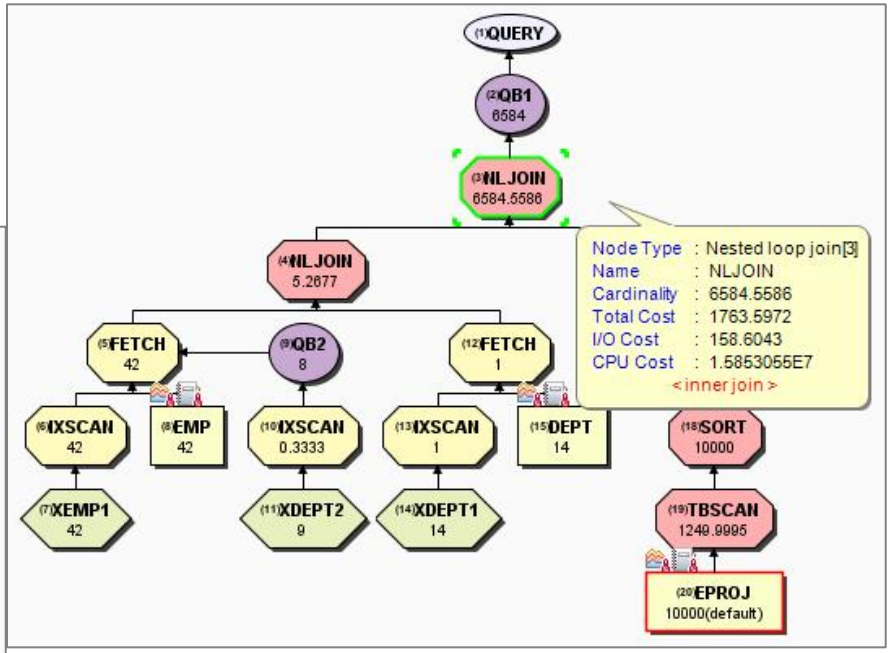


Conflicting statistics explanation

- **Results**
  - Accurate estimated costs
  - Better query performance
  - Less CPU consumption
  - Improved maintenance window throughput

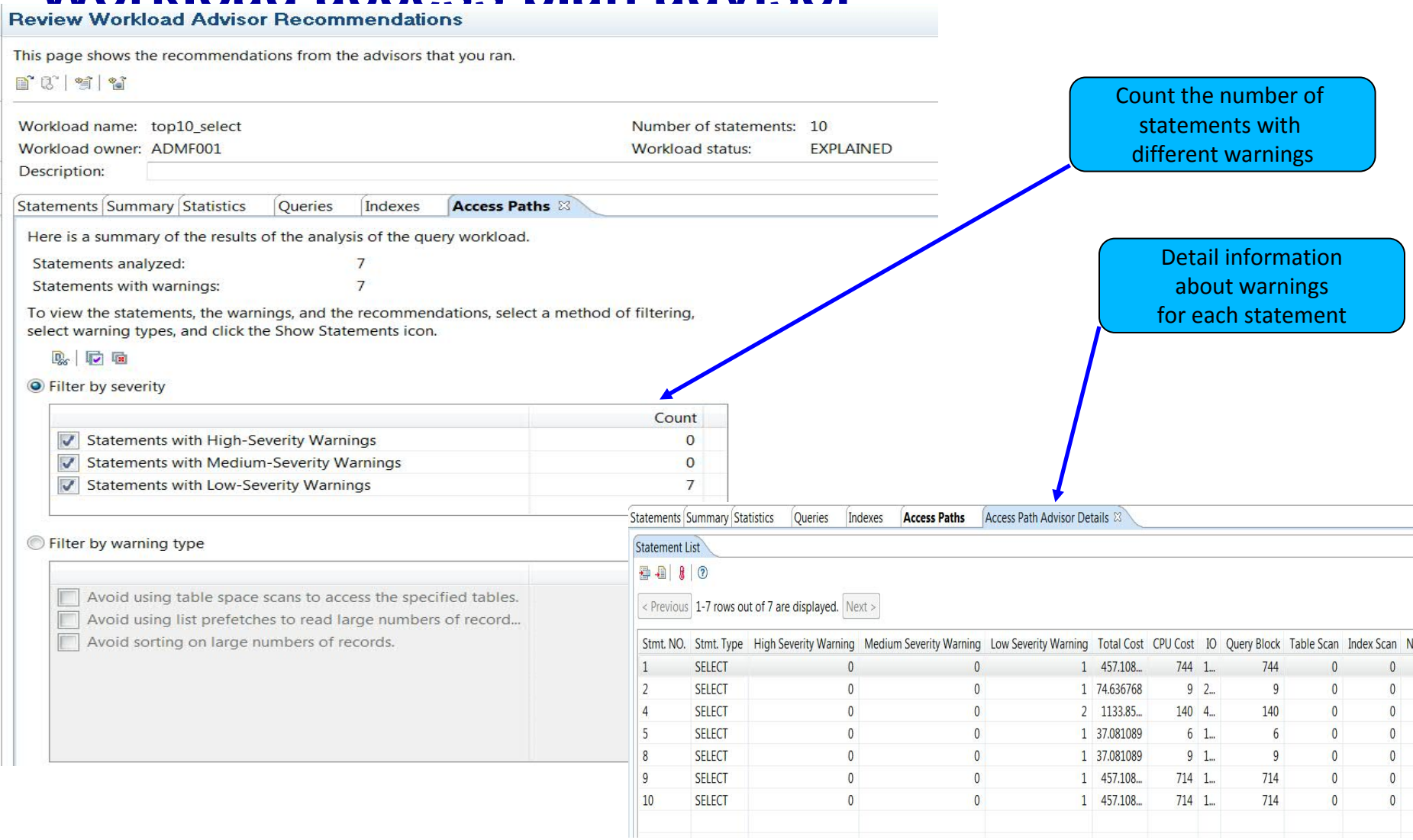
Analyze access plans

- **Visualize access path**
  - See flow of query processing
  - See indexes and operations
  - See optimizer rationale



- **Assess access path stability to reduce risk of performance regression**
  - Is the optimizer able to apply the filtering early?
  - Are there indexes that support an efficient path?
  - Do statistics allow distinction between the choices?

Workload access plan advisor

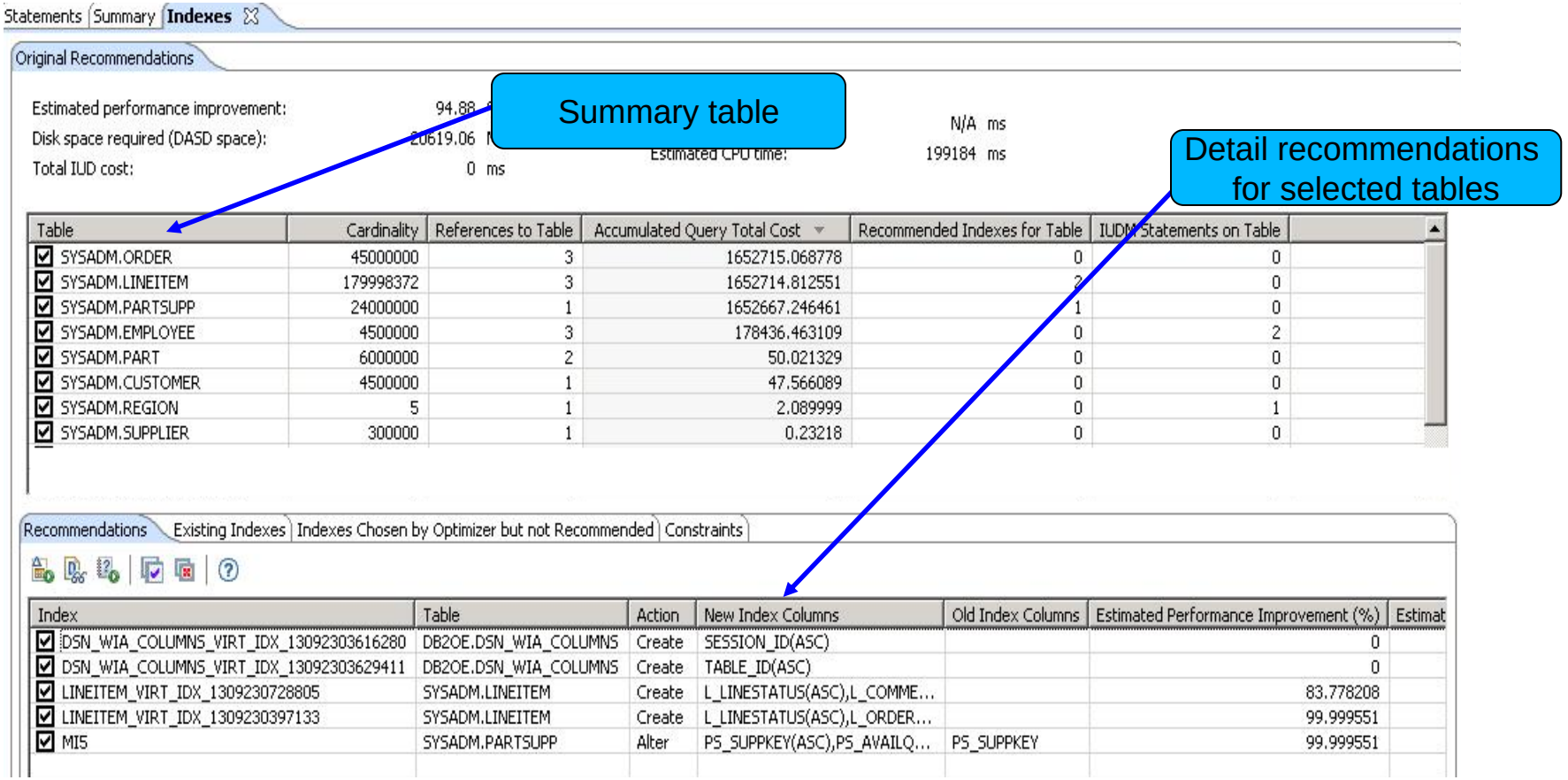


Count the number of statements with different warnings

Detail information about warnings for each statement

Workload Index Advisor Improvement

- Summary table lists all tables that have recommendations, allowing "slice and dice" view
- Details of selected tables in summary table will be shown along the existing indexes and recommendations



Workload summary report

- Allows user to review, e-mail or print the html report that summarizes the run states of all last successful run of the workload advisors
- Lists the recommended RUNSTATS and indexes, and displays the query and access path warnings.

IBM Query Tuner Workload Summary Report

This report contains a summary of the recommendations from the workload advisors. Examine the recommendations and any corresponding scripts, and take app recommendations were generated when the workload advisors analyzed the query workload, not when this report was generated. Navigate to the different section top of page.

Recommended Actions | Statistics | Indexes | Access Paths | Queries | Run Log

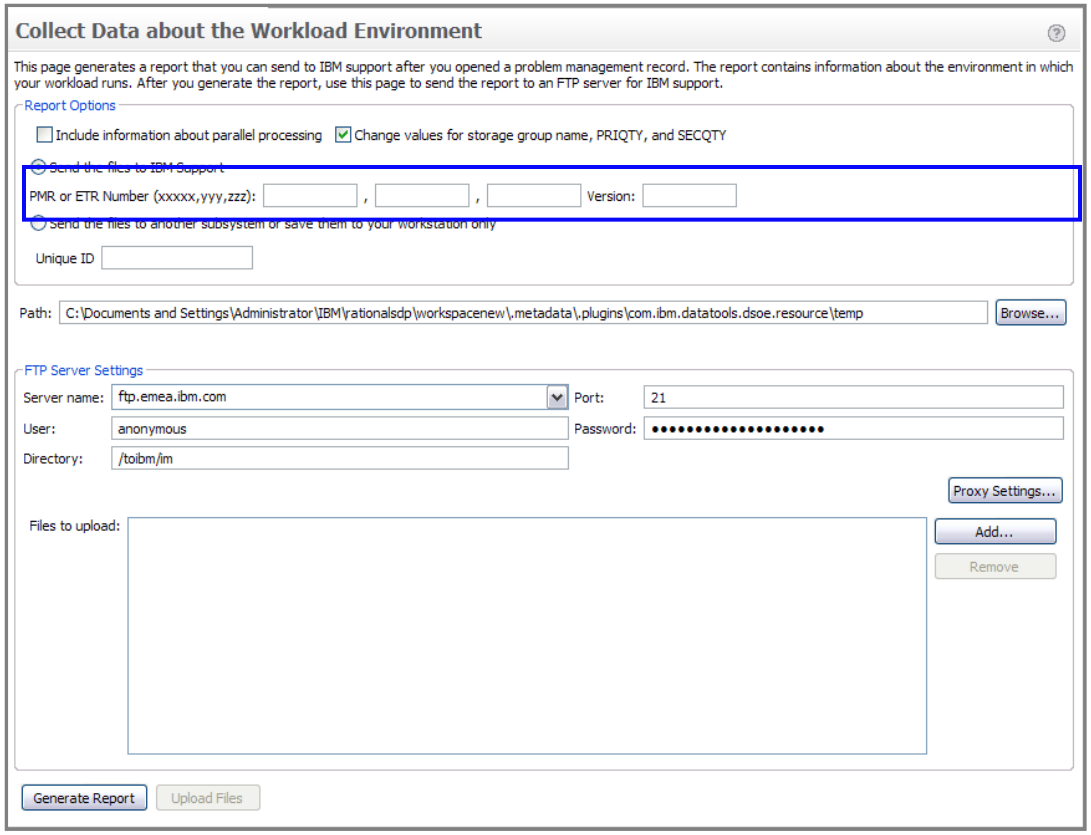
Overview

Recommendation generation timestamp: 2011-06-27 22:19:14
Database server configuration: jdbc:db2://dtec630.vmec.svl.ibm.com:446/STLEC1 (DSN10015)
Owner of the query workload: ADMF001
Workload name: top10_select
Default schema: ADMF001
Number of statements in the query workload: 10
Number of statements analyzed in the query workload: 10
Workload description:

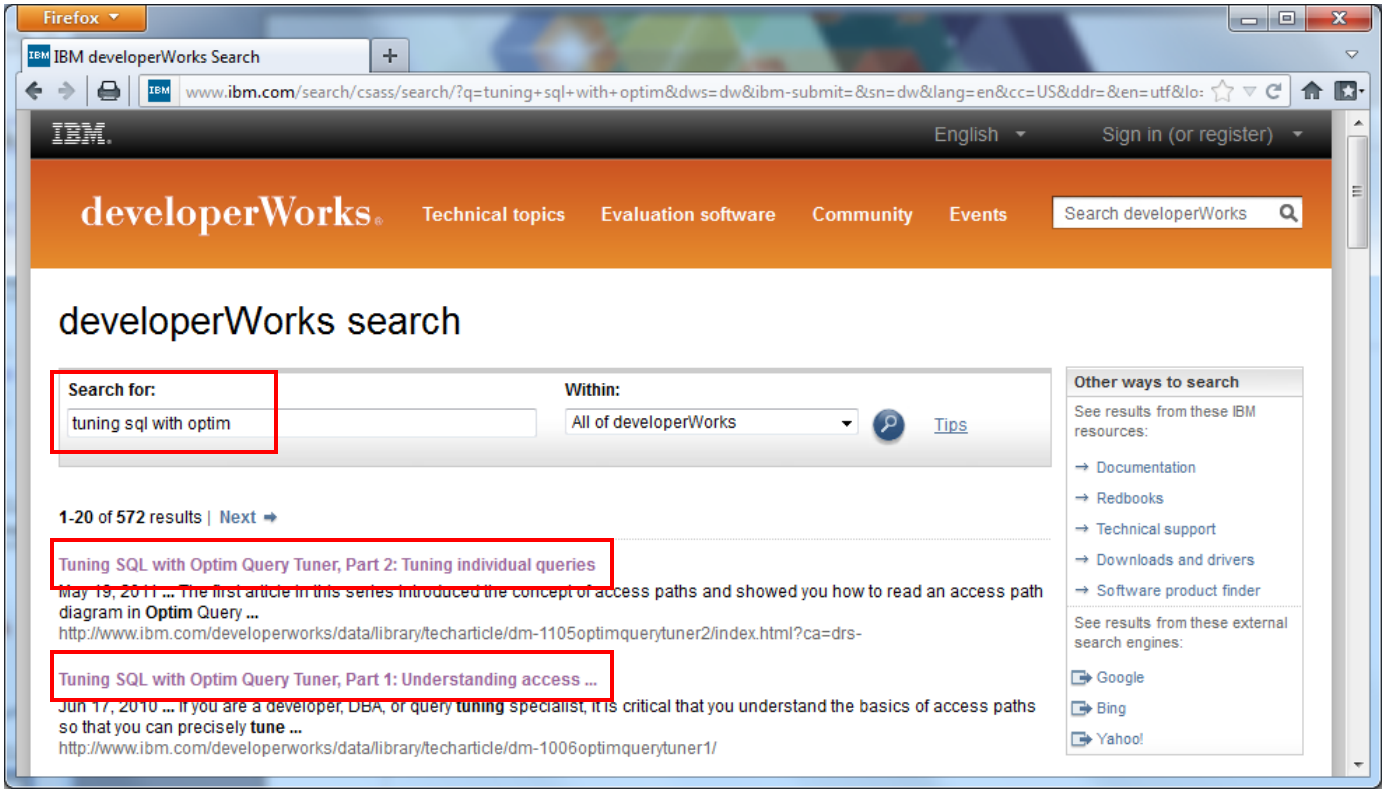
Advisor	Warnings			Recommendation		
	High	Medium	Low	RUNSTATS Commands	INDEX DDL Statements	Timestamp
Workload Statistics Advisor	1	0	0	5	0	2011-06-19 19:30:23
Workload Index Advisor	0	0	0	0	1	2011-06-19 11:59:30
Workload Query Advisor	0	0	1	0	0	2011-06-19 11:58:22
Workload Access Path Advisor	0	0	8	0	0	2011-06-19 12:00:23

Environment capture facilitates collaboration

- **Enable environment reproduction**
- **Speed up service process**



Query tuning technical articles



Also useful with Data Studio

http://www.ibm.com/developerworks

Workstation-based query tuning offerings

	Data Studio	Optim Query Workload Tuner for z/OS
Queries from all sources	✓	✓
Reports	✓	✓
Query Formatter	✓	✓
Access Plan Graph	✓	✓
Query Statistics Advisor	✓	✓
Query Annotation		✓
Visual Plan Hint		✓
Query Index Advisor		✓
Query Advisor		✓
Access Path Advisor		✓
Workload Statistics Advisor		✓
Workload Index Advisor		✓
Workload Query Advisor		✓

Comparison of query tuning tools for z/OS

- **Optim Query Workload Tuner**
- Better support for modern development environment and dynamic SQL
- Eclipse-based, GUI and stored procedure driven
- Integrates with OMEGAMON and Query Monitor GUI interfaces
- Provides virtual index capability for single queries and across workloads
- Recommends rewriting queries only when improvements result
- Has limited support to create statistics in Query Environment Capture and Workload Environment Capture service support
- Strategic investment spans platforms

- **DB2 SQL Performance Analyzer**
- Better support for classic z/OS environment, DBRMs, batch analysis, and z/OS libraries
- ISPF and batch driven
- Integrates with OMEGAMON VTAM and Query Monitor 3270 interfaces
- Creates real indexes for “WHAT-IF” scenarios for single queries
- Offers a best practices Query Advisor with approximately 150 rules
- Has full support for cloning statistics
- Continued z/OS specific investment

Tools used in this presentation

Migration Step		DB2 Tool Used
Step 1	Examine Key Performance Indicators and establish performance baseline	OMEGAMON XE for DB2 Performance Expert
Step 2	Identify and analyze packages that will have automatic rebinds	DB2 Path Checker
Step 3	Identify and analyze packages that will have equivalent or better performance	DB2 Path Checker
Step 4	Use triage techniques to identify additional problematic SQL	DB2 Path Checker
Step 5	Improve Statistics and resolve access path regressions	Optim Query Workload Tuner for z/OS DB2 SQL Performance Analyzer
Step 6	Re-examine Key Performance Indicators after migration	OMEGAMON XE for DB2 Performance Expert

Other IBM DB2 tools useful with DB2 migrations

Migration task / capability	DB2 for z/OS Tool
Create pre-production test environment (subsystem & object clones) to test DB2	DB2 Cloning Tool
Convert LOBs to in-line; Convert existing tables to Hash Access	DB2 Admin Tool
Measure and track SQL performance before & after migration	DB2 Query Monitor
Identify & free unused packages; reduce bind impacts	DB2 Bind Manager
Undo and Redo Temporal Data	DB2 Log Analysis Tool
Ensure access to critical DB2 10 core functions (during & after migration) with cost reductions and performance	DB2 Utilities Suite & DB2 Sort
Establish and maintain DB2 10 utility syntax as company standards	DB2 Utilities Enhancement Tool
Take advantage of DB2 10 utility improvements that reduce CPU and elapsed time for increased productivity	DB2 Automation Tool
Safeguard DB2 10 Data	InfoSphere Guardium Data Encryption Tool for DB2

IBM's portfolio of tools for DB2

Database Management

- DB2 Administration Tool
- DB2 Object Comparison Tool
- DB2 Utilities Suite
- DB2 Sort
- DB2 High Performance Unload
- DB2 Utilities Enhancement Tool
- DB2 Automation Tool
- DB2 Cloning Tool
- DB2 Bind Manager
- DB2 Path Checker
- Optim Data Growth

Performance Management

- Tivoli OMEGAMON XE for DB2 Performance Expert
- Tivoli OMEGAMON XE for DB2 Performance Monitor
- DB2 Buffer Pool Analyzer
- DB2 Query Monitor
- DB2 SQL Performance Analyzer
- InfoSphere Optim Query Tuner
- InfoSphere Optim Query Workload Tuner
- InfoSphere Optim pureQuery Runtime

Backup & Recovery

- DB2 Recovery Expert
- DB2 Log Analysis Tool
- DB2 Change Accumulation Tool

Data Governance

- Guardium S-TAP for z/OS
- Optim Test Data Management
- IBM Data Encryption for DB2 and IMS Databases

www.ibm.com/software/data/db2/zos

www.ibm.com/software/data/tools