z390 and zCOBOL Portable Mainframe Assembler and COBOL with zCICS Support

Melvyn Maltz (in association with Don Higgins)
Automated Software Tools Corporation

Thursday, November 5, 2009 9:00 – 10:00 AM
Whittlebury, Northamptonshire, UK

Trademark Acknowledgements

- **IBM Corporation**
  - **z/OS, HLASM, CICS, VSAM**
- **Microsoft Corporation**
  - **Windows Vista, XP, and 2000**
  - **Visual Express C++**
- **Sun Microsystems**
  - **J2SE, J2RE**

Presentation Outline

- **z390 Portable Mainframe Assembler v1.5.01**
  - **Assemble, link, execute HLASM compatible programs**
- **zCOBOL V1 Portable Mainframe COBOL (v1.5.01)**
  - **Compile, link, execute COBOL programs**
- **zCICS V8 Support by Melvyn Maltz (v1.5.01)**
  - **Support EXEC CICS COBOL and assembler**
  - **Run local and remote TN3270 CICS trans. over TCP/IP**
- **Questions and Answers**

z390 Portable Mainframe Assembler

- **z390 Open Source Java Project**
- **Execute HLASM compatible macro code**
- **Assemble HLASM compatible programs**
- **Link object code into z390 load modules**
- **Execute load modules on J2SE platforms:**
  - **Windows (XP and Vista) and flavours of Linux**
  - **24/31 bit AMODE/RMODE**
  - **32/64 bit GPR/FPR, HFP/BFP/DFP**
  - **All new z10 PP instructions supported**
  - **QSAM, VSAM, SOA, CICS, TN3270**

Z390 Structured macro code

Example conditional macro code:

```
:&I SETA 1
AWHILE (&I LE &LIMIT)
   AIF ('&ID(&I)' EQ 'DSH')
        MNOTE 'FOUND ID'
        AEXIT AWHILE
   AEND
   :&I SETA &I+1
AEND
```

Integrated in mz390 macro processor

ZSTRMAC utility available to convert

Google "ZSTRMAC" for online docs

Example generated HLASM conditional code

```
&I   SETA 1
.AWHILE_1_T ANOP
  AIF (&I GT &LINIT).AWHILE_1_E
     AIF ('&ID(&I)' EQ 'DSH').AIF_1
     MNOTE 'FOUND ID'
     AGO .AWHILE_1_E
.AIF_1    ANOP
&I   SETA &I+1
      AGO .AWHILE_1_T
.AWHILE_1_E ANOP
```

Z390 Structured Programming Macros

Example structured macros:

```
FIND SUBENTRY
    LA  R1,ID
    LA   R2,ID_END
    WHILE (CLR,R1,LT,R2)
     IF (CLC,0(,3,R1),EQ,=C‘DSH’)
          WTO ‘FOUND ID’
          SUBEXIT RC=0
     ENDIF
     LA  R1,3(R1)
  ENDDO
  WTO ‘NOT FOUND’
   SUBEXIT RC=1
```

- WHILE_1_T DS 0H
- CLR R1,R1
- BNL WHILE_1_E
- …..
- CLC 0(3,R1),0(R2)
- BNE IF_1
- ….
- IF_1 DS 0H
- …..
- WHILE_1 DS 0H

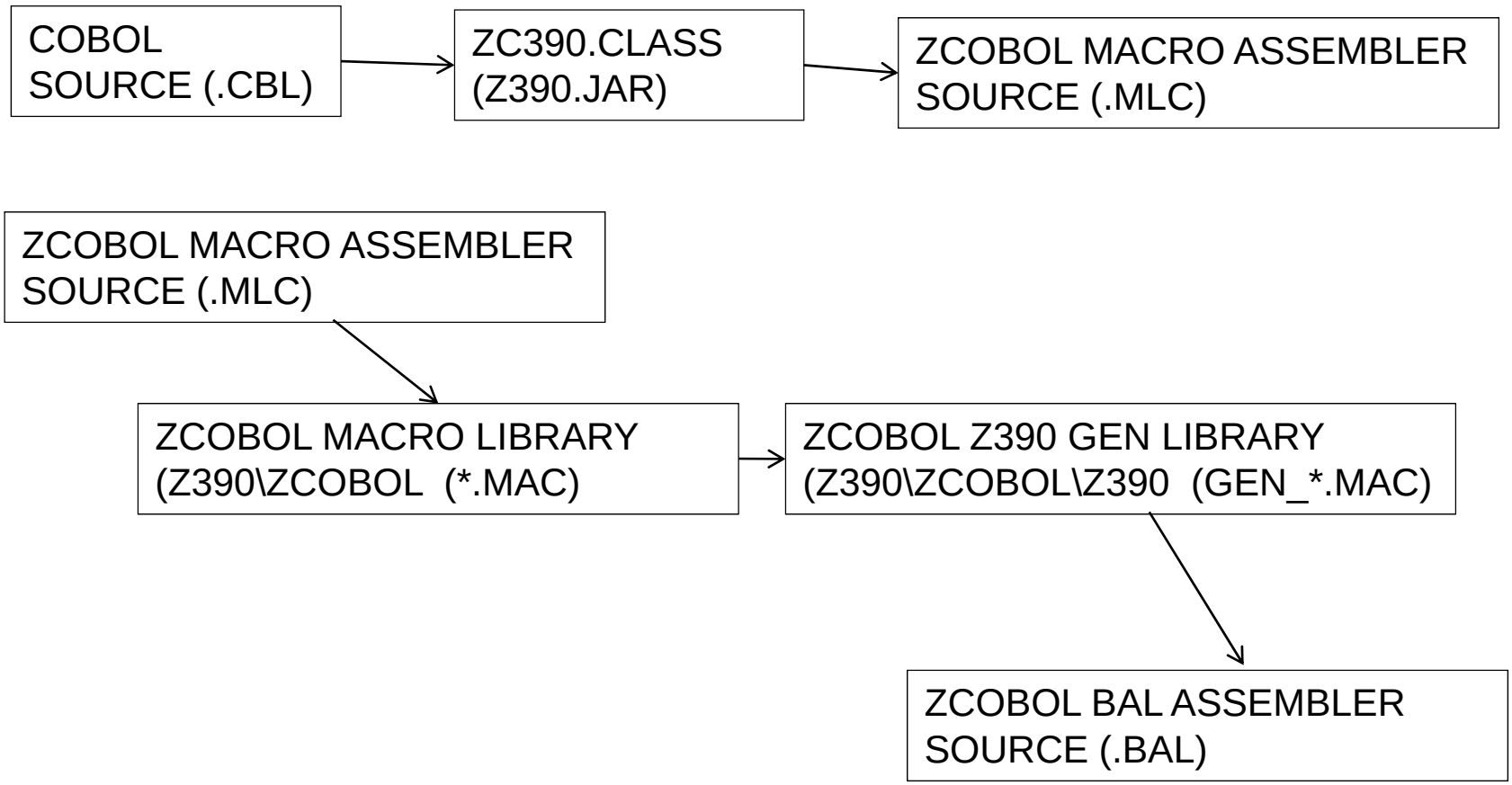
z390 Compatibility Options

- **VSE macros which map to MVS compatible z390 macros including CDLOAD, COMRG, EOJ DTFPR, DTFSD, OPEN, CLOSE, GETIME, GETVIS**
- **HLASM defaults for compatibility including EBCDIC and ASCII codepages matching z/OS**
- **Optional ASCII mode**
- **RECFM=FT/VT for ASCII to/from EBCDIC for QSAM file compatibility with ASCII text files**
- **Regression tests showing use of options**
- **Google "z390 options" for online docs**

zCOBOL Portable Mainframe COBOL

- **Compiler architecture**
- **Compiler examples of source code generation**
- **Compiler symbol table and system functions**
- **Compiler register allocation**
- **Compiler code generation**
- **Compiler commands**
- **Demo and regression test programs**

zCOBOL Portable Mainframe COBOL



zCOBOL Compiler Architecture

- **zc390.java parser CBL to MLC macro assembler**
- **zcobol library for all COBOL verb macros (139)**
- **zcobol\z390 library for all HLASM gen macros (102)**
- **zcobol\java for all java code gen macros (11)***
- **zcobol\vce for all C++ code gen macros (11)***
- **zcobol\i586 for all HLA/MASM gen macros (11)***

- **Note once the z390 code gen macros are stabilized, they can all be copied to other target language libraries and modified to gen other source code.**

zCOBOL to z390 code gen example 1

COBOL SOURCE:

77 CTR-1 COMP PIC S9(9)..

01 SYSTEM-DATE.

02 SYSTEM-DD PIC 99.

02 SYSTEM-MM PIC 99.

HLASM > MACROS > BAL:

WS 77,CTR_1,COMP,PIC,S9(9)

- **GEN_WS**
  - **CTR_1 DS FL4**

WS 01,SYSTEM_DATE

WS 02,SYSTEM_DD,PIC,99

WS 02,SYSTEM_MM,PIC,99

- **GEN_WS**
  - **SYSTEM_DATE DS 0CL4**
  - **SYSTEM_DD DS ZL2**
  - **SYSTEM_MM DS ZL2**

zCOBOL to z390 code gen example 2

IF CTR-1 = 2 GO TO OPT-2.

IF CTR_1,=,2

- **GEN_COMP**
  - **L R0,CTR_1**
  - **CHI R0,2**
- **GEN_BC 7,PG_IF_1**
  - **BRC 7,PG_IF_1**

GO TO,OPT_2

- **GEN_B PG_OPT_2**
  - **J PG_OPT_2**

PERIOD

- **GEN_LABEL PG_IF_1,ENDIF**
  - **PG_IF_1 DS 0H ENDIF**

zCOBOL symbol table and functions

- **Global symbol table copybook zcobol\ZC_WS.CPY**
  - **All the COBOL verb and code generation macros share global symbol table via COPY ZC_WS**
- **Symbol lookup macro zcobol\ZC_SYM_FIND.MAC**
  - **GBLA &(ZC_IX_&SYM),&SYM_IX**
  - **:&SYM_IX SETA &(ZC_IX_&SYM)**
- **Symbol reference function zcobol\ZCGETFLD.CPY**
  - **Return qualified symbol name to resolve duplicates**
  - **Call GEN_BASE.MAC to gen WS/LK base code if any**
  - **Call GEN_SIX.MAC to gen subscript/index code**

zCOBOL to HLASM register allocation

- **R0-R3 work within single COBOL statement**
- **R4-R5 bases for linkage section data items**
- **R6-R7 bases for working storage items as required**
- **R8 z390 initial code base for load, then WS#2**
- **R9 zcobol ZCVT with function call entries**
- **R10 z390 zCICS support DFHTCTTE**
- **R11 z390 zCICS support DFHEIBLK**
- **R12 z390 WS#3**
- **R13 save area in DFHEISTG for zCICS else WS#1**
- **R14 return address for calls**
- **R15 entry address for calls**

zCOBOL to HLASM code generation

- **CSECT with PROGRAM-ID name starts with code to dynamically load ZC390LIB.390**
- **R9 set to ZC390CVT which is at ZC390LIB entry**
- **R13 set to DFHEISTG for CICS or WS following procedure code with standard save area.**
- **Procedure code is base free**
  - **All branches use relative instructions**
  - **All literal references use LARL to even length literals**
  - **WS and LK base registers are set as required within COBOL sentences to provide RS/RX type access.**

zCOBOL Sample z390 GEN_ADD code

```
        ……
        AENTRY ADD_NUM_LIT
        ACASE (C2A('&SYM_PIC_TYPE(&TARGET)'))
        ……..
        AWHEN C'H'
          LH    R0,&SYM_NAME(&TARGET)
          AHI   R0,&NUM
          STH   R0,&SYM_NAME(&TARGET)
        AWHEN C'G'
         AIF (K'&NUM LE 2)
          AGSI  &SYM_NAME(&TARGET),&NUM
          ……..
```

zCOBOL Compile Commands

- **ZC390C – compile to z390 relocatable object code**
- **ZC390CL – compile and link z390 390 load module**
- **ZC390CLG – compile, link, and execute z390 pgm**
- **ZCJAVCLG – compile and execute J2SE java pgm**
- **ZCVCECLG – compile, link, and execute C++ pgm**
- **ZC586CLG – compile, link, and execute MASM pgm**
- **Note other system software requirements (all free):**
- **All require J2SE and z390 installs**
- **ZCVCECLG requires MS Visual Express C++ install**
- **ZC586CLG requires HLA and MASM installs**

zCOBOL Demo compile and execute

- **The COBOL HELLO.CBL ”Hello World” program:**
- **.....**
- **DISPLAY ”Hello World”**
- **STOP RUN.**
- **Commands to compile HELLO.CBL in each language**
  - **ZC390CLG zcobol\demo\HELLO > MLC > HELLO.390**
  - **ZCJAVCLG zcobol\demo\HELLO > JAVA > HELLO.class**
  - **ZCVCECLG zcobol\demo\HELLO > CPP > HELLO.exe**
  - **ZC586CLG zcobol\demo\HELLO > ASM > HELLO.exe**

zCOBOL Demo HLASM generated code

- *** 000400   DISPLAY 'Hello World'.**
- **BAS   ZC_R1,ZC_DISPLAY_1**
- **DC   AL2(11,0),C'Hello World’**
- **ZC_DISPLAY_1 DS 0H**
- **SVC   35**

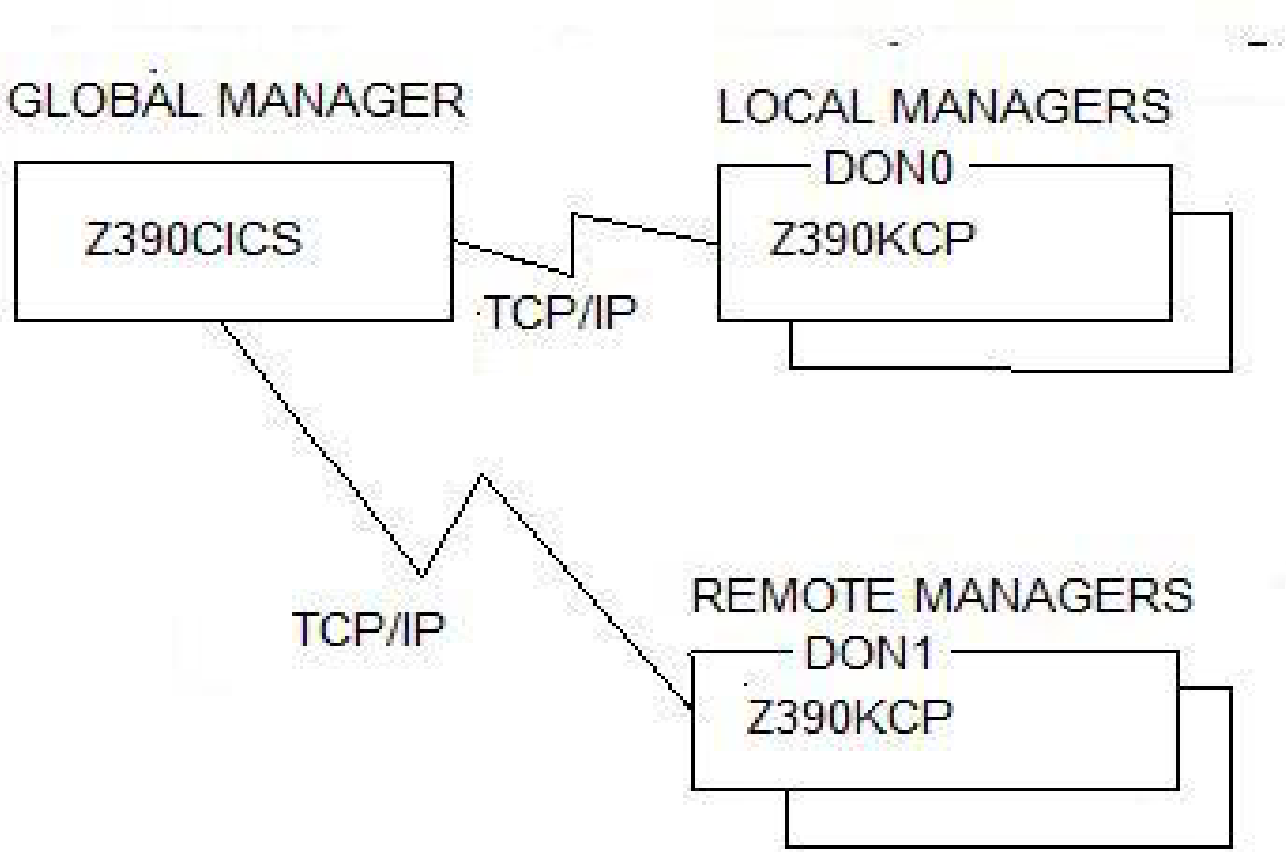
zCOBOL Demo and Regression Tests

- **Demos in zcobol\demo include:**
  - **HELLO.CBL - display ”Hello World”**
  - **DATETIME.CBL- display current time and date**
  - **COPYFILE.CBL- copy line sequential file**
- **Regression tests in zcobol\test include:**
  - **TESTCMP1 – test ADD, SUBTRACT, MULTIPLY, DIVIDE**
  - **TESTFUN1 – test functions NUMERIC, etc.**
  - **TESTIF1 – test IF ELSE ENDIF**
  - **TESTISP1 - test INSPECT TALLY, REPLACING, etc.**
  - **TESTMOV1 – test MOVE including EDIT for DISPLAY**
  - **TESTPM1 – test PERFORM THRU, TIMES, VARYING**
  - **TESTSIX1 - test 2 dimensional subscripting**

zCICS V8 by Melvyn Maltz

zCICS with zCOBOL and VSAM

zCICS Overview



zCICS GUI Screen

zCICS V8 supported commands

zCICS Supported Commands

General
- ADDRESS
- ASSIGN
- HANDLE AID
- HANDLE CONDITION
- IGNORE CONDITION
- POP HANDLE
- PUSH HANDLE

TC
- RECEIVE
- SEND

FC
- READ
- STARTBR
- READNEXT
- READPREV
- ENDBR
- RESETBR

SC
- FREEMAIN
- GETMAIN

TS
- DELETEQ
- READQ
- WRITEQ

PC
- ABEND
- HANDLE ABEND
- LINK
- LOAD
- RELEASE
- RETURN
- XCTL
- RETURN
- XCTL

IC
- ASKTIME
- ASKTIME ABSTIME
- DELAY
- FORMATTIME
- START
- RETRIEVE
- CANCEL

KC
- ENQ
- DEQ

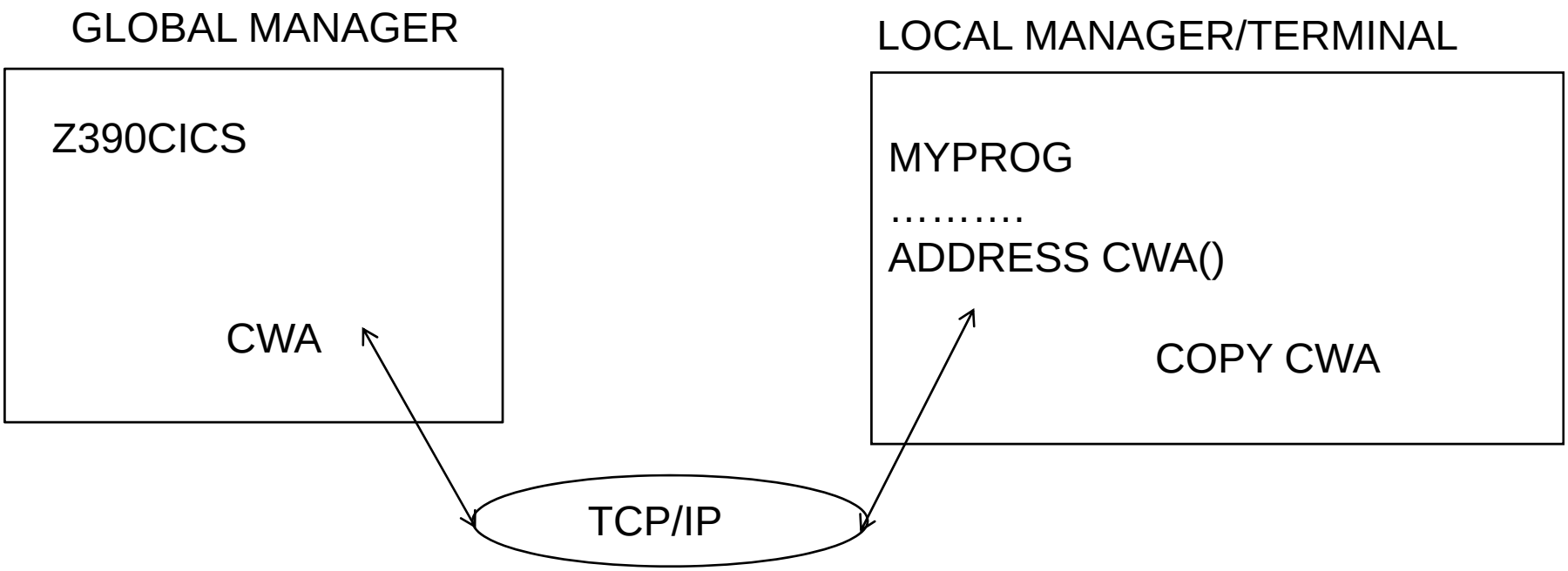
BMS
- SEND MAP
- RECEIVE MAP
- SEND CONTROL

DC
- DUMP

System
- INQUIRE FILE
- SET FILE

zCICS CWA and ENQ/DEQ

INI CWASIZE=nnnnnnn….



EXEC CICS ENQ RESOURCE()

zCICS BMS Extensions

- **More cross-checking for Macro and execution**

  MAPFAIL now uses EIBRESP2.

  ATTRB=(ALPHA)

  XINIT=FFhh

  PICIN/PICOUT supported by Assembler as an edit word

  PICOUT=5C20216B202020

  Data is 12345, displayed as *12,345

  PICOUT=5B20216B202020

  Data is 1234 , displayed as $1,234

zCICS BMS Map Layout Example

```
                1         2         3         4         5         6         7         8
       1...+....0....+....0....+....0....+....0....+....0....+....0....+....0....+....0
      ********************************************************************************
    1 *     @TESTGUI6 UPDATE NAME, ADDR, AND/OR ZIP (PF1=HELP PF2=ERASE INPUT PF3=EXIT)*  1
    2 *                                                                              *  2
    3 *     @ENTER NAME@_____________________________________________@               *  3
    4 *                                                                              *  4
    5 *     @ENTER ADDR@_____________________________________________@               *  5
    6 *                                                                              *  6
    7 *     @ENTER ZIP @_____@                                                       *  7
    8 *                                                                              *  8
    9 *     @....@.....................................                              *  9
   10 *                                                                              * 10
   11 *     @....@.....................................                              * 11
   12 *                                                                              * 12
   13 *     @....@.....                                                              * 13
   14 *                                                                              * 14
   15 *     @PRESS F1 FOR HELP                                                       * 15
   16 *                                                                              * 16
   17 *     @..............................                                          * 17
   18 *                                                                              * 18
   19 *@TEST OCCURS       @.....@.....@.....@.....@.....@SUM=@..........              * 19
   20 *@TEST GRPNAME      @..-..-..@        @.................                      * 20
   21 *@TEST PICS         @............@                                            * 21
   22 *@..............@............                                                  * 22
   23 *@CURSOR LOCATION=@.........                                                   * 23
      ********************************************************************************
                1         2         3         4         5         6         7         8
       1...+....0....+....0....+....0....+....0....+....0....+....0....+....0....+....0
   →
```

zCICS Supplied Transactions

- **Many test transactions**

- **CEMT I TERm**
- **CEMT I TRAn**
- **CEMT I FILe**
- **CEMT I SYStem**
- **CEMT I ENQueue**
- **CEBR**

- **CEMT S TER OUT**
- **CEMT P SHU**
- **CEMT P SHU IMM**

zCICS Supplied Transaction Example

```
CEMT I ENQ
RESOURCE-------- LENGTH USE COUNT OWNER -------WAITING-----
   --
MYRES4                  6         1 DON0  1
MYRES5                  6         1 DON1  0
```

zCICS Temporary Storage Screen A

zCICS Temporary Storage Screen B

zCICS Seq. Terminal Support (1 of 2)

- **Regression test your transactions.**

- **Run a transaction with INI parm SEQ_TERM=TRACE**
- **Run the extract program Z390SEQ to build the data streams**
- **Sequence all of your data streams**
- **Application changes occur**
- **Set INI parm SEQ_TERM=YES**
- **Run the simulation, you can see it happen on screen**
- **Your whole life will flash before your eyes**

zCICS Seq. Terminal Support (2 of 2)

- Regression test your transactions.
  - Run the comparator Z390CMPG, review the output
  - Refine the comparator by building an exclusion file for variable data like dates and times

zCICS Documentation (1 of 2)

- There's a lot of it.
  - None of it is meant to replace IBM's Manuals.
  - The information given refers to zCICS, its implementation, workings, extensions and command/parameter support.

zCICS Documentation (2 of 2)

- Readme
- Application Programming Guide
- Diagnosis Reference
- History
- Sequential Terminal Support
- Supplied Transactions
- System Programmer's Guide
- VSAM Guide
- Basic Mapping Support

z390 zCOBOL zCICS Q and A Time

- **Can I compile and test EXEC CICS COBOL programs using z390 zCICS?**
- **Which zCOBOL extension is highest priority?**
- **Which zCICS extension is highest priority?**
- **Which z390 extension is highest priority?**
- **How do I request a bug fix or enhancement?**
- **How can I volunteer to help?**

Z390 and zCOBOL Direction

- **Z390 major priorities**
  - **Full VSAM update and alternate index support**
  - **SQL support**
- **Zcobol major priorities are as follows:**
  - **NIST ANSI 85 test suite completion**
  - **Full VSAM update and alternate index support**
  - **SQL support**
- **The user community helps set direction**
- **Submit RPI's for fixes and enhancements**
- **Join z390 and zcobol user groups for updates**

Z390 and zCOBOL Documentation

All z390 and zCICS support documentation is on www.z390.org

- **Download link for z390 which includes zCOBOL and zCICS**
- **Support link to submit RPI's for fixes and enhancements**
- **Documentation on assembler, linker, emulator, zCICS support**

- **All the zCOBOL documentation is on www.zcobol.org**
  - **Demo Programs**
  - **User Guide**
  - **NIST ANSI 85 COBOL Test Suite Results**
  - **Options**
  - **Regression Test Programs**
  - **zCOBOLGroup – join zcobol-subscribe@yahoogroups.com**