Transaction Debugging Using Dumps

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Contents

- **Analyzing a transaction dump**
- **ASRA abend cookbook**
- **Locating the failure**
- **Finding the last EXEC CICS command**
- **Cookbook to locate storage fields**
- **Locating relevant data**
- **Cookbook to locate information involved in a link**
- **Fault Analyzer overview**
- **Analyzing a transaction dump with Fault Analyzer**
- **Transaction dump table**
- **Printing transaction dumps**

Introduction

- **This presentation demonstrates the methodology for diagnosing a program check (abend ASRA) in a CICS COBOL application.**
- **A similar approach may be taken when dealing with abends in applications written in other languages supported by CICS, e.g. Assembler or PL1.**
- **The presentation shows how to approach the failure using CICS diagnostic data, coupled with COBOL storage contents and program listing information...**
- **The presentation also shows the ways that Fault Analyzer can be used to assist with problem determination**

Why COBOL?

- Y2K demonstrated that the COBOL programming language is still very pervasive
- Very many COBOL programs have been developed over the years, and inherited by different programmers from those who wrote them initially
- An application maintenance policy requires problem determination skills and techniques
- Straw poll - how many sites have the need for COBOL experience?

Using CICS Transaction Dumps

- **Use the transaction dump to locate:**
  - The point of failure
  - PSW address
  - The failing module
  - The failing instruction
  - The last EXEC CICS command
  - Relevant data areas
  - Called program information
  - Linking program information

Dump analysis

- **Problem determination analysis is a skill like any other**
  - It requires time, experience, and education in order to be successful
- **Knowing how to approach a CICS dump is a useful skill to possess**
  - Once you appreciate dump content, format, etc, it is a good grounding on how to approach CICS (and application) problems in the future
- **This presentation includes a** manual **approach to dump analysis**
- **There are tools and products available to assist in problem determination**
  - For example, IBM’s Fault Analyzer – providing transaction dump and system dump analysis
    - Fault Analyzer gets control through exits at abend time
    - Transaction abends are analyzed in real time and a report produced
    - Abend information can be saved in a “history file” for later analysis
- **The presentation also includes a review of using Fault Analyzer for transaction dumps**

Traditional ways to analyze CICS dumps

- **CICS generates two types of dump:**
  - Transaction dumps (when a specific CICS task abends, or requests a dump)
  - System dumps (SDUMPs), when the CICS region itself is dumped
- **CICS supplies a batch program for transaction dump formatting**
  - DFHDU650 (for CICS TS 3.2)
- **IPCS is provided by z/OS for SDUMP analysis**
  - IPCS has both an ISPF interaction, and a batch interface
  - It analyses the dump and formats out key state data and control blocks
  - It allows products to provide dump formatting exits for their own control blocks
- **CICS provides a VERBEXIT for IPCS SDUMP formatting**
  - e.g. VERBX DFHPD650 ‘KE’
- **DFHDU650 and IPCS are static formatters (no dynamic navigation)**

Dump basics - how to read a dump

Counting in Hex/Finding Offsets/Locating Addresses

```
                 03 04             0B 0C              13 14             1B 1C
               02 | | 05         0A | | 0D          12 | | 15         1A | | 1D
             01   | |   06     09   | |   0E      11   | |   16     19   | |   1E
           00     | |     07 08     | |     0F  10     | |     17 18     | |     1F
                 _| |_             _| |_              _| |_             _| |_
00000000   098B8000 000A0001 0972A618 0003EFE8  0948A238 09723530 00006500 C00000A0   *..........w....Y..s............*


                 23 24             2B 2C              33 34             3B 3C
               22 | | 25         2A | | 2D          32 | | 35         3A | | 3D
             21   | |   26     29   | |   2E      31   | |   36     39   | |   3E
           20     | |     27 28     | |     2F  30     | |     37 38     | |     3F
                 _| |_             _| |_              _| |_             _| |_
00000020   00000000 00000000 00000000 00000000  00000000 895DE3F2 09F4BEA8 09F4B132   *...................i)T2.4.y ...*
00000040   09F46220 095DF810 F20002C8 098B8148  0972A618 00000000 00000000 00000000   *.4...)8.2..H..a...w............*
```

The CICS Task Control Area (TCA)

```
00000  0A560180 000A0001 0A83F228 00049980  0A81FA10 0A833880 00000000 80000060  *.........c2...r..a...c.........-*  0A560080
00020  00000000 0000482C 00000000 00000000  00000000 8004D506 0A8BA120 00000132  *......................N.........*  0A5600A0
00040  80018BBC 80018778 0000001E 0A8C124C  0A81E634 00000000 00000000 00000000  *......g........<.aW.............*  0A5600C0
00060  00010000 0A906E30 E6D6D9D2 C1E2D9C1  00014000 00000000 00000000 000A0000  *......>.WORKASRA.. .............*  0A5600E0
00080  00000001 00000000 FFFFFFFF 00000000  00500050 00000000 00000000 00000000  *................................*  0A560100
000A0  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  *................................*  0A560120

 (1)      (2)                                                                                (3)                        (4)
```

DUMP EXAMPLE

ASRA Abend Cookbook

- FROM THE DUMP...
- 1.Determine the type of program check that occurred.
- Read in CICS Problem Determination Guide for possible causes.
- 2. Review the information in the Transaction Environment.
- 3. Review the exception trace entries at abend. Pay particular attention to the full trace, as well as the last EXEC CICS command prior to the failure.
- 4. Note the PSW address and the failing instruction length.
- 5. Determine the offset of the failing instruction:
  - Use CESE output
  - Refer to DFHAP0001 message and subtract the stub length
  - Look at OFFSET on *EXC trace entry and subtract stub length
  - Calculate the offset: Subtract the entry point address from the PSW, then subtract the failing instruction length from this
- 6.Calculate the offset of the last EXEC CICS command (Register 14).
  - Subtract the program's entry point address from the Register 14 address to determine the offset into the program of the last statement executed.

ASRA Abend Cookbook (continued)

- **PROGRAM LISTING - Equating an offset to an instruction:**
- **1. Once an offset is obtained, refer to the offset table in the program listing.**
- **2. Using the offset table, locate the first hex location larger than the offset obtained.**
- **3. Back up to the previous verb. This is the actual statement you want to review. NOTE THE LINE NUMBER.**
- **Hint. If you are looking for an offset that is register 14 or an EXEC CICS command, the verb in the offset table should be a CALL.**
- **4. Refer to the compile output portion of the program listing to locate the corresponding line number. Here you should have the COBOL statement that relates to the offset obtained from the dump.**
- **5. If the abend is not obvious, follow the "Cookbook to locate storage fields".**

Locate the Point of Failure – PSW and registers

```
ES37CICS   --- CICS TRANSACTION DUMP ---  CODE=ASRA   TRAN=PAYR   ID=1/0005

SYMPTOMS= AB/UASRA PIDS/565501800 FLDS/DFHABAB RIDS/PAYPGM1

PSW & REGISTERS AT TIME OF INTERRUPT

PSW                  078D0000   8CB04E80   00060004   00000000

REGS 0-7             0C410590   0C40F378   0C411160   0CB04E0C     0CB04B78   00000000   00000000   0C4111B0
REGS 8-15            0C410F18   0C410450   0CB04C50   0CB04D1C     0CB04C3C   0C40F2E0   8CB04E5E   00000000

REGISTERS AT LAST EXEC COMMAND

REGS 0-7             0C410590   0C40F378   0C4111B0   0CB04E0C     0CB04B78   00000000   00000000   0C4111B0
REGS 8-15            0C410F18   0C410450   0CB04C50   0CB04D1C     0C40CDB0   0C40F2E0   8CB04E5E   00000000
```

Locate the Point of Failure – transaction info

```
Transaction environment for transaction_number(0000035)

transaction_id(PAYR)       orig_transaction_id(PAYR)
initial_program(PAYMENU )  current_program(PAYPGM1 )
facility_type(TERMINAL)    facility_name(DYPG)            Start_code(TP)
netname(IBMXDYPG)          profile_name(DFHCICST)
userid(CICSUSER)           cmdsec(NO)                     ressec(NO)
spurge(NO)                 dtimeout(4769679)              tpurge(NO)
taskdatakey(USER)          taskdataloc(ANY)
twasize(00000)             twaaddr(        )
remote(NO)                 dynamic(NO)
priority(001)              Tclass(NO)                     runaway_limit(0020000)
indoubt_wait(YES)          indoubt_wait_mins(000000)
indoubt_action(????)       cics_uow_id(C01C2CABB379EEE02)confdata(NO)
system_transaction(NO)     restart_count(00000)           restart(NO)
```

Locate the Point of Failure - abbreviated trace

```
00035 QR AP 00E1 EIP  ENTRY WRITEQ-TS                                    0004,0C40F2E0 . 2\,08000A02 ....         =000113=
00035 QR TS 0201 TSQR ENTRY WRITE        CALC,0C410F18 , 0000000C,YES,MAIN,EXEC                                   =000114=
00035 QR AP 00E1 EIP  EXIT  WRITEQ-TS    OK                              00F4,00000000 ....,00000A02 ....         =000118=
00035 QR AP 1942 APLI *EXC* Program-CheckSTART_PROGRAM,PAYPGM1,CEDF,FULLAPI,EXEC,NO,0C3478A0,0C409C50 , 0000007,2*=000119=
00035 QR AP 0781 SRP  *EXC* ABEND_ASRA   PAYPGM1,FFFFFFFF,CICS                                                    =000127=
```

Reviewing the Trace Entries prior to the Abend…

The (edited) Trace Entries show that the transaction (task number 35) had issued an EXEC CICS WRITEQ command to CICS Temporary Storage.

Control returned from CICS to the application (as shown by the EIP EXIT Trace Entry). The next trace entry shows an Exception Trace event (*EXC*) issued by CICS module DFHAPLI. This shows that a Program Check was detected. CICS passes control to the System Recovery Program (DFHSRP) and this issues a further *EXC* trace showing the Abend ASRA.

Since the EIP EXIT trace call showed that control returned from CICS at this point, we know the abend occurred whilst not in CICS code.

For further information, Full Trace rather than Abbreviated can be used...

Locate Point of Failure - full trace

Reviewing the relevant Trace Entries using Full Trace…

```
AP 00E1 EIP ENTRY WRITEQ-TS                          REQ(0004) FIELD-A(0C40F2E0 . 2\) FIELD-B(08000A02 ....)
              TASK-00035 KE_NUM-002B TCB-QR   /0069C168 RET-8CB04E5E TIME-05:28:48.6413453754 INTERVAL-00.0001408750   =000113=

AP 00E1 EIP EXIT WRITEQ-TS OK                        REQ(00F4) FIELD-A(00000000 ....) FIELD-B(00000A02 ....)
              TASK-00035 KE_NUM-002B TCB-QR   /0069C168 RET-8CB04E5E TIME-05:28:48.6414570004 INTERVAL-00.0000125000   =000118=

AP 1942 APLI  *EXC* - Program-Check   FUNCTION(START_PROGRAM) PROGRAM(PAYPGM1) CEDF_STATUS(CEDF) EXECUTION_SET(FULLAPI)
                   ENVIRONMENT_TYPE(EXEC) SYNCONRETURN(NO) LANGUAGE_BLOCK(0C3478A0) COMMAREA(0C409C50 , 00000007) LINK_LEVEL(2)
                   SYSEIB_REQUEST(NO)
             TASK-00035 KE_NUM-002B TCB-QR   /0069C168 RET-8BF7FE5C TIME-05:28:48.6692091254 INTERVAL-00.0277521250*  =000119=
           1-0000  00580000 000000DA 00000000 00000000  B81B5D40 00000000 02000100 D7C1E8D7  *.................) ........PAYP*
             0020  C7D4F140 0C3D9EA0 0C3D4A50 063D9E01  00000001 01B00202 0CB01E30 0C3478A0  *GM1 ......$&..................*
             0040  00002CE8 00000000 0C409C50 00000007  00020002 02020000                    *...Y..... .&..........        *
           2-0000  F0C3F461 C1D2C5C1 018400C4 0000FFFF  C4C6C8C1 D7D3C9F1 0C003F10 0BDA7080  *0C4/AKEA.d.D...DFHAPLI1........*
             0020  0BE77680 0C336400 00000004 00000004  FF850004 00000000 078D0000 8CB04E80  *.X.............e.............*
             0040  00060004 00000000 8CB04E80 80000000  0C410590 0C40F378 0C411160 0CB04E0C  *..........+......... 3....-..+.*
             0060  0CB04B78 00000000 00000000 0C4111B0  0C410F18 0C410450 0CB04C50 0CB04D1C  *......................&..<&..(.*
             0080  0CB04C3C 0C40F2E0 8CB04E5E 00000000  006FB01F 00000002 00000000 00000000  *..<.. 2\..+;....?.............*


AP 0781 SRP  *EXC* - ABEND_ASRA PROGRAM(PAYPGM1 ) OFFSET(FFFFFFFF) EXEC_KEY(CICS)
             TASK-00035 KE_NUM-002B TCB-QR   /0069C168 RET-8BE60322 TIME-05:28:48.6694091254 INTERVAL-00.0000113750   =000127=
           1-0000  D7C1E8D7 C7D4F140 F0C3F461 C1D2C5C1  FFFFFFFF 00030781                    *PAYPGM1 0C4/AKEA......a        *
           2-0000  00                                                                         *.                             *
           3-0000  F0C3F461 C1D2C5C1 018400C4 0000FFFF  C4C6C8C1 D7D3C9F1 0C003F10 0BDA7080  *0C4/AKEA.d.D...DFHAPLI1........*
             0020  0BE77680 0C336400 00000004 00000004  FF850004 00000000 078D0000 8CB04E80  *.X.............e...........+.*
             0040  00060004 00000000 8CB04E80 80000000  0C410590 0C40F378 0C411160 0CB04E0C  *..........+......... 3....-..+.*
             0060  0CB04B78 00000000 00000000 0C4111B0  0C410F18 0C410450 0CB04C50 0CB04D1C  *......................&..<&..(.*
             0080  0CB04C3C 0C40F2E0 8CB04E5E 00000000  006FB01F 00000002 00000000 00000000  *..<.. 2\..+;....?.............*
```

Locate the Point of Failure - the PSW

Relating a PSW to a Load Module

```
PSW & REGISTERS AT TIME OF INTERRUPT

PSW                078D0000     8CB04E80     00060004     0BB45C00
                                    |         |   |
                                    |         |   |
                                    |         |   -----------------------> Interrupt code
                                    |         |
                                    |         --------------------> Instruction Length
                            Address of next instruction
                            to be executed

PROGRAM INFORMATION FOR THE CURRENT TRANSACTION
   Number of Levels 00000002
INFORMATION FOR PROGRAM AT LEVEL 00000002 of 00000002
   Program Name     PAYPGM1      Invoking Program PAYMENU
   Load Point       0CB01E30     Program Length   00002CE8
   Entry Point      8CB01E50     Addressing Mode  AMODE 31
   Language Defined Unknown      Language Deduced Unknown
   Commarea Address 0C409C50     Commarea Length  00000007
   Execution Key    USER         Data Location    ANY
   Environment      User application
```

Adding the program length to the Load Point address gives an address of 0CB04B18. Yet - this is lower than the PSW address. This means the abend must have occurred outside the current program, as known to CICS.

Locate the Point of Failure - the load module

Relating a PSW to a Load Module (continued)

```
LOAD LIST ELEMENT
   Program Name     BONUSCK      Entry Point      8CB04B40
00000000   0C369070 0BE99088 0C3D4978 8CB04B40      *.....Z.h.......             *   0C369160

----- MODULE INDEX -----
LOAD PT.    NAME     ENTRY PT   LENGTH      LOAD PT.    NAME    ENTRY PT   LENGTH
0C2CC790  DFHCRR    0C2CC7B0  000012B0     0C7E60A0  DFHEITMT  0C7E60A0  00009950
0C2D1000  DFHZATS   0C2D1028  00003218     0C9D8000  DFHAMP    0C9D8020  000243A0
0C2D4220  DFHZXST   0C2D4240  00002438     0CA00000  CEEEV007  0CA00000  00065828
0C2D6660  DFHZNAC   0C2D6680  0000A438     0CA66000  DFHEMTD   0CA66028  00018450
0C2E0AA0  DFHZXRE   0C2E0AC0  00000E08     0CB00000  PAYMENU   0CB00020  00001E28
0C2E18B0  DFHZATA   0C2E18D8  000048A0     0CB01E30  PAYPGM1   0CB01E50  00002CE8
0C2E6150  DFHQRY    0C2E6190  00000F00     0CB04B20  BONUSCK   0CB04B40  000019B8
```

Using the Load List Elements, a program can be found that has an entry point just prior to the PSW address.

Using this information with the Module Index from the dump, it can be seen that program BONUSCK has a Load Point and Program Length that cover the address where the PSW is pointing. This shows that BONUSCK was in control when the abend ASRA occurred...

PSW address CB04E80 - CB04B40 (BONUSCK entry point address) = 340.

340 - 6 (instruction length) = 33A. Therefore, the abend occurred at X'33A' in program BONUSCK.

Locate Point of Failure - msgs and *EXC* trace

Quick methods to locate the Failing Offset

FROM THE TRACE TABLE

```
AP 0781 SRP  *EXC* - ABEND_ASRA PROGRAM(PAYPGM1 ) OFFSET(FFFFFFFF) EXEC_KEY(CICS)
         TASK-00035 KE_NUM-002B TCB-QR   /0069C168 RET-8BE60322 TIME-05:28:48.6694091254 INTERVAL-00.0000113750    =000127=
       1-0000  D7C1E8D7 C7D4F140 F0C3F461 C1D2C5C1  FFFFFFFF 00030781                    *PAYPGM1 0C4/AKEA.......a        *
       2-0000  00                                                                        *.                               *
       3-0000  F0C3F461 C1D2C5C1 018400C4 0000FFFF  C4C6C8C1 D7D3C9F1 0C003F10 0BDA7080  *0C4/AKEA.d.D....DFHAPLI1........*
         0020  0BE77680 0C336400 00000004 00000004  FF850004 00000000 078D0000 8CB04E80  *.X...............e............+.*
         0040  00060004 00000000 8CB04E80 80000000  0C410590 0C40F378 0C411160 0CB04E0C  *..........+.......... 3....-..+.*
         0060  0CB04B78 00000000 00000000 0C4111B0  0C410F18 0C410450 0CB04C50 0CB04D1C  *.......................&..<&..(.*
         0080  0CB04C3C 0C40F2E0 8CB04E5E 00000000  006FB01F 00000002 00000000 00000000  *..<.. 2\..+;.....?..............*
         00C0  00000000 00000000 806FA03C 00000001  FF850004 00000000 078D0000 8CB04E80  *.........?.......e............+.*
         00E0  00060004 00000000 8CB04E80 80000000  0C410590 0C40F378 0C411160 0CB04E0C  *..........+.......... 3....-..+.*
         0100  0CB04B78 00000000 00000000 0C4111B0  0C410F18 0C410450 0CB04C50 0CB04D1C  *.......................&..<&..(.*
         0120  0CB04C3C 0C40F2E0 8CB04E5E 00000000  006FB01F 00000002 00000000 00000000  *..<.. 2\..+;.....?..............*
```

CICS SYSTEM LOG

+DFHAP0001 ES37CICS An abend (code 0C4/AKEA) has occurred at offset X'FFFFFFFF' in module PAYPGM1.

CICS TD QUEUE- CEEMSG.

CEE3204S The system detected a protection exception.

From compile unit BONUSCK at entry point BONUSCK at compile unit offset +0000033A at address 0CB04E7A.

To obtain the correct offset if using the DFHAP0001 message or trace the program stub size and the length of the bad instruction must be subtracted from the offset. The COBOL stub size is the difference between the entry and load points. In this particular case, the offset is shown as x'FFFFFFFF', indicating CICS was not able to determine the failing program, as a dynamic call had taken place.

The Last EXEC CICS Command (R14)

PSW and registers...

```
PSW & REGISTERS AT TIME OF INTERRUPT
REGS 0-7          0C410590   0C40F378   0C411160   0CB04E0C     0CB04B78   00000000   00000000   0C4111B0
REGS 8-15         0C410F18   0C410450   0CB04C50   0CB04D1C     0CB04C3C   0C40F2E0   8CB04E5E   00000000

REGISTERS AT LAST EXEC COMMAND
REGS 0-7          0C410590   0C40F378   0C4111B0   0CB04E0C     0CB04B78   00000000   00000000   0C4111B0
REGS 8-15         0C410F18   0C410450   0CB04C50   0CB04D1C     0C40CDB0   0C40F2E0   8CB04E5E   00000000
```

Trace Entries for Dumping Transaction...

```
AP 00E1 EIP EXIT WRITEQ-TS OK                      REQ(00F4) FIELD-A(00000000 ....) FIELD-B(00000A02 ....)
  TASK-00035 KE_NUM-002B TCB-QR   /0069C168 RET-8CB04E5E TIME-05:28:48.6414570004 INTERVAL-00.0000125000    =000118=

AP 1942 APLI  *EXC* - Program-Check   FUNCTION(START_PROGRAM) PROGRAM(PAYPGM1) CEDF_STATUS(CEDF) EXECUTION_SET(FULLAPI)
   ENVIRONMENT_TYPE(EXEC) SYNCONRETURN(NO) LANGUAGE_BLOCK(0C3478A0) COMMAREA(0C409C50 , 00000007)
   LINK_LEVEL(2)SYSEIB_REQUEST(NO)
```

The Last EXEC CICS Command (R14) continued

Control blocks for the dumping transaction...

```
TASK CONTROL AREA (SYSTEM AREA)  ---  TCAPCHS is at offset X'40'
000000  00000000 00000000 00000000 00000000  0000035C 0BDC9EE4 00000042 00000000  *...................*...U........*  BE77780
000020  00000000 00000000 00000000 00000000  00000000 00000000 0C33E720 00000000  *..........................X.....*  BE777A0
000040  0C40F2E0 00000000 00000000 00000000  00000000 00000000 00000000 00000000  *. 2.............................*  BE777C0

TRANSACTION STORAGE-USER31               ADDRESS 0C40AB70 TO 0C411D5F    LENGTH 000071F0

004760  00000000 00000000 00000000 00000000 00104001 0C40EFD8 00000000  8CB04E5E  *.................. .. .Q......+;*  C40F2D0
004780  00000000 0C410590 0C40F378 0C4111B0 0CB04E0C 0CB04B78 00000000  00000000  *......... 3.......+.............*  C40F2F0
0047A0  0C4111B0 0C410F18 0C410450 0CB04C50 0CB04D1C 0C40CDB0 00000000  0C40F3A8  *..............<...(.. ....... 3y*  C40F310
0047C0  00000000 00000000 0C40F2E0 0C410450 00000000 00000000 00000000  00000000  *......... 2.....................*  C40F330

----- MODULE INDEX -----
LOAD PT.    NAME     ENTRY PT   LENGTH      LOAD PT.    NAME     ENTRY PT   LENGTH
0C2D6660  DFHZNAC    0C2D6680  0000A438     0CA66000  DFHEMTD    0CA66028  00018450
0C2E0AA0  DFHZXRE    0C2E0AC0  00000E08     0CB00000  PAYMENU    0CB00020  00001E28
0C2E18B0  DFHZATA    0C2E18D8  000048A0     0CB01E30  PAYPGM1    0CB01E50  00002CE8
0C2E6150  DFHQRY     0C2E6190  00000F00     0CB04B20  BONUSCK    0CB04B40  000019B8
```

Register 14 in any case is equal to 0CB04E5E. This address also falls into program BONUSCK whose entry point is 0CB04B40. Subtracting the entry point from Register 14, we get an offset of 31E.

Locate Instructions using the program offset

The offset table in the program listing

```
LINE #   HEXLOC   VERB            LINE #   HEXLOC   VERB            LINE #   HEXLOC   VERB

000067   0002D6   MOVE            000068   0002DC   CALL            000075   00032A   DIVIDE
000079 000340   IF                000080   00035E   MOVE            000083   000364   GOBACK
```

Relate the offset to the actual compile line

```
000019     LINKAGE SECTION.
000055     01  PAYPASS.                                                  BLL=0003+000
000056         10 BONI-CHECK           PIC 9(7).                         BLL=0003+000
000057         10 SALARY-CK            PIC S9999999V99 USAGE COMP-3.     BLL=0003+007
000058     01  PAYCALC.                                                  BLL=0004+000
000059         10 MONTHLY-SALARY       PIC S999999V99  USAGE COMP-3.     BLL=0004+000
000060    *
000061     PROCEDURE DIVISION USING DFHEIBLK DFHCOMMAREA PAYPASS.
000062    *
000063     CALCULATE-BONUS.
000064    *EXEC CICS WRITEQ TS QUEUE('CALC')
000065    *                    FROM(PAYPASS) MAIN
000066    *END-EXEC.
000067         Move length of PAYPASS to dfhb0020
000068         Call 'DFHEI1' using by content x'0a02e0000700004900f0f0f0f2f5
000069    -    '404040' by content 'CALC    ' by reference PAYPASS by
000070         reference dfhb0020 end-call.
000071
000072    *
000073    * CALCULATE MONTHLY SALARY
000074    *
000075          DIVIDE SALARY-CK BY 12 GIVING MONTHLY-SALARY.
000076    *
000077    * IF BONUS AMOUNT IS LARGER THAN MONTHLY SALARY THEN ERROR
```

Locate Instructions Using Offset (continued)

- The PSW address points to the instruction at offset X'33A'. Looking at the 'HEXLOC' column, 340 is the first offset larger than 33A. Backing up to the previous verb, we see that #75 is the line number where the failure occurred (PSW calculated offset).

- The Register 14 calculated offset is 31E. Following the same procedure above, we see that the VERB is a CALL and the COBOL line number is 68. Backing up to the first outdented statement, we see that an EXEC CICS WRITEQ TS command was issued.

ASRA Abend Cookbook worksheet

- FROM THE DUMP...
- **1.** Determine the type of program check that occurred.
  - An 0C4 occurred. This is a protection exception problem.
- 2. Review the information in the Transaction Environment.
  - Transaction environment shows the current program, userid, how envoked, etc.
- 3. Review the exception trace entries.
  - The exception trace entry showed that an ASRA 0C4 occurred.
  - The offset calculated was not a good one, it was FFFFFFFF.
  - The last EXEC CICS command was an EXEC CICS WRITEQ TS.
  - CICS suspected that the program in control at the time of the failure was PAYPGM1.
- 4. Note the PSW address and failing instruction length.
  - The PSW address was CB04E80 and the failing instruction length was 6.
- 5. Locate the offset of the failing instruction.
  - Subtract the entry point address from the PSW address.
  - Entry point of CB04B40 subtracted from PSW address CB04E80 gives an offset of 340.
  - Subtract the assembler instruction length from the answer above.
  - 6 (on PSW line - interrupt information) subtracted from 340 gives 33A.
- 6. Calculate the offset of the last EXEC CICS command (Register 14).
  - Subtract the entry point address from the R14 address
  - Entry point of CB04B40 subtracted from R14 CB04E5E gives an offset of 31E.

ASRA Abend Cookbook worksheet (continued)

- FROM THE PROGRAM LISTING...
- 1. Using the offset table, locate the first hexloc larger than the offset obtained for the PSW and register 14.
- 2. PSW offset of 33A.
  - The first hexloc larger than 33A is 340.
- 3. Back up to the previous COBOL verb. This is the failing statement. Note the LINE #.
  - Backing up to the previous verb, we see the line number is 75.
- 4. Refer to the compile listing of the program to locate the corresponding line number.
  - The statement where the abend occurred is 'DIVIDE SALARY-CK BY 12 GIVING MONTHLY-SALARY'.
- 5. Register 14 offset is 31E.
  - The first hexloc larger than 31E is 32A.
- 6. Back up to the previous COBOL verb. This is the last EXEC CICS statement. Note the LINE # of 68.
- 7. Refer to the compile listing of the program to locate the corresponding line number. For a CICS command, look back up at the first "out-dented" line to see the actual command.
  - The last EXEC CICS statement was EXEC CICS WRITEQ TS QUEUE('CALC') FROM(PAYPASS) MAIN END-EXEC.
- 8. If the abend is not obvious, follow the "Cookbook to locate storage fields".

Locating Relevant Data Areas

- **COBOL has two types of data areas:**
  - Working storage
    - Data items are in contiguous storage
    - Storage is pre-allocated
    - Addressed by Base Locator cells (BLW or BL)
- **Linkage section**
  - Storage passed to a program
  - Storage acquired by a program
  - Addressed by Base Locator (BLL)
- **Each 01 level is addressed by a different BLL cell**
- **Base locator cells reside in the COBOL Task Global Table (TGT).**

Checklist to find TGT address (COBOL for z/OS)

- **Approach 1**
  - Use Register 9 address from 'REGISTERS AT TIME OF INTERRUPT' or from 'REGISTERS AT LAST EXEC COMMAND'
- **Approach 2**
  - Record Register 13 address from 'REGISTERS AT TIME OF INTERRUPT' or from 'REGISTERS AT LAST EXEC COMMAND'
  - Add 5C to this address. Go there in the dump. At that storage location will be an address that is the TGT address.
- **Approach 3**
  - Go to the trace table. Look for an EXEC CICS command that your program issued (EIP ENTRY). Write down the Field A address.
  - Add 5C to this address. Go there in the dump. At that storage location will be an address that is the TGT address.
- **Approach 4**
  - Obtain the address in field TCAPCHS (from the System TCA)
  - Add 5C to this address. Go there in the dump. At that storage location will be an address that is the TGT address.
- **Approach 5**
  - If the LE run-time option TRMTHDACT=UADUMP is set, look at the CEEMSG output. The TGT address will be identified.

Finding the TGT Address in a Dump...

Approach 1 and 2:

```
PSW & REGISTERS AT TIME OF INTERRUPT

PSW                 078D0000   8CB04E80   00060004   00000000
REGS 0-7            0C410590   0C40F378   0C411160   0CB04E0C          0CB04B78   00000000   00000000  0C4111B0
REGS 8-15           0C410F18   0C410450   0CB04C50   0CB04D1C          0CB04C3C   0C40F2E0   8CB04E5E   0000000
```

Approach 3:

```
== TRACE ENTRIES FOR DUMPING TRANSACTION ==

00035 QR  AP 00E1 EIP   ENTRY WRITEQ-TS                                    0004,0C40F2E0. 2\,08000A02 ....     =000113=

AP 00E1 EIP ENTRY WRITEQ-TS                          REQ(0004) FIELD-A(0C40F2E0 . 2\) FIELD-B(08000A02 ....) TASK-00035 KE_NUM-002B TCB-QR
    /0069C168
    RET-8CB04E5E TIME-05:28:48.6413453754 INTERVAL-00.0001408750  =000113=
```

Approach 4:

```
TASK CONTROL AREA (SYSTEM AREA)   TCAPCHS is at offset X'40' (pointer to high level save area)

000000  00000000 00000000 00000000 00000000  0000035C 0BDC9EE4 00000042 00000000  *.................*...U........*  0BE77780
000020  00000000 00000000 00000000 00000000  00000000 00000000 0C33E720 00000000  *.........................X.....*  0BE777A0
000040  0C40F2E0 00000000 00000000 00000000  00000000 00000000 00000000 00000000  *. 2...........................*  0BE777C0
```

Approach 2 and 4:

```
TRANSACTION STORAGE-USER31               ADDRESS 0C40AB70 TO 0C411D5F    LENGTH 000071F0

000000  E4F0F0F0 F0F0F3F5 00000000 00000000  00000000 8C00ABA8 00026B98 0BC4B418  *U0000035...............y..,q.D..*  0C40AB70
004720  C2D6D5E4 E2C3D240 81000000 0C40F288  0C40F89C 94000000 0C40F288 00000000  *BONUSCK a.... 2h. 8.m.... 2h....*  0C40F290
004780  00000000 0C410590 0C40F378 0C4111B0  0CB04E0C 0CB04B78 00000000 00000000  *......... 3.......+.............*  0C40F2F0
0047A0  0C4111B0 0C410F18 0C410450 0CB04C50  0CB04D1C 0C40CDB0 00000000 0C40F3A8  *.............<...(.. ....... 3y*  0C40F310
0047C0  00000000 00000000 0C40F2E0 0C410450  00000000 00000000 00000000 00000000  *......... 2....... ...........30*  0C40F330
```

Finding the TGT Address (continued)

Approach 5:

CESEMSG OUTPUT (TRMTHDACT=UADUMP)

Information for enclave PAYPGM1 called by enclave PAYMENU

```
    Program BONUSCK was compiled 02/05/03 5:00:31 AM
    TGT for BONUSCK: 0C410450

    Program PAYPGM1 was compiled 02/05/03 2:52:01 AM
    TGT for PAYPGM1: 0C410BC0

    Storage and control blocks for non-active routines:
    TGT for PAYMENU : 0C4099F0
```

Cookbook to Locate Storage Fields

- **From the compile listing for the program…**
- **1. Go to the Data Division Map and note the following:**
  - The Field you wish to locate
  - The BLW/BLL number
  - The hex displacement of the field
  - Data type and the number of bytes
- **2. Find the TGT Memory Map at the end of the compile listing. Record the offset within the TGT where the Base Locators for Working Storage (BLW) or Base Locators for Linkage (BLL) can be found.**

- **From the dump…**
- **1. Obtain the TGT address.**
- **2. Add the offset from step 2 above to the TGT address. Go there in the dump. This will point to another address which is the first base locator for working storage (BLW0) or the first base locator for linkage (BLL0).**
- **3. If the field you wish to find is located off of BLW0/BLL0 then note this address. If it is located off of BLW1/BLL1 then note the address in the next word, BLW2/BLL2 the third word... etc.**
- **4. Add the displacement of the field, from the compile listing, to the base locator address found in the previous step.**
- **5. Go to the address obtained in the previous step. Starting at this address, highlight the number of bytes for the field as defined in the program listing.**

The Program Listing

The Data Division map

```
Source   Hierarchy and                     Base       Hex-Displacement  Asmblr Data
 LineID   Data Name                         Locator    Blk   Structure   Definition    Data Type

      3  PROGRAM-ID BONUSCK---------------------------------------------------------------------*
     55    1  PAYPASS . . . . . . . . . . . .BLL=0003   000                 DS 0CL12      Group
     56      2  BONI-CHECK. . . . . . . . . .BLL=0003   000   0 000 000   DS 7C         Disp-Num
     57      2  SALARY-CK . . . . . . . . . .BLL=0003   007   0 000 007   DS 5P         Packed-Dec
     58    1  PAYCALC . . . . . . . . . . . .BLL=0004   000                 DS 0CL5       Group
     59      2  MONTHLY-SALARY. . . . . . . .BLL=0004   000   0 000 000   DS 5P         Packed-Dec
```

TGT Memory Map

```
TGTLOC.                                         *** VARIABLE PORTION OF TGT ***
                                                000120  BASE LOCATORS FOR SPECIAL REGISTERS
000000  RESERVED - 72 BYTES                                 000128  BASE LOCATORS FOR WORKING STORAGE
000048  TGT IDENTIFIER                                      00012C  BASE LOCATORS FOR LINKAGE SECTION
00004C  RESERVED - 4 BYTES                                  000140  CLLE ADDR. CELLS FOR CALL LIT. SUB-PGMS.
000050  TGT LEVEL INDICATOR                                 000144  INTERNAL PROGRAM CONTROL BLOCKS
000051  RESERVED - 3 SINGLE BYTE FIELDS
000054  32 BIT SWITCH                                        *** DSA MEMORY MAP ***
000058  POINTER TO RUNCOM                                   DSALOC
00005C  POINTER TO COBVEC
000064  NUMBER OF FCB'S                                     000000  REGISTER SAVE AREA
000068  WORKING-STORAGE LENGTH                              00004C  STACK NAB (NEXT AVAILABLE BYTE)
000114  WORKING-STORAGE ADDRESS                             000058  ADDRESS OF INLINE-CODE PRIMARY DSA
000118  POINTER TO FIRST SECONDARY FCB CELL     00005C  ADDRESS OF TGT
00011C  POINTER TO STATIC CLASS INFO BLOCK                  000080  PROCEDURE DIVISION RETURNING VALUE
```

Transaction Dump Areas - Registers and Transaction Storage...

```
PSW & REGISTERS AT TIME OF INTERRUPT

PSW                 078D0000   8CB04E80   00060004   00000000
REGS 0-7            0C410590   0C40F378   0C411160   0CB04E0C           0CB04B78   00000000   00000000   0C4111B0
REGS 8-15           0C410F18   0C410450   0CB04C50   0CB04D1C           0CB04C3C   0C40F2E0   8CB04E5E   00000000

EXEC INTERFACE BLOCK.
000000   0052848F 0099036F D7C1E8D9 0000035C  C4E8D7C7 00000660 00077D0A 02000000  *..d..r.?PAYR...*DYPG...-..'.....* 0C4000D0
000020   000000D7 C1E8D9D6 D3D34000 00000000  000000C3 C1D3C340 40404000 00000000  *...PAYROLL ........CALC    .....* 0C4000F0


PROGRAM COMMUNICATION AREA               ADDRESS 0C409C50 TO 0C409C56    LENGTH 00000007
000000   40F0F0F0 F0F1F0                                                           * 000010                         * 0C409C50


TRANSACTION STORAGE-USER31               ADDRESS 0C40AB70 TO 0C411D5F    LENGTH 000071F0

000000   E4F0F0F0 F0F0F3F5 00000000 00000000  00000000 8C00ABA8 00026B98 0BC4B418  *U0000035...............y..,q.D..* 0C40AB70

0059C0   00000000 00000000 0CB04C3C 00000001  0C410594 0C410408 0CB04C9C 00000000  *..........<........m......<.....* 0C410530
0059E0   0CB04B40 0CB04C58 0C410594 0CB04C4C  00000000 0C4111B0 00000000 00000000  *... ..<....m..<<................* 0C410550
005A00   00000000 0C411160 0C4111B0 00000000  0C4000D0 0C409C50 0C410F18 00000000  *......-......... ... ...........* 0C410570
005A20   00000000 40000000 00000000 00000000  00000000 00000001 0C410450 0C411160  *.... ..........................-* 0C410590
006080   00000000 00000000 00000000 00000000  00000000 00000000 F3E3C7E3 00000000  *........................3TGT....* 0C410BF0
0060A0   05000000 60030220 0C410818 000D4C2C  0C410D40 00000000 00000362 00000000  *....-.........<.... ............* 0C410C10
0060C0   00000000 0C410D78 00000000 00000000  0C40CDB0 0000017C 00000000 00000000  *................ ...............* 0C410C30
0060E0   00000000 00000001 E2E8E2D6 E4E34040  C9C7E9E2 D9E3C3C4 00000000 00000000  *........SYSOUT  IGZSRTCD........* 0C410C50
006100   00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  *................................* 0C410C70
```

Worksheet to Locate Storage Fields

- From the compile listing for the program:
- 1. Go to the Data Division Map and note the following:
  - SALARY-CK uses BLL 3 plus a displacement of 7. It is a packed numeric data type 5 characters long.
  - MONTHLY-SALARY uses BLL 4 plus a displacement of 0. It is a packed numeric data type 5 characters long.
- 2. Find the TGT Memory Map at the end of the compile listing and record the offset within the TGT where the Base Locators for Linkage (BLL) can be found.
  - The first base locator for linkage can be found at offset 12C from the beginning of the TGT.

Worksheet to Locate Storage Fields (continued)

- **From the dump:**
- **1. Obtain the TGT address**
  - The address of the TGT from R9 on page 1 of the dump is C410450.
- **2. Add the offset of the BLL cells to the TGT address obtained above, and go there. This will point to another address, which is the first BLL.**
  - Adding 12C to C410450 gives C41057C. Going to that storage location we find an address of 00000000. This is BLL 0.
- **3.If the field you wish to find is located off of BLL 0 then note this address.**
  - We want BLL 3 and BLL 4, so go over 4 words for BLL 3 and you see that the address is C410F18. The next word is BLL 4, but it is 00000000. THIS IS THE CAUSE OF THE 0C4!
- **4. Add the displacement of the field, from the compile listing, to the base locator found in the previous step.**
  - Adding the displacement of SALARY-CK (7) to BLL 3 (C410F18), we get C410F1F.
- **5. Go to the address obtained in the previous step. Starting at this address, highlight the number of bytes for the field - as defined in the program listing.**
  - Looking at storage at address C410FF for 5 bytes, we find that the data is 005275000C. This data looks fine.

A final look at the program...

PAYCALC was not passed as an external reference when BONUSCK was invoked, nor was storage acquired for it at runtime via a GETMAIN or a READ SET command. As such, nothing mapped the 01 structure to its actual storage, and BLL 4 remained 0.

```
000019    LINKAGE SECTION.
000055    01  PAYPASS.                                                  BLL=0003+000
000056        10 BONI-CHECK           PIC 9(7).                         BLL=0003+000
000057        10 SALARY-CK            PIC S9999999V99 USAGE COMP-3.     BLL=0003+007
000058    01  PAYCALC.                                                  BLL=0004+000
000059        10 MONTHLY-SALARY       PIC S999999V99  USAGE COMP-3.     BLL=0004+000
000060   *
000061    PROCEDURE DIVISION USING DFHEIBLK DFHCOMMAREA PAYPASS.
000062   *
000063    CALCULATE-BONUS.
000064   *EXEC CICS WRITEQ TS QUEUE('CALC')
000065   *                    FROM(PAYPASS) MAIN
000066   *END-EXEC.
000067        Move length of PAYPASS to dfhb0020
000068        Call 'DFHEI1' using by content x'0a02e0000700004900f0f0f0f2f5
000069   -    '404040' by content 'CALC    ' by reference PAYPASS by
000070        reference dfhb0020 end-call.
000071
000072   *
000073   * CALCULATE MONTHLY SALARY
000074   *
000075         DIVIDE SALARY-CK BY 12 GIVING MONTHLY-SALARY.
000076   *
000077   * IF BONUS AMOUNT IS LARGER THAN MONTHLY SALARY THEN ERROR
```

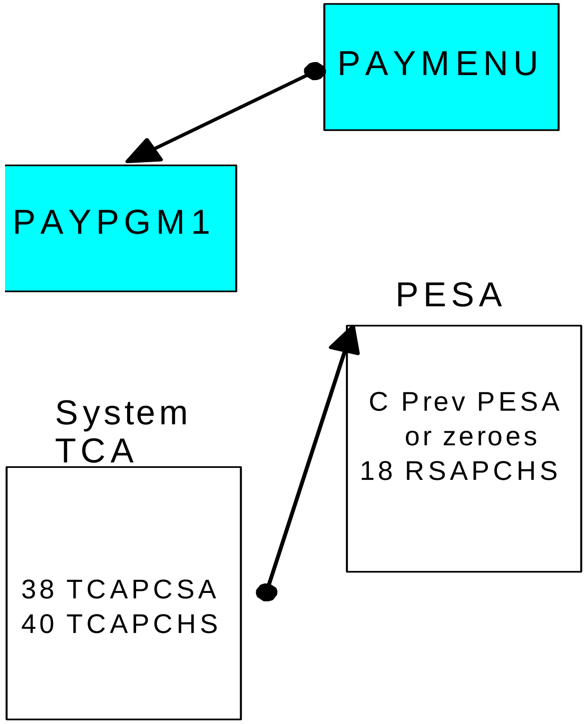
A final look at the storage in the dump...

BLL cells 0, 1, 2, 3 and 4

```
0059C0   00000000 00000000 0CB04C3C 00000001  0C410594 0C410408 0CB04C9C 00000000  *..........<........m......<.....* 0C410530
0059E0   0CB04B40 0CB04C58 0C410594 0CB04C4C  00000000 0C4111B0 00000000 00000000  *... ..<....m..<<...............* 0C410550
005A00   00000000 0C411160 0C4111B0 00000000  0C4000D0 0C409C50 0C410F18 00000000  *.......-......... ... ..........* 0C410570
005A20   00000000 40000000 00000000 00000000  00000000 00000001 0C410450 0C411160  *.... ........................-* 0C410590
006080   00000000 00000000 00000000 00000000  00000000 00000000 F3E3C7E3 00000000  *.......................3TGT....* 0C410BF0
0060A0   05000000 60030220 0C410818 000D4C2C  0C410D40 00000000 00000362 00000000  *....-.........<.... ............* 0C410C10
0060C0   00000000 0C410D78 00000000 00000000  0C40CDB0 0000017C 00000000 00000000  *................ ..............* 0C410C30
0060E0   00000000 00000001 E2E8E2D6 E4E34040  C9C7E9E2 D9E3C3C4 00000000 00000000  *........SYSOUT  IGZSRTCD........* 0C410C50
006100   00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  *................................* 0C410C70
006120   00000000 00000000 00000000 00000000  00000000 00000000 0CB01F4C 00000001  *.........................<....* 0C410C90
006140   0C410D28 0C410AF0 0CB02448 00000000  8CB01E50 0CB01FB0 0C410D28 0CB01F84  *.......0.......................d* 0C410CB0
006160   00000000 0C410DD8 00000000 00000000  00000000 0C410D88 0C410DD8 00000000  *.......Q...............h...Q....* 0C410CD0
006180   0C4000D0 0C409C50 00000000 00000000  00000000 00000000 00000000 00000000  *. ... .........................* 0C410CF0
0061A0   00000000 00000000 00000000 00000000  00000000 00000000 40000000 00000000  *....................... .......* 0C410D10
0061C0   00000000 00000000 00000001 00000000  0C410BC0 0C410D88 0C410DD8 00000000  *.......................h...Q....* 0C410D30
0061E0   C8C1D5C3 0C40BA18 0C40BA18 00000000  8C410D50 0C4111E8 00001000 00000B68  *HANC. ... .............Y........* 0C410D50
006200   0C410D50 000003D8 000003C9 00000000  00000000 00000000 00000000 00000000  *.......Q...I....................* 0C410D70
006220   00000000 00000000 C9C7E9E2 D9E3C3C4  00000000 00000000 00000000 00000000  *........IGZSRTCD................* 0C410D90
006240   00000000 00000000 E2E8E2D6 E4E34040  00000000 00000000 0E000000 00000000  *........SYSOUT  ................* 0C410DB0
006260   0F000000 00000000 40404040 40404040  00000000 00000000 00000000 00000000  *........        ................* 0C410DD0
0062C0   00000000 00000000 000000F0 F0F0F0F1  F0C2D6D5 E4E2C3D2 40000000 00000000  *...........000010BONUSCK .......* 0C410E30
0062E0   F0F0F0F0 F1F00009 C3C8D9C9 E2E3C9D5  C5000000 C90004C8 C1C1E200 00000000  *000010..CHRISTINE...I..HAAS.....* 0C410E50



006300   00000000 0000C1F0 F0F1F2F1 F2F0F161  F0F161F1 F9F6F5D7 D9C5E240 40404000  *......A00121201/01/1965PRES    .* 0C410E70
006320   12C6F0F8 61F1F461 F1F9F3F3 00527500  0C000100 000C0004 22000C00 00000000  *.F08/14/1933....................* 0C410E90
006340   00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  *................................* 0C410EB0
0063A0   00000000 00000000 F0F0F0F0 F0F0F500  5275000C 00000000 40404040 40404040  *........0000005.........        * 0C410F10
0063C0   40404040 40404040 40404040 40404040  40404040 40404040 404040D7 C8D6D5C5  *                           PHONE* 0C410F30
```

Program Linkage information

```
PROGRAM INFORMATION FOR THE CURRENT TRANSACTION
Number of Levels 00000002
INFORMATION FOR PROGRAM AT LEVEL 00000002 of 00000002
Program Name     PAYPGM1      Invoking Program PAYMENU
Load Point       0CB01E30     Program Length   00002CE8
Entry Point      8CB01E50     Addressing Mode  AMODE 31
Language Defined Unknown      Language Deduced Unknown
Commarea Address 0C409C50     Commarea Length  00000007
Execution Key    USER         Data Location    ANY
Environment      User application

INFORMATION FOR PROGRAM AT LEVEL 00000001 of 00000002
Program Name     PAYMENU      Invoking Program CICS
Load Point       0CB00000     Program Length   00001E28
Entry Point      8CB00020     Addressing Mode  AMODE 31
Language Defined Unknown      Language Deduced Unknown
Commarea Address 0C403988     Commarea Length  00000007
Execution Key    USER         Data Location    ANY
Environment      User application
```



Cookbook to Locate Information in a CICS Link

- 1. Locate field TCAPCSA. If it is equal to zeroes, stop. This means that no link is currently active.
- 2. Add x'18' to the address found in TCAPCSA.
- 3. Go to that location in storage. It will be within a heading of KERNEL STACK ENTRY OWNED BY DFHPGLE with an eyecatcher of DFHPESA.
- 4. At that location should be another address. This address can be used just like TCAPCHS to locate the linker's working storage and registers. For COBOL II programs, this IS the TGT address.
- 5. If this is a COBOL for MVS program or higher, add x'5C' to the address found in the previous step and go there in the dump. At that storage location will be another address that is the TGT address.
- 6. Follow the Cookbook to Locate Storage Fields at this point to find any fields you wish.
- 7. If there are more than two links involved, there will be multiple PESA's. To see if there are additional links, take the address in step 1 above and add x'C' to it. If this is zeroes, there are no more links.
- 8. If it is not zero, add x'18' to the address that was found at offset x'C' to find the third program's working storage and registers, and so forth.

Locating Storage involved in a Link

```
TASK CONTROL AREA (SYSTEM AREA)  ---  TCAPCSA is at offset X'38'
000000  00000000 00000000 00000000 00000000  0000035C 0BDC9EE4 00000042 00000000  *...................*...U........*  0BE77780
000020  00000000 00000000 00000000 00000000  00000000 00000000 0C33E720 00000000  *..........................X.....*  0BE777A0
000040  0C40F2E0 00000000 00000000 00000000  00000000 00000000 00000000 00000000  *. 2.............................*  0BE777C0


KERN STACK ENTRY OWNED BY DFHPGLE
000000  00000490 0C33E0C0 00000000 8BF7FE5C  8BB00280 00000410 0C33E4A0 00006000  *.............7.*..........U...-.*  0C33E380

...
0003A0  00EC6EC4 C6C8D7C5 E2C10180 00000000  8C2412F4 00000000 0C407C68 00000000  *..>DFHPESA.........4............*  0C33E720
0003C0  00000000 00070000 00000000 00000C40  39A80000 00000000 00000C34 78280C33  *............... .y..............*  0C33E740
0003E0  DEE40000 00000000 08000100 00068880  80000000 00000000 00000C40 39F00000  *.U............h............ .0..*  0C33E760
000400  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  *................................*  0C33E780
000420  00000000 00000000 00000C40 00D00C40  39880C40 7C680000 00000000 00000000  *........... ... .h. ............*  0C33E7A0
000440  00008C00 684E0002 6B980BC4 B4180C33  DE900BE7 79888C00 3F100C33 DB900C00  *.....+..,q.D.......X.h..........*  0C33E7C0
000460  4F0F0C00 5F0E0C00 6F0D0C00 7F0C0004  73C80000 00150C34 78280BE7 76800000  *........?........H.........X....*  0C33E7E0
000480  00000000 00000000 05330180 0C33EA60                                        *...............-                *  0C33E800



TRANSACTION STORAGE-USER31               ADDRESS 0C4039A0 TO 0C40AB6F    LENGTH 000071D0

000000  E4F0F0F0 F0F0F3F5 8C009E08 0C33E0C0  0C00AE07 00000024 8C347844 0C33E3E4  *U0000035......................TU*  0C4039A0
....
004300  0C4099F0 0CB0012C 0CB002A4 0C405BE0  00000000 0C407D60 00000000 00000000  *. r0.......u. £...... '-........*  0C407CA0
004320  0C407C68 0C4099F0 00000000 00000000  00000000 00000000 00000000 00000000  *. ... r0........................*  0C407CC0
004340  00000000 00000000 00000000 00000000  00000000 00000000 00000000 0CB007E4  *...............................U*  0C407CE0
```

Worksheet to Locate Information in a Link

- **1. Locate field TCAPCSA within the dump.**
  - The TCAPCSA address is C33E720. Since this is not zeroes, we know that a link is currently active.
- **2. To locate storage fields for the LINKED FROM program, add x'18' to the address in TCAPCSA.**
  - Adding x'18' to C33E720 gives us C33E738. Going there in the dump, we find an address of C407C68 (as this is COBOL for MVS, add 5C to this address to then take us to address C407CC4. This contains the TGT address - C4099F0).
  - This is akin to having TCAPCHS for the LINKED FROM program. To find storage areas for the LINKED FROM program, use the 'Cookbook to Locate the TGT' and the 'Cookbook to Locate Storage Fields' substituting the address we just obtained, C407CC4, for Register 13, the EIP entry or TCAPCHS address (approaches 2 through 4).
- **3. To see whether a third link is involved, take the address in TCAPCSA and add x'C' to it. At that storage location, if it is zeroes, no further links are involved.**
  - TCAPCSA address of C33E720 plus x'C' gives us C33E72C. This location contains zeroes.

COBOL... COBOL, COBOL,

- Depending on what level of COBOL your program is compiled against, various differences will be seen.

- CICS has supported various flavours of COBOL
  - OS/VS COBOL
  - VS COBOL II
  - IBM COBOL for OS/390 and VM
  - IBM Enterprise COBOL for z/OS and OS/390

- One noticeable difference is the TGT eyecatcher.
  - This will be TGT, 2TGT or 3TGT...

- NOTE – 3TGT is the eyecatcher for Enterprise COBOL…

```
00000000 40000000 00000000 00000000  00000000 00000001 0C410450 0C411160  *.... ..........................-* 0C410590
00000000 00000000 00000000 00000000  00000000 00000000 F3E3C7E3 00000000  *........................3TGT....* 0C410BF0
05000000 60030220 0C410818 000D4C2C  0C410D40 00000000 00000362 00000000  *....-.........<.... ............* 0C410C10
```

FAULT ANALYZER

Fault Analyzer

- **IBM product to assist with problem determination**
  - 5655-U28

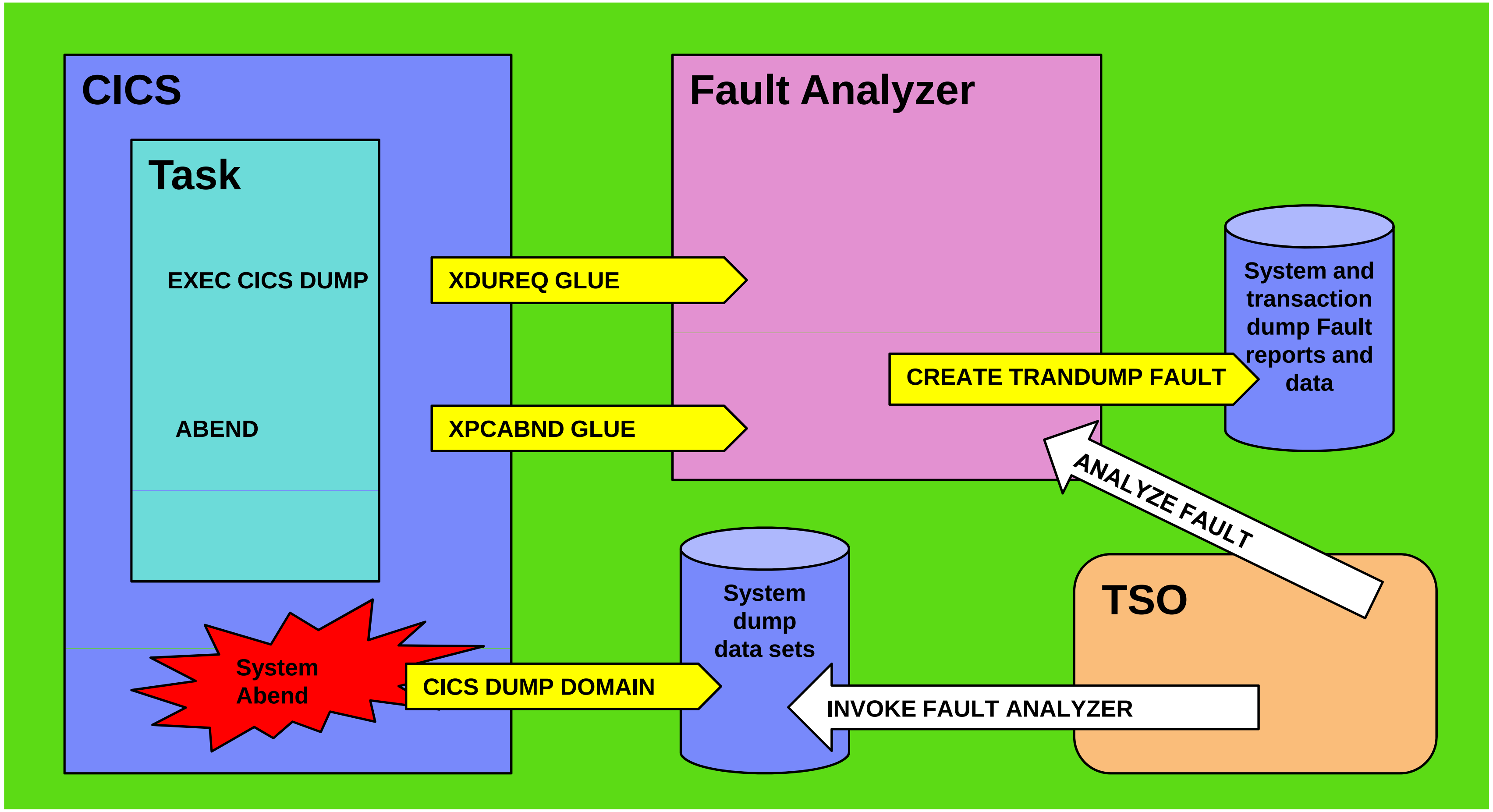
- **Provides abend analysis assistance**

  COBOL
  PL/I
  Assembler
  C/C++
  Language Environment
  UNIX System Services
  CICS
  IMS
  DB2
  MQSeries
  WebSphere
  Java

Fault Analyzer and CICS

- **Problem determination and dump analysis assistance for Faults**
- **Fault Analyzer provides diagnostic analysis for CICS**
  - Transaction abends
  - System dumps
- **For transaction abends and dumps, Fault Analyzer is invoked to capture information at the time**
  - Via CICS XPCABND GLUE for transaction abends
  - Via CICS XDUREQ GLUE for EXEC CICS DUMP TRANSACTION commands
  - Via LE abnormal termination exit CEECXTAN
  - The information and report can be saved in a history file for later analysis
- **For system dumps, Fault Analyzer runs against the SDUMP itself**
  - Fault Analyzer does not need to be installed in the CICS region to do this
  - The dump taken as normal, and analysed / dynamically navigated after the event

How Fault Analyser is used with CICS

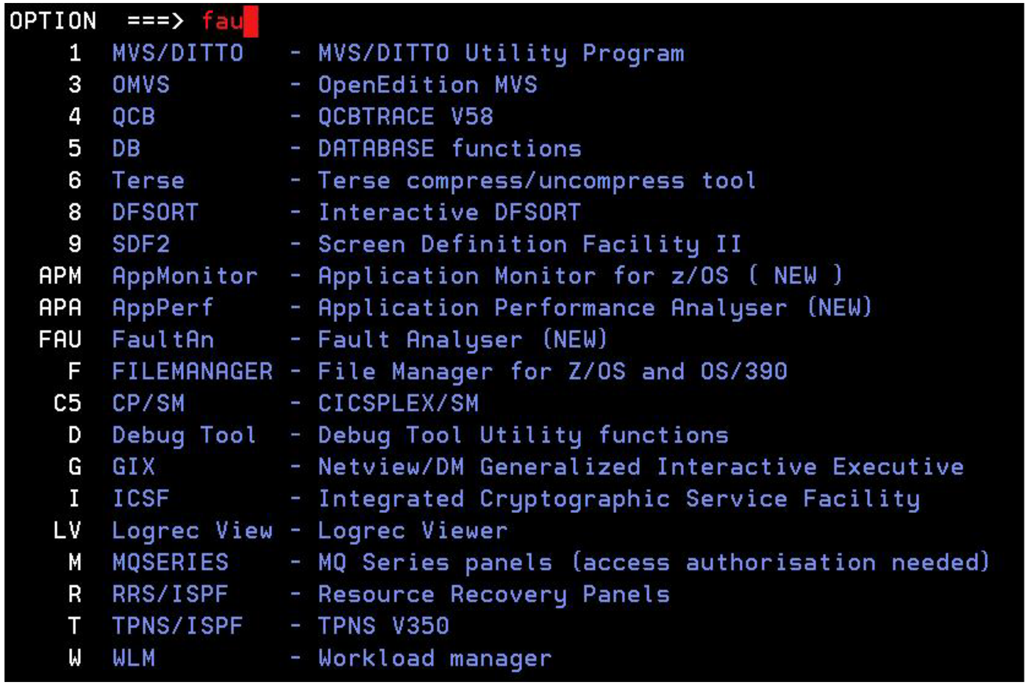


Fault Analyzer – setup work

- **Add the Fault Analyzer library to the CICS DFHRPL concatenation**
  - DD DSN=PP.FAULTANL.V810.SIDIAUTH,DISP=SHR
- **Add an entry into PLT for PI and SD:**
  - DFHPLT TYPE=ENTRY,PROGRAM=IDIPLT
  - This allows CICS to invoke Fault Analyzer via its GLUEs at dump or abend time, to capture **transaction** dump information for a Fault report
- **Define the Fault Analyzer programs and map to CICS, or utilise program autoinstall to define them**
  - IDIPLT, IDIPLTD, IDIPLTS, IDIXCX52, IDIXCX53, IDIXFA, IDIXMAP
- **Configure CICS LE abnormal termination CEECXTAN CSECT exit IDIXCCEE**
  - This exit invokes Fault Analyzer for LE programs

Invoking Fault Analyzer

- You can invoke if from under TSO...

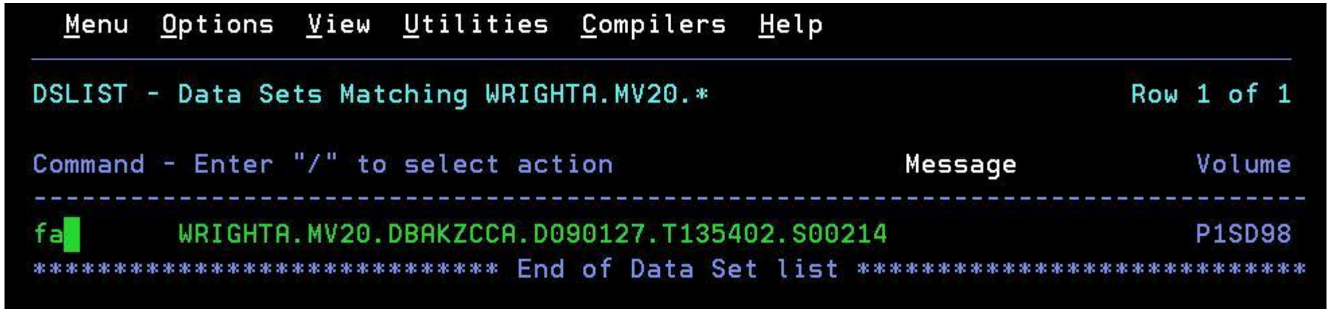


```
OPTION  ===> fau
     1  MVS/DITTO    - MVS/DITTO Utility Program
     3  OMVS         - OpenEdition MVS
     4  QCB          - QCBTRACE V58
     5  DB           - DATABASE functions
     6  Terse        - Terse compress/uncompress tool
     8  DFSORT       - Interactive DFSORT
     9  SDF2         - Screen Definition Facility II
   APM  AppMonitor   - Application Monitor for z/OS ( NEW )
   APA  AppPerf      - Application Performance Analyser (NEW)
   FAU  FaultAn      - Fault Analyser (NEW)
     F  FILEMANAGER  - File Manager for Z/OS and OS/390
    C5  CP/SM        - CICSPLEX/SM
     D  Debug Tool   - Debug Tool Utility functions
     G  GIX          - Netview/DM Generalized Interactive Executive
     I  ICSF         - Integrated Cryptographic Service Facility
    LV  Logrec View  - Logrec Viewer
     M  MQSERIES     - MQ Series panels (access authorisation needed)
     R  RRS/ISPF     - Resource Recovery Panels
     T  TPNS/ISPF    - TPNS V350
     W  WLM          - Workload manager
```

- or explicitly invoke it against a system dump data set (or

  a history file

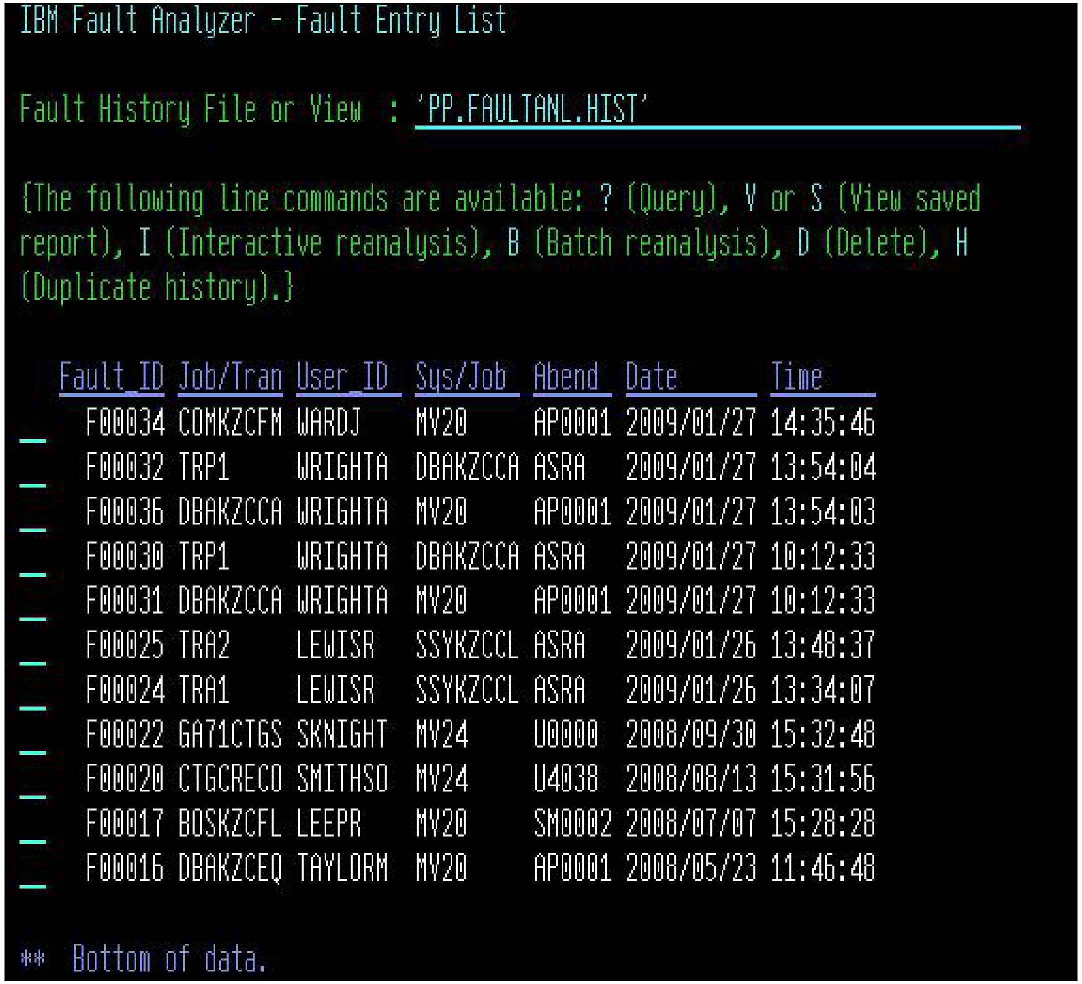
  in ISPF 3.4)



```
   Menu  Options  View  Utilities  Compilers  Help
 ------------------------------------------------------------------------------
 DSLIST - Data Sets Matching WRIGHTA.MV20.*                          Row 1 of 1

 Command - Enter "/" to select action                  Message          Volume
 -------------------------------------------------------------------------------
 fa        WRIGHTA.MV20.DBAKZCCA.D090127.T135402.S00214                  P1SD98
 ***************************** End of Data Set list ****************************
```

Fault Entry List

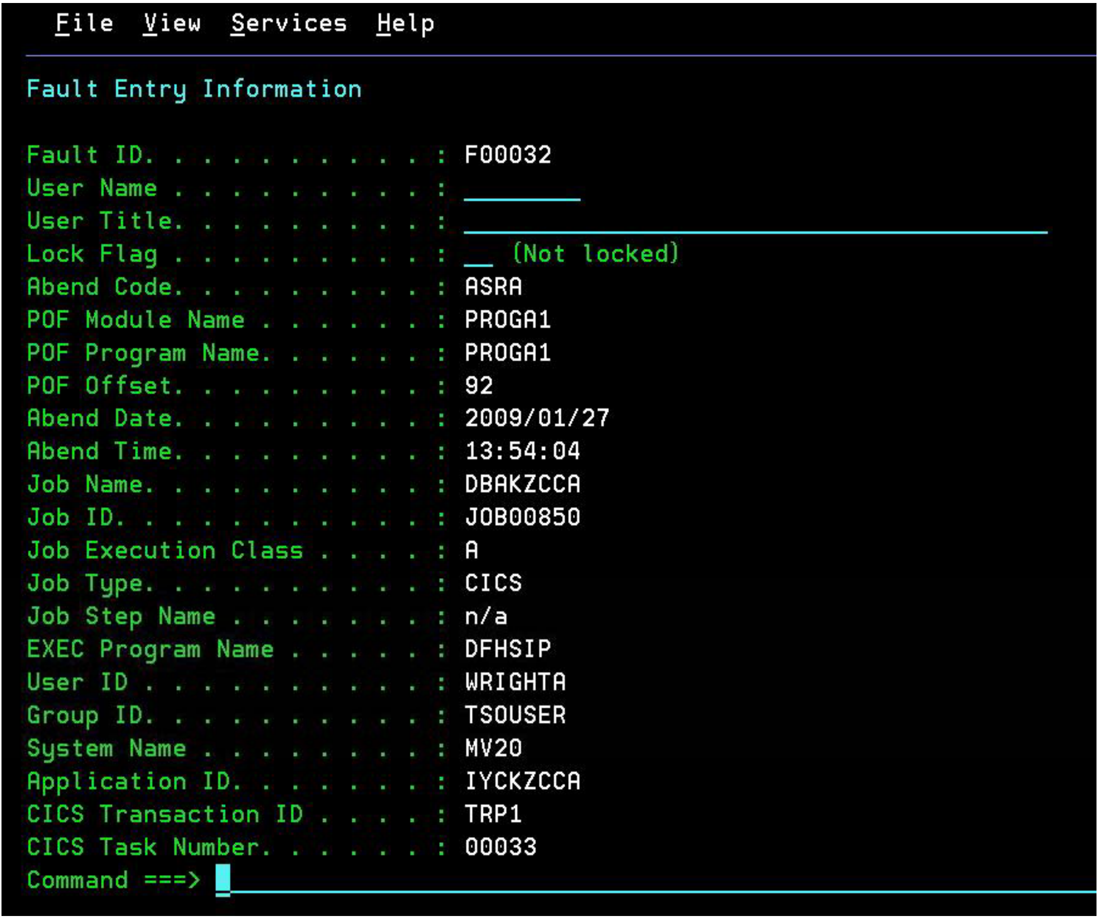
- **Fault History File**
  - Holds dump data
- **For System dumps**
- **For Transaction dumps too**
- **In reverse order**
  - Newest to oldest
- **Jobname**
  - For SDUMPs
- **Transid**
  - For tran dumps



```
IBM Fault Analyzer - Fault Entry List

Fault History File or View  : 'PP.FAULTANL.HIST'

(The following line commands are available: ? (Query), V or S (View saved
report), I (Interactive reanalysis), B (Batch reanalysis), D (Delete), H
(Duplicate history).)

   Fault_ID Job/Tran User_ID  Sys/Job  Abend  Date       Time
_    F00034 COMKZCFM WARDJ    MV20     AP0001 2009/01/27 14:35:46
_    F00032 TRP1     WRIGHTA  DBAKZCCA ASRA   2009/01/27 13:54:04
_    F00036 DBAKZCCA WRIGHTA  MV20     AP0001 2009/01/27 13:54:03
_    F00030 TRP1     WRIGHTA  DBAKZCCA ASRA   2009/01/27 10:12:33
_    F00031 DBAKZCCA WRIGHTA  MV20     AP0001 2009/01/27 10:12:33
_    F00025 TRA2     LEWISR   SSYKZCCL ASRA   2009/01/26 13:48:37
_    F00024 TRA1     LEWISR   SSYKZCCL ASRA   2009/01/26 13:34:07
_    F00022 GA71CTGS SKNIGHT  MV24     U0000  2008/09/30 15:32:48
_    F00020 CTGCRECO SMITHSO  MV24     U4038  2008/08/13 15:31:56
_    F00017 BOSKZCFL LEEPR    MV20     SM0002 2008/07/07 15:28:28
_    F00016 DBAKZCEQ TAYLORM  MV20     AP0001 2008/05/23 11:46:48

**  Bottom of data.
```

The Query option - ?

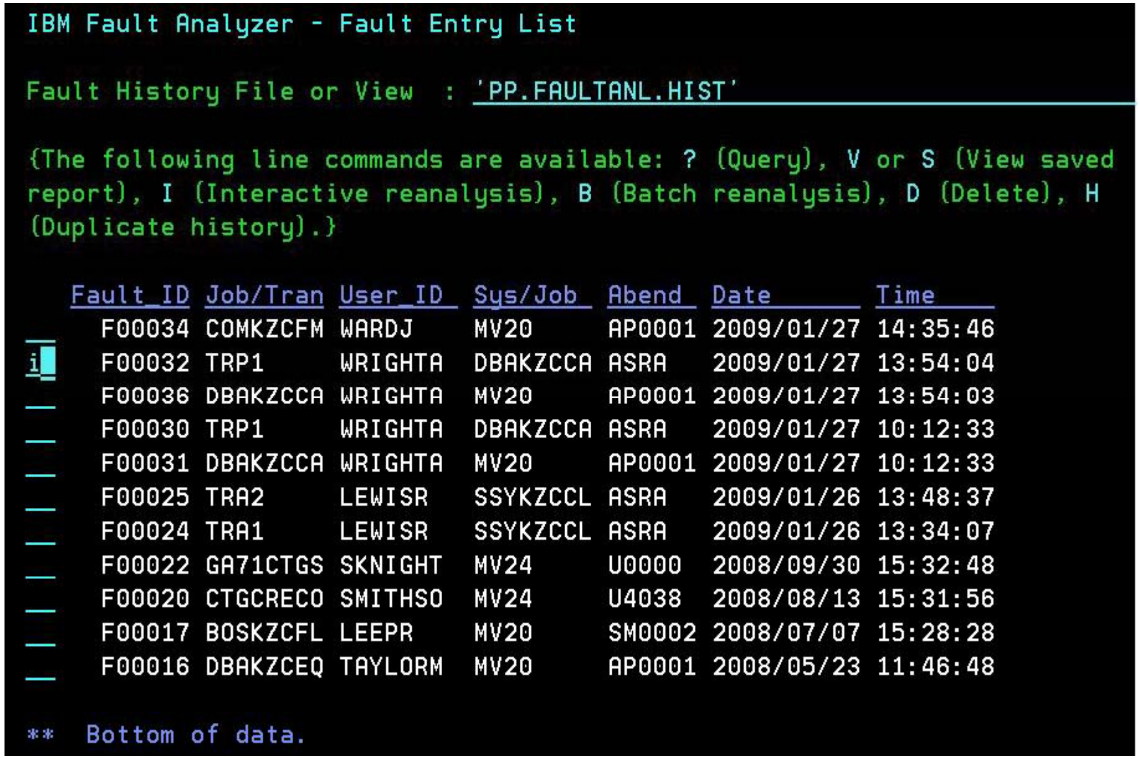
- **Query gives you a view of a Fault's info**
- **Each Fault has specific attributes:**
  - abcode, Jobname,etc.
- **Transaction dumps have info on transid, tasknum, etc**
- **Query provides an overview of a Fault**
  - Helps locate the one of interest



```
Fault Entry Information

Fault ID. . . . . . . . . . . . : F00032
User Name . . . . . . . . . . . : 
User Title. . . . . . . . . . . : 
Lock Flag . . . . . . . . . . . : __ (Not locked)
Abend Code. . . . . . . . . . . : ASRA
POF Module Name . . . . . . . . : PROGA1
POF Program Name. . . . . . . . : PROGA1
POF Offset. . . . . . . . . . . : 92
Abend Date. . . . . . . . . . . : 2009/01/27
Abend Time. . . . . . . . . . . : 13:54:04
Job Name. . . . . . . . . . . . : DBAKZCCA
Job ID. . . . . . . . . . . . . : JOB00850
Job Execution Class . . . . . . : A
Job Type. . . . . . . . . . . . : CICS
Job Step Name . . . . . . . . . : n/a
EXEC Program Name . . . . . . . : DFHSIP
User ID . . . . . . . . . . . . : WRIGHTA
Group ID. . . . . . . . . . . . : TSOUSER
System Name . . . . . . . . . . : MV20
Application ID. . . . . . . . . : IYCKZCCA
CICS Transaction ID . . . . . . : TRP1
CICS Task Number. . . . . . . . : 00033
Command ===>
```

Analyzing a transaction dump Fault

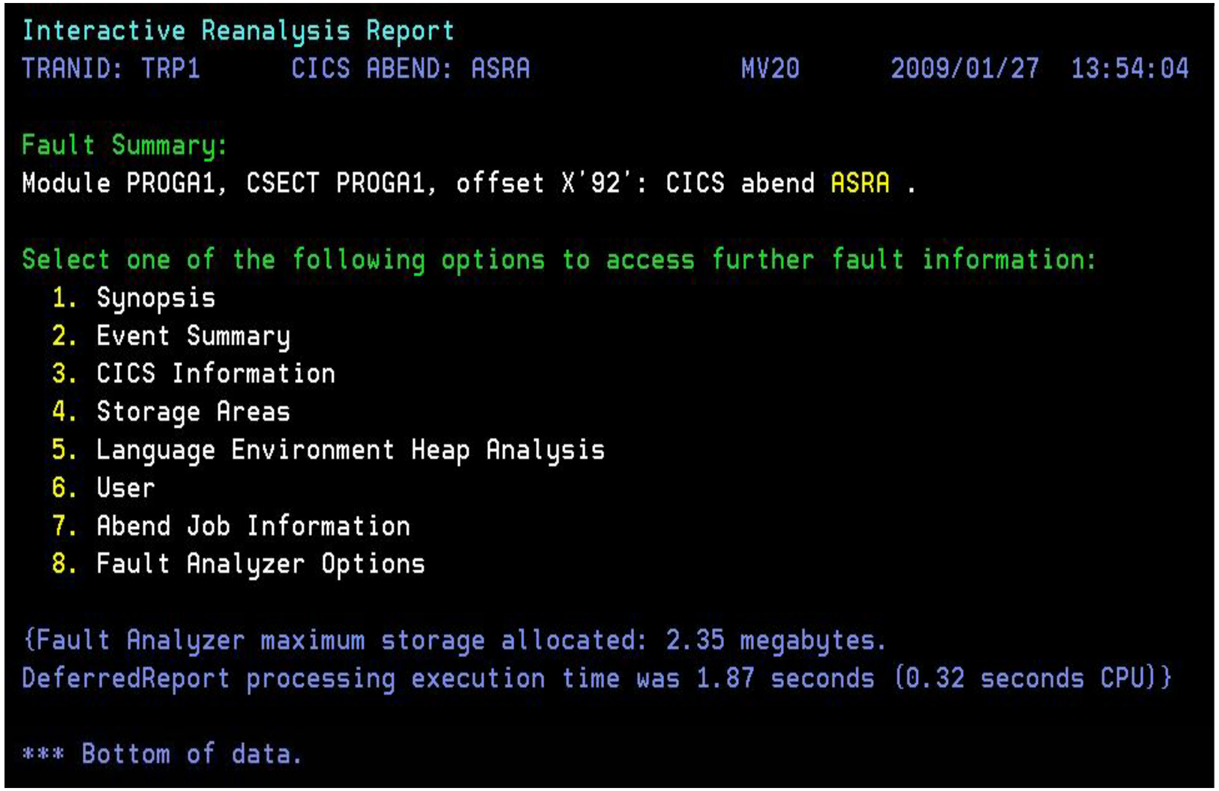
- **The dump can be interactively analysed (using I)**
- **The original report can be reviewed (using V or S)**
  - This was produced at the time of the transaction abend or DUMP TRANSACTION command



```
IBM Fault Analyzer - Fault Entry List

Fault History File or View  : 'PP.FAULTANL.HIST'

(The following line commands are available: ? (Query), V or S (View saved
report), I (Interactive reanalysis), B (Batch reanalysis), D (Delete), H
(Duplicate history).)

   Fault_ID Job/Tran User_ID  Sys/Job  Abend  Date       Time
_    F00034 COMKZCFM WARDJ    MV20     AP0001 2009/01/27 14:35:46
i    F00032 TRP1     WRIGHTA  DBAKZCCA ASRA   2009/01/27 13:54:04
_    F00036 DBAKZCCA WRIGHTA  MV20     AP0001 2009/01/27 13:54:03
_    F00030 TRP1     WRIGHTA  DBAKZCCA ASRA   2009/01/27 10:12:33
_    F00031 DBAKZCCA WRIGHTA  MV20     AP0001 2009/01/27 10:12:33
_    F00025 TRA2     LEWISR   SSYKZCCL ASRA   2009/01/26 13:48:37
_    F00024 TRA1     LEWISR   SSYKZCCL ASRA   2009/01/26 13:34:07
_    F00022 GA71CTGS SKNIGHT  MV24     U0000  2008/09/30 15:32:48
_    F00020 CTGCRECO SMITHSO  MV24     U4038  2008/08/13 15:31:56
_    F00017 BOSKZCFL LEEPR    MV20     SM0002 2008/07/07 15:28:28
_    F00016 DBAKZCEQ TAYLORM  MV20     AP0001 2008/05/23 11:46:48

**   Bottom of data.
```

The Interactive Reanalysis Report - I

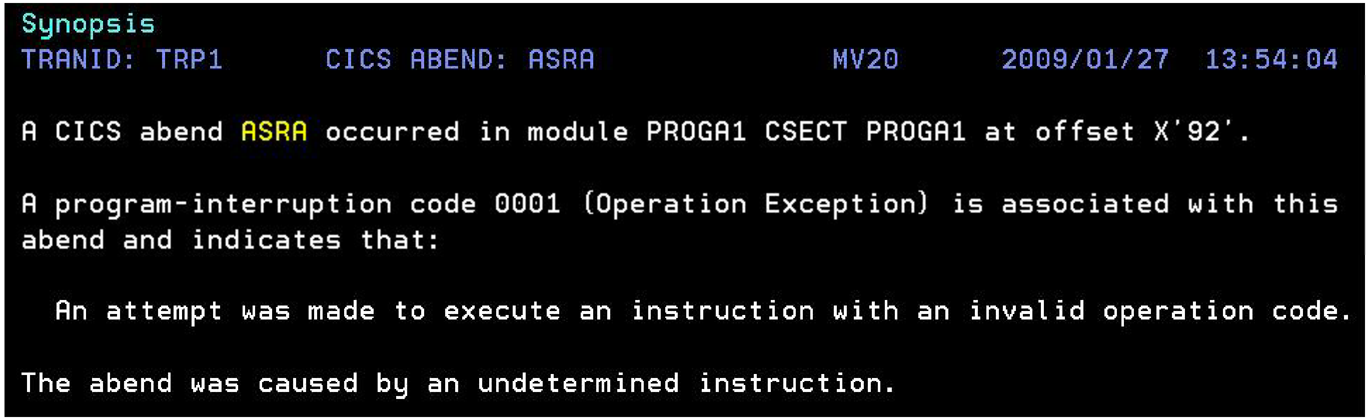
- Fault Summary **describes the failing environment**
- **The options list allows you to review further information about the cause of the dump**
- **Let's select the dump** Synopsis **(1) and then the** Event Summary **(2) ...**



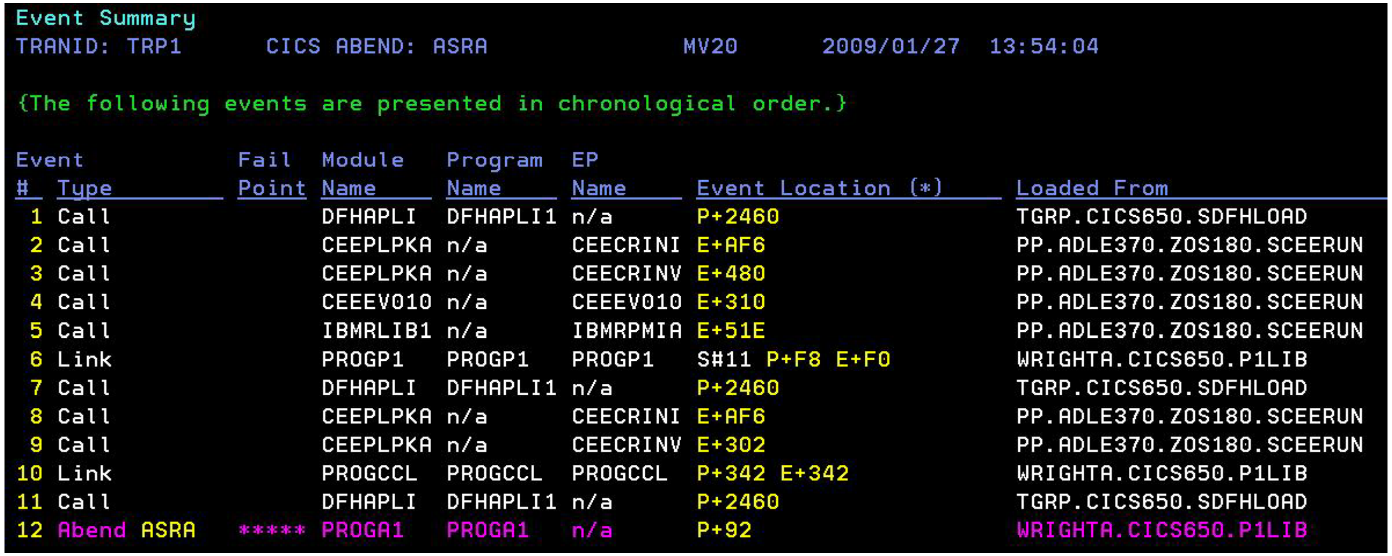
```
Interactive Reanalysis Report
TRANID: TRP1      CICS ABEND: ASRA             MV20      2009/01/27  13:54:04

Fault Summary:
Module PROGA1, CSECT PROGA1, offset X'92': CICS abend ASRA .

Select one of the following options to access further fault information:
  1. Synopsis
  2. Event Summary
  3. CICS Information
  4. Storage Areas
  5. Language Environment Heap Analysis
  6. User
  7. Abend Job Information
  8. Fault Analyzer Options

{Fault Analyzer maximum storage allocated: 2.35 megabytes.
DeferredReport processing execution time was 1.87 seconds (0.32 seconds CPU)}

*** Bottom of data.
```

Synopsis and Event Summary options (1 and 2)

- Synopsis **(outlines the type of abend, and where it occurred)**
- Event Summary **(gives the program call stack that led to the abend)**
- Yellow **is** hypertext!



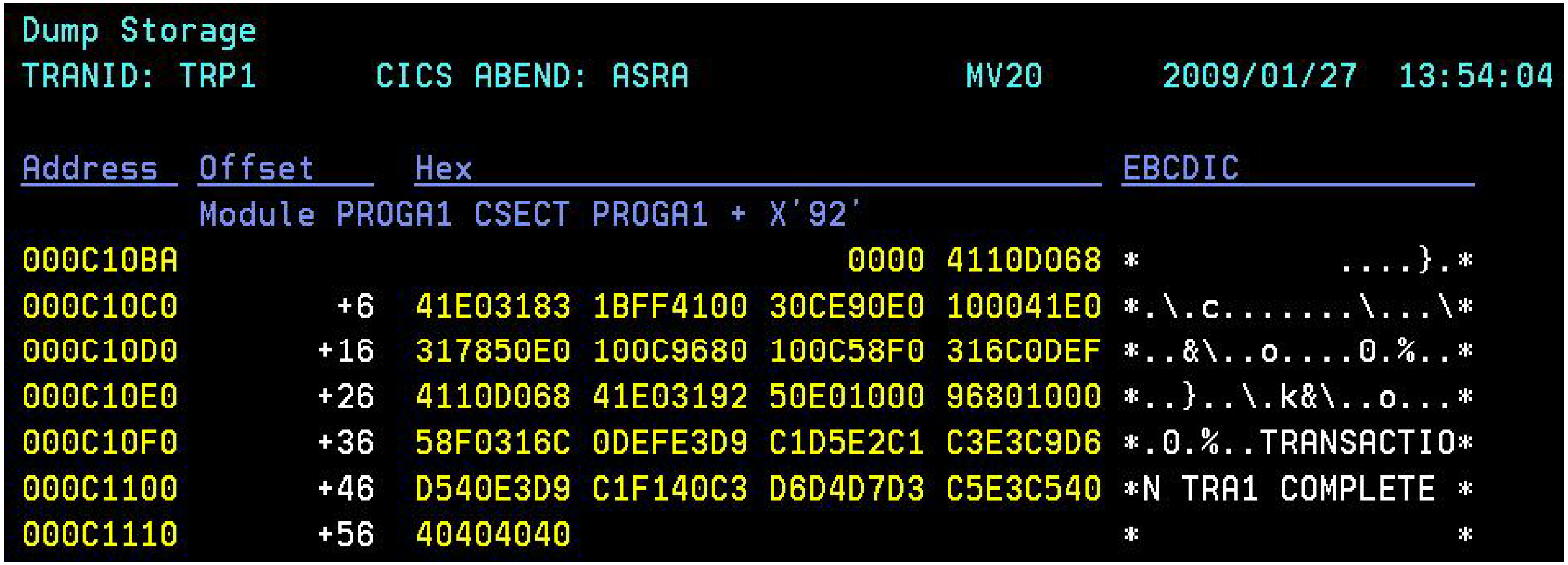
```
Synopsis
TRANID: TRP1      CICS ABEND: ASRA              MV20      2009/01/27  13:54:04

A CICS abend ASRA occurred in module PROGA1 CSECT PROGA1 at offset X'92'.

A program-interruption code 0001 (Operation Exception) is associated with this
abend and indicates that:

  An attempt was made to execute an instruction with an invalid operation code.

The abend was caused by an undetermined instruction.
```



```
Event Summary
TRANID: TRP1      CICS ABEND: ASRA              MV20      2009/01/27  13:54:04

{The following events are presented in chronological order.}

Event            Fail  Module   Program  EP
#  Type          Point Name     Name     Name     Event Location (*)       Loaded From
 1 Call                DFHAPLI  DFHAPLI1 n/a      P+2460                   TGRP.CICS650.SDFHLOAD
 2 Call                CEEPLPKA n/a      CEECRINI E+AF6                    PP.ADLE370.ZOS180.SCEERUN
 3 Call                CEEPLPKA n/a      CEECRINV E+480                    PP.ADLE370.ZOS180.SCEERUN
 4 Call                CEEEV010 n/a      CEEEV010 E+310                    PP.ADLE370.ZOS180.SCEERUN
 5 Call                IBMRLIB1 n/a      IBMRPMIA E+51E                    PP.ADLE370.ZOS180.SCEERUN
 6 Link                PROGP1   PROGP1   PROGP1   S#11 P+F8 E+F0           WRIGHTA.CICS650.P1LIB
 7 Call                DFHAPLI  DFHAPLI1 n/a      P+2460                   TGRP.CICS650.SDFHLOAD
 8 Call                CEEPLPKA n/a      CEECRINI E+AF6                    PP.ADLE370.ZOS180.SCEERUN
 9 Call                CEEPLPKA n/a      CEECRINV E+302                    PP.ADLE370.ZOS180.SCEERUN
10 Link                PROGCCL  PROGCCL  PROGCCL  P+342 E+342              WRIGHTA.CICS650.P1LIB
11 Call                DFHAPLI  DFHAPLI1 n/a      P+2460                   TGRP.CICS650.SDFHLOAD
12 Abend ASRA    ***** PROGA1   PROGA1   n/a      P+92                     WRIGHTA.CICS650.P1LIB
```

Clicking on P+92, from Event Summary stack...

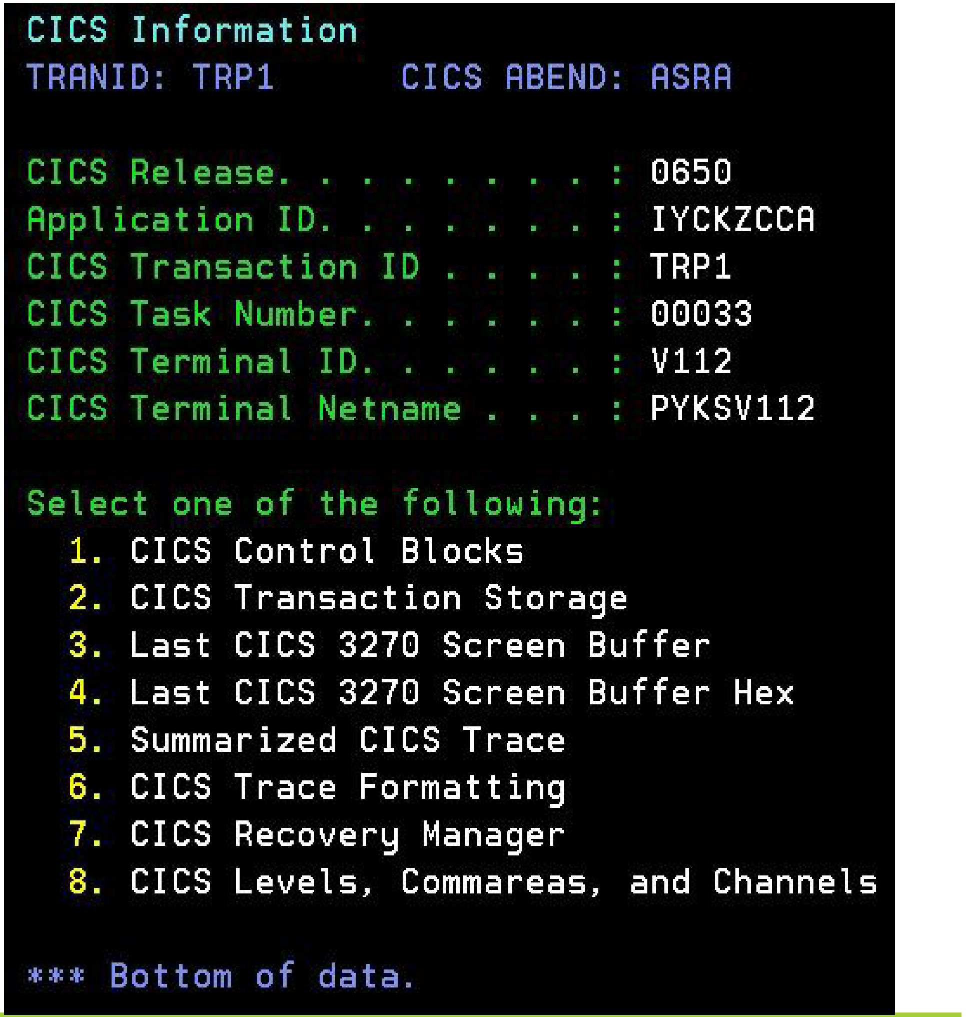
- This link takes you to the memory location associate with the program + offset x’92’
- This shows the offending piece of code (0000 in this example)
- Fault Analyzer is built around this dynamic content navigation ...



```
Dump Storage
TRANID: TRP1      CICS ABEND: ASRA              MV20      2009/01/27   13:54:04

Address   Offset      Hex                                   EBCDIC
          Module PROGA1 CSECT PROGA1 + X'92'
000C10BA                                  0000 4110D068 *          ....}.*
000C10C0        +6  41E03183 1BFF4100 30CE90E0 100041E0 *.\.c.......\...\*
000C10D0       +16  317850E0 100C9680 100C58F0 316C0DEF *..&\..o....0.%..*
000C10E0       +26  4110D068 41E03192 50E01000 96801000 *..}..\.k&\..o...*
000C10F0       +36  58F0316C 0DEFE3D9 C1D5E2C1 C3E3C9D6 *.0.%..TRANSACTIO*
000C1100       +46  D540E3D9 C1F140C3 D6D4D7D3 C5E3C540 *N TRA1 COMPLETE *
000C1110       +56  40404040                            *                *
```

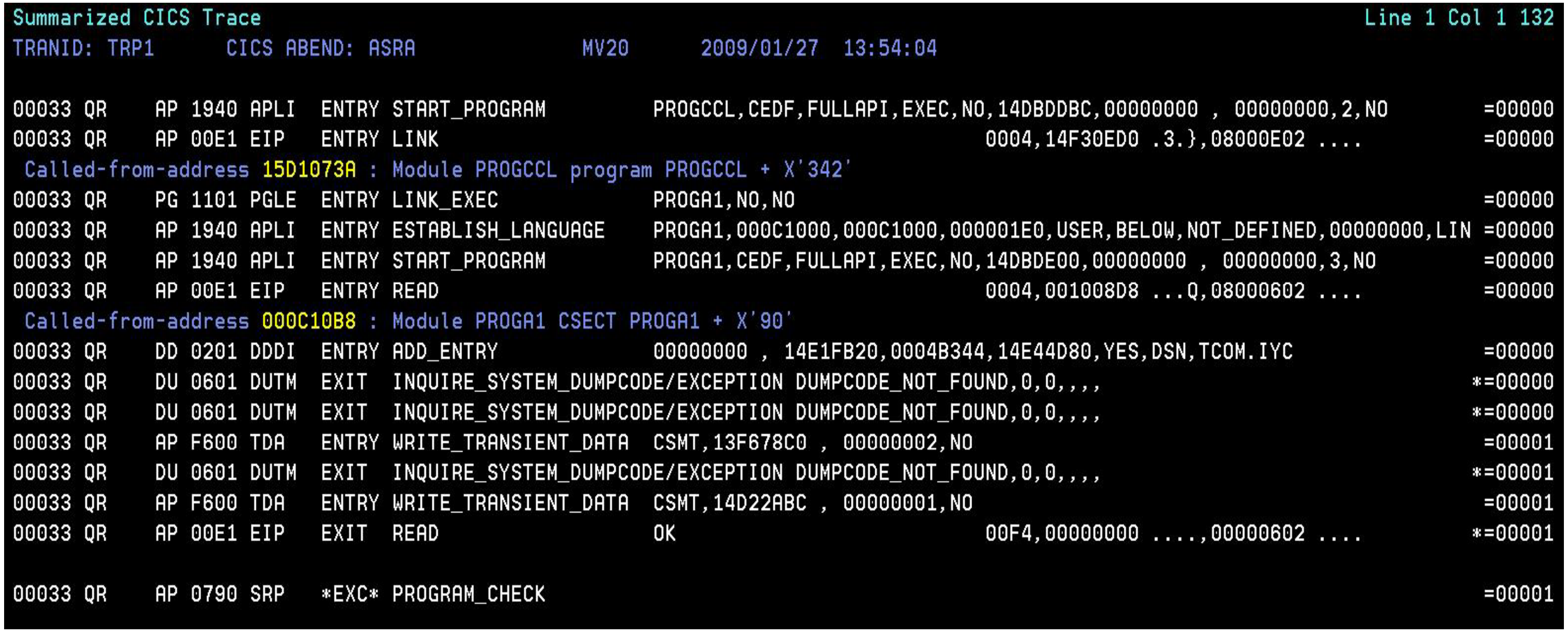
The CICS Information option (3)

- **You can review the task's CICS environment at the time of the transaction dump**
- **The** CICS Control Blocks **shows the EIB, TWA, CSA, OFL, CWA, TCA, TACB, EIS, EIUS and TCTTE**
- Transaction Storage **shows all USER24, USER31, etc, storage**
- **Let's review the** Summarized CICS Trace **(5) and** CICS Trace Formatting **(6) ...**



```
CICS Information
TRANID: TRP1        CICS ABEND: ASRA

CICS Release. . . . . . . . . : 0650
Application ID. . . . . . . . : IYCKZCCA
CICS Transaction ID . . . . . : TRP1
CICS Task Number. . . . . . . : 00033
CICS Terminal ID. . . . . . . : V112
CICS Terminal Netname . . . . : PYKSV112

Select one of the following:
  1. CICS Control Blocks
  2. CICS Transaction Storage
  3. Last CICS 3270 Screen Buffer
  4. Last CICS 3270 Screen Buffer Hex
  5. Summarized CICS Trace
  6. CICS Trace Formatting
  7. CICS Recovery Manager
  8. CICS Levels, Commareas, and Channels

*** Bottom of data.
```

Summarized CICS Trace (5) ...

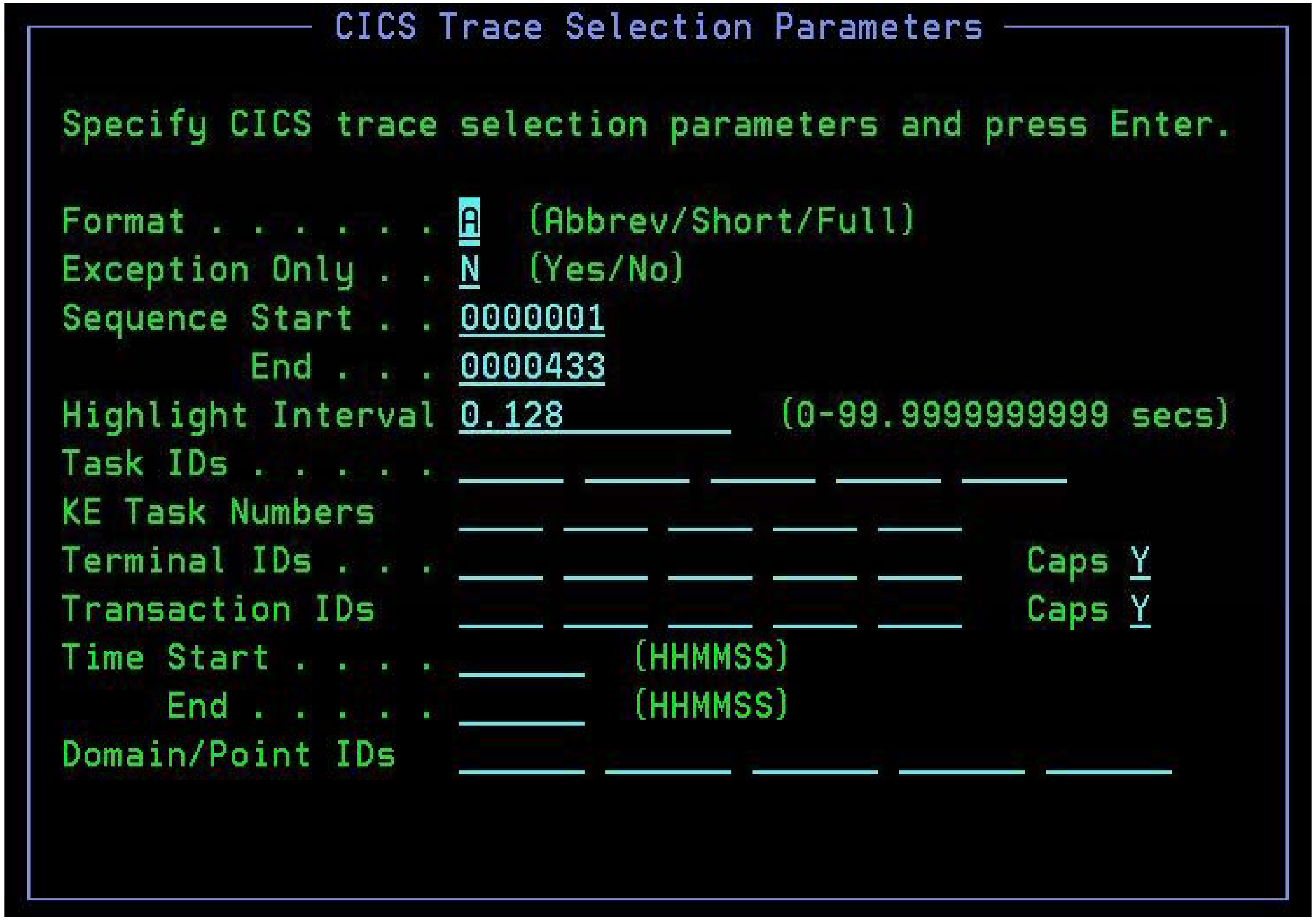


```
Summarized CICS Trace                                                                                             Line 1 Col 1 132
TRANID: TRP1      CICS ABEND: ASRA              MV20      2009/01/27  13:54:04

00033 QR    AP 1940 APLI  ENTRY START_PROGRAM         PROGCCL,CEDF,FULLAPI,EXEC,NO,14DBDDBC,00000000 , 00000000,2,NO        =00000
00033 QR    AP 00E1 EIP   ENTRY LINK                                              0004,14F30ED0 .3.},08000E02 ....          =00000
 Called-from-address 15D1073A : Module PROGCCL program PROGCCL + X'342'
00033 QR    PG 1101 PGLE  ENTRY LINK_EXEC             PROGA1,NO,NO                                                          =00000
00033 QR    AP 1940 APLI  ENTRY ESTABLISH_LANGUAGE    PROGA1,000C1000,000C1000,000001E0,USER,BELOW,NOT_DEFINED,00000000,LIN =00000
00033 QR    AP 1940 APLI  ENTRY START_PROGRAM         PROGA1,CEDF,FULLAPI,EXEC,NO,14DBDE00,00000000 , 00000000,3,NO         =00000
00033 QR    AP 00E1 EIP   ENTRY READ                                              0004,001008D8 ...Q,08000602 ....          =00000
 Called-from-address 000C10B8 : Module PROGA1 CSECT PROGA1 + X'90'
00033 QR    DD 0201 DDDI  ENTRY ADD_ENTRY             00000000 , 14E1FB20,0004B344,14E44D80,YES,DSN,TCOM.IYC                =00000
00033 QR    DU 0601 DUTM  EXIT  INQUIRE_SYSTEM_DUMPCODE/EXCEPTION DUMPCODE_NOT_FOUND,0,0,,,,                               *=00000
00033 QR    DU 0601 DUTM  EXIT  INQUIRE_SYSTEM_DUMPCODE/EXCEPTION DUMPCODE_NOT_FOUND,0,0,,,,                               *=00000
00033 QR    AP F600 TDA   ENTRY WRITE_TRANSIENT_DATA  CSMT,13F678C0 , 00000002,NO                                           =00001
00033 QR    DU 0601 DUTM  EXIT  INQUIRE_SYSTEM_DUMPCODE/EXCEPTION DUMPCODE_NOT_FOUND,0,0,,,,                               *=00001
00033 QR    AP F600 TDA   ENTRY WRITE_TRANSIENT_DATA  CSMT,14D22ABC , 00000001,NO                                           =00001
00033 QR    AP 00E1 EIP   EXIT  READ                  OK                          00F4,00000000 ....,00000602 ....         *=00001

00033 QR    AP 0790 SRP   *EXC* PROGRAM_CHECK                                                                               =00001
```

- **EXEC CICS commands are hyperlinked where they were issued**
  - Identifies calling program and offset within it
- **The** Summarized CICS Trace **defaults to the most interesting entries**
- **Standard Abbreviated trace formatting by default ...**

CICS Trace Formatting (6) ...

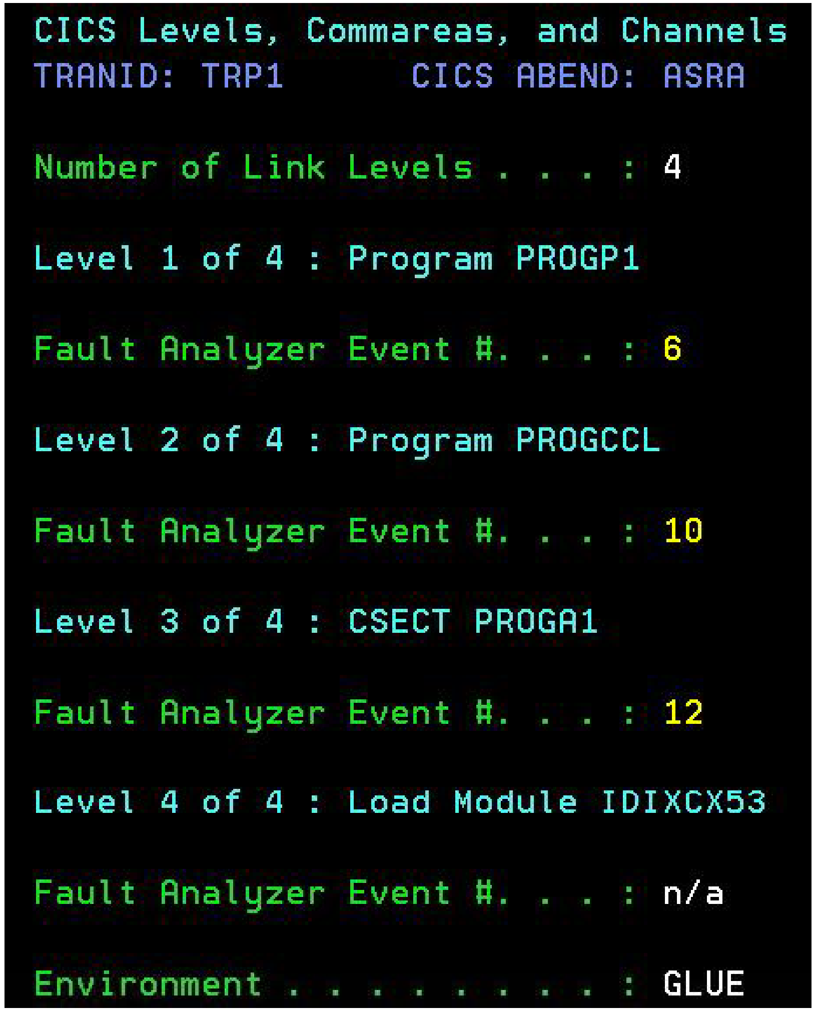
- Formatting options can be changed
- Short or Full trace may be used instead
- The Highlight Interval time period can be changed
- Can show more than summarized entries



```
                    CICS Trace Selection Parameters

 Specify CICS trace selection parameters and press Enter.

 Format . . . . . . . A   (Abbrev/Short/Full)
 Exception Only . .   N   (Yes/No)
 Sequence Start . .   0000001
          End . . .   0000433
 Highlight Interval   0.128____          (0-99.9999999999 secs)
 Task IDs . . . . .   _____ _____ _____ _____ _____
 KE Task Numbers      ____ ____ ____ ____ ____
 Terminal IDs . . .   ____ ____ ____ ____ ____    Caps Y
 Transaction IDs      ____ ____ ____ ____ ____    Caps Y
 Time Start . . . .   ______     (HHMMSS)
      End . . . . .   ______     (HHMMSS)
 Domain/Point IDs     ______ ______ ______ ______ ______
```

CICS Levels, Commareas, Channels (8)

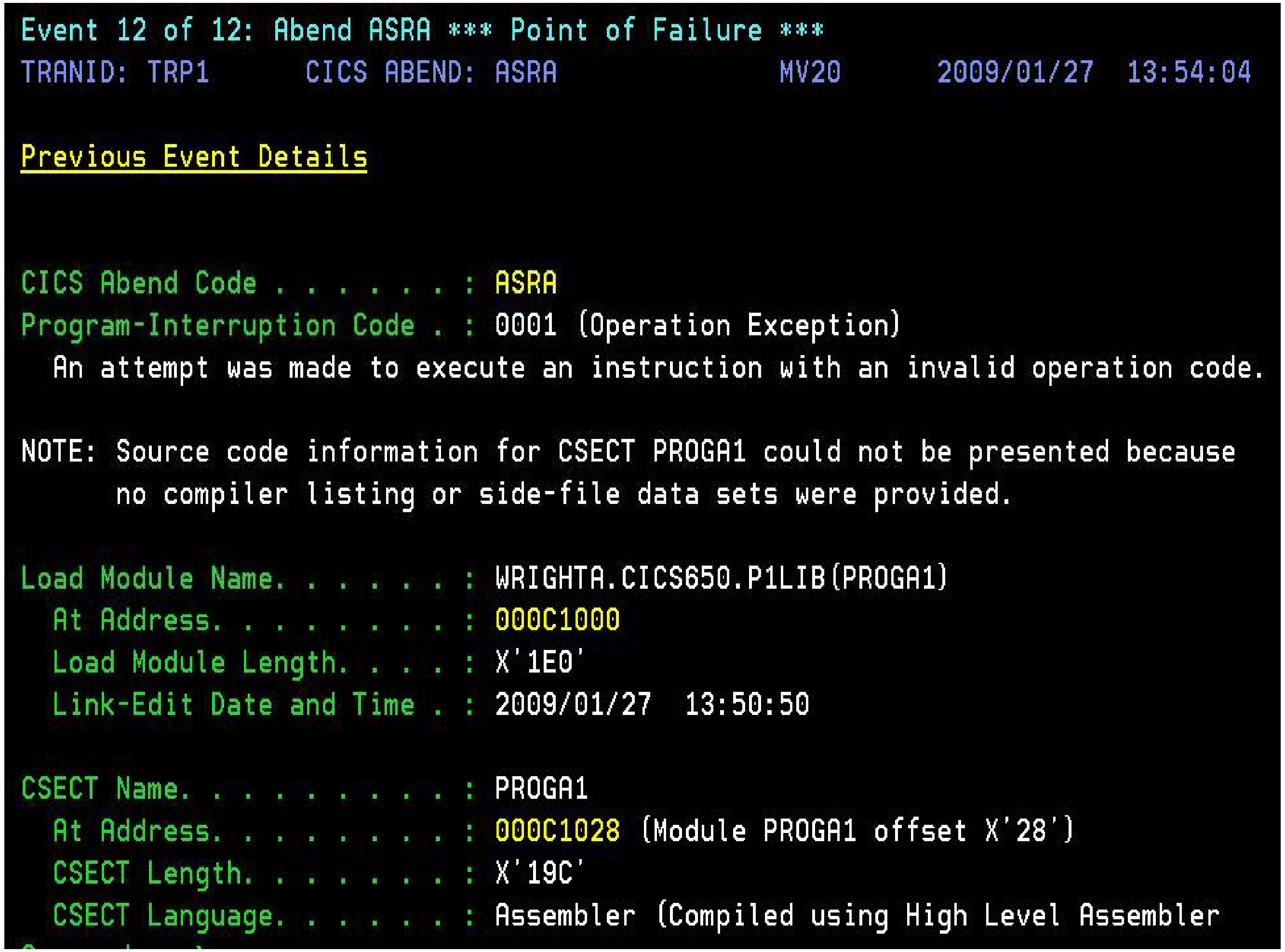
- **The CICS** Link Level **summary shows the nested hierarchy of the programs within the transaction being analysed**
  - PROGA1 (the program which had the abend) is at Link Level 3
  - Note that IDIXCX53 is seen because it was part of the Fault Analyzer run-time code which captured the transaction dump itself!
- **Clicking on an** Event **number takes you to a summary for that event (let's try number** 12 **...)**
  - Events were also accessible from the **Event Summary** (2) ...



```
CICS Levels, Commareas, and Channels
TRANID: TRP1       CICS ABEND: ASRA

Number of Link Levels . . . : 4

Level 1 of 4 : Program PROGP1

Fault Analyzer Event #. . . : 6

Level 2 of 4 : Program PROGCCL

Fault Analyzer Event #. . . : 10

Level 3 of 4 : CSECT PROGA1

Fault Analyzer Event #. . . : 12

Level 4 of 4 : Load Module IDIXCX53

Fault Analyzer Event #. . . : n/a

Environment . . . . . . . . : GLUE
```

CICS Event Details example

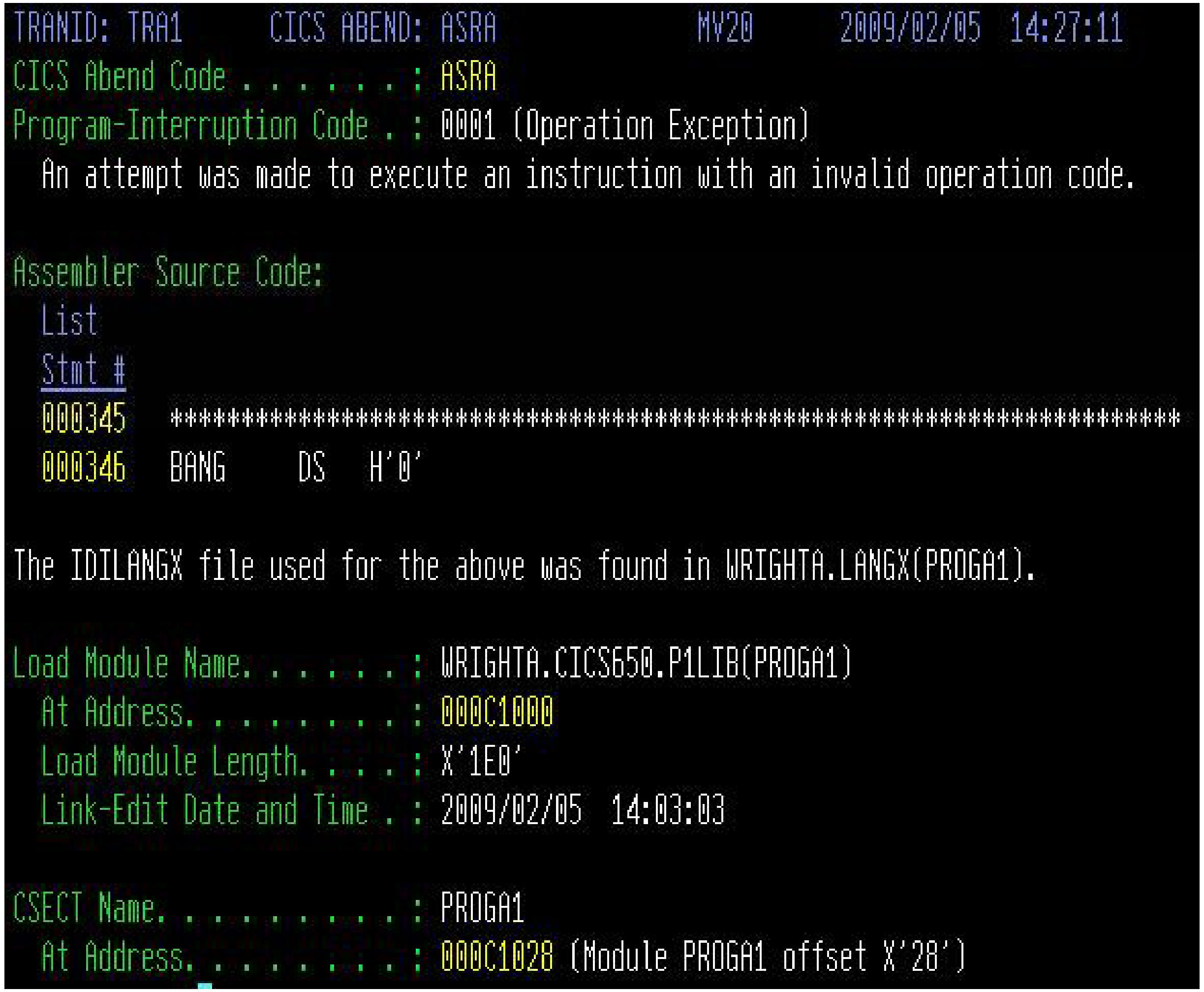
- **The abend** Event, **12**
- **Not shown: instructions near point of failure, PSW, GPRs, EIB ...**
- **Older** Event **data relates to the linking programs**
- **No listing was available here**



```
Event 12 of 12: Abend ASRA *** Point of Failure ***
TRANID: TRP1      CICS ABEND: ASRA             MV20      2009/01/27  13:54:04

Previous Event Details



CICS Abend Code . . . . . . . : ASRA
Program-Interruption Code . . : 0001 (Operation Exception)
  An attempt was made to execute an instruction with an invalid operation code.

NOTE: Source code information for CSECT PROGA1 could not be presented because
      no compiler listing or side-file data sets were provided.

Load Module Name. . . . . . . : WRIGHTA.CICS650.P1LIB(PROGA1)
  At Address. . . . . . . . . : 000C1000
  Load Module Length. . . . . : X'1E0'
  Link-Edit Date and Time . . : 2009/01/27  13:50:50

CSECT Name. . . . . . . . . . : PROGA1
  At Address. . . . . . . . . : 000C1028 (Module PROGA1 offset X'28')
  CSECT Length. . . . . . . . : X'19C'
  CSECT Language. . . . . . . : Assembler (Compiled using High Level Assembler
```

Relating an Event to the line of source

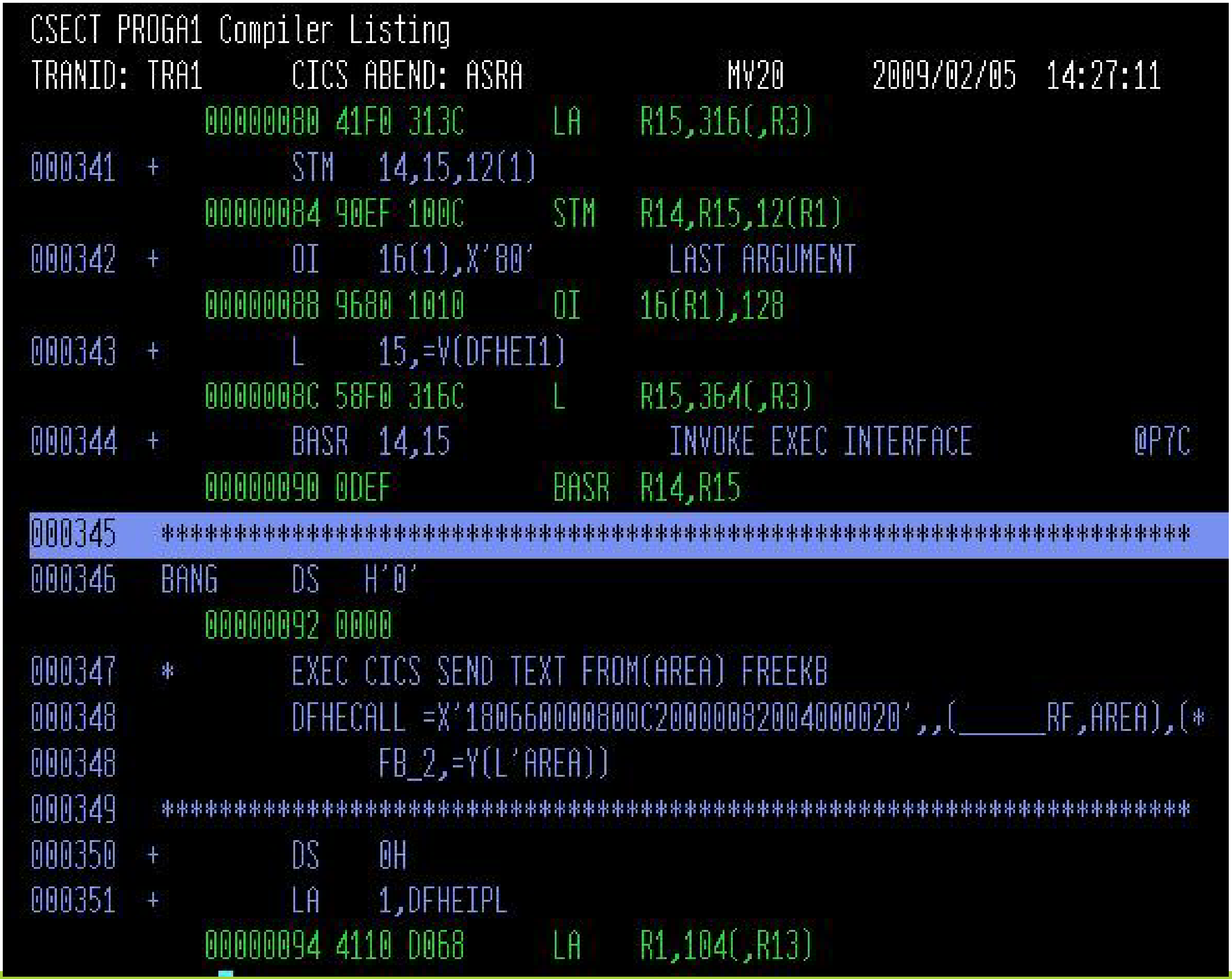
- **An example of when a program listing *was* available......**
  - The assembly JCL had ADATA on its ASM PARM, and a step to IDILANGX to copy the ADATA metadata into a data set for Fault Analyzer to refer to
- **(Click on the** List Stmt # **to see failing instructions in context...**



```
TRANID: TRA1      CICS ABEND: ASRA             MV20      2009/02/05  14:27:11
CICS Abend Code . . . . . . . : ASRA
Program-Interruption Code . : 0001 (Operation Exception)
  An attempt was made to execute an instruction with an invalid operation code.

Assembler Source Code:
  List
  Stmt #
  000345   ***********************************************************************
  000346   BANG     DS   H'0'

The IDILANGX file used for the above was found in WRIGHTA.LANGX(PROGA1).

Load Module Name. . . . . . . : WRIGHTA.CICS650.P1LIB(PROGA1)
  At Address. . . . . . . . . : 000C1000
  Load Module Length. . . . . : X'1E0'
  Link-Edit Date and Time . . : 2009/02/05  14:03:03

CSECT Name. . . . . . . . . . : PROGA1
  At Address. . . . . . . . . : 000C1028 (Module PROGA1 offset X'28')
```

Seeing a failing source line in context

- **Line 346 is the cause of the program check S0C1**
- **This is a very contrived example, to demonstrate how you can easily review your program source as part of dump analysis ...**



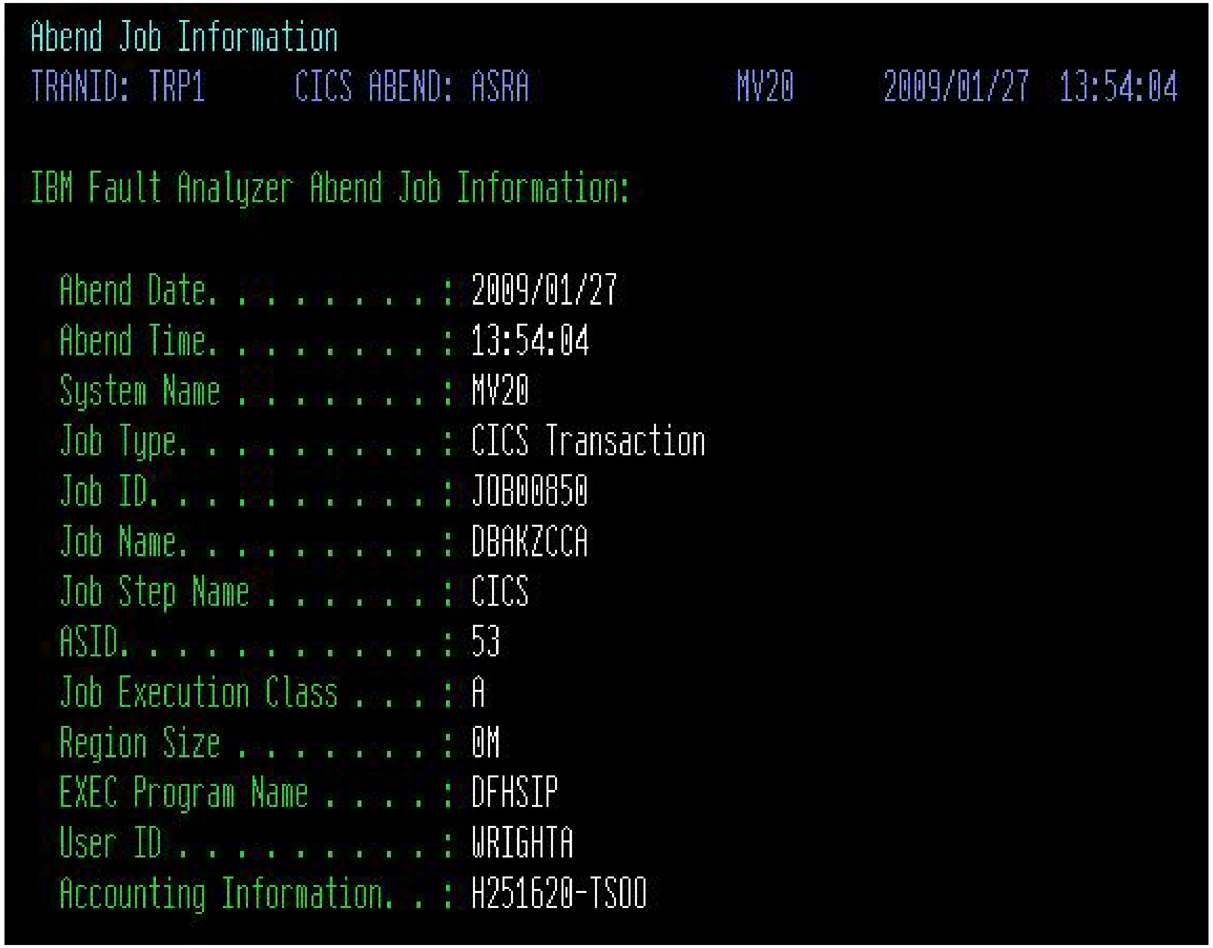
```
CSECT PROGA1 Compiler Listing
TRANID: TRA1      CICS ABEND: ASRA            MV20     2009/02/05  14:27:11
            00000080 41F0 313C      LA    R15,316(,R3)
000341  +         STM   14,15,12(1)
            00000084 90EF 100C      STM   R14,R15,12(R1)
000342  +         OI    16(1),X'80'           LAST ARGUMENT
            00000088 9680 1010      OI    16(R1),128
000343  +         L     15,=V(DFHEI1)
            0000008C 58F0 316C      L     R15,364(,R3)
000344  +         BASR  14,15                 INVOKE EXEC INTERFACE          @P7C
            00000090 0DEF           BASR  R14,R15
000345   ***********************************************************************
000346   BANG     DS    H'0'
            00000092 0000
000347   *        EXEC CICS SEND TEXT FROM(AREA) FREEKB
000348            DFHECALL =X'180660000800C20000082004000020',,(______RF,AREA),(*
000348                  FB_2,=Y(L'AREA))
000349   ***********************************************************************
000350  +         DS    0H
000351  +         LA    1,DFHEIPL
            00000094 4110 D068      LA    R1,104(,R13)
```

Remaining Interactive Reanalysis Report options

- **4 - Storage Areas**
  - Shows Hex-dumped storage for the Events
- **5 - Language Environment Heap Analysis**
  - Breaks down the Heap storage used by the LE enclave
  - Bytes allocated, bytes free, number of storage elements
- **6 – User**
  - Shows the CICS concatenated data sets with source DSECTs
- **7 – Abend Job Information**
  - Shows the CICS job environment, DFHRPL and STEPLIB members, transaction program details and linkedit mapping, execution environment and LE runtime options
- **8 – Fault Analyzer Options**
  - Options in effect, data sets used by Fault Analyzer, exit programs invoked....

Abend Job Information (7) – Job Overview

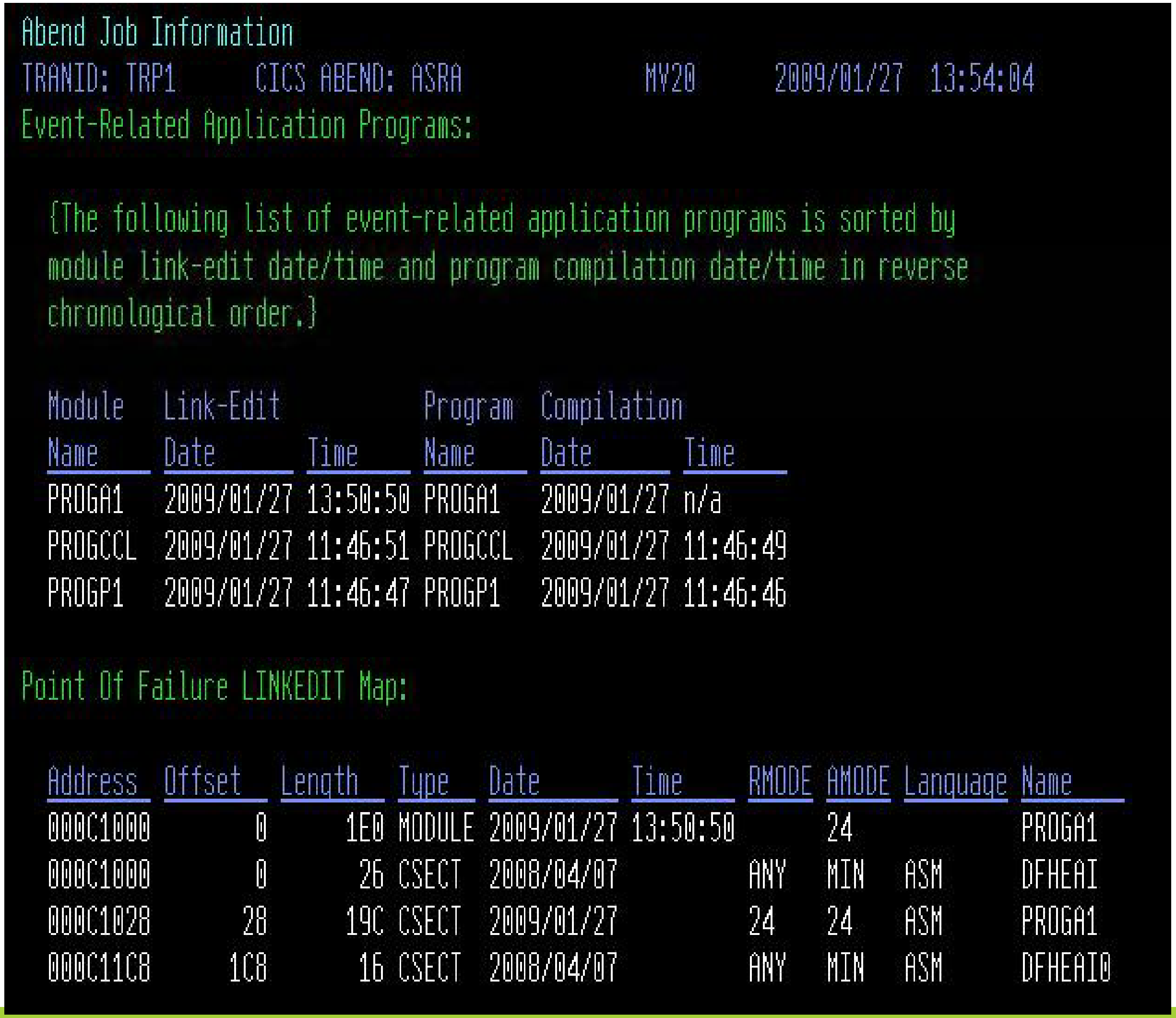
- This provides a useful overview of the failing environment ...
- The job ID, Name, Step Name, ASID number, etc ...
- DFHRPL and STEPLIB are given (not shown here)



```
Abend Job Information
TRANID: TRP1      CICS ABEND: ASRA            MV20      2009/01/27  13:54:04

IBM Fault Analyzer Abend Job Information:

  Abend Date. . . . . . . . : 2009/01/27
  Abend Time. . . . . . . . : 13:54:04
  System Name . . . . . . . : MV20
  Job Type. . . . . . . . . : CICS Transaction
  Job ID. . . . . . . . . . : JOB00850
  Job Name. . . . . . . . . : DBAKZCCA
  Job Step Name . . . . . . : CICS
  ASID. . . . . . . . . . . : 53
  Job Execution Class . . . : A
  Region Size . . . . . . . : 0M
  EXEC Program Name . . . . : DFHSIP
  User ID . . . . . . . . . : WRIGHTA
  Accounting Information. . : H251620-TS00
```

Abend Job Info (7) – Event-Related Programs

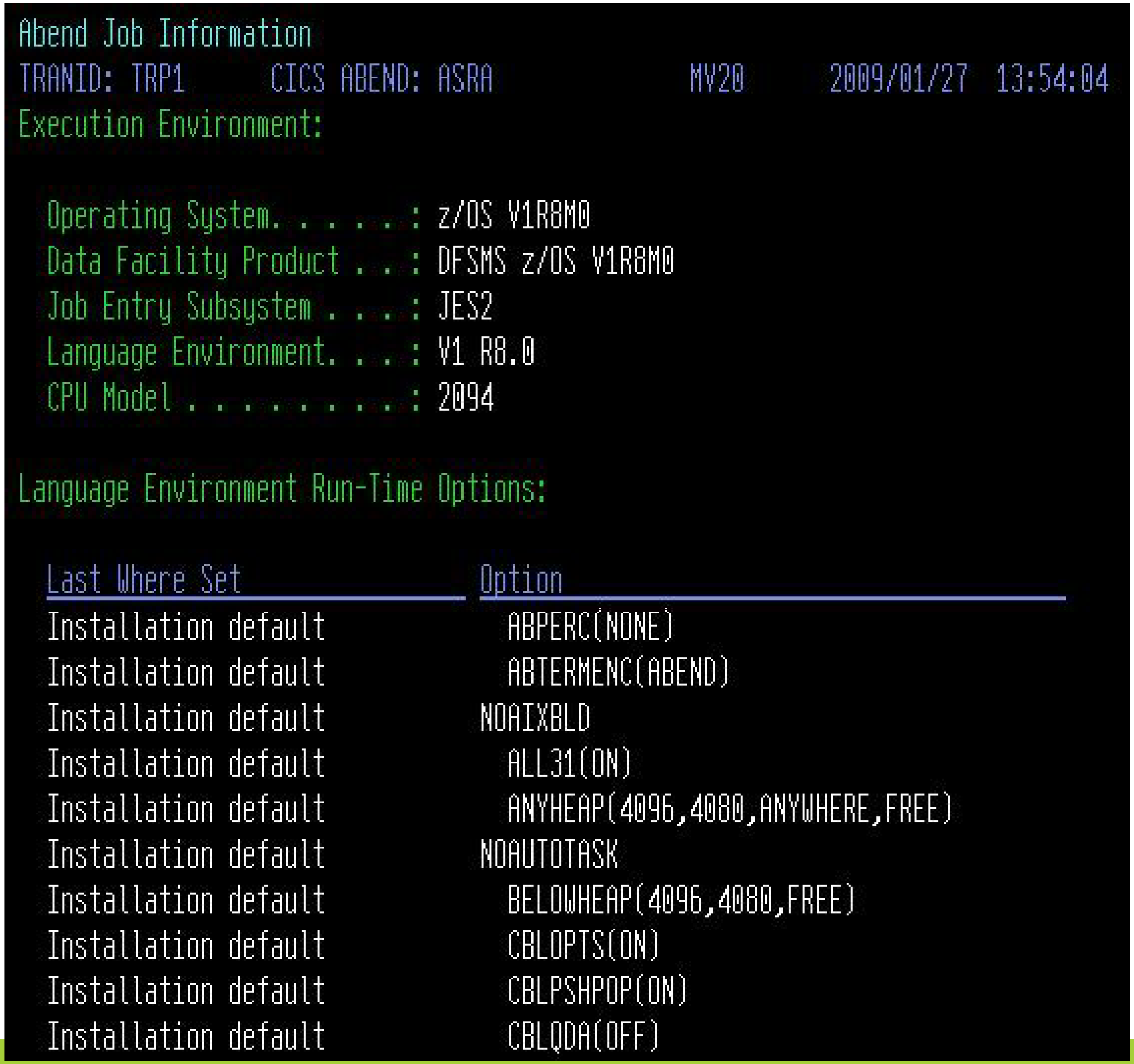
- **The transaction's programs are listed, with their compilation and linkedit dates and times**
- **The failing program's linkedit map is expanded**
  - The CSECT AMODEs and RMODEs are displayed



```
Abend Job Information
TRANID: TRP1     CICS ABEND: ASRA            MV20     2009/01/27  13:54:04
Event-Related Application Programs:

 {The following list of event-related application programs is sorted by
 module link-edit date/time and program compilation date/time in reverse
 chronological order.}

 Module   Link-Edit            Program  Compilation
 Name     Date       Time      Name     Date       Time
 PROGA1   2009/01/27 13:50:50 PROGA1   2009/01/27 n/a
 PROGCCL  2009/01/27 11:46:51 PROGCCL  2009/01/27 11:46:49
 PROGP1   2009/01/27 11:46:47 PROGP1   2009/01/27 11:46:46

Point Of Failure LINKEDIT Map:

 Address  Offset  Length  Type   Date       Time     RMODE AMODE Language Name
 000C1000       0     1E0 MODULE 2009/01/27 13:50:50       24             PROGA1
 000C1000       0      26 CSECT  2008/04/07          ANY   MIN   ASM      DFHEAI
 000C1028      28     19C CSECT  2009/01/27          24    24    ASM      PROGA1
 000C11C8     1C8      16 CSECT  2008/04/07          ANY   MIN   ASM      DFHEAI0
```

Abend Job Info (7) – Environment / LE options

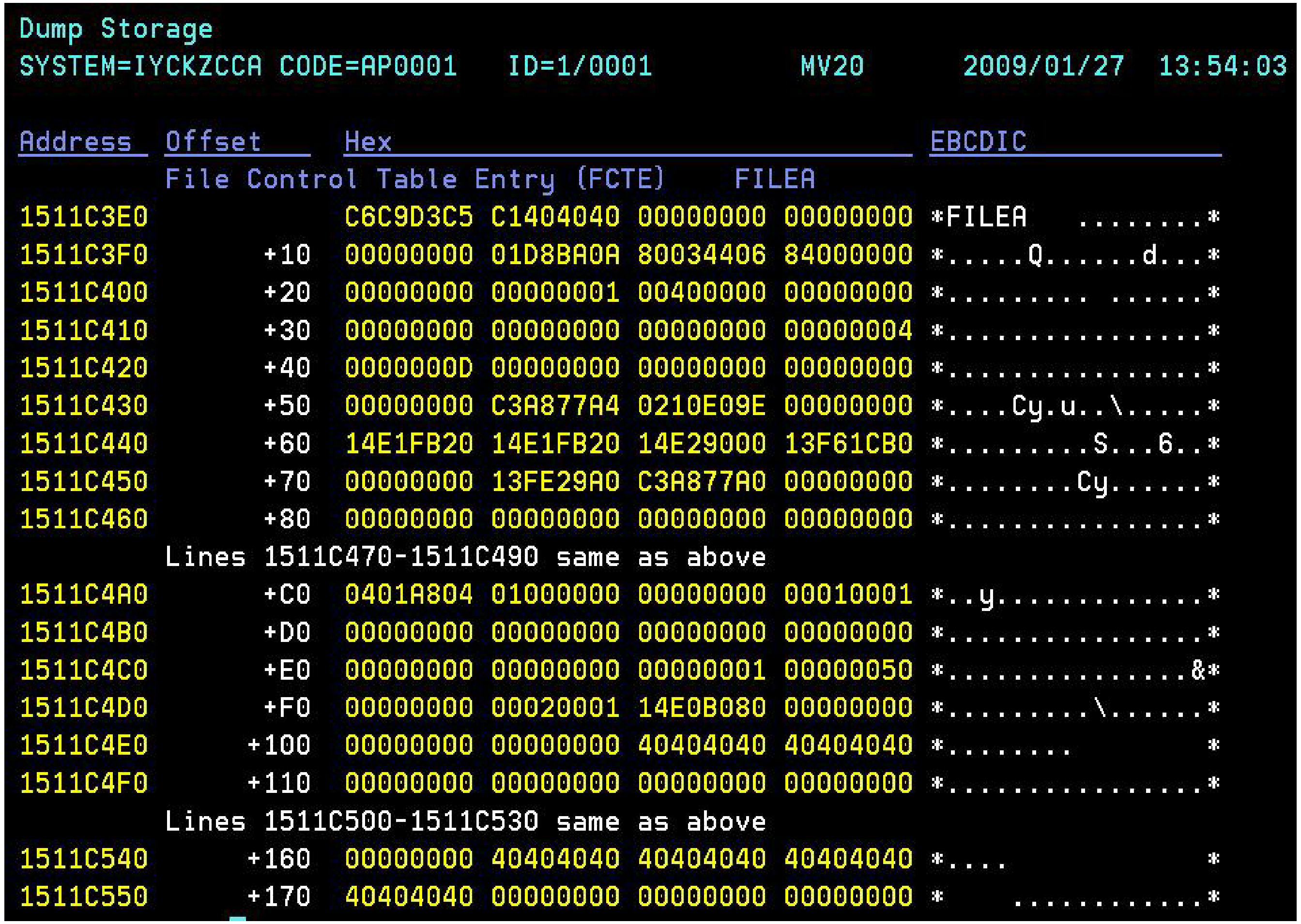
- **The z/OS level, JES type and CPU Model are returned**
  - Levels of SMS and LE are returned too
- **The Language Environment run-time options are formatted out**
  - Not all shown here for clarity
  - This gives a helpful overview of Language Environment settings



```
Abend Job Information
TRANID: TRP1      CICS ABEND: ASRA            MV20      2009/01/27  13:54:04
Execution Environment:

  Operating System. . . . . . : z/OS V1R8M0
  Data Facility Product . . . : DFSMS z/OS V1R8M0
  Job Entry Subsystem . . . . : JES2
  Language Environment. . . . : V1 R8.0
  CPU Model . . . . . . . . . : 2094

Language Environment Run-Time Options:

  Last Where Set                Option
  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)
  Installation default            CBLPSHPOP(ON)
  Installation default            CBLQDA(OFF)
```

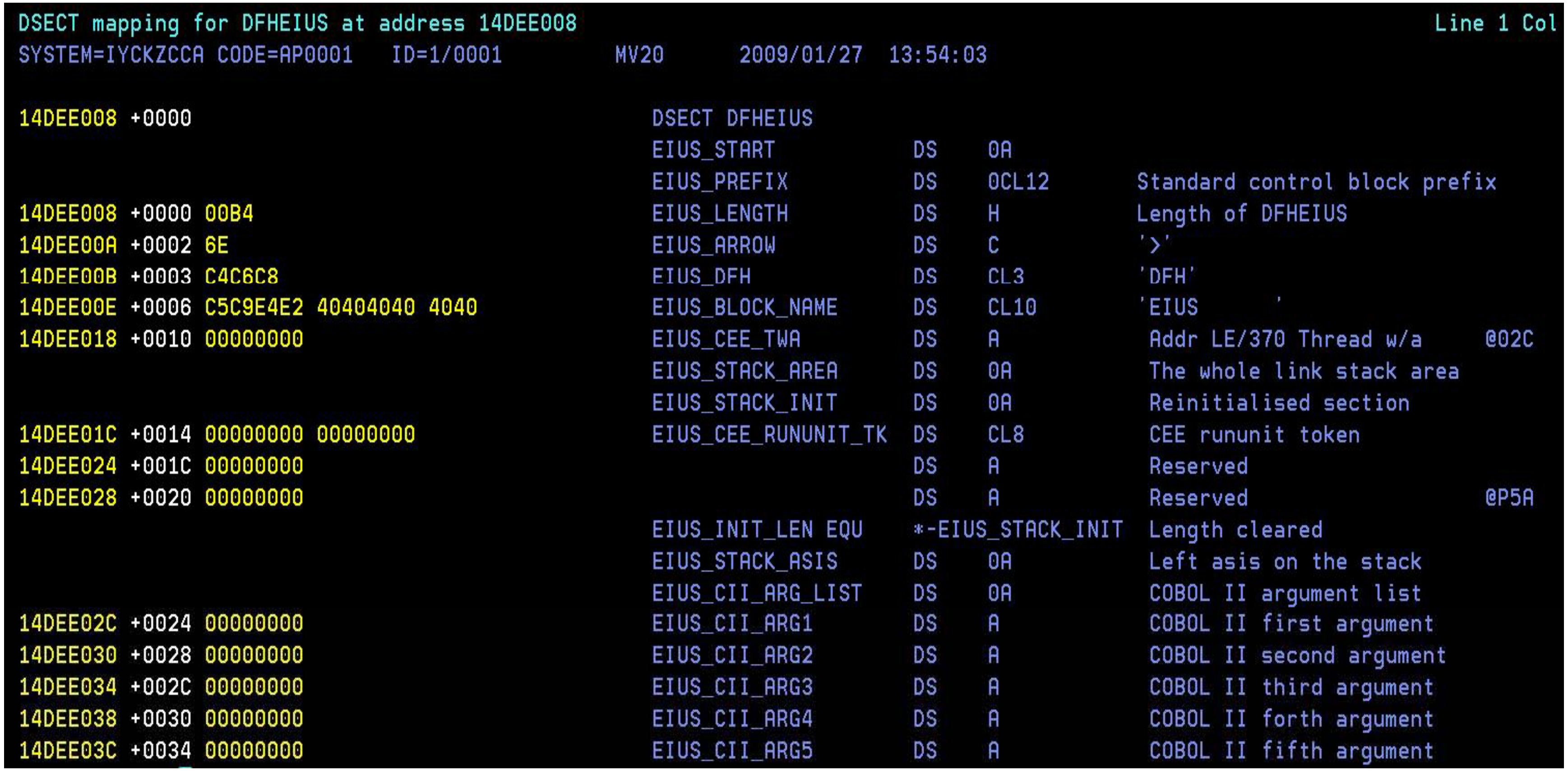
A SHOW storage example

- **Enter SHOW command followed by an address**
  - e.g. SHOW 1511C3E0
- **The storage is displayed**
- **PF7 and PF8 to navigate backwards and forwards**
- **Relative offsets given**



```
Dump Storage
SYSTEM=IYCKZCCA CODE=AP0001   ID=1/0001         MV20      2009/01/27  13:54:03

Address  Offset     Hex                                 EBCDIC
         File Control Table Entry (FCTE)    FILEA
1511C3E0            C6C9D3C5 C1404040 00000000 00000000 *FILEA   ........*
1511C3F0       +10  00000000 01D8BA0A 80034406 84000000 *.....Q......d...*
1511C400       +20  00000000 00000001 00400000 00000000 *......... ......*
1511C410       +30  00000000 00000000 00000000 00000004 *................*
1511C420       +40  0000000D 00000000 00000000 00000000 *................*
1511C430       +50  00000000 C3A877A4 0210E09E 00000000 *....Cy.u..\.....*
1511C440       +60  14E1FB20 14E1FB20 14E29000 13F61CB0 *.........S...6..*
1511C450       +70  00000000 13FE29A0 C3A877A0 00000000 *........Cy......*
1511C460       +80  00000000 00000000 00000000 00000000 *................*
         Lines 1511C470-1511C490 same as above
1511C4A0       +C0  0401A804 01000000 00000000 00010001 *..y.............*
1511C4B0       +D0  00000000 00000000 00000000 00000000 *................*
1511C4C0       +E0  00000000 00000000 00000001 00000050 *...............&*
1511C4D0       +F0  00000000 00020001 14E0B080 00000000 *.........\......*
1511C4E0      +100  00000000 00000000 40404040 40404040 *........        *
1511C4F0      +110  00000000 00000000 00000000 00000000 *................*
         Lines 1511C500-1511C530 same as above
1511C540      +160  00000000 40404040 40404040 40404040 *....            *
1511C550      +170  40404040 00000000 00000000 00000000 *    ............*
```

A DSECT mapping example

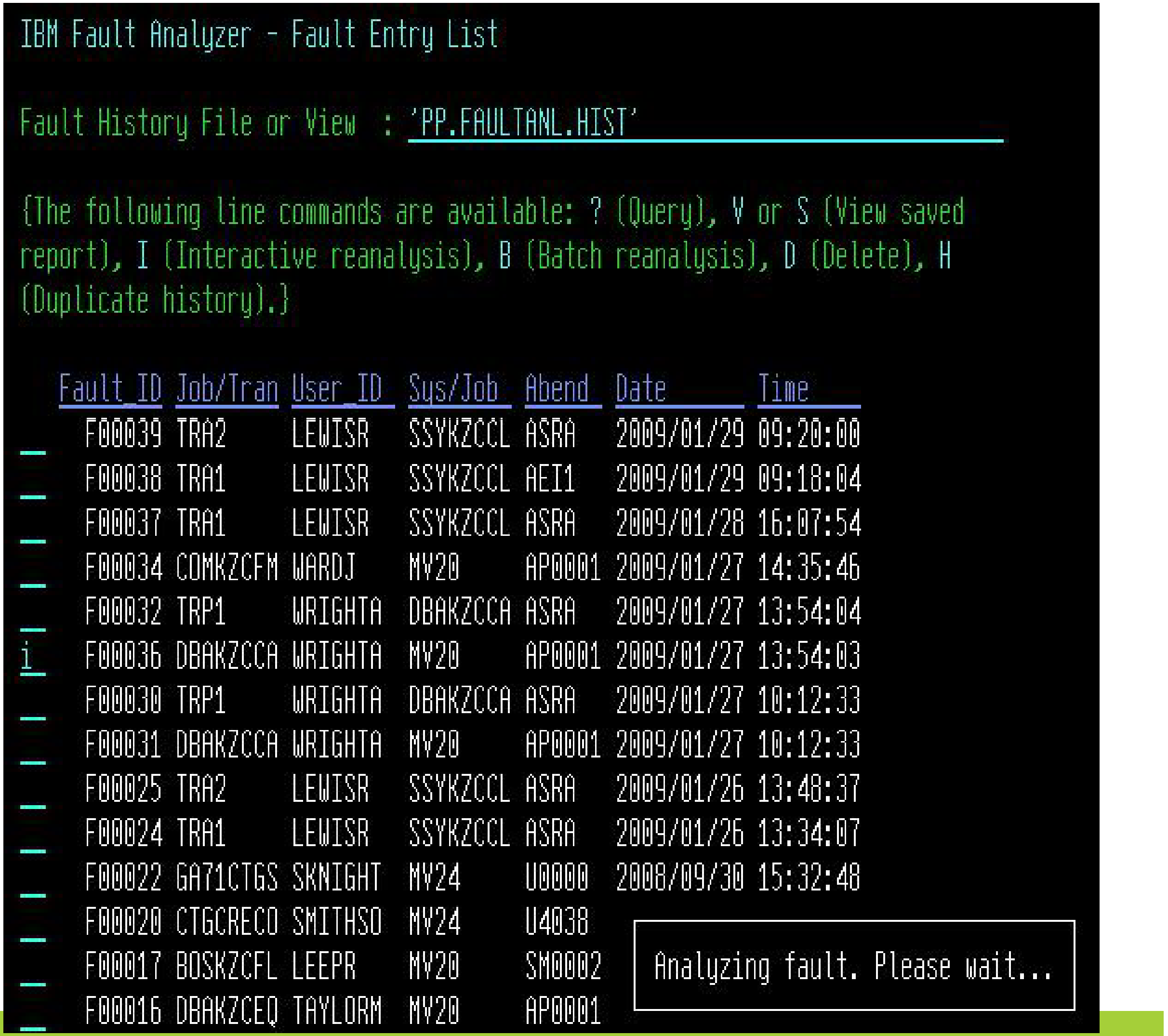


```
DSECT mapping for DFHEIUS at address 14DEE008                                                              Line 1 Col
SYSTEM=IYCKZCCA CODE=AP0001   ID=1/0001         MV20      2009/01/27  13:54:03

14DEE008 +0000                                      DSECT DFHEIUS
                                                    EIUS_START           DS    0A
                                                    EIUS_PREFIX          DS    0CL12       Standard control block prefix
14DEE008 +0000 00B4                                 EIUS_LENGTH          DS    H           Length of DFHEIUS
14DEE00A +0002 6E                                   EIUS_ARROW           DS    C           '>'
14DEE00B +0003 C4C6C8                               EIUS_DFH             DS    CL3         'DFH'
14DEE00E +0006 C5C9E4E2 40404040 4040               EIUS_BLOCK_NAME      DS    CL10        'EIUS      '
14DEE018 +0010 00000000                             EIUS_CEE_TWA         DS    A            Addr LE/370 Thread w/a     @02C
                                                    EIUS_STACK_AREA      DS    0A           The whole link stack area
                                                    EIUS_STACK_INIT      DS    0A           Reinitialised section
14DEE01C +0014 00000000 00000000                    EIUS_CEE_RUNUNIT_TK  DS    CL8          CEE rununit token
14DEE024 +001C 00000000                                                  DS    A            Reserved
14DEE028 +0020 00000000                                                  DS    A            Reserved                   @P5A
                                                    EIUS_INIT_LEN EQU    *-EIUS_STACK_INIT  Length cleared
                                                    EIUS_STACK_ASIS      DS    0A           Left asis on the stack
                                                    EIUS_CII_ARG_LIST    DS    0A           COBOL II argument list
14DEE02C +0024 00000000                             EIUS_CII_ARG1        DS    A            COBOL II first argument
14DEE030 +0028 00000000                             EIUS_CII_ARG2        DS    A            COBOL II second argument
14DEE034 +002C 00000000                             EIUS_CII_ARG3        DS    A            COBOL II third argument
14DEE038 +0030 00000000                             EIUS_CII_ARG4        DS    A            COBOL II forth argument
14DEE03C +0034 00000000                             EIUS_CII_ARG5        DS    A            COBOL II fifth argument
```

- **Select a control block address (e.g. DFHEIUS); press PF4**
- **Enter the DSECT name, and the storage is mapped for you ...**

Analyzing a system dump Fault

- **As with transaction dumps, the system dump Fault can be interactively analyzed (using I)**
- **Remember the Fault can be created by running Fault Analyzer against the original SDUMP data set**
- **This example is the system dump that was generated by CICS at the time of the S0C1 which produced the ASRA transaction dump ...**



```
IBM Fault Analyzer - Fault Entry List

Fault History File or View  : 'PP.FAULTANL.HIST'

(The following line commands are available: ? (Query), V or S (View saved
report), I (Interactive reanalysis), B (Batch reanalysis), D (Delete), H
(Duplicate history).)

     Fault_ID Job/Tran User_ID  Sys/Job  Abend  Date       Time
_      F00039 TRA2     LEWISR   SSYKZCCL ASRA   2009/01/29 09:20:00
_      F00038 TRA1     LEWISR   SSYKZCCL AEI1   2009/01/29 09:18:04
_      F00037 TRA1     LEWISR   SSYKZCCL ASRA   2009/01/28 16:07:54
_      F00034 COMKZCFM WARDJ    MV20     AP0001 2009/01/27 14:35:46
_      F00032 TRP1     WRIGHTA  DBAKZCCA ASRA   2009/01/27 13:54:04
i      F00036 DBAKZCCA WRIGHTA  MV20     AP0001 2009/01/27 13:54:03
_      F00030 TRP1     WRIGHTA  DBAKZCCA ASRA   2009/01/27 10:12:33
_      F00031 DBAKZCCA WRIGHTA  MV20     AP0001 2009/01/27 10:12:33
_      F00025 TRA2     LEWISR   SSYKZCCL ASRA   2009/01/26 13:48:37
_      F00024 TRA1     LEWISR   SSYKZCCL ASRA   2009/01/26 13:34:07
_      F00022 GA71CTGS SKNIGHT  MV24     U0000  2008/09/30 15:32:48
_      F00020 CTGCRECO SMITHSO  MV24     U4038
_      F00017 BOSKZCFL LEEPR    MV20     SM0002  Analyzing fault. Please wait...
_      F00016 DBAKZCEQ TAYLORM  MV20     AP0001
```

CICS Transaction Dumps

- **Controlling transaction dumps**
  - via the CICS Transaction Dump Table
- **Printing CICS transaction dumps**
  - via the supplied dump utilities

The Transaction Dump Table

This is a dynamically created table used in CICS to control transaction dumps.

```
CEMT INQ TRDUMPCODE
     STATUS:  RESULTS - OVERTYPE TO MODIFY
      Trd(AEIN) Tra         Loc Max( 999 ) Cur(0003)
      Trd(AEYD) Tra         Loc Max( 005 ) Cur(0001)
      Trd(ARCH)     Sys     Loc Max( 002 ) Cur(0002)
      Trd(ASRA) Tra         Loc Max( 010 ) Cur(0003)
      Trd(ATNI) Tra         Loc Max( 000 ) Cur(0047)
      Trd(GONE)         Shu Loc Max( 001 ) Cur(0000)
      Trd(MAGA) Tra Sys     Loc Max( 999 ) Cur(0005)
      Trd(SVIO) Tra Sys Shu Rel Max( 999 ) Cur(0000)
```

Dump related messages go to the CDUL log.

TRDUMAX (SIT option) controls the initial setting for the MAX parameter

Printing CICS Transaction Dumps

- **Refer to the CICS Operations and Utilities Guide for additional information.**
- **The CICS supplied Dump Utility Program**
  - DFHDU660 - CICS TS 4.1
  - DFHDU650 - CICS TS 3.2
  - DFHDU640 - CICS TS 3.1
  - DFHDU630 - CICS TS 2.3
- **The utility suffix represents the release number of CICS**
  - Note that CICS TS 3.1 used R640!

Printing CICS Transaction Dumps (continued)

- To list the available dumps in the transaction dump data set:

```
  SELECT TYPE=SCAN
```

- Selecting dumps to be formatted by the utility:

```
 SELECT TYPE={OR | NOTOR | AND | NOTAND | SCAN}
 TRANID=({value|generic-value,...})
 DUMPCODE=({value|generic-value,...})
 DUMPID=({value|value-range,...})
 PAGESIZE=({value|60})
 TIME=({time|time-range,...})
 UPPERCASE=(YES|NO})
 END
```

- Example:

```
  SELECT TYPE=OR,DUMPID=(1/0005)
  SELECT
TYPE=NOTOR,TRANID=(CE+T,CS*),DUMPCODE=(ATN*,AZI6)
```

References and further reading ...

- **CICS TS 3.2 InfoCenter**
  - http://publib.boulder.ibm.com/infocenter/cicsts/v3r2
- **Rational Developer for System z**
  - http://www-306.ibm.com/software/awdtools/rdz/
- **Debug Tool for System z**
  - http://www-306.ibm.com/software/awdtools/debugtool/
- **Problem determination tools**
  - http://www-306.ibm.com/software/awdtools/deployment
- **Fault Analyzer**
  - http://publibfp.boulder.ibm.com/cgi-bin/bookmgr/BOOKS/idiugi00/CCONTENTS
- **CICSPlex System Manager WUI**
  - http://publib.boulder.ibm.com/infocenter/cicsts/v3r2/topic/com.ibm.cics.ts.cpsmwui.doc/topics/eyuad_overview.html
- **CICS Explorer**
  - http://www-306.ibm.com/software/htp/cics/explorer/

Summary

- **CICS debugging made easier...!**
- **Follow the cookbooks**
- **Be sure you are aware of what level of COBOL the program was compiled with:**
  - 2TGT versus 3TGT
  - Correct utilities
  - Correct manuals
- **Observe EYEBALL information in dumps**
- **Use log messages (CEEMSG, JESMSGLG, MSGUSR, etc).**
- **Fault Analyzer is extremely powerful and very useful**
- **Take advantage of the dump tables and the dump utilities**
- **Good luck ☺**