

16520: Application Development for z/OS - Not your Father's Green Screen

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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.

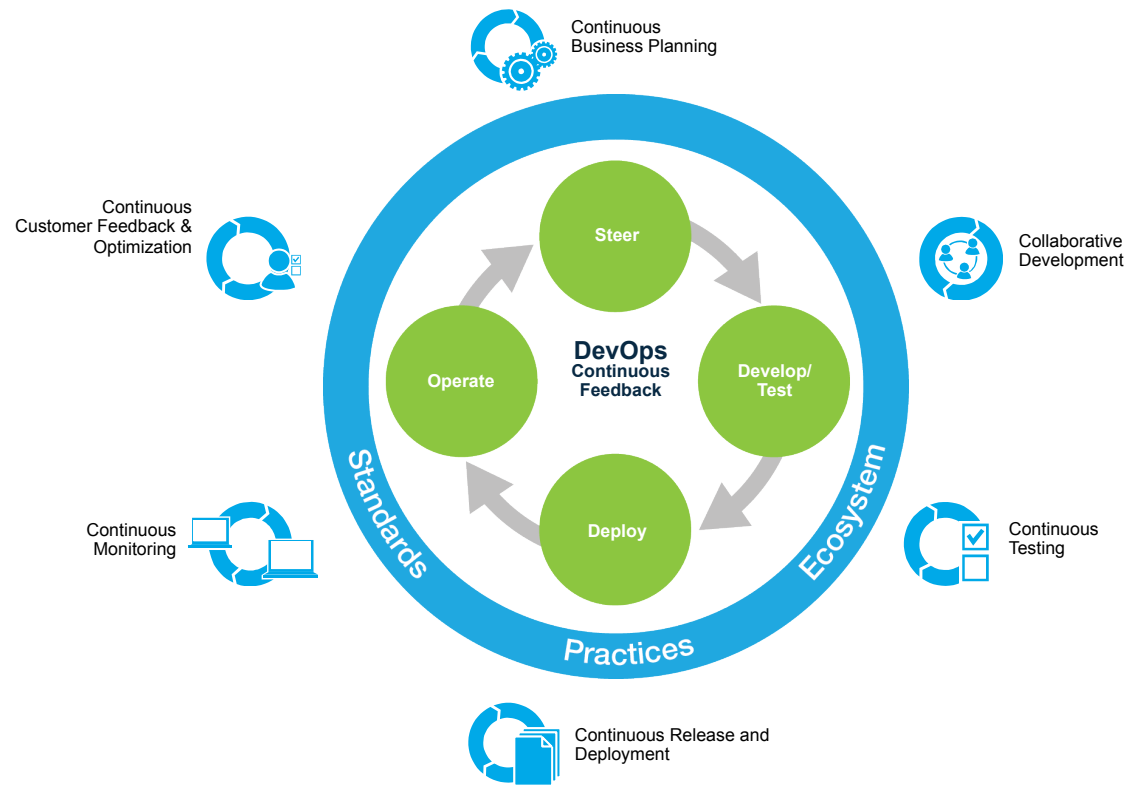
Advances in remote system communication and interaction, syntax-highlighting, parsing, and code understanding for Assembler, PL/I, C/C++, and COBOL source code, as well as programming assists such as code snippets and templates are all available to application programmers. Interactive debug of applications, 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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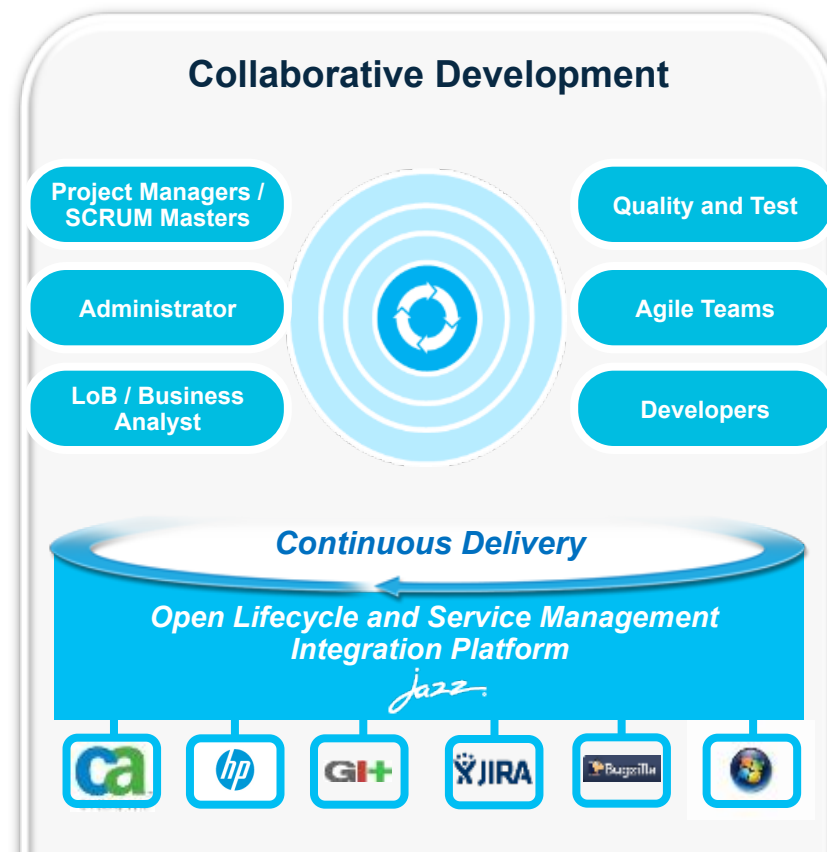
Collaborative Development

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

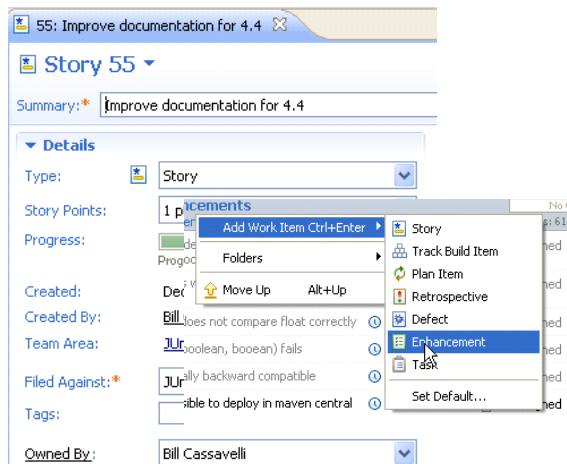
- ✓ **Manage many sources - JavaScript to COBOL**
- ✓ **Single work item can span technologies & solutions**
- ✓ **Quickens agile adoption on the mainframe**
- ✓ **Integrates existing SCMs and deployment tools**

- IBM Rational solution for Collaborative Lifecycle Management (CLM)
 - IBM Rational Team Concert
 - IBM Rational Doors Next Generation
 - IBM Rational Quality Manager

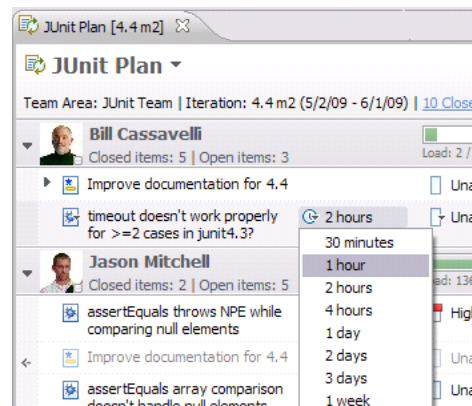


Rational Team Concert – A single tool, many capabilities

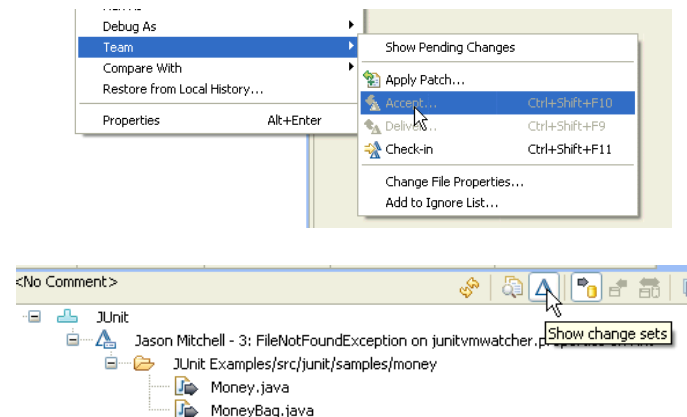
Work Items



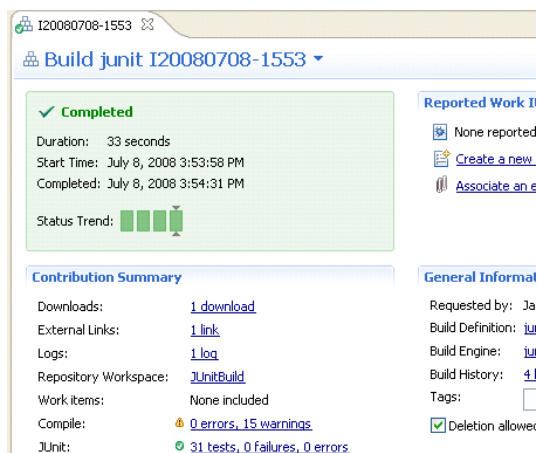
Planning



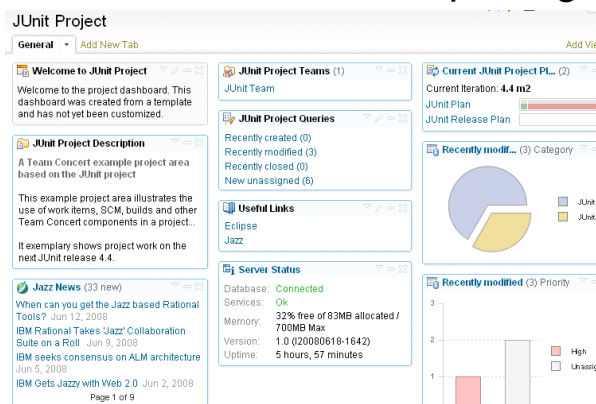
Source Control



Builds – Continuous



Dashboards & Reporting



Method 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

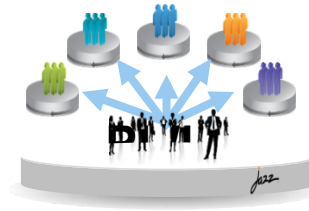
- Associate Existing Work Item
- Associate New Work Item
- Associate and Try Again (experimental)
- Override 'Descriptive Change Sets' Precondition

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Rational Developer for System z: An Integrated Development Environment for System z



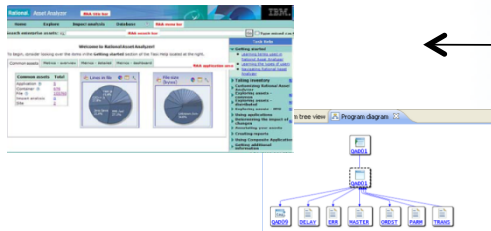
Integration with Team
Concert for Lifecycle and
Source Management



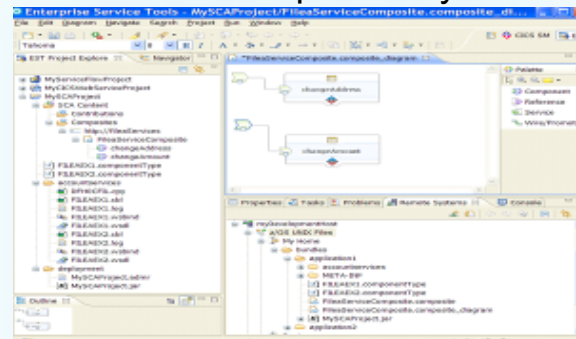
Access to typical System
z sub-system functionality
in z/OS, CICS, IMS, DB2,
WAS



Integration with Asset
Analyzer for Application
Understanding and Impact
Analysis

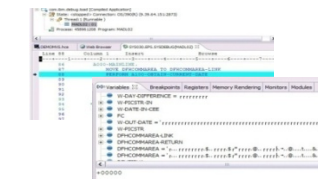


Rational Developer for System z

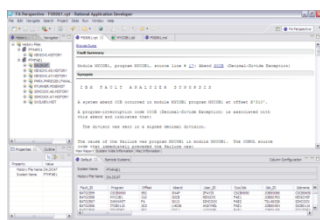


New

Out of the Box debugger
and code coverage
capabilities



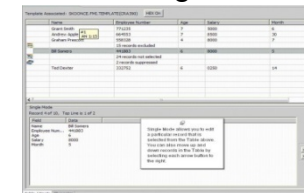
Integration with Fault
Analyzer for Dump Analysis



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 File
Manager for file and test
data handling



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



The Benefits of RDz



Instead of maneuvering to access panels and working **sequentially**, in RDz the functionality you need is always in-focus – you work **concurrently**

Edit a program

Access Datasets + Dataset Management

File Compare

Submit a Compile

File Search

Dataset Statistics

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	2010/04/07...	S622	ABENDED		1
DD50001	2010/04/07...	S622	ABENDED		1
DD50001	2010/04/07...	U0004	NORMAL	004	1
DD50001	2010/04/07...	U0012	NORMAL	00C	1

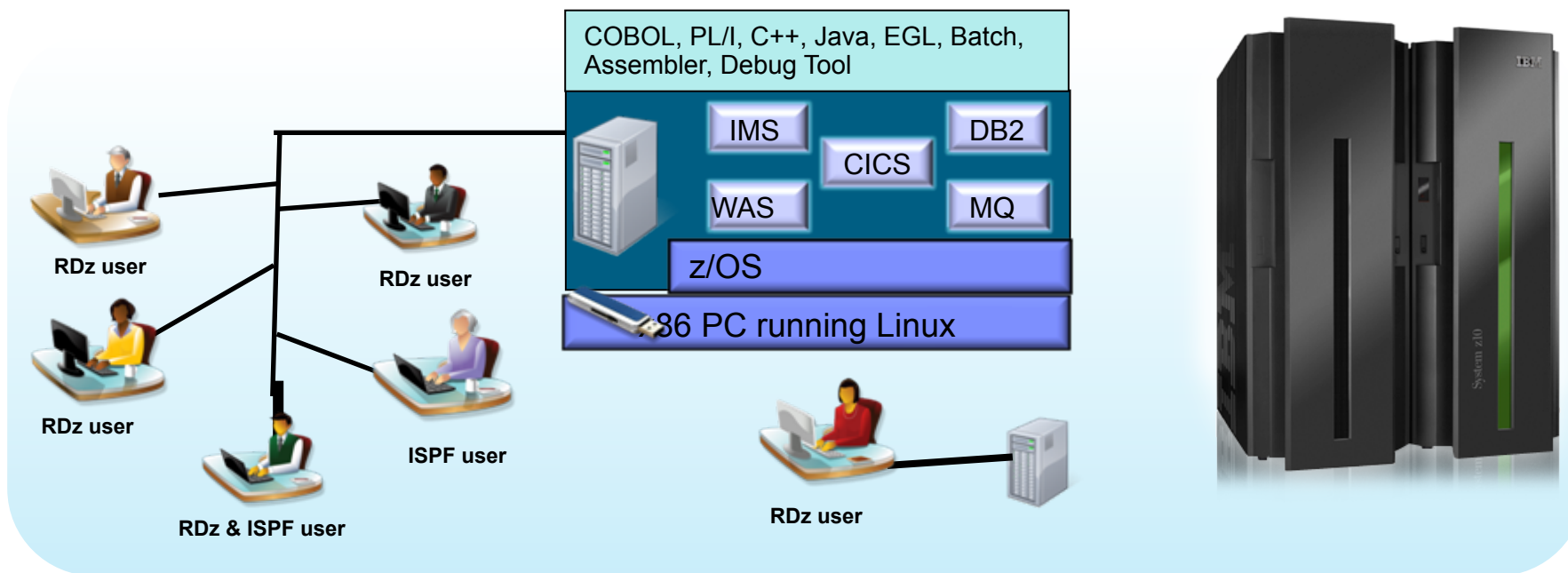
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Rational Development and Test Environment for System z



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

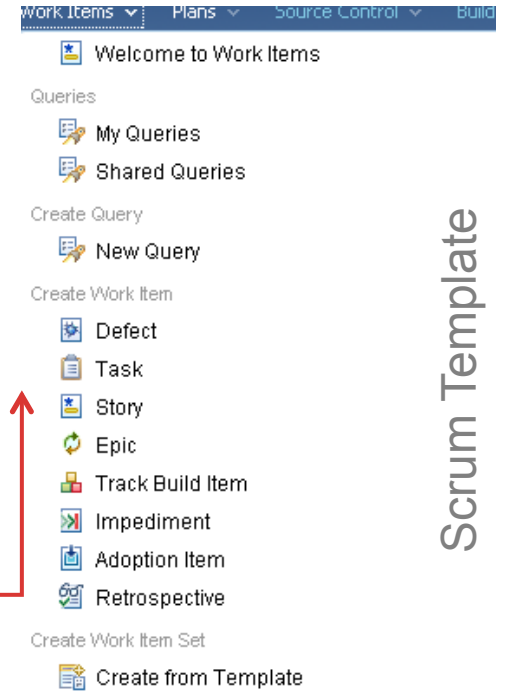
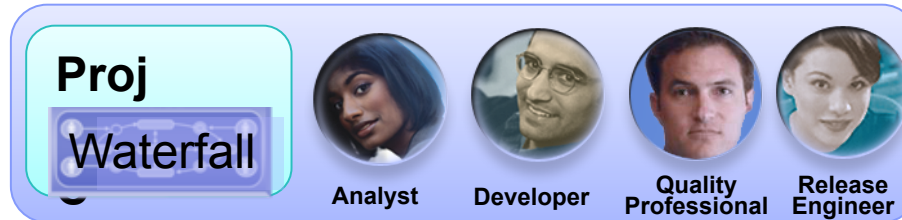
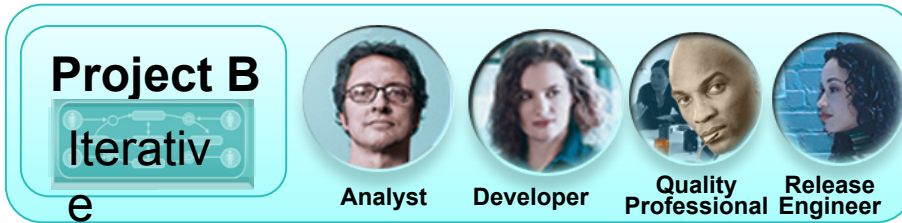
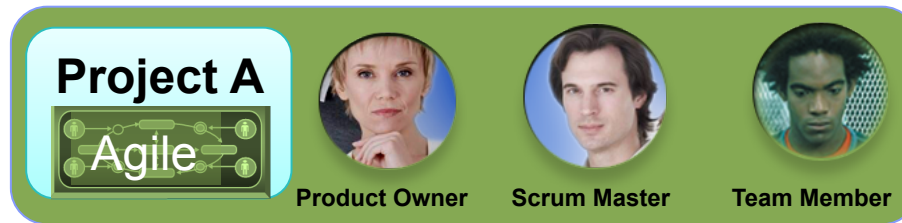
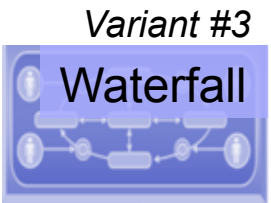
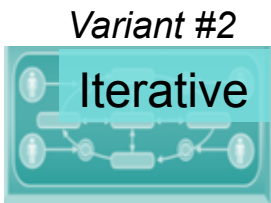
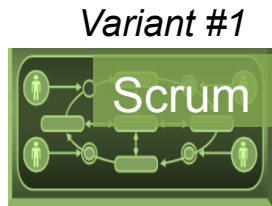
Use ONE tool to support both agile and non-agile



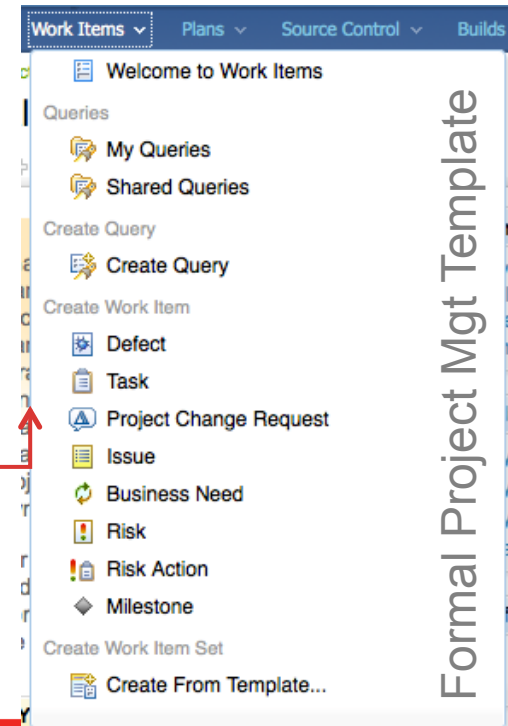
Process Architect



Project Manager



Scrum Template



Formal Project Mgt Template

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Multiple plan views facilitate continuous planning



The screenshot displays three overlapping views of the 'BRM Sprint 2 (1.0) Plan' in the SHARE software:

- Roadmap View (Top):** Shows a list of tasks with columns for Actions, Summary, Effective Effort, Owned By, and Rank. A Gantt chart on the right shows task durations across a timeline from March 13, 2011, to April 2, 2011.
- Taskboard View (Bottom Left):** Shows a grid of task cards categorized by 'Story' and 'Open' status. Cards include 'Donor Dividend Allocation Criteria' and 'Frequency of dividend transfer'.
- Details View (Bottom Right):** Shows a 'Planned Time' view for individual team members. It lists team members with their status (Closed/Open items) and workload (Load: X/Y | +/- h).

Actions	Summary	Effective Effort	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	-

Team Member	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

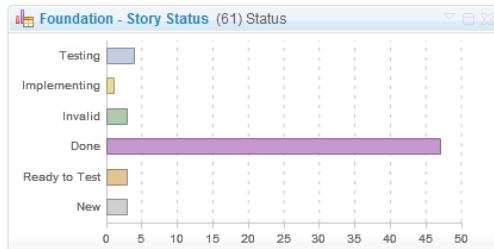
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Progress Tracking - Everyone can see live project status



Story Status Current Iteration

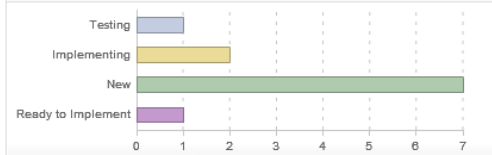
Shows the status of all stories planned for the current iteration



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

CCM - Story Status (11) Status

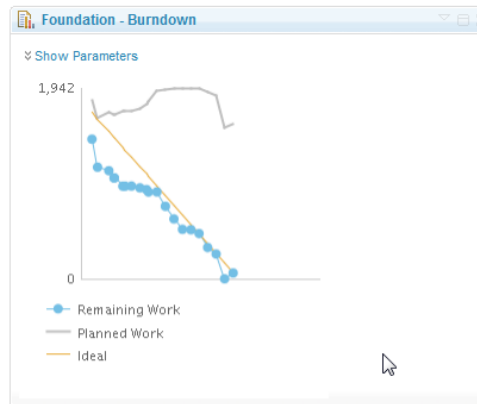


CCM - Current Stories (11)

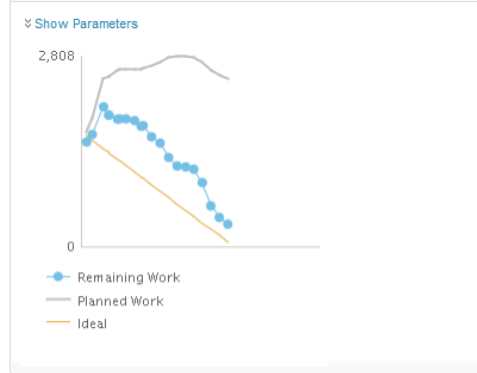
- 150244: address "run as administrator" issues on win7
- 142127: As a user I want to see all extended state groups in taskboards
- 150966: Improve the performance of loading a work item

Burndown Current Iteration

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



CCM - Burndown

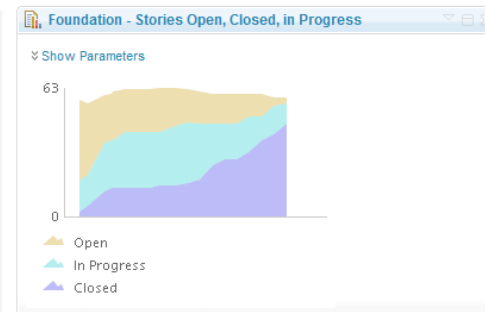


Burndown RM

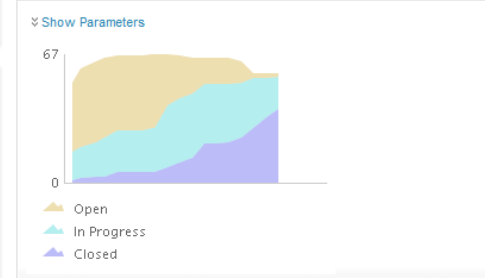


Stories Open/Closed/In Progress

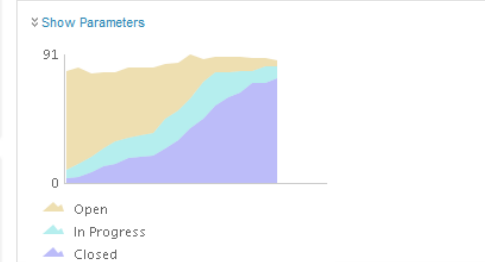
Shows the number of stories which are open, in progress, done during the iteration.



CCM - Stories Open, Closed, in Progress



RM - Stories Open, Closed, In Progress



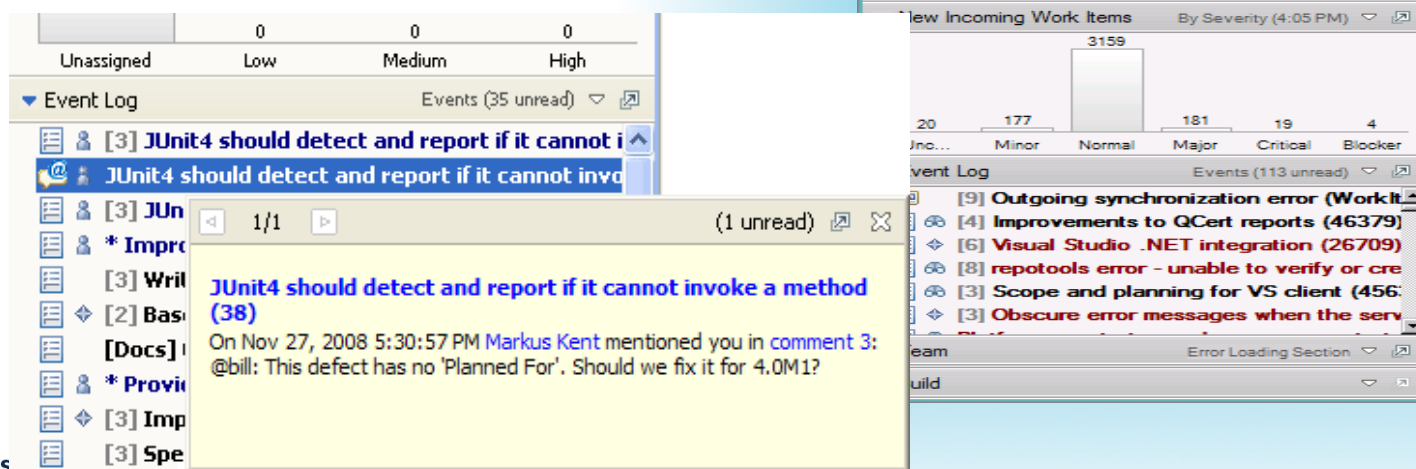
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In-context Collaboration – Team View

Team Central

- Shows what is happening on project:
 - News & events
 - What's being worked on
 - Changes
- Configurable (RSS feeds) - New kinds of information easily added
- Personalized, Persistent - Each team member can tailor to their needs



The screenshot displays the Team Central interface with several sections:

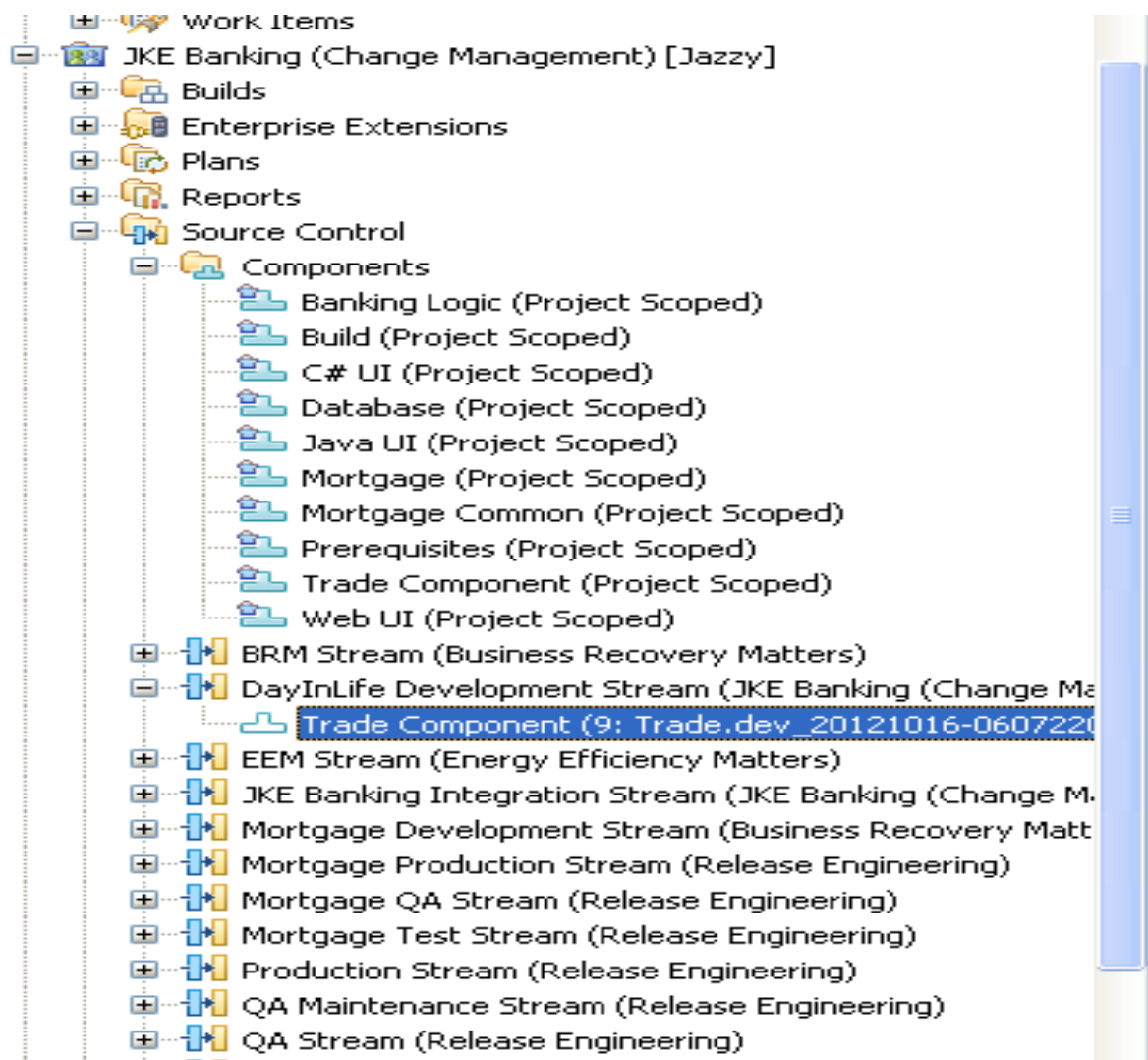
- News (48 unread):** Lists recent news items such as "Gorkem Ercan: Eclipse moment of competition" and "Litnik De Roy: Dark side of the moon Jun 04".
- Team Load:** Shows work time left for team members, with "Hours: 0 / 0" and "Estimated: 0%" for one member and "Estimated: 100%" for another.
- My Open Work Items:** A bar chart showing work items by priority: Unassigned (3963), Low (282), Medium (531), and High (111).
- New Incoming Work Items:** A bar chart showing work items by severity: Minor (20), Normal (177), Major (3159), Critical (181), and Blocker (19).
- Event Log:** Lists events such as "[3] JUnit4 should detect and report if it cannot i" and "[9] Outgoing synchronization error (Workit".

A pop-up window shows a detailed view of an event:

JUnit4 should detect and report if it cannot invoke a method (38)
 On Nov 27, 2008 5:30:57 PM Markus Kent mentioned you in comment 3:
 @bill: This defect has no 'Planned For'. Should we fix it for 4.0M1?

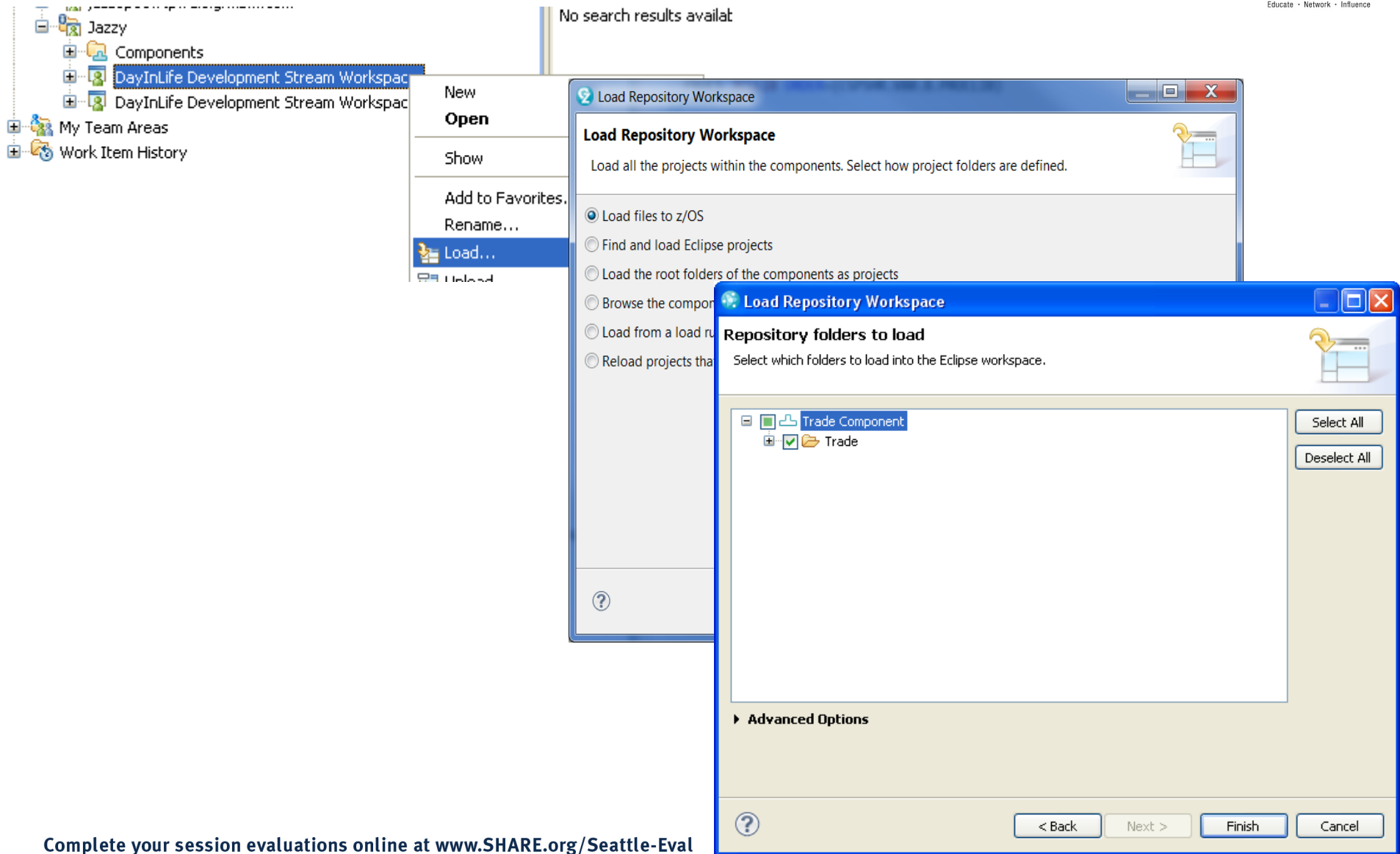
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Source Control Management



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Load the source artifacts



No search results available

DayInLife Development Stream Workspac

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 projects
- Load the root folders of the components as projects
- Browse the components
- Load from a load rule
- Reload projects that have changed

Repository folders to load

Select which folders to load into the Eclipse workspace.

- Trade Component
 - Trade

Select All

Deselect All

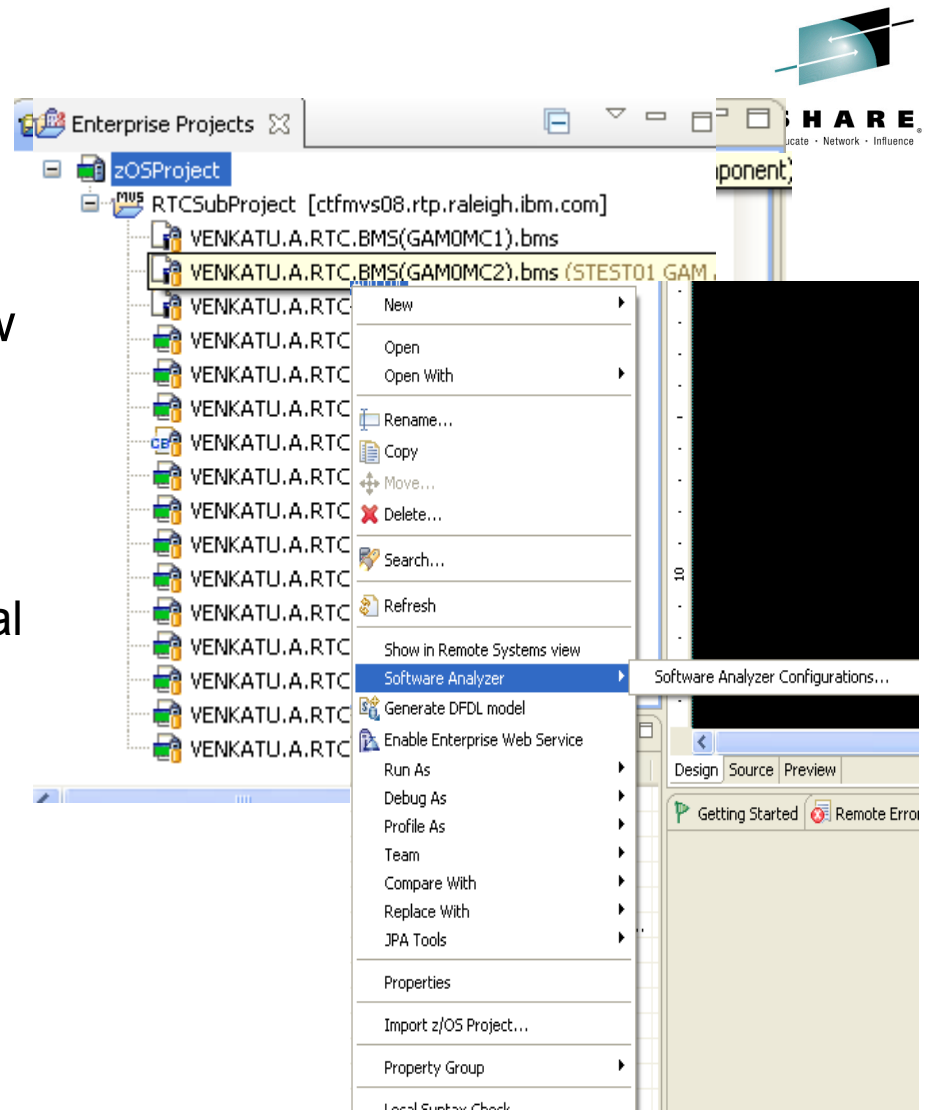
Advanced Options

< Back Next > Finish Cancel

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RDz and RTC together

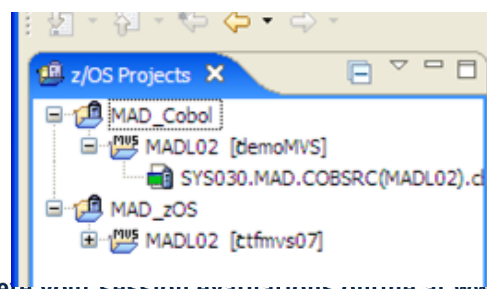
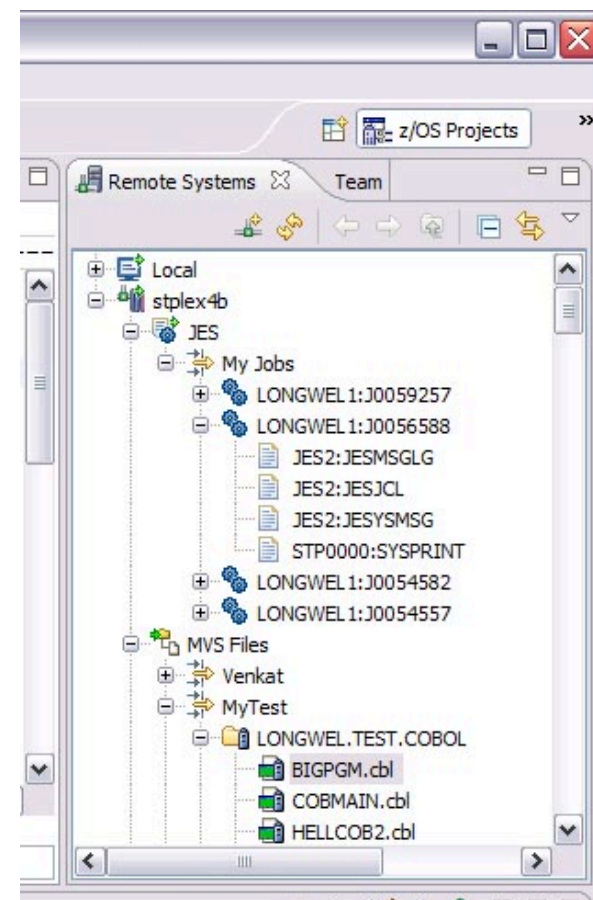
- Once the project is loaded, it will appear in the RDz z/OS projects view
- RDz augments the development productivity & experience
 - Appropriate editors (COBOL, maps, etc.) and functions (content assist, real time syntax check, etc.)
 - High value functions (Enterprise web services, SFM, Code review, Unit testing, program analysis/control flow etc.)



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Navigate datasets and jobs live 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



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Edit capabilities in RDz



- RDz at a high level has different types of editors
 - LPEX Editor
 - Supports editing of COBOL, PLI, HLASM JCL, C/C++, Rexx etc.
 - Provides ISPF like edit experience including prefix commands, command line and even look and feel
 - Supports advanced edit functions for COBOL, PLI and HLASM like real time syntax checking, content assist
 - COBOL, PLI, and JCL advanced editors
 - Based on the Eclipse editor infrastructure, provide more advanced edit capabilities like quick fixes, hyper-linking, hover, easy navigation between various edit sessions or within the same edit session.
 - Supports real time syntax checking, content assist, key word highlighting etc.

```

Line 49      Column 1      Insert
-----+---+*A-1-B-----2-----3-----+---+
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 GAMOBED.
000040      COPY GAMOBED.
000041      01 DATABASECONNECTION.
000042      49 SCHEMA
000043      49 PIC X VALUE '...'.
000044
000045      01 ITABLEPREPARE.
000046      49 ITABLE-VAR-LEN
000047      49 ITABLE-VAR-TXT
000048
000049      01 INVENTORYPREP.
000050      02 PIC X(12) VALUE 'INSERT'.
000051      02 INVNTDBCON PIC X(9).
000052      02 TABLENAME PIC X(11).
    
```

```

PROCEDURE DIVISION.

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

Change to "MOVE"

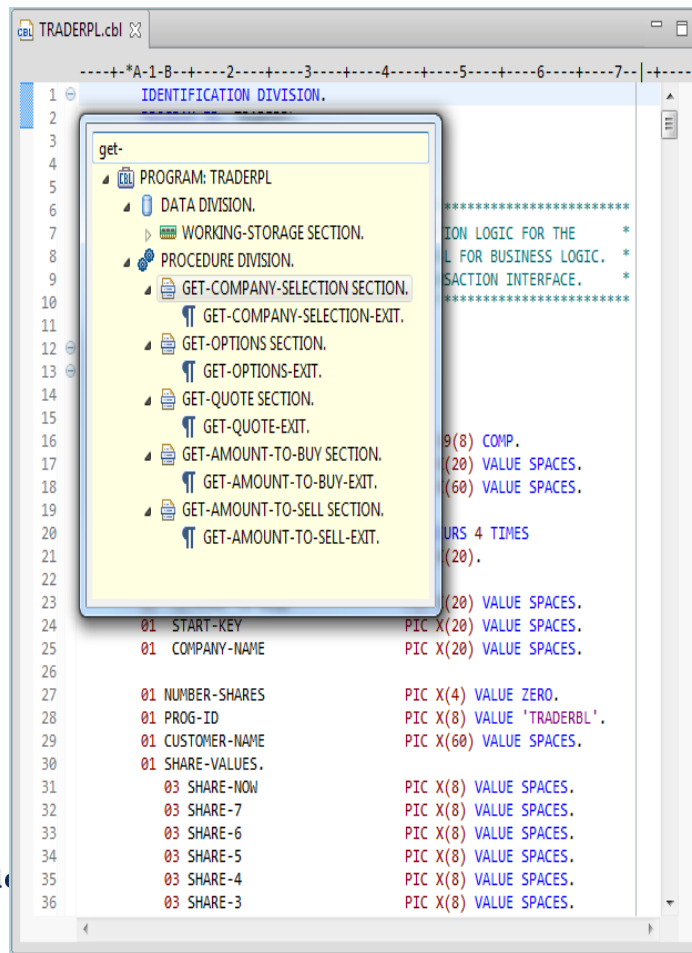
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COBOL, PL/I and JCL Editor improvements

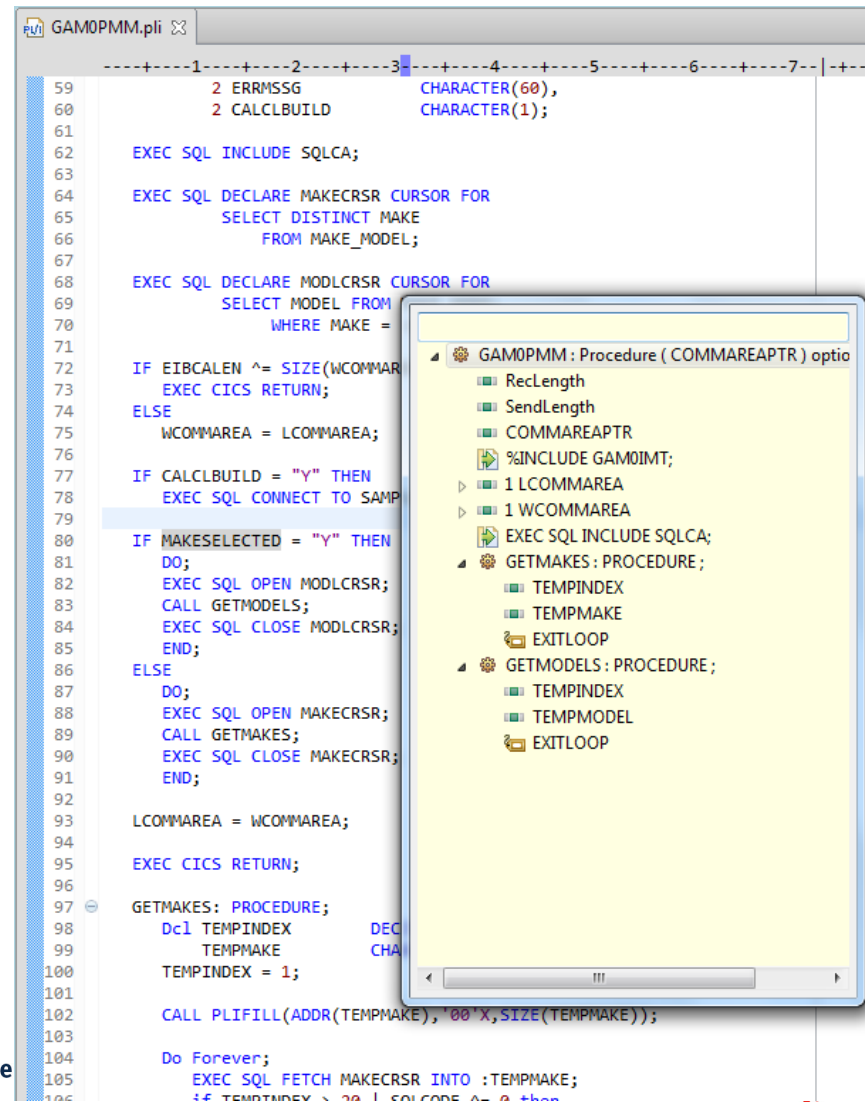
■ Quick Outline

- Press Ctrl+O to activate



The screenshot shows a COBOL editor window titled 'TRADERPL.cbl'. A project tree is displayed on the left side, showing the following structure:

- PROGRAM: TRADERPL
 - DATA DIVISION.
 - WORKING-STORAGE SECTION.
 - PROCEDURE DIVISION.
 - GET-COMPANY-SELECTION SECTION.
 - GET-COMPANY-SELECTION-EXIT.
 - GET-OPTIONS SECTION.
 - GET-OPTIONS-EXIT.
 - GET-QUOTE SECTION.
 - GET-QUOTE-EXIT.
 - GET-AMOUNT-TO-BUY SECTION.
 - GET-AMOUNT-TO-BUY-EXIT.
 - GET-AMOUNT-TO-SELL SECTION.
 - GET-AMOUNT-TO-SELL-EXIT.



The screenshot shows a PL/I editor window titled 'GAMOPMM.pli'. The code is as follows:

```
59 2 ERRMSG CHARACTER(60),
60 2 CALCLBUILD CHARACTER(1);
61
62 EXEC SQL INCLUDE SQLCA;
63
64 EXEC SQL DECLARE MAKECRSR CURSOR FOR
65 SELECT DISTINCT MAKE
66 FROM MAKE_MODEL;
67
68 EXEC SQL DECLARE MODLCRSR CURSOR FOR
69 SELECT MODEL FROM
70 WHERE MAKE =
71
72 IF EIBCALEN ^= SIZE(WCOMMAREA)
73 EXEC CICS RETURN;
74 ELSE
75 WCOMMAREA = LCOMMAREA;
76
77 IF CALCLBUILD = "Y" THEN
78 EXEC SQL CONNECT TO SAMPLE;
79
80 IF MAKESELECTED = "Y" THEN
81 DO;
82 EXEC SQL OPEN MODLCRSR;
83 CALL GETMODELS;
84 EXEC SQL CLOSE MODLCRSR;
85 END;
86 ELSE
87 DO;
88 EXEC SQL OPEN MAKECRSR;
89 CALL GETMAKES;
90 EXEC SQL CLOSE MAKECRSR;
91 END;
92
93 LCOMMAREA = WCOMMAREA;
94
95 EXEC CICS RETURN;
96
97 GETMAKES: PROCEDURE;
98 Dcl TEMPINDEX DEC;
99 TEMPMAKE CHAR;
100 TEMPINDEX = 1;
101
102 CALL PLIFILL(ADDR(TEMPMAKE), '00', SIZE(TEMPMAKE));
103
104 Do Forever;
105 EXEC SQL FETCH MAKECRSR INTO :TEMPMAKE;
106 IF TEMPINDEX > 20 | SQLCODE AS 8 then
```

A procedure tree overlay is shown on the right side of the code, titled 'GAMOPMM: Procedure (COMMAREAPTR) optio'. The tree structure is:

- GAMOPMM: Procedure (COMMAREAPTR) optio
 - RecLength
 - SendLength
 - COMMAREAPTR
 - %INCLUDE GAMOIMT;
 - 1 LCOMMAREA
 - 1 WCOMMAREA
 - EXEC SQL INCLUDE SQLCA;
 - GETMAKES: PROCEDURE;
 - TEMPINDEX
 - TEMPMAKE
 - EXITLOOP
 - GETMODELS: PROCEDURE;
 - TEMPINDEX
 - TEMPMODEL
 - EXITLOOP

Comple

attle

Editor Productivity Features – real time syntax checking

Real-time syntax check without requiring code compile or save

```
*GAMOVCDJ.jcl
-----1-----2-----3-----4-----5-----6-----7-----8
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 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 //SYSIN 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')
```

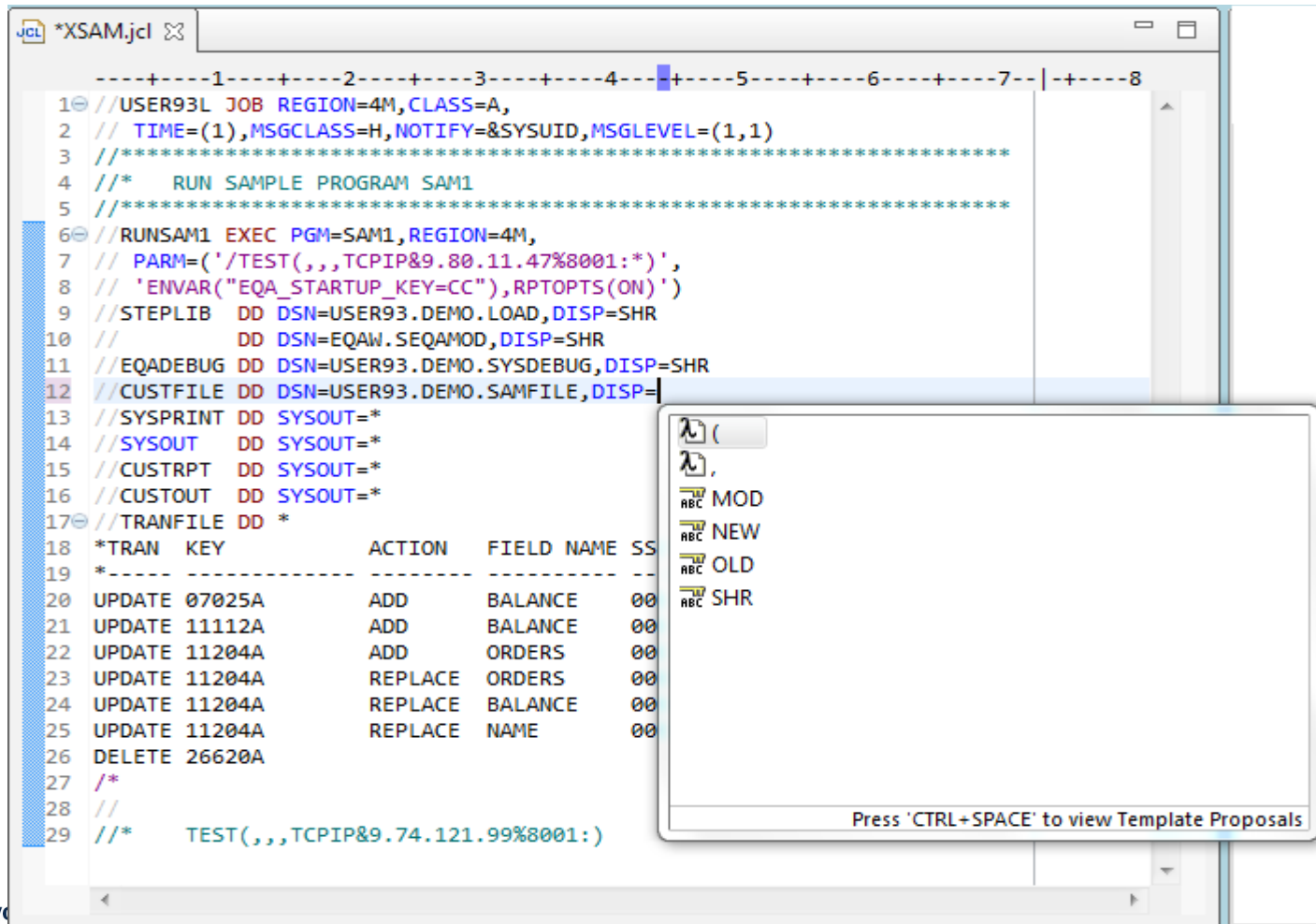
"DYNAMNBR" expected instead of this input
1 Quick Fix is available:
Change to "DYNAMNBR"
Press 'F2' for focus

```
CUSBATCH.cbl
Line 183 Column 31 Insert
-----+*A-1-B-----2-----3-----4-----5-----6-----
Unable to resolve reference to NON-DEFINED-NAME MOVE ' ' TO NON-DEFINED-NAME.
000179 MOVE ' ' TO CUST-LN-DATA.
000180 MOVE ' ' TO CUST-ADDR1-DATA.
000181 MOVE ' ' TO CUST-CITY-DATA.
000182 MOVE ' ' TO CUST-ST-DATA.
000183 MOVE ' ' TO CUST-CTRY-DATA.
000184 GET-CUST-INFO-EXIT.
000185 EXIT.
000186 NO-CUST-INFO.
000187 IF EXITNOW THEN
000188 STOP RUN
000189 ELSE
000190 MOVE WCUSTNO to CUSTNOO
000191 END-IF.
000192 NO-CUST-INFO-EXIT.
000193 EXIT.
000194 *
000195 -----+-----
FILL-CUST-DATA.
```

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JCL Editor Content Assist

- **Keyword syntax proposals**
 - Press Ctrl+SPACE to activate



The screenshot shows a JCL editor window with a list of JCL statements. The statement on line 12, `//CUSTFILE DD DSN=USER93.DEMO.SAMFILE, DISP=`, is highlighted. A content assist popup is open, showing a list of template proposals for the `DD` statement. The proposals are:

- MOD
- NEW
- OLD
- SHR

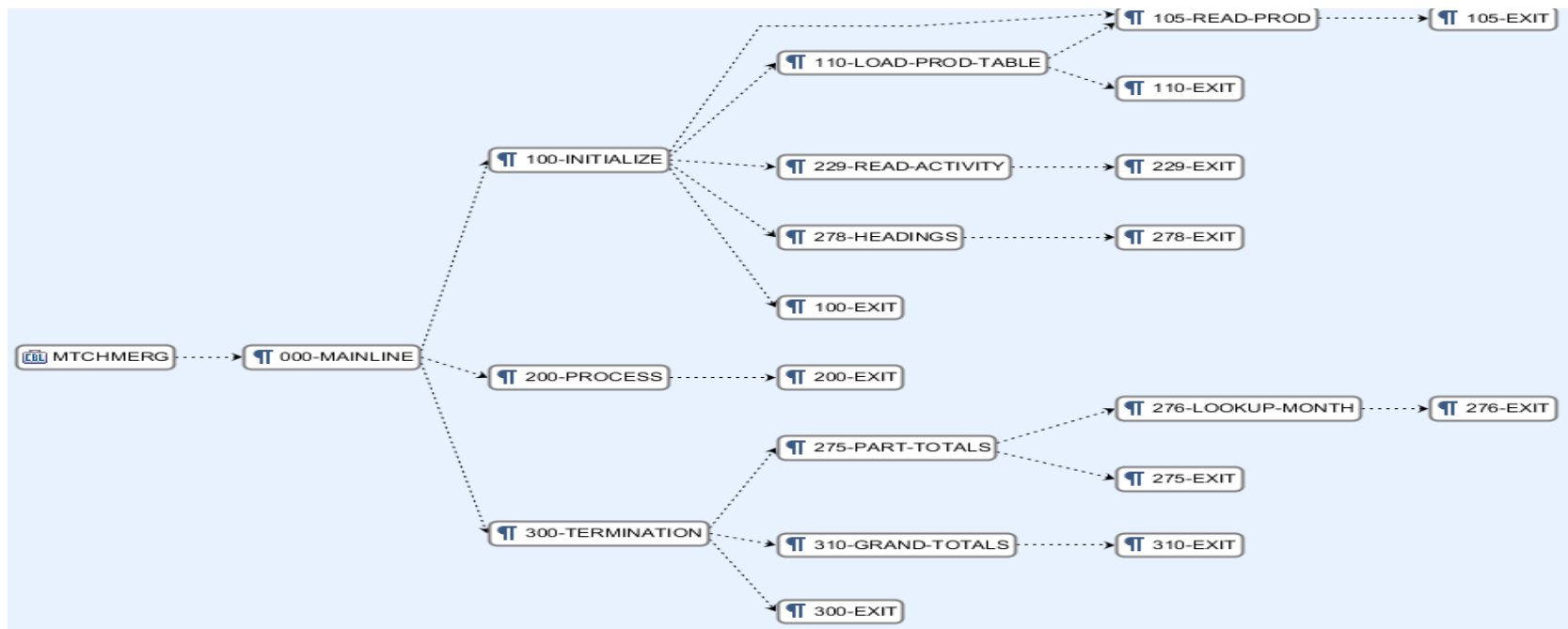
At the bottom of the popup, it says: "Press 'CTRL+SPACE' to view Template Proposals".

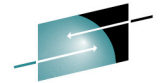
```
1 //USER93L JOB REGION=4M, CLASS=A,
2 // TIME=(1),MSGCLASS=H, NOTIFY=&SYSUID,MSGLEVEL=(1,1)
3 //*****
4 //* RUN SAMPLE PROGRAM SAM1
5 //*****
6 //RUNSAM1 EXEC PGM=SAM1, REGION=4M,
7 // PARM=(' /TEST(,,TCPIP&9.80.11.47%8001:*)',
8 // 'ENVAR("EQA_STARTUP_KEY=CC"),RPTOPTS(ON)')
9 //STEPLIB DD DSN=USER93.DEMO.LOAD,DISP=SHR
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 //CISTRPT 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:)
```

Complete y

Enhanced Application Quality & Structure Analysis

- Application Analysis
 - Control flow diagrams for COBOL and **PLI** 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

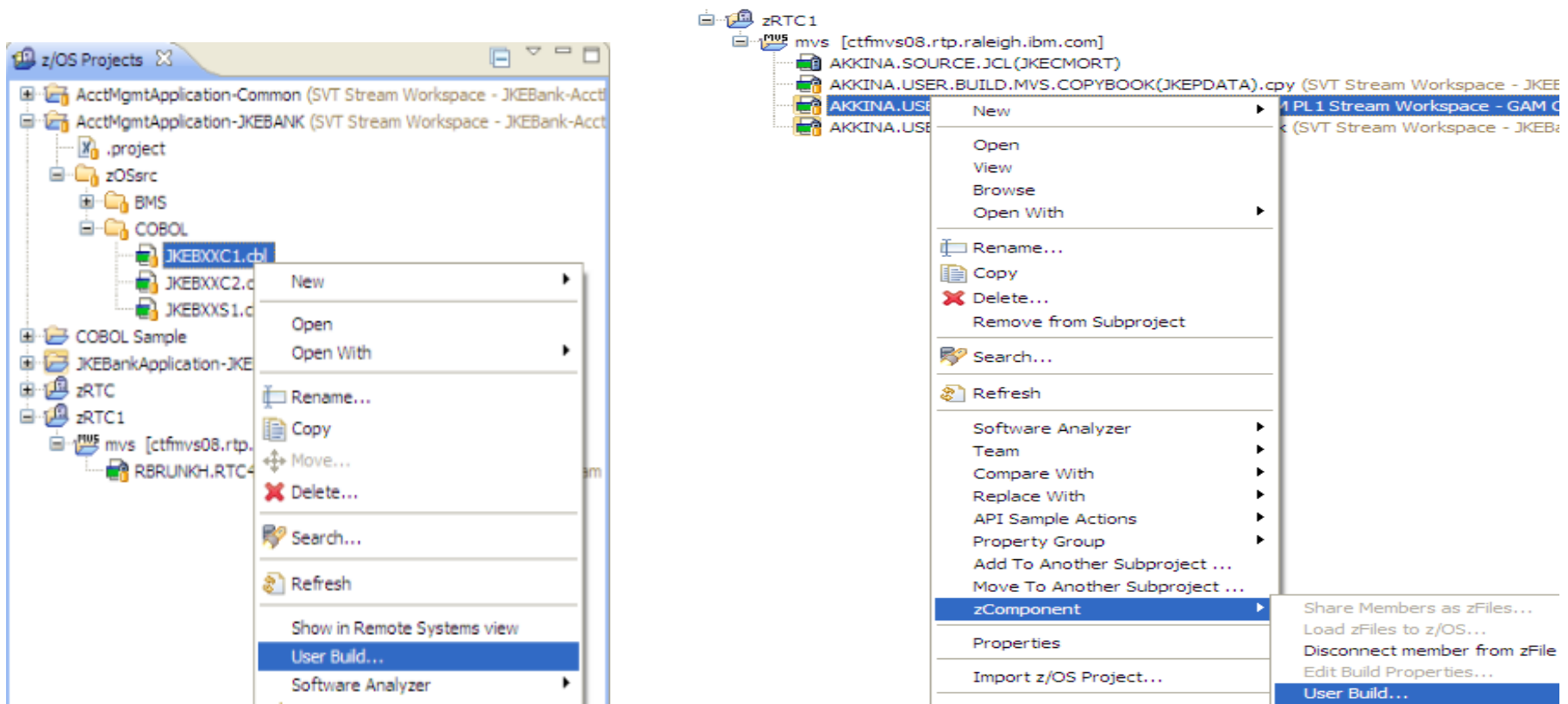
Showing data elements from WARDRPT.cbl

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 both in zComponent projects and RDz remote z/OS projects

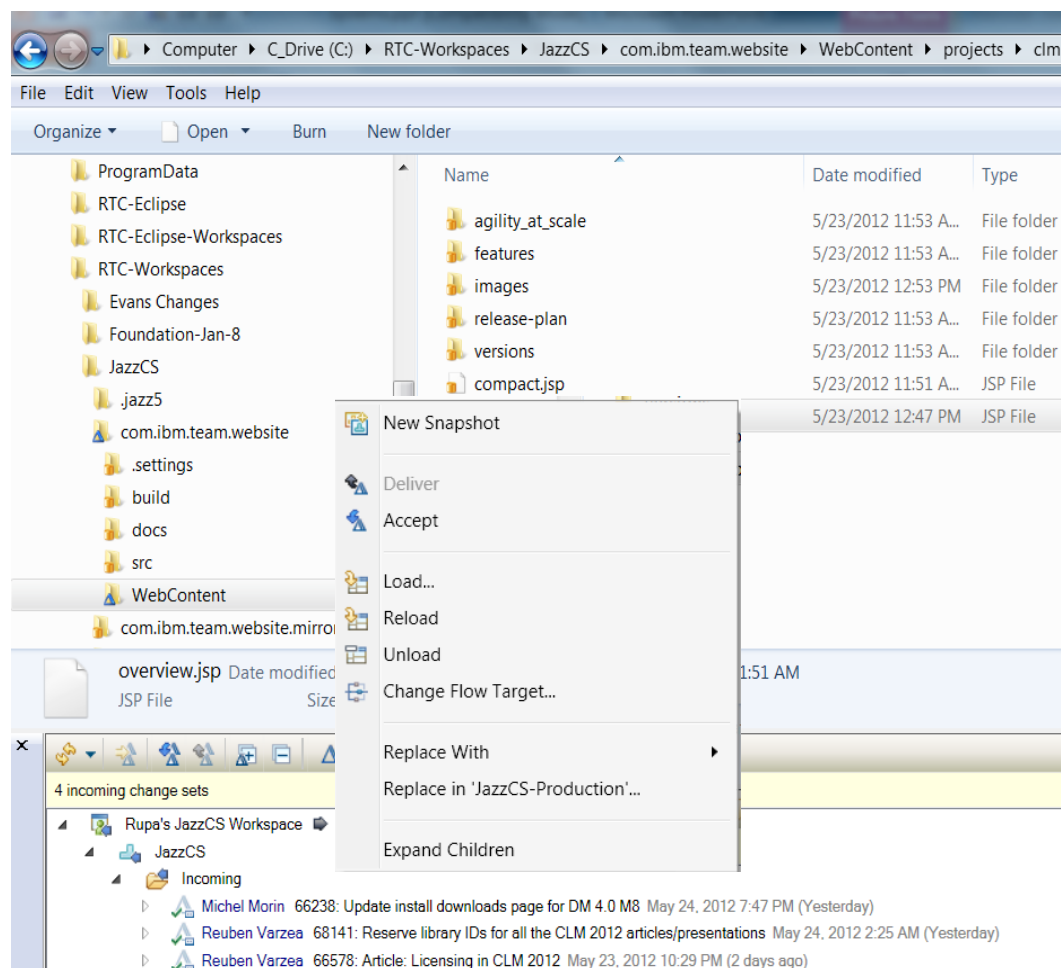
- Builds just one the single file selected, supports Error feedback
- Generates JCL based on the associated RTC Language definitions and Translators



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Pending Changes

- If you want finer grained control on your SCM operations, then the Pending Changes view is for you
 - Check in, deliver, accept changes
 - Suspend, resume, discard changes
 - Replace, reload out-of-sync
 - Resolve conflicts
 - Open change sets and work items via the web client



Traceability : Check-in History



- Someone made a costly mistake merging and you want to understand exactly where the mistake was made
 - Problem : Traditional history commands & UI only show before/after & merge states for a change set ... it does not show intermediates
 - Solution : Use Check-in history in Eclipse, CLI or .NET clients

Merges	Comment	Creator	Date Created
	Fix progress monitor saving and deleting	Dmitry Karasik	Jul 7, 2010 3:18 PM
	118086: make deliver work without a source workspace - Merges	John Camelon	Jun 29, 2010 10:17 AM
	Merges	John Camelon	Jun 22, 2010 2:52 PM
	118086: make deliver work without a source workspace	John Camelon	Jun 21, 2010 5:13 PM
	108873: deprecate atomicStreamUpdate, provide createChangeSetForStream() & postDeliver() - Fix co...	John Camelon	Jun 21, 2010 10:23 AM
	108873: deprecate atomicStreamUpdate, provide createChangeSetForStream() & postDeliver() - Merges	John Camelon	Jun 18, 2010 4:39 PM
	108873: deprecate atomicStreamUpdate, provide createChangeSetForStream() & postDeliver()	John Camelon	Jun 18, 2010 3:54 PM
	119130: Error fetching changeset links - fix	John Camelon	Jun 28, 2010 2:39 PM

Check-in History	Type	Date
	Final - Modified	Jun 18, 2010 4:37 PM
	Proposed	Jun 18, 2010 4:37 PM
	Modified	Jun 18, 2010 4:37 PM
	Initial	Jun 18, 2010 4:37 PM

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Integrated Debugger

- **RDz introduced a new feature called 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 Supported:**
 - ✓ 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 added support for:**
 - ✓ PLI v4.x, v3.9
 - ✓ C/C++ V1R13, V2R1
 - ✓ IMS TM
 - ✓ DB2 Stored procedures

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Integrated Debugger



✓ **Host-offload architecture:**

- ✓ Remote debugger with only a small footprint on the mainframe:
 - Leverages workstation CPUs enabling faster processing of debug information
 - Enables scalability and reliability
- ✓ Debugger client is supported on Windows and Linux

✓ **Simple and Secure Connections:**

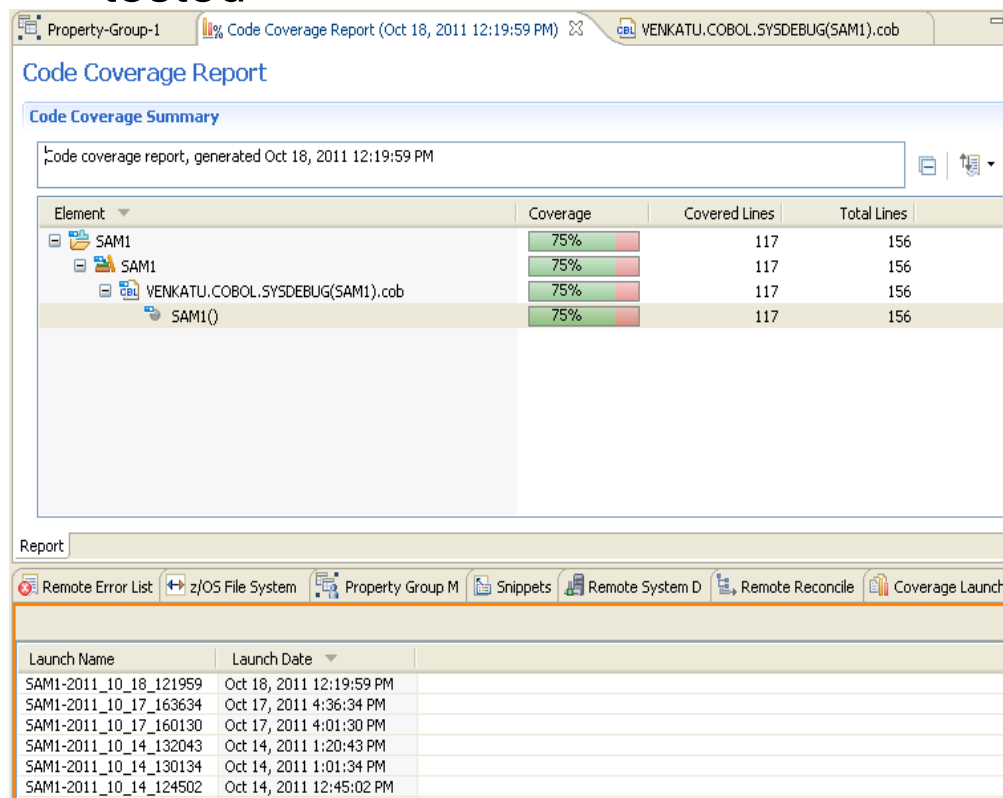
- ✓ Single client can handle multiple debug sessions on multiple hosts or an application that spans multiple systems
- ✓ Client initiated debug – no need to specify client IP address and port (v9.0.1.2)
- ✓ SSL/TLS support

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Enhanced Application Quality – Code Coverage

- Line Level Code Coverage - provides tools to measure and report on test coverage of an application
- Leverages the Integrated Debugger technology
- Indicating what source code lines were tested and remain to be tested



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.COBOI.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

```

374 -----*A-1-B-----2-----3-----4-----5-----6-----7-----
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
393 200-PROCESS-UPDATE-TRAN.
394  ADD +1 TO NUM-UPDATE-REQUESTS.
395  PERFORM 720-POSITION-CUST-FILE.
396  IF CUST-KEY NOT = TRAN-KEY OR WS-CUST-FILE-EOF = 'Y'
397      MOVE 'NO MATCHING KEY: ' TO ERR-MSG-DATA1
398      MOVE TRAN-KEY TO ERR-MSG-DATA2
399      PERFORM 299-REPORT-BAD-TRAN
400  ELSE
401  *
402  *      Subroutine SAM2 will apply an update to a customer record
403  *
404      CALL 'SAM2' USING CUST-REC, TRANSACTION-RECORD,
405                      WS-TRAN-OK, WS-TRAN-MSG
406  IF WS-TRAN-OK NOT = 'Y'
407      MOVE WS-TRAN-MSG TO ERR-MSG-DATA1
408      MOVE SPACES TO ERR-MSG-DATA2
409      PERFORM 299-REPORT-BAD-TRAN

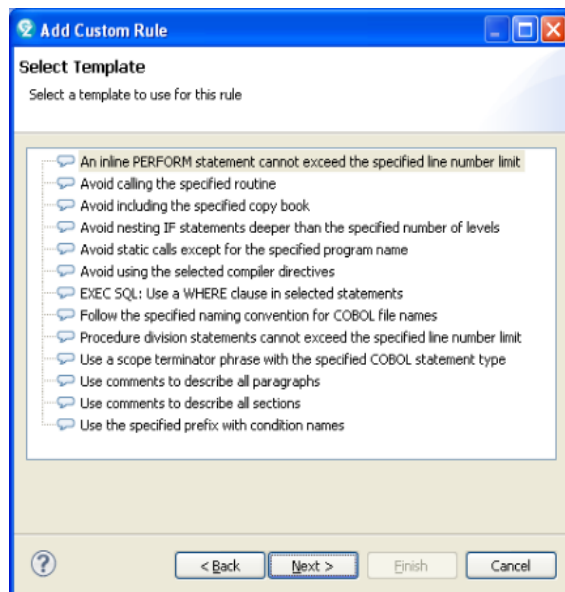
```

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Enhanced Quality & Structure Analysis – Code review



- Code Review/Governance - provides predefined rules and templates for COBOL and PL/I applications
 - Ensure adherence to corporate standards
 - Custom rules for COBOL and PL/I



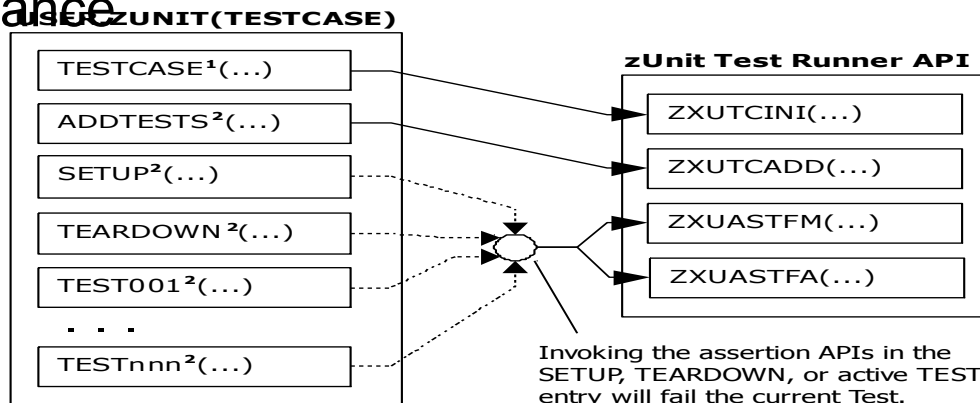
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zUnit – Unit testing framework for z/OS



- Frameworks that assist developers in writing code to perform repeatable, self-checking unit tests are collectively known as xUnit.
- [xUnit](#) defines a set of concepts that together provide a light-weight architecture for implementing unit testing frameworks.
 - JUnit, for example, is a very popular instance of the xUnit architecture.
- **zUnit** is a xUnit instance for System z
- Goal is to encourage the **continuous integration and continuous testing** methodology for System z Application development and maintenance



¹Language-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.

²Language-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 link-name procedures that are declared at the package level (non-nested).

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Snapshots for every build



Build MVS Dependency Build Test 20120619-0908330825

✓ **Completed**

Duration: 53 seconds
Start Time: June 19, 2012 9:08:33 AM
Completed: June 19, 2012 9:09:27 AM

Status Trend:

Contribution Summary

Changes: [Show changes](#)
Downloads: [7 downloads](#)
Logs: [1 log](#)
Snapshot: [MVS Dependency Build Test 20120619-0908330825](#)
Work items: [3 included in build](#)

Associated Release

Released builds are available as ch
[Create a release to associate v](#)

Reported Work Items

Work items reported against this build to help stabilize it.

- None reported against this build
- [Create a new work item](#)
- [Associate an existing work item](#)

General Information

Requested by: ADMIN
Build Definition: [MVS Dependency Build Test](#)
Build Engine: [Setup engine 15560](#)
Build History: [19 builds](#)
Tags:

Snapshot

Name:*

Details

Created by: ADMIN
Created on: Jun 19, 2012 9:08 AM
Modified on: Jun 19, 2012 9:08 AM
Description:

Links

- [Create a new repository workspace](#)
- [Create a new stream](#)
- [Compare with snapshot](#)
- [Compare with repository workspace or](#)

Components

Shows the components in this snapshot.

- [Liam Test RWS \(4: MVS Dependency Build Dev_20111108-0955580222\)](#)
- [Mortgage Component \(69: MVS Dependency Build Dev KA_20120619-0853550520\)](#)
- [plx test \(2: MVS Dependency Build Dev_20110328-0857420358\)](#)

Show Repository Files

Complete your session

Summary

- Many companies spend more than 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 them
- Continual renewal is required
 - tools help to guide, govern, drive, and accomplish this change

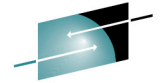
Getting started

Next steps to modernize your enterprise applications

www.ibm.com/rational/modernization



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16721: Decision Management: Making the Right Change, at the Right Time

3/4/15



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