C07

The LE Zone Revisited

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Transaction & Messaging Technical Conference
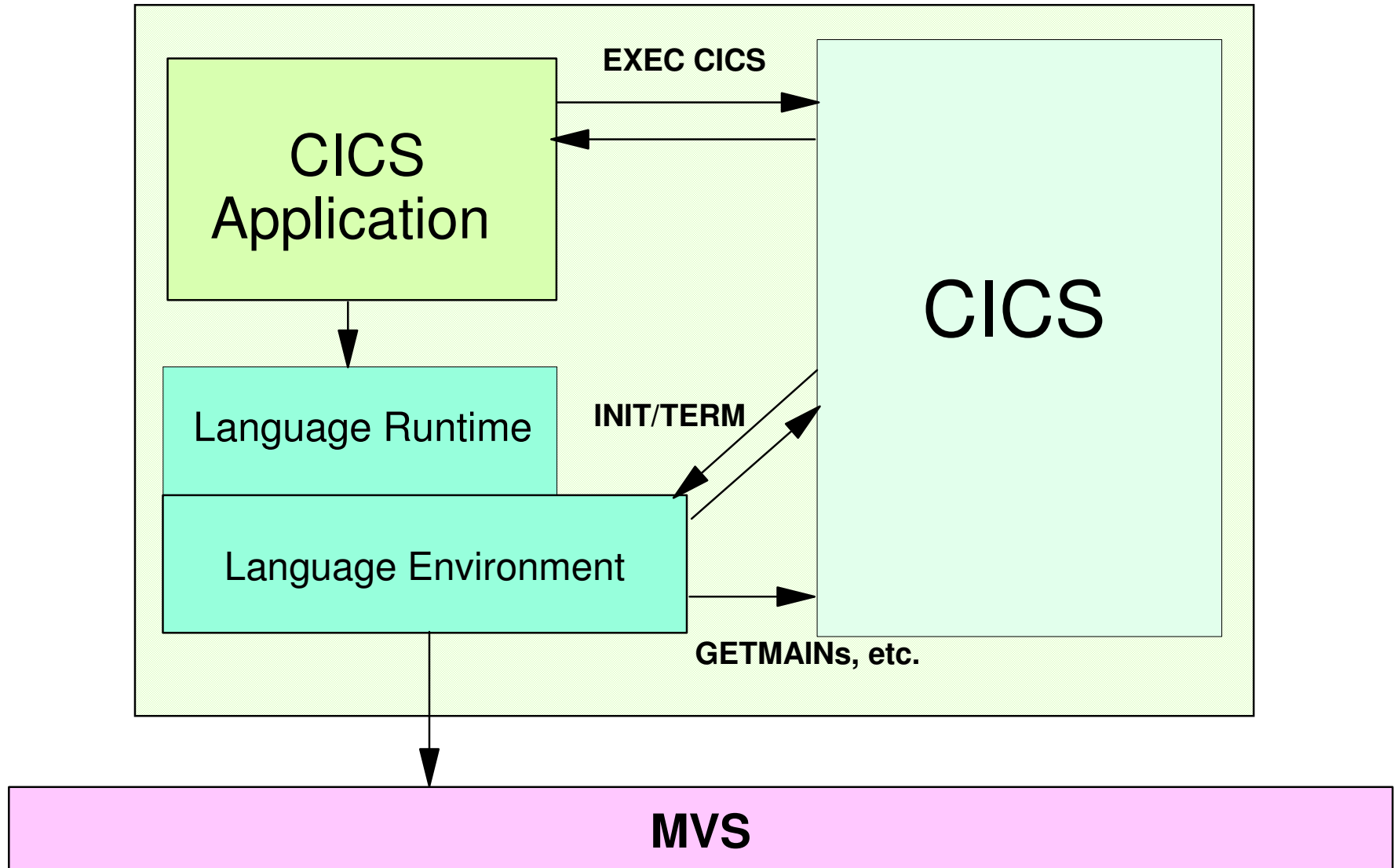
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Agenda

- **The Basics**
- **Installation Considerations**
- **Translator News**
- **Runtime Options**
- **LE and Storage**
- **Storage Tuning**
- **Abends and Error Handling**
- **New Functions and Changes**
- **Dump and Trace Enhancements**

Where LE fits

Notes: Language Environment - What is It?

- **Common runtime environment for participating HLLs**
  - ‣ **Combines key runtime services**
    - ▪ **Message handling**
    - ▪ **Condition handling**
    - ▪ **Storage management**
- **Set of interfaces consistent across program languages**
  - ‣ **Can be called directly or implicitly**
- **Past problems**
  - ‣ **Ability to call each other and behave consistently across operating systems**
  - ‣ **Different rules for:**
    - ▪ **Implementing data structures**
    - ▪ **Condition handling**
    - ▪ **Interfacing with system services and library routines**
- **Supported by CICS/ESA V3.3 and later**
- **Basic services**
  - ‣ **Program initialization and termination**
  - ‣ **Storage allocation**
  - ‣ **Communications between programs in different languages**
    - ▪ **Using HLL call statements**
  - ‣ **Indicate handling conditions**
- **Common library services**
  - ‣ **Math**
  - ‣ **Date and time**
- **Language specific**

Terminology

- ***Process*** - collection of resources (code and data)
  - ▸ Highest level of LE program management model
  - ▸ CICS equivalent is a transaction
- ***Enclave*** - collection of routines
  - ▸ COBOL equivalent is "run unit"
  - ▸ C/C++ equivalent is "program" (main C function and sub functions)
  - ▸ PL/I equivalent is "main procedure and subroutines"
  - ▸ CICS equivalent is "program level"

LE and COBOL Differences

- **VS COBOL II run unit**
  - ▸ Storage and runtime options managed at transaction level

- **Language Environment enclave**
  - ▸ Storage and runtime options managed at enclave level

★ **Impact**
  - ★ Increased LE GETMAIN/FREEMAIN activity for LINK and XCTL
  - ★ Run-time options not inherited by nested enclaves
  - ★ Consider using CALL instead of LINK

Installation Considerations

- **Start with BEST-TO-DATE maintenance for LE AND CICS**
- **Add LE PPT entries**
  - ‣ Use CEECCSD in SCEESAMP
    - ▪ *Watch changes when migrating to a new release*
  - ‣ Autoinstall can be used
    - ▪ Installs everything
    - ▪ Watch PQ58277!
- **Add CEE group to GRPLIST**
- **Add LE DCT entries**
  - ‣ Use CEECDCT in SCEESAMP or DFHDCT2$
    - ▪ RDO can be used in CICS TS 1.3 and onward
  - ‣ CESE - messages, dumps, reports, C/C++ stderr output, PL/I stream output
  - ‣ CESO - C/C++ stdout stream output

Notes: Installation Considerations

- **Increase ERDSA - how much depends on languages used**
  - ‣ LE runtime is larger than older COBOL, PL/I runtimes
  - ‣ LE in z/OS 1.2 CEEEV003 (C++) size is 3180K
- **Increase UDSA/EUDSA - how much depends on runtime options used and application behavior**
  - ‣ Excessive LINK levels can eat up storage
  - ‣ Runtime options that force below the line storage use
- **Potential region size increase**

Installation Considerations ...

- **Adding LE to CICS startup**
  - ‣ STEPLIB/JOBLIB/LINKLST
  - ‣ Add SCEERUN - must be authorized
  - ‣ Remove libraries with runtime routines from earlier versions of COBOL or C/370

- **DFHRPL**
  - ‣ Add SCEECICS <=== **MUST be ahead of SCEERUN!!**
  - ‣ Add SCEERUN

OS/390 R2.10 Migration - HIPER

- **CEEQMATH is merged with 3 other modules into one module in CEEPLPKA**
- **Separate CEEQMATH load module no longer shipped**
- **CICS tries to load CEEQMATH from DFHRPL before LE initialization**
- **LE doesn't initialize - NO DFHAP1203 message produced**
  - PQ35302/UQ40919 (CICS R4.1)
  - PQ40678/UQ47316 (CICS TS R1.1)
  - PQ35306/UQ40920 (CICS TS R1.2)
  - PQ35306/UQ40921 (CICS TS R1.3)

Notes: OS/390 R2.10 Migration

In OS/390 R2.10, modules CEEPLPKA, CEEQMATH, CEEOVLD and CEELCLE into a single load module named CEEPLPKA. Since CICS/ESA 3.3, CICS has loaded the CEEQMATH module from DFHRPL before calling LE for partition initialization. If CICS cannot load the CEEQMATH module, the call to initialize LE is not made.

So, since there is no longer a separate CEEQMATH module, DFHAPLI2 has been changed to look for CEEPLPKA rather than CEEQMATH.

Without the appropriate PTF for this problem, LE will not initialize in an OS/390 R2.10 environment!!

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Translator Options

- **COBOL3**
  - Translate programs compiled by COBOL/370, COBOL for MVS, or COBOL for OS/390
  - Allows programs to exploit enhancements of new COBOL compilers
    - Lower and mixed case input for:
      - Translator options
      - EXEC CICS commands (keywords and arguments)
      - CBL and PROCESS statements
      - Compiler directives (EJECT, SKIP1)
    - No translation done from lower to upper case
      - Make sure names of files, transactions, etc. match external definition
    - **Make sure that all included copybooks are pre-translated with COBOL3 option if using non-integrated translator**
  - **Now the default in CICS TS 2.2**
    - COBOL2, ANSI85, LANGLVL, FE options are obsolete
  - Added by PN70904

Translator Options ...

- **MAIN**
  - ➤ (C/C++ only)
  - ➤ Requests translator to insert declaration of 'dfheiptr ptr' in translated program
  - ➤ Implies that source contains a main function
  - ➤ MAIN is the default
- **NOMAIN**
  - ➤ Requests translator to insert declaration of 'dfheiptr ptr' with the 'extern' attribute.
  - ➤ Implies that source does NOT contain a main function
- **Introduced with PQ25450**

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Notes: Translator Output Using COBOL2

Working storage

```
01  DFHEID0 PICTURE S9(7) COMPUTATIONAL-3 VALUE ZERO.
01  DFHEIB0 PICTURE S9(4) COMPUTATIONAL VALUE ZERO.
01  DFHEICB  PICTURE X(8) VALUE IS '        '.
01  DFHB0040  COMP PIC S9(8).
01  DFHB0041  COMP PIC S9(8).
            .
            .
01  DFHC0030  PIC X(3).
01  DFHDUMMY COMP PIC S9(4) VALUE ZERO.
01  DFHEIV0  PICTURE X(77).
```

EXEC CICS command expansion

```
*EXEC CICS SEND MAP('MENU') MAPSET('DFH0CGA')
*         MAPONLY ERASE END-EXEC.
    MOVE '   0              00028   ' TO DFHEIV0
    MOVE 'MENU' TO DFHC0070
    MOVE LENGTH OF DFHEICB TO DFHB0020
    MOVE 'DFH0CGA' TO DFHC0071
  CALL 'DFHEI1' USING DFHEIV0  DFHC0070 DFHEICB DFHB0020
  DFHC0071.
```

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Notes: Translator Output Using COBOL3

Working storage

```
01    dfhb0020   comp pic s9(4) is global.
01    dfhb0021   comp pic s9(4) is global.
01    dfhb0022   comp pic s9(4) is global.
01    dfhb0023   comp pic s9(4) is global.
01    dfhb0024   comp pic s9(4) is global.
01    dfhb0025   comp pic s9(4) is global.
```

EXEC CICS command expansion

```
*EXEC CICS SEND MAP('MENU') MAPSET('DFH0CGA')
*         MAPONLY ERASE END-EXEC.
    Call 'DFHEI1' using by content x'1804f0000700000000
-    '05620400007200000 20f0f0f0f2f8404040' by content
-    'MENU    ' by content x'4040404040404040' by content
-    x'0000' by content 'DFH0CGA'
    end-call.
```

Make sure that all included copybooks are pre-translated with COBOL3 option

CICS Integrated Translator

- Eliminates separate translation step
- Eliminates the need to translate included members separately
- Should specify DFHELII stub routine
- Must specify CICS, LIB, NODYNAM, RENT and NOANALYZE compile options
- Specifying translator options
  - COBOL
    - // PARM='NODYNAM,LIB,OBJECT,RENT,MAP,XREF,CICS(''NODEF,SP'')
    - Don't use SIZE(MAX) compile option
  - PL/I
    - PP(CICS('opt1 opt2 optn ...'))
    - XOPTS option not allowed
- DB2 coprocessor for SQL statements
  - Requires DB2 V7
  - Produces DBRM

CICS Integrated Translator ...

- ## Requires:
  - ► CICS TS 2.2
  - ► IBM COBOL for OS/390 and VM Version 2 Release 2, with APAR PQ45462, PQ49375, and PQ55290, or Enterprise COBOL for z/OS and OS/390 Version 3.
  - ► VisualAge PL/I for OS/390, Version 2 Release 2.1, with APAR PQ45562 and PQ51233, or Enterprise PL/I for z/OS and OS/390 Version 3.

CICS-Supplied Procedures - CICS TS 2.2

Language	LE-conforming compilers			Non-LE-conforming compilers	
	Online	EXCI	Integrated Translator	Online	EXCI
Assembler	-	-	-	**DFHEITAL**	**DFHEXTAL**
C	DFHYITDL	DFHYXTDL	-	-	-
C++	DFHYITEL	DFHYXTEL	-	-	-
COBOL	DFHYITVL	DFHYXTVL	DFHZITCL	-	-
PL/I	DFHYITPL	DFHYXTPL	DFHZITPL	-	-

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Linkedit Tips

- **COBOL/370, COBOL/MVS, and COBOL/390**
  - ‣ Use DFHELII stub (or DFHECI)
    - ▪ Should use DFHELII for integrated translator
- **VS COBOL II or OS/VS COBOL**
  - ‣ Use DFHECI stub
  - ‣ Don't link with IGZETUN
    - ▪ Not supported
    - ▪ Causes message IGZ0014W to be logged
- **C/C++ MUST be linked RMODE(ANY) AMODE(31)**

Linkedit Tips ...

- **PL/I**
  - ► CEESTART is only entry point for PL/I for MVS and VM
  - ► To relink OS PL/I modules with LE for MVS and VM

```
INCLUDE  SYSLIB(CEESTART)
INCLUDE  SYSLIB(CEESG010)
INCLUDE  SYSLIB(DFHELII)
REPLACE  DFHPL1OI
REPLACE  IBMFEPIA
REPLACE  PLISTART
CHANGE   IBMBINT(CEEBINT)
CHANGE   PLIMAIN(CEEMAIN)
         .        Other REPLACE statements if needed
         .
INCLUDE  objlib(objmod)
ORDER CEESTART
ENTRY CEESTART
NAME loadmod(R)
```

LE Runtime Options

- **CEEDOPT CSECT specifies runtime options**
  - ► **"Online" version**
    - Found in SCEESAMP(CEECOPT)
    - Linked as part of CEECCICS
    - Has storage options optimized for online use
      - **ALL31=((ON),OVR)**
      - **HEAP=((4K,4080,ANYWHERE,KEEP,4K,4080),OVR)**
      - **STACK=((4K,4080,ANYWHERE,KEEP,4K,4080),OVR)**
  - ► **"Batch" version**
    - Found in SCEESAMP(CEEDOPT)
    - Has much larger storage options
      - **ALL31=((OFF),OVR)** *
      - **HEAP=((32K,32K,ANYWHERE,KEEP,8K,4K),OVR)**
      - **STACK=((128K,128K,BELOW,KEEP),OVR)** *
    - * **In z/OS 1.2, these values change to:**
      - **ALL31=((ON),OVR)**
      - **STACK=((128K,128K,ANYWHERE,KEEP),OVR)**

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Specifying Runtime Options

- **Java programs and CICS IIOP services use the LE preinitialization module CEEPIPI**

  ‣ **Uses "batch" version of CEEDOPT**

- **Normal CICS tasks, such as those started from a terminal, set LE runtime options using:**

  1. **Globally (Installation defaults)**
     ◆ "Online" version of CEEDOPT in CEECOPT
  2. **Region-wide options**
     ◆ CEEROPT
  3. **By program**
     ◆ CEEUOPT
     ◆ #pragma runopts
        ‣ **C programs**
     ◆ DECLARE PLIXOPT
        ‣ **PL/I programs**
  4. **Dynamically with CLER**

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Using CEEROPT

1. **Use CEEWROPT JCL in SCEESAMP**

2. **Copy in CEECOPT member from SCEESAMP**

3. **Change CSECT name and labels from CEEDOPT to CEEROPT**

4. **Change the options on the CEEXOPT macro**
   - ► **Specify only those options you want to be different from the defaults**

5. **Assemble and linkedit into YOURLIB**

6. **Place YOURLIB in the DFHRPL concatenation**
   - ► **NOT in STEPLIB**
   - ► **Does not need to be authorized**

7. **Define CEEROPT with CEDA in a group**

Notes: Using CEEROPT - Sample JCL

This is a sample job to assemble and link CEEROPT

```
//USASSC2R JOB ,'CICSROPT',CLASS=A,MSGCLASS=C,NOTIFY=USASSC2
//********************************************************************
//*   JOB TO CREATE REGION-WIDE RUN-TIME OPTIONS DEFAULTS           *
//********************************************************************
//STEP1 EXEC PGM=ASMA90,PARM='DECK,NOOBJECT'
//SYSPRINT DD SYSOUT=*
//SYSUT1 DD UNIT=SYSDA,SPACE=(CYL,(1,1))
//SYSUT2 DD UNIT=SYSDA,SPACE=(CYL,(1,1))
//SYSUT3 DD UNIT=SYSDA,SPACE=(CYL,(1,1))
//SYSPUNCH DD DSN=&&TEMPOBJ(CEEROPT),DISP=(,PASS),UNIT=SYSDA,
// SPACE=(TRK,(1,1,1)),DCB=(BLKSIZE=3120,LRECL=80,DSORG=PO)
//SYSLIB DD DISP=SHR,DSN=PP.ADLE370.ZOS120.SCEEMAC
//         DD DSN=SYS1.MACLIB,DISP=SHR
//SYSIN DD *
CEEROPT  CSECT
CEEROPT  AMODE ANY
CEEROPT  RMODE ANY
         CEEXOPT                                                  X
                 STORAGE=((00,NONE,NONE,0K),OVR),                 X
                 TERMTHDACT=((MSG,CICSDDS,96),OVR),               X
                 USRHDLR=((CEEWUCHA),OVR)
         END
/*
//STEP2    EXEC  PGM=IEWL,
//               PARM='NCAL,RENT,LIST,XREF,LET,MAP,SIZE=(9999K,96K)'
//SYSPRINT DD  SYSOUT=*
//SYSUT1   DD  UNIT=SYSDA,SPACE=(TRK,(5,5))
//SYSLMOD  DD  DSN=MARDIEG.CICSPLUT.LOADLIB,DISP=SHR
//SYSLIB   DD  DSN=&&TEMPOBJ,DISP=(OLD,PASS)
//SYSLIN   DD  *
 INCLUDE SYSLIB(CEEROPT)
  ENTRY   CEEROPT
  ORDER   CEEROPT
  NAME    CEEROPT(R)
/*
```

Using CEEUOPT

1. **Use CEEUOPT in SCEESAMP**
2. **JCL is in CEEWUOPT in SCEESAMP**
3. **Modify CEEUOPT to include desired run-time options**
   - ► *Only include those options to be changed*
4. **Run CEEWUOPT to assemble and link CEEUOPT**
5. **Compile and link program to use special run-time options**

Note: Understand the implications of CEEUOPT!

- ◆ You must remember it is there
- ◆ You must remember which programs are using it
- ◆ It may need to be changed when the LE release changes

Notes: Using CEEUOPT

This is a sample job to assemble and link CEEUOPT

```
//CICSU5L  JOB (89875Y),'GIBBS.RALVMS',MSGCLASS=H,MSGLEVEL=(1,1),
//    CLASS=B,NOTIFY=CICSU5
//*****************************************************************
//*  JOB TO CREATE APPLICATION-SPECIFIC RUN-TIME OPTIONS DEFAULTS    *
//*****************************************************************
//MAGLIB    JCLLIB ORDER=CICSLVL2.CICSR410.GIBBS
//STEP1 EXEC PGM=ASMA90,PARM='DECK,NOOBJECT'
//SYSPRINT DD SYSOUT=*
//SYSUT1 DD UNIT=SYSDA,SPACE=(CYL,(1,1))
//SYSUT2 DD UNIT=SYSDA,SPACE=(CYL,(1,1))
//SYSUT3 DD UNIT=SYSDA,SPACE=(CYL,(1,1))
//SYSPUNCH DD DSN=&&TEMPOBJ(CEEUOPT),DISP=(,PASS),UNIT=SYSDA,
// SPACE=(TRK,(1,1,1)),DCB=(BLKSIZE=6160,LRECL=80,DSORG=PO)
//SYSLIB DD DSN=LE370.V1R7M0.SCEEMAC,DISP=SHR
//         DD DSN=SYS1.MACLIB,DISP=SHR
//SYSIN DD *
CEEUOPT   CSECT
CEEUOPT   AMODE ANY
CEEUOPT   RMODE ANY
          CEEXOPT ABPERC=(),                                      X
                  ALL31=(OFF)
          END
/*
//STEP2     EXEC  PGM=IEWL,
//          PARM='NCAL,RENT,LIST,XREF,LET,MAP,SIZE=(9999K,96K)'
//SYSPRINT DD  SYSOUT=*
//SYSUT1    DD  UNIT=SYSDA,SPACE=(TRK,(5,5))
//SYSLMOD   DD  DSN=CICSLVL2.CICSR410.GIBBS.LOADLIB,DISP=SHR
//SYSLIB    DD  DSN=&&TEMPOBJ,DISP=(OLD,PASS)
//SYSLIN    DD  *
 INCLUDE SYSLIB(CEEUOPT)
 ENTRY    CEEUOPT
 ORDER    CEEUOPT
 NAME     CEEUOPT(R)
/*
```

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Notes: Using CEEUOPT ...

This is a sample job to compile and link a program to include a CEEUOPT module

```
//CICSU5LE JOB (89875Y),'GIBBS.RALVMS',MSGCLASS=H,
//          MSGLEVEL=(1,1),CLASS=B,NOTIFY=CICSU5
//*
//*************************************************
//* TRANSLATE, COMPILE, AND LINK USING LE/370
//*************************************************
//MAGLIB    JCLLIB ORDER=CICSLVL2.CICSR410.GIBBS
//STEP1     EXEC DFHYITVL,OUTC='*'
//TRN.SYSIN  DD DSN=CICSLVL2.CICSR410.SDFHSAMP(DFH0CMNU),
//              DISP=SHR
//LKED.SYSLMOD DD DSN=CICSLVL2.CICSR410.GIBBS.LOADLIB,
//              DISP=SHR
//LKED.SYSIN DD *
   INCLUDE SYSLIB(CEEUOPT)
   NAME DFH0CMNU(R)
/*
```

Dynamic Runtime Options

- ## New CLER transaction
  - ‣ Display current runtime options
    - ▪ Optionally direct report to CESE
  - ‣ Dynamic LE runtime modification
    - ▪ TRAP, RPTOPTS/RPTSTG, ALL31, CBLPSHPOP, TERMTHDACT
  - ‣ PQ38838 (LE)

```
 CLER                                                       ARCH IYK2Z7O2


               Language Environment Region Level Runtime Options


 Type in your Choices.


 Runtime option      Choice  Possible choices.


 TRAP            ==>  ON      ON, OFF
 RPTOPTS         ==>  OFF     ON, OFF
 RPTSTG          ==>  OFF     ON, OFF
 ALL31           ==>  ON      ON, OFF
 CBLPSHPOP       ==>  ON      ON, OFF
 TERMTHDACT      ==>  MSG     QUIET,MSG,TRACE,DUMP,UAONLY,UATRACE,UADUMP,UAIMM


 When finished, press ENTER.
 PF:  1=Help    3=Quit    5=Current Settings   9=Error List
```

Dynamic Runtime Options ...

- **Display LE runtime options with CLER transaction**

```
 CLER                                                       PAGE 1 OF 6


              Language Environment Region Level Runtime Options.


 Current Settings


 LAST WHERE SET           OPTIONS
 --------------------     ---------------------------------------------
 Installation default     ABPERC(NONE)
 Installation default     ABTERMENC(ABEND)
 Installation default    NOAIXBLD
 Installation default     ALL31(ON)
 Installation default     ANYHEAP(4096,4080,ANYWHERE,FREE)
 Installation default    NOAUTOTASK
 Installation default     BELOWHEAP(4096,4080,FREE)
 Installation default     CBLOPTS(ON)
 CICS CLER Trans          CBLPSHPOP(OFF)
               .
 Region default           STORAGE(00,NONE,NONE,0)
 Region default           TERMTHDACT(MSG,CICSDDS,96)
               .


 PF:  1=Help   3=Quit   8=Forward   10=RPT->CESE
```

Important CICS Runtime Options

LE370.SCEESAMP(CEECOPT) - z/OS 1.2 DEFAULTS

```
CEEDOPT   CSECT
CEEDOPT   AMODE ANY
CEEDOPT   RMODE ANY
          CEEXOPT ,                                              X
                  ABTERMENC=((ABEND),OVR),                       X
                  ALL31=((ON),OVR),                              X
                  ANYHEAP=((4K,4080,ANYWHERE,FREE),OVR),         X
                  BELOWHEAP=((4K,4080,FREE),OVR),                X
                  CBLOPTS=((ON),OVR),                            X
          *       CBLPSHPOP=((ON),OVR),                          X
                  HEAP=((4K,4080,ANYWHERE,KEEP,4K,4080),OVR),    X
                  HEAPCHK=((OFF,1,0),OVR),                       X
                  LIBSTACK=((32,4080,FREE),OVR),                 X
                  RPTOPTS=(OFF,OVR),                             X
                  RPTSTG=((OFF),OVR),                            X
                  STACK=((4K,4080,ANYWHERE,KEEP,4K,4080),OVR),   X
          *       STORAGE=((NONE,NONE,NONE,0K),OVR),             X
          *       TERMTHDACT=((TRACE,CESE,96),OVR),              X
                  TRAP=((ON),OVR)
          END
```

* You may want to change the defaults on these runtime options.

Notes: Runtime Options

Note: The previous page shows **only a subset** of the runtime options in the CEECOPT member, but they are some of the more important ones in a CICS environment and can have storage and performance impacts.   While the previous page shows some of the more important runtime options in a CICS environment, remember that **ALL** runtime options must be specified in the CEECOPT member.

Remember, runtime options can change from release to release and may have new defaults or additional sub-parameters. It's important to check the new defaults in each new release.

The **OVR** parameter indicates whether the runtime option may be overridden or not.

LE and Storage

- **LE uses more storage than language-specific runtimes**
  - ► Allocates/frees storage for each enclave
    - ▪ VS COBOL II, COBOL for MVS and VM and COBOL for OS/390
    - ▪ Not for OS/VS COBOL
- **Has more storage areas than language-specific runtimes**
  - ► STACK, LIBSTACK, HEAP, ANYHEAP, BELOWHEAP
- **LE has more and bigger control blocks**
- **LE runtime load modules are bigger**
  - ► LE 2.10 - 4.8M
- **Your programs will be bigger!**
  - ► More CSECTs are linkedited
    - ▪ `DFH0CALL compiled with VS COBOL II          x'1B28'   (dec 6952)`
    - ▪ `DFH0CALL compiled with LE COBOL             x'2560'   (dec 9568)`
    - ▪ `DFH0CALL compiled with LE COBOL and COBOL3  x'2478'   (dec 9336)`
    - ▪ `DFH0CALL compiled with integrated translator x'24E8'   (dec 9448)`

LE Storage Areas

- **Stack storage**
  - ‣ Contiguous area automatically allocated at run unit initialization
  - ‣ Used for routine linkage and automatic storage
    - ▪ C and PL/I automatic storage
    - ▪ COBOL local storage
  - ‣ User and LIBSTACK

- **Heap storage**
  - ‣ Dynamically allocated when a routine first requests storage
  - ‣ Stays until enclave terminates (or explicitly frees it)
  - ‣ COBOL - working storage, TGT
  - ‣ PL/I - CONTROLLED or BASED variables
  - ‣ PL/I - storage allocated by ALLOCATE statements
  - ‣ C/C++ - variables allocated from malloc(), calloc(), or realloc()

Notes: HEAP Storage

HEAP storage comes in two flavors: user and runtime. The ANYHEAP and BELOWHEAP parameters represent storage used by the runtime. The HEAP parameter specifies *user* HEAP storage. Looking at a RPTSTG report, you will see the term HEAP24. This represents the amount of user HEAP storage that is allocated below the 16Mb line. The HEAP parameter is specified as:

HEAP=(*init_size, incr_size*, <u>ANYWHERE</u>|ANY|BELOW, <u>KEEP</u>|FREE, *initsz24*,
    incrsz24, <u>OVR</u>|NOVR)

If ALL31(OFF) is in effect, and the application is running 24 bit mode, but HEAP(,,ANY) is specified, then the HEAP(,,,initsz24,incrsz24) values take effect. This is where you will see HEAP24 values.

LE Storage Areas ...

- **Thread Work Area (LE_TWA)**
  - ► Process (task) level storage
  - ► One per task
  - ► Includes PICB, PCB, dummy stack, dummy CAA
  - ► Not related to runtime options

- **Run Unit Work Area (LE_RUWA)**
  - ► Enclave level storage
  - ► Includes EICB, TICB, language work area, *initial* STACK, *initial* LIBSTACK, *initial* HEAP, *Initial* ANYHEAP
  - ► Use RUWAPOOL=YES SIT parm for better performance
    - ■ CICS APAR PQ16844 (R4.1), PQ19370 (CICS TS R1 and R2)
    - ■ Must be used with LE APAR PQ14888

CICS Storage-Related Runtime Options

- **Recommended storage-related runtime options ***

```
ALL31=(ON),
ANYHEAP=(4K,4080,ANYWHERE,FREE),
BELOWHEAP=(4K,4080,FREE),
HEAP=(4K,4080,ANYWHERE,KEEP,4K,4080),
HEAPCHK=(OFF,1,0,0),
LIBSTACK=(32,4080,FREE),
RPTOPTS=(OFF),
RPTSTG=(OFF),
STACK=(4K,4080,ANYWHERE,KEEP,4K,4080)
```

* *ALL storage related options* should be evaluated and optimized for use by <u>YOUR</u> applications. *<u>The ones shown here may not be the optimum for you!!</u>*

Specifying Storage Requirements

- **Storage requirements are defined by:**
  - CEECOPT, CEEROPT, CEEUOPT, #pragma (C), PLIXOPT (PL/I)
    - Must run RPTSTG to determine requirements
    - When programs change, process must be repeated
    - Dynamically called programs affect enclave storage
  - Storage tuning is difficult to manage!
- **Need dynamic tuning of LE runtime options**
  - STACK, HEAP
- **Minimize incremental GETMAIN/FREEMAINs**
  - Performance improvement
- **Remove burden from application programmers to determine storage requirements**
  - Usability improvement

New LE Storage Tuning Options

- **Storage Tuning Exit**
  - ▸ New in LE 2.9
  - ▸ Can collect storage tuning information without RPTSTG(ON)
  - ▸ Can dynamically set STACK, LIBSTACK, HEAP, ANYHEAP, and BELOWHEAP runtime options for selected enclaves
  - ▸ Sample exit provided
    - ■ Requires PQ31185/PQ31262 (CICS R4.1/CICS TS R1 and R2)

- **Dynamic Storage Tuning**
  - ▸ New in LE 2.10
  - ▸ Available with CICS TS 1.3 and up
  - ▸ New AUTODST SIT parameter
  - ▸ Requires PQ42025 (LE) AND PQ39052 (CICS)
    - ■ Also need PQ45031 to run with STGPROT
  - ▸ For more details, see:
    http://www-1.ibm.com/servers/eserver/zseries/zos/le/assist/support/pq42025.html

Storage Tuning Exit

- **Sample exit CEECSTX provided in SCEESAMP**
  - Can collect tuning data OR provide storage tuning values
  - In collection mode, writes 'storage used' information, by enclave, to LESD TD queue
    - STACK, LIBSTACK, HEAP, ANYHEAP, BELOWHEAP
    - Initial, incremental, max, largest used, segments acquired, segments freed
  - **Running in collection mode has serious performance impact**
  - In tuning mode, reads VSAM file containing values to be used and tunes the enclave
    - User creates VSAM file based on LESD information
    - Can provide tuning information for up to 50 programs
    - Sample cannot run with STGPROT=YES as provided

Notes: Storage Tuning Exit

The sample storage tuning exit is member CEEWCSTX in SCEESAMP. It includes code to restore the system EIB, which will cause an 0C4 if running with Storage Protection enabled. You can comment out the MVC instruction after the WRT_WTO1 label to avoid this problem.

```
WRT_WTO1 DS    0H
*        MVC   DFHEIBLK(EIBLENG),EIBSAVE Restore system EIB
```

Note that it is also necessary to have the appropriate PTFs applied for APARs PQ31185 (CICS R4.1) or PQ31262 (CICS TS R1 and R2) so that it is not necessary to restore the system EIB following an EXEC CICS call.

You will need a program to interpret the information written to the LESD TD queue in order to determine the values to supply the VSAM file used as input to the CEECSTX exit when it is running in TUNING mode.

Storage Tuning Exit ...

```
          J E S 2   J O B   L O G  --  S Y S T E M   M V 2 C  --  N O D E   W I N M V S 2 C

19.33.13 JOB01603 ---- FRIDAY,    13 APR 2001 ----
19.33.13 JOB01603  ICH70001I MARDIEG  LAST ACCESS AT 19:31:21 ON FRIDAY, APRIL 13, 2001
19.33.13 JOB01603  $HASP373 MARDIEG5 STARTED - INIT 1    - CLASS M - SYS MV2C
19.33.13 JOB01603  IEF403I MARDIEG5 - STARTED - TIME=19.33.13
19.33.14 JOB01603  DFHPA1101  IYK2Z7O2 DFHSITJP IS BEING LOADED.
19.33.14 JOB01603  DFHPA1108  IYK2Z7O2 DFHSITJP HAS BEEN LOADED. (GENERATED AT: MM/DD= 10/15 HH:MM= 04:31).
19.33.14 JOB01603  DFHPA1100  IYK2Z7O2 OVERRIDE PARAMETERS FROM JCL EXEC STATEMENT: SI
19.33.14 JOB01603  DFHPA1102  IYK2Z7O2 OVERRIDE PARAMETERS FROM SYSIN:
                   --------------  Lines Deleted  ---------------
                       System log (DFHSHUNT) initialization has ended. Log stream
                       MARDIEG.IYK2Z7O2.DFHSHUNT is connected to structure ****************.
19.33.25 JOB01603  +DFHAP1203I IYK2Z7O2 Language Environment/370 is being initialized.
19.33.26 JOB01603  +CEECSTX: Region init
19.33.27 JOB01603  +DFHSO0101I IYK2Z7O2 Sockets domain initialization has ended.
19.33.27 JOB01603  +DFHWB1007 IYK2Z7O2 Initializing CICS Web environment.
19.33.27 JOB01603  +DFHWB1008 IYK2Z7O2 CICS Web environment initialization is complete.
19.33.27 JOB01603  +DFHSI1517 IYK2Z7O2 Control is being given to CICS.
                   --------------  Lines Deleted  ---------------
19.33.51 JOB01603  +CEECSTX: New load module
19.33.51 JOB01603  +CEECSTX:   CICS provides the name
19.33.51 JOB01603  +CEECSTX:   Program name = CEL4RTO
19.33.51 JOB01603  +CEECSTX:   Program not found in file
19.34.29 JOB01603  +CEECSTX: New load module
19.34.29 JOB01603  +CEECSTX:   CICS provides the name
19.34.29 JOB01603  +CEECSTX:   Program name = DFH0CMNU
19.34.29 JOB01603  +CEECSTX: Enclave init
19.34.29 JOB01603  +CEECSTX:   CICS provides the name
19.34.29 JOB01603  +CEECSTX:   Program name = DFH0CMNU
19.34.29 JOB01603  +CEECSTX:   Program found in table
19.34.35 JOB01603  +CEECSTX: New load module
19.34.35 JOB01603  +CEECSTX:   CICS provides the name
19.34.35 JOB01603  +CEECSTX:   Program name = DFH0CALL
19.34.35 JOB01603  +CEECSTX: Enclave init
19.34.35 JOB01603  +CEECSTX:   CICS provides the name
19.34.35 JOB01603  +CEECSTX:   Program name = DFH0CALL
19.34.35 JOB01603  +CEECSTX:   Program found in table
```

Dynamic Storage Tuning

- **Available in CICS TS 1.3 (with OS/390 2.10) when AUTODST=YES is specified in the SIT**
  - ▶ Programs with CEEUOPT/#pragma/PLIXOPT that specify STACK, LIBSTACK, HEAP, BELOWHEAP, or ANYHEAP are not tuned
  - ▶ Tuning performed only on program that starts the enclave
    - ■ Increase the *initial* size based on allocated storage
      - ▶ Not on storage actually used
      - ▶ Size is never decreased
  - ▶ Overhead is minimal
  - ▶ Can result in performance improvement
    - ■ Most benefit seen in applications that use COBOL CALL
      - ▶ Often requires incremental HEAP, STACK storage
    - ■ Less benefit to applications that use only LINKs

LE Storage Tuning

- **ALL31(OFF) - Avoid it!**
  - ‣ Uses more UDSA than VS COBOL II
  - ‣ Causes extra GETMAIN/FREEMAINs
  - ‣ Not required by OS/VS COBOL
    - Only compatibility run-time is used
  - ‣ If you **must**, isolate its usage

- **Storage related runtime defaults are CICS-friendly after LE 2.9 and take the storage check zones (SCZs) into account**
  - ‣ If using pre-LE 2.9:
    - Allocate in bytes rather than K to allow for CICS storage check zones
    - Use 4080 instead of 4K
    - Especially important on *INCREMENTAL* values

LE Storage Tuning ...

- **Review CEECOPT**

- **Consider the AUTODST option**
  - ‣ CICS TS 1.3 and LE 2.10 and up

- **Consider runtime options by REGION (with LE 1.8 and higher and PQ22683)**

- **Run RPTSTG(ON) in TEST regions to determine best values (if running below CICS TS 1.3 and LE 2.10)**
  - ‣ Run on a representative sampling of transactions
  - ‣ Tune toward the 'high end' of requirements to prevent unnecessary GETMAINs

- **Use CEEUOPT only if necessary for exceptions**

Sample RPTOPT Report

How to tell where a runtime option is set

```
TC02MENU 20010414215215 Options Report for Enclave FILECMNU 04/14/01 9:52:15 PM
TC02MENU 20010414215215 Language Environment V02 R10.00
TC02MENU 20010414215215
TC02MENU 20010414215215 LAST WHERE SET           OPTION
TC02MENU 20010414215215
------------------------------------------------------------------------
TC02MENU 20010414215215 Installation default    ABPERC(NONE)
TC02MENU 20010414215215 Installation default    ABTERMENC(ABEND)
TC02MENU 20010414215215 Installation default   NOAIXBLD
TC02MENU 20010414215215 Programmer default      ALL31(OFF)
TC02MENU 20010414215215 Installation default    ANYHEAP(4096,4080,ANYWHERE,FREE)
TC02MENU 20010414215215 Installation default   NOAUTOTASK
TC02MENU 20010414215215 Installation default    BELOWHEAP(4096,4080,FREE)
TC02MENU 20010414215215 Installation default    CBLOPTS(ON)
TC02MENU 20010414215215 Installation default    CBLPSHPOP(ON)
TC02MENU 20010414215215 Installation default    CBLQDA(OFF)
TC02MENU 20010414215215 Installation default    CHECK(ON)
TC02MENU 20010414215215 Installation default    COUNTRY(US)
TC02MENU 20010414215215 Installation default   NODEBUG
TC02MENU 20010414215215 Installation default    DEPTHCONDLMT(10)
TC02MENU 20010414215215 Installation default    ENVAR("")
TC02MENU 20010414215215 Installation default    ERRCOUNT(0)
              ------- (Lines Deleted) -------
```

Sample RPTOPT Report (Cont.)

```
TC02MENU 20010414215215 Storage user exit        HEAP(1984,4080,ANYWHERE,KEEP,4096,4080)
TC02MENU 20010414215215 Installation default     HEAPCHK(OFF,1,0)
TC02MENU 20010414215215 Installation default     LIBRARY(SYSCEE)
TC02MENU 20010414215215 Storage user exit        LIBSTACK(32,4080,FREE)
                 ------- (Lines Deleted) -------
TC02MENU 20010414215215 CICS CLER Trans          RPTOPTS(ON)
TC02MENU 20010414215215 CICS CLER Trans          RPTSTG(ON)
TC02MENU 20010414215215 Installation default    NORTEREUS
TC02MENU 20010414215215 Installation default     RTLS(OFF)
TC02MENU 20010414215215 Installation default    NOSIMVRD
TC02MENU 20010414215215 Storage user exit        STACK(5576,4080,ANYWHERE,KEEP,4096,4080)
TC02MENU 20010414215215 Region default           STORAGE(00,NONE,NONE,0)
TC02MENU 20010414215215 Region default           TERMTHDACT(MSG,,96)
TC02MENU 20010414215215 Installation default    NOTEST(ALL,"*","PROMPT","INSPPREF")
TC02MENU 20010414215215 Installation default     THREADHEAP(4096,4080,ANYWHERE,KEEP)
                 ------- (Lines Deleted) -------
TC02MENU 20010414215215 Installation default     TRACE(OFF,4096,DUMP,LE=0)
TC02MENU 20010414215215 Installation default     TRAP(ON,SPIE)
TC02MENU 20010414215215 Installation default     UPSI(00000000)
TC02MENU 20010414215215 Region default           USRHDLR(CEEWUCHA,)
TC02MENU 20010414215215 Installation default     VCTRSAVE(OFF)
TC02MENU 20010414215215 Installation default     VERSION()
TC02MENU 20010414215215 Installation default     XPLINK(OFF)
TC02MENU 20010414215215 Installation default     XUFLOW(AUTO)
```

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Student Notes

On the RPTOPTS report, the runtime options showing **'Installation Default'** are derived from the global **CEECOPT** module. **'Programmer Default'** options are taken from a **CEEUOPT** module that was linked in with the particular program for this Enclave, although they could also be the result of a #pragma statement on a C/C++ program, or a PLIXOPT statement on a PL/I program.

'Region Default' options are taken from the **CEEROPT** (region options module) in effect for this run of CICS. And those options showing the comment **'CICS CLER Trans'** were specified by the **CLER** transaction during this run of CICS.

Those options showing **'Storage user exit'** were provided by the **Storage Tuning Exi**t.

Sample RPTSTG Report

```
TC02UPDT 20010414230934 Storage Report for Enclave FILECALL 04/14/01 11:09:34 PM
TC02UPDT 20010414230934 Language Environment V02 R10.00
TC02UPDT 20010414230934
TC02UPDT 20010414230934      STACK statistics:
TC02UPDT 20010414230934       Initial size:                                    4096
TC02UPDT 20010414230934       Increment size:                                  4080
TC02UPDT 20010414230934       Maximum used by all concurrent threads:         33128
TC02UPDT 20010414230934       Largest used by any thread:                     33128
TC02UPDT 20010414230934       Number of segments allocated:                       7
TC02UPDT 20010414230934       Number of segments freed:                           0
          ------- (Lines Deleted) -------
TC02UPDT 20010414230934      LIBSTACK statistics:
TC02UPDT 20010414230934       Initial size:                                      32
TC02UPDT 20010414230934       Increment size:                                  4080
TC02UPDT 20010414230934       Maximum used by all concurrent threads:             0
TC02UPDT 20010414230934       Largest used by any thread:                         0
TC02UPDT 20010414230934       Number of segments allocated:                       0
TC02UPDT 20010414230934       Number of segments freed:                           0
          ------- (Lines Deleted) -------
TC02UPDT 20010414230934      HEAP statistics:
TC02UPDT 20010414230934       Initial size:                                    4096
TC02UPDT 20010414230934       Increment size:                                  4080
TC02UPDT 20010414230934       Total heap storage used (sugg. initial size):    976
TC02UPDT 20010414230934       Successful Get Heap requests:                       1
TC02UPDT 20010414230934       Successful Free Heap requests:                      0
TC02UPDT 20010414230934       Number of segments allocated:                       0
TC02UPDT 20010414230934       Number of segments freed:                           0
```

Sample RPTSTG Report (Continued)

```
------- (Lines Deleted) -------
TC02UPDT 20010414230934     ANYHEAP statistics:
TC02UPDT 20010414230934       Initial size:                              4096
TC02UPDT 20010414230934       Increment size:                            4080
TC02UPDT 20010414230934       Total heap storage used (sugg. initial size):     12472
TC02UPDT 20010414230934       Successful Get Heap requests:               190
TC02UPDT 20010414230934       Successful Free Heap requests:              160
TC02UPDT 20010414230934       Number of segments allocated:                 2
TC02UPDT 20010414230934       Number of segments freed:                     0
TC02UPDT 20010414230934     BELOWHEAP statistics:
TC02UPDT 20010414230934       Initial size:                              4096
TC02UPDT 20010414230934       Increment size:                            4080
TC02UPDT 20010414230934       Total heap storage used (sugg. initial size):       168
TC02UPDT 20010414230934       Successful Get Heap requests:                 1
TC02UPDT 20010414230934       Successful Free Heap requests:                0
TC02UPDT 20010414230934       Number of segments allocated:                 1
TC02UPDT 20010414230934       Number of segments freed:                     0
TC02UPDT 20010414230934     Additional Heap statistics:
TC02UPDT 20010414230934       Successful Create Heap requests:              0
TC02UPDT 20010414230934       Successful Discard Heap requests:             0
TC02UPDT 20010414230934       Total heap storage used:                      0
TC02UPDT 20010414230934       Successful Get Heap requests:                 0
TC02UPDT 20010414230934       Successful Free Heap requests:                0
TC02UPDT 20010414230934       Number of segments allocated:                 0
TC02UPDT 20010414230934       Number of segments freed:                     0
TC02UPDT 20010414230934     Largest number of threads concurrently active:   1
TC02UPDT 20010414230934 End of Storage Report
```

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STORAGE Runtime Option

The STORAGE runtime option has the following parameters:
STORAGE(00,NONE,NONE,0K)

Reserve size for out-of-storage condition (not used by CICS). But if you specify a value, a GETMAIN will be done for that amount from below the 16Mb line.

DSA allocation initial image - stack frames, PL/I and C auto storage

Initial image value for free heap storage

Initial image value for allocated heap storage - COBOL working storage, TGT

Notes: STORAGE Runtime Option

The STORAGE(NONE,NONE,NONE,0K) parameter specifies whether storage is to be initialized to binary zeros. **STORAGE(00,NONE,NONE,0K) is the equivalent of WSCLEAR=YES for COBOL.**

The **third** storage parameter *MAY* need to be 00 if running *very old* PL/I programs. **It is a BIG performance hit!**

The **fourth** parameter is not used by CICS, **but if non-zero will cause a GETMAIN for the value specified from below the 16M line.**

TERMTHDACT

TERMTHDACT(<u>TRACE</u>|QUIET|MSG|DUMP|UADUMP|UAONLY|UAIMM|UATRACE,<u>CESE</u>|CICSDDS,<u>96</u>|reg_stor_amt)

- Specifies information to be provided for condition 2 or higher errors

  - *QUIET -* no messages or dumps are written for LE condition 2 or higher errors

  - *MSG* - writes message to MSGUSR

  - *TRACE*

    - ‣ Message indicating the cause of termination

    - ‣ Trace of active routines on the activation stack (traceback)

    - ‣ Runtime options report

Notes: LE Conditions

Conditions are returned from callable services, with 1 being the lowest.

1. Informational and/or warning
2. Error
3. Critical message
4. LE has encountered an internal error

TERMTHDACT ...

TERMTHDACT(Continued)

- ▸ *DUMP*
  - Message indicating the cause of termination
  - Trace of active routines on the activation stack
  - LE dump containing thread/enclave/process storage and control blocks
  - Runtime options report
- ▸ *UADUMP*
  - Message indicating the cause of termination
  - Trace of active routines on the activation stack
  - LE dump containing thread/enclave/process storage and control blocks
  - Runtime options report
  - U4039 transaction dump

TERMTHDACT ...

TERMTHDACT(Continued)

- ► *UAONLY*
  - U4039 transaction dump
- ► *UATRACE*
  - Message indicating the cause of termination
  - Trace of active routines on the activation stack
  - Runtime options report
  - U4039 transaction dump
- ► *UAIMM*
  - Immediately request a dump
    - Prior to condition management processing
    - For software-raised conditions or signals UAIMM behaves just like UAONLY
  - U4039 transaction dump

TERMTHDACT ...

TERMTHDACT(Continued)

- **_CESE_/_CICSDDS_**
  - CESE - LE dump output will be written to the CESE queue
  - CICSDDS - LE dump output will be written to the CICS transaction dump
- **_reg_stor_amt_ = (** 96 | 0-256 **)**
  - Controls the amount of storage dumped around registers
  - Default is 96 bytes
  - Introduced by PQ39636
- **TERMTHDACT=(TRACE,CESE,96) is the CICS default**
- **_TRACE, DUMP, UADUMP_, and _UATRACE_ written to CESE cause _LOTS_ of writes and _hurt performance_**
- **_TERMTHDACT(MSG)_ is recommended for CICS in production if using the CESE default**

Abends and Error Handling

Condition handling varies depending on whether a CICS HANDLE ABEND is active or not:

- **If *active*:**
  - ‣ LE condition handling does not get control
  - ‣ Action specified by CICS HANDLE ABEND is taken
  - ‣ User-written condition handlers registered using CEEHDLR are ignored

- **If *inactive*:**
  - ‣ LE condition handling gets control if TRAP(ON) option is specified
  - ‣ Normal LE condition handling is performed

- **CICS HANDLE CONDITION and HANDLE AID are *not affected* by LE condition handling**

Notes: The TRAP Runtime Option

- TRAP(**ON**|OFF)
  - ▸ Specifies whether LE routines handle abends and program interrupts
  - ▸ Similar to STAE|NOSTAE option in COBOL, C, and PL/I and to SPIE|NOSPIE in C and PL/I
  - ▸ With *TRAP(OFF)*:
    - *ABTERMENC has no effect*
    - *Abnormal termination exit is not driven for enclave termination*
    - *Assembler user exit is not driven for enclave termination*
    - *User condition handlers are not enabled*
    - *No LE messages or LE dump output is generated*
    - *Standard CICS system action occurs*
    - *COBOL and PL/I error handlers for conditions like ON SIZE and ON UNITs are not invoked*
  - ▸ With *TRAP(ON)*:
    - *LE condition handler is fully enabled*
    - *TRAP(ON) is required when using LE callable services*

Abends and Error Handling ...

Changes in abend timing

- **VS COBOL II detected abends**
  - Write error message
  - Issue 1xxx abend

- **LE detected abends**
  - Signal software-generated condition
  - LE condition manager gives control to any registered user condition handlers
  - If condition is unhandled, enclave is terminated and 4038 abend is issued
    - 4038 abend is issued with NODUMP and CANCEL options
  - Terminating the enclave before the abend is issued means that a HANDLE ABEND LABEL does not get control

Abends and Error Handling ...

- **For compatible error handling use CEEWUCHA user condition handler**
  - ‣ Signal software-generated condition
  - ‣ LE condition manager gives control to any registered user condition handlers
  - ‣ CEEWUCHA gets control
    - ▪ Writes error message
    - ▪ Produces an LE dump
    - ▪ Issues 1xxx abend (COBOL)
    - ▪ Allows HANDLE ABEND to get control

Notes: CEEWUCHA

What is it?

CEEWUCHA is a sample LE Condition Handler that can be registered via the USRHDLR() runtime option. It was introduced in LE R1.5 and R1.6 by PN89393 (9703). As of LE R1.7 and above, it is shipped with the product.

What does it do?

CEEWUCHA is designed to provide compatibility with existing VS COBOL II applications running under CICS.   It will:

 - Change the basic defaults of Language Environment's condition handling. HANDLE ABEND LABEL will get control when a runtime error (such as IGZ0061S) occurs.

- Convert all unhandled COBOL runtime detected errors to the corresponding user 1xxx abends issued by VS COBOL II.

- Cause LE's condition handling to ignore and not print COBOL's message IGZ0014W, which is generated when IGZETUN or IGZEOPT is linkedited with a VS COBOL II application.

It can also be used to put back PL/I APLS abends for PL/I raised sev2+ conditions that go unhandled.

Notes: CEEWUCHA (Cont.)

How it works

When the CEEWUCHA exit is used in conjunction with the LE runtime option of TERMTHDACT(MSG), you will receive COBOL 1xxx abends instead of LE 4038 abends. You will receive CICS transaction dumps showing the COBOL II abend and NOT the LE 4038 abend, which is issued with the CANCEL and NODUMP options.

When an error occurs, LE will look for registered error handlers starting with the current routine (current stack frame) that received the error, and will work its way back to stack frame 0. If none are found, then CEEWUCHA receives control. See item BDC000011401.

CEEWUCHA will convert the abend code to the 1xxx COBOL abend, write a message and the trace information to the CESE transient data queue, and take a CICS transaction dump containing the 1xxx abend.

Since it is supplied as a usermod with source provided, you can alter CEEWUCHA's actions, such as preventing traceback information from being written to the CESE queue.

Where is it located?

The sample code for the exit is located in the SCEESAMP library in the CEEWUCHA member.

Notes: CEEWUCHA (Cont.)

How is it installed?

There is a sample SMP/E install job in the SCEESAMP library in the CEEWUCHA member. You will need to add a program definition for CEEWUCHA in the CSD (preferably in the CEE group).

You will need to code a **USRHDLR (CEEWUCHA)** entry in the CEECOPT member and install the new option or use it as an override in the CEEUOPT member for individual programs.

How does CEEWUCHA relate to CEEBXITA?

CEEWUCHA is an error handler that receives control prior to the LE Abend-Termination Exit (CEEBXITA). Dumps can be taken during the error handler rather than in the termination exit because the program has not terminated yet.

Note that by default, CEEWUCHA calls CEE3DMP, which causes output to CEEMSG (CESE). To suppress the dump, simply comment out the CALL statement to CEE3DMP in the sample CEEWUCHA exit.

Notes: CEEWUCHA (Cont.)

What does this mean in a non-COBOL II environment?

I ran some tests to see whether I would still get my 1xxx abends in CICS TS 2.2. I had modified one of the CICS sample programs to force a subscript overflow. With CEEWUCHA specified as the USRHDLR, and with the sample program translated and compiled with CICS TS 1.3 libraries and COBOL II runtime libraries, I got my 1006 abend.

Using the same program (translated and compiled on CICS TS 1.3 with COBOL II runtime libraries) but without specifying CEEWUCHA as a USRHDLR, I got a 4038 abend.

When I recompiled the program using the CICS TS 2.2 procs and LE libraries, I got an AICA abend both with and without CEEWUCHA present.

VS COBOL II Compatibility

Abend codes

- VS COBOL II runtime issues abend code 1xxx when error is detected
- LE runtime issues abend 4038
- CEEWUCHA converts unhandled runtime detected errors to 1xxx abend codes

IGZ0014W messages

- Programs linked with IGZETUN or IGZEOPT cause IGZ0014W message
- CEEWUCHA can suppress them for better performance

CBLPSHPOP

- CBLPSHPOP(**ON**|OFF)
  - ▸ Controls whether CICS PUSH/POP HANDLE commands are issued when VS COBOL II or LE COBOL subroutines are called
  - ▸ Suspend/restore current effects of EXEC CICS:
    - IGNORE CONDITION
    - HANDLE ABEND
    - HANDLE AID
    - HANDLE CONDITION
  - ▸ VS COBOL II issues PUSH/POP HANDLE automatically on CALLS to COBOL subroutines
    - Without PUSH HANDLE, a subroutine inherits any IGNORE or HANDLE from the caller
    - Without POP HANDLE, the caller inherits any IGNORE or HANDLE effects invoked by the subroutine

CBLPSHPOP ...

- May need CBLPSHPOP(ON) if:
  - ► Calling program contains
    - ◾ IGNORE CONDITION
    - ◾ HANDLE ABEND PROGRAM(program)
  - ► Subroutine contains
    - ◾ IGNORE CONDITION
    - ◾ HANDLE ABEND
    - ◾ HANDLE AID
    - ◾ HANDLE CONDITION

- Performance is MUCH better with CBLPSHPOP(OFF)

New Functions and Changes

- **LE Control Block isolation**
  - ► Overlays of LE control blocks can cause every transaction using LE to abend
  - ► Allocate LE region level control blocks from CICS-key storage
    - ▪ When STGPROT is enabled
  - ► PQ37675 (LE)
  - ► PQ41240 (COBOL)
    - • COBCOM and COBVEC
- **Service routine mechanism**
  - ► Provides LE a new method of accessing CICS services
    - ▪ Service routine vector table provides addresses for:
      - • Trace/dump services (in CICS TS 1.3)
      - • GETMAIN/FREEMAIN (future enhancement)
      - • Subpool management (future enhancement)
    - ▪ PQ33491/PQ36592 (CICS R4.1/CICS TS)

Dump and Trace Enhancements

- **Runtime options report added to CEEDUMP**
  - For TERMTHDACT(TRACE, DUMP, UADUMP, and UATRACE)
  - U4083 abend clarification
    - New feedback codes added
  - PQ38324 (LE)

- **Control the amount of storage dumped around registers in CEEDUMP**
  - Suboption to TERMTHDACT
  - Default is TERMTHDACT=(TRACE,CESE,96)
  - PQ39636 (LE)

Notes: U4083 New Reason Codes

U4083 (X'FF3')

Explanation: The back chain was found in error. The reason code describes the most likely cause of the abend.

Reason codes:

X'01' (1)

A save area loop exists. The save area points to itself or another save area incorrectly points to a higher save area.

X'02' (2)

Traversal of the back chain resulted in a program check.

X'03' (3)

Under normal conditions, all save area chains should end with a save area pointed to by CEECAADDSA. In this case, the save area chain terminated with a back chain pointer of 0.

X'04' (4)

Under normal conditions, all non-XPLINK save areas are presumed to be word-aligned. Either a linkage stack has been encountered with the character string of "F1SA' (X'C6F1E2C1') in a backward pointer field of the save area chain, or a misaligned (non-word) boundary save area is in the chain. Examine the save area chain to determine which is the case.

Notes: U4083 New Reason Codes ...

Reason codes (cont.):

X'05' (5)

A condition was raised prior to the allocation of the main stack frame, or after the main routine terminated.

X'06' (6)

The dsa format was not set to up or down.

X'07' (7)

The savearea chain cannot be reached or is non-existent. The pointer referencing the back chain is set to 0 (R13).

X'08' (8)

A save area on the chain points to itself.

X'09' (9)

Under normal conditions, all XPLINK save areas are presumed to be quad-word-aligned (the starting address must end in '0'). A misaligned (non-quad-word) boundary XPLINK save area is in the chain.

X'0F' (15)

The save area chain is not intact.

Dump and Trace Enhancements ...

- **Format LE storage areas for a task via CICS VERBX**
  - ▶ New APS keyword added to CICS VERBX
    - ■ VERBX DFHPD530 'APS=<taskid=00031>'
  - ▶ Invokes LE VERBX
    - ■ VERBX CEEERRIP ASID(00nn) CAA(xxxxxxxx) DSA(xxxxxxxx) ALL
  - ▶ Formats the LE CAA, PCB, MEML, RCB, EDB, Runtime Options, Heap Control Blocks, Stack Storage Control Blocks (User and Lib), DSA, Condition Management Control Blocks, Traceback
  - ▶ PQ37898/PQ39051 (CICS R4.1/CICS TS R1)

Dump and Trace Enhancements ...

- **Provide a mechanism for LE to add diagnostic information to the CICS transaction dump**
  - ► Alternative to using the CESE TD queue
  - ► Uses new macro DFHLEDTM
    - ■ Available to vendors
    - ■ Pass records up to 133 bytes
  - ► PQ38478 (CICS R4.1) / PQ38479 (CICS TS R1)/PQ47560 (CICS TS R2)
  - ► LE support in z/OS 1.2

Dump and Trace Enhancements ...

- **Extend AP 1948/1949 trace points to include the Register Save Area (RSA)**
  - On rununit initialization/termination, begin/end invocation
  - Add data area to contain RSA
  - PQ37250/PQ37251 (CICS R4.1/CICS TS)

```
AP 1949 APLI EVENT RETURN-FROM-LE/370 - Rununit_Termination       OK Program_name(DFH0CMNU)

 TASK-00030 KE_NUM-003A TCB-QR    /008CE498 RET-9240BE48 TIME-22:37:30.2013197814 INTERVAL-00.0000134062  =000784=
  1-0000   0000001F                                                            *....           *
  2-0000   00000000                                                            *....           *
  3-0000   C4C6C8F0 C3D4D5E4                                                   *DFH0CMNU        *
  4-0000   129681C8                                                            *.oaH            *
  5-0000   00000020 000064F0 00000000 C9000000  01600005 00108100 00000000 1296ACB4 *.......0....I....-......o..*
  6-0000   C1E4E3D6 F8000000 80000000 000015C8  00000000 80000000 00000040 00000000 *AUTO8..........H...... ....*
    0020   88000000 000004F0 00000000 00000FF0  00000000 80000000 00000FF0 00000000 *h......0.......0......0....*
    0040   80000000 00000FF0 00000000 F8000000  00000000 00000000 00000000 00000000 *.......0....8..............*
```

Data Area 4 = RSA
Data Area 5 = PGMINFO2
Data Area 6 = storage tuning area

Dump and Trace Enhancements ...

- **Extend EISR trace entries to include RSA contents**
  - PQ44065(CICS R4.1) / PQ44198 (CICS TS)
  - AP E160-161 entries will include RSA address and contents
    - AP E160-161 entries are produced by EI level 2 trace

```
AP E160 EXEC ENTRY HANDLE CONDITION IOERR NOSTG INVREQ PLX STMT_#(78440000)

 TASK-00037 KE_NUM-003B TCB-QR   /008CE498 RET-80082314 TIME-18:12:15.7038310786 INTERVAL-00.0000107343   =000012=
  1-0000  00340000 002292ED 75600204 00004B11  2A100000 00000000 00000000 00000000  *......k..-..............*
     0020  F7F8F4F4 F0F0F0F0 00111100 002A2A00  00101000                            *78440000............    *
  2-0000  92ED7560                                                                  *k..-                    *
  3-0000  12ED7174                                                                  *....                    *
  4-0000  0181211F 0101104F C3C5E3D9 0000037C  E3C3F0F2 000002F8 00007D78 04000000  *.a.....|CETR...@TC02.'.....*
     0020  00000000 00000000 00000000 00000000  00000040 40404040 40404000 00000000  *.................   .....*
     0040  00000000 00000000 00000000 00000000  00000000 00                         *....................     *
  5-0000  12B13018                                                                  *....                    *
  6-0000  00000000 0004105C 00000000 92ED698C  00000000 12B135EE 12ED7174 12B14624  *.......*....k.............*
     0020  92ED5028 12B13018 000410D0 00000000  12B14017 00000004 12ED6027 12ED7026  *k.&........}...... ..-.....*
     0040  12ED7C9C 12ED6974                                                        *..@.....                *
```

Data Area 5 = RSA address
Data Area 6 = RSA contents

And Coming Soon ...

- **Add LE trace component to CETR**
  - ► Module DFHLETR will
    - ■ Register the caller with the CICS trace facility
    - ■ Allow the caller to make trace entries into the CICS trace
  - ► Invoked by using new macro DFHLETRM
  - ► PQ42311(CICS R4.1) / PQ42470 (CICS TS)
  - ► LE support provided by PQ69143 - check status

LEDATA IPCS VERBX

- **Includes formatting for COBOL and C control blocks**
- **HEAP segment analysis**
- **CEEIPCSP member required by IPCS**
- **LE dump exit routines required by IPCS**
- **Latest LEDATA APARS: PQ40079, PQ41687, and PQ39635**

```
VERBEXIT LEDATA 'parameter,parameter,...'


Report Type Parameters:          Data Selection Parameters:
                                      DETAIL | EXCEPTION

    SUMMARY
    HEAP | STACK | SM            Control Block Selection Parameters
    CM
    MH                                   CAA(caa-address)
    CEEDUMP                              DSA(dsa-address)
    ALL                                  TCB(tcb-address)
                                         ASID(address-space-id)
                                         NTHREADS(value)
```

LEDATA IPCS VERBX - Sample Output

```
VERBEXIT CEEERRIP ASID(0036) CAA(14D082D0) DSA(14D09268) ALL


*************************************************************************
                         LANGUAGE ENVIRONMENT DATA
*************************************************************************


 Language Environment Product 04 V01 R02.00
TCB: 00000000                    LE Level: 0E                    ASID: 0036


Active Members: COBOL


  CEECAA:  14D082D0
  +000000  FLAG0:00      LANGP:08      BOS:14D08E38        EOS:14D09E38
  +000044  TORC:00000000      TOVF:800266A8      ATTN:14D04E98
  +00015C  HLLEXIT:00000000        HOOK:50C0D064 05C058C0 C00605CC
  +0001A4  DIMA:0001C674    ALLOC:0700C3C8      STATE:0700C3C8
  +0001B0  ENTRY:0700C3C8    EXIT:0700C3C8      MEXIT:0700C3C8
              .
              .
              .
  CEEPCB:  14D02CA0
  +000000  PCBEYE:CEEPCB      SYSTM:03    HRDWR:03      SBSYS:05      FLAG2:98
  +00000C  DBGEH:00000000    DMEMBR:14D02ED0    ZLOD:15693A48
  +000020  ZDEL:15691AE8    ZGETST:0001E528      ZFREEST:0001DFD8
  +00002C  LVTL:00073FB0    RCB:00077390      SYSEIB:0005BA94
  +000038  PSL:000000B0    PSA:14D033F8      PSRA:157B9DD0
  +000044  OMVS_LEVEL:7F800000      PCB_CHAIN:00000000
```

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LEDATA IPCS VERBX - Sample Output ...

```
Language Environment Run-Time Options in effect.

LAST WHERE SET            Override    OPTIONS
*****************************************************************************
INSTALLATION DEFAULT      OVR         ABPERC(NONE)
INSTALLATION DEFAULT      OVR         ABTERMENC(ABEND)
INSTALLATION DEFAULT      OVR       NOAIXBLD
INSTALLATION DEFAULT      OVR         ALL31(ON)
INSTALLATION DEFAULT      OVR         ANYHEAP(00004096,00004080,ANY  ,FREE)
INSTALLATION DEFAULT      OVR       NOAUTOTASK
INSTALLATION DEFAULT      OVR         BELOWHEAP(00004096,00004080,FREE)
INSTALLATION DEFAULT      OVR         CBLOPTS(ON)
INSTALLATION DEFAULT      OVR         CBLPSHPOP(ON)
                            .
                            .
REGION DEFAULT            OVR         STORAGE(00,NONE,NONE,00000000)
REGION DEFAULT            OVR         TERMTHDACT(MSG,CICSDDS,00000096)
INSTALLATION DEFAULT      OVR       NOTEST(ALL,*,PROMPT,INSPPREF)
INSTALLATION DEFAULT      OVR         THREADHEAP(00004096,00004080,ANY  ,KEEP)
IGNORED                   OVR         THREADSTACK(OFF,00004096,00004080,ANY  ,KEEP,
                                             00004096,00004080)
INSTALLATION DEFAULT      OVR         TRACE(OFF,00004096,DUMP,LE=00000000)
INSTALLATION DEFAULT      OVR         TRAP(ON,SPIE)
INSTALLATION DEFAULT      OVR         UPSI(00000000)
REGION DEFAULT            OVR         USRHDLR(CEEWUCHA)
INSTALLATION DEFAULT      OVR         VCTRSAVE(OFF)
                            .
```

Getting the CAA

VERBX DFHPD530 'AP'

===AP: AP DOMAIN TRANSACTION SUMMARY

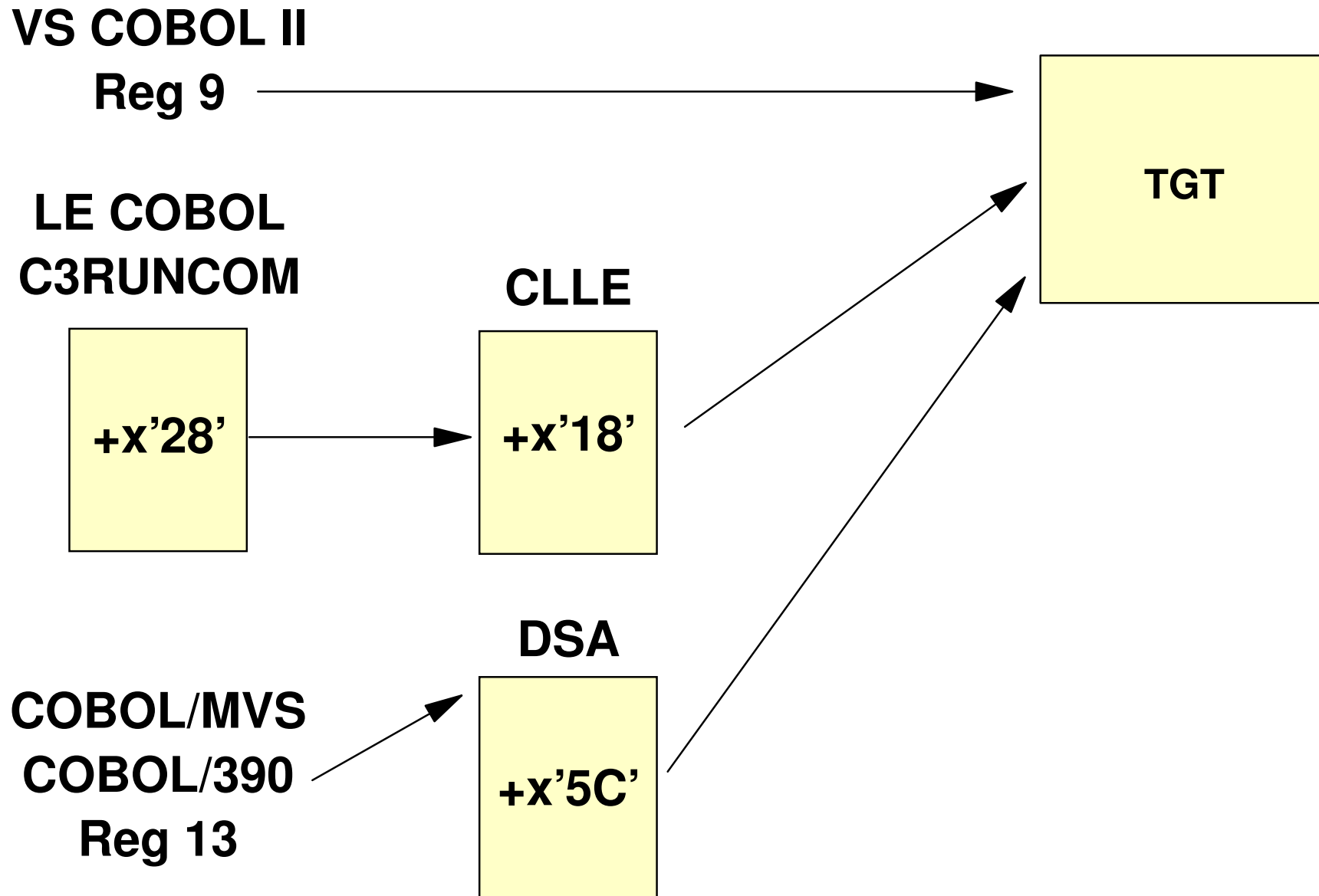| Tran No	Tran Id	Orig Tran	TCA Addr	TWA Addr	EIB Addr	SEIB Addr	EIS Addr	EIUS Addr	Facility Type	Facility Id
00003	CSOL	CSOL	13C9A680	008B7000	13CDA0D0	13C9AA94	13C9A988	13CDA008		
00005	CSSY	CSSY	0005C080	008B7000	000400D0	0005C494	0005C388	00040008		
00006	CSSY	CSSY	0005C680	008B7000	000470D0	0005CA94	0005C988	00047008		
TCP	CSTP	CSTP	13C9B080	14B11430	14B110D0	13C9B494	13C9B388	14B11008		
00019	CSHQ	CSHQ	13C9B680	008B7000	14B090D0	13C9BA94	13C9B988	14B09008		
00025	CSNE	CSNE	13C9C080	008B7000	14B0A0D0	13C9C494	13C9C388	14B0A008		
00040	UPDT	UPDT	0005B680	008B7000	002000D0	0005BA94	0005B988	00200008	TC	TC05

F TCA.00040   Then, STCA + x'94' is the CAA

SYS_TCA.00040 0005B780 Task Control Area (System Area)

```
0000  00000000 00000000 00000000 00000000  0000040C 1A077D7C 0000006C 00000000  *...........'@...%...*  0005B780
0020  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  *...................*  0005B7A0
0040  14D09268 00000000 00000000 00000000  00000000 00000000 00000000 00000000  *.}k................*  0005B7C0
0060  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  *...................*  0005B7E0
0080  00000000 0005BAEC 00000000 00000000  0005B988 14D082D0 00200128 002003E0  *...........h.}b}..*  0005B800
00A0  00000000 8004D100 00000000 00000000  E4D7C4E3 14B284B0 00000000 00000000  *....J.UPDT..d......*  0005B820
```

> **Note that with LE 2.10 and the appropriate CICS APAR, you can request the CICS and LE control blocks for a single task using the CICS VERBX (see PQ37898 for CICS R4.1 or PQ39051 for CICS TS).**

Finding the TGT in an LE Environment

VS COBOL II

Reg 9 ───────────────────────────────►

LE COBOL

C3RUNCOM

CLLE

TGT

+x'28' ──────► +x'18'

DSA

COBOL/MVS

COBOL/390

Reg 13 ──────► +x'5C'

Notes: Compiler Information

- Applications may still be compiled using the following compilers (no integrated translator support):
  - **COBOL:**
    - IBM COBOL for MVS and VM Version 1 (5688-197)
    - IBM COBOL for OS/390 and VM Version 2 (5648-A25)
    - IBM Enterprise COBOL for z/OS and OS/390 Version 3 (5655-G53)
  - **PL/I**
    - OS PL/I V2.3 Compiler, Library and Interactive Test (5668-909)
    - OS PL/I V2.3 Compiler and Library (5668-910)
    - OS PL/I V2.3 Library only (5668-911)
    - IBM PL/I for MVS and VM Version 1 (5688-235)
    - IBM VisualAge PL/I for OS/390 Version 2 (5655-B22)
    - IBM Enterprise PL/I for z/OS and OS/390 Version 3 (5655-H31)
  - **C**
    - OS/390 C/C++ (5647-A01)
    - C/C++ for MVS/ESA (5655-121)

Notes: LE Service Information

- PQ38324 - Runtime options report added to CEEDUMP
  - UQ47603 608 (F010)
  - UQ47631 609 (F010)
  - UQ47632 703 (F010)
- PQ39635 - Add new reason codes for abend U4083
  - UQ48165 608 (F011)
  - UQ48166 609 (F011)
  - UQ48167 703 (F011)
- PQ39636 - Control the amount of storage dumped around registers in CEEDUMP
  - UQ48112 608 (F011)
  - UQ48113 609 (F011)
  - UQ48114 703 (F011)
- PQ41240 (COBOL) / PQ37675 (LE) - LE Control Block isolation
  - UQ46995 608 (F009)   UQ47026 608 (F009)
  - UQ46996 609 (F009)   UQ47027 609 (F009)
  - UQ46997 703 (F009)   UQ47208 703 (F009)
- PQ38838 - Dynamic LE runtime option management (CLER transaction)
  - UQ48504 608 (F011)
  - UQ48505 609 (F011)
  - UQ48506 703 (F011)

Notes: LE Service Information

- PQ42025 - Dynamic storage tuning
  - ➤ **UQ48561 703 (F011)**
- PQ58277 - Use of CICS Program Autoinstall
  - ➤ **DOC APAR worth noting**

Notes: CICS Service Information

- PQ37250 - Extend AP 1948/1949 trace entries to include the RSA
  - **UQ46892 R4.1 (F009)**
- PQ37251 - Extend AP 1948/1949 trace entries to include the RSA
  - **UQ46904 R5.2 (F009)**
  - **UQ46905 R5.3 (F009)**
- PQ44065 - Extend DFHEISR trace entries to include RSA contents
  - **UQ49840 R4.1 (F101)**
- PQ44198 - Extend DFHEISR trace entries to include RSA contents
  - **UQ49876 R5.2 (F101)**
  - **UQ49889 R5.3 (F101)**
- PQ39051 - Format LE data areas for a task via CICS VERBX
  - **UQ46584 R5.2 (F008)**
  - **UQ46585 R5.3 (F008)**
- PQ37898 - Format LE data areas for a task via CICS VERBX
  - **UQ46004 R4.1 (F008)**

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Notes: CICS Service Information ...

- PQ31185 - Provide support for CEECSTX
  - **UQ37578 R4.1 (F911)**
- PQ31262 - Provide support for CEECSTX
  - **UQ37583 R5.2 (F911)**
  - **UQ37584 R5.3 (F911)**
- PQ38478 - Incorporate LE diagnostic information in CICS transaction dump
  - **UQ51747 R4.1 (F103)**
- PQ38479 - Incorporate LE diagnostic information in CICS transaction dump
  - **UQ51836 R5.2 (F103)**
  - **UQ51840 R5.3 (F103)**
- PQ47560 - Incorporate LE diagnostic information in CICS transaction dump
  - **UQ56747 R6.1 (F108)**
- PQ39052 - Dynamic storage tuning for LE data areas
  - **UQ39052 R5.3 (F011)**

Notes: CICS Service Information ...

- PQ45031 - Allow AUTODST to run with STGPROT enabled
  - ‣ **UQ51885 R5.3 (F103)**
- PQ47600 - Allow AUTODST to run with STGPROT enabled
  - ‣ **UQ54422 R6.1 (F105)**
- PQ42311 - Allow LE to write trace entries into the CICS trace
  - ‣ **UQ49830 R4.1 (F101)**
- PQ42470 - Allow LE to write trace entries into the CICS trace
  - ‣ **UQ49841 R5.2 (F101)**

Languages "Heads Up"

- Translator support for the earlier (Pre-Language Environment) compilers is withdrawn in CICS TS 2.2:
  - ► **OS/VS COBOL (5740-CB1, 5740-LM1, and 5734-CB4)**
  - ► **VS COBOL II (5668-958, and 5688-023)**
  - ► **OS PL/I Version 1 (5734-PL1)**
  - ► **OS PL/I Version 2 (5668-910 and 5668-909)**
  - ► **SAA AD/CYCLE C/370 (5688-216)**
- *It is planned that run-time support for OS/VS COBOL programs (regardless of run-time library used) and for any other programs running under pre-Language Environment run-time libraries will be withdrawn in the next release.*

Notes: Language Support

Excerpt from the IBM white paper **COBOL and PL/I Compilers and CICS Transaction Server V2.2:**

"CICS TS V2.2 continues to provide object compatibility, i.e. all applications will continue to work. CICS Customers can, for example, move their existing OS/VS COBOL or COBOL II applications to CICS TS V2 in complete safety as there are no planned changes which will have a mandatory requirement for customers to recompile and re-test their applications. While, IBM has introduced the Integrated Translator support for COBOL and PL/I, we continue to provide the COBOL and PL/I translators with CICS TS and IBM intends to continue to do so. However, IBM has made changes to the translators supplied with CICS TS V2.2 to remove support for pre-Language Environment compilers, such as:

 * OS/VS COBOL (5740-CB1, 5740-LM1, and 5734-CB4)
 * VS COBOL II (5668-958, also 5688-023 and 5688-022)
 * OS PL/I Version 2 (5668-910)
 * SAA AD/Cycle C/370 (5688-216)

What does this mean?

The removal of support, primarily refers to the removal of support from an IBM service and support standpoint. It does not necessarily imply that the support has been technically removed. In fact, in the case of C or PL/I the translators are not sensitive to language level therefore technically they will continue to work with OS PL/I Version 2 and SAA AD/Cycle C/370.

In the case of COBOL the translator is sensitive to language level. Now, while the COBOL2 option has been removed from the CICS TS V2.2 version of the translator IBM knows of no reason why you can't put a CICS COBOL II source program through the CICS TS V2.2 translator using the COBOL3 default. COBOL3 is a superset of COBOL2 and as such should not cause a problem for COBOL II source code. So again with COBOL II it continues to technically work, but is unsupported.

But, in the case of OS/VS COBOL the changes made to the translator will inhibit it's use with old OS/VS COBOL source code.

Notes: Language Support

So if I have OS/VS COBOL applications what are my options?

Your options are basically these:

1. If your are planning to make changes to an old OS/VS COBOL application then consider making the additional changes required to convert from OS/VS COBOL ANSI 68/74 source to ANSI 85 standard that is required for the new COBOL 3 compiler. Then you can use the CICS TS V2.2 translator with the latest COBOL compiler. IBM provides tools and services to help with this migration.

2. Use an old CICS translator and an old OS/VS COBOL compiler. The continued use of a translator from a previous version of CICS with a current version of CICS can be done without any software licensing issues. Provided the customer has a current license for bothCICS TS V2.2 and the applicable compiler, the customer may retain, and continue to use, any translator shipped with any earlier level of CICS, and customers do not require a license for earlier levels of CICS merely in order to support any such use or retention of translators.

Note: If used in this way, any translator which was shipped with a level of CICS that is not (or no longer) in service is unsupported.

What happens in the CICS release after CICS TS V2.2?

In the next release of CICS after CICS TS V2.2, it is planned that native support for the old language runtimes will be removed.The old runtimes are:

* OS/VS COBOL (5740-CB1, 5740-LM1, and 5734-CB4)
* VS COBOL II (5668-958, also 5688-023 and 5688-022)
* OS PL/I Version 2 (5668-910)

Notes: Language Support

What does this mean?

Again, the removal of support, primarily refers to the removal of support from an IBM service and support standpoint. It does not imply that the support has been technically removed and things will stop working or will fail. In the release following CICS TS V2.2. it is being planned that native support for the old language run-times will be removed. In order to keep running these applications they must be running under LE. For example, the runtime library routines for OS/VS COBOL programs have been provided by IBM with the OS/VS COBOL product, the VS COBOL II product and with the Language Environment run-time libraries. So if a customer running with CICS after CICS TS V2.2, has OS/VS COBOL applications running but the run-time library is for instance VS COBOL II then a problem will not be accepted by IBM support unless it is recreated using the LE run-time libraries as this will be the only supported environment. A similar situation exists for PL/I. So, the only migration effort is a run-time library migration to LE in order to remain fully supported by IBM.

So for the release after CICS TS V2.2, CICS will continue to provide object compatibility, i.e. All applications will continue to work. CICS Customers can, for example, move their existing OS/VS COBOL or VS COBOL II applications to CICS TS V2.2 or later in complete safety as there are no planned changes which will have a mandatory requirement for customers to recompile and re-test their applications."

LE Release Information

LE Release	MVS/OS390 Release	LEDATA	LE FMID	Support Withdrawn
LE 1.6	OS/390 R1.2	06	HMWL610 JMWL6xx*	1/31/2001
LE 1.7	OS/390 R1.3	07	HMWL710	3/31/2001
LE 1.8	OS/390 R2.4 OS/390 R2.5	08	HMWL810	3/31/2001
LE 1.9	OS/390 R2.6	09	HMWL910	3/31/2002
LE 2.7	OS/390 R2.7	0A	HLE6607	3/31/2002
LE 2.8	OS/390 R2.8	0B	HLE6608	9/30/2002
LE 2.9	OS/390 R2.9	0C	HLE6609	3/31/2003
LE 2.10	OS/390 R2.10 z/OS 1.1	0D	HLE7703	
	z/OS 1.2	0E	HLE7705	
	z/OS 1.3	0F	HLE7706	
	z/OS 1.4	10	HLE7707	

* Each language has a separate FMID

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References

- **Enterprise COBOL for z/OS and OS/390:**
- **Compiler and Run-Time Migration Guide**
- **GC27-1409-00**
- **z/OS V1R4.0 Lang Env Prog Guide** *
- **z/OS V1R4.0 Language Environment**
- **Customization** *
- **z/OS V1R4.0 Lang Env Debug Guide** *
- **z/OS V1R4.0 Language Environment**
- **Run-Time Messages** *
- **New white papers:**
  - Language Environment within CICS TS: Questions and Answers
    - http://www-3.ibm.com/software/ts/cics/enews/
  - COBOL and PL/I Compilers and CICS Transaction Server V2.2
    - http://www-3.ibm.com/software/ts/cics/v2/cobol.html

* For **your** LE level

Summary

- **Maximize your performance:**
  - RUWAPOOL=YES
  - Consider AUTODST
  - Review use of CBLPSHPOP
  - TERMTHDACT=(xxxx,CICSDDS,xx)
  - Verify CICS runtime options in use
    - CEECOPT in CEECCICS
    - CEEROPT
    - Any user options
- **Check CEECCSD for new members at MVS or z/OS release change**