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Session: C02

Application Performance Tuning in DB2 9 for z/OS



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North America

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May 7, 2007 11:10 a.m. – 12:10 p.m.

Platform: DB2 for z/OS



GoFurther

Agenda

- **Introduction**
- **Identifying Problem Query**
- **Problem Resolution with Design Advisors**
- **Problem Resolution with Tuning Tools**
- **Capturing Application Workloads**
- **Performing Health Check for Application Workloads with Design Advisors**
- **Monitoring Workload Exceptions**



Introduction



Application Performance Problem

- Applications are designed and implemented very quickly
- Often there is insufficient skill and resource to perform an adequate review of SQL performance and database physical design
- Entire applications can be developed and/or enhanced with performance "surprises" discovered in production
- Tuning an entire workload requires analyzing each query in the workload, the frequency of execution, and cost of individual operations
- The overwhelming amount of resource required to perform the review often means the analysis is either not done, or done incompletely



DB2 Solution

- **Problem Query Identification**
 - ✓ **Snapping queries from various sources**
 - ✓ **Monitoring performance exceptions**

- **Problem Query Resolution**
 - ✓ **Design Advisors for recommendation of stats, index, and query design**
 - ✓ **Turing tools for deep analysis of problem query**
 - ✓ **Query format to present a readable query**
 - ✓ **Annotation of optimizer rewritten query to embed critical information**
 - ✓ **Intelligent report to show the underlying physical design with critical information**
 - ✓ **Visual explain to show the access path choice**
 - ✓ **Visual optimization hints to implement emergency solution**
 - ✓ **Service SQL to send relevant doc to IBM for diagnosis**

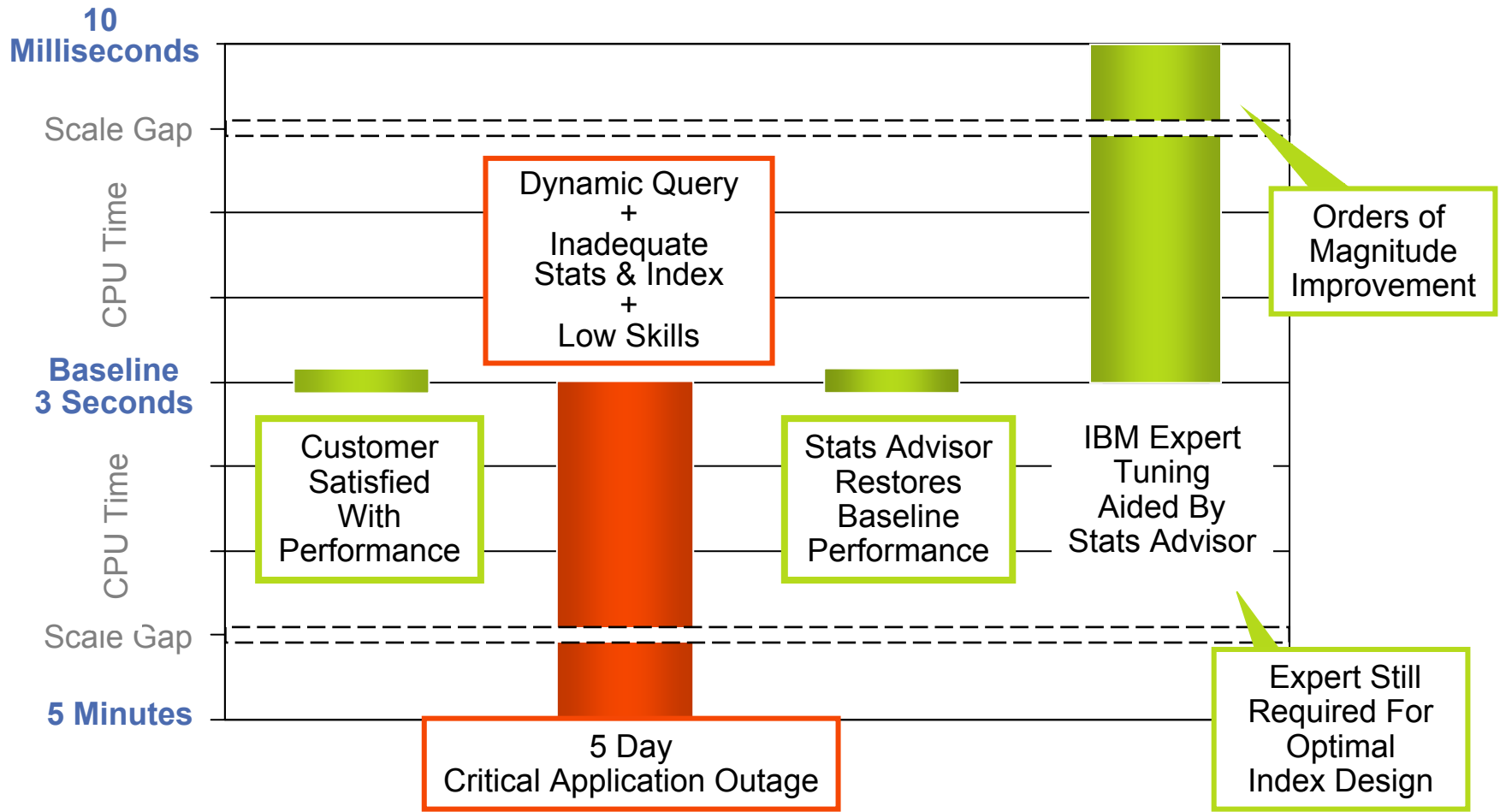
- **Tuning Application Workload**
 - ✓ **Automatic collection of application queries**
 - ✓ **Design Advisors for regular health check**
 - ✓ **Monitoring application performance exceptions**
 - ✓ **Problem resolution with Design Advisors and tuning tools**



Identifying Problem Query



Scenario: Critical application outage



Scenario: Critical application outage

Post-mortem Analysis

- It sounds easy but actually not
 - ✓ Inadequate query tuning and physical database design skills
 - ✓ Took 3 days to identify the problem query
 - ✓ No idea how to investigate the performance problem

- Customer costs
 - ✓ Time and money lost due to application outage
 - ✓ Loss of confidence in IT team
 - ✓ Extensive and costly performance review performed for simple regression

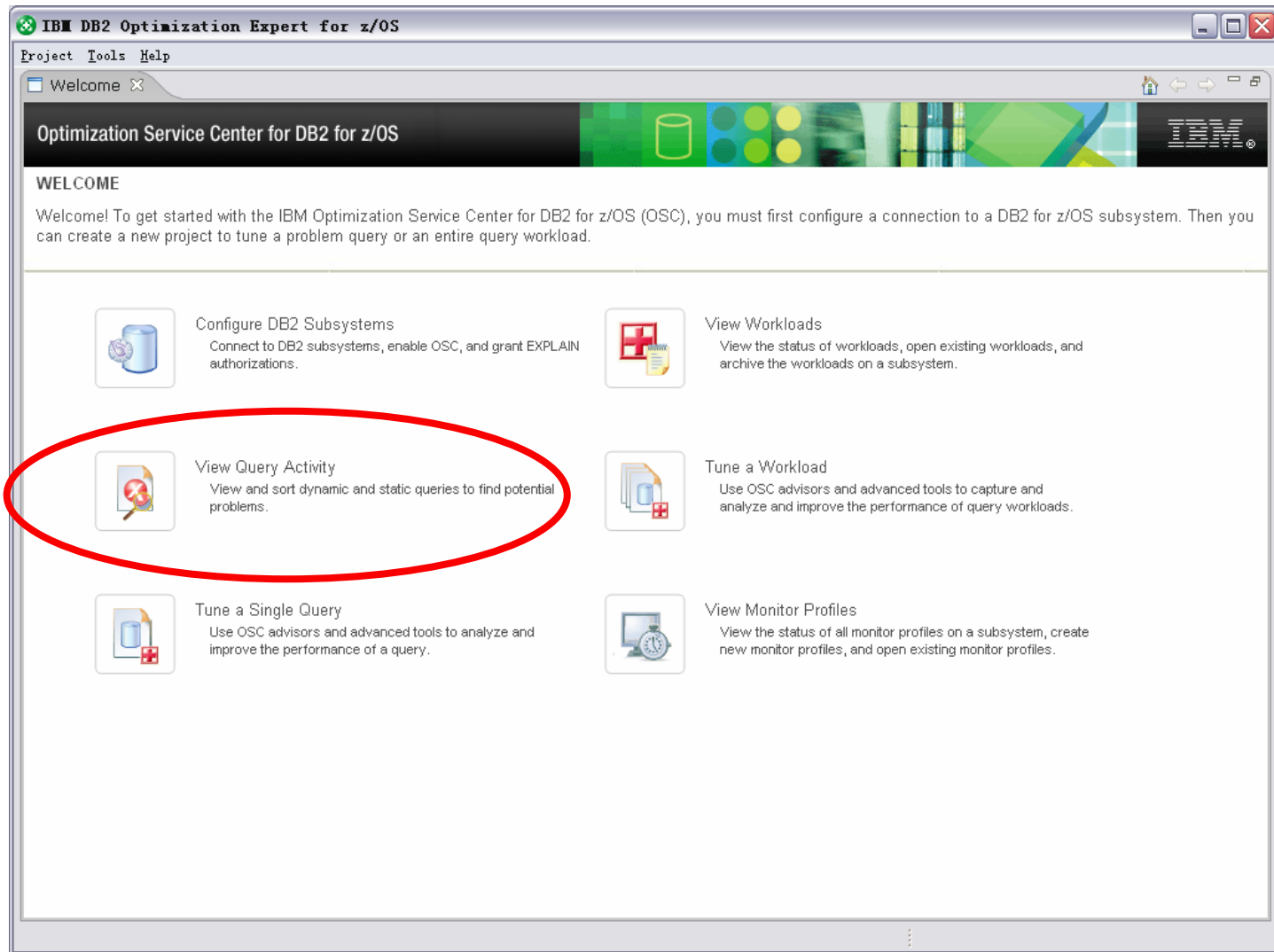
- Lack of expert design rules and methodology
 - ✓ Original query performance was actual suboptimal
 - ✓ Good design rules and methodology would result in faster & more stable performance



- Identifying Problem Query
 - From Dynamic Statement Cache
 - Many other query sources are supported
- Identifying Problem Query with Query Monitors
 - Automatic notification for performance exceptions



Identifying Problem Query – Welcome Panel



Identifying Problem Query – Dynamic Statement Cache

The screenshot displays the IBM DB2 Optimization Expert for z/OS interface. The main window is titled 'Configure Subsystems | View Queries | View Workloads | View Monitors'. The 'Subsystem Context' section shows the selected subsystem as 'BJ23V91A <enabled>'. The 'Queries List' section is active, showing a 'Query source' dropdown menu with the following options: 'Statement cache', 'Catalog plan or package', 'Query Management Facility', 'Query Management Facility HPO', and 'Monitor'. A red box highlights the dropdown menu, and a blue callout box points to it with the text 'Sources: Cache, Catalog, QMF, QMFHPO, Monitor etc.'.



Identifying Problem Query – Dynamic Statement Cache

The screenshot shows the IBM DB2 Optimization Expert for z/OS interface. The main window is titled "Configure Subsystems | View Queries [BUSY] | View Workloads | View Monitors". The "Project Navigator" on the left shows a tree view with "Welcome", "Configure Subsystem", "View Monitors", "View Queries", and "View Workloads". The main area is divided into "Subsystem Context" and "Queries List". The "Subsystem Context" section shows "Subsystem: BJ23V91A <enabled>" and a "Configure..." button. The "Queries List" section has a "Retrieve SQL statements from statement cache table" dialog box open. The dialog box contains an information icon, the text "Retrieve SQL statements from stat...able Elapsed time: 1.4 seconds", a progress bar with five green bars, and buttons for "Run in Background", "Cancel", and "Details >>". A blue thought bubble with the text "Extract from Cache..." is connected to the "Details >>" button. The status bar at the bottom shows "Retrieve SQL stateme... cache table" with a green progress indicator.



Identifying Problem Query – Dynamic Statement Cache

Cached Statements, sorted by descending accumulated CPU time

IBM DB2 Optimization Expert for z/OS

Project Navigator

Configure Subsystems View Queries View Workloads View Monitors

Subsystem Context

Select the subsystem from which you want to view queries.

Subsystem: BJ23V91A <enabled> Configure...

Queries List

Select the query source. Then specify how you want to view the queries by selecting a view. To create a custom view Click View New.

Query source: Statement cache Enable Cache Trace Disable Cache Trace

View name: ACCUM_CPU_DESC View Customize Refresh

Advisors Tools

All of the rows are displayed. The number of rows is 24.

STAT_EXEC	STAT_CPU	STAT_ELAP	STMT_TEXT
5	9.888036967...	189.97687...	SELECT L_ORDERKEY, SUM(L_EXTENDEDPRICE) AS REVENUE, O_ORDERDATE, O_SHIPPRIORITY FROM
5	8.001804591...	88.504505...	SELECT L_SUPPKEY, COUNT(*), MIN(L_TAX), MAX(L_TAX), SUM(L_EXTENDEDPRICE), AVG(L_EXT
5	2.412140131...	31.538043...	SELECT DISTINCT O_ORDERKEY FROM SYSADM.LINEITEM, SYSADM.ORDER WHERE L_ORDERKEY = O
5	1.040755511...	247.02081...	SELECT N_NAME, L_EXTENDEDPRICE AS REVENUE FROM CUSTOMER, ORDER, LINEITEM, SUPPLIE
1	0.804309323...	1.3527300...	DELETE FROM SYSIBM.SYSCOLDISTSTATS WHERE TBOWNER = 'SYSADM'
5	0.557750597...	33.846088...	SELECT S_SUPPKEY, S_NAME, SUM(L_EXTENDEDPRICE*(1-L_DISCOUNT)) AS REVENUE FROM SYS
5	0.111229434...	10.281691...	SELECT L_ORDERKEY, L_SUPPKEY, L_SHIPDATE, L_RETURNFLAG FROM SYSADM.LINEITEM WHERE L_S
5	0.110829547...	33.650882...	SELECT * FROM SYSADM.LINEITEM L, SYSADM.ORDER O, SYSADM.SUPPLIER S WHERE L.L_RECEIPT
1	0.033946693...	0.1935956...	DELETE FROM SYSIBM.SYSCOLDIST WHERE TBOWNER = 'SYSADM'
1	0.008425281...	0.0234471...	DELETE FROM DSN.STATEMENT_CACHE_TABLE
0	0.001826585...	0.0018725...	SELECT STMT_ID, STMT_TOKEN, COLLID, PROGRAM_NAME, INV_DROPALT, INV_REVOKE, INV_LEU
0	4.601565308...	0.0019182...	SELECT CURRENT SQLID FROM SYSIBM.SYSDUMMY1
0	3.659374853...	3.6578119...	SELECT 1 FROM SYSIBM.SYSDUMMY1 WHERE 0 = 1;
0	0.0	0.0	SELECT CURRENT TIMESTAMP AS TIMESTAMP FROM SYSIBM.SYSDUMMY1



Identifying Problem Query – Dynamic Statement Cache

IBM DB2 Optimization Expert for z/OS

Project Navigator

Project Tools Help

1. Filter
2. Sort
3. Columns

Filter Rows

Specify criteria to limit the query rows that are returned by typing values in the Value column and specifying operators in the Operator column. If you do not want to filter the queries, do not

View name: ACCUM_CPU_DESC

Maximum rows: 100

Column Name	Operator	Value	Comment
STAT_ELAP	=		The accumulated elapsed time that i
STAT_CPU	=		The accumulated CPU time that is us
STAT_SUS_SYN...	=		The accumulated wait time for synchron
STAT_SUS_LOCK	=		The accumulated wait time for lock a
STAT_SUS_SWIT	=		The accumulated wait time for synchron
STAT_SUS_GLCK	=		The accumulated wait time for globa
STAT_SUS_OTHR	=		The accumulated wait time for read
STAT_SUS_OT...	=		The accumulated wait time for write
AVG_STAT_CPU	=		Average accumulated CPU time.
AVG_STAT_ELAP	>	40	Average accumulated elapsed time used.
AVG_STAT_SUS...	=		Average accumulated wait time for a
AVG_STAT_SUS...	=		Average accumulated wait time for a
AVG_STAT_SUS...	=		Average accumulated wait time for a
AVG_STAT_SUS...	=		Average accumulated wait time for a
AVG_STAT_SUS...	=		Average accumulated wait time for a
AVG_STAT_SUS...	=		Average accumulated wait time for a

< Back Next > Finish Cancel

Retrieve SQL stateme... table: (0%)

custom view Click V

SYSADM.LINITEM WH

User-defined view:
filters, ordering, attributes



Identifying Problem Query – Dynamic Statement Cache

Sort Rows

If you want to sort the queries, specify which columns are to be used to sort the result rows by moving columns from the list of available columns to the list of sorted columns list. Then select

Steps

1. Filter
2. Sort
3. Columns

Available columns

- STMT_ID
- STMT_TOKEN
- COLLID
- PROGRAM_NAME
- INV_DROPALT
- INV_REVOKE
- INV_LRU
- INV_RUNSTATS
- CACHED_TS
- USERS
- COPIES
- LINES
- PRIMAUTH
- CURSQLID
- BIND_QUALIFIER
- BIND_ISO
- BIND_CDATA
- BIND_DYNRL
- BIND_DEGRE
- BIND_SQLRL
- BIND_CHOLD
- STAT_TS

Sort columns

- STAT_CPU

Up
Down
 Ascending
 Descending

< Back Next > Finish Cancel

Retrieve SQL stateme... table: (0%)

User-defined view:
filters, **ordering**,
attributes



Identifying Problem Query – Dynamic Statement Cache

IBM DB2 Optimization Expert for z/OS

Project Navigator

Project Tools Help

Create View

Customize Columns

Specify the columns that you want to be displayed in the view by moving columns to the "Display columns" list. Then click Finish.

Steps

1. Filter
2. Sort
3. Columns

Available columns

- STMT_ID
- STMT_TOKEN
- COLLID
- PROGRAM_NAME
- INV_DROPALT
- INV_REVOKE
- INV_LRU
- INV_RUNSTATS
- USERS
- COPIES
- LINES
- PRIMAUTH
- CURSQLID
- BIND_QUALIFIER
- BIND_ISO
- BIND_CDATA
- BIND_DYNRL
- BIND_DEGRE
- BIND_SQLRL
- BIND_CHOLD
- STAT_GPAG
- STAT_SYNR

Display columns

- STAT_EXEC
- STAT_CPU
- STAT_ELAP
- STMT_TEXT

< Back Next > Finish Cancel

Retrieve SQL stateme... table: (0%)

TE, 0_SHIPPRIORITY PRO
DEDPRICE), AVG(L_EXTE
WHERE L_ORDERKEY = 0
NEITEM WHERE 0_ORDERKE
AS REVENUE FROM SYSAD
DM.LINEITEM WHERE L_SU
ER S WHERE L_L_RECEIPT

User-defined view:
filters, ordering,
attributes



Identifying Problem Query – Dynamic Statement Cache

The screenshot shows the IBM DB2 Optimization Expert for z/OS interface. The 'View Queries' tab is active, showing the 'Subsystem Context' and 'View Queries List' sections. The 'Subsystem' is set to 'BJ23V91A <enabled>'. The 'Query source' is 'Statement cache', and the 'View name' is 'ACCUM_CPU_DESC'. The 'View Queries List' section shows a table with one row of data, highlighted in red. A blue callout box points to this row with the text 'Problem Query Identified!'.

Subsystem: BJ23V91A <enabled>

Query source: Statement cache [Enable Cache Trace] [Disable Cache Trace]

View name: ACCUM_CPU_DESC * [View] [Customize] [Refresh]

Advisors... Tools...

All of the rows are displayed. The number of rows is 1.

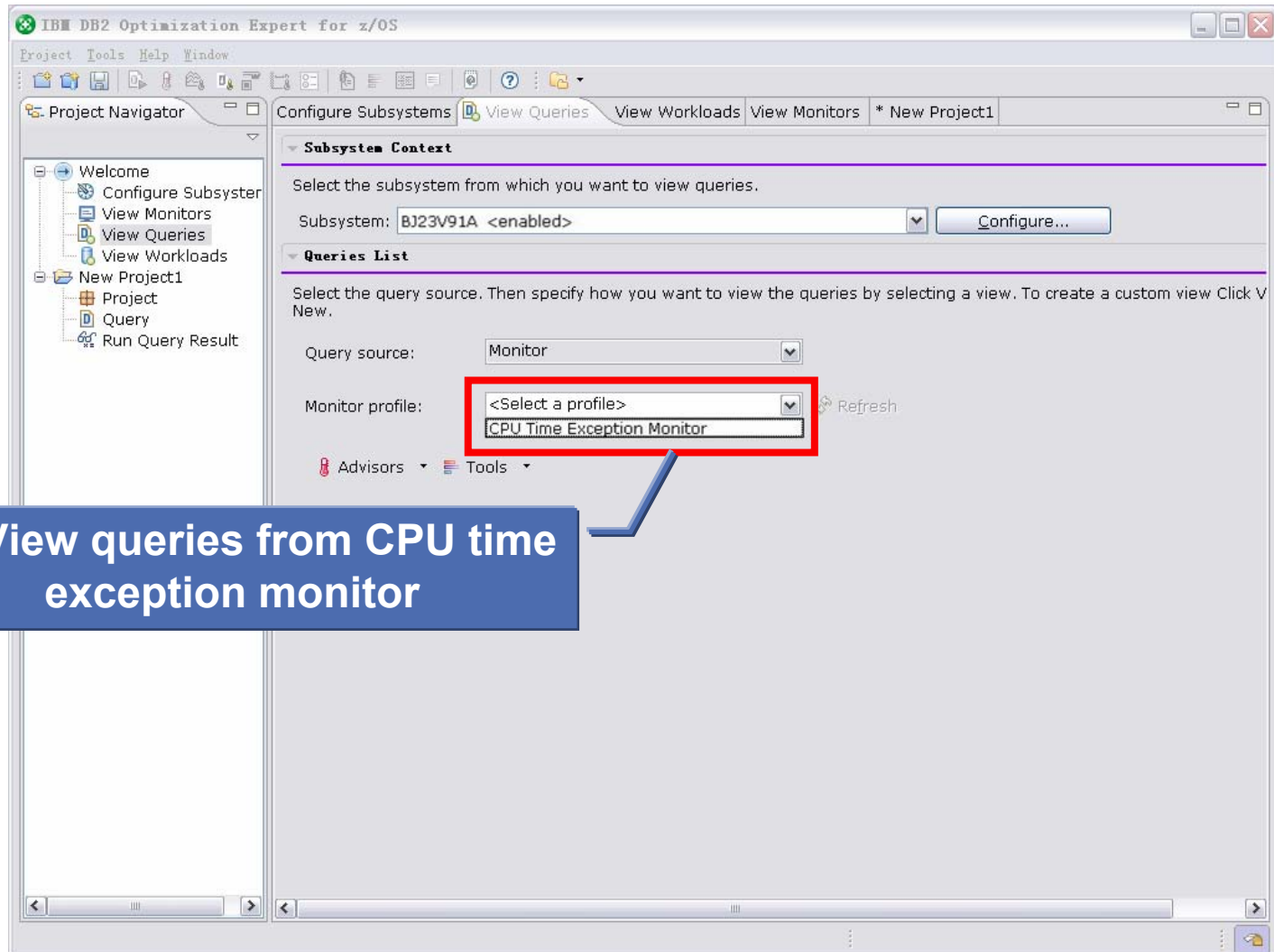
STAT_EXEC	STAT_CPU	STAT_ELAP	STMT_TEXT
5	1.0407555511285175	247.0208168179381	SELECT N_NAME, L_EXTENDEDPRIE AS REVENUE FROM CUSTOMER.

Retrieve SQL stateme... table: (0%)

Problem Query Identified!



Identifying Problem Query – Query Monitor



Identifying Problem Query – Query Monitor

The screenshot displays the IBM DB2 Optimization Expert for z/OS interface. The main window is titled "Query Monitor" and shows the following configuration:

- Subsystem: BJ23V91A <enabled>
- Query source: Monitor
- Monitor profile: CPU Time Exception Monitor

The interface indicates that all rows are displayed and the number of rows is 7. The following SQL query is highlighted in red, indicating it is the problem query:

```
STMT_TEXT
SELECT * FROM SYSADM.LINEITEM L ,SYSADM.ORDER O ,SYSADM.SUPPLIER S WHERE L.L_RECEIPTDATE <= '1999-12-
SELECT DISTINCT O_ORDERKEY FROM SYSADM.LINEITEM , SYSADM.ORDER WHERE L_ORDERKEY = O_ORDERKEY AND
SELECT L_ORDERKEY, SUM(L_EXTENDEDPRICE) AS REVENUE , O_ORDERDATE, O_SHIPRIORITY FROM SYSADM.CUSTO
SELECT L_ORDERKEY,L_SUPPKEY ,L_SHIPDATE,L_RETURNFLAG FROM SYSADM.LINEITEM WHERE L_SUPPKEY BETWEEN
SELECT L_SUPPKEY, COUNT(*) ,MIN(L_TAX) ,MAX(L_TAX) , SUM(L_EXTENDEDPRICE) , AVG(L_EXTENDEDPRICE) FROM S
SELECT O_ORDERPRIORITY, COUNT(*) FROM SYSADM.ORDER , SYSADM.LINEITEM WHERE O_ORDERKEY = L_ORDERKE
SELECT S_SUPPKEY, S_NAME , SUM(L_EXTENDEDPRICE*(1-L_DISCOUNT)) AS REVENUE FROM SYSADM.ORDER , SYSADM
```

A blue callout box with the text "Problem Query Identified!" points to the highlighted query.



Ready for Problem Resolution – All Users

The screenshot shows the IBM DB2 Optimization Expert for z/OS interface. The main window is titled "Configure Subsystem | View Queries | View Workloads | View Monitor". The "View Queries" tab is active, showing the "Subsystem Context" section with "Subsystem: BJ23V91A <enabled>". Below this is the "View Queries List" section, which includes a "Query source" dropdown set to "Statement cache" and a "View name" dropdown set to "ACCUM_CPU_DESC". A red box highlights the "Advisors..." menu, which contains the following options:

- Run All Advisors
- Run Statistics Advisor
- Run Query Advisor
- Run Access Path Advisor
- Run Index Advisor
- Show Advisor Options

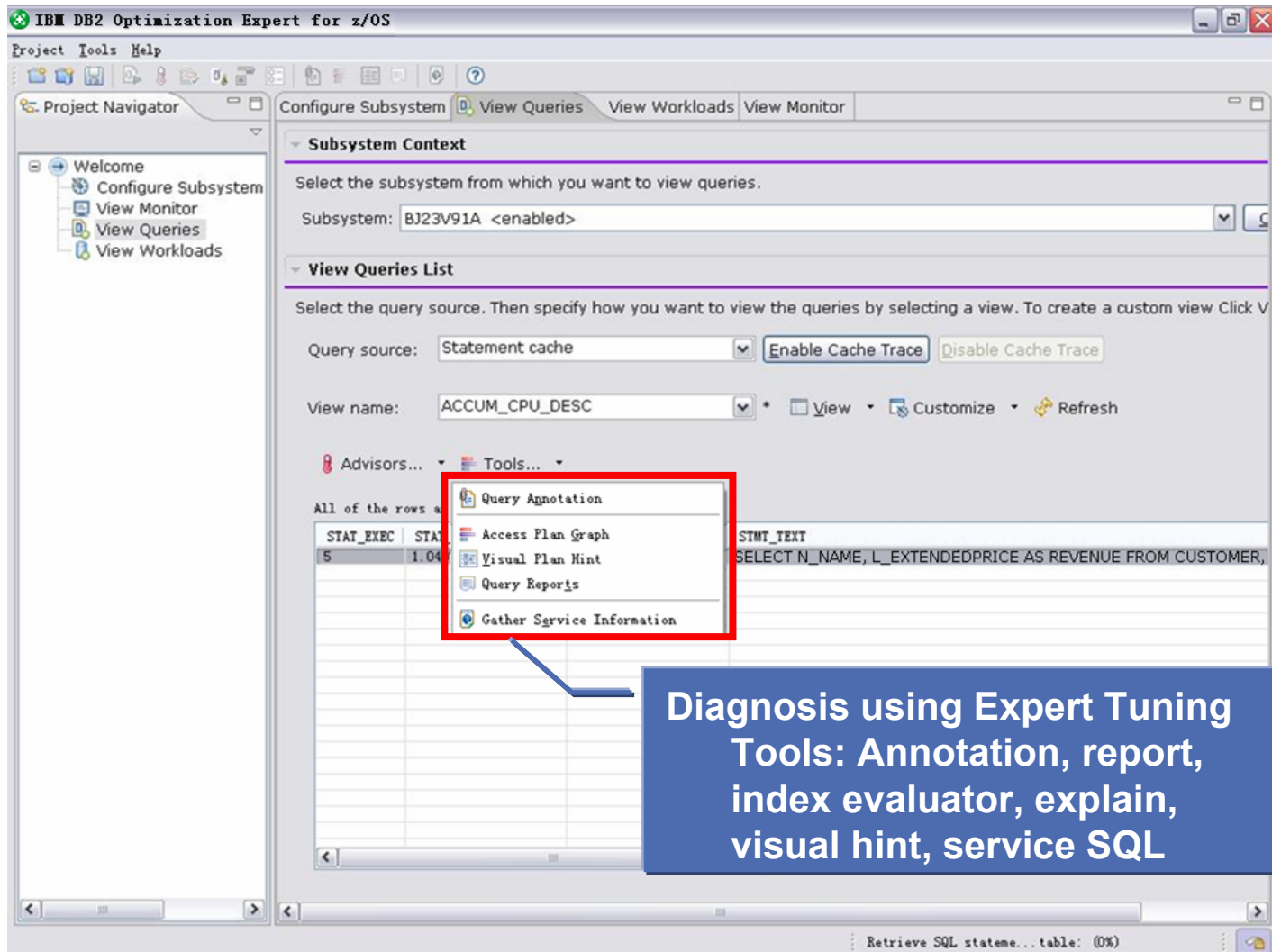
A blue callout box points to the "Run All Advisors" option with the text: "Diagnosis using Design Advisors: Stats Advisor, Index Advisor, Access Path Advisor, and Query Advisor".

STAT_ELAP	STMT_TEXT
0.0208168179381	SELECT N_NAME, L_EXTENDEDPRICE AS REVENUE FROM CUSTOMER, I

Retrieve SQL stateme... table: (0%)



Ready for Problem Resolution – Expert Users



The screenshot displays the IBM DB2 Optimization Expert for z/OS application window. The interface includes a Project Navigator on the left, a main workspace with tabs for 'Configure Subsystem', 'View Queries', 'View Workloads', and 'View Monitor', and a bottom status bar. The 'View Queries' tab is active, showing the 'Subsystem Context' and 'View Queries List' sections. A context menu is open over a table of query statistics, listing options: 'Query Annotation', 'Access Plan Graph', 'Visual Plan Hint', 'Query Reports', and 'Gather Service Information'. A blue callout box points to this menu with the text: 'Diagnosis using Expert Tuning Tools: Annotation, report, index evaluator, explain, visual hint, service SQL'. The table below the menu shows columns for 'STAT_EXEC', 'STAT', and 'STMT_TEXT', with one row containing the value '5' under 'STAT_EXEC' and '1.04' under 'STAT'. The 'STMT_TEXT' column contains the SQL statement: 'SELECT N_NAME, L_EXTENDEDPRICE AS REVENUE FROM CUSTOMER,'.

STAT_EXEC	STAT	STMT_TEXT
5	1.04	SELECT N_NAME, L_EXTENDEDPRICE AS REVENUE FROM CUSTOMER,





Problem Resolution with Design Advisors



- Quick way to identify the cause of performance problem
- Recommended for all users
- Three Advisors
 - Statistics Advisor
 - Index Advisor
 - Query Advisor
 - Access Path Advisor



Tuning Problem Query with Design Advisors

IBM DB2 Optimization Expert for z/OS

Project Tools Help

Project Navig... Configure Subsystems View Queries View Workloads View Monitors * New Project1 x

Source:

Specify the source of the query that you want to tune and then, if applicable, select a view, customize, and save it. After the query is identified, tune the query in the Query text section.

Query source: Text

Query text

There are several options to tune the selected query. Format or categorize selected query text, analyze the query, or use additional tools for more analysis.

Query Advisors Tools EXPLAIN timestamp:2007-02-13 15:21:29.277

EXPLAIN options Use subsystem EXPLAIN information Use local EXPLAIN information

- Run All Advisors
- Run Statistics Advisor
- Run Query Advisor
- Run Access Path Advisor
- Run Index Advisor
- Show Advisor Options

```
SELECT N_NATIONKEY, O_ORDERKEY, L_ORDERKEY, S_SUPPKEY, R_REGIONKEY, L_SHIPDATE, O_ORDERDATE
FROM CUSTOMER, ORDER, LINEITEM, SUPPLIER, NATION, REGION
WHERE C_CUSTKEY = O_CUSTKEY AND O_ORDERKEY = L_ORDERKEY AND L_SUPPKEY = S_SUPPKEY
AND C_NATIONKEY = N_NATIONKEY AND N_REGIONKEY = R_REGIONKEY
AND R_NAME = 'USA' AND YEAR(L_SHIPDATE) = 1994 AND O_ORDERDATE >= DATE('1994-01-01')
AND O_ORDERDATE < DATE('1994-01-01') + 1 YEAR;
```

Project Query

Advisors make
tuning
recommendations



Tuning Problem Query with Stats Advisor

The screenshot shows the IBM DB2 Optimization Expert for z/OS interface. The main window displays the 'Recommendations' section, which is highlighted with a red box. Below this, the 'Selected Recommendations: No.1: Run repairing RUNSTATS' section is also highlighted with a red box. This section contains two columns: 'RUNSTATS Control Statements' and 'Description'. The 'Control Statements' column lists three RUNSTATS commands. The 'Description' column provides a detailed explanation of the recommendation. To the right of the description, there are four buttons: 'Details...', 'Run...', 'Copy', and 'Save'. A blue callout box labeled 'Recommendation Summary' points to the 'Recommendations' table. Another blue callout box labeled 'RUNSTATS commands' points to the 'RUNSTATS Control Statements' column. A third blue callout box labeled 'Recommendation Explanation' points to the 'Description' column. At the bottom of the window, the 'Statistics Advisor' tab is highlighted with a yellow circle.

Recommendation Summary

Number	Priority	Recommendation	Description
1	High	Run repairing RUNSTATS	Repair statistics problems for this query. Ga...
2	Low	Run complete RUNSTATS	Gather and recollect all of relevant statistic...

Selected Recommendations: No.1: Run repairing RUNSTATS

View more details for this recommendation, run the statement, or copy the statement for later use.

RUNSTATS Control Statements	Description	Actions
RUNSTATS INDEX(SYSADM.PXR@RKNM) SHRLEVEL CHANGE REPORT YES	Repair statistics problems for this query. Gather missing statistics. Recollect conflicting statistics and potential obsolete statistics. Collect statistics for potential data skew and data correlation problems.	Details... Run... Copy Save
RUNSTATS INDEX (SYSADM.PXL@OKSDRFSKEPDC KEYCARD, SYSADM.SXL@PKSKOKEPDSQN KEYCARD) SHRLEVEL CHANGE REPORT YES		
RUNSTATS INDEX(SYSADM.PXS@SKNK) SHRLEVEL CHANGE REPORT YES		

RUNSTATS commands

Recommendation Explanation

Project Query **Statistics Advisor**

Run the Query Advisor



Tuning Problem Query with Stats Advisor

The screenshot displays the IBM DB2 Optimization Expert for z/OS interface. The main window shows the 'Statistics Advisor Details' page, which is highlighted with a red border. The page title is 'Table, index, column, and column group details'. The content includes a 'Statistics Advisor Detail Report' with the following information:

- Analysis Begin Time: 2007-02-14 15:54:41.986
- Analysis End Time: 2007-02-14 15:54:42.747

Below this, there is a section for 'TABLE SYSADM.REGION' with the following details:

- Cardinality: 5.0
- Collection Time: 0001-01-01 00:00:00.0
- Statistics Status: OK

The 'INDEXES:' section lists the following index:

- SYSADM.PXR@RKNM (R_REGIONKEY,R_NAME)
- First Key Cardinality: 5.0
- Full Key Cardinality: 5.0
- Data Repetition Factor: -1.0
- Collection Time: 0001-01-01 00:00:00.0
- Statistics Status: missing

The 'Interesting Columns:' section lists the following column:

- R_REGIONKEY
- Cardinality: 5.0
- Uniform Statistics Collection Time: 0001-01-01 00:00:00.0

The interface also shows a 'Conflicts detail' section below the main report. The Project Navigator on the left shows the 'Statistics Advisor' folder expanded. The bottom of the window has a tabbed interface with 'Statistics Advisor Details' selected, and a 'Run the Query Advisor' button.

Detailed
Recommendation
Explanation



Tuning Problem Query with Query Advisor

The screenshot displays the IBM DB2 Optimization Expert for z/OS interface. The main window is titled "Query Advisor Recommendations List" and contains a table with the following data:

No	Severity	Confidence	Line Number	Description
1	Low	Medium	16	Consider rewriting the following predi

Below the table, the "SQL Text" section shows the following query:

```
AND SYSADM.ORDER.O_ORDERKEY = SYSADM.LINEITEM.L_ORDERKEY  
AND SYSADM.NATION.N_REGIONKEY = SYSADM.REGION.R_REGIONKEY  
AND SYSADM.CUSTOMER.C_NATIONKEY = SYSADM.SUPPLIER.S_NATIONKEY  
AND SYSADM.LINEITEM.L_SUPPKEY = SYSADM.SUPPLIER.S_SUPPKEY  
AND SYSADM.SUPPLIER.S_NATIONKEY = SYSADM.NATION.N_NATIONKEY  
AND SYSADM.CUSTOMER.C_NAME = 'IBM'  
AND YEAR( SYSADM.LINEITEM.L_SHIPDATE ) = 1994
```

The "Selected Recommendation:" section is divided into two columns: "Description" and "Explanation".

Description: Consider rewriting the following predicate so that it is either an indexable or a stage-1 predicate: YEAR(SYSADM.LINEITEM.L_SHIPDATE) = 1994 so that it might filter out unnecessary rows earlier. Check the explanation for this warning for more details about possible impact and examples.

Explanation: The specified SQL statement might perform faster if you rewrite the stage 2 predicate as an indexable predicate or as a stage 1 predicate. Stage 1 predicates are better than stage 2 predicates because they disqualify rows earlier and reduce the amount of processing that DB2 needs to perform during later stages of evaluation. Also, because processing of stage 2 predicates can take many CPU cycles, these predicates are generally slower than stage 1 predicates. Indexable predicates, which are

Callouts in the image point to the "Recommendation Summary" (top right), "Recommendation Explanation" (middle right), and "Recommendation Detail" (left side).

At the bottom, the "Query Advisor" tab is highlighted with a yellow circle, and the "Run the Query Advisor" button is visible in the bottom right corner.

Recommendation Detail

Recommendation Summary

Recommendation Explanation



Tuning Problem Query with Index Advisor

The screenshot displays the IBM DB2 Optimization Expert for z/OS interface. The main window shows the 'Index Advisor Recommendations' section, which lists several index recommendations for a selected query. A red box highlights this section. A blue callout box labeled 'Index Recommendation' points to the 'Index Advisor Recommendations' header. Below the recommendations, a 'Run Selected DDL Statements' dialog box is open, showing the SQL statements for creating the recommended indexes. A blue callout box labeled 'DDL for creating recommended index' points to the dialog box. The dialog box contains the following SQL statements:

```
CREATE INDEX DB2OE.CUSTOMER_VIRT_IDX_1171438532131 ON
SYSADM.CUSTOMER ( C_NAME ASC, C_NATIONKEY ASC, C_CUSTKEY
ASC) FREEPAGE 0 PCTFREE 10;

CREATE INDEX DB2OE.REGION_VIRT_IDX_1171438532105 ON
SYSADM.REGION ( R_NAME ASC, R_REGIONKEY ASC) FREEPAGE 0
PCTFREE 10;

CREATE INDEX DB2OE.ORDER_VIRT_IDX_1171438563818 ON
SYSADM.ORDER ( O_CUSTKEY ASC, O_ORDERDATE ASC, O_ORDERKEY
ASC) FREEPAGE 0 PCTFREE 10;

CREATE INDEX DB2OE.NATION_VIRT_IDX_1171438588804 ON
SYSADM.NATION ( N_REGIONKEY ASC, N_NATIONKEY ASC, N_NAME
ASC) FREEPAGE 0 PCTFREE 10;
```

The dialog box also has 'Run' and 'Cancel' buttons. At the bottom of the main window, the 'Index Advisor' tab is selected and circled in yellow.

Feature Details	Object Name	Columns	Estimated Disk Space
<input checked="" type="checkbox"/> CUSTOMER			
<input checked="" type="checkbox"/> Index	CUSTOMER_...	C_NAME(ASC), C_NATIONKEY(...)	206.0234375 M
<input checked="" type="checkbox"/> REGION			
<input checked="" type="checkbox"/> Index	REGION_VIR...	R_NAME(ASC), R_REGIONKEY(...)	0.0234375 M
<input checked="" type="checkbox"/> ORDER			
<input checked="" type="checkbox"/> Index	ORDER_VIRT...	O_CUSTKEY(ASC), O_ORDERD...	1024.0703125 M
<input checked="" type="checkbox"/> NATION			
<input checked="" type="checkbox"/> Index	NATION_VIR...	N_REGIONKEY(ASC), N_NATIO...	0.0234375 M

DDL for creating recommended index

Index Recommendation



Tuning Problem Query with Access Path Advisor

Access Path Warning List

Warning Description

Corresponding record in PLAN_TABLE

Warning Explanation

The screenshot displays the IBM DB2 Optimization Expert for z/OS interface. The main window is titled 'Access Path Advisor' and contains the following sections:

- Access Path Warning List:** A table with the following data:

Severity	Query Block Number	Plan Number	Description
APA_HIGH_SEVERITY	1	2	The inner table SYSADM.OR...
- Access Path Warning Details:** Two text boxes:
 - Description:** The inner table SYSADM.ORDER in the nested loop join is accessed by a relational scan. When a large number of records are returned after the outer table is accessed, DB2 might be using an inefficient access path. Check the explanation for this warning for
 - Explanation:** When the DB2 optimizer chooses a nested loop join, DB2 first scans the outer table and then scans the inner table one time for each qualifying row in the outer table. The DB2 optimizer might choose to access the inner table by using a table space scan.
- PLAN_TABLE record:** A table with the following data:

QBLOCKNO	PLANNO	MIXOPSEQ	METHOD	CREATOR	TNAME	CORRE...	ACCESST...	PROCES...
1	2	0	1	SYSADM	ORDER		R	
1	1	0	0	SYSADM	LINEITEM		R	

The 'Access Path Advisor' tab is highlighted with a yellow circle at the bottom of the window.





Problem Resolution with Tuning Tools



- Deep-dive into the root cause of the problem
- Recommended for expert users
- Expert Tuning Tools
 - Query Annotation
 - Query Report
 - Visual Explain
 - Visual Plan Hint
 - Service SQL



Tuning Problem Query with Tuning Tools

Expert tools can be invoked in the same Query Project

IBM DB2 Optimization Expert for z/OS

Project Tools Help

Project Navigator

- Welcome
- Configure Subsystem
- View Monitors
- View Queries
- View Workloads
- New Project1
 - Project
 - Query

Configure Subsystems | View Queries | View Workloads | View Monitors | New Project1

Source:

Specify the source of the query that you want to tune and then click the **Next** button to proceed to the next step and save it. After the query is identified, tune the query using the tools available in the **Tools** menu.

Query source:

Query text

There are several options to tune the selected query. Format or categorize selected query text, analyze the query, or use additional tools for more analysis.

Query | Advisors | Tools | EXPLAIN timestamp:

EXPLAIN options: Run EXPLAIN | Use local EXPLAIN information

- Query Annotation
- Access Plan Graph
- Visual Plan Hint
- Query Reports
- Gather Service Information

```
SELECT N_NAME, L_EXTENDER, ORDER, LINEITEM, SUPPLIER, NATION, REGION
WHERE C_CUSTKEY = O_CUSTKEY AND L_SUPPKEY = S_SUPPKEY
AND C_NATIONKEY = S_NATIONKEY AND N_REGIONKEY = R_REGIONKEY
AND R_NAME = 'ASIA' AND C_NAME = 'IBM' AND YEAR(L_SHIPDATE) = 1994 AND O_ORDERDATE >= DATE('1994-01-01')
AND O_ORDERDATE < DATE('1994-01-01') + 1 YEAR;
```

Project | Query



Understanding Query with Query Annotation

Original and transformed Query

Formatted, reorganized query text

Annotations (catalog stats, cost estimation)

Annotation

Annotation
CARDF=5 QUALIFIED_ROWS=0.99999994 NF
CARDF=4,500,000 QUALIFIED_ROWS=9.999995
CARDF=25 QUALIFIED_ROWS=25.0 NPAG
CARDF=300,000 QUALIFIED_ROWS=300,000.0
CARDF=45,000,000 QUALIFIED_ROWS=6,823,580.
CARDF=179,998,372 QUALIFIED_ROWS=7,199,935
COLCARDF=4,500,000/3,000,000 MAX_FREQ=/ FF=
COLCARDF=45,000,000/45,000,000 MAX_FREQ=/ FI
COLCARDF=5/5 MAX_FREQ=/ FF=0.1999
COLCARDF=25/25 MAX_FREQ=/ FF=0.039
COLCARDF=303,104/300,000 MAX_FREQ=/ FF=:
COLCARDF=25/25 MAX_FREQ=/ FF=0.039
COLCARDF=450,000 MAX_FREQ= FF=2.22
COLCARDF=450,000 MAX_FREQ= FF=2.222220650292E-6
COLCARDF=2,304 MAX_FREQ= FF=0.455
COLCARDF=2,304 MAX_FREQ= FF=0.695
COLCARDF=5 MAX_FREQ= FF=0.1999



Understanding Query with Query Annotation

Original Transformed

Query Annotation

Indicate which annotation to display and customize your view. Selecting a row will highlight all of the relevant rows for this table. Selecting a join predicate will highlight all of the join predicate rows in both of the joined tables. Click Reset Text to return to the original text view.

Annotation to display: All

Expand All Collapse All Customize Save

Formatted Query

```
SELECT SYSADM.NATION.N_NAME  
, SYSADM.LINEITEM.L_EXTEN, EDPRICE AS REVENUE  
FROM SYSADM.REGION  
, SYSADM.CUSTOMER  
, SYSADM.NATION  
, SYSADM.SUPPLIER  
, SYSADM.ORDER  
, SYSADM.LINEITEM  
WHERE ( SYSADM.CUSTOMER.C_CUSTKEY = SYSADM.ORDER.O_CUSTKEY  
AND SYSADM.ORDER.O_ORDERKEY = SYSADM.LINEITEM.L_ORDERKEY  
AND SYSADM.NATION.N_REGIONKEY = SYSADM.REGION.R_REGIONKEY  
AND SYSADM.CUSTOMER.C_NATIONKEY = SYSADM.SUPPLIER.S_NATIONI  
AND SYSADM.LINEITEM.L_SUPPKEY = SYSADM.SUPPLIER.S_SUPPKEY  
AND SYSADM.SUPPLIER.S_NATIONKEY = SYSADM.NATION.N_NATIONKEY  
AND SYSADM.CUSTOMER.C_NAME = 'IBM'  
AND YEAR( SYSADM.LINEITEM.L_SHIPDATE ) = 1994  
AND SYSADM.ORDER.O_ORDERDATE < ( DATE( '1994-01-01' ) + 1 YEARS  
AND SYSADM.ORDER.O_ORDERDATE >= DATE( '1994-01-01' )  
AND SYSADM.REGION.R_NAME = 'ASIA'  
)
```

	Annotation
FROM SYSADM.REGION	CARDF=5 QUALIFIED_ROWS=0.99999994 NF
, SYSADM.CUSTOMER	CARDF=4,500,000 QUALIFIED_ROWS=9.999995
, SYSADM.NATION	CARDF=25 QUALIFIED_ROWS=25.0 NPAG
, SYSADM.SUPPLIER	CARDF=300,000 QUALIFIED_ROWS=300,000.0
, SYSADM.ORDER	CARDF=45,000,000 QUALIFIED_ROWS=6,823,580.
, SYSADM.LINEITEM	CARDF=179,998,372 QUALIFIED_ROWS=7,199,935
WHERE (SYSADM.CUSTOMER.C_CUSTKEY = SYSADM.ORDER.O_CUSTKEY	COLCARDF=4,500,000/3,000,000 MAX_FREQ=/ FF=
AND SYSADM.ORDER.O_ORDERKEY = SYSADM.LINEITEM.L_ORDERKEY	COLCARDF=45,000,000/45,000,000 MAX_FREQ=/ FI
AND SYSADM.NATION.N_REGIONKEY = SYSADM.REGION.R_REGIONKEY	COLCARDF=5/5 MAX_FREQ=/ FF=0.1999
AND SYSADM.CUSTOMER.C_NATIONKEY = SYSADM.SUPPLIER.S_NATIONI	COLCARDF=25/25 MAX_FREQ=/ FF=0.039
AND SYSADM.LINEITEM.L_SUPPKEY = SYSADM.SUPPLIER.S_SUPPKEY	COLCARDF=303,104/300,000 MAX_FREQ=/ FF=:
AND SYSADM.SUPPLIER.S_NATIONKEY = SYSADM.NATION.N_NATIONKEY	COLCARDF=25/25 MAX_FREQ=/ FF=0.039
AND SYSADM.CUSTOMER.C_NAME = 'IBM'	COLCARDF=450,000 MAX_FREQ= FF=2.22E-6
AND YEAR(SYSADM.LINEITEM.L_SHIPDATE) = 1994	COLCARDF=450,000 MAX_FREQ= FF=2.222220650292E-6
AND SYSADM.ORDER.O_ORDERDATE < (DATE('1994-01-01') + 1 YEARS	COLCARDF=2,304 MAX_FREQ= FF=0.455
AND SYSADM.ORDER.O_ORDERDATE >= DATE('1994-01-01')	COLCARDF=2,304 MAX_FREQ= FF=0.695
AND SYSADM.REGION.R_NAME = 'ASIA'	COLCARDF=5 MAX_FREQ= FF=0.1999

Two tables with small number of qualified rows. Either one could be the leading table.

The most selective local predicate. (FF=2.22E-6)



Query Report – Table Report

Legend for column names that have been truncated	
PARTS	-- Number of partitions in tablespace
QUALROWS	-- Optimizer's estimate for how many rows qualify if this table were the outer table
CLU	-- Is the index the clustering index?
UR	-- Unique rule
CR	-- Clusterratiof

TABLE_SPACE	NACTIVEF	PARTS	SEGSIZE	PG_SIZE						
DB4REGN.TSREGION	900.0	5	0	4						
		TABLE	CARDF	NPAGESF	TABNO	QUALROWS				
		SYSADM.REGION	5	0	6	0.99999994				
		INDEX	CLU	UR	NLEAF	NLEVEL	CR	KEYCOLNAME	COLCARDF	MCARDF
		SYSADM.PXR@RKNM	Y	U	5	2	1.0	R_REGIONKEY	5	5
								R_NAME	5	5
		COLUMN_GROUP	MCARDF							
DB4NATN.TSNATION	4500.0	25	0	4						
		TABLE	CARDF	NPAGESF	TABNO	QUALROWS				
		SYSADM.NATION	25	0	5	25.0				
		INDEX								
		SYSADM.PXN@NKNMFI								
		COLUMN_GROUP								
DB4CUST.TSCUST	192569.0	60	0	4						
		TABLE	CARDF	NPAGESF	TABNO	QUALROWS				
		SYSADM.CUSTOMER	4500000	0	1	9.999995				
		INDEX	CLU	UR	NLEAF	NLEVEL	CR	KEYCOLNAME	COLCARDF	MCARDF
		SYSADM.PXC@CKNKMS	Y	U	29040	3	1.0	C_CUSTKEY	4500000	4500000
								C_NATIONKEY	25	-1
								C_MKTSEGMENT	5	4500000
		SYSADM.UXC@NKCK	N	U	17858	3	0.999	C_NATIONKEY	25	25
								C_CUSTKEY	4500000	4500000
		COLUMN_GROUP	MCARDF							

Two indexes on the table 'CUSTOMER', but neither contains the column key 'C_NAME'.



Query Report – Predicate Report

Legend for column names that have been truncated

FF	--Filter factor
BT	--Whether this predicate is a boolean term predicate
S1	--Whether the predicate is a stage 1 predicate
JN	--Whether this predicate is a join predicate
AJ	--Whether this predicate is an anti-join predicate
PTC	--Whether the predicate belongs to a query selection when the set of predicates
MARKE	--Whether this predicate is a marked predicate
PREDNO	--The predicate number

Three EQUAL join predicates and one EQUAL local predicate on the table 'CUSTOMER'

TABLE	TABNO	COLNAME	COLNO	COLCARD	HIGH2KEY	LOW2KEY	MAX FREQ	TYPE	OTH TABLE	OTH TABNO	OTH COLNAME	
SYSADM.CUSTOMER	1	C_CUSTKEY	1	4500000	8044AA1F40404040	8000000240404040		EQUAL	SYSADM.ORDER	2	O_CUSTKEY	
		C_NATIONKEY	4	25	8000001740404040	8000000140404040		EQUAL	SYSADM.SUPPLIER	4	S_NATIONKEY	
									EQUAL	SYSADM.NATION	5	N_NATIONKEY
		C_NAME	2	450000	Customer	Customer		EQUAL		0	VALUE	
SYSADM.ORDER	2	O_CUSTKEY	2	3000000	8044AA1E40404040	8000000240404040		EQUAL	SYSADM.CUSTOMER	1	C_CUSTKEY	
		O_ORDERKEY	1	45000000	8ABA94E740404040	8000000240404040		EQUAL	SYSADM.LINEITEM	3	L_ORDERKEY	
		O_ORDERDATE	5	2304	1998-08-02	1992-01-01		RANGE		0	VALUE	
									RANGE		0	VALUE
SYSADM.LINEITEM	3	L_ORDERKEY	1	45000000	8ABA94E740404040	8000000240404040		EQUAL	SYSADM.ORDER	2	O_ORDERKEY	
SYSADM.SUPPLIER	4	S_SUPPLIERKEY	4	45000000	8ABA94E740404040	8000000140404040		EQUAL	SYSADM.CUSTOMER	1	C_NATIONKEY	
SYSADM.NATION	5	N_NATIONKEY	5	45000000	8ABA94E740404040	8000000140404040		EQUAL	SYSADM.SUPPLIER	4	S_SUPPLIERKEY	
SYSADM.NATION	5	N_REGIONKEY	2	5	8000000440404040	1032050526		EQUAL	SYSADM.REGION	6	R_REGIONKEY	
SYSADM.REGION	6	R_REGIONKEY	1	5	8000000340404040	8000000140404040		EQUAL	SYSADM.NATION	5	N_REGIONKEY	
		R_NAME	2	5	MIDDLE E	AMERICA		EQUAL		0	VALUE	

One EQUAL join predicate and one EQUAL local predicate on the table 'REGION'



Query Report – Index Report

TABLE	CORR_NAME				
SYSADM.REGION					
	INDEX	INDEX_ONLY	ONE_FETCH	EQUAL_UNIQUE	GB_OB_DISTINCT
	SYSADM.PXR@RKNM	Y	N	N	N
	KEYCOL	ORDER	COLUMN_CARD	MULTI_COL_CARD	PRED
	R_REGIONKEY	ASCENDING	5.0	5.0	SYSADM.NATION.N_REGIONKEY=SYSADM.REGION.R_REGIONKEY (FF:0.19999998307907104)
	R_NAME	ASCENDING	5.0	5.0	SYSADM.REGION.R_NAME='ASIA' (FF:0.19999998307907104)

TABLE	CORR_NAME				
SYSADM.NATION					
	INDEX	INDEX_ONLY	ONE_FETCH	EQUAL_UNIQUE	GB_OB_DISTINCT
	SYSADM.PXN@NKNMRK				
	KEYCOL	ORDER	COLUMN_CARD	MULTI_COL_CARD	PRED
	N_NATIONKEY	ASCENDING	25.0	25.0	SYSADM.SUPPLIER.S_NATIONKEY=SYSADM.NATION.N_NATIONKEY (FF:0.19999998307907104)
	N_REGIONKEY	ASCENDING	5.0	25.0	SYSADM.NATION.N_REGIONKEY=SYSADM.REGION.R_REGIONKEY (FF:0.19999998307907104)

This index supports index-only scan on the table 'REGION'.

These two indexes supports index + fetch scan on the table 'CUSTOMER'.

QB: PLAN:3

TABLE	CORR_NAME				
SYSADM.CUSTOMER					
	INDEX	INDEX_ONLY	ONE_FETCH	EQUAL_UNIQUE	GB_OB_DISTINCT
	SYSADM.PXC@CKNKMS	N	N	N	N
	KEYCOL	ORDER	COLUMN_CARD	MULTI_COL_CARD	PRED
	C_CUSTKEY	ASCENDING	4500000.0	4500000.0	SYSADM.CUSTOMER.C_CUSTKEY=SYSADM.ORDER.O_CUSTKEY (FF:2.2222218376555247E-7)
	C_NATIONKEY	ASCENDING	25.0	-1.0	SYSADM.CUSTOMER.C_NATIONKEY=SYSADM.SUPPLIER.S_NATIONKEY (FF:0.039999999910593033)
	C_MKTSEGMENT	ASCENDING	5.0	4500000.0	SYSADM.CUSTOMER.C_NATIONKEY=SYSADM.NATION.N_NATIONKEY (FF:0.039999999910593033)
	INDEX	INDEX_ONLY	ONE_FETCH	EQUAL_UNIQUE	GB_OB_DISTINCT
	SYSADM.UXC@NKCK	N	N	N	N
	KEYCOL	ORDER	COLUMN_CARD	MULTI_COL_CARD	PRED



Understanding the Access Path with Visual Explain

The screenshot displays the IBM DB2 Optimization Expert for z/OS interface. A blue callout box labeled "Access Plan Graph" points to the main diagram area. A red box highlights the "Node Descriptor" window on the left and the "Access Plan Graph" area on the right.

Node Descriptor:

Query: QUERY

@ query

Show attribute explanation Views: it_...

Name	Value
Type	SELECT
CPU Cost (ms)	6181
CPU Cost (su)	16055
Cost Category	A
Reason	
Timestamp	2007-02-15 19:32:36.18

Attribute explanation:

Buttons: Save as ... Print ... Su...

Access Plan Graph:

The graph shows a hierarchical structure of operations. At the top is a green circle labeled "QUERY". Below it is a blue circle "QB1 17", followed by a blue octagon "NLJOIN 17.8252". The graph branches into several paths, including "NLJOIN 18.0096", "NLJOIN 16.09", "XONLYSCAN 4", "WFSCAN 6.8", "WORK FILE 6.8", "XONLYSCAN 2.3647", "XOXO@CKOKODSP 45000000", "SORT 6.8", "NLJOIN 6.8", "XONLYSCAN 5", "XSCAN 180000", "FETCH 1.36", and "CUSTOMER 4500000". A yellow arrow points to a node labeled "PXL@OKSDRFSKEPD 179998372".

Bottom tabs: Project, Query, Query Annotation, Report, Access Plan Graph

Bottom right: Annotate Query

Hierarchical
Descriptor
Structure

Detailed
Descriptor
Attributes



Implementing Emergency Solution with Visual Plan Hint

The screenshot displays the IBM DB2 Optimization Expert for z/OS interface. The main window shows a query plan graph with nodes: REGION, NATION, SUPPLIER, LINEITEM, CUSTOMER, and ORDER. A blue arrow points from a text box to the graph. A red-bordered window titled 'Visual Plan Hint' is overlaid on the right, showing a hierarchical join sequence: JOIN (JOIN (JOIN (JOIN (CUSTOMER, NATION), REGION), ORDER), LINEITEM), SUPPLIER). The interface includes a menu bar, a toolbar, and a status bar at the bottom.

Default Join Sequence

CBNO	CREATOR	TNAME	CORRELATION_NAME	ACCESSTYPE	ACCESSCREATOR	ACCESSNAME	PREFETCH	PAGE_RANGE	METHOD	SORTN_JOIN
------	---------	-------	------------------	------------	---------------	------------	----------	------------	--------	------------



Implementing Emergency Solution with Visual Plan Hint

IBM DB2 Optimization Expert for z/OS

Project Tools Help

Configure Subsystems View Queries View Workloads View Monitors * New Project1

Query Blocks: Graph Report Validate Hints Deploy Hints Zoom In Zoom Out

Show Local Predicates Show Join Predicates Create Join Node Default Join Sequence Delete Selected Nodes

Hint Customization Rule

CREATOR	SYSADM	
TNAME	CUSTOMER	
CORRELATION_NAME	NULL	
ACCESSTYPE	INDEX	NULL
ACCESSCREATOR	DB2OE	NULL
ACCESSNAME	CUSTOMER_VIRT_IDX_11716082	NULL CUSTOMER_VIRT_IDX_11716082 PXC@CKNKMS UXC@NKCK
PREFETCH		
PAGE_RANGE		
METHOD	NULL	
SORTN_JOIN	N	NULL
SORTC_JOIN	N	NULL
PARALLELISM_MODE	NULL	NULL
ACCESS_DEGREE	NULL	NULL
JOIN_DEGREE	NULL	NULL
PRIMARY_ACCESSTYPE		NULL

OK Cancel

Project Query Query Annotation Report Access Plan Graph Visual Plan Hint

Annotate Query

Customize the access path using hint



Automatic Collection of Relevant Information for PMR Analysis

IBM DB2 Optimization Expert for z/OS

Project Tools Help

Service SQL

Generate Options

Specify options for generating a report about the query. You can also specify an FTP server to send the report to IBM Software Support.

Options

Convert to version: No conversion

Generate CREATE statements Generate statistics Parallelism Edited

PMR or ETR Number (xxxxx,yyy,zzz): , , Version:

C:/Program Files/IBM/OE Browse...

Generate Report Send Report to IBM

Include analysis results

FTP Server Settings

Server name: testcase.software.ibm.com Port: 21

User: anonymous Password: *****

Directory: /toibm/im Proxy Settings...

Upload file list: Add... Remove

< Back Next > Finish Cancel

Send Service Information

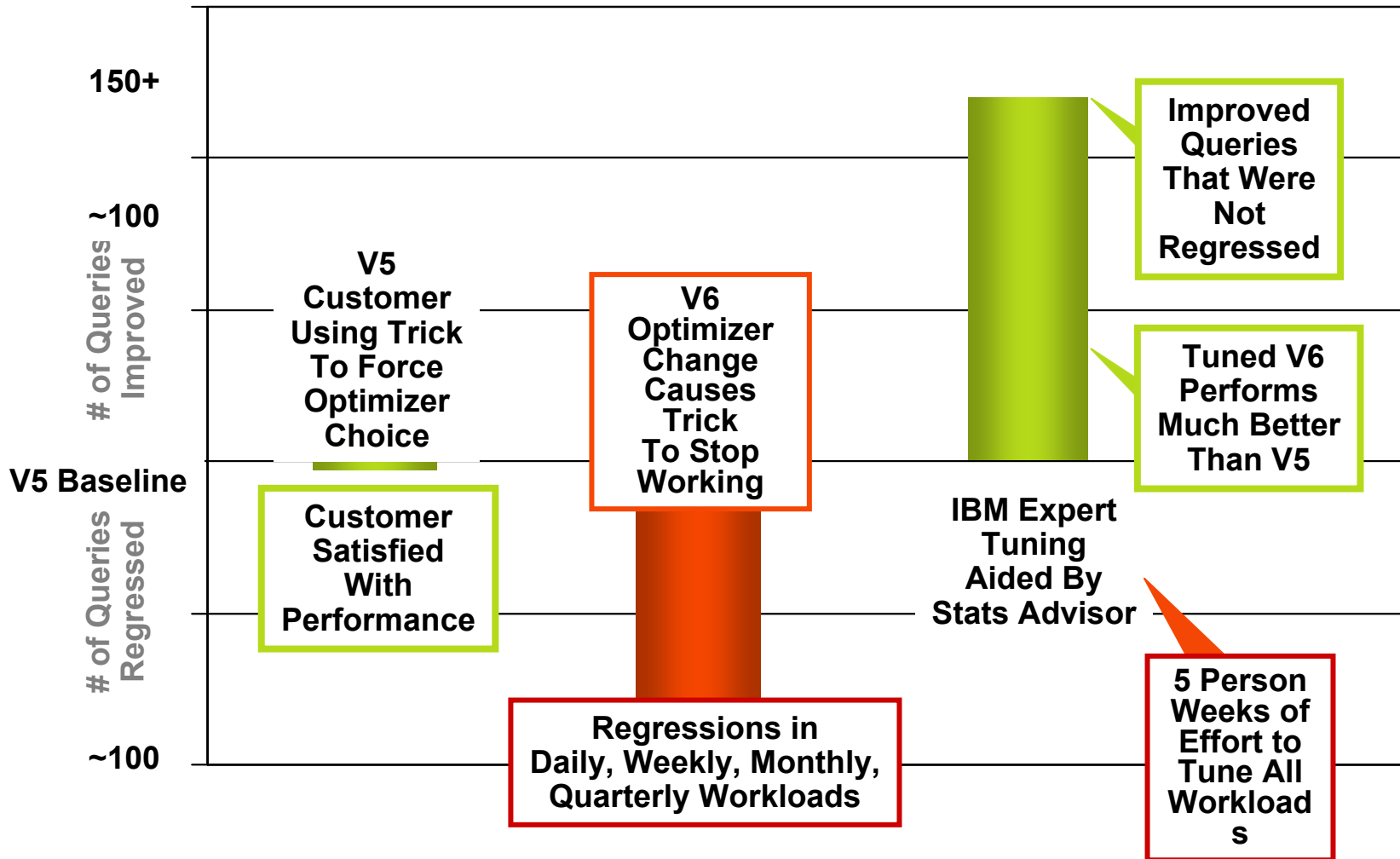
Annotate Query



Capturing Application Workloads



Scenario: Version to version migration failure



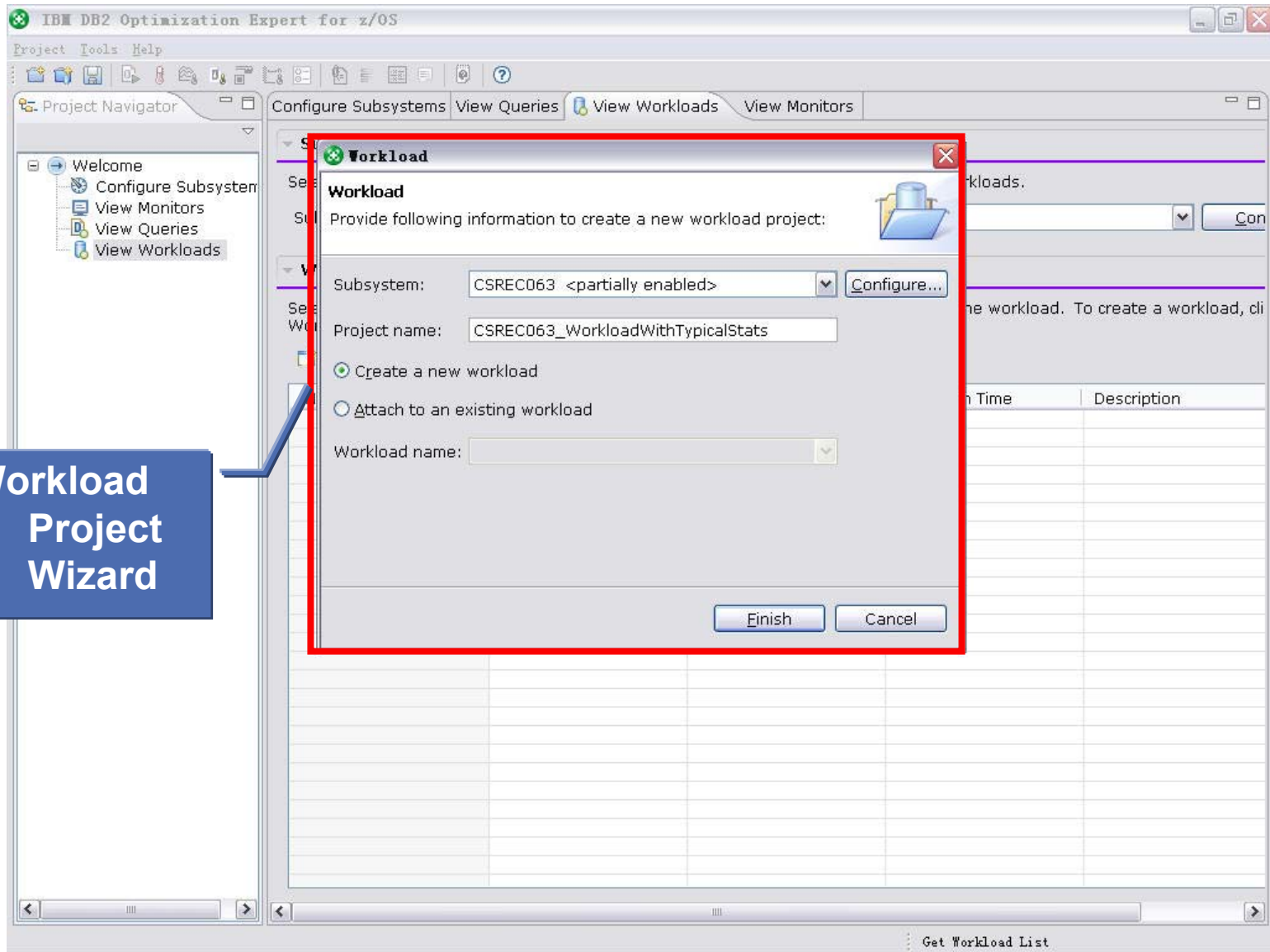
Scenario: Version to version migration failure

Post-mortem Analysis

- Customer satisfied with V5 performance, but it was actually sub-optimal
- Complexity of problem tested the limits of expert analysis
 - ✓ 30 table joins nested behind several layers of views
 - ✓ Column names changed in views
 - ✓ Days to analyze a single query
 - ✓ 100s of queries in multiple workloads
- Customer costs
 - ✓ 6-8 month delay in migration
 - ✓ Person weeks of effort to resolve problems
 - ✓ Inability to take advantage of V6 enhancements



Capturing Workload Queries



**Workload
Project
Wizard**



Capturing Workload Queries – General Info.

Workload Wizard

Provide the following information to create a workload.

Steps

- 1. Workload
- 2. Source
- 3. Filter
- 4. Capture

Workload name:

Owner:

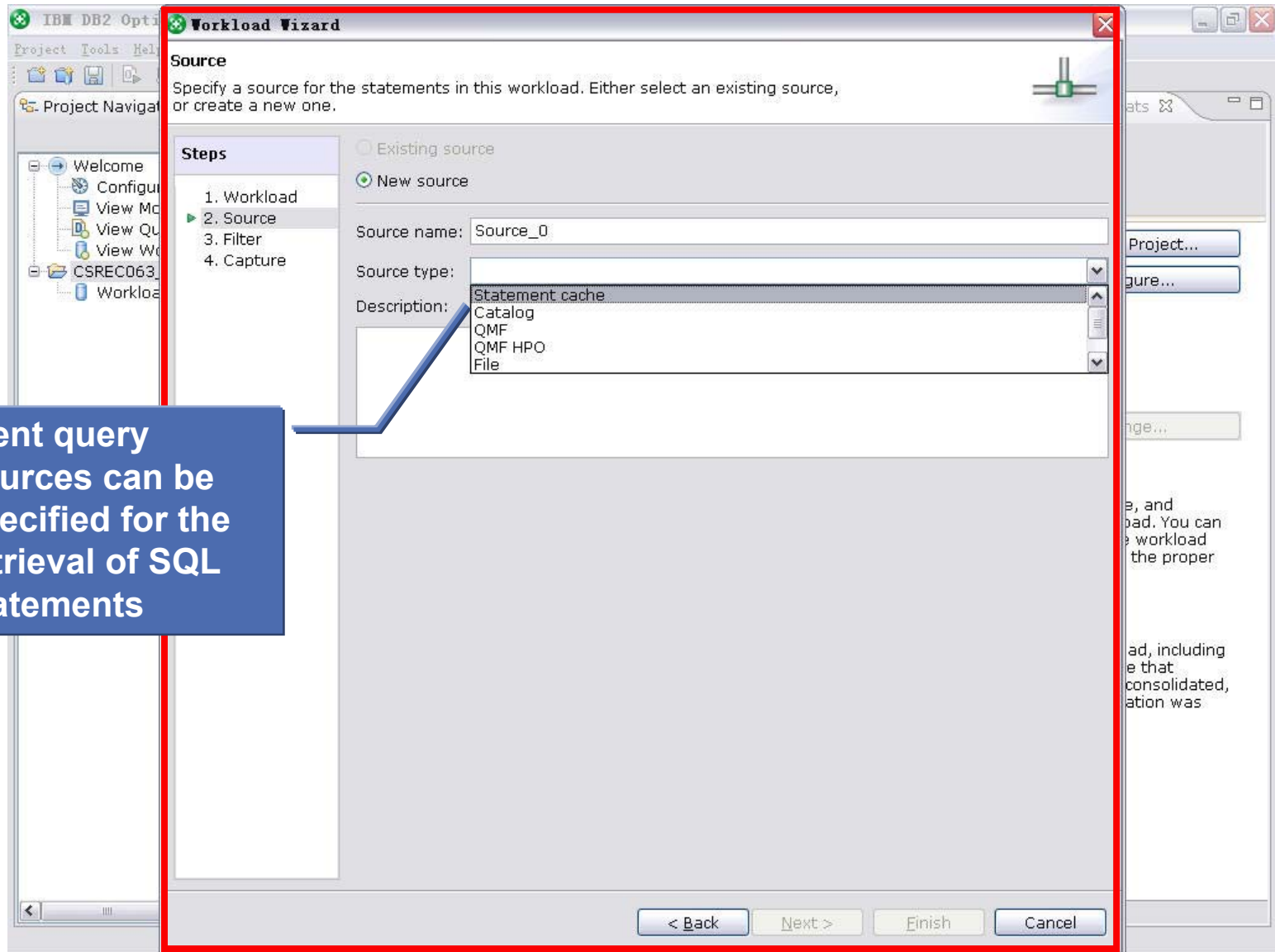
Description:

< Back Next > Finish Cancel

Workload Wizard



Capturing Workload Queries – Query Source



Different query sources can be specified for the retrieval of SQL statements



Capturing Workload Queries – Selection Criteria

Source Filter
Use the Operator and Value columns to define filtering criteria. Only those statements that satisfy the criteria are included in this workload.

Steps

1. Workload
2. Source
3. Filter
4. Capture

Column Name	Operator	Value	Comment
PRIMAUTH	=	ADMF001	The primary authorization ID that did the initial PREPARE.
CURSQLID	=		The CURRENT SQLID that did the initial PREPARE.
SCHEMA	=		The value of the CURRENT SCHEMA special register.
BIND_QUALIFIER	=		The BIND qualifier. For unqualified table names.
BIND_ISO	=		The value of the ISOLATION BIND option that was used.
BIND_CDATA	=		The value of the CURRENTDATA BIND option that was used.
BIND_DYNRL	=		The value of the DYNAMICRULES BIND option that was used.
BIND_DEGREE	=		The value of the CURRENT DEGREE special register.
BIND_SQLRL	=		The value of the CURRENT RULES special register.
BIND_CHOLD	=		The value of the WITH HOLD attribute of the statement.
STAT_EXEC	=		The number of times this statement has been executed.
STAT_GPAG	=		The number of getpage operations that are performed.
STAT_SYNR	=		The number of synchronous buffer reads that are performed.
STAT_WRIT	=		The number of buffer write operations that are performed.
STAT_EROW	=		The number of rows that are examined for table access.
STAT_PROW	=		The number of rows that are processed for table access.
STAT_SORT	=		The number of sorts that are performed for table access.
STAT_INDX	=		The number of index scans that are performed.
STAT_RSCN	=		The number of tablespace scans that are performed.
STAT_PGRP	=		The number of parallel groups that are created.
STAT_RIDLIMT	=		The number of times a RID list was not used.
STAT_RIDSTOR	=		The number of times a RID list was not used.
AVG_STAT_GPAG	=		The average number of getpage operations.
AVG_STAT_SYNR	=		The average number of synchronous buffer reads.
AVG_STAT_WRIT	=		The average number of buffer write operations.
AVG_STAT_ER...	=		The average number of rows that are examined.
AVG_STAT_PR...	=		The average number of rows that are processed.
AVG_STAT_SORT	=		The average number of sorts.
AVG_STAT_INDX	=		The average number of index scans.
AVG_STAT_RSCN	=		The average number of tablespace scans.
AVG_STAT_PGRP	=		The average number of parallel groups that are created.

Selection criteria

< Back Next > Finish Cancel



Capturing Workload Queries – When & How

Workload Wizard

Capture Type

Specify any related options. To customize the capture profile, select the Customize profile to choose from more options.

Steps	Capture profile	Description
1. Workload	Immediately	
2. Source	One Time	
3. Filter	Time Period	
▶ 4. Capture	Periodic Sampling	
	Customize	

Profile Details

< Back Next > Finish Cancel

Capture the workload now or later, once, multiple times or periodically



Capturing Workload Queries – Capturing

The screenshot displays the IBM DB2 Optimization Expert for z/OS interface. The main window is titled 'Workload Project' and contains the following elements:

- Project Navigator:** A tree view on the left showing the project structure, including 'Welcome', 'Configure Subsystem', 'View Monitors', 'View Queries', 'View Workloads', and 'CSRECO63_WorkloadWithTypic...'.
- Workload Project Panel:** The main area with the following details:
 - Project:** CSRECO63_WorkloadWithTypicalStats
 - Subsystem:** CSRECO63 <partially enabled>
 - Buttons: 'Rename Project...', 'Configure...', 'Change...'
- Define Workload... Dialog:** A modal dialog box with a red border, containing:
 - Information icon and text: 'Define Workload... Elapsed time: 15.2 seconds'
 - A progress bar with five green segments.
 - Text: 'Define capture task for the workload'
 - Buttons: 'Run in Background', 'Cancel', 'Details >>'
- Run Advisors:** A section with a thermometer icon and text: 'Get recommendations for workloads that could improve workload performance. Schedule workload analysis for a later time.'
- History:** A section with a notepad icon and text: 'View the history of this workload, including when it was created, each time that statements were captured or consolidated, and each time EXPLAIN information was gathered.'
- Schedule Tasks:** A section with a calendar icon and text: 'Schedule when to capture statements, consolidate statements, and gather EXPLAIN information.'

A blue callout box with the word 'Capturing' is positioned over the 'Define Workload...' dialog box.



Capturing Workload Queries – Completion

Queries captured!

IBM DB2 Optimization Expert for z/OS

Project Tools Help

Project Navigator

- Welcome
- Configure Subsystem
- View Monitors
- View Queries
- View Workloads
- CSRECO63_WorkloadWi
 - Workload

Configure Subsystems View Queries View Workloads View Monitors CSRECO63_WorkloadWithTypicalStats

Workload Project

To tune a workload, specify the workload name and choose one of the following actions.

Project: CSRECO63_WorkloadWithTypicalStats [Rename Project...](#)

Subsystem: CSRECO63 <partially enabled> [Configure...](#)

Workload Name: WorkloadWithTypicalStats

Workload Owner: SYSADM

Summary Status: CAPTURED [Change...](#)

Description:

Workload Statements
Capture workload statements, get recommendations from the advisors, and use tools to tune an individual query.

Users
Grant or revoke owner, update, and read-only access to the workload. You can create authorization IDs in the workload control center only if you have the proper authority.

Run Advisors
Get recommendations for workloads that could improve workload performance. Schedule workload analysis for a later time.

History
View the history of this workload, including when it was created, each time that statements were captured or consolidated, and each time EXPLAIN information was gathered.

Schedule Tasks
Schedule when to capture statements, consolidate statements, and gather EXPLAIN information.

Workload

Define Workload...



Capturing Workload Queries – Browsing

The screenshot displays the IBM DB2 Optimization Expert for z/OS interface. The main window shows the 'Workload Statements' view for a workload named 'CSRECO63_WorkloadWithTypicalStats'. The interface includes a Project Navigator on the left, a toolbar at the top, and a central area for viewing and managing statements. A red box highlights the table of captured statements, which includes columns for source, elapsed time, and statement text. A blue callout box labeled 'Captured Statements' points to this table.

Project Tools Help

Project Navigator

- Welcome
- Configure Subsystem
- View Monitors
- View Queries
- View Workloads
- CSRECO63_WorkloadWithTypicalStats
 - Workload
 - Statements

Configure Subsystems View Queries View Workloads View Monitors * CSRECO63_WorkloadWithTypicalStats

Workload Statements

Immediately capture statements or multiple sources to this workload, launch workload advisors, use tools to tune selected queries from the workload, or schedule tasks for capture, consolidation, and analysis.

Capture Workload Tools Schedule Remove Query Tools Refresh

All of the rows are displayed. The number of rows is 10.

Source	Accumulated El...	Average Elapse...	Accumulated C...	Average CPU Ti...	Statement Text
CHE	0.001967156	0.001967156	0.0019474978	0.0019474978	SELECT C_NAME,C_ADDRESS,N...
CHE	0.005028826	0.005028826	0.004934781	0.004934781	SELECT O_ORDERKEY,O_CUSTKE...
CHE	0.0029194686	0.0029194686	0.0028823551	0.0028823551	SELECT S_SUPPKEY,S_NAME, SU...
CHE	0.0029387153	0.0029387153	0.0018932667	0.0018932667	SELECT C_NAME,C_ADDRESS,N...
CHE	0.0047716247	0.0047716247	0.004721173	0.004721173	SELECT O_ORDERKEY,O_CUSTKE...
CHE	0.0034057186	0.0034057186	0.0033768355	0.0033768355	SELECT S_SUPPKEY,S_NAME, SU...
CHE	0.0020138593	0.0020138593	0.0019925022	0.0019925022	SELECT C_NAME,C_ADDRESS,N...
CHE	0.004906592	0.004906592	0.0046221213	0.0046221213	SELECT O_ORDERKEY,O_CUSTKE...
CHE	0.0027890936	0.0027890936	0.0025451551	0.0025451551	SELECT S_SUPPKEY,S_NAME, SU...
CHE	0.004266531	0.004266531	0.0040141614	0.0040141614	INSERT INTO REGION (SELECT N...

Workload Statements

Define Workload...

Captured Statements



Capture Workload Queries with Monitor

The screenshot shows the IBM DB2 Optimization Expert for z/OS application window. The title bar reads "IBM DB2 Optimization Expert for z/OS". Below the title bar is a menu bar with "Project", "Tools", and "Help". The main content area has a "Welcome" tab and a header with "DB2 Optimization Expert for z/OS" and the IBM logo. The main text says "WELCOME" and provides instructions on how to get started. Below this are six task cards, each with an icon and a description. The "View Monitor Profiles" card is circled in red. At the bottom right, there is a "Define Workload..." button.

IBM DB2 Optimization Expert for z/OS

Project Tools Help

Welcome

DB2 Optimization Expert for z/OS

WELCOME

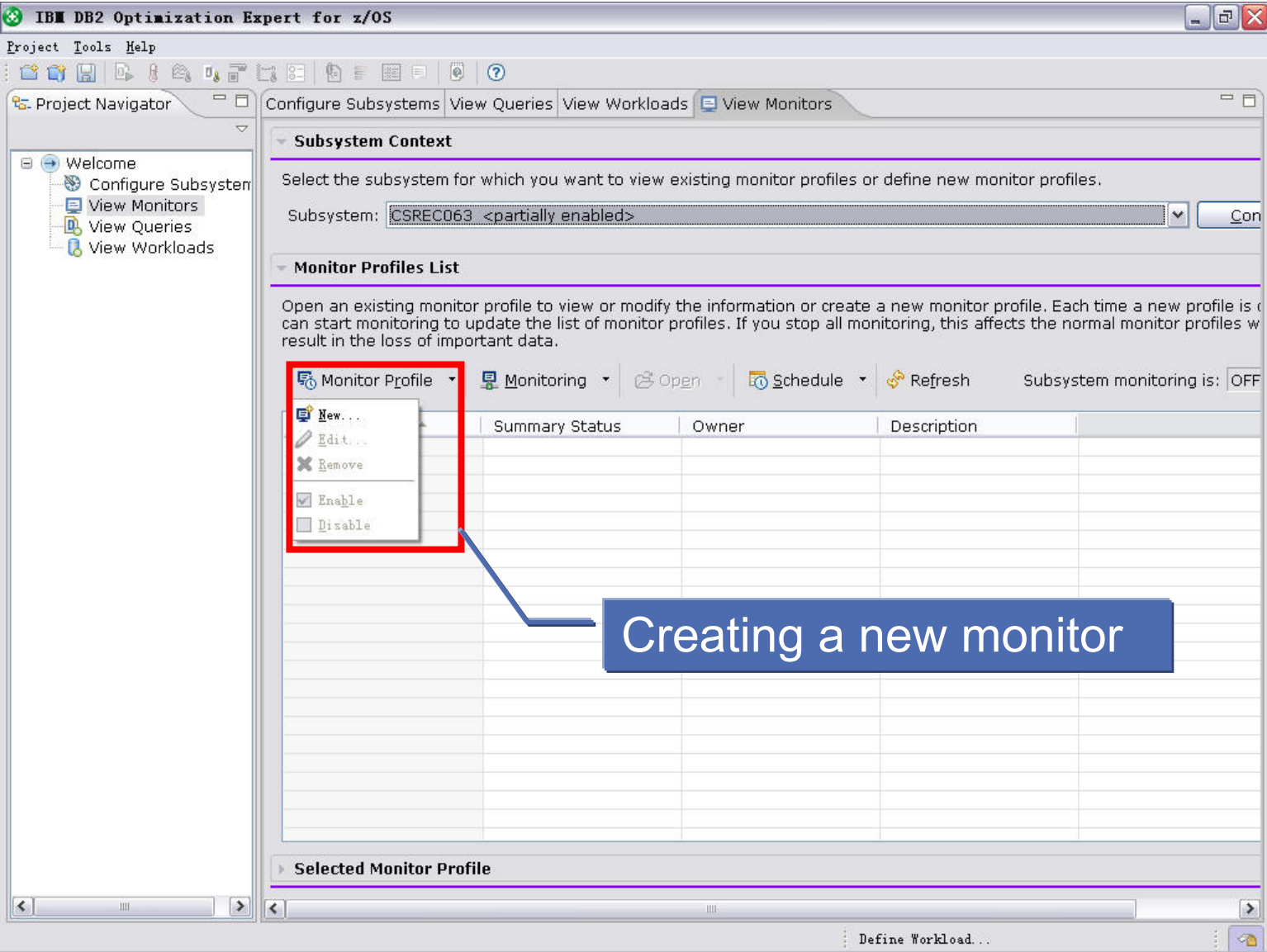
Welcome! To get started with the DB2 Optimization Expert (OE), you must first configure a connection to a DB2 for z/OS subsystem. Then you can create a new project to tune a problem query or an entire query workload.

- Configure DB2 Subsystems**
Connect to DB2 subsystems, enable OE, and grant EXPLAIN authorizations.
- View Workloads**
View the status of workloads, open existing workloads, and archive the workloads on a subsystem.
- View Query Activity**
View and sort dynamic and static queries to find potential problems.
- Tune a Workload**
Use OE advisors and advanced tools to capture and analyze and improve the performance of query workloads.
- Tune a Single Query**
Use OE advisors and advanced tools to analyze and improve the performance of a query.
- View Monitor Profiles**
View the status of all monitor profiles on a subsystem, create new monitor profiles, and open existing monitor profiles.

Define Workload...



Capture Workload Queries with Monitor



The screenshot shows the IBM DB2 Optimization Expert for z/OS interface. The main window has tabs for "Configure Subsystems", "View Queries", "View Workloads", and "View Monitors". The "View Monitors" tab is active, showing the "Monitor Profiles List".

Subsystem Context
Select the subsystem for which you want to view existing monitor profiles or define new monitor profiles.
Subsystem: CSRECO63 <partially enabled>

Monitor Profiles List
Open an existing monitor profile to view or modify the information or create a new monitor profile. Each time a new profile is created you can start monitoring to update the list of monitor profiles. If you stop all monitoring, this affects the normal monitor profiles which result in the loss of important data.

Monitor Profile | Monitoring | Open | Schedule | Refresh | Subsystem monitoring is: OFF

	Summary Status	Owner	Description

Selected Monitor Profile

Define Workload...

A red box highlights the context menu for the "Monitor Profile" header, which includes options: "New...", "Edit...", "Remove", "Enable" (checked), and "Disable". A blue arrow points from this menu to a blue callout box.

Creating a new monitor



Capture Workload Queries with Monitor

Monitor Wizard

Monitor Name
Provide a name for the monitor profile, and specify the type of monitor profile.

Steps

1. Monitor Name
2. Source
3. Filter
4. Start Monitor

Subsystem: CSRECO63 <partially enabled>

Monitor name: Normal Monitor

Owner: SYSADM

Select which type of monitor to create.

Normal - Monitor all SQL statements that run within a monitor source

Exception - Monitor SQL statement pushes that meet specific exception conditions

Description:

< Back Next > Finish Cancel

Monitor wizard for capturing application workload

Selected Monitor Profile

Define Workload...



Capture Workload Queries with Monitor

The screenshot shows the 'Monitor Wizard' dialog box in IBM DB2. The 'Monitor Source' section is active, with 'Dynamic statements' selected. The 'Authorization ID' is set to 'ADMFO01' and the 'IP address' is '9.181.133.73'. A blue callout box points to these fields with the text: 'Scope of the monitor: Auth. ID: ADMFO01 IP: 9.181.133.73'. The 'Source List' table is empty.

Monitor Source
Define sources for the monitor profile. You can specify more than one statement source in a single monitor profile. Specify Authorization ID and IP address for each dynamic statement source, and specify

Steps

1. Monitor Name
2. Source
3. Filter
4. Start Monitor

Dynamic statements

Authorization ID: ADMFO01
IP address: 9.181.133.73

Embedded statements

Plan name:
Collection ID:
Package name:

Source List

Authorizati...	IP Address	Plan Name	Collection ID	Package N...

< Back Next > Finish Cancel

Selected Monitor Profile

Define Workload...



Capture Workload Queries with Monitor

Settings
Define a filter to specify when the monitor profile pushes out information about a statement execution and which information is recorded at each statement push.

Steps

1. Monitor Name
2. Source
3. Filter
4. Start Monitor

Monitor type: Normal execution
Description: Monitor a normal query exception.

General Settings

- Push out EXPLAIN information

Granularity:

- Push out number of executions and accumulated CPU time (recommended for minimal effects to performance)
- Push out complete runtime information

Limit for statement pushes that leave the cache: 5000

< Back **Next >** Finish Cancel

Selected Monitor Profile

Define Workload...

Capturing runtime and explain information for up to 5000 statements



Capture Workload Queries with Monitor

The screenshot displays the IBM DB2 Optimization Expert for z/OS interface. The main window is titled "Workload Statements" and shows a list of captured queries. A blue callout box highlights the authentication information: "Statements captured Auth. ID: ADMF001 IP: 9.181.133.73". The table below shows the captured statements with columns for execution time and statement text.

	Accumulated Ela...	Average Elaps...	Accumulated C...	Average CPU Ti...	Statement Text
R	1.1260938E-4	1.1260938E-4	1.11054695E-4	1.11054695E-4	SELECT 1 FROM SYSIBM.SYSDUMMY1
R	0.0048566284	0.0024283142	0.0021274262	0.0010637131	SELECT C_NAME,C_ADDRESS,N_NAM
R	0.007253484	0.003626742	0.0050335685	0.0025167842	SELECT O_ORDERKEY,O_CUSTKEY,O
R	0.0029460466	0.0014730233	0.0028902674	0.0014451337	SELECT S_SUPPKEY,S_NAME, SUM(L
R	0.0047927657	0.0023963829	0.004579288	0.002289644	SELECT O_ORDERKEY,O_CUSTKEY,O
R	0.003707945	0.0018539726	0.0034317768	0.0017158884	SELECT S_SUPPKEY,S_NAME, SUM(L
R	0.0052859383	0.0026429691	0.004823123	0.0024115616	SELECT O_ORDERKEY,O_CUSTKEY,O
R	0.0021096093	0.0010548047	0.0020319007	0.0010159503	SELECT S_SUPPKEY,S_NAME, SUM(L



Performing Health Check for Application Workloads with Design Advisors



Design Advisors

- Stats Advisor – stats recommendation for access path selection
- Index Advisor – recommendation for index design
- Query Advisor – recommendation for query design



Tune Query Workload

The screenshot displays the IBM DB2 Optimization Expert for z/OS interface. The main window is titled "Workload Project" and shows configuration details for a workload named "DemoWorkload". The configuration includes the project name, subsystem (V9EC03), workload name, owner (SYSADM), and summary status (EXPLAINING). A red box highlights the "Run Advisors" section, which contains a list of advisor options: "Run All Advisors", "Run Workload Statistics Advisor", "Run Workload Index Advisor", "Run Workload Query Advisor", and "Show Advisor Options". A blue callout box labeled "Workload-based Advisors" points to this list. The interface also includes a Project Navigator on the left and a status bar at the bottom indicating "Retrieving PLAN_TABLE Records".

Workload Project

To tune a workload, specify the workload name and choose one of the following actions.

Project: V9EC03_DemoWorkload Rename Project...

Subsystem: V9EC03 <partially enabled> Configure...

Workload Name: DemoWorkload

Workload Owner: SYSADM

Summary Status: EXPLAINING

Description: Change...

Workload-based Advisors

- Run **A**ll Advisors
- Run Workload **S**tatistics Advisor
- Run Workload **I**ndex Advisor
- Run Workload **Q**uery Advisor
- Show Advisor **O**ptions

Workload Statements: Immediately capture workload statements, get tuning recommendations from the workload advisors, and use tool to tune an individual query.

Run Advisors: Get recommendations that could improve workload performance. Schedule workload advisors.

Schedule Task: Schedule when to capture statements, consolidate statements, and gather EXPLAIN information.

Users: Create user-defined roles in the workload control center only if you have the proper authority.

History: View the history of this workload, including when it was created, each time that statements were captured or consolidated, and each time EXPLAIN information was gathered.

Retrieving PLAN_TABLE Records



Tune Query Workload – Statistics Advisor

Recommendation Summary

Number	Priority	Recommendation	Description
1	High	Run complete RUNSTATS	Gather or Recollect all relevant statistics for...
2	Low	Run partial RUNSTATS	Repair the statistics problems within this w...

RUNSTATS command

```
RUNSTATS TABLESPACE DB4PART.TSPART
TABLE(SYSADM.PART) SAMPLE 5
COLUMN
(P_MFGR,P_SIZE,P_RETAILPRICE,P_TYPE,P_PAR
TKEY,
P_NAME)
COLGROUP(P_NAME) HISTOGRAM
NUMQUANTILES 20
COLGROUP(P_TYPE) HISTOGRAM
NUMQUANTILES 20
COLGROUP(P_MFGR) FREQVAL COUNT 10
SORTDEVT SYSDA
INDEX(SYSADM.UXP@SZTPKMF KEYCARD
FREQVAL NUMCOLS 1 COUNT 10,
```

Recommendation Explanation

Description

Gather or Recollect all relevant statistics for the entire workload. Periodical statistics collection brings all relevant statistics up to date and consistent, and avoids the workload performance degradation due to obsolete statistics.

Actions

- Details...
- Run...
- Copy
- Save

Workload | Statements | Advisors | Statistics Advisor

Get Statistics Recommendation



Tune Query Workload – Index Advisor

IBM DB2 Optimization Expert for z/OS

Project Navigator

- Welcome
- Configure Subsystems
- View Monitors
- View Queries
- View Workloads
- New Project1
- V9EC03_DemoWorkload
 - Workload
 - Advisors
 - Index Advisor
 - Statements

Configure Subsystems | View Queries | View Workloads | View Monitors | * V9EC03_DemoWorkload

Workload Index Advisor Recommendations

The following information shows the index recommendations for this workload. You can view the performance improvement when all recommendations are applied. There is the option to run index analysis again with different values to see if there are better recommendations.

Workload performance improvement is an estimate based on applying all recommendations.

Estimated performance improvement: 36.39 %
Disk space required(DASD space): 44626.41 MB

Feature Details	Action	Object...	Columns	Estimated Di
<input checked="" type="checkbox"/> Index	Create	LINEITE...	L_DISCOUNT(ASC), L...	1796.082031
<input checked="" type="checkbox"/> Index	Create	LINEITE...	L_DISCOUNT(ASC), L...	4056.003906

Buttons: Show DDL..., Show Related SQL..., What-If Analysis..., Run..., Select All, Deselect All

Run Selected DDL Statements

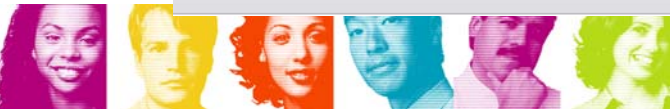
Save Action

```
CREATE INDEX "DB2OE"."SUPPLIER_VIRT_IDX_1171449271453" ON "SYSADM"."SUPPLIER" ("S_SUPPKEY" ASC, "S_NATIONKEY" ASC, "S_NAME" ASC) NOT PADDED FREEPAGE 0 PCTFREE 10;  
  
CREATE INDEX "DB2OE"."SUPPLIER_VIRT_IDX_1171448270672" ON "SYSADM"."SUPPLIER" ("S_ACCTBAL" ASC) NOT PADDED FREEPAGE 0 PCTFREE 10;  
  
CREATE INDEX "DB2OE"."SUPPLIER_VIRT_IDX_1171448270675" ON "SYSADM"."SUPPLIER" ("S_SUPPKEY" ASC, "S_ACCTBAL" ASC) NOT PADDED FREEPAGE 0 PCTFREE 10;  
  
CREATE INDEX "DB2OE"."REGION_VIRT_IDX_1171448180065" ON "SYSADM"."REGION" ("R_REGIONKEY" ASC) NOT PADDED FREEPAGE 0 PCTFREE 10;
```

Run Cancel

Get Index Recommendation

Index Recommendation



Tune Query Workload – Query Advisor

Recommendation Summary

The following is a summary of the queries analyzed in the workload. Use this criteria to filter the view for specific statements.

Statements Sorted by	Number
Statements Analyzed Successfully	94
Statements with Warnings	34
Number of High Severity Warnings	0
Number of Medium Severity Warnings	4
Number of Low Severity Warnings	50
Statements with High Severity Warnings	0
Statements with Medium Severity Warnings	4
Statements with Low Severity Warnings	31

View statements that meet the following criteria:

Severity of warning severity: High severity
 Medium severity
 Low severity
 Show statements that do not contain warnings

[Restore Defaults](#) [Save as Defaults](#) [View Statements](#)

Workload | Statements | Advisors | **Query Advisor Summary** | [Get Index Recommendation](#)



Tune Query Workload – Query Advisor

Recommendations List for one query

Recommendation Description

Recommendation Explanation

The screenshot shows the IBM DB2 Optimization Expert for z/OS interface. The main window displays the 'Query Advisor Recommendations List' for query 332. A table lists one recommendation with a severity of 'Low' and a confidence of 'Low'. Below the table, the 'SQL Text' is shown as 'SELECT * FROM LINEITEM WHERE L_COMMENT='BNQ2y5xz1BBC06n4' for fetch only'. The 'Selected Recommendation' section is expanded, showing a 'Description' and an 'Explanation' for the recommendation. The 'Query Advisor' tab is selected in the bottom navigation bar.

No	Severity	Confidence	Line Number	Description
1	Low	Low		Consider replacing the asterisk (*) or

SQL Text

```
SELECT * FROM LINEITEM WHERE L_COMMENT='BNQ2y5xz1BBC06n4' for fetch only
```

Selected Recommendation:

Description	Explanation
Consider replacing the asterisk (*) or the long column list of table SYSADM.LINEITEM in the SELECT list with the names of only the required columns in table SYSADM.LINEITEM. Check the explanation for this warning for more details about possible impact and examples.	Using asterisks in the select list of an SQL statement is generally considered a bad practice and should be avoided. Extraneous columns cause DB2 to return unnecessarily long rows, thereby increasing CPU cost and overhead as the qualified rows are returned to the client. In addition, if a query performs a sort, the long select column list increases the cost of performing the sort and might discourage the access path that performs the sort. Extraneous columns also increase the sort data length, and might



Monitoring Workload Exceptions



Defining Performance Exceptions

- Two kinds of exceptions
 - **CPU time exception**
 - **CPU spike exception**
- Notify performance exception as soon as it occurs



Capture Workload Exceptions with Monitor

Monitor Name
Provide a name for the monitor profile, and specify the type of monitor profile.

Steps

1. Monitor Name
2. Source
3. Filter
4. Start Monitor

Subsystem: CSREC063 <partially enabled>

Monitor name: CPU Time Exception Monitor

Owner: SYSADM

Select which type of monitor to create.

- Normal - Monitor all SQL statements that run within a monitor source
- Exception - Monitor SQL statement pushes that meet specific exception conditions

Description:

< Back Next > Finish Cancel

Number of push out for all statements when the statement leaves the cache: 5000

Number of push out for each statement when exception threshold is met:

Define Workload...



Capture Workload Exceptions with Monitor

Monitor Source

Define sources for the monitor profile. You can specify more than one statement source in a single monitor profile. Specify Authorization ID and IP address for each dynamic statement source, and specify

Steps

1. Monitor Name
2. Source
3. Filter
4. Start Monitor

Dynamic statements

Authorization ID: ADMF001

IP address: 9.181.133.73

Embedded statements

Plan name:

Collection ID:

Package name:

Add Remove

Source List

Authorizati...	IP Address	Plan Name	Collection ID	Package N...
ADMF001	9.181.133.73			

< Back Next > Finish Cancel

Number of push out for all statements when the statement leaves the cache: 5000

Number of push out for each statement when execution threshold is met:

Define Workload...

**Scope of the exception monitor –
Auth ID: ADMF001
IP: 9.181.133.73**



Capture Workload Exceptions with Monitor

Settings
Define a filter to specify when the monitor profile pushes out information about a statement execution and which information is recorded at each statement push.

Steps

1. Monitor Name
2. Source
3. Filter
4. Start Monitor

Monitor type:

- CPU time exception
- Relative CPU time exce

Description:

Monitor Settings
Specify the type of normal monitor information to push out, or specify threshold criteria for the selected exception monitor types.

CPU time threshold: seconds

Relative CPU time threshold: %

General Settings

- Push out EXPLAIN information

Granularity:

- Push out number of executions and accumulated CPU time (recommended for minimal effects to performance)
- Push out complete runtime information

Limit for individual statement push when exception threshold is met:

Limit for all statement pushes when exception threshold is met:

< Back Next > Finish Cancel

Number of push out for all statements when the statement leaves the cache:

Number of push out for each statement when exception threshold is met:

Define Workload...

Raise the exception whenever CPU time for a single execution exceeds 0.002 second



Capture Workload Exceptions with Monitor

Start Monitor
Start or schedule the monitor profile, and specify monitoring details.

Steps

1. Monitor Name
2. Source
3. Filter
- ▶ 4. Start Monitor

Start monitor profile:
Start Now
Schedule
Do Not Start
Disable

Description:
The monitor profile starts immediately when you finish the monitor wizard.

Profile Details
Interval for consolidating statement pushes: 30 minutes

Post new exceptions, if there is any, every 30 minutes

< Back Next > Finish Cancel

Number of push out for all statements when the statement leaves the cache: 5000
Number of push out for each statement when execution threshold is met:

Define Workload...



Capture Workload Exceptions with Monitor

The screenshot displays the IBM DB2 Optimization Expert for z/OS interface. The main window is titled "CSREC063_CPU Time Exception Monitor". The "Workload Statements" section is active, showing a table of captured exceptions. A red box highlights the table, and a blue callout box points to it with the text "Exceptions captured Auth ID: ADMF001 IP: 9.181.133.73".

Workload Statements

Immediately capture statements or multiple sources to this workload, launch workload advisors, use tools to tune selected queries from the workload, or schedule tasks for capture, consolidation, and analysis.

Capture Workload Tools Schedule Remove Query Tools Refresh

All of the rows are displayed. The number of rows is 4.

Exe...	Source	Accumulated Ela...	Average Elap...	Accumulat...	Average CP...	Statement Text
1	MONITOR	4.2859367E-5	4.2859367E-5	4.2703123...	4.2703123E...	SELECT 1 FROM SYSIB
10	MONITOR	0.009633453	9.633453E-4	0.0089606...	8.960639E-4	SELECT * FROM SCQA
42	MONITOR	0.0075379997	1.7947618E-4	0.0072187...	1.7187552E...	INSERT INTO DSNACC.
116	MONITOR	0.024593571	2.1201355E-4	0.0193262...	1.6660566E...	INSERT INTO DSNACC.

Workload Statements

Defining Monitor Profile...



Tuning Problem Queries

The screenshot shows the IBM DB2 Optimization Expert for z/OS interface. The main window is titled "IBM DB2 Optimization Expert for z/OS" and has a menu bar with "Project", "Tools", and "Help". The "View Queries" tab is active, showing the "Subsystem Context" and "Queries List" sections.

Subsystem Context: Select the subsystem from which you want to view queries. Subsystem: CSRECO63 <partially enabled> [Configure]

Queries List: Select the query source. Then specify how you want to view the queries by selecting a view. To create a custom view Click View New.

Query source: Monitor [v]
Monitor profile: CPU Time Exception Monitor [v] Refresh

Advisors Menu (highlighted in red):

- Run All Advisors
- Run Statistics Advisor
- Run Query Advisor
- Run Access Path Advisor
- Run Index Advisor
- Show Advisor Options

Queries List Table:

	LAST_UPDATE_TS	LAST_EXPLAIN_TS	CACHED_TS
... the number of rows is 4.			
... NACC.JSRE...	2007-02-14 00:54:19...	2007-02-14 00:54:1...	2007-02-14 00:54:19.74
... NACC.JSRE...	2007-02-14 01:01:58...	2007-02-14 01:01:5...	2007-02-14 01:01:58.66
... SYSIBM.SY...	2007-02-14 01:26:20...	2007-02-14 01:26:2...	2007-02-14 01:26:20.65
... SCQA0000...	2007-02-14 01:26:22...	2007-02-14 01:26:2...	2007-02-14 01:26:22.41

Callout Box: Running design advisors or expert expert tools for problem query

Defining Monitor Profile...



User Feedback Opportunity (UFO) Sessions

- **Data Server Administration Console (DB2 for z/OS, DB2 for LUW, Informix)**
Provide input on a web-based administration console for the IBM data servers (DB2 for z/OS; DB2 Linux, Unix, Windows; and Informix IDS). We are exploring designs for a health, availability, and troubleshooting user interface.
- **DB2 for z/OS Query Optimization**
Come and try the latest, generally available IBM Optimization Service Center for DB2 for z/OS (OSC)! This session will focus on the overall user experience of OSC, from Getting Started materials to identifying and analyzing problem queries, reviewing and implementing solution recommendations, and automating tuning across workloads.
- **Getting the Documentation You Want When You Want It**
Provide feedback on how you use documentation in your shop and how we can make it easier for you to get the information you need when you need it.
- **DB2 for z/OS Futures**
In small group sessions, help direct the goals of future releases of DB2 for z/OS. Help us understand your role and pain points in using and implementing DB2.

UFO Sessions held in the Willow Glen III Room; stop by to sign up!



Session: C02

Application Performance Tuning in DB2 9 for z/OS

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