z/OS Basics: Q & A on a Dump using IPCS

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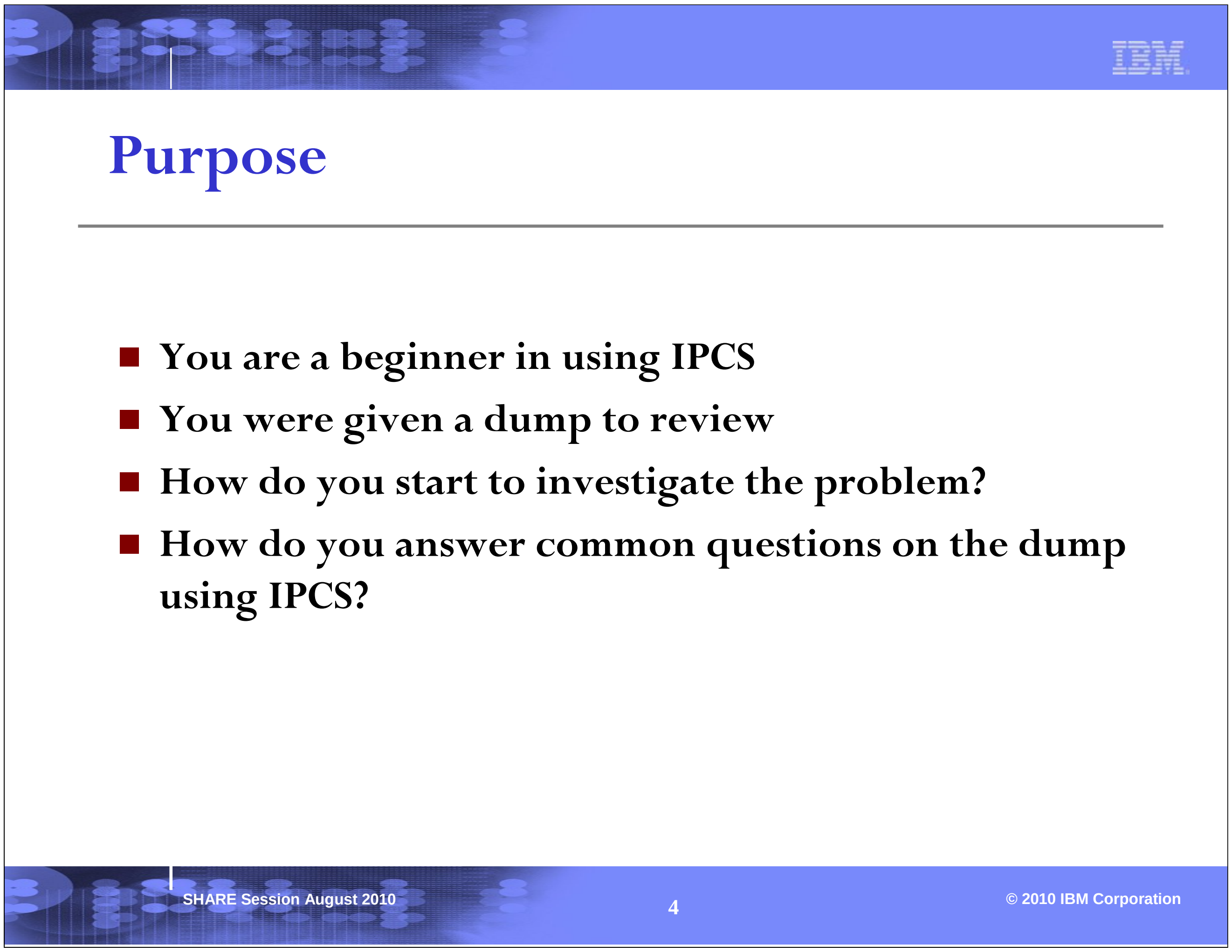
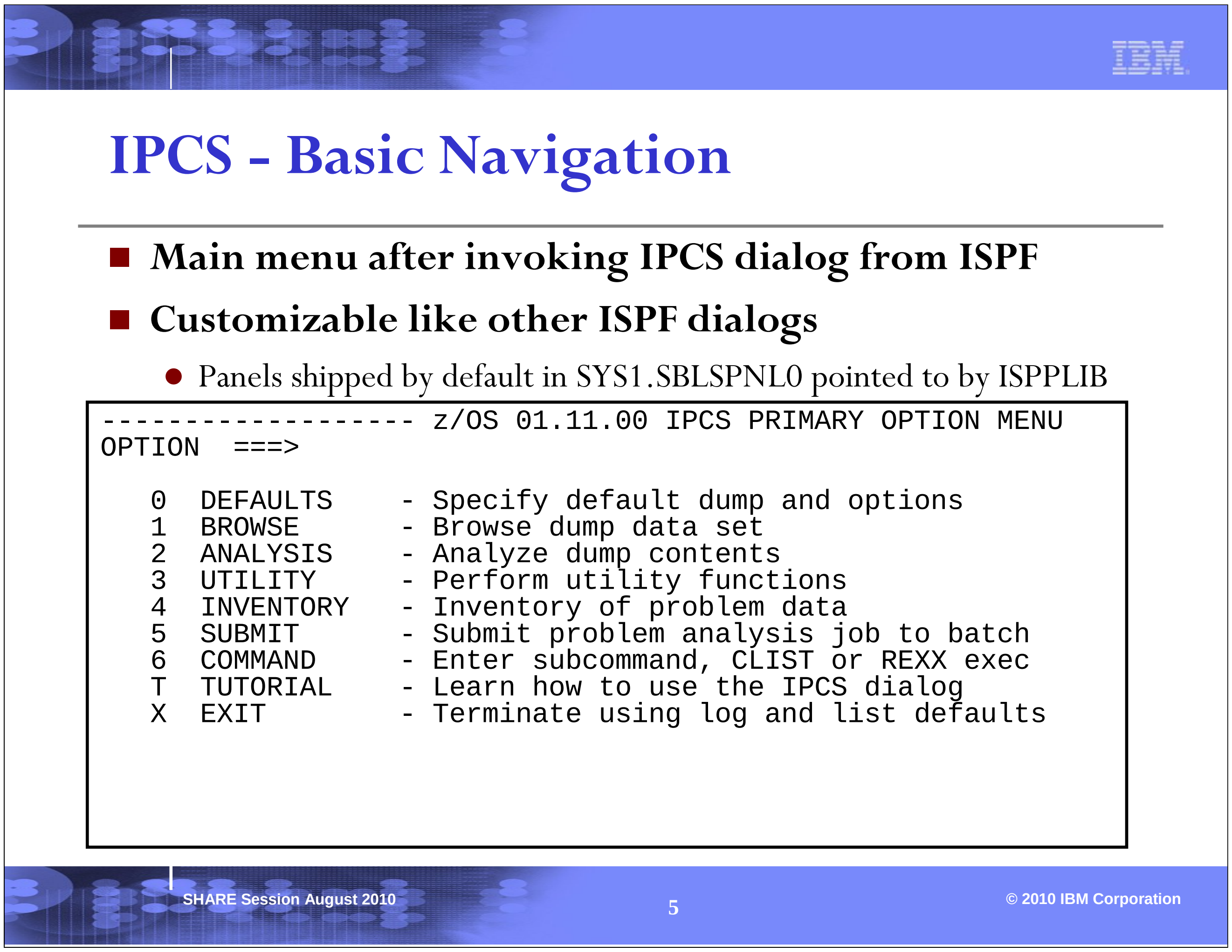
Agenda



Purpose

- You are a beginner in using IPCS
- You were given a dump to review
- How do you start to investigate the problem?
- How do you answer common questions on the dump using IPCS?

The purpose of this presentation is not to provide you with a comprehensive procedure for diagnosing problems, but rather to familiarize you with some of the IPCS commands that can be used on a dump.



IPCS - Basic Navigation

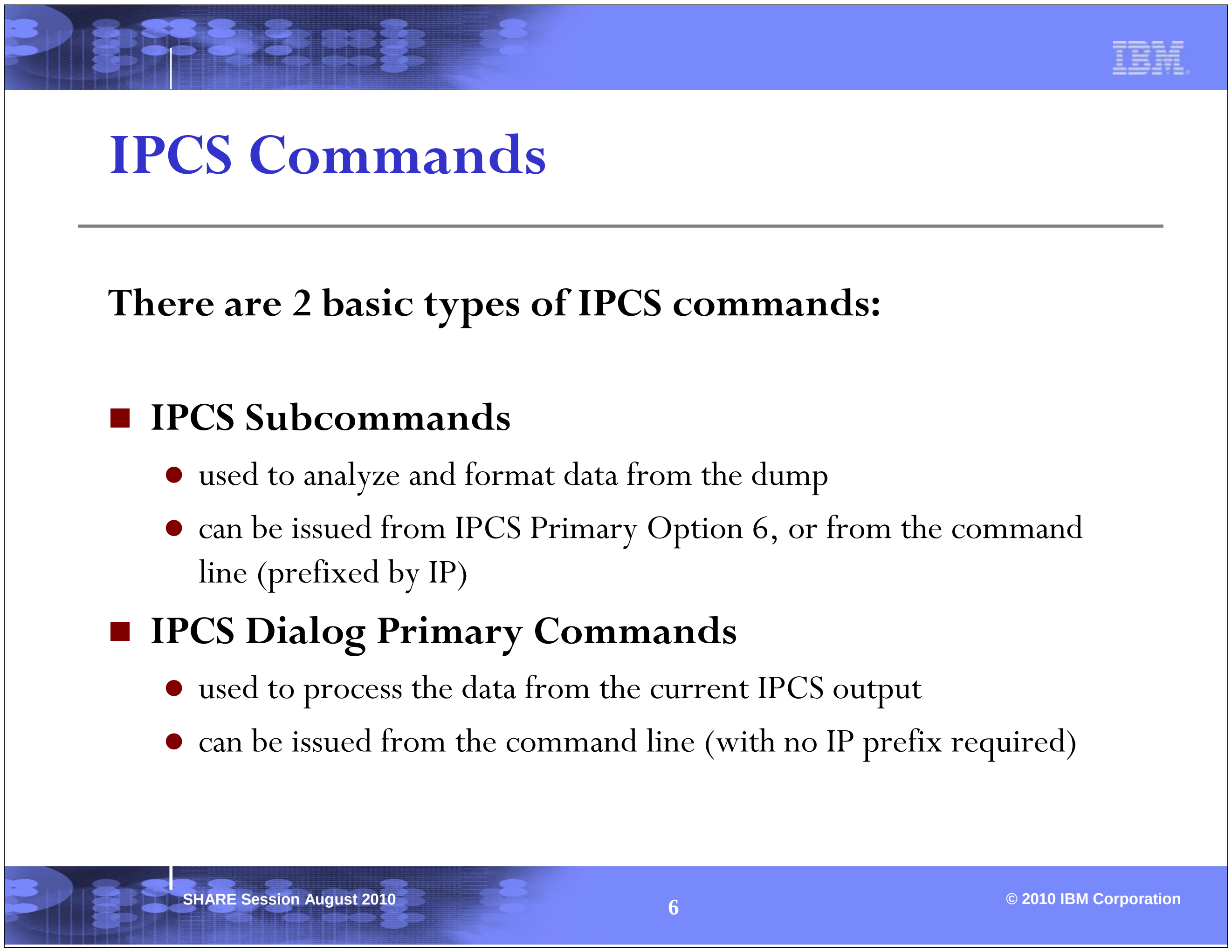
- **Main menu after invoking IPCS dialog from ISPF**
- **Customizable like other ISPF dialogs**
  - Panels shipped by default in SYS1.SBLSPNL0 pointed to by ISPPLIB

```
------------------- z/OS 01.11.00 IPCS PRIMARY OPTION MENU
OPTION  ===>

   0  DEFAULTS     - Specify default dump and options
   1  BROWSE       - Browse dump data set
   2  ANALYSIS     - Analyze dump contents
   3  UTILITY      - Perform utility functions
   4  INVENTORY    - Inventory of problem data
   5  SUBMIT       - Submit problem analysis job to batch
   6  COMMAND      - Enter subcommand, CLIST or REXX exec
   T  TUTORIAL     - Learn how to use the IPCS dialog
   X  EXIT         - Terminate using log and list defaults
```

This is the main menu that's presented when IPCS is invoked in ISPF Dialog Mode. We'll discuss some of the options during this presentation. Note that the z/OS release level is at the top of the menu. You should use the same level of IPCS as the dump.

You can jump to an OPTION from any IPCS command line by entering '=n', where 'n' is the OPTION #. For example, entering '=0' on the IPCS command line will jump to IPCS OPTION 0 - DEFAULTS.



IPCS Commands

There are 2 basic types of IPCS commands:

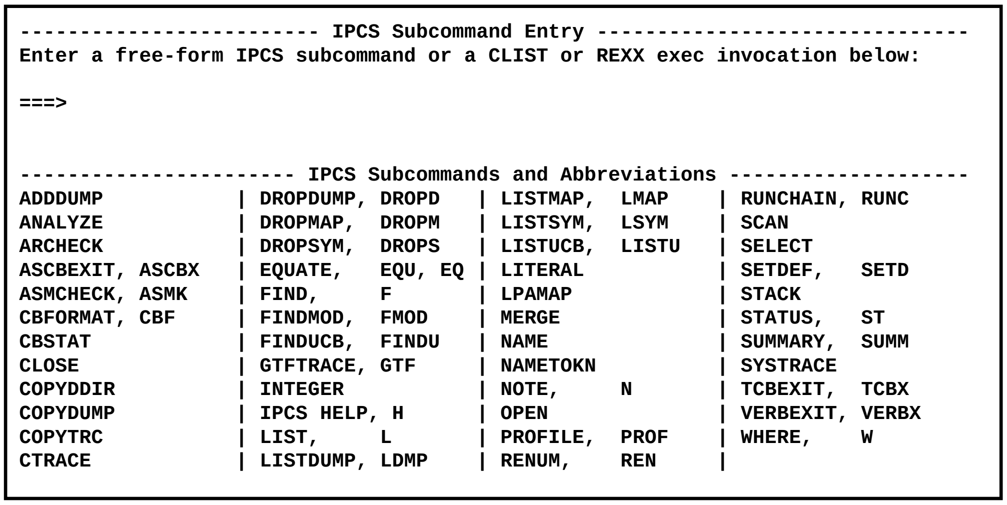
- **IPCS Subcommands**
  - used to analyze and format data from the dump
  - can be issued from IPCS Primary Option 6, or from the command line (prefixed by IP)
- **IPCS Dialog Primary Commands**
  - used to process the data from the current IPCS output
  - can be issued from the command line (with no IP prefix required)

Instead of navigating through some of the IPCS panels, one can invoke IPCS commands to accomplish the same tasks on a dump.

There are 2 basic types of IPCS commands: subcommands and primary commands. Subcommands work on the dump and primary commands work on the current IPCS output.

IPCS Option 6: COMMAND Panel

- Lists many of the IPCS subcommands available



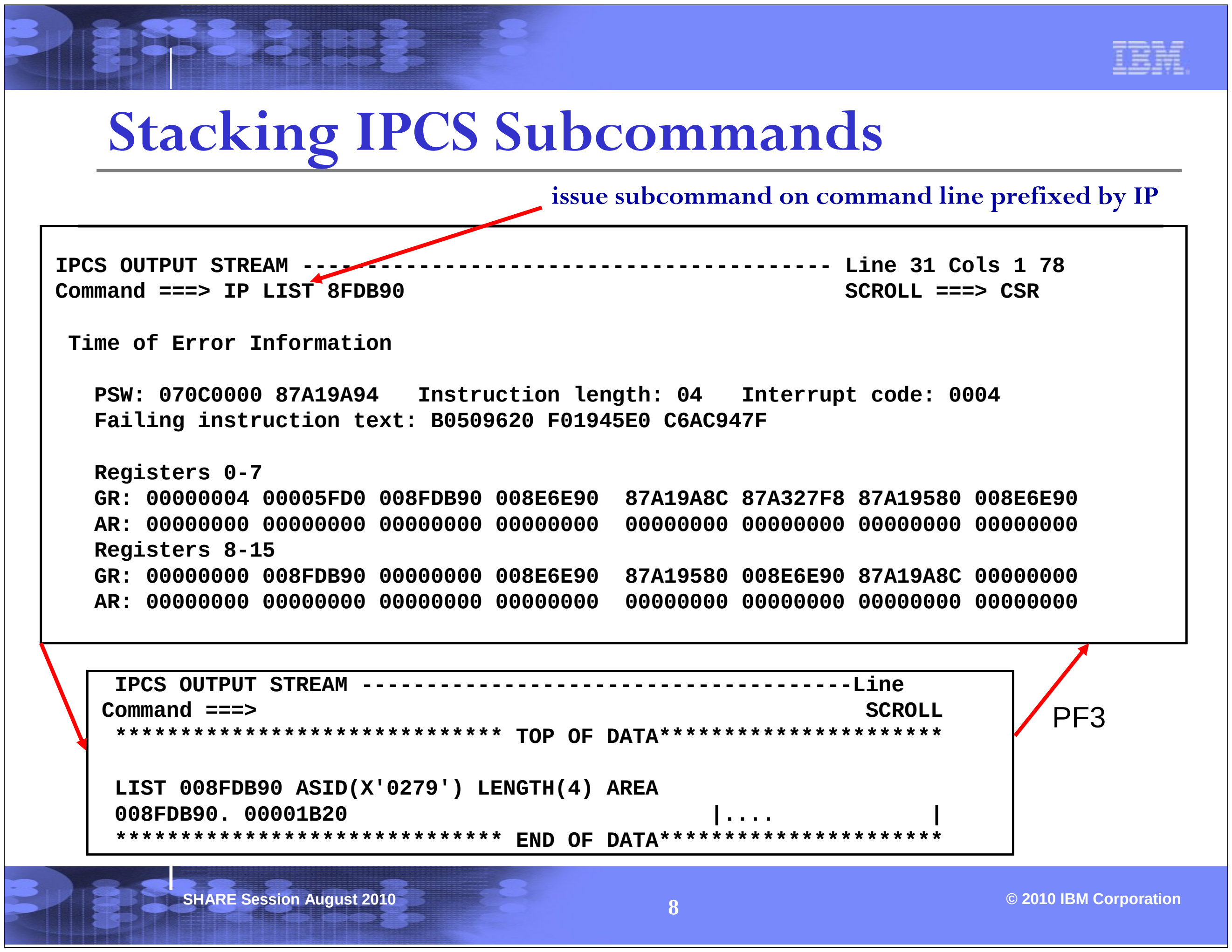
```
------------------------- IPCS Subcommand Entry -------------------------------
Enter a free-form IPCS subcommand or a CLIST or REXX exec invocation below:

===>


----------------------- IPCS Subcommands and Abbreviations --------------------
ADDDUMP           | DROPDUMP, DROPD   | LISTMAP,  LMAP    | RUNCHAIN, RUNC
ANALYZE           | DROPMAP,  DROPM   | LISTSYM,  LSYM    | SCAN
ARCHECK           | DROPSYM,  DROPS   | LISTUCB,  LISTU   | SELECT
ASCBEXIT, ASCBX   | EQUATE,   EQU, EQ | LITERAL           | SETDEF,   SETD
ASMCHECK, ASMK    | FIND,     F       | LPAMAP            | STACK
CBFORMAT, CBF     | FINDMOD,  FMOD    | MERGE             | STATUS,   ST
CBSTAT            | FINDUCB,  FINDU   | NAME              | SUMMARY,  SUMM
CLOSE             | GTFTRACE, GTF     | NAMETOKN          | SYSTRACE
COPYDDIR          | INTEGER           | NOTE,     N       | TCBEXIT,  TCBX
COPYDUMP          | IPCS HELP, H      | OPEN              | VERBEXIT, VERBX
COPYTRC           | LIST,     L       | PROFILE,  PROF    | WHERE,    W
CTRACE            | LISTDUMP, LDMP    | RENUM,    REN     |
```

- IPCS subcommands can also be entered from any IPCS Command line with prefix of IP

IPCS subcommands can be entered from IPCS Option 6 (IPCS Subcommand Entry), or they can be issued on any command line with the prefix of IP (short form of IPCS). Details about these IPCS subcommands can be found in the z/OS MVS IPCS Commands manual.



Stacking IPCS Subcommands

issue subcommand on command line prefixed by IP

```
IPCS OUTPUT STREAM ------------------------------------------ Line 31 Cols 1 78
Command ===> IP LIST 8FDB90                                   SCROLL ===> CSR

 Time of Error Information

   PSW: 070C0000 87A19A94   Instruction length: 04   Interrupt code: 0004
   Failing instruction text: B0509620 F01945E0 C6AC947F

   Registers 0-7
   GR: 00000004 00005FD0 008FDB90 008E6E90  87A19A8C 87A327F8 87A19580 008E6E90
   AR: 00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
   Registers 8-15
   GR: 00000000 008FDB90 00000000 008E6E90  87A19580 008E6E90 87A19A8C 00000000
   AR: 00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
```

```
 IPCS OUTPUT STREAM --------------------------------------Line
Command ===>                                                 SCROLL
 ****************************** TOP OF DATA**********************

 LIST 008FDB90 ASID(X'0279') LENGTH(4) AREA
 008FDB90. 00001B20                        |....            |
 ****************************** END OF DATA**********************
```

To be able to stack IPCS subcommands, SYS1.SBLSTBL0 must be concatenated to ISPTLIB, and ISPF keyword NEWAPPL(BLSG) must be used when invoking IPCS initially.

In this example, the IPCS LIST subcommand is issued while viewing the output of a command. The output of the LIST command will be displayed next. Hitting PF3 will return IPCS to the previous output screen.

Specifying the *data-descr* in IPCS Subcommands

- **There are 3 basic attributes of a data-descriptor (data-descr):**
  - Virtual Address in Hex (required)
    - address that begins with an alphabet must end with a period
  - Length (optional) – default is 4 bytes
  - ASID (optional) – default depends on type of dump and what is dumped
  - For example,
    - IP LIST 123458 ASID(X'20') LEN(100)
    - IP WHERE FE1268.

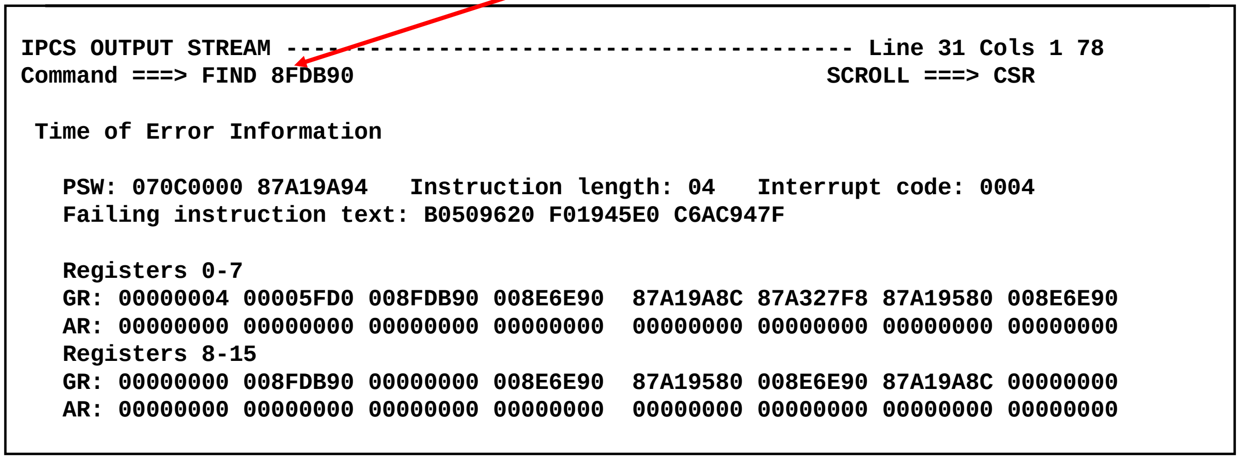
If you look into the IPCS Commands manual, you will see that some of the IPCS subcommands accept 'data-descr' as a parameter. Basically this is the virtual address that needed to be supplied to the command. There are many attributes of the 'data-descr'. The most common ones are the virtual address, length and ASID.

If you don't specify the length, the default is 4 bytes. If you don't specify ASID, IPCS will use the one in its default table. To see the default values issue the IPCS subcommand SETDEF (or IP SETD) and look at the bottom section for Local Defaults. The default ASID is in the last line.

You can change the default ASID by using the SETDEF subcommand. For example, IP SETD ASID(x'nn').

Using a IPCS Primary command

Issue Primary command on command line



```
IPCS OUTPUT STREAM ------------------------------------------ Line 31 Cols 1 78
Command ===> FIND 8FDB90                                    SCROLL ===> CSR

 Time of Error Information

   PSW: 070C0000 87A19A94   Instruction length: 04   Interrupt code: 0004
   Failing instruction text: B0509620 F01945E0 C6AC947F

   Registers 0-7
   GR: 00000004 00005FD0 008FDB90 008E6E90  87A19A8C 87A327F8 87A19580 008E6E90
   AR: 00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
   Registers 8-15
   GR: 00000000 008FDB90 00000000 008E6E90  87A19580 008E6E90 87A19A8C 00000000
   AR: 00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
```

FIND is a great example of an IPCS Primary command. Note that no IP prefix is required when a primary command is issued.

(1) What type of dump is it?

The following unformatted dumps require IPCS for viewing:

- **SVC dump**
  - Recovery initiated dump
  - Console dump
  - SLIP dump
- **Standalone dump**
- **SYSMDUMP**

Knowing the type of dump will give you an idea of why the dump was taken and how you should start your investigation

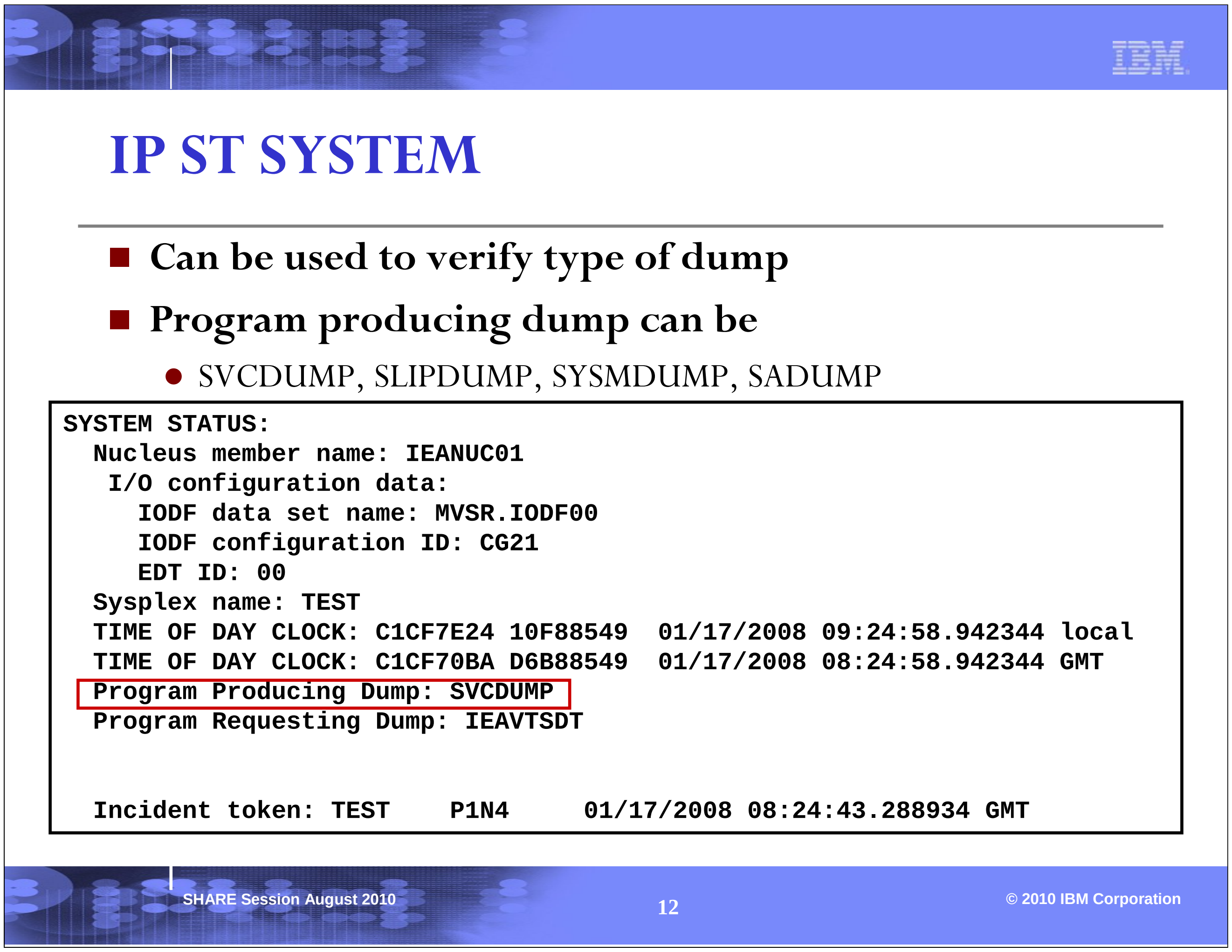
The most common type of dump is the SVC Dump. SYSMDUMP is very much like an SVC Dump but with less contents. Standalone dumps represents a system outage and is more complicated to work with. If you hear of a Transaction Dump, it is similar in contents to a SYSMDUMP.

We will focus more on SVC dumps in this session.

A recovery initiated dump is taken due to an error. So one would need to find out what is the error and why it occurred.

Console dumps are taken via the DUMP command on the operator's console. It is usually due to a problem with a job or address space. One would need to analyze the units of work in the address space. This will require reviewing the TCBs and RBs in the address space. We will touch on this near the end of the session.

SLIP dumps are taken for a purpose. One would need to find out the SLIP trap that caused the dump to be taken, then get the PSW/registers information and investigate accordingly.



IP ST SYSTEM

- Can be used to verify type of dump
- Program producing dump can be
  - SVCDUMP, SLIPDUMP, SYSMDUMP, SADUMP

```
SYSTEM STATUS:
  Nucleus member name: IEANUC01
   I/O configuration data:
     IODF data set name: MVSR.IODF00
     IODF configuration ID: CG21
     EDT ID: 00
  Sysplex name: TEST
  TIME OF DAY CLOCK: C1CF7E24 10F88549  01/17/2008 09:24:58.942344 local
  TIME OF DAY CLOCK: C1CF70BA D6B88549  01/17/2008 08:24:58.942344 GMT
  Program Producing Dump: SVCDUMP
  Program Requesting Dump: IEAVTSDT


  Incident token: TEST    P1N4     01/17/2008 08:24:43.288934 GMT
```

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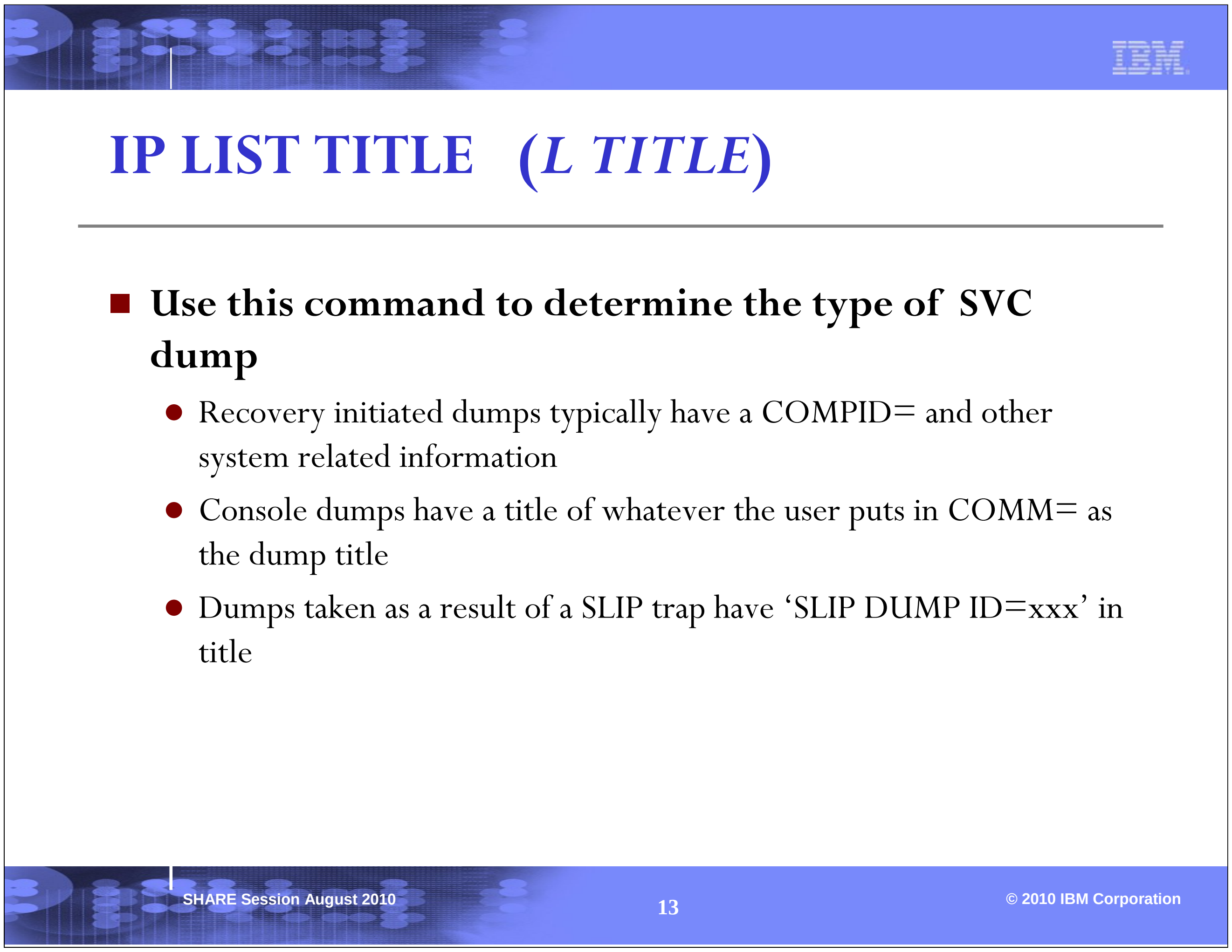
The time of the dump is the time that global data capture completed. This is an example of an SVC dump.

Note that SVCDUMP in the ST SYSTEM output can mean a recovery initiated SVC dump or a Console dump. To distinguish these types of dumps you need to look at the dump title (see next page).



IP LIST TITLE (*L TITLE*)

- **Use this command to determine the type of SVC dump**
  - Recovery initiated dumps typically have a COMPID= and other system related information
  - Console dumps have a title of whatever the user puts in COMM= as the dump title
  - Dumps taken as a result of a SLIP trap have 'SLIP DUMP ID=xxx' in title

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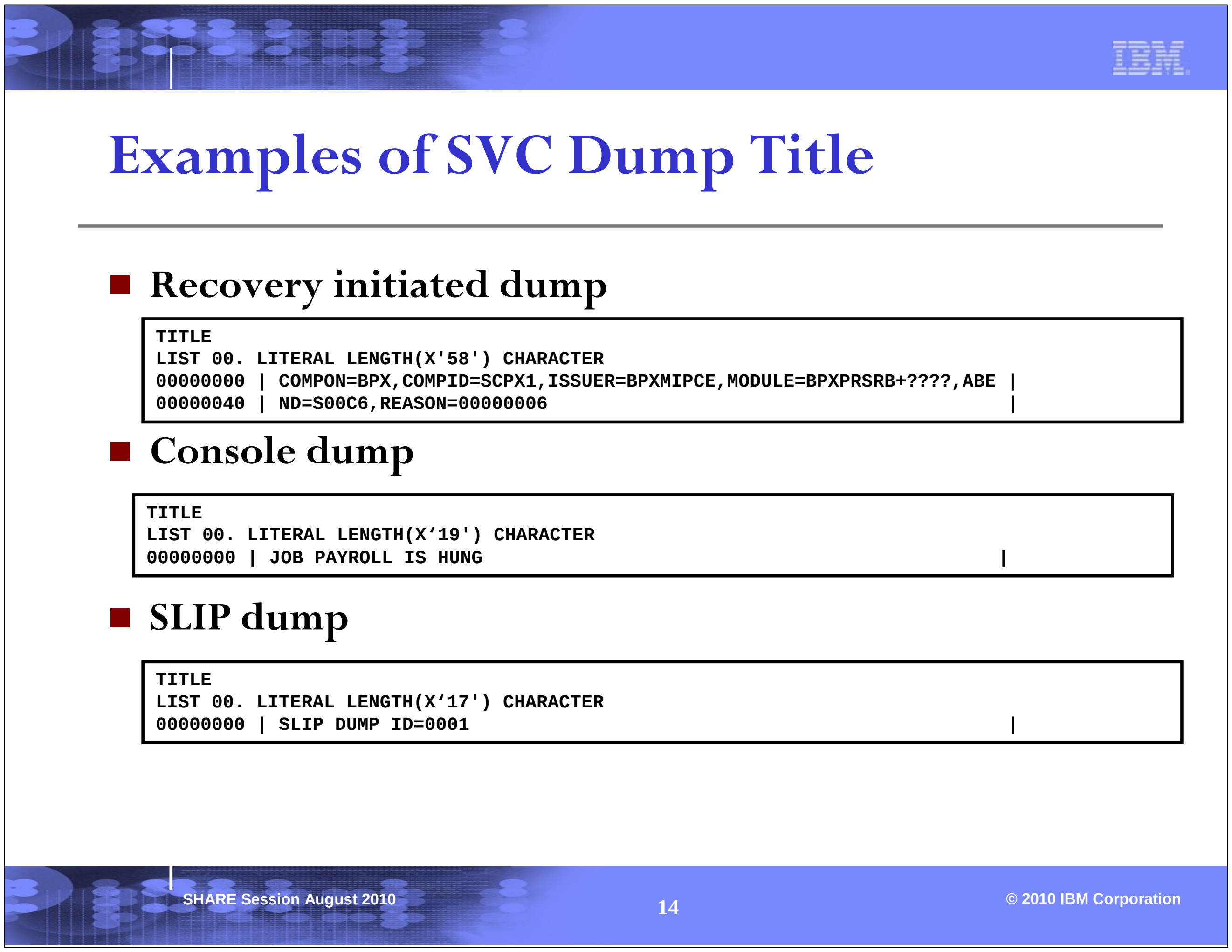
The dump title can provide a clue as to why the dump was taken. See the examples on next page.



Examples of SVC Dump Title

- Recovery initiated dump

```
TITLE
LIST 00. LITERAL LENGTH(X'58') CHARACTER
00000000 | COMPON=BPX,COMPID=SCPX1,ISSUER=BPXMIPCE,MODULE=BPXPRSRB+????,ABE |
00000040 | ND=S00C6,REASON=00000006                                          |
```

- Console dump

```
TITLE
LIST 00. LITERAL LENGTH(X'19') CHARACTER
00000000 | JOB PAYROLL IS HUNG                                              |
```

- SLIP dump

```
TITLE
LIST 00. LITERAL LENGTH(X'17') CHARACTER
00000000 | SLIP DUMP ID=0001                                                |
```

Recovery initiated dumps have dump titles that are pre-coded in the recovery routines. They usually contain technical information about the component or product that experienced the error.

Console dump titles are supplied by the user via the DUMP command on the console, They are usually less technical and more human-like.

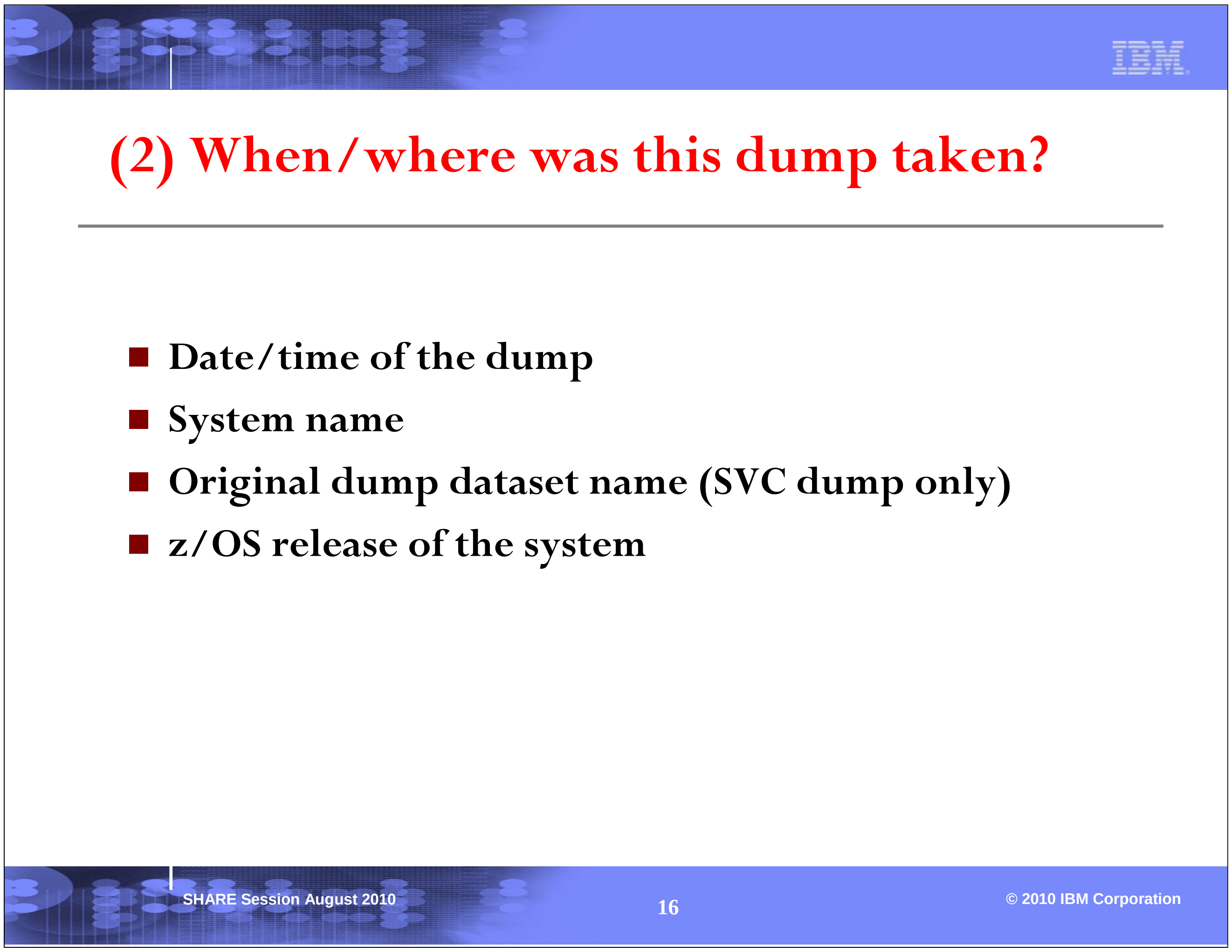
SLIP dump titles are system generated and contain the words ‘SLIP DUMP ID=‘ in it.

IP LIST SLIPTRAP (*L SLIPTRAP*)

- If the SVC dump is a SLIP dump, use this command to find out the SLIP trap that matched (and caused this dump to be taken)
- Example:

```
SLIPTRAP
LIST 00. LITERAL LENGTH(X'22') CHARACTER
00000000 | SLIP SET,C=9C6,ID=$WK5,A=SVCD,ML=1                                  |
```

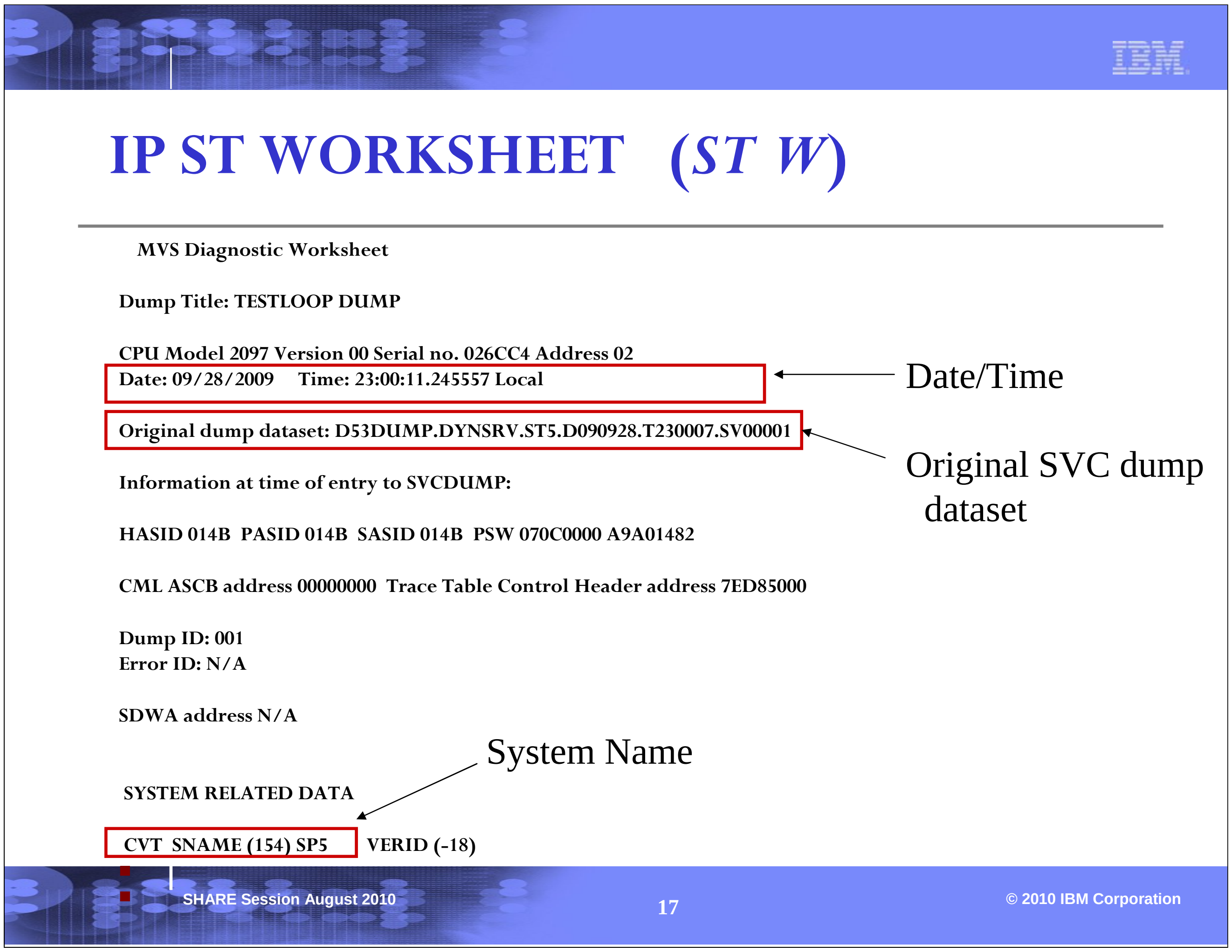
In this example, the dump was taken as a result of a SLIP on an abend9C6. The ID of the SLIP is $WK5.



(2) When/where was this dump taken?

- Date/time of the dump
- System name
- Original dump dataset name (SVC dump only)
- z/OS release of the system

It is important to find out when and where the dump was taken. You may need to correlate this dump with other events occurring on the same system at around the same time.



IP ST WORKSHEET (*ST W*)

```
MVS Diagnostic Worksheet

Dump Title: TESTLOOP DUMP

CPU Model 2097 Version 00 Serial no. 026CC4 Address 02
Date: 09/28/2009     Time: 23:00:11.245557 Local

Original dump dataset: D53DUMP.DYNSRV.ST5.D090928.T230007.SV00001

Information at time of entry to SVCDUMP:

HASID 014B  PASID 014B  SASID 014B  PSW 070C0000 A9A01482

CML ASCB address 00000000  Trace Table Control Header address 7ED85000

Dump ID: 001
Error ID: N/A

SDWA address N/A

 SYSTEM RELATED DATA

 CVT  SNAME (154) SP5    VERID (-18)
```

Date/Time

Original SVC dump dataset

System Name

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This is an example of a SVC dump taken on system SP5 on 9/28/09. The time is actually the time of the end of the global data capture phase of SVC dump.

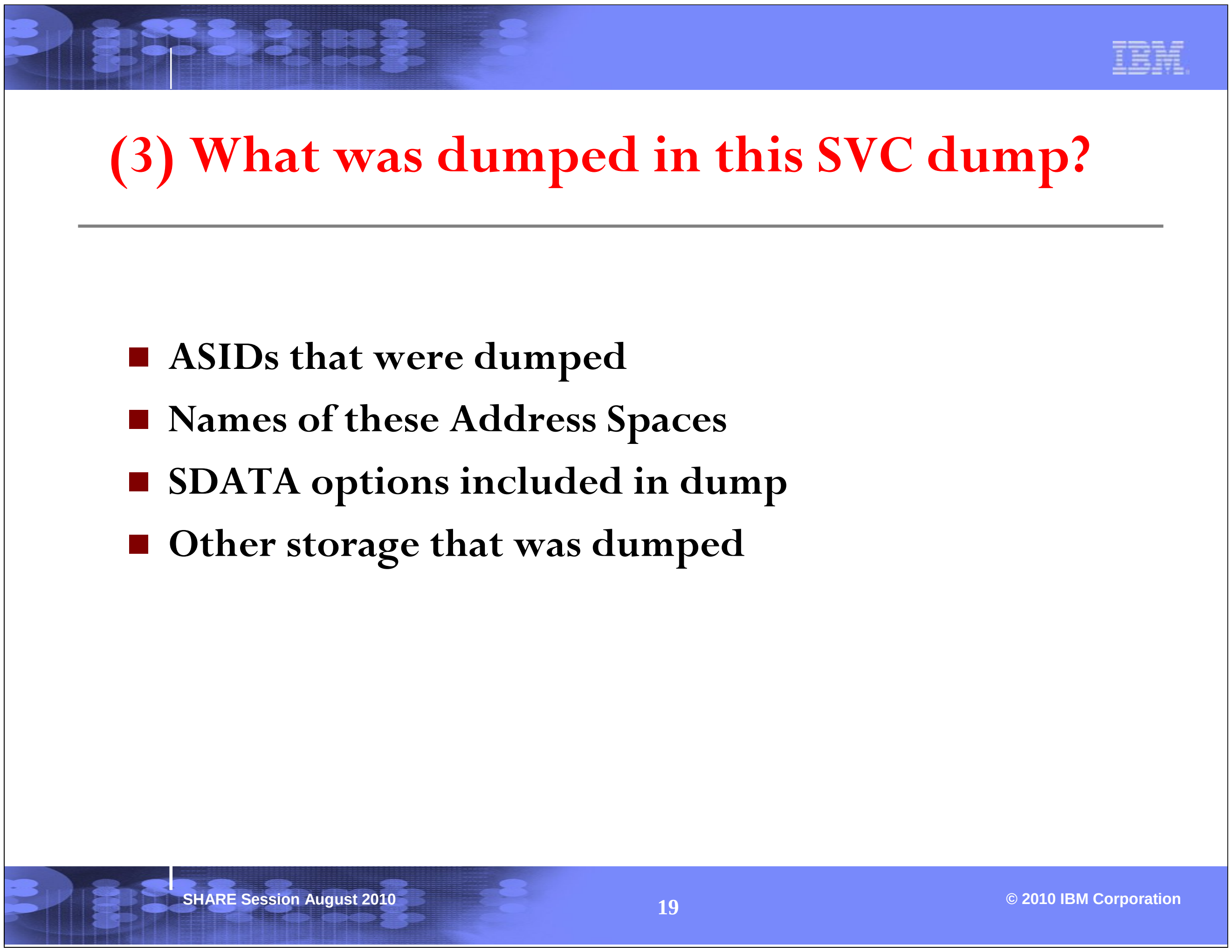
IP CBF CVT

- Can be used to verify system release level on which dump was taken
- Example:

```
CVT: 00FDEAC0
   -0028  PRODN.... SP7.1.1   PRODI.... HBB7760   VERID....
```

- In the above example, dump was taken on a z/OS R11 system

This is important because you should use the same level of IPCS as the z/OS release of the system on which the dump was taken.

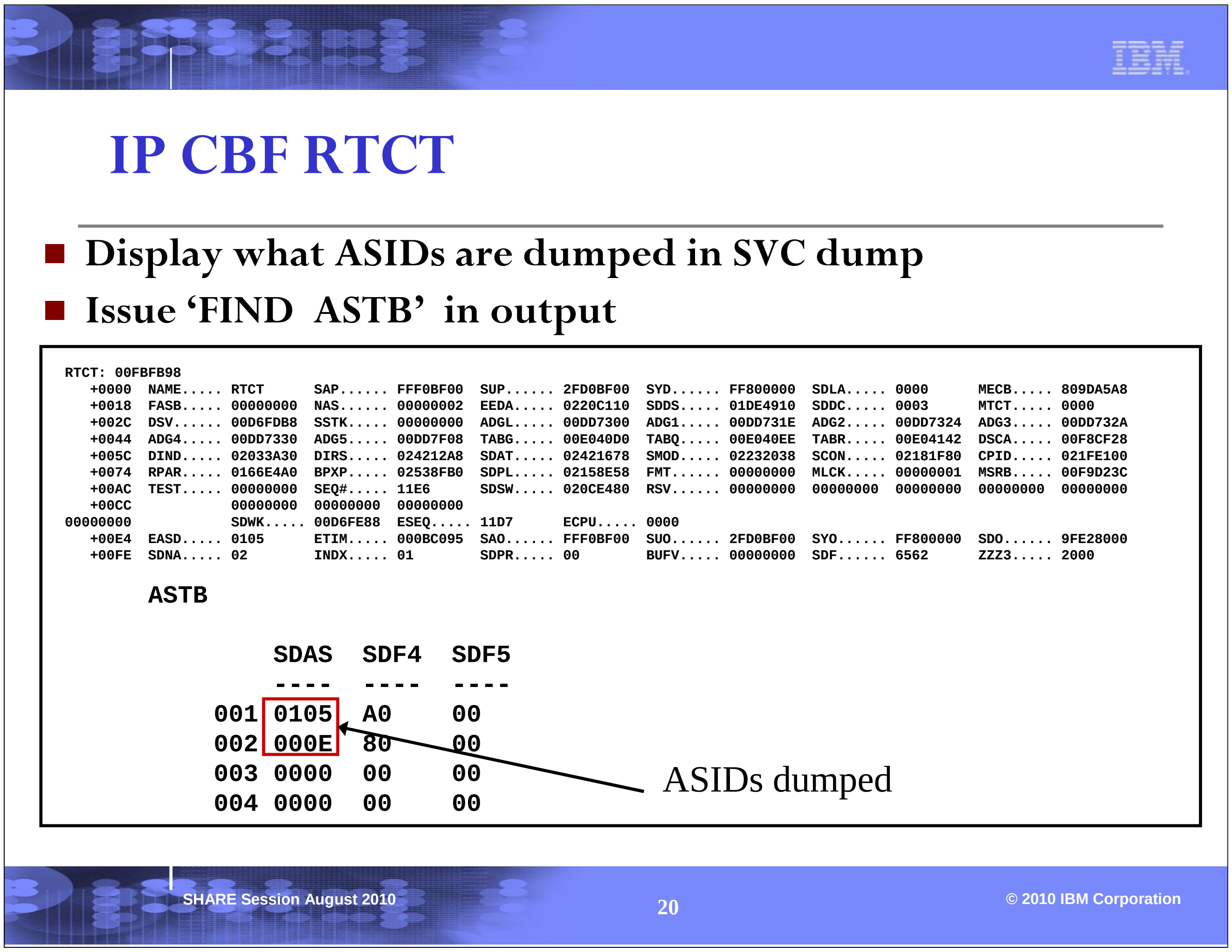


(3) What was dumped in this SVC dump?

- ASIDs that were dumped
- Names of these Address Spaces
- SDATA options included in dump
- Other storage that was dumped

An SVC dump usually contain one or more address spaces. You will need to know the ASID numbers so that you can specify the right ones when using IPCS subcommands.

The SDATA options describe what area of storage is included in the dump.



IP CBF RTCT

- Display what ASIDs are dumped in SVC dump
- Issue ‘FIND ASTB’ in output

```
RTCT: 00FBFB98
   +0000  NAME..... RTCT      SAP...... FFF0BF00  SUP...... 2FD0BF00  SYD...... FF800000  SDLA..... 0000      MECB..... 809DA5A8
   +0018  FASB..... 00000000  NAS...... 00000002  EEDA..... 0220C110  SDDS..... 01DE4910  SDDC..... 0003      MTCT..... 0000
   +002C  DSV...... 00D6FDB8  SSTK..... 00000000  ADGL..... 00DD7300  ADG1..... 00DD731E  ADG2..... 00DD7324  ADG3..... 00DD732A
   +0044  ADG4..... 00DD7330  ADG5..... 00DD7F08  TABG..... 00E040D0  TABQ..... 00E040EE  TABR..... 00E04142  DSCA..... 00F8CF28
   +005C  DIND..... 02033A30  DIRS..... 024212A8  SDAT..... 02421678  SMOD..... 02232038  SCON..... 02181F80  CPID..... 021FE100
   +0074  RPAR..... 0166E4A0  BPXP..... 02538FB0  SDPL..... 02158E58  FMT...... 00000000  MLCK..... 00000001  MSRB..... 00F9D23C
   +00AC  TEST..... 00000000  SEQ#..... 11E6      SDSW..... 020CE480  RSV...... 00000000  00000000  00000000  00000000  00000000
   +00CC            00000000  00000000  00000000
00000000            SDWK..... 00D6FE88  ESEQ..... 11D7      ECPU..... 0000
   +00E4  EASD..... 0105      ETIM..... 000BC095  SAO...... FFF0BF00  SUO...... 2FD0BF00  SYO...... FF800000  SDO...... 9FE28000
   +00FE  SDNA..... 02        INDX..... 01        SDPR..... 00        BUFV..... 00000000  SDF...... 6562      ZZZ3..... 2000

          ASTB

                 SDAS   SDF4   SDF5
                 ----   ----   ----
             001 0105   A0     00
             002 000E   80     00
             003 0000   00     00
             004 0000   00     00
```

ASIDs dumped

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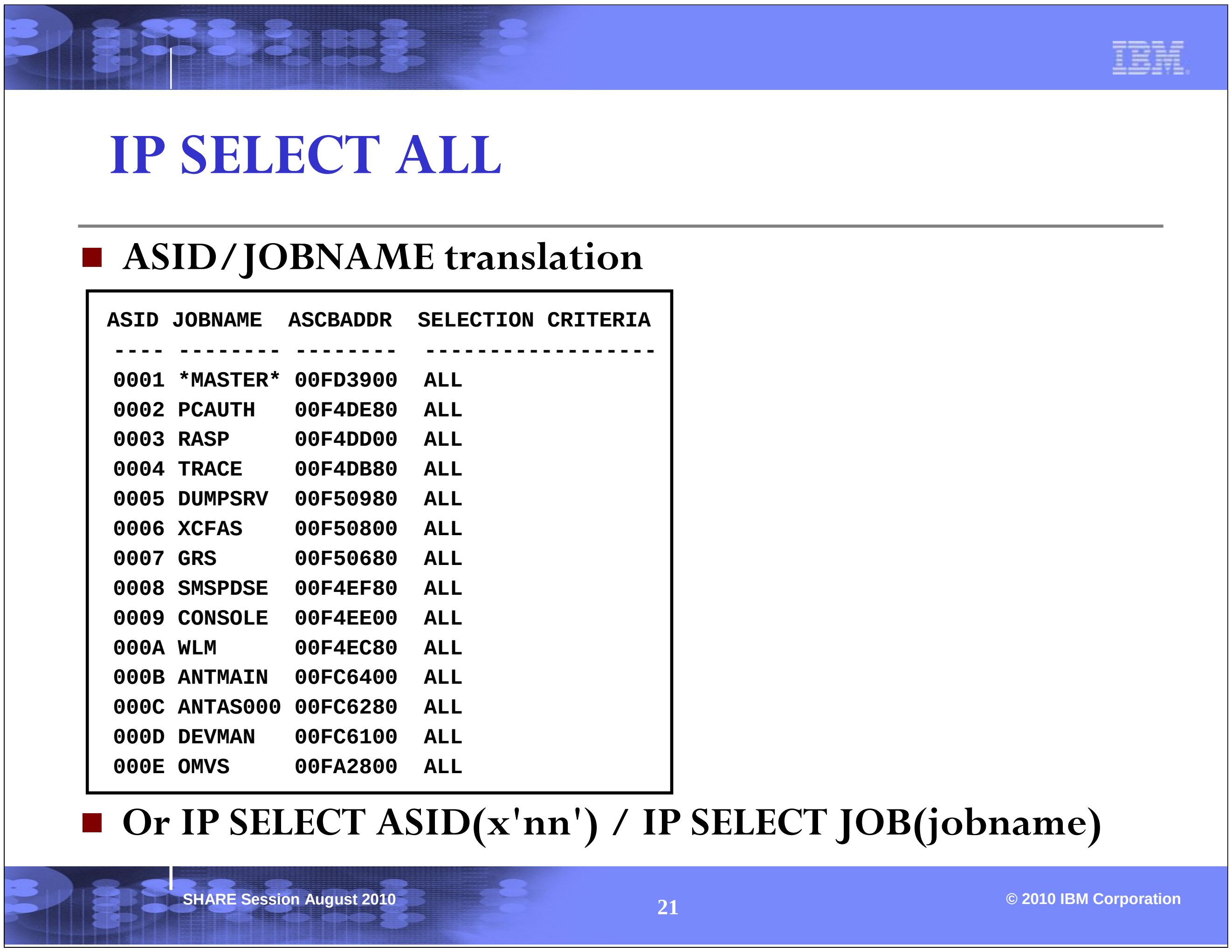
Knowing which address spaces are dumped is useful for determining what address space storage you can expect to find in the dump. It may give you a clue about what address spaces are involved in the problem.



IP SELECT ALL

- ASID/JOBNAME translation

```
ASID JOBNAME  ASCBADDR  SELECTION CRITERIA
---- -------- --------  -----------------
0001 *MASTER* 00FD3900  ALL
0002 PCAUTH   00F4DE80  ALL
0003 RASP     00F4DD00  ALL
0004 TRACE    00F4DB80  ALL
0005 DUMPSRV  00F50980  ALL
0006 XCFAS    00F50800  ALL
0007 GRS      00F50680  ALL
0008 SMSPDSE  00F4EF80  ALL
0009 CONSOLE  00F4EE00  ALL
000A WLM      00F4EC80  ALL
000B ANTMAIN  00FC6400  ALL
000C ANTAS000 00FC6280  ALL
000D DEVMAN   00FC6100  ALL
000E OMVS     00FA2800  ALL
```

- Or IP SELECT ASID(x'nn') / IP SELECT JOB(jobname)

This report associates an ASID with a JOBNAME. From the CBF RTCT example in last page, we can see that asid(x'E') corresponds to a jobname of OMVS.

IP CBF RTCT+9C? STR(SDUMP) VIEW(FLAGS)

- Determine what SDATA options are included in dump

```
SDUMP_PL: 02B7DF48

   ==> FLAGS SET IN SDUFLAG0:
    HDR/HDRADR specified.
    ECB specified.
    Schedule dump request ASID specified.

   ==> FLAGS SET IN SDUFLAG1:
    SVC dump request.
    48+ byte parameter list.

    ==> FLAGS SET IN SDUSDATA:
     Dump all PSAs.
     Dump the nucleus.
     Dump SQA.
     Dump LSQA.
     Dump rgn-private area.
     Dump LPA mod. for rgn.
     Dump trace data.
     Dump CSA.
     Dump SWA.
     Dump summary dump data.
     Dump all nucleus.
```

SDATA=(ALLPSA,NUC,SQA,LSQA, RGN,LPA,TRT,CSA,SWA,SUM,ALLNUC)

Knowing the dump options that were requested can help you determine why the storage or report that you're browsing is not available. This is because the option that would have included the relevant storage was not requested. For example, if you're trying to browse private storage of an address space, and the storage is not available, it may be due to RGN not being specified in SDATA.

IPCS Option 4: Inventory

- <u>IPCS Inventory:</u> IPCS Option 4 (=4 on any IPCS command line) brings up the following panel:

```
IPCS INVENTORY – SMTUSR1.DUMPZ11.DEBUG ------------------------------------
Command ===>                                                  SCROLL ===> CSR

AC Dump Source                                                        Status
__ DSNAME('SMTUSR1.TEST1.DUMP') . . . . . . . . . . . . . . . . . . . OPEN
   Title=COMPON=CMND-ESTAE,COMPID=SC1B8,ISSUER=IEECB860,FAILURE IN COMMAND K
   Psym=RIDS/IEE8203D#L RIDS/IEE8203D PIDS/5752SC1B8 AB/S00C4 RIDS/IEECB860#
__ DSNAME('SMTUSR1.TEST2.DUMP') . . . . . . . . . . . . . . . . . . . CLOSED
   Title="TO BE OR NOT TO BE"
```

Useful line commands in the AC field:

DD	Delete the source and optionally, the source dataset
SD	Establish the source as the IPCS local and global default
LZ	List dump description with storage summary

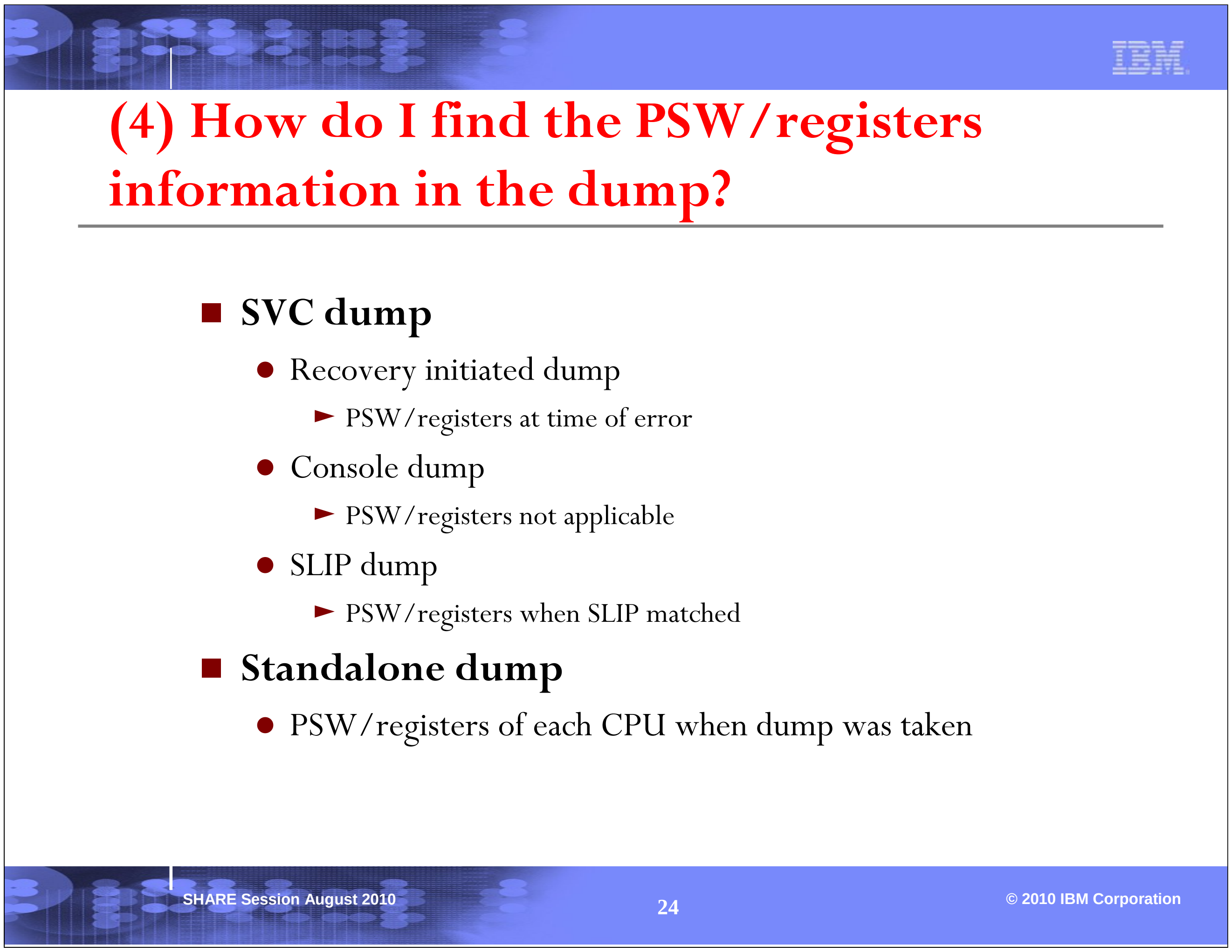
The IPCS inventory panel allows the user to view all the dumps in his IPCS dump directory. The IPCS inventory panel shows all the dumps the user has initialized under IPCS and is currently working with.

One can enter a line command in the column AC next to a dump, and then hit <enter>.

SD selects a dump to be used as the current source for IPCS.

DD deletes information of a dump from the IPCS directory. This is needed when the user does not need to review the dump anymore. The dump will disappear from the IPCS inventory.

LZ gives information about the address spaces, dataspaces and storage dumped in the dump.



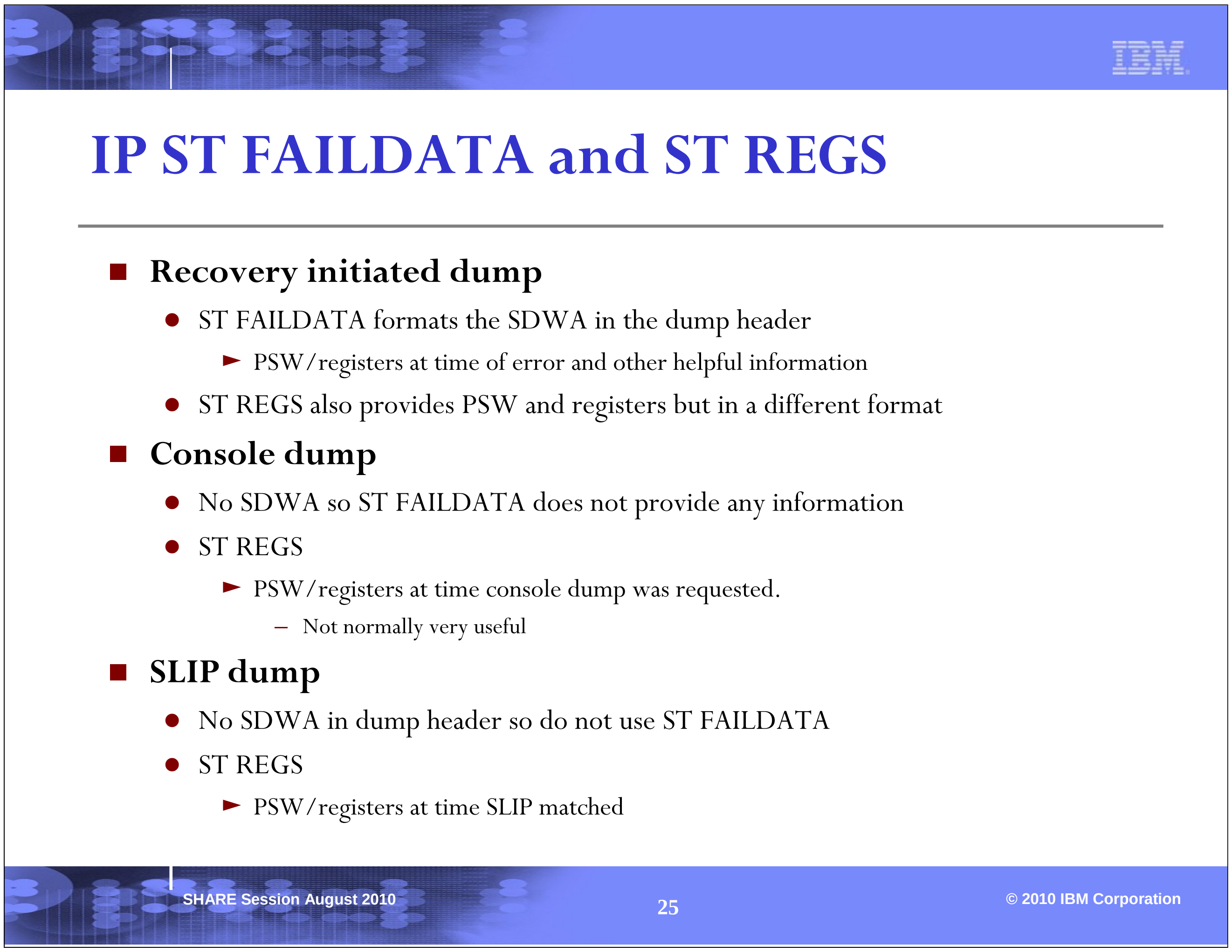
(4) How do I find the PSW/registers information in the dump?

- **SVC dump**
  - Recovery initiated dump
    - PSW/registers at time of error
  - Console dump
    - PSW/registers not applicable
  - SLIP dump
    - PSW/registers when SLIP matched
- **Standalone dump**
  - PSW/registers of each CPU when dump was taken

There is always a set of PSW/registers information crucial for debugging a recovery initiated dump or SLIP dump.

For a console dump, one needs to investigate the state of an address space, and there is no PSW/registers of interest initially.

For a standalone dump, one needs to investigate the state of the whole system. The PSW/registers of each CPU is a good place to start, but there are many other pieces of information to be reviewed. Details of how to investigate a standalone dump will not be covered in this session.



IP ST FAILDATA and ST REGS

- **Recovery initiated dump**
  - ST FAILDATA formats the SDWA in the dump header
    - PSW/registers at time of error and other helpful information
  - ST REGS also provides PSW and registers but in a different format
- **Console dump**
  - No SDWA so ST FAILDATA does not provide any information
  - ST REGS
    - PSW/registers at time console dump was requested.
      - Not normally very useful
- **SLIP dump**
  - No SDWA in dump header so do not use ST FAILDATA
  - ST REGS
    - PSW/registers at time SLIP matched

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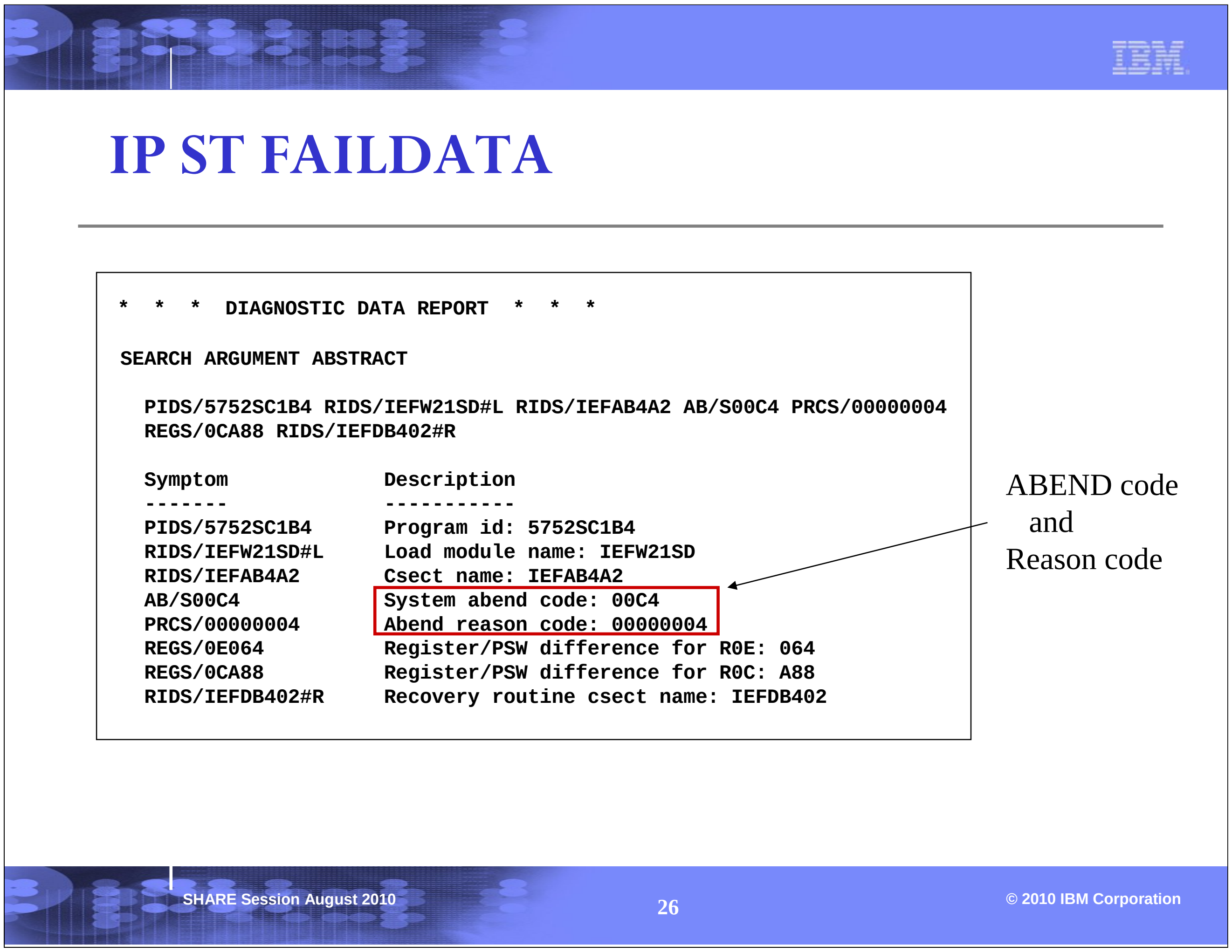
An SVC dump may be captured as the result of a program recognizing that an error has occurred and invoking recovery, as a result of a SLIP trap, or because the operator/system programmer requests a dump. The most basic and crucial piece of debugging information is typically the PSW and register information at the time of error or failure.

The availability of this information will depend on how the dump was taken. ST FAILDATA typically gives the most information about a problem, but is only available if a populated SDWA (System Diagnostic Work Area) is available. This will only be the case if a recovery routine requests that the dump be captured. In a console dump, the registers found in ST REGS show what was happening at the time the dump was requested, which means the program running at the time is not likely the one of interest, and the PSW and registers are less useful. In a SLIP generated dump, there is no SDWA, but the PSW/registers may be of value since they are captured at the time the SLIP trap springs.



IP ST FAILDATA

```
*   *   *  DIAGNOSTIC DATA REPORT  *   *   *

SEARCH ARGUMENT ABSTRACT

  PIDS/5752SC1B4 RIDS/IEFW21SD#L RIDS/IEFAB4A2 AB/S00C4 PRCS/00000004
  REGS/0CA88 RIDS/IEFDB402#R

  Symptom             Description
  -------             -----------
  PIDS/5752SC1B4      Program id: 5752SC1B4
  RIDS/IEFW21SD#L     Load module name: IEFW21SD
  RIDS/IEFAB4A2       Csect name: IEFAB4A2
  AB/S00C4            System abend code: 00C4
  PRCS/00000004       Abend reason code: 00000004
  REGS/0E064          Register/PSW difference for R0E: 064
  REGS/0CA88          Register/PSW difference for R0C: A88
  RIDS/IEFDB402#R     Recovery routine csect name: IEFDB402
```

ABEND code
and
Reason code

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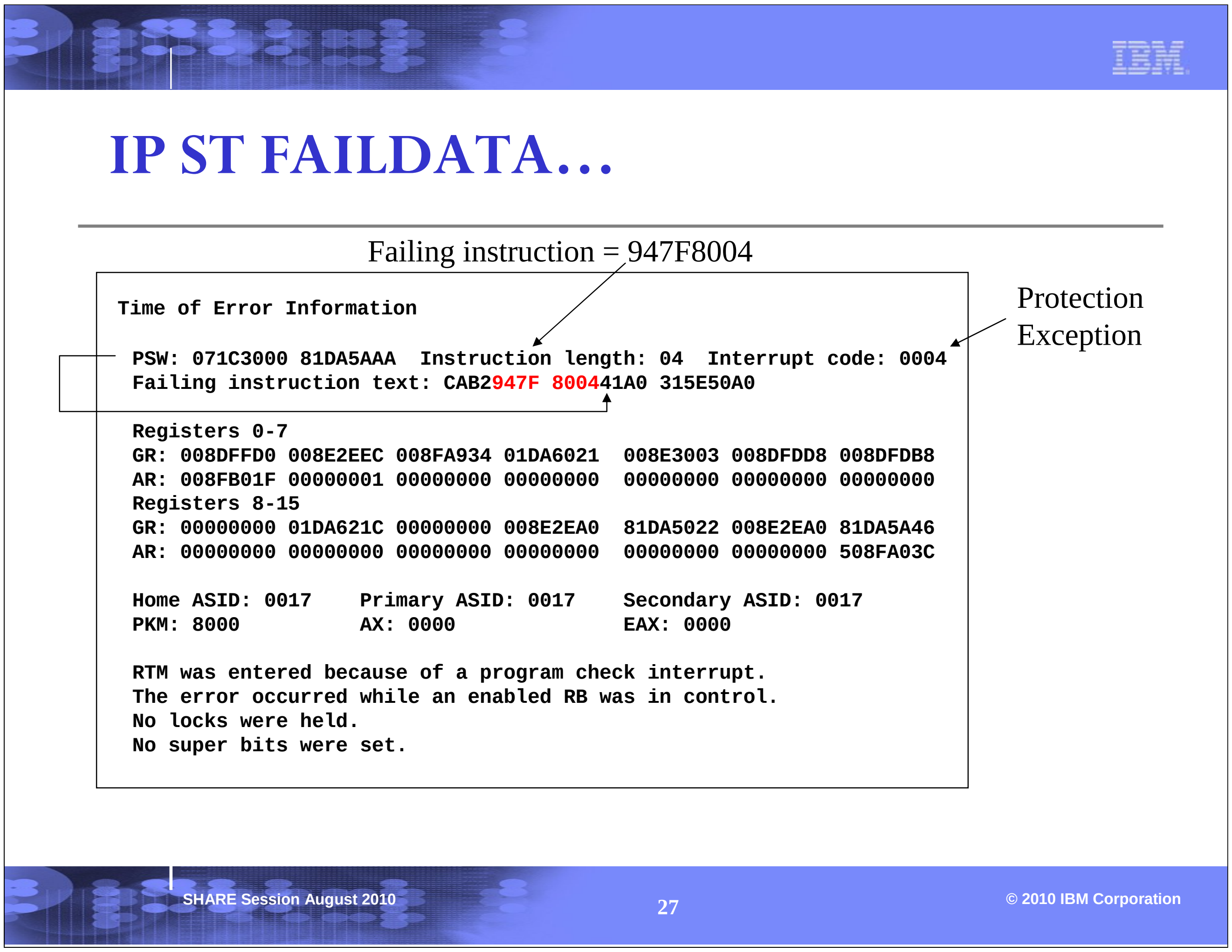
The first page of the ST FAILDATA output contains information about the program involved with the error, as well as the ABEND code and reason code.



IP ST FAILDATA…

Failing instruction = 947F8004

Protection Exception

```
Time of Error Information

  PSW: 071C3000 81DA5AAA  Instruction length: 04  Interrupt code: 0004
  Failing instruction text: CAB2947F 800441A0 315E50A0

  Registers 0-7
  GR: 008DFFD0 008E2EEC 008FA934 01DA6021  008E3003 008DFDD8 008DFDB8
  AR: 008FB01F 00000001 00000000 00000000  00000000 00000000 00000000
  Registers 8-15
  GR: 00000000 01DA621C 00000000 008E2EA0  81DA5022 008E2EA0 81DA5A46
  AR: 00000000 00000000 00000000 00000000  00000000 00000000 508FA03C

  Home ASID: 0017    Primary ASID: 0017    Secondary ASID: 0017
  PKM: 8000          AX: 0000              EAX: 0000

  RTM was entered because of a program check interrupt.
  The error occurred while an enabled RB was in control.
  No locks were held.
  No super bits were set.
```

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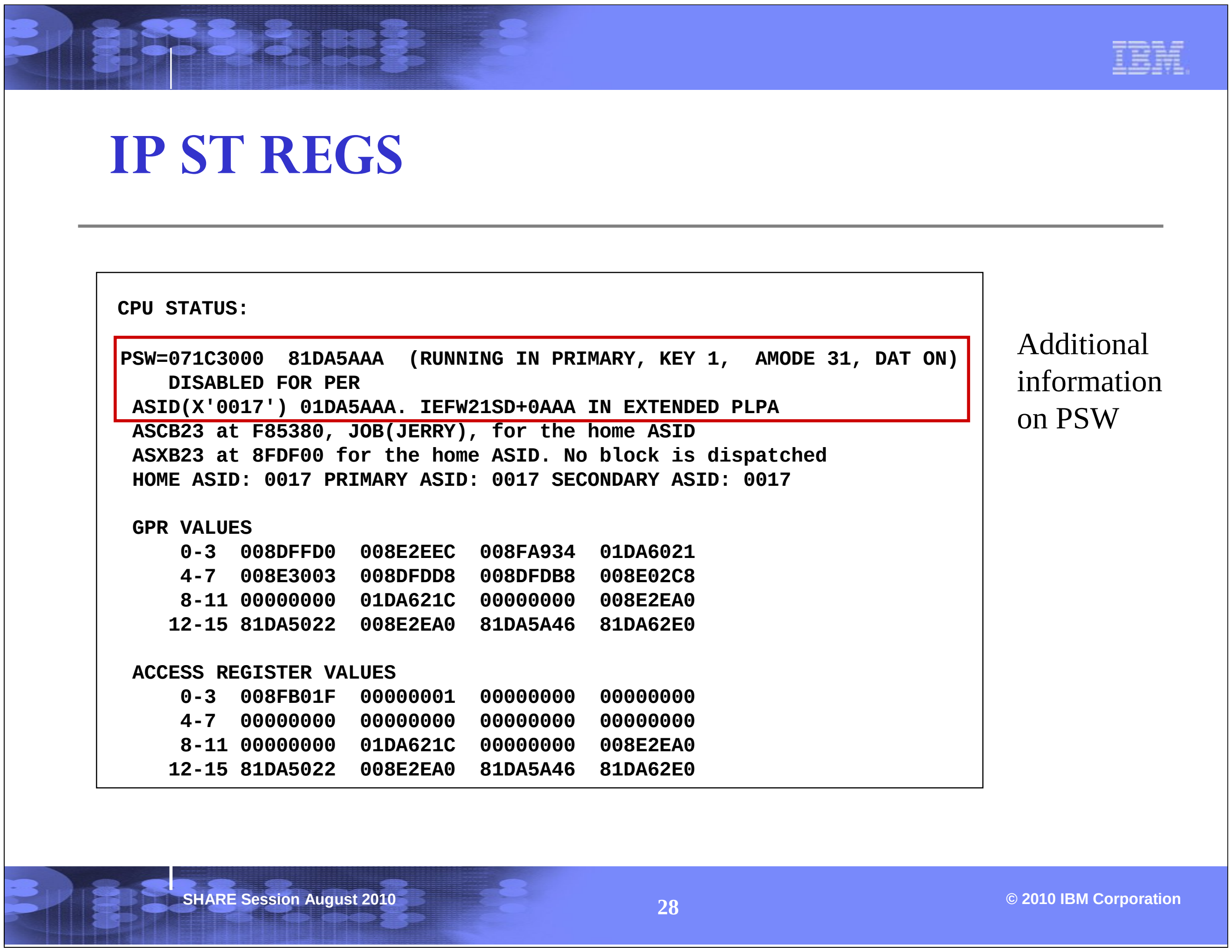
Find out the PIC (Program Interrupt Code) from the Interrupt code. In this example, it is a PIC4 (Protection Exception).

For PIC 10,11,38,39,3A,3B the PSW at time of error points at the failing instruction.

For PIC 4, the PSW points after the failing instruction.

When reviewing the Failing instruction text, start in the middle (6 bytes into text), and backup the number of bytes (if necessary) specified by the Instruction length. For a PIC 4, we back up by the Instruction length (4 bytes in this case).



IP ST REGS

```
CPU STATUS:

PSW=071C3000  81DA5AAA  (RUNNING IN PRIMARY, KEY 1,  AMODE 31, DAT ON)
    DISABLED FOR PER
 ASID(X'0017') 01DA5AAA. IEFW21SD+0AAA IN EXTENDED PLPA
 ASCB23 at F85380, JOB(JERRY), for the home ASID
 ASXB23 at 8FDF00 for the home ASID. No block is dispatched
 HOME ASID: 0017 PRIMARY ASID: 0017 SECONDARY ASID: 0017

 GPR VALUES
     0-3  008DFFD0  008E2EEC  008FA934  01DA6021
     4-7  008E3003  008DFDD8  008DFDB8  008E02C8
     8-11 00000000  01DA621C  00000000  008E2EA0
    12-15 81DA5022  008E2EA0  81DA5A46  81DA62E0

 ACCESS REGISTER VALUES
     0-3  008FB01F  00000001  00000000  00000000
     4-7  00000000  00000000  00000000  00000000
     8-11 00000000  01DA621C  00000000  008E2EA0
    12-15 81DA5022  008E2EA0  81DA5A46  81DA62E0
```

Additional information on PSW

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This report is not dependent on an SDWA (as ST FAILDATA), and is useful for both SLIP dumps and dumps generated by a recovery routine. It provides more information on the PSW, but the Failing Instruction Text, Instruction Length, and Interrupt Code are not provided (as with ST FAILDATA).

It also provides contents of Access registers and Control registers (not shown above).

IP ST CPU REGS

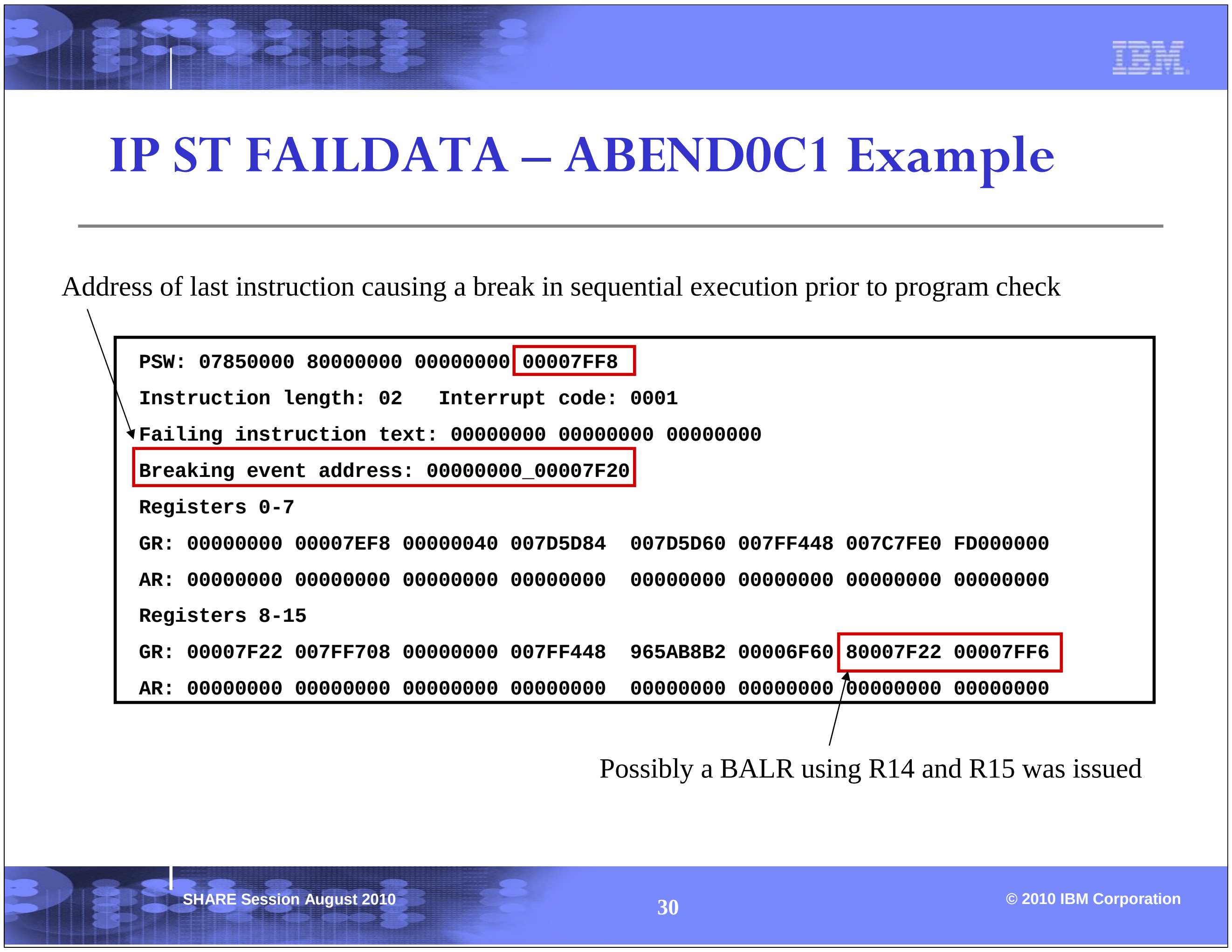
- Display registers for each CPU in a SADUMP

```
CPU(X'01') STATUS:
PSW=00020000 80000000 00000000 00004084
    (Running in PRIMARY, key 0, AMODE 31, DAT OFF)
    Disabled for PER I/O MCH
  ASCB25 at FA2380, JOB(KILLER), for the home ASID
  ASXB25 at 8FDD00 and TCB25D at 8FF2A0 for the home ASID
  HOME ASID: 0019 PRIMARY ASID: 0019 SECONDARY ASID: 0019

 CLTE: 0245AF80
  +0000  BLSD..... 00000000  XDS...... 00000000  XRES..... 00000000  X
  +0018  IXSH..... 00FCF7E0  IXDS..... 00000000  IXLL..... 00000000  U
  +0030  WLMQ..... 00FCF7F0  REGS..... 00000000  CNTX..... 00FCF800  S
  HOLDING LOCK(S): CPU
  CURRENT FRR STACK IS: PROGRAM
  Unable to complete FRR stack analysis, unknown stack pointer

  General purpose register values
     0-1  00000000_00000000  0000001C_00000000
     2-3  20202020_00F51450  0C0C0C0C_00000003
     4-5  073D9136_023F7C68  073D916A_012C6738
     6-7  073D91D4_02450900  073D9288_00FD5100
     8-9  04280000_022E0548  24082C30_00000000
    10-11 00000000_00FD57A0  00000000_01FAC3EC
    12-13 04280000_811EB3F0  00000000_023F8488
    14-15 00000000_40000000  00000000_00000000
```

This command is particularly useful in a standalone dump. In this example, the PSW for CPU1 is indicative of a WAIT084 RC04 (FRR stack corruption). The registers at the time of the Wait State follow for CPU1.



IP ST FAILDATA – ABEND0C1 Example

Address of last instruction causing a break in sequential execution prior to program check

```
PSW: 07850000 80000000 00000000 00007FF8
Instruction length: 02   Interrupt code: 0001
Failing instruction text: 00000000 00000000 00000000
Breaking event address: 00000000_00007F20
Registers 0-7
GR: 00000000 00007EF8 00000040 007D5D84  007D5D60 007FF448 007C7FE0 FD000000
AR: 00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
Registers 8-15
GR: 00007F22 007FF708 00000000 007FF448  965AB8B2 00006F60 80007F22 00007FF6
AR: 00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
```

Possibly a BALR using R14 and R15 was issued

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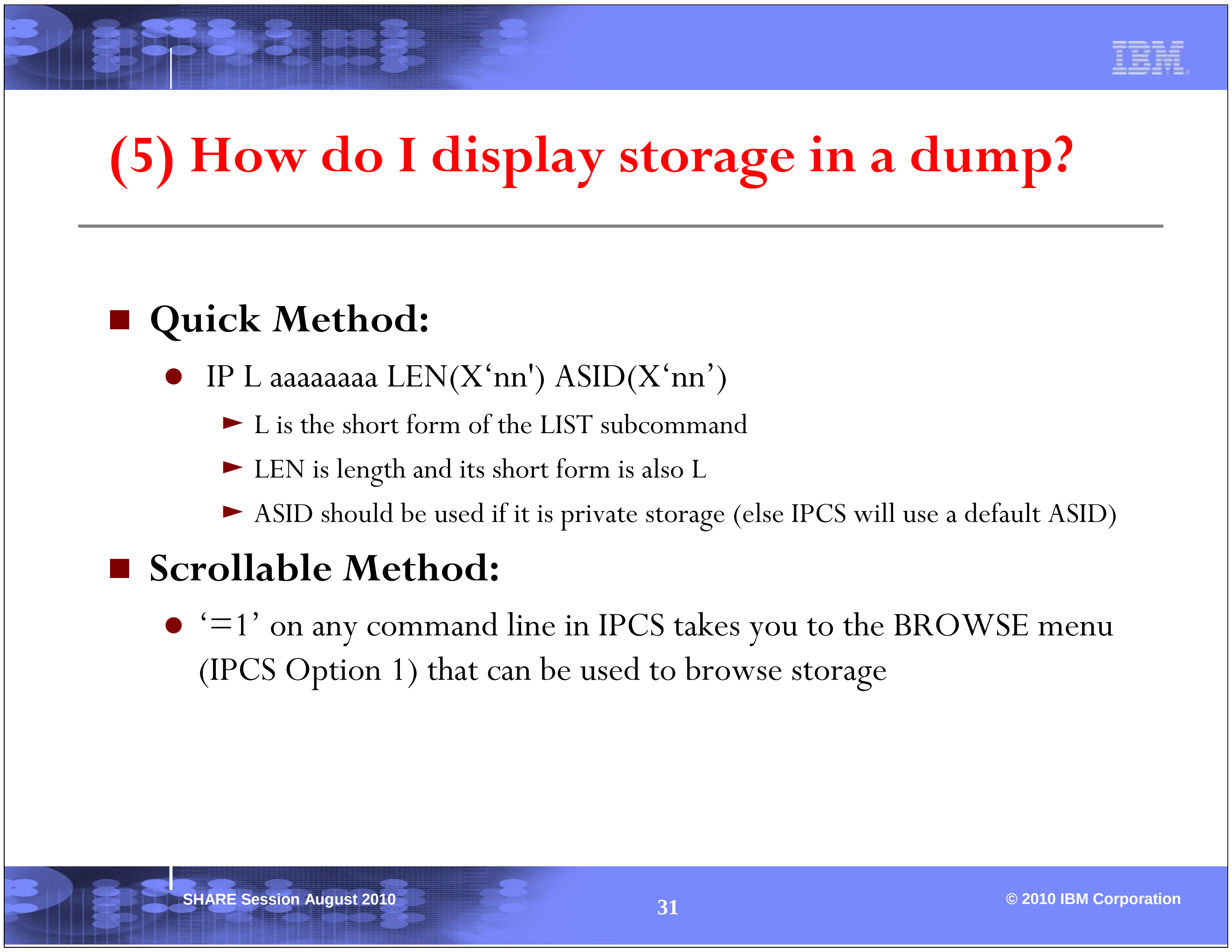
The Interrupt code of x’0001’ indicates a PIC 1 (Operation Exception). The failing instruction was 2 bytes in length. Note from the Failing instruction text that we tried to execute zeros, hence the PIC 1. There was likely a BALR R14,R15 from address x’7F20’ to address x’7FF6’. It was at x’7FF6’ that we then tried to execute the zeros. The PSW instruction address was incremented by the machine by 2 bytes and so it now contains x’7FF8’.

BEAR = Breaking Event Address Register, that is, the address of the last instruction causing a break in sequential execution saved in a 64-bit hardware register (1 register per CP). Examples of such instructions are BALR, BASR and LPSW.

BEAR contents are provided in the output of ST FAILDATA, VERBX LOGDATA, or in the RTM2WA (see later).



(5) How do I display storage in a dump?

- **Quick Method:**
  - IP L aaaaaaaa LEN(X‘nn') ASID(X‘nn’)
    - L is the short form of the LIST subcommand
    - LEN is length and its short form is also L
    - ASID should be used if it is private storage (else IPCS will use a default ASID)
- **Scrollable Method:**
  - ‘=1’ on any command line in IPCS takes you to the BROWSE menu (IPCS Option 1) that can be used to browse storage

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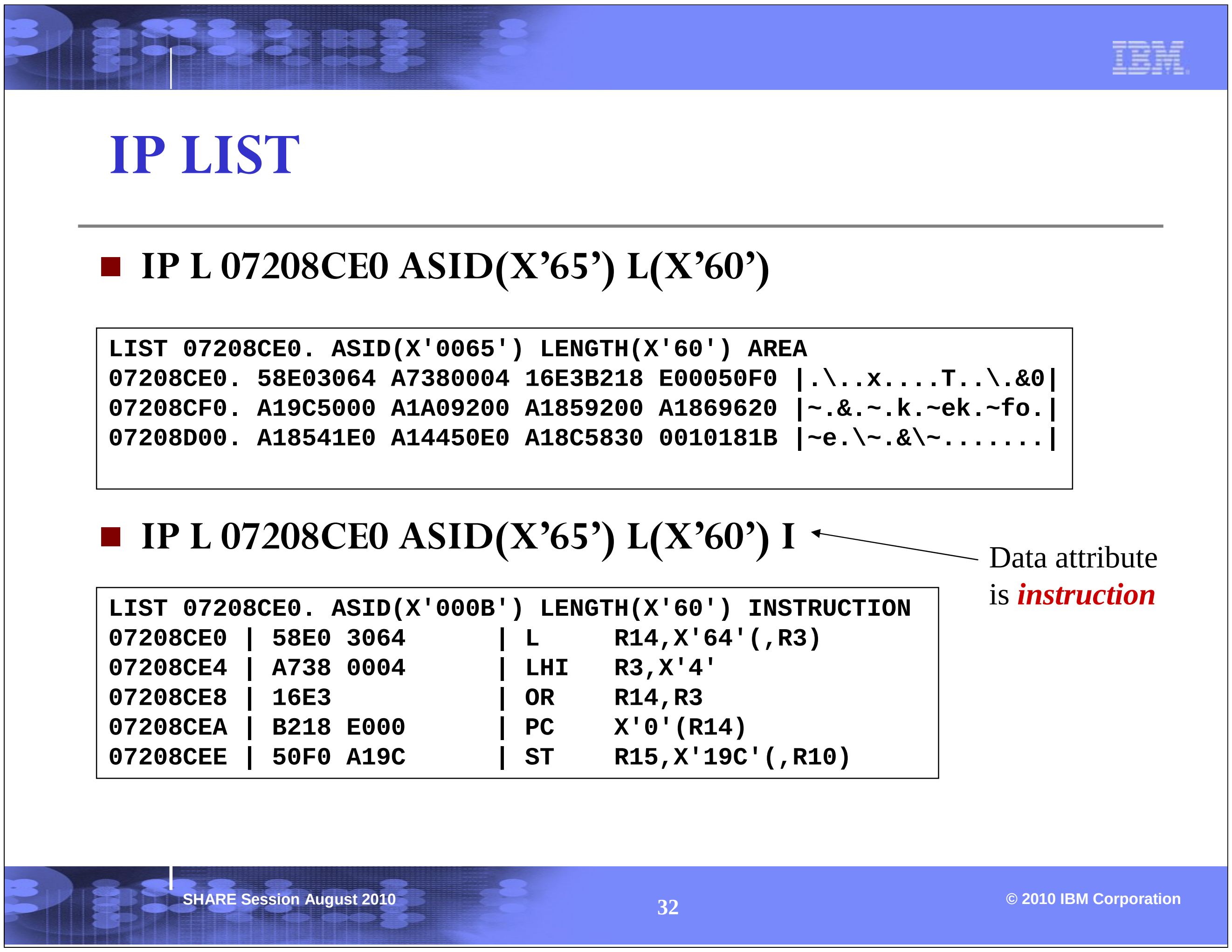
Described are two ways of displaying storage, each with their own benefits.

The IPCS LIST subcommand is useful if you’re examining an IPCS report and you just want to know where an address points. After seeing the output from LIST you can then ‘PF3’ back to the report. On the other hand, if you want to look at a PSW address and scan backwards in storage to look for module eyecatchers, then IPCS Option 1 will allow you to easily scroll through storage.



IP LIST

- IP L 07208CE0 ASID(X’65’) L(X’60’)

```
LIST 07208CE0. ASID(X'0065') LENGTH(X'60') AREA
07208CE0. 58E03064 A7380004 16E3B218 E00050F0 |.\..x....T..\.&0|
07208CF0. A19C5000 A1A09200 A1859200 A1869620 |~.&.~.k.~ek.~fo.|
07208D00. A18541E0 A14450E0 A18C5830 0010181B |~e.\~.&\~.......|
```

- IP L 07208CE0 ASID(X’65’) L(X’60’) I

Data attribute is ***instruction***

```
LIST 07208CE0. ASID(X'000B') LENGTH(X'60') INSTRUCTION
07208CE0 | 58E0 3064       | L      R14,X'64'(,R3)
07208CE4 | A738 0004       | LHI    R3,X'4'
07208CE8 | 16E3            | OR     R14,R3
07208CEA | B218 E000       | PC     X'0'(R14)
07208CEE | 50F0 A19C       | ST     R15,X'19C'(,R10)
```

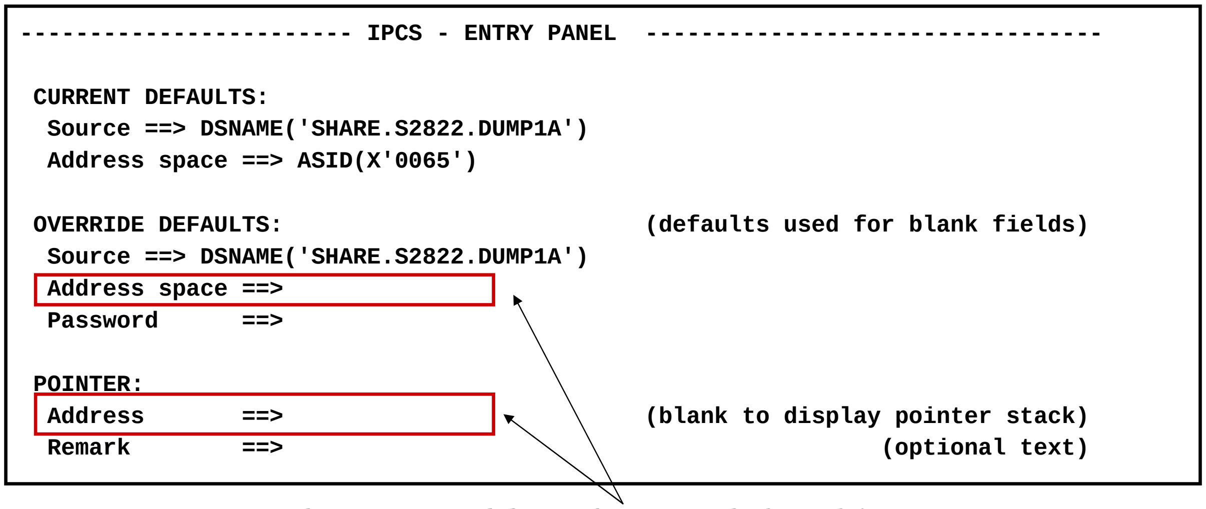
In our example, the address we’re interested in is x’07208CE0’ in ASID(x’65’).

In the first example, LIST can be used to display x’60’ bytes of the data.

In the second example, adding a data attribute of I (instruction) changes the output to display the data as if they are instructions.

IPCS Option 1: BROWSE Panel

- **Browsing Storage:** IPCS Option 1 (=1 on any IPCS command line) brings up the following panel:

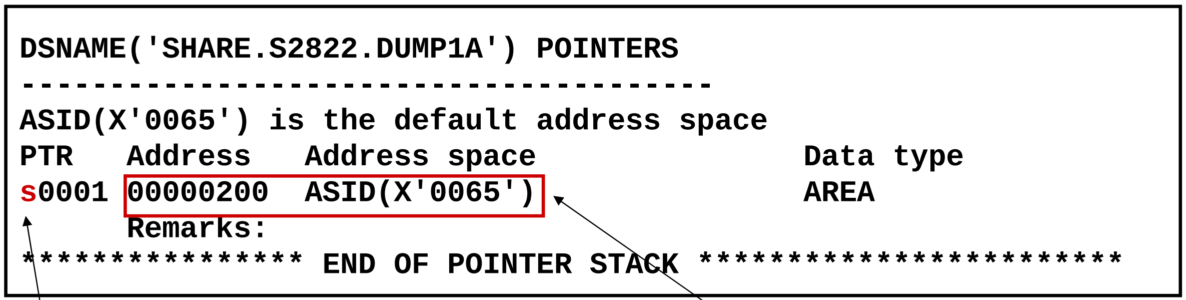


```
------------------------ IPCS - ENTRY PANEL  --------------------------------

 CURRENT DEFAULTS:
  Source ==> DSNAME('SHARE.S2822.DUMP1A')
  Address space ==> ASID(X'0065')

 OVERRIDE DEFAULTS:                         (defaults used for blank fields)
  Source ==> DSNAME('SHARE.S2822.DUMP1A')
  Address space ==>
  Password      ==>

 POINTER:
  Address       ==>                         (blank to display pointer stack)
  Remark        ==>                                          (optional text)
```

- Enter ASID and storage address here and then hit <ENTER> , or just hit <ENTER> to get to the Pointer Stack on next page

An “Address” and “Address space” can be filled in on this screen to jump right to the scrollable storage at the specified address. However, hitting <ENTER> on this screen without filling in an “Address” under the “POINTER” will bring up a POINTER STACK containing a list of pointers that have been defined for this dump.

IPCS Option 1: Browse Panel Pointer Stack



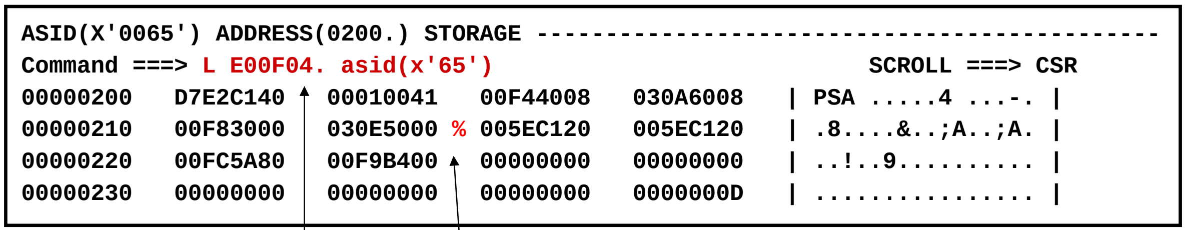
```
DSNAME('SHARE.S2822.DUMP1A') POINTERS
---------------------------------------
ASID(X'0065') is the default address space
PTR    Address    Address space              Data type
s0001  00000200   ASID(X'0065')              AREA
       Remarks:
**************** END OF POINTER STACK ************************
```

Enter line commands in the PTR field:

D Delete the pointer from the stack
E Edit the pointer, the address, address space, data type, and remark
F Format and display the structure described by the pointer
I Insert a pointer after this pointer
R Repeat this pointer immediately following this pointer
S Select the storage addressed by the pointer for display

In our example, the address we're interested in browsing is x'200'. Thus, we can enter 00000200 in the "Address" field for pointer (PTR) 0001. The "Address space" value of ASID(X'0065') is sufficient since this is PSA storage. An 's' can then be placed next to the PTR 0001 that we just defined for address x'200', followed by hitting <ENTER>. We are then taken to scrollable storage at address x'200', which does indeed contain the 'PSA' eyecatcher (see next page).

IPCS Option 1: Browse Panel Storage Display



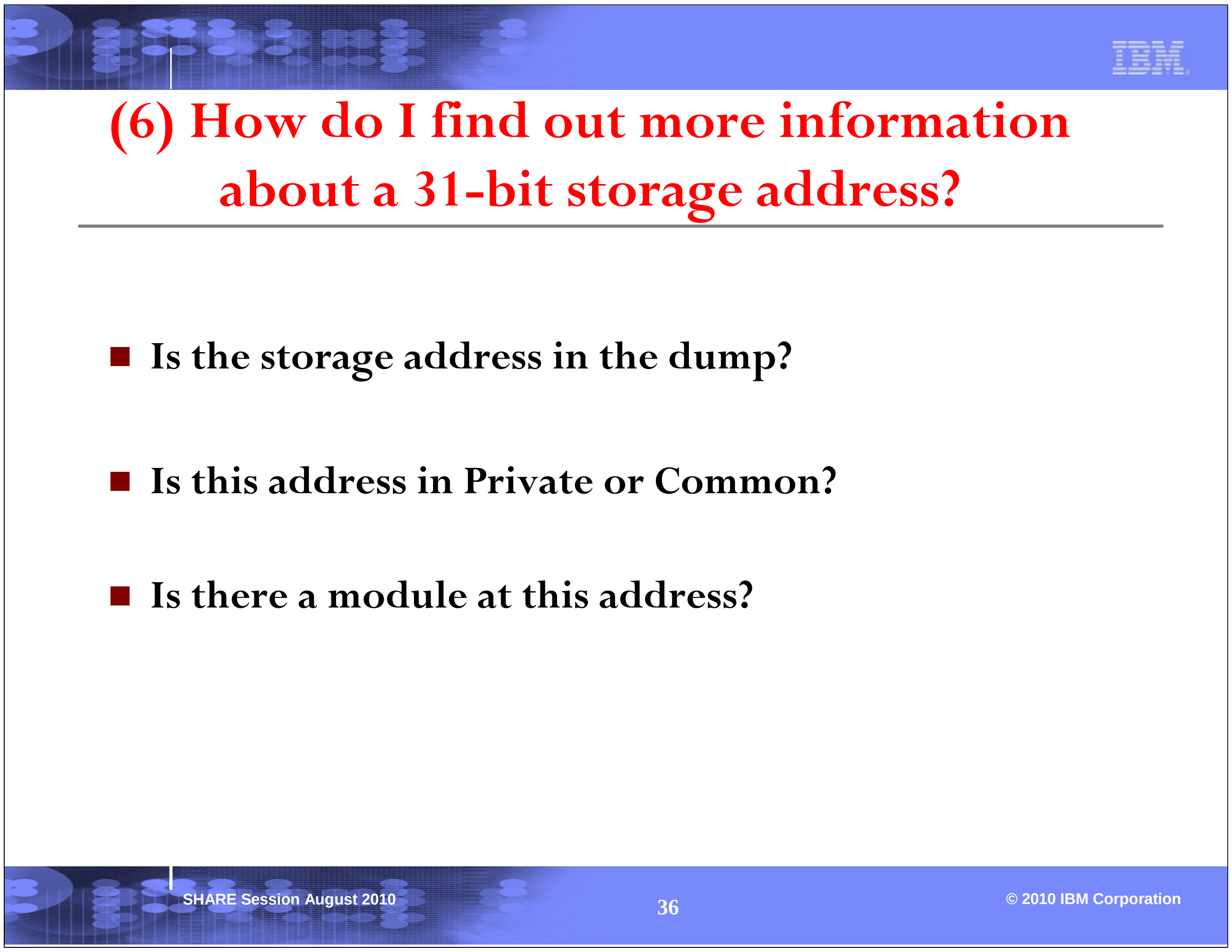
```
ASID(X'0065') ADDRESS(0200.) STORAGE -------------------------------------------
Command ===> L E00F04. asid(x'65')                            SCROLL ===> CSR
00000200   D7E2C140   00010041   00F44008   030A6008   | PSA .....4 ...-. |
00000210   00F83000   030E5000 % 005EC120   005EC120   | .8....&..;A..;A. |
00000220   00FC5A80   00F9B400   00000000   00000000   | ..!..9.......... |
00000230   00000000   00000000   00000000   0000000D   | ................ |
```

- **To display a different storage location while in Browse:**
  - Use the LOCATE Primary command (short form is also L), or
  - Put an indirect storage pointer on the left of a storage address and then hit enter
    - % = 24-bit ? = 31-bit ! = 64-bit

While viewing the storage in BROWSE, a LOCATE primary command can be used to change the display to a different storage location.

The command "L E00F04. asid(x'65')" in the above example refers to the IPCS Primary command '**LOCATE**', not the IPCS LIST Subcommand. The '.' after the address x'E00F04' tells IPCS that the LOCATE is being done on an address, rather than an IPCS symbol with the same name. This is particularly important when using an address that begins with a letter (i.e., A,B,C,D,E,F).

One can also put an indirect storage pointer on the left of any address on the BROWSE display and then hit <ENTER>. BROWSE will then display the storage at that address.



(6) How do I find out more information about a 31-bit storage address?

- Is the storage address in the dump?
- Is this address in Private or Common?
- Is there a module at this address?

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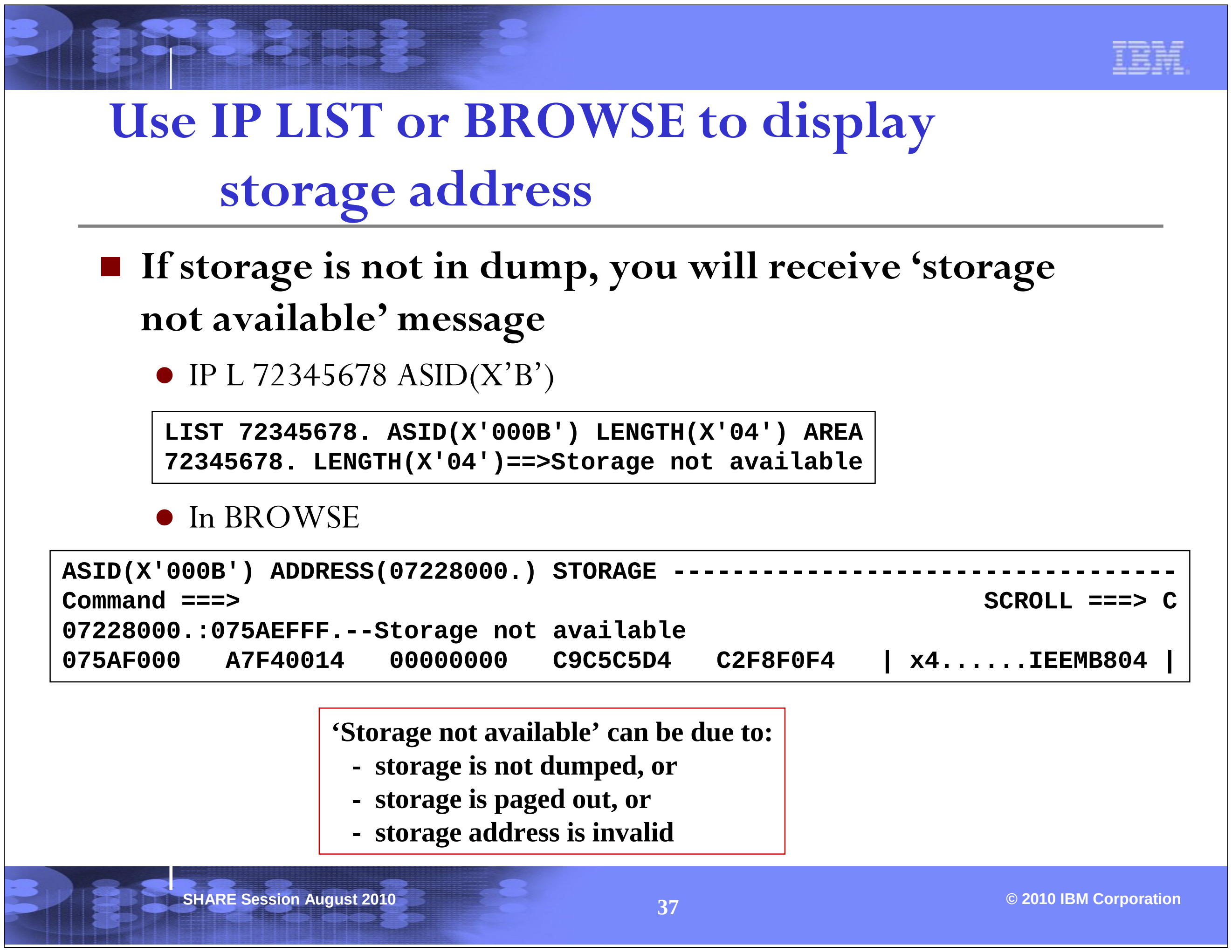
When you are debugging a problem with a set of PSW and registers, it is important that you know where the PSW and registers point to. This section will answer some of the questions you may have on an address.

If the address is in common storage, an ASID parameter is not needed when displaying the storage.



Use IP LIST or BROWSE to display storage address

- **If storage is not in dump, you will receive 'storage not available' message**
  - IP L 72345678 ASID(X'B')

```
LIST 72345678. ASID(X'000B') LENGTH(X'04') AREA
72345678. LENGTH(X'04')==>Storage not available
```

  - In BROWSE

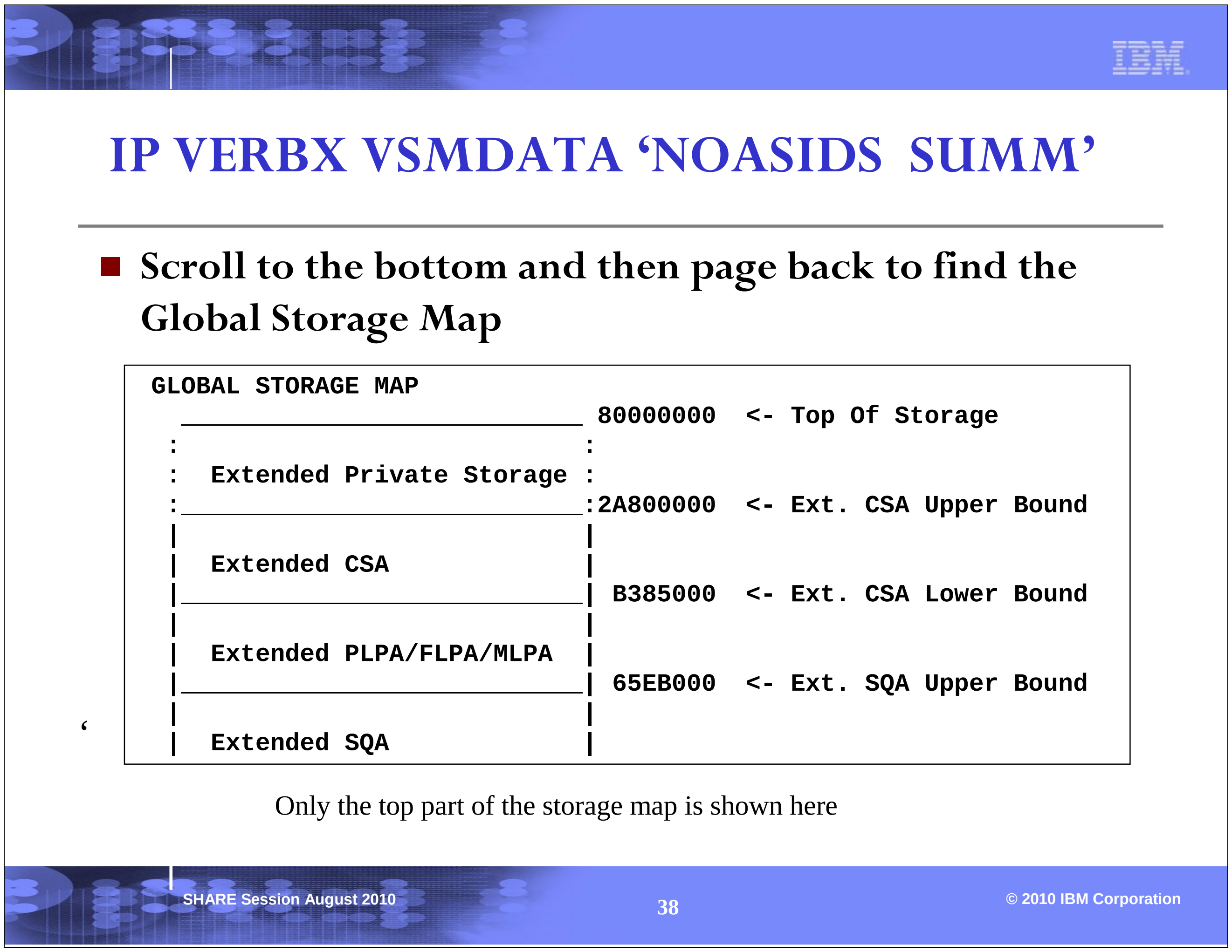
```
ASID(X'000B') ADDRESS(07228000.) STORAGE ---------------------------------
Command ===>                                                  SCROLL ===> C
07228000.:075AEFFF.--Storage not available
075AF000   A7F40014   00000000   C9C5C5D4   C2F8F0F4   | x4......IEEMB804 |
```

'Storage not available' can be due to:
- **storage is not dumped, or**
- **storage is paged out, or**
- **storage address is invalid**

There are several reasons for 'storage not available', and it also depends on the kind of dump.

Since everything should be dumped in a standalone dump, 'storage not available' most likely means that the storage address is invalid.

In a SVC dump or SYSMDUMP, some common area (for example, LPA) are usually not dumped. So it is important to know which area the storage address belongs to (see next page).



IP VERBX VSMDATA ‘NOASIDS SUMM’

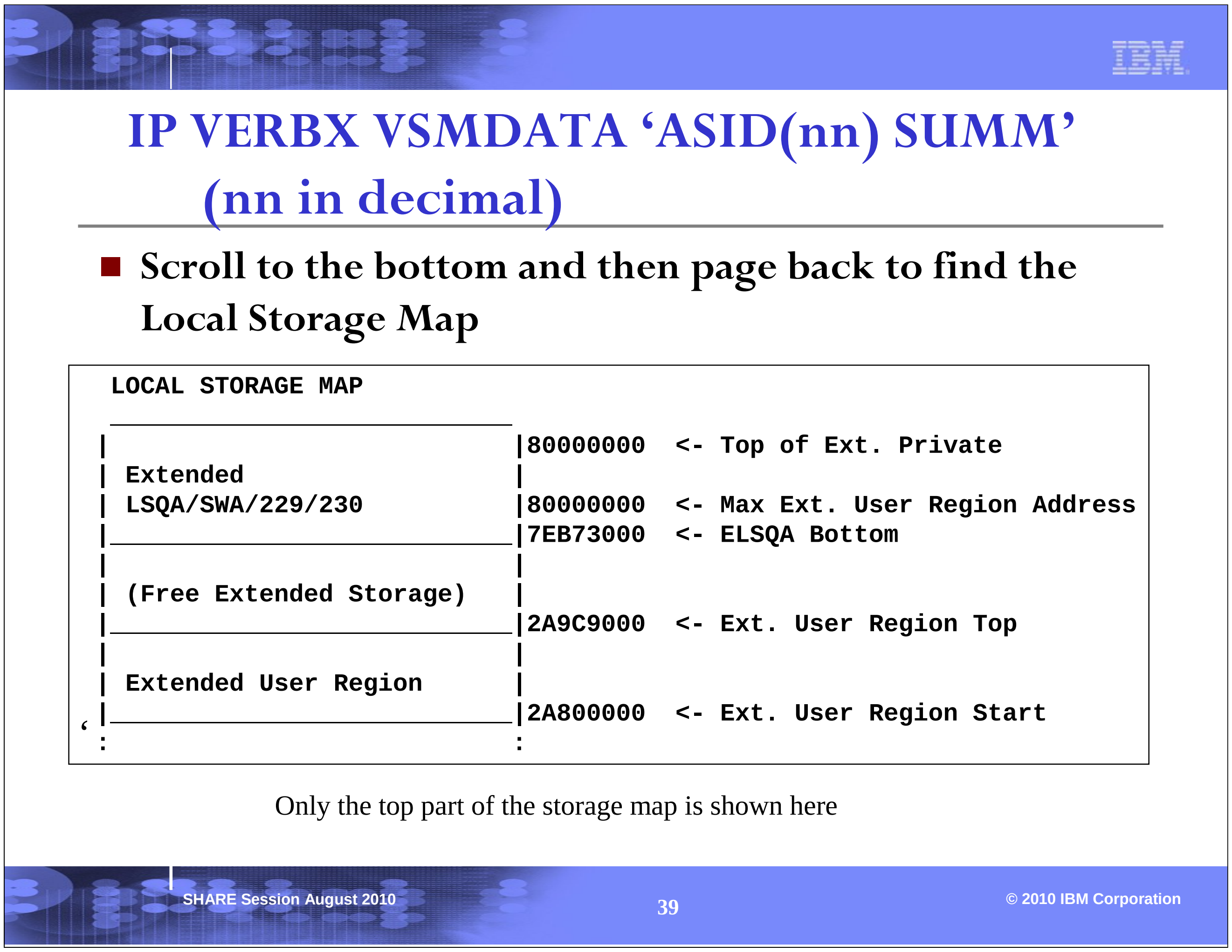
- Scroll to the bottom and then page back to find the Global Storage Map

```
GLOBAL STORAGE MAP
    ___________________________________ 80000000  <- Top Of Storage
   :                                   :
   :  Extended Private Storage :
   :___________________________________:2A800000  <- Ext. CSA Upper Bound
   |                                   |
   |  Extended CSA                     |
   |___________________________________| B385000  <- Ext. CSA Lower Bound
   |                                   |
   |  Extended PLPA/FLPA/MLPA          |
   |___________________________________| 65EB000  <- Ext. SQA Upper Bound
   |                                   |
   |  Extended SQA                     |
```

‘

Only the top part of the storage map is shown here

VERBX VSMDATA with a parameter of NOASIDS provides a global storage map that shows the boundaries of different area of storage for every address space. This will allow you to figure out whether the address at hand is in private or common. To see the details of the private storage of an address space see next page.



IP VERBX VSMDATA ‘ASID(nn) SUMM’ (nn in decimal)

- Scroll to the bottom and then page back to find the Local Storage Map

```
 LOCAL STORAGE MAP
  ___________________________
 |                           |80000000  <- Top of Ext. Private
 | Extended                  |
 | LSQA/SWA/229/230          |80000000  <- Max Ext. User Region Address
 |___________________________|7EB73000  <- ELSQA Bottom
 |                           |
 | (Free Extended Storage)   |
 |___________________________|2A9C9000  <- Ext. User Region Top
 |                           |
 | Extended User Region      |
‘|___________________________|2A800000  <- Ext. User Region Start
 :                           :
```

Only the top part of the storage map is shown here

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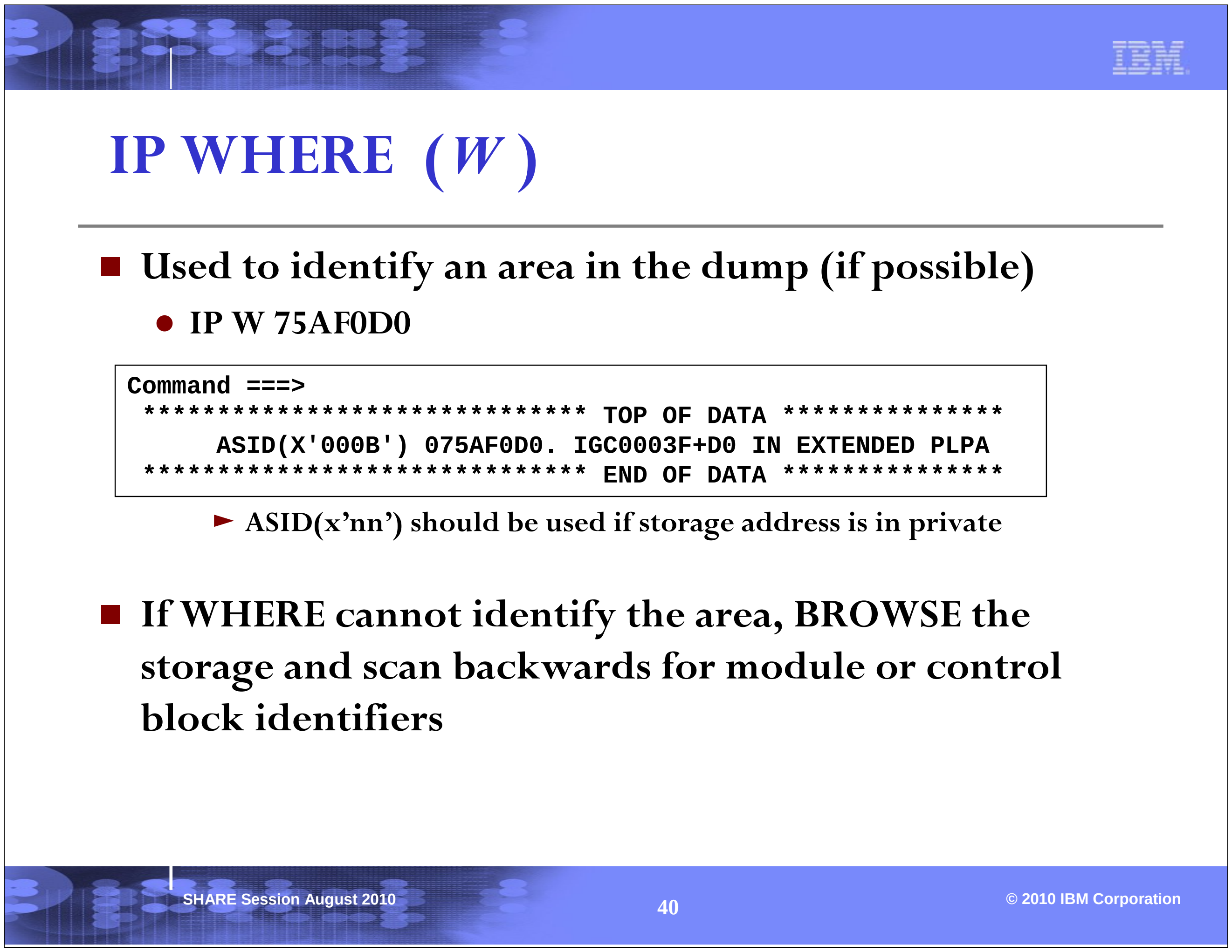
To see the details of the layout of private storage in a particular address space, use VERBX VSMDATA with an ASID parameter. This is useful after you have determined that the address at hand is in the private region of an address space.



IP WHERE (*W*)

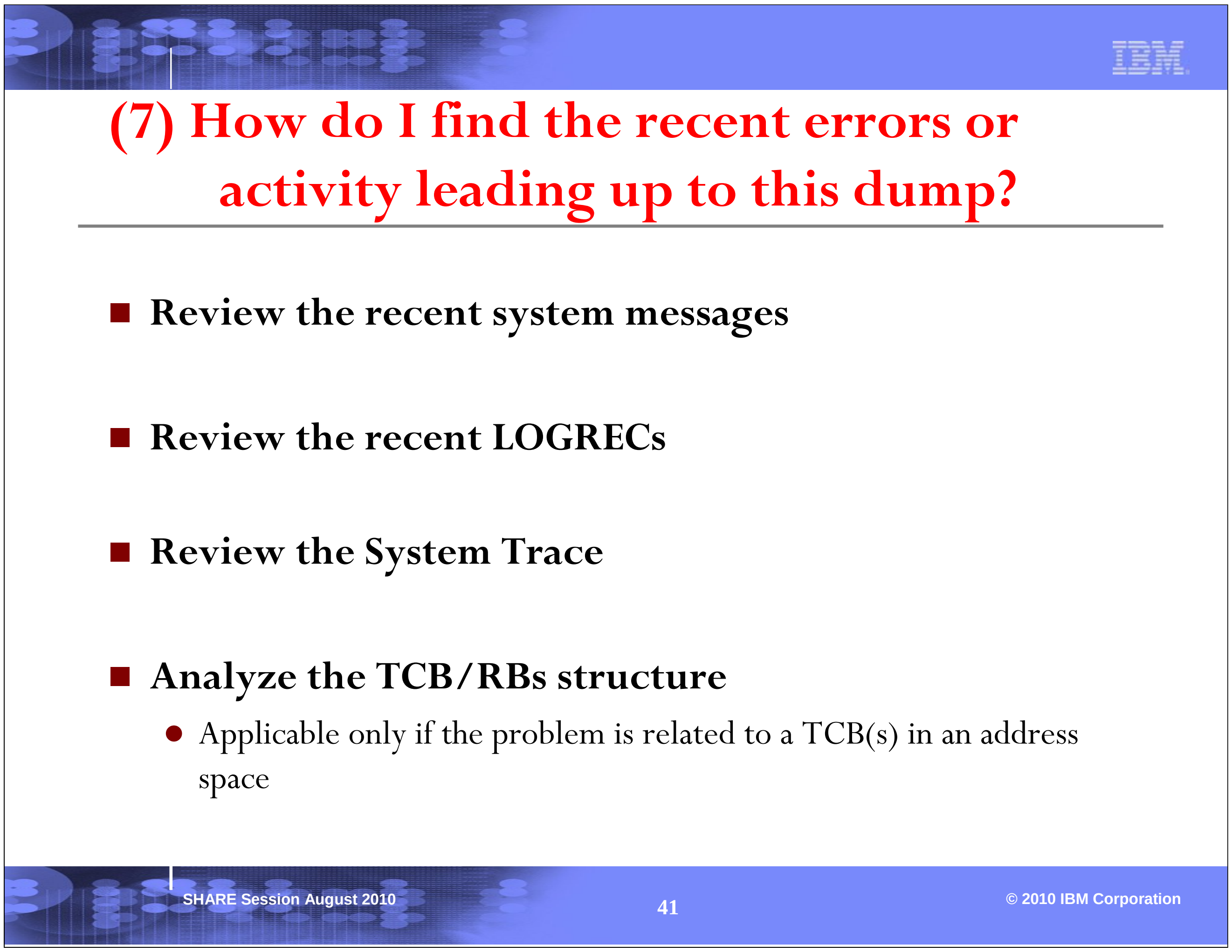
- Used to identify an area in the dump (if possible)
  - IP W 75AF0D0

```
Command ===>
 ****************************** TOP OF DATA ***************
      ASID(X'000B') 075AF0D0. IGC0003F+D0 IN EXTENDED PLPA
 ****************************** END OF DATA ***************
```

  - ► ASID(x'nn') should be used if storage address is in private

- If WHERE cannot identify the area, BROWSE the storage and scan backwards for module or control block identifiers

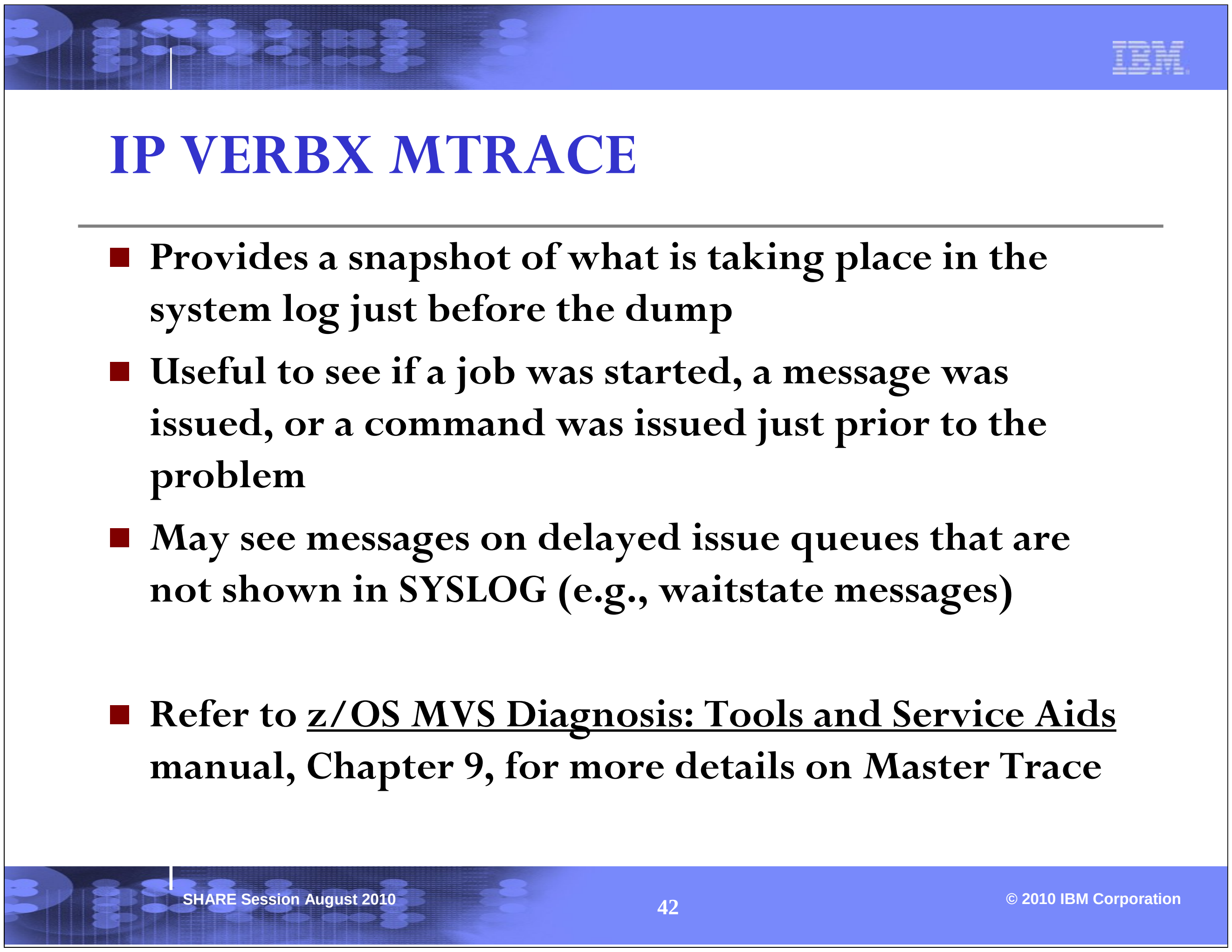
For an address that may point to a module or a common control block, the IPCS WHERE subcommand can be used. Note that the ASID parameter should be used if the address is in private.



(7) How do I find the recent errors or activity leading up to this dump?

- Review the recent system messages
- Review the recent LOGRECs
- Review the System Trace
- Analyze the TCB/RBs structure
  - Applicable only if the problem is related to a TCB(s) in an address space

It is always a good practice to find out 'what led up to the problem'. There are a few area in the dump that can help.

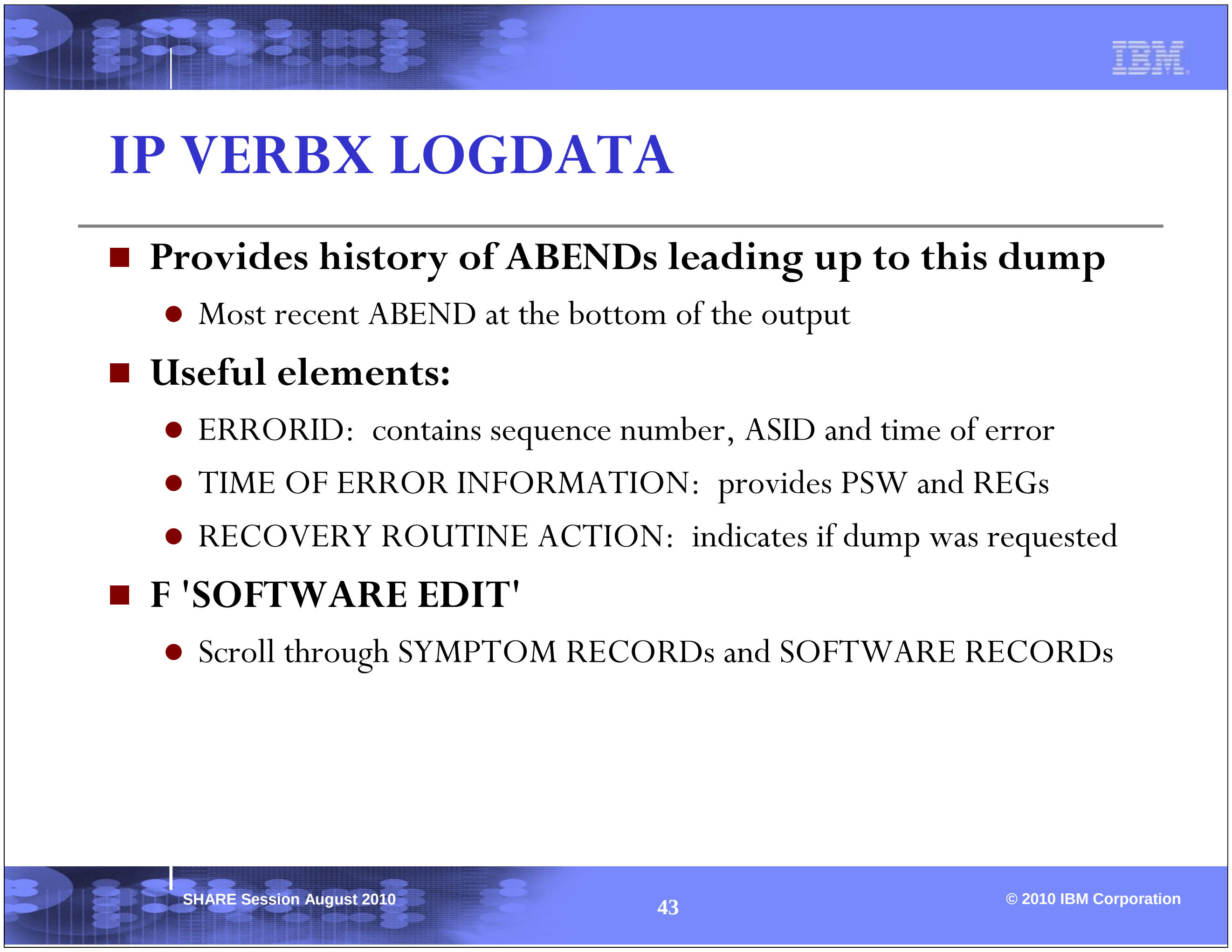


IP VERBX MTRACE

- Provides a snapshot of what is taking place in the system log just before the dump
- Useful to see if a job was started, a message was issued, or a command was issued just prior to the problem
- May see messages on delayed issue queues that are not shown in SYSLOG (e.g., waitstate messages)

- Refer to z/OS MVS Diagnosis: Tools and Service Aids manual, Chapter 9, for more details on Master Trace

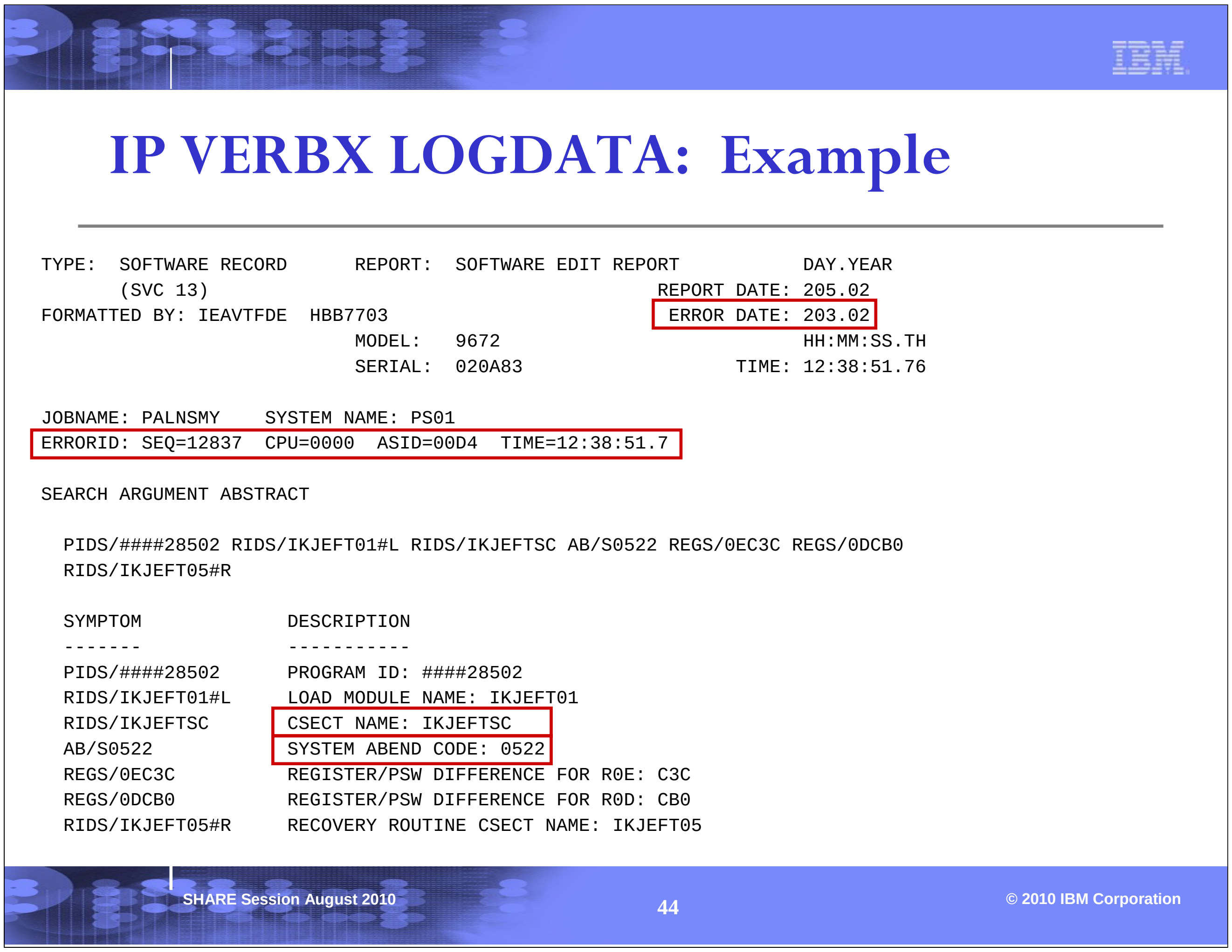
VERBX MTRACE displays the last messages that were issued to SYSLOG leading up to the dump, and may also give an indication of what jobs started just prior to the problem.



IP VERBX LOGDATA

- **Provides history of ABENDs leading up to this dump**
  - Most recent ABEND at the bottom of the output
- **Useful elements:**
  - ERRORID: contains sequence number, ASID and time of error
  - TIME OF ERROR INFORMATION: provides PSW and REGs
  - RECOVERY ROUTINE ACTION: indicates if dump was requested
- **F 'SOFTWARE EDIT'**
  - Scroll through SYMPTOM RECORDs and SOFTWARE RECORDs

VERBX LOGDATA is useful for reviewing the most recent ABENDs that occurred prior to the dump. The SOFTWARE RECORDs and SYMPTOM RECORDs are often of most value.



IP VERBX LOGDATA: Example

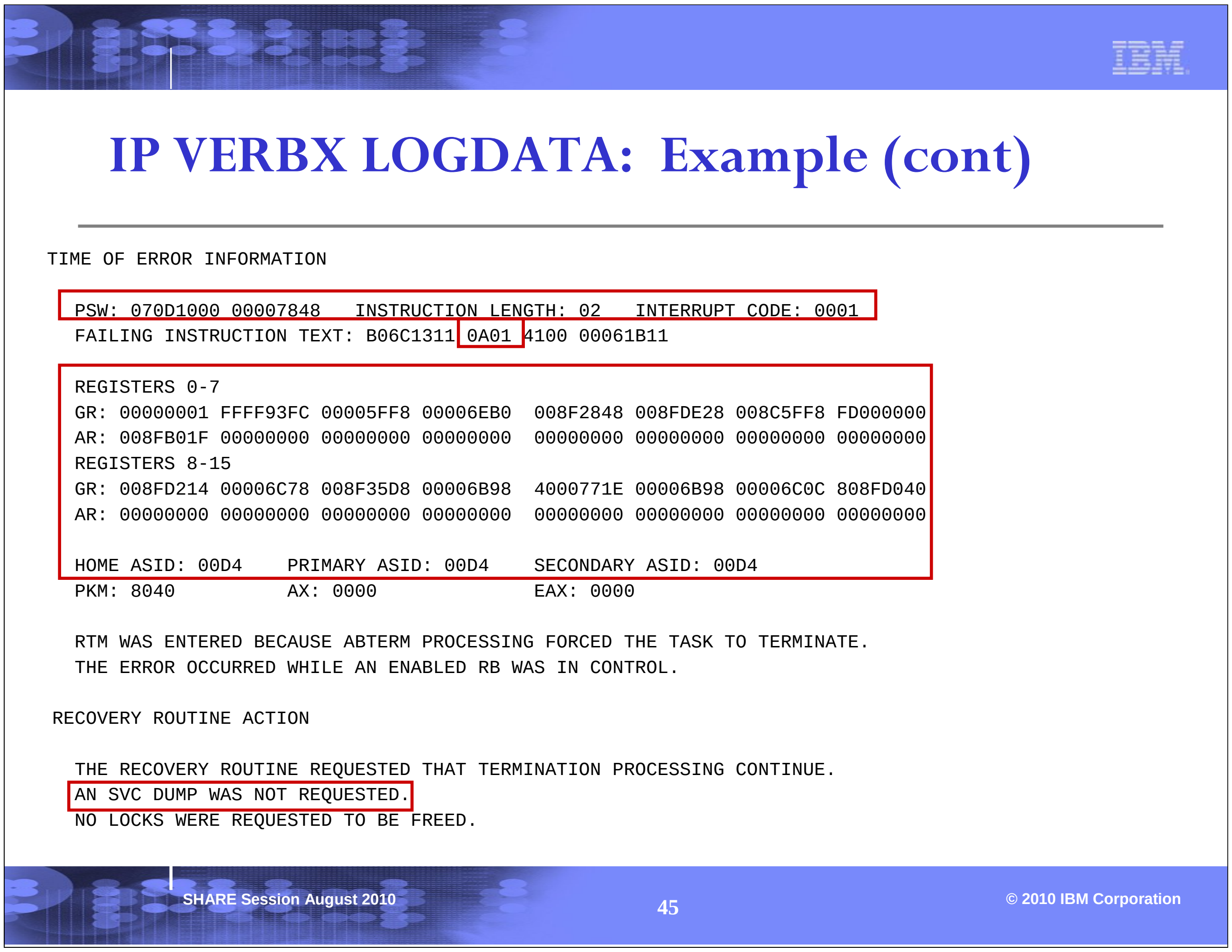
```
TYPE:  SOFTWARE RECORD      REPORT:  SOFTWARE EDIT REPORT           DAY.YEAR
       (SVC 13)                                       REPORT DATE: 205.02
FORMATTED BY: IEAVTFDE  HBB7703                        ERROR DATE: 203.02
                            MODEL:   9672                           HH:MM:SS.TH
                            SERIAL:  020A83                   TIME: 12:38:51.76

JOBNAME: PALNSMY    SYSTEM NAME: PS01
ERRORID: SEQ=12837  CPU=0000  ASID=00D4  TIME=12:38:51.7

SEARCH ARGUMENT ABSTRACT

  PIDS/####28502 RIDS/IKJEFT01#L RIDS/IKJEFTSC AB/S0522 REGS/0EC3C REGS/0DCB0
  RIDS/IKJEFT05#R

  SYMPTOM             DESCRIPTION
  -------             -----------
  PIDS/####28502      PROGRAM ID: ####28502
  RIDS/IKJEFT01#L     LOAD MODULE NAME: IKJEFT01
  RIDS/IKJEFTSC       CSECT NAME: IKJEFTSC
  AB/S0522            SYSTEM ABEND CODE: 0522
  REGS/0EC3C          REGISTER/PSW DIFFERENCE FOR R0E: C3C
  REGS/0DCB0          REGISTER/PSW DIFFERENCE FOR R0D: CB0
  RIDS/IKJEFT05#R     RECOVERY ROUTINE CSECT NAME: IKJEFT05
```

SEQ (sequence number): if sequence numbers are the same for multiple ABEND records, it indicates that this is the same ABEND being recorded by different recovery routines

ASID: ASID that encountered the error

TIME: Time the error occurred

This example is of an abend522 that occurred in TSO csect IKJEFTSC in asid(x'D4') PALNSMY at 12:38:51 on Julian day 203 in the year 2002.



IP VERBX LOGDATA: Example (cont)

```
TIME OF ERROR INFORMATION

  PSW: 070D1000 00007848   INSTRUCTION LENGTH: 02   INTERRUPT CODE: 0001
  FAILING INSTRUCTION TEXT: B06C1311 0A01 4100 00061B11

  REGISTERS 0-7
  GR: 00000001 FFFF93FC 00005FF8 00006EB0  008F2848 008FDE28 008C5FF8 FD000000
  AR: 008FB01F 00000000 00000000 00000000  00000000 00000000 00000000 00000000
  REGISTERS 8-15
  GR: 008FD214 00006C78 008F35D8 00006B98  4000771E 00006B98 00006C0C 808FD040
  AR: 00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000

  HOME ASID: 00D4    PRIMARY ASID: 00D4    SECONDARY ASID: 00D4
  PKM: 8040          AX: 0000              EAX: 0000

  RTM WAS ENTERED BECAUSE ABTERM PROCESSING FORCED THE TASK TO TERMINATE.
  THE ERROR OCCURRED WHILE AN ENABLED RB WAS IN CONTROL.

 RECOVERY ROUTINE ACTION

  THE RECOVERY ROUTINE REQUESTED THAT TERMINATION PROCESSING CONTINUE.
  AN SVC DUMP WAS NOT REQUESTED.
  NO LOCKS WERE REQUESTED TO BE FREED.
```

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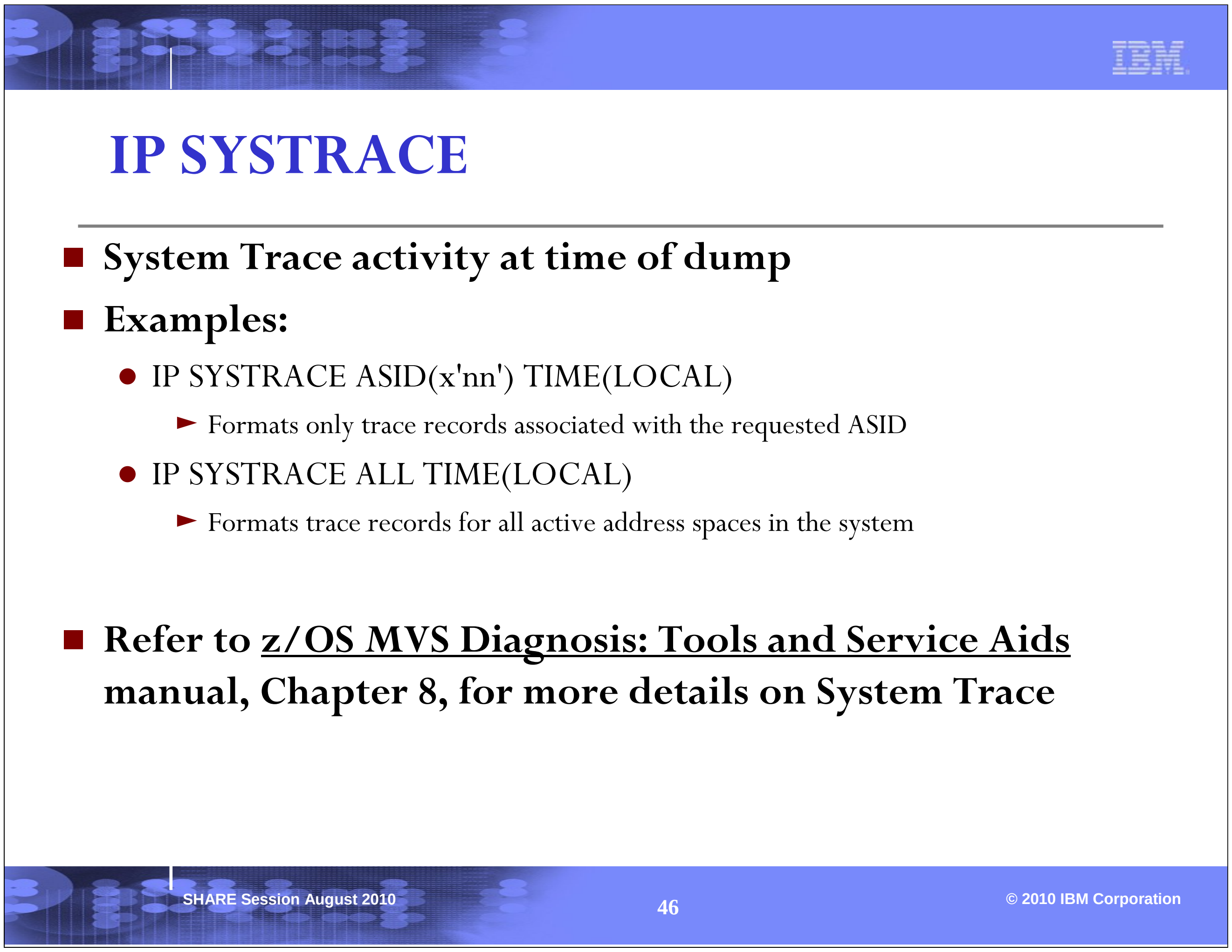
The failing instruction was an SVC 1 (x’0A01’) Wait that was issued by PSW address x’7846’. Note that the PSW address x’7848’ points after the failing instruction, so we had to back up by the INSTRUCTION LENGTH (02) to find the failing PSW address x’7846’ and failing instruction (x’0A01) in the FAILING INSTRUCTION TEXT.

The registers displayed are the registers at the time of the failure (abend522). An SVC dump was not requested by recovery for this abend522.



IP SYSTRACE

- **System Trace activity at time of dump**
- **Examples:**
  - IP SYSTRACE ASID(x'nn') TIME(LOCAL)
    - ► Formats only trace records associated with the requested ASID
  - IP SYSTRACE ALL TIME(LOCAL)
    - ► Formats trace records for all active address spaces in the system
- **Refer to z/OS MVS Diagnosis: Tools and Service Aids manual, Chapter 8, for more details on System Trace**

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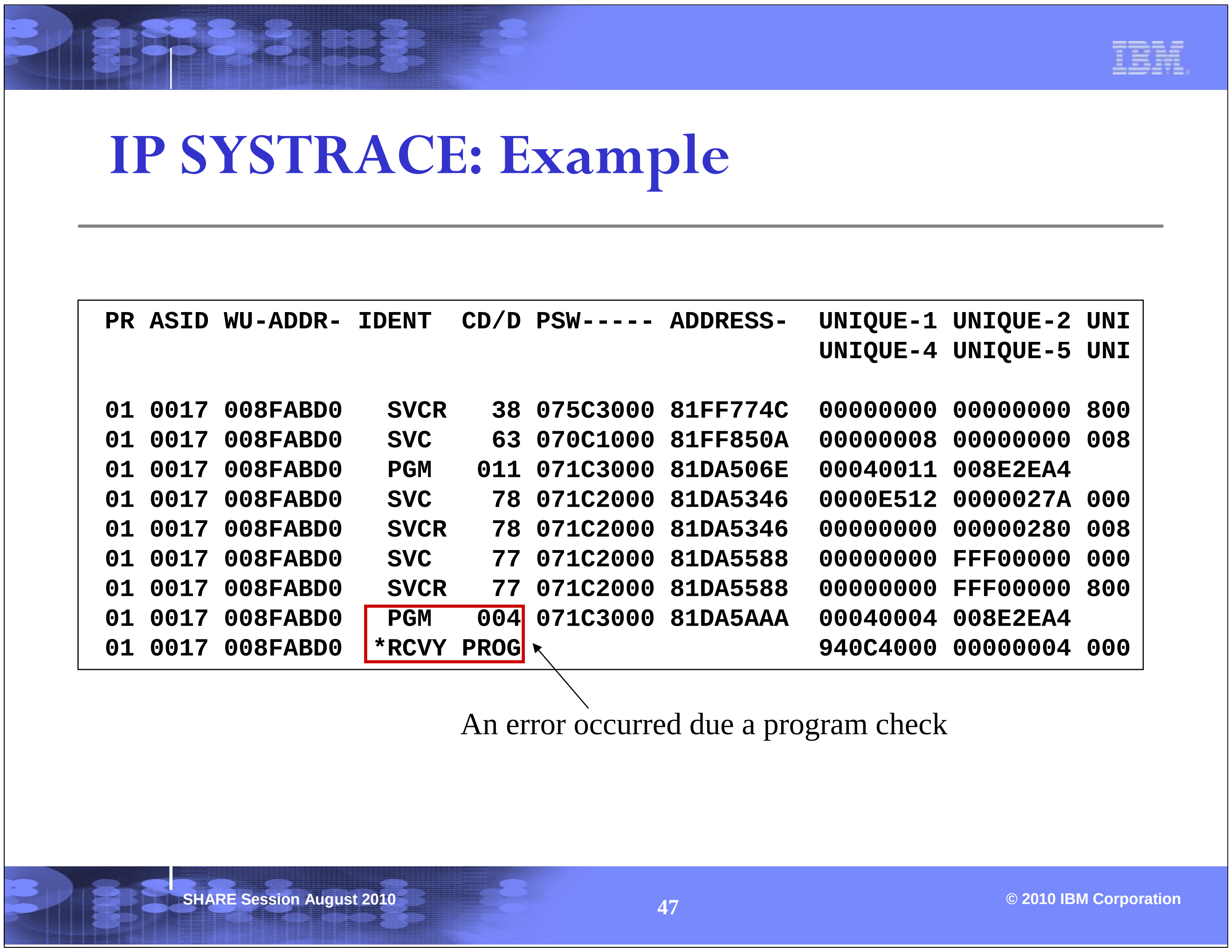
The TIME(LOCAL) parameter converts the time in SYSTRACE to local time. The default is raw timestamps.



IP SYSTRACE: Example

```
PR ASID WU-ADDR- IDENT  CD/D PSW----- ADDRESS-  UNIQUE-1 UNIQUE-2 UNI
                                                UNIQUE-4 UNIQUE-5 UNI

01 0017 008FABD0   SVCR   38 075C3000 81FF774C  00000000 00000000 800
01 0017 008FABD0   SVC    63 070C1000 81FF850A  00000008 00000000 008
01 0017 008FABD0   PGM   011 071C3000 81DA506E  00040011 008E2EA4
01 0017 008FABD0   SVC    78 071C2000 81DA5346  0000E512 0000027A 000
01 0017 008FABD0   SVCR   78 071C2000 81DA5346  00000000 00000280 008
01 0017 008FABD0   SVC    77 071C2000 81DA5588  00000000 FFF00000 000
01 0017 008FABD0   SVCR   77 071C2000 81DA5588  00000000 FFF00000 800
01 0017 008FABD0   PGM   004 071C3000 81DA5AAA  00040004 008E2EA4
01 0017 008FABD0  *RCVY PROG                    940C4000 00000004 000
```

An error occurred due a program check

A PGM entry means a program interrupt occurred and a RCVY entry means RTM (Recovery Termination Manager) was entered to process the error. It is always a good practice to look for RCVY entries in the trace table.

IP SUMM FORMAT ASID(x'nn')

- **Formats the key control blocks of an address space**
  - First scroll down to bottom to see the TCB summary

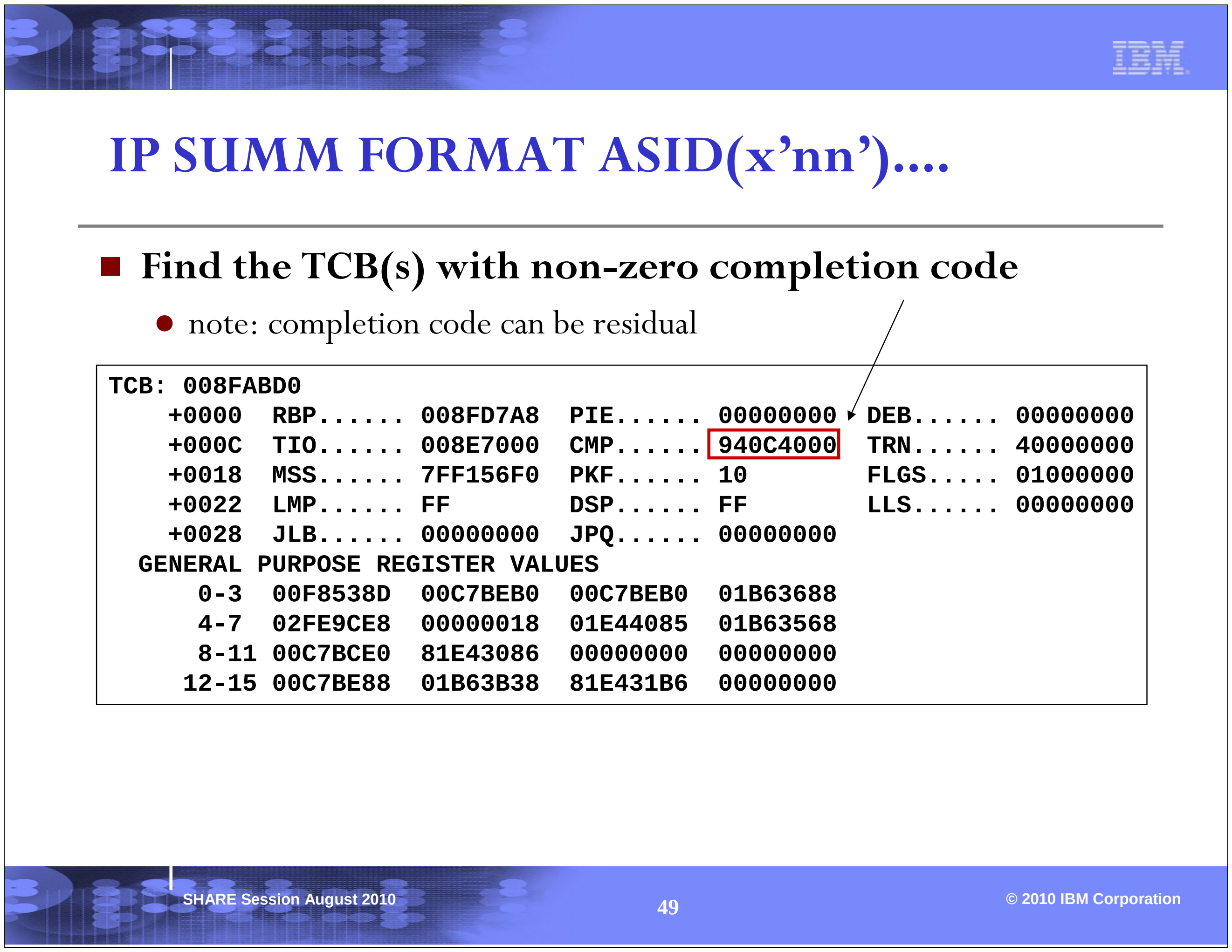
```
 * * * *   T C B   S U M M A R Y   * * * *

JOB CONSOLE  ASID 000B ASCB 00FA8080 FWDP 00000000 BWDP 00000000
00000008
    TCB AT    CMP      NTC      OTC      LTC      TCB      BACK
   008FE050 00000000 00000000 00000000 008FF890 008FD0D0 00000000
   008FD0D0 00000000 00000000 008FE050 00000000 008FF890 008FE050
   008FF890 00000000 008FD0D0 008FE050 008F0938 008FF2A0 008FD0D0
   008FF2A0 00000000 00000000 008FF890 008F92F0 008F9E88 008FF890
   008F9E88 00000000 008FF2A0 008FF890 00000000 008F9CF0 008FF2A0
   .....
   ...
   008FABD0 940C4000 00000000 008F5170 00000000 00000000 00647E88
```

Lines omitted here

non-zero completion code (ABEND0C4)

The SUMMARY subcommand can be used to format the control blocks of an address space. The TCBs in the address space should be investigated for any recent errors. At the bottom of the SUMM FORMAT output is the TCB summary. Note any TCBs with non-zero completion code under the CMP field.

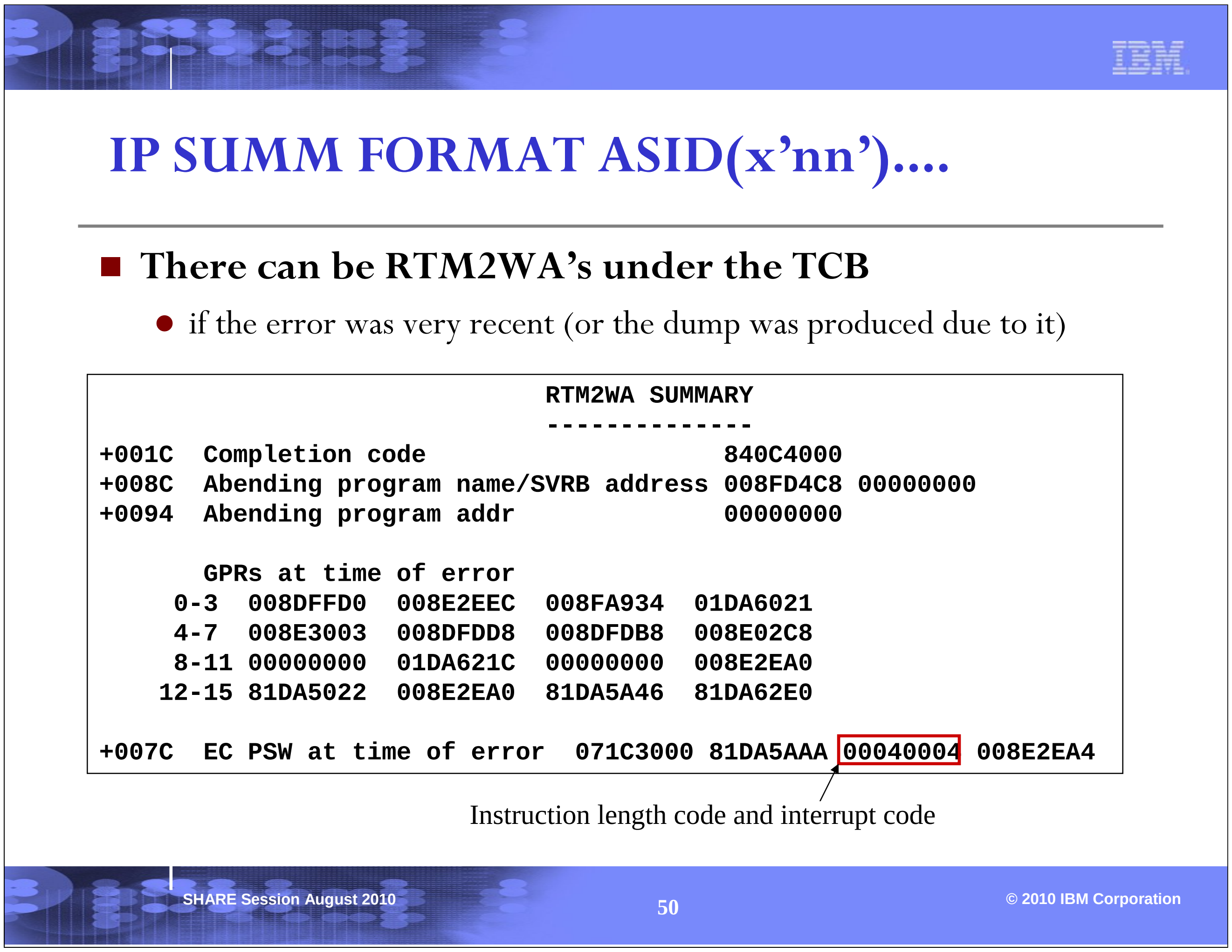


IP SUMM FORMAT ASID(x’nn’)....

- Find the TCB(s) with non-zero completion code
  - note: completion code can be residual

```
TCB: 008FABD0
    +0000  RBP...... 008FD7A8  PIE...... 00000000  DEB...... 00000000
    +000C  TIO...... 008E7000  CMP...... 940C4000  TRN...... 40000000
    +0018  MSS...... 7FF156F0  PKF...... 10        FLGS..... 01000000
    +0022  LMP...... FF        DSP...... FF        LLS...... 00000000
    +0028  JLB...... 00000000  JPQ...... 00000000
  GENERAL PURPOSE REGISTER VALUES
      0-3  00F8538D  00C7BEB0  00C7BEB0  01B63688
      4-7  02FE9CE8  00000018  01E44085  01B63568
      8-11 00C7BCE0  81E43086  00000000  00000000
     12-15 00C7BE88  01B63B38  81E431B6  00000000
```

Once you found a TCB with non-zero completion code, you can issue a FIND of ‘TCB: 00xxxxxx’ from the top of the output to find the TCB. The error under this TCB may be the one causing the dump to be taken. Or it can be a residual completion code.



IP SUMM FORMAT ASID(x’nn’)….

- There can be RTM2WA’s under the TCB
  - if the error was very recent (or the dump was produced due to it)

```
                             RTM2WA  SUMMARY
                             --------------
+001C  Completion code                    840C4000
+008C  Abending program name/SVRB address 008FD4C8 00000000
+0094  Abending program addr              00000000

       GPRs at time of error
     0-3  008DFFD0  008E2EEC  008FA934  01DA6021
     4-7  008E3003  008DFDD8  008DFDB8  008E02C8
     8-11 00000000  01DA621C  00000000  008E2EA0
    12-15 81DA5022  008E2EA0  81DA5A46  81DA62E0

+007C  EC PSW at time of error  071C3000 81DA5AAA 00040004 008E2EA4
```

Instruction length code and interrupt code

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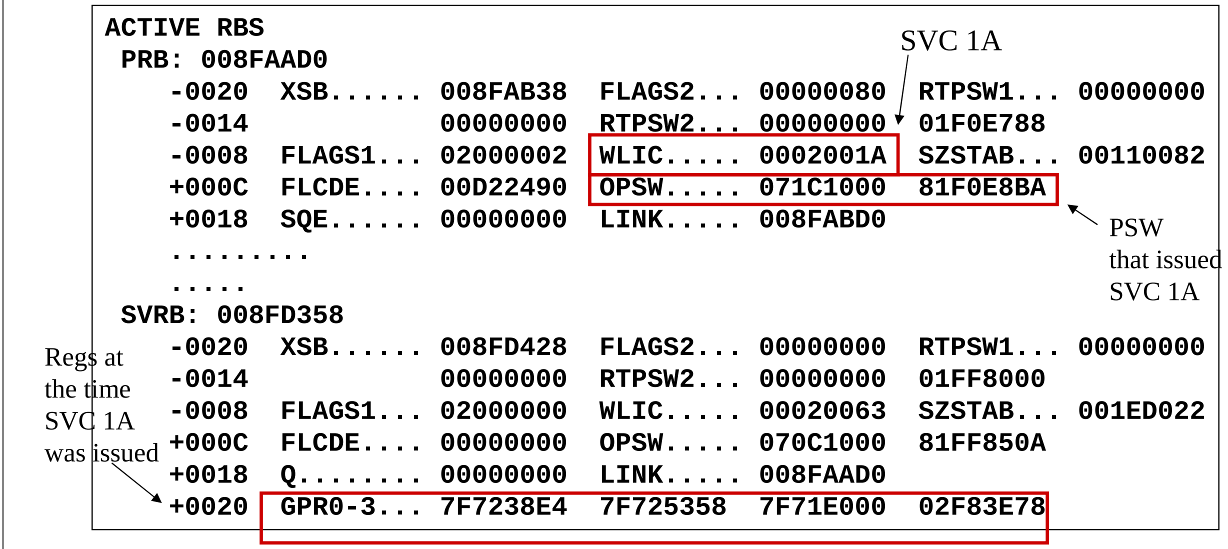
If the TCB is going through recovery processing for the error in the completion code, you will find a RTM2WA (RTM2 Work Area) after the TCB. The above shows the RTM2WA Summary which contains the PSW at time of error and the registers, as well as the instruction length code, interrupt code, and the translation exception address (not applicable in this case since the interrupt code represents a protection exception).

The Translation Exception Address is the address that caused a PIC 10,11,38,39,3A or 3B.

IP SUMM FORMAT ASID(x'nn')....

- **There are RBs under each TCB**
  - RBs are used to save status after an interrupt (usually an SVC)

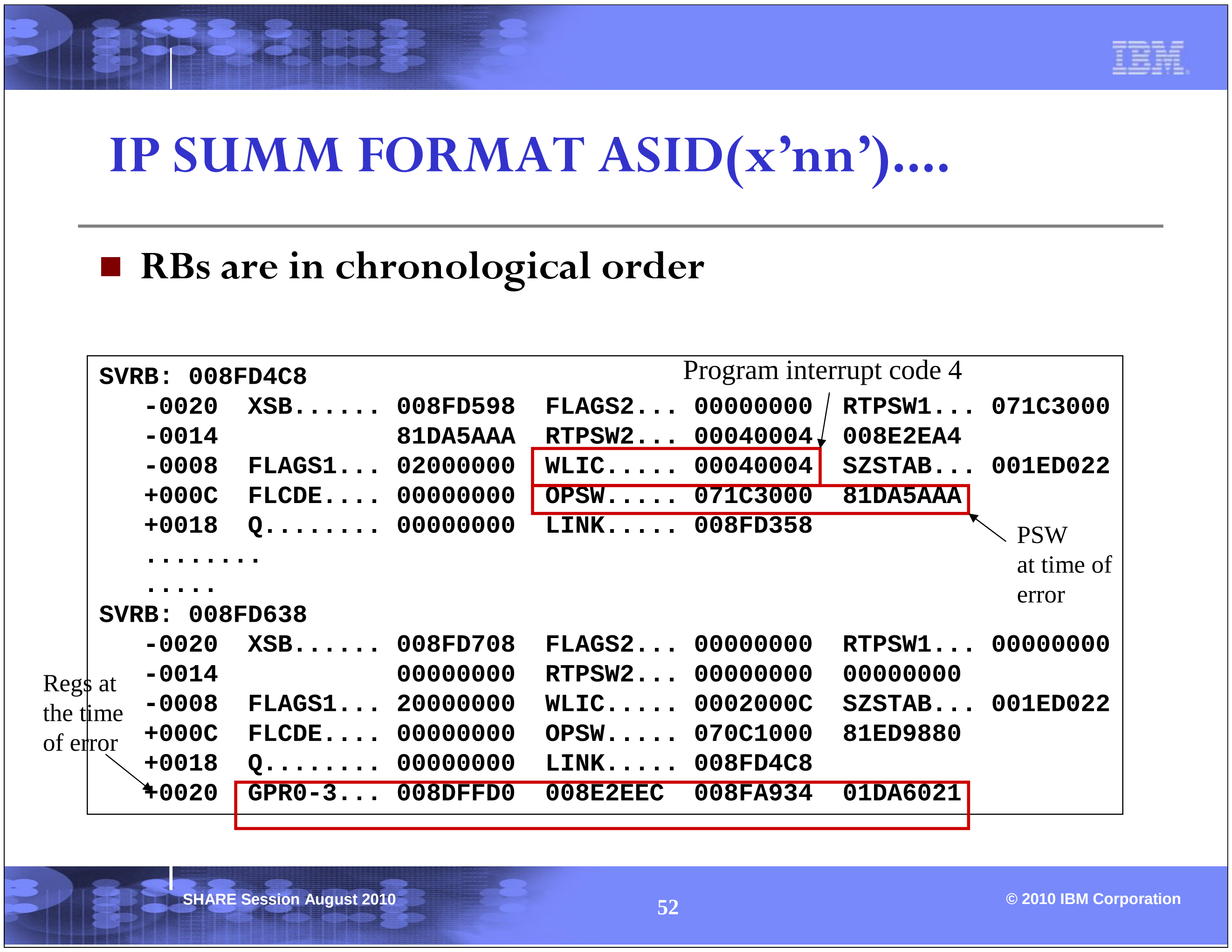


```
ACTIVE RBS
 PRB: 008FAAD0
    -0020  XSB...... 008FAB38  FLAGS2... 00000080  RTPSW1... 00000000
    -0014            00000000  RTPSW2... 00000000  01F0E788
    -0008  FLAGS1... 02000002  WLIC..... 0002001A  SZSTAB... 00110082
    +000C  FLCDE.... 00D22490  OPSW..... 071C1000  81F0E8BA
    +0018  SQE...... 00000000  LINK..... 008FABD0
    .........
    .....
 SVRB: 008FD358
    -0020  XSB...... 008FD428  FLAGS2... 00000000  RTPSW1... 00000000
    -0014            00000000  RTPSW2... 00000000  01FF8000
    -0008  FLAGS1... 02000000  WLIC..... 00020063  SZSTAB... 001ED022
    +000C  FLCDE.... 00000000  OPSW..... 070C1000  81FF850A
    +0018  Q........ 00000000  LINK..... 008FAAD0
    +0020  GPR0-3... 7F7238E4  7F725358  7F71E000  02F83E78
```

The RBs are used to save status (PSW and Registers) after an interrupt, and can be used to show the recent activity of the TCB.

In the SUMM FORMAT output, RBs are listed in chronological order: oldest RB at the top, most recent RB at the bottom. Note that each TCB has RBs under it, so make sure that you are looking at the right ones. Check RBLINK field (offset x'1C') of the first RB, it contains the TCB address. RBLINK in subsequent RBs points backwards to the previous RB.

In this example, the first RB indicates that an SVC x'1A' (LOCATE SVC) was issued at 1F0E8BA. The WLIC field contains the instruction length code and the interrupt code, and an SVC instruction has a length of 2 bytes. The registers at the time of the SVC x'1A' were saved in the next RB (an SVRB). Then an SVC x'63' (DYNAMIC ALLOCATION SVC) was issued from 1FF850A. The registers at the time of the SVC x'63' were saved in the next SVRB (see next page).



IP SUMM FORMAT ASID(x'nn')….

- RBs are in chronological order

Program interrupt code 4

```
SVRB: 008FD4C8
    -0020  XSB...... 008FD598  FLAGS2... 00000000  RTPSW1... 071C3000
    -0014            81DA5AAA  RTPSW2... 00040004  008E2EA4
    -0008  FLAGS1... 02000000  WLIC..... 00040004  SZSTAB... 001ED022
    +000C  FLCDE.... 00000000  OPSW..... 071C3000  81DA5AAA
    +0018  Q........ 00000000  LINK..... 008FD358
    ........
    .....
SVRB: 008FD638
    -0020  XSB...... 008FD708  FLAGS2... 00000000  RTPSW1... 00000000
    -0014            00000000  RTPSW2... 00000000  00000000
    -0008  FLAGS1... 20000000  WLIC..... 0002000C  SZSTAB... 001ED022
    +000C  FLCDE.... 00000000  OPSW..... 070C1000  81ED9880
    +0018  Q........ 00000000  LINK..... 008FD4C8
    +0020  GPR0-3... 008DFFD0  008E2EEC  008FA934  01DA6021
```

PSW at time of error

Regs at the time of error

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Then under the processing of the SVC x'63', a program check occurred (protection exception) at 1DA5AAA. The WLIC field has 0004004. This does not represent an SVC interrupt because the instruction length is 4. It was a program interrupt. The registers at the time of error were saved in the next SVRB. The second SVRB in the picture represents RTM processing after the PIC 4.

Note that eventually you will reach the bottom RB (the most recent RB). This most recent RB is called the Top RB and is pointed to by TCBRBP (sorry, it is confusing, the Top RB is at the bottom). The registers of the Top RB are saved in the TCB.

Reference Information

- **Manuals**
  - z/OS MVS IPCS Commands
  - z/OS MVS IPCS Customization
  - z/OS MVS IPCS User’s Guide
  - z/OS MVS Diagnosis: Reference
  - z/OS MVS Diagnosis: Tools and Service Aids
  - z/OS MVS System Codes

Index