



# Application Development for z/OS

Not your Father's Green Screen

*Mike Fulton, IBM Distinguished Engineer  
CTO DevOps for Enterprise Systems*

*Thursday, August 13<sup>th</sup>, 2015*

*3:15pm to 4:15pm Dolphin, Oceanic 7*



#SHAREorg



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# Abstract



Ask most people how they write and maintain applications on z/OS and you hear "oh, you use this thing called a green screen" followed by a chuckle.

In reality, application development for zEnterprise applications has been transformed over the past several years to the point where application developers enjoy the same or better features from integrated development environments as programmers who work on other platforms.

Advances in remote system communication and interaction, syntax-highlighting, parsing, and code understanding for Assembler, PL/I, C/C++, and COBOL source code, as well as programming assists such as code snippets and templates are all available to application programmers. Interactive debug of applications, written in multiple programming languages and running in various runtime environments is also possible and can greatly boost programmer productivity.

Come and learn about how these features can enable application developers who are new to the mainframe to interact with, update, and efficiently enhance mainframe applications.

# IBM DevOps point of view

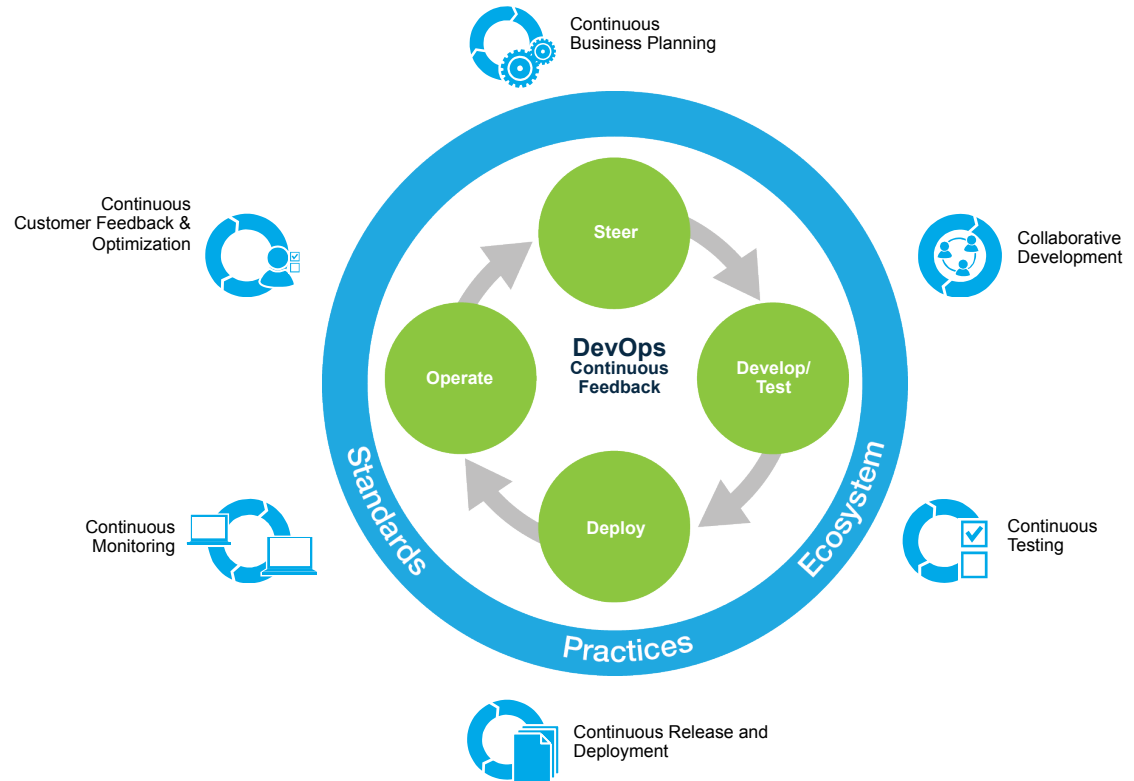
Enterprise capability for continuous software delivery that enables organizations to seize market opportunities and reduce time to customer feedback



**Accelerate software delivery – for faster time to value**

**Reduce time to customer feedback – for improved customer experience**

**Balance speed, cost, quality and risk – for increased capacity to innovate**



Clients are achieving **measurable business outcomes with DevOps**

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# Collaborative Development

*Integrated Application Lifecycle Management for all platforms*

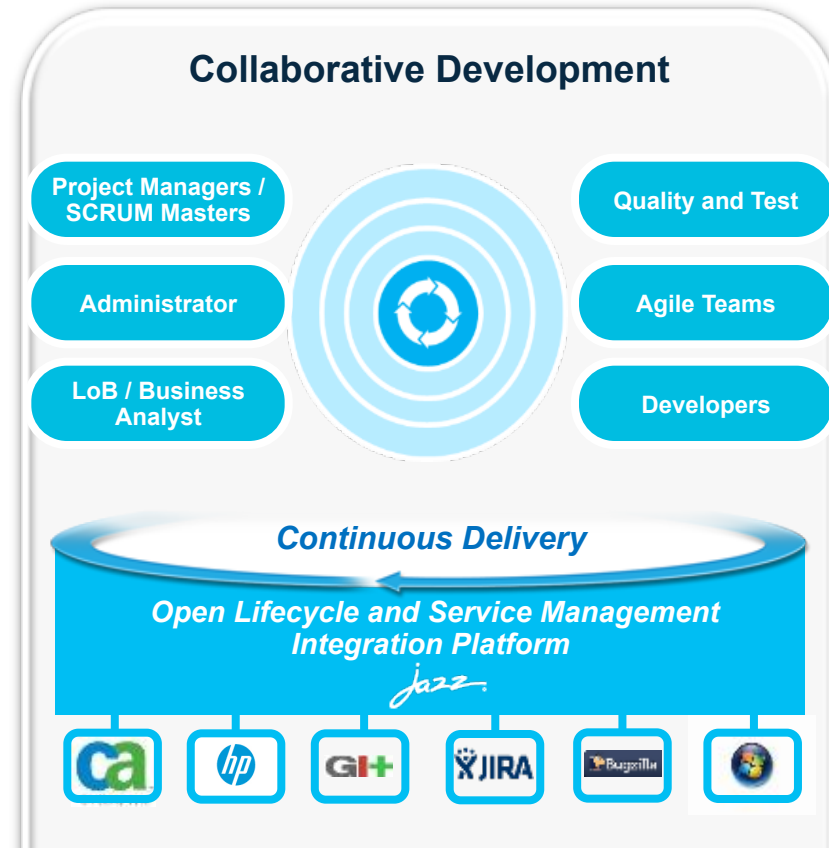
- Accelerate **time to delivery** with real-time planning
- Improve **quality** with lifecycle traceability
- Maximize **time to value** with in-context collaboration
- Refine **predictability** with development intelligence
- Reduce **costs** with continuous improvement

- ✓ **Manage many sources - JavaScript to COBOL**
- ✓ **Single work item can span technologies & solutions**
- ✓ **Quickens agile adoption on the mainframe**
- ✓ **Integrates existing SCMs and deployment tools**

IBM Rational Collaborative Lifecycle Management (CLM)

- IBM Rational Team Concert
- IBM Rational Doors Next Generation
- IBM Rational Quality Manager

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# Rational Team Concert: One tool, many capabilities



## Work Items

## Planning

## Source Control

## Builds – Continuous

## Dashboards & Reporting

## Enforcement and Automation

**Problem**  
A work item must be associated with the change set or a comment must be set.

**Reason**  
All change sets should be associated with a work item which is planned for t

This makes it e through the it why your chan

- Solutions**
- Associate Existing Work Item
  - Associate New Work Item
  - Associate and Try Again (experimental)
  - Override 'Descriptive Change Sets' Precondition

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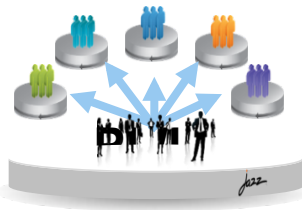


# Rational Developer for System z:

## An Integrated Development Environment for System z



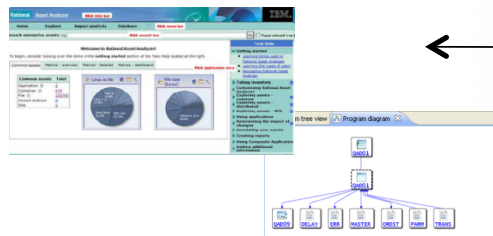
Integration with Team Concert for Lifecycle and Source Management



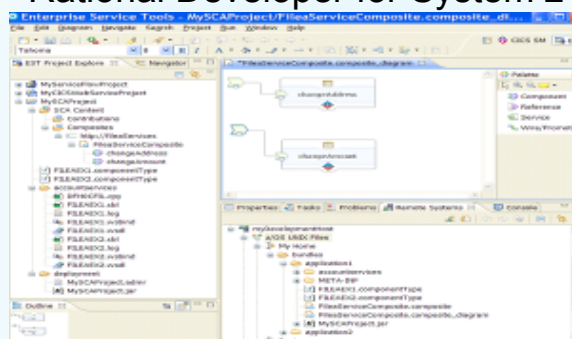
Access to typical System z sub-system functionality in z/OS, CICS, IMS, DB2, WAS



Integration with Asset Analyzer for Application Understanding and Impact Analysis

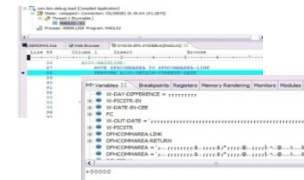


### Rational Developer for System z

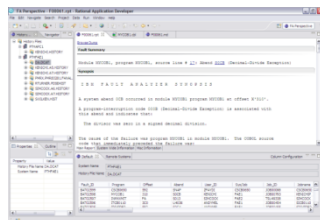


**New**

Out of the Box debugger and code coverage capabilities



Integration with Fault Analyzer for Dump Analysis

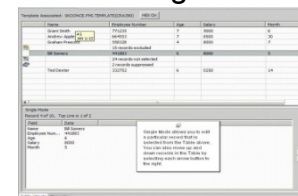


A modern IDE for productive development of cross-platform applications written in COBOL, PL/I, ASM, Java, EGL or C/C++ in System z CICS, IMS, DB2, Batch applications



Integration with RD&T for flexible access to System z environment

Integration with File Manager for file and test data handling



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# Rational Developer for System z

## RDz: stay focused: work concurrently not sequentially



**Edit a program**

```

Line 376      Column 31      Insert
-----+*A-1-B-----+-----2-----+-----3-----+-----4-----+-----5-----+-----6-----+-----7-----+-----
000374
000375
000376      400-NUMERIC-RANGE-EDITS.
000377      MOVE "400-NUMERIC-RANGE-E
000378      ***** Call to VSAM file to
000379      IF_ (MEDICATION-COST > .99,
000380
000381
000382
000383
000384
000385
000386
000387
000388
000389
000390
000391
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000399
000400
000401
000402
000403
000404
000405
000406
000407
    
```

**File Compare**

- Cut Ctrl+X
- Copy Ctrl+Insert
- Paste Ctrl+V
- Select
- Selected
- Deselect Alt+U
- Filter view
- Show all Ctrl+W
- Source
- Refactor
- Open Declaration F3
- Open Perform Hierarchy
- View
- Run As
- Debug As
- Profile As
- Update
- Syntax Check
  - Local
  - Remote
- Browse Copy Member
- Open Copy Member
- Refresh Cached Copy
- Content assist

**Access Datasets + Dataset Management**

- New Connection
- z/OS UNIX Files
- z/OS UNIX Shells
- MVS Files
- My Data Sets
  - DD50001.BENCHMARK.COBOL
    - BNCHS601.cbl
    - MSTRUPDT.cbl
    - SANDBOX.cbl
    - WARDRPT.cbl
  - DD50001.BENCHMARK.COPYLIB
  - DD50001.BENCHMARK.DBRMLIB

**Dataset Statistics**

Property	Value
Attribute	
BLKSIZE	32720
DSNTYPE	DATA_LIBRARY
DSORG	PO
EXTENTS	4
IRFCI	RN

**Access Jobs (Outlist facility)**

Resource	Job ID	Job Name	Return Info	Use	Priority
DD50001:TSU16893	TSU16893	DD5000	ABENDed		1
DD50001:TSU16886	TSU16886	DD5000	ABENDed		1
DD50001:TSU16840	TSU16840	DD5000	ABENDed		1
DD50001:TSU16839	TSU16839	DD5000	ABENDed		1
DD50001			ABENDed		1
DD50001			ABENDed		1
DD50001			ABENDed		1
DD50001			ABENDed		1
DD50001			U0004	004	1
DD50001			U0012	00C	1

**Submit a Compile**

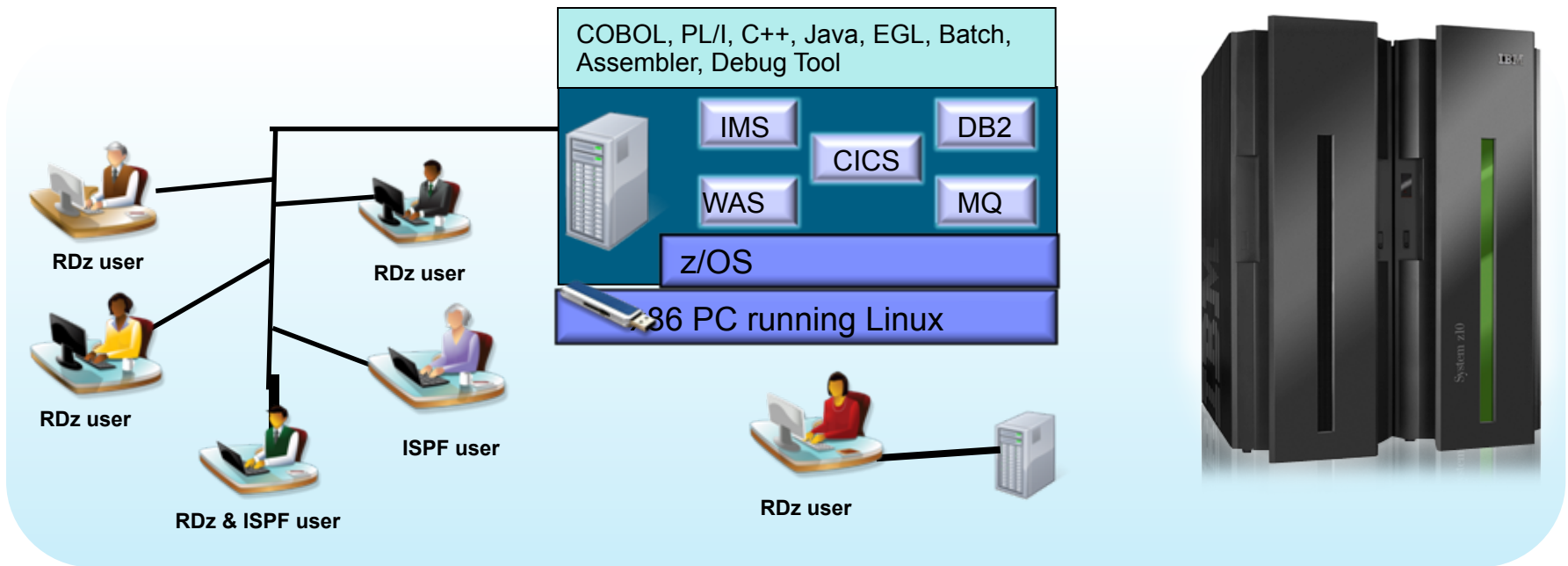
**File Search**

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# Rational Development and Test Environment for System z

## The ultimate in modern application development for System z



- Increase availability of z/OS testing environment and resources
  - Liberate developers to rapidly prototype new applications
  - Develop and test System z applications anywhere, anytime!
  - Eliminate costly delays by reducing dependencies on operations staff
- Improve quality and lower risk via automation, measurement, and collaboration
- Focus on what is required for the change at hand, then scale

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# Any process: Executable and repeatable

Use ONE tool to support both agile and non-agile

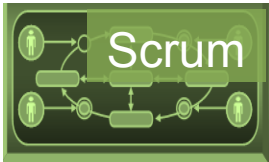


**Process Architect**



**Project Manager**

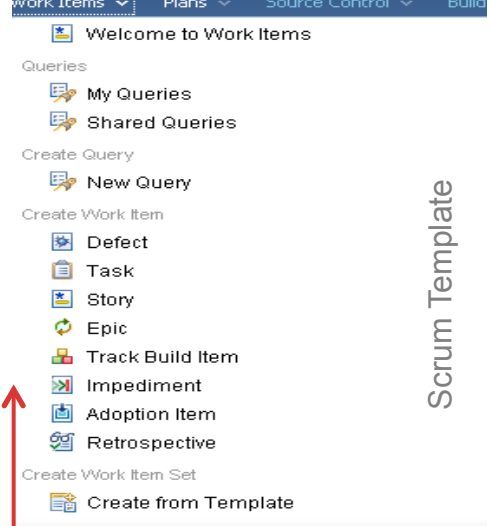
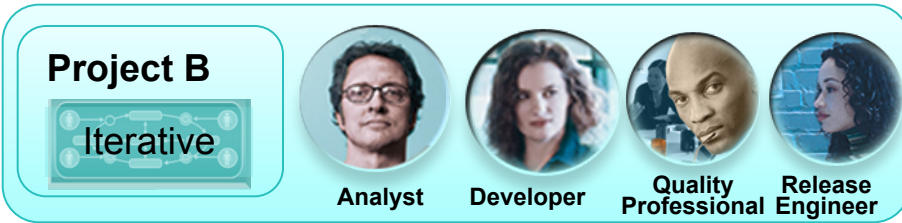
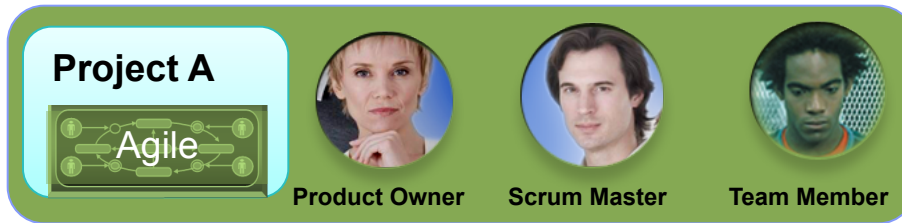
*Variant #1*



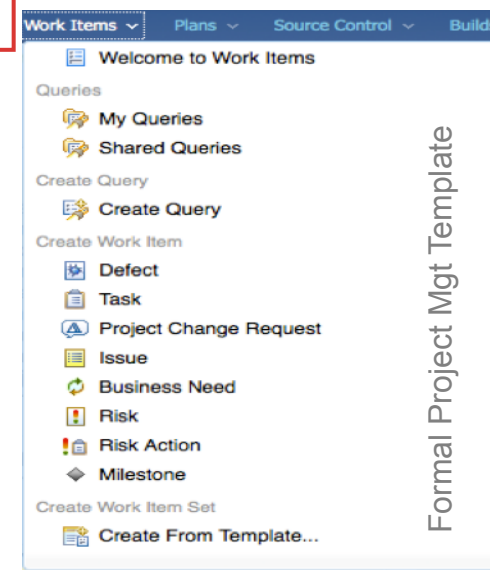
*Variant #2*



*Variant #3*



Scrum Template

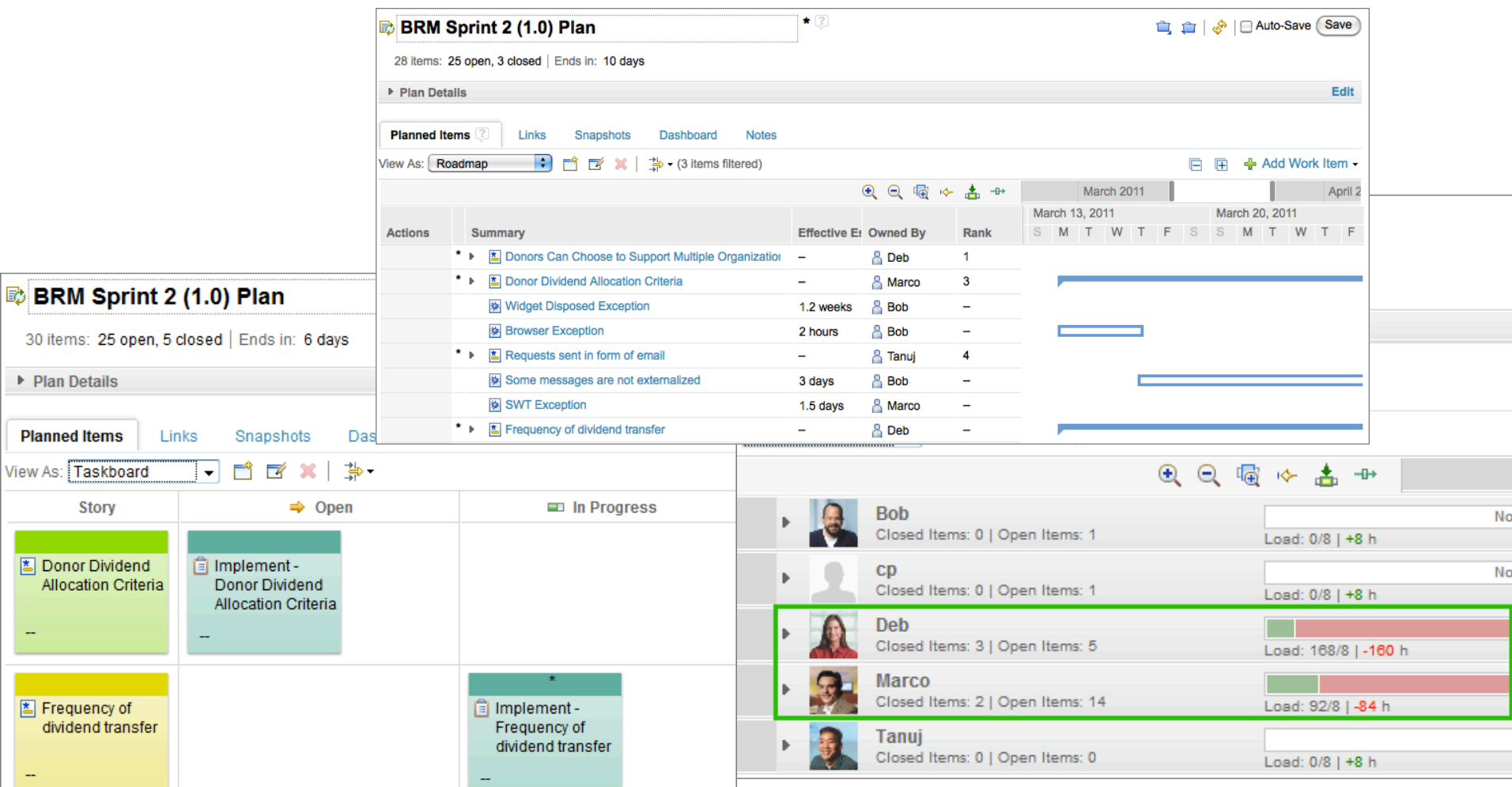


Formal Project Mgt Template

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# Multiple plan views facilitate continuous planning



The screenshot displays two overlapping views of the 'BRM Sprint 2 (1.0) Plan' in the SHARE tool. The top view is the 'Roadmap' view, showing a table of tasks with columns for Actions, Summary, Effective Est, Owned By, Rank, and a Gantt chart. The bottom view is the 'Taskboard' view, showing a Kanban board with columns for Story, Open, and In Progress.

**Roadmap View Data:**

Actions	Summary	Effective Est	Owned By	Rank
▶	Donors Can Choose to Support Multiple Organization	-	Deb	1
▶	Donor Dividend Allocation Criteria	-	Marco	3
	Widget Disposed Exception	1.2 weeks	Bob	-
	Browser Exception	2 hours	Bob	-
▶	Requests sent in form of email	-	Tanuj	4
	Some messages are not externalized	3 days	Bob	-
	SWT Exception	1.5 days	Marco	-
▶	Frequency of dividend transfer	-	Deb	-

**Taskboard View Data:**

Story	Open	In Progress
Donor Dividend Allocation Criteria	Implement - Donor Dividend Allocation Criteria	
Frequency of dividend transfer		Implement - Frequency of dividend transfer

**Team Load Summary:**

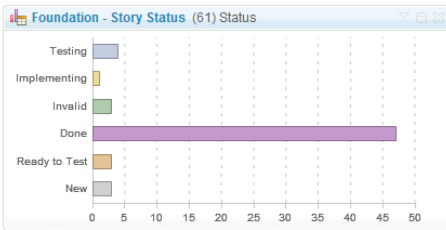
Name	Closed Items	Open Items	Load
Bob	0	1	0/8   +8 h
cp	0	1	0/8   +8 h
Deb	3	5	168/8   -160 h
Marco	2	14	92/8   -84 h
Tanuj	0	0	0/8   +8 h

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# Progress Tracking: live status for everyone

## Story Status Current Iteration

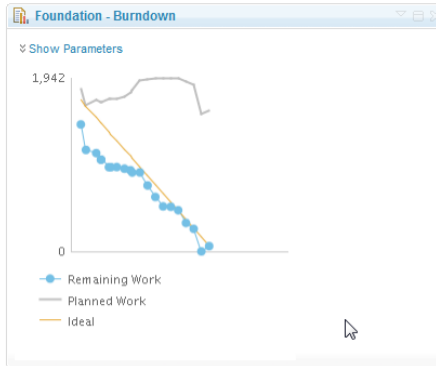
Shows the status of all stories planned for the current iteration



- ### Foundation - Current Stories (61)
- 155918: Provide TVT testcases and testcase updates to TVT team
  - 155399: [Repository - M14] Performance, quality and robustness enhancements
  - 154407: [Continuation] Manage and repair DB inconsistencies during 3.0.1 M14
  - 155024: Track the fixing of hangs occurring on shutdown of the CLM server
  - 155033: Explore servlet dispatching enablement as a backup option
  - 155030: [Application SDK - 14] Performance, quality and robustness enhancements
  - 155120: LPA Web UI fixes and polish
  - 111848: User can validate consistency of configuration information across contexts
  - 155168: Fix bugs and improve the quality of LPA services
  - 155624: update JREs for 3.0 iFix1 and 3.0.1
- Page 1 of 7

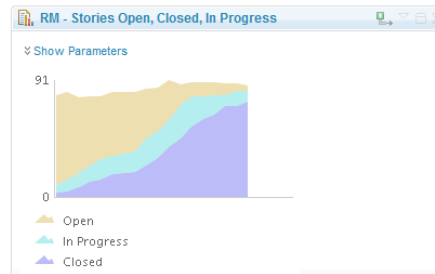
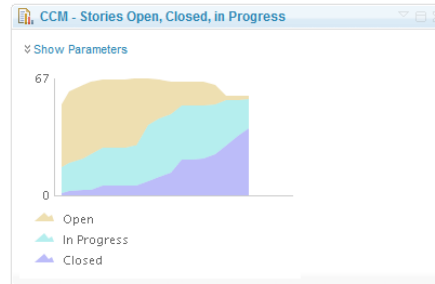
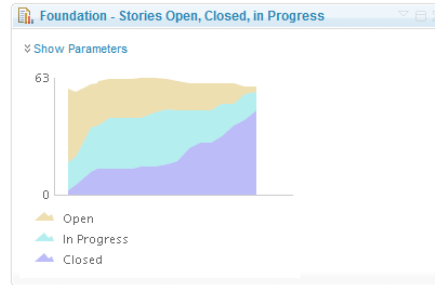
## Burndown Current Iteration

Shows the remaining amount of estimated work in hours of work items planned for the current iteration.



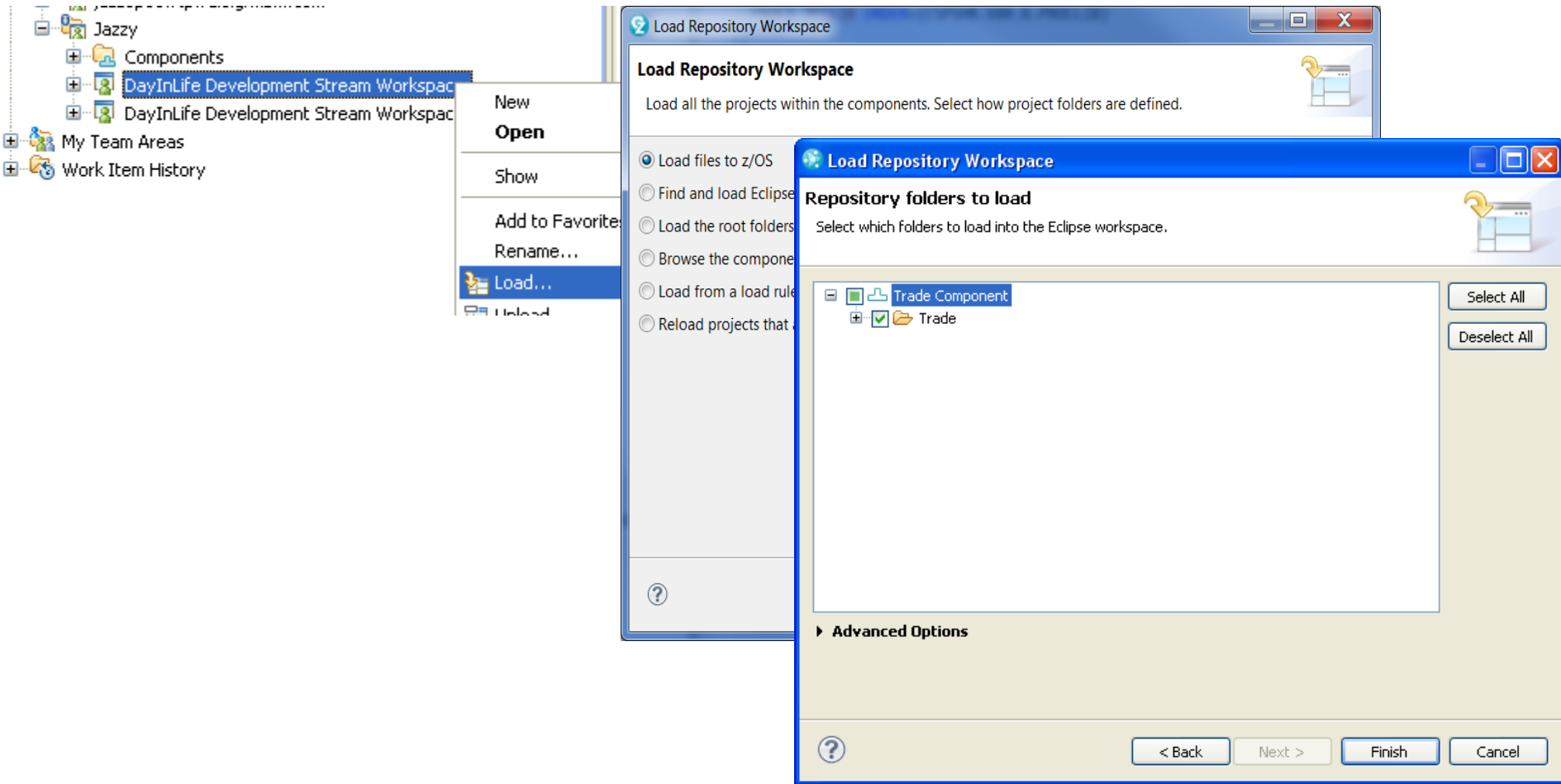
## Stories Open/Closed/In Progress

Shows the number of stories which are open, in progress, done during the iteration.



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# Load the source artifacts



**Load Repository Workspace**

Load all the projects within the components. Select how project folders are defined.

- Load files to z/OS
- Find and load Eclipse
- Load the root folders
- Browse the compone
- Load from a load rule
- Reload projects that

**Load Repository Workspace**

Repository folders to load

Select which folders to load into the Eclipse workspace.

- Trade Component
  - Trade

**Advanced Options**

< Back   Next >   Finish   Cancel

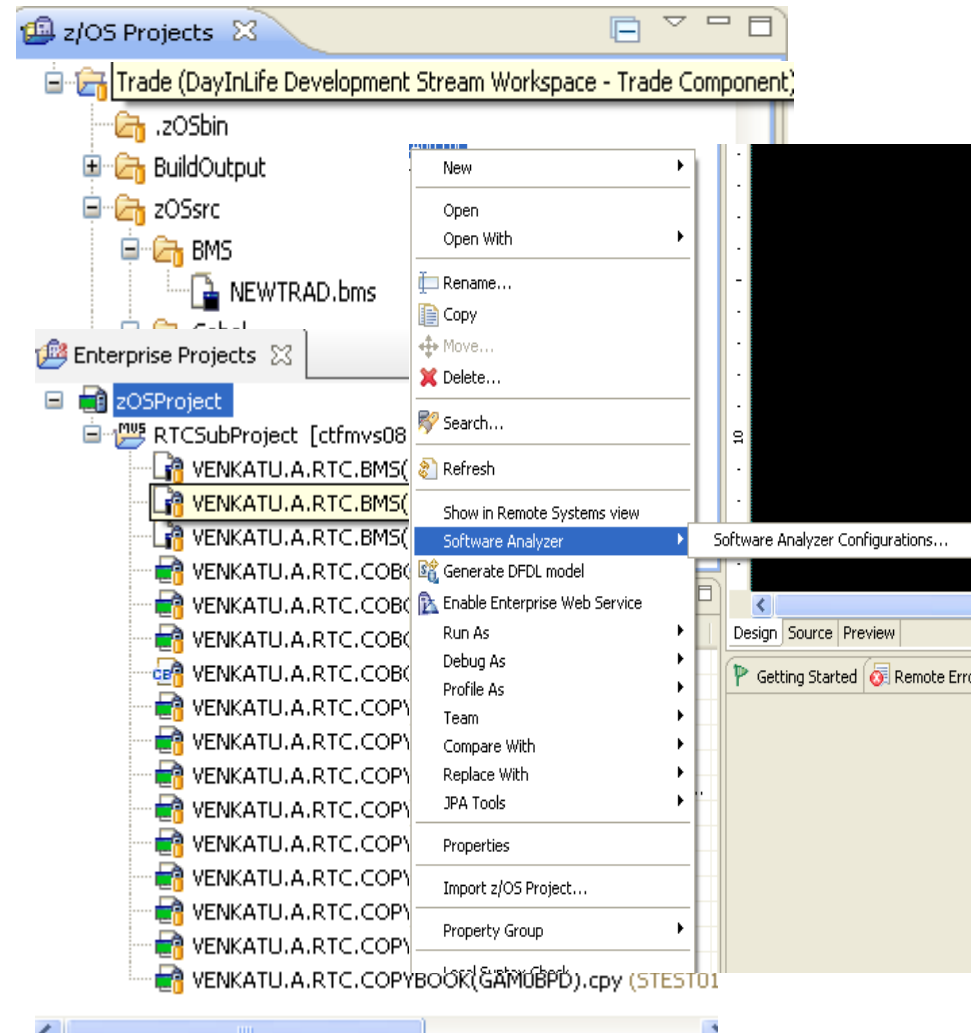
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# RDz and RTC together

RDz Projects View shows Loaded Projects

RDz understands z/OS Development

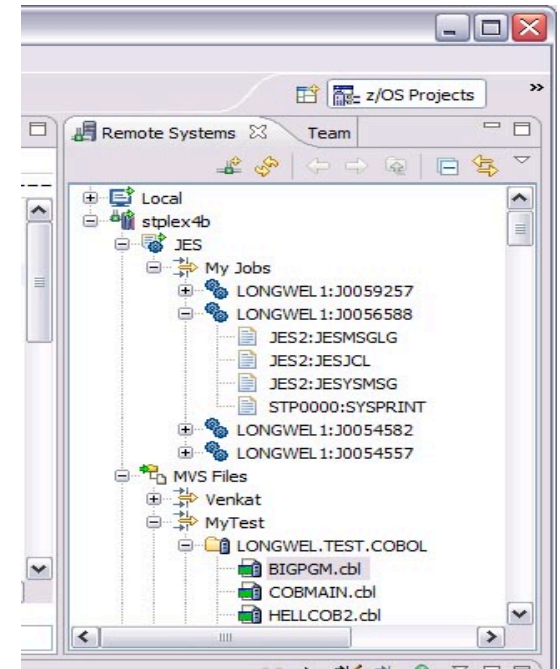
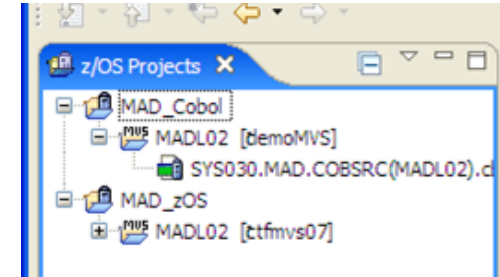
- Rich, Language Specific Editors
- Enterprise web services
- Service Flow Modeler
- Code review
- Unit testing
- program analysis/control flow
- ...



Complete your session evaluations online at [www.SHARE.org/Orlando-Eval](http://www.SHARE.org/Orlando-Eval)

# Navigate datasets and jobs on zOS

- 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



Complete your session evaluations online at [www.SHARE.org/Orlando-Eval](http://www.SHARE.org/Orlando-Eval)



# Edit capabilities in RDz

RDz at a high level has 2 types of editors

- COBOL, PLI, and JCL advanced editors
  - Based on the Eclipse editor infrastructure
  - Quick fixes, hyper-linking, hover
  - Easy navigation between edit sessions
  - Real time syntax checking, content assist, key word highlighting
- LPEX Editor
  - COBOL, PLI, HLASM, JCL, C/C++, REXX
  - ISPF-like experience including prefix commands, command line, look and feel
  - Supports advanced edit functions for COBOL, PLI and HLASM like real time syntax checking, content assist

```
PROCEDURE DIVISION.  
  
    INITIALIZE INPUTS-OUTPUTS.  
    INITIALIZE INVO.  
    INITIALIZE LOCINVO.  
    MOVE LOW-VALUE TO LOCINVO.  
    MVE LOW-VALUE TO INVO.
```

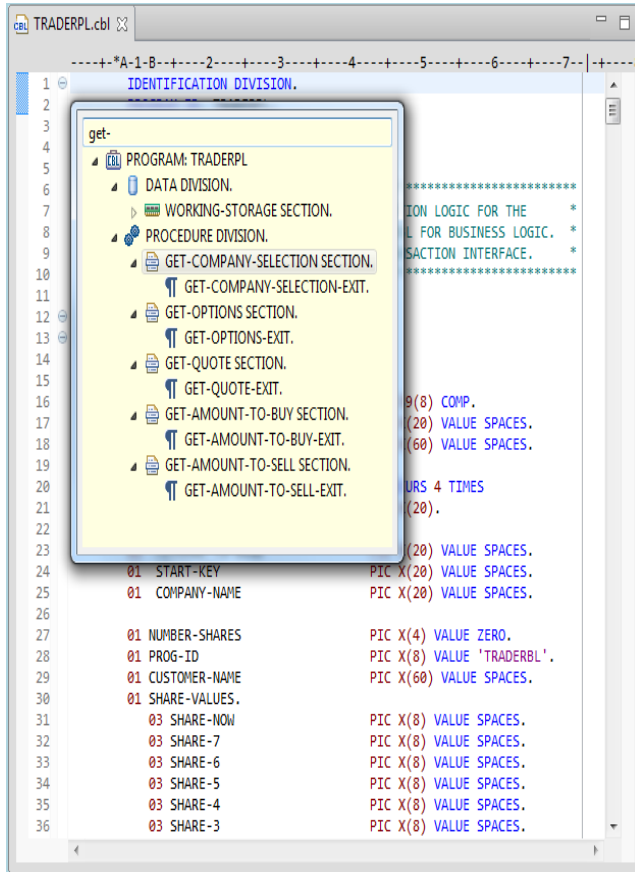
Change to "MOVE"

Line	Column	Insert
000027	*	*
000028	*****	*****
000029	IDENTIFICATION DIVISION.	
000030	PROGRAM-ID. GAMOVDB.	
000031		
000032	DATA DIVISION.	
000033		
000034	WORKING-STORAGE SECTION.	
000035		
000036	COPY GAMOBMD.	
000037	COPY GAMOBDD.	
000038	COPY GAMOBED.	
000039	COPY GAMOBBCD.	
000040	COPY GAMOBPD.	
000041	01 DATABASECONNECTION.	
000042	49 SCHEMA	PIC S
000043	49 PIC X VALUE '...'	
000044		
000045	01 ITABLEPREPARE.	
000046	49 ITABLE-VAR-LEN	PIC S
000047	49 ITABLE-VAR-TXT	PIC S
000048		
12	01 INVENTORYPREP.	
000050	02 PIC X(12) VALUE 'INSERT'	
000051	02 INVNTDBCON PIC X(9).	
000052	02 TABLENAME PIC X(11).	

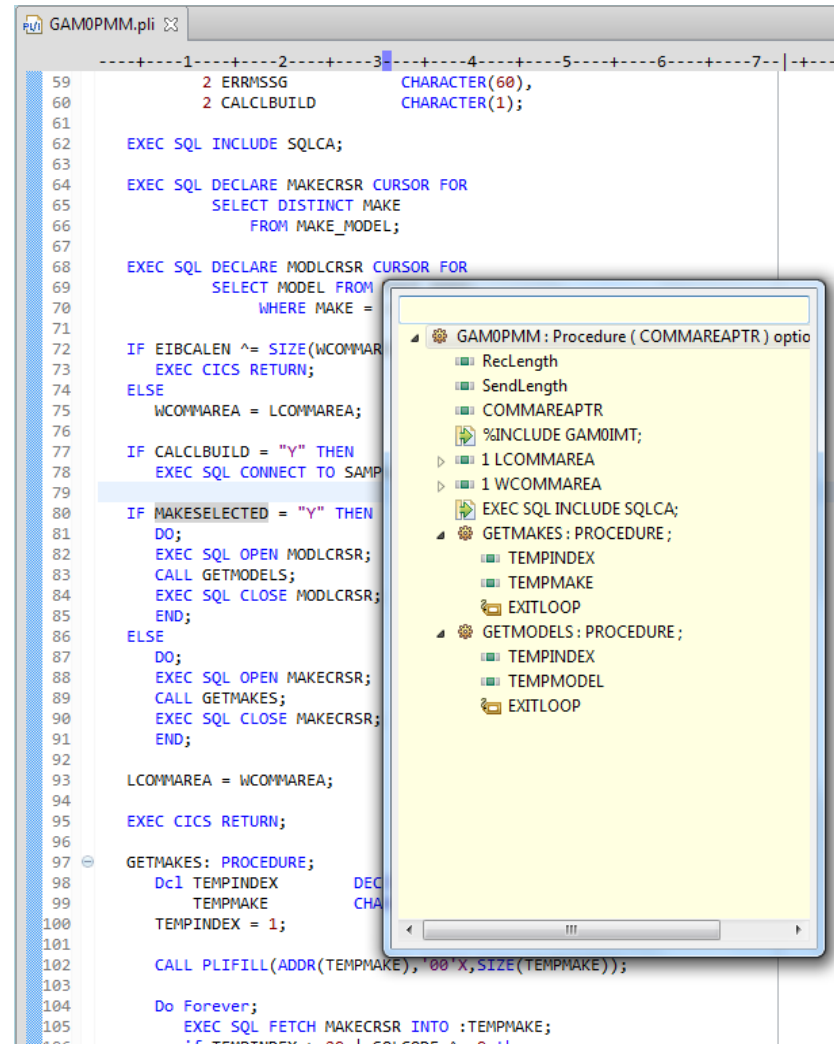
# COBOL, PL/I and JCL Editor improvements

## Quick Outline

- Press Ctrl+O to activate



The screenshot shows the COBOL editor interface for a file named 'TRADERPL.cbl'. A 'get-' dialog box is open, displaying a tree view of the program's structure. The tree includes sections like 'IDENTIFICATION DIVISION.', 'DATA DIVISION.', 'WORKING-STORAGE SECTION.', 'PROCEDURE DIVISION.', and several 'GET-' sections such as 'GET-COMPANY-SELECTION SECTION.', 'GET-OPTIONS SECTION.', 'GET-QUOTE SECTION.', 'GET-AMOUNT-TO-BUY SECTION.', and 'GET-AMOUNT-TO-SELL SECTION.'. The main editor area shows COBOL code with various data declarations and procedures.



The screenshot shows the PL/I editor interface for a file named 'GAMOPMM.pli'. The main editor area contains PL/I code, including SQL-related statements like 'EXEC SQL INCLUDE SQLCA;', 'EXEC SQL DECLARE MAKECRSR CURSOR FOR SELECT DISTINCT MAKE FROM MAKE\_MODEL;', and 'EXEC SQL DECLARE MODLCRSR CURSOR FOR SELECT MODEL FROM WHERE MAKE ='. A procedure tree overlay is visible on the right side, showing the structure of the 'GAMOPMM : Procedure ( COMMAREAPTR ) optio' procedure, including sub-procedures like 'GETMAKES : PROCEDURE;', 'TEMPINDEX', 'TEMPMAKE', 'EXITLOOP', and 'GETMODELS : PROCEDURE;'.

# Editor Productivity Features

Real time syntax checking without code compile or save

```
*GAM0VCDB.jcl
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 //JOB LIB DD DSN=DB2.V8R1M0.SDSNEXIT,DISP=SHR
33 // DD DSN=DB2.V8R1M0.SDSNLOAD,DISP=SHR
34 //GAMDROP EXEC PGM=IKJEFT01,DYNAMNBR=20
35 //SYSTSPRT DD SYSOUT=*
36 //SYSPRINT DD SYSOUT=*
37 //SYSUDUMP DD SYSOUT=*
38 //SYSTSIN DD *
39 DSN SYSTEM(DSN8)
40 RUN PROGRAM(DSNTIAD) PLAN(DSNTIA81) -
41 PARM('RCO') -
42 LIB('DB2WK8.RUNLIB.LOAD')
43 END
44 //SYSTIN DD *
45 DROP TABLE &SCHEMA.MAKE_MODEL;
46 DROP TABLE &SCHEMA.DEALERSHIP;
47 DROP TABLE &SCHEMA.EASTINVNTRY;
48 DROP TABLE &SCHEMA.CENTINVNTRY;
49 DROP TABLE &SCHEMA.PACINVNTRY;
50 COMMIT WORK;
51 /*
52 //GAMCDB EXEC PGM=IKJEFT01,DYNAMNBR=20
53 //SYSTSPRT DD SYSOUT=*
54 //SYSPRINT DD SYSOUT=*
55 //SYSUDUMP DD SYSOUT=*
56 //SYSTSIN DD *
57 DSN SYSTEM(DSN8)
58 RUN PROGRAM(DSNTIAD) PLAN(DSNTIA81) -
59 LIB('DB2WK8.RUNLIB.LOAD')
```

"DYNAMNBR" expected instead of this input  
1 Quick Fix is available:  
Change to "DYNAMNBR"  
Press 'F2' for focus

```
*GAM0VII.cbl
287
288 3010-COPY-COMMAREA.
289 MOVE LOW-VALUES TO LOCINVO.
290 MOVE " " TO LOCSELECTFIELD.
291 MOVE '1' TO ARRAY-INDEX.
292 PERFORM UNTIL ARRAY-INDEX > 10
293 IF SHOWWINO(ARRAY-INDEX) NOT = ' '
294 MOVE ARRAY-INDEX TO LOCNUMOUT(ARRAY-INDEX)
295 END-IF
296 MOVE SHOWWINO (ARRAY-INDEX) TO LOCVINOUT (ARRAY-INDEX)
297 MOVE SHOWYEARO (ARRAY-INDEX) TO LOCYEAROUT (ARRAY-INDEX)
298 MOVE SHOWMODELO (ARRAY-INDEX) TO LOCMODELOUT (ARRAY-INDEX)
299 MOVE SHOWPRICEO (ARRAY-INDEX) TO LOCPRICEOUT (ARRAY-INDEX)
300 MOVE SHOWNEWAUTOO (ARRAY-INDEX) TO LOCNEWOUT (ARRAY-INDEX)
301
302 COMPUTE ARRAY-INDEX = ARRAY-INDEX + 1
303 END-PERFORM.
304 MOVE MESSAGE-OUT TO LOCMESSAGEOUT.
305
306
307 3050-SEND-MAP.
308 EXEC CICS
309 SEND MAP('GAMQRY1')
310 MAPSET('GAMBMC3')
311 FROM(LOCINVO)
312 ERASE
313 END-EXEC.
314
```

Unable to resolve reference to LOCNEWOUT



# JCL Editor Content Assist

## Keyword syntax proposals

- Press Ctrl+SPACE to activate

The screenshot shows a JCL editor window with a file named \*XSAM.jcl. The editor contains JCL code with a table of transactions. A content assist popup is visible over the code, listing template proposals for the 'MOD' keyword. The popup also includes the instruction 'Press CTRL+SPACE to view Template Proposals'.

```
1 //USER93L JOB REGION=4M,CLASS=A,  
2 // TIME=(1),MSGCLASS=H,NOTIFY=&SYSUID,MSGLEVEL=(1,1)  
3 //*****  
4 //* RUN SAMPLE PROGRAM SAM1  
5 //*****  
6 //RUNSAM1 EXEC PGM=SAM1,REGION=4M,  
7 // PARM=('/TEST(,,TCPIP&9.80.11.47%8001:*)',  
8 // 'ENVAR("EQA_STARTUP_KEY=CC"),RPTOPTS(ON)')  
9 //STEPLIB DD DSN=USER93.DEMO.LOAD,DISP=SHR  
10 // DD DSN=EQAW.SEQAMOD,DISP=SHR  
11 //EQADEBUG DD DSN=USER93.DEMO.SYSDEBUG,DISP=SHR  
12 //CUSTFILE DD DSN=USER93.DEMO.SAMFILE,DISP=  
13 //SYSPRINT DD SYSOUT=*  
14 //SYSOUT DD SYSOUT=*  
15 //CUSTRPT DD SYSOUT=*  
16 //CUSTOUT DD SYSOUT=*  
17 //TRANFILE DD *  
18 *TRAN KEY ACTION FIELD NAME SS  
19 *-----  
20 UPDATE 07025A ADD BALANCE 00  
21 UPDATE 11112A ADD BALANCE 00  
22 UPDATE 11204A ADD ORDERS 00  
23 UPDATE 11204A REPLACE ORDERS 00  
24 UPDATE 11204A REPLACE BALANCE 00  
25 UPDATE 11204A REPLACE NAME 00  
26 DELETE 26620A  
27 /*  
28 //  
29 /* TEST(,,TCPIP&9.74.121.99%8001:)
```

Content Assist Popup:

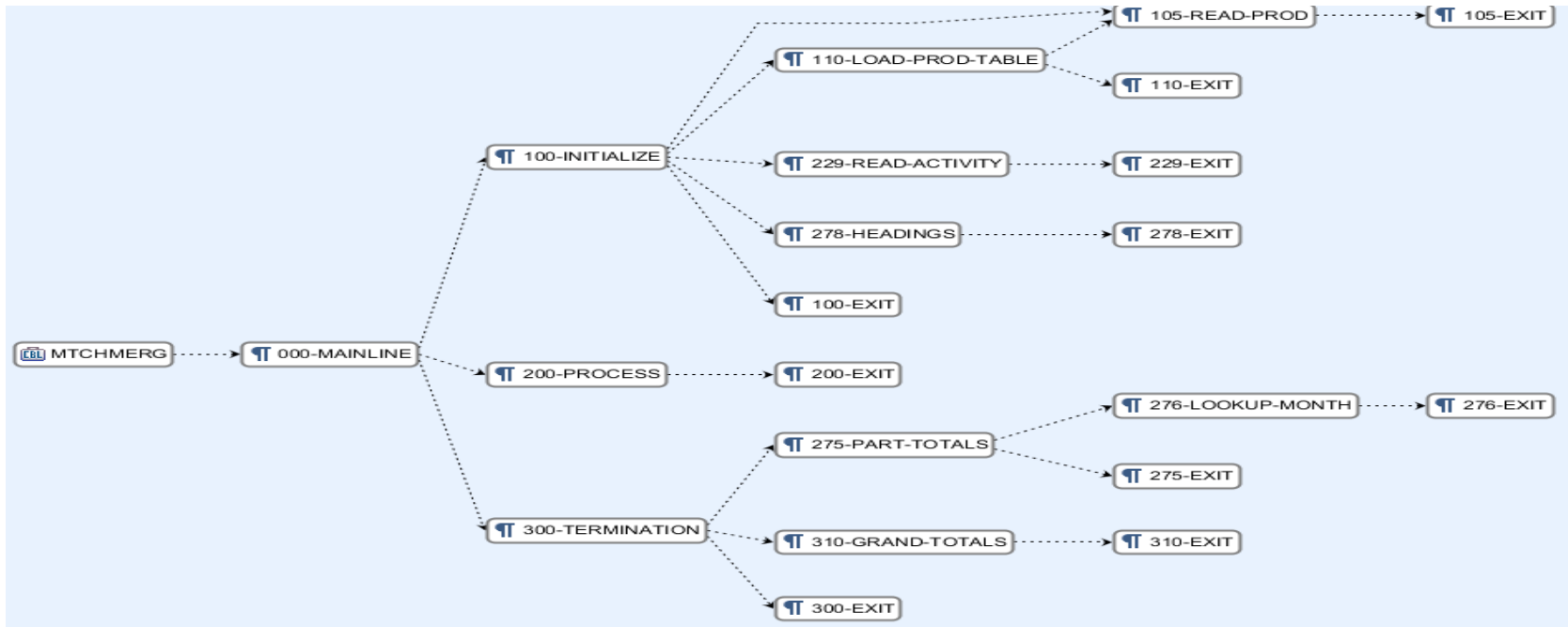
- MOD
- NEW
- OLD
- SHR

Press 'CTRL+SPACE' to view Template Proposals

# Enhanced Application Quality & Structure Analysis

## Application Analysis

- Control flow diagrams for COBOL and PL/1 programs,
  - **Graphical representation of the program flow with links to the source**
- Helps identify and highlight potential unreachable code



# Enhanced Structure Analysis – Data Element Table

- A table representation of the user-defined data items and symbols in a program
  - ▶ Hyperlinks in the table are integrated with the editor allowing easy access to the declaration of the data items.
- Generated by showing the “symbol table” generated when RDz real-time syntax check parses the program

Data Element Table X

Showing data elements from WARDRPT.cbl      Search:

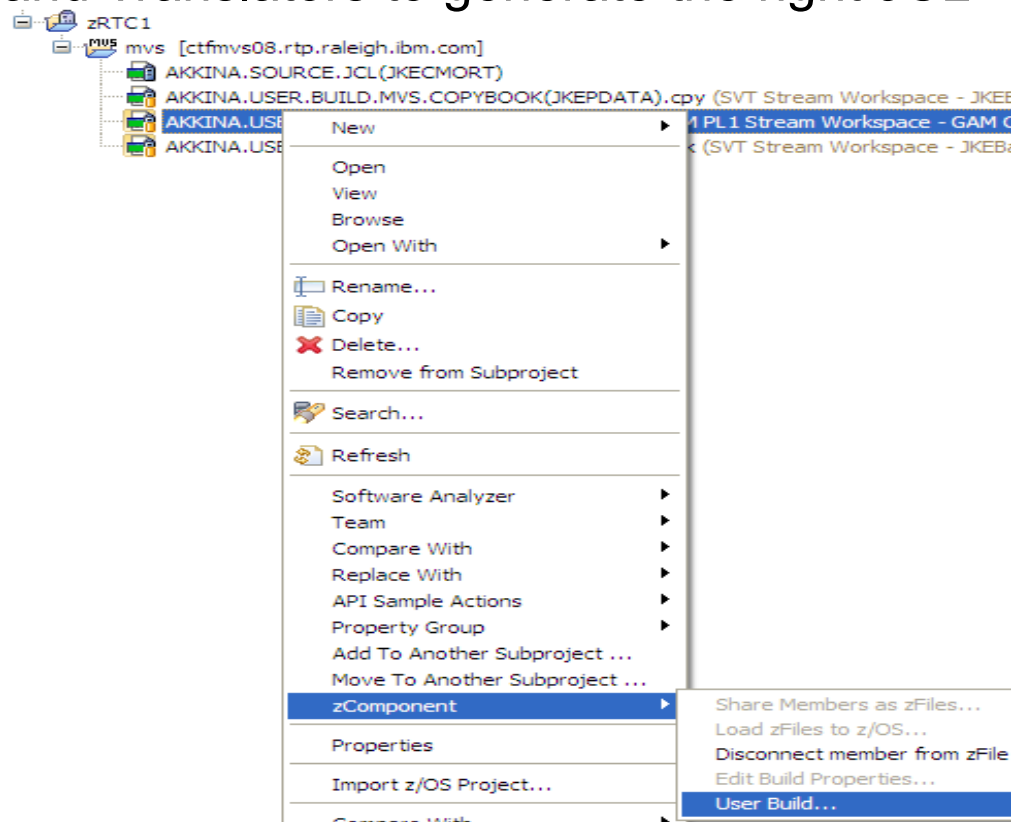
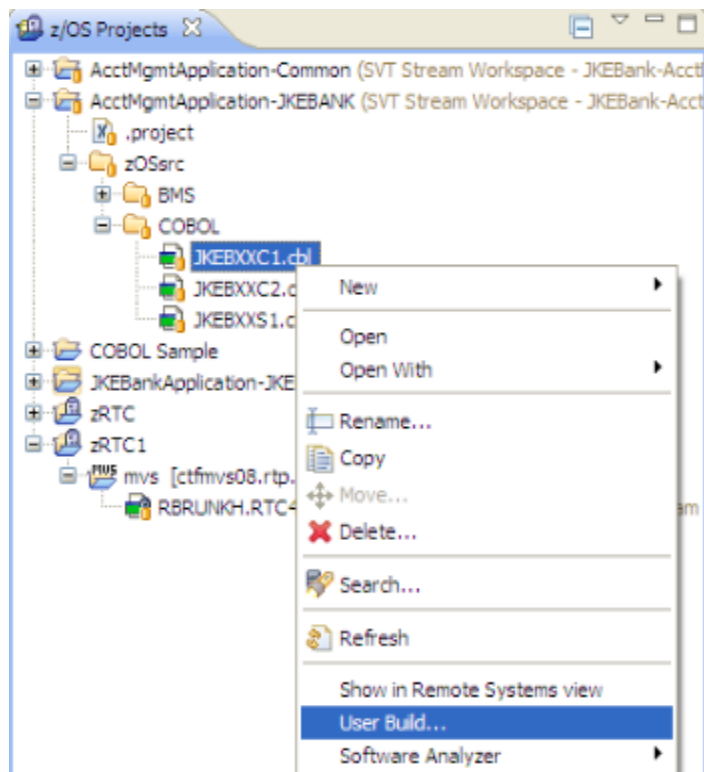
Data Item Name:	Data Type:	Level:	Top-Level Item:	Declaration:	Initial Value:	Line ...	Reference count:	Full Declaration:
PATLISTEST-S-ID	Data	10	PATIENT-MASTER-REC	PIC X(08)		378	0	10 PATLISTEST-S-ID PIC X
PATMSTR	File Descriptor	0	PATMSTR			116	4	FD PATMSTR RECORD CO.
PATMSTR-FOUND	Data	88	FILE-STATUS-CODES			134	1	88 PATMSTR-FOUND VALUE "0
PATMSTR-KEY	Data	5	PATMSTR	PIC X(06)		120	2	05 PATMSTR-KEY PIC X(06).
PATMSTR-REC	Data	1	PATMSTR			119	1	01 PATMSTR-REC.
PATMSTR-STATUS	Data	5	FILE-STATUS-CODES	PIC X(2)		133	3	05 PATMSTR-STATUS PIC X
PATPERSN	File Descriptor	0	PATPERSN			123	4	FD PATPERSN RECORD CO
PATPERSN-FOUND	Data	88	FILE-STATUS-CODES			136	1	88 PATPERSN-FOUND VALUE "
PATPERSN-KEY	Data	5	PATPERSN	PIC X(06)		127	2	05 PATPERSN-KEY PIC X(06).
PATPERSN-REC	Data	1	PATPERSN			126	2	01 PATPERSN-REC.
PATPERSN-STATUS	Data	5	FILE-STATUS-CODES	PIC X(2)		135	3	05 PATPERSN-STATUS PIC
PATSRCH	File Descriptor	0	PATSRCH			98	4	FD PATSRCH RECORDING
PAYMENT-METHOD-TYPE	Data	5	PATIENT-PERSONAL-...	PIC X(02)		313	0	05 PAYMENT-METHOD-TYPE
PEDIATRICS	Data	88	INPATIENT-DAILY-REC			157	0	88 PEDIATRICS VALUE "1010".



# User Build from RDz

User build is supported in zComponent projects and remote z/OS projects

- Builds the file selected, supports Error feedback
- Uses RTC Language definitions and Translators to generate the right JCL



# Pending Changes

## Need fine-grained SCM control?

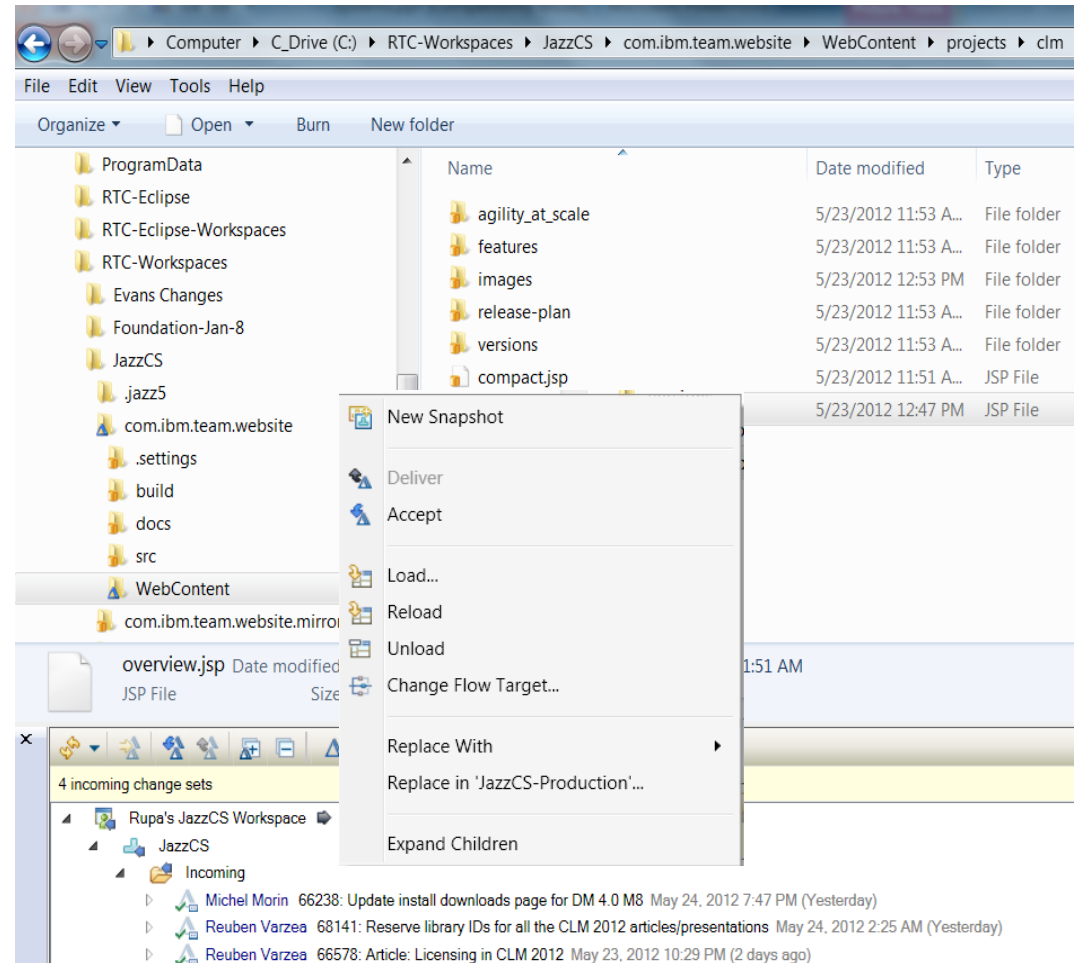
- Check out the pending changes view

## Eclipse Rich Client:

- Check in, deliver, accept changes
- Suspend, resume, discard changes
- Replace, reload out-of-sync
- Resolve conflicts

## Web Client:

- Open change sets and work



# RDz Integrated Debugger



## A GUI-based multi-platform, multi-language debugger

- ✓ Full asynchronous mode
  - ✓ Thread-level control of multi-threaded applications
- ✓ Automonitor support

### RDz v9.0.1 Base Support:

- ✓ COBOL V5.1, V4, V3.4
- ✓ Batch, Batch IMS, Batch DB2, CICS 5.1, 4.2, 4.1
- ✓ Interactive Code coverage – Out of the box

### RDz 9.1 new support:

- ✓ PLI v4.x, v3.9
- ✓ C/C++ V1R13, V2R1
- ✓ IMS TM
- ✓ DB2 Stored procedures

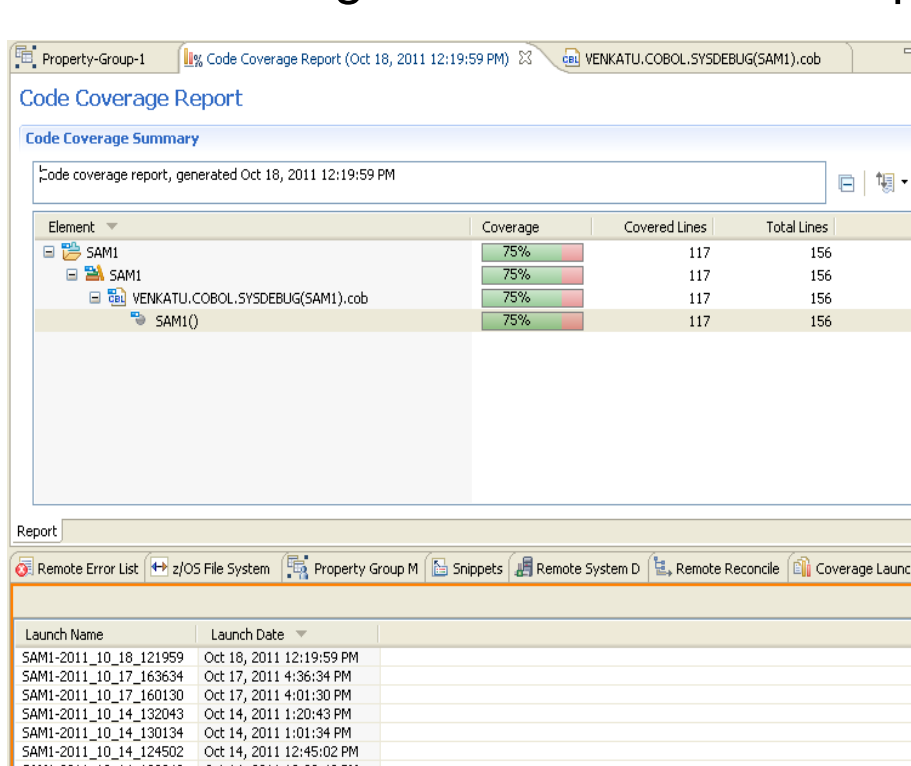
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# Enhanced Application Quality – Code Coverage

Measure and report test coverage of an application

- Supports multiple languages including COBOL and Java
- Leverages the Integrated Debugger technology
- Indicates what source code was tested and remains to be tested
- View Coverage at module / source / procedure level

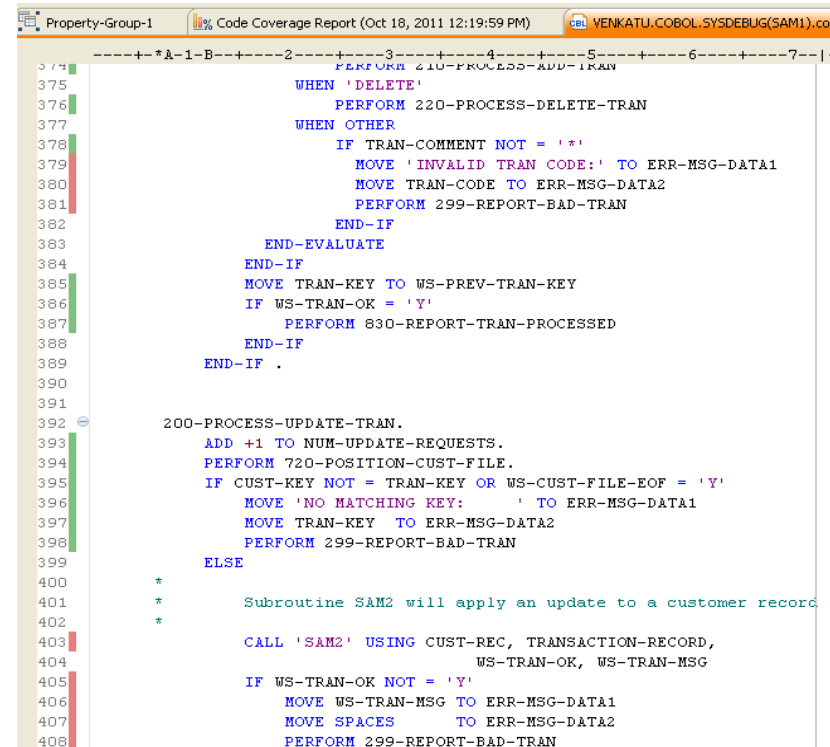


**Code Coverage Report**  
Code coverage report, generated Oct 18, 2011 12:19:59 PM

Element	Coverage	Covered Lines	Total Lines
SAM1	75%	117	156
SAM1	75%	117	156
VENKATU.COBO.L.SYSDEBUG(SAM1).cob	75%	117	156
SAM1()	75%	117	156

Launch Name	Launch Date
SAM1-2011_10_18_121959	Oct 18, 2011 12:19:59 PM
SAM1-2011_10_17_163634	Oct 17, 2011 4:36:34 PM
SAM1-2011_10_17_160130	Oct 17, 2011 4:01:30 PM
SAM1-2011_10_14_132043	Oct 14, 2011 1:20:43 PM
SAM1-2011_10_14_130134	Oct 14, 2011 1:01:34 PM
SAM1-2011_10_14_124502	Oct 14, 2011 12:45:02 PM

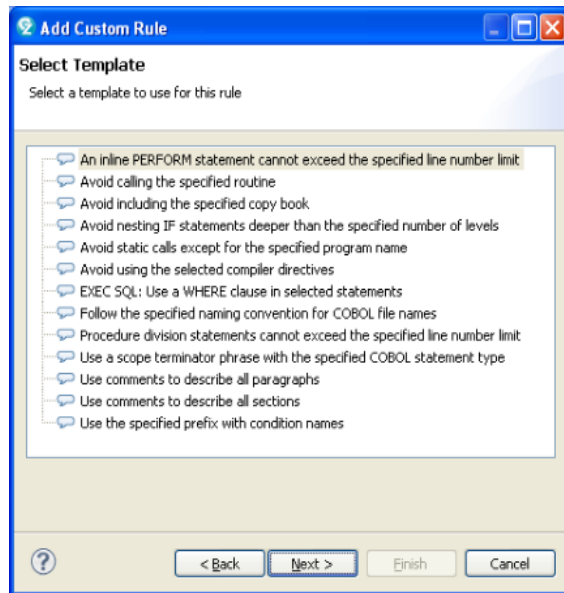


```

375 PERFORM 210-PROCESS-ADD-TRAN
376 WHEN 'DELETE'
377 PERFORM 220-PROCESS-DELETE-TRAN
378 WHEN OTHER
379 IF TRAN-COMMENT NOT = '*'
380 MOVE 'INVALID TRAN CODE:' TO ERR-MSG-DATA1
381 MOVE TRAN-CODE TO ERR-MSG-DATA2
382 PERFORM 299-REPORT-BAD-TRAN
383 END-IF
384 END-EVALUATE
385 END-IF
386 MOVE TRAN-KEY TO WS-PREV-TRAN-KEY
387 IF WS-TRAN-OK = 'Y'
388 PERFORM 830-REPORT-TRAN-PROCESSED
389 END-IF
390 END-IF .
391
392 200-PROCESS-UPDATE-TRAN.
393 ADD +1 TO NUM-UPDATE-REQUESTS.
394 PERFORM 720-POSITION-CUST-FILE.
395 IF CUST-KEY NOT = TRAN-KEY OR WS-CUST-FILE-EOF = 'Y'
396 MOVE 'NO MATCHING KEY:' TO ERR-MSG-DATA1
397 MOVE TRAN-KEY TO ERR-MSG-DATA2
398 PERFORM 299-REPORT-BAD-TRAN
399 ELSE
400 *
401 * Subroutine SAM2 will apply an update to a customer record
402 *
403 CALL 'SAM2' USING CUST-REC, TRANSACTION-RECORD,
404 WS-TRAN-OK, WS-TRAN-MSG
405 IF WS-TRAN-OK NOT = 'Y'
406 MOVE WS-TRAN-MSG TO ERR-MSG-DATA1
407 MOVE SPACES TO ERR-MSG-DATA2
408 PERFORM 299-REPORT-BAD-TRAN
  
```

## Predefined rules and templates

- for COBOL and PL/I applications
- Ensure corporate standard adherence
- Custom rules for COBOL and PL/I

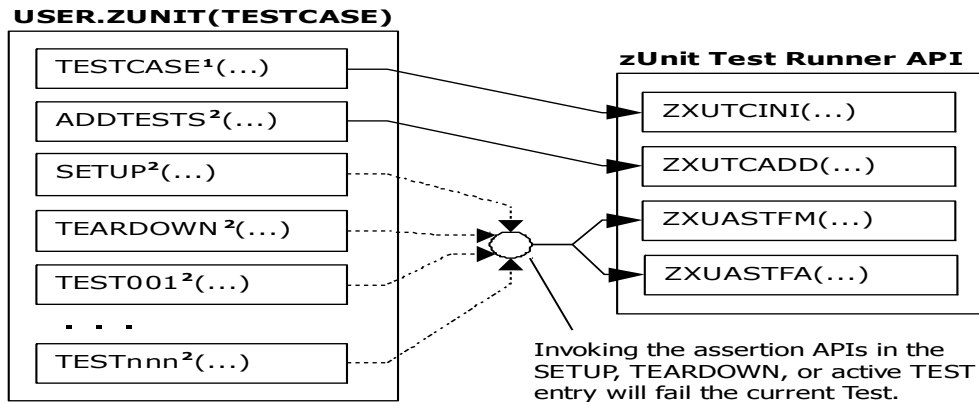




# zUnit: Unit testing framework for z/OS

A Framework for developers to write:

- repeatable, self-checking unit tests, based on xUnit.
- [xUnit](#) a light-weight architecture to implement unit test frameworks.
  - JUnit, for example, is a very popular instance of the xUnit architecture.
- **zUnit** is an xUnit instance for System z
- zUnit encourages **continuous integration and continuous testing**
  - for System z Application development and maintenance



<sup>1</sup>Language-specific details:

- In COBOL, this is the first program appearing in the Test Case source file and it will be invoked by the Test Runner for Test Case initialization.
- In PL/I, this is the procedure declared with option(fetchable) in the Test Case source file and it will be invoked by the Test Runner for Test Case initialization.

<sup>2</sup>Language-specific details:

- In COBOL, these are expected to be subprograms (non-nested and therefore compatible with FUNCTION-POINTER).
- In PL/I, these are expected to be internal procedures that are declared at the package level (non-nested).

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# IBM Problem Determination Tools for z/OS (PD Tools)

## Application Performance Analyzer for z/OS

- Identify performance and response time problems. Assists in reducing resource consumptions.

## Debug Tool for z/OS

- Interactive debugging, understanding execution flow, COBOL modernization, code coverage and much more.

## Fault Analyzer for z/OS

- Abend analysis at source-level reporting to speed up the problem analysis steps.

## File Manager for z/OS

- Data manipulation on z/OS including data in DB2, IMS, CICS, MQ, data sets and HFS files.

IBM Problem Determination Tools Modernization Solution Pack

# IBM Debug Tool Version 13



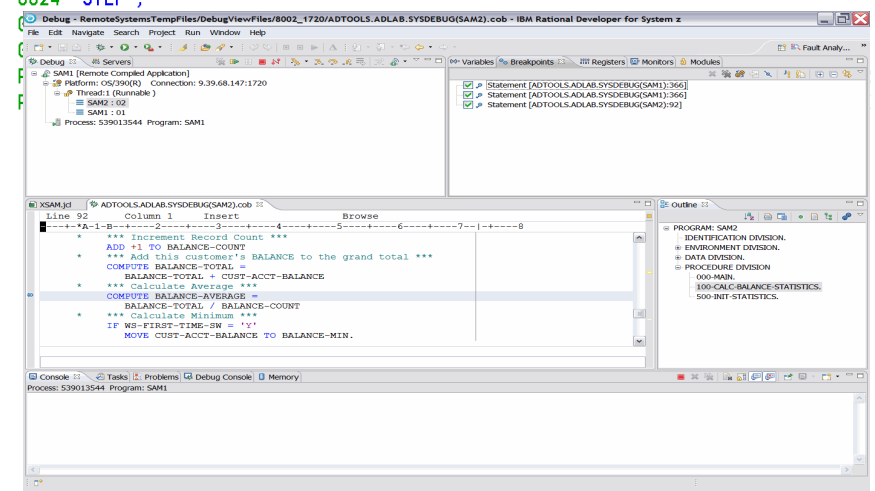
Debug Tool can help you increase debugging efficiencies and reduce application development cycle times.

- Program testing and analysis aid that helps you examine, monitor, and control the execution of applications on z/OS (CICS/DB2/IMS/COBOL/PLI/ASM,C/C++/ASM/JAVA w Toolkit)

- Proven 3270 and eclipse interfaces
- Improved Code Coverage facilities for COBOL and PL/1
- Automatic start of IMS MPP region with dynamic transaction routing
- Playback support in RD/z
- Support for new instruction set available with z13 hardware
- Support for Enterprise COBOL V5.2 and V5,1 compilers
- Support for Enterprise PL/I V4.5 compiler
- Support for z/OS XL C/C++ V2.1 compilers
- Support for CICS Transaction Server V5.2
- Supporting CICS TS V5.3 Open Beta program
- DB2 V11 for z/OS
- IMS 13 Transaction and Database Servers
- WAS for z/OS V8.5
- MQ for z/OS V8.0

```

COBOL   LOCATION: SAM1 :> 315.1
Command ==>
MONITOR -+---1-+---2-+---3-+---4-+---5-+---6- LINE: 1 OF 5
          +---1-+---2-+---3-+---4-+---
0001  1 BALANCE-COUNT          +0000006.00
0002  2 NUM-DETAIL-LINES      +000000005
0003  3 ***** AUTOMONITOR *****
0004  02 CUST-NAME             'Parker, Ford'
0005  02 RPT-CUST-NAME         'Deeds, Darren'
***** BOTTOM OF MONITOR *****
SOURCE: SAM1 +---1-+---2-+---3-+---4-+---5- LINE: 312 OF 467
312          CALL 'SAM2' USING CUST-REC,
313          CUSTOMER-BALANCE-STATS
314          MOVE CUST-ID       TO RPT-CUST-ID
315          MOVE CUST-NAME     TO RPT-CUST-NAME
316          MOVE CUST-OCCUPATION TO RPT-CUST-OCCUPATION
317          MOVE CUST-ACCT-BALANCE TO RPT-CUST-ACCT-BALANCE
LOG 0-+---1-+---2-+---3-+---4-+---5- LINE: 23 OF 26
0023 GO ;
0024 STEP ;
    
```



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# Debug Tool: Continuous advancements

## Technical Preview

### Web: Code coverage

- Browser interface for reviewing code coverage report.
- Quickly understand coverage of regression testing effort.
- Drill down to source line level for detailed analysis.
- Code coverage services can be accessed via APIs.

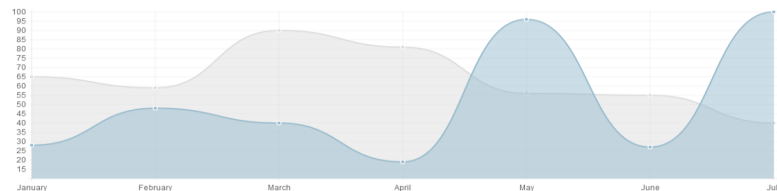
### Eclipse: Load Module Analyzer

- Analyzes MVS load modules or program objects to determine the language translator (compiler or assembler) used to generate the object for each CSECT.
- Invoke Load Module Analyzer from Eclipse environment.

### ISPF: JCL Wizard

- An ISPF edit macro that can be used to modify a JCL or procedure member, creating the statements to invoke Debug Tool in various environments.
- Creates statements to invoke Debug Tool for z/OS for:
  - Terminal Interface Manager, Mainframe Interface, Remote GUI.

Summary and chronological Information



Connected to: TLBA07ME.TOROLAB.IBM.COM

Groups		Users	
GUI	92%	glen	92%
Server	87%	jesse	87%
Regression	55%	francisco	55%

Working with CC reports expanding on a user: Annotated and color coded

```

71
72 e MOVE SPACE TO TBND003F-DATA-OUT.
73
74 e IF TBND003F-DATA-IN IS NUMERIC
75 e IF TBND003F-DATA-IN u 1 OR TBND003F-DATA-IN e 26
76 u MOVE 'INVALID TABLE 2 POINTER' TO TBND003X-MSG
77 u MOVE 341 TO RETURN-CODE
78 ELSE
79 e MOVE WK-LETTER (TBND003F-DATA-IN) TO
80 TBND003F-DATA-OUT
81 e MOVE 0 TO RETURN-CODE
82 END-IF
83 ELSE
84 u MOVE 'TABLE 2 PTR NOT NUMERIC' TO TBND003X-MSG
    
```

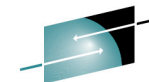
Lookup z/OS Job DTSP Server Profile DTCN Server Profiles Instrument JCL for Debug Tool Debugging Load Module Analyzer LMA Report Viewer

Language	Active	Language	Active
DPS	Active (IMS)	IMS	
DSH	Active (DB2)	DB2	
EDC	Active (C/C++)	C/C++	
RZA	Active (TCP/IP)	TCP/IP	
IBM	Active (PL/I)	PL/I	
IEDC	Active (C/C++)	C/C++	
IEL	Active (PL/I)	PL/I	
IEH	Active (PL/I)	PL/I	
IGY	Active (COBOL)	COBOL	
IG2	Active (COBOL)	COBOL	
IIBM	Active (PL/I)	PL/I	
ILB	Active (OS/VS COBOL)	OS/VS COBOL	

1 5655-Q10 Debug Tool Version 13 Release 1.2 Load Module Analyzer 2014/09/09 16:50 Page 3  
EQAPGMMN:  
0000000 (?) (No IDR data available)

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# Enterprise COBOL V5.1 & V5.2 Exploitation



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Educate • Network • Influence

## Enterprise COBOL V5.2

- Provides easy migration from COBOL V5.1
- Includes all enhancements delivered in COBOL V5.1 PTFs
  - Restored migration features, performance features, new programming features
- Provides Day 1 support for z13 processor
  - Instruction scheduler tuned to new micro architecture at ARCH 11
  - Expanded use of Decimal Floating Point for PACKED-DECIMAL data
  - Uses new SIMD instructions for INSPECT TALLYING or REPLACING statements
- Improves Application Performance
  - Well-structured, compute intensive batch applications running on z13 (compiled with Enterprise COBOL V5.2) have shown CPU time reduction of up to 14% over the same applications running on zEC12 (compiled with the GA release of Enterprise COBOL V5.1) <sup>1</sup>

<sup>1</sup> Results are based on an internal compute-intensive test suite. Performance results from other applications may vary.

**developerWorks Article:** [Prepare to upgrade to Enterprise COBOL for z/OS V5 Enterprise COBOL for z/OS V5.1.1 Migration Guide](#)

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## PD Tools Exploitation

- The new DWARF format side file of COBOL V5.1 brings a significant advantage for its users especially when performing problem diagnosis using tools like PD Tools:
  - Program information required for problem diagnosis is stored in the same file as the load module.
  - This simplifies the management of side files as it is no longer required to maintain load modules and matching side files separately.
  - Since DWARF information is created and stored while link edit the program, it eliminates the possibility of side file mismatch.
  - No performance penalty for selecting the DWARF option. DWARF information is not loaded into storage while program executes normally. It is only read from the file when it is required by problem diagnosis tools like PD Tools.
- Application Performance Analyzer for z/OS, Debug Tool for z/OS and Fault Analyzer for z/OS fully exploit the new DWARF format COBOL V5.1 side file format.
- All tools supports new z13 hardware instructions exploited by the compiler.
- File Manager for z/OS continues to support COBOL V5.1 level COPYBOOKS.

# Improved Productivity

Application is abending. What do I do?

## Simple S0CB in COBOL program analysis

### Steps without FA:

1. Capture CEEDUMP or MVS dump
2. Determine abend offset into program from dump traceback
3. Obtain a matching compiler listing – need to make sure it really matches!
4. Using the listing, identify the matching source line for the abend offset
5. Identify data fields involved and their offsets into working storage
6. Validate the content of each data field in the dump to determine the one(s) in error
7. Fix the problem



Do I really want to do this?



# Improved Productivity

## Solution provided by Fault Analyzer report

```
.pthfmd2:2820/KENICHI.HISTORY(F00002)-Report ☒
1
2 Module COBTSE, program COBTSE, source line # 17: Abend S0CB (Decimal-Divide Exception)
3
4 I B M   F A U L T   A N A L Y Z E R   S Y N O P S I S
5
6
7 A system abend 0CB occurred in module COBTSE program COBTSE at offset X'458'.
8
9 A program-interruption code 000B (Decimal-Divide Exception) is associated with
10 this abend and indicates that:
11
12     The divisor was zero in a signed decimal division.
13
14 The cause of the failure was program COBTSE in module COBTSE.  The COBOL source
15 code that immediately preceded the failure was:
16
17 Source
18 Line #
19 -----
20 000017          DIVIDE NUM1 BY NUM2 GIVING NUM3.
21
22 The COBOL source code for data fields involved in the failure:
23
24 Source
25 Line #
26 -----
27 000006          01 NUM1 PIC 99 VALUE ZERO.
28 000007          01 NUM2 PIC 99 VALUE ZERO.
29 000008          01 NUM3 PIC 999 VALUE ZERO.
30
31 Data field values at time of abend:
32
33 NUM1 = 10
34 NUM2 = 0   *** Cause of error ***
35 NUM3 = 23
```

Gives you an explanation of failure and pinpoint erroneous source line #

Displays source information involving in the error

Showing you precisely what data needing the fix

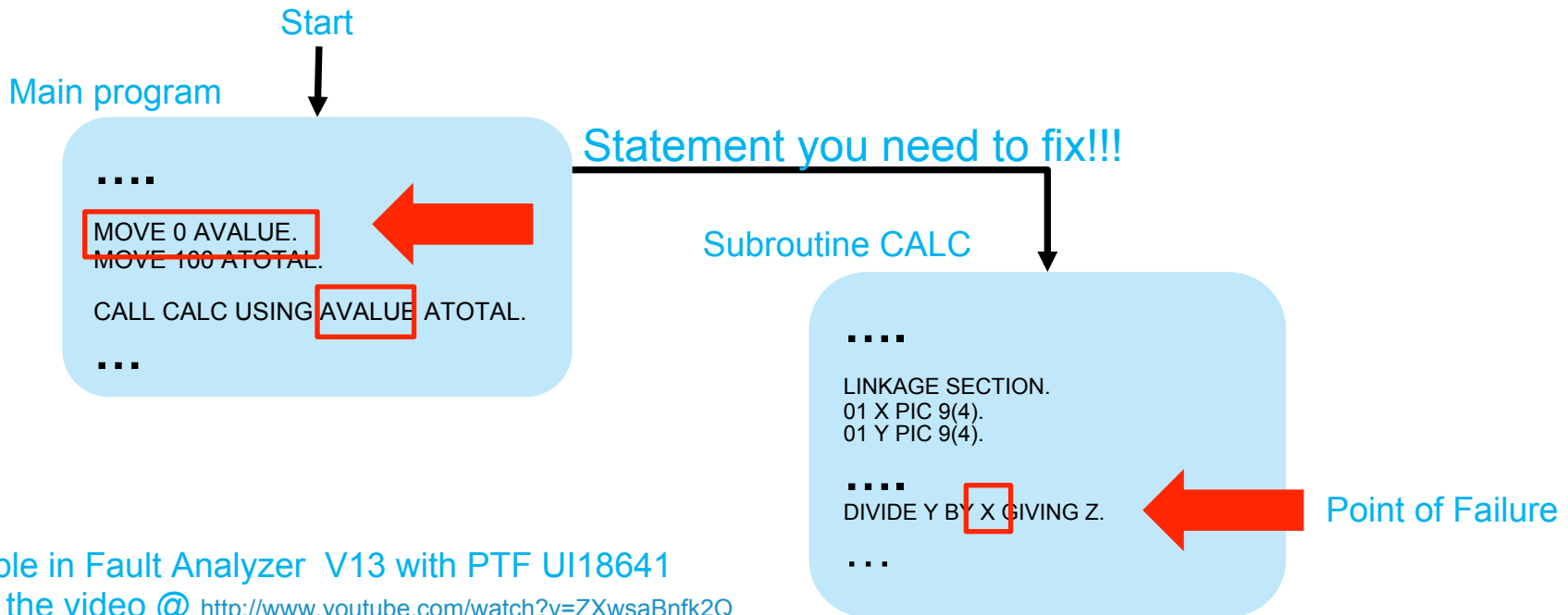
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# Fault Analyzer: Continuous advancement



## COBOL Explorer: Post-mortem debugger

- **Want to understand the execution path which led to a failure from a dump?**
- **Want to see how a variable changed and contributed to a failure?**
- COBOL Explorer is a new feature of Fault Analyzer which lets you interactively navigate through your application from the point of failure, examining variable ref/def



Available in Fault Analyzer V13 with PTF UI18641  
Watch the video @ <http://www.youtube.com/watch?v=ZXwsaBnfk2Q>

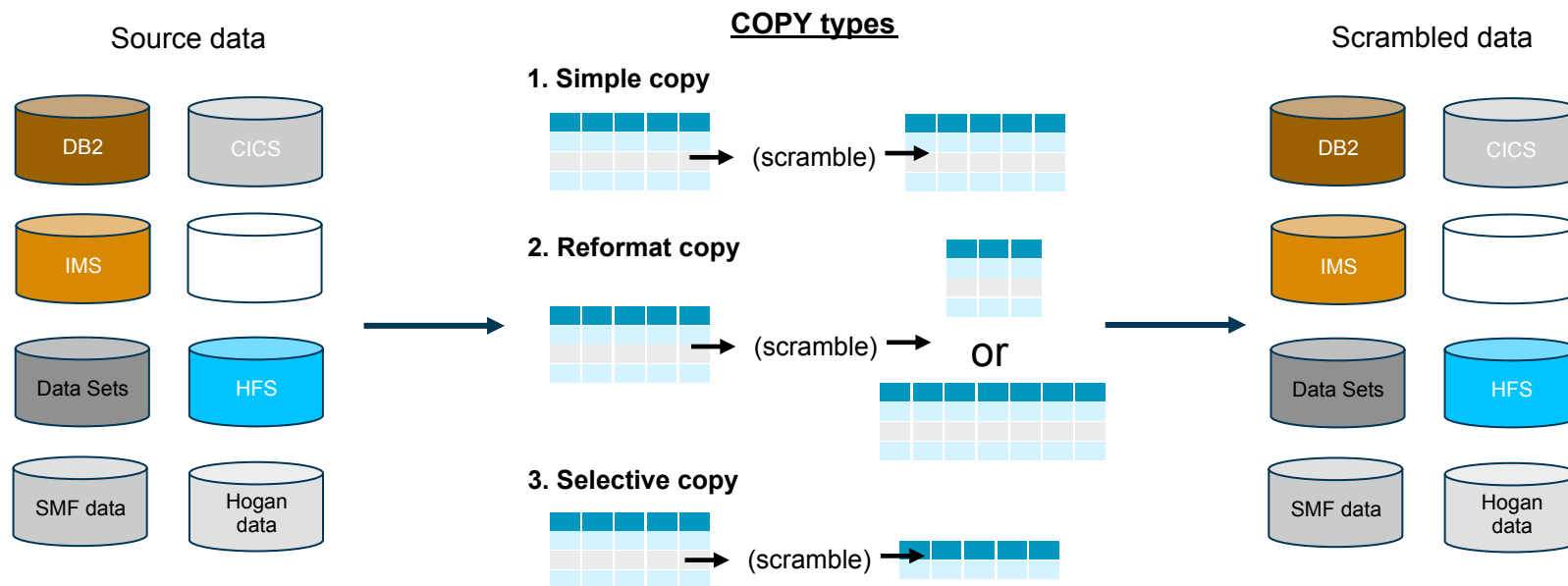
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# File Manager: Continuous advancements

## Data scrambling – protecting sensitive information

File Manager in conjunction with Optim ODPP APIs provides powerful data scrambling for your enterprise data residing in a variety of locations on z/OS.

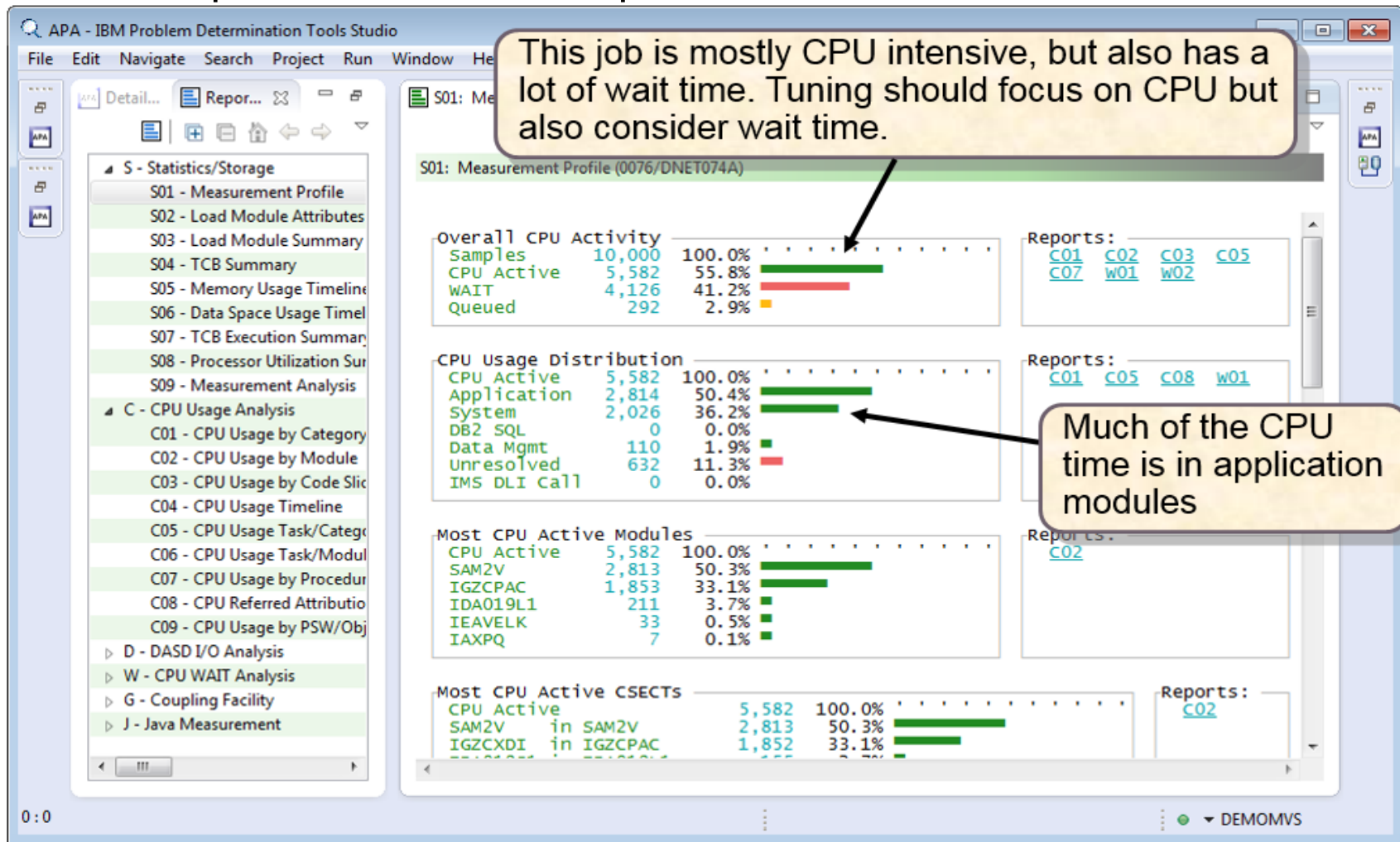
- Work with complex data structures such as SMF records and CSC Hogan Systems data.
- Support for most data sources found on z/OS: DB2, IMS, Data Sets, HFS files, WebSphere MQ, and CICS TS.
- Take advantage of powerful File Manager’s copy function.



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# APA: Continuous advancements

## How to fix performance related problems?



# APA: Continuous advancements

## How to fix performance related problems?

W03: Wait Time Referred Attribution (0076/DNET074A)

Name	Description	Percent of Time in WAIT * 10.00%	±1.0%
SAM1V-001	TCB=006FF3A0	41.26	
- SAM1V	Application	41.15	
- SAM1V	CSECT in SAM1V	41.15	
- 001876	Attribution	38.58	
- IDA019L1	Offset in	38.58	
- IDA019R3	virtual	38.57	
- IDA019RL	I/O (VIO)	0.01	
- 0017B2	and VSAM	1.28	
- IDA019L1	Attribution	1.28	
- IDA019R3	Offset in	1.28	
- IDA019RL	SAM1V	1.28	
- 0017B2	virtual	1.28	
- IDA019L1	I/O (VIO)	1.28	
- IDA019R3	and VSAM	1.28	
- IDA019RL	I/O (VIO)	1.28	
- 0017B2	and VSAM	1.28	

W03: Wait Time Referred Attribution Source Program Mapping (0076/DNET074A)

```

000491 00157E          IF CRUNCH-IO-LOOPS > 0
000492 001580          OPEN I-O      CUSTOMER-FILE2
000493 00158C          69 <- wait time attributed to above statement
000494 001580          EVALUATE     WS-CST2FILE-STATUS
000495 001580          WHEN '00'
          ----- 8 line(s) not displayed
000504 0015F0          IF WS-CUST2-FILE-OPEN = 'Y'
000505 0015FC          PERFORM 510-CRUNCH-CUSTFILE
000506 001618          CLOSE CUSTOMER-FILE2
000507 001580          52 <- wait time attributed to above statement
000508 001580          END-IF
          ----- 29 line(s) not displayed
000538 00177E          512-ADD-CUST2-RECORD .
000539 00177E          MOVE WORK-KEY TO CUST2-KEY .
000540 001788          WRITE CUST2-REC .
000541 001782          128 <- wait time attributed to above statement
000542 0017C0          IF WS-CUSTFILE-STATUS NOT = '00'
          ----- 6 line(s) not displayed
000549 001876          514-DEL-CUST2-RECORD .
000550 001876          MOVE WORK-KEY TO CUST2-KEY .
000551 001876          DELETE CUSTOMER-FILE2 .
000552 001876          3638 <- wait time attributed to above statement
000553 001884          IF WS-CUSTFILE-STATUS NOT = '00'
          ----- 1 line(s) not displayed
000554 001884          DISPLAY 'I/O ERROR ON CUST2 VSAM WRITE' .
          * GENERATE CPU USAGE IN SAM2V
000555 001892          MOVE CRUNCH-BALANCE-STATS-ZEROS TO CRUNCH-BALANCE-STATS.
000556 001898          CALL 'SAM2V' USING CUST-REC, CUSTOMER-BALANCE-STATS,
          CRUNCH-CPU-LOOPS .
000557 001876          1 <- wait time attributed to above statement
000558 0018EC          ADD +1 TO WORK-KEY-NUM.
          ----- 18 line(s) not displayed
000577 0019D8          730-READ-CUSTOMER-FILE.
000578 0019D8          READ CUSTOMER-FILE
000579 0019D8          1 <- wait time attributed to above statement
  
```

# Summary

Many companies spend >70% on keeping lights on, and that amount is increasing

IT organizations have problems modifying applications at speed of business

IBM provides a structured approach to incrementally modernize your portfolio

- based on business priorities

Change without a plan is chaos

A Plan without change is stagnation

Business goals change

- applications need to change to address goals

Continual renewal is required

- tools help to guide, govern, drive, and accomplish change



# Getting started

## Next steps to modernize your enterprise applications

[www.ibm.com/rational/modernization](http://www.ibm.com/rational/modernization)

- [Try latest System z software for free](#)
- [Sign up for free web-based training](#)
- [Join IBM Rational Cafe Communities](#)
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Grazie  
Italian

ขอบพระคุณ  
Thai

Gracias  
Spanish



Merci  
French

Спасибо  
Russian

شكراً  
Arabic

Obrigado  
Brazilian Portuguese

Danke  
German

多谢  
Simplified Chinese

நன்றி  
Tamil

ありがとうございました  
Japanese

감사합니다  
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