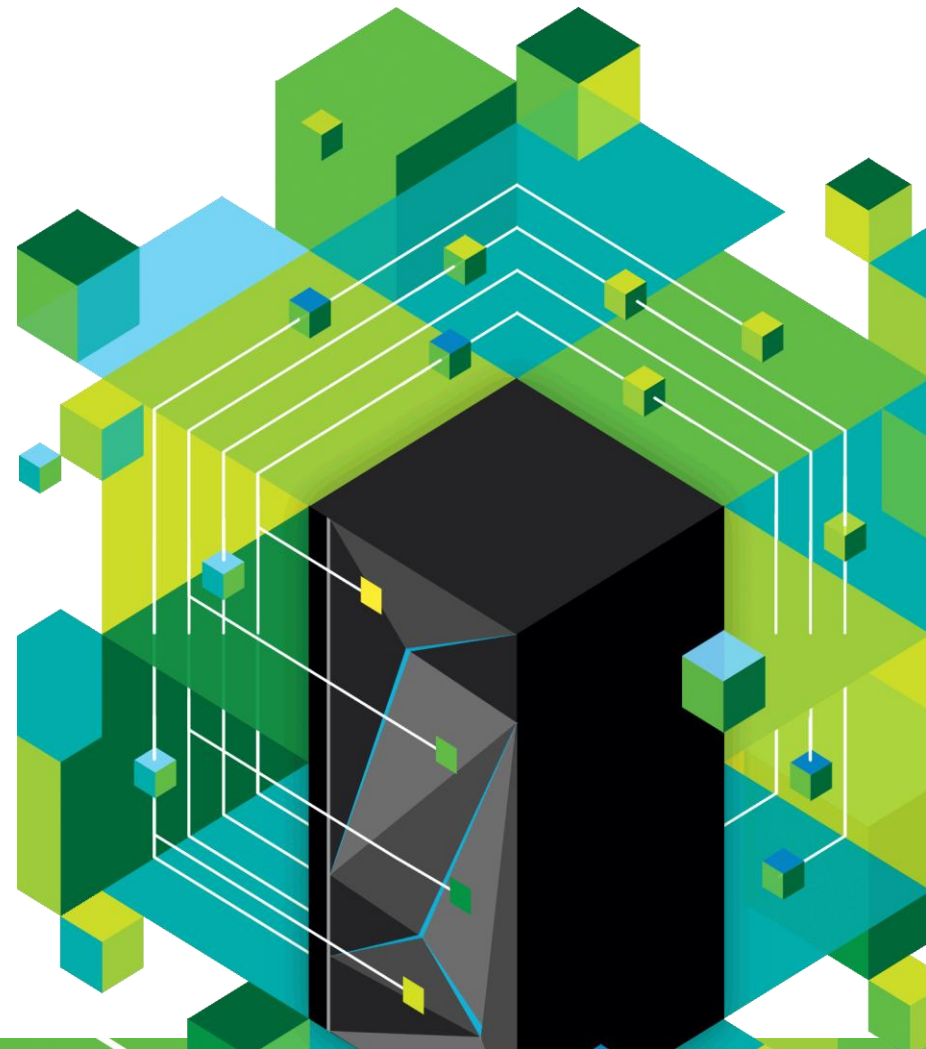


DBA Tools with System i Navigator

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IBM DB2 for i Center of Excellence

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Learn more at www.ibm.com/power



Why do I need a DBA?



Ease of Database Management

Typical DBA Tasks	DB2 for IBM i
Manage DASD Space Allocation	Automated
Review Table Space Allocations & Extents	Automated
Review & Balance Indexes	Automated
Application Rebinding	Automated
Maintain Database Integrity	Automated
Update Database Statistics	Automated
Synchronized OS & DB User Security	Automated
Reload Data for Hardware & Software Upgrades	Automated
Load Data into Database	System i Navigator
Build and Manage DB Backup & Recovery	System i Navigator
Create & Review Indexes for Tables	System i Navigator / Automated Index Advisor
Performance Analysis & Tuning (DB & System)	System i Navigator
Create and Maintain DB Schema	System i Navigator & 3rd Party Tools
Automated DB Performance Profiling	3rd Party Tools
Advanced DB Performance Analysis & Tuning	System i Navigator 3rd Party Tools
Data Replication & Consolidation	Multiple IBM & 3rd Party Products

DBA tasks that an IBM i Administrator or Developer SHOULD care about:

- Monitoring, Analyzing, and Improving Database Performance
- Keeping an eye on database limits
 - You don't want your application to fail by exceeding a built in limit
- Wasted space
 - Reducing Redundancy (e.g., unneeded indexes)
 - Files with empty records or no data at all
- SQL Optimization and Tuning
 - ODBC, Reporting Tools, Applications using SQL
 - SQL is the STRATEGIC database interface....you want to ensure it is optimized!

System Performance Tools are not DATABASE performance tools

System performance should assume a well tuned application, and that includes database !

If you haven't tuned the database, you could be making decisions based on questionable data

Why Use SQL?

- Take advantage of features and functions only available via SQL
 - XML, Text Search, EVI s, etc.
- Programmer Productivity
- PERFORMANCE
- Take advantage of modern solutions and tooling based on SQL
 - Data modeling tools
- More easily turn data into information
- Protect sensitive data
 - Field Level Encryption
- Increase reusability of existing components in both current and future applications
- Increase the life expectancy and extend the value of legacy applications
- Reusability of data, functions, procedures, across platforms and systems
- Availability of talented SQL programmers

IBM i Navigator – the DBA tool for DB2 for i

Ships with IBM i Access for Windows

- The database graphical user interface is a component of System i Navigator
- IBM i Navigator comes with the base operating system for no extra charge
 - None of the database GUI support requires an IBM i Access License
- When installing IBM i Access on your PC
 - Database is not selected by default. Select “Custom” install

For general information on IBM i Access Express for Windows check our web site at:

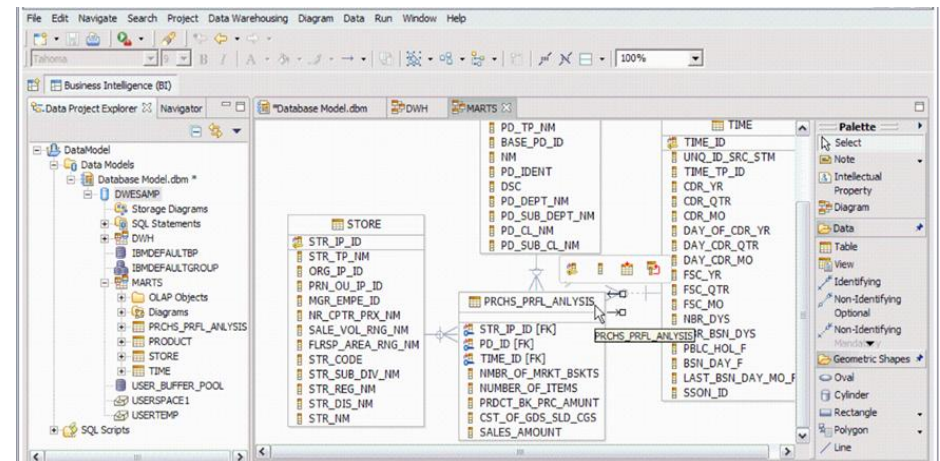
- <http://www-03.ibm.com/systems/i/software/access/>
 - (PTFs are available from a link off the above page)

We recommend the latest version of the client be installed.

- Some new functions available
- **Works fine with down level servers**

Other DB2 DEVELOPER Tools of Interest (not discussed here)

- Infosphere Data Architect
 - Data Modeling
 - Reverse Engineer PFs/LFs to document or recreate with SQL
- Rational Developer for Power for Business
 - Adds Data perspective – build stored procedures, work with objects
- Optim Data Studio
 - DB2 family database functions
- DB2 Connect
 - Plug Ins for workbenches such as MS Visual Studio and Ruby on Rails
- 3rd party Development Tools
 - SquirrelL



Side Note: You need to get the appropriate Authority to DO YOUR JOB !!!

*JOBCTL (Job Control Authority)

- Whatever worked with *JOBCTL in IBM i 6.1 will continue to work

QIBM_DB_SQLADM – Database Administrator

- This is a database specific alternative to *JOBCTL. It is a superset of the function authorized by QIBM_DB_SYSMON.
- Examples:
 - Change parallel degree for DB2 SMP feature
 - Work with Plan Cache
 - Work with OmniFind Text Search Server

QIBM_DB_SYSMON – Database Information

- This allows a user to view some system level details, but not specifics about operations or anything related to changing or controlling the database.
- Examples:
 - QUSRJOBI for SQL information
 - Show SQL Information for Jobs

User Authorization Commands:

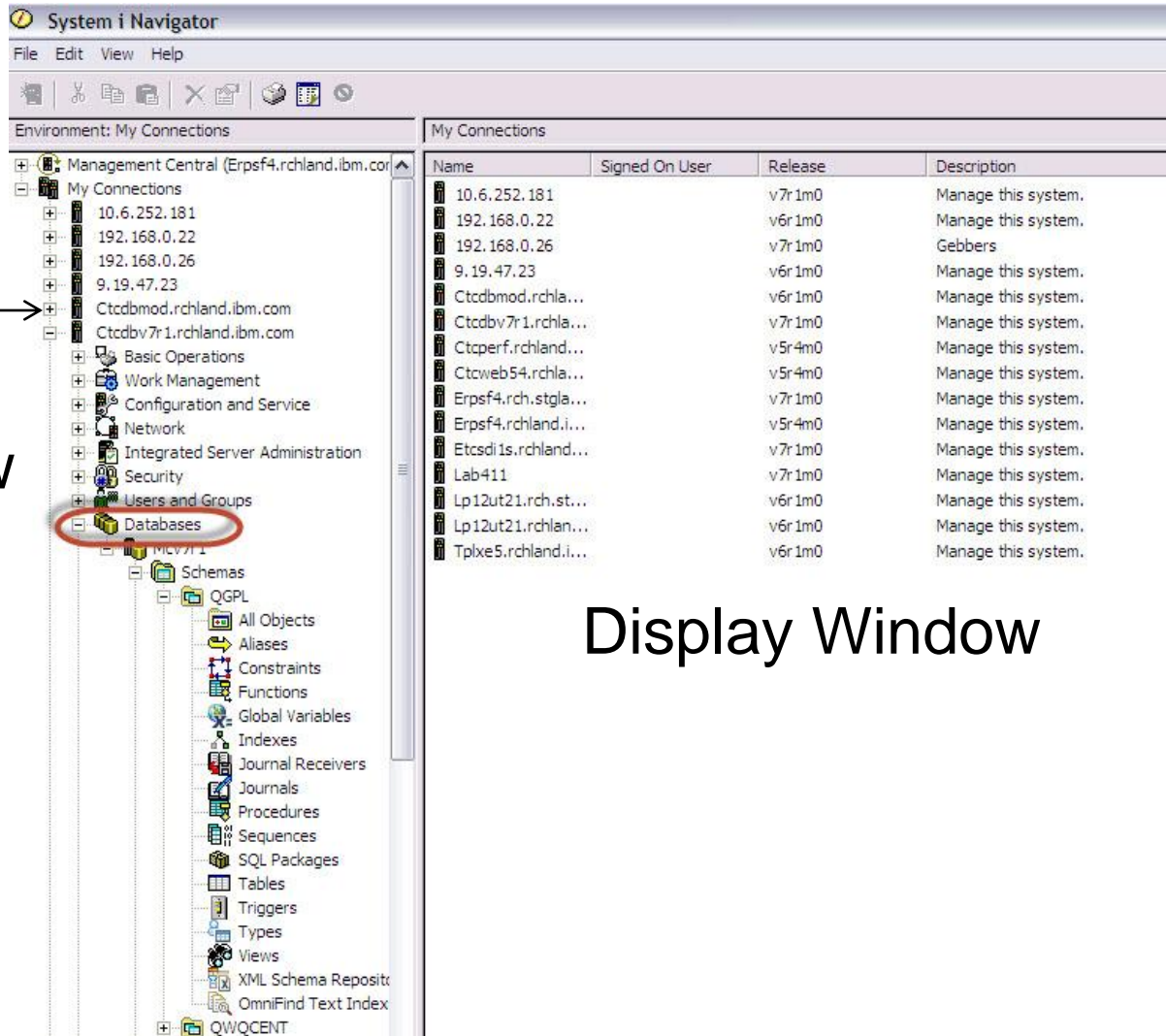
```
CHGFCNUSG FCNID(QIBM_DB_SQLADM)  
USER(userid) USAGE(*ALLOWED)
```

```
CHGFCNUSG FCNID(QIBM_DB_SYSMON)  
USER(userid) USAGE(*ALLOWED)
```

No Special Authority required when using OnDemand Performance Center with own job

- Starting and ending SQL Performance Monitors on your own job
- Analysis of SQL Monitor data and Plan Cache snapshots
- Visual Explain in Run SQL Scripts

General Navigation through iNav



+ Expand

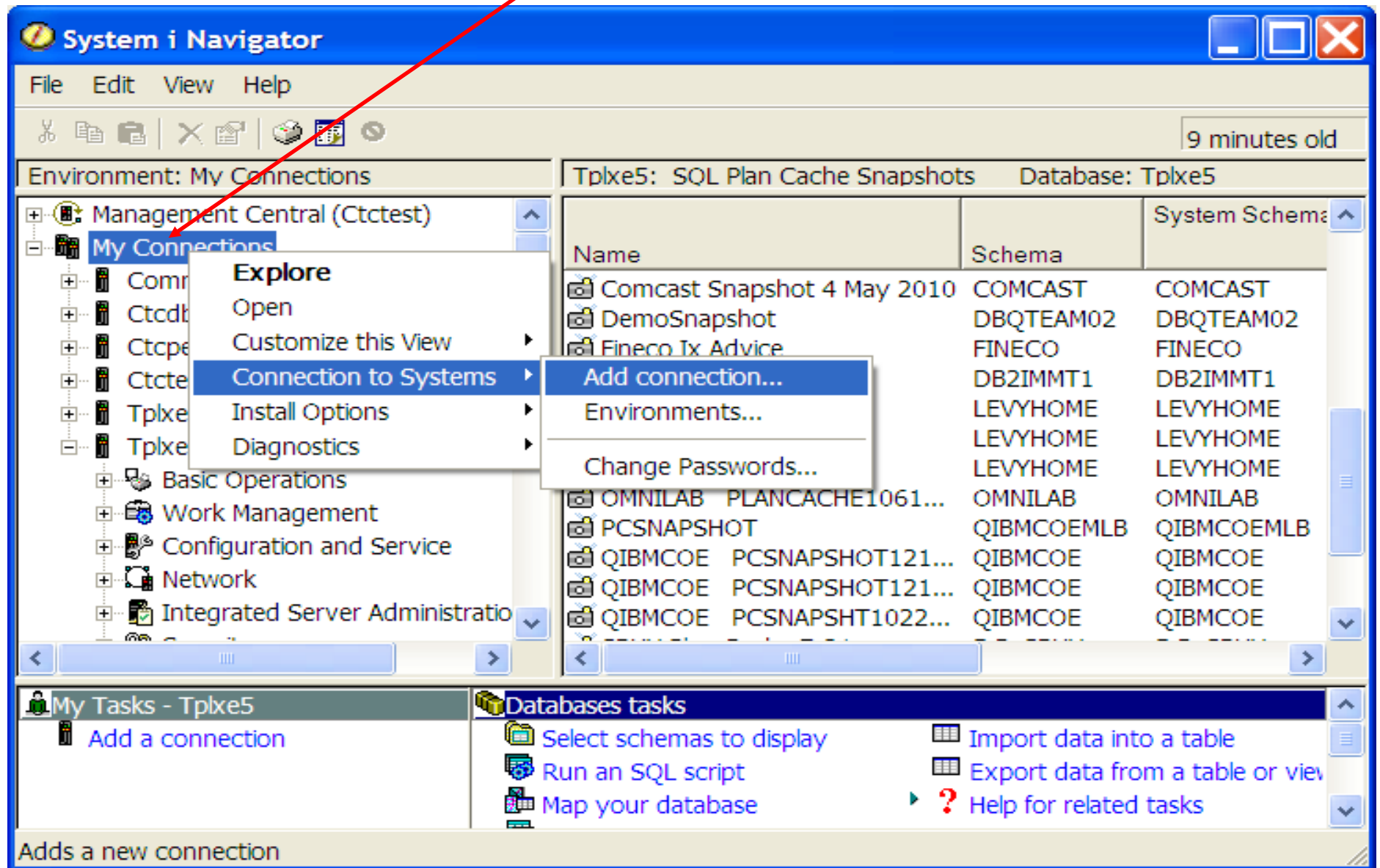
• Left click to show Information in display window

• Right click on any object for context sensitive Menu

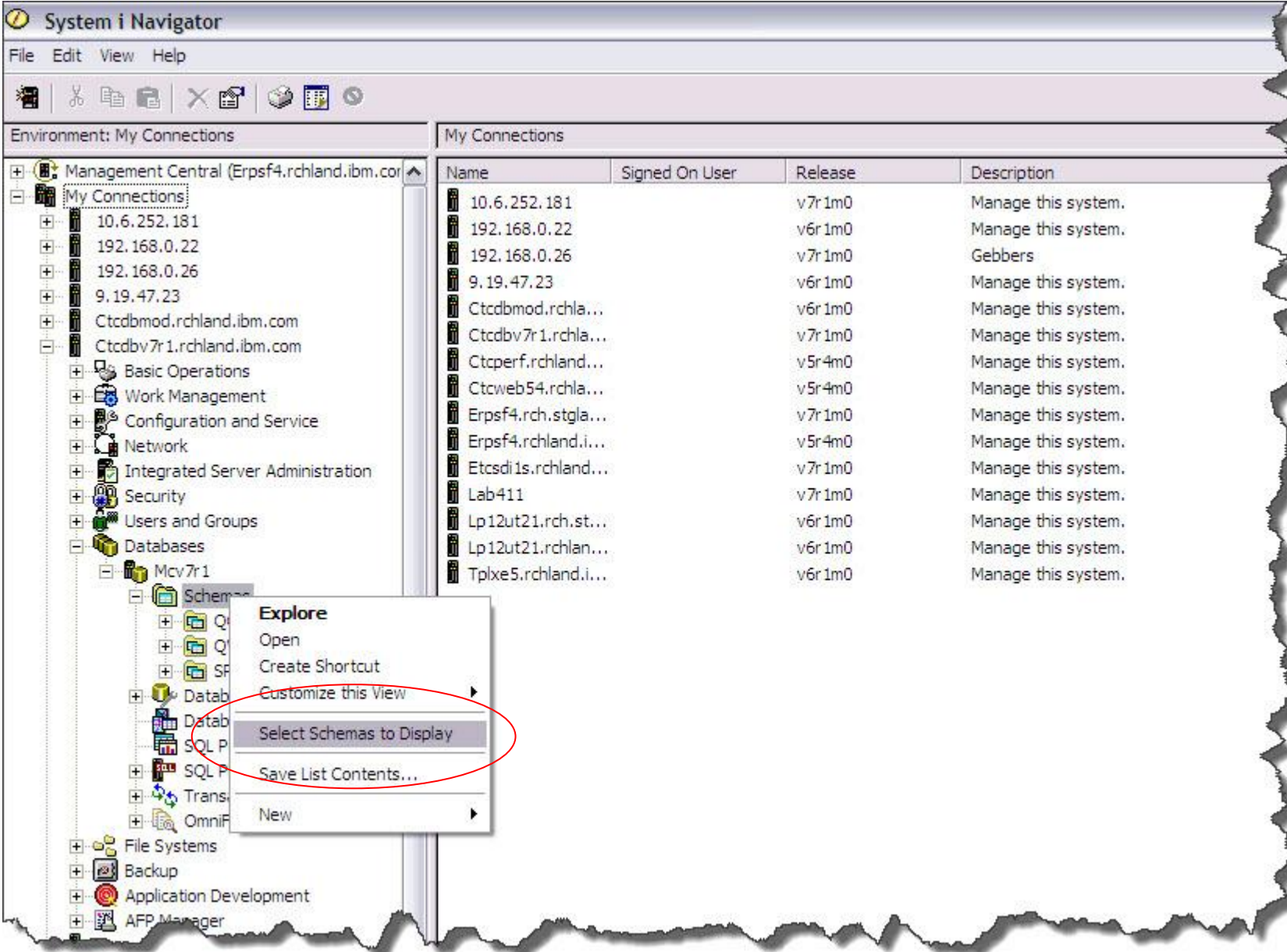
Display Window

Add a connection

Right Click on My Connections



Select Schemas (Libraries) to display – right click on Schemas



The screenshot shows the System i Navigator interface. The left pane displays a tree view of 'My Connections' under 'Management Central (Erpsf4.rchland.ibm.com)'. The right pane shows a table of connections. A context menu is open over the 'Schemas' folder in the left pane, with the 'Select Schemas to Display' option highlighted by a red circle.

Name	Signed On User	Release	Description
10.6.252.181		v7r1m0	Manage this system.
192.168.0.22		v6r1m0	Manage this system.
192.168.0.26		v7r1m0	Gebbers
9.19.47.23		v6r1m0	Manage this system.
Ctcdbmod.rchla...		v6r1m0	Manage this system.
Ctcdbv7r1.rchla...		v7r1m0	Manage this system.
Ctcperf.rchland...		v5r4m0	Manage this system.
Ctcweb54.rchla...		v5r4m0	Manage this system.
Erpsf4.rch.stgla...		v7r1m0	Manage this system.
Erpsf4.rchland.i...		v5r4m0	Manage this system.
Etcsdis.rchland...		v7r1m0	Manage this system.
Lab411		v7r1m0	Manage this system.
Lp12ut21.rch.st...		v6r1m0	Manage this system.
Lp12ut21.rchlan...		v6r1m0	Manage this system.
Tplx5.rchland.i...		v6r1m0	Manage this system.

Select Schema to include in the list

Specify schemas to display

Enter schema names:

dbqteqm02

Search for schemas:

Filter

Name: All names Search

Schemas found: 0

Name	Text
------	------

Add -->

Selected schemas:

Name	System Name	Owner	Created By	Text
QGPL	QGPL			General Purpose
QSYS2	QSYS2			System Library for
QTEMP	QTEMP			
SYSIBM	SYSIBM			System Library for
TESTDBTOM	TESTDBTOM			COLLECTION - cr

OK

View objects within schema by selecting that schema

The screenshot shows the System i Navigator interface. The left pane displays a tree view of connections and schemas. The 'QWQCENT' schema is selected, and its contents are listed in the right pane. The right pane shows a list of object types including All Objects, Aliases, Constraints, Functions, Global Variables, Indexes, Journal Receivers, Journals, Procedures, Sequences, SQL Packages, Tables, Triggers, Types, Views, XML Schema Repository (XSR), and OmniFind Text Indexes.

Environment: My Connections Ctcdbv7r1.rchland.ibm.com: QWQCENT Database: Mcv7r1 Schema: QWQCENT

Management Central (Erpsf4.rchland.ibm.com)

My Connections

- 10.6.252.181
- 192.168.0.22
- 192.168.0.26
- 9.19.47.23
- Ctcdbmod.rchland.ibm.com
- Ctcdbv7r1.rchland.ibm.com
- Basic Operations
- Work Management
- Configuration and Service
- Network
- Integrated Server Administration
- Security
- Users and Groups
- Databases
 - Mcv7r1
 - Schemas
 - QGPL
 - QWQCENT**
 - All Objects
 - Aliases
 - Constraints
 - Functions
 - Global Variables
 - Indexes
 - Journal Receivers
 - Journals
 - Procedures
 - Sequences
 - SQL Packages
 - Tables
 - Triggers
 - Types
 - Views
 - XML Schema Repository (XSR)
 - OmniFind Text Index
 - SPORTSAUTH
 - Database Maintenance

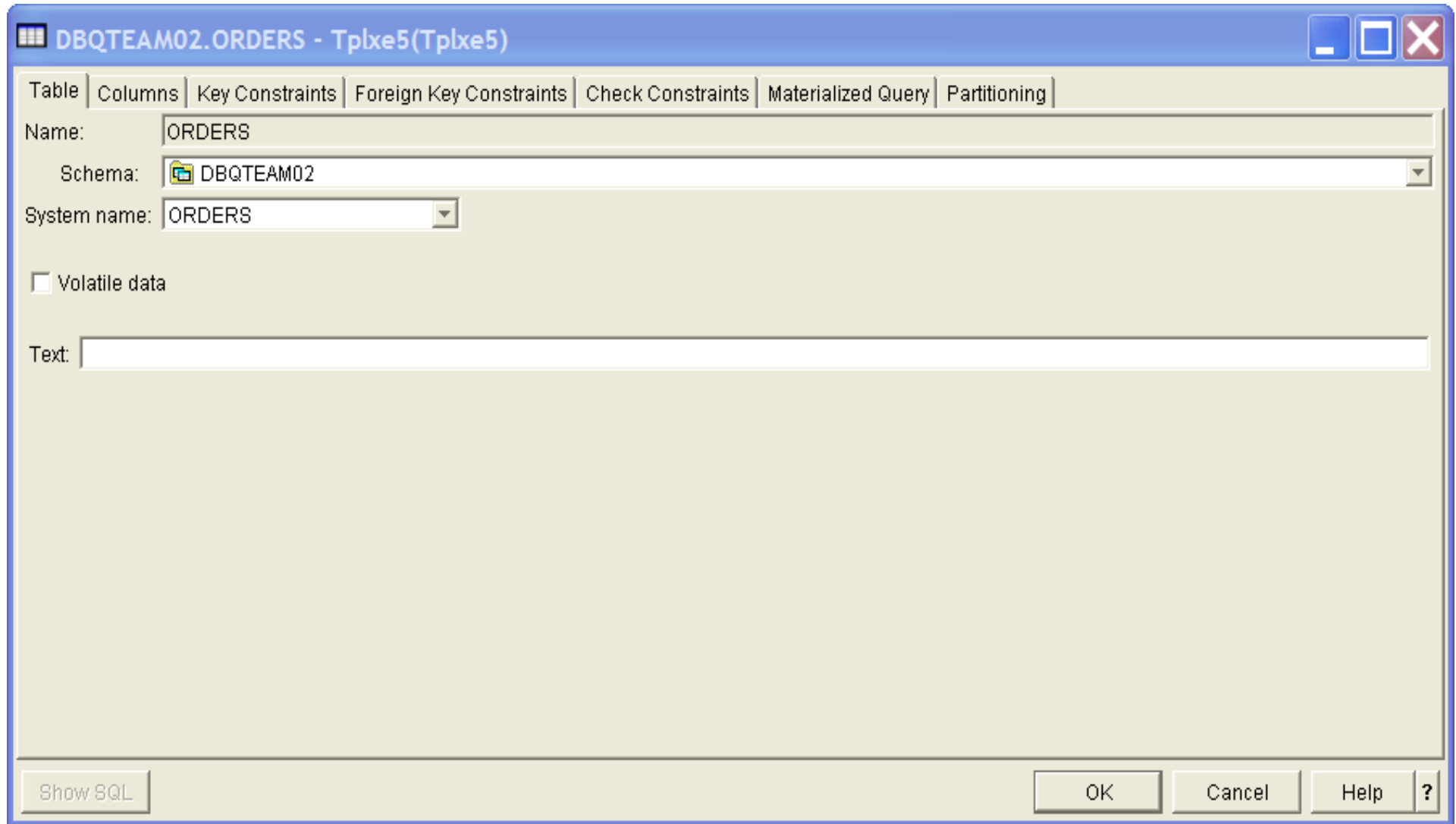
SQL Aliases
 User Defined Functions
 Index Info
 Stored Procedures
 Table Info
 Triggers
 User Defined Types
 XML Schema (7.1)
 OmniFind Text Indexes (6.1)

Click on Tables – Right click on specific Table for more info

The screenshot shows the 'System i Navigator' interface. On the left, a tree view shows the hierarchy: Databases > Tplxe5 > Schemas > DBQTEAM02 > Tables. A red arrow points from the 'Tables' folder to the 'ORD' table in the main table list. The table list has columns: Name, System Name, Partitioned, Owner, Definer, and Last Altered. A context menu is open over the 'ORD' table, listing various actions. The 'Definition' option is highlighted in blue. Below the table list, there are sections for 'My Tasks - Tplxe5' and 'Databases' with various icons and links.

Name	System Name	Partitioned	Owner	Definer	Last Altered
CUS	S	No	QSECOFR	QSECOFR	9/24/10 8:40:09 AM
DAT		No	QSECOFR	QSECOFR	9/24/10 8:40:11 AM
DBM	A2	No	QSECOFR	QSECOFR	9/24/10 8:40:13 AM
DEP		No	QSECOFR	QSECOFR	9/24/10 8:40:21 AM
ORD	MS	No	QSECOFR	QSECOFR	9/24/10 8:39:49 AM
ORD		No	QSECOFR	QSECOFR	9/24/10 8:39:34 AM
PAR		No	QSECOFR	QSECOFR	9/24/10 8:40:07 AM
QZG	65	No	QSECOFR	QSECOFR	9/24/10 8:40:15 AM
QZG	84	No	DBQTEAM02	DBQTEAM02	9/28/10 3:41:30 PM
QZG	86	No	DBQTEAM02	DBQTEAM02	9/28/10 4:05:36 PM
SUP		No	QSECOFR	QSECOFR	9/24/10 8:40:08 AM

Table Definition



DBQTEAM02.ORDERS - Tplxe5(Tplxe5)

Table | Columns | Key Constraints | Foreign Key Constraints | Check Constraints | Materialized Query | Partitioning

Name: ORDERS

Schema: DBQTEAM02

System name: ORDERS

Volatile data

Text:

Show SQL OK Cancel Help ?

Show Column Definitions

DBQTEAM02.ORDERS - Tplxe5(Tplxe5)

Table Columns Key Constraints Foreign Key Constraints Check Constraints Materialized Query Partitioning

Column Name	System Name	Data Type	Length	Nullable	Implicitly ...	Default Value	Tex
ORDERKEY	ORDERKEY	DECIMAL	16,0	No		No default	
PARTKEY	PARTKEY	INTEGER		No		No default	
SUPPKEY	SUPPKEY	INTEGER		No		No default	
LINENUMBER	LINENUMBER	INTEGER		No		No default	
QUANTITY	QUANTITY	DECIMAL	15,2	No		No default	
EXTENDEDPRICE	EXTEN00001	DECIMAL	15,2	No		No default	
DISCOUNT	DISCOUNT	DECIMAL	15,2	No		No default	
TAX	TAX	DECIMAL	15,2	No		No default	
RETURNFLAG	RETURNFLAG	CHARACTER	1	No		No default	
LINESTATUS	LINESTATUS	CHARACTER	1	No		No default	
SHIPDATE	SHIPDATE	DATE		No		No default	
COMMITDATE	COMMITDATE	DATE		No		No default	
RECEIPTDATE	RECEI00001	DATE		No		No default	
SHIPMODE	SHIPMODE	CHARACTER	10	No		No default	
SUPPLYCOST	SUPPLYCOST	DECIMAL	15,2	No		No default	
CUSTKEY	CUSTKEY	INTEGER		No		No default	
ORDERDATE	ORDERDATE	DATE		No		No default	
ORDERPRIORITY	ORDER00001	CHARACTER	15	No		No default	

Show SQL ?

View or Add Constraints

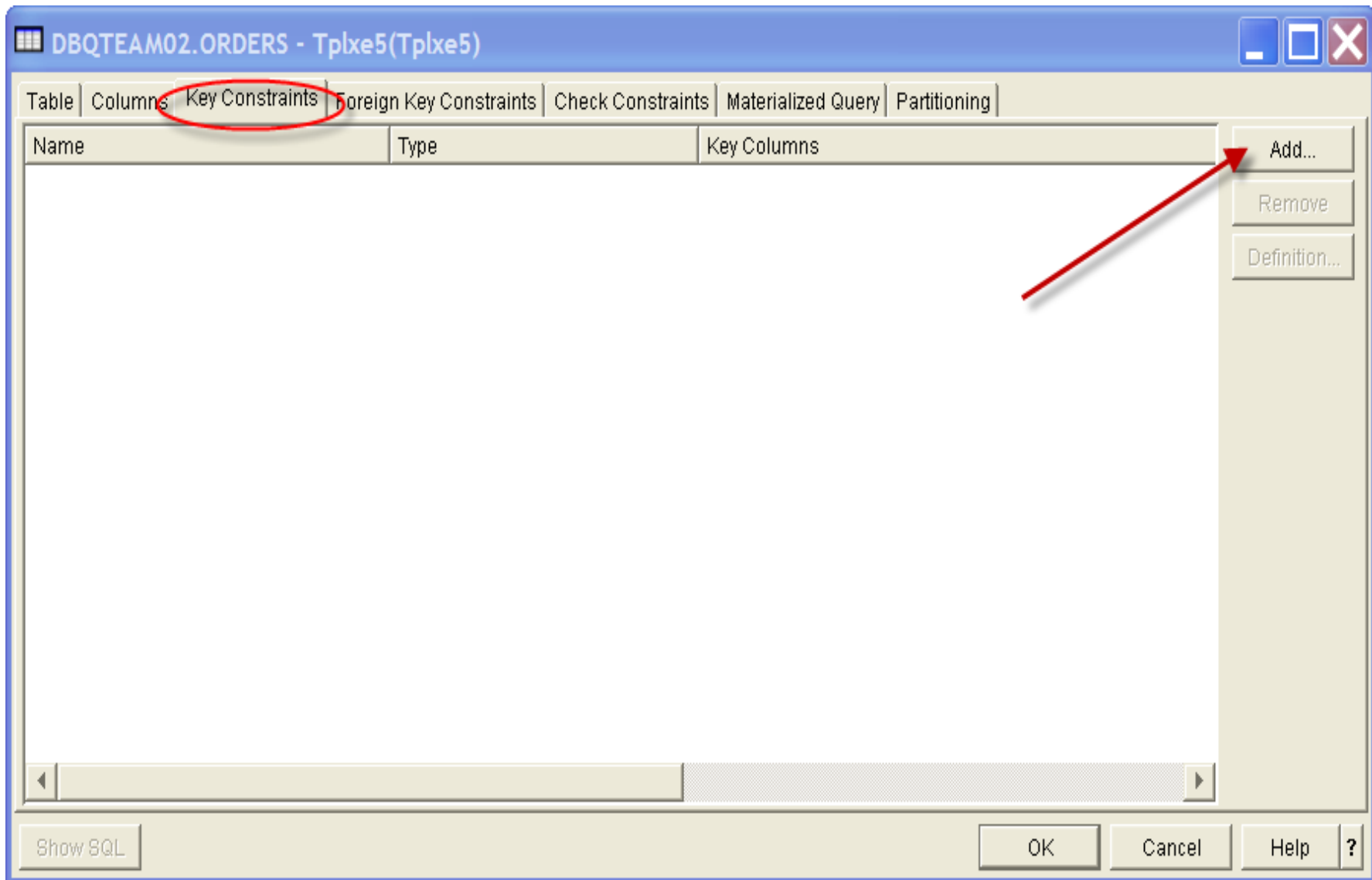


Table Description

The screenshot shows the 'System i Navigator' interface. On the left, a tree view shows the database structure under 'DBQ'. The 'ORDERS' table is selected. A context menu is open over the 'ORDERS' table, with the 'Description' option highlighted. A red arrow points from the 'ORDERS' table in the tree to the 'Description' option in the menu.

The main pane displays the table description for 'ORDERS' in the 'DBQTEAM02' schema. The table has the following columns: Name, Partitioned, Owner, and Definer.

Name	Partitioned	Owner	Definer
ORDERS	No	QSECOFR	QSECOFR

The bottom pane shows 'My Tasks - Tplxe5' with various database tasks listed, such as 'Add a connection', 'Run an SQL script', and 'Map your database'.

Table Description

Answers questions like:

How big is this table/file getting anyway?

– Works for indexes and views too!

AQP.SALES Description - Ctcdbv7r1(C1040f40)

General Allocation Usage Activity Details

Type: Table

Description:

Data size: 3.77 GB

Varying length data size: 0 bytes

Current number of rows: 63000692

Deleted rows: 9

Rows in varying length storage: 0

Maximum percent deleted rows allowed: None

Reuse deleted rows

Volatile: No

OK Cancel Help ?

AQP.SALES Description - Ctcdbv7r1(C1040f40)

General Allocation Usage Activity Details

Text:

System name: SALES

Creation date: 4/25/10 3:06:55 AM

Created by: MCKINLEY

Last used: 4/25/10 3:06:55 AM

Number of partitions: 1

Maximum partitions: 1

Maximum wait time: 30

Maximum row wait time: 60

Maximum row length: 523

Sort sequence: By hex value

Language identifier: English (United States)

Format level check

Format level identifier: 289A2D6CA26F3

Allowed activity:

Read	Update
Write	Delete

Media preference: Any

Auxiliary storage pool: 1

Level identifier: 1100425030655

Distributed: No

OK Cancel Help ?

Show Indexes from TABLE list – right click, Show Indexes

The screenshot shows the 'System i Navigator' application. On the left, a tree view shows the hierarchy: Environment: My Connections > Tplxe5 > Schemas > DBQTEAM02 > All Objects. The main pane displays a table list for 'Tplxe5: Tables' with the following entries:

Name
CUSTOMERS
DATES
DBMONDATA2
DEPTS
ORDER_SUMMARIES
ORDERS
PARTS
QZG0000365
QZG0000784
QZG0000786
SUPPLIERS

A context menu is open over the 'ORDERS' table, with 'Show Indexes' selected. The menu items include: Edit Contents, View Contents, Data, Definition, Generate SQL..., Index Advisor, Journaling, Lock Holders, Locked Rows, Permissions, Reset Usage Counts..., Show Indexes, Show Materialized Query Tables, Show Related, Statistic Data, Comments..., Cut, Copy, Delete..., Rename..., New, and Description.

In the background, a table for 'DBQTEAM02' is visible with columns: Owner, Definer, and Last Altered. The data rows are as follows:

Owner	Definer	Last Altered
QSECOFR	QSECOFR	9/24/10 8:40
QSECOFR	QSECOFR	9/24/10 8:40
QSECOFR	QSECOFR	9/24/10 8:40
QSECOFR	QSECOFR	9/24/10 8:40
QSECOFR	QSECOFR	9/24/10 8:30
QSECOFR	QSECOFR	9/24/10 8:40
QSECOFR	QSECOFR	9/24/10 8:40
DBQTEAM02	DBQTEAM02	9/28/10 3:40
DBQTEAM02	DBQTEAM02	9/28/10 4:00
QSECOFR	QSECOFR	9/24/10 8:40

At the bottom, the 'My Tasks - Tplxe5' pane shows tasks like 'Add a connection', 'Select schemas to display', 'Run an SQL script', and 'Map your database'. The status bar at the bottom left indicates '1 - 11 of 11 objects'.

Index Information for a table

Indexes for DBQTEAM02.ORDERS - Tplx5

File Edit View Help

6 minutes old

Database: Tplx5 Indexes for DBQTEAM02.ORDERS

Name	Sche...	Index Partition	Type	Owner	Text	Unique Partial Key Values	Last Query Use	Last Query Statistics Use	Query Use Count
ORD_IX_...	DB...	ORD_IX_99	Index	QSEC...	ORDER...	2 0 ...			0
ORDERS...	DB...	ORDER00005	Index	DBQT...		1064 -1 ...	9/28/10 4:06:...	9/28/10 4:06:2...	7
ORDERS...	DB...	ORDER00006	Index	DBQT...		1000 -1 ...	9/28/10 2:02:...	9/28/10 2:02:4...	3
ORDERS...	DB...	ORDER00002	Index	DBQT...		3 36 ...	9/28/10 10:16...	9/28/10 4:06:1...	1
ORDERS...	DB...	ORDER00001	Index	DBQT...		150000 1...	9/28/10 9:59:...	9/28/10 3:42:2...	3
ORDERS...	DB...	ORDER00003	Index	DBQT...		1000 0 ...	9/28/10 2:06:...	9/28/10 2:06:1...	4
ORDERS...	DB...	ORDER00004	Index	DBQT...		1064 0 ...	9/28/10 3:42:...	9/28/10 4:06:2...	5
ORDERS...	DB...	ORDER00007	Index	DBQT...	Index g...	3 7 ...			0
ORDERS...	DB...	ORDER00008	Index	DBQT...	Index g...	3 7 ...			0
ORDERS...	DB...	ORDER00009	Index	DBQT...	Index g...	150000 1...			0
ORDERS...	DB...	ORDER00010	Index	DBQT...	Index g...	3 1696...			0
ORDERS...	DB...	ORDER00011	Index	DBQT...	Index g...	3 1696...			0
ORDERS...	DB...	ORDER00012	Index	DBQT...	Index g...	3 7 ...	9/28/10 4:06:...	9/28/10 4:06:2...	1
ORDERS...	DB...	ORDER00013	Index	DBQT...	Index g...	3 12 ...		9/28/10 4:06:1...	0
ORDERS...	DB...	ORDER00014	Index	DBQT...	Index g...	4 11 ...		9/28/10 4:06:1...	0
ORDERS...	DB...	ORDER00015	Index	DBQT...	Index g...	150000 6...		9/28/10 4:06:3...	0
ORDERS...	DB...	ORDER00016	Index	DBQT...	Index g...	10000 0 ...	9/28/10 4:06:...	9/28/10 4:06:4...	7
ORDERS...	DB...	ORDER00021	Index	DBQT...	Index g...	20000 -1 ...			0
ORDERS...	DB...	ORDER00022	Index	DBQT...	Index g...	10000 -1 ...	9/28/10 4:06:...	9/28/10 4:06:4...	4
ORDERS...	DB...	ORDER00023	Index	DBQT...	Index g...	20000 0 ...		9/28/10 4:06:4...	0
ORDERS...	DB...	ORDER00024	Index	DBQT...	Index g...	3 -1 ...	9/28/10 4:06:...	9/28/10 4:06:2...	1

1 - 21 of 21 objects

Additional index information

Indexes for DBQTEAM02.ORDERS - Tplx5

File Edit View Help

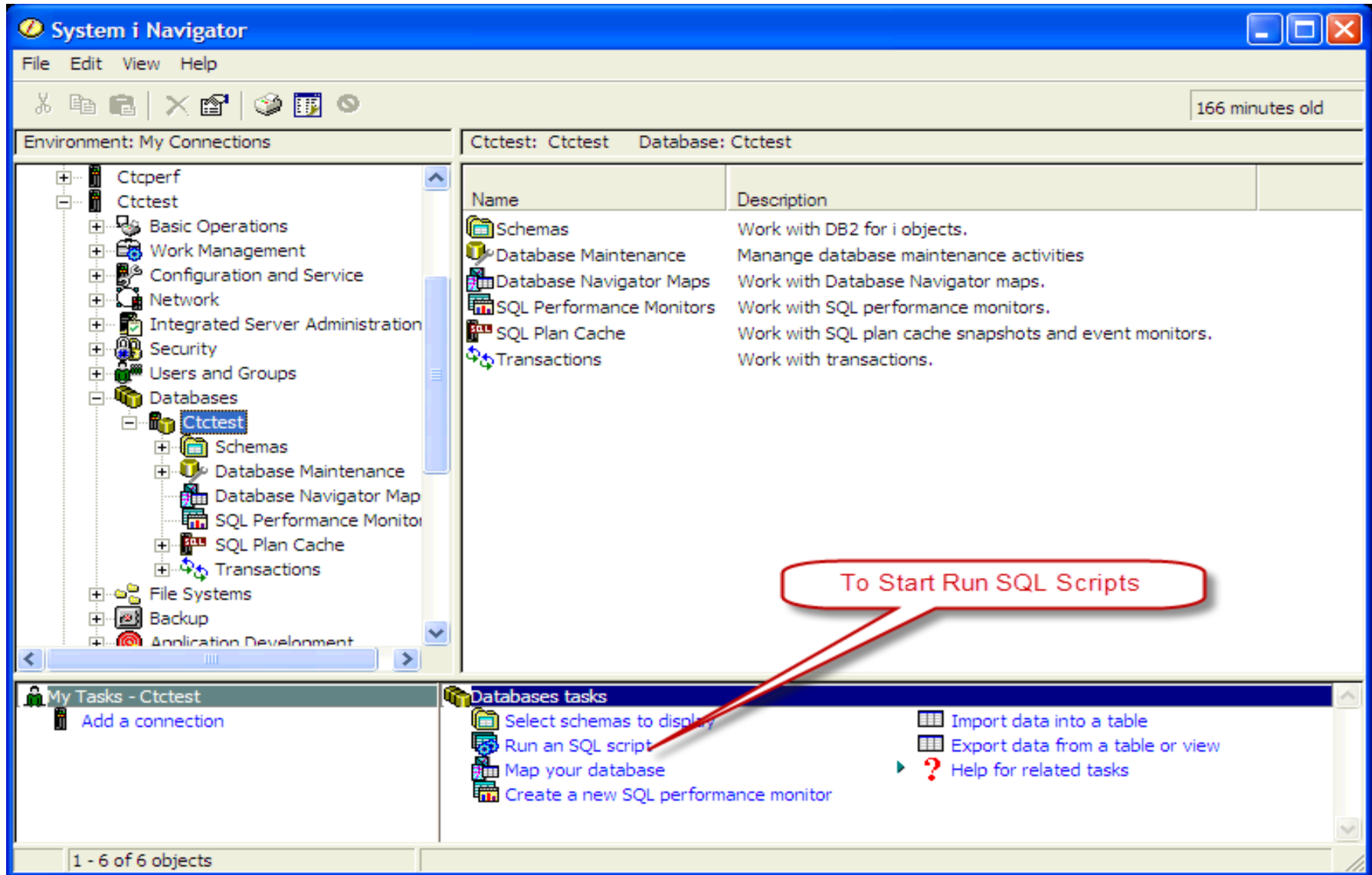
8 minutes old

Database: Tplx5 Indexes for DBQTEAM02.ORDERS

Query Statistics Use Count	Last Used Date	Days Used Count	Date Reset Days	Key Columns	Valid	Maximum Size	Duplic... Key Order	Logical Page Size	EVI Distinct Values	Sort Sequ...	Spa
0		0		LINESTATUS	Yes	1 TB	FIFO	65536	0	By h...	Yes
7	9/2...	1		SHIPDATE	Yes	EVI	FIFO	0	65535	By h...	Yes
3	9/2...	1		SUPPKEY	Yes	EVI	FIFO	0	65535	By h...	Yes
25	9/2...	1		YEAR, MONTH	Yes	1 TB	FIFO	65536	0	By h...	Yes
5	9/2...	2		ORDERKEY, YEAR	Yes	1 TB	FIFO	65536	0	By h...	Yes
21	9/2...	1		SUPPKEY	Yes	1 TB	FIFO	65536	0	By h...	Yes
47	9/2...	1		SHIPDATE	Yes	1 TB	FIFO	65536	0	By h...	Yes
0		0		RETURNFLAG, YEAR, MONTH, SHIPM...	Yes	1 TB	FIFO	65536	0	By h...	Yes
0		0		YEAR, RETURNFLAG, PARTKEY	Yes	1 TB	FIFO	65536	0	By h...	Yes
0		0		ORDERKEY, YEAR, PARTKEY	Yes	1 TB	FIFO	65536	0	By h...	Yes
0		0		YEAR, ORDERKEY, RETURNFLAG	Yes	1 TB	FIFO	65536	0	By h...	Yes
0		0		YEAR, ORDERKEY, SUPPKEY	Yes	1 TB	FIFO	65536	0	By h...	Yes
10	9/2...	1		RETURNFLAG, YEAR, QUARTER	Yes	1 TB	FIFO	65536	0	By h...	Yes
11		0		YEAR, QUARTER, RETURNFLAG	Yes	1 TB	FIFO	65536	0	By h...	Yes
4		0		QUARTER, RETURNFLAG	Yes	1 TB	FIFO	65536	0	By h...	Yes
2		0		ORDERKEY, LINENUMBER	Yes	1 TB	FIFO	65536	0	By h...	Yes
12	9/2...	1		CUSTKEY	Yes	1 TB	FIFO	65536	0	By h...	Yes
0		0		PARTKEY	Yes	EVI	FIFO	0	65535	By h...	Yes

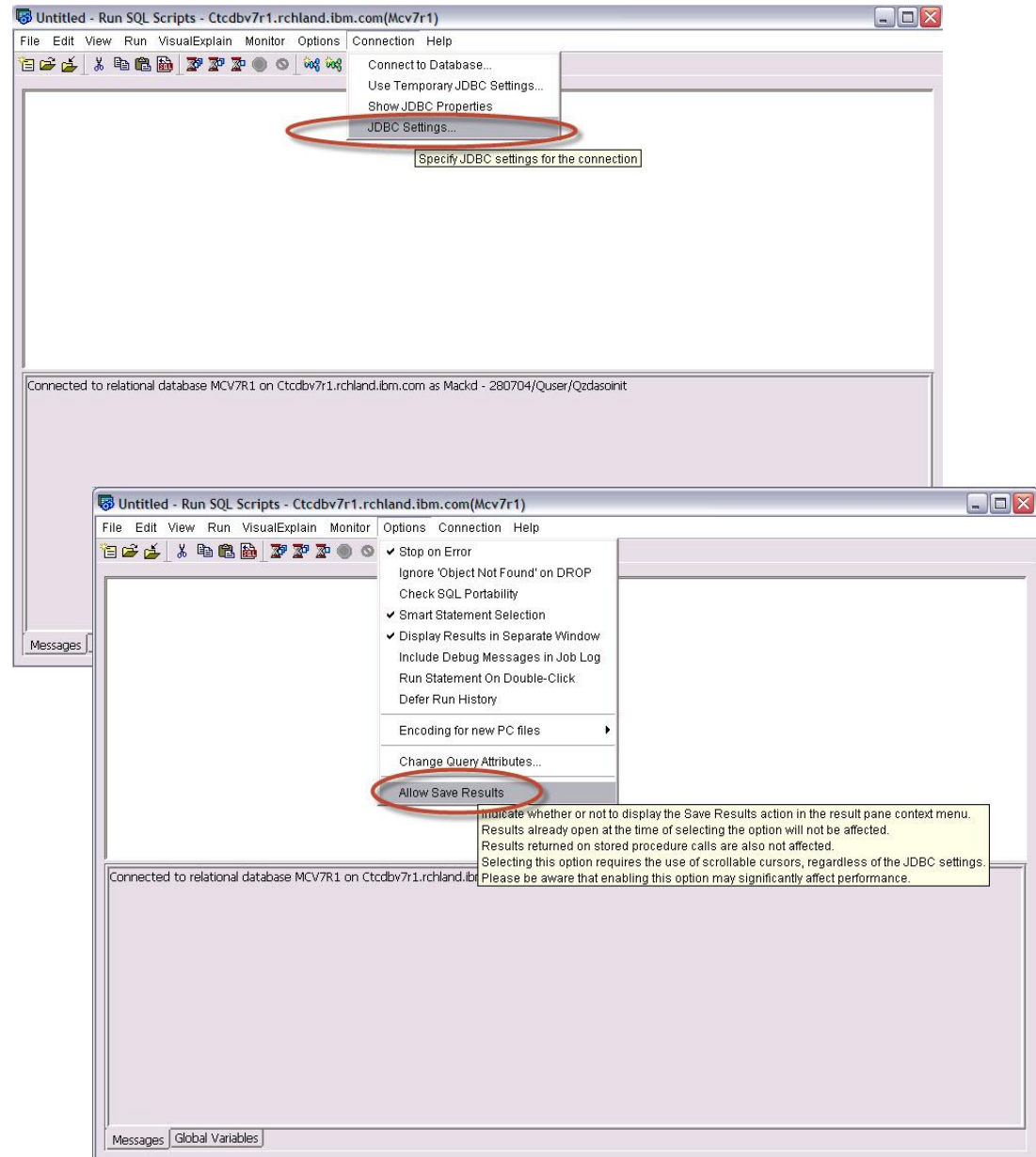
1 - 18 of 21 objects

Creating Objects with SQL Scripting and Wizards



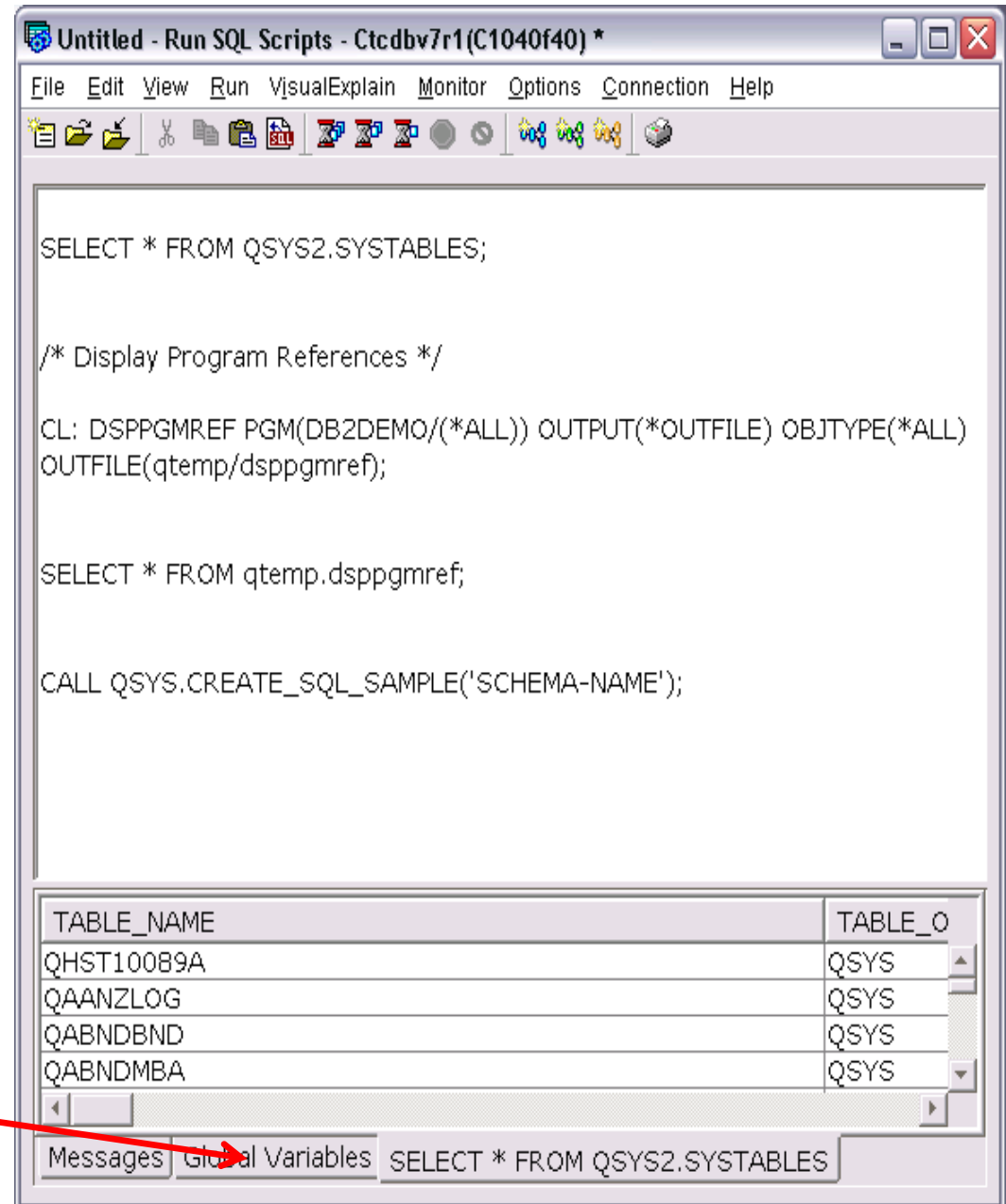
Run SQL Scripts Settings

- Set up your default environment
- CONNECTIONS -> JDBC Settings
- Can set:
 - SQL or System Naming Convention
 - Schema list override or use libl
 - Isolation level
 - Some Performance Settings
 - Some translation settings
- OPTIONS
 - Check SQL Portability
 - Change Query Attributes
 - Allow Save Results to save into a spreadsheet, for instance



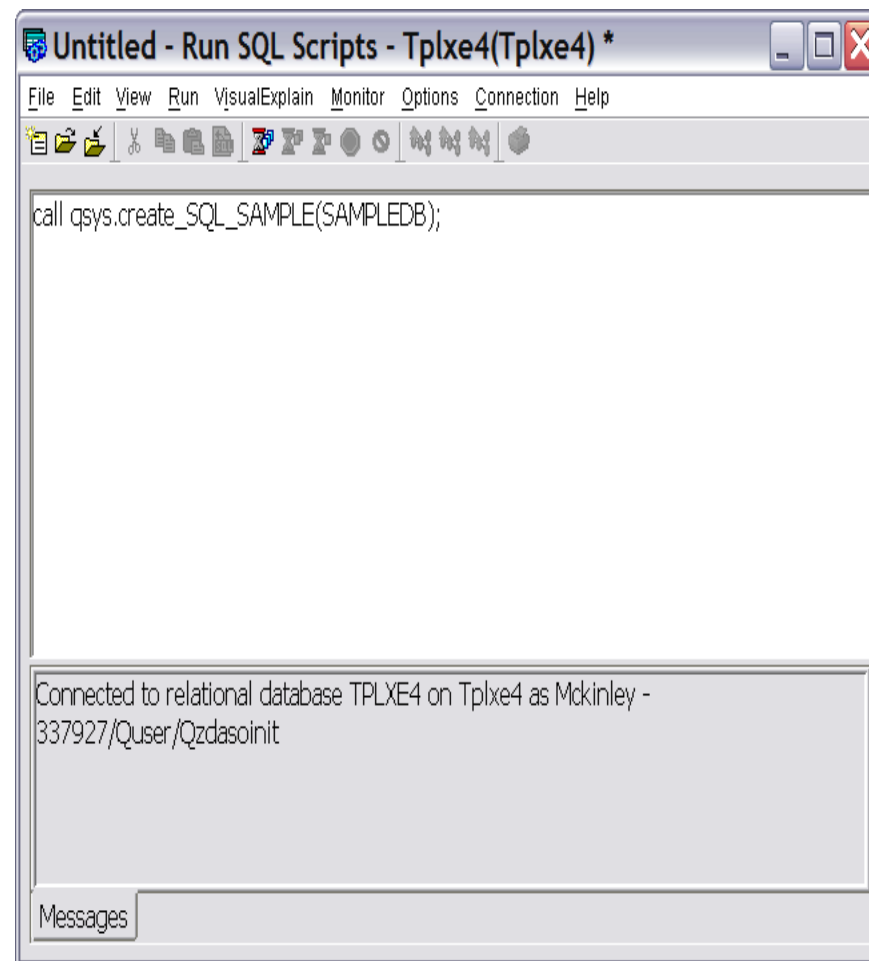
Run SQL Scripts

- Create/save scripts for repetitive tasks
- Both SQL statements and CL commands
- Debug Stored Procedures
- Do Visual Explain on queries, for performance analysis and tuning
- Syntax error highlighting
- SQL state errors in message box, including second level text
- Prompting of CL commands
- Support for Global Variables 7.1 (new tab)



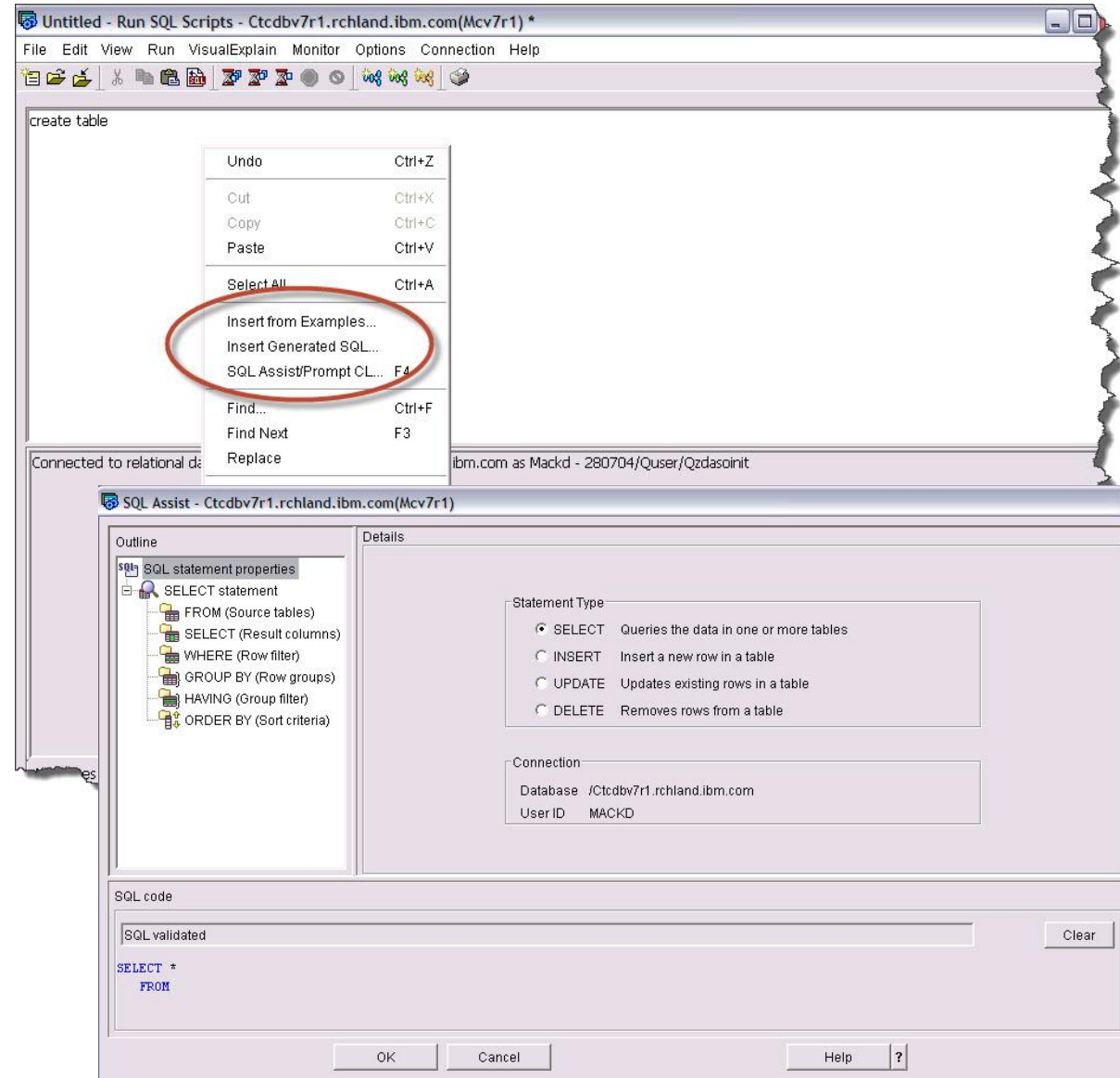
Creating a Schema (Library) with Free Form SQL

- **CREATE SCHEMA MYSCHEMA;**
 - Organizational construct
 - Library/Folder
- A stored procedure is shipped with IBM i that can create sample schemas
 - CALL
CREATE_SQL_SAMPLE('CORPDATA');
 - Contains tables (including sample data), views, aliases, indexes, and RI
 - CORPDATA is used in the SQL manuals and labs



SQL/CL Scripting with Assists

- Enter SQL/CL Command
- Right Click to get menu
 - Insert from Examples
 - Choose from many prebuilt SQL Statements
 - SQL Assist/Prompt CL
 - Wizard guides you through creation



Generate SQL

Regenerate SQL CREATE/ALTER statements directly from the existing objects

- Helpful for when the original statements are no longer available
- Teach programmers about SQL syntax of objects

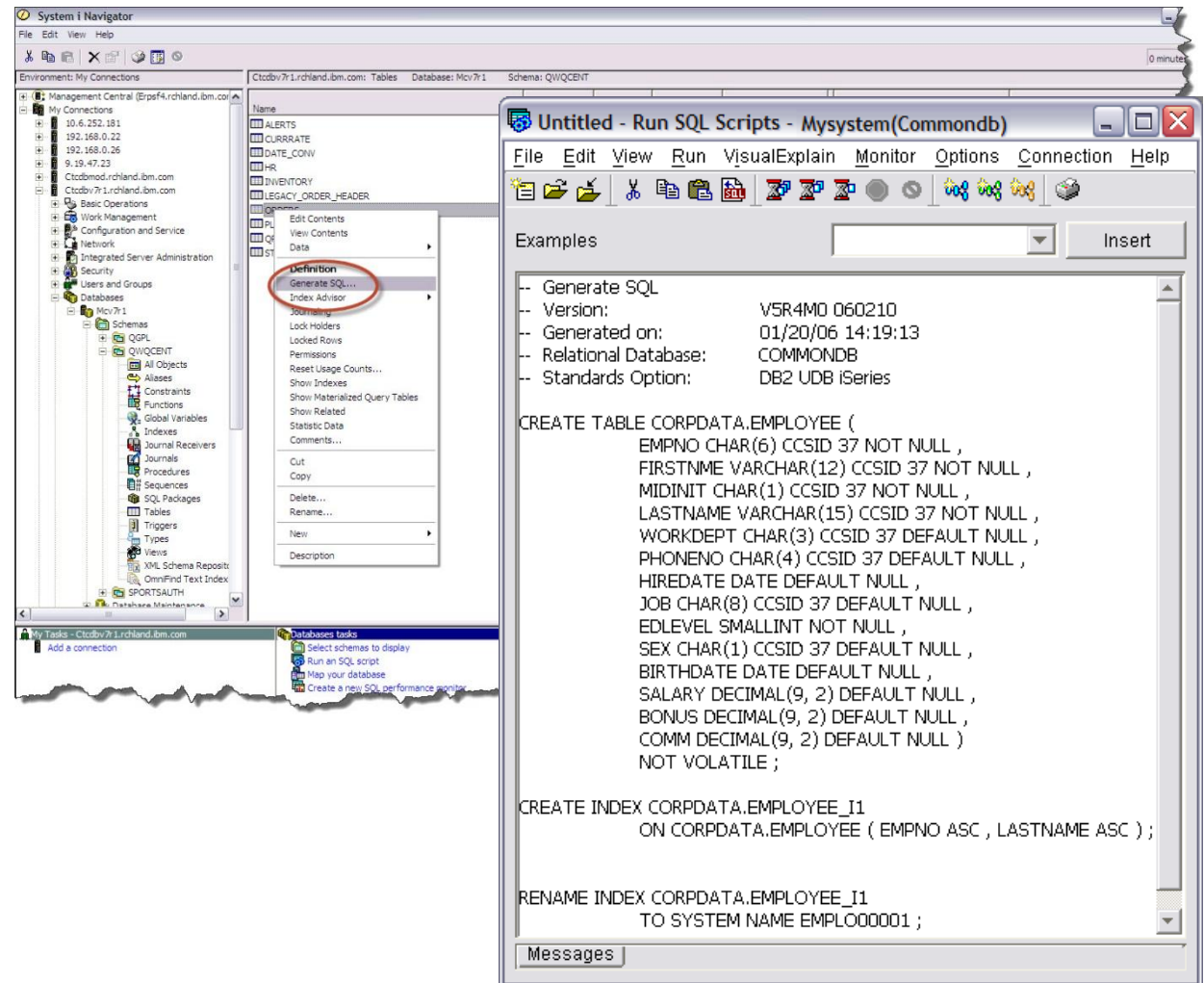
See what the SQL form of my DDS-created files would be like

Include generating short names of objects

Save to

- SRCPF
- IFS file
- UTF8 file
- Spread sheet

Does not generate RI and triggers for tables



Scenario

Find the first occurrence of “**IBM**” in a very large book...



What do you do first?

Turn to the index!

in-dex Something that serves to guide, point out, or otherwise facilitate efficient reference.

Creating a useful index

is both a *Science* and an *Art*.

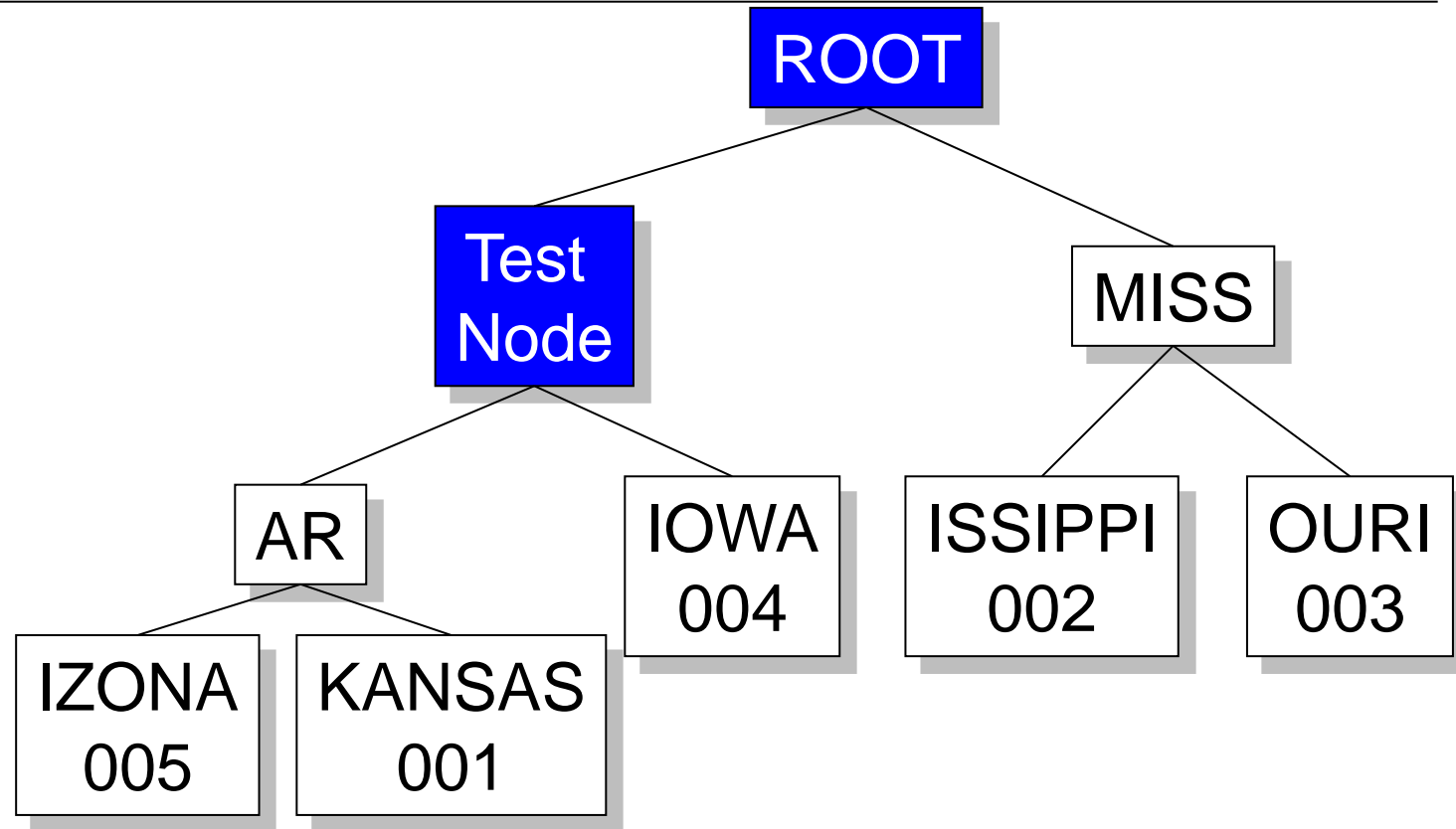


DB2 for i

- Two types of indexing technologies are supported
 - *Radix* Index
 - *Encoded Vector* Index
- Each type of index has specific uses and advantages
- Respective indexing technologies compliment each other
- Indexes can be used for statistics (building a plan) and implementation (query execution)
- Indexes can provide RRNs and/or data
- Indexes are scanned or probed
 - Probe can only occur on contiguous, leading key columns
 - Scan can occur on any key column
 - Probe and scan can be used together

Radix Index

Database Table	
001	ARKANSAS
002	MISSISSIPPI
003	MISSOURI
004	IOWA
005	ARIZONA
...	...



ADVANTAGES:

- Very fast access to a single key value
- Also fast for small, selected range of key values (low cardinality)
- Provides order

DISADVANTAGES:

- Table rows retrieved in order of key values (not physical order) which equates to random I/O's
- No way to predict which physical index pages are next when traversing the index for large number of key values

Encoded Vector Index (EVI)

- Index for delivering fast data access in analytical and reporting environments
 - Advanced technology from IBM Research
 - Used to produce dynamic bitmaps and RRN lists
 - Fast access to statistics to improve query optimizer decision making
- Not a “tree” structure
- Can only be created through an SQL interface or Navigator for i GUI

```
CREATE ENCODED VECTOR INDEX MySchema.IXName  
    ON MySchema.TabName(KEY(s))  
    INCLUDE ( SUM(SomeOtherColName));
```



New in 7.1
Maintained
aggregate

Encoded Vector Index (EVI)

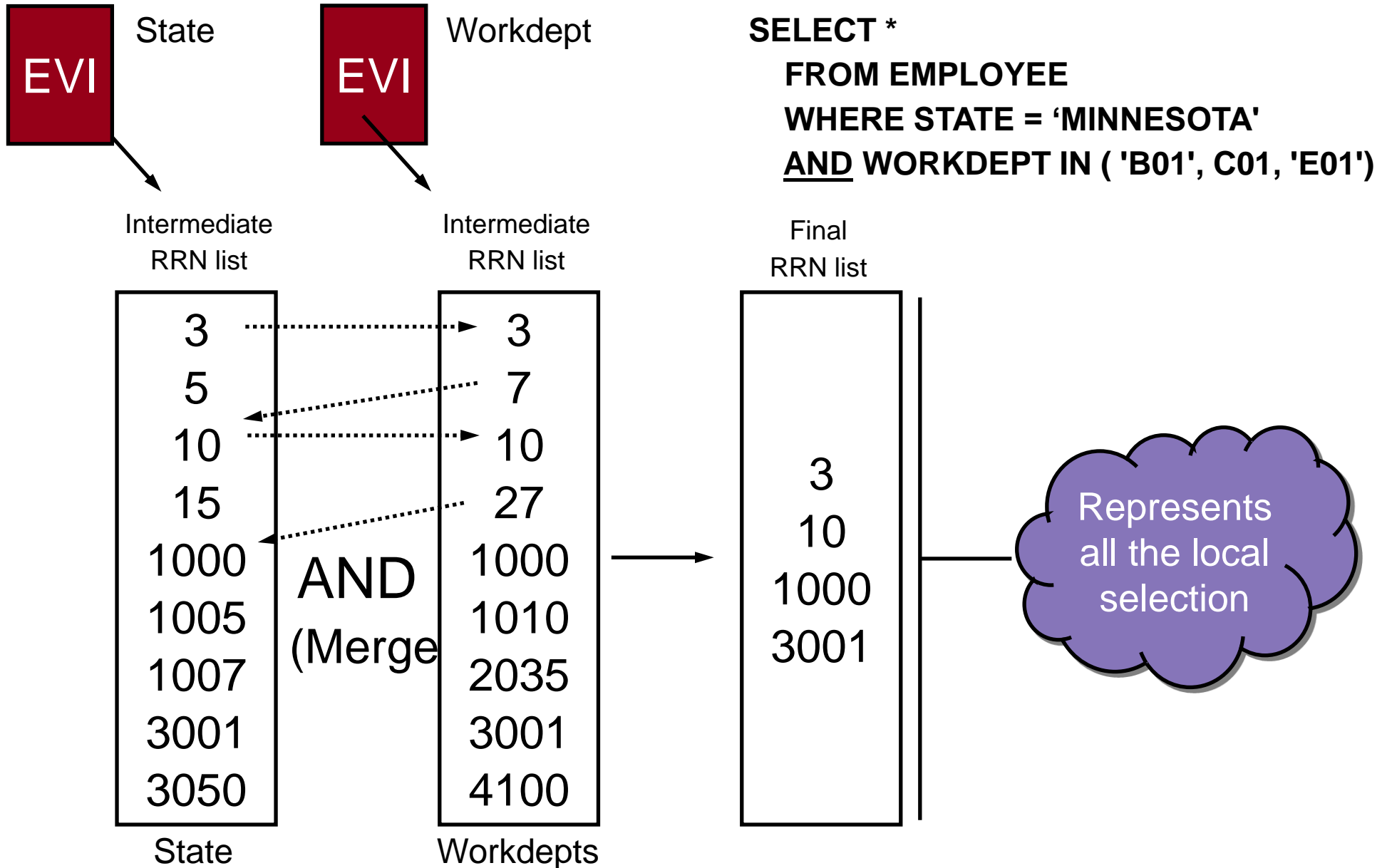
Symbol Table				
Key Value	Code	Count	Include Sum()	Include Sum()
Arizona	1	5000	1500	2005
Arkansas	2	7300	3200	450
...				
Wisconsin	49	340	575	1200
Wyoming	50	2760	210	0

optional

Vector	RRN
1	1
17	2
5	3
9	4
2	5
7	6
50	7
49	8
5	9
...	...

- Symbol table contains information for each distinct key value
 - Each key value is assigned a unique code (key compression)
 - Code is 1, 2, or 4 bytes depending on number of distinct key values
 - Enhanced in i 7.1 to include SUM and COUNT in the definition
- Rather than a bit array for each distinct key value, use one array of codes

Index ANDing Zig Zag Example



Autonomic Index Creation

- DB2 Optimizer can have DB2 automatically create a temporary index
- Both full and sparse (“where” statement added) indexes can be created
- Temporary indexes are **not** used for statistics
- Temporary indexes are *maintained*
- CQE
 - Temporary indexes are not reused and not shared
 - Usually a bottleneck in query performance
 - Can impact overall system performance
 - Can increase the amount of temporary storage used
- SQE
 - Temporary indexes are reused and shared across jobs and queries
 - Creation is based on “watching” the query requests over time
 - Creation is based on optimizer’s own index advice
 - Temporary index maintenance is delayed when all associated cursors closed

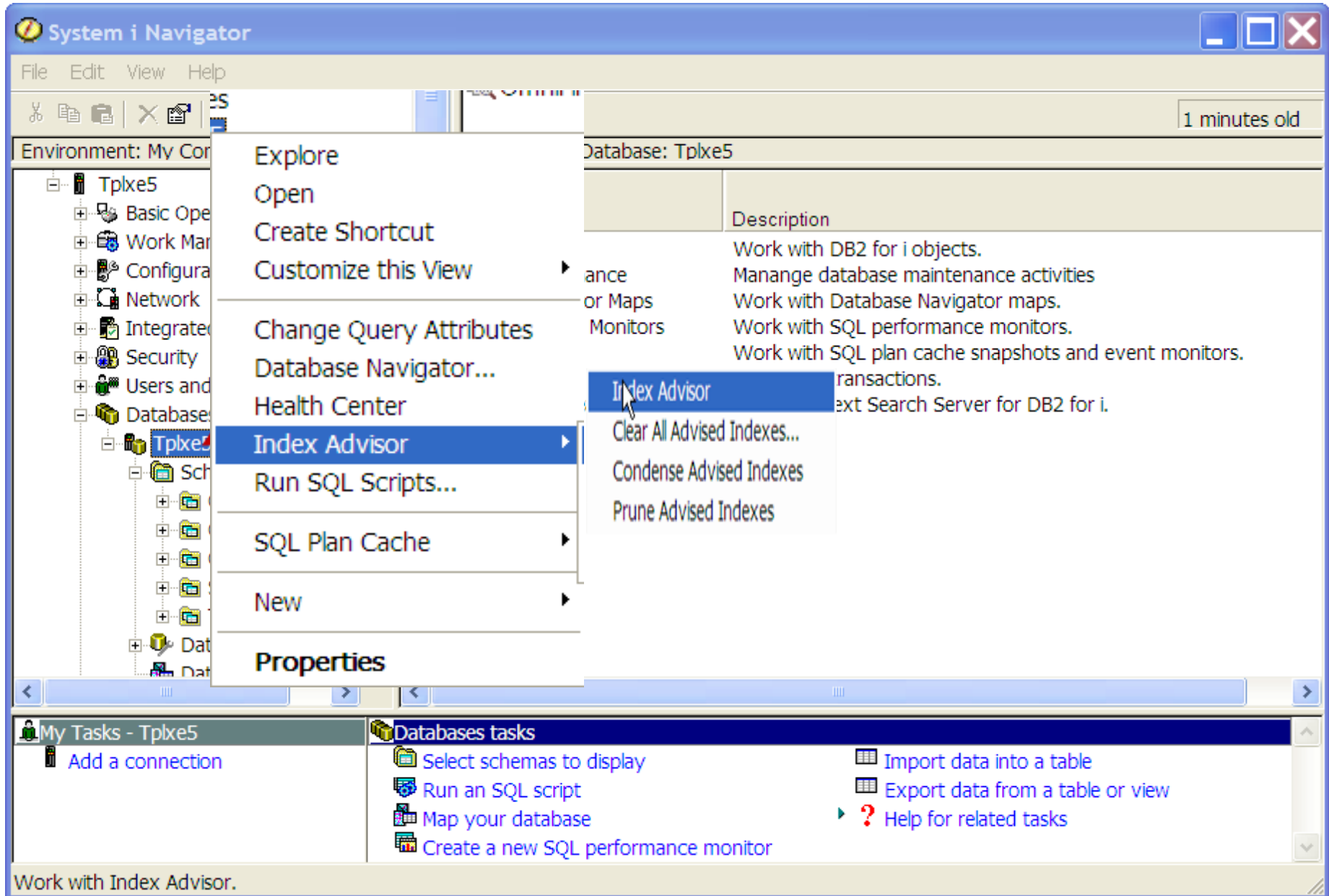
What should you do?

Create all advised indexes?

Nothing, let the system handle it?

Monitor, analyze, and tune important tables and queries?

System Wide Index Advice – right click on SYSTEM



Index advice

Index Advisor - Tplxe5

File Edit View Help

9 minutes old

Database: Tplxe5 Advised Indexes for Tplxe5

Table for Which Index was Advised	Schema	System Schema	System Name	Partition	Keys Advised	Leading Keys Order Independent	Advised Index Type
SUPPLIERS	DBQTEA...	DBQTEAM01	SUPPLIERS	For all p...	COUNTRY, SUPPKEY	COUNTRY	Binary Radix
DATES	DBQTEA...	DBQTEAM01	DATES	For all p...	WEEK, DATEKEY	WEEK	Binary Radix
CUSTOMERS	DBQTEA...	DBQTEAM01	CUSTOMERS	For all p...	CUSTKEY		Binary Radix
ORDERS	DBQTEA...	DBQTEAM01	ORDERS	For all p...	SUPPKEY		Encoded vector (not u
ORDERS	DBQTEA...	DBQTEAM01	ORDERS	For all p...	SHIPDATE		Encoded vector (not u
PARTS	DBQTEA...	DBQTEAM01	PARTS	For all p...	PARTKEY		Binary Radix
ORDERS	DBQTEA...	DBQTEAM01	ORDERS	For all p...	YEAR, RETURNFLAG, QUA...	YEAR, RETURNFLA...	Binary Radix
ORDERS	DBQTEA...	DBQTEAM01	ORDERS	For all p...	CUSTKEY		Binary Radix
ORDERS	DBQTEA...	DBQTEAM01	ORDERS	For all p...	PARTKEY		Encoded vector (not u
QZG0000743	DBQTEA...	DBQTEAM01	QZG0000743	For all p...	QQSYS, QQJOB, QQUSER,...	QQSYS, QQJOB, Q...	Binary Radix
QZG0000365	DBQTEA...	DBQTEAM01	QZG0000365	For all p...	QQSYS, QQUSER, QQJOB,...	QQSYS, QQUSER, ...	Binary Radix
ORDERS	DBQTEA...	DBQTEAM01	ORDERS	For all p...	CUSTKEY		Encoded vector (not u
QZG0000784	DBQTEA...	DBQTEAM02	QZG0000784	For all p...	QQRID, QQSTIM	QQRID	Binary Radix
QZG0000365	DBQTEA...	DBQTEAM02	QZG0000365	For all p...	QQC12, QQRID	QQC12, QQRID	Binary Radix
QZG0000365	DBQTEA...	DBQTEAM02	QZG0000365	For all p...	QQC12, QQRID, QQTIME	QQC12, QQRID	Binary Radix
SUPPLIERS	DBOTEAM...	DBOTEAM02	SUPPLIERS	For all p...	SUPPKEY	SUPPKEY	Binary Radix

155 - 169 of ... objects

Index advise (Scroll right)

Index Advisor - Tplxe5

File Edit View Help

53 minutes old

Database: Tplxe5 Advised Indexes for Tplxe5

Last Advised for Query Use	Times Advised	Estimat... ndex Creation	Reason Advised	Logic... age Size	Most Expe... Query	Aver... of Query	Rows in Table when Advised	NLSS Table Advi	N. S. A	MTI Used	MTI Created	MTI Last Used
9/24/10 1:02:16 ...	4	00:00:...	Row sele...	64	2	1.00...	1000	*HEX	...	0	0	
9/24/10 1:02:16 ...	4	00:00:...	Row sele...	64	2	1.00...	1450	*HEX	...	0	0	
9/24/10 1:54:54 ...	4	00:00:...	Row sele...	64	2	2.00...	15000	*HEX	...	0	0	
9/24/10 1:02:16 ...	4	00:00:...	Row sele...	64	2	1.00...	600572	*HEX	...	0	0	
9/24/10 1:02:16 ...	4	00:00:...	Row sele...	64	2	1.00...	600572	*HEX	...	0	0	
9/24/10 1:54:54 ...	5	00:00:...	Row sele...	64	2	1.59...	20000	*HEX	...	0	0	
9/24/10 1:34:50 ...	5	00:00:...	Row sele...	64	2	2.00...	600572	*HEX	...	0	0	
9/24/10 1:54:54 ...	5	00:00:...	Row sele...	64	2	2.00...	600572	*HEX	...	0	0	
9/24/10 1:54:54 ...	5	00:00:...	Row sele...	64	2	1.40...	600572	*HEX	...	0	0	
9/24/10 2:22:27 ...	5	00:00:...	Row sele...	64	5	5.00...	552	*HEX	...	2	1	9/24/10 2:22:27 F
9/24/10 2:32:22 ...	6	00:00:...	Row sele...	64	118	42.6...	871	*HEX	...	0	0	
9/24/10 1:54:54 ...	8	00:00:...	Row sele...	64	2	1.62...	600572	*HEX	...	0	0	
9/28/10 3:44:36 ...	1	00:00:...	Row sele...	64	1	0.00...	591	*HEX	...	0	0	
7/1/10 2:09:55 PM	1	00:00:...	Row sele...	64	1	0.00...	871	*HEX	...	0	0	
7/1/10 2:09:55 PM	1	00:00:...	Row sele...	64	1	0.00...	871	*HEX	...	0	0	
6/24/10 4:53:20 ...	1	00:00:...	Row sele...	64	1	0.00...	1000	*HEX	...	0	0	

155 - 169 of ... objects

Create Index by....right clicking on Index advised

Index Advisor - Tplxe5

File Edit View Help

9 minutes old

Database: Tplxe5 Advised Indexes for Tplxe5

Table for Which Index was Advised	Schema	System Schema	System Name	Partition	Keys Advised	Leading Keys Order Independent	Advised Index Type
SUPPLIERS	DBQTEA...	DBQTEAM01	SUPPLIERS	For all p...	COUNTRY, SUPPKEY	COUNTRY	Binary Radix
DATES	DBQTEA...	DBQTEAM01	DATES	For all p...	WEEK, DATEKEY	WEEK	Binary Radix
CUSTOMERS	DBQTEA...	DBQTEAM01	CUSTOMERS	For all p...	CUSTKEY		Binary Radix
ORDERS	DBQTEA...	DBQTEAM01	ORDERS	For all p...	SUPPKEY		Encoded vector (not u
ORDERS	DBQTEA...	DBQTEAM01	ORDERS	For all p...	SHIPDATE		Encoded vector (not u
PARTS	DBQTEA...	DBQTEAM01	PARTS	For all p...	PARTKEY		Binary Radix
ORDERS	DBQTEA...	DBQTEAM01	ORDERS	For all p...	YEAR, RETURNFLAG, QUA...	YEAR, RETURNFLA...	Binary Radix
ORDERS	DBQTEA...	DBQTEAM01	ORDERS	For all p...	CUSTKEY		Binary Radix
ORDERS	DBQTEA...	DBQTEAM01	ORDERS	For all p...	PARTKEY		Encoded vector (not u
QZG0000743	DBQTEA...	DBQTEAM01	QZG0000743	For all p...	QQSYS, QQJOB, QQUSER,...	QQSYS, QQJOB, Q...	Binary Radix
QZG0000365	DBQTEA...	DBQTEAM01	QZG0000365	For all p...	QQSYS, QQUSER, QQJOB,...	QQSYS, QQUSER, ...	Binary Radix
ORDERS	DBQTEA...	DBQTEAM01	ORDERS	For all p...	CUSTKEY		Encoded vector (not u
QZG0000784	DBQTEA...	DBQTEAM01	QZG0000784	For all p...	QQRID, QQSTIM	QQRID	Binary Radix
QZG0000365	DBQTEA...	DBQTEAM01	QZG0000365	For all p...	QQC12, QQRID	QQC12, QQRID	Binary Radix
QZG0000365	DBQTEA...	DBQTEAM02	QZG0000365	For all p...	QQC12, QQRID, QQTIME	QQC12, QQRID	Binary Radix
SUPPLIERS	DBOTEAM...	DBOTEAM02	SUPPLIERS	For all p...	SUPPKEY	SUPPKEY	Binary Radix

155 - 169 of ... objects

SQL Statement Analysis

■ Database Monitor

- Requires you to turn it on (iNav, also STRDBMON CL Command)
 - Summary – no problem, run all day, but limited analysis available
 - Detail – BE VERY CAREFUL
 - Performance hit may be significant
 - Captures SQL being processed by CQE as well as SQE
- Try to collect problem statements/apps
- Try to use FILTERS to isolate what you collect
- Can send captured data to another system to analyze

■ SQL Plan Cache

- SQE Only
- Data collected by system all day – with negligible impact to system performance
- Can analyze statements while still running
- Save (capture) SQL Plan Cache snapshots for later analysis
 - Useful for comparing before and after

Starting a DB performance Monitor

The screenshot shows the 'System i Navigator' application window. The main pane displays a table of SQL Performance Monitors for the 'Tp1xe5' database. A context menu is open over the 'SQL Performance Monitors' folder in the left-hand tree view.

Name	Type	Status	Schema
Comcast CQE Oonly June 29	Detailed	Imported	COMCAST
DB2WEBQUERY MARCH 2008	Detailed	Ended	DBQSCHEMA
DBQTEAM01 DB2 WebQuery data	Detailed	Imported	DBQTEAM01
dbqteam01 Test_app run1	Detailed	Ended	DBQTEAM01
DBQteam01 Test_app run2	Detailed	Ended	DBQTEAM01
DBQTEAM02 TEST_APP run1	Detailed	Ended	DBQTEAM02
DBQTEAM02 Test_app run2	Detailed	Ended	DBQTEAM02
delete trigger test	Detailed	Ended	RXPT
INSERTCS 0618720001	Detailed	Ended	DENTON
INSERTCSJJ0618730001	Detailed	Ended	DENTON
INSERTN 0618710001	Detailed	Ended	DENTON
test 1	Detailed	Ended	MCAIN
test 2	Detailed	Ended	MCAIN
test 3	Detailed	Ended	MCAIN
er fire	Detailed	Ended	RXPT
Advice 1	Detailed	Imported	FINECO
Advice 2	Detailed	Imported	FINECO
MONTEAM	Detailed	Imported	CLDAN

The context menu includes options: Explore, Open, Create Shortcut, Customize this View, Verify..., Import..., Save List Contents..., and New.

At the bottom, the 'My Tasks - Tp1xe5' pane shows tasks such as 'Add a connection', 'Select schemas to display', 'Run an SQL script', 'Map your database', 'Import data into a table', 'Export data from a table or view', and 'Help for related tasks'.

Analyzing Database (SQL Performance) Monitor Data

System i Navigator

Environment: My Connections Ctcdbv7r1.rchland.ibm.com: SQL Performance Monitors Database: Mcv7r1

Name	Type	Status	Schema	Table	Created By	Date Created	Jobs
DCRANK ROA 263564...	Detailed	Ended	DCRANK	ROA	DCRANK	5/6/13 7:16...	263564/DCRANK/QPADEV000G
DENTON CURR 28003...	Detailed	Ended	DENTON	CURR	DENTON	5/16/13 9:0...	280038/DENTON/QPADEV000G
DENTON GETDIAG 2341...	Detailed	Ended	DENTON	GETDIAG	DENTON	12/4/12 3:3...	234192/QUSER/QZDASOINIT
DENTON REPEATLOOP23...	Detailed	Ended	DENTON	REPEATLOOP	DENTON	12/3/12 3:1...	234094/QUSER/QZDASOINIT
DENTON RLOOP1 2340...	Detailed	Ended	DENTON	RLOOP1	DENTON	12/3/12 3:2...	234094/QUSER/QZDASOINIT
DENTON RLOOP2 2340...	Detailed	Ended	DENTON	RLOOP2	DENTON	12/3/12 3:2...	234094/QUSER/QZDASOINIT
DENTON ROWNBR1 173...	Detailed	Ended	DENTON	ROWNBR1	DENTON	7/27/12 2:0...	173878/QUSER/QZDASOINIT
DTNETTEST MON001 251...	Detailed	Ended	DTNETTEST	MON001	MCKINLEY	3/1/13 1:33...	All jobs - filtered
dv6	Detailed	Ended	MCKINLEY	QZG0000905	MCKINLEY	12/17/12 5:...	239682/QUSER/QZDASOINIT
dv6mon20	Detailed	Ended	MCKINLEY	QZG0000919	MCKINLEY	12/18/12 6:...	239946/QUSER/QZDASOINIT
dvmon6	Detailed	Ended	MCKINLEY	QZG0000909	MCKINLEY	12/18/12 3:...	239693/QUSER/QZDASOINIT
ji2_cqe14	Detailed	Imported	J12	QDBMNCQE14	MCKINLEY	10/18/12 9:...	
ji2_cqe16	Detailed	Imported	J12	QDBMNCQE16	MCKINLEY	10/18/12 11...	
ji2_cqe18	Detailed	Imported	J12	QDBMNCQE18	MCKINLEY	10/18/12 1:...	
ji2_cqe20	Detailed	Imported	J12	QDBMNCQE20	MCKINLEY	10/18/12 3:...	
ji2_cqe24	Detailed	Imported	J12	QDBMNCQE24	MCKINLEY	10/18/12 7:...	
ji2ceq04	Detailed	Imported	J12	QDBMNCQE04	MCKINLEY	10/17/12 11...	
MCKINLEY TEST 239788...	Detailed	Ended	MCKINLEY	TEST	MCKINLEY	12/19/12 8:...	All jobs - filtered
Promo 2 BRMS No advised i...	Detailed	Ended	DC_467_8D	QZG0000980	DCRANK	3/6/13 1:19...	252060/QUSER/QZDASOINIT
Promo 2 BRMS with advise...	Detailed	Ended	DC_467_8D	QZG0000981	DCRANK	3/6/13 1:29...	252060/QUSER/QZDASOINIT
ptdbmon01	Detailed	Imported	PT	QZG0000752	MCKINLEY	2/25/13 8:2...	
PT JOBCAPT 2618990...	Detailed	Ended	PT	JOBCAPT	MCKINLEY	4/26/13 9:3...	261899/MCKINLEY/QPADEV000X
QGPL DOUGTEST 25...	Detailed	End	QGPL	DOUGTEST	MACKD	3/22/13 1:4...	256279/MACKD/QPADEV0009
QGPL JAVA 01834...	Detailed		QGPL	JAVA	DENTON	11/30/10 2:...	All jobs
QIBMDB2COEQDBMNCQ...	Detailed		QIBMDB2COE	QDBMNCQE01	MCKINLEY	9/12/12 11:...	All jobs
QIBMDB2COEQDBMNCQ...	Detailed		QIBMDB2COE	QDBMNCQE01	MCKINLEY	9/11/12 1:5...	All jobs
QIBMDB2COEQDBMNCQ...	Detailed		QIBMDB2COE	QDBMNCQE01	MCKINLEY	2/8/13 2:16...	All jobs
QIBMDB2COEQDBMNCQ...	Detailed		QIBMDB2COE	QDBMNCQE01	MCKINLEY	2/27/13 9:2...	All jobs
QIBMDB2COEQDBMNCQ...	Detailed		QIBMDB2COE	QDBMNCQE02	MCKINLEY	2/27/13 10:...	All jobs
QIBMDB2COEQDBMNCQ...	Detailed		QIBMDB2COE	QDBMNCQE03	MCKINLEY	2/27/13 11:...	All jobs
QIBMDB2COEQDBMNCQ...	Detailed		QIBMDB2COE	QDBMNCQE04	MCKINLEY	2/27/13 12:...	All jobs
QIBMDB2COEQZDASMC...	Detailed		QIBMDB2COE	QZDASMON02	MCKINLEY	2/27/13 10:...	All jobs - filtered

Context menu for 'End' status:

- End
- Analyze...
- Show Statements...
- Compare...
- Comments...
- Delete...
- Rename...
- Properties

Taskbar: Databases tasks

- Select schemas to display
- Run an SQL script
- Map your database
- Create a new SQL performance monitor
- Import data into a table
- Export data from a table or view
- Help for related tasks

Show Statements (consider Filtering)

- Filter to minimize statement loading time and analysis
- Sort on any column to zero in on what you are looking for
 - Longest running statements
 - User or job specific statements

The screenshot shows the 'Statements' window in IBM DB2. The window is titled 'Statements - JI_qzdasoinit02 - Ctcdv7r1.rchland.ibm.com(Mcv7r1)'. It has a 'Filters to apply:' section on the left with several checkboxes and input fields. The main area displays a table of statements. The columns are: Start Time, Most Expensive Time, Total Processing Time, Total Times Run, Average Processing Time, and Statement. The 'Most Expensive Time' and 'Total Processing Time' columns are circled in red. The status bar at the bottom indicates 'Status: Complete' and has buttons for 'Columns...', 'Save Results...', 'Refresh', 'Close', and 'Help'.

Start Time	Most Expensive Time	Total Processing Time	Total Times Run	Average Processing Time	Statement
10/17/12 10:01:46 PM	0.0272	0.0691	1	0.0551	SELECT PSE
10/17/12 10:01:51 PM	0.0303	0.0303	1	0.0303	SELECT LOF
10/17/12 10:01:46 PM	0.0187	0.0388	1	0.0388	SELECT PLC
10/17/12 10:01:59 PM	0.0182	0.0363	1	0.0363	select MEMH
10/17/12 10:02:08 PM	0.0137	0.0137	1	0.0137	UPDATE OBI
10/17/12 10:01:40 PM	0.0117	0.0120	1	0.0120	SELECT REI
10/17/12 10:01:51 PM	0.0094	0.0099	2	0.0049	insert into G
10/17/12 10:01:51 PM	0.0060	0.0125	1	0.0125	SELECT a Q
10/17/12 10:01:48 PM	0.0057	0.0057	1	0.0057	SELECT SSS
10/17/12 10:01:48 PM	0.0057	0.0057	1	0.0057	SELECT PR
10/17/12 10:01:53 PM	0.0055	0.0057	1	0.0057	SELECT LEA
10/17/12 10:01:48 PM	0.0055	0.0055	1	0.0055	SELECT SSS
10/17/12 10:01:50 PM	0.0052	0.0052	1	0.0052	INSERT INK
10/17/12 10:01:48 PM	0.0051	0.0051	1	0.0051	SELECT SSS
10/17/12 10:01:56 PM	0.0050	0.0054	1	0.0054	SELECT LEA
10/17/12 10:01:59 PM	0.0049	0.0109	1	0.0109	SELECT * FF
10/17/12 10:01:59 PM	0.0048	0.0096	1	0.0096	select MEMH
10/17/12 10:01:48 PM	0.0047	0.0047	1	0.0047	SELECT SSS
10/17/12 10:01:48 PM	0.0047	0.0047	1	0.0047	SELECT SSS
10/17/12 10:01:53 PM	0.0045	0.0049	1	0.0049	SELECT LEA
10/17/12 10:01:51 PM	0.0044	0.0093	1	0.0093	select REP.F
10/17/12 10:01:48 PM	0.0039	0.0039	1	0.0039	SELECT SSS
10/17/12 10:01:47 PM	0.0033	0.0035	1	0.0035	SELECT LEA
10/17/12 10:02:03 PM	0.0022	0.0024	1	0.0024	SELECT REI
10/17/12 10:02:00 PM	0.0011	0.0022	1	0.0022	SELECT * FF
10/17/12 10:01:52 PM	0.0007	0.0008	1	0.0008	SELECT TAS

Live Analysis through SQL Plan Cache: Show Statements

The screenshot shows the System i Navigator interface. The left pane displays a tree view of connections, with 'SQL Plan Cache' selected. A context menu is open over 'SQL Plan Cache', showing options: Explore, Open, Create Shortcut, Customize this View, Show Statements... (highlighted), and Properties. A red arrow points from the 'SQL Plan Cache' item in the tree to the 'Show Statements...' option in the menu.

The right pane shows a table of tables in the 'Tp1xe5' database, 'DBC' schema. The table has columns: Name, System Name, and Partitioned.

Name	System Name	Partitioned
CUSTOMERS	CUSTOMERS	No
DATES	DATES	No
DBMONDATA2	DBMONDATA2	No
DEPTS	DEPTS	No
ORDER_SUMMARIES	ORDER_SUMS	No
ORDERS	ORDERS	No
PARTS	PARTS	No
QZG0000365	QZG0000365	No
QZG0000784	QZG0000784	No
QZG0000786	QZG0000786	No
SUPPLIERS	SUPPLIERS	No

The bottom pane shows 'My Tasks - Tp1xe5' with tasks like 'Add a connection', 'Select schemas to display', 'Run an SQL script', 'Map your database', 'Import data into a table', 'Export data from a table or view', and 'Help for related tasks'.

At the bottom of the window, a status bar reads: 'Work with SQL statements in the system SQL plan cache.'

Filtering

SQL Plan Cache Statements - Tplxe5(Tplxe5)

Filters to apply:

- Minimum runtime for the longest execution of the
0 Seconds
- Statements that ran on or after this date and time:
10/5/10 2:03:35 PM
- Top 'n' most frequently run statements:
0
- Top 'n' statements with the largest total accumula
0
- Statements the following user has ever run:
[Empty text box]
- Statements that are currently active
- Statements for which an index has been advised
- Statements for which statistics have been advised
- Include statements initiated by the operating system
- Statements that reference the following objects:

Schema	Name
- Statements that contain the following text:
[Empty text box]

Statements:

Status: Click Apply or Refresh to load the list

Columns... Save Results... **Refresh**

Close Help ?

Save statements to a Plan Cache Snapshot

The screenshot shows the 'SQL Plan Cache Statements - Tplxe5(Tplxe5)' dialog box. It features a table of statements with columns for 'Last Time Run', 'Most Expensive Time (sec)', 'Total Processing Time (sec)', and 'Total Times Run'. The table contains 20 rows of data. Two smaller dialog boxes are overlaid on the main window: 'Save Statements to SQL Plan Cache Snapshot - Tplxe5(Tplxe5)' and 'Information'.

Last Time Run	Most Expensive Time (sec)	Total Processing Time (sec)	Total Times Run
10/4/10 9:43:12 AM	93.0327	93.0327	1
10/4/10 9:43:59 AM	47.5247	47.5247	1
10/3/10 10:00:53 PM	20.3678	20.3678	1
10/5/10 11:06:58 AM	7.4804	7.4804	1
10/1/10 9:04:06 AM	6.8896	6.8896	1
10/1/10 9:04:31 AM	6.8564	6.8564	1
10/3/10 8:53:56 AM	4.7978	4.7978	1
10/1/10 8:36:46 AM	4.7713	4.7713	1
10/1/10 8:36:18 AM	4.7625	4.7625	1
10/1/10 8:43:58 AM	4.1504	4.1504	1
10/1/10 8:44:33 AM	3.6911	3.6911	1
			1
			4
			1
			4
			1
			3
			3
10/1/10 8:55:54 AM		2.1145	2
10/1/10 7:31:30 AM		1.9261	2
10/1/10 8:55:54 AM		1.8908	2
10/3/10 10:52:58 PM		1.8033	1
10/1/10 7:40:11 AM		1.6885	2
10/3/10 10:30:44 PM		1.6125	1
10/1/10 8:55:54 AM	0.6982	1.3927	2
10/1/10 8:55:54 AM	0.7498	1.3762	2
10/1/10 7:45:56 AM	1.2913	1.2913	1
			1

The 'Save Statements to SQL Plan Cache Snapshot' dialog box shows 'Name: DemoSnapshot' and 'Schema: DBQTEAM02'. The 'Information' dialog box displays the message: 'Information successfully saved to DemoSnapshot.'

Analyze the snapshot

System i Navigator

File Edit View Help

Environment: My Connections | Tplxe5: SC | Database: Tplxe5

0 minutes old

System Schema

Name	Schema	System Schema
Comcast Snapshot 4 May 2010	COMCAST	COMCAST
DemoSnapshot	DBQTEAM02	DBQTEAM02
Fineco	NECO	FINECO
IMMT1	DB2IMMT1	DB2IMMT1
Levy H	LEVYHOME	LEVYHOME
Levy H	LEVYHOME	LEVYHOME
Levy H	LEVYHOME	LEVYHOME
Levy H	LEVYHOME	LEVYHOME
OMNILAB	OMNILAB	OMNILAB
PCSNA	IBMCOEMLB	QIBMCOEMLB
QIBMCOE	IBMCOE	QIBMCOE
QIBMCOE	IBMCOE	QIBMCOE
QIBMCOE	IBMCOE	QIBMCOE
QIBMCOE	IBMCOE	QIBMCOE

Context Menu:

- Analyze...
- Show Statements...
- Compare...
- Comments...
- Delete...
- Rename...
- Properties**

Left Tree:

- Environment: My Connections
 - QSYS2
 - QTEMP
 - SYSIBM
 - TESTDBTOM
 - Database Maintenance
 - Database Navigator Maps
 - SQL Performance Monitors
 - SQL Plan Cache
 - SQL Plan Cache Snapshots**
 - SQL Plan Cache Event Monitors
 - Transactions
 - OmniFind Text Search
- File Systems

Bottom Panels:

- My Tasks - Tplxe5
 - Add a connection
- Databases tasks
 - Select schemas to display
 - Run an SQL script
 - Map your database
 - Import data into a table
 - Export data from a table or view
 - Help for related tasks

15 - 26 of 30 objects

Invoking Visual Explain

- Visually explain how the statement was processed by DB2
 - Incredibly powerful information
 - Right click on a statement

Statements - sports auth AFTER - Ctcdv7r1.rchland.ibm.com(Mcv7r1)

Filters to apply:

- Minimum runtime for the longest execution of the [0] Seconds
- Statements that ran on or after this date and time [2/6/13] [6:43:29 PM]
- Statements that reference the following objects:
- Statements that contain the following text:

Reset All Filters

Start Time	Most Expensive Time	Total Processing Time	Total Times Run	Average Processing Time	Statement
2/6/13 11:20:01 PM	186.8084	186.8084	1	186.8084	select INVBA...
2/7/13 6:21:23 PM	5	105.1415	1	105.1415	DELETE FROM...
2/7/13 7:51:07 AM	7	43.8737	1	43.8737	Delete From...
2/7/13 6:21:23 PM	9	43.5869	1	43.5869	Insert Into PL...
2/7/13 6:21:23 PM	8	40.2418	1	40.2418	Insert Into PL...
2/7/13 6:21:23 PM	9	39.1908	1	39.1908	Insert Into PL...
2/7/13 9:52:11 AM	35.2993	35.2993	1	35.2993	UPDATE TRI...
2/7/13 7:05:31 PM	33.6867	33.6867	1	33.6867	Delete From...
2/7/13 7:00:20 PM	29.7109	29.7109	1	29.7109	Delete From...
2/7/13 6:49:03 PM	24.1195	24.1195	1	24.1195	Delete From...
2/7/13 9:59:07 AM	22.8179	22.8179	1	22.8179	UPDATE TRI...
2/7/13 6:28:20 PM	22.4849	22.4849	1	22.4849	Delete From...
2/7/13 6:27:48 PM	21.3828	21.3828	1	21.3828	Insert Into PL...
2/7/13 6:21:23 PM	20.9400	20.9400	1	20.9400	Delete From...
2/7/13 6:37:30 PM	16.7651	16.7651	1	16.7651	Delete From...
2/7/13 6:24:37 PM	16.4785	16.4785	1	16.4785	Insert Into PL...
2/7/13 6:51:32 PM	11.3556	11.3556	1	11.3556	Delete From...
2/7/13 6:25:19 PM	10.5452	20.8070	2	10.4035	Insert Into PL...
2/7/13 6:31:55 PM	10.1849	10.1849	1	10.1849	Insert Into PL...
2/7/13 6:39:49 PM	10.0487	10.0487	1	10.0487	Delete From...
2/7/13 6:05:10 PM	9.9211	9.9211	1	9.9211	Insert Into PL...
2/7/13 6:18:53 PM	8.2384	8.2384	1	8.2384	Insert Into PL...
2/7/13 6:19:41 PM	8.0439	8.0439	1	8.0439	Delete From...
2/7/13 6:02:10 PM	7.9546	7.9546	1	7.9546	Delete From...
2/6/13 11:07:59 PM	7.2867	7.2867	1	7.2867	with ovr (LPS...
2/7/13 6:20:17 PM	7.2786	7.2786	1	7.2786	Insert Into PL...
2/7/13 6:24:39 PM	6.7756	6.7756	1	6.7756	Insert Into PL...

Status: Complete

Columns... Save Results... Refresh

Close Help ?

Visual Explain

- Active window - Look at DB objects (indexes, constraints, etc.) involved
- Attributes show all the settings that impact query optimizer
 - Labels include optimizer's estimates
 - SQE plans show decomposed SQL statement for each operation
- Icon Highlighting to speed analysis
 - Expensive nodes
 - Index Advised nodes
- Debug messages help bridge to picture

The screenshot shows the Visual Explain interface for a query. The main window displays a hierarchical execution plan with the following nodes from top to bottom:

- Final Select
- Hash Scan
- Temporary Distinct Hash Table
- Nested Loop Join
- Table Scan (AQP.LOCATIONDIM)
- Logic
- Logic
- EVISymbol Table Probe (AQP.EVILCOCSUM)

On the right side, there is a table of performance metrics:

Attribute	Value
Time Information	
Timestamp for Creation of Monit...	2010-04-28-08
Statement Start Timestamp	2010-04-28-08
Statement End Timestamp	2010-04-28-08
Total Estimated Run Time (ms)	.006
Actual Runtime Information	
Optimization Time (ms)	25
Run Time (ms)	5
Statement Open Time (ms)	Not Available
Statement Fetch Time (ms)	5
Statement Close Time (ms)	Not Available
Rows Fetched	1
Total Times Query Was Run	1
Total Time For All Runs (ms)	6
Synchronous Database Reads	0.0
Asynchronous Database Reads	0.0
Page Faults	1
Temporary Storage Used (MB)	1
Total Times Temporary Results ...	0.0
Reason Temporary Result Was ...	No Existing Ter
Information about SQL stateme...	
Statement Number	158

At the bottom of the window, the SQL statement is displayed:

```
select I.State, I.City, Sum(quantity) as TotalItems, Sum(amount) as totalSales from Sales S JOIN LOCATIONDim L on
I.locationid= S.Locationid Where I.state = ? GROUP BY I.State, I.City
```

Visual Explain – Index Advisor

Visual Explain - Tplxe5.rchland.ibm.com(Tplxe5)

File View Actions Options Help

Statistics and Index Advisor

Attribute	Value
Time Information	
Timestamp for Creation of Monitor Entry	2008-02-21-12.11.44
Statement Start Timestamp	2008-02-21-12.11.44
Statement End Timestamp	2008-02-21-12.11.44
Total Estimated Run Time (ms)	50
Actual Runtime Information	
Optimization Time (ms)	4
Run Time (ms)	13
Statement Open Time (ms)	13
Statement Fetch Time (ms)	Not Available
Statement Close Time (ms)	Not Available
Rows Fetched	1
Total Times Query Was Run	1
Total Time For All Runs (ms)	14
Synchronous Database Reads	Not Available
Asynchronous Database Reads	Not Available
Page Faults	Not Available
Information about SQL statement exe...	
Statement Number	24
Statement Function	Select
Statement Operation	Open
Statement Type	Dynamic
Statement Name	STMT0044
Statement Outcome	Unsuccessful
SQL Return Code	-666

Final Select

Table Scan
QSYS2.SYSIXADV

```
select * from qsys2.sysixadv where table_schema = 'MCAIN'
```

Statement text

View Actions Options Help

- Zoom
- Overview
- Icon Spacing
- Orientation
- Arrow Labels
- Icon Labels
- Highlight Expensive Icons
- Highlight Index Advised**
- Highlight LPG
- Highlight Materialized Query Tables
- Refresh

Index Advice at statement level

- Click on walking shoes icon
- Click on CREATE to walk through creation of index

Visual Explain - sports auth AFTER - Ctcdbv7r1.rchland.ibm.com(Mcv7r1)

File View Actions Options Help

Index and Statistics Advisor - Ctcdbv7r1.rchland.ibm.com(Mcv7r1)

Index Advisor Statistics Advisor

It is recommended that the following indexes be created:

Create	Table Name	Schema	Index Type	Columns
<input checked="" type="checkbox"/>	INVBAL	MM4R4LIB	EVI	ISTORE
<input checked="" type="checkbox"/>	INVBAL	MM4R4LIB	EVI	INUMBR
<input checked="" type="checkbox"/>	TBLSTR	MM4R4LIB	Binary Radix	STRHDO STPOLL STCLDT STSDAT
<input checked="" type="checkbox"/>	TBLSTR	MM4R4LIB	Binary Radix	STRHDO STPOLL STCLDT STRNUM STSDAT
<input checked="" type="checkbox"/>	INVMST	MM4R4LIB	Binary Radix	INUMBR

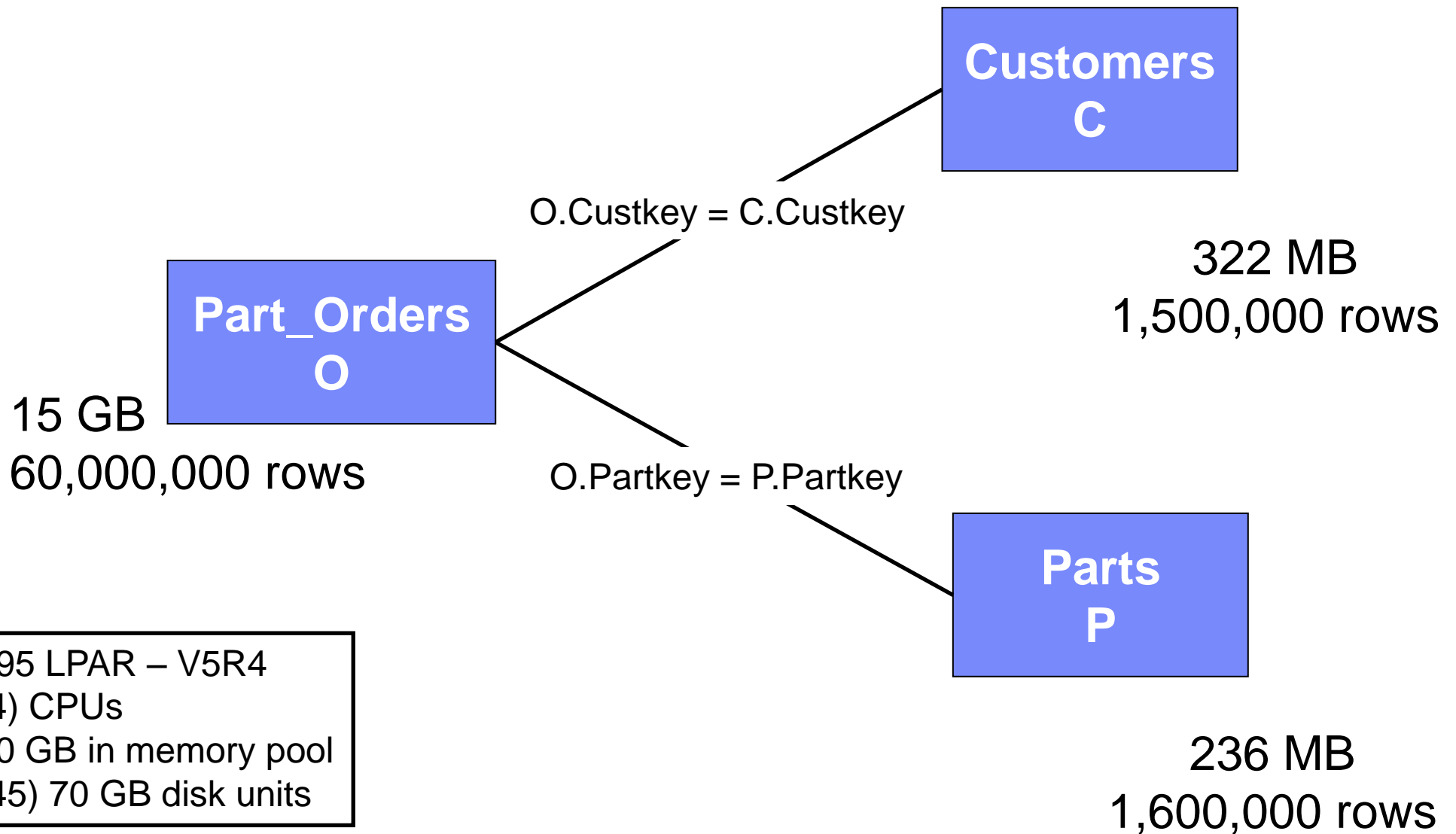
4.632E7
Nested Loop Join
4.634E7
0.0

select INVBAL.ISTORE,INVBAL
inval.inumbr=insmst.snumbr

Create ...

OK Help ?

Indexing Strategy – Case Study



595 LPAR – V5R4
(4) CPUs
10 GB in memory pool
(45) 70 GB disk units

Indexing Strategy – Case Study

- 80 SQL requests from a single JDBC connection...
 - 2 SETs
 - 53 SELECTs
 - 15 INSERTs
 - 5 UPDATEs
 - 15 DELETEs
 - 73 via SQE
 - 5 via CQE

- Scenarios...
 1. No indexes
 2. Indexes on join columns only
 - 4 radix indexes
 3. Indexes for selecting, joining, grouping, ordering
 - 13 radix indexes
 - 2 encoded vector indexes

Indexing Strategy – Case Study

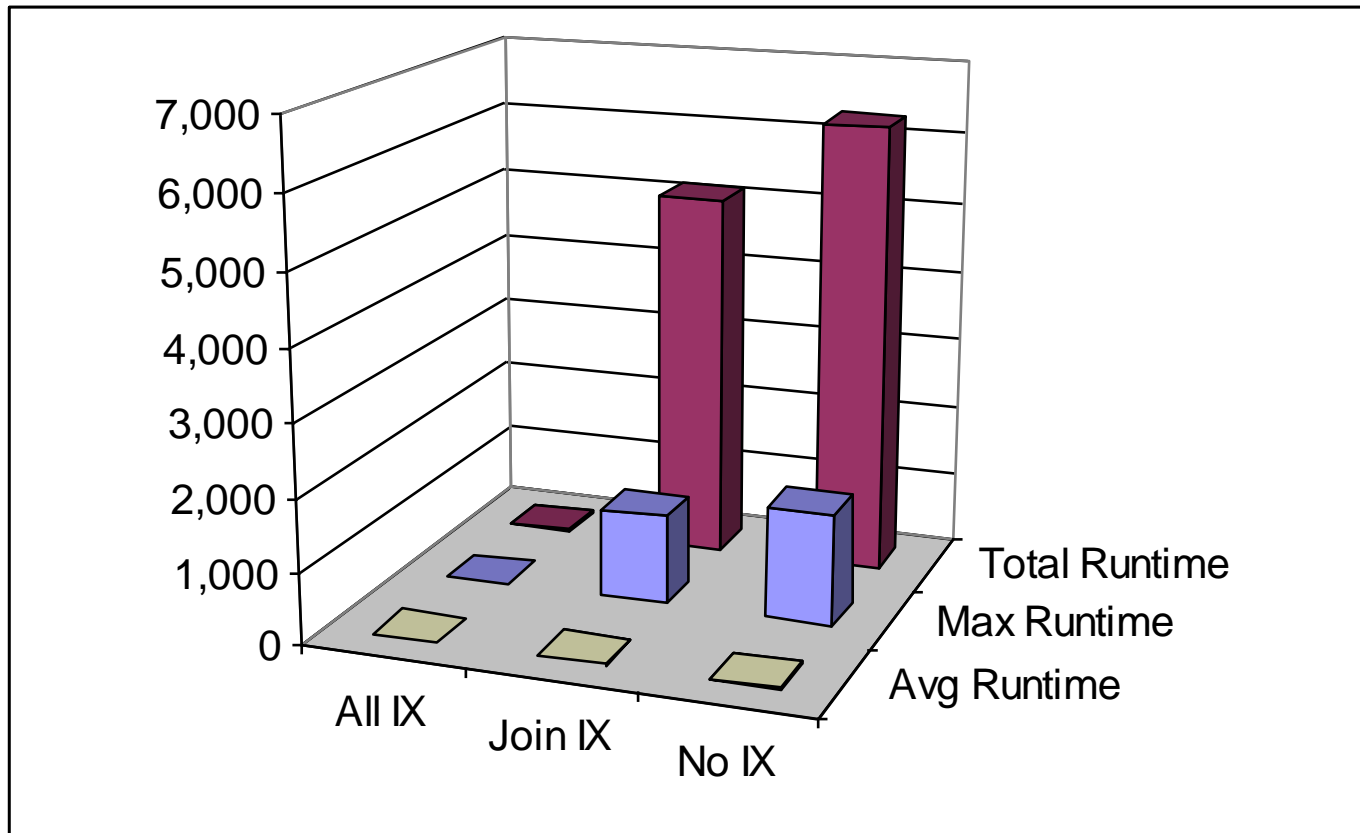
– Indexes on join columns only

- ✓ create index part_orders_ix1 on part_orders (custkey);
- ✓ create index part_orders_ix2 on part_orders (partkey);
- ✓ create index customers_ix1 on customers (custkey);
- ✓ create index parts_ix1 on parts (partkey);

– Index for selecting, joining, grouping, ordering

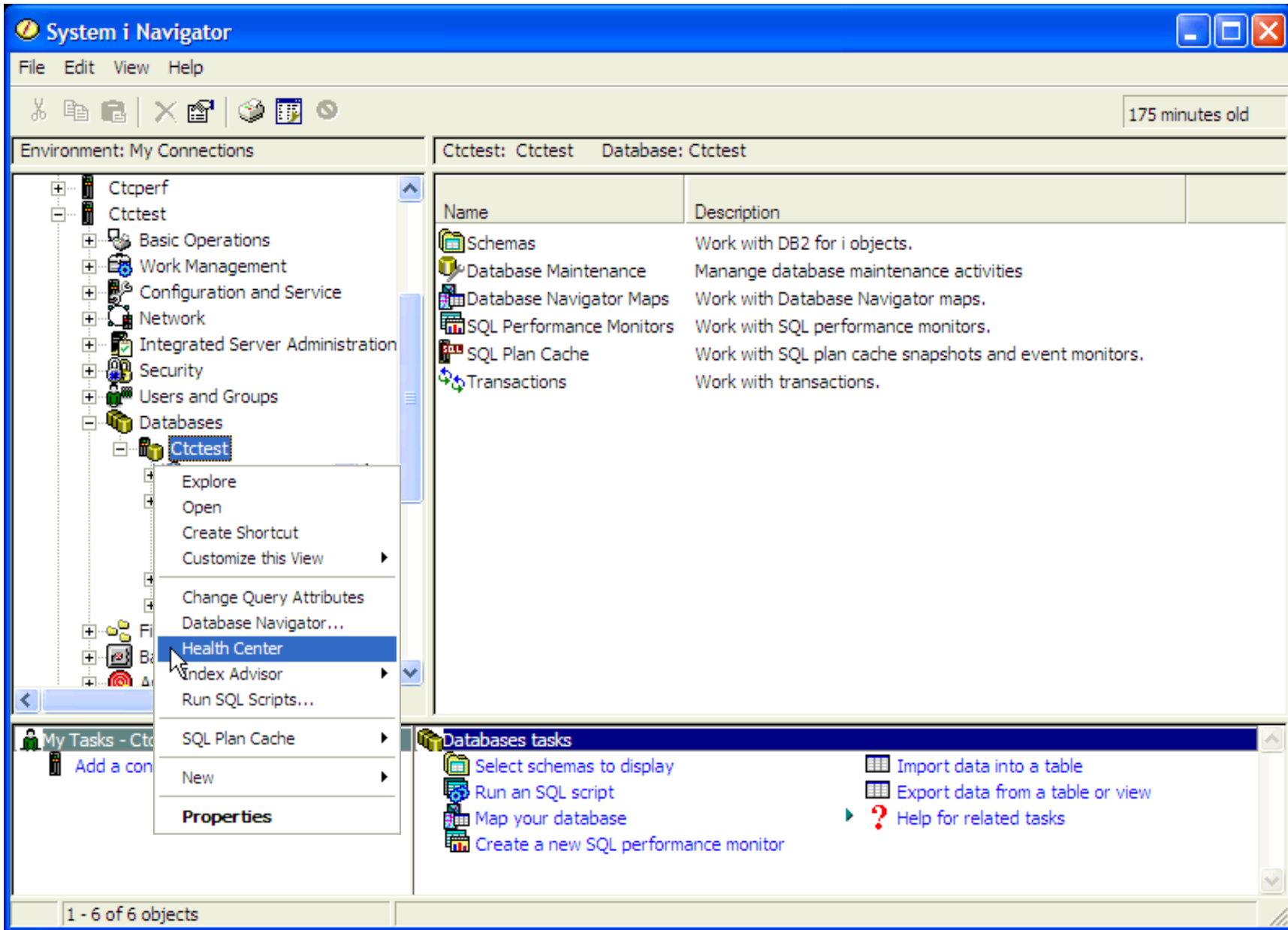
- ✓ create index part_orders_ix3 on part_orders (returnflag, custkey);
- ✓ create index part_orders_ix4 on part_orders (shipmode, custkey);
- ✓ create index part_orders_ix5 on part_orders (orderkey, linenumber, custkey);
- ✓ create index part_orders_ix6 on part_orders (orderkey, custkey);
- ✓ create index part_orders_ix7 on part_orders (returnflag, partkey);
- ✓ create index part_orders_ix8 on part_orders (shipmode, partkey);
- ✓ create index part_orders_ix9 on part_orders (orderkey, linenumber, partkey);
- ✓ create index customers_ix2 on customers (customer, custkey);
- ✓ create index parts_ix2 on parts (part, partkey);
- ✓ create encoded vector index part_orders_evi1 on part_orders (returnflag);
- ✓ create encoded vector index part_orders_evi2 on part_orders (shipmode);

Indexing Strategy – Case Study Results



	Total Time	Max Time	Avg Time
All Indexes	23.547	2.493	0.076
Join Indexes	5,138.851	1,249.081	20.975
No Indexes	6,302.275	1,533.910	20.265

Starting Health Center – Right Mouse Click on DB name



Health Center

- Overview to see database object counts by category
- View database wide or schema specific
 - % wildcards can be used
- Capture to history file
- View history of counts for trending
- Environmental Limits

Health Center - Ctcdbv7r1(C1040f40)

Overview | Environmental Limits | Activity | Size Limits | Design Limits

Settings for analysis
Schema: DB2DEMO

Metric - 4/28/10 12:47:48 PM

Metric - 4/28/10 12:47:48 PM	Value
Schemas	1
Tables	
Views	
Indexes	
Binary radix indexes	12
Encoded vector indexes	1
Constraints	
Triggers	
Aliases	
Procedures	
Functions	
Miscellaneous	
Sequences	0
Global variables	0
SQL packages	0
User-defined distinct types	0
User-defined array types	0
XSR objects	0
Text indexes	0
Journals	1
Journal receivers	3
Schema mask	DB2DEMO

Refresh | View History... | Save...

Monitoring Long Running Jobs – Database Maintenance (7.1)

The screenshot shows the System i Navigator interface. The left pane displays a tree view of the environment, with the 'Database Maintenance' folder under the 'C1040F40' database highlighted by a red circle. The right pane shows a table of database objects with their names and descriptions. The bottom pane shows a list of tasks available for the database.

Name	Description
Schemas	Work with DB2 for i objects.
Database Maintenance	Manage database maintenance activities
Database Navigator Maps	Work with Database Navigator maps.
SQL Performance Monitors	Work with SQL performance monitors.
SQL Plan Cache	Work with SQL plan cache snapshots and event mon
Transactions	Work with transactions.
OmniFind Text Search	OmniFind Text Search Server for DB2 for i.

Task	Description
Select schemas to display	Import data into a table
Run an SQL script	Export data from a table or view
Map your database	Help for related tasks

Table Re-orgs (as an example)

The screenshot shows the IBM System i Navigator interface. The main window is titled "System i Navigator" and displays a tree view of database objects on the left and a table of table reorganizations on the right.

Environment: My Connections

- XML Schema Repository (C)
- OmniFind Text Indexes
- QGPL
- SPLMCHRM
- Database Maintenance
 - Check Pending Constraints
 - Index Builds
 - Index Rebuilds
 - Table Alters
 - Table Reorganizations**
 - Text Index Builds
- Database Navigator Maps
- SQL Performance Monitors
- SQL Plan Cache
- Transactions
- OmniFind Text Search
- Text Servers
- 1
- Text Indexes

Ctcdbv7r1: Table Reorganizations Database: C1040f40

Name	Schema

My Tasks - Ctcdbv7r1

- Add a connection

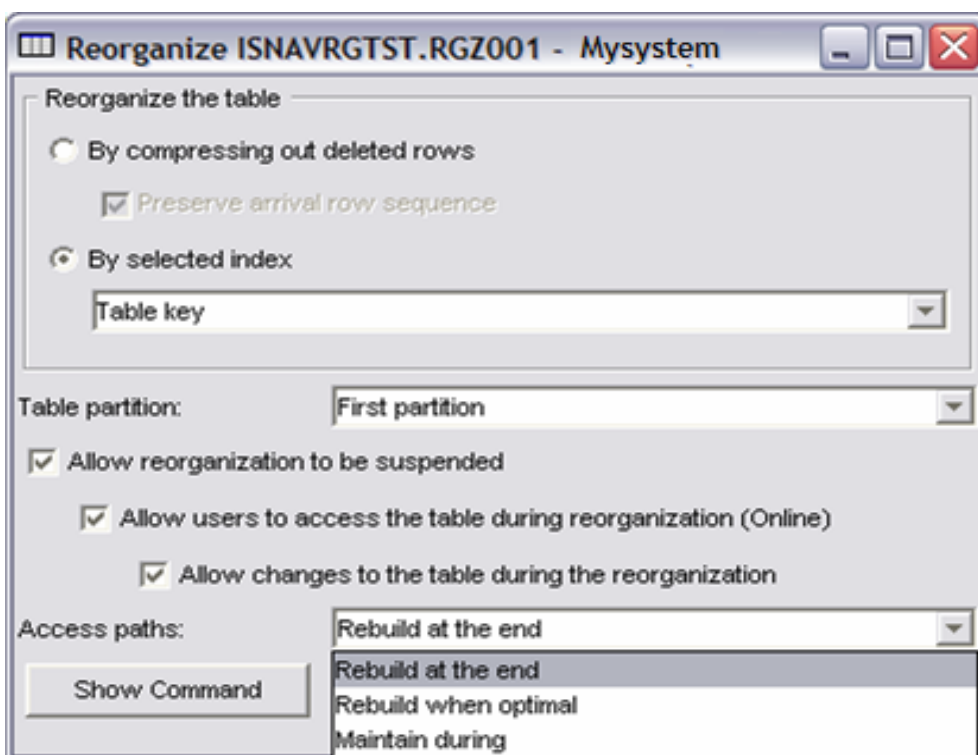
Databases tasks

- Select schemas to display
- Run an SQL script
- Map your database
- Import data into a table
- Export data from a table or
- Help for related tasks

0 objects

Reorganize Table Progress Monitoring

- New reorganize table options:
 - Allow suspend (cancel)
 - Allow online access
 - Allow changes
 - Influence when to rebuild access paths
- Allow reorganize to be suspended and resumed later



Right Mouse click on the reorg to see status

Reorganize MJATST2.DBITXTTBL - Ctcdbv7r1(C1040f40)

Status: In progress

- ✓ Preparation phase (100% complete)
- Reorganization phase
 - Reorganizing rows (45.67% complete)
 - ⊕ Rebuilding access paths (Progress. complete)



Details:

Partition:	First partition
Reorganize the table by:	Compressing out delet..
Allow reorganization to be suspended:	Yes
Allow users to access the table during reorganization (Online):	Yes
Allow changes to the table during reorganization:	Yes
Access paths:	Rebuild at the end
Reorganization job:	001766/Quser/Qzdasoi..
Current number of rows:	1280196
Number of deleted rows:	239985
Number of rows to reorganize:	320181
Parallel degree requested:	*10
Parallel degree used:	0
Total Elapsed time:	00:00:23
History	
4/27/10 9:41:45 AM to 4/27/10 9:42:08 AM:	00:00:23

Taskbar: bunnav... | C:\Documents ... | C:\Documents ... | untitled - Paint

DB2 for i Center of Excellence (Lab Services)

■ How can we help?

- IBM i for Business Intelligence Installation Services
- DB2 Web Query Getting Started Services
- Query/400 Modernization Services 
- DB2 for i Modernization Workshop(s)
- DB2 for i SQL Performance Workshop
- DB2 for i SQL Performance Health Check
- DB2 for i Very Large Database (VLDB) Assessment*
- DB2 for i remote database administration and engineer services 

For more information, contact Mike Cain (cain@us.ibm.com)
Or Doug Mack (mackd@us.ibm.com)



IBM Systems and Technology Group Lab Services
Helping our clients WIN the race

