# Transforming Db2 for z/OS Application Development Experience

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# Agenda

- Overview
- Installation
- Features
- Demo
- What's next?

# Overview

# Meet our persona

## Deb, New z/OS Developer

- Code, debug, and tune application programs (written in Java, COBOL, PL1, etc.) that access Db2 for z/OS via SQL
- Code, run, and tune SQL statements
- Code, deploy, and debug Db2 for z/OS stored procedures

# Pain points

**Deb, New z/OS Developer**

- Requires Z domain specific skills to get started
- Needs to interact with different tools on different platforms
- Reduced productivity

Image by storyset on Freepik

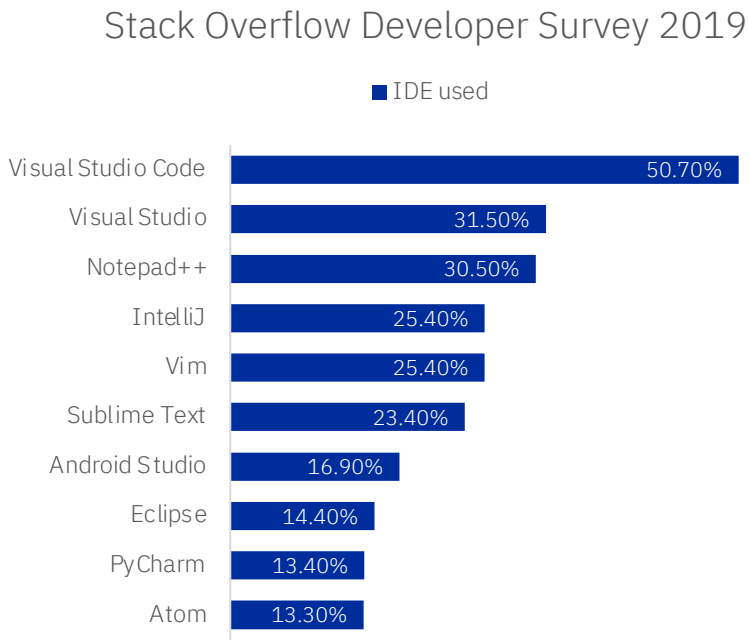
# Db2 Developer Extension

An extension for Visual Studio Code that provides language support for developing Db2 for z/OS SQL applications.

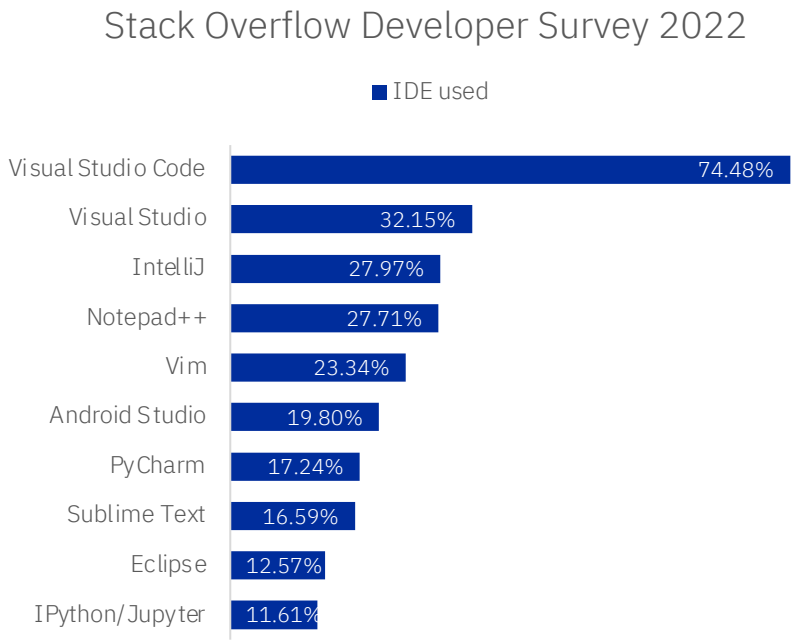
# Why VS Code?

- Lightweight
- Rich git integration
- Integrated terminal support
- Board language support
- Extensive and active extension support
- Z support with other extensions (Z Open Editor, Zowe Explorer)
- Extensions deployable to other platforms (Eclipse Theia, RedHat CodeReady Workspaces, etc.)

# Why VS Code?




*Data from Stack Overflow Developer Survey 2019*

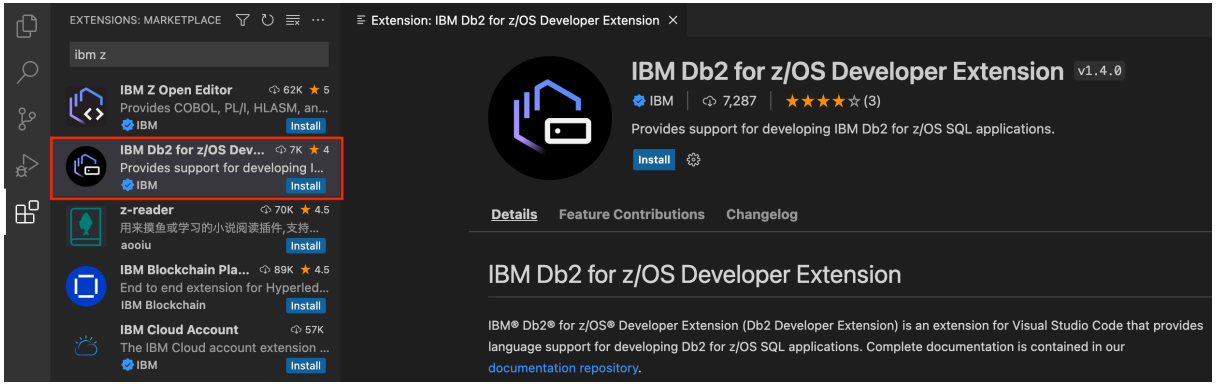



*Data from Stack Overflow Developer Survey 2022*

# Installation

# How to install

1. Install and open VS Code
2. Switch to the Extensions view
3. Search for "ibm z"
4. Click the "Install" button for "IBM Db2 for /OS Developer Extension"

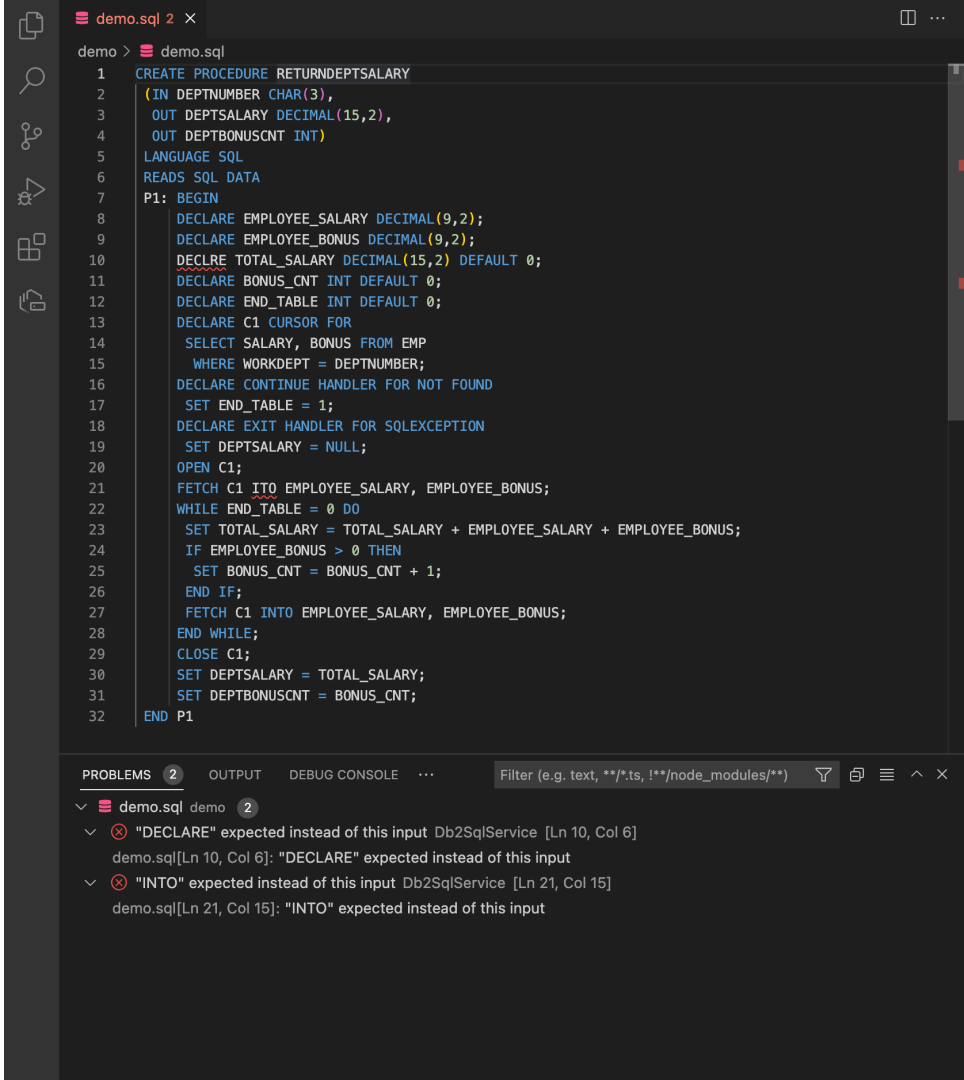


# Features

- SQL language support
  - Syntax highlighting
  - Syntax checking
  - Code completion
  - Signature help
  - Format SQL statements
- Run SQL statements
- Deploy, run, and debug native stored procedures
- Tune SQL
  - Visual Explain
  - Statistics Advisor
  - Capture Query Environment

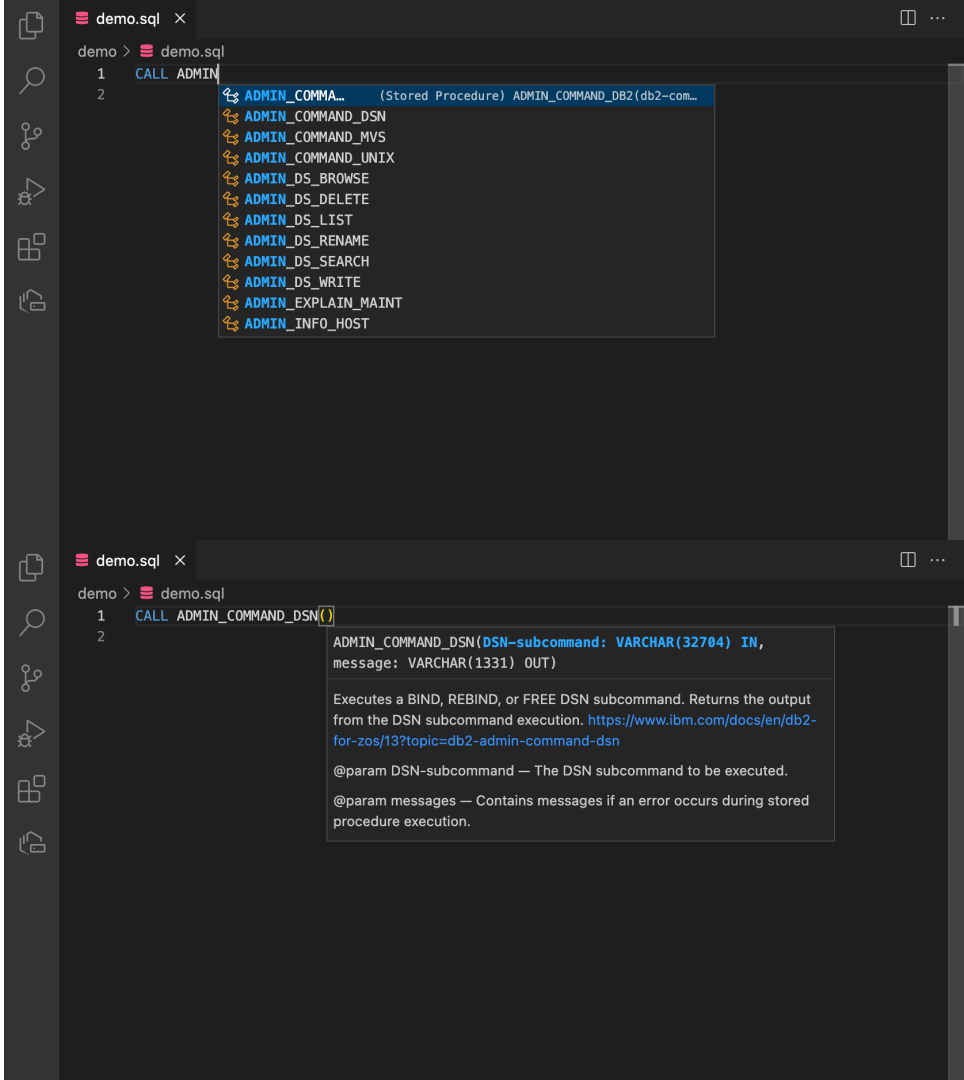
# Syntax highlighting and syntax checking

- Improves readability of SQL statements by highlighting keywords
- Checks for SQL syntax errors and provides hints to resolve errors



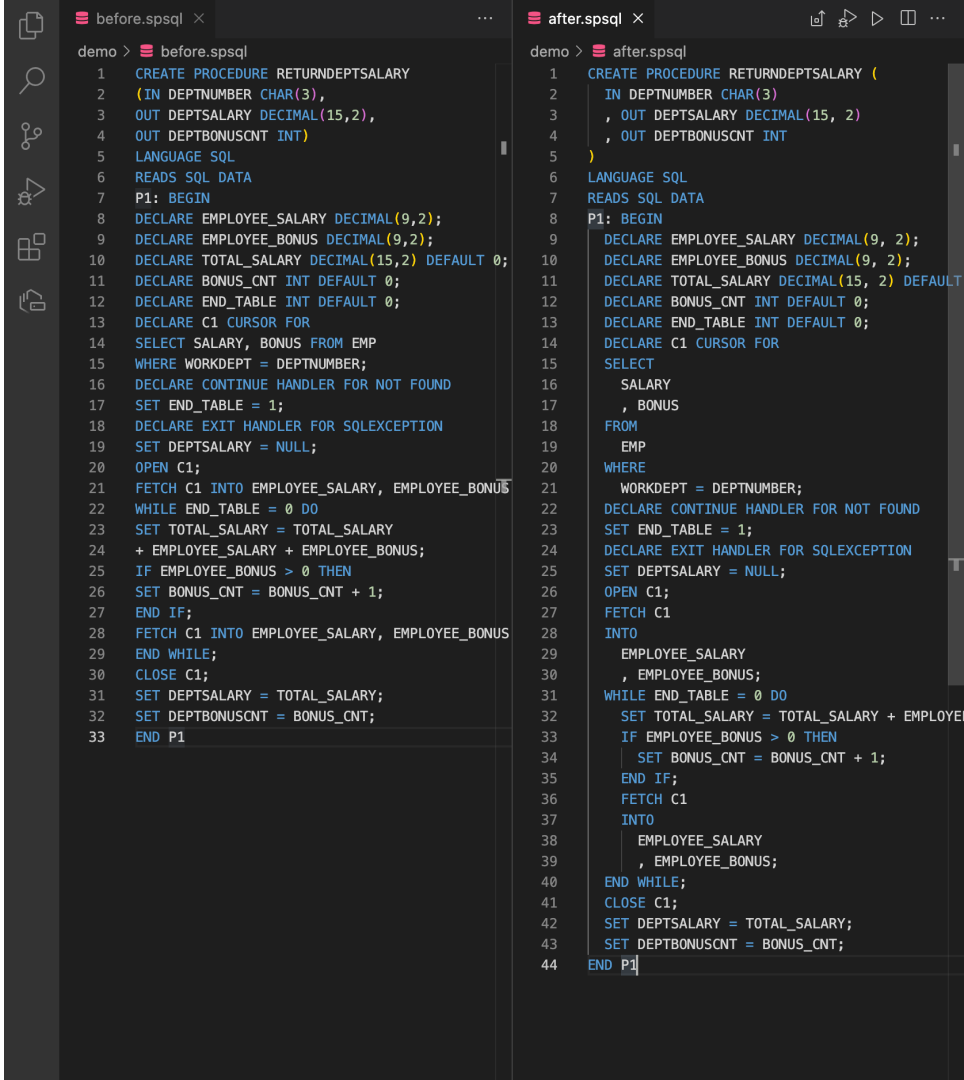
# Code completion and signature help

- Suggests names for built-in Db2 functions and Db2-supplied stored procedures
- Provides parameter information for built-in Db2 functions and Db2-supplied stored procedures



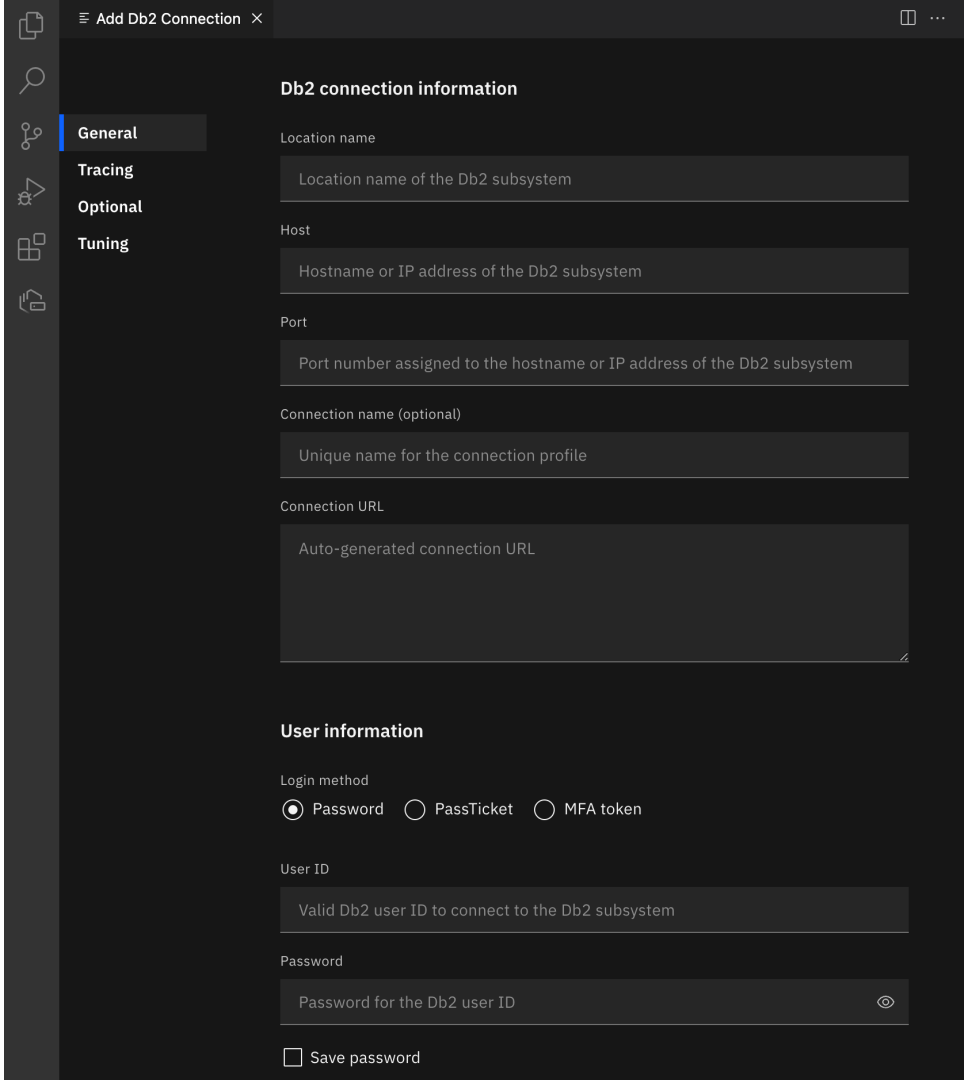
# Format SQL statements

– Easier to parse large blocks of code and understand the relationship between different blocks of SQL elements and clauses



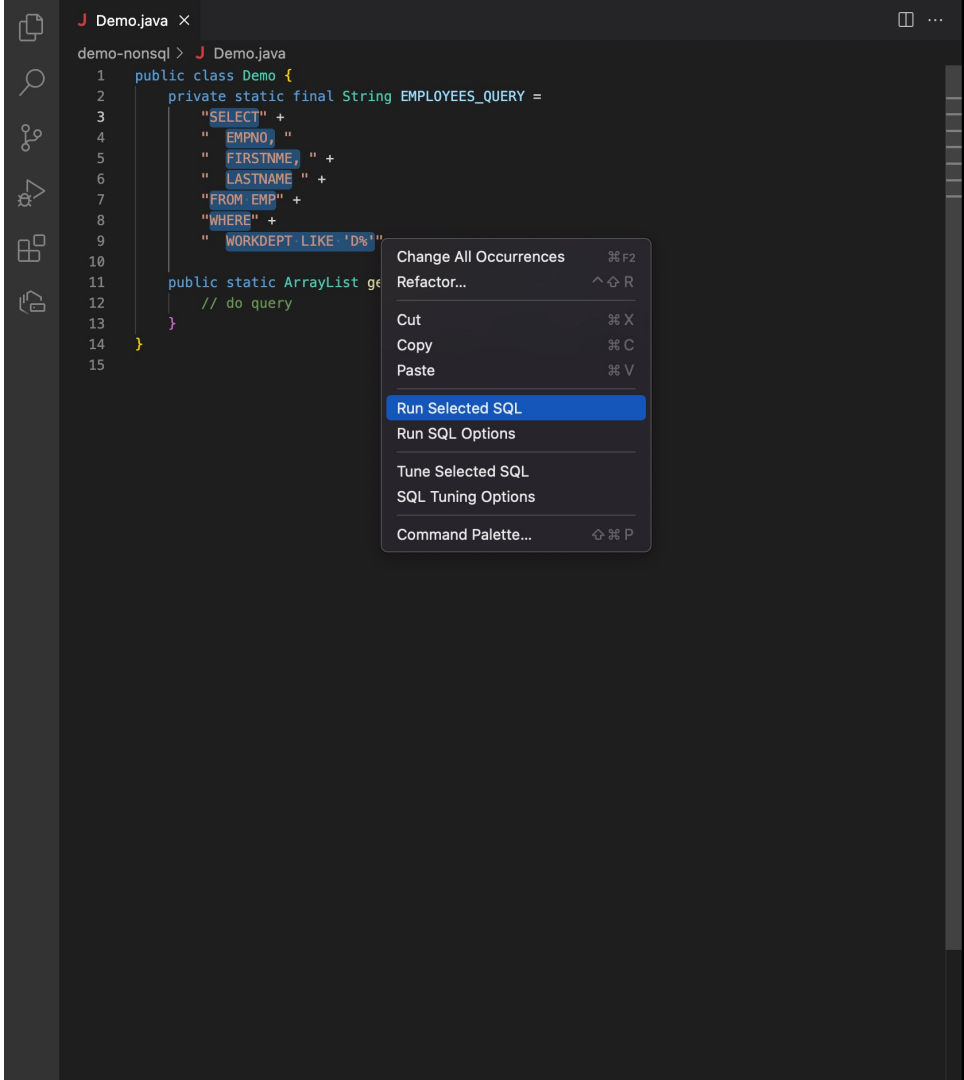
# Connect to Db2 for z/OS

- Supports different authentication methods:
  - User ID and password
  - RACF PassTicket
  - Multi-factor authentication (MFA) token
- Specify JDBC properties
- Enable JDBC trace



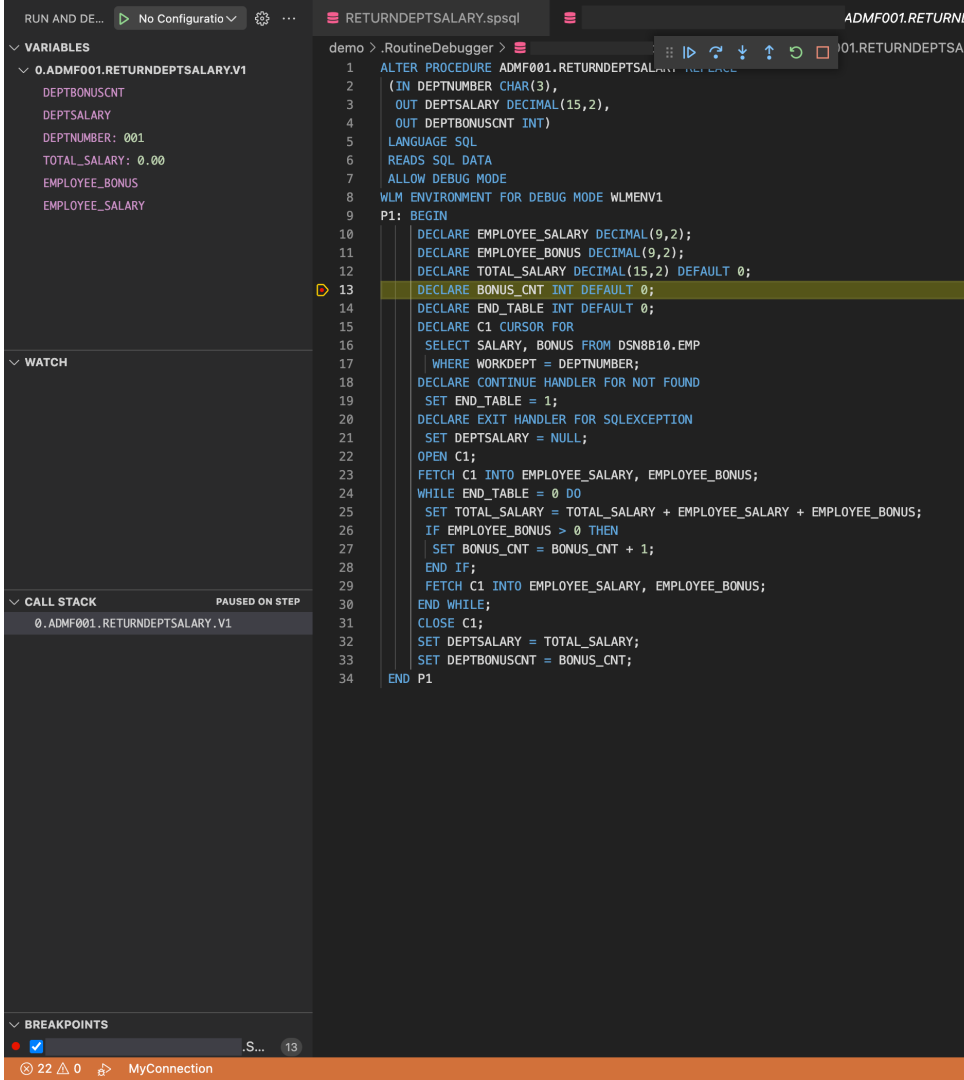
# Run SQL

- Run selected SQL from any type of file
- Run all SQL statements in a file
- Change commit and rollback options



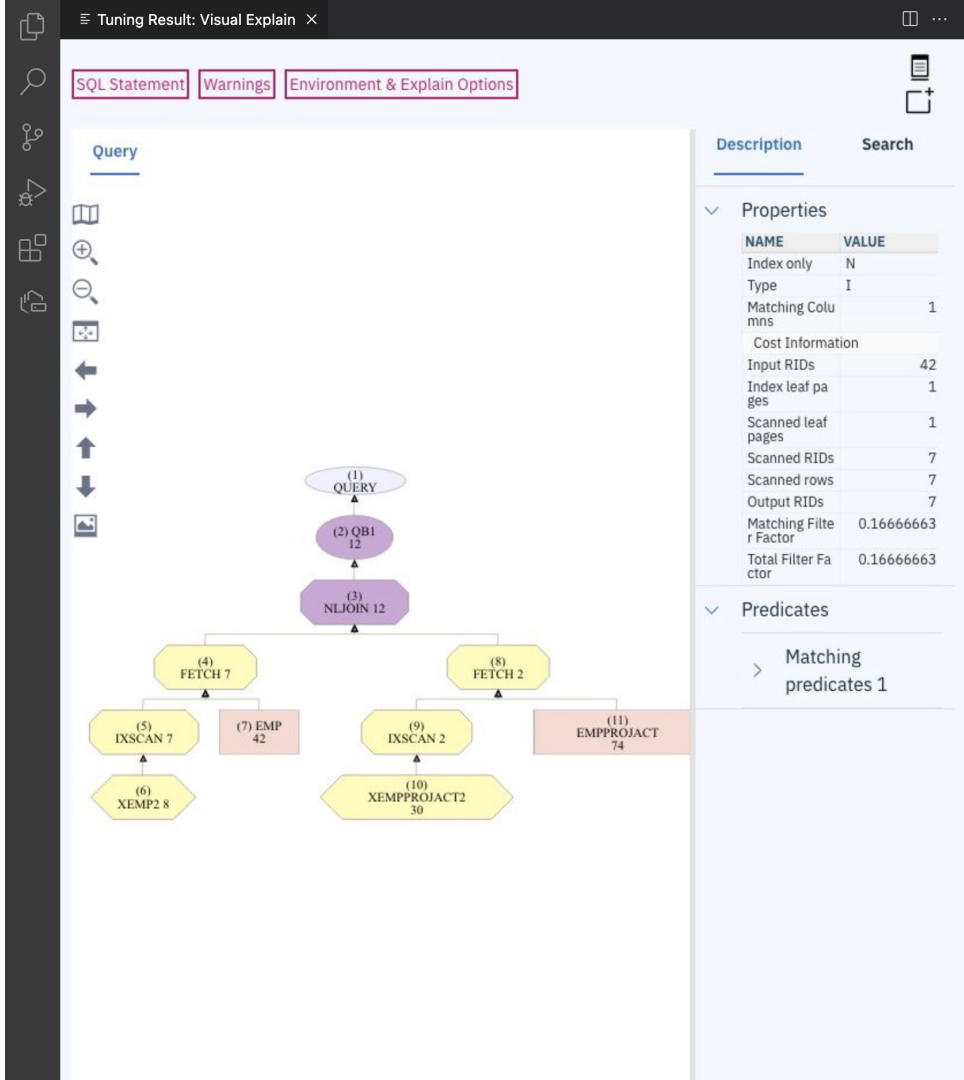
# Native stored procedures

- Deploy, run, and debug native stored procedures
- File extension must end with .spsql



# Tune SQL

- View graphical representation of access path
- Generate statistics to improve query performance
- Capture statement's environment to troubleshoot problems when tuning an SQL statement



# Prerequisites for SQL Tuning Services

- SQL Tuning Services documentation
- IBM DB2 Accessories Suite for z/OS, 4.2
- APAR PH42944

# Demo

- SQL language support
- Connecting to Db2 and running SQL
- Working with native stored procedures
- Tuning SQL
- Running SQL from z/OS (with Zowe Explorer)

# What's next?

**... More developer features**

**... More support for catalog navigation**

1Q 2023
- Advanced Tuning Services integration
- Initial support for catalog navigation
- Usability enhancements

May 31, 2022 V1.4
- Db2 for z/OS V13 support, Usability enhancements

March 15, 2022 V1.3.4
- JDBC driver version 4.29.24 support
- Usability enhancements

2H 2021 Releases:
- No charge Tuning Services integration
- Usability enhancements

1H 2021 Releases:
- Format SQL, embedded SQL execution, usability enhancements
- Stored procedure debug

2020 Releases:
- JDBC trace and properties
- Code completion, snippets, connect to Db2, run SQL (BYOL)
- Syntax checking, syntax highlighting

# Advanced tuning feature: **Index Advisor**

Tuning Result: Index Advisor

## Summary

Number of recommendations: 2
Number of existing indexes: 8
CPU cost saving: 93.8730853391685%

## Candidate indexes

| Table | DDL | Explanation | Key columns | Full key cardinality | Index size |
|---|---|---|---|---|---|
| SYSIBM.SYSCOLUMNS | `CREATE INDEX "SYSIBM"."SYSCOLUMNS_VIRT_IDX_166443307115256240" ON "SYSIBM"."SYSCOLUMNS" ( "TBNAME" ASC ) NOT PADDED FREEPAGE 0 PCTFREE 10` | Supports join predicates. | TBNAME(ASC):-1 | 370 | 0.1015625MB |
| SYSIBM.SYSTABLES | `CREATE INDEX "SYSIBM"."SYSTABLES_VIRT_IDX_166443307114184282" ON "SYSIBM"."SYSTABLES" ( ( "DBID" + 1 ) ASC ) NOT PADDED FREEPAGE 0 PCTFREE 10` | Supports local predicates. | ( "DBID" + 1 ) (ASC):20 | 20 | 0.0234375MB |

## Existing indexes

| Index | Table | Key columns | Unique | Clustering | DPSI | Exclude null keys | Include columns | Time last used |
|---|---|---|---|---|---|---|---|---|
| SYSIBM.DSNDCX01 | SYSIBM.SYSCOLUMNS | TBCREATOR(ASC):-1<br>TBNAME(ASC):-1<br>NAME(ASC):-1 | Y | N | N | N | | 2022-09-28 |
| SYSIBM.DSNDCX02 | SYSIBM.SYSCOLUMNS | TYPESCHEMA(ASC):-1<br>TYPENAME(ASC):-1 | N | N | N | N | | |
| SYSIBM.DSNDCX05 | SYSIBM.SYSCOLUMNS | TBCREATOR(ASC):-1<br>TBNAME(ASC):-1 | N | N | N | N | | 2022-09-28 |
| SYSIBM.DSNDCX06 | SYSIBM.SYSCOLUMNS | TBCREATOR(ASC):-1<br>TBNAME(ASC):-1 | N | N | N | N | | 2022-09-26 |

# Advanced tuning feature: **Access Path Advisor**

Tuning Result: Access Path Advisor

## Summary

Health status: Bad
Number of recommendations: 3
High severity recommendations: 1
Medium severity recommendations: 0
Low severity recommendations: 2

## Recommendations

| | | |
|---|---|---|
| 1 | Severity: High | Avoid reading all index keys on an index scan (QBLOCKNO = 1, PLANNO = 2). The table SYSIBM.SYSCOLUMNS is accessed by a non-matching index scan (QBLOCKNO = 1, PLANNO = 2). If a table is accessed by non-matching index scan, then all the index keys and their RIDs are read. When a large number of keys and RIDs are accessed, Db2 might be using an inefficient access path. Consider run the Statistics Advisor or run the Index Advisor to determine whether creating an index might improve the access path. |
| 2 | Severity: Low | Avoid table space scans (QBLOCKNO = 1, PLANNO = 1) on table SYSIBM.SYSTABLES. The table is accessed by a table space scan. Consider running the Statistics Advisor, because the improving statistics might improve the access path. Also, consider running the Index Advisor to determine whether creating an index might improve the access path. |
| 3 | Severity: Low | Avoid sorting (QBLOCKNO = 1, PLANNO = 3) on a large number of records. A sort is used. When a large number of records are returned before sorting, Db2 might be using an inefficient access path. Consider rewriting the query or designing an index to avoid the sort if possible. |
| | Explanation | Db2 uses a sort to process operations such as join processing, GROUP BY operations, ORDER BY operations, the removal of duplicates, and sub-query processing. If the number of rows to be sorted is large, the cost of the sort will be high.You can use indexes to order data, sometimes eliminating the need for sorting. Some sorts can be avoided if index keys are in the order needed by ORDER BY, GROUP BY, a join operation, or DISTINCT in an aggregate function. |
| | Example | Consider the following query:SELECT C1,C2,C3 FROM T WHERE C1 > 1 ORDER BY C1 OPTIMIZE FOR 1 ROW;An ascending index on C1 or an index on (C1, C2, C3) might eliminate a sort.OPTIMIZE FOR 1 ROW can also be used to avoid sorts because it can have a significant effect on the access path. |

# Resources

## IBM Db2 for z/OS Developer Extension

- VS Code Marketplace: https://marketplace.visualstudio.com/items?itemName=IBM.db2forzosdeveloperextension
- Documentation: https://ibm.github.io/db2forzosdeveloperextension-about/
- Report issues or give suggestions: https://github.com/IBM/db2forzosdeveloperextension-about/issues

## Other Resources

- Visual Studio Code: https://code.visualstudio.com/
- SQL Tuning Services: https://www.ibm.com/docs/en/db2-for-zos/13?topic=db2-sql-tuning-services
- IBM Z Open Editor: https://marketplace.visualstudio.com/items?itemName=IBM.zopeneditor
- Zowe Explorer: https://marketplace.visualstudio.com/items?itemName=Zowe.vscode-extension-for-zowe