What's New in z/OS Language Environment?

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Agenda

- New Function APARs
- What's New in z/OS V1.13?
- What's New in z/OS V1.12?

- Additional information available in Appendix:
  - What's New in z/OS V1.11?
  - Sources for Additional Information

New Function APARS

- CEEPIPI call_sub with writable static

New Function APARs

- **PK99010 – CEEPIPI call_sub with writable static**
  - **V1R9: UK52873 V1R10: UK52874 V1R11: UK52875**
  - **CEEPIPI call_sub of a subroutine with writable static where C/C++ is not the language of the entry point**
    - **Supports CEEFETCH and CEEPGFD as well**
  - **NOTE: PE – PM27753**
    - **Affects AMODE 24 programs statically linked with C**
    - **C is inherently 31bit, so code change returned function descriptor in 31bit storage that AMODE 24 program could not access.**
    - **Don't need to be calling the C program to be affected.**

What's new in z/OS R13?

- Removal of RTO Usermods
- High Register Support
- CEEPIPI Multiple Main support
- Deferred Debug
- DCE removal
- I/O Abend recovery
- BSAM >64K Tracks

Removal of RTO Usermods

Statement of direction from the V1R13 Announcement:

z/OS V1.13 is planned to be the last release to support changing the default Language Environment runtime options settings using SMP/E-installable USERMODs. IBM recommends using the CEEPRMxx PARMLIB member to set these options.

Removal of RTO Usermods…

- If you are using the CEEWDOPT, CEEWCOPT or CEEWQDOP ++USERMOD sample jobs to set your installation default run-time options, start using CEEPRMxx NOW.
- If you are using the CEEWDOPT, CEEWCOPT or CEEWQDOP ++USERMOD sample jobs and "cloning" copies of Language Environment modules, see the Hot Topics article, "CEEROPT and the Attack of the Clones" (issue #19, P95)

  http://www-03.ibm.com/systems/z/os/zos/bkserv/hot_topics.html
- If anyone still believes they need these CSECTs or ++USERMODs please see me!

High Register Support

- PL/I and C/C++ compilers are capable of exploiting high halves of 64-bit general purpose registers in AMODE 31 applications
  - Integer arithmetic operations
  - Instructions introduced by the High Word Facility
- Language Environment has been enhanced:
  - to ensure this usage does not impact callers
  - to provide full register contents for diagnostic purposes

High Register Support

- Support to save/restore full 64-bit register contents when AMODE 31 application is called from the operating system or by another driver program
- AMODE 31 CEEDUMP support to display full 64 bit registers
  - When unavailable the high half of the 64 bit register is displayed as '********'
- AMODE 31 LEDATA support to display high halves of 64 bit registers when formatting the MCH control block
- CEEDUMP/LEDATA support rolled back via PM04026
  - V1R10: UK59090 V1R11: UK59091

High Register Support

- **PM04026 – High Register Support**
  - **CEEDUMP**

```
Machine State:

      ILC..... 0002    Interruption Code..... 0009

      PSW..... 078D2400 A19C60FE

      GPR0..... 00000000_00000000  GPR1..... 00000000_0000000A  GPR2.....
   00000000_A1CD09BC  GPR3..... 00000000_219C60B8

      GPR4..... 00000000_2199D2D8  GPR5..... 00000000_21F91A00  GPR6.....
   00000000_21F92AC8  GPR7..... 00000000_219BDE40

      GPR8..... 00000000_A19C63A8  GPR9..... 00000000_21F93368  GPR10....
   00000000_A19C6070  GPR11.... 00000000_A19C60A0

      GPR12.... 00000000_21713B58  GPR13.... 00000000_2199D6D8  GPR14....
   00000000_00000000  GPR15.... 00000000_00000006
```

High Register Support

- **PM04026 – High Register Support**
  - **IPCS**

```
Machine State
+000248  MCH_EYE:ZMCH
+000250  GPR00:00000000    GPR01:0000000A
+000258  GPR02:A1CD09BC    GPR03:219C60B8
+000260  GPR04:2199D2D8    GPR05:21F91A00
+000268  GPR06:21F92AC8    GPR07:219BDE40
+000270  GPR08:A19C63A8    GPR09:21F93368
+000278  GPR10:A19C6070    GPR11:A19C60A0
+000280  GPR12:21713B58    GPR13:2199D6D8
+000288  GPR14:00000000    GPR15:00000006
+000290  PSW:078D2400 A19C60FE
```

High Register Support

- **PM04026 – High Register Support**
  - **IPCS**

```
+000388  GPR_H00:00000000        GPR_H01:00000000
+000390  GPR_H02:00000000        GPR_H03:00000000
+000398  GPR_H04:00000000        GPR_H05:00000000
+0003A0  GPR_H06:00000000        GPR_H07:00000000
+0003A8  GPR_H08:00000000        GPR_H09:00000000
+0003B0  GPR_H10:00000000        GPR_H11:00000000
+0003B8  GPR_H12:00000000        GPR_H13:00000000
+0003C0  GPR_H14:00000000        GPR_H15:00000000
```

CEEPIPI Multiple Main Support

- Additional interfaces provided in Preinit to facilitate conversion from the Preinitialization Compatibility Interface (PICI) to Preinit / CEEPIPI
  - Support for multiple main environments on one TCB;
  - Support for a user word that can be accessed from both outside and within a Preinit environment

CEEPIPI Multiple Main Support

Support for Multiple Main Environments on one TCB

- New CEEPIPI function: init_main_dp
- Allows the Preinit assembler driver to create multiple main CEEPIPI environments on the same TCB
- Main programs can be called on these environments, but only one call can be active at a time on a given TCB

CEEPIPI Multiple Main Support

Support for Multiple Main Environments on one TCB...

CALL CEEPIPI(init_main_dp,ceexptbl_addr,service_rtns,token)

- init_main_dp (input) - A fullword containing the init_main_dp function code (integer value = 19).
- ceexptbl_addr (input) - A fullword containing the address of the PreInit table to be used during initialization of the new environment.
- service_rtns (input) - A fullword containing the address of the service routine vector or 0, if there is no service routine vector.
- token (output) - A fullword containing a unique value used to represent the environment.

CEEPIPI Multiple Main Support

Support for Preinit User Word

- Facilitates communication between the Preinit assembler driver and the user code running within a Preinit environment

- Preinit assembler driver uses CEEPIPI interfaces to access the user word
  - CEEPIPI(set_user_word,...) sets the user word value
  - CEEPIPI(get_user_word,...) retrieves the user word value from the last set_user_word call

CEEPIPI Multiple Main Support

Support for Preinit User Word…

- Code running within Preinit environment accesses the user word from within the CAA control block
  - Field CEECAA_USER_WORD in the assembler CEECAA mapping
    - 4 byte field located at offset +3F0x
  - Modifications to this field by the user code running in the Preinit environment are not saved between CEEPIPI calls
    - Next CEEPIPI call will use value from last set_user_word call

CEEPIPI Multiple Main Support

Support for Preinit User Word…

CALL CEEPIPI(set_user_word,token,value)

- set_user_word (input) - A fullword containing the set_user_word function code (integer value = 17)
- token (input) - A fullword with the value of the token of the environment
- value (input) - A fullword value that will be used to initialize the user word in the initial thread CAA when the application is invoked

CEEPIPI Multiple Main Support

Support for Preinit User Word…

CALL CEEPIPI(get_user_word,token,value)

- get_user_word (input) - A fullword containing the get_user_word function code (integer value = 18)
- token (input) - A fullword with the value of the token of the environment
- value (output) - A fullword that will be returned containing the current value that will be used to initialize the CAA user word when the next application is invoked

Deferred Debug Support

- Support to allow debugging to start at a particular C/C++ entry point
  - Currently available for COBOL and PL/I
- New callable service CEEKRGPM provided
- New RCB fields
  - CEERCB_PMUSER – pm_user address supplied on the CEEKRGPM call
  - CEERCB_PMADDR – pm_addr address supplied on the CEEKRGPM call
- Support available via PTFs for APAR PM15192
  - V1R10: UK90027 V1R11: UK90028 V1R12: UK90029

Deferred Debug Support

- CEEKRGPM callable service

```
+--- Syntax ----------------------------------------------+
|                                                         |
|  CEEKRGPM ( pm_addr, rsvd_word1, pm_user, [fc] )        |
|     POINTER    *pm_addr;                                |
|     INT4       *rsvd_word1;                             |
|     POINTER    *pm_user;                                |
|     FEED_BACK  *fc;                                     |
+---------------------------------------------------------+
```

- Call this CWI interface as follows:

```
L    R15,CEECAACELV-CEECAA(,R12)
L    R15,68(,R15)
BALR R14,R15
```

Deferred Debug Support

- CEEKRGPM callable service
  - pm_addr (input)
    - The address of a pattern match routine that is to be registered or zero when no pattern match routine should be registered (de-registration).
  - rsvd_word1 (input)
    - A fullword reserved for future use. This must be set to zero.
  - pm_user (input)
    - The address of an area supplied by the user for the user's use, or zero when no user area is provided. (The user is responsible for freeing this area, if necessary.)
  - fc (output/optional)

Deferred Debug Support

- CEEPIPI call_sub
  - If CEERCB_PMADDR is non-zero
    - The pattern match routine will be called specifying function code 177, along with the name and entry point (from the PIPI table) of the call_sub routine about to be invoked, as well as the supplied pm_user address.
    - This call will occur just prior to calling the debug event handler with PIPI Subroutine Initialization event (115)
    - The pattern match routine will not be called for call_sub_addr, call_sub_addr_nochk or call_sub_addr_nochk2 requests
    - The pattern match routine will not be called if no routine name is available in the PIPI table

DCE Removal

- Starting in z/OS V1R13, the z/OS Distributed Computing Environment (DCE) and Distributed Computing Environment Security Server (DCE Security Server) will no longer ship with z/OS.
- Minor updates made to documentation and C headers

DCE Removal

- pthread.h
  - Removed inclusion of <dce/dce_pthreads.h>
  - Added a #error message in place of the header inclusion to gracefully fail the compile with a meaningful message.
  - This header also contains equates __COND_DCE and __MUTEX_DCE. There are no references in the external publications for these definitions. Definitions for these have been left in the header for compatibility.

DCE Removal

- signal.h
  - Removed inclusion of <dce/dce_signal.h>
  - Added a #error message in place of the header inclusion to gracefully fail the compile with a meaningful message.
  - This header also contains a signal definition called SIGDCE. References to this signal have been removed or reworded in the external publications, but signal definition in the header has been left for compatibility.

DCE Removal

- Update CEE5224W explanation

CEE5224W The signal SIGDCE was received.

Explanation: **DCE has been removed as of z/OS V1R13. On previous releases** the SIGDCE signal was generated as a result of a MODIFY DCEKERN,DEBUG pid= command. It communicates to a DCE-enabled process a desire to enable DCE run-time debug messages. If the target process is not a DCE process, the target process does not know how to handle SIGDCE.

Programmer response: None.

System action: No system action taken.

Symbolic feedback code: CEE538

I/O Abend Recovery

- The C-RTL is unable to ignore certain DFSMS abends, requiring application developers to write condition handlers or SIGABND handlers to attempt recovery.
- I/O Abend Recovery provides a mechanism to enable the C-RTL to recover gracefully from an abend condition during output or CLOSE processing, when the abend can not be ignored.
- The C-RTL function that triggered the abend condition will gracefully return to the application instead of bringing down the enclave (if condition handling is not in effect).

I/O Abend Recovery

- Two different ways to invoke abend recovery behavior:
  - New fopen()/freopen() keyword
  - New environment variable
- Either method can be used to control how the C-RTL treats abend conditions that can not be ignored.
- When either method is set up to recover from the abend, the C-RTL will instruct the function to return a failing value to the application and set errno to 92.
- Diagnostic information will also be set in the __amrc structure.

I/O Abend Recovery

- fopen()/freopen() keyword usage
  - abend=**abend** | recover
  - **abend** instructs the runtime library to ignore abend conditions that can be ignored. No attempt is made to recover from abend conditions that cannot be ignored.
  - **recover** instructs the runtime library to attempt to recover from an abend issued during certain low-level I/O operations (WRITE / CHECK sequence and CLOSE).
  - This method specifies the behavior for only the stream being opened.
  - This method overrides the setting of the _EDC_IO_ABEND environment variable

```
fopen("//'myfile.data'","wb,type=record,abend=recover");
```

I/O Abend Recovery

- Environment variable usage
  - Environment variable name is _EDC_IO_ABEND
  - **ABEND** and RECOVER are the possible values
    - The values invoke the same behavior as their relative fopen() keyword values.
    - When unset or set to something other than RECOVER, the default behavior is ABEND.
    - The setting of the environment variable defines the behavior for the life of an open stream
    - The environment variable can be overridden by the fopen() keyword.

```
setenv("_EDC_IO_ABEND", "RECOVER", 1);
```

I/O Abend Recovery

- CEECAA Updates (with offsets)
  - **CEECAASHAB_RECOVER_IN_ESTAE_MODE (+30C)**
    - [Bit in the CEECAAFLAG1 field] When ON, the Language Environment ESTAE resumes to the abend shunt in the mode and key in which the Language Environment ESTAE was established.
  - **CEECAASHAB_KEY (+30D)**
    - [Character] IPK result when CEECAASHAB is set.
  - These fields are added to safe guard against key switching and doing a retry in a different key than which the recovery routine was established.

BSAM Greater Than 64K Tracks

- XL C/C++ Run-time Library support for large format sequential data sets greater than 65,535 tracks/volume when opened for BSAM (seek) under binary and text I/O
  - This is Part III of the C/C++ RTL efforts to exploit DFSMSdfp support for large format sequential data sets
    - V1R8 – data sets opened for QSAM I/O
    - V1R12 – data sets opened for BSAM (seek) under record I/O
  - Note: Allocation of a new large format sequential data set can be accomplished by specifying the keyword DSNTYPE=LARGE on a JCL DD statement or using the dynamic allocation equivalent.
  - Supported data set types: large format sequential data sets that are single or multivolume, residing on SMS-managed or non-SMS managed devices, catalogued or uncatalogued.

BSAM Greater Than 64K Tracks

- XL C/C++ Run-time Library support for large format sequential data sets…
  - Invoked by calling the fopen() function on a pre-existing large format sequential data set (DNSTYPE=LARGE was specified).
  - New macro __DSNT_LARGE added for use with dynalloc() function.
  - No support for the fopen() or freopen() equivalent of DSNTYPE=LARGE
  - Once the data set is opened, other OS I/O functions can be used to process the stream.

BSAM Greater Than 64K Tracks

- Large Files versions of ftello() and fseeko() have been added that work on large format sequential data sets that are opened for any type of I/O (record, binary or text)
  - Allows reporting of and repositioning, either directly or relatively, to offsets greater than 2GB – 1.
    - AMODE 31 ftell() and fseek() behavior remains unchanged: offsets used for reporting and repositioning are still limited to 2GB - 1.
  - In order to use the large files versions of ftello() and fseeko(), define the following feature test macro in your application:

```
#define _LARGE_FILES 1
```

    - fgetpos() and fsetpos() can be used with large files without any source code modification

What's new in z/OS R12?

- CEEPRMxx OVR/NONOVR support
- BAM XTIOT support
- Heap Storage Reallocation Performance

CEEPRMxx OVR/NONOVR Support

- CEEPRMxx Override/Nonoverride support
  - Existing syntax will be unchanged and fully supported (no migration action)
  - New syntax will match current CEEDOPT usermod syntax
    - ALL31(ON) – existing
    - ALL31=((ON),OVR) – new
  - This includes "NOxxxxx" options
    - NODEBUG – existing
    - DEBUG=((OFF),OVR) – new
      - Suboption is required for these "NO" options

CEEPRMxx OVR/NONOVR Support

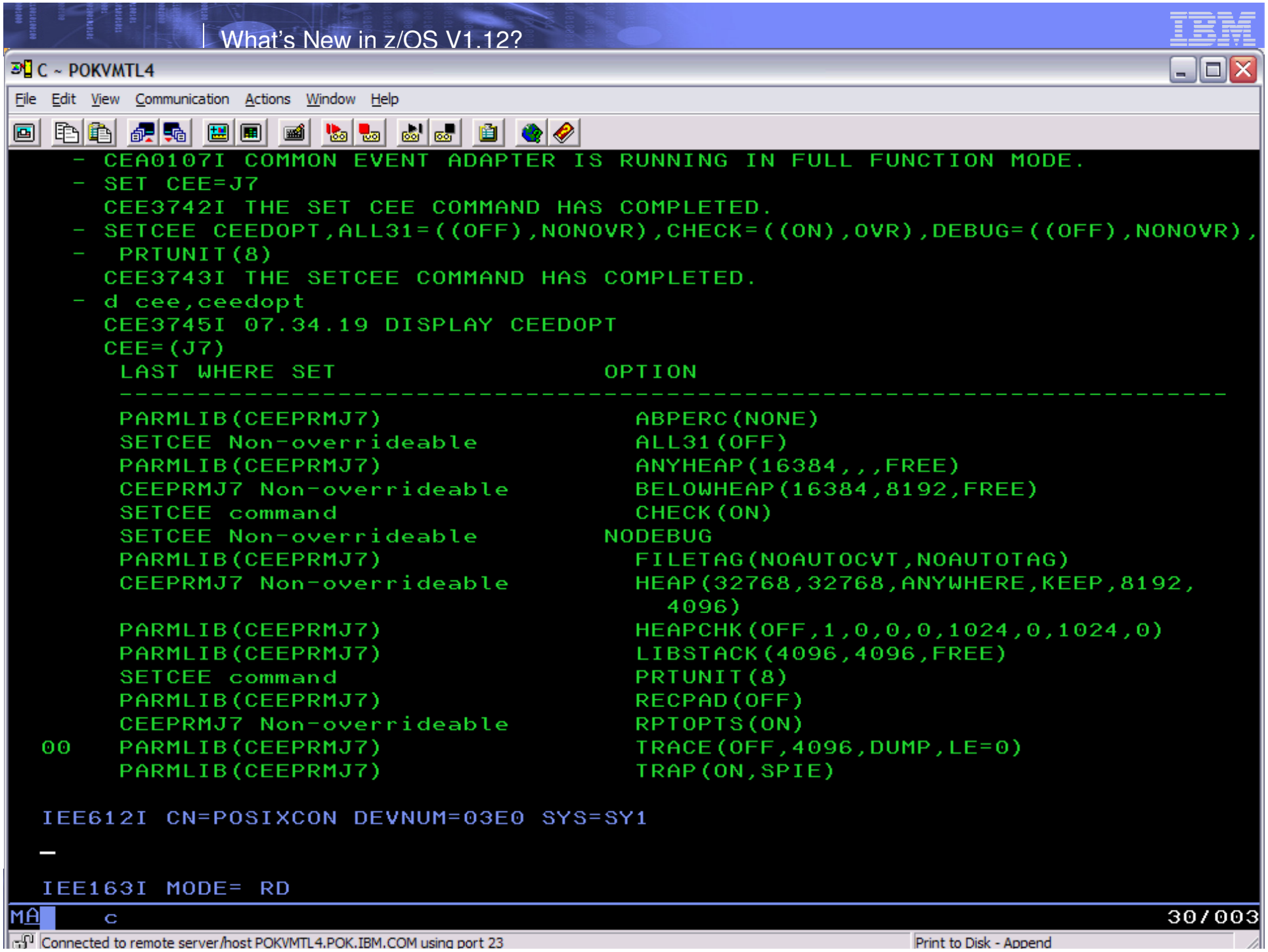
- CEEPRMxx Override/Nonoverride support
  - Will work in SETCEE, SET CEE and syntax checker.
  - D CEE updated to show non-overrideable when appropriate

```
CEE=(A8)
  LAST WHERE SET                  OPTION
  ------------------------------------------------------
  SETCEE Non-overrideable         ALL31(ON)

  CEEPRMA8 Non-overrideable       RPTOPTS(ON)
  CEEPRMA8 Non-overrideable       TRAP(ON,SPIE)
```

CEEPRMxx OVR/NONOVR Support

- CEEPRMxx Override/Nonoverride support
  - SETCEE CEEDOPT,TRAP=((ON),OVR)
    - Acceptable syntax in CEEPRMxx
      - leaving out the 2nd suboption
  - D CEE updated to show only specified suboptions

```
CEE=(A8)
   LAST WHERE SET                        OPTION
   ------------------------------------------------------
   SETCEE Non-overrideable               ALL31(ON)

   CEEPRMA8 Non-overrideable             RPTOPTS(ON)
   SETCEE Non-overrideable               TRAP(ON,)
```


C ~ POKVMTL4
File Edit View Communication Actions Window Help
- CEA0107I COMMON EVENT ADAPTER IS RUNNING IN FULL FUNCTION MODE.
- SET CEE=J7
CEE3742I THE SET CEE COMMAND HAS COMPLETED.
- SETCEE CEEDOPT,ALL31=((OFF),NONOVR),CHECK=((ON),OVR),DEBUG=((OFF),NONOVR),
- PRTUNIT(8)
CEE3743I THE SETCEE COMMAND HAS COMPLETED.
- d cee,ceedopt
CEE3745I 07.34.19 DISPLAY CEEDOPT
CEE=(J7)
LAST WHERE SET OPTION
PARMLIB(CEEPRMJ7) ABPERC(NONE)
SETCEE Non-overrideable ALL31(OFF)
PARMLIB(CEEPRMJ7) ANYHEAP(16384,,,FREE)
CEEPRMJ7 Non-overrideable BELOWHEAP(16384,8192,FREE)
SETCEE command CHECK(ON)
SETCEE Non-overrideable NODEBUG
PARMLIB(CEEPRMJ7) FILETAG(NOAUTOCVT,NOAUTOTAG)
CEEPRMJ7 Non-overrideable HEAP(32768,32768,ANYWHERE,KEEP,8192,
4096)
PARMLIB(CEEPRMJ7) HEAPCHK(OFF,1,0,0,0,1024,0,1024,0)
PARMLIB(CEEPRMJ7) LIBSTACK(4096,4096,FREE)
SETCEE command PRTUNIT(8)
PARMLIB(CEEPRMJ7) RECPAD(OFF)
CEEPRMJ7 Non-overrideable RPTOPTS(ON)
00 PARMLIB(CEEPRMJ7) TRACE(OFF,4096,DUMP,LE=0)
PARMLIB(CEEPRMJ7) TRAP(ON,SPIE)
IEE612I CN=POSIXCON DEVNUM=03E0 SYS=SY1
IEE163I MODE= RD
MA c
30/003
Connected to remote server/host POKVMTL4.POK.IBM.COM using port 23
Print to Disk - Append

BAM XTIOT Support

- Language Environment now supports the use of certain DDNAMEs that have been dynamically allocated with XTIOT, UCB nocapture, or DSAB-above-the-line options specified in the SVC99 parameters (S99TIOEX, S99ACUCB, S99DSABA flags).
  - CEEDUMP DDNAME – supported
  - CEEOPTS DDNAME – NOT supported
  - MSGFILE DDNAME – supported
- C/C++ function fopen() and dynalloc() updated to support the use of new XTIOT options

Heap storage reallocation

- The Language Environment callable service CEECZST (and the C/C++ function realloc()) support a new environment variable
  - _CEE_REALLOC_CONTROL
    - Parameter 1 – Lower bound threshold
      - The number of bytes above which the tolerance percentage (parm 2) will be applied
    - Parameter 2 – Tolerance Percentage
      - The percentage of extra storage to be obtained
      - 0 to 100

Heap storage reallocation

- Example
  - _CEE_REALLOC_CONTROL=100,20
    - First request is for 80 bytes
      - Storage obtained as normal
    - A request to change this storage to 90 bytes
      - Storage obtained as normal
    - A request to change this storage to 100 bytes
      - At or above threshold, percentage is applied
      - Storage obtained is 120 bytes (100 + 100 * 20%)
    - A request to change this storage to 110 bytes
      - No storage need be obtained (we already have 120 bytes)

Heap storage reallocation

- Can be very useful for programs that make many requests to reallocate storage larger than originally requested.
  - Many string manipulation routines make heavy use of storage reallocation.
- If tolerance percentage is 0 or _CEE_REALLOC_CONTROL is not set no change in behavior.

The End..

Thank you!

Appendix

- What's New in z/OS V1.11?
- Sources for Additional Information

What's new in z/OS R11?

- Assembler Macro Updates
- CICS Additional Floating Point Support
- CELQPIPI service routines update
- Additional diagnostics for HEAPPOOLs

Assembler Macro Updates

- Create CEEGLOB assembler macro similar to IBM Language Environment for z/VSE
- Add support in CEEPPA for the SERVICE keyword option
- Add support in CEEENTRY for the RMODE and AMODE keyword options
- Add support in CEEFETCH to handle both Language Environment and non-Language Environment code and provide support to do an "Language Environment-load" if module previously loaded

Assembler Macro Updates

CEEGLOB global assembler variables:

- **&CEEGPRO (alias &GPRO)** Product number
- **&CEEGVER (alias &GVER)** Product version
- **&CEEGREL (alias &GREL)** Product release
- **&CEEGMOD (alias &GMOD)** Product modification level

- **&CEEGENV (alias &GENV**) OS environment from which the macro has been invoked

Assembler Macro Updates

CEEPPA Service Keyword

- New SERVICE keyword to set the service level string for a routine.
  - `Syntax: SERVICE=service_string`
- The service string length and contents are located following the timestamp and version information.
- This field is not interrogated by Language Environment.
- The SERVICE keyword can only be specified on the first CEEPPA macro in the assembler source, all other instances of the keyword are ignored.
- When the SERVICE keyword is in use, the timestamp is generated automatically, the TSTAMP option is forced to YES even when the user specified TSTAMP=NO.
  - If the TSTAMP option if forced to YES the following severity 4 MNOTE is generated:
    SERVICE PARAMETER SPECIFIED TSTAMP PARAMETER FORCED TO 'YES'

Assembler Macro Updates

CEEPPA Service Keyword

```
192+*         Time Stamp
193+*,Time Stamp = 2009/02/02 15:16:00                          01-CEEPP
194+*,Version 1 Release 1 Modification 0                        01-CEEPP
195+CEETIMES DS    0F                                           01-CEEPP
196+         DC    CL4'2009'          Year                      01-CEEPP
197+         DC    CL2'02'            Month                     01-CEEPP
198+         DC    CL2'02'            Day                       01-CEEPP
199+         DC    CL2'15'            Hours                     01-CEEPP
200+         DC    CL2'16'            Minutes                   01-CEEPP
201+         DC    CL2'00'            Seconds                   01-CEEPP
202+         DC    CL2'1'             Version                   01-CEEPP
203+         DC    CL2'1'             Release                   01-CEEPP
204+         DC    CL2'0'             Modification              01-CEEPP
205+         DC    AL2(6)             Length of Service String  @D2A  01-CEEPP
206+         DC    C'011100'          Service parm              @D2A  01-CEEPP
```

Assembler Macro Updates

Example with CEEGLOB and CEEPPA

```
         GBLC   &GVER,&GREL,&GMOD
         CEEGLOB
ASMTSTRC CEEENTRY PPA=MYPPA,BASE=R11,MAIN=YES
         LA     3,12
         ST     3,RETCODE
         LA     2,8
         LA     3,0
         ST     2,0(,3)
         CEETERM RC=RETCODE,MODIFIER=0
RETCODE  DS     F
R3       EQU    3
R11      EQU    11
         LTORG  ,
* The service level string is set to the concatenation of the CEEGLOB values for
* the Version, Release and Modification Level
MYPPA    CEEPPA SERVICE=&GVER.&GREL.&GMOD
         CEEDSA ,
         CEECAA ,
         CEEOCB ,
         END    ASMTSTRC
```

Assembler Macro Updates

Sample CEEDUMP output

```
Traceback:

DSA    Entry       E  Offset  Statement   Load Mod            Program Unit          Service  Status
1      CEEHDSP     +00004B34               CEEPLPKA            CEEHDSP               HLE7750  Call
2      ASMTSTRC    +0000008A               ASMRC01G            ASMTSTRC              011100   Exception

DSA    DSA Addr    E  Addr     PU Addr     PU Offset  Comp Date  Compile Attributes
1      2159C0B0    0D1BB3E0   0D1BB3E0    +00004B34  20080319   CEL
2      2159C030    0006D000   0006D000    +0000008A  20080512   ASM
```

Assembler Macro Updates

CEEENTRY updated with RMODE and AMODE keyword

- New RMODE and AMODE keywords that will allow for the specification of the modules CSECT RMODE and AMODE settings. The default for both will remain **ANY**.
- Syntax:

  RMODE= <ANY | 24 | 31> the default, if unspecified, is ANY

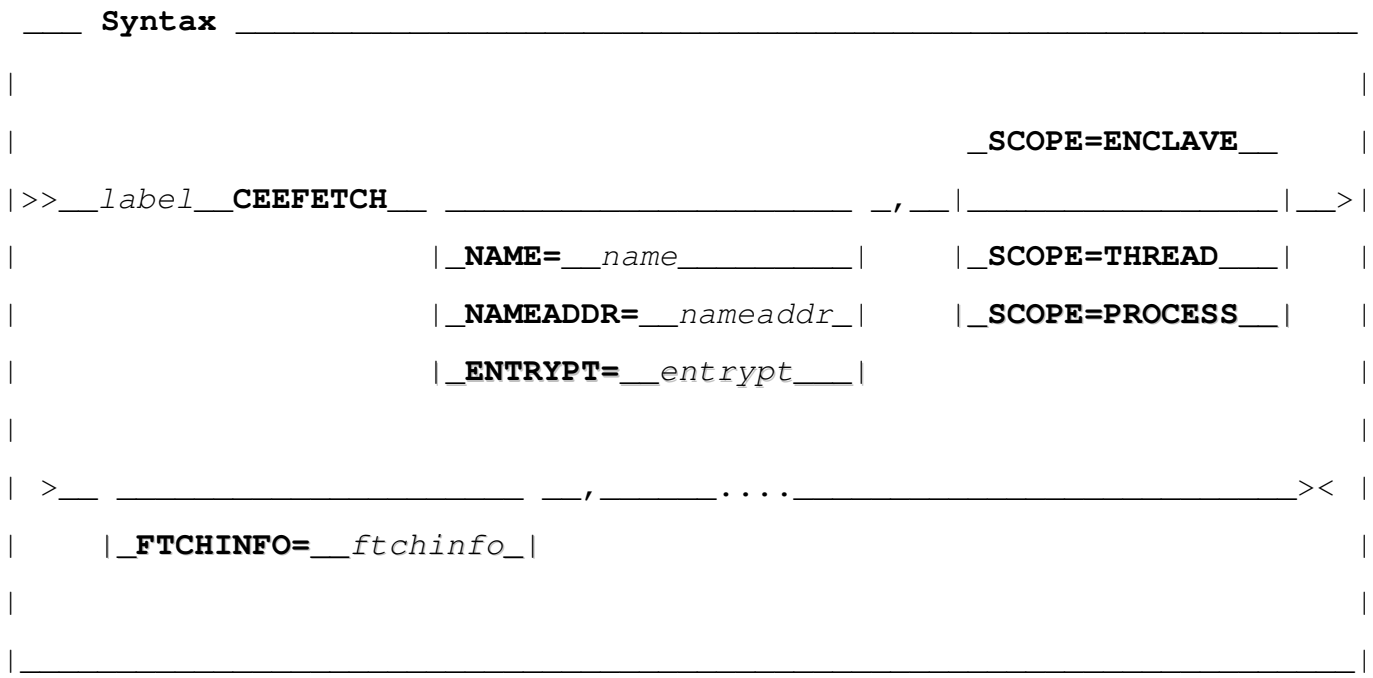
  AMODE= <ANY | 24 | 31 | ANY31> the default, if unspecified, is ANY
- Example:

```
MAIN     CEEENTRY PPA=MAINPPA,…,RMODE=24,AMODE=31
```

Assembler Macro Updates

CEEFETCH Enhancements

- Three new keywords are introduced in CEEFETCH: FTCHINFO, ENTRYPT, and SCOPE=PROCESS



Assembler Macro Updates

CEEFETCH Enhancements

SCOPE=PROCESS

- Indicates that the load is to be scoped to the process level. Modules loaded at the process level are deleted automatically at process termination.
- SCOPE=ENCLAVE remains the default
- SCOPE=THREAD is still supported

Assembler Macro Updates

CEEFETCH Enhancements

FTCHINFO=__*ftchinfo*

- Used in combination with NAME or NAMEADDR to request a *load attempt* on a target module whose characteristics are unknown
- Set to a previously allocated storage area in the form of a register (enclosed in parentheses) or the name of a fullword address variable, that will contain any information discovered about the target module, see CEEFTCH for mapping details
- If the module is identified as a Language Environment conforming AMODE 24 or AMODE 31 subroutine, then processing would be as normal (added to the member list, function pointer obtained, added to the load list table), otherwise only a load of the target will be attempted.

Assembler Macro Updates

CEEFETCH Enhancements

ENTRYPT=__*entrypt*

- Used in combination with FTCHINFO to *obtain information about a previously loaded module and to do any corresponding processing on it as if it was initially loaded by CEEFETCH*
- The *NAME* and *NAMEADDR* keywords are mutually exclusive with ENTRYPT
- If the module is identified as a Language Environment conforming AMODE 24 or AMODE 31 subroutine, then it will be added to the member list, have a function pointer obtained, and added as an entry in to the load list table.
- Set to the entry point for a previously loaded target module stored either in the form of a register (enclosed in parentheses) or the name of a fullword address variable

Assembler Macro Updates

CEEFETCH Enhancements

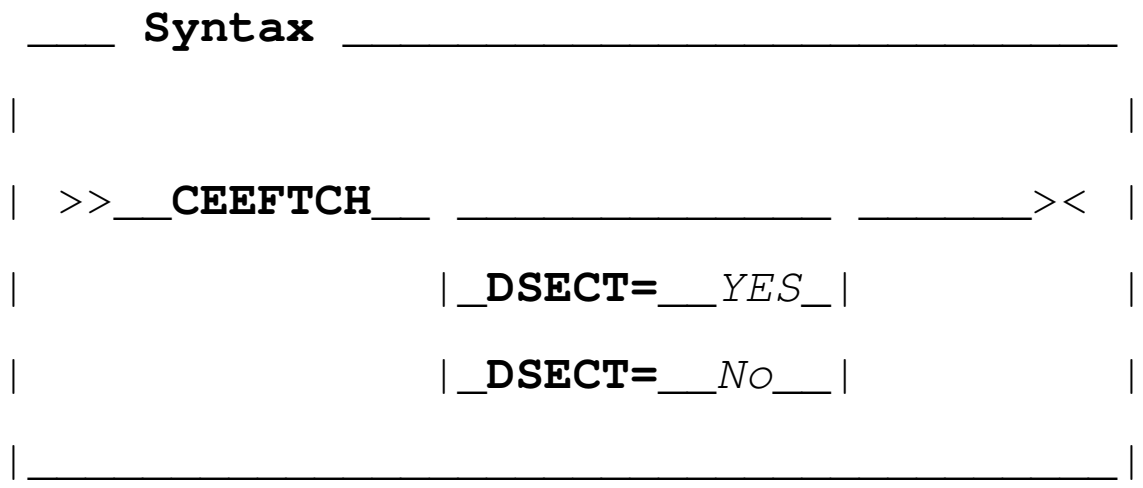
- New messages/feedback codes associated with CEEFETCH

Symbolic Feedback	Severity	Message Number	Message Text
CEE3DV	3	3519	The version specified in the CEEFTCH control block passed to the CEEFETCH macro is not supported.
CEE3QS	1	3932	The system service CSVQUERY failed with return code <return_code> and reason code 0.

Assembler Macro Updates

CEEFTCH

- macro used to generate a mapping for the module information in the FTCHINFO storage area



Assembler Macro Updates

CEEFTCH

- **DSECT=YES**
  - Indicates that a DSECT mapping should be generated.
  - This is the default for the mapping if the DSECT option is not specified.
- **DSECT=NO**
  - Indicates that a data area mapping should be generated.
  - The following tables show the format of the CEEFTCH mapping Version 1 (CEEFTCH_VERSION = 1).

CEEFTCH mapping

Offset Dec	Offset Hex	Type	Len	Name(Dim)	Description
0	(0)	Structure	64	CEEFTCH	Start of CEEFETCH
0	(0)	Character	8	CEEFTCH_EYE_CATCHER	Eyecatcher
8	(8)	Unsigned	2	CEEFTCH_VERSION	Version requested
10	(A)	BIT(8)	1	CEEFTCH_FLAGS1	CEEFTCH flags1
10	(A)	BIT(1)	1	CEEFTCH_A24	X'80' target is AMODE 24
10	(A)	BIT(1) POS(2)	1	CEEFTCH_A31	X'40' target is AMODE 31
10	(A)	BIT(1) POS(3)	1	CEEFTCH_A64	X'20' target is AMODE 64
10	(A)	BIT(1) POS(4)	1	CEEFTCH_XPLINK	X'10' target is XPLINK
10	(A)	BIT(1) POS(5)	1	CEEFTCH_LE	X'08' target is Language Environment conforming
10	(A)	BIT(1) POS(6)	1	CEEFTCH_MAIN	X'04' target is MAIN
10	(A)	BIT(1) POS(7)	1	CEEFTCH_SUB	X'02' target is a SUB
10	(A)	BIT(1) POS(8)	1	CEEFTCH_DLL	X'01' target is DLL

CEEFTCH mapping

Offset Dec	Offset Hex	Type	Len	Name(Dim)	Description
11	(B)	BIT(8)	1	CEEFTCH_FLAGS2	CEEFTCH flags2
11	(B)	BIT(1)	1	CEEFTCH_SEGMENTED	X'80' target module is divided into multiple initial load segments (deferred load segments, if any, are not counted)
11	(B)	BIT(1) POS(2)	1	CEEFTCH_CICS	X'40' CICS environment
11	(B)	BIT(6) POS(3)	1	*	Available
12	(C)	SIGNED	4	*	Available
16	(10)	ADDRESS	8	CEEFTCH_CEESTART64	Address of 64bit CEESTART
16	(10)	SIGNED	4	*	
20	(14)	ADDRESS	4	CEEFTCH_CEESTART	Address of 31bit CEESTART

CEEFTCH mapping

Offset Dec	Offset Hex	Type	Len	Name(Dim)	Description
24	(18)	ADDRESS	8	CEEFTCH_MOD64	Address of 64bit target
24	(18)	SIGNED	4	*	
28	(1C)	ADDRESS	4	CEEFTCH_MOD	Address of 31bit target
32	(20)	SIGNED	8	CEEFTCH_MOD_LEN64	Length of 64bit target
32	(20)	SIGNED	4	*	
36	(24)	SIGNED	4	CEEFTCH_MOD_LEN	Length of 31bit target
40	(28)	ADDRESS	8	CEEFTCH_EP64	Address of 64bit EntryPt
40	(28)	SIGNED	4	*	
44	(2C)	ADDRESS	4	CEEFTCH_EP	Address of 31bit EntryPt
48	(30)	UNSIGNED	8	*	Available
56	(38)	UNSIGNED	8	*	Available

ASMFT3E1 example

Example using FTCHINFO to load a module and test the mapping bits to determine characteristics:

```
* ================================================================
* USE NEW FTCHINFO SUPPORT IN CEEFETCH TO ATTEMPT A LOAD
* OF TARGET MODULE 31BIT 'CPPSUBRT'
* ================================================================
ASMFT3E1 CEEENTRY PPA=MYPPA,MAIN=YES,BASE=4,AUTO=WORKSIZE,             X
               ENCLAVE=YES
         USING WORKAREA,13
         LA    2,1
         STH   2,CEEFTCH_VERSION               SET MAP VERSION TO 1
         LA    2,CEEFTCH                       STORE ADDR OF
         ST    2,INFOPT                        CEEFTCH IN INFOPT
         CEEFETCH NAME=CPPSUBRT,                                      X
               TOKEN=TOKEN1,FEEDBACK=FB2,                             X
               MF=(E,LABEL1),FTCHINFO=INFOPT,SCOPE=PROCESS
         CLC   FB2(8),CEE000                   CHECK FEEDBACK CODE
         BE    GOOD_FB
         CALL  CEEMSG,(FB2,DEST,FB3)           DISPLAY FEEDBACK
         CEETERM  RC=16,MODIFIER=0
         B     DONE                            LEAVE IF BAD
GOOD_FB  DS    0H

           BALR   14,15                              31BIT TARGET EXEC
```

ASMFT3E1 example

```
* ===================================================================
* TEST THE FLAG BITS
* ===================================================================
          TM       CEEFTCH_FLAGS1,CEEFTCH_DLL
          JZ       XPLINK_T
          CALL  CEEMOUT,(DLLC,DEST,FB),VL,MF=(E,CALLMOUT)
XPLINK_T  EQU      *
          TM       CEEFTCH_FLAGS1,CEEFTCH_XPLINK
          JZ       AMODE_T
          CALL  CEEMOUT,(XPC,DEST,FB),VL,MF=(E,CALLMOUT)
AMODE_T   EQU      *
          TM       CEEFTCH_FLAGS1,CEEFTCH_A24
          JZ       AMODE_3
          CALL  CEEMOUT,(A24C,DEST,FB),VL,MF=(E,CALLMOUT)
AMODE_3   EQU      *
          TM       CEEFTCH_FLAGS1,CEEFTCH_A31
          JZ       AMODE_6
          CALL  CEEMOUT,(A31C,DEST,FB),VL,MF=(E,CALLMOUT)
AMODE_6   EQU      *
          TM       CEEFTCH_FLAGS1,CEEFTCH_A64
          JZ       LE_T
          CALL  CEEMOUT,(A64C,DEST,FB),VL,MF=(E,CALLMOUT)
LE_T      EQU      *
          TM       CEEFTCH_FLAGS1,CEEFTCH_LE
          JZ       SUB_T
          CALL  CEEMOUT,(LEC,DEST,FB),VL,MF=(E,CALLMOUT)
```

ASMFT3E1 example

```
SUB_T    EQU      *
         TM       CEEFTCH_FLAGS1,CEEFTCH_SUB
         JZ       MAIN_T
         CALL  CEEMOUT,(SUBC,DEST,FB),VL,MF=(E,CALLMOUT)
MAIN_T   EQU      *
         TM       CEEFTCH_FLAGS1,CEEFTCH_MAIN
         JZ       CICS_T
         CALL  CEEMOUT,(MAINC,DEST,FB),VL,MF=(E,CALLMOUT)
CICS_T   EQU      *
         TM       CEEFTCH_FLAGS2,CEEFTCH_CICS
         JZ       SEG_T
         CALL  CEEMOUT,(CICSC,DEST,FB),VL,MF=(E,CALLMOUT)
SEG_T    EQU      *
         TM       CEEFTCH_FLAGS2,CEEFTCH_SEGMENTED
         B        DONE
         CALL  CEEMOUT,(SEGC,DEST,FB),VL,MF=(E,CALLMOUT)
DONE     DS       0H
*********************************************************************
*        DELETE LOADED ROUTINE                                      *
*********************************************************************
         CEERELES TOKEN=TOKEN1,FEEDBACK=FB2
         CALL  CEEMSG,(FB2,DEST,FB3)                    DISPLAY FB
         CEETERM  RC=0,MODIFIER=0
```

ASMFT3E1 example

```
* ================================================================
*        CONSTANTS
* ================================================================
TOKEN1   DS       F
MODNAME  DC       CL8'CPPSUBRT'
FB3      DC       CL12'FEEDBACKCODE'
FB2      DS       CL12'FEEDBACKCODE'
DEST     DC       F'2'            DESTINATION IS THE LE MESSAGE FILE
CEE000   DS       3F'0'           SUCCESS FEEDBACK CODE
*
LEC      DC       Y(LEEND-LESTR)
LESTR    DC       C'I AM LE.'
LEEND    EQU      *
*
A24C     DC       Y(A24END-A24STR)
A24STR   DC       C'I AM AMODE24.'
A24END   EQU      *
*
A31C     DC       Y(A31END-A31STR)
A31STR   DC       C'I AM AMODE31.'
A31END   EQU      *
*
A64C     DC       Y(A64END-A64STR)
A64STR   DC       C'I AM AMODE64.'
A64END   EQU      *
*
```

ASMFT3E1 example

```
XPC      DC       Y(XPEND-XPSTR)
XPSTR    DC       C'I AM XPLINK.'
XPEND    EQU      *
*
CICSC    DC       Y(CICSEND-CICSSTR)
CICSSTR  DC       C'I AM IN CICS.'
CICSEND  EQU      *
*
MAINC    DC       Y(MAINEND-MAINSTR)
MAINSTR  DC       C'I AM A MAIN.'
MAINEND  EQU      *
*
SUBC     DC       Y(SUBEND-SUBSTR)
SUBSTR   DC       C'I AM A SUBROUTINE.'
SUBEND   EQU      *
*
DLLC     DC       Y(DLLEND-DLLSTR)
DLLSTR   DC       C'I AM A DLL.'
DLLEND   EQU      *
*
SEGC     DC       Y(SEGEND-SEGSTR)
SEGSTR   DC       C'I AM SEGMENTED.'
SEGEND   EQU      *
```

ASMFT3E1 example

```
*
MYPPA    CEEPPA  ,                CONSTANTS DESCRIBING THE CODE BLOCK
* ===================================================================
*        THE WORKAREA AND DSA
* ===================================================================
WORKAREA DSECT
         ORG   *+CEEDSASZ         LEAVE SPACE FOR THE DSA FIXED PART
FB       DS      3F               SPACE FOR A 12-BYTE FEEDBACK CODE
*
*
CALLMOUT CALL  ,(,,),VL,MF=L      3-ARGUMENT PARAMETER LIST
LABEL1   CEEFETCH MF=L
         CEEFTCH DSECT=NO
INFOPT   DS    A
*
EPPTR    DS    A
*
         DS    0D
WORKSIZE EQU   *-WORKAREA
         CEEDSA  ,                MAPPING OF THE DYNAMIC SAVE AREA
         CEECAA  ,                MAPPING OF THE COMMON ANCHOR AREA
*
*
         END      ASMFT3E1
```

CICS AFP Support

CICS AFP (Additional Floating Point) Support

- Prior to CICS TS Version 4, Language Environment was unable to fully support Binary Floating Point (BFP) and Decimal Floating Point (DFP)
  - Before this change, Language Environment did not fully support BFP or DFP operations in applications that run in a CICS environment.
    - It was possible to compile XL C/C++ and Enterprise PL/I programs with the AFP(VOLATILE) compiler option and do BFP/DFP operations, as long as the default floating point rounding mode was not altered.
  - In a CICS TS environment, certain BFP and DFP program checks would always result in a CEE3207 message.
    - The same program checks would result in CEE321X, CEE322X, and CEE323X messages in a non-CICS environment.
  - Floating point registers 1,3,5,7, and 8-15, along with the floating point control register (FPC) did not appear in CEEDUMPs or IPCS dumps, when running under CICS TS

CICS AFP Support

CICS AFP (Additional Floating Point) Support

- With this new support, binary and decimal floating point operations are fully supported in the CICS TS Version 4 or later environment.
  - The AFP(VOLATILE) compiler option is no longer required
  - All applicable floating point registers 0-15 and the FPC register appear in dumps after program checks or ABENDs.
  - It is now possible to run many simultaneous programs in a CICS TS region that do binary or decimal floating point operations with non-default rounding modes, with no interference between the applications.

CICS AFP Support

CICS AFP (Additional Floating Point) Support

- Language Environment and CICS TS Version 4 and later will automatically activate the new CICS AFP support when the CICS environment is started
- CEEDUMPs and formatted IPCS dumps will sometimes show additional registers after CICS program checks and ABENDs:
  - Floating point registers 0-15 (before this change only 2, 4, 6, 8 were included)
  - Floating point control register (FPC)
  - High registers (and low registers, as before)
  - Access registers
- Floating point 0C7 program checks are now mapped into the same CEE32xx messages in CICS and non-CICS environments

CELQPIPI Enhancements

CELQPIPI Service Routines

- AMODE 64 Preinitialization (CELQPIPI) previously has supported only 2 service routines:
  - LOAD
  - DELETE
- As of z/OS R11 more service routines will be supported.
  - GETSTORE
  - FREESTORE
  - MSGRTN
- All these service routines are analogous to those routines in AMODE 31 Preinitialization (CEEPIPI).

HEAPPOOLS Diagnostic Enhancements

Enhancements to HEAPPOOLS (and HEAPPOOLS 64) diagnostics

- Format the heap pools structures and storage using IPCS
- Format the heap pools trace with finer granularity
- Limit the heap pools trace to specific pools
- Control the size of the heap pools trace

HEAPPOOLS Diagnostic Enhancements

Enhancements to HEAPPOOLS (and HEAPPOOLS 64) diagnostics

- Changes to the HEAPCHK run-time option
  - Four (4) new sub-options are added to the HEAPCHK run-time option
    - Default values provide the same behavior as in prior releases
  - These sub-options control:
    - The number of trace entries per pool (size of the trace)
    - The pool(s) to be traced

HEAPPOOLS Diagnostic Enhancements

Enhancements to HEAPPOOLS (and HEAPPOOLS 64) diagnostics

- Syntax

```
                |-OFF-|
>>-HEAPChk--(--+-----+--,-------------------------------------->
                |-ON--|

>--+-----------+--,--+-------+--,--+------------+--,--+-----------------+-->
   |-frequency-|     |-delay-|     |-call depth-|     |-pool call depth-|

>--,--+----------------+--,--+------------+--,---------------->
      |-num of entries-|     |-pool number-|

>----+------------------+--,--+---------------+-----------)-><
     |-num of entries 31-|     |-pool number 31-|
```

HEAPPOOLS Diagnostic Enhancements

Enhancements to HEAPPOOLS (and HEAPPOOLS 64) diagnostics

- **Number of Entries**
  - Specifies the number of entries to be recorded in the heap pool trace table for the main user heap in the application. If the heap pool trace table is available and Number of Entries is 0, then the heap pool trace table is not generated.

- **Pool Number**
  - Filter the entries of heap pool trace table recording only those entries of a specific poolid for the main user heap in the application. The value should be a valid pool number (1-12). If heap pool trace table is available and Pool Number is 0 then, the entries of all pools will be traced.

HEAPPOOLS Diagnostic Enhancements

Enhancements to HEAPPOOLS (and HEAPPOOLS 64) diagnostics

- **IPCS – Formatting the heap pools trace**
  - **HPT(*value*) | HPTTCB (*value*) | HPTCELL(*value*) | HPTLOC(*value*)**
    - **HPT - (existing keyword)**
      - If the value is 0 or *, the trace for every heappools poolid is formatted. If the value is a single number (1-12), the trace for the specific heappools poolid is formatted.
    - **HPTTCB**
      - Filters the heappool trace table (if available) printing only those entries for a given TCB address (value).
    - **HPTCELL**
      - Filters the heappool trace table (if available) printing only those entries for a given cell address (value).

HEAPPOOLS Diagnostic Enhancements

Enhancements to HEAPPOOLS (and HEAPPOOLS 64) diagnostics

- **IPCS – Formatting the heap pools trace**
  - **HPT(*value*) | HPTTCB (*value*) | HPTCELL(*value*) | HPTLOC(*value*)**
    - **HPTLOC**
      - Filters the heappool trace table (if available) printing only those entries for a given virtual storage location (value)**.** The valid values are the following**:**
        - 31: Display entries located on virtual storage below the bar
        - 64: Display entries located on virtual storage above the bar
        - ALL: Entries located on virtual storage below / above the bar
  - **NOTE:** Filter options without specifying HPT implies HPT(*).

HEAPPOOLS Diagnostic Enhancements

- IPCS heap pools report
  - Formatted when HEAP or ALL is specified
  - The Heappool report will be very similar to the Heap Report.
  - The report will contain the following information:
    - QPCB
    - QPCB Entry for each pool
    - Addresses
    - Free chain validation
    - Extent validation:
      - Address and size of extent
      - Each free and allocated cell

Sources for Additional Information

- Language Environment Debugging Guide
- Language Environment Run-Time Messages
- Language Environment Programming Reference
- Language Environment Programming Guide
- Language Environment Programming Guide for 64-bit Virtual Addressing Mode
- Language Environment Customization
- Language Environment Run-Time Application Migration Guide
- Language Environment Writing ILC Applications
- Language Environment Vendor Interfaces
- Language Environment Concepts Guide
- MVS IPCS Commands
- CICS Supplied Transactions