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Dynamic Tracer - Subroutine -- B. C. Health Association
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Abstract: This subroutine is an debugging aid and traces the sequence of program instruction execution.

Before each execution of an instruction, the routine prints following data:

a. Instruction to be executed
b. The location of the instruction to be executed
c. The contents of the operands in the instruction

The routine is particularly useful in the following situation.

1. A user program is written in Assembler and has a serious bug but don't know how it happens.

2. A user program is so huge that it is very hard to narrow down or find what part of the program coding is making trouble.

CAN WE use this at NW2?

The format of the dynamic tracer call is described here.

Format:

```
col.1    col. 10  col. 16
---------------------------------------------------
         CALL     TRACE,(start-addr,upper-limit)
```

CALL ; External subroutine call
TRACE The subroutine name of DYNAMIC TRACER
start-addr: Tracer starting point

upper-limit: Highest address that the tracer can print.

Example:

```
         CALL TRACE,(TAG2,LAST)
TAG2     LA   3,H6+1
         LA   4,MAX

         -
         -
         -
         -
LAST     NOP  *+4
```

The dynamic tracer traces the user program coding only and does not trace the system routine such as:

- system supervisor routine branched by SVC instruction
- Logical IOCS routine branched by BALR 14,15 instruction.

I/O device: The dynamic tracer uses printer I/O, therefore following device assignment is requested, and included in the user JCL.

```
// DVC 21 // LFD PRNTR2
```

<u>Usage:</u> The dynamic tracer is only to trace the sequence of the instructions execution, therefore the repetitive use of the tracer should be avoided. It produces a large volume of printer spool file so easily, therefore after getting enough tracer dump, the job sould be cancelled.

Sample printout of the dynamic tracer:

```
 LOC.   OBJECT CODE      ADDR1 ADDR2  LINE    SOURCE STATEMENT
00086C D201 27EE 2A4C 007F0 00A4E   105 TAG1        MVC   MDTBL+2(2),=P'29'
                                    106             CALL  TRAC3,(TAG2,LAST) LINE①
000872                            A 107+            DS    0H
000872 0700                       A 108+            CNOP  0,4
000874 4510 2882            00884 A 109+            BAL   1,*+16
000878 0000088A                   A 110+            DC    A(TAG2)
00087C 80                         A 111+            DC    X'80'
00087D 000A0E                     A 112+            DC    AL3(LAST)
                                  A 113+            EXTRN TRAC3
000880 00000000                   A 114+            DC    A(TRAC3)
000884 58F0 287E            00880 A 115+            L     15,*-4
000888 05EF                       A 116+            BALR  14,15
00088A 4130 22EA            002EC   117 TAG2        LA    3,H6+1            LINE②
00088E 4140 23A8            003AA   118             LA    4,WAX             LINE③
000892 5850 2A1E            00A20   119             L     5,=F'7'           LINE④
000896 D502 2374 3000 00376 00000   120 TAG3        CLC   MSG+7(3),0(3)     LINE⑤
00089C 4780 28CC            008CE   121             BE    TAG4              LINE⑥
0008A0 5A40 2A22            00A24   122             A     4,=F'2'
0008A4 5A30 2A26            00A28   123             A     3,=F'6'
0008A8 4650 2894            00896   124             BCT   5,TAG3

LINKMAP

 LABEL       TYPE       ESID        LNK ORG      HIADDR      LENGTH      OB
 CALEN      CSECT        01        00001300     00001E13    00000A54     00
 PRUV         ENTRY      01        00001414                              00

          FLAG CODES -
      E - EXCLUSIVE 'A' REF    G - GENERATED EXTRN       I - INCLUSIV
      N - NOT INCLUDED         P - PROMOTED COMMON       R - SHARED H
      V - VCON ITEM
```

```
COL. 1   COL. 2                  COL. 3   COL. 4                                COL 5.

001C4A   41C022EA                00001BAE 400016AC            LINE(11)
001C4E   414023A6                0000146A8 4000176A           LINE(12)
001C52   58502A1E                00001441 00000007            LINE(13)
001C56   D50223743000            E3E4C540 40404040 40404040 40404040   ** E2E4D
001C5C   478028CC                00000000 40001C8E            LINE(15)  LINE(14)
001C60   5A402A22                0000176A 00000002            LINE(16)
001C64   5A302A26                000016AC 0000000C
001C68   46502894                00000007 40001C56
001C56   D50223743000            E3E4C540 40404040 4040404C 40404040   ** D406D
001C5C   478028CC                00000000 40001C8E
001C60   5A402A22                0000176C 00000002
001C64   5A302A26                00001632 0000000C
001C69   46502894                00000006 40001C56
001C56   D50223743000            E3E4C540 40404040 4040404C 40404040   ** E3E4C
001C5C   478028CC                00000000 40001C8E
001C5E   F81023A82A50            0C0C000C 000C000C 000C000C 000C000C   ** CC1C0
001C94   D25123AA23A9            000C000C 000C000C 000C000C 000C000C   ** 000C0
001C9A   D28320552054            40404040 40404040 40404040 40404040   ** 4040
001CA0   D20320552360            40404040 40404040 40404040 40404040   ** F1F9F
001CA6   45C029F2                A000106A 40001084
001D64   58102A16                80001C39 00000C00
001D88   58002446                00000008 00001417
001D8C   92201031                20       40000000
001DC0   58F01034                00000008 0000CEF8
001DC4   05EF                    40001C4A 0000CEF8
001DC6   D28320552054            F1F9F8F0 40404040 40404040 40404040   ** 40F1F
001DCC   07FC                    0000CEF8 00001CAA
001CAA   415027EC                00000005 40001EAE
001CAE   419023FC                00001BAE 400017BE
001CB2   F81028062A50            031C0700 45102812 80000000 CA264700   ** 0C1CC
001CB8   FA1028062A51            000C0700 45102812 80000000 CA264700   ** 1C00C
001CBE   D20140002806            000C000C 000C000C 000C000C 000C000C   ** 001CC
001CC4   5A402A22                0000176E 00000002
001CC3   F91128065000            001C0700 45102812 80000000 CA264700   ** 031CC
001CCE   474028F6                00001770 40001CB6
001CB8   FA1028062A51            001C0700 45102812 80000000 0A264700   ** 1C00C
001CBE   D20140002806            000C000C 000C000C 000C000C 000C000C   ** 002CC
001CC4   5A402A22                00001770 00000002
001CC8   F91128065000            002C0700 45102812 80000000 0A264700   ** C31C
001CCE   474028F6                00001772 40001CB6
001CB8   FA1028062A51            002C0700 45102812 80000000 0A264700   ** 1C00
001CBE   D20140002806            000C000C 000C000C 000C000C 000C000C   ** 003C
001CC4   5A402A22                00001772 00000002
001CC8   F91128065000            003C0700 45102812 80000000 0A264700   ** 031C
001CCE   474028F6                00001774 40001CB6
001CB8   FA1028062A51            003C0700 45102812 80000000 0A264700   ** 1C00
001CBE   D20140002806            000C000C 000C000C 000C000C 000C000C   ** 004C
001CC4   5A402A22                00001774 00000002
001CC8   F91128065000            004C0700 45102812 80000000 0A264700   ** 031C
001CCE   474028F6                00001776 40001CB6
001CB8   FA1028062A51            004C0700 45102812 80000000 CA264700   ** 1C00
001CBE   D20140002806            000C000C 000C000C 000C000C 000C000C   ** 005C
001CC4   5A402A22                00001776 00000002
001CC8   F91128065000            005C0700 45102812 80000000 CA264700   ** 031C
001CCE   474028F6                00001778 40001CB6
```

Explanation:

Line 1 indicates the start of Dynamic tracer routine, and the start point is TAG2, highest printable address is LAST.

Line 2. Link Map shows the ORIG ADDR of CALEN is '13C0'hx and line 2 location is '088A' therefore the actual location of the line ② instruction is '13C0' + '088A' = '1C4A'. This is shown in the column 1 of the tracer dump line ⑪.

Trace dump output

col. 1 : Location of the traced program instruction

col. 2 : Executed instruction.
Line ② of the source code is LA instruction and its object code is 413022EA. The same code appears in col. 2 of the tracer dump. See line ⑪ of the dump.

col 3 : content of operand-1. (Before execution)

In this example, the instruction in line ② is LA and in this case, the operand-1 is register-3.
The content of register-3 BEFORE the execution was '00001BAE'.
After the execution, the content of register-3 must be equal to the operand of OP2.

col. 4 : Content of operand-2. (Before execution)

Again, in Line ②, the instruction is LA, and in this case the operand-2 consists of the content of register-2 plus '2EA'hx.

Line ⑪ indicates the OP2 result was '16AC'. This value will be stored to register-3 as the result of this instruction execution.

col. 5 : Content of operand-2 for SS-type instruction

For SS1 and SS2 type instruction, the content of OP1 and OP2 will be printed in Hex. And regardless of the length of both operands, there will be 16 hex. print out, therefore, if the operand is shorter than the printed length, then ignore the excess character. If too long, then the exceeding part will not be seen.

Source line ⑤ is a CLC instruction and this is a SS1 type instruction, and comparing only first 3 bytes , but 16 hex bytes are printed. The operand-1 and 2 are divided by 2 asterisks. See the line ⑭ of the trace dump.