DBA Tools with System i Navigator

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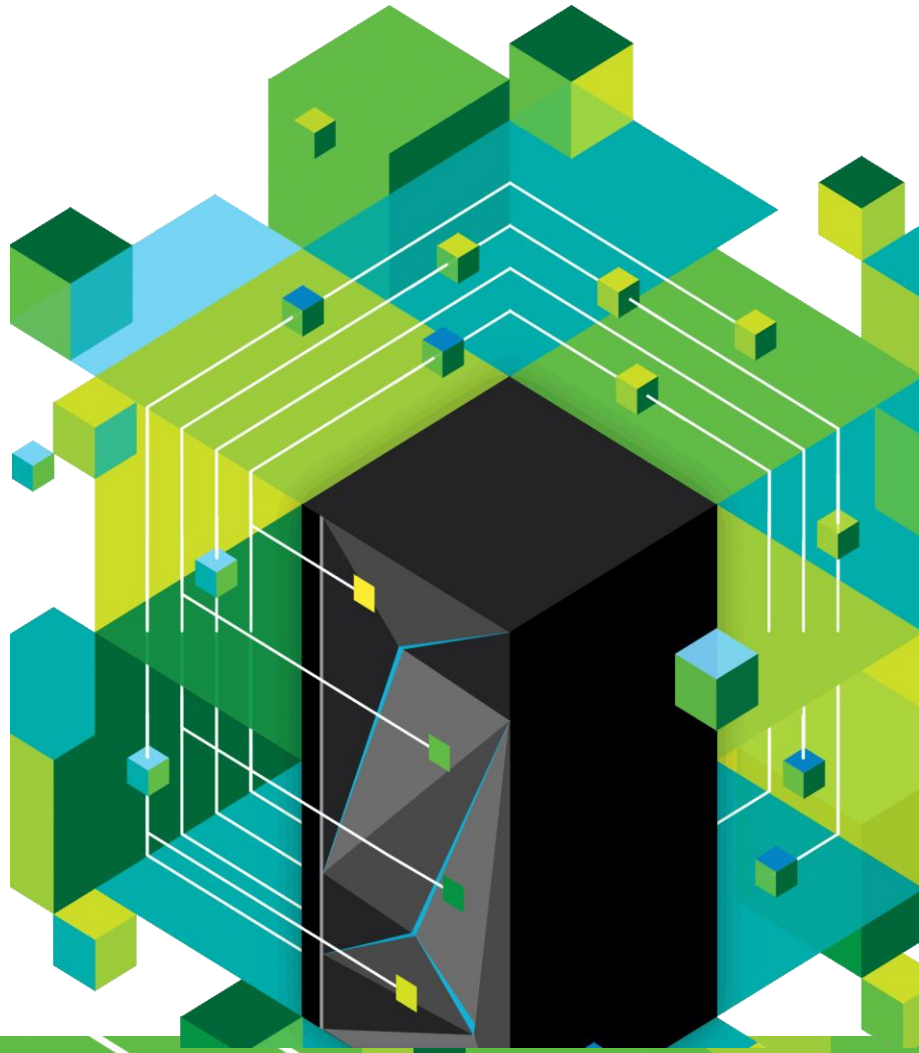

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Why do I need a DBA?

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:

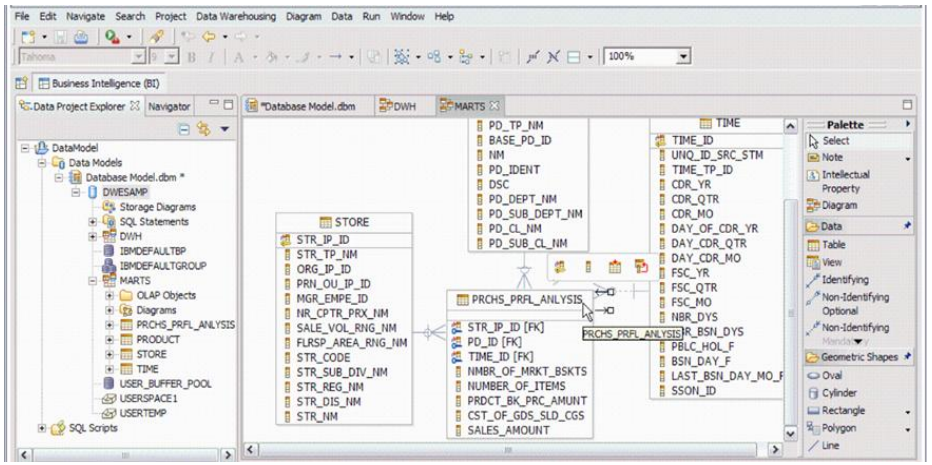
- http://www-03.ibm.com/systems/i/software/access/
  - (PTFs are available from a link off the above page)

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
  - SQuirreL

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:

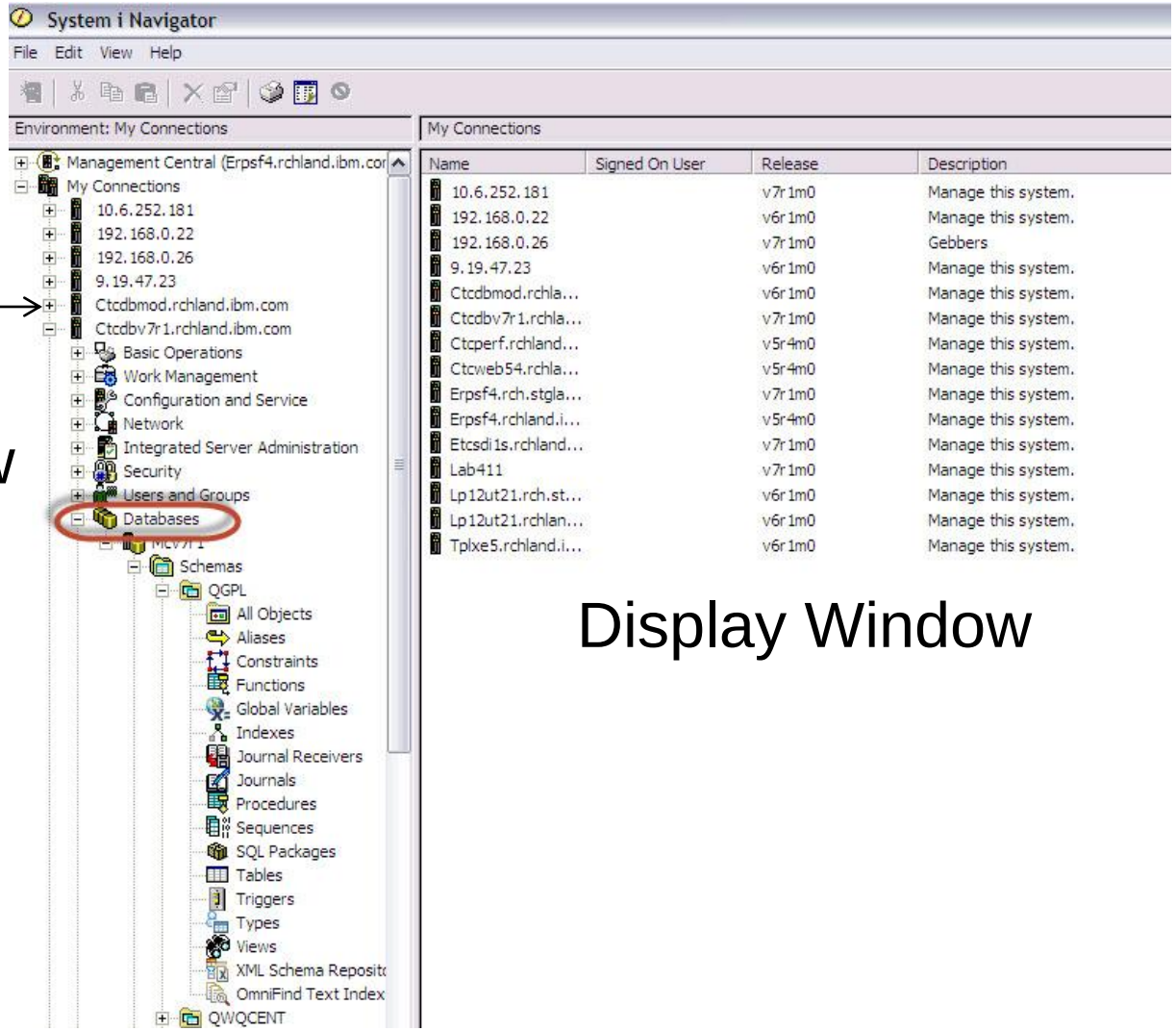
```
CHGFCNUSG FCNID(QIBM_DB_SQLADM)
    USER(userid) USAGE(*ALLOWED)

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

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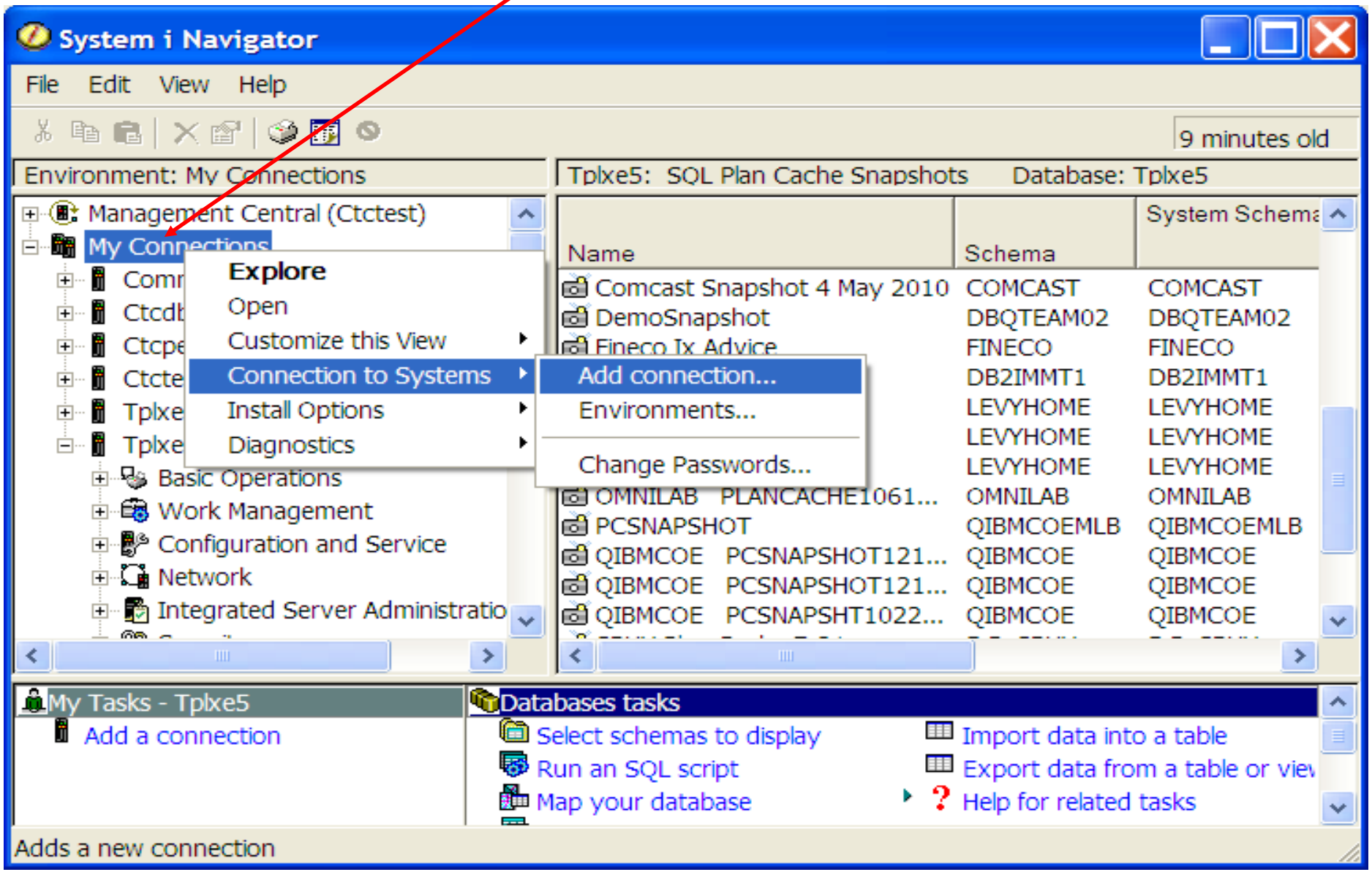
Add a connection

Right Click on My Connections



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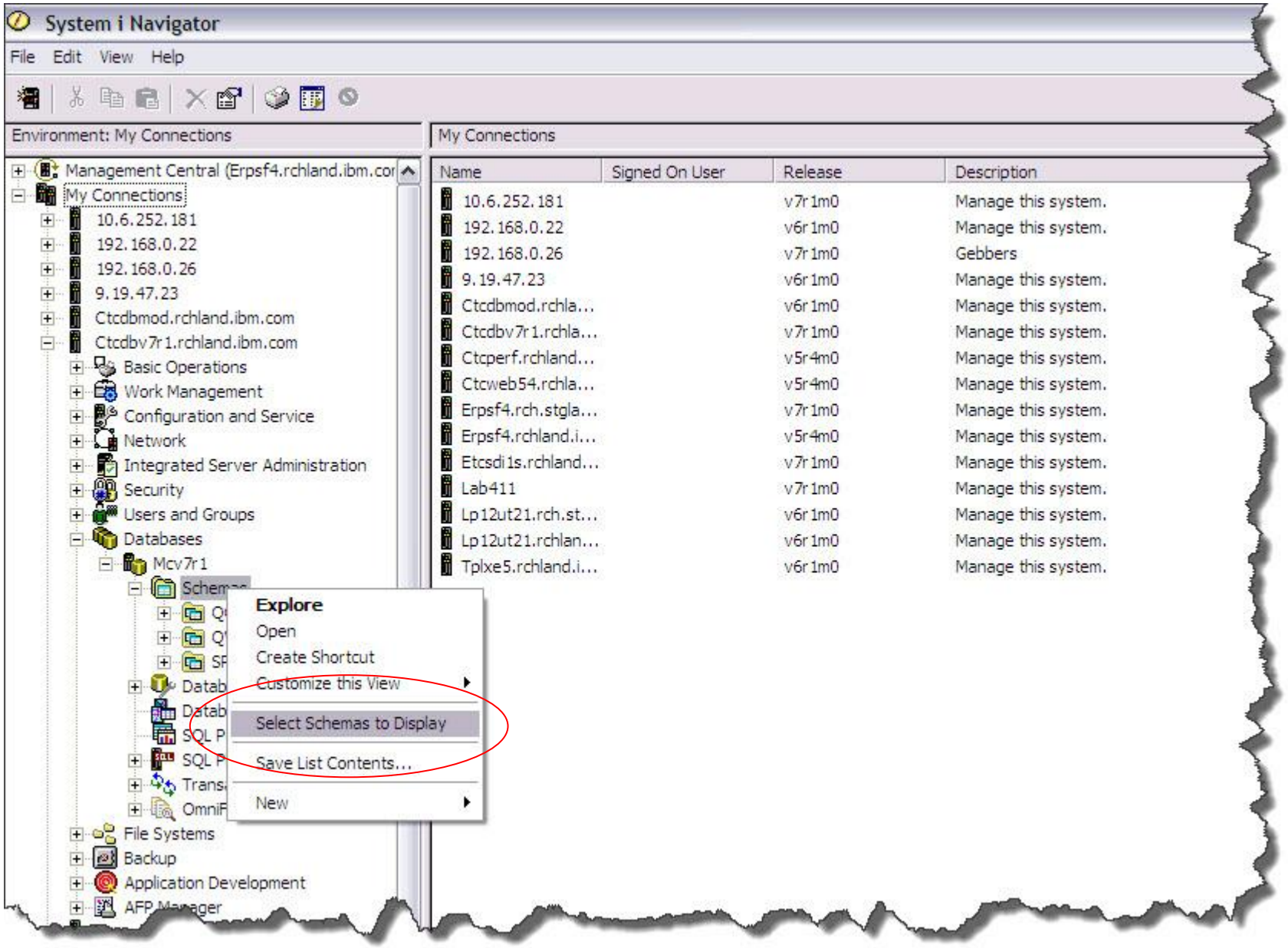
Select Schemas (Libraries) to display – right click on Schemas



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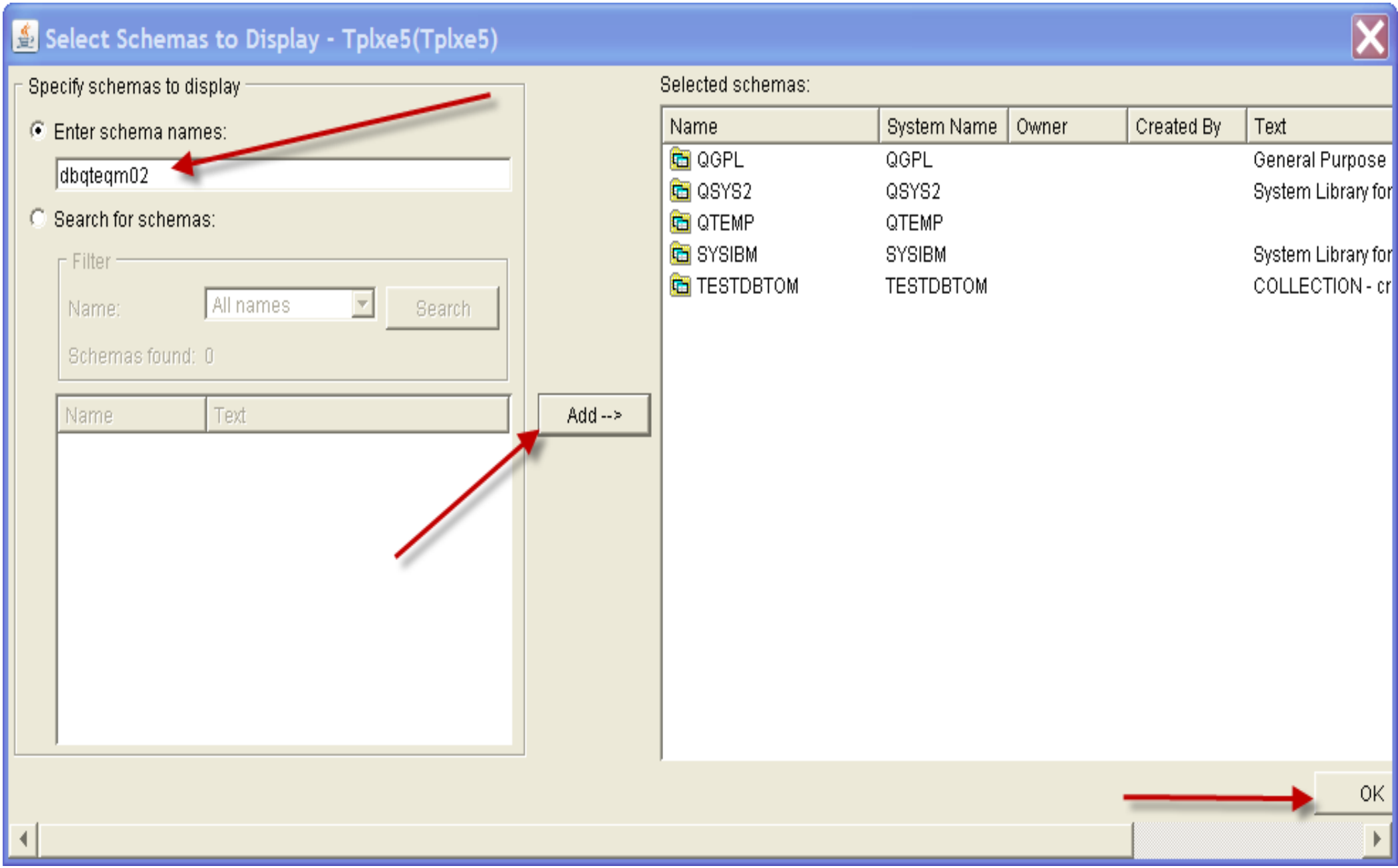
Select Schema to include in the list



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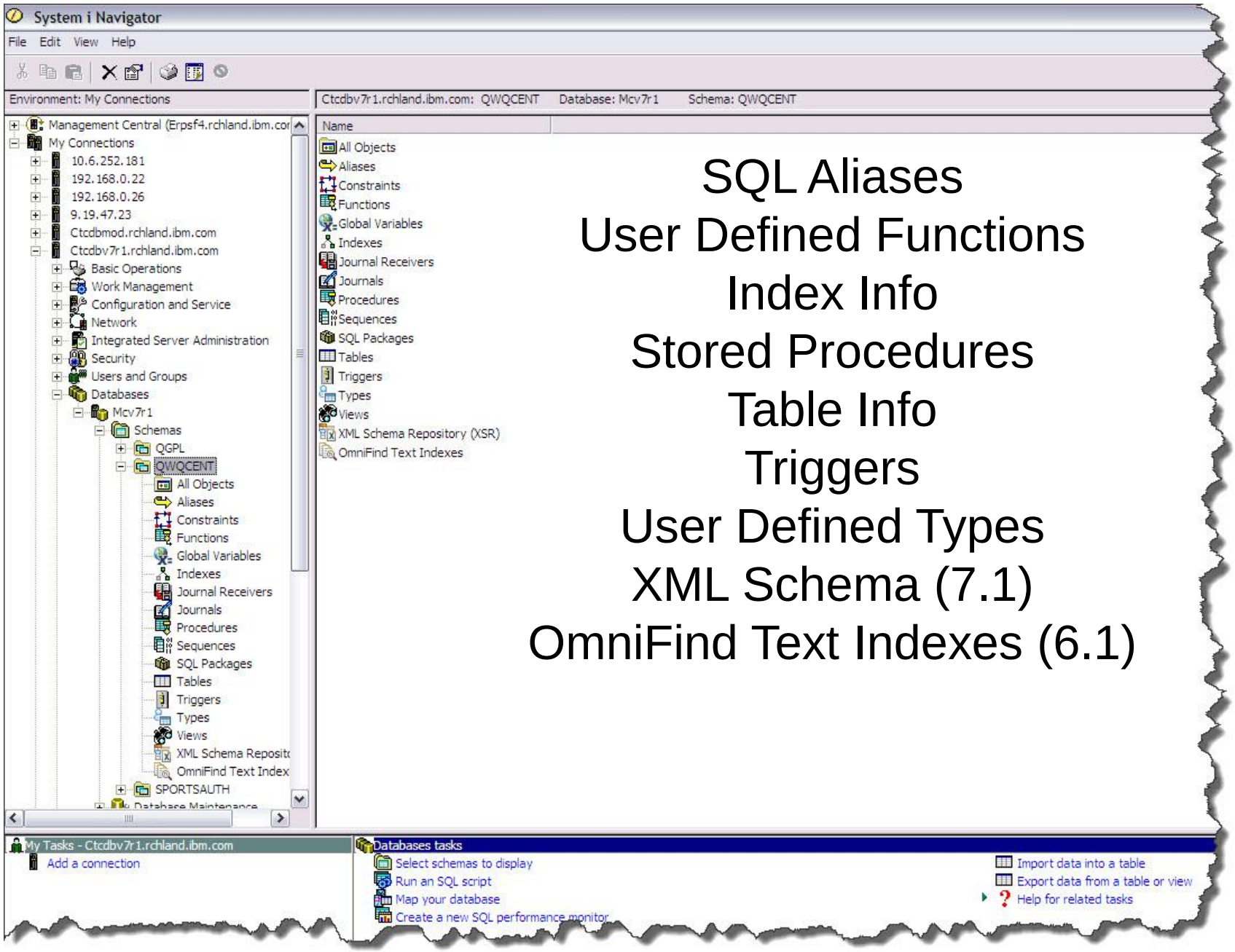
View objects within schema by selecting that schema



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

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

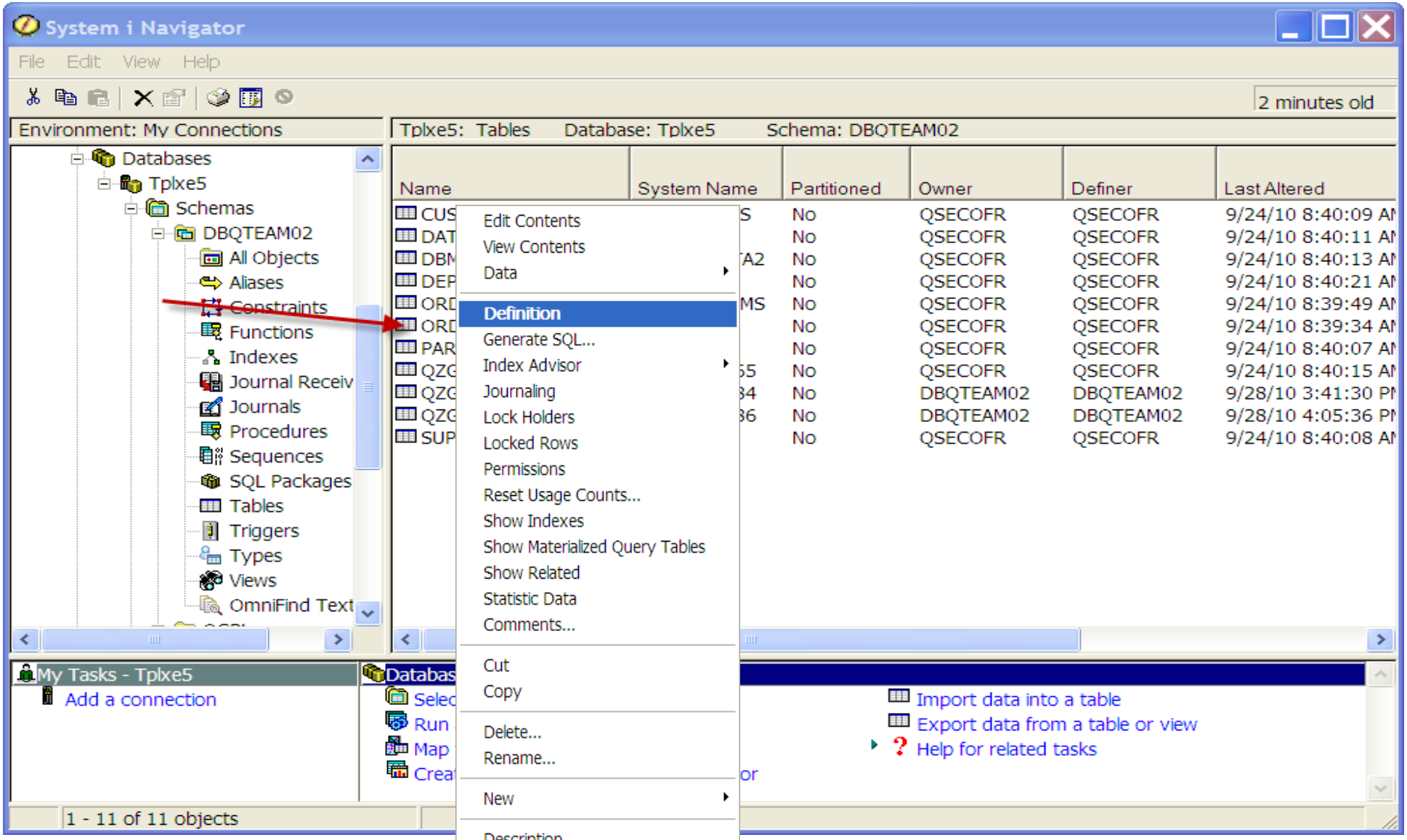

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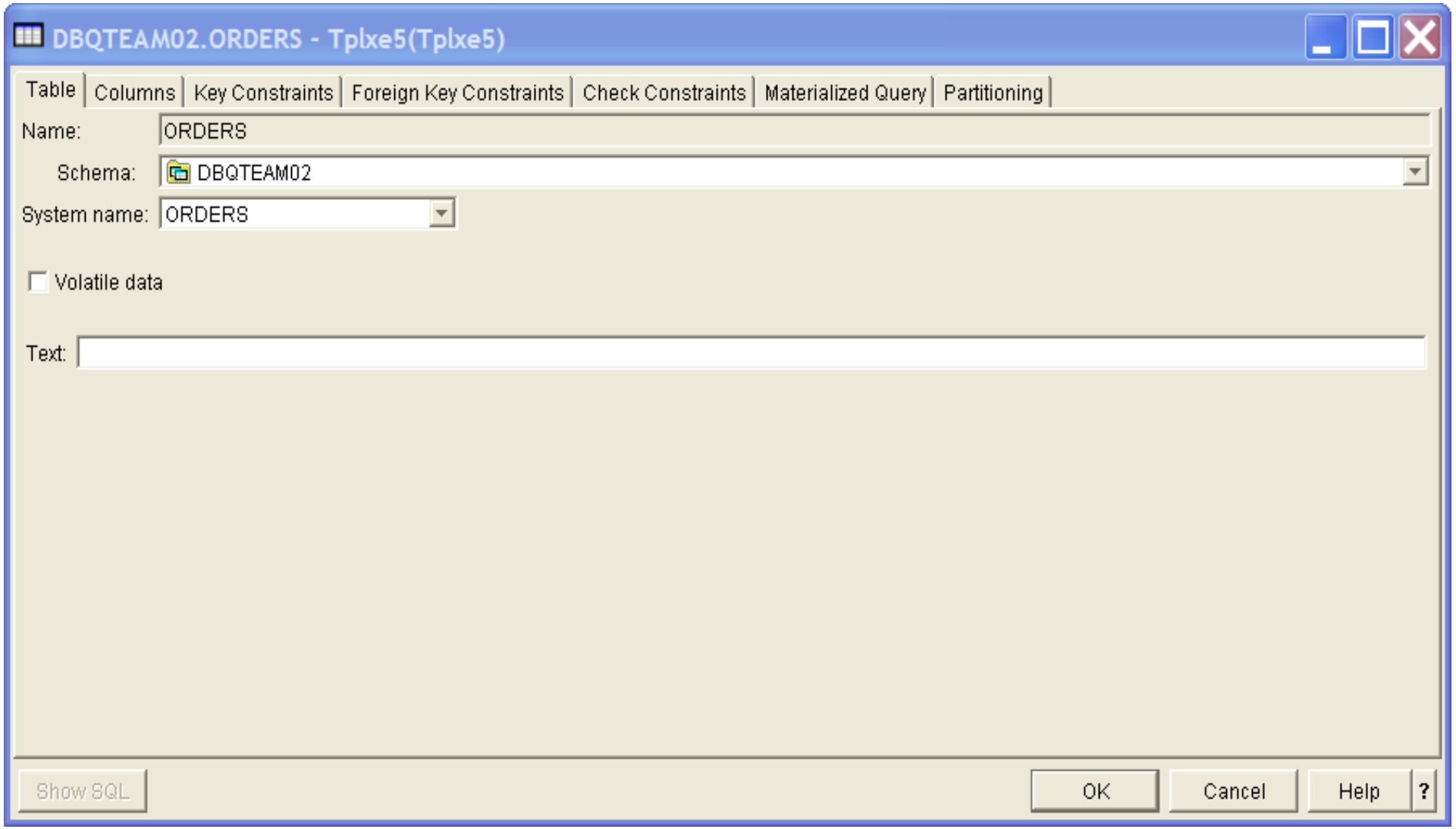
Table Definition



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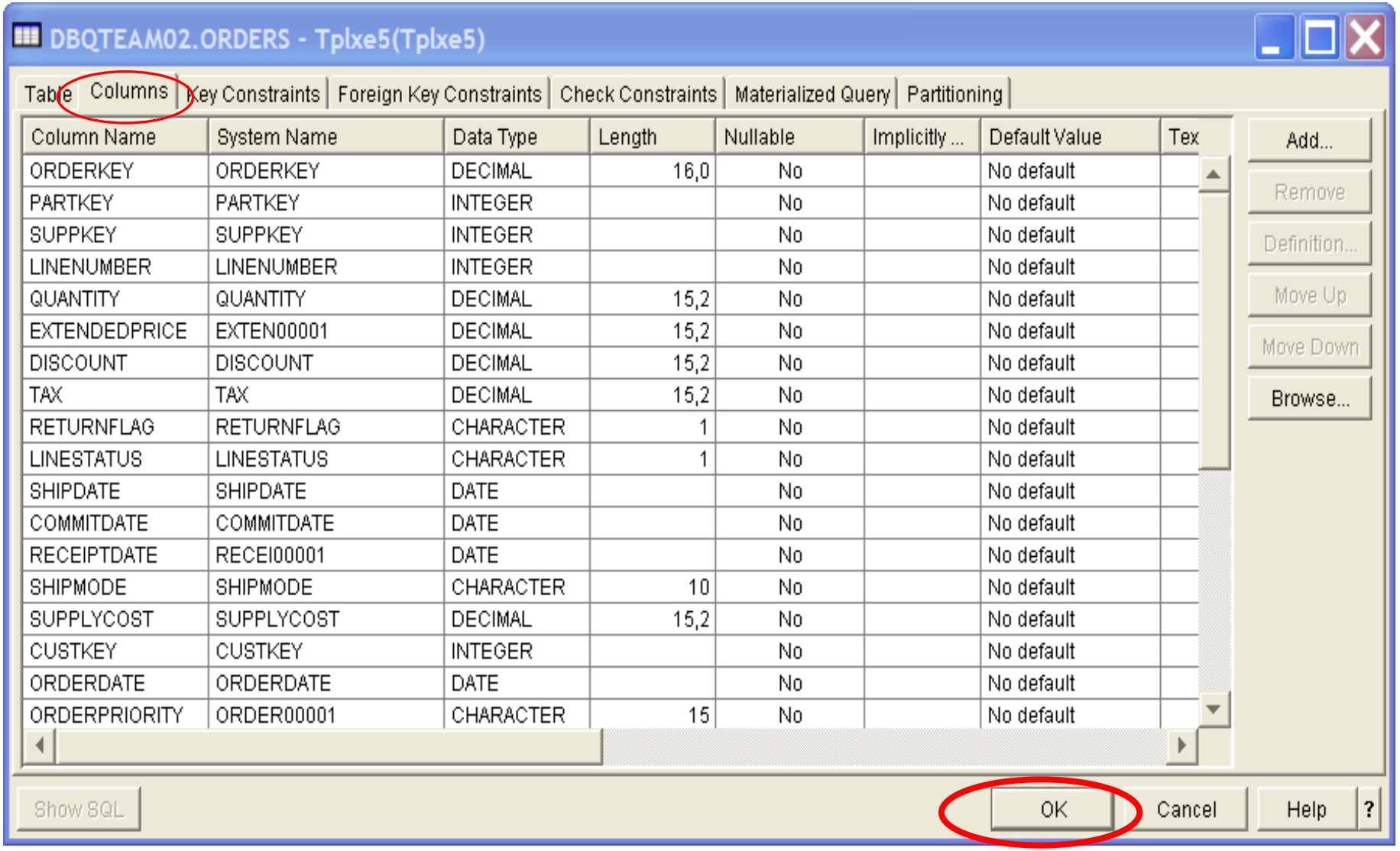
Show Column Definitions



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View or Add Constraints

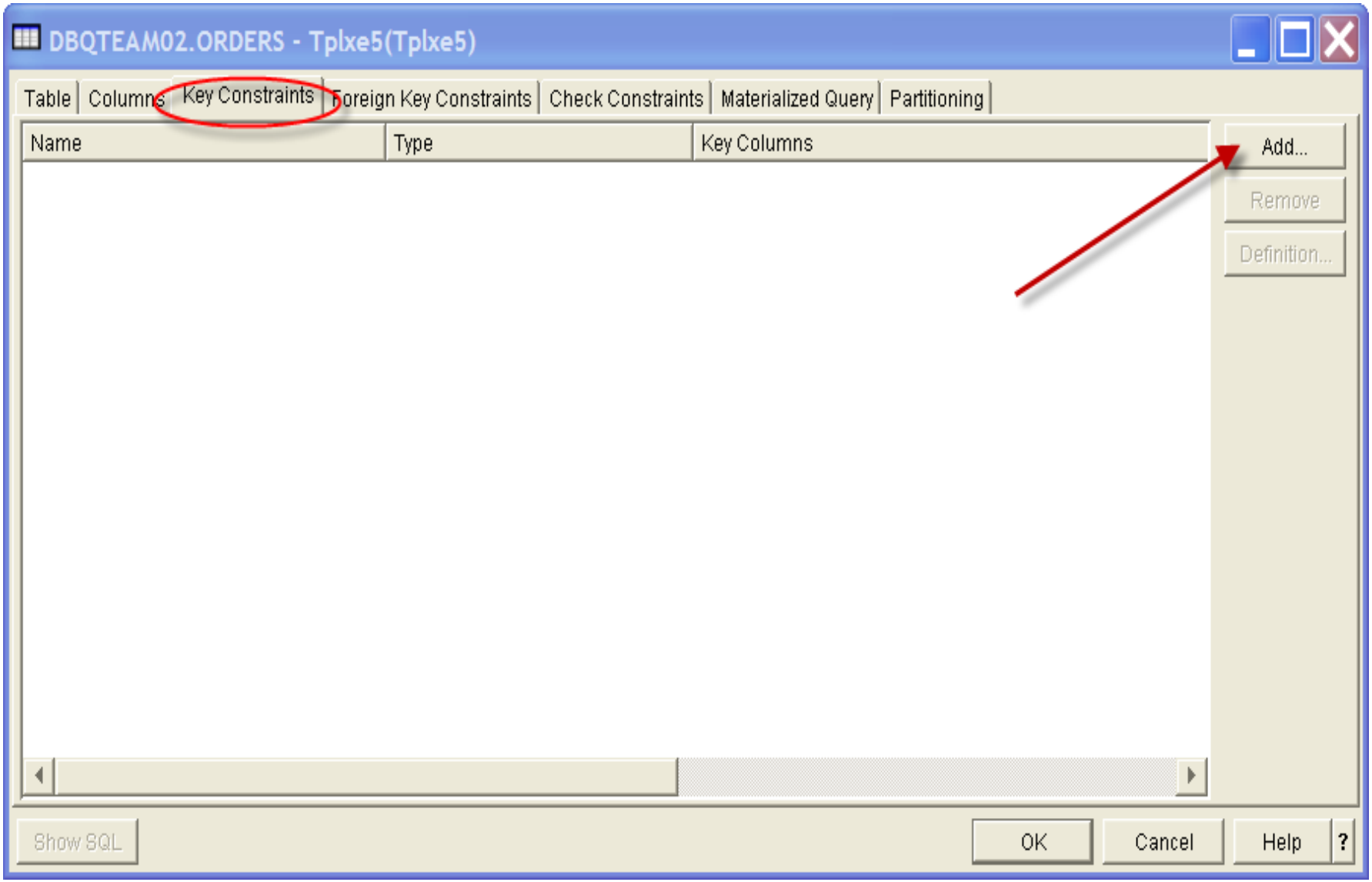

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Table Description

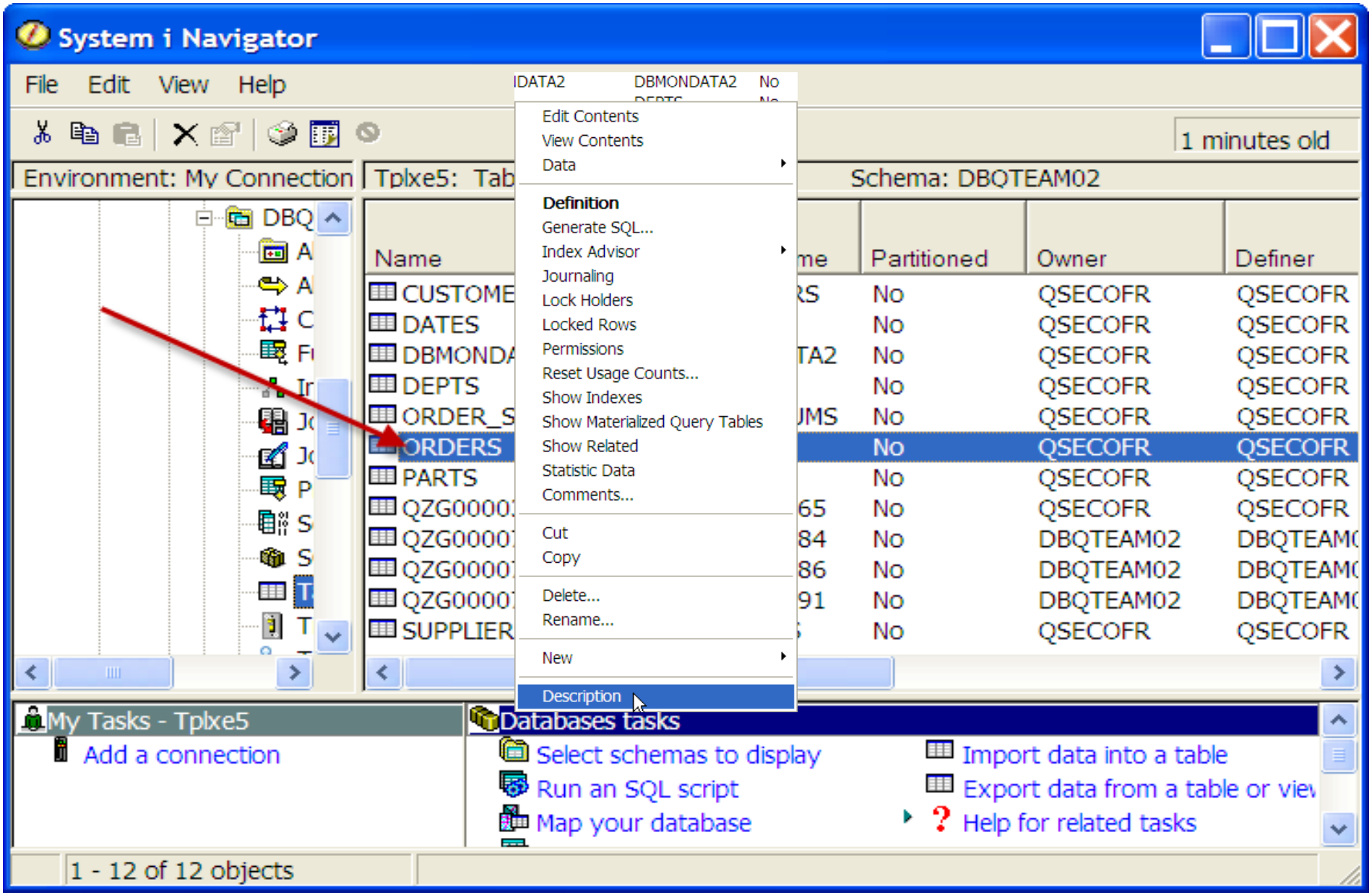

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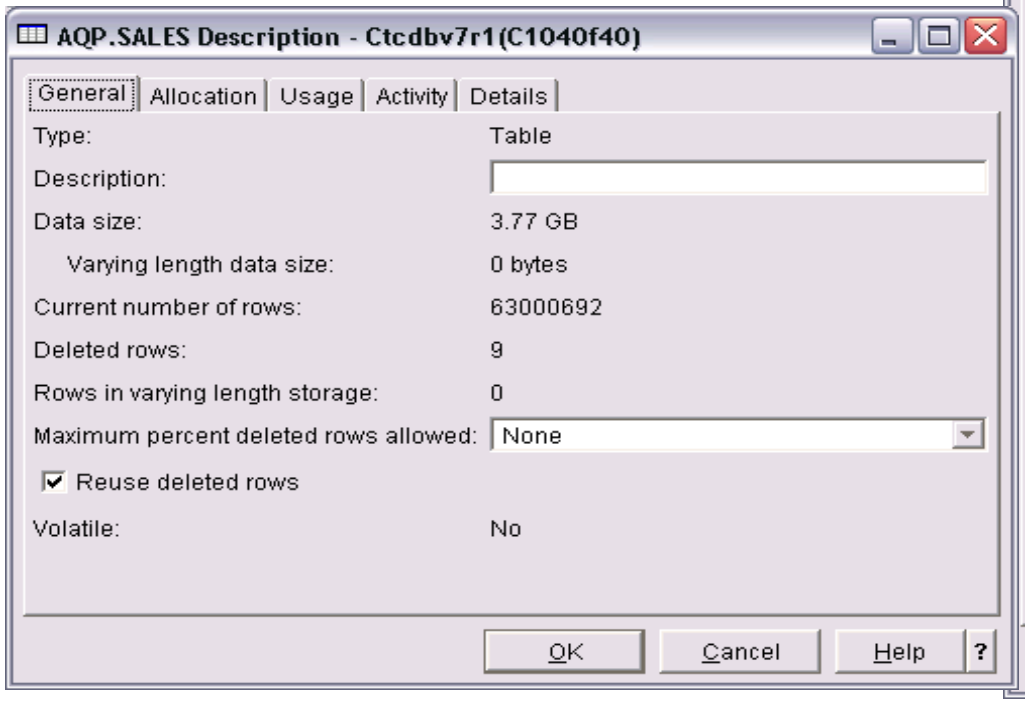
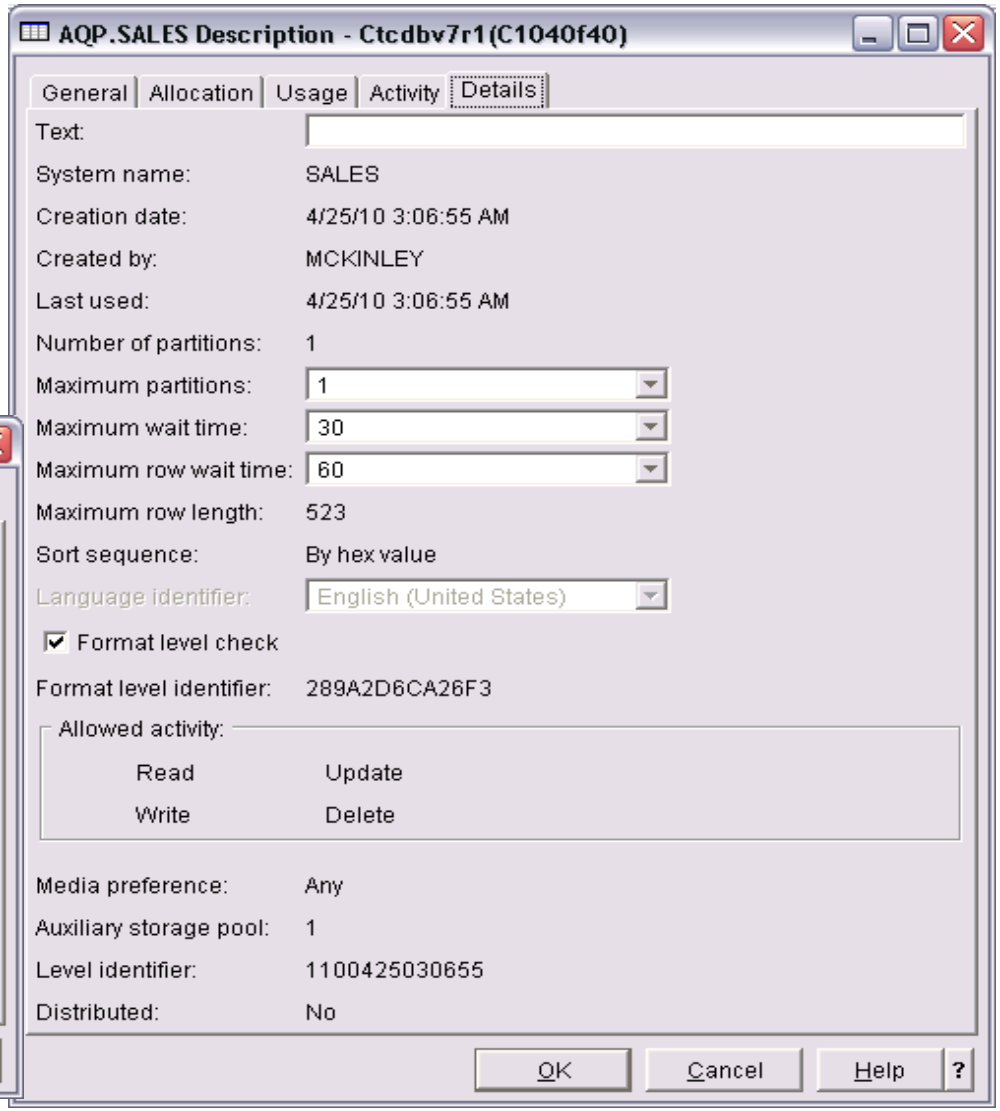
Table Description

Answers questions like:

How big is this table/file getting anyway?

- Works for indexes and views too!





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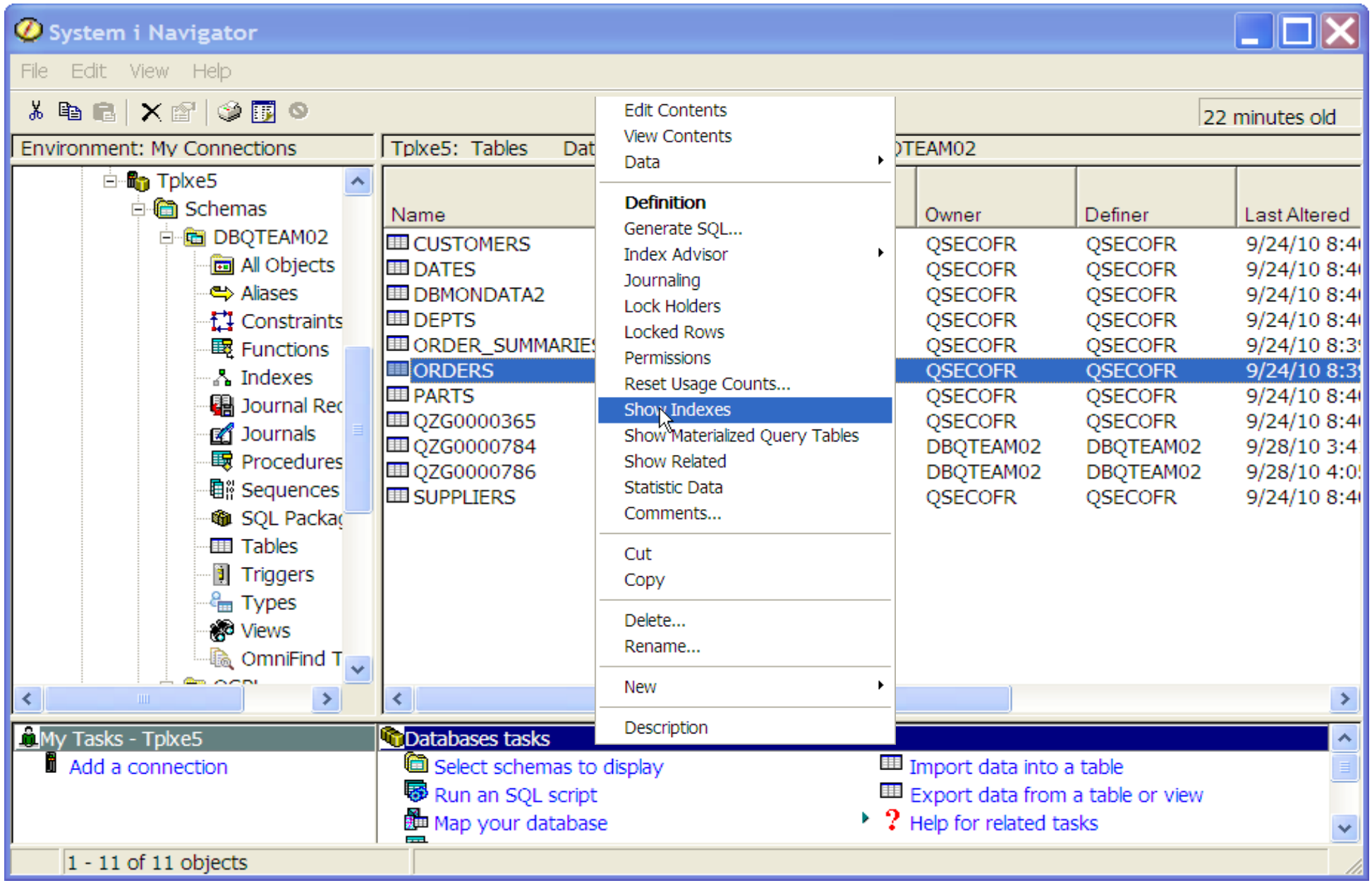
Show Indexes from TABLE list – right click, Show Indexes



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Index Information for a table

Indexes for DBQTEAM02.ORDERS - Tplxe5

File Edit View Help

6 minutes old

Database: Tplxe5 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

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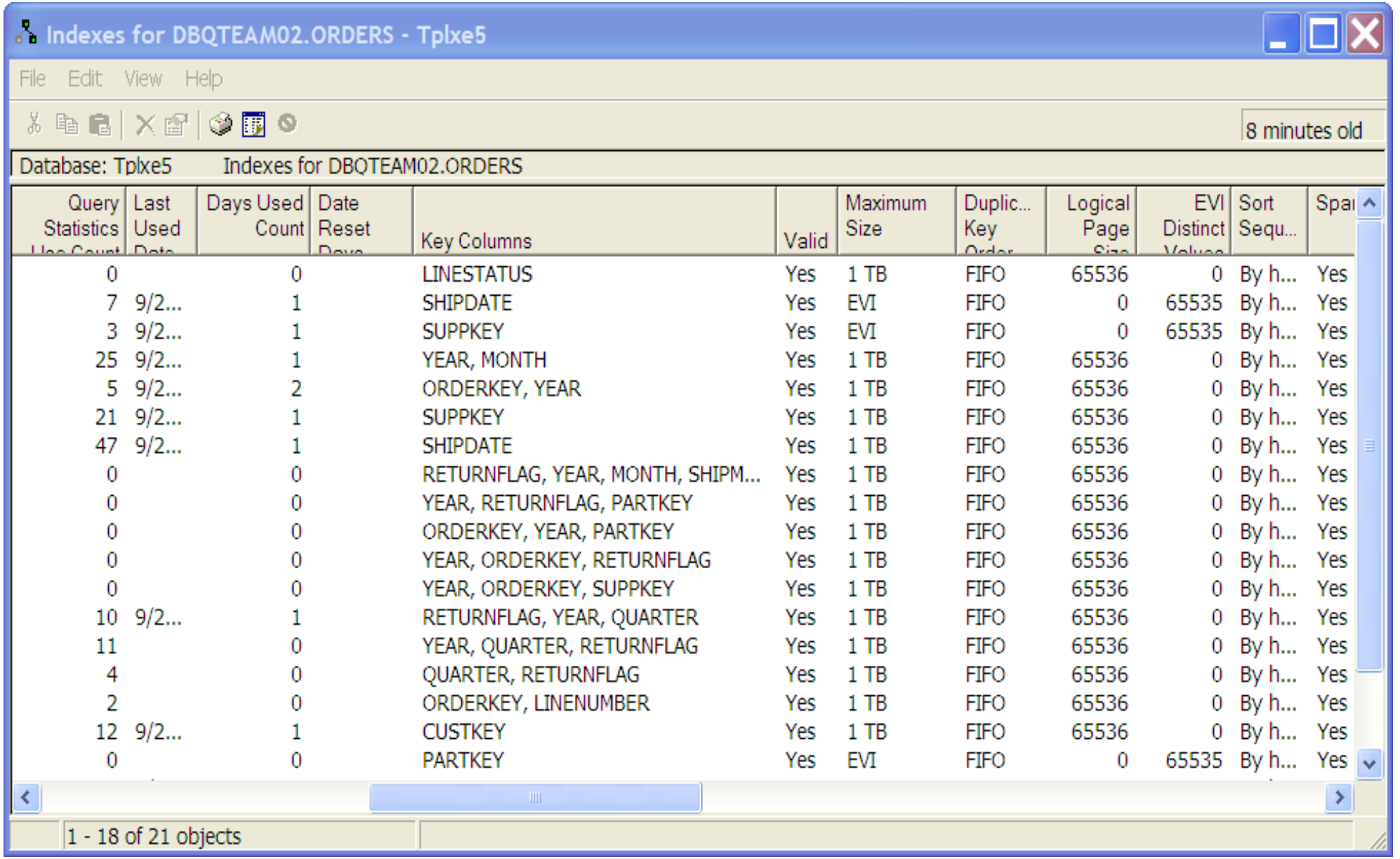
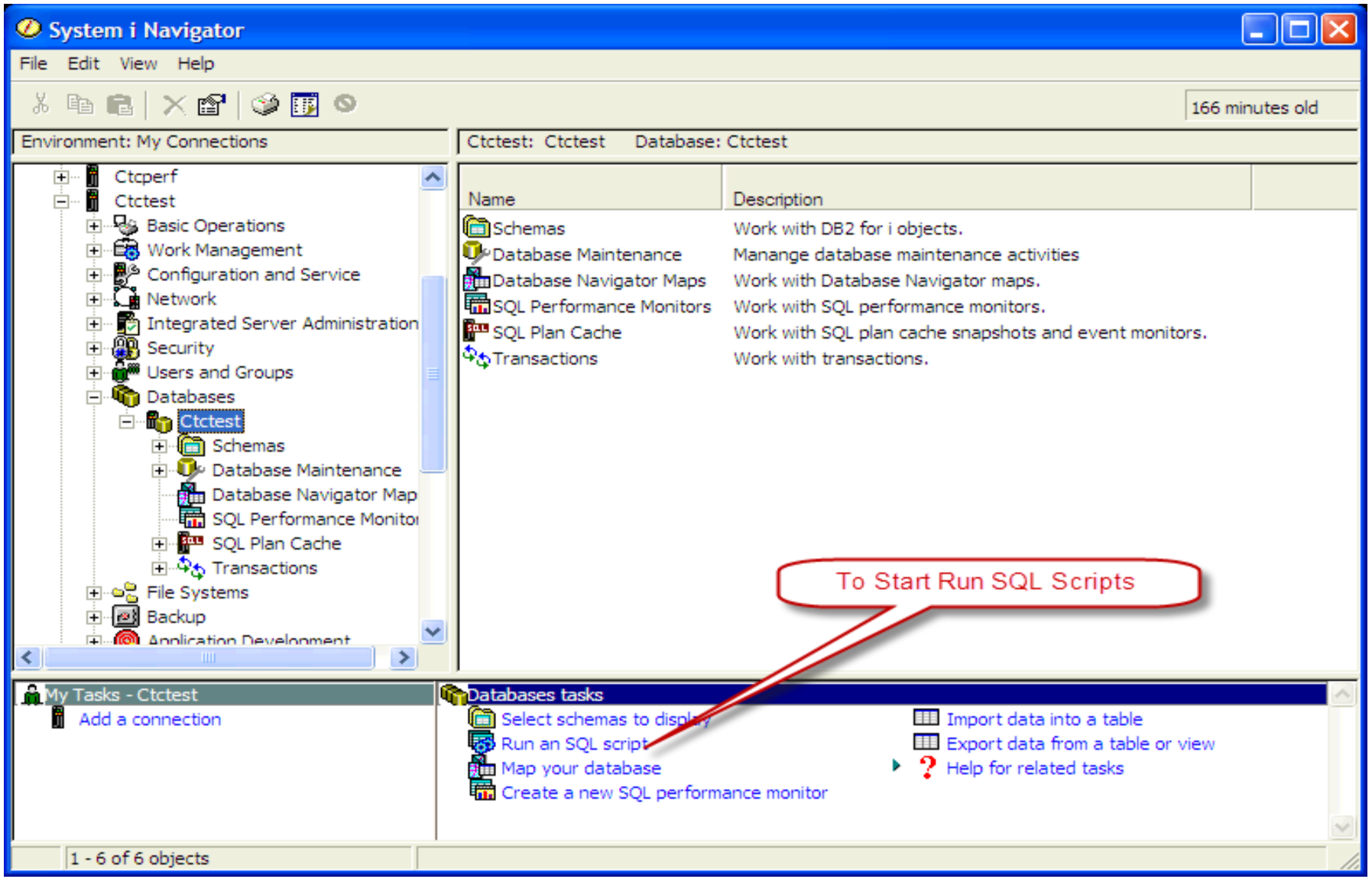
Additional index information



Query Statistics	Last Used	Days Used Count	Date Reset	Key Columns	Valid	Maximum Size	Duplic... Key	Logical Page	EVI Distinct	Sort Sequ...	Spar
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

Creating Objects with SQL Scripting and Wizards



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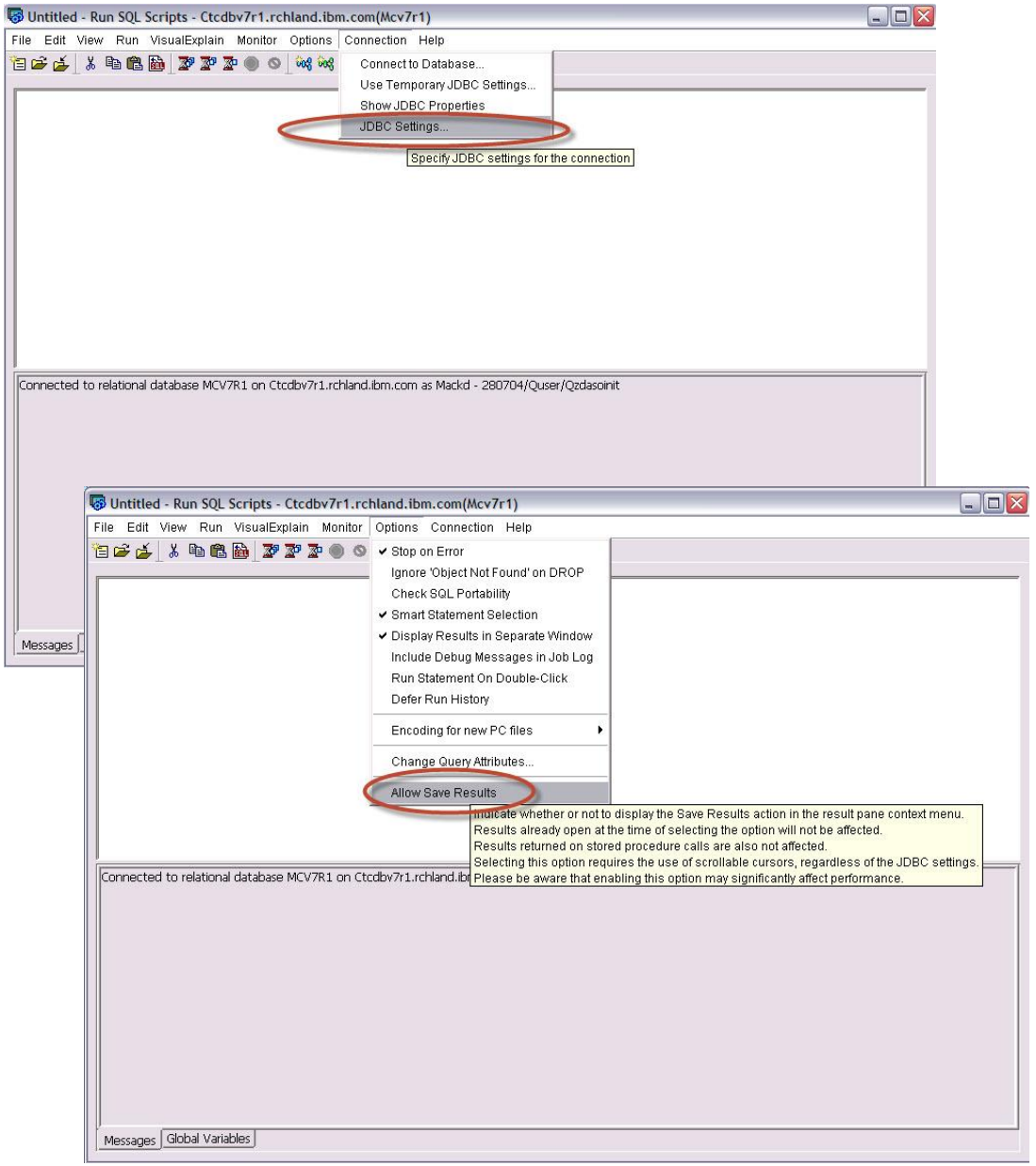
Run SQL Scripts Settings

- 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



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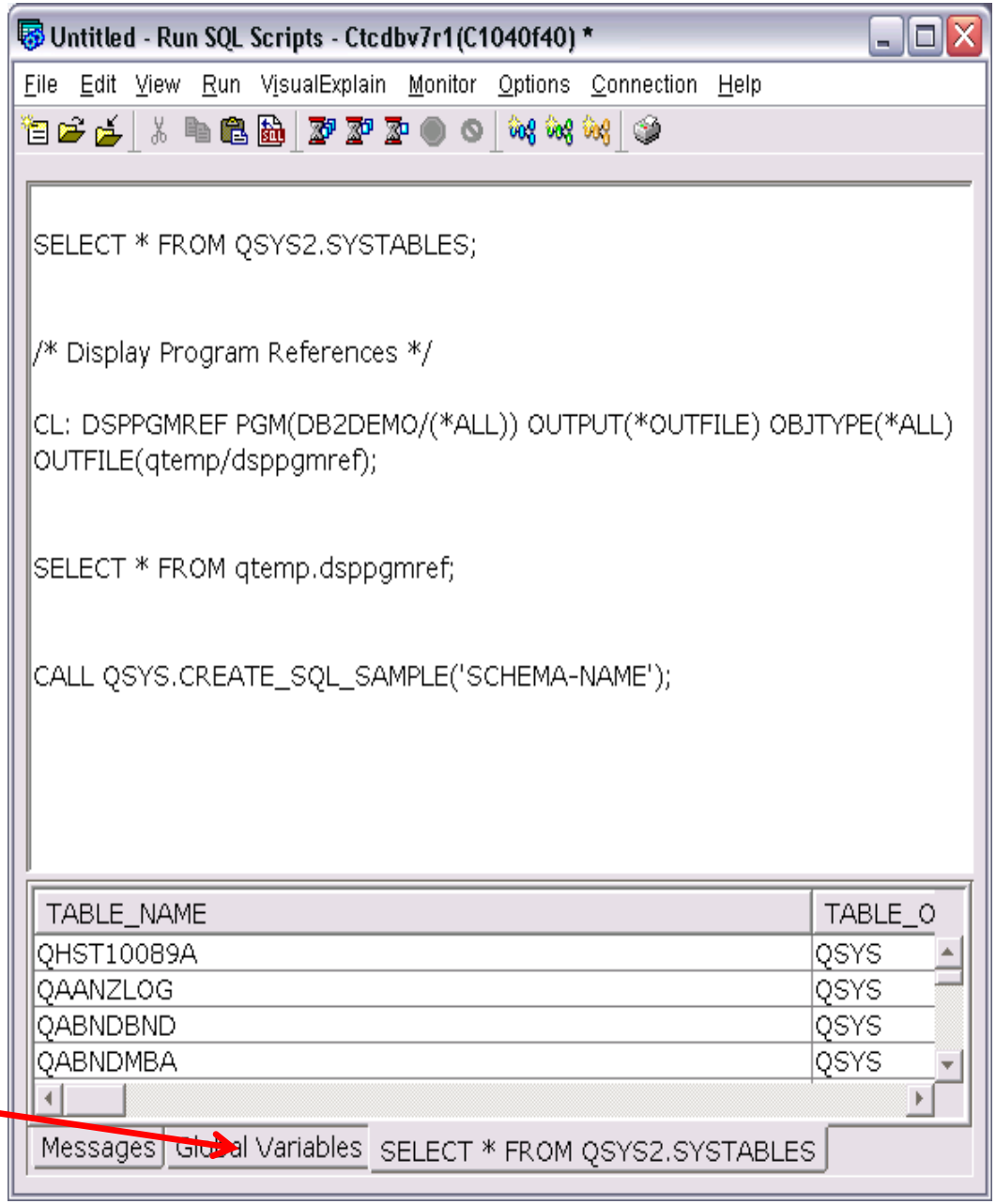
Run SQL Scripts

- 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)



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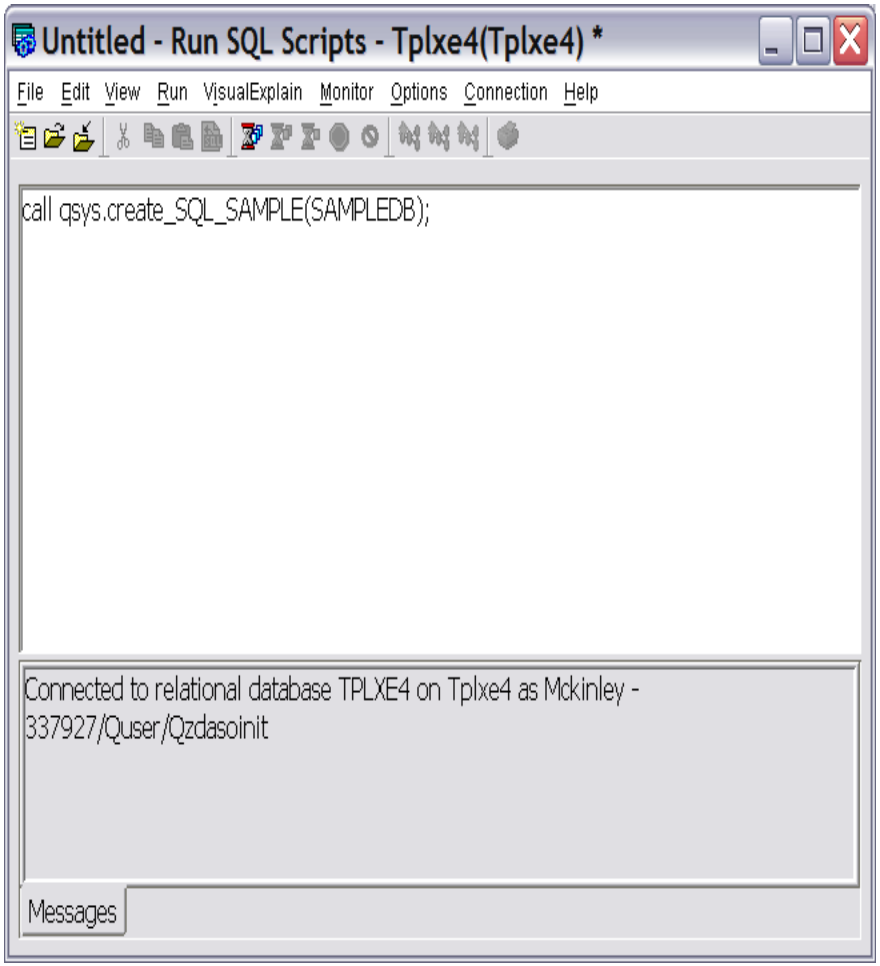
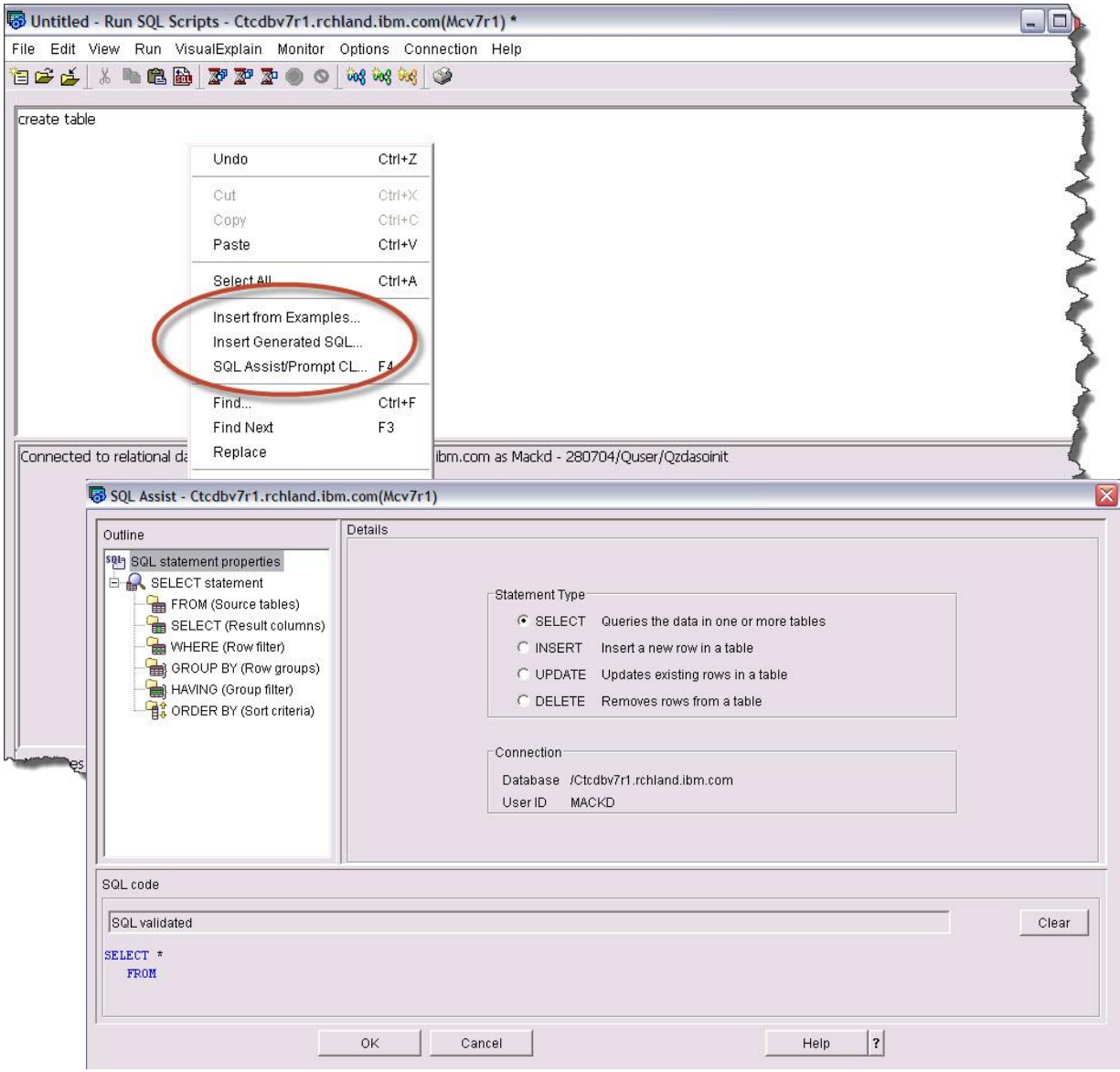
Creating a Schema (Library) with Free Form SQL

- 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



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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

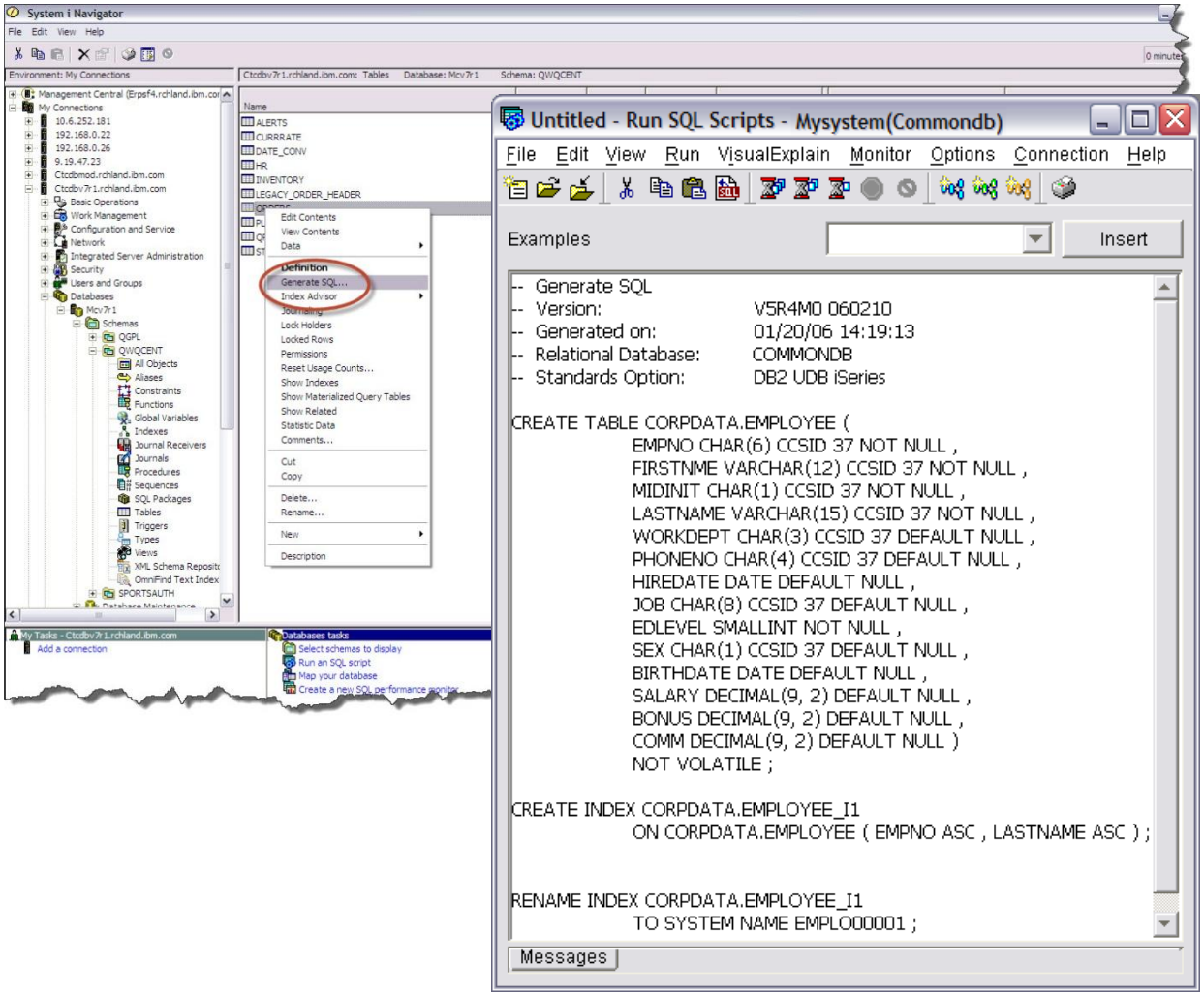
See what the SQL form of my DDS-created files would be like

Include generating short names of objects

Save to

- SRCPF
- IFS file
- UTF8 file
- Spread sheet

Does not generate RI and triggers for tables



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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

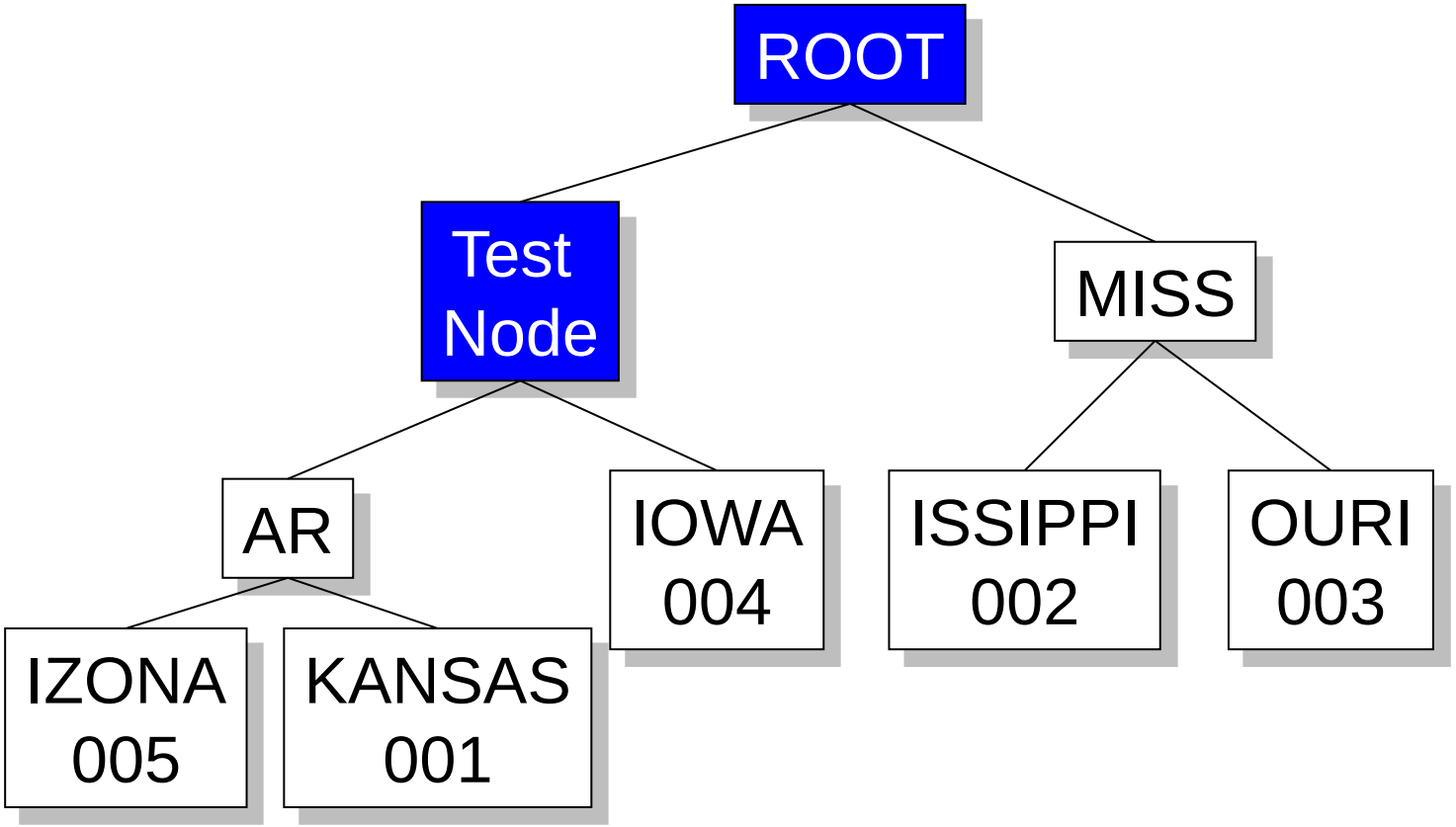
is both a *Science* and an *Art*.

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));
```

Encoded Vector Index (EVI)

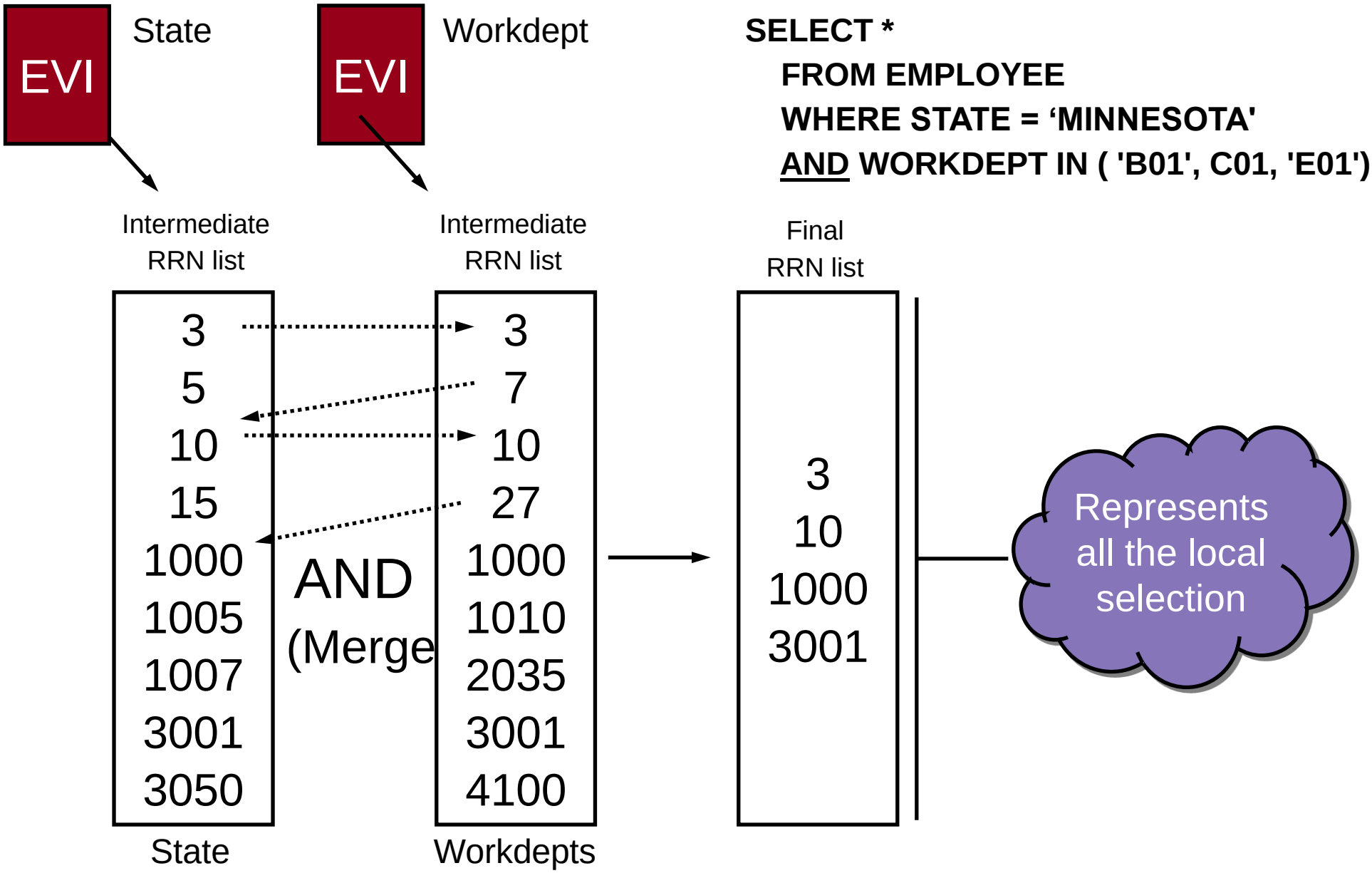
Symbol Table				
Key Value	Code	Count	Include Sum()	Include Sum()
Arizona	1	5000	1500	2005
Arkansas	2	7300	3200	450
…				
Wisconsin	49	340	575	1200
Wyoming	50	2760	210	0

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 then 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

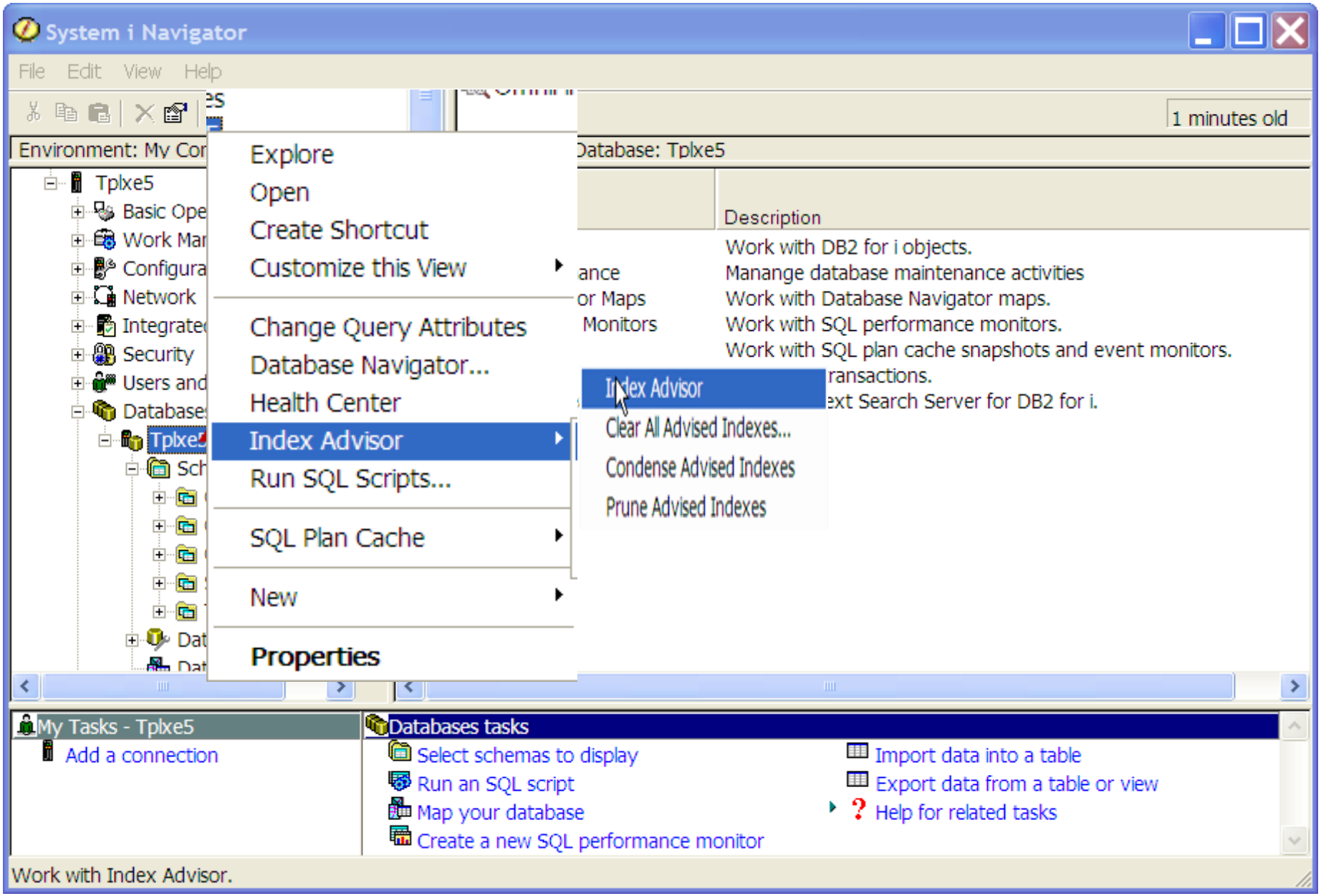
What should you do?

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



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Index advice

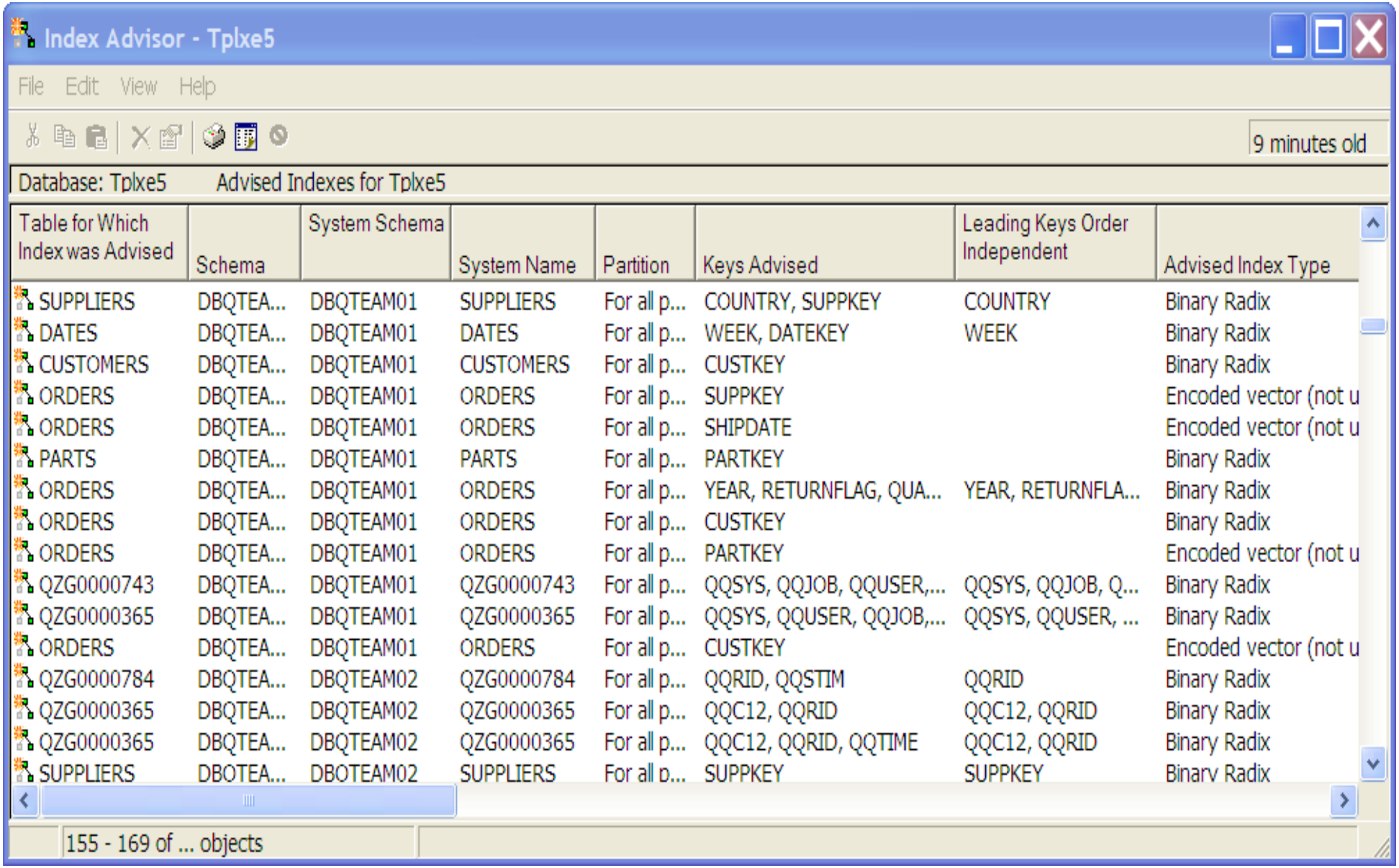

Table for Which Index was Advised	Schema	System Schema	System Name	Partition	Keys Advised	Leading Keys Order Independent	Advised Index Type
SUPPLIERS	DBQTEA...	DBQTEAM01	SUPPLIERS	For all p...	COUNTRY, SUPPKEY	COUNTRY	Binary Radix
DATES	DBQTEA...	DBQTEAM01	DATES	For all p...	WEEK, DATEKEY	WEEK	Binary 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	DBQTEA...	DBQTEAM02	SUPPLIERS	For all p...	SUPPKEY	SUPPKEY	Binary Radix

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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 Advi...	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

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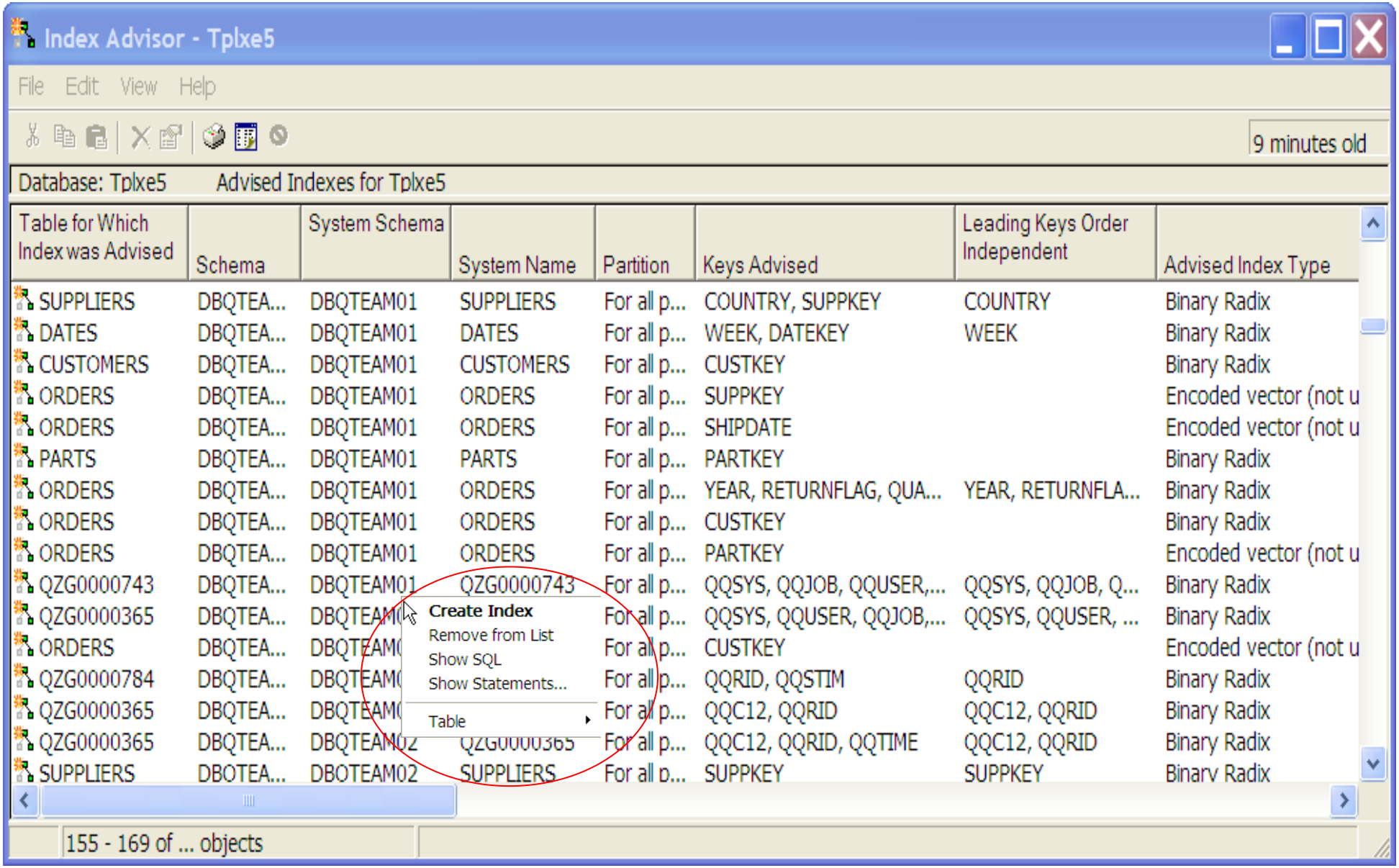
Create Index by….right clicking on Index advised



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SQL Statement Analysis

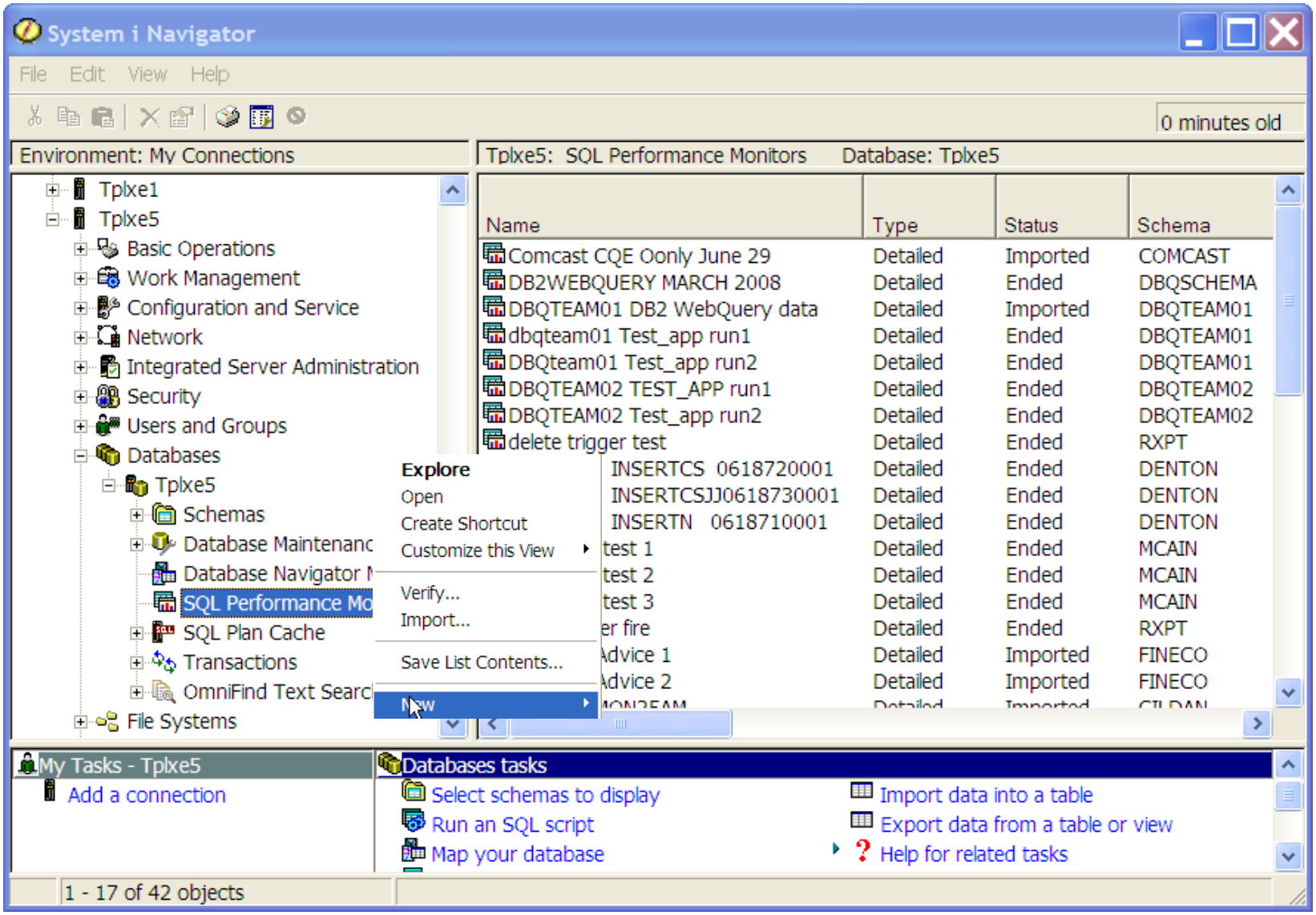
- Database Monitor
  - Requires you to turn it on (iNav, also STRDBMON CL Command)
    - Summary – no problem, run all day, but limited analysis available
    - Detail – BE VERY CAREFUL

      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



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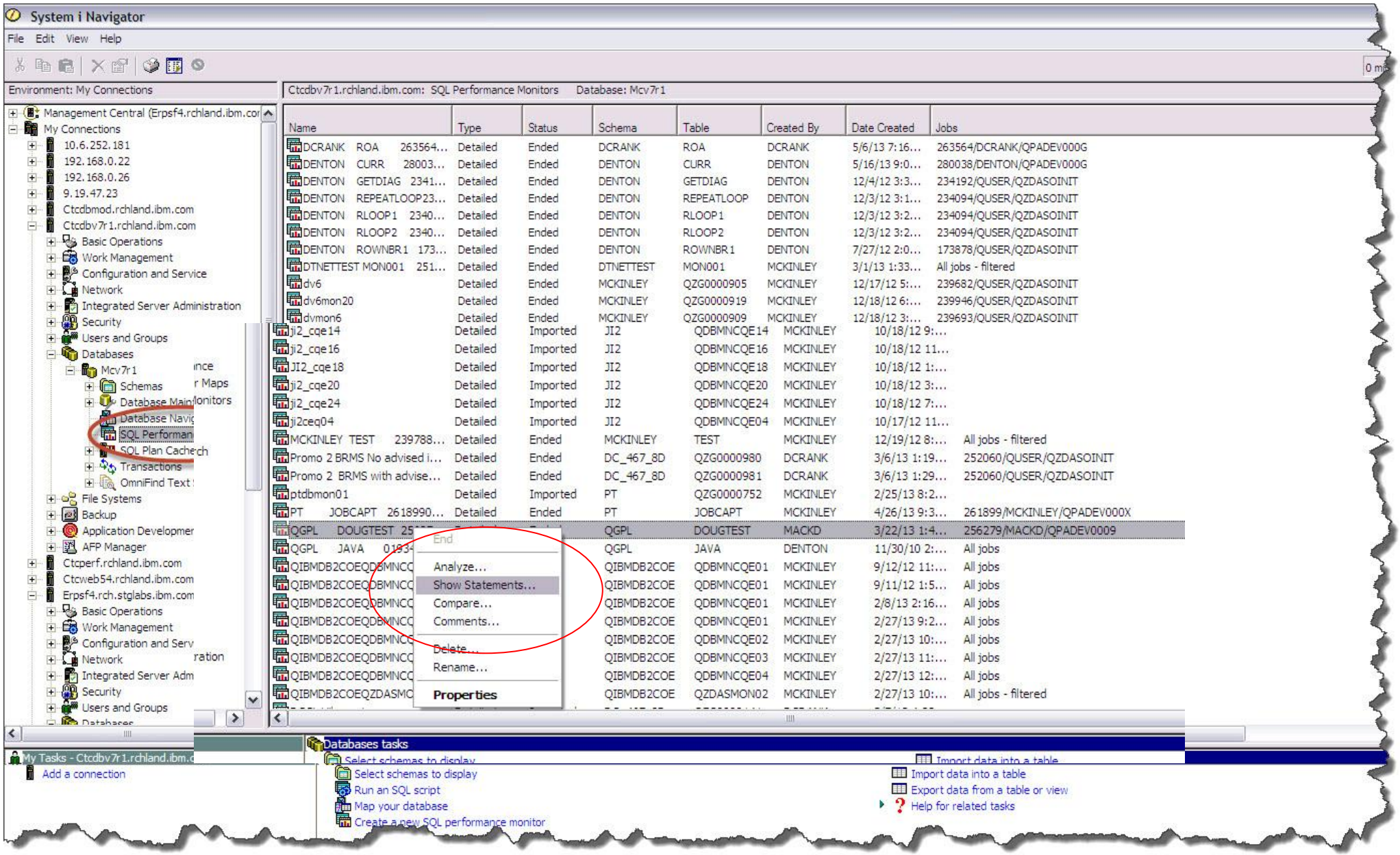
Analyzing Database (SQL Performance) Monitor Data



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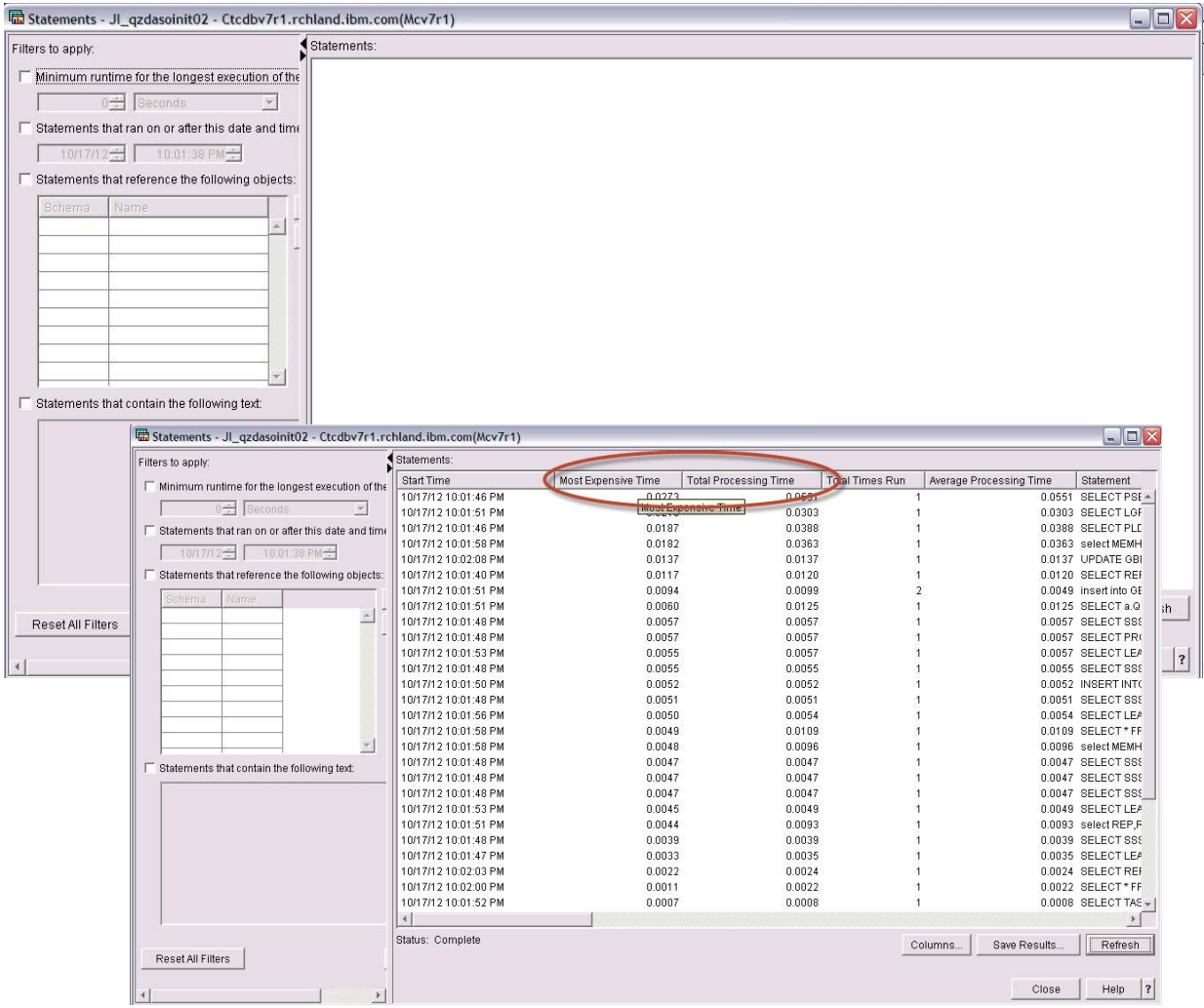
Show Statements (consider Filtering)

- 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



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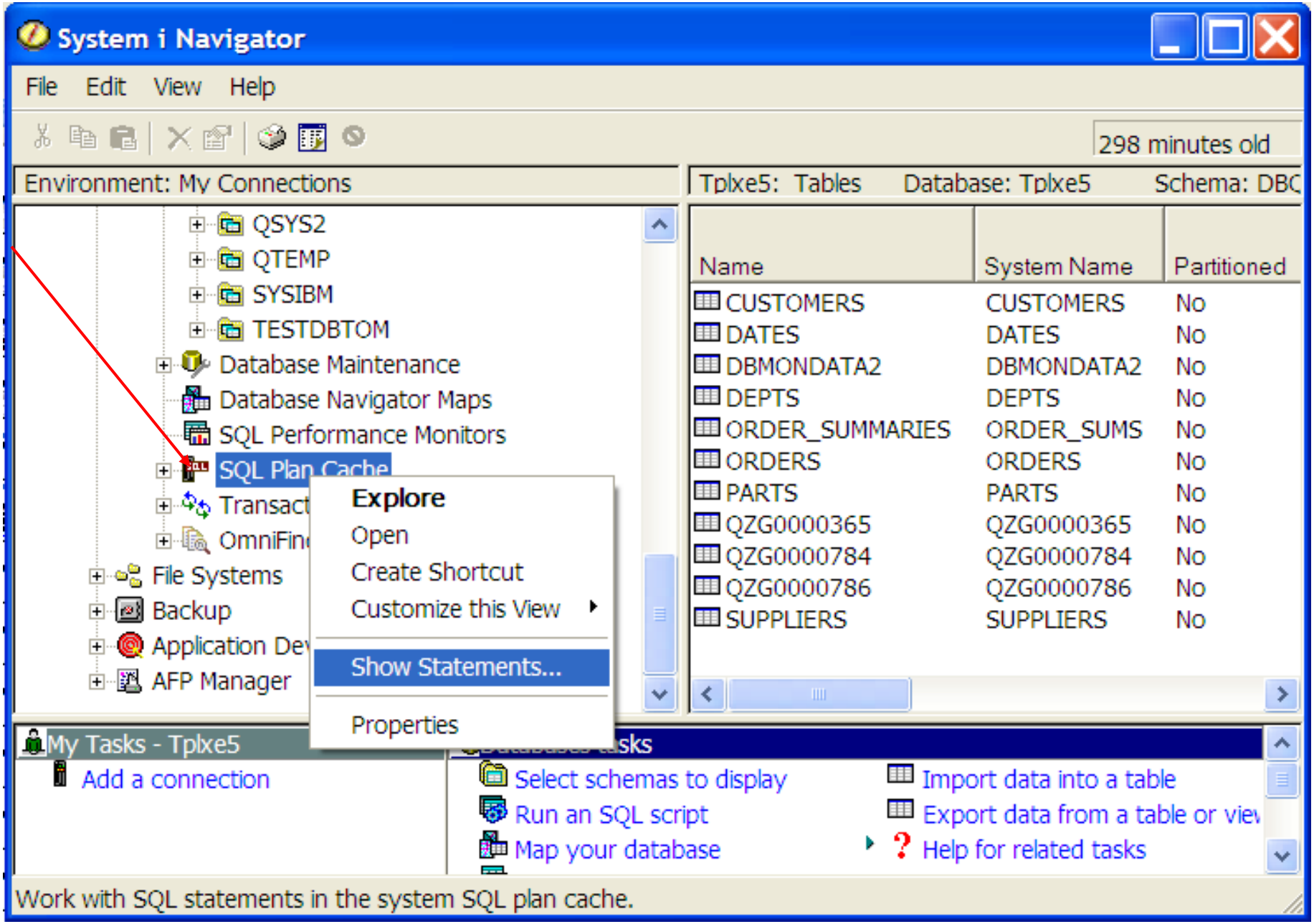
Live Analysis through SQL Plan Cache: Show Statements



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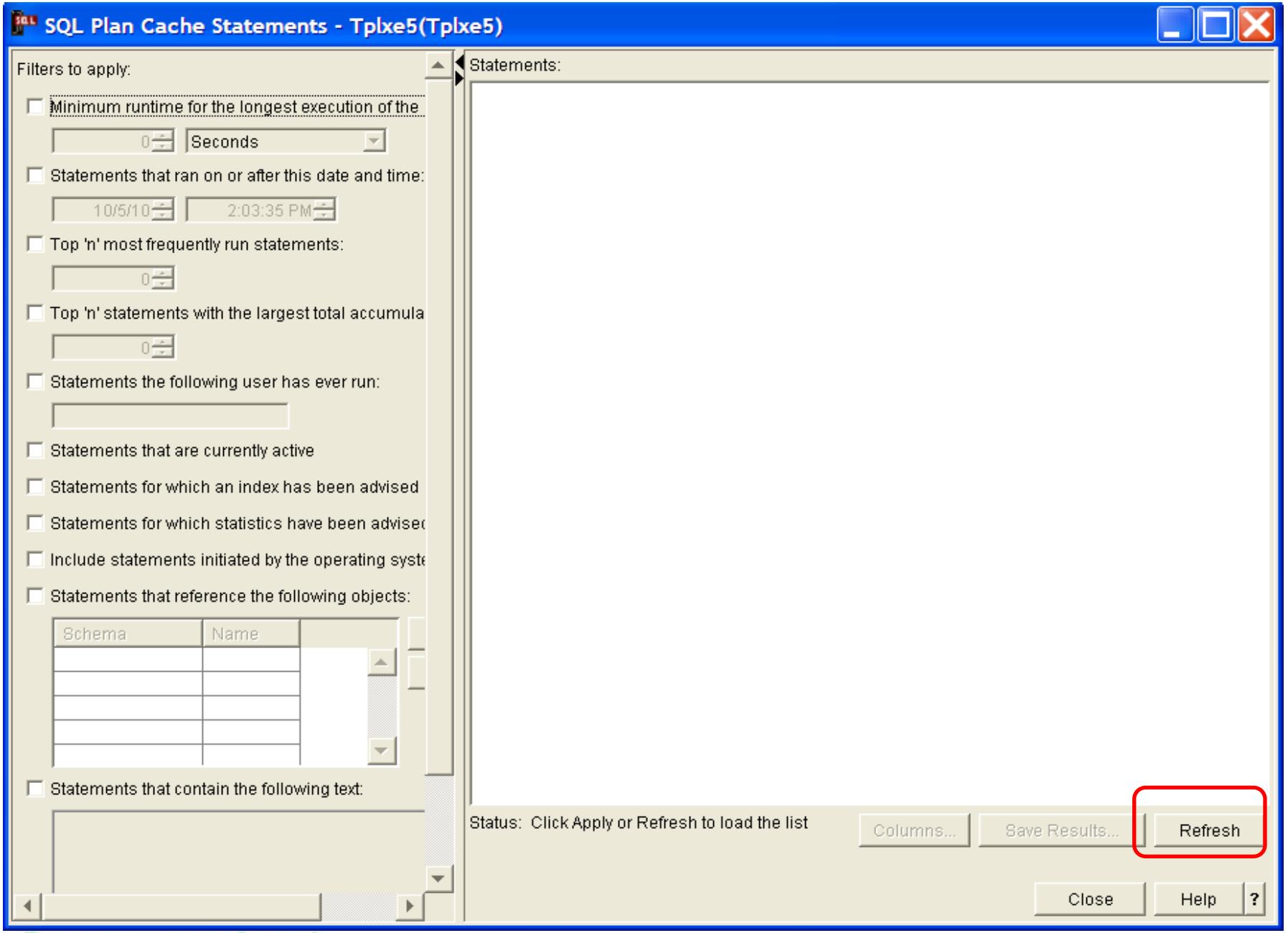
Filtering



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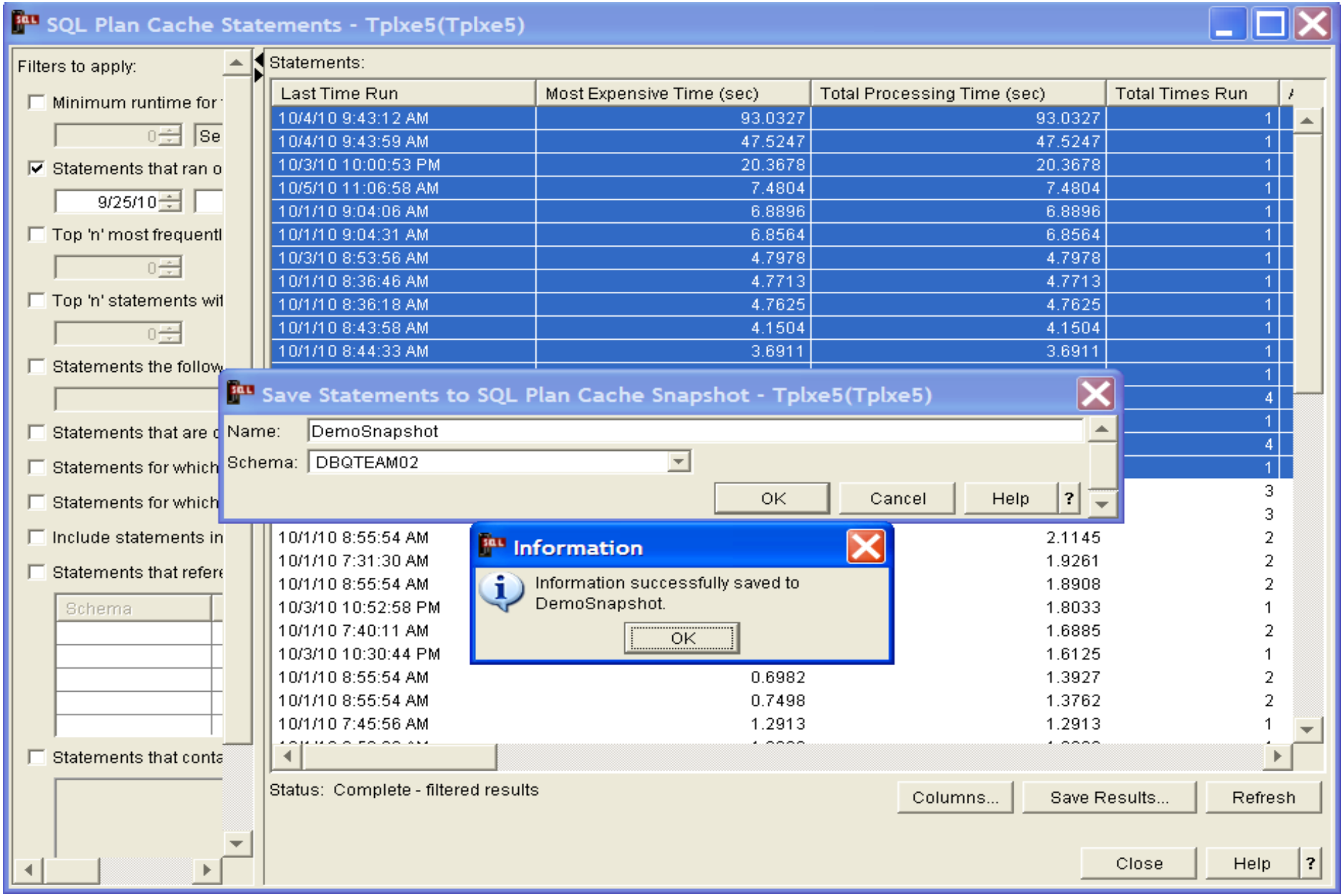
Save statements to a Plan Cache Snapshot



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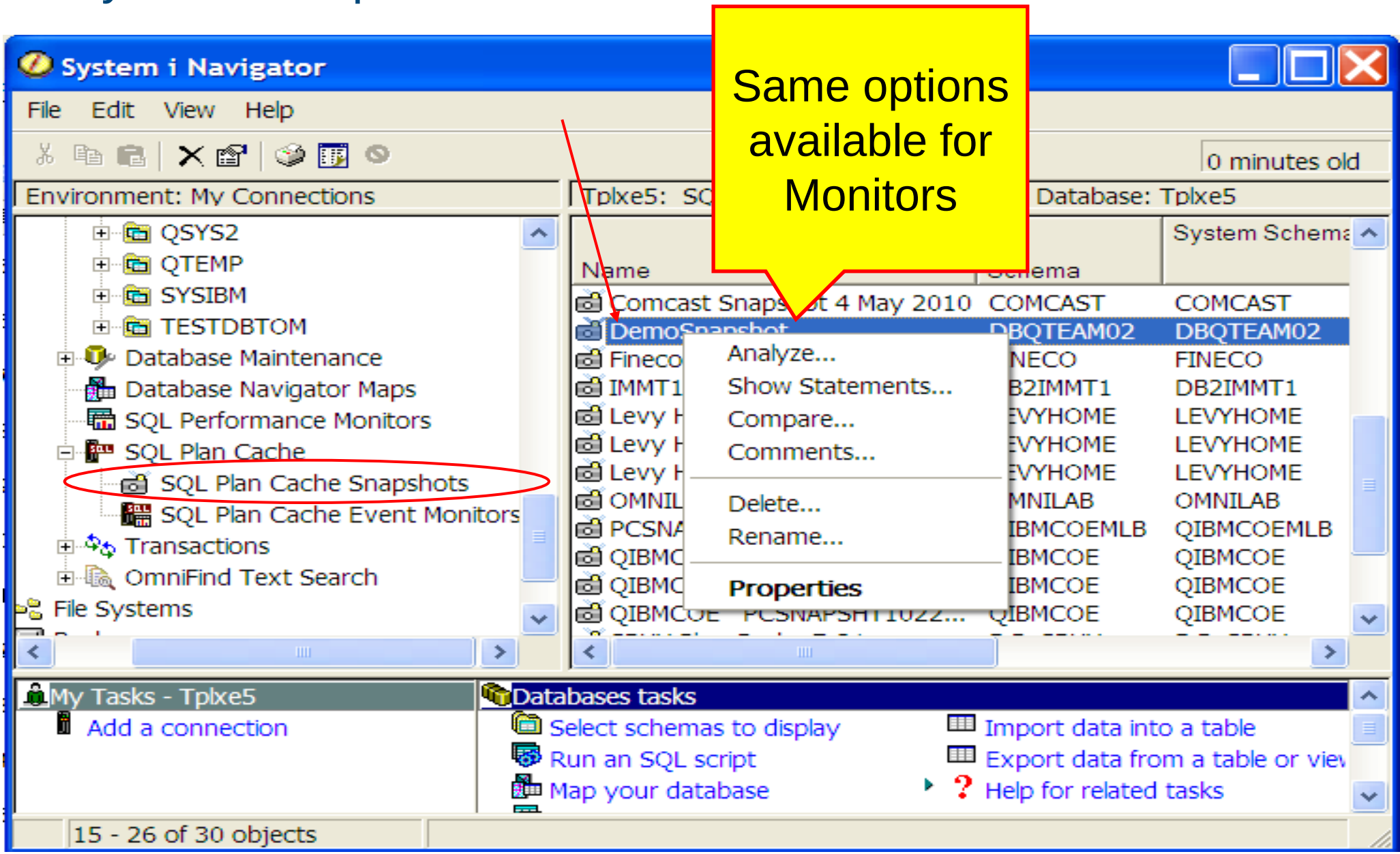
Analyze the snapshot



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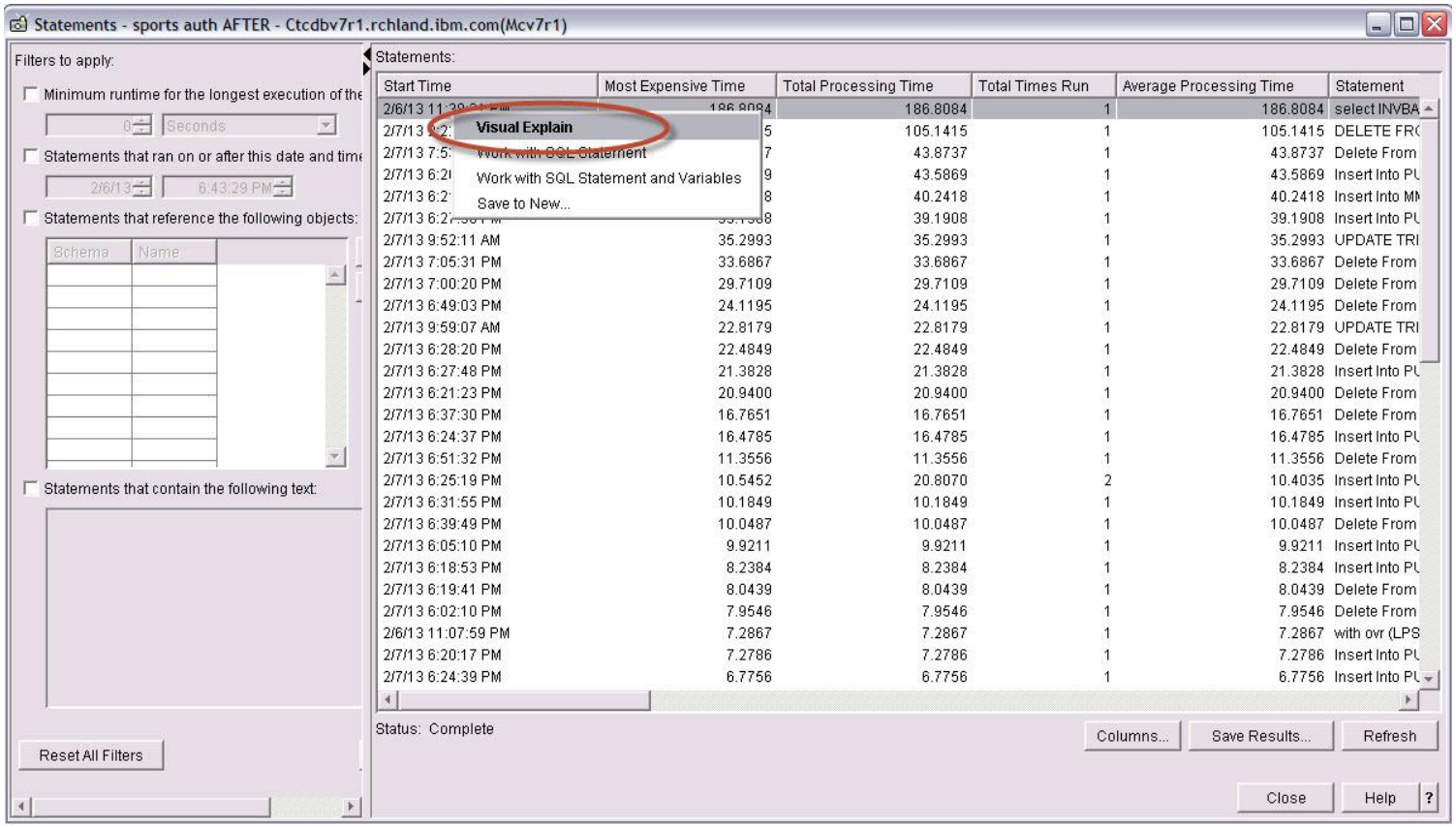
Invoking Visual Explain

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



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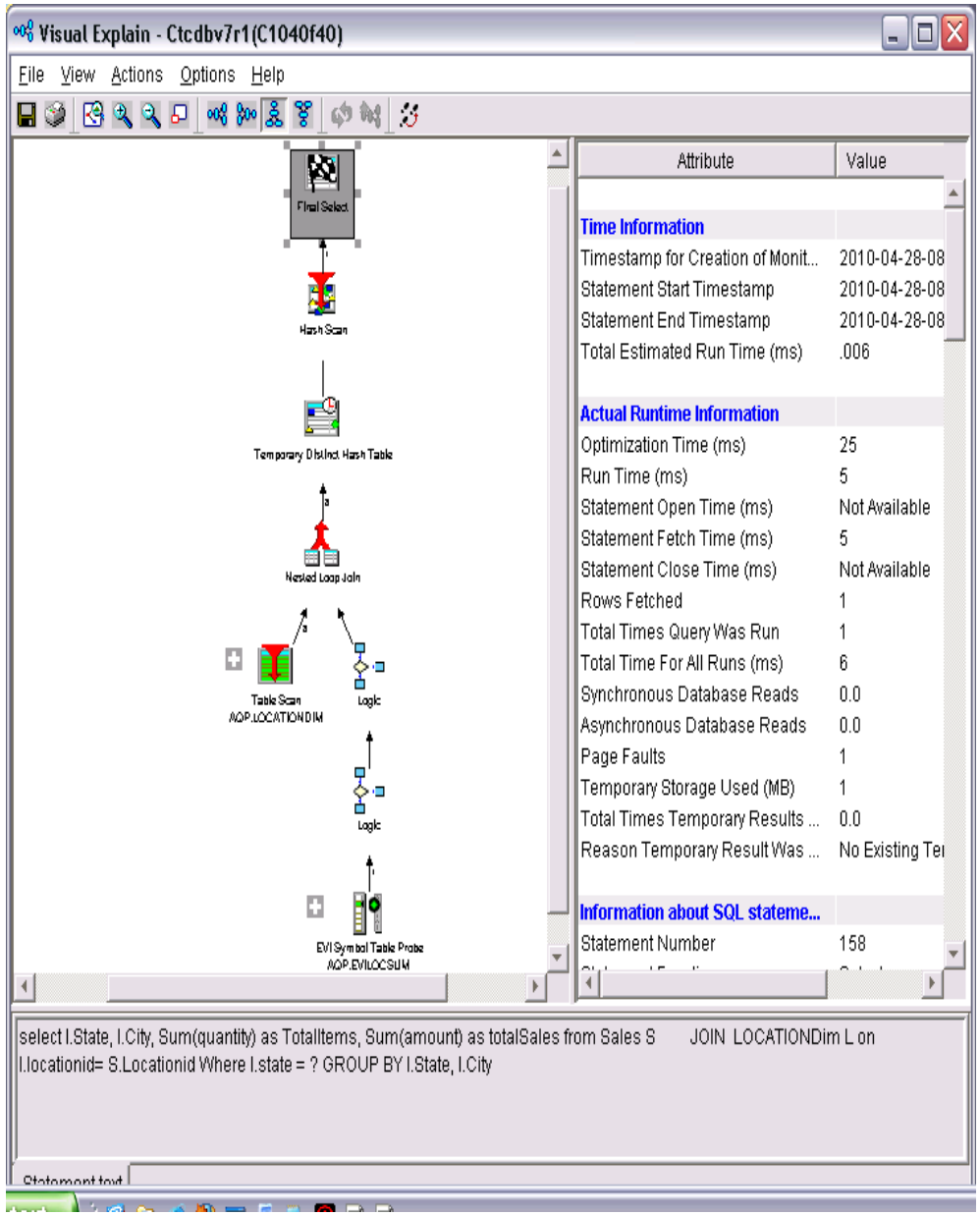
Visual Explain

- 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



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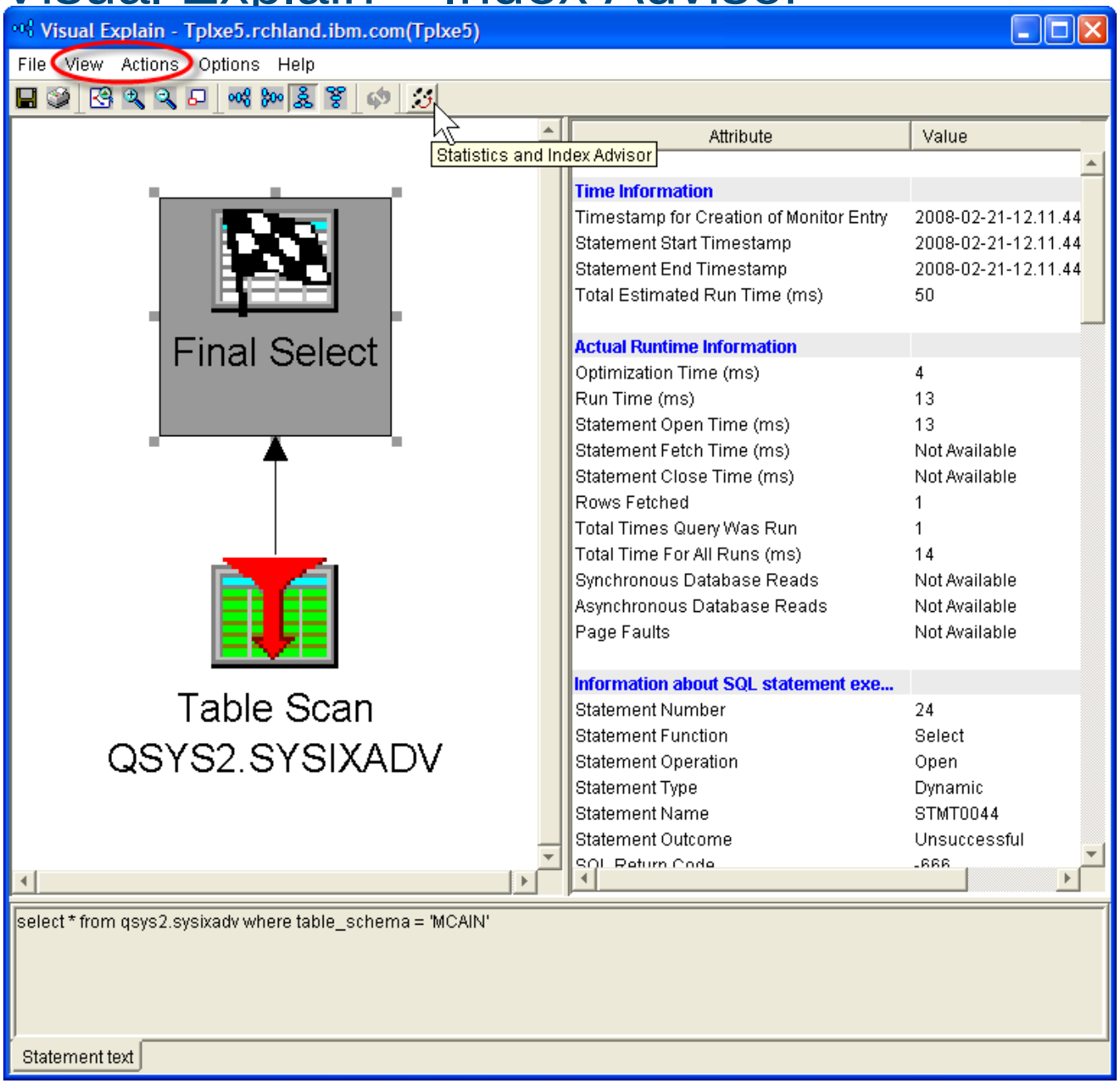
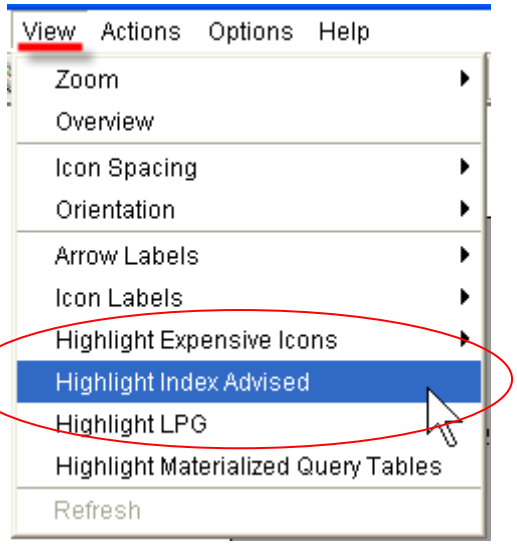
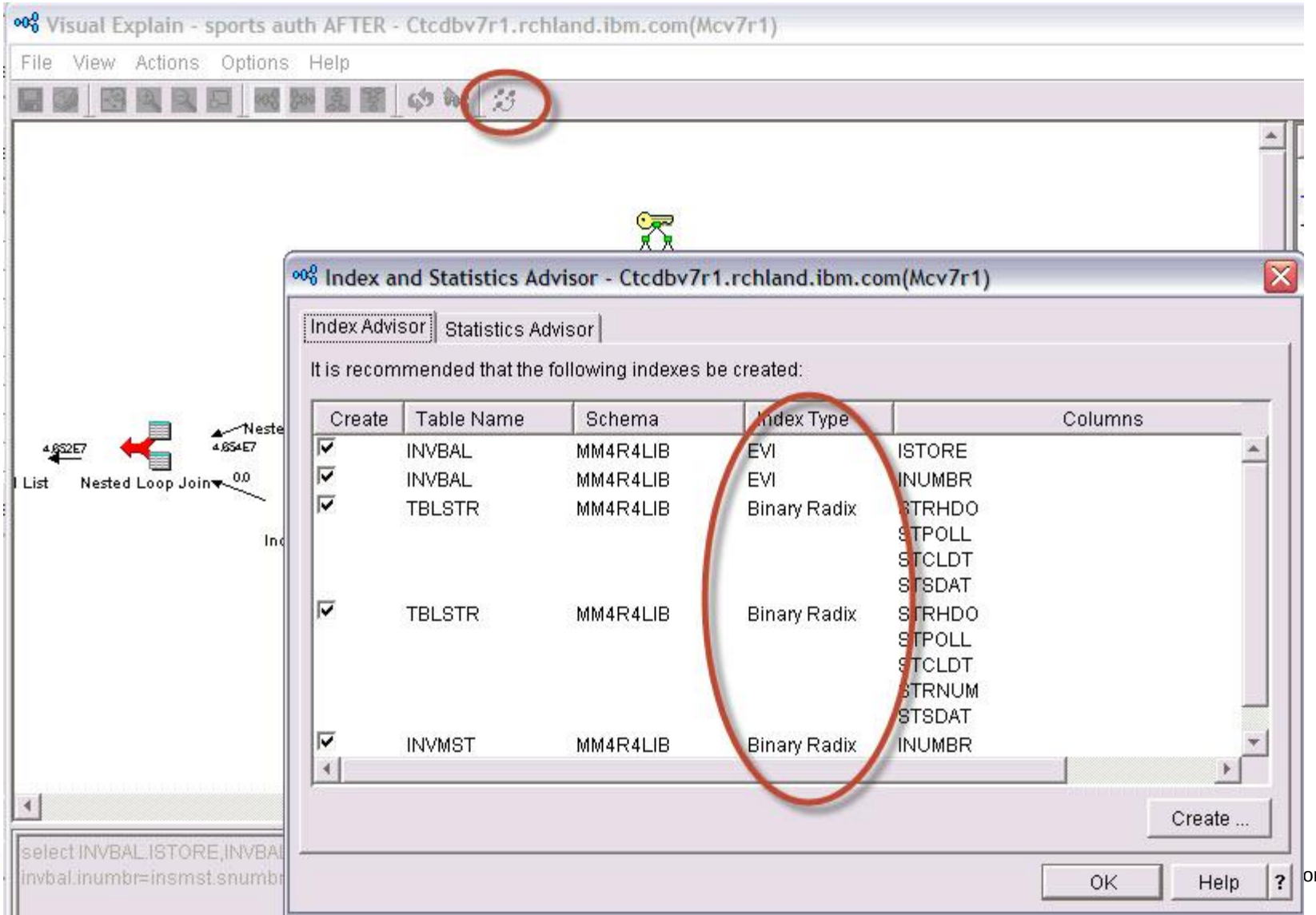
Visual Explain – Index Advisor



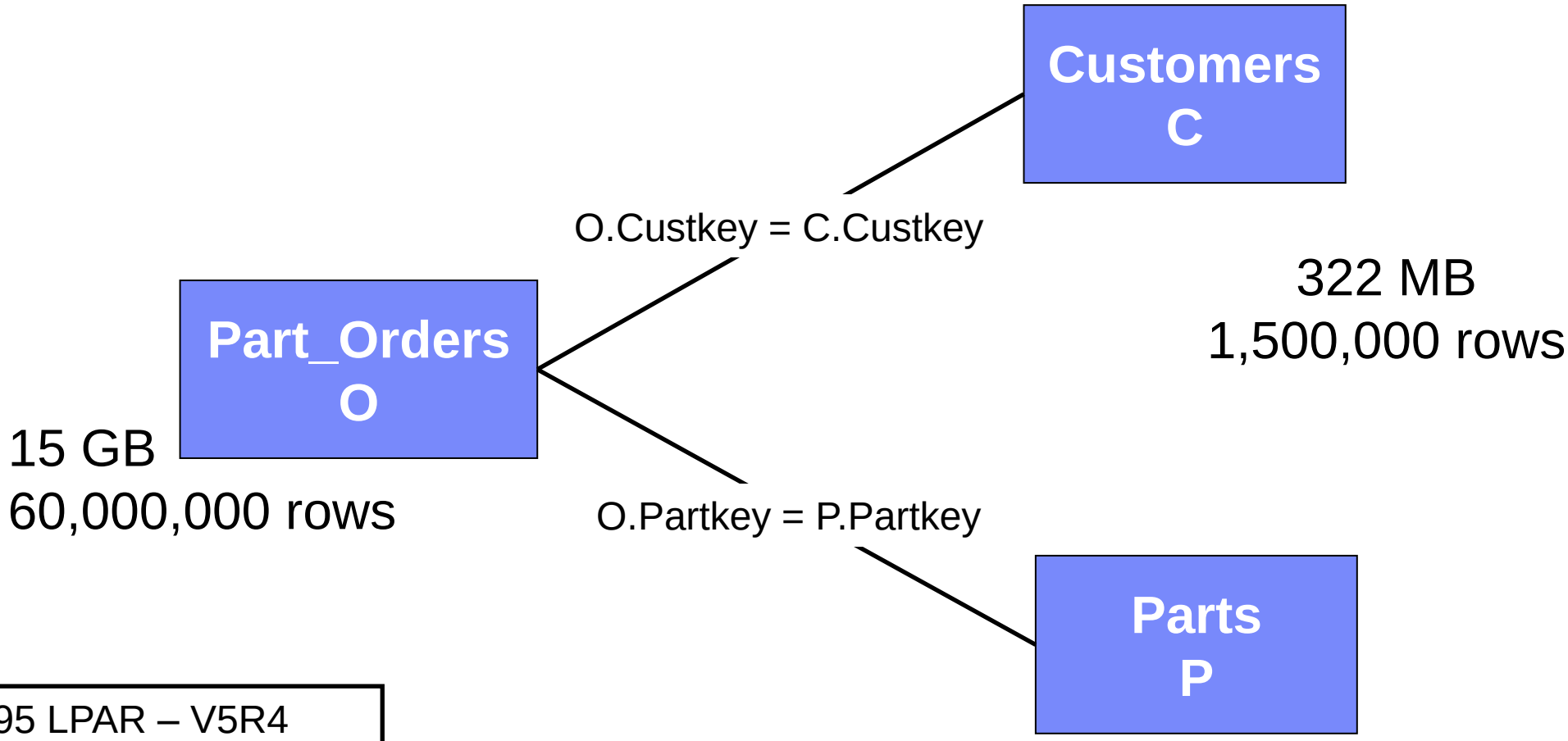


Index Advice at statement level

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



Indexing Strategy – Case Study



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

Indexing Strategy – Case Study

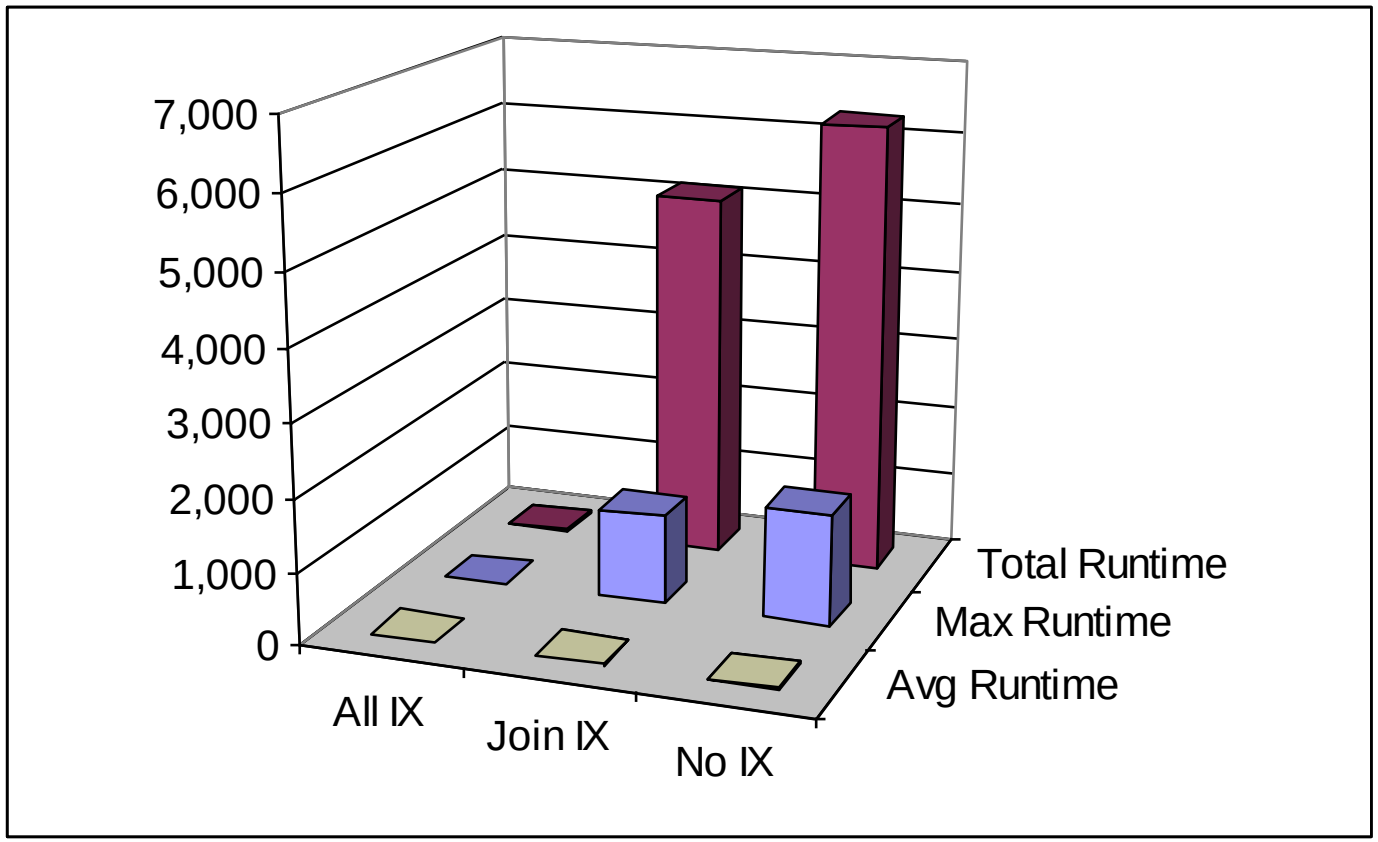
- 80 SQL requests from a single JDBC connection…
  - 2 SETs
  - 53 SELECTs
  - 15 INSERTs
  - 5 UPDATEs
  - 15 DELETEs
  - 73 via SQE
  - 5 via CQE

- 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

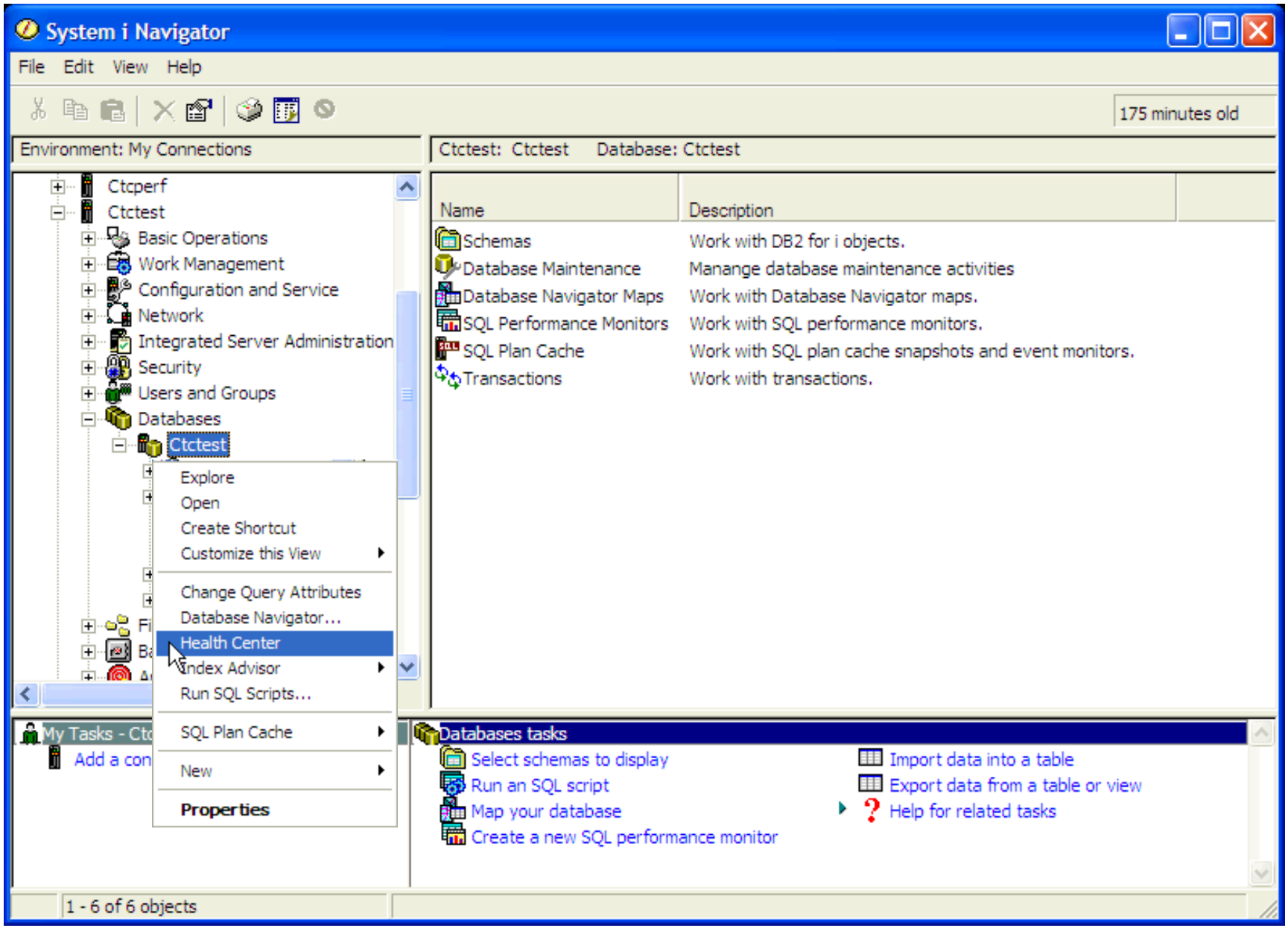
- Indexes on join columns only
  - ✓ create index part_orders_ix1 on part_orders (custkey);
  - ✓ create index part_orders_ix2 on part_orders (partkey);
  - ✓ create index customers_ix1 on customers (custkey);
  - ✓ create index parts_ix1 on parts (partkey);
- Index for selecting, joining, grouping, 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



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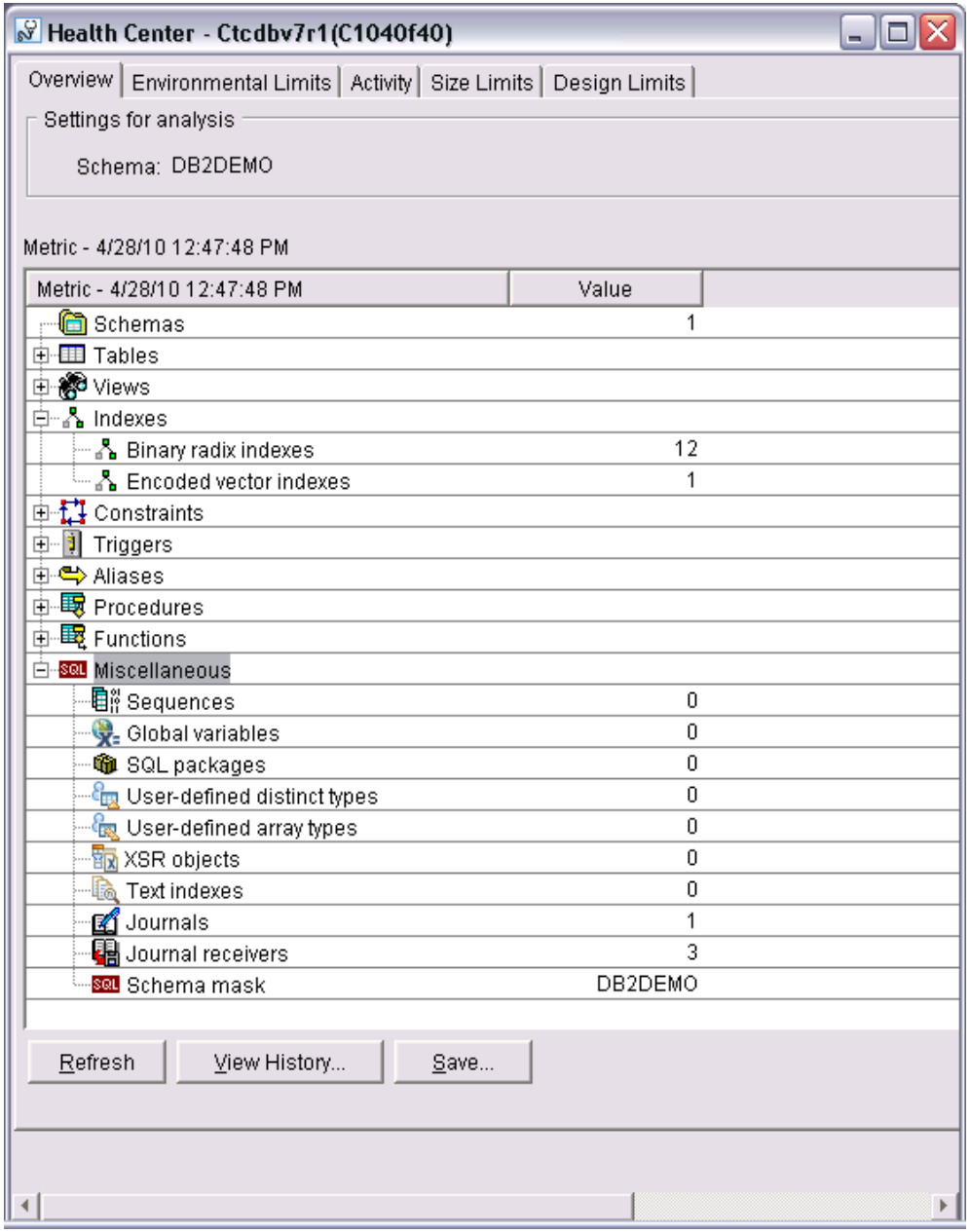
Health Center

- 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



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Monitoring Long Running Jobs – Database Maintenanace (7.1)

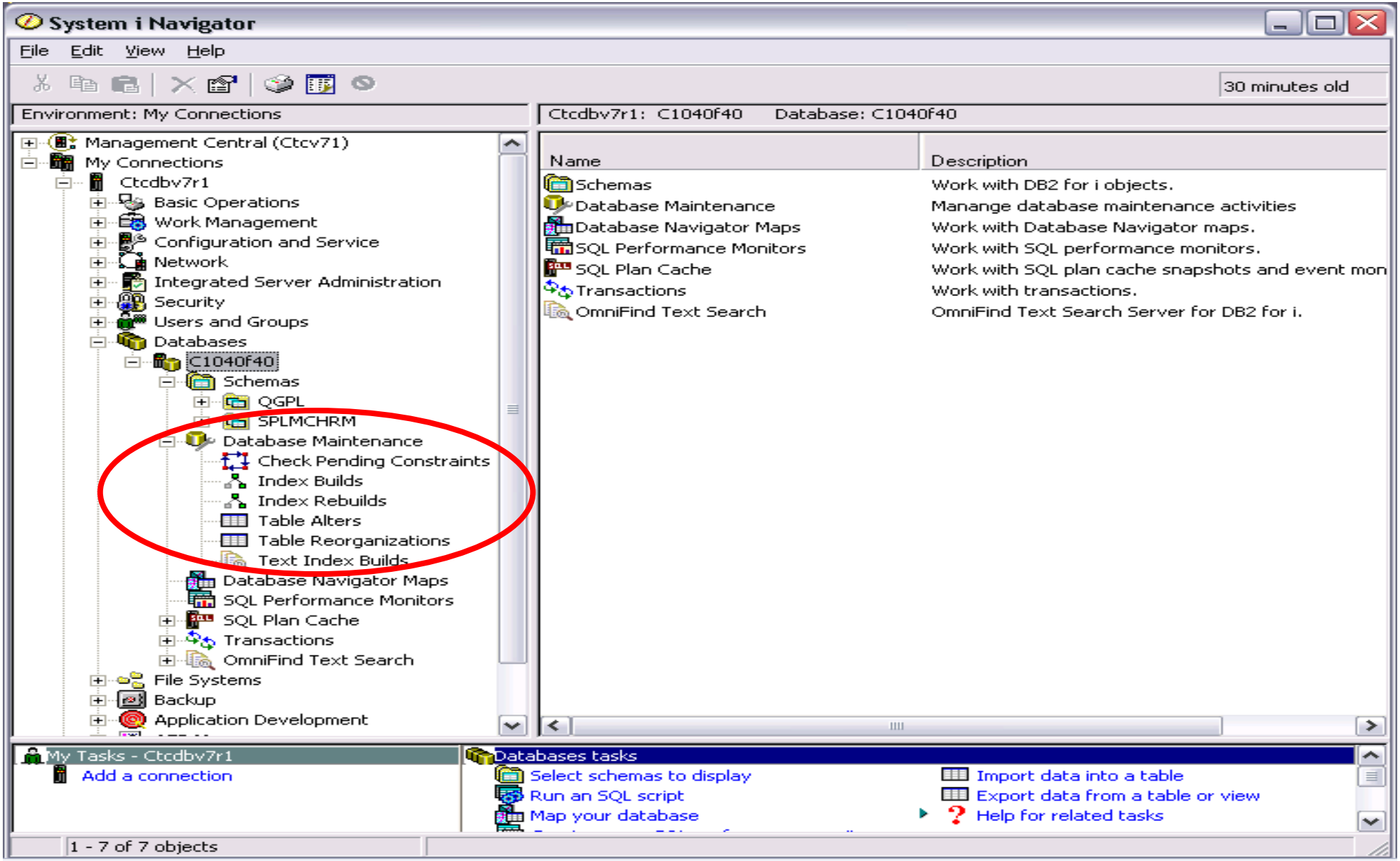

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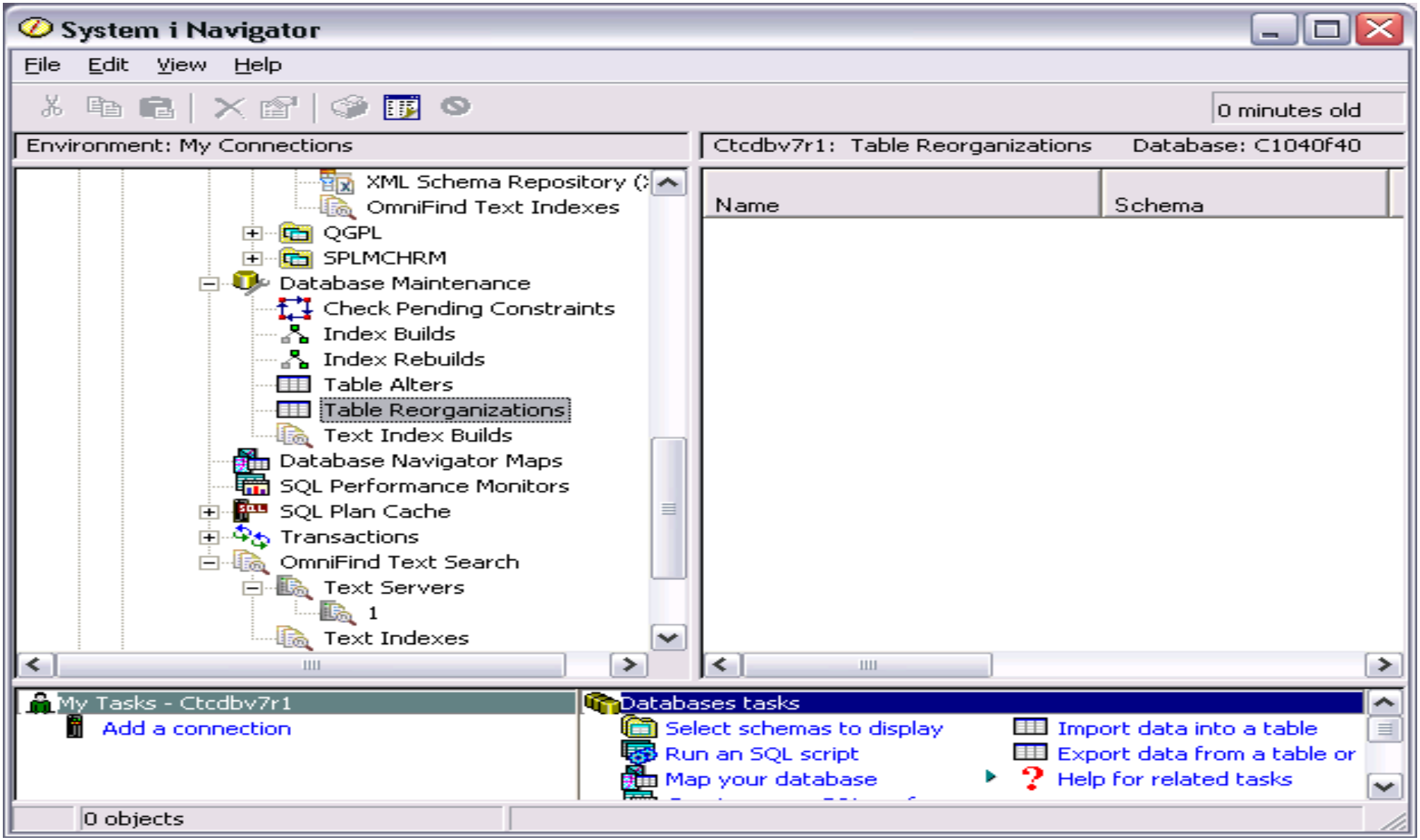
Table Re-orgs (as an example)



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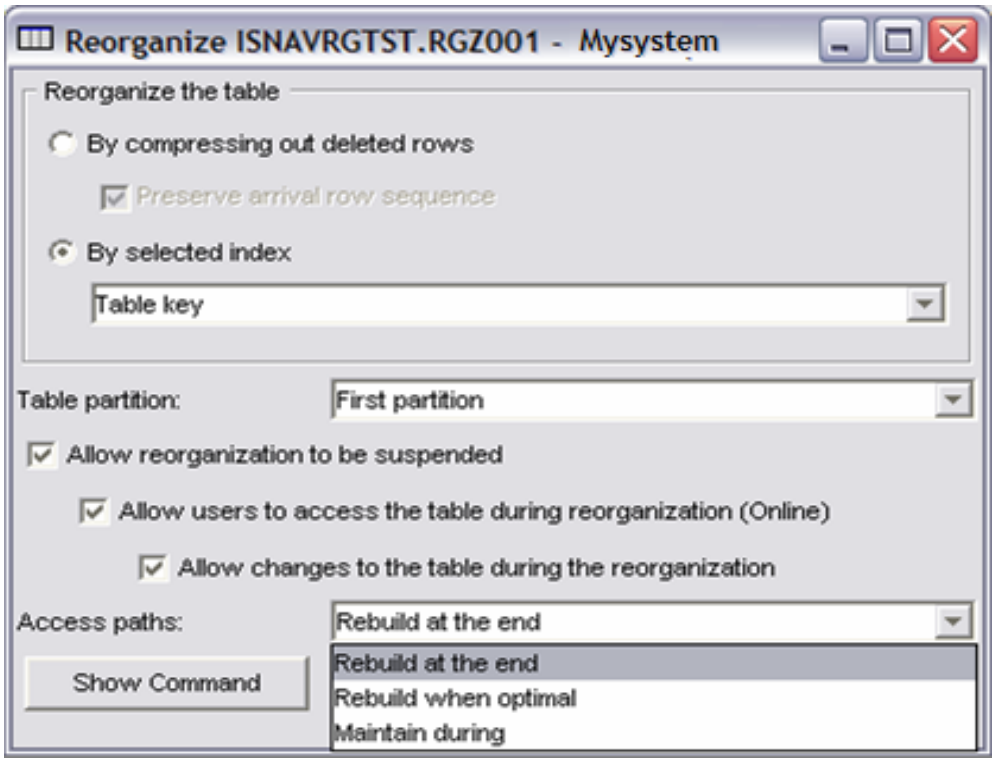
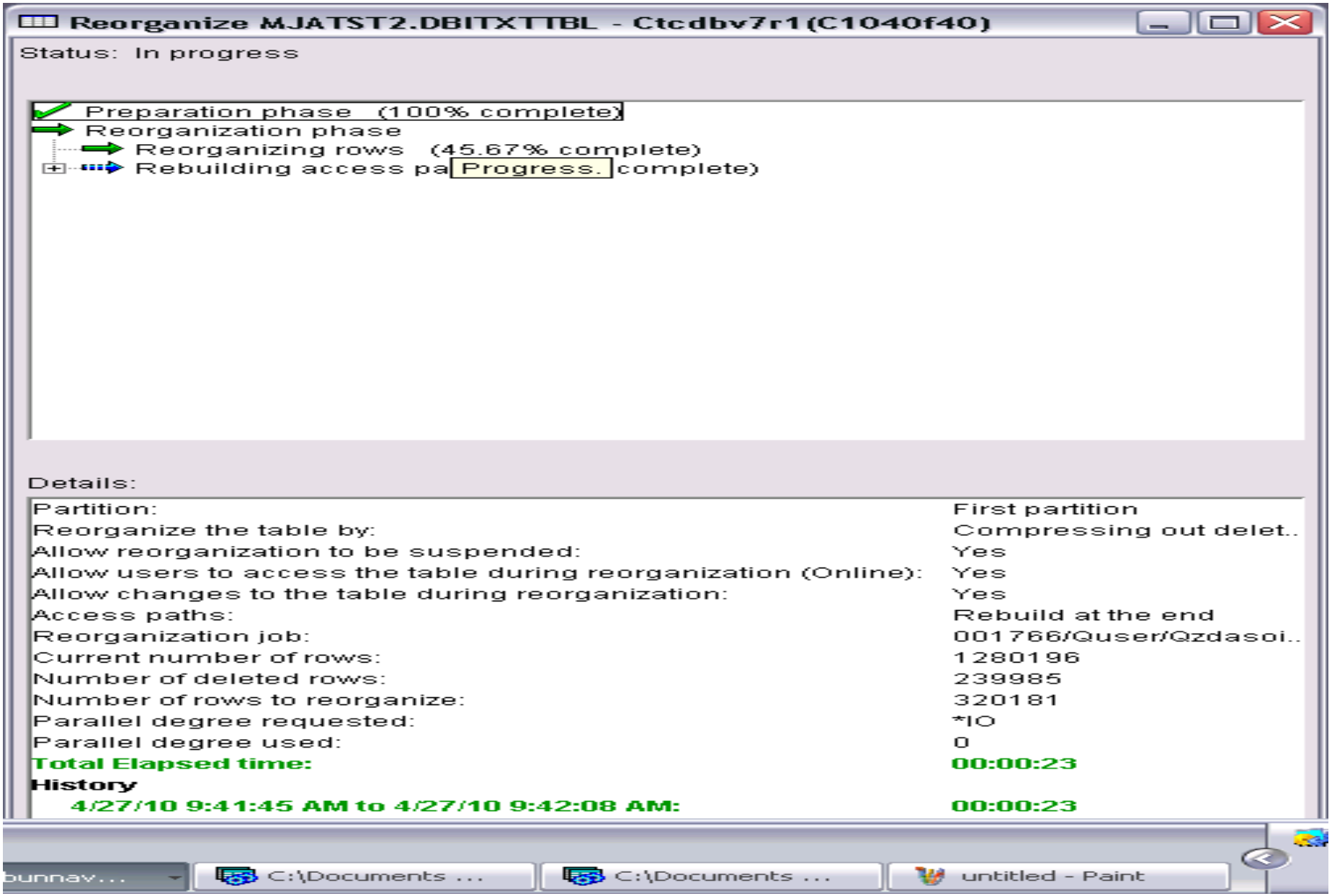
Reorganize Table Progress Monitoring

- 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



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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 NEW!
- 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 NEW!

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