# Identifying and Resolving Db2 System Problems

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## Objectives

## Identifying and Resolving Db2 System Problems

In this module, you will look at some problem scenarios associated with system aspects of Db2 and the type of data you may need to obtain to assist with problem analysis. You will discover the commands used for creating Db2 dumps and for starting and stopping Db2 traces. Finally you will be presented with a brief overview of the Db2 backup and recovery strategies and utilities used to ensure the consistency of Db2 data.

After completing this module, you will be able to:

- Identify Solutions to Db2 Problem Scenarios
- Identify the Types of Data That Need to be Gathered for Problem Analysis
- Run Dumps and Traces for Db2
- Describe Db2 Backup and Recovery Processing

How do you handle DB2 if the z/OS system fails?

What if there are problems writing to the active or archive logs?

What action do you take if there are units of recovery left incomplete during a DB2 restart?

If there are I/O errors with the bootstrap data set, what should you do?

This section looks at several Db2 problem scenarios and identifies the steps that you can take as an operator to diagnose and resolve the problem.

DB2 operator

```
$HASP373 DB1ADIST STARTED
DSNY024I  -DB1A DSNYASCP DIST INITIALIZATION IS STARTING
DSNR001I  -DB1A RESTART INITIATED
DSNR003I  -DB1A RESTART...PRIOR CHECKPOINT RBA=00042C2139DF
DSNR004I  -DB1A RESTART...UR STATUS COUNTS
IN COMMIT=0, INDOUBT=2, INFLIGHT=0, IN ABORT=1, POSTPONED ABORT=3
DSNR005I  -DB1A RESTART...COUNTS AFTER FORWARD RECOVERY
```

Postponed abort in the restart messages indicates the number of units of work that could not perform backout when DB2 was last brought down. If automatic recovery is not enabled, a –RECOVER POSTPONED command will need to be issued.

If the system has failed or a hardware or software problem necessitates an IPL of the system, it will probably mean that Db2 was unable to be brought down gracefully. If you have any warning that you are about to lose the system then you can attempt the -STOP DB2 MODE(FORCE) command, which will terminate currently executing programs, including utilities. This will enable Db2 to provide a more controlled restart.

**Click** **Play** to view the steps that should be taken if the z/OS system fails and you cannot enter this command.

DB2 operator

Any information, such as the abend dump which was taken in the example here, needs to be passed to the relevant DB2 specialist.
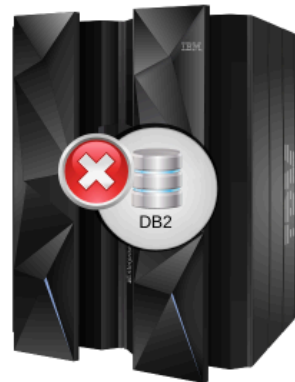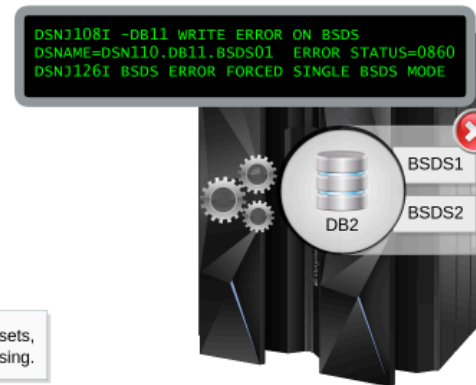
The Internal Resource Lock Manager (IRLM) forms an integral part of the overall Db2 data processing strategy as it controls access to data. If IRLM fails it may produce a message similar to the one shown in the simulation above, and will terminate Db2.

**Click** **Play** to see the steps that should be taken in this scenario.

DB2 operator

In this scenario, because there are two bootstrap data sets, DB2 will enter single BSDS mode and continue processing.

```
DSNJ108I -DB11 WRITE ERROR ON BSDS
DSNAME=DSN110.DB11.BSDS01  ERROR STATUS=0860
DSNJ126I BSDS ERROR FORCED SINGLE BSDS MODE
```

Generally there are two bootstrap data sets (BSDS) created for your Db2 subsystem because this data set contains information that is critical to Db2. In the situation where one BSDS cannot be accessed because of an I/O error, it needs to be recovered as soon as possible.

**Click** **Play** to see the steps that should be taken in this scenario, in consultation with the systems programmer.

DSNJ111E - OUT OF SPACE IN ACTIVE LOG DATA SETS

D R,L

DB2 operator

You will need to enter system commands that identify whether the log offload process is being held up by an outstanding system request.

DB2

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The logs contain records of all data changes and other significant Db2 events and are used during restart and recovery to restore the Db2 system to a consistent state. A number of possible problems can occur with the logs such as out-of-space conditions, write or read I/O errors, or loss of dual active logging.

**Click** **Play** to see the steps that should be taken with an out of space scenario.
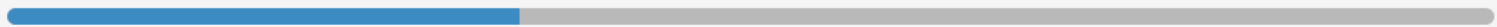
How do you perform a dump on a DB2 address space?

What data should you gather if DB2 hangs?

How do you start a DB2 trace and what type of information will it gather?

Which commands will provide me with additional system data?

This section focuses on identifying the data that you will need to gather when problems such as those discussed in the previous section of this module, occur.

You may already have a process in place when serious Db2 errors occur, which will no doubt contain additional requirements to the generic items discussed here.

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```
******************************* TOP OF DATA *******************************
J E S 2   J O B   L O G  --  S Y S T E M   S Ø W 1  --  N O D E   S V S C J E S 2

---- SATURDAY,  29 NOV 2014 ----
IEF695I START DBAGMSTR WITH JOBNAME DBAGMSTR IS ASSIGNED TO USER STCOPER , GROU
$HASP373 DBAGMSTR STARTED
DSNYØ24I  -DBAG DSNYASCP MSTR INITIALIZATION IS STARTING
DSNZØØ2I -DBAG DSNZINIT SUBSYSTEM DBAG SYSTEM PARAMETERS LOAD MODULE NAME IS DB
DSNZØ16I  -DBAG DSNZINIT
```

DB2 logs

```
SDSF SYSLOG   4555.1Ø2 SØW1 SØW1 11/23/2014 ØW
  COMMAND INPUT ===>                                          SCROLL ===> CSR
Ø29Ø  S DBAGIRLM
Ø281  $HASP1ØØ DBAGIRLM ON STCINRDR
Ø29Ø  IEF695I START DBAGIRLM WITH JOBNAME DBAGIRLM IS ASSIGNED TO USER STCOPER
      , GROUP GROUPZ
ØØ9Ø  $HASP373 DBAGIRLM STARTED
ØØ9Ø  DXR18ØI DJAGØØ1 AUTOMATIC RESTART MANAGER IS NOT ENABLED
ØØ9Ø  DXR117I DJAGØØ1 INITIALIZATION COMPLETE
ØØ9Ø  DSNYØØ1I  -DBAG SUBSYSTEM STARTING
ØØ9Ø  DSNJ127I  -DBAG SYSTEM TIMESTAMP FOR BSDS= 14.348 16:39:27.21
```

When problems result in Db2 failing, you need to gather as much relevant data as possible so you, the DBA, or system programmer can determine the circumstances and resolve the problem so it does not occur again.

The first type of data you will usually need to gather focuses on the activity that was occurring at the time of the error. The system log can identify system-wide activity that was occurring at the time of the error. A copy of the JES2 job log for the failing Db2 address space should also be obtained as this provides specific details experienced by that Db2 component. A copy of the Db2 logs is useful, and there are several utilities that the DBA and system programmer can use for printing and formatting data within them.

DB2 operator

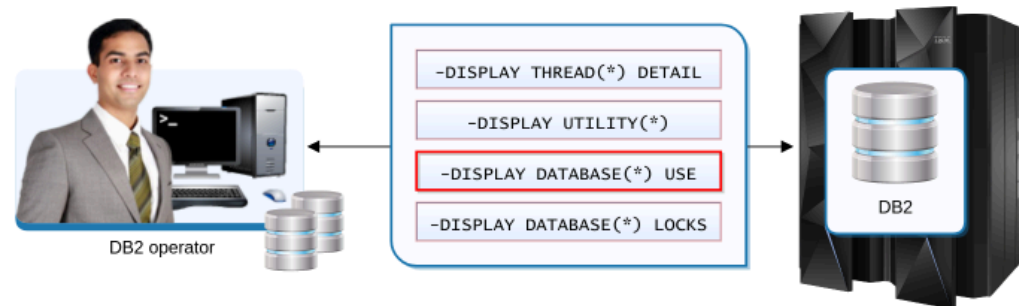D GRS,CONTENTION

D A,ALL

D SSI,ALL
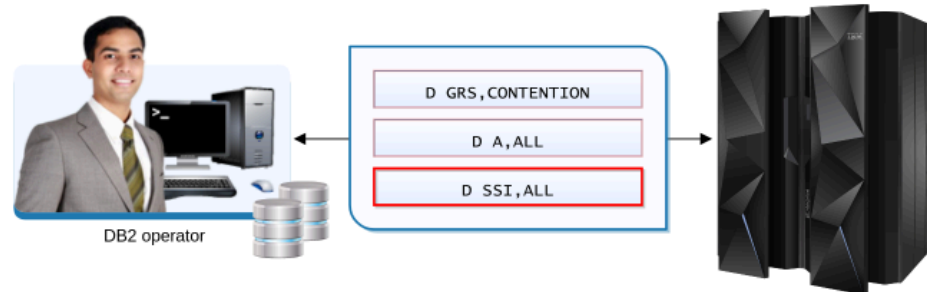
This command is used to display the following information about all subsystems defined to z/OS.

```
IEFJ100I  06.31.47  SSI DISPLAY
 SUBSYS=JES2 (PRIMARY)
    DYNAMIC=YES      STATUS=ACTIVE        COMMANDS=REJECT
    FUNC=  1   2   3   4   5   6   7   8   9  10  11  12  13  16  17  18
          19  20  21  53  54  64  70  71  75  77  79  80  81  82  83  84
          85
 SUBSYS=DB11
    DYNAMIC=NO       STATUS=ACTIVE        COMMANDS=N/A
    FUNC=  4   8  10  41  50
 SUBSYS=IRLM
    DYNAMIC=YES      STATUS=INACTIVE      COMMANDS=REJECT
    FUNC=NONE
```

If the Db2 problem prevents any Db2 commands from being issued, then there are several MVS commands that may provide useful information about the state of the system when Db2 became hung or failed.

**Mouse-over** the commands above for a description of the information they provide.

```
-DISPLAY THREAD(*) DETAIL

-DISPLAY UTILITY(*)

-DISPLAY DATABASE(*) USE

-DISPLAY DATABASE(*) LOCKS
```

DB2 operator

DB2

This command displays table spaces and indexes spaces for all databases within the DB2 subsystem that are currently in use and shows connection information for the thread linked with the activity.

If the Db2 problem does allow you to issue commands, several commands such as those displayed here, may provide valuable information.

**Mouse-over** the commands above for a description of the information they provide.

```
   DYNAMIC=NO        STATUS=INACTIVE     COMMANDS=N/A
 FUNC=NONE
SUBSYS=DB1A
   DYNAMIC=NO        STATUS=ACTIVE       COMMANDS=N/A
 FUNC=  4   8  10  41  50
SUBSYS=DJ1A
   DYNAMIC=NO        STATUS=ACTIVE       COMMANDS=N/A
 FUNC= 51
SUBSYS=DB1B
   DYNAMIC=NO        STATUS=ACTIVE       COMMANDS=N/A
 FUNC=  8  10  41  50
SUBSYS=DJ1B
   DYNAMIC=NO        STATUS=INACTIVE     COMMANDS=N/A
 FUNC=NONE
SUBSYS=CICS
   DYNAMIC=YES       STATUS=ACTIVE       COMMANDS=REJECT
 FUNC=  4   8   9  73
SUBSYS=AXR
   DYNAMIC=YES       STATUS=ACTIVE       COMMANDS=REJECT
 FUNC= 10

IEE612I CN=C01    DEVNUM=160 SYS=PROD
dump comm=(dump of db2 mstr)
IEE163I MODE= RD
```

**Step 1 of 3**

If Db2 is not responsive and does not accept any commands you enter, then it could indicate a hang situation. In this scenario, you may be instructed to create a dump of the problem address space before having to cancel Db2.

**Type** **DUMP COMM=(DUMP OF DB2 MSTR)** and **press** **Enter** to initiate the dump process.

```
SUBSYS=DB1A
   DYNAMIC=NO        STATUS=ACTIVE        COMMANDS=N/A
  FUNC=  4   8  10  41  50
SUBSYS=DJ1A
   DYNAMIC=NO        STATUS=ACTIVE        COMMANDS=N/A
  FUNC= 51
SUBSYS=DB1B
   DYNAMIC=NO        STATUS=ACTIVE        COMMANDS=N/A
  FUNC=  8  10  41  50
SUBSYS=DJ1B
   DYNAMIC=NO        STATUS=INACTIVE      COMMANDS=N/A
  FUNC=NONE
SUBSYS=CICS
   DYNAMIC=YES       STATUS=ACTIVE        COMMANDS=REJECT
  FUNC=  4   8   9  73
SUBSYS=AXR
   DYNAMIC=YES       STATUS=ACTIVE        COMMANDS=REJECT
  FUNC= 10
 DUMP COMM=(DUMP OF DB2 MSTR)
*08 IEE094D SPECIFY OPERAND(S) FOR DUMP COMMAND

IEE612I CN=C01    DEVNUM=160 SYS=PROD
r 08,jobname=(db11mstr)
IEE163I MODE= RD
```

**Step 2 of 3**

You can see from the console screen that you are prompted to enter the address space to be dumped. You are going to dump the MSTR Db2 address space, but the DIST, IRLM, and DBM1 address spaces can also be specified if required and are separated by commas in the command.

**Type** **R 08,JOBNAME=(DB11MSTR)** and **press** **Enter** to dump the MSTR address space.

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```
SUBSYS=CICS
   DYNAMIC=YES        STATUS=ACTIVE        COMMANDS=REJECT
 FUNC=  4   8   9   73
SUBSYS=AXR
   DYNAMIC=YES        STATUS=ACTIVE        COMMANDS=REJECT
 FUNC= 10
 DUMP COMM=(DUMP OF DB2 MSTR)
*08 IEE094D SPECIFY OPERAND(S) FOR DUMP COMMAND
 R 08,JOBNAME=(DB11MSTR)
 IEE600I REPLY TO 08 IS;JOBNAME=(DB11MSTR)
 IEA045I AN SVC DUMP HAS STARTED AT TIME=08.07.03 DATE=11/30/2014
 FOR ASID (0038)
 QUIESCE = YES
 IEA794I SVC DUMP HAS CAPTURED:
 DUMPID=001 REQUESTED BY JOB (*MASTER*)
 DUMP TITLE= DUMP OF DB2 MSTR
 IEA611I COMPLETE DUMP ON MVS1.SVCDUMP.S0w1.D141130.T130703.S00001
 DUMPID=001 REQUESTED BY JOB (*MASTER*)
 FOR ASID (0022)
 INCIDENT TOKEN: SYSPLEXA S0w1      11/30/2014 08.07.03

IEE612I CN=C01    DEVNUM=160 SYS=PROD

IEE163I MODE= RD
```

---

**Step 3 of 3**

In this scenario your response has been received and a successful dump has been taken.

A number of other operands can be specified with your dump response including specific storage areas to be dumped. If you require this level of information you should reference IBM's MVS System Commands manual for the appropriate command syntax.

```
SUBSYS=CICS
   DYNAMIC=YES      STATUS=ACTIVE       COMMANDS=REJECT
  FUNC=  4   8   9  73
SUBSYS=AXR
   DYNAMIC=YES      STATUS=ACTIVE       COMMANDS=REJECT
  FUNC= 10
  DUMP COMM=(DUMP OF DB2 MSTR)
*08 IEE094D SPECIFY OPERAND(S) FOR DUMP COMMAND
 R 08,JOBNAME=(DB11MSTR)
 IEE600I REPLY TO 08 IS;JOBNAME=(DB11MSTR)
 IEA045I AN SVC DUMP HAS STARTED AT TIME=08.07.03 DATE=11/30/2014
 FOR ASID (0038)
 QUIESCE = YES
 IEA794I SVC DUMP HAS CAPTURED:
 DUMPID=001 REQUESTED BY JOB (*MASTER*)
 DUMP TITLE= DUMP OF DB2 MSTR
 IEA611I COMPLETE DUMP ON MVS1.SVCDUMP.S0w1.D141130.T130703.S00001
 DUMPID=001 REQUESTED BY JOB (*MASTER*)
 FOR ASID (0022)
 INCIDENT TOKEN: SYSPLEXA S0w1      11/30/2014 08.07.03

IEE612I CN=C01    DEVNUM=160 SYS=PROD
-db11 display TRACE(*)
IEE163I MODE= RD
```

If there are problems, you may be instructed to run a trace on Db2. Your first task should be to check the current trace settings.

**Type** -DB11 DISPLAY TRACE(*) and **press** Enter to see this information.

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```
R 08,JOBNAME=(DB11MSTR)
IEE600I REPLY TO 08 IS;JOBNAME=(DB11MSTR)
IEA045I AN SVC DUMP HAS STARTED AT TIME=08.07.03 DATE=11/30/2014
FOR ASID (0038)
QUIESCE = YES
IEA794I SVC DUMP HAS CAPTURED:
DUMPID=001 REQUESTED BY JOB (*MASTER*)
DUMP TITLE= DUMP OF DB2 MSTR
IEA611I COMPLETE DUMP ON MVS1.SVCDUMP.S0w1.D141130.T130703.S00001
DUMPID=001 REQUESTED BY JOB (*MASTER*)
FOR ASID (0022)
INCIDENT TOKEN: SYSPLEXA S0w1      11/30/2014 08.07.03
-DB11 DISPLAY TRACE(*)
DSNW127I  -DB11 CURRENT TRACE ACTIVITY IS - 343
TNO TYPE    CLASS        DEST QUAL IFCID
01  STAT    01,03,04,05, SMF  NO
01          06
02  ACCTG   01           SMF  NO
*********END OF DISPLAY TRACE SUMMARY DATA*********
DSN9022I  -DB11 DSNWVCM1 '-DISPLAY TRACE' NORMAL COMPLETION
IEE612I CN=C01   DEVNUM=160 SYS=PROD

IEE163I MODE= RD
```

This field indicates the type of trace that is active. Possible values in this field are:

ACCTG - accounting records
AUDIT - audit data
MONITOR - monitor data
PERFM - performance records
STAT - statistical data

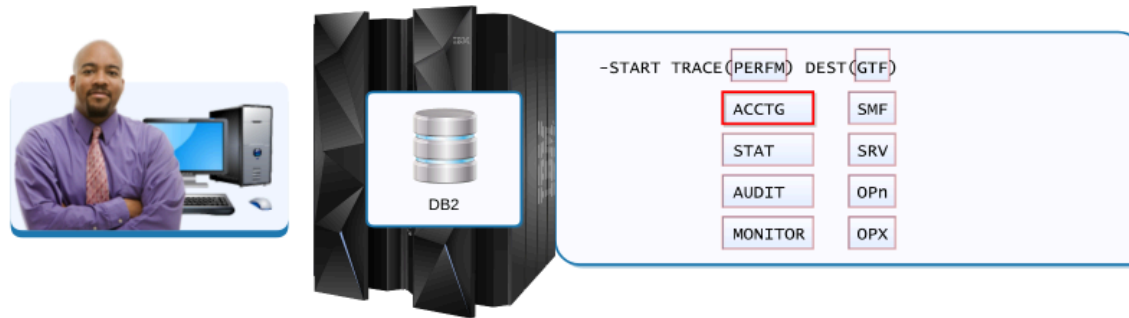The response from this command provides information on active traces.

**Mouse-over** the responses for a description of that information.

```
DUMPID=001 REQUESTED BY JOB (*MASTER*)
 FOR ASID (0022)
 INCIDENT TOKEN: SYSPLEXA SOw1    11/30/2014 08.07.03
 -DB10 DISPLAY TRACE(*)
 DSNW127I  -DB11 CURRENT TRACE ACTIVITY IS - 343
 TNO TYPE    CLASS         DEST QUAL IFCID
 01  STAT   01,03,04,05, SMF  NO
 01      06
 02  ACCTG  01                 SMF  NO
 ********END OF DISPLAY TRACE SUMMARY DATA*********
 DSN9022I  -DB11 DSNWVCM1 '-DISPLAY TRACE' NORMAL COMPLETION
 -DB11 MODIFY TRACE(STAT) TNO(1) IFCID(1,2,3) CLASS(01)
 DSNW130I  -DB11 STAT TRACE STARTED, ASSIGNED TRACE NUMBER 01
 DSN9022I  -DB11 DSNWVCM1 '-MODIFY TRACE' NORMAL COMPLETION
 DSNW127I  -DB11 CURRENT TRACE ACTIVITY IS -
 TNO TYPE    CLASS         DEST QUAL IFCID
 01  STAT   01             SMF  NO   001,002,003
 02  ACCTG  01             SMF  NO
 ********END OF DISPLAY TRACE SUMMARY DATA*********
 DSN9022I  -DB11 DSNWVCM1 '-DISPLAY TRACE' NORMAL COMPLETION

 IEE612I CN=C01   DEVNUM=160 SYS=PROD

 IEE163I MODE= RD
```

You are able to change the trace events being used by an active trace using the -MODIFY TRACE command.

In the example shown here, the -DB11 MODIFY TRACE(STAT) TNO(1) IFCID(1,2,3) CLASS(01) command has been entered to modify trace number one so that class type one accepts additional trace events. A display command is then re-entered to show the change.

```
-START TRACE(PERFM) DEST(GTF)
         ACCTG        SMF
         STAT         SRV
         AUDIT        OPn
         MONITOR      OPX
```

DB2

Depending on the classes you select to run, the accounting trace can also vary greatly in its impact on the DB2 subsystem.

The traces you have seen so far have been active already but you may be instructed to start one that is not currently running. You need to be aware that when starting any trace there is likely to be an overhead associated with the performance of the actively running Db2 subsystem. The examples above display the most commonly used syntax for various types of traces that can be started.

**Mouse-over** the options for an example of their purpose.

```
DUMPID=001 REQUESTED BY JOB (*MASTER*)
 FOR ASID (0022)
 INCIDENT TOKEN: SYSPLEXA S0w1      11/30/2014 08.07.03
 -DB11 DISPLAY TRACE(*)
 DSNW127I  -DB11 CURRENT TRACE ACTIVITY IS - 343
 TNO TYPE    CLASS          DEST QUAL IFCID
 01  STAT    01,03,04,05, SMF  NO
 01        06
 02  ACCTG  01              SMF  NO
 *********END OF DISPLAY TRACE SUMMARY DATA*********
 DSN9022I  -DB11 DSNWVCM1 '-DISPLAY TRACE' NORMAL COMPLETION
 -DB11 MODIFY TRACE(STAT) TNO(1) IFCID(1,2,3) CLASS(01)
 DSNW130I  -DB11 STAT TRACE STARTED, ASSIGNED TRACE NUMBER 01
 DSN9022I  -DB11 DSNWVCM1 '-MODIFY TRACE' NORMAL COMPLETION
 DSNW127I  -DB11 CURRENT TRACE ACTIVITY IS -
 TNO TYPE    CLASS          DEST QUAL IFCID
 01  STAT    01              SMF  NO   001,002,003
 02  ACCTG  01              SMF  NO
 *********END OF DISPLAY TRACE SUMMARY DATA*********
 DSN9022I  -DB11 DSNWVCM1 '-DISPLAY TRACE' NORMAL COMPLETION

IEE612I CN=C01    DEVNUM=160 SYS=PROD
-db11 start trace(perfm) class(1,2,3) dest(smf)■
IEE163I MODE= RD
```

**Step 1 of 3**

In this example, support has requested that you run a performance trace as there is an issue with the Db2 subsystem. They require classes 1, 2 and 3 of data to be gathered, with trace output to be recorded in SMF.

**Type** **-DB11 START TRACE(PERFM) CLASS(1,2,3) DEST(SMF)** and **press** **Enter** to start this trace.

```
-DB11 MODIFY TRACE(STAT) TNO(1) IFCID(1,2,3) CLASS(01)
 DSNW130I  -DB11 STAT TRACE STARTED, ASSIGNED TRACE NUMBER 01
 DSN9022I  -DB11 DSNWVCM1 '-MODIFY TRACE' NORMAL COMPLETION
 DSNW127I  -DB11 CURRENT TRACE ACTIVITY IS -
 TNO TYPE    CLASS         DEST QUAL IFCID
 01  STAT    01            SMF  NO   001,002,003
 02  ACCTG   01            SMF  NO
 *********END OF DISPLAY TRACE SUMMARY DATA*********
 DSN9022I  -DB11 DSNWVCM1 '-DISPLAY TRACE' NORMAL COMPLETION
 -DB11 START TRACE(PERFM) CLASS(1,2,3) DEST(SMF)
 DSNW130I  -DB11 PERFM TRACE STARTED, ASSIGNED TRACE NUMBER 03
 DSN9022I  -DB11 DSNWVCM1 '-START TRACE' NORMAL COMPLETION
 -DB11 DISPLAY TRACE
 DSNW127I  -DB11 CURRENT TRACE ACTIVITY IS - 653
 TNO TYPE    CLASS         DEST QUAL IFCID
 01  STAT    01            SMF  NO   001,002,003
 02  ACCTG   01            SMF  NO
 03  PERFM   01,02,03      SMF  NO
 *********END OF DISPLAY TRACE SUMMARY DATA*********
 DSN9022I  -DB11 DSNWVCM1 '-DISPLAY TRACE' NORMAL COMPLETION

IEE612I CN=C01    DEVNUM=160 SYS=PROD
-db11 stop trace(perfm)■
IEE163I MODE= RD
```

**Step 2 of 3**

The system indicates that a trace has begun. A -DB11 DISPLAY TRACE command has also been entered so that you can see that the trace is now running. When enough data has been captured and support has indicated that the trace should be halted, a -STOP TRACE command can be issued.

**Type** the **-DB11 STOP TRACE(PERFM)** command and **press** Enter to stop all performance trace activity.

```
DSNW127I   -DB11 CURRENT TRACE ACTIVITY IS -
TNO TYPE   CLASS        DEST QUAL IFCID
01  STAT   01           SMF  NO   001,002,003
02  ACCTG  01           SMF  NO
*********END OF DISPLAY TRACE SUMMARY DATA*********
DSN9022I   -DB11 DSNWVCM1 '-DISPLAY TRACE' NORMAL COMPLETION
-DB11 START TRACE(PERFM) CLASS(1,2,3) DEST(SMF)
DSNW130I   -DB11 PERFM TRACE STARTED, ASSIGNED TRACE NUMBER 03
DSN9022I   -DB11 DSNWVCM1 '-START TRACE' NORMAL COMPLETION
-DB11 DISPLAY TRACE
DSNW127I   -DB11 CURRENT TRACE ACTIVITY IS - 653
TNO TYPE   CLASS        DEST QUAL IFCID
01  STAT   01           SMF  NO   001,002,003
02  ACCTG  01           SMF  NO
03  PERFM  01,02,03     SMF  NO
*********END OF DISPLAY TRACE SUMMARY DATA*********
DSN9022I   -DB11 DSNWVCM1 '-DISPLAY TRACE' NORMAL COMPLETION
-DB11 STOP TRACE(PERFM)
DSNW131I   -DB11 STOP TRACE SUCCESSFUL FOR TRACE NUMBER(S) 03
DSN9022I   -DB11 DSNWVCM1 '-STOP TRACE' NORMAL COMPLETION

IEE612I CN=C01    DEVNUM=160 SYS=PROD

IEE163I MODE= RD
```

**Step 3 of 3**

The messages indicate that the trace has stopped and support should now be able to analyze the captured data.

It is also possible to stop specific trace information from being captured rather than all trace output, using the -STOP TRACE command. For example, entering -DB11 STOP TRACE(PERFM) CLASS (2,3) will still allow class 1 records for the performance trace to be captured. If you needed to stop all trace activity, then the -DB11 STOP TRACE(*) command can be issued.
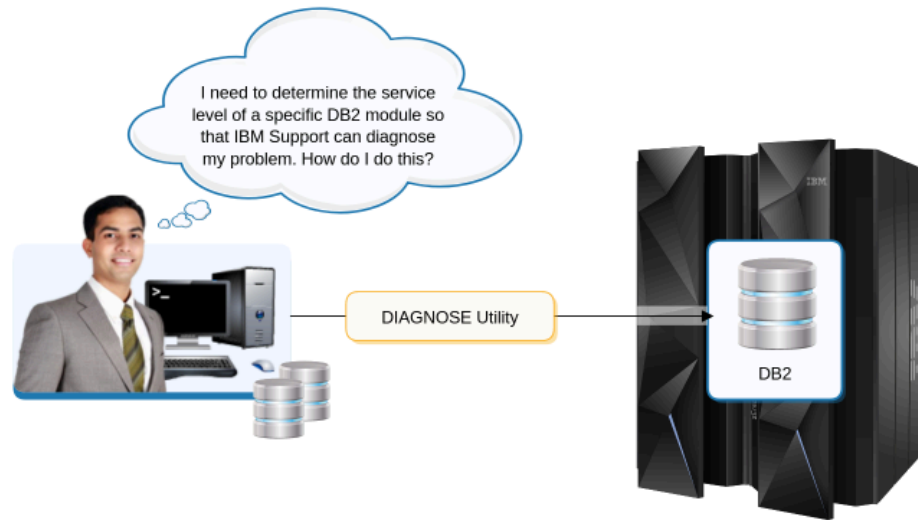
If contacted by IBM, you may be instructed to run a DIAGNOSE utility that will assist with being able to diagnose problems. This utility is able to gather and report on, a wide variety of Db2 system related activity and can be run as a batch job or from the Db2 Utilities panel within ISPF.

You can enter DB2 commands to display thread, database and utility activity.

You can enter various z/OS display commands to identify system activity.

You can create a dump for any of the DB2 address spaces.

You can start and stop a DB2 trace and modify the attributes of an active trace.

In this section you looked at a number of commands used to display data associated with Db2 and z/OS system activity.

You also discovered how to take a dump of a Db2 address space and start, stop and modify a Db2 trace.

Is there a utility to take a volume level backup of DB2 data?

How does DB2 recovery processing work?

What are incremental backups and how are they used?

Is there a utility to backup individual table spaces and index spaces?

Is there anyway to check following a restore process, that data is consistent?

This section will provide you with a broad overview of the Db2 backup and recovery process and discuss the commands and utility jobs that an operator may need to invoke to perform this processing.

```
    File  Edit  Edit_Settings  Menu  Utilities  Compilers  Test  Help
--------------------------------------------------------------------------
EDIT        DBPROD.UTILLIB(DBBACK1) - 01.02           Columns 00001 00072
Command ===>                                           Scroll ===> CSR
****** ***************************** Top of Data ******************************
000100 //DBBACK1 JOB  CLASS=A,MSGCLASS=X
000200 //MYLIB JCLLIB ORDER=PRODDB.PROCLIB
000300 //STEP1 EXEC DSNUPROC,TIME=1440,
000400 // UTPROC='',
000500 // SYSTEM='DB11'
000600 //SYSIN     DD *
000700 BACKUP SYSTEM
000800 /*
****** ************************** Bottom of Data ****************************
```

There are several parameters that can be coded to override those found in the procedure. The UTPROC parameter is used
to specify whether the utility is run from the beginning or is restarted from a particular phase. In this example it is defaulting
to starting from the beginning. The SYSTEM parameter is used to identify this job to the relevant Db2 subsystem.

If you need to take volume level copies of Db2 data and logs then the BACKUP SYSTEM utility can be used. This simple-to-use utility doesn't require that logs be suspended and allows write I/Os to continue during the backup operation. It does require that all data sets are SMS managed and if dumping system level backups to tape, then DFSMShsm V1R8 or above is needed.

**Mouse-over** the statements for more information.

```
000100 //DBFULL JOB  CLASS=A,MSGCLASS=X
000200 //MYLIB JCLLIB ORDER=DSN110.PROCLIB
000300 //STEP1 EXEC DSNUPROC,TIME=1440,
000400 // UTPROC='',
000500 // SYSTEM='DB11'
000600 //SYSCOPY  DD DSN=COPY.DSN8D10A.DSN8S10D,
000700 //          SPACE=(TRK,(10,5),RLSE),DISP=(,CATLG)
000800 //SYSIN DD *
000900 COPY TABLESPACE DSN8D10A.DSN8S10D
001000 /*
```
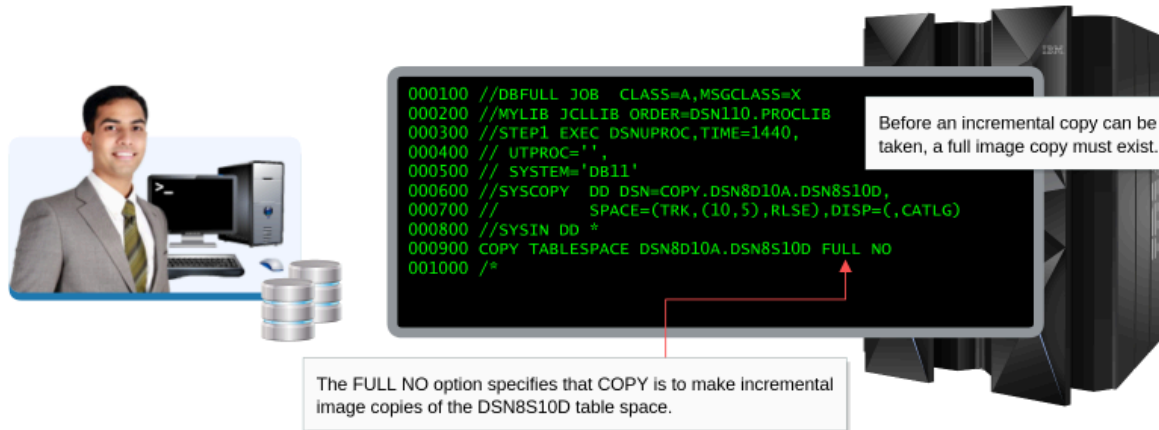
The full image copy is to be saved to this data set.

The in-stream control statements indicate that a full image copy of table space DSN8S10D in database DSN8D10A is to be made.

While the BACKUP SYSTEM utility provides Db2 system wide copying of data, the COPY utility can initiate a full image object copy, which copies all pages from an individual table space or index space. This may be useful prior to a REORG or LOAD for these objects as it provides a quick source of recovery, or it may be useful if you do not have the time or space to perform a full system backup.

While the example above is creating a single image copy, the COPY utility can also be used to simultaneously create four sequential image copies and one FlashCopy image of the object, which can be used in various recovery scenarios.

```
000100 //DBFULL JOB   CLASS=A,MSGCLASS=X
000200 //MYLIB JCLLIB ORDER=DSN110.PROCLIB
000300 //STEP1 EXEC DSNUPROC,TIME=1440,
000400 // UTPROC='',
000500 // SYSTEM='DB11'
000600 //SYSCOPY  DD DSN=COPY.DSN8D10A.DSN8S10D,
000700 //          SPACE=(TRK,(10,5),RLSE),DISP=(,CATLG)
000800 //SYSIN DD *
000900 COPY TABLESPACE DSN8D10A.DSN8S10D FULL NO
001000 /*
```

Before an incremental copy can be taken, a full image copy must exist.

The FULL NO option specifies that COPY is to make incremental image copies of the DSN8S10D table space.

The COPY utility can also be used to create incremental copies of data, that is, only those pages of data that have changed since the last copy operation, will be selected for copying.
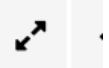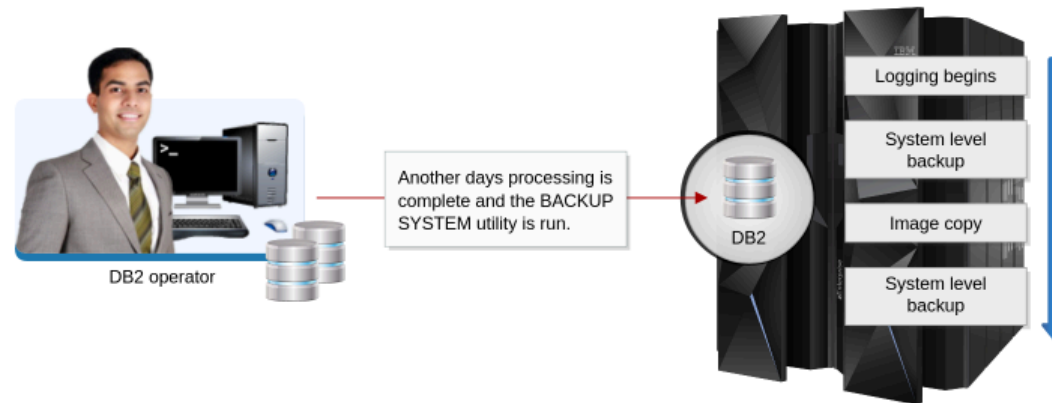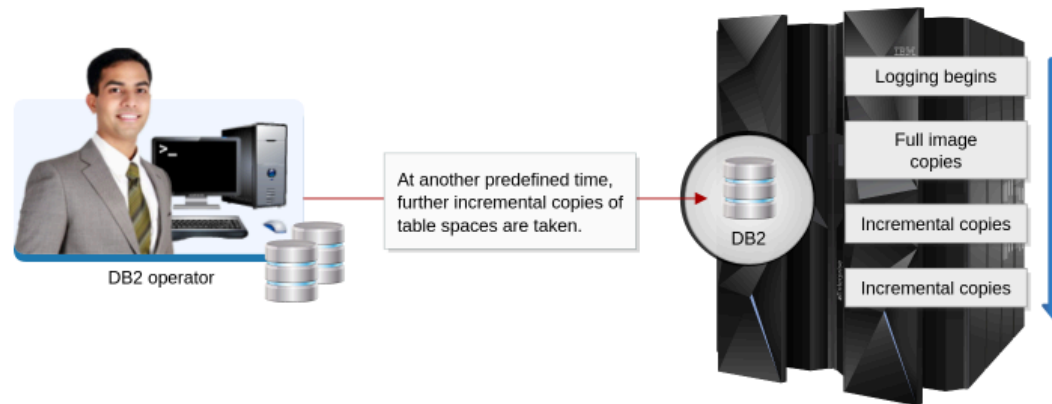
There is always a trade-off when deciding on a backup and recovery strategy. The more backups that are taken, the less time for recovery is required, but more time to create the backups is required.

**Click** **Play** to view one possible backup strategy using the BACKUP SYSTEM and COPY utilities.

In the last scenario, a full system backup was taken after each days Db2 processing. Your organization may require that backups of important Db2 data be taken more regularly so that any recovery is quicker.

**Click** **Play** to view another possible backup strategy using the COPY utility's full image and incremental capabilities.

Logging begins

Monday night
System level backup

DB2

Tuesday night
System level backup

DB2 activity throughout the day

DB2 problem

Run RESTORE SYSTEM utility

Roll forward logs

---

Obviously the method used for backing up your Db2 data will dictate the recovery method used and the length of time for recovery of data. The RESTORE SYSTEM utility uses the copied data created by the BACKUP SYSTEM utility, to restore data to that point in time, and then logs can be used to apply data changes to as recently as possible.
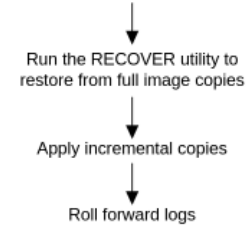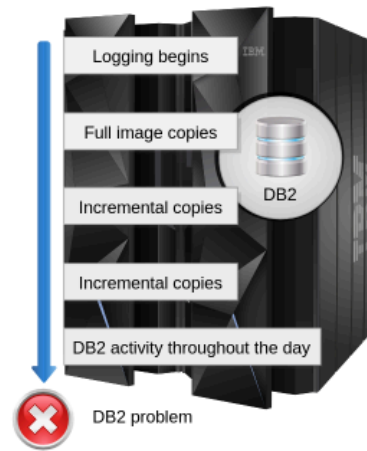
The RECOVER utility can restore individual data objects such as table spaces or indexes to a point in time when a backup was taken, and then optionally re-apply records from the log. This utility can use a combination of system backups (BACKUP SYSTEM utility), the COPY utility image copies, and logs to achieve this.

```
//SYSPRINT DD  SYSOUT=*
//SYSUDUMP DD  SYSOUT=*
//SYSUT1   DD  UNIT=3390,SPACE=(4000,(50,50),,,ROUND)
//SYSREC   DD  UNIT=3390,SPACE=(4000,(200,200),,,ROUND)
//SYSIN    DD  *

 REPORT RECOVERY TABLESPACE DSNDB06.SYSGPAUT
 REPORT RECOVERY TABLESPACE DSNDB06.SYSRTSTS
 REPORT RECOVERY TABLESPACE DSNDB06.SYSTSASC
 REPORT RECOVERY TABLESPACE DSNDB06.SYSTSUNI
```

```
  335 18:00:19.70 DSNUGUTC -  REPORT RECOVERY TABLESPACE DSNDB06.SYSGPAUT
-DBAG 335 18:00:21.91 DSNUPREC - REPORT RECOVERY TABLESPACE DSNDB06.SYSGPAUT
-DBAG 335 18:00:23.41 DSNUPREC -  REPORT RECOVERY ENVIRONMENT RECORD:
   MINIMUM   RBA: 000000000000
   MAXIMUM   RBA: FFFFFFFFFFFF
   MIGRATING RBA: 000000000000
-DBAG 335 18:00:23.41 DSNUPPCP - REPORT RECOVERY TABLESPACE DSNDB06.SYSGPAUT SYS
                  AND SYSTEM LEVEL BACKUPS
= 2014-08-22-09.06.59.617595,  IC TYPE = *M*,  SHR LVL =  ,  DSNUM    = 0000, S
=       ,                    IC BACK =  ,   STYPE   = R,  FILE SEQ = 0000,  P
= 0000,  HIGH DSNUM = 0000,   OLDEST VERSION =   -1,  LOGICAL PART = 0000,   L
= DB7MOD1 ,    AUTHID =   GREGH   ,     COPYPAGESF = -1.0E+00
= -1.0E+00               ,              CPAGESF = -1.0E+00
= DSNDB06.SYSGPAUT                               , MEMBER NAME =        , INSTAN
```

Another utility that is useful for in the recovery purposes is the REPORT utility. This utility can be used to display information about the image copy data sets and archive log data sets that might be required during recovery processing.

| CHECK DATA | CHECK INDEX | CHECK LOB |
|---|---|---|
| Checks the status of referential constraints, can delete invalid rows of data and reset a check pending status. | Checks that an index is consistent with its corresponding table data. | Checks large object table spaces for structural defects or invalid data. |

After some types of recovery you may be instructed to run a CHECK DATA, CHECK INDEX or CHECK LOB utility to ensure data is consistent and synchronized with parent or dependent tables.

You can use the BACKUP SYSTEM utility to take a volume level backup of DB2 data.

You can run the COPY utility to backup individual table spaces and index spaces.

You know the difference between a full image copy and an incremental copy.

You understand how DB2 recovery processing is performed.

You can check table space and index space validity following recovery processing.

In this section, a broad introduction to the Db2 backup and recovery utilities used within the Data Center was presented, along with scenarios explaining how these tasks can be performed.