Introduction to IPCS for Application Programmers

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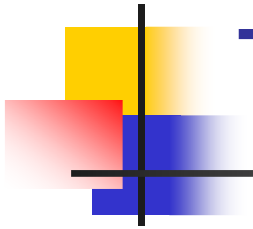

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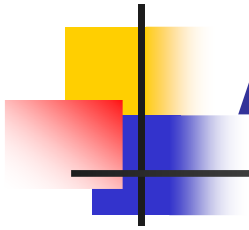
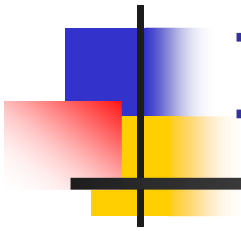
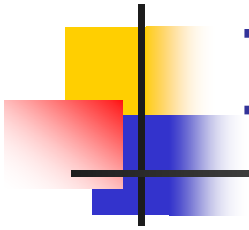


Agenda

- IPCS Overview
- Capturing a Dump
- A Guided Tour
  - Initializing A Dump
  - Status
  - Browsing Storage
  - Address Spaces and Tasks
  - Other Interesting Commands
- Sources of Additional Information

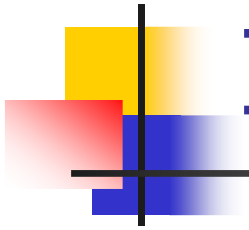


IPCS Overview



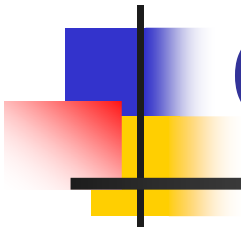
IPCS Overview

- Interactive Problem Control System (IPCS)
  - Formatting and analysis support for
    - Unformatted dumps (SVC, Console, SYSMDUMP, transaction, stand-alone)
    - Traces (GTF, component, master console, system)
  - Several different interfaces
    - Line / Batch / Dialog mode
      - Most popular is full screen (dialog) mode run under ISPF

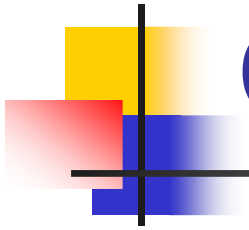


IPCS Overview…

- Advantages over Formatted Dump
  - Provides a more complete picture of the problem
  - Powerful commands and formatters available for dump analysis
- Disadvantages
  - Additional skills required for analysis
  - Application programmers may not have access to system dumps and/or IPCS

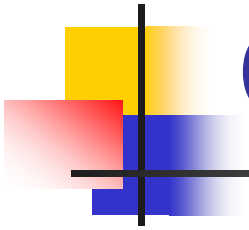


Capturing a Dump



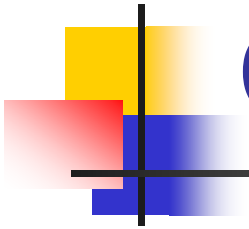
Capturing a Dump

- System Mechanisms
  - SLIP, SVC, Console Dumps
  - Not usually available to Application Programmers
- Language Environment Mechanisms
  - TERMTHDACT Run-time Option is used to request a dump for an unhandled condition of severity 2 or greater
    - Suboption UADUMP/UATRACE/UAONLY
  - Application can use CEE3ABD callable service to request a dump while terminating
    - Type of dump controlled using TERMTHDACT setting



Capturing a Dump…

- TERMTHDACT Run-time Option not Sufficient
  - Application must also either:
    - Allocate a SYSMDUMP DD
      - SYSMDUMP DD DSN=<dump name>, SPACE=(CYL,(200,200),RLSE),DISP=(NEW,DELETE, CATLG),DCB=(RECFM=FBS,DSORG=PS,LRECL=4160, BLKSIZE=24960),UNIT=SYSDA
      - Not always convenient to add to JCL or to execution environment
  - Or, specify the DYNDUMP Run-time Option…

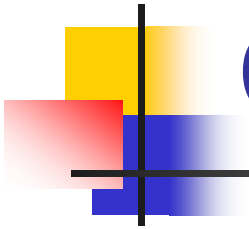


Capturing a Dump…

- DYNDUMP run-time option
  - DYNDUMP(hlq,U4039-ABEND,U40xx-ABEND)
    - hlq
      - *USERID or *USERID.hlq
      - *TSOPREFIX or *TSOPRE
        - (also *TSOPREFIX.hlq or *TSOPRE.hlq)
      - Up to 26 characters of an MVS data set name

Capturing a Dump…

- DYNDUMP run-time option
  - DYNDUMP(hlq,U4039-ABEND,U40xx-ABEND)
    - U4039-ABEND
      - NODYNAMIC (default)
        - DYNDUMP turned off for U4039 ABENDs
      - DYNAMIC
        - DYNDUMP active for U4039 ABENDs if no SYSMDUMP, SYSUDUMP or SYSABEND DD.
      - FORCE
        - DYNDUMP active for U4039 ABENDs even with above DDs allocated
      - BOTH
        - DYNDUMP plus SYSMDUMP/SYSUDUMP/SYSABEND

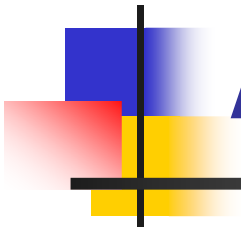


Capturing a Dump…

- DYNDUMP run-time option
  - DYNDUMP(hlq,U4039-ABEND,U40xx-ABEND)
    - U40xx-ABEND
      - TDUMP (Default)
        - DYNDUMP is active for all U40xx ABENDs (other than U4039) which request a dump.
      - NoTDUMP
        - DYNDUMP is not active for U40xx ABENDs

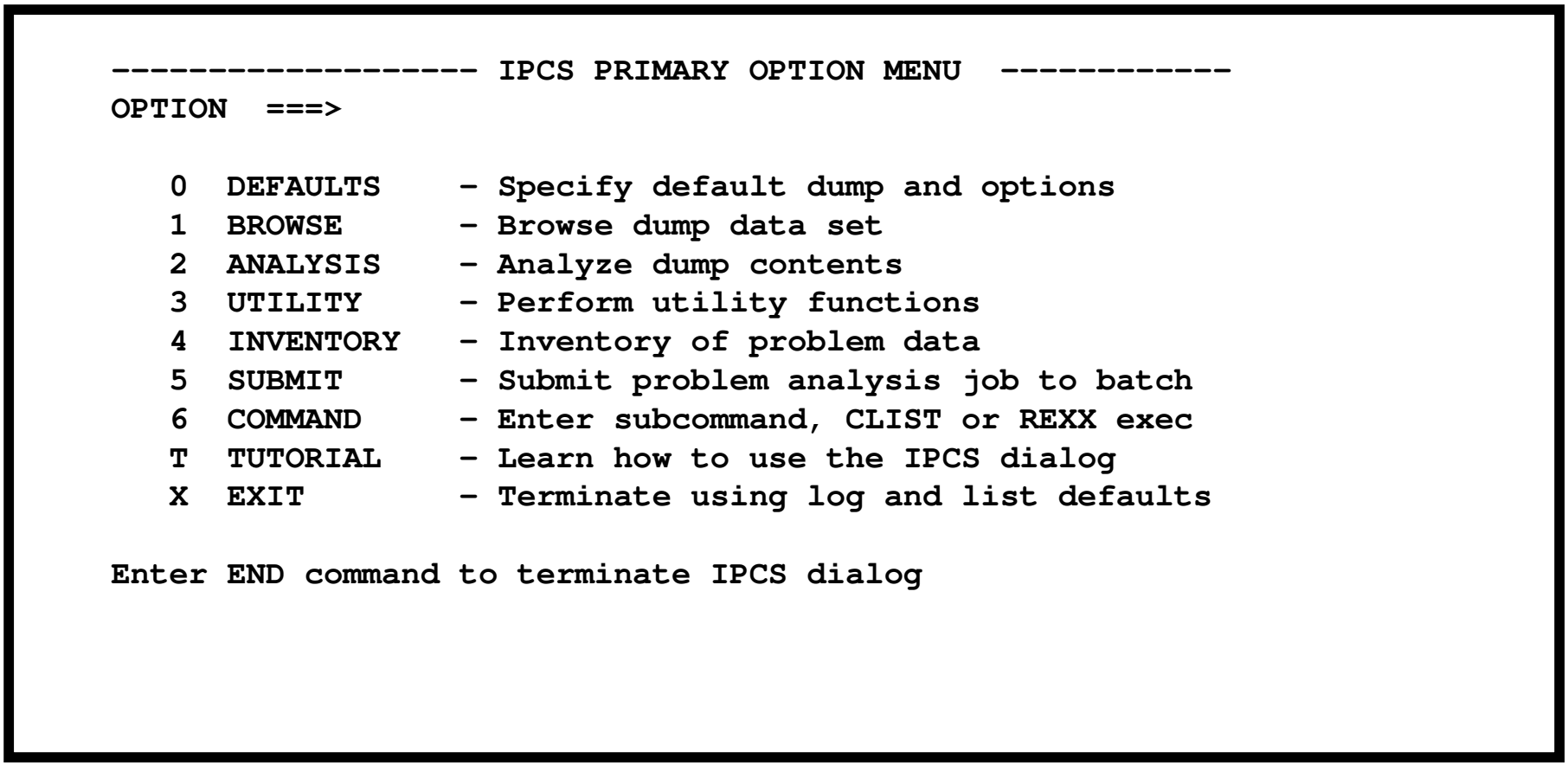
Capturing a Dump…

```
+CEE3798I ATTEMPTING TO TAKE A DUMP FOR ABEND U4039 TO
  DATA SET: PETRO.D018.T1525234.INTIPCS
IGD101I SMS ALLOCATED TO DDNAME (SYS00001)  084
   DSN (PETRO.D018.T1525234.INTIPCS                    )
   STORCLAS (STANDARD) MGMTCLAS (MIGONLY) DATACLAS (    )
   VOL SER NOS= SL7330
IGD104I PETRO.D018.T1525234.INTIPCS
  RETAINED,  DDNAME=SYS00001
IEA822I COMPLETE TRANSACTION DUMP WRITTEN TO
  PETRO.D018.T1525234.INTIPCS
+CEE3797I LANGUAGE ENVIRONMENT HAS DYNAMICALLY CREATED A
  DUMP.
```



A Guided Tour

The Main IPCS Panel



Initializing the Dump

- Use IPCS Option 0 to tell IPCS which dump to process

```
---------------------- IPCS Default Values ------------------
Command ===>

You may change any of the defaults listed below. The defaults shown before
any changes are LOCAL. Change scope to GLOBAL to display global defaults.

  Scope    ==> BOTH     (LOCAL, GLOBAL, or BOTH)

  If you change the Source default, IPCS will display the current default
  Address Space for the new source and will ignore any data entered in
  the Address Space field.

  Source   ==> DSNAME('PETRO.D018.T1525234.INTIPCS')
  Address Space    ==>
  Message Routing ==> NOPRINT TERMINAL NOPDS
  Message Control ==> CONFIRM VERIFY FLAG(TERMINATING)
  Display Content ==> MACHINE REMARK REQUEST NOSTORAGE SYMBOL

Press ENTER to update defaults.
```

Initializing the Dump...

- Issue an IPCS command to cause IPCS to initialize the dump

```
------------------ IPCS PRIMARY OPTION MENU  ----------------------------
OPTION  ===> ip status faildata
   0  DEFAULTS     - Specify default dump and options
   1  BROWSE       - Browse dump data set
   2  ANALYSIS     - Analyze dump contents
```

```
IKJ56650I TIME-03:32:46 PM. CPU-00:00:00 SERVICE-45812 SESSION-00:13:06 JANUAR
BLS18122I Initialization in progress for DSNAME('PETRO.D018.T1525234.INTIPCS')
BLS18124I TITLE=JOBNAME INTIPCS  STEPNAME GO                 USER  4039
BLS18223I Dump written by z/OS 01.13.00 SYSMDUMP - level same as IPCS level
BLS18222I z/Architecture mode system
BLS18160D May summary dump data be used by dump access? Enter Y to use, N to
   bypass.
Y
BLS18123I 17,196 blocks, 71,535,360 bytes, in DSNAME('PETRO.D018.T1525234.INTI
IKJ56650I TIME-03:34:06 PM. CPU-00:00:00 SERVICE-48680 SESSION-00:14:27 JANUAR
BLS18224I Dump of z/OS 01.13.00 - level same as IPCS level
 ***
```

IPCS Status Command

```
 *  *  *  DIAGNOSTIC DATA REPORT  *  *  *
SEARCH ARGUMENT ABSTRACT
  RIDS/CEEPLPKA#L RIDS/#UNKNOWN AB/U4039 PRCS/00000000 REGS/0B0DA REGS/05000

  Symptom              Description
  -------              -----------
  RIDS/CEEPLPKA#L      Load module name: CEEPLPKA
  RIDS/#UNKNOWN        Csect name: #UNKNOWN
  AB/U4039             User Abend code: 4039
  PRCS/00000000        Abend reason code: 00000000
  REGS/0B0DA           Register/PSW difference for R0B: 0DA
  REGS/05000           Register/PSW difference for R05: 000
   ...
```

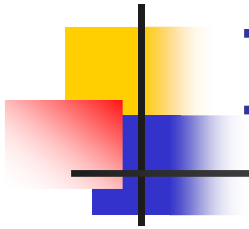
IPCS Status Command…

```
 ...
Time of Error Information

  PSW: 07851000 80000000 00000000 0D7B1682
  Instruction length: 02   Interrupt code: 000D
  Failing instruction text: 00181610 0A0D58D0 D00498EC

  Breaking event address: 00000000_00000000
  AR/GR 0-1    00000000/00000000_84000000  00000000/00000000_84000FC7
  AR/GR 2-3    00000000/00000000_21096E08  00000000/00000000_00040004
  AR/GR 4-5    00000000/00000000_0D7A5D70  00000000/00000000_0D7B1682
  AR/GR 6-7    00000000/00000000_2100E348  00000000/00000000_2100B448
  AR/GR 8-9    00000000/00000000_21096E08  00000000/00000000_2109699C
  AR/GR 10-11  00000000/00000000_2109750F  00000000/00000000_8D7B15A8
  AR/GR 12-13  00000000/00000000_2100FBE0  00000000/00000000_21099608
  AR/GR 14-15  00000000/00000000_8D7A4E44  00000000/7F4A4D00_00000000

  Home ASID: 0053    Primary ASID: 0053    Secondary ASID: 0053
  PKM: 00C0          AX: 0000              EAX: 0000
  This Task's ASID/TCB: 0053/008D89F0
```

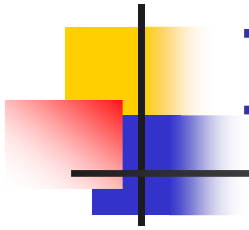


IPCS Browse

- Option 1 on the IPCS Primary Options Panel
  - Allows user to browse raw storage in the dump
  - Maintains a handy list of user-defined pointers
  - To access, specify 1 on the Primary Options Panel, and then hit <enter> on the next panel

IPCS Browse...

```
DSNAME('PETRO.D018.T1525234.INTIPCS') POINTERS  ----------------------------
Command ===>                                                SCROLL ===> CSR
ASID(X'0053') is the default address space
PTR   Address             Address space                        Data type
00001 00.                 ASID(X'0053')                        AREA
      Remarks:
****************************** END OF POINTER STACK ******************************
```



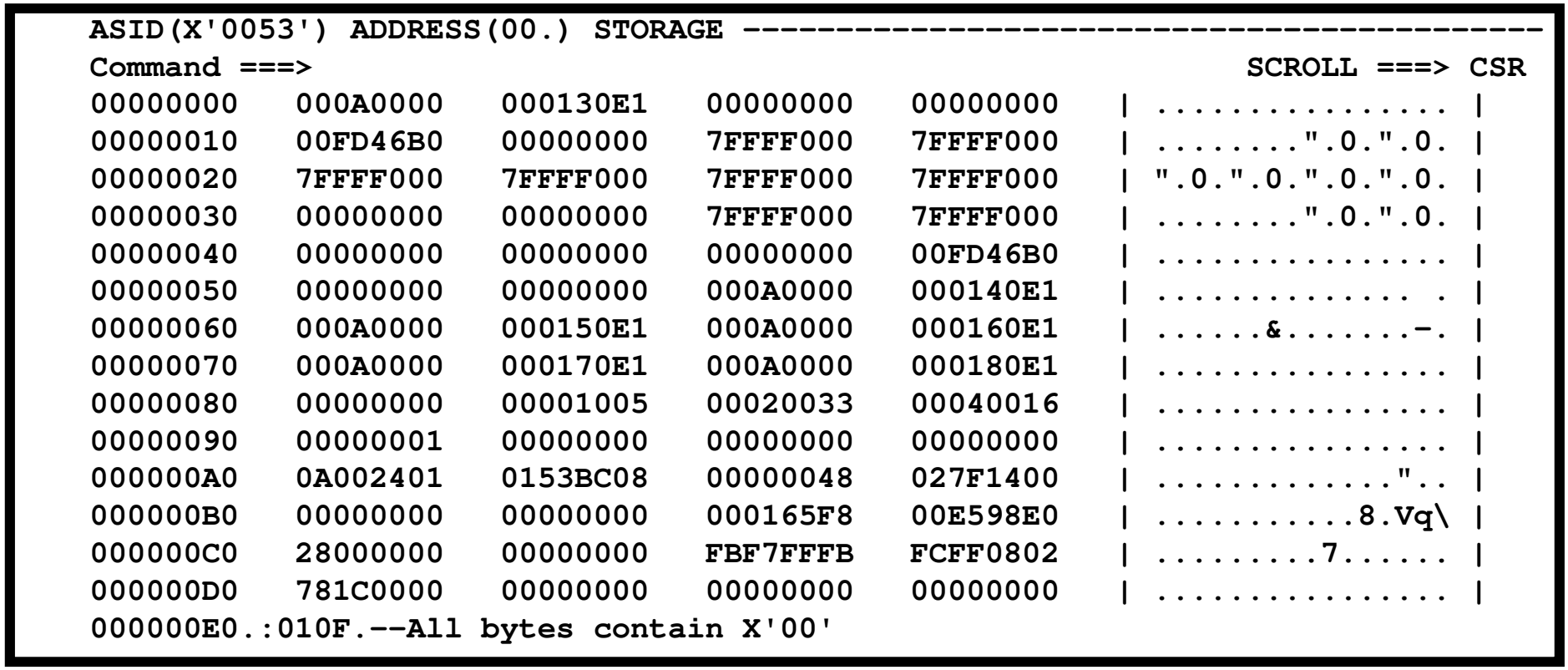
IPCS Browse...

- Pointer Stack Panel – Line Commands
  - Entered by typing over pointer number
    - S – Select a pointer entry for browsing
    - F – Format pointer entry storage
    - I – Insert a pointer entry
    - D – Delete a pointer entry
    - R – Repeat a pointer entry
    - E – Edit a pointer entry

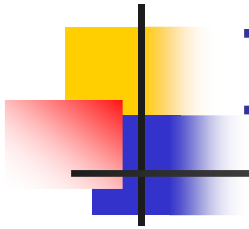
IPCS Browse...

```
DSNAME('PETRO.D018.T1525234.INTIPCS') POINTERS  ----------------------------
Command ===>                                                SCROLL ===> CSR
ASID(X'0053') is the default address space
PTR   Address            Address space                          Data type
s0001 00.                ASID(X'0053')                          AREA
      Remarks:
****************************** END OF POINTER STACK ******************************
```

IPCS Browse...



```
ASID(X'0053') ADDRESS(00.) STORAGE ----------------------------------------
Command ===>                                                 SCROLL ===> CSR
00000000   000A0000   000130E1   00000000   00000000   | ................ |
00000010   00FD46B0   00000000   7FFFF000   7FFFF000   | ........".0.".0. |
00000020   7FFFF000   7FFFF000   7FFFF000   7FFFF000   | ".0.".0.".0.".0. |
00000030   00000000   00000000   7FFFF000   7FFFF000   | ........".0.".0. |
00000040   00000000   00000000   00000000   00FD46B0   | ................ |
00000050   00000000   00000000   000A0000   000140E1   | ............... . |
00000060   000A0000   000150E1   000A0000   000160E1   | ......&.......-. |
00000070   000A0000   000170E1   000A0000   000180E1   | ................ |
00000080   00000000   00001005   00020033   00040016   | ................ |
00000090   00000001   00000000   00000000   00000000   | ................ |
000000A0   0A002401   0153BC08   00000048   027F1400   | ............"... |
000000B0   00000000   00000000   000165F8   00E598E0   | ...........8.Vq\ |
000000C0   28000000   00000000   FBF7FFFB   FCFF0802   | .........7...... |
000000D0   781C0000   00000000   00000000   00000000   | ................ |
000000E0.:010F.--All bytes contain X'00'
```



IPCS Browse...

- Many ISPF-like Browse commands work
  - PF7|PF8 page up|down
  - PF3 return
  - UP|DOWN n scroll up|down n lines
  - FIND (more later)
  - PF5 Repeat Find

IPCS Browse...

- Locate command – Used to jump to another address

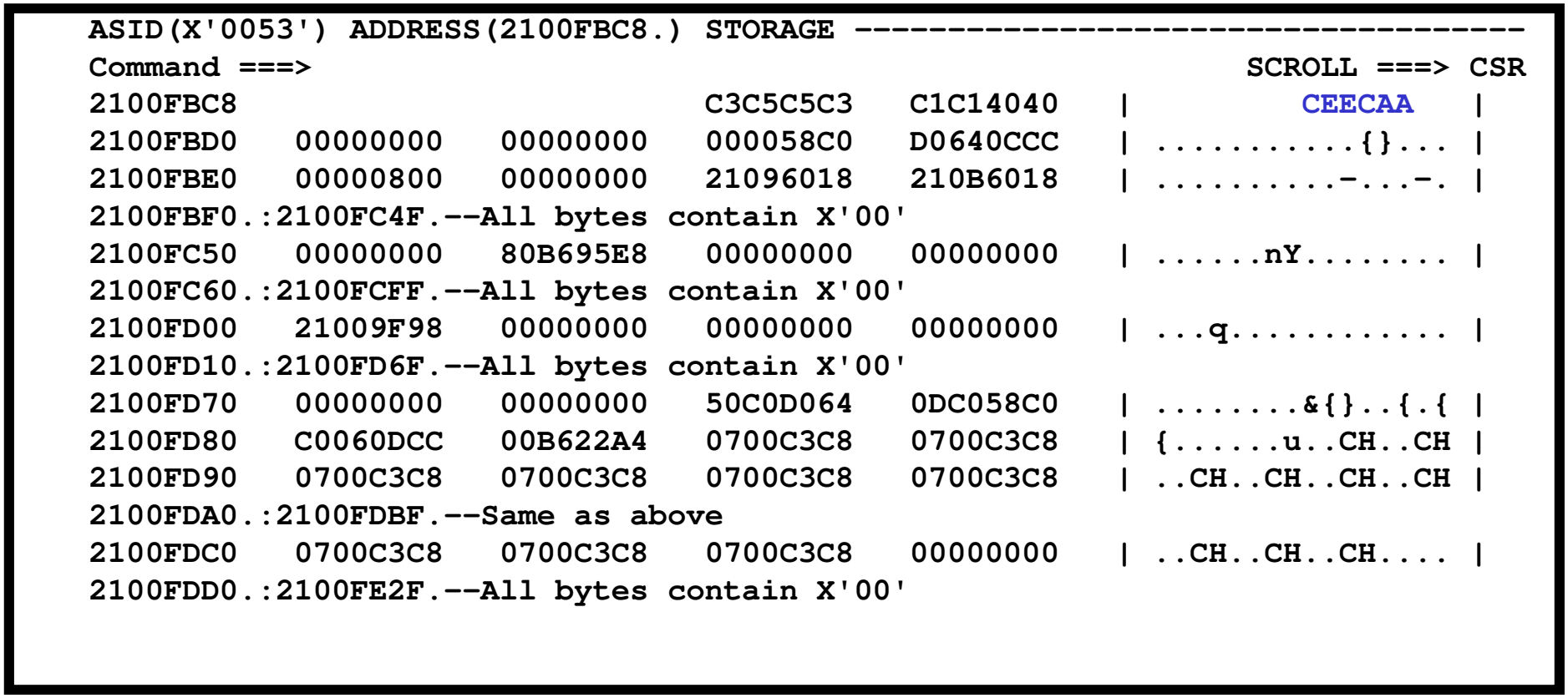
```
ASID(X'0053') ADDRESS(00.) STORAGE ----------------------------------------
Command ===> l 2100FBE0                                    SCROLL ===> CSR
00000000   000A0000   000130E1   00000000   00000000   | ................ |
00000010   00FD46B0   00000000   7FFFF000   7FFFF000   | ........".0.".0. |
00000020   7FFFF000   7FFFF000   7FFFF000   7FFFF000   | ".0.".0.".0.".0. |
00000030   00000000   00000000   7FFFF000   7FFFF000   | ........".0.".0. |
00000040   00000000   00000000   00000000   00FD46B0   | ................ |
00000050   00000000   00000000   000A0000   000140E1   | ............... . |
00000060   000A0000   000150E1   000A0000   000160E1   | ......&.......-. |
00000070   000A0000   000170E1   000A0000   000180E1   | ................ |
00000080   00000000   00001005   00020033   00040016   | ................ |
00000090   00000001   00000000   00000000   00000000   | ................ |
000000A0   0A002401   0153BC08   00000048   027F1400   | ............."... |
000000B0   00000000   00000000   000165F8   00E598E0   | ...........8.Vq\ |
000000C0   28000000   00000000   FBF7FFFB   FCFF0802   | .........7...... |
000000D0   781C0000   00000000   00000000   00000000   | ................ |
000000E0.:010F.--All bytes contain X'00'
```

IPCS Browse...

- X – Symbol representing current location in dump

```
 ASID(X'0053') ADDRESS(2100FBE0.) STORAGE ----------------------------------
Command ===> 1 x-18                                          SCROLL ===> CSR
2100FBE0   00000800   00000000   21096018   210B6018   | ..........-...-. |
2100FBF0.:2100FC4F.--All bytes contain X'00'
2100FC50   00000000   80B695E8   00000000   00000000   | ......nY........ |
2100FC60.:2100FCFF.--All bytes contain X'00'
2100FD00   21009F98   00000000   00000000   00000000   | ...q............ |
2100FD10.:2100FD6F.--All bytes contain X'00'
2100FD70   00000000   00000000   50C0D064   0DC058C0   | ........&{}..{.{ |
2100FD80   C0060DCC   00B622A4   0700C3C8   0700C3C8   | {......u..CH..CH |
2100FD90   0700C3C8   0700C3C8   0700C3C8   0700C3C8   | ..CH..CH..CH..CH |
2100FDA0.:2100FDBF.--Same as above
2100FDC0   0700C3C8   0700C3C8   0700C3C8   00000000   | ..CH..CH..CH.... |
2100FDD0.:2100FE2F.--All bytes contain X'00'
2100FE30   00000000   00000000   00000000   21009760   | ............p- |
2100FE40   00000000   00000000   80B65E38   80B65D58   | ..........;...). |
2100FE50.:2100FE7F.--All bytes contain X'00'
```

IPCS Browse...



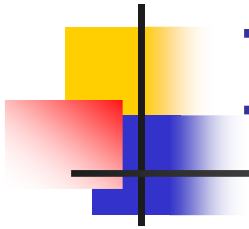
```
ASID(X'0053') ADDRESS(2100FBC8.) STORAGE ----------------------------------
Command ===>                                                 SCROLL ===> CSR
2100FBC8                          C3C5C5C3   C1C14040   |          CEECAA   |
2100FBD0   00000000   00000000   000058C0   D0640CCC   | ..........{}... |
2100FBE0   00000800   00000000   21096018   210B6018   | .........-...-. |
2100FBF0.:2100FC4F.--All bytes contain X'00'
2100FC50   00000000   80B695E8   00000000   00000000   | ......nY........ |
2100FC60.:2100FCFF.--All bytes contain X'00'
2100FD00   21009F98   00000000   00000000   00000000   | ...q............ |
2100FD10.:2100FD6F.--All bytes contain X'00'
2100FD70   00000000   00000000   50C0D064   0DC058C0   | ........&{}..{.{ |
2100FD80   C0060DCC   00B622A4   0700C3C8   0700C3C8   | {......u..CH..CH |
2100FD90   0700C3C8   0700C3C8   0700C3C8   0700C3C8   | ..CH..CH..CH..CH |
2100FDA0.:2100FDBF.--Same as above
2100FDC0   0700C3C8   0700C3C8   0700C3C8   00000000   | ..CH..CH..CH.... |
2100FDD0.:2100FE2F.--All bytes contain X'00'
```

IPCS Browse...

- Stack command – saves address on the pointer list

```
 DSNAME('PETRO.D018.T1525234.INTIPCS') POINTERS ----------------
Command ===>  ip stack 2100FBE0                          SCROLL ===> CSR
ASID(X'0053') is the default address space
PTR   Address          Address space                    Data type
00001 00.              ASID(X'0053')                    AREA
      Remarks:
************************ END OF POINTER STACK ************************
```

```
 DSNAME('PETRO.D018.T1525234.INTIPCS') POINTERS  ---------------
Command ===>                                             SCROLL ===> CSR
ASID(X'0053') is the default address space
PTR   Address          Address space                    Data type
00001 00.              ASID(X'0053')                    AREA
      Remarks:
00002 2100FBE0.        ASID(X'0053')                    AREA
      Remarks: CAA Pointer
************************ END OF POINTER STACK ************************
```



IPCS Browse...

- Word Selection when browsing storage
  - Selection codes used with the storage panel allows a user to treat storage contents as addresses
    - L - Interpret the word as a 24-bit address and stack it
    - H - Interpret the word as a 31-bit address and stack it
    - % - Interpret the word as a 24-bit address, stack it, and display the addressed storage
    - ? - Interpret the word as a 31-bit address, stack it, and display the addressed storage
    - ! - Interpret the double word as a 64-bit address, stack it, and display the addressed storage

IPCS Browse...

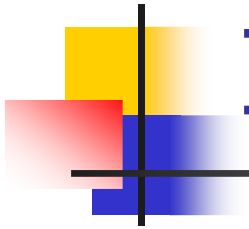
```
 ASID(X'0053') ADDRESS(2100FBE0.) STORAGE ----------------------------------
Command ===>                                                  SCROLL ===> CSR
2100FBE0   00000800   00000000 ? 21096018   210B6018   | ..........-...-. |
2100FBF0.:2100FC4F.--All bytes contain X'00'
```

```
 ASID(X'0053') ADDRESS(21096018.) STORAGE ----------------------------------
Command ===>                                                  SCROLL ===> CSR
21096018                        E2E3D2E4   21010454   |          STKU.... |
21096020   21010454   00020000   00000000   00000000   | ................ |
21096030   00104001   21010688   210964B0   A1000320   | .. ....h....~... |
```

```
DSNAME('PETRO.D018.T1525234.INTIPCS') POINTERS  ----------------------------
Command ===>                                                  SCROLL ===> CSR
ASID(X'0053') is the default address space
...
00002 2100FBE0.          ASID(X'0053')                          AREA
      Remarks: CAA Address
00003 21096018.          ASID(X'0053')                          AREA
      Remarks:
```

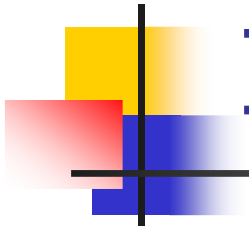
IPCS Browse...

- Finding specific values in storage
  - Use the FIND command
    - Entered on the command line of any storage browse panel
    - find ccc – locates an EBCDIC string
      ex: find ceecaa
    - find x'xxxx' – locates a hexadecimal value
      ex: find x' 47f0f014'
    - find * - uses the same find value as the previous find command
    - find first / last / next / prev
    - find nobreak (or nobr) – tells IPCS to to continue processing if it cannot retrieve storage from the dump
    - Can also specify storage boundary, column boundary, mask value, data length, ASCII data…



IPCS Browse...

- EQUATE command - Allows a user to create a symbol with an associated address and attributes
  - Syntax: EQUATE/EQU/EQ name <addr>
    ex: ip equ caa 2100FBE0
  - Symbol can be used in places where an address may be specified
    ex: l caa



IPCS Browse...

- EQUATE command...
  - Use "equate *name*" without providing an address to assign the value of "X" (current location) to the specified symbol name
  - Use LISTSYM command to show all defined equates
    - The list will be long, since IPCS defines many equates on its own
  - Use "dropsym *name* purge" to delete a symbol

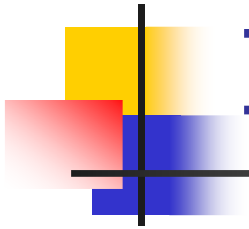
IPCS Browse...

```
IPCS OUTPUT STREAM ---------------------------------------- Line 0 Cols 1 7
Command ===>                                                SCROLL ===> CSR
 ****************************** TOP OF DATA ********************************
 SYMBOL        ADDRESS  ATTRIBUTES
 ABENDCODE          00. LITERAL LENGTH(X'04') STRUCTURE(Sdwaabcc) NODROP
 ASCB83         FA2780. ASID(X'0001') LENGTH(X'0180') STRUCTURE(Ascb) NODROP
 ASVT           FABDA8. ASID(X'0001') POSITION(X'+01E0') LENGTH(X'2074')
                        STRUCTURE(Asvt) NODROP
 ASXB83         8FDB60. ASID(X'0053') LENGTH(X'0300') STRUCTURE(Asxb) NODROP
 CAA          2100FBE0. ASID(X'0053') LENGTH(X'04') AREA DROP
 COMMON         900000. ASID(X'0001') LENGTH(X'700000') AREA(Common) NODROP
 COMPONENTID        00. LITERAL LENGTH(X'09') CHARACTER NODROP
 CVT            FD46B0. ASID(X'0001') POSITION(X'-28') LENGTH(X'0528')
                        STRUCTURE(Cvt) NODROP
 DAESYMPTOMS        00. LITERAL LENGTH(X'54') CHARACTER NODROP
 DSA001       21099608. ASID(X'0053') LENGTH(X'50') AREA DROP
 DSA002       21096510. ASID(X'0053') LENGTH(X'50') AREA DROP
 DSA003       21096370. ASID(X'0053') LENGTH(X'50') AREA DROP
 DSA004       210961D0. ASID(X'0053') LENGTH(X'50') AREA DROP
 DSA005       21096030. ASID(X'0053') LENGTH(X'50') AREA DROP
```

IPCS Browse...

- List command - Displays storage in the dump
  - Boring by itself, but by adding INST attribute, IPCS will disassemble instructions at the given address
  - ip list 0D7B166E len(24) inst :

```
IPCS OUTPUT STREAM ------------------------------------- Line 0 Col
Command ===>                                                SCROLL ===
 ****************************** TOP OF DATA ***************************
LIST 0D7B166E. ASID(X'0053') LENGTH(X'18') INSTRUCTION
 ASID(X'0053') ADDRESS(0D7B166E.) KEY(00)
 0D7B166E | 4110 0FC7      | LA      R1,X'FC7'
 0D7B1672 | 41F0 0000      | LA      R15,X'0'
 0D7B1676 | 4100 0084      | LA      R0,X'84'
 0D7B167A | 8900 0018      | SLL     R0,X'18'
 0D7B167E | 1610           | OR      R1,R0
 0D7B1680 | 0A0D           | SVC     X'0D' ABEND, type 4, calls IEAVTRT2
 0D7B1682 | 58D0 D004      | L       R13,X'4'(,R13)
 ****************************** END OF DATA ***************************
```



IPCS Summary Command

- Produces information associated with an address space
  - Defaults to current ASID, but user can identify other(s) to work with using ASIDLIST, JOBLIST, JOBNAME keywords
- summary format (or summ format)
  - produces detailed report of major control blocks in the address space
    - ASCB / ASSB
    - TCBs / STCBs / RBs
    - RTM2WA
    - Load Lists / Job Pack Queue
    - Linkage stacks / Save Areas
    - TCB Summary

IPCS Summary Command...

- TCB Summary
  - Found at the end of the Summary output

```
  * * * *   T C B   S U M M A R Y   * * * *

JOB INTIPCS  ASID 0053 ASCB 00FA2780 FWDP 00F6A880 BWDP 00F72B80 PAGE
00000005
    TCB AT    CMP      NTC      OTC      LTC      TCB      BACK     PAGE
   008FE040 00000000 00000000 00000000 008FF890 008FD0C0 00000000 00000045
   008FD0C0 00000000 00000000 008FE040 00000000 008FF890 008FE040 00000051
   008FF890 00000000 008FD0C0 008FE040 008FF260 008FF260 008FD0C0 00000055
   008FF260 00000000 00000000 008FF890 008D89F0 008D89F0 008FF890 00000061
   008D89F0 84000FC7 00000000 008FF260 00000000 00000000 008FF260 00000068
```

IPCS Summary Command...

- TCB/STCB/RB Information

```
TCB: 008D89F0
   +0000  RBP..... 008FD928  PIE..... 000060C8  DEB..... 008CA048
   +000C  TIO..... 008CFFD0  CMP..... 84000FC7  TRN..... 00000000
   +0018  MSS..... 7F4251C0  PKF..... 80        FLGS.... 00000000  00
   +0022  LMP..... FF        DSP..... FF        LLS..... 008FF450
   +0028  JLB..... 008D98B8  JPQ..... 008FF470

   General purpose register values
     0-3  7F459B80  00000480  08556600  7F42EE70
     4-7  7F43B640  00003E92  00001040  7F430E60
    8-11  7F42FC50  000B0003  7F439DE8  00003E91
   12-15  0B411150  00000008  03F8C000  00000480

          64-Bit GPRs from TCB/STCB
    0-1  00000004_7F459B80  00000000_00000480
    2-3  00000048_08556600  00000000_7F42EE70
    4-5  00000048_7F43B640  00000000_00003E92
    6-7  00000000_00001040  00000000_7F430E60
    8-9  00000000_7F42FC50  00000048_000B0003
```

IPCS Summary Command...

- RTM2WA Information

```
                              RTM2WA SUMMARY
                              --------------
+001C  Completion code                        84000FC7
+008C  Abending program name/SVRB address INTRIPCS
+0094  Abending program addr                  21000000

       GPRs at time of error
     0-3  84000000  84000FC7  21096E08  00040004
     4-7  0D7A5D70  0D7B1682  2100E348  2100B448
     8-11 21096E08  2109699C  2109750F  8D7B15A8
    12-15 2100FBE0  21099608  8D7A4E44  00000000

+06D8  PSW at time of error: 07851000 80000000 00000000 0D7B1682
+0084  Instruction Length Code: 0002  Interruption Code: 000D
+06C8  Translation Exception Identification: 00000000 00000000
+00DC  SDWACOMP                    00000000
+00E8  Return code from recovery routine-00
   Continue with termination-implies percolation
+00E0  Retry Address returned from recovery exit 00000000
```

IPCS Summary Command...

- Load List

```
EP....... CEEMENU3
ENTPT.... A1115000  RRBP..... 00000000  USE...... 0001      SP....... FC
Reenterable. Reusable.
APF library.
LOADCNT.. 0001      SYSCT.... 0000
NRFAC.... 00000001  MSBAD.... 21115000  LNTH..... 0000C810
NAMEL.... 0008      ASID..... 0053      PROVIDI.. 00000002
PROVIDD.. 00010000  00E11639  60D3D5D2  D3E2E360
EPTOKEN.. 000001E2  0053001F

EP....... IGZINSH
ENTPT.... A10BF000  RRBP..... 00000000  USE...... 0001      SP....... FC
Reenterable. Reusable.
APF library.
LOADCNT.. 0001      SYSCT.... 0000
NRFAC.... 00000001  MSBAD.... 210BF000  LNTH..... 00050088
NAMEL.... 0008      ASID..... 0053      PROVIDI.. 00000002
PROVIDD.. 00010000  10AD1339  60D3D5D2  D3E2E360
```

IPCS Summary Command...

- Linkage Stack Entry

```
LINKAGE STACK ENTRY  00  FROM TCB.  LSED: 7F45A010
 LSEH: 7F45A000
    FNXT..... 00000000  BSEA..... 00000000  TYPE..... 89
     HEADER ENTRY
    RFS...... 0FD0      NES...... 0128

LINKAGE STACK ENTRY  01  FROM TCB.  LSED: 7F45A138
 LSE: 7F45A018
    GENERAL PURPOSE REGISTER VALUES
    00-01.... 00000000  0B3C1068  00000000  A100B200
    02-03.... 00000000  A100B200  00000000  0000E670
    ...
    PKM...... 00C0      SASN..... 0053      SINS..... 00000605
    EAX...... 0000      PASN..... 0053      PINS..... 00000605
    PSW...... 07043000  80000000            PSWE..... 00000000  0B3BE1C4
    TARG..... 00000000  8B3F9C8A            MSTA..... 00000000  00000000
    TYPE..... 8C
```

Where Command

- Identifies an area at a given address
  - where 21000F68

```
ASID(X'0053') 21000F68. AREA(Subpool251Key08)+0F68 IN EXTENDED PRIVATE
ASID(X'0053') 21000F68. INTRIPCS+0F68 IN EXTENDED PRIVATE
```

  - where 0D7B1682

```
ASID(X'0053') 0D7B1682. CEEPLPKA+0D1682 IN EXTENDED PLPA
```

Master Trace

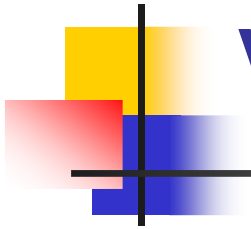
- Option 2.7.3
  - Formats the master trace table, containing the most recently issued console messages

```
21:07:26.84 TSU00010 00000090  $HASP100 WELLIE0  ON TSOINRDR
21:07:27.09 TSU00010 00000090  $HASP373 WELLIE0  STARTED
21:07:35.21 POSIXCON 00000090  slip
   set,a=svcd,c=0c4,enable,sdata=(csa,sum,trt,psa,nuc,sqa,grsq,rgn,lpa),end
21:07:35.22 POSIXCON 00000090  IEE727I SLIP TRAP ID=0001 SET
21:09:35.53 JOB00011 00000090  $HASP100 INTIPCS ON INTRDR PETRO FROM WELLIE0
21:09:35.56 JOB00011 00000290  IRR010I USERID WELLIE0 IS ASSIGNED TO THIS JOB.
21:09:35.80 JOB00011 00000090  ICH70001I WELLIE0  LAST ACCESS AT 21:07:26 ON
   WEDNESDAY, JULY 18, 2012
21:09:35.80 JOB00011 00000090  $HASP373 INTIPCS STARTED - INIT 1 - CLASS 2
   21:09:36.82          00000090  IEA045I AN SVC DUMP HAS STARTED AT
   TIME=21.09.36 DATE=07/18/2012 523
                523 00000090  FOR ASID (0019)
                523 00000090  QUIESCE = YES
```

System Trace

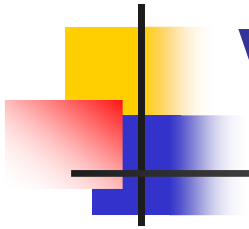
- Option 2.7.4 or SYSTRACE command
  - Formats the system trace table, containing information on significant system events
    - Sample trace entries:

```
00-014B 008D89F0 SVC  6D 00000000_20FB1B62  0000001C 00000004 2111D5A8 Espie
                         07850000 80000000
00-014B 008D89F0 SSRV 78          8AEF2CA0  0000FA12 00000160 000060A0 Getmain
                                            014B0000
00-014B 008D89F0 SVC  3C 00000000_20FB19EA  A0FB1720 00000100 A111D5A8 Estae
                         07851000 80000000
00-014B 008D89F0 PGM 004 00000000_20F00080  00040004 00000000          00000000
                         07850000 80000000            00000000          00000000
00-014B 008D89F0*SVC   D 00000000_20FEF8B2  00000000 84000000 84000FC7
                         07851000 80000000
```



VERBEXIT Command

- Calls an IBM or user-supplied verb exit
  - Optionally can provide parameters to tailor how the verb exit runs
  - Verb Exits useful for application debugging
    - LEDATA – Formats Language Environment diagnostic information as well as application information
    - OMVSDATA – Formats z/OS UNIX diagnostic information
    - DFHPDxxx – Formats CICS diagnostic information (and Language Environment info, too!)



VERBEXIT Command...

- LEDATA Parameters

Report type parameters:

SUMMARY | ALL

HEAP | STACK | SM

HPT(value)

CM

MH

CEEDUMP

COMP(value)

PTBL(value)

Control block selection parameters:

CAA(caa-address)

DSA(dsa-address)

TCB(tcb-address)

ASID(address-space-ID)

NTHREADS(value)

Additional Component Support

- Option 2.6 – over 50 components!

```
------------------ IPCS MVS DUMP COMPONENT DATA ANALYSIS --------------------
OPTION ===>                                                SCROLL ===> CSR

To display information, specify "S option name" or enter S to the left
of the option desired.  Enter ? to the left of an option to display
help regarding the component support.

S Name     Abstract
  ALCWAIT  Allocation wait summary
  AOMDATA  AOM analysis
  APPCDATA APPC/MVS Data Analysis
  ASCHDATA APPC/MVS Scheduler Data Analysis
  ASMCHECK Auxiliary storage paging activity
  ASMDATA  ASM control block analysis
  AVMDATA  AVM control block analysis
  CICS410  CICS Version 4 Release 1 analysis
  COMCHECK Operator communications data
  COUPLE   XCF Coupling analysis
  CSFDATA  ICSF control block analysis
  CTRACE   Component trace summary
  DAEDATA  DAE header data
  DB2DATA  DB2 analysis
  DIVDATA  Data in virtual storage
```

CBFORMAT Command

- Formats a control block
  - Syntax: CBF(ORMAT) <cbaddr> STR(<cbname>)
    - <cbaddr> can be address or symbol
    - STR(UCTURE) support provided by various components
      - IPCS Commands, Appendix D for MVS control blocks
      - Language Environment Debugging Guide for LE control blocks
        - CEExxx for AMODE 24/31 (CEECAA, CEECIBH, CEEDSA, CEEEDB, CEEHANC, CEESTKH, etc.)
        - CELxxxx for AMODE 64 (CELCIBH, CELDSA, CELEDB, CELLAA, CELLCA, CELSANC, etc.)

CBFORMAT Command…

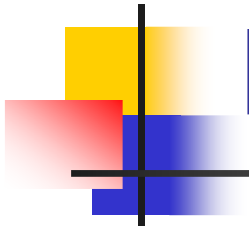
- ip cbf 21099608 str(ceedsa)
  OR
  ip cbf dsa1 str(ceedsa)

```
IPCS OUTPUT STREAM ----------------------------------------
Command ===>
 ****************************** TOP OF DATA **********************
      DSA:  21099608
    +000000  FLAGS:0000  MEMD:1001   BKC:21096510      FWC:210996E0
    +00000C  R14:A1011460      R15:A1061FF8      R0:210997E0
    +000018  R1:2100B488       R2:21096E08       R3:00000001
    +000024  R4:2100B488       R5:2100E5D0       R6:000077FC
    +000030  R7:21011FFF       R8:00007A80       R9:00000004
    +00003C  R10:2109750F      R11:A1011000      R12:2100FBE0
    +000048  LWS:00000000      NAB:210996A8      PNAB:00000000
    +000064  RENT:00000000     CILC:00000000     MODE:00000000
    +000078  RMR:00000000
****************************** END OF DATA **********************
```

CBFORMAT Command…

- Can be used from Browse's Pointer Stack

```
DSNAME('PETRO.D018.T1525234.INTIPCS') POINTERS  --------------------------
Command ===>                                                 SCROLL ===> CSR
ASID(X'0053') is the default address space
PTR   Address          Address space                        Data type
00001 00.              ASID(X'0053')                        AREA
      Remarks:
f0002 2100FBE0.        ASID(X'0053')                        STRUCTURE(Ceecaa)
      Remarks: CAA Pointer
***************************** END OF POINTER STACK ****************************
```



RUNCHAIN Command

- Allows the user to process a chain of control blocks
- User provides:
  - Starting address
  - Link offset
  - Additional parameters to tell RUNCHAIN what to do with each control block / address

RUNCHAIN Command...

```
ip runc address(21099608) link(4) display length(x'50') name(dsa)

DSA001
LIST 21099608. ASID(X'0053') LENGTH(X'50') AREA
ASID(X'0053') ADDRESS(21099608.) KEY(88)
21099608.                   00001001 21096510 |        ........|
21099610. 210996E0 A1011460 A1061FF8 210997E0 |..o\~..-~..8..p\|
21099620. 2100B488 21096E08 00000001 2100B488 |...h..>........h|
21099630. 2100E5D0 000077FC 21011FFF 00007A80 |..V}...........:.|
21099640. 00000004 2109750F A1011000 2100FBE0 |........~......\|
21099650. 00000000 210996A8                   |......oy         |

DSA002
LIST 21096510. ASID(X'0053') LENGTH(X'50') AREA
ASID(X'0053') ADDRESS(21096510.) KEY(88)
21096510. 0808CEE1 21096370 21099608 8D7A4E44 |..........o..:+.|
21096520. 8D7B15A8 2109699C 2109696C 2100E7F8 |.#.y.......%..X8|
21096530. 00000794 0D7A5D70 21009F50 00000000 |...m.:).....&....|
21096540. 2100B448 8D7A4C62 2109850E 2109750F |.....:<...e.....|
21096550. 0D7A0F50 2100FBE0 00000000 21099608 |.:.&...\......o.|
```

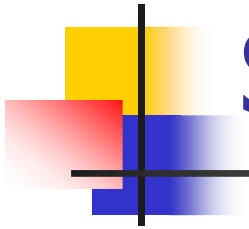
RUNCHAIN Command...

```
ip runc address(21099608) link(4) name(dsa) exec((cbf x str(ceedsa)))

LIST 21099608. ASID(X'0053') LENGTH(X'04') AREA
ASID(X'0053') ADDRESS(21099608.) KEY(88)
      DSA:  21099608
   +000000  FLAGS:0000  MEMD:1001   BKC:21096510      FWC:210996E0
   +00000C  R14:A1011460      R15:A1061FF8      R0:210997E0
   +000018  R1:2100B488       R2:21096E08       R3:00000001
   +000024  R4:2100B488       R5:2100E5D0       R6:000077FC
   +000030  R7:21011FFF       R8:00007A80       R9:00000004
   +00003C  R10:2109750F      R11:A1011000      R12:2100FBE0
   +000048  LWS:00000000      NAB:210996A8      PNAB:00000000
   +000064  RENT:00000000     CILC:00000000     MODE:00000000
   +000078  RMR:00000000

LIST 21096510. ASID(X'0053') LENGTH(X'04') AREA
ASID(X'0053') ADDRESS(21096510.) KEY(88)
      DSA:  21096510
   +000000  FLAGS:0808  MEMD:CEE1   BKC:21096370      FWC:21099608
   +00000C  R14:8D7A4E44      R15:8D7B15A8      R0:2109699C
```

Sources of Additional Information



Sources of Additional Info

- All Language Environment documentation is available on the z/OS DVD collection and on the Language Environment website
  - Language Environment Debug Guide
  - Language Environment Runtime Messages
  - Language Environment Programming Reference
  - Language Environment Programming Guide
  - Language Environment Customization
  - Language Environment Migration Guide
  - Language Environment Writing ILC Applications
- Language Environment Web site
  - http://www.ibm.com/systems/z/os/zos/features/lang_environment/

Sources of Additional Info…

- IPCS documentation is available on the z/OS DVD collection
  - MVS IPCS Commands
  - MVS IPCS User's Guide