

CA Development Environment for z Systems

Adopt a modern approach that benefits millennial developers and experienced IT staff

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Build Swiftly



As an Enterprise Application Development team, we need the ability to easily manage, develop, and maintain **cross enterprise applications** using **diverse teams**, **different tools**, on **different platforms** to maximize productivity, quality and MTTR.

Go Agile

Go Agile with agile processes and tools that speed time to market for mainframe teams

Onboard Quickly

Onboard quickly your team with modern toolsets and languages on the mainframe

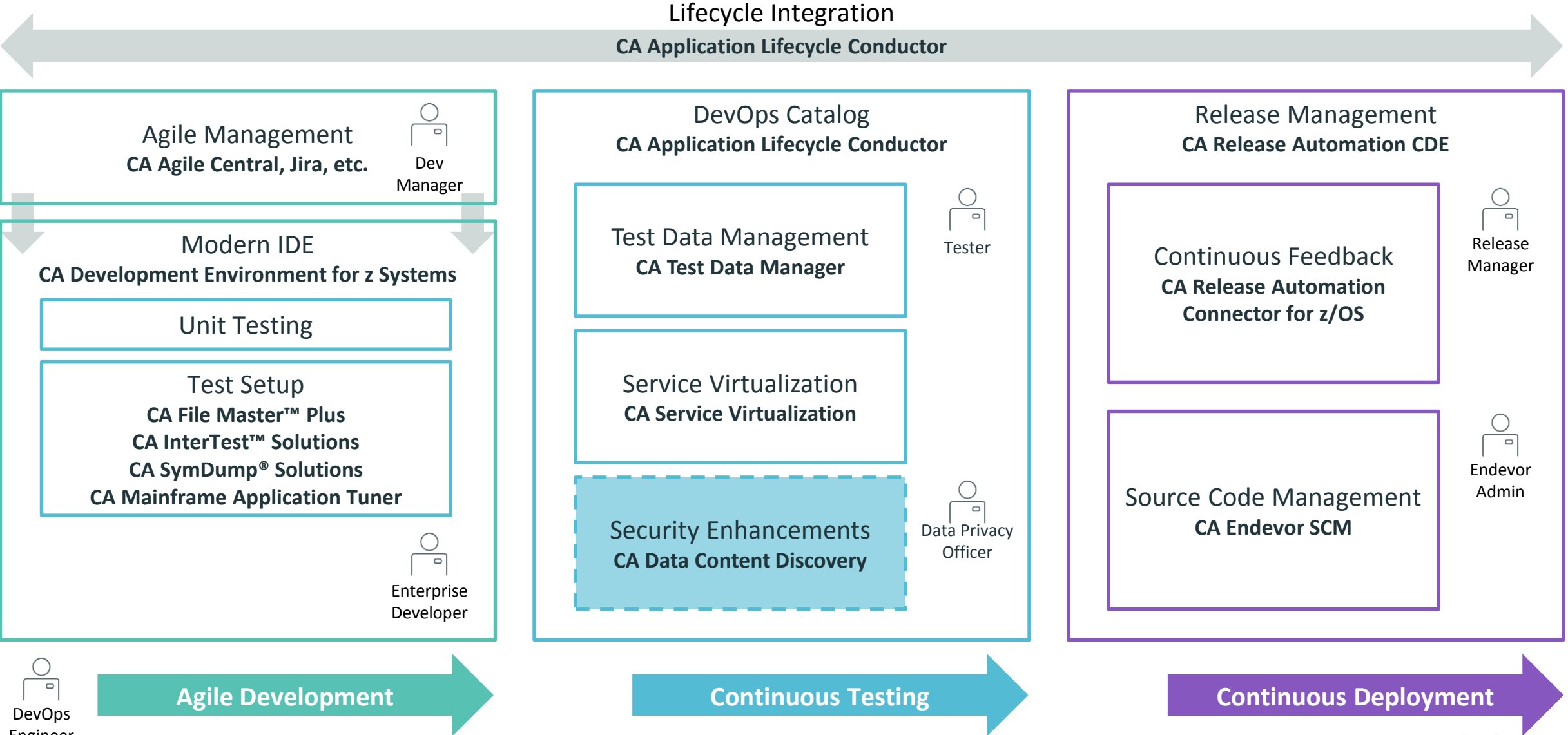
Integrate Mainframe

Integrate mainframe into enterprise development with traceability and governance of SDLC mobile to mainframe

Agile Development

Develop and maintain mainframe applications with agile and modern methodologies, toolsets and coding languages

An automated flow from Build through Deploy



CA Endevor SCM - Update Finance application to sort records - CA Development Environment for z Systems - C:\Users\dubmi01\IBM\rationalsdp\workspace

File Edit Source Refactor Navigate Search Project Run CA Mainframe Application Tuner CA File Master Plus CA Endevor SCM Window Help

Quick Access z/OS Projects CA InterTest CA SymDump CA File Master Plus CA File Master Plus for IMS CA File Master Plus for DB2 for z/OS CA Mainframe Application Tuner CA Endevor SCM CA ALC Client

Repository View Project View Project Explorer

Sample Project

- Sample Project (Endevor on CA32)
 - FINANCE
 - ACCTREC
 - SMPTEST
 - T
 - ABC.TEST : [0102]
 - AMXRPT01.CBL : [0100]
 - AMXRPT02.CBL : [0100]
 - AMXRPT03.CBL : [0100]
 - AMXTST01.CBL : [0100]
 - CAWDE01.CBL : [0100]
 - CAWDE02.CBL : [0100]
 - CAWDE03.CBL : [0100]
 - CAWDE04.CBL : [0100]
 - CAWDE05.CBL : [0100]
 - CAWDE06.CBL : [0100]
 - CAWDE07.CBL : [0100]
 - CAWDE08.CBL : [0100]
 - CAWDE09.CBL : [0100]
 - CAWDE10.CBL : [0100]
 - CAWDE11.CBL : [0100]
 - CAWDE12.CBL : [0100]
 - CAWDE13.CBL : [0100]
 - CAWDE14.CBL : [0100]
 - CAWDE15.CBL : [0100]

Quick Access to CA Endevor Source Code Management

Internal Web Browser *US69: Update Finance application to sort records

```
-----*A-1-B-+-2-----3-----4-----5-----  
EVALUATE TRUE  
  WHEN SQLCODE = +0  
    PERFORM STORE-DATA-CUR  
  WHEN SQLCODE = +100  
    CONTINUE  
  WHEN OTHER  
    GO TO TROUBLE  
  END-EVALUATE  
  
  IF SQLCODE NOT = +100 AND  
  *****  
  * UNCOMMENT NEXT STATEMENT TO FORCE DB2Q OUTPUT  
  * TYPE1 OF DCLSYSTABLES NOT = 'T' AND  
  * TERM-FUNCTION = TDQNAME THEN  
    PERFORM WRITE-TDQ  
  END-IF  
  
  IF ROW-COUNT-CUR >= 18  
    AND TERM-FUNCTION NOT = TDQNAME THEN  
      PERFORM DISPLAY-DATA-CUR  
  *****  
  
  END-PERFORM  
  
  IF ROW-COUNT-CUR > 0  
    AND TERM-FUNCTION NOT EQUAL TO TDQNAME THEN  
      PERFORM DISPLAY-DATA-CUR  
  END-IF.  
  
END-MESSAGE.  
  
IF CUR-OPENED THEN
```

Integrated with CA Application Development Tools, including:

- CA File Master Plus
- CA InterTest / SymDump
- CA Mainframe Application Tuner

Modern Rich Edit environment

Task List

Find

All Defects for <All Users> in Finance Report - Workspace 1 [Rally1]

- DE165: Automated test AMXTST01 failure for environment Test
- DE166: Automated test of CAWDEM2 failed in the Quality Assurance enviro
- DE167: Automated test of CAWDEM2 failed in the Quality Assurance enviro
- DE168: Automated test of CAWDEM2 failed in the Quality Assurance enviro
- DE169: Automated test of CAWDEM2 failed in the Quality Assurance enviro

All User Stories for <All Users> in Finance Report - Workspace 1 [Rally1]

- US64: Add value column to customer table
- US66: Group by transaction category on report
- US71: Add new sorting level to transaction detail report
- US74: Filter customers feature for transaction report
- US75: Add scheduled start time option for Finance Report groups

Unmatched [Rally1]

- US63: Add transaction count to Finance Report

Integrated Agile Planning

Properties Search ... Summar... Compon...

Property Value

Info

CCID: US69

Comment For CA World 2016

Connection: Endevor on CA32

Element: *

Environment: SMPTEST

Path: Endevor on CA32

Stage: T

Subsystem: ACCTREC

System: FINANCE

Type: *

CA Endevor SCM Log

Program Control Flow

Improved Developer Productivity

CA technologies

CA ALC

Top Business Value Propositions

1. Productivity

- Customers state achieved goals of between 5% and 47% increased productivity
 - with an average increase of 20%

2. Attract/Retain the next generation of z/Developers

- Modern user interface with tooling similar to what new skills are used to in distributed env.

3. Application/Software Modernization

- Mature SOA tools, wizards and generators make the mainframe an integral part in the API economy

4. Cross-platform development using one tool

- Provides developers doing both Java and Distributed application work and z/OS development and maintenance a single integrated workbench

5. Code Quality

- Static application scanners and formatting tools available to improve code performance and maintain-ability

CA Development Environment for z Systems - Overview

Lifecycle Tools

- Debug z/OS applications from the workstation as they execute live in the remote runtime with CA InterTest
- Read/Write/Update VSAM datasets via integration with CA File Master Plus
- Access CA SymDump reports for analyzing ABENDS and associating back to source code

Host Tooling Integration

InterTest
SymDump
File Master Plus
Endevor

z/OS Application Development

[COBOL, PL/I,
C/C++, JCL,
Screens, Stored
Procedures, etc]

Enterprise Service Tools

[Web Services
For CICS/IMS]

Mainframe / Runtime Integration

Eclipse Framework

Eclipse Platform and Java Development

- Plug-in integration framework
- Java Development (useful for System z Java development)
- Distributed team integration
- Database access/search tools

Traditional Development Environment

- Connect to z/OS systems
- Work with z/OS resources like COBOL, PL/I, C, C++, JCL, assembler, etc using the intelligent and advanced edit and analysis capabilities
- Perform dataset management actions like allocating datasets and migrating datasets
- Perform typical edit, compile, and debug tasks on remote z/OS resources from the workstation
- Create, build, and catalog DB2 stored procedures on z/OS
- Perform Program analysis, code review to enforce coding standards etc. on the workstation
- Screen design
- Visually create, modify, build, and deploy BMS maps sets or MFS/IMS maps remotely or on the local workstation
- Code Generation
- Generate program code from UML, easily integrated into web service applications

z/OS Web Service and Flow Creation

- Implements SOA and Web Services for CICS and IMS COBOL and PLI applications
- Bottom-up/Top-down/meet-in-the-middle COBOL to XML mapping support
- Integrated COBOL and PL/I XML converters, XML schemas, and WSDL generation
- Service Flow Modeler to build/deploy service flows out of your existing Commarea, Channel, MQ, and Terminal CICS applications.
- Service deployment modelling tools

Mainframe / System z Runtime Support

- Access to Endevor
- CICS Explorer with Application Deployment Manager
- Interact with the Job Entry Subsystem (JES) to submit jobs, monitor jobs, and review job output
- Process integration (JCL, TSO, ISPF applications) via Menu Manager

Modern IDE Eclipse-based development

The functionality you need is always in focus

Work concurrently not sequentially

Edit a program

Access Datasets + Dataset Management

File Compare

Submit a Compile/syntax check

Access Jobs

Dataset Statistics

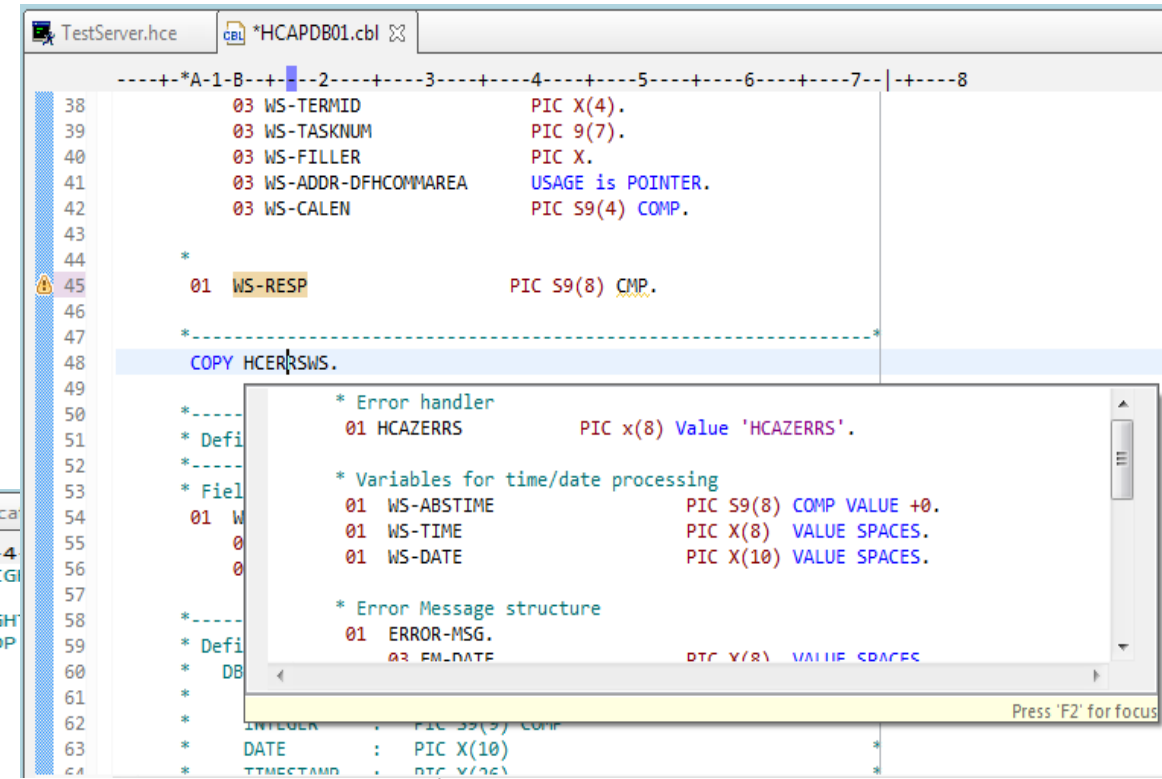
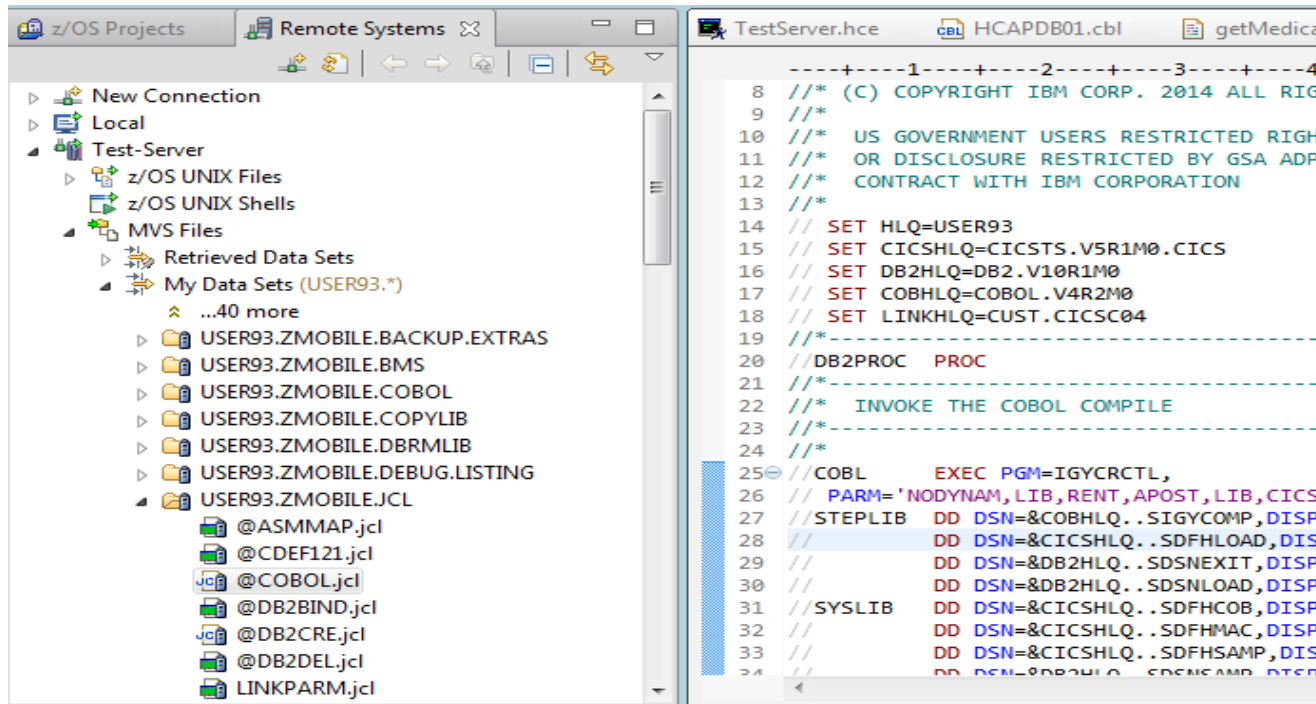
File Search

Property	Value
Attribute	
BLKSIZE	32720
DSNTYPE	DATA_LIBRARY
RECFM	FB
SECONDARY	2
SPACE	TRACK

Resource	Job ID	Job Name	Job Status	Start Date	End Date	Reason	User	Return Code	Return Status	Spool Tracks	Priority
DD50001:TSU16893	TSU16893	DD50001	ABENDED	2010/04/07...	5622	ABENDED			ABEND	1	1
DD50001:TSU16886	TSU16886	DD50001	ABENDED	2010/04/07...	5622	ABENDED			ABEND	1	1
DD50001:TSU16841	TSU16841	DD50001	ABENDED	2010/04/07...	5622	ABENDED			ABEND	1	1
DD50001:TSU16831	TSU16831	DD50001	ABENDED	2010/04/07...	5622	ABENDED			ABEND	1	1
DD50001:TSU16824	TSU16824	DD50001	ABENDED	2010/04/07...	5622	ABENDED			ABEND	1	1
DD500011:JOB16655	JOB16655	DD500011	COMPLETION	2010/04/07...	U0004	NORMAL	004		COMPLETION	1	1
DD500011:JOB16649	JOB16649	DD500011	COMPLETION	2010/04/07...	U0012	NORMAL	00C		COMPLETION	1	1

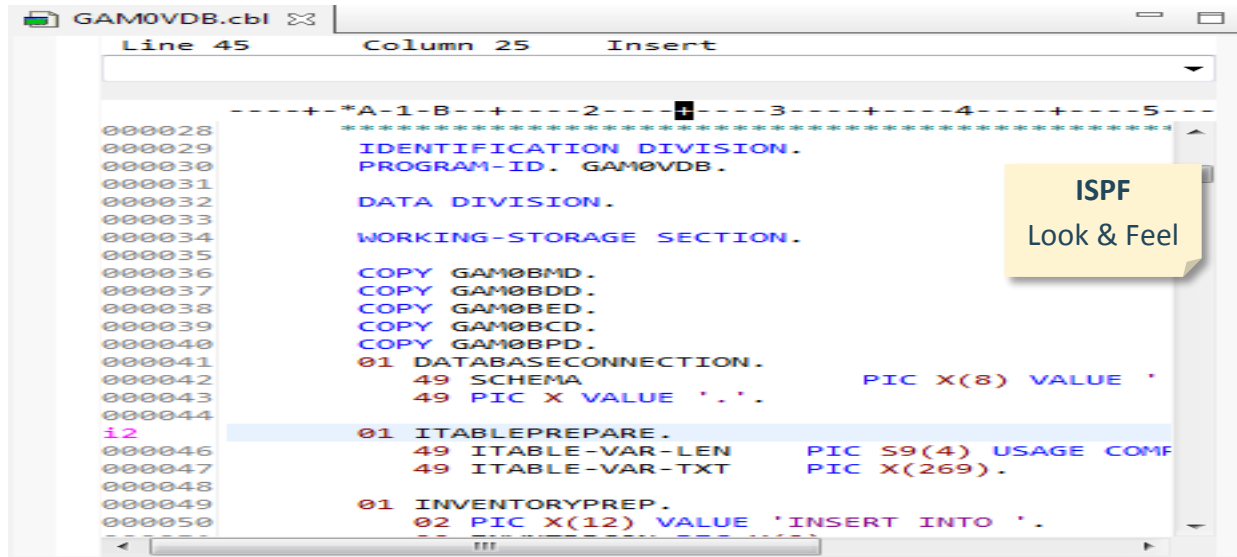
Modern mainframe application development

- Easy access to mainframe resources
- Advanced editors and program understanding tools
- Improved code quality through static analysis
- Unit testing tools
- Remote debugging
- SCM integration



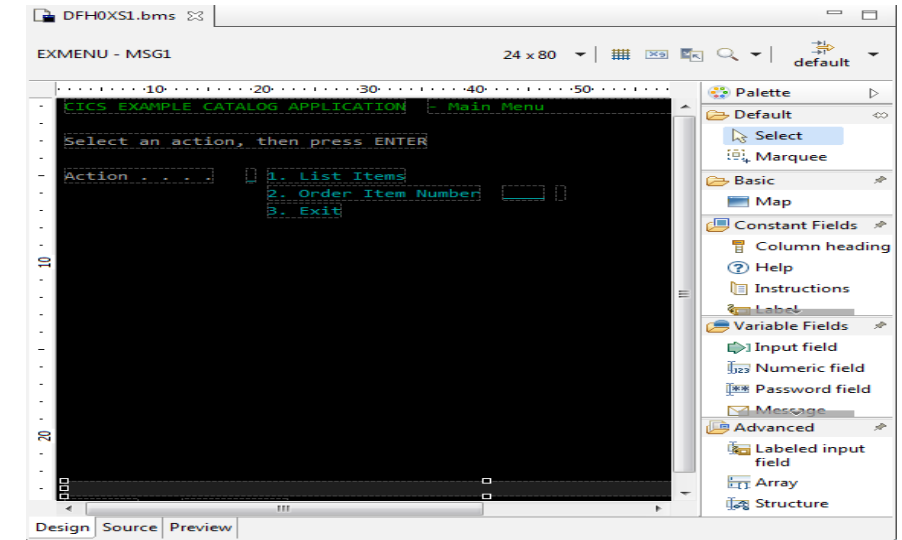
Specialized editors

LPEX editor – COBOL, PL/I, HLASM, JCL, C/C++, REXX

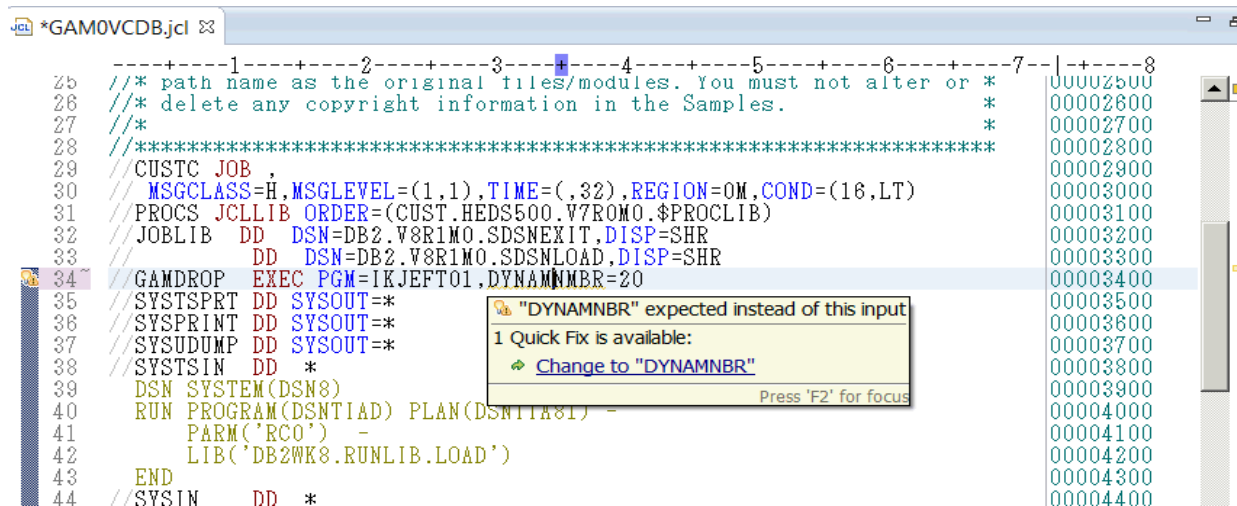


```
000028  -----+*A-1-B-+-----2-----3-----4-----5-----
000029  IDENTIFICATION DIVISION.
000030  PROGRAM-ID.  GAM0VDB.
000031
000032  DATA DIVISION.
000033
000034  WORKING-STORAGE SECTION.
000035
000036  COPY  GAM0BMD.
000037  COPY  GAM0BDD.
000038  COPY  GAM0BED.
000039  COPY  GAM0BCD.
000040  COPY  GAM0BPD.
000041  01 DATABASECONNECTION.
000042  49 SCHEMA                                PIC X(8) VALUE '
000043  49 PIC X VALUE '.'.
000044
000045  01 ITABLEPREPARE.
000046  49 ITABLE-VAR-LEN                        PIC S9(4) USAGE COMP
000047  49 ITABLE-VAR-TXT                        PIC X(269).
000048
000049  01 INVENTORYPREP.
000050  02 PIC X(12) VALUE 'INSERT INTO '.
```

Screen editors – BMS, MFS

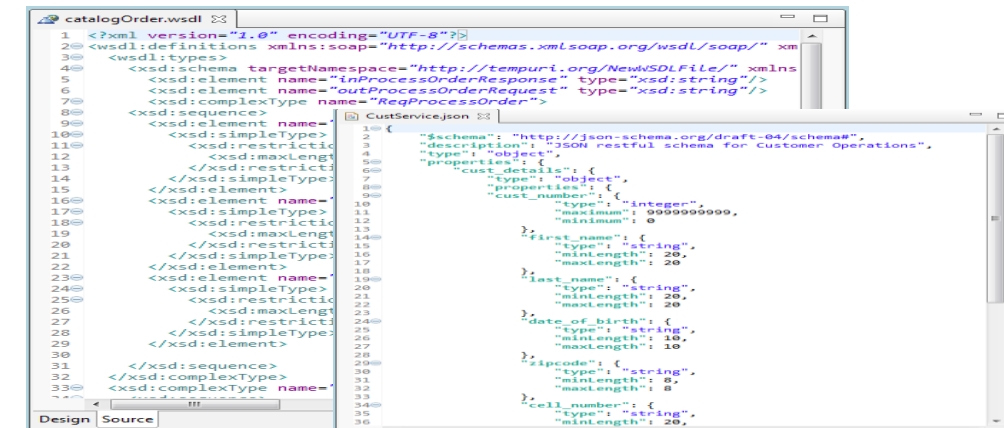


Advanced Eclipse style editors – COBOL, PL/I, JCL, Java



```
25  /* path name as the original files/modules. You must not alter or *
26  /* delete any copyright information in the Samples.                *
27  /*
28  /******
29  CUSTC JOB ,
30  MSGCLASS=H,MSGLEVEL=(1,1),TIME=(,32),REGION=0M,COND=(16,LT)
31  PROCS JCLLIB ORDER=(CUST.HEDS500.V7ROM0.$PROCLIB)
32  JOBLIB DD DSN=DB2.V8R1M0.SDSNEXIT,DISP=SHR
33  DD DSN=DB2.V8R1M0.SDSNLOAD,DISP=SHR
34  GAMDROP EXEC PGM=IKJEFT01,DYNAMNBR=20
35  SYSTSPT DD SYSOUT=*
36  SYSPRINT DD SYSOUT=*
37  SYSUDUMP DD SYSOUT=*
38  SYSTSIN DD *
39  DSN SYSTEM(DSN8)
40  RUN PROGRAM(DSNITAD) PLAN(DSNIT81) -
41  PARM('RC0') -
42  LIB('DB2WK8.RUNLIB.LOAD')
43  END
44  //SYSIN DD *
```

Modern language editors – WSDL, XML, JSON, etc



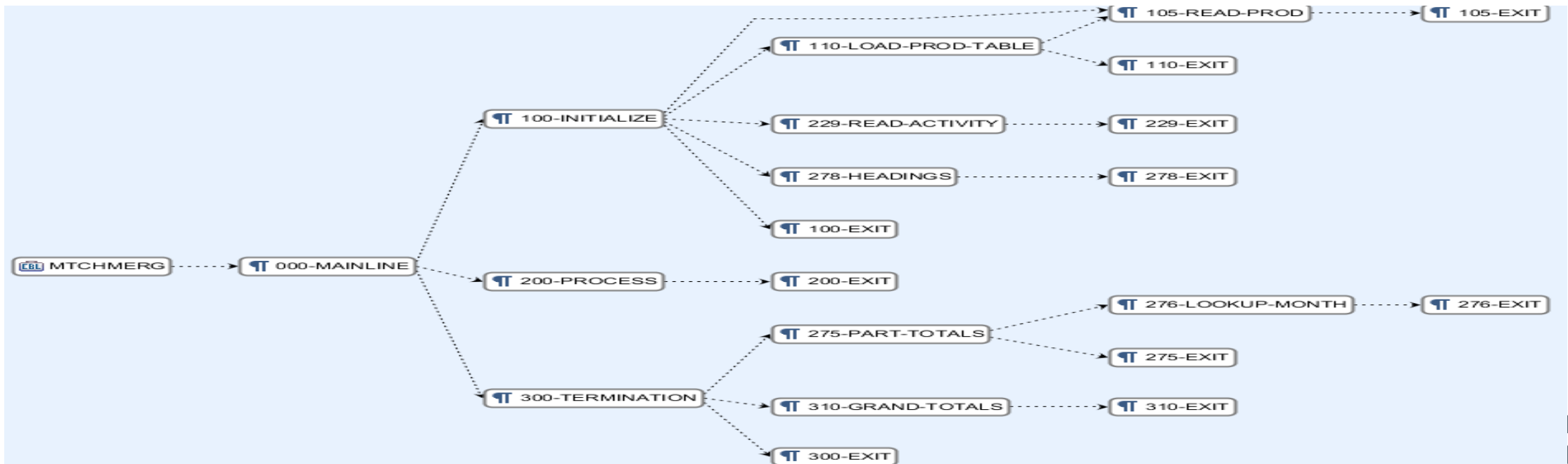
Editor capabilities (a partial list)

- Open, View, Browse copybooks, includes, procedures, datasets, called programs
- Syntax coloring; Content assist; Real-time syntax check; Quick fixes
- Hex editing; Auto comment changed lines; Block cursor for multi-line editing
- Compare to another version; Merge changes; Local change history
- Preprocessor support; Formatting; Manage sequence numbers
- Identify potentially unreachable code; Rename variables; Find & Replace
- Code reuse through Snippets and Templates
- Vertical lines at margins and cursor
- Highlight matching scope terminators
- Mark occurrences of variables
- ISPF Command line; ISPF prefix area
- Multiple edit sessions at once (side by side)
- Hover help for variables, copybooks, includes
- Bookmarks; Task Tags; Hyperlinks; Outline view



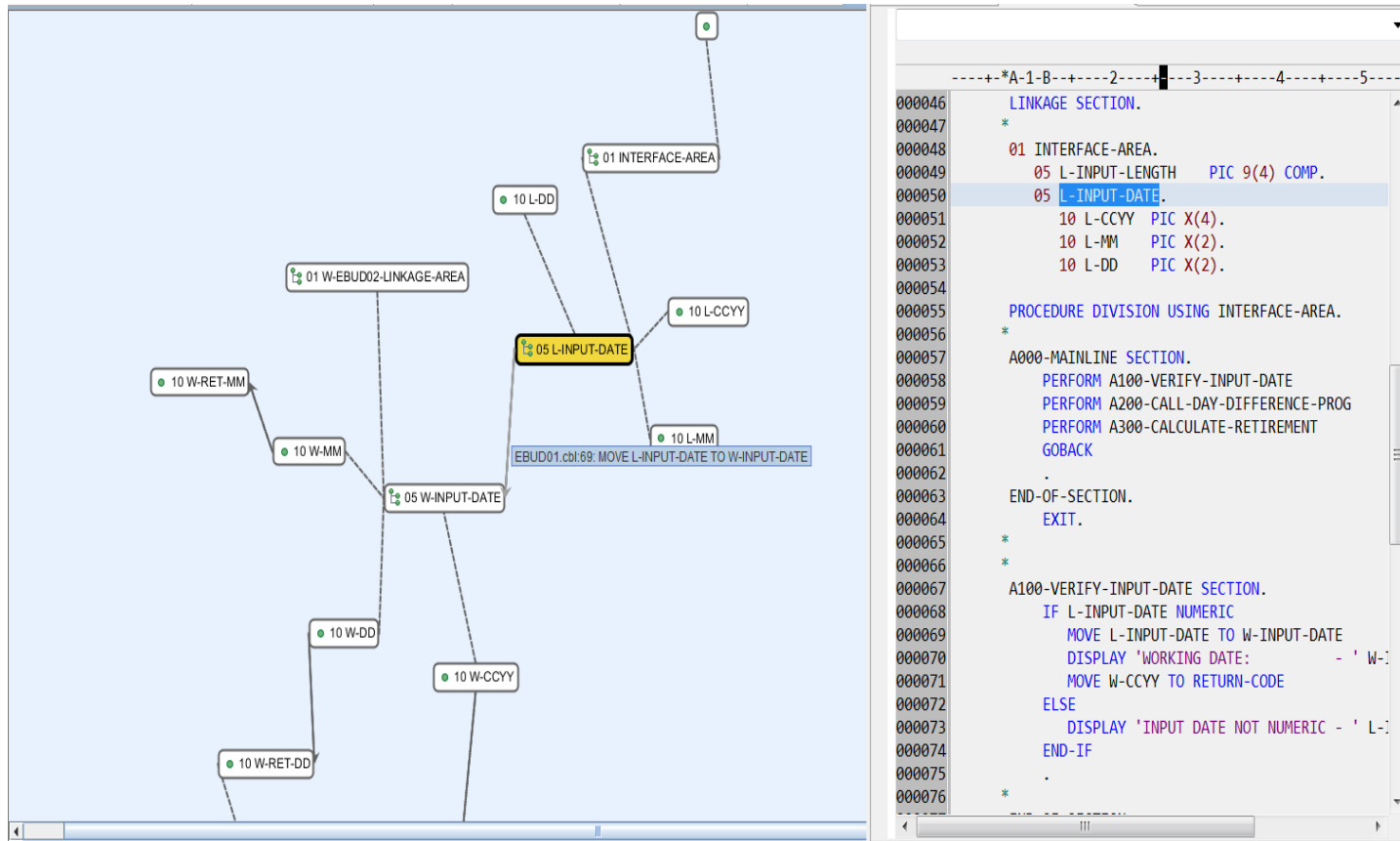
Program Control Flow

- Application Analysis
 - Control flow diagrams for COBOL and PL/I
 - Graphical representation of the program flow
 - Links to source
- Focus on a program segment
 - Menu action > Show program control flow From/To here



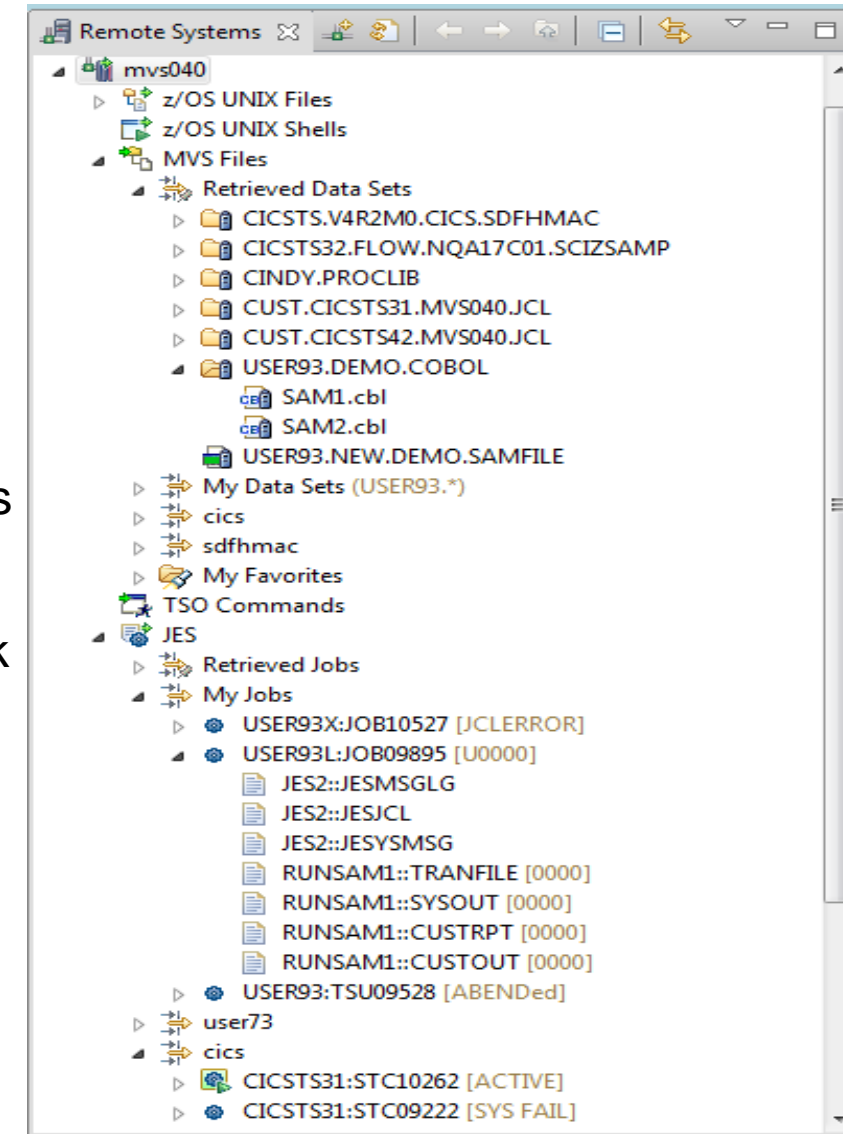
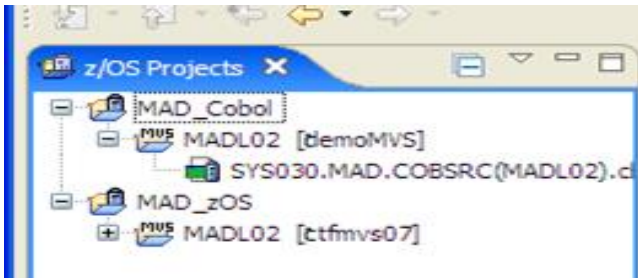
Data Flow

- Discover data relationships
- Ideally suited for maintenance and support tasks such as:
 - Field Expansion
 - ABEND analysis involving invalid data (S0C7, S0C4, etc.)
 - Data element change impact analysis



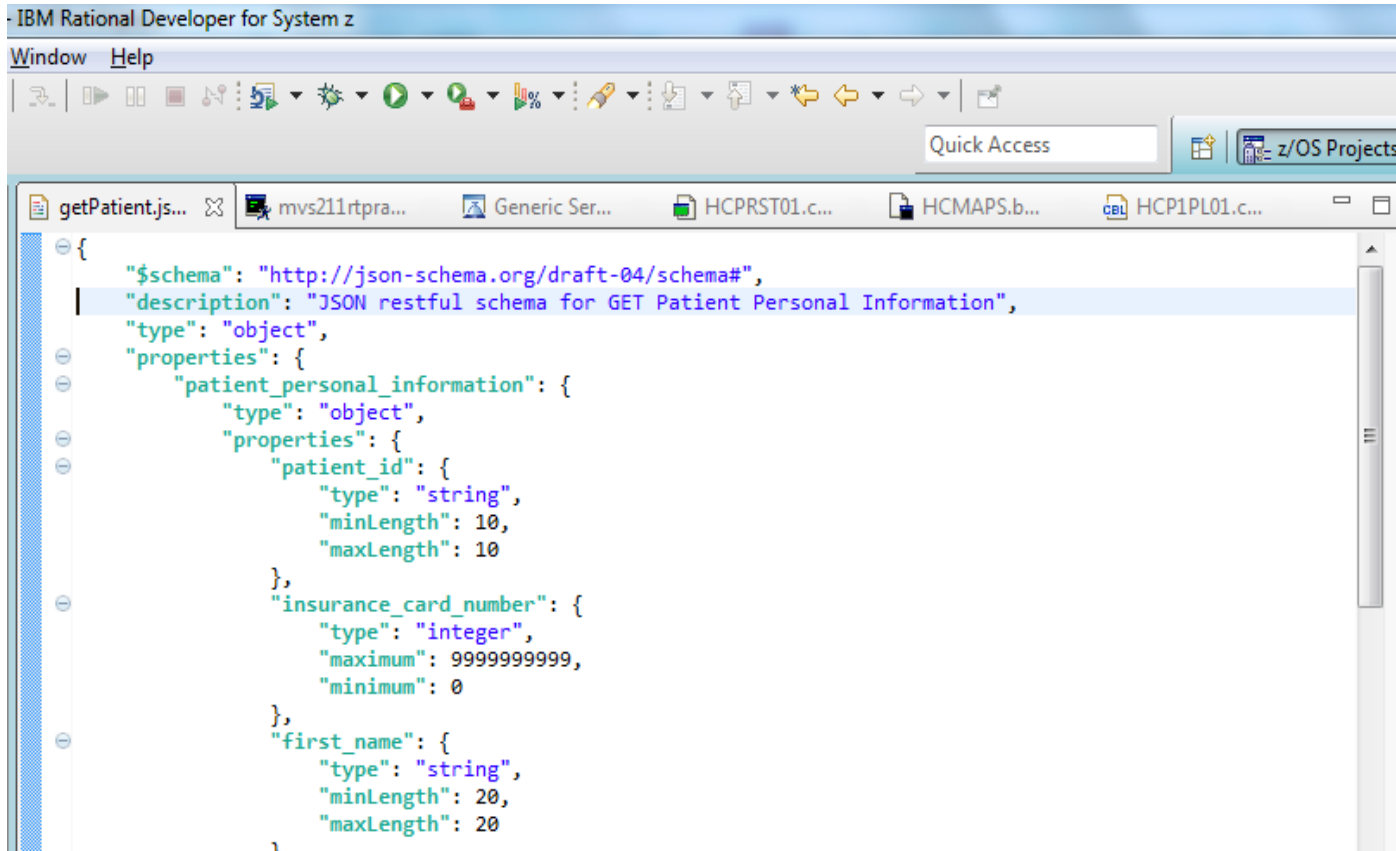
Navigate datasets and jobs live on z/OS

- Connect to multiple hosts concurrently
- Respects existing security configurations and user IDs
- Search, filter, browse, edit, compare, migrate, and allocate new MVS datasets and USS files
- Copy source code, members, or datasets between systems with a few mouse clicks.
- Access JES queues submit jobs, view job state, and open output spools
- Submit TSO or USS commands
- Add datasets and members into projects to group applications and work items together logically
- Open an emulator in the IDE to configured hosts



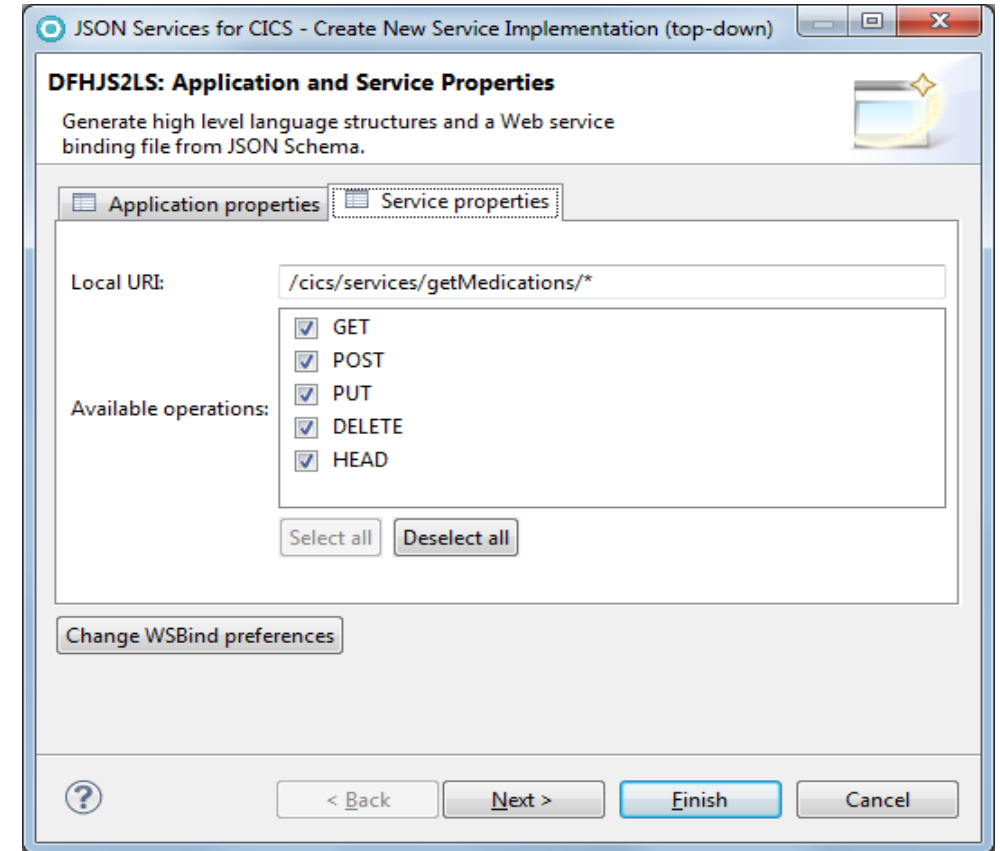
Service Enablement

- Enterprise Service Tools perspective is used for service enabling traditional mainframe applications
- Advanced editors for JSON, WSDL, XML, XSD
- Wizard driven tools for easy creation and deployment of web service artifacts
- Generic Service Client and Web Services Explorer for service testing



The screenshot shows the IBM Rational Developer for System z interface. The main editor window displays a JSON schema for 'GET Patient Personal Information'. The schema includes a root object with a '\$schema' field pointing to 'http://json-schema.org/draft-04/schema#', a 'description' field, and a 'type' of 'object'. The 'properties' field contains three nested objects: 'patient_personal_information' (an object with 'patient_id' as a string of length 10 and 'insurance_card_number' as an integer between 0 and 999999999), and 'first_name' (a string of length 20).

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "description": "JSON restful schema for GET Patient Personal Information",
  "type": "object",
  "properties": {
    "patient_personal_information": {
      "type": "object",
      "properties": {
        "patient_id": {
          "type": "string",
          "minLength": 10,
          "maxLength": 10
        },
        "insurance_card_number": {
          "type": "integer",
          "maximum": 999999999,
          "minimum": 0
        }
      }
    },
    "first_name": {
      "type": "string",
      "minLength": 20,
      "maxLength": 20
    }
  }
}
```



The screenshot shows the 'JSON Services for CICS - Create New Service Implementation (top-down)' dialog box. The 'Application properties' tab is selected. The 'Local URI' field is set to '/cics/services/getMedications/*'. The 'Available operations' list includes GET, POST, PUT, DELETE, and HEAD, all of which are checked. There are 'Select all' and 'Deselect all' buttons below the list. A 'Change WSBind preferences' button is located at the bottom left. The bottom of the dialog features a question mark icon, '< Back', 'Next >', 'Finish', and 'Cancel' buttons.

JSON Services for CICS - Create New Service Implementation (top-down)

Generate high level language structures and a Web service binding file from JSON Schema.

DFHJS2LS: Application and Service Properties

Application properties | **Service properties**

Local URI: /cics/services/getMedications/*

Available operations:

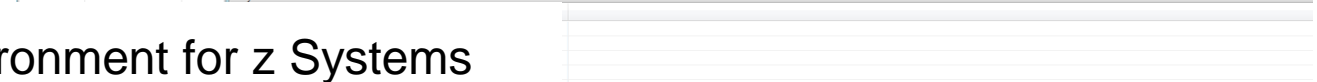
- ☒ GET
- ☒ POST
- ☒ PUT
- ☒ DELETE
- ☒ HEAD

Select all Deselect all

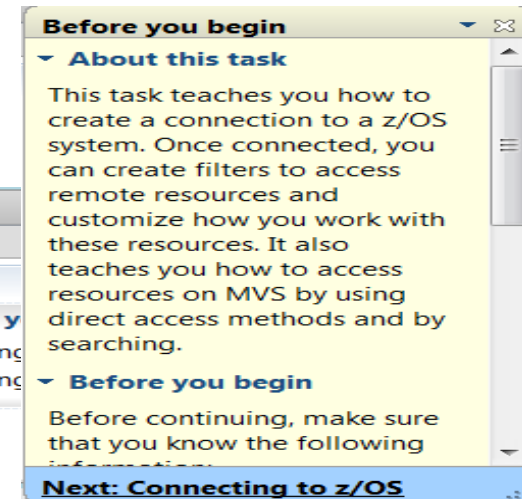
Change WSBind preferences

? < Back Next > Finish Cancel

Host Connection Emulator in CA Development Environment for z Systems



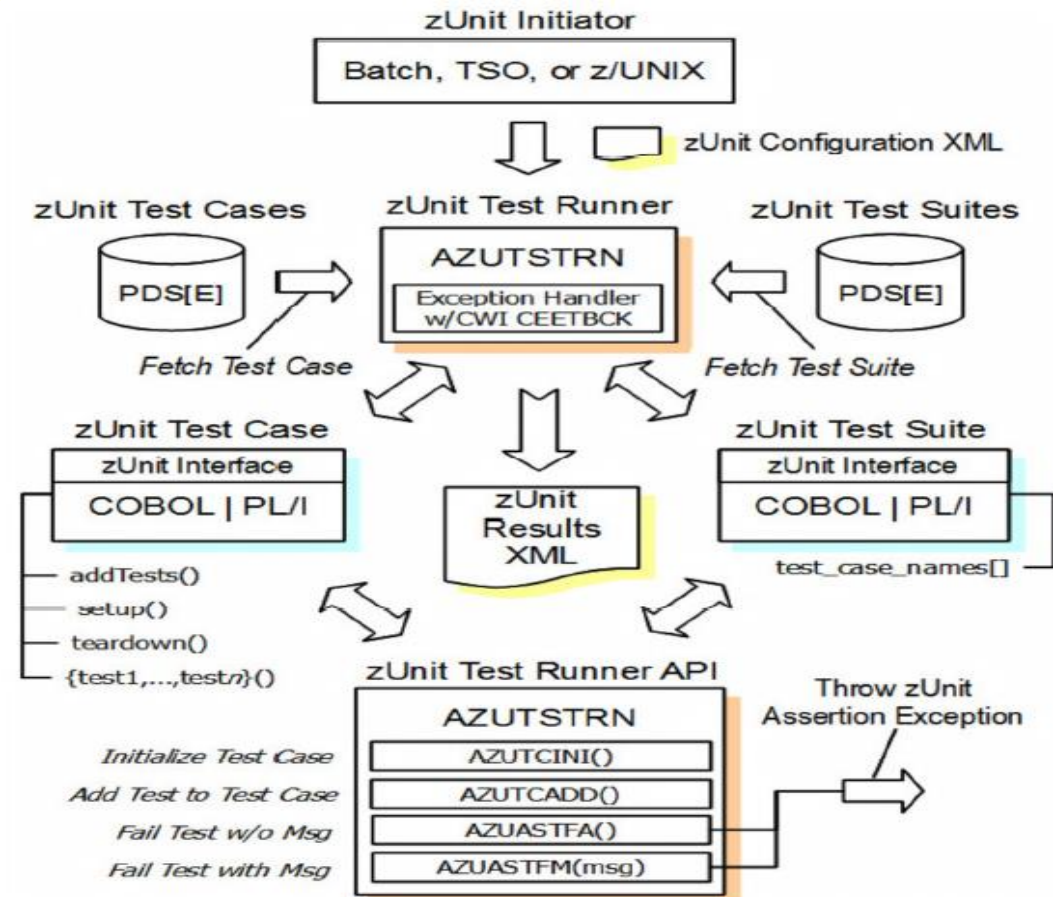
Getting Star Remote Err Program C z/OS File S Property Gr Snippets Rem



zUnit – Automated unit testing framework for z/OS

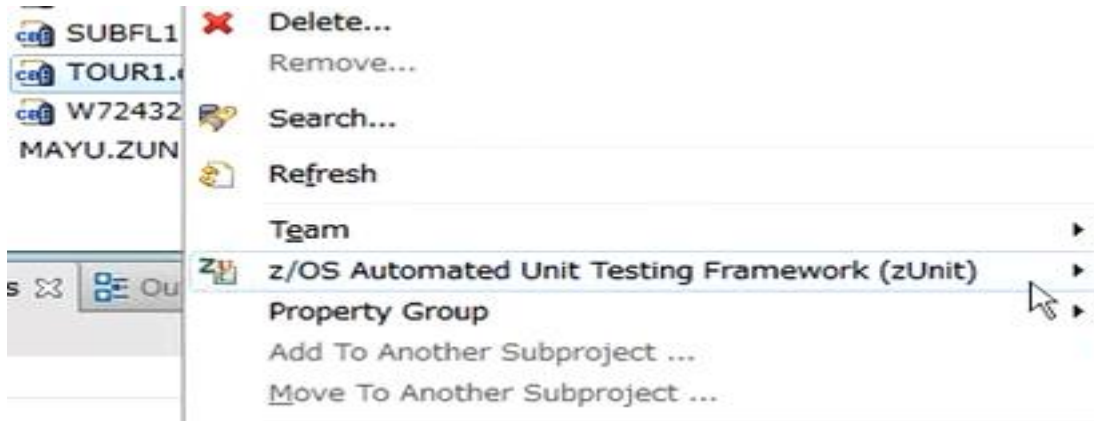
Frameworks that assist developers in writing code to perform repeatable, self-checking unit tests are collectively known as xUnit. xUnit defines a light-weight architecture for implementing unit testing frameworks.

- JUnit is an instance of xUnit for Java
- zUnit is an instance of xUnit for z Systems
 - IDz supports COBOL and PL/I
- Unit testing is automated
 - Code, not people, determines
 - **pass**, **fail**, or **error**
 - Failures** are anticipated
 - actual does not equal expected
 - Errors** are unexpected
 - Abend in the code being tested



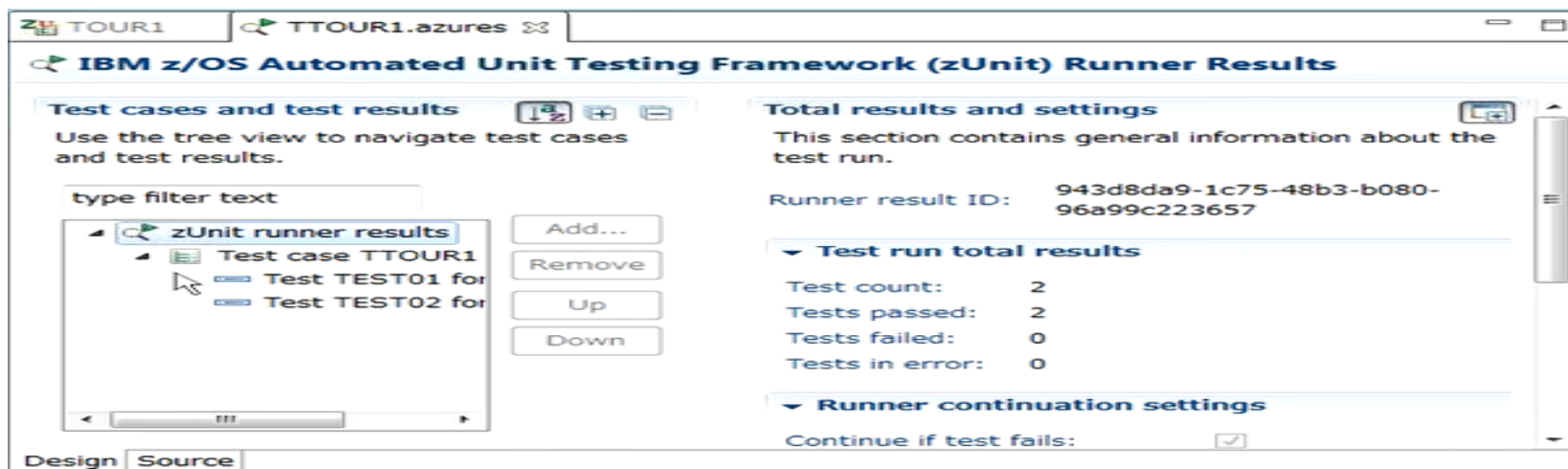
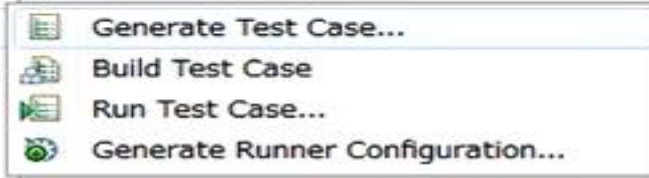
zUnit tools

- Wizard driven test generation
- Test Data Entry editor
- zUnit results viewer



Value of Selected Field 2400

Level	Name	PIC	USAGE	TEST01 :Input	TEST01 :Expected
Layout					
1	RESULT_CODE				
2	RESULT_CODE	X	DISPLAY		
CODE-FL					
Record:Record1					
Stub Parameter					
Layout					
1	CODE_REC				
3	I_TOUR				
5	I_TOUR_CODE	X(3)	DISPLAY	A01	A02
5	I_TOUR_NAME	X(20)	DISPLAY	ASIA-TOUR	CANADA-TOUR
5	I_TOUR_EXPENSE	9(7)	DISPLAY	1200	2400
5	I_NUMBER_ENT...	9(3)	DISPLAY	3	7



Data Tooling

- Easy access to databases
- Edit tables, Load/Extract data, Run SQL, Generate DDL, Create Stored Procedures
- additional capabilities when IBM Data Studio is also installed

The screenshot displays the Rational Application Developer for WebSphere Software interface. The main window shows a project named 'z/OS Projects - HCZMSA1.MEDICATION'. The left pane shows a project explorer with folders for 'Stored Procedures', 'Synonyms', and 'Tables'. The 'Tables' folder is expanded, showing a list of tables including 'BLOODPRESSURE', 'HEARTRATE', 'MEDICATION', 'MEDICATION', 'PATIENT', and 'PRESCRIPTION'. The 'MEDICATION' table is selected, and its data is displayed in the central pane. The table has columns: MEDICATIONID [INTEGER], PATIENTID [INTEGER], DRUGNAME [CHAR(50)], and STRENGTH [CHAR(50)]. The data is as follows:

MEDICATIONID [INTEGER]	PATIENTID [INTEGER]	DRUGNAME [CHAR(50)]	STRENGTH [CHAR(50)]
1000004	5	XYZ	50
1000002	1	ACE inhibitors	5 mg
1000003	1	Vitamin D	1000 IU
1000005	1	METOPROLOL	100
1000006	4	FLOVENT	500
1000007	4	ALBUTEROL	250
1000008	8	AMOXICILLIN	500
1000021	5	VITAMIN D	1000
<new row>			

The right-hand pane shows a COBOL program 'HCAPDB01.cbl' with the following code:

```
-----*A-1-B-----2-----3-----4-----5-----6-----*
* Insert row into Patient table based on customer number
MOVE ' INSERT PATIENT' TO EM-SQLREQ
EXEC SQL
  INSERT INTO PATIENT
    ( PATIENTID,
      USERNAME,
      FIRSTNAME,
      LASTNAME,
      DATEOFBIRTH,
      INSCARDNUMBER,
      ADDRESS,
      CITY,
      POSTCODE,
      PHONEMOBILE,
      EMAILADDRESS )
  VALUES ( DEFAULT,
            :CA-USERID,
            :CA-FIRST-NAME,
            :CA-LAST-NAME,
```

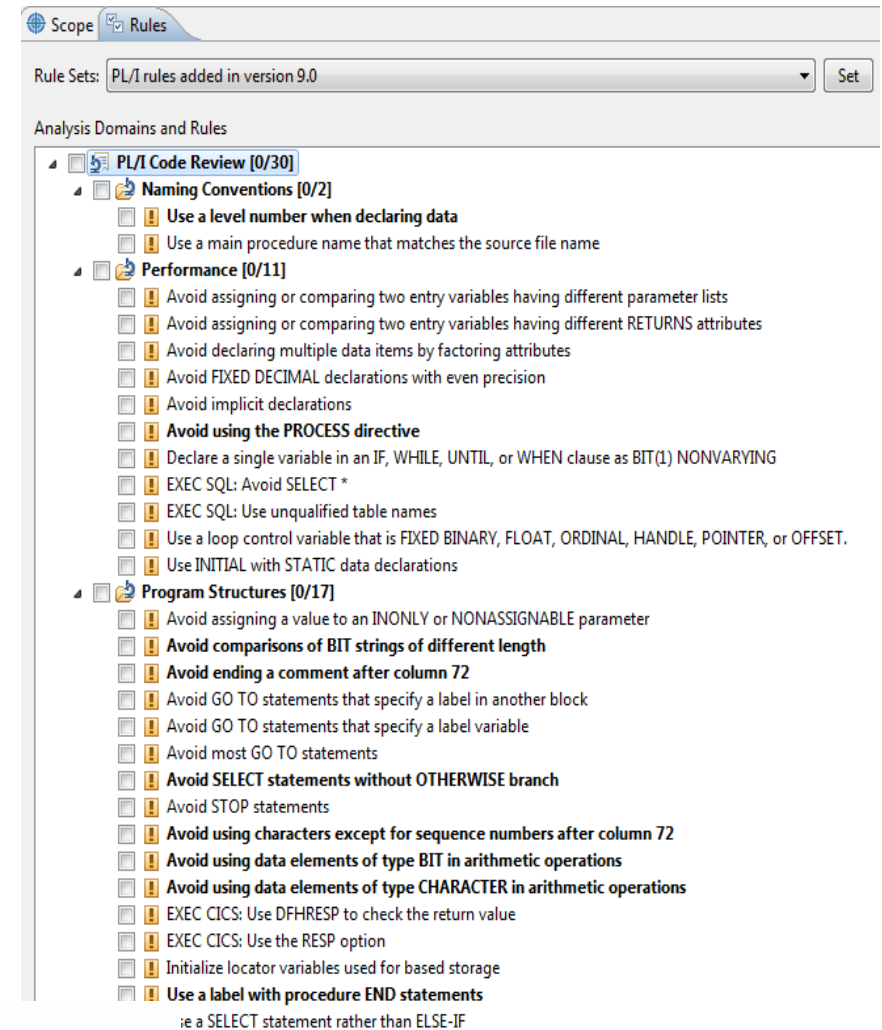
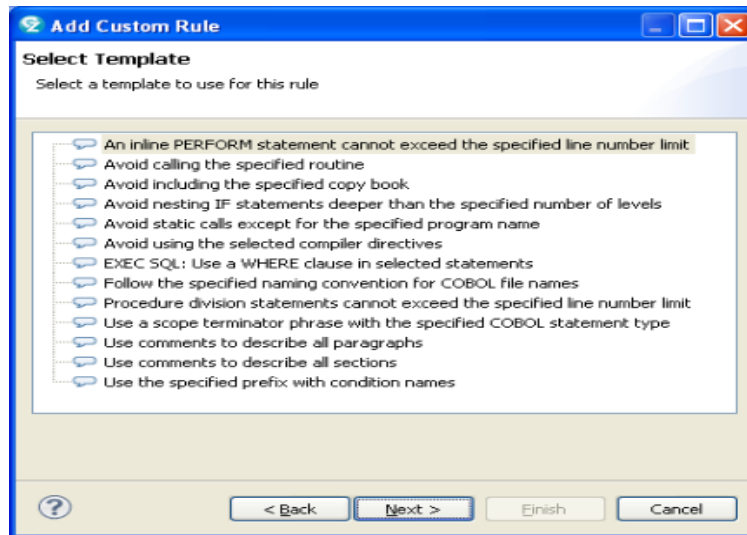
The bottom pane shows a status window with a table of query results for 'MEDICATION'. The table has columns: Status, Operation, Date, Conn, PRESCRIPTIONID, PATIENTID, PDATETIME, and TAKEN. The data is as follows:

Status	Operation	Date	Conn	PRESCRIPTIONID	PATIENTID	PDATETIME	TAKEN
✓ Succeeded	"HCZMSA1"."MEDICATION"	12/18/14 10:45 PM	NQA1	1000001	1	2014-09-22 12:13:01.6...	Y
✓ Succeeded	Return All Rows	12/19/14 9:52 AM	NQA1	2	1000004	2014-12-18 12:00:00.0	N
✓ Succeeded	Return All Rows	12/19/14 12:58 PM	NQA1	3	1000005	2014-12-18 08:00:00.0	N
✓ Succeeded	Return All Rows	12/19/14 4:39 PM	NQA1	4	1000005	2014-12-18 20:00:00.0	N
✓ Succeeded	Return All Rows	12/19/14 4:39 PM	NQA1	5	1000005	2014-12-19 08:00:00.0	N
✓ Succeeded	Return All Rows	1/12/15 1:38 PM	NQA1	6	1000005	2014-12-19 20:00:00.0	N
✓ Succeeded	Return All Rows	1/13/15 3:11 PM	NQA1	7	1000005	2014-12-20 08:00:00.0	N
✓ Succeeded	"HCZMSA1"."MEDICATION"	1/14/15 3:07 PM	NQA1				

Total 96 records shown

Software Analysis - Code Review and Code Governance

- Provides predefined rules and templates for COBOL and PL/I applications
- Tooling to assist in creating shop specific rules
 - Ensure adherence to corporate standards
 - Examine code for areas of improvement
 - Assist with compiler adoption



COBOL Code Review [2/45]

Enterprise COBOL [2/2]

- ✓ ⚠ Avoid use of language that is obsolete in Enterprise COBOL 5.1
- ✓ ✗ Avoid use of language that is not supported in Enterprise COBOL 5.1

Open discussion:

IBM CARMA Plugin & CA Endeavor Plugin