



***COBOL modernization:
Bring OS/VS COBOL to enterprise COBOL
with IBM tools***





Debug Tool Utilities and Advanced Functions



Reasons for Compiler and Runtime Modernization:

- Compiler Currency:
 - ▶ Keep the shop current for support reasons, running the “*supported*” version of z/OS Enterprise COBOL and PLI (i.e. **Sarbanes Oxley compliance**)
 - ▶ Assure that the applications *will execute* with new releases of IBM operating systems and subsystems (i.e. **CICS 3.1**)
- Enable “Enterprise Modernization”:
 - ▶ support “Web services and Java connectors” via **IBM WebSphere Developer for zSeries (WDz)** development.



- COBOL Modernization Process with IBM Tools
 - ▶ *Migrate to the Language Environment Runtime*
 - ▶ *Discovery*
 - ▶ *Convert*
 - ▶ *Test and Promote*

Supported COBOL Compilers and Runtimes and Need for Cobol Modernization



Present IBM z/OS COBOL Compilers and Support:

	MVS & VM	PIDs	Market Withdrawn	Service Withdrawn
	OS/VS COBOL V1.2.4	5740-CB1	Yes 06/30/1992	Yes 06/30/1994
		5740-LM1	Yes 06/30/1992	Yes 06/30/1994
	VS COBOL II V1.4.0	5668-958	Yes 06/30/1997	Yes 03/31/2001
		5688-022	Yes 06/30/1997	Yes 03/31/2001
		5688-023	Yes 06/30/1997	Yes 03/31/2001
	COBOL/370 1.1	5688-197	Yes 10/31/1995	Yes 09/31/1997
	COBOL for MVS & VM Ver 1 Rel 2	5688-197	Yes 09/06/2000	Yes 12/31/2001
	COBOL for OS/390 & VM Ver 2	5648-A25	Yes 12/31/2002 (MVS Feature)	Yes 12/31/2004 (MVS Feature)
	Enterprise COBOL for z/OS V3R1	5655-G53	Yes 09/27/2002	Yes 04/04/2004
	Enterprise COBOL for z/OS V3R2, V3R3	5655-G53	Yes	Yes
	Enterprise COBOL for z/OS V3R4	5655-G53	No	No

Status of Unsupported COBOL with DB2 and IMS:

- DB2 8.0
 - ▶ Programs compiled and linked with the **OS/VS COBOL** compiler are not supported (in DB2 version 8.0 or IMS version 9.0 environment)
 - ▶ Any change to the old **OS/VS COBOL** programs will have to be compiled with a supported level of LE conforming COBOL
- IMS 9.0
 - ▶ Programs compiled and linked with the **OS/VS COBOL** tools will run in the IMS version 9.0 environment unsupported



Status of OS/VS COBOL and COBOL II with CICS:

- CICS TS 2.2
 - ▶ **OS/VS COBOL** pre-compiler will not work
 - ▶ Must use **COBOL/390** precompiler
- CICS TS 2.3
 - ▶ **OS/VS COBOL** load module must run with the LE runtime
 - ▶ Any modules attempting to use the **OS/VS COBOL** runtime will abend at initialization
- CICS TS 3.1
 - ▶ Any modules compiled with **OS/VS COBOL** **will abend when loaded**, even when running with LE runtime
 - ▶ **COBOL II** modules are unsupported but do run with the LE runtime



Reasons for COBOL Modernization:

- Prevent CICS System Failure:
 - ▶ **Load modules** compiled with OS/VS COBOL running in TS CICS 3.1 regions **will abend** when invoked
 - ▶ Not using the OSVS COBOL compiler is not the issue
 - ▶ The question is:
“Do you have any load modules running in a CICS region that were built with the OSVS COBOL compiler any time in the past?”

IBM Tool to Enable COBOL Modernization



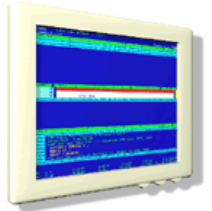
IBM Tools To Support Compiler Modernization:

- ▶ ***IBM Debug Tool Utilities and Advanced Functions for z/OS Version 7.1.0***

Program Number 5655-R45



Debug Tool Utilities and Advanced Functions Functional (DTUAF)



- Set of tools to support z/OS application development and support
- Common User Interface Across Systems And Subsystems
- Consistent Across Languages
 - ▶ COBOL, C, C++, PL/I, Assembler
- Environments Supported
 - ▶ CICS, TSO, JES/Batch, IMS Including IMS/TM, DB2 Including Stored Procedures
- Utilities and Advanced Functions Features:
 - ▶ **Source-level Debugger**
 - ▶ Language Sensitive
 - ▶ Logging Of Debug Session
 - ▶ Frequency Sampler
 - ▶ Playback support
 - ▶ **Load Module Analyzer**
 - ▶ **A new code coverage tool**
 - ▶ **Debug support for OS/VS COBOL**
 - ▶ **COBOL Modernization Utility**
 - ▶ Information Available At
www.ibm.com/software/awdtools/deployment



COBOL Modernization Process

IBM COBOL Modernization Process:

1. Migrate to the Language Environment Runtime

Convert and test all applications to the LE runtime environment

2. Discovery

Identify all OS/VS COBOL executables and source

3. Convert

Convert the OS/VS COBOL (COBOL 74) source to COBOL 85 standard and rebuild the modules

4. Test and Promote

Test all converted modules and migrate to production



IBM Tools to Support COBOL Modernization Process:

- *Migrate to the Language Environment Runtime*
 - ▶ Convert and test all applications to the LE runtime environment
 - *IBM Debug Tool Utilities and Advanced Functions Load Module Analyzer Utility*
 - *IBM Debug Tool Utilities and Advanced Functions Coverage Utility*
- *Discovery*
 - ▶ Identify all OS/VS COBOL executables and source
 - *IBM Debug Tool Utilities and Advanced Functions Load Module Analyzer Utility*
- *Convert*
 - ▶ Convert the OS/VS COBOL (COBOL 74) source to COBOL 85 standard and rebuild the modules
 - *IBM Debug Tool Utilities and Advanced Functions COBOL Modernization Tool*
 - *IBM Debug Tool Utilities and Advanced Functions Interactive Debugger*
- *Test and Promote*
 - ▶ Test all converted modules and migrate to production
 - *IBM Debug Tool Utilities and Advanced Functions Interactive Debugger*
 - *IBM Debug Tool Utilities and Advanced Functions Coverage Utility*



IBM COBOL Modernization Process:

- Migrate to the Language Environment Runtime
 - ▶ Convert and test all applications to the LE runtime environment
- *Discovery*
 - ▶ *Identify all back level (i.e. OS/VS COBOL and VS COBOL II) executables and source files*
- Convert
 - ▶ Convert the OS/VS COBOL (COBOL 74) source to COBOL 85 standard and rebuild the modules
- Test and Promote
 - ▶ Test all converted modules and migrate to production



***Static Runtime Compiler Version
Discovery:
DTAF Load Module Analyzer***



DTUAF Load Module Analyzer Utility Overview:



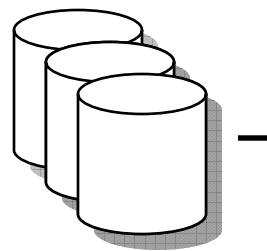
- Utility for reporting details of CSECTs contained in a z/OS executable
- *Part of the Debug Tool Utilities and Advanced Functions*
- Supports LE migrations and COBOL & PLI compiler version upgrades
- Works for all Versions of IBM z/OS compilers and assemblers:
 - ▶ PLI, COBOL, C/C++, PLX, assembler, etc.
- Reports compiler versions and compile dates for all CSECTs
- Order Debug Tool Utilities and Advanced Functions PID
 - ▶ **5655-R45**

▪ LMA Utility Features:

- ▶ Reports compiler versions for all CSECTs that make up a load module
- ▶ Reports compile dates for all CSECTs that make up a load module
- ▶ Can be executed interactively from ISPF panels
- ▶ Can be submitted to run in batch
- ▶ Report display options are configurable:
 - Utility report features
 - Filter compiler versions reported
 - Filter CSECTs that are part of the LE runtime
 - Filter CSECTs that are part of the compiler
- Information available at www.ibm.com/software/awdtools/deployment



DTUAF Load Module Analyzer Utility:



Load Libraries



**Load Module
Analyzer Utility**



Load Module CSECTs Details Report

1 5655-P15 Dbeng Tool Version 6 Release 1.1 Load Module Analyzer 2006/02/09 09:49 Page 10
Load Module DBR2903.C008.LOAD(YM001)

CSECT	Sq	Offset	Len/Ext	Program-ID	Trn-Date	Program-Description
YTM01A	0	860	574023103	2006/02/09	05/YS C080, Version 1 Release 2, BARM-H0RES	
YTM01B	860	560	574023103	2006/02/09	05/YS C080, Version 1 Release 2, BARM-H0RES	
YTM01C	1000	606	574023103	2006/02/09	05/YS C080, Version 1 Release 2, BARM-H0RES	
YTM01D	1608	489	574023103	2006/02/09	05/YS C080, Version 1 Release 2, BARM-H0RES	

1 5655-P15 Dbeng Tool Version 6 Release 1.1 Load Module Analyzer 2006/02/09 09:49 Page 10
Load Module DBR2903.C008.LOAD(C080112)

CSECT	Sq	Offset	Len/Ext	Program-ID	Trn-Date	Program-Description
C08011X	0	576	574023103	2005/11/11	05/YS C080, Version 1 Release 2, BARM-H0RES	



DTUAF Load Module Analysis Utility:

- Reports compiler version and dates for all CSECTs that make up a load module
- Can identify load modules running in production that was compiled with OS/VS COBOL
- From the reporting of back level compiler version modules:
 - ▶ Source conversion requirements can be defined
 - ▶ Testing plans can be defined



DTUAF Load Module Analysis Utility Report:

- Report Output
 - ▶ Section three:
 - List of load modules names
 - List of CSECTs that make up the load module
 - List of the compile dates for each CSECT
 - List of the compiler version for each CSECT

```

1 5655-M19  Debug Tool Version 5 R1 - BETA Load Module Analyser  2005/05/20  11:17  Page   3
Load Module  DNET603.CODE.LOAD(ABJIVP01)

CSECT      Length  Program-ID  Trn-Date   Program-Description
ABJIVP01   1148  5740CB103  2005/03/03  OS/VS COBOL Version 1 Release 2

1 5655-M19  Debug Tool Version 5 R1 - BETA Load Module Analyser  2005/05/20  11:17
Load Module  DNET603.CODE.LOAD(COB01)

CSECT      Length  Program-ID  Trn-Date   Program-Description
COB01A     5F8  5740CB103  2005/03/01  OS/VS COBOL Version 1 Release 2
COB01B     53C  5740CB103  2005/03/01  OS/VS COBOL Version 1 Release 2
COB01C     5DA  5740CB103  2005/03/01  OS/VS COBOL Version 1 Release 2
COB01D     4CC  5740CB103  2005/03/01  OS/VS COBOL Version 1 Release 2

```



Evaluation Version of Load Module Analyzer

- Download a copy from the CICS Support Website:
 - ▶ http://www-1.ibm.com/support/docview.wss?rs=1083&context=SSGMGV&context=SSZPSF&context=SSNQZF&dc=D400&uid=swg24010925&loc=en_US&cs=utf-8&lang=en

The screenshot shows the IBM Support website interface. The browser address bar displays the URL: http://www-1.ibm.com/support/docview.wss?rs=1083&context=SSGMGV&context=SSZPSF&context=SSNQZF&dc=D400&uid=swg24010925&loc=en_US&cs=utf-8&lang=en. The page title is "CH1A: Load Module Analyzer scans for OS/VS COBOL and Additional Floating Point". The main content area includes an abstract, a download description, and possible uses. The abstract states: "Scans load libraries for modules that have specific characteristics." The download description explains that the utility has filtering capabilities. The possible uses section lists two main functions: identifying OS/VS COBOL programs and identifying C, C++ and PL/I programs that use volatile floating point registers. The right sidebar contains document information, including product categories (Software, Host Transaction Processing, Transaction Servers, CICS Transaction Server), operating system (z/OS), software version (2.2, 2.3, 3.1, 3.2), reference number (4010925), IBM Group (Software Group), and modified date (2006-06-06).

IBM COBOL Modernization Process:

- Migrate to the Language Environment Runtime
 - ▶ Convert and test all applications to the LE runtime environment
- Discovery
 - ▶ Identify all OS/VS COBOL executables and source
- **Convert**
 - ▶ *Convert the OS/VS COBOL (COBOL 74) source to COBOL 85 standard and rebuild the modules (including Report Writer syntax)*
- Test and Promote
 - ▶ Test all converted modules and migrate to production



DTUAF COBOL Modernization Utility

Overview:



- Utility to analyze, report, and convert COBOL source to be compliant with selected COBOL compiler versions
- **Part of the Debug Tool Utilities and Advanced Functions**
- Supports conversions from and to:
 - ▶ OS/VS COBOL, COBOL II, COBOL for VM & MVS, OS/390 COBOL, z/OS COBOL, Enterprise COBOL
- Identifies, sizes, and upgrades COBOL programs to enable migration to CICS 3.1
- Converts standard 68 and 74 standard to 85
- Order Debug Tool Utilities and Advanced Functions PID
 - ▶ **5655-R45**

- **COBOL Modernization Utility Features:**
 - ▶ Identifies COBOL language elements and CICS commands in the input source programs that are:
 - Not supported by the target language
 - Supported in a different manner
 - ▶ Converts COBOL 74 & 68 elements to the equivalent in the target language
 - ▶ Reports identification of source requiring conversion for COBOL 68 & 74 to COBOL 85
 - ▶ **Converted Source**
 - Converted COBOL program source
 - Converted COBOL copy files
- **information available at:**
www.ibm.com/software/awdtools/deployment



COBOL Modernization Utility Function:

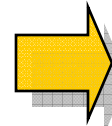
- **Analyses and Reports COBOL Source Inventory:**
 - ▶ Identification of source requiring conversion for COBOL 68 & 74 to COBOL 85
 - Source elements identified
 - Source elements converted
 - Source elements requiring manual conversion
- **Converts COBOL Source:**
 - ▶ Converted COBOL program source
 - ▶ Converted COBOL copy files



IBM Debug Tool Utilities and Advanced Functions:

- Main Menu

From the Debug Tool utilities, COBOL Modernization Utility is selected.



```

Session A - [24 x 80]
----- Debug Tool Utilities -----
More: +
0 Manage Job Card
  For Program Preparation and Setup File Management

1 Program Preparation
  Compile old or new COBOL programs with newer compilers, convert old COBOL
  source into new COBOL source, use other compilers, and link edit.

2 Manage and Use Debug Tool Setup Files
  You can manage setup files and use them to run your program interactively
  with Debug Tool in TSO Foreground or submit your program to run in
  the background using MVS batch.

3 Code Coverage
  Measure code coverage in programs written in COBOL, PL/I, C/C++ and
  Assembler when compiled with specific IBM compilers and HLASM.

4 Manage IMS Programs

Option ==> █
F1=Help   F2=Split   F3=Exit   F7=Backward F8=Forward F9=Swap
F12=Cancel

MA a 22/014
Connected to remote server/host demomvs.demopkg.ibm.com using lu/p HP DeskJet 820Cse on LPT1:
  
```

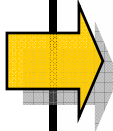


COBOL Modernization Utility ISPF Interface:

- Main Menu

- ▶ From this menu:

- The default options can be set
 - Language extensions can be defined
 - Code can be reviewed and converted



```

Session A - [32 x 80]
----- CCCA Master Menu -----
Userid   - DNET603
Terminal - 3278
Time     - 00:25
PF Keys  - 12
Applid   - ISR

1  CONVERT   - Convert COBOL source programs
2  CUSTOMIZE - LCP Development Aid
0  OPTIONS   - Set environment and conversion options

COBOL and CICS Command Level Conversion Aid for OS/390 & MVS & VM
5648-B05 Version 2 Release 1
Copyright (C) IBM Corp 1982, 1998 - All rights reserved

PF1 Help  PF3 Exit  PF4 Return

Option ==> 1
F1=Help   F2=Split  F3=Exit   F5=Refresh F7=Up     F8=Down
F12=Cancel

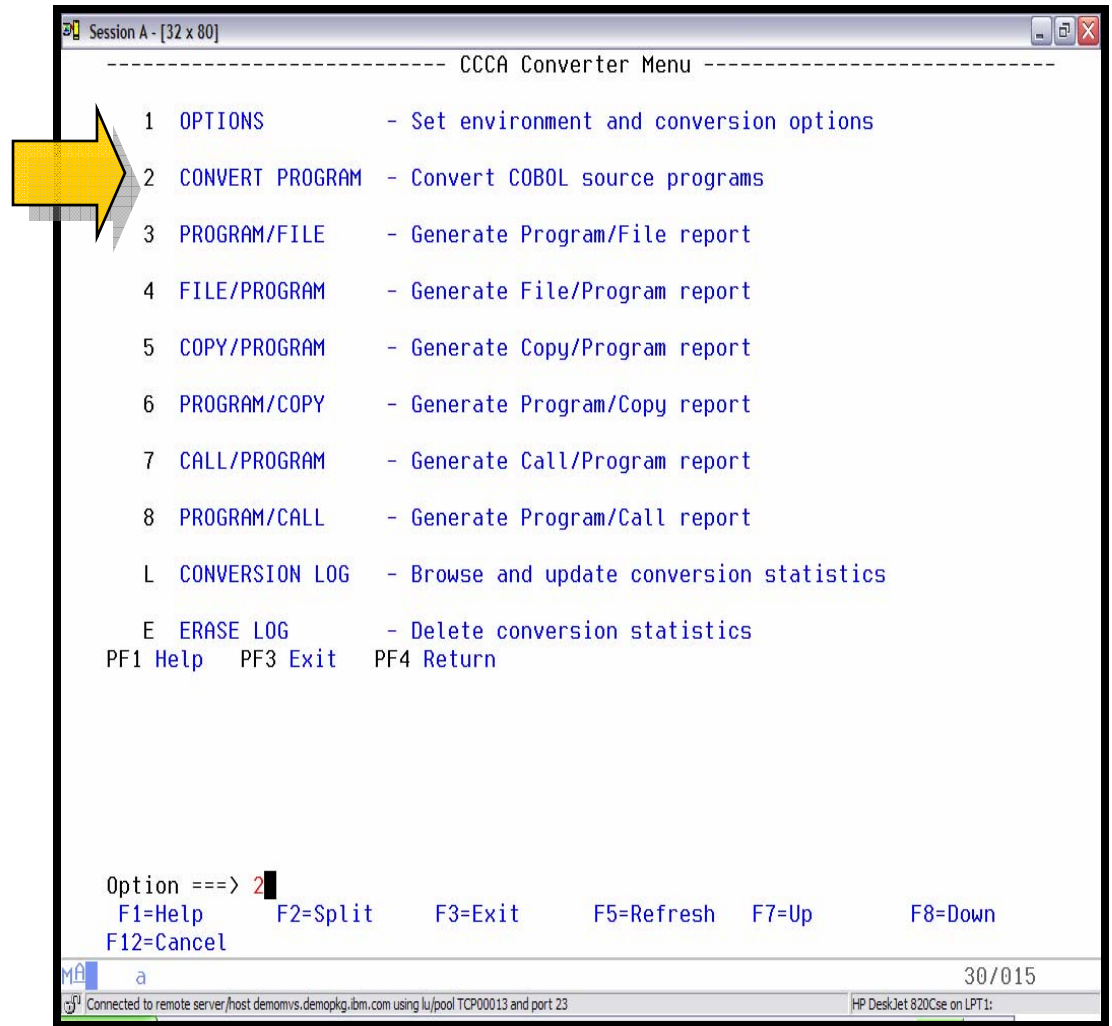
MA a 30/015
Connected to remote server/host demomvs.demopkg.ibm.com using lu/pool TCP00013 and port 23
HP DeskJet 820Cse on LPT1:
  
```



COBOL Modernization Utility ISPF Interface:

- Convert Menu

- ▶ From this menu code can be converted
- ▶ When code is converted a project conversion report log is generated automatically
- ▶ Individual reports are generated for each converted source file



COBOL Modernization Utility ISPF Interface:

- Conversion
 - ▶ Define the “to be converted” COBOL source and copybook libraries
 - ▶ Define the output converted COBOL source and copybook libraries
 - ▶ Select the options of converting language sensitive runtimes (CICS, SQL, etc)

```

Session A - [32 x 80]
----- CCCA Conversion selection -----
Program source:                                Options:
Project . . . ===>                               Language level ===> *      (* 1-11)
Library . . . ===>                               CICS . . . . . ===> N      (Y N)
Type. . . . . ===>                               SQL. . . . . ===> N      (Y N)
Member. . . . . ===>                               DLI. . . . . ===> N      (Y N)
                                                    (Blank for member list, * for all members)

Other source file:
Data set name ===> 'DNET603.OSVS.COBOL'

Copy libraries:
DDNAME ===> SYSLIB   LIBRARY ===> 'DNET603.OSVS.COPY'
===>                               ===>
===>                               ===>
===>                               ===>
===>                               ===>
===>                               ===>

Output source:
Program library ===> 'DNET603.C390.SOURCE'
Copy library. . ===> 'DNET603.C390.COPY'

PF1 Help  PF3 Exit  PF4 Return  ENTER Build JCL

Command ===>
F1=Help   F2=Split   F3=Exit   F5=Refresh  F7=Up     F8=Down
F12=Cancel

MA a
06/024
Connected to remote server/host demomvs.demopkg.ibm.com using lu/pool TCP00013 and port 23
HP DeskJet 820Cse on LPT1:
  
```


COBOL 85 Converted (LE Conforming):

```

Session A - [32 x 80]
File Edit Edit_Settings Menu Utilities Compilers Test Help
EDIT          DNET603.C390.SOURCE(TDM01A) - 01.00          Columns 00001 00072
000045
000046          *****
000047          * PROGRAM WORKING STORAGAGE                      *
000048          *****
000049          WORKING-STORAGE SECTION.
000050          01  LCP-YYYYMMDD-TIME.
000051          05  LCP-YYYYMMDD.
000052          10  LCP-CENTURY          PIC X(2).
000053          10  LCP-YY              PIC X(2).
000054          10  LCP-MM              PIC 9(2).
000055          10  LCP-DD              PIC X(2).
000056          05  LCP-TIME.
000057          10  LCP-HHMMSS.
000058          15  LCP-HH              PIC X(2).
000059          15  LCP-MN              PIC X(2).
000060          15  LCP-SS              PIC X(2).
000061          10  LCP-HS              PIC X(2).
000062          05  LCP-GMT            PIC X(5).
- - - - - 53 Line(s) not Displayed
000116          *****
000117          * GET THE SYSTEM DATE                          *
000118          *****
000119          MOVE FUNCTION CURRENT-DATE TO LCP-YYYYMMDD-TIME
000120          MOVE CORRESPONDING LCP-YYYYMMDD TO LCP-MMDDYY-08
000121          MOVE LCP-MMDDYY-08 TO TODAY-DATE
000122
Command ==>
F1=Help      F2=Split    F3=Exit     F5=Rfind    F6=Rchange  F7=Up
F8=Down     F9=Swap     F10=Left   F11=Right   F12=Cancel

M a 30/015
  
```

IBM COBOL Modernization Process:

- Migrate to the Language Environment Runtime
 - ▶ Convert and test all applications to the LE runtime environment
- Discovery
 - ▶ Identify all OS/VS COBOL executables and source
- Convert
 - ▶ Convert the OS/VS COBOL (COBOL 74) source to COBOL 85 standard and rebuild the modules
- *Test and Promote*
 - ▶ *Test all converted modules and migrate to production*



DTUAF Coverage Utility Overview:



- Code coverage utility for z/OS applications to support Regression and Unit testing and Sarbanes-Oxley compliance
- Part of the *IBM Debug Tool Utilities and Advanced Functions*
- Supports IBM Compilers:
 - ▶ COBOL, C, C++, PL/I, assembler
- Supports all z/OS application runtime Environments
 - ▶ CICS, TSO, JES/Batch, IMS Including IMS/TM, DB2 Including Stored Procedures
- Focus support for QA regression testing in as seamless and scaleable
- **Enables Sarbanes-Oxley z/OS compliance**
- Order Debug Tool Utilities and Advanced Functions PID
 - ▶ **5655-R45**
- **Debug Tool Code Coverage Utility Features:**
 - ▶ Does not require any updates to the test case runtimes (does not require updates to present regression test cases)
 - ▶ Supports any number of testers running multiple executions
 - ▶ Accumulates coverage statistics accross multiple runs by multiple testers
 - ▶ Reports:
 - Reports statement coverage
 - Reports statement frequency
 - Reports branch execution
 - Provides 1403 reports for coverage
 - Provides Browser HTML reports for coverage
 - Generates XML report output for migration
- Information available at: www.ibm.com/software/awdtools/deployment




DTUAF Coverage Utility Delivered Function:

- *Sarbanes-Oxley Compliance*
 - ▶ *Automates the creation of a documented audit trail of all testing (both unit and QA testing) for all program changes migrated into production*
- *Regression Testing Validation*
 - ▶ *Verification that a regression test run has exercised all changed programs and changed lines of code*
- *Regression Testing Optimization*
 - ▶ *Identification of redundant regression test cases along with identification of missing regression test cases*
- *Test Management Monitoring of Testing Effort*
 - ▶ *Background monitoring and measurement of the testing team effort*
- *Unit Test Validation*
 - ▶ *Verification that the level of Unit Testing has exercised all changed lines of code*
- *Application Understanding*
 - ▶ *Runtime understanding of how one or more programs **work***



Coverage Utility:

- DTUAF Coverage Utility:
 - A the setup and JCL generation functions are accessed from the Debug Tool DTSU main menu



```
Session A - [32 x 80]
----- Debug Tool Utilities -----
0  Manage Job Card
   For Program Preparation and Setup File Management
1  Program Preparation
   Compile old or new COBOL programs with newer compilers, convert old COBOL
   source into new COBOL source, use other compilers, and link edit.
2  Manage and Use Debug Tool Setup Files
   You can manage setup files and use them to run your program interactively
   with Debug Tool in TSO Foreground or submit your program to run in
   the background using MVS batch.
3  Code Coverage
   Measure code coverage in programs written in COBOL, PL/I, C/C++ and
   Assembler when compiled with specific IBM compilers and HLASM.
4  Manage IMS Programs
   You can dynamically update LE Runtime options and create private
   message region.
G  Getting Started

Enter X to Terminate

Option ==> 3
F1=Help    F2=Split    F3=Exit    F7=Backward  F8=Forward  F9=Swap
F12=Cancel

Má a 30/015
Connected to remote server/host demomvs.demopkg.ibm.com using lu/pool TCP00049 ar HP DeskJet 820Cse on LPT1:
```

Coverage Utility:

- DTUAF Coverage Utility:
 - A the setup and JCL generation functions are accessed from the Debug Tool DTSU main menu

```
Session A - [32 x 80]
----- Debug Tool Coverage Utility -----
Option ==>

0 Defaults      Manipulate defaults
1 CntlFile     Work with the Control File
2 Setup        Create JCL for Setup
3 StartMon     Create JCL to Start the Monitor
4 Reports      Create JCL for Reports
5 Monitor      Control the Monitor
6 FastPath     FastPath

Enter X to Terminate

F1=Help      F2=Split      F3=Exit      F7=Backward  F8=Forward  F9=Swap
F10=Actions  F12=Cancel

02/014
Connected to remote server/host demomvs.demopkg.ibm.com using lu/c HP DeskJet 820Cse on LPT1:
```

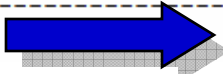
Debug Tool Coverage Reports:

- **Summary Report:**
 - ▶ Report showing a "easy to read" matrix of all programs, number of statements executed and not executed, and summary statistics
- **Annotated Listing:**
 - ▶ Report generation of the compiler listing adding "flags-tags" to each source statement showing if the statement executed or if the program branch was taken.
- **XML:**
 - ▶ An XML generation of the coverage statistics collected that can be migrated to alternate platforms and managed for the Coverage Utility's user's unique analysis



Coverage Summary Report:

```

1 ***** DTCU SUMMARY:                PROGRAM AREA DATA                *****
0          DATE: 12/05/2004
          TIME: 09:32:07
          TEST CASE ID:
0 |<--          PROGRAM IDENTIFICATION          -->|
  |          |          |          |          |          |          |          |
  | PA LOAD MOD PROCEDURE | LISTING NAME |          | STATEMENTS: | BRANCHES: |          |
  |          |          |          |          |          | TOTAL   EXEC   % | CPATH  TAKEN  % |
  |-----|-----|-----|-----|-----|-----|-----|-----|
  1 COB01   PROG        DNET603.CODE.COBOLST (COB01A)   6      6 100.0   0      0 100.0
  2          PROGA                        5      4  80.0   6      5  83.3
  3          PROCA                        1      0   0.0   0      0 100.0
  4          LOOP1                       3      3 100.0   2      1  50.0
  5          LOOP2                       2      2 100.0   2      1  50.0
  6 COB01   PROGB        DNET603.CODE.COBOLST (COB01B)   6      5  83.3   6      4  66.7
  7          PROCB                        1      1 100.0   0      0 100.0
  8          LOOP1                       3      3 100.0   2      1  50.0
  9 COB01   PROGC        DNET603.CODE.COBOLST (COB01C)   5      5 100.0   6      6 100.0
 10          PROCC                        3      2  66.7   2      1  50.0
 11          LOOP1                       4      3  75.0   4      2  50.0
 12          LOOP2                       2      2 100.0   2      1  50.0
 13 COB01   PROGD        DNET603.CODE.COBOLST (COB01D)   4      0   0.0   4      0   0.0
 14          PROCD                        1      0   0.0   0      0 100.0
 15          LOOP1                       1      0   0.0   0      0 100.0
  |-----|-----|-----|-----|-----|-----|-----|-----|
Summary for all PAs:                    47      36  76.6   36      22  61.1

```

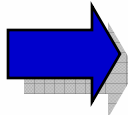
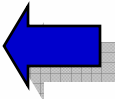


Coverage Annotation Listing Report:

1 DTCU Annotation Symbols
 -
 Each instruction line of the listing has a character to the right of the statement number to indicate what happened during the test run:
 0 & A conditional branch instruction that has executed both ways
 > A conditional branch instruction that has branched but not fallen through
 V A conditional branch instruction that has fallen through but not branched
 : Non-branch instruction that has executed
 ^ Instruction that has not executed
 @ Data area in the assembler listing
 % An unconditional branch instruction that has executed in the assembler listing

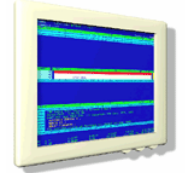
```

000036
000037      * THE FOLLOWING ALWAYS PERFORMED
000038
000039      PROG.
000040      * ACCESS BY TOP LEVEL QUALIFIER
000041 :          MOVE 'ILCHIMVS' TO TASTRUCT                29          >0001<
000042
000043      * ACCESS BY MID LEVEL QUALIFIERS
000044 :          MOVE 'ILSPR' TO LOC-ID                        30          >0001<
000045 :          MOVE 'AIX' TO OP-SYS                          33          >0001<
000046
000047      * ACCESS BY LOW LEVEL QUALIFIERS
000048 :          MOVE 'KY' TO STATE                             31          >0001<
000049 :          MOVE 'LEX' TO CITY                             32          >0001<
000050 :          MOVE 'VM ' TO OP-SYS                          33          >0001<
000051      .
000052
000053      PROGA.
000054 &          PERFORM LOOP1 UNTIL TAPARM1 = 0              70 24          >0001<
000055
000056 >          IF TAPARM2 = 0 THEN                            25          >0001<
000057      *   PROCA NOT EXECUTED
000058 ^   1          PERFORM PROCA.                            66          >0000<
000059
  
```



Debug Tool Utilities Advanced Functions Interactive Facility



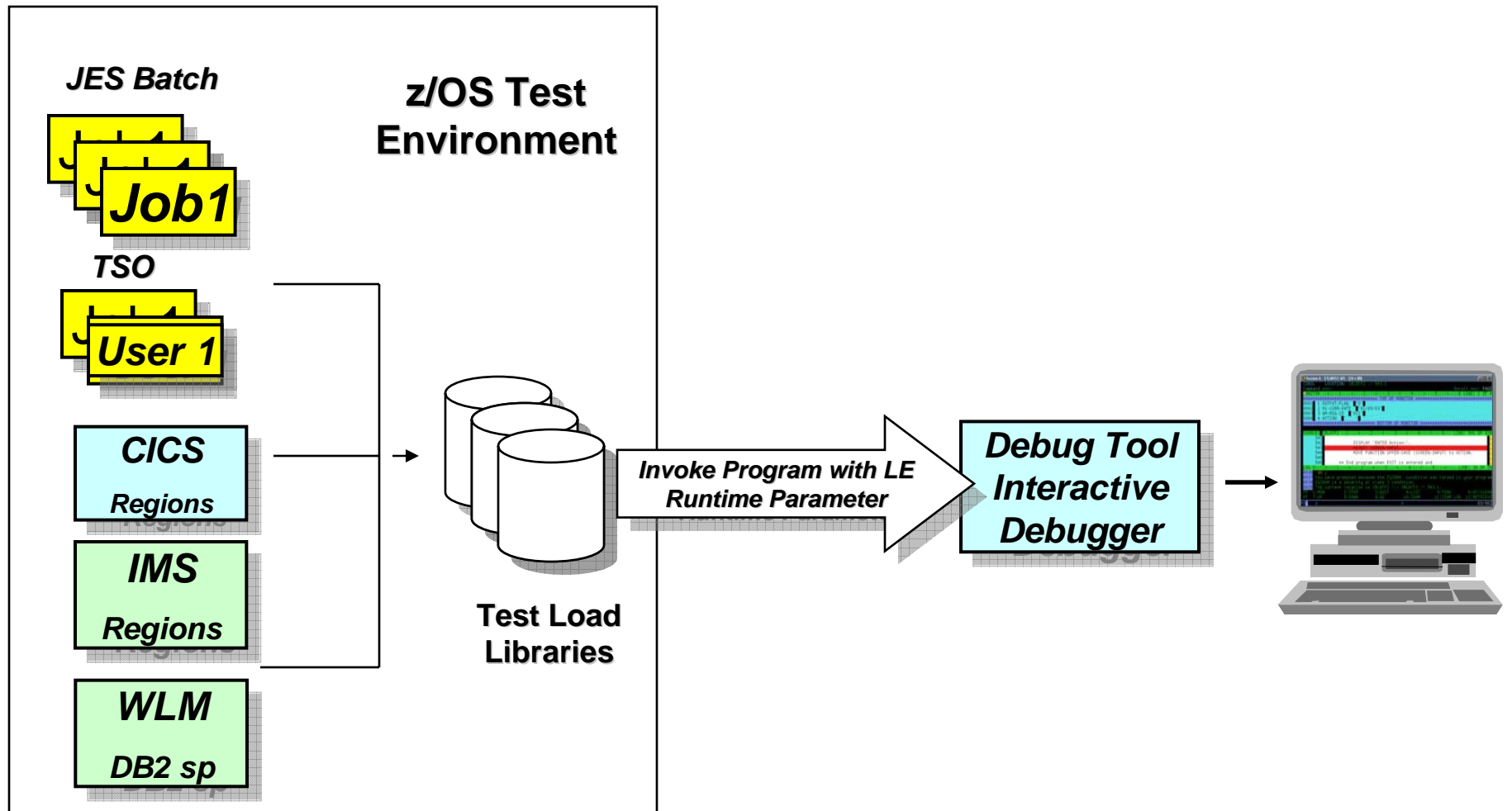


DTUAF Interactive Debugger Overview:

- *Interactive Source Debugger for z/OS compiled and assembled programs*
 - *Base Feature of [Debug Tool Utilities and Advanced Functions](#)*
 - *Common User Interfaces Across All z/OS Subsystems*
 - *Consistent Across Languages*
 - ▶ **COBOL (all versions), C/C++, PL/I, assembler**
 - *All z/OS Subsystems Supported:*
 - ▶ **CICS, TSO, JES/Batch, IMS Including IMS/TM, DB2 Including Stored Procedures, Unix System Services (USS), MQSeries**
 - *Order Debug Tool Utilities and Advanced Functions PID*
 - ▶ **5655-R45**
- *Interactive Debug Features:*
 - ▶ **Source-level Debugging**
 - ▶ **Step Mode Debugging**
 - ▶ **Multiple Breakpoints - Conditional**
 - ▶ **3270 and Workstation GUI Interfaces**
 - ▶ **Customizable 3270 Interface**
 - ▶ **Programmable Command Script Support for Background Execution**
 - ▶ **Interactive “Playback” support for all programs**
 - ▶ **“Automonitor” support for COBOL, PL/I, and assembler programs**
 - ▶ **Object level “disassembly” debug support**
 - ▶ **Support for terminal and background CICS and IMS TM transactions**
 - ▶ **Command logging Of Debug Session**
 - ▶ **Dynamic Program Source Logic Patching**
 - ▶ **Frequency Sampler**
 - *Information available at:*
www.ibm.com/software/awdtools/deployment



DTUAF Interactive Debugger:



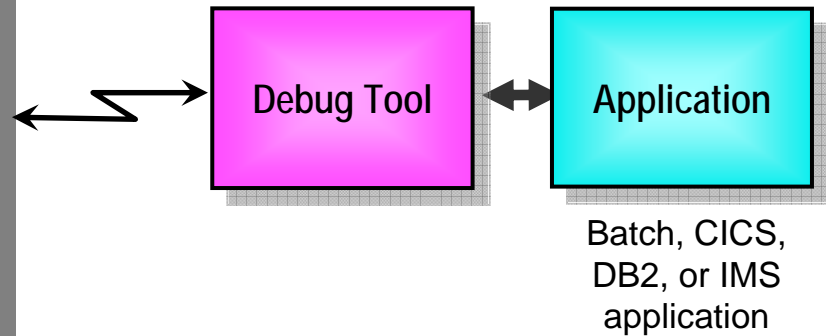
DTUAF 3270 VTAM Interface:

```

Session A - STLMVS1.WS - [24 x 80]
COBOL LOCATION: CBLATP2 :> 543.1
Command ==> Scroll ==> PAGE
MONITOR --+---+---1---+---2---+---3---+---4---+---5---+---6 LINE: 1 OF 4
***** TOP OF MONITOR *****
0001 1 OUTPUT-FLAG 'D'
0002 2 H1-CURR-DATE '01/05/03'
0003 3 GM-MSG-ID '01I'
0004 4 ACTION ' '
***** BOTTOM OF MONITOR *****

SOURCE: CBLATP2 --+---+---2---+---3---+---4---+---5--- LINE: 541 OF 939
541
542 DISPLAY 'ENTER Action:'.
543 ACCEPT SCREEN-INPUT.
544 MOVE FUNCTION UPPER-CASE (SCREEN-INPUT) TO ACTION.
545
546 ** End program when EXIT is entered and

LOG 0--+---+---1---+---2---+---3---+---4---+---5---+---6 LINE: 36 OF 39
0036 GO ;
0037 You were prompted because the IGZ00H condition was raised in your program
0038 IGZ00H is a severity or class 3 condition.
0039 The current location is CBLATP2 :> CBLATP2 :> 543.1.
PF 1:MON 2:STEP 3:QUIT 4:LIST 5:FIND 6:AT/CLEAR
PF 7:UP 8:DOWN 9:GO 10:ZOOM 11:ZOOM LOG 12:RETRIEVE
MA a A 03/002
  
```



- Full-screen mode**

- ▶ 3270 interface
 - ▶ Work with Debug Tool from a VTAM terminal
 - ▶ Debug Tool uses a terminal that you specify... your CICS or TSO terminal can be used





[→ Go to IBM](#)

© Copyright IBM Corporation 2007. All rights reserved.

The information contained in these materials is provided for informational purposes only, and is provided AS IS without warranty of any kind, express or implied. IBM shall not be responsible for any damages arising out of the use of, or otherwise related to, these materials. Nothing contained in these materials is intended to, nor shall have the effect of, creating any warranties or representations from IBM or its suppliers or licensors, or altering the terms and conditions of the applicable license agreement governing the use of IBM software. References in these materials to IBM products, programs, or services do not imply that they will be available in all countries in which IBM operates. Product release dates and/or capabilities referenced in these materials may change at any time at IBM's sole discretion based on market opportunities or other factors, and are not intended to be a commitment to future product or feature availability in any way.

IBM, the IBM logo, the on-demand business logo, Rational, the Rational logo, and other IBM products and services are trademarks of the International Business Machines Corporation, in the United States, other countries or both. Other company, product, or service names may be trademarks or service marks of others.

