

IBM Data Studio® for Mainframe Developers



Presented by David Simpson, Themis Inc.

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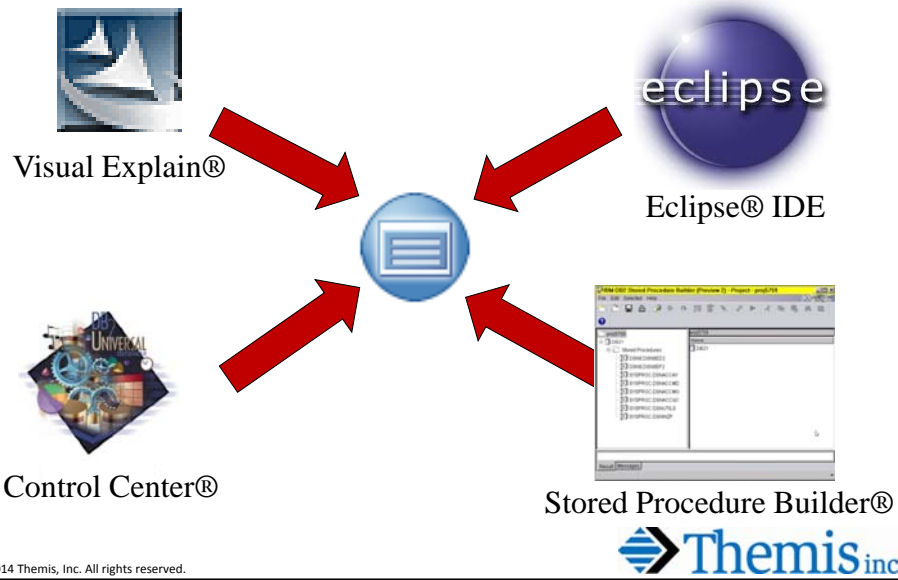
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David Simpson is currently a Vice President at Themis Inc. He teaches courses on SQL, Application Programming, Database Administration as well as optimization, performance and tuning. He also installs and maintains the database systems used for training at Themis. Since 1993 David has worked as a developer and DBA in support of very large transactional and business intelligence systems. David is a certified DB2 DBA on both z/OS and LUW. David was voted Best User Speaker and Best Overall Speaker at IDUG North America 2006. He was also voted Best User Speaker at IDUG Europe 2006 and is a member of the IDUG Speakers Hall of Fame.

IBM Data Studio®



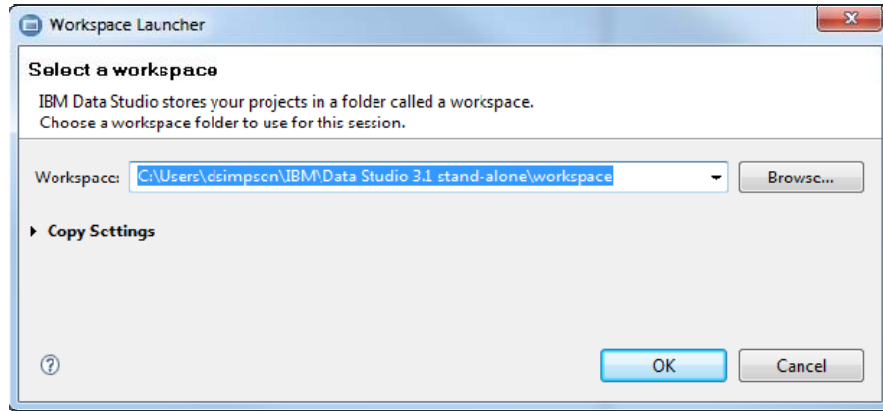
Eclipse Terminology

- Workspace
- View
- Perspective
- Project

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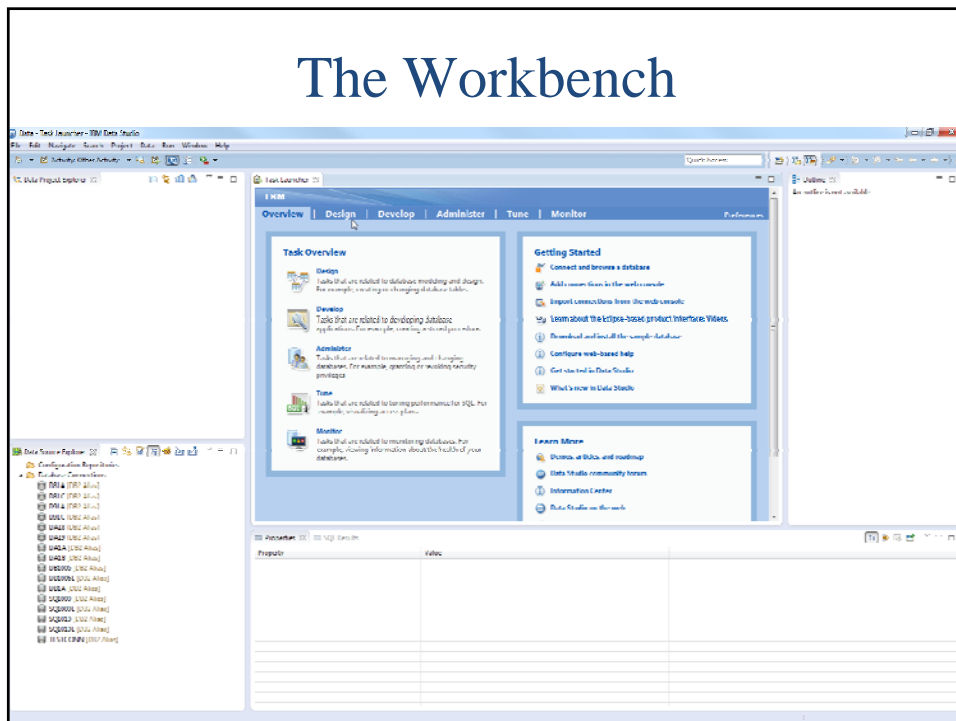
Workspace



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The Workbench



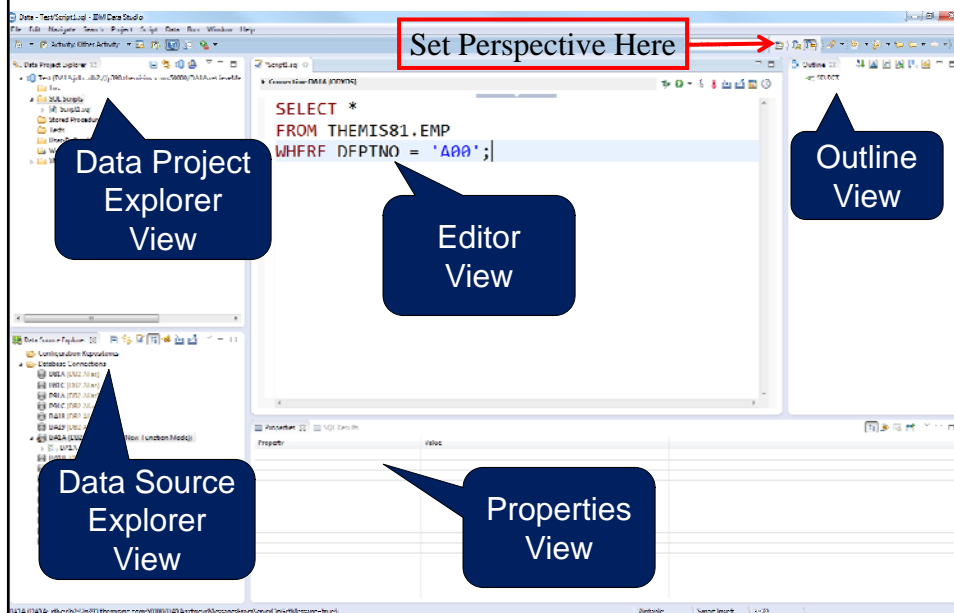
Eclipse Tips & Tricks

- Expand and Contract Views by double-clicking the tab
- Use “Window -> Reset Perspective” when bad things happen
- <CTRL> – Spacebar gives context sensitive help

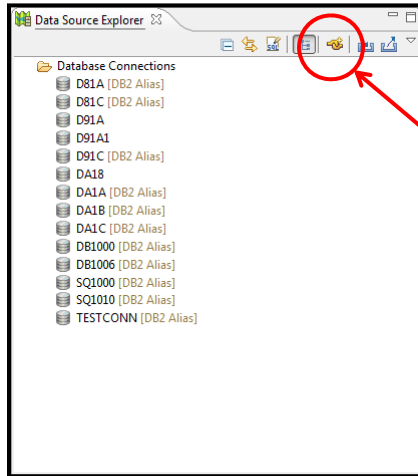


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The Data Perspective



Configuring a Database Connection

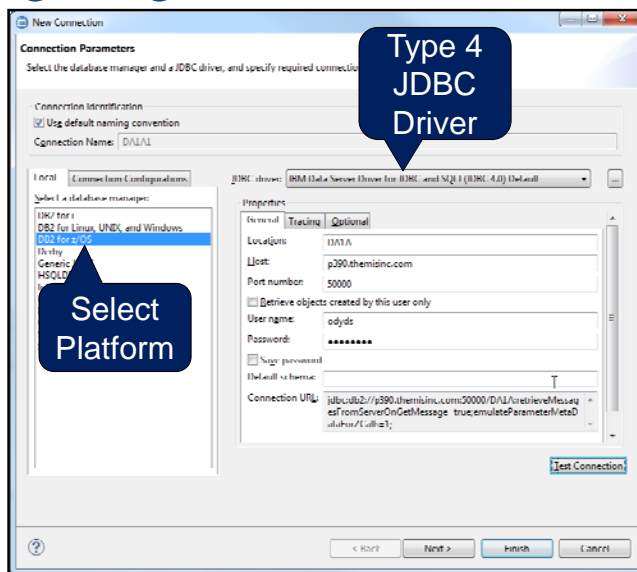


New connection profile here will initiate the wizard.



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Configuring a Database Connection



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Configuring a Database Connection

Properties

General Tracing Optional

Location: DA1A

Host: p390.tffemisinc.com

Port number: 9500

Retrieve objects created

User name: myuser

Password:

Save password

Default schema:

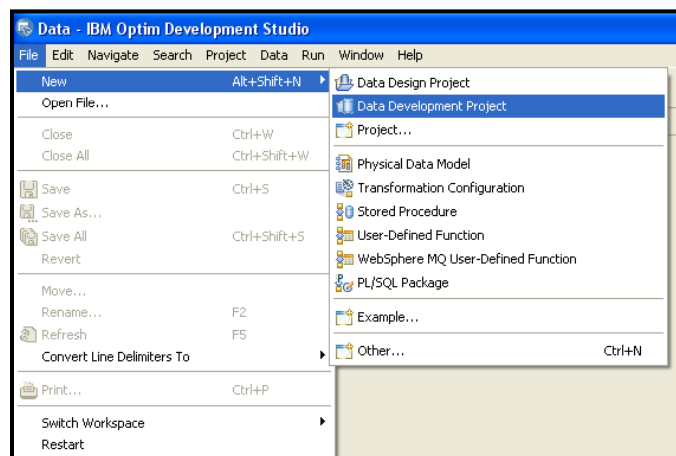
Connection string: p390.tffemisinc.com:9500/DA1A:retrieveMessage...
sFromServerOnGetMessage=true;emulateParameterMetaDa
taForZCalls=1;

Test Connection

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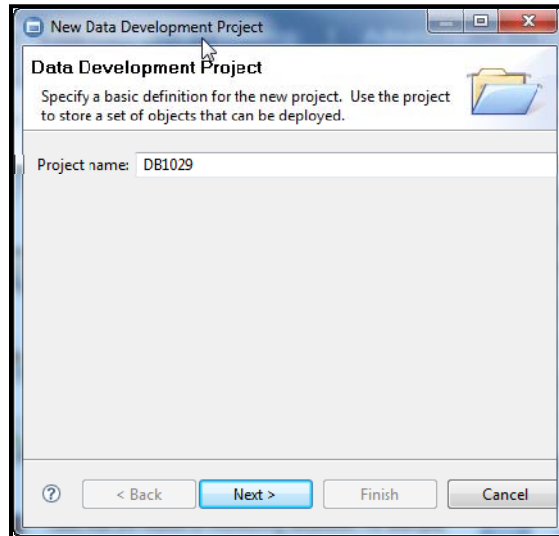
Creating a Project



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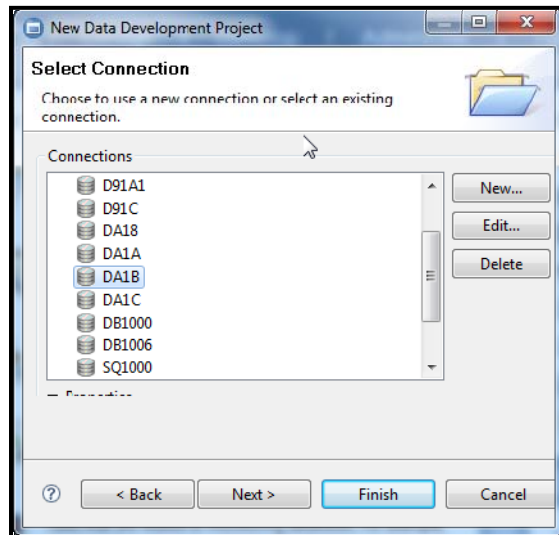
Creating a Project



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Creating a Project



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IBM Data Studio Functions

- Catalog Interface
- Physical Data Models
- Database Administration
- SQL Scripts
- Developing and debugging SQL PL Stored Procedures
- Testing any kind of Stored Procedures
- Query Tuning



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Catalog Interface

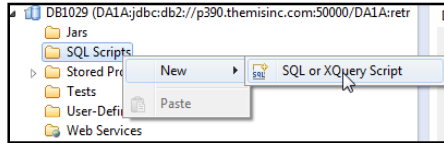
The screenshot displays the 'Data Source Explorer' window. The left pane shows a tree view of the database structure, including Databases, Rules, Schemas, Tables, and Constraints. The right pane shows a detailed view of the 'PROJECT' table, including its columns, constraints, dependencies, and indexes.

- Columns:**
 - PROJNO [CHAR(6) PK FK]
 - ACTNO [SMALLINT PK FK]
 - ACSTAFF [DECIMAL(5, 2) Nullable]
 - ACSTDATE [DATE PK]
 - ACENDATE [DATE Nullable]
- Constraints:**
 - PROJNO
 - RPAA93 (-> ACT)
 - RPAP93 (-> PROJ)
- Dependencies:**
- Indexes:**
 - XPROJAC01 [UNIQUE]
 - XPROJAC02

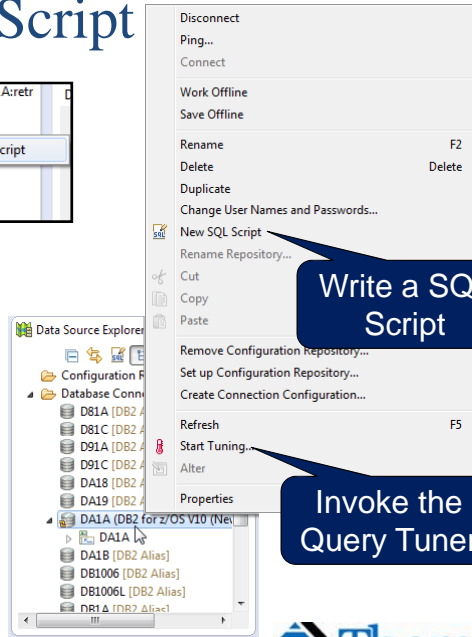


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Creating a SQL Script



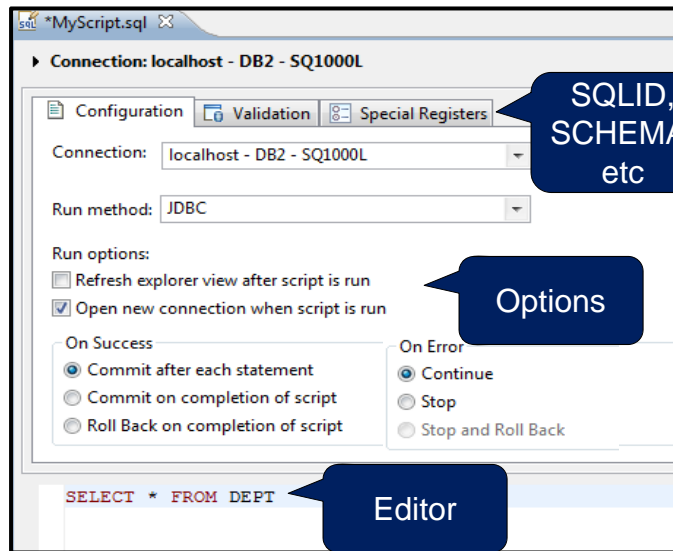
OR



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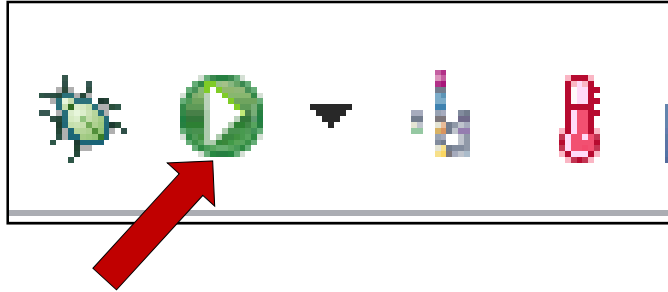
Editing the Script



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Running the Script



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Script Output

Status	Operation	Date	Connectio...	Status	Result1
✓	Succee Debug DB1...	2/29/12 3:2...	DA1B	1	A00 SPIFFY COMPUTER ... 000010
✗	Failed Deploy DB1...	2/29/12 3:4...	DA1B	2	B01 PLANNING 000020
⚠	Warnin Deploy DB1...	2/29/12 3:5...	DA1B	3	C01 INFORMATION CEN... 000030
⚠	Warnin Deploy DB1...	2/29/12 3:5...	DA1B	4	D01 DEVELOPMENT CE... NULL
✓	Succee Run DB1029...	2/29/12 3:5...	DA1B	5	D11 MANUFACTURING ... 000060
⚠	Warnin Deploy DB1...	2/29/12 4:0...	DA1B	6	D21 ADMINISTRATION S... 000070
⚠	Warnin Deploy DB1...	2/29/12 4:0...	DA1B	7	E01 SUPPORT SERVICES 000050
✓	Succee Debug DB1...	2/29/12 4:0...	DA1B	8	E11 OPERATIONS 000090
⚠	Warnin Deploy DB1...	2/29/12 4:1...	DA1B	9	E21 SOFTWARE SUPPORT 000100
✓	Succee Debug DB1...	2/29/12 4:2...	DA1B	10	F22 BRANCH OFFICE F2 NULL
⚠	Warnin Deploy DB1...	2/29/12 4:5...	DA1B	11	G22 BRANCH OFFICE G2 NULL
✗	Failed SELECT * FR...	2/29/12 9:4...	SQ1000L	12	H22 BRANCH OFFICE H2 NULL
✓	Succee SELECT * FR...	2/29/12 10:...	SQ1000L	13	I22 BRANCH OFFICE I2 NULL

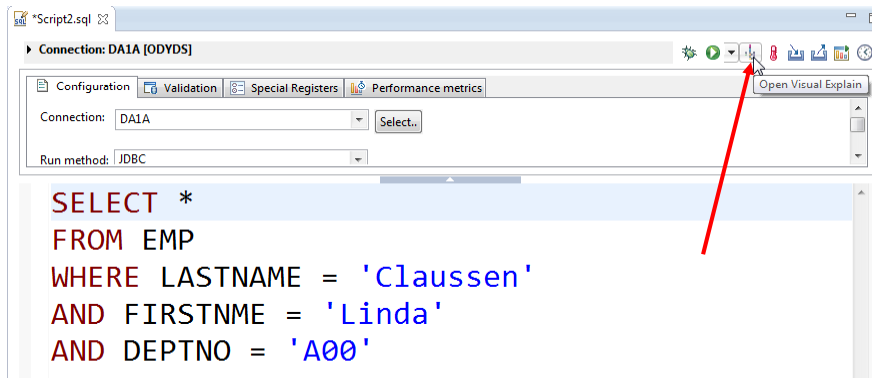
Result

History



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Using Visual Explain



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DB2 10 Explain Tables

PLAN_TABLE	DSN_QUERY_TABLE
DSN_COLDIST_TABLE	DSN_SORTKEY_TABLE
DSN_DETCOST_TABLE	DSN_SORT_TABLE
DSN_FILTER_TABLE	DSN_STATEMENT_CACHE_TABLE
DSN_FUNCTION_TABLE	DSN_STATEMNT_TABLE
DSN_KEYTGTDIST_TABLE	DSN_STRUCT_TABLE
DSN_PGRANGE_TABLE	DSN_USERQUERY_TABLE
DSN_PGROUPTABLE	DSN_VIEWREF_TABLE
DSN_PREDICAT_TABLE	DSN_VIRTUAL_INDEXES
DSN_PTASK_TABLE	

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Visual Explain Options

Collect Explain Data

Modify the runtime environment for the query
Specify values for Visual Explain to use for special registers when fetching explain information.

CURRENT DEGREE: <database default>

CURRENT MAINTAINED TABLE TYPES FOR OPTIMIZATION: <database default>

CURRENT REFRESH AGE: <database default>

CURRENT SCHEMA: THEMIS81

CURRENT SQLID: DBAGRP

Use upper case for the SQLID and schema

Set preferences to current values

< Back Next > Finish Cancel

Schema for unqualified table references in the query

What Authority & which set of Explain tables?

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IBM Data Studio Access Path Graph

Conversion: DATA (EMP)

```

SELECT *
FROM EMP
WHERE LASTNAME = 'Claussen'
AND FIRSTNAME = 'Linda'
AND DEPTNO = 'A00'
    
```

Index XEMP03

Index XEMP02

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Node Detail - Operations

Name	Value
Input RIDs	51834
Index Leaf Pages	564
Matching Predicates	Filter Factor
THEMIS81.EMP.LASTNAME='Wynton'	0.001
THEMIS81.EMP.FIRSTNAME='John'	0.0038
Scanned Leaf Pages	1
Output RIDs	2
Total Filter Factor	2.0930573E-5
Matching Columns	2

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Optimizer Predicate Categories

- Stage 1 or Stage 2
- Indexable or Non Indexable
- Indexable matching, Indexable Screening
- Filter Factor
- Predicate Type (Equal, Between, Range, Like, etc..)



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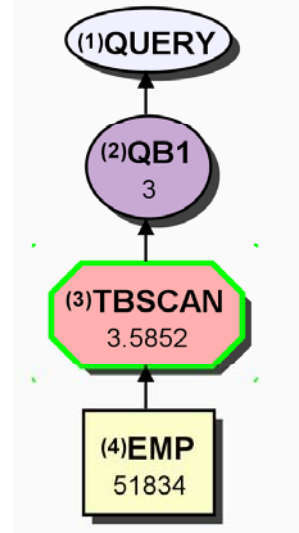
Table Scans and Stage 2 Predicates

The screenshot shows the 'Access Plan Diagram' window in SQL Studio. The 'Description of Selected Node' pane is highlighted with a red box and contains the following information:

- rscan
 - Stage1_Predicates
 - THEMIS81.EMP.EDLEVEL=12
 - Stage2_Predicates
 - SUBSTR(THEMIS81.EMP.LASTNAME,1,1)='S'
 - '1971-05-15' BETWEEN THEMIS81.EMP.BIRTHDATE AND THEMIS81.E

The 'Attributes' pane below shows a table with the following columns:

Name
Input Cardinality
Scanned Rows
Stage 1 Predicates
THEMIS81.EMP.EDLEVEL=12
Stage 1 Returned Rows



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Data Studio Single Query Tuning

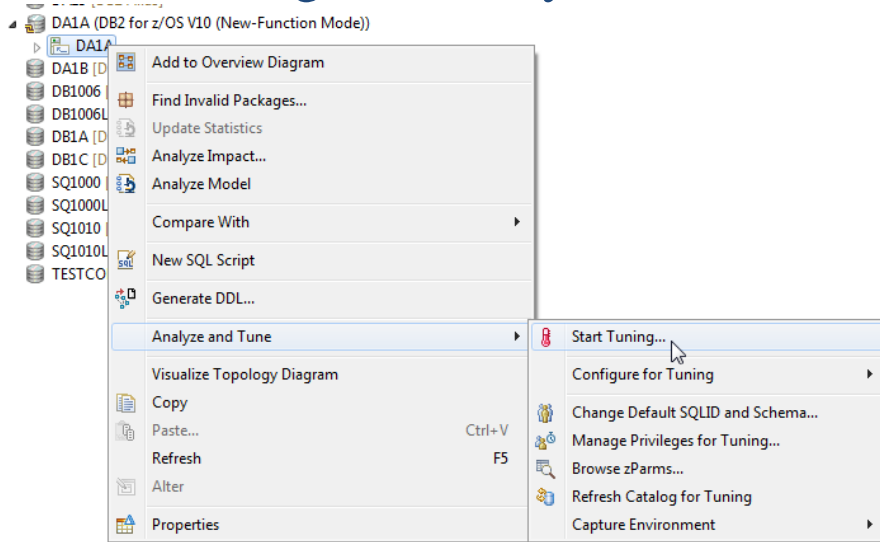
Basic single query tuning features: These can also be done using the **Optimization Service Center Tool**, which is being deprecated as of V9.

- Capture queries from many data sources (Files, Cobol programs, XML files, etc.)
- View formatted queries.
- View access plan graphs.
- Capture information about the data server that queries run against, a feature which corresponds to Service SQL in Optimization Service Center for DB2 for z/OS
- Generate reports on the performance of queries.
- Run the Query Statistics Advisor to analyze the statistics that are available for the data that a query accesses, check for inaccurate, outdated, or conflicting statistics, and look for additional statistics that you might capture to improve how the data server processes the query.
- See any reformatting of an SQL statement the Optimizer modifies



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Using the Query Tuner



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Using the Query Tuner

- DB2 for z/OS Sources
 - Statement Cache
 - Catalog Plan or Package
 - QMF
 - QMF HPO
 - DB2 Query Monitor
 - User-defined SQL Repository
 - SQL Procedure
 - Plan Table
 - Statement Table
 - Function Table
 - View, Trigger, or SQL UDF

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Using the Query Tuner

The screenshot shows the 'Run Single-Query Advisors And Analysis Tools' dialog box in the Query Tuner Workflow Assistant. The 'Select Activities' sub-dialog is open, showing the following options:

- Analysis tools:**
 - Format SQL statement
 - Display access plan graph
 - Show access plan in Access Plan Explorer
- Generate recommendations in these categories:** (For more information, click the Help icon.)
 - Statistics
 - Query revision
 - Access path
 - Indexes
- Generate reports:**
 - Recommendation summary
 - Table, predicate and index

Buttons: Select All, Select Defaults, Clear All, OK, Cancel.

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Using the Query Tuner

The close-up screenshot shows the 'Select Activities' dialog box with the following options:

- Analysis tools:**
 - Format SQL statement
 - Display access plan graph
 - Show access plan in Access Plan Explorer
- Generate recommendations in these categories:** (For more information, click the Help icon.)
 - Statistics
 - Query revision
 - Access path
 - Indexes
- Generate reports:**
 - Recommendation summary
 - Table, predicate and index

Buttons: Select All, Select Defaults, Clear All.

Options not available in the "free" product

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Query Tuner Output

The screenshot shows the IBM Query Tuner interface. On the left, a tree view under 'Analysis Results' shows 'Query 1' expanded to 'Analysis Result 1', which contains several report files: 'IndexReport2012-02-25-17-16-10.475.html', 'PredicateReport2012-02-25-17-16-10.475.html' (highlighted), 'TableReport2012-02-25-17-16-10.475.html', and 'TuningReport_20120225171611_im.html'. Below this is a 'Single Query' section with a context menu open, listing options like 'Open Single-Query Recommendations', 'Open Formatted Query', 'Open Access Plan Graph', etc. A small browser window titled 'IBM Query T...' is visible in the top right.

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Advisors

The screenshot shows the 'Statistics' tab of the 'Summary - Analysis Result 1' window. It displays a recommendation to 'Repair statistics problems for this query'. Below the recommendation, there is a 'Recommended RUNSTATS commands' section with a text area containing the following commands:

```
RUNSTATS TABLESPACE "DTHM81"."TS00EMP"  
  TABLE("THEMIS81"."EMP")  
  COLUMN("FIRSTNAME")  
  COLGROUP("FIRSTNAME") FREQVAL COUNT 10  
  SORTDEVT SYSDA  
  INDEX("THEMIS81"."XEMP03" KEYCARD FREQVAL NUMCOLS 1 COUNT 10  
  "THEMIS81"."XEMP01",  
  "THEMIS81"."XEMP02" FREQVAL NUMCOLS 1 COUNT 10)  
SHRLEVEL CHANGE REPORT YES UPDATE ALL HISTORY NONE
```

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Reports

Open Summary Report

Report name: TuningReport_20130721135013_sf.html

IBM Query Tuner Report

This report contains a summary of the recommendations from the Query Tuner advisors and tools. Examine the recommendations and corresponding DDL scripts, if applicable, and take appropriate actions to tune your query. You can also examine the formatted query and access plan summary, and cross reference the recommendations generated by the advisors. Use the table, column, and index information to do further analysis and tuning. Navigate to the different sections using the action buttons and then return to the top of the report using [Back to top](#).

Recommended Action View Query Access Plan DB Catalog Info Save Report...

Overview

Recommendation generation timestamp: 2013-07-12 13:50:04

Database server configuration: jdbc:db2://p390.themisinc.com:50000/DA1A (DSN10015)

Estimated plan cost: 5.369 units

Critical problems: 1 statistics recommendations, 0 index recommendations, 0 query recommendations, and 0 access path warnings.

Best practices: 1 statistics recommendations, 0 index recommendations, 0 query recommendations, and 0 access path warnings.

Advice Number	Advice Type	Tuning Recommendation Description
1	Statistics	CRITICAL: Repair statistics Query Tuner found problems with the repair statistics for this query. Use RUNSTATS to gather missing statistics. Recollect conflicting statistics and potential obsolete statistics. Collect statistics for potential data skew and data correlation problems. Important: if statistics are missing, Query tuner estimates subsequent recommendations based on database default statistics. Click here to review the recommended RUNSTATS script.
2	Statistics	Consolidate statistics Use RUNSTATS to recollect all the relevant statistics for this query for an accurate evaluation Important: if statistics are missing, Query tuner estimates subsequent recommendations based on database default statistics. Click here to review the recommended RUNSTATS script.

[Back to top](#)

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Stored Procedure Development



<http://www.youtube.com/watch?v=pnwxEJdmeJDk>

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Types of Stored Procedures

➤ External

- COBOL
- C, C++
- PL/I
- Assembler
- REXX
- Java
- SQL PL

➤ Native

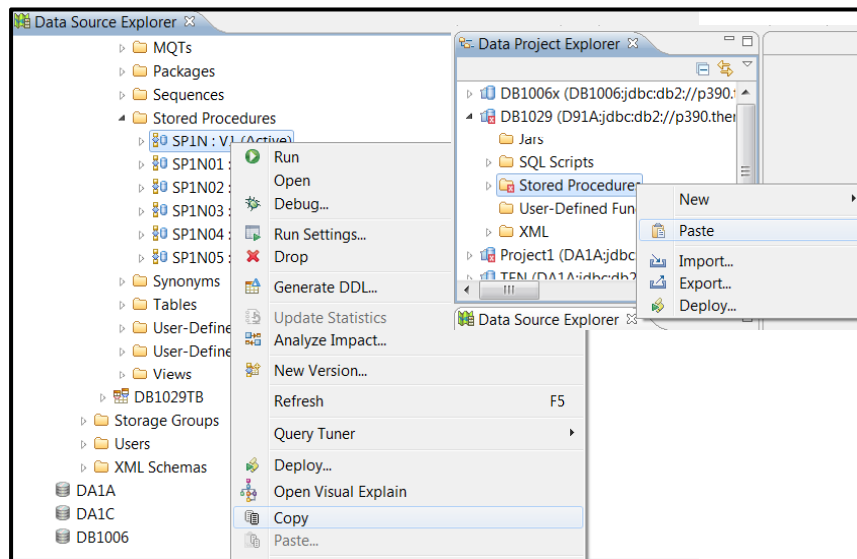
- SQL PL



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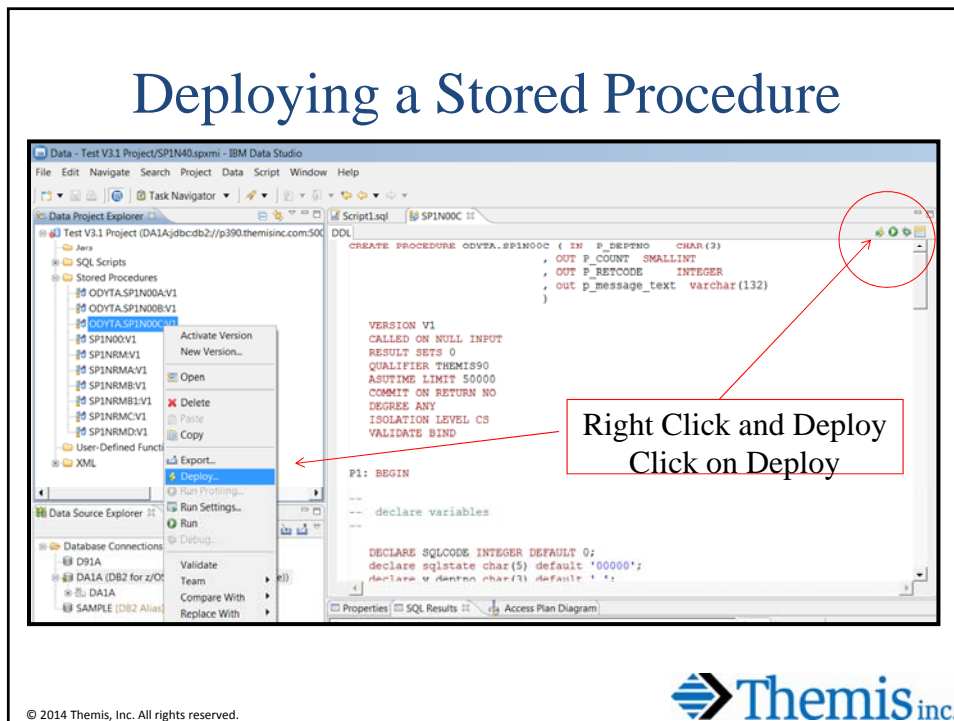
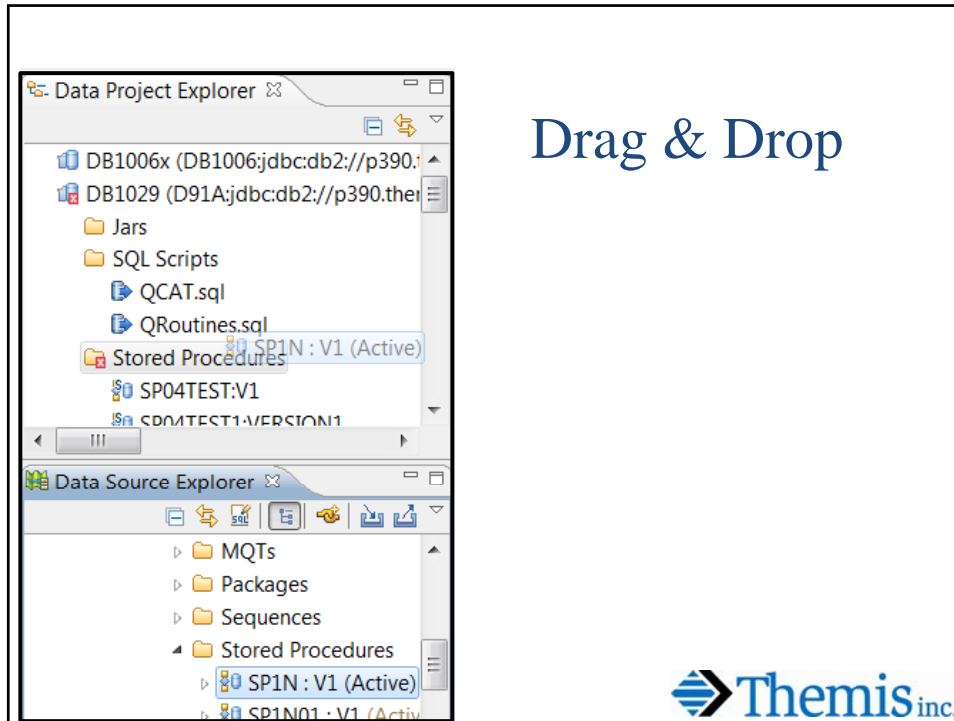


Copying an Existing Procedure

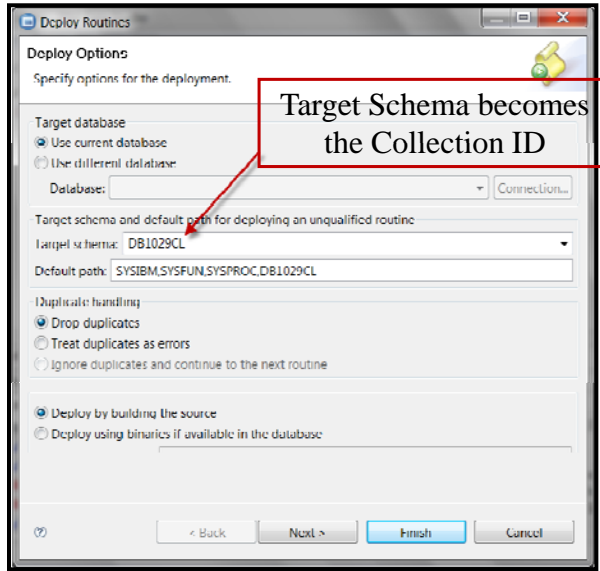


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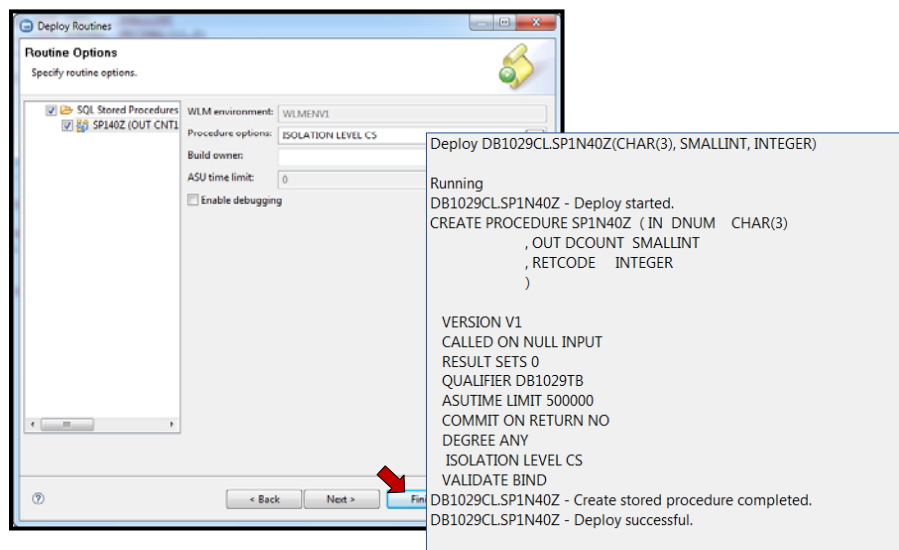


Deploying a Stored Procedure



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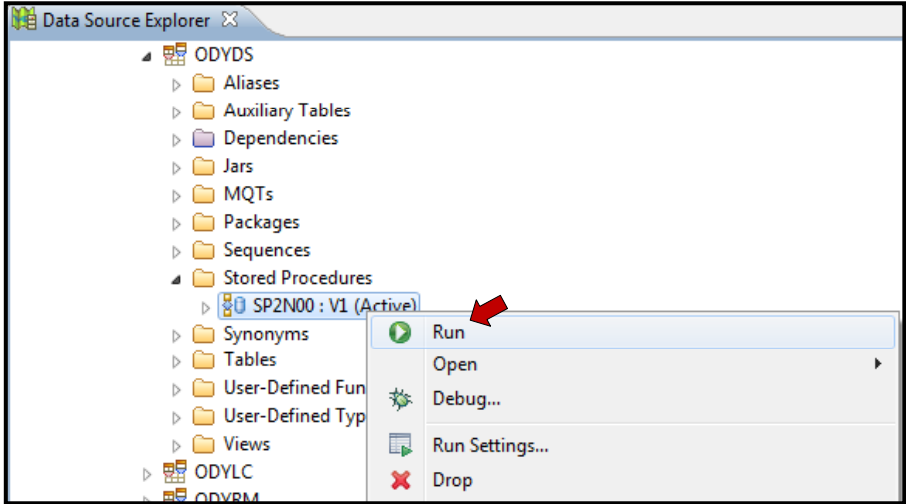
Deploying a Stored Procedure



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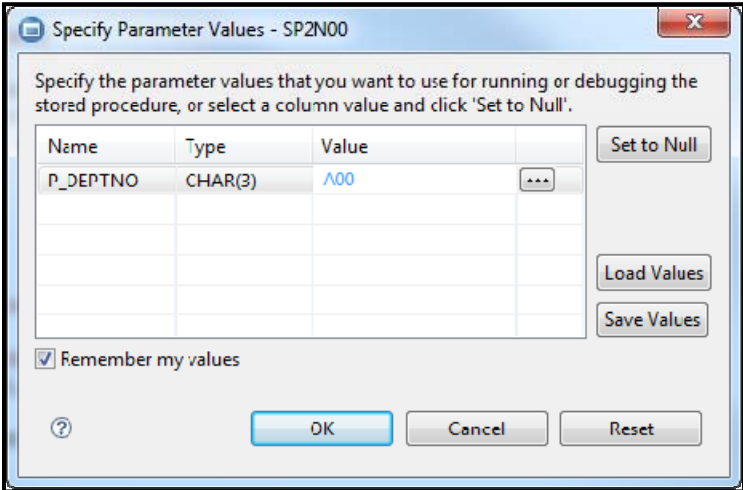


Running a Stored Procedure



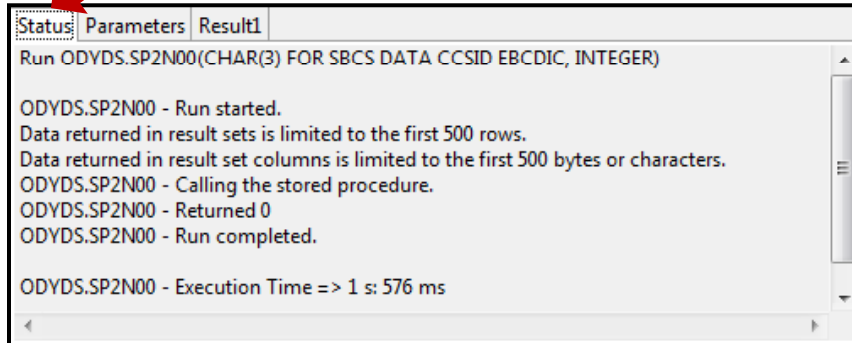
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Running a Stored Procedure



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Running a Stored Procedure



Run ODYDS.SP2N00(Char(3) FOR SBCS DATA CCSID EBCDIC, INTEGER)

```

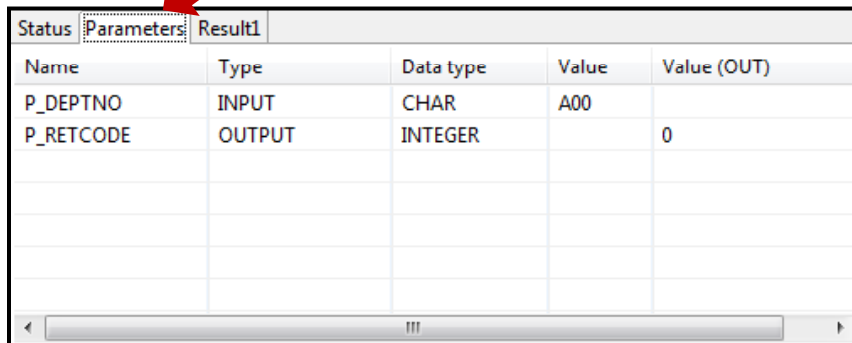
ODYDS.SP2N00 - Run started.
Data returned in result sets is limited to the first 500 rows.
Data returned in result set columns is limited to the first 500 bytes or characters.
ODYDS.SP2N00 - Calling the stored procedure.
ODYDS.SP2N00 - Returned 0
ODYDS.SP2N00 - Run completed.

ODYDS.SP2N00 - Execution Time => 1 s: 576 ms
    
```

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Running a Stored Procedure

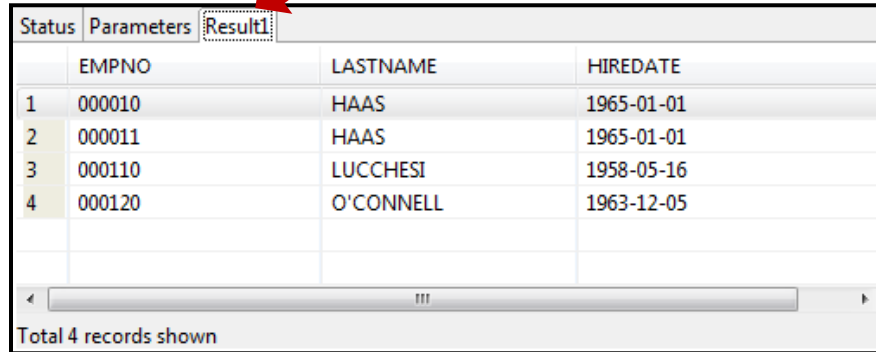


Name	Type	Data type	Value	Value (OUT)
P_DEPTNO	INPUT	CHAR	A00	
P_RETCODE	OUTPUT	INTEGER		0

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Running a Stored Procedure



Status	Parameters	Results	
	EMPNO	LASTNAME	HIREDATE
1	000010	HAAS	1965-01-01
2	000011	HAAS	1965-01-01
3	000110	LUCCHESI	1958-05-16
4	000120	O'CONNELL	1963-12-05

Total 4 records shown

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For More Information

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