

# SQLAdria - Vodice, June 2025

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## IBM SQL Data Insights for Db2 v13 Installation Lab

The purpose of this repository is to guide the participant though a worked example of how to setup and use SQL Data Insights. The hands on lab consists of a Windows Image (with 3270 emulator and putty) and a Linux on Z image running a z/OS guest.

The HOL was originally written in github using markdown. If you prefer to access these instructions in a web browser, open the repository at the link below. *TO-DO: PROVIDE LINK TO THE INSTALLATION GUIDE*

## Contents

The following ten steps cover what you need to do to get “Up and Running” with SQLDI Technology for Db2 V13. Step 11 is added for problem determination steps just in case things don’t work out perfectly.

1. SQL DI Deployment Overview and Planning
2. Prepare the SQLDI Administration Userid and Group
3. Prepare a large ZFS for SQLDI\_HOME
4. Upload and Install the SQL DI Technology components
5. Prepare a certificate and Keyring for user authentication
6. Prepare network ports
7. Create the SQLDI Server Instance
8. Create Db2 Artefacts to support SQLDI (catalog tables, procs, udfs and packages)
9. Create the sample table for IVP Testing
10. Perform an IVP Test

## 11. Problem Determination Steps

# 1. SQL DI Deployment Overview and Planning

This section explains the context of the SQLDI Hands on Learning

1. The components and dependences of an SQLDI Instance
2. The HOL Environment that will be used for the Setup Lab

## 1.1 The Components and Dependencies of an SQLDI Instance

The first step is to understand all the components that are needed to build an SQLDI environment, their dependencies, and how they interact with each other. Study the diagram below, and read the notes that follow.

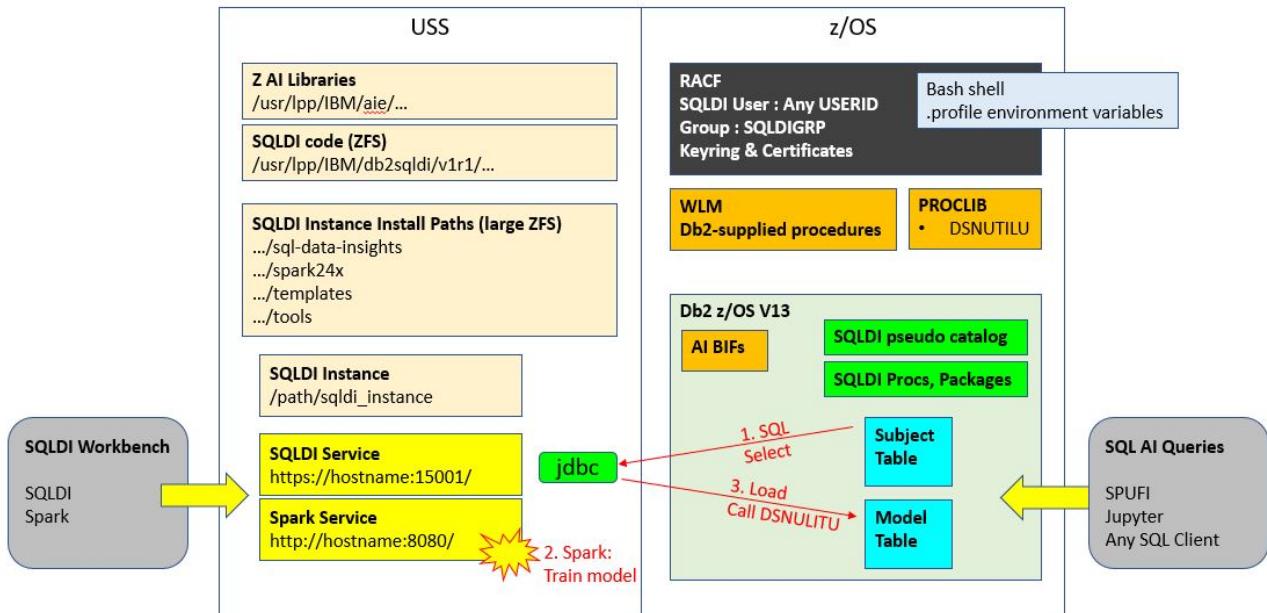


Figure 1: SQLDI Components

The SQLDI Server is a set of services running in USS, which interact with artefacts in Db2 z/OS.

**Left Hand Side: The SQLDI Server instance** SQL Data Insights is a very self-contained package that installs easily into USS. It includes it's own copy of Spark, db2 jdbc driver, model training services, web server for the SQLDI browser interface, as well as tools like the bash shell. All you need to do is install it from the correct SMP/E FMID that comes with Db2 v13 (5698-DB2, FMID: HDBDD18).

After installation, you must create an SQLDI instance. This is dependent on a number of USS and z/OS pre-requisites being set correctly.

- The USS environment must reflect the correct PATH and LIBPATH variables for the various Z AI libraries, the deep learning compiler etc...
- The script to create an SQLDI instance must be executed by the SQLDI instance userid, which must have the correct RACF properties
- It must reference a RACF keyring containing the authentication certificate to access z/OS
- It must also specify the network ports that SQLDI and Spark will use.

- It must also specify a USS paths with enough space to deploy the SQLDI instance.

The script to create an SQLDI instance is easy to invoke. The hard work is the careful planning and provisioning of the environment that it needs.

### Right Hand Side: The Db2 z/OS V13 subsystem, with several artifacts to support the SQLDI Server instance You need

- a standard Db2 V13 system, with the DB2-provided procedures and their WLM environments and associated PROCLIB members.
- The SQLDI pseudo catalog for the SQLDI server to store metadata
- Several new SQLDI stored procedures, Three UDFs and corresponding packages to be bound.
- A new WLM environment for the UDFs to execute in, and create a PROCLIB member to invoke them.

The notes above are a summary of the key pre-requisite considerations for SQLDI deployment. A comprehensive list of requirements is published in the [SQLDI Knowledge Center](#) for Db2 13.

### 1.2 The HOL Environment that will be used for the Setup Lab

The Hands on Learning lab is hosted in a virtualised environment accessed via the Cloud using ZVA. Booking requests can be made by IBMers, so that the environment will not be freely ready after the labs you are running today.

The diagram below illustrates the nature of ZVA, and how to access it. Documented here: [ZVA\\_System\\_Access..](#)

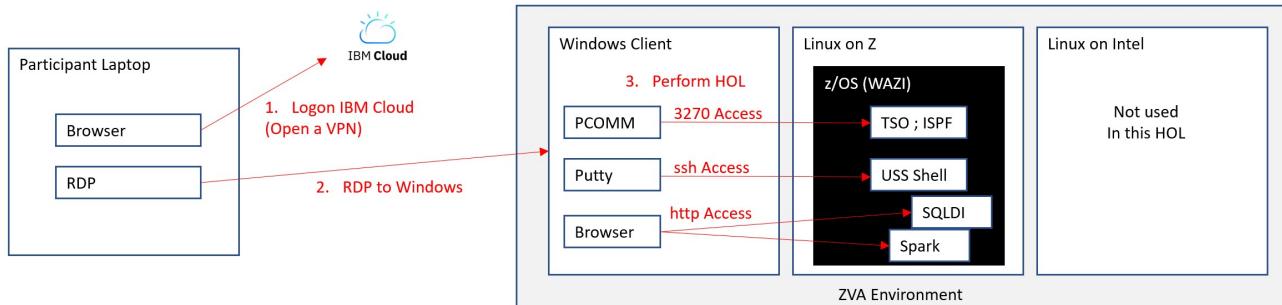


Figure 2: zva

The rest of this document contains the instructions for you to install and configure SQLDI on the ZVA image.

### You will NEED to Know The following

#### Userids and Passwords in z/OS.

The z/OS userids and passwords that you will be using once you have accessed the ZVA or ZTrial system are

- IBMUSER ( password SYS1 ) is a high privilege z/OS userid with Db2 Access
- AIDBADM ( password aidbadm ) is the userid that will be used as the SQLDI instance owner.

## TCPIP hostnames.

Do NOT attempt to use TCPIP addresses during this HOL. The z/OS TCPIP stack has not been customised during the ZVA provisioning process. You must use hostnames, which have been setup.

From **Windows** you should point the applications (PCOMM and putty) at the z/OS system using hostname wg31.

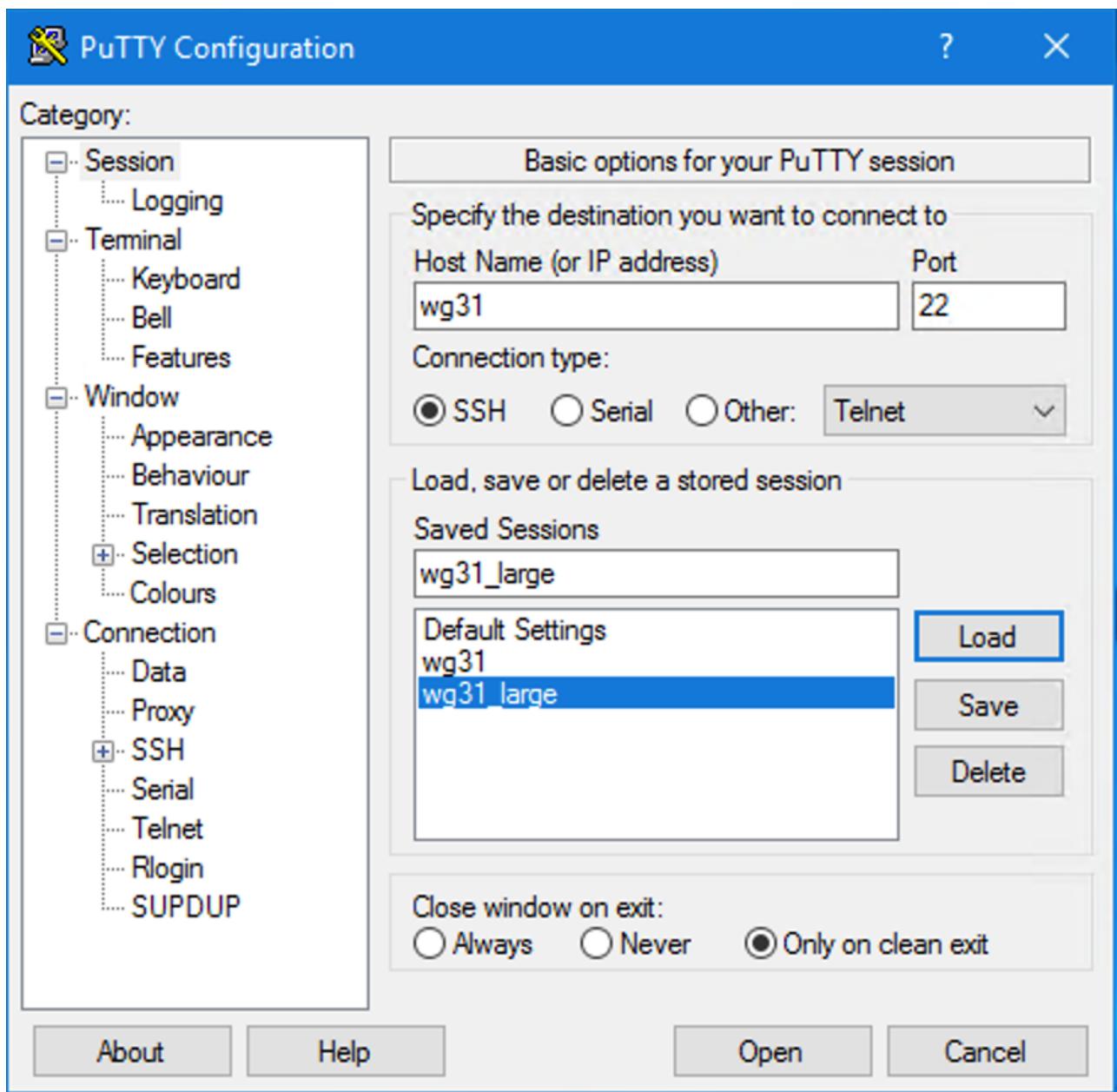


Figure 3: putty\_wg31

From **USS** (where SQLDI runs) you should define your SQLDI and Spark instances to be located at hostname wg31.washington.ibm.com.

---

## TASK

Let's check that all the components needed in USS are in place.

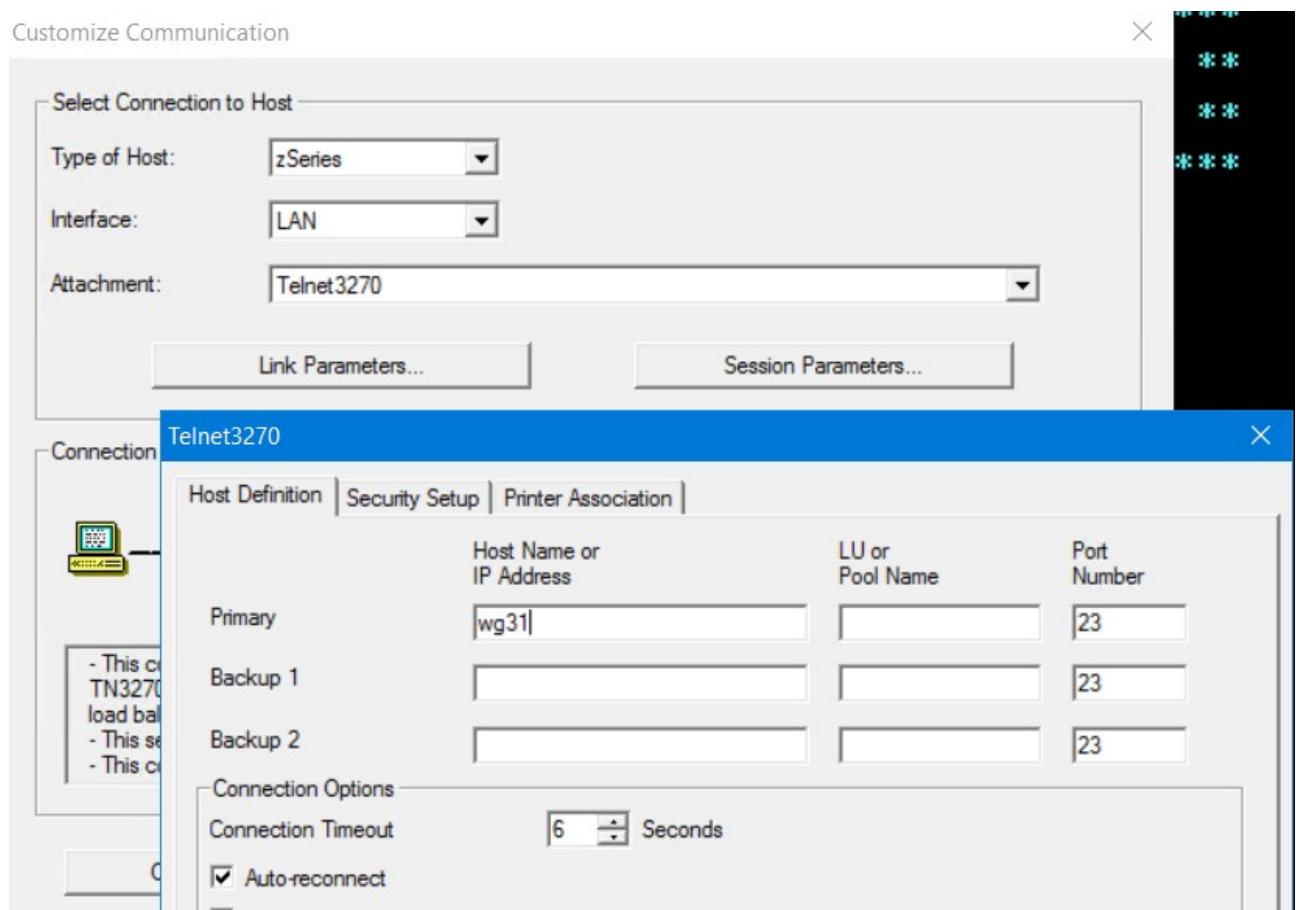
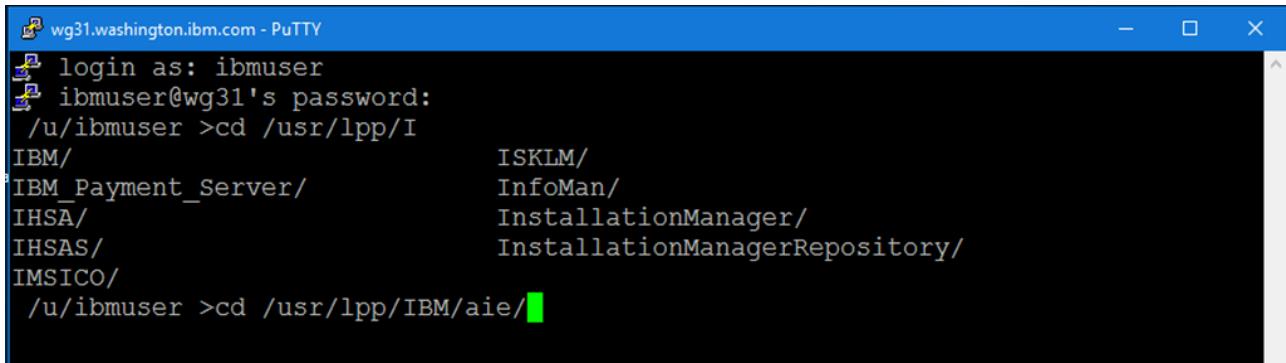


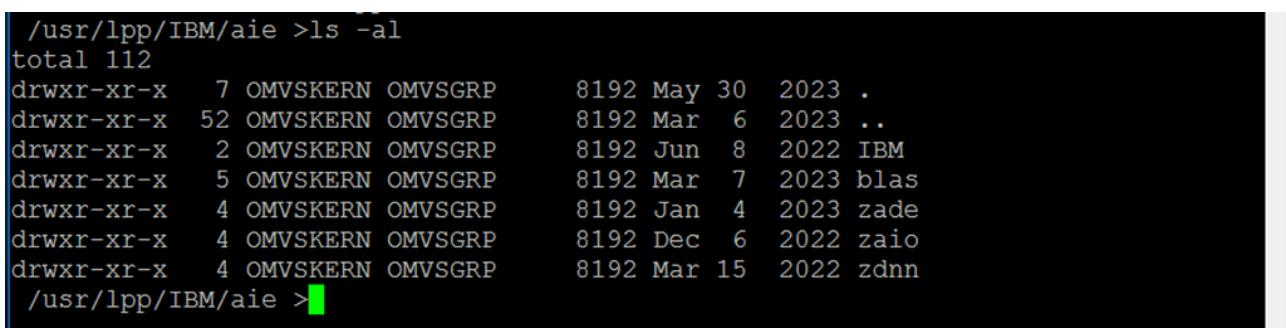
Figure 4: pcomm\_wg31

You will need to login as **ibmuser** into the PuTTY terminal.



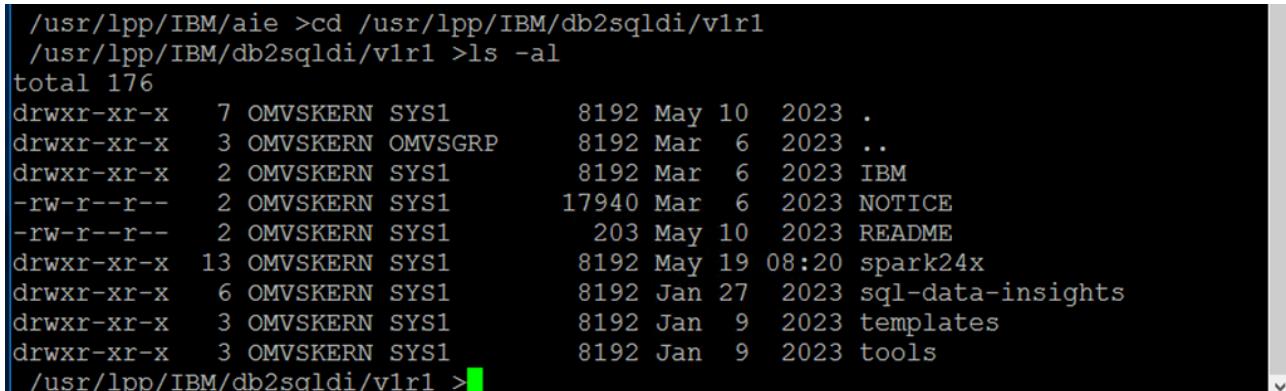
```
wg31.washington.ibm.com - PuTTY
login as: ibmuser
ibmuser@wg31's password:
/u/ibmuser >cd /usr/lpp/I
IBM/ ISKLM/
IBM_Payment_Server/ InfoMan/
IHSA/ InstallationManager/
IHSAS/ InstallationManagerRepository/
IMSICO/
/u/ibmuser >cd /usr/lpp/IBM/aie/
```

Figure 5: Login using PuTTY



```
/usr/lpp/IBM/aie >ls -al
total 112
drwxr-xr-x 7 OMVSKERN OMVSGRP 8192 May 30 2023 .
drwxr-xr-x 52 OMVSKERN OMVSGRP 8192 Mar 6 2023 ..
drwxr-xr-x 2 OMVSKERN OMVSGRP 8192 Jun 8 2022 IBM
drwxr-xr-x 5 OMVSKERN OMVSGRP 8192 Mar 7 2023 blas
drwxr-xr-x 4 OMVSKERN OMVSGRP 8192 Jan 4 2023 zade
drwxr-xr-x 4 OMVSKERN OMVSGRP 8192 Dec 6 2022 zaio
drwxr-xr-x 4 OMVSKERN OMVSGRP 8192 Mar 15 2022 zdnn
/usr/lpp/IBM/aie >
```

Figure 6: List path with libraries



```
/usr/lpp/IBM/aie >cd /usr/lpp/IBM/db2sqldi/v1r1
/usr/lpp/IBM/db2sqldi/v1r1 >ls -al
total 176
drwxr-xr-x 7 OMVSKERN SYS1 8192 May 10 2023 .
drwxr-xr-x 3 OMVSKERN OMVSGRP 8192 Mar 6 2023 ..
drwxr-xr-x 2 OMVSKERN SYS1 8192 Mar 6 2023 IBM
-rw-r--r-- 2 OMVSKERN SYS1 17940 Mar 6 2023 NOTICE
-rw-r--r-- 2 OMVSKERN SYS1 203 May 10 2023 README
drwxr-xr-x 13 OMVSKERN SYS1 8192 May 19 08:20 spark24x
drwxr-xr-x 6 OMVSKERN SYS1 8192 Jan 27 2023 sql-data-insights
drwxr-xr-x 3 OMVSKERN SYS1 8192 Jan 9 2023 templates
drwxr-xr-x 3 OMVSKERN SYS1 8192 Jan 9 2023 tools
/usr/lpp/IBM/db2sqldi/v1r1 >
```

Figure 7: Verify the SQLDI libraries are mounted

---

## 2. Prepare the SQLDI Administration Userid and Group

There are two parts to this task. The first pertaining to RACF profiles, the second pertaining to USS environment variables.

In a nutshell, you need to setup the following: 1. A RACF userid with an omvs segment to be the SQLDI instance owner. 2. which has generous CPU and Memory limits to reflect the fact that model training might take some time. 3. which is a member of a RACF group named SQLDIGRP. 4. and has USS environment settings that include PATH and LIBPATH values to link to all the Z AI libraries and the Deep Learning Compiler.

**Note: Db2 permissions** The SQLDI instance owner itself does not need Db2 permissions. The userid that logs onto SQLDI via the Web UI will need to be a member of SQLDIGRP and will also need Db2 privileges.

We will use this logistical planning matter as a basis for problem determination later on on the HOL.

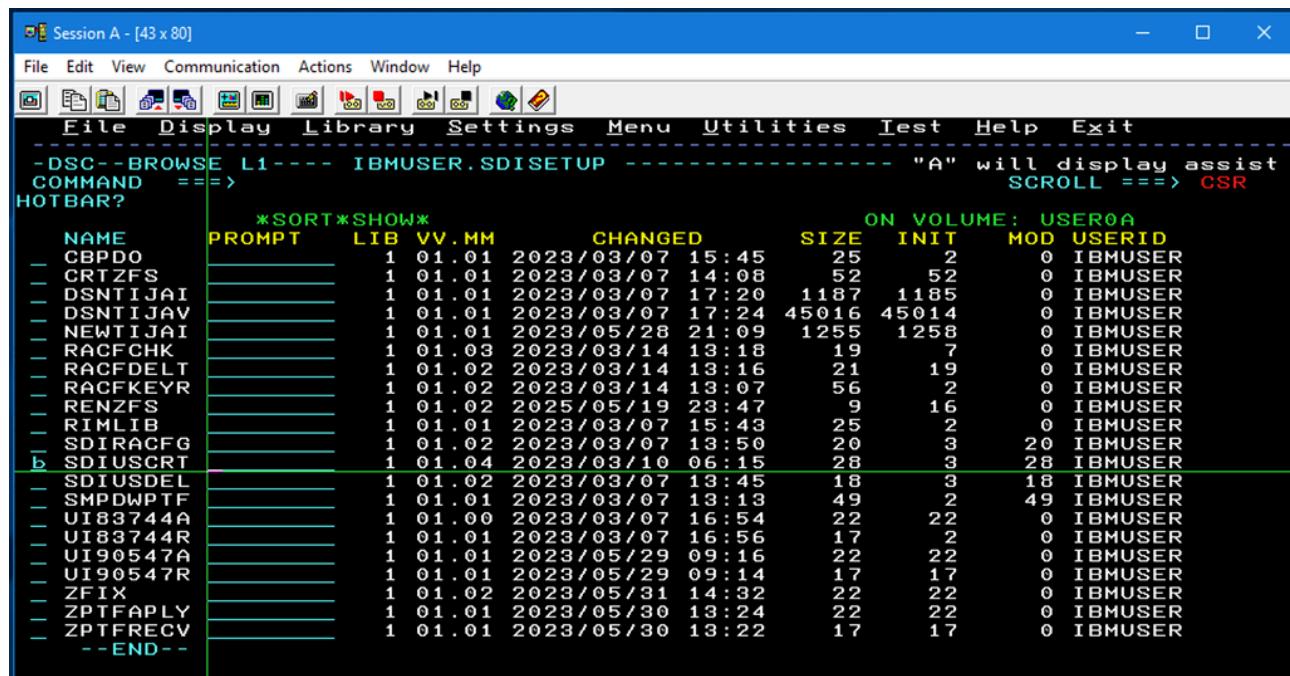
## 2.1 RACF User Profiles

Decide on a userid that will be the SQLDI owner within USS.

You will create **AIDBADM** user:

### TASK

The JCL that was used to define RACF userid is found in **IBMUSER.SDISETUP(SDIUSCRT)** . It is standard RACF user profile, with a TSO signon and an omvs id.



NAME	PROMPT	LIB	VV.MM	CHANGED	SIZE	INIT	MOD	USERID
CBPDO		1	01.01	2023/03/07 15:45	25	2	0	IBMUSER
CRTZFS		1	01.01	2023/03/07 14:08	52	52	0	IBMUSER
DSNTIJAI		1	01.01	2023/03/07 17:20	1187	1185	0	IBMUSER
DSNTIJAV		1	01.01	2023/03/07 17:24	45016	45014	0	IBMUSER
NEWTIJAI		1	01.01	2023/05/28 21:09	1255	1258	0	IBMUSER
RACFCHK		1	01.03	2023/03/14 13:18	19	7	0	IBMUSER
RACFDELT		1	01.02	2023/03/14 13:16	21	19	0	IBMUSER
RACFKEYR		1	01.02	2023/03/14 13:07	56	2	0	IBMUSER
RENZFS		1	01.02	2025/05/19 23:47	9	16	0	IBMUSER
RIMLIB		1	01.01	2023/03/07 15:43	25	2	0	IBMUSER
SDIRACFG		1	01.02	2023/03/07 13:50	20	3	20	IBMUSER
SDIUSCRT	b	1	01.04	2023/03/10 06:15	28	3	28	IBMUSER
SDIUSDEL		1	01.02	2023/03/07 13:45	18	3	18	IBMUSER
SMPDWPTF		1	01.01	2023/03/07 13:13	49	2	49	IBMUSER
UI83744A		1	01.00	2023/03/07 16:54	22	22	0	IBMUSER
UI83744R		1	01.01	2023/03/07 16:56	17	2	0	IBMUSER
UI90547A		1	01.01	2023/05/29 09:16	22	22	0	IBMUSER
UI90547R		1	01.01	2023/05/29 09:14	17	17	0	IBMUSER
ZFIX		1	01.02	2023/05/31 14:32	22	22	0	IBMUSER
ZPTFAPPLY		1	01.01	2023/05/30 13:24	22	22	0	IBMUSER
ZPTFRECV		1	01.01	2023/05/30 13:22	17	17	0	IBMUSER
--END--								

Figure 8: IBMUSER.SDISETUP

Submit the JCL:

### TASK

If you want to make additional RACF userids able to operate SQLDI, those users would also need similar customisation as the following steps for AIDBADM.

With the TSO command **tso lu aidbadm omvs** you can display the RACF user profile, or you can go using the panels:

- ISPF main panel
- m.3 ( for RACF )
- 4 ( for user profiles )

```

-DSC- BROWSE IBMUSER.SDISETUP(SDIUSCRT) - 01.04 Line 00000000 Col 001 080
Command ==> sub
*****
***** Top of Data *****
//IBMUSERJ JOB (USR),'ADD USER',CLASS=A,MSGCLASS=H,
// NOTIFY=&SYSUID,MSGLEVEL=(1,1),REGION=0M
//*****
//*
//** CREATE SQDLI USERIDS
//*
//*****
//NEWID EXEC PGM=IKJEFT01,DYNAMNBR=75,TIME=100,REGION=6M
//SYSPRINT DD SYSOUT=*
//SYSTSPRT DD SYSOUT=*
//SYSTERM DD DUMMY
//SYSUADS DD DSN=SYS1.UADS,DISP=SHR
//SYSLBC DD DSN=SYS1.BROADCAST,DISP=SHR
//SYSTSIN DD *
AU AIDBADM NAME('AIDBADM') PASSWORD(SYS1)
OWNER(SYS1) DFLTGRP(SYS1) UACC(READ) OPERATIONS SPECIAL
TSO(ACCTNUM(ACCT#)) PROC(DBSPROCD) JOBCCLASS(A) MSGCLASS(X)
HOLDCLASS(X) SYSOUTCLASS(X) SIZE(4048) MAXSIZE(0)
OMVS(HOME(/u/aidbadm) PROGRAM(/bin/bash) CPUTIMEMAX(86400))
MEMLIMIT(32G) ASSIZEMAX(1200000000) AUTOUID
PERMIT ACCT# CLASS(ACCTNUM) ID(AIDBADM)
PERMIT ISPFPROC CLASS(TSOPROC) ID(AIDBADM)
PERMIT DBSPROC CLASS(TSOPROC) ID(AIDBADM)
PERMIT JCL CLASS(TSOAUTH) ID(AIDBADM)
PERMIT OPER CLASS(TSOAUTH) ID(AIDBADM)
PERMIT ACT CLASS(TSOAUTH) ID(AIDBADM)
PERMIT MOUNT CLASS(TSOAUTH) ID(AIDBADM)
AD 'AIDBADM.*' OWNER(AIDBADM) UACC(READ) GENERIC
*****
***** Bottom of Data *****

```

Figure 9: Submit member SDIUSCRT

- D - AIDBADM ( to display the user profile for AIDBADM )
- s - OMVS ( to include the omvs segment details 0 )

If the lab has been reset correctly, AIDBADM will be a member of the RACF Group 'SYS1', and will have an omvs segment with various omvs properties set.

```

BROWSE - RACF COMMAND OUTPUT----- LINE 00000000 COL 001 080
COMMAND ==> -
*****
***** Top of Data *****
USER=AIDBADM NAME=AIDBADM OWNER=USER1 CREATED=22.212
DEFAULT-GROUP=SYS1 PASSDATE=22.213 PASS-INTERVAL=180 PHRASEDATE=N/A
ATTRIBUTES=GRPACC
REVOKE DATE=NONE RESUME DATE=NONE
LAST-ACCESS=22.221/22:24:10
CLASS AUTHORIZATIONS=NONE
NO-INSTALLATION-DATA
NO-MODEL-NAME
LOGON ALLOWED (DAYS) (TIME)
-----
ANYDAY GROUP=SYS1 AUTH=USE CONNECT-OWNER=USER1 CONNECT-DATE=22.212
CONNECTS= 39 UACC=READ LAST-CONNECT=22.221/22:24:10
CONNECT ATTRIBUTES=NONE
REVOKE DATE=NONE RESUME DATE=NONE
SECURITY-LEVEL=None SPECIFIED
CATEGORY-AUTHORIZATION
None SPECIFIED
SECURITY-LABEL=None SPECIFIED

OMVS INFORMATION
-----
UID= 0000990029
HOME= /u/aidbadm
PROGRAM= /bin/sh
CPUTIMEMAX= 0000864000
ASSIZEMAX= NONE
FILEPROCMAX= NONE
PROCUSERMAX= NONE
THREADSMAX= NONE
MMAPAREAMAX= NONE
MEMLIMIT= 24G
*****
***** Bottom of Data *****

```

Check the RACF profiles for user AIDBADM.

## TASK

For each of the users, they need an OMVS segment with certain properties specified. We want to see the following values set for the SQLDI user.

- CPUTIMEMAX 864000 (to avoid the risk of timeouts during long model training tasks)
- MEMLIMIT 4GB minimum (because SQLDI and Spark need sufficient memory)
- PROGRAM /bin/sh (or change it to /bin/bash if you prefer that as a default)
- HOME /u/aidbadm (to follow the standard convention for the home directory of a user)

If the OMVS properties needs to be amended, go to RACF User Profiles ( ISPF M.3.4 ) and select “2” to change the user profile of AIDBADM

```
EDIT      AIZ.AIDB0211.HOLFILES(ADDUSER) - 01.02          Columns 00001 00072
. . .
. . .           RACF - USER PROFILE SERVICES . . .
OPTION ==> 2_          PROFILE DISPLAYED
SELECT ONE OF THE FOLLOWING:
1   ADD          Add a user profile
2   CHANGE       Change a user profile
3   DELETE       Delete a user profile
4   PASSWORD     Change your own password and related information
5   AUDIT        Monitor user activity (Auditors only)

D or 8   DISPLAY      Display profile contents
S or 9   SEARCH       Search the RACF data base for profiles

ENTER THE FOLLOWING INFORMATION:
USER      ==> AIDBADM      Userid
```

Specify that you want to change optional features

```
RACF - CHANGE USER AIDBADM
COMMAND ==>

OWNER          _____ Userid or group name
USER NAME      _____
DEFAULT GROUP  _____ Group name

- Change PASSWORD related information
s Add or Change OPTIONAL information

TO ASSIGN A USER ATTRIBUTE, ENTER YES, TO CANCEL, ENTER NO
GROUP ACCESS   _____ SPECIAL
ADSP          _____ OPERATIONS
OIDCARD        _____ AUDITOR
NO-PASSWORD    _____ ROAUDIT
                  _____ RESTRICTED

CHANGE OR DELETE THE MODEL PROFILE USED FOR USER DATA SETS (OPTIONAL):
NEW MODEL      _____
DELETE         _____ YES if no model is to be used
```

Select omvs

```

RACF - CHANGE USER AIDBADM
COMMAND ==>
To add or change the following information, enter any character.

- CLASS AUTHORITY
- INSTALLATION DATA
- SECURITY LEVEL or CATEGORIES
- SECURITY LABEL
- LOGON RESTRICTIONS
- NATIONAL LANGUAGES
- DFP PARAMETERS
- TSO PARAMETERS
- OPERPARM PARAMETERS
- CICS PARAMETERS
- WORK ATTRIBUTES
- OMVS PARAMETERS
- NETVIEW PARAMETERS
- DCE PARAMETERS
- OVM PARAMETERS
- LN NOTES PARAMETERS
- NDS PARAMETERS
- KERB PARAMETERS
- LDAP PROXY PARAMETERS
- ENTERPRISE IDENTITY MAPPING
- CS DATA PARAMETERS
- MFA PARAMETERS

```

Edit CPUMAXTIME and MEMLIMIT to meet the criteria

```

RACF - CHANGE USER AIDBADM
OMVS PARAMETERS

COMMAND ==>
Delete ALL OMVS information (NOOMVS) _____ Enter YES to DELETE
-- OR --
Choose to CHANGE or DELETE, then press ENTER.

More: -
Specify CPU Time (CPUTIMEMAX) 86400 _____ 7 - 2147483647
Delete CPU Time (NOCPUTIMEMAX) _____ Enter any character
10485760 -
2147483647
Enter any character
Specify Address Space Size (ASSIZEMAX) _____
Delete Address Space Size (NOASSIZEMAX) _____
Specify Files Per Process (FILEPROCMAX) _____ 3 - 524287
Delete Files Per Process (NOFILEPROCMAX) _____ Enter any character
Specify Processes Per UID (PROCUSERMAX) _____ 3 - 32767
Delete Processes Per UID (NOPROCUSERMAX) _____ Enter any character
Specify Threads Per Process (THREADSMAX) _____ 0 - 100000
Delete Threads Per Process (NOTHREADSMAX) _____ Enter any character
Specify Memory Map Area Size (MMAPAREAMAX) _____ 1 - 16777216
Delete Memory Map Area Size (NOMMAPAREAMAX) _____ Enter any character
Specify Non-Shared Memory Size (MEMLIMIT) 24 _____ G Multiplier
Delete Non-Shared Memory Size (NOMEMLIMIT) _____ Enter any character
Specify Shared Memory Size (SHMEMMAX) _____ - Multiplier
Delete Shared Memory Size (NOSHMEMMAX) _____ Enter any character

```

And verify the changes

```

BROWSE - RACF COMMAND OUTPUT----- LINE 00000000 COL 001 080
COMMAND ===> _ SCROLL ===> CSR
***** Top of Data *****
USER=AIDBADM NAME=AIDBADM OWNER=USER1 CREATED=22.212
DEFAULT-GROUP=SYS1 PASSDATE=00.000 PASS-INTERVAL=180 PHRASEDATE=N/A
ATTRIBUTES=None
REVOKE DATE=None RESUME DATE=None
LAST-ACCESS=UNKNOWN
CLASS AUTHORIZATIONS=None
NO-INSTALLATION-DATA
NO-MODEL-NAME
LOGON ALLOWED (DAYS) (TIME)
-----
ANYDAY ANYTIME
GROUP=SYS1 AUTH=USE CONNECT-OWNER=USER1 CONNECT-DATE=22.212
CONNECTS= 00 UACC=READ LAST-CONNECT=UNKNOWN
CONNECT ATTRIBUTES=None
REVOKE DATE=None RESUME DATE=None
SECURITY-LEVEL=None SPECIFIED
CATEGORY-AUTHORIZATION
NONE SPECIFIED
SECURITY-LABEL=None SPECIFIED

OMVS INFORMATION
-----
UID= 0000990029
HOME= /u/aidbadm
PROGRAM= /bin/sh
CPUTIMEMAX= 0000086400
ASSIZEMAX= NONE
FILEPROCMAX= NONE
PROCUSERMAX= NONE
THREADSMAX= NONE
MMAPAREAMAX= NONE
MEMLIMIT= 24G
***** Bottom of Data *****

```

## 2.2 RACF Group Profiles

A RACF Group profile with the specific name “SQLDIGRP” is required for SQLDI, and userids that invoke SQLDI must be added into that group. You need to create the “SQLDIGRP” group and connect user “AIDBADM” to it. You can do this in any one of the following ways:

1. using the RACF Panels ( ISPF M.3 )
2. Using TSO commands below from ISPF Option 6.
  
3. Customising and Submitting the Job in IBMUSER.SDIRACFG illustrated below

If you choose the third option, this is the JCL that you must customize and submit.

```

//IBMUSERJ JOB (FB3), 'IBMUSER', NOTIFY=&SYSUID,
// MSGCLASS=H, CLASS=A, MSGLEVEL=(1,1),
// REGION=OM, COND=(4,LT)
//S1      EXEC PGM=IKJEFT01

//SYSTSPRT DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSTSIN DD *

ADDGROUP SQLDIGRP OMVS(AUTOGID) OWNER(IBMUSER)

CONNECT (AIDBADM) GROUP (SQLDIGRP) OWNER(IBMUSER)

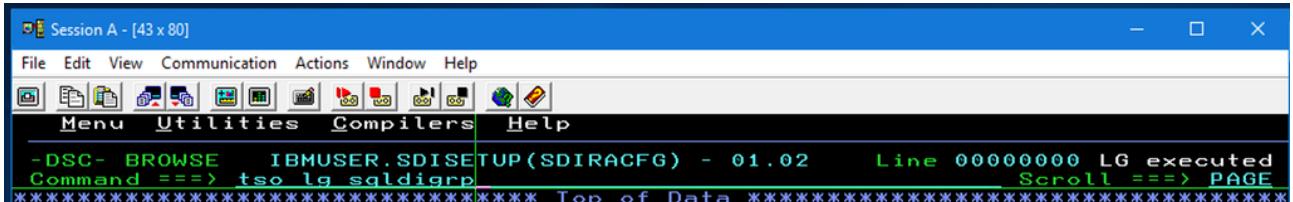
CONNECT (IBMUSER) GROUP (SQLDIGRP) OWNER(IBMUSER)

SETROPTS RACLIST(FACILITY) REFRESH

/*

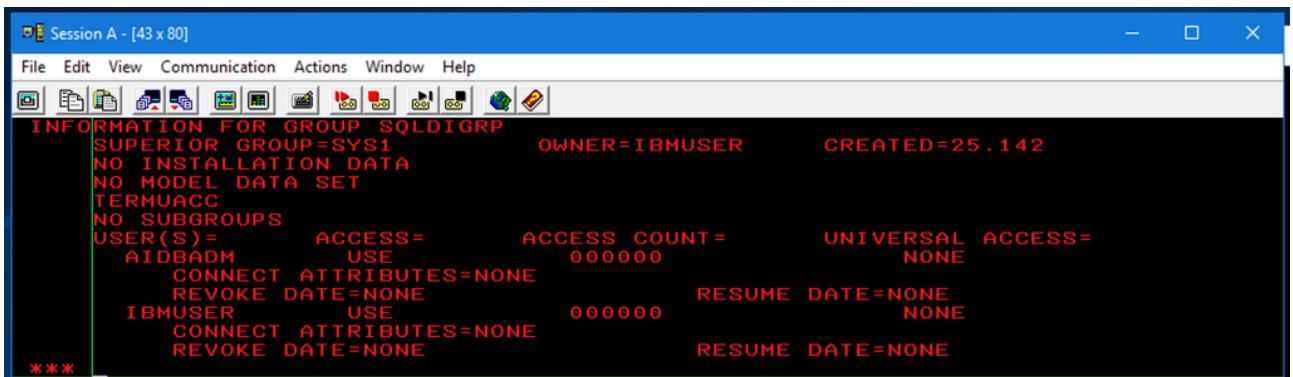
```

And verify that aidbadm is now a member of group SQLDIGRP



The screenshot shows a terminal window titled "Session A - [43 x 80]". The menu bar includes File, Edit, View, Communication, Actions, Window, and Help. Below the menu is a toolbar with various icons. The command line shows "-DSC- BROWSE IBMUSER.SDISETUP(SDIRACFG) - 01.02 Line 00000000 LG executed". The user has typed "Command ==> tso lg sldigrp". At the bottom, it says "\*\*\*\*\* Top of Data \*\*\*\*\*" and "Scroll ==> PAGE".

Figure 10: Command



The screenshot shows a terminal window titled "Session A - [43 x 80]". The menu bar and toolbar are identical to Figure 10. The command "tso lg sldigrp" has been run, and the output is displayed. It shows information for group SQLDIGRP, including its superior group (SYS1), owner (IBMUSER), and creation date (25.142). It also lists users and their access rights. The output ends with "\*\*\*".

INFORMATION FOR GROUP SQLDIGRP			
SUPERIOR GROUP=SYS1	OWNER=IBMUSER	CREATED=25.142	
NO INSTALLATION DATA			
NO MODEL DATA SET			
TERMUACC			
NO SUBGROUPS			
USER(S)=	ACCESS=	ACCESS COUNT=	UNIVERSAL ACCESS=
AIDBADM	USE	000000	NONE
	CONNECT ATTRIBUTES=None		
	REVOKE DATE=None		RESUME DATE=None
IBMUSER	USE	000000	NONE
	CONNECT ATTRIBUTES=None		
	REVOKE DATE=None		RESUME DATE=None

Figure 11: Command result

## 2.3 USS Environment Variables

The RACF user profile for AIDBADM has been checked for having an omvs segment, and for the required properties to run SQLDI.

The environment variables for a userid operating in USS are a mixture of environment variables set at a system level, and environment variables set for a specific useric using the .profile.

The **aidbadm** user needs to define PATH and LIBPATH environment variables so that all the required executables can be invoked at runtime.

---

## TASK

Open a terminal session into USS (e.g. using putty) and **logon as ibmuser**. You should find yourself in the home directory for the ibmuser user.

Now, list all the files in your home directory with the **ls -al** command. (Files beginning with . are hidden unless you specify **-al**.)

You first need to copy the .profile.aidbadm file prepared for you in the aidbadm user home directory.

(**Note:** Contents may differ from your screen)

```
/u/ibmuser >ls -al
total 192
drwxr-xr-x  3 AIDBADM  SYS1      8192 Jul 28 02:20 .
drwxr-xr-x  40 OMVSKERN SYS1    16384 Jan 25 2022 ..
-rw-------  1 AIDBADM  SYS1     6312 Jul 27 06:35 .bash_history
-rwxr-xr-x  1 AIDBADM  SYS1     2891 Jul 26 23:58 .profile
```

```

/u/ibmuser >cp .profile.aidbadm /u/aidbadm/
/u/ibmuser >ls -al /u/aidbadm/
total 114
drwxrwxrwx    3 OMVSKERN SYS1      8192 May 21 09:49 .
drwxr-xr-x  34 OMVSKERN SYS1   16384 May 28 2023 ..
-rw-----   1 990025  SYS1    3885 May 19 10:49 .bash_history
-rw-r--r--   1 990025  SYS1    1896 May 19 10:42 .profile
-rw-r--r--   1 OMVSKERN SYS1   1896 May 21 09:49 .profile.aidbadm
-rw-----   1 990025  SYS1     14 Mar  9 2023 .sh_history
-rw-r--r--   1 990025  SYS1   1894 May 19 10:38
drwxr-xr-x   2 990025  SYS1      0 Aug 15 2023 wg31.washington.ibm.com
/u/ibmuser >

```

Figure 12: aidbadm user path in USS

```

-rwxr-xr-x   1 AIDBADM  SYS1      2891 Jul 26 23:58 .profile.aidbadm
-rw-----   1 AIDBADM  SYS1      1654 Jul 28 02:20 .sh_history

```

You then copy the .profile.aidbadm as .profile in aidbadm user home directory and change ownership of the new file to aidbadm user.

```

/u/ibmuser >cp .profile.aidbadm /u/aidbadm/.profile
/u/ibmuser >chown aidbadm /u/aidbadm/.profile

```

You can easily view the contents of the new .profile with the cat command as follows: (**NOTE:** Contents in your profile may differ from this output)

```

/u/ibmuser >cd /u/aidbadm
/u/aidbadm >cat .profile
export HOST=$(uname -n)
export PS1=' ${PWD} >'
export NET_IP=`host $HOST | grep addresses | awk '{ print \$5 }' `
export LANG=En_US
export TERM=xterm
set -o vi
export _BPXX_AUTOCVT=ON
export _BPX_SHAREAS=NO
_BPXX_AUTOCVT=ON

# PATH -
PATH=.:${HOME}/bin:/usr/sbin:/usr/bin:${PATH}:/usr/local/bin:/usr/lpp/ldap/sbin:/usr/lpp

# Add BASH to PATH
export PATH=/u/user1/tools/bash-4.3.48-2/bin:${PATH}

# use latest java version
if [ -r /usr/lpp/java/J8.0_64 ]
then
  export JAVA_HOME=${JAVA_HOME}:~/lpp/java/J8.0_64
  export PATH="${PATH}:~/lpp/java/bin"
  #Needed by jaydebeapi to find libj9a2e.so
  export LIBPATH=$LIBPATH:~/lib/s390x:~/lib/s390x/classic
fi

```

```

if [ -z "$IBM_JAVA_OPTIONS" ]; then
    export IBM_JAVA_OPTIONS="-Dfile.encoding=UTF-8"
else
    if [[ ! "$IBM_JAVA_OPTIONS" == *"-Dfile.encoding=UTF-8" ]]; then
        export IBM_JAVA_OPTIONS=$IBM_JAVA_OPTIONS:-Dfile.encoding=UTF-8
    fi
fi

if [ -r .envfile ]
then
    echo "execute ENVIRONMENT .envfile "
    . .envfile
fi

```

Some required variables (like JAVA\_HOME) are already specified, but none of the required SQLDI library paths are defined.

Even though we haven't yet installed the AI libraries and the SQLDI libraries, this HOL is structured to keep all the user profile settings together, and we know exactly what the paths will be.

If you are comfortable with the vi editor, then you can edit the `.profile` inside USS. Most of us would prefer to use the ISPF editor, as shown below.

Open ISPF edit (Option 2) and open the `/u/aidbadm/.profile` USS file.

```

# JAVA
export JAVA_HOME=/usr/lpp/java/J8.0_64
export PATH=$PATH:/apps/zospt/bin:/usr/lpp/java/J8.0_64/bin
# ZOAU REQUIREMENTS
export _BPXX_AUTOCVT=ON
export ZOAU_HOME=/usr/lpp/IBM/zooutil
export PATH=${ZOAU_HOME}/bin:$PATH
# ZOAU MAN PAGE REQS (OPTIONAL)
export MANPATH=${ZOAU_HOME}/docs/%L:$MANPATH
export CLASSPATH=${ZOAU_HOME}/lib/*:${CLASSPATH}
export LIBPATH=${ZOAU_HOME}/lib:${LIBPATH}
# IBM Python - Ansible supported
export PATH=/usr/lpp/IBM/cyp/v3r9/pyz/bin:$PATH
export PYTHONPATH=/usr/lpp/IBM/cyp/v3r9/pyz
export PYTHONPATH=${PYTHONPATH}: ${ZOAU_HOME}/lib
# Rocket Ported Git
export _CEE_RUNOPTS='FILETAG(AUTOCVT,AUTOTAG) POSIX(ON)'
export PATH=/usr/lpp/Rocket/rsusr/ported/bin:$PATH
# SQLDI Setup
export SQLDI_INSTALL_DIR=/usr/lpp/IBM/db2sqldi/v1r1
export ZADE_INSTALL_DIR=/usr/lpp/IBM/aie/zade
export ZAIE_INSTALL_DIR=/usr/lpp/IBM/aie
export BLAS_INSTALL_DIR=/usr/lpp/cbclib
export SPARK_HOME=$SQLDI_INSTALL_DIR/spark24x
# SQLDI PATH

```

```

PATH=/bin:$PATH
PATH=$SQLDI_INSTALL_DIR/sql-data-insights/bin:$PATH
PATH=$SQLDI_INSTALL_DIR/tools/bin:$PATH
PATH=$ZADE_INSTALL_DIR/bin:$PATH
PATH=$PATH:$JAVA_HOME/bin
export PATH=$PATH
# SQLDI LIBPATH
LIBPATH=/lib:/usr/lib
LIBPATH=$LIBPATH:$JAVA_HOME/bin/classic
LIBPATH=$LIBPATH:$JAVA_HOME/bin/j9vm
LIBPATH=$LIBPATH:$JAVA_HOME/lib/s390x
LIBPATH=$LIBPATH:$SPARK_HOME/lib
LIBPATH=$BLAS_INSTALL_DIR/lib:$LIBPATH
LIBPATH=$ZADE_INSTALL_DIR/zade/lib:$LIBPATH
LIBPATH=$ZADE_INSTALL_DIR/zdnn/lib:$LIBPATH
LIBPATH=$ZADE_INSTALL_DIR/zaio/lib:$LIBPATH
export LIBPATH=$LIBPATH
# SQLDI OTHER
export IBM_JAVA_OPTIONS="-Dfile.encoding=UTF-8"
export _BPXK_AUTOCVT=ON
export _BPX_SHAREAS=NO
export _ENCODE_FILE_NEW=ISO8859-1
export _ENCODE_FILE_EXISTING=UNTAGGED
export _CEE_RUNOPTS="FILETAG(AUTOCVT,AUTOTAG) POSIX(ON)"
export TERM=xterm
alias vi1='vi -W filecodeset=utf-8'
alias vi2='vi -W filecodeset=iso8859-1'
alias ll='ls -ltcpa'
export PS1=' ${PWD} > '

```

Save the file. Then lets check whether the `.profile` is being invoked when the aidbadm user logs on.

---

## TASK

Open a new putty session, and logon as aidbadm. Then type the command `env` to see all the current environment variables.

Logging on will invoke the `.profile` script. Note that if you are already logged on within USS you need to invoke the `.profile` again to reflect your changes.

You might find it easier to check individual environment settings with an `echo` command. For example

---

## TASK

Some users with non-english keyboards at the Europe and AP Technical Academy had great difficulty in editing the `.profile` file using ISPF. If you encounter similar difficulties, please don't waste your time attempting to overcome such challenges. Instead, you could replace the existing `.profile` file with a pre-customised file.

```
/u/aidbadm >env  
MAIL=/usr/mail/AIDBADM  
ZAIE_INSTALL_DIR=/u/aidb0020/aie  
HOST=SOW1  
PATH=/u/aidb0020/aie/zade/bin:/u/aidb0020/tools/bin:/u/aidb0020/sql-data-insights/bin:/bin:/u/user1/tools/bash-4.3.48-2/bin:./u/aidbadm/bin:/usr/sbin:/usr/bin:./usr/sbin:/usr/local/bin:/usr/lpp/ldap/sbin:/usr/lpp/NFS:/usr/lpp/java/J8.0_64/bin:/usr/lpp/java/J8.0_64/bin  
SQLDI_INSTALL_DIR=/u/aidb0020  
_BPXK_AUTOCVT=ON  
SHELL=/bin/sh  
IBM_JAVA_OPTIONS=-Dfile.encoding=UTF-8  
_ENCODE_FILE_NEW=ISO8859-1  
PS1= ${PWD} >  
_CEE_RUNOPTS=FILETAG(AUTOCVT,AUTOTAG) POSIX(ON)  
ZADE_INSTALL_DIR=/u/aidb0020/aie/zade  
_=bin/env  
STEPLIB=none  
LOGNAME=AIDBADM  
LANG=En_US  
LIBPATH=/u/aidb0020/aie/zaio/lib:/u/aidb0020/aie/zdnn/lib:/u/aidb0020/aie/zade/lib:/u/aidb0020/aie/blas/lib:/lib:/usr/lib:/usr/lpp/java/J8.0_64/bin/classic:/usr/lpp/java/J8.0_64/bin/j9vm:/usr/lpp/java/J8.0_64/lib/s390x:/u/aidb0020/spark24x/lib  
BLAS_INSTALL_DIR=/u/aidb0020/aie/blas  
TERM=xterm  
_BPX_SHAREAS=NO  
HOME=/u/aidbadm  
_ENCODE_FILE_EXISTING=UNTAGGED  
SPARK_HOME=/u/aidb0020/spark24x  
NET_IP=  
JAVA_HOME=/usr/lpp/java/J8.0_64  
TZ=CST6CDT  
MANPATH=/usr/man/%L  
NLSPATH=/usr/lib/nls/msg/%L/%N:/usr/lib/nls/msg/%L/%N.cat  
/u/aidbadm >
```

Figure 13: env

```
/u/aidbadm >  
/u/aidbadm >echo $PATH  
/u/aidb0020/aie/zade/bin:/u/aidb0020/tools/bin:/u/aidb0020/sql-data-insights/bin:/bin:/u/user1/tools/bash-4.3.48-2/bin:./u/aidbadm/bin:/usr/sbin:/usr/bin:./usr/sbin:/usr/local/bin:/usr/lpp/ldap/sbin:/usr/lpp/NFS:/usr/lpp/java/J8.0_64/bin:/usr/lpp/java/J8.0_64/bin  
/u/aidbadm >
```

Figure 14: echo

1. Log on to putty as user **ibmuser**.
2. cd /u/ibmuser and then list the files ls -la

```
wg31.washington.ibm.com - PuTTY
/usr/lpp/IBM/db2sqldi/v1r1 >cd
/u/ibmuser >ls -al
total 11332
drwxr-xr-x 19 OMVSKERN SYS1      8192 May 19 10:49 .
drwxr-xr-x 34 OMVSKERN SYS1     16384 May 28 2023 ..
drwx----- 3 OMVSKERN SYS1      8192 Jan  6 2023 .ansible
-rw----- 1 OMVSKERN SYS1      7973 May 19 11:02 .bash_history
drwxr-xr-x 3 OMVSKERN SYS1      8192 Jan  6 2023 .cache
drwxr-xr-x 4 OMVSKERN SYS1      8192 Mar 27 2017 .eclipse
-rw-rw-rw- 1 OMVSKERN SYS1       68 Feb 22 2023 .gitconfig
-rwxrwxrwx 1 OMVSKERN SYS1     2166 Jul 11 2023 .profile
-rw-r--r-- 1 OMVSKERN SYS1     1896 May 19 10:49 .profile.aidbadm
-rw----- 1 OMVSKERN SYS1      42 Jan  8 2023 .python_history
-rw----- 1 OMVSKERN SYS1     1618 May 10 2023 .sh_history
drwx----- 2 OMVSKERN SYS1      8192 Feb 14 2023 .ssh
```

Figure 15: ibmuser path

3. cp .profile.aidbadm /u/aidbadm/.profile

```
/u/ibmuser >cp .profile.aidbadm /u/aidbadm/
/u/ibmuser >ls -al /u/aidbadm/
total 114
drwxrwxrwx  3 OMVSKERN SYS1      8192 May 21 09:49 .
drwxr-xr-x 34 OMVSKERN SYS1     16384 May 28 2023 ..
-rw----- 1 990025  SYS1      3885 May 19 10:49 .bash_history
-rw-r--r-- 1 990025  SYS1      1896 May 19 10:42 .profile
-rw-r--r-- 1 OMVSKERN SYS1     1896 May 21 09:49 .profile.aidbadm
-rw----- 1 990025  SYS1      14 Mar  9 2023 .sh_history
-rw-r--r-- 1 990025  SYS1     1894 May 19 10:38 -
drwxr-xr-x  2 990025  SYS1      0 Aug 15 2023 wg31.washington.ibm.com
/u/ibmuser >
```

Figure 16: ibmuser path

4. ls -al /u/aidbadm

**!!! Alternative Task : !!!** Edit the .profile and check that the following environment variables are set correctly. Type them if needed.

- PATH
- LIBPATH
- ZAIE\_INSTALL\_DIR
- SQLDI\_INSTALL\_DIR
- ZADE\_INSTALL\_DIR
- BLAS\_INSTALL\_DIR
- JAVA\_HOME
- SPARK\_HOME

### 3. Prepare a large ZFS for SQLDI\_HOME

The requirements for the zFS are that it will support an `SQLDI_HOME` path over over 100GB (for a realistic small system). The script to create the SQLDI instance checks the ZFS and fails if it is less than 4GB.

## TASK

You will need to go to your TSO session and search for IBMUSER.SDISETUP(CRTZFS)

```
Session A - [43 x 80]
File Edit View Communication Actions Window Help
File Display Library Settings Menu Utilities Test Help Exit
-DSC--BROWSE L1---- IBMUSER.SDISETUP ----- ROW 00001 OF 00021
COMMAND ===> SCROLL ==> CSR
HOTBAR?
*SORT*SHOW*
NAME PROMPT LIB VV.MM CHANGED SIZE INIT MOD USERID
CBPDO 1 01.01 2023/03/07 15:45 25 2 0 IBMUSER
CRTZFS 1 01.01 2023/03/07 14:08 52 52 0 IBMUSER
DSNTJIAI 1 01.01 2023/03/07 17:20 1187 1185 0 IBMUSER
```

Figure 17: IBMUSER.SDISETUP(CRTZFS)

And then submit the JCL.

-DSC- BROWSE IBMUSER.SDISETUP(CRTZFS) - 01.01 Line 00000000 Col 001 080

Command ==> sub Scroll ==> PAGE

```
***** Top of Data *****
//IBMUSERJ JOB (SDI),'CREATE ZFS',CLASS=A,MSGCLASS=H,
// NOTIFY=&SYSPID,MSGLEVEL=(1,1)
//*****
//** PURPOSE: CREATE ZFS DATASET AND MOUNTPOINT
//**
//** NOTES: Modify the JOB statement as appropriate and change
//**         the following to suit your installation requirements
//**
//** @pathprefix@ - Directory path to prefix /usr/lpp/IBM
//**
//** @zfsdsn@ - Name of the 'common' ZFS dataset to be created
//**             and mounted at @pathprefix@
//**
//** @volume@ - Volume on which tocreate ZFS dataset
//**
//*****
//CREATE EXEC PGM=IDCAMS,REGION=0M
//SYSPRINT DD SYSOUT=*
//SYSIN DD *
 DEFINE -
   CLUSTER -
   (
     NAME(IBMUSER.SDI13.ZFS) -
     LINEAR -
     CYL(4000 1000) VOLUME(USER0A) -
     DATACLASS(DCEXTEAV) -
     SHAREOPTIONS(3) -
   )
/*
//*
// SET ZFSDSN='IBMUSER.SDI13.ZFS'
//FORMAT EXEC PGM=IOEAGFMT,REGION=0M,COND=(0,LT),
// PARM='aggregate &ZFSDSN -compat'
//SYSPRINT DD SYSOUT=*
//STDOUT DD SYSOUT=*
 F1=Help      F3=Exit      F5=Rfind    F12=Cancel
```

Figure 18: JCL for zFS generation

Wait for the correct execution and result for the JCL

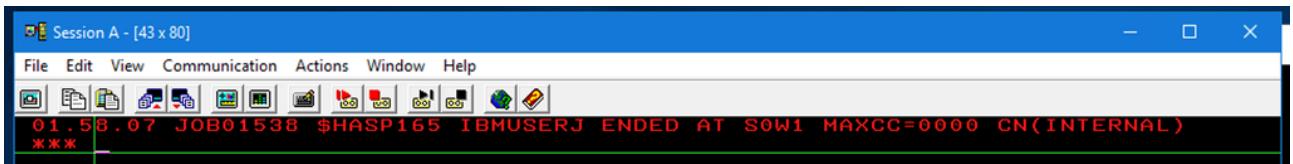


Figure 19: Successful execution

You can check the size of the ZFS in KB with the following command in USS, it has been mounted from the creation JCL. Use the VT100 terminal connected to USS. Command `df -k /u/sqlidi13`:

```
/u/ibmuser >df -k /u/sqlidi13
Mounted on      Filesystem          Avail/Total    Files    Status
/u/sqlidi13    (IBMUSER.SDI13.ZFS)  2850695/2880000 4294967292 Available
/u/ibmuser >zfsadm grow -aggregate IBMUSER.SDI13.ZFS -size 5000000
```

Figure 20: Check size of the zFS

Now grow the zFS to ensure that it is over 4GB in size, use the command `zfsadm grow -aggregate IBMUSER.SDI13.ZFS -size 5000000`:

```
/u/ibmuser >df -k /u/sqlidi13
Mounted on      Filesystem          Avail/Total    Files    Status
/u/sqlidi13    (IBMUSER.SDI13.ZFS)  2850695/2880000 4294967292 Available
/u/ibmuser >zfsadm grow -aggregate IBMUSER.SDI13.ZFS -size 5000000
```

Figure 21: Grow command for zFS

Change `/u/sqlidi13` ownership to AIDBADM user. Command: `chown AIDBADM /u/sqlidi13`.

Check that it worked. Command: `ls -latr /u/sqlidi13/`

## 4. Create SQLDI Pseudo-catalog

### TASK

You will need to go to your TSO session and search for `IBMUSER.SDISETUP(DSNTIJAI)`, and execute the JCL.

and wait for the correct return code.

## 5. Prepare a Certificate and Keyring for SQLDI

Authentication for the SQLDI server is achieved by referencing a certificate in a RACF keyring during the SQLDI instance creation.

Additionally, we could setup network encryption rules using RACF certificates and PAGENT rules. z/OS uses Application-Transparent TLS (AT-TLS), so there would be no difference in the SQLDI setup steps. Encryption is outside the scope of this HOL.

```
/u/ibmuser >ls -altr /u/sqldi13/
total 32
drwxr-xr-x  34 OMVSKERN  SYS1      16384 May 28  2023 ..
drwxr-xr-x   2 AIDBADM  SYS1          0 May 21 09:58 .
/u/ibmuser >
```

Figure 22: Check ownership change

The screenshot shows a TSO session window titled "Session A - [43x80]". The menu bar includes File, Edit, View, Communication, Actions, Window, Help, and Utilities. The Utilities menu is open, showing options like BROWSE, EDIT, and FIND. The main area displays a command-line interface for creating a pseudo-catalog:

```
-DSC--BROWSE L1---- IBMUSER.SDISETUP ----- ROW 00001 OF 00020
COMMAND ===> SCROLL ===> CSR
HOTBAR?
*SOR*T*SHOW*
NAME      PROMPT    LIB VV.MM     CHANGED      SIZE  INIT  MOD  USERID
CBPDO      1 01.01 2023/03/07 15:45       25    2    0  IBMUSER
CRTZFS    1 01.01 2023/03/07 14:08       52    52   0  IBMUSER
DSNTIJAI  1 01.01 2023/05/28 21:09      1255  1258  0  IBMUSER
DSNTIJAV  1 01.01 2023/03/07 17:24      45016 45014 0  IBMUSER
```

Figure 23: Create pseudo-catalog

A JCL job for creating a keyring containing a self-signed certificate is provided in IBMUSER.SDISETUP(RACFKEYR). Logon to TSO, review and submit this job to create the RACF artefacts. The steps performed by this job are

1. create a keyring
2. create a certificate authority (identified by label WMLZCACert)
3. create a certificate (identified by label WMLZCert\_WMLZID) and signed by the CA above
4. connect both the user certificate and the CA certificate to the keyring
5. grant permission to list the keyring to aidbadm (and any other user that might want to list it)
6. perform a RACF refresh

## TASK

Go to dataset IBMUSER.SDISETUP(RACFKEYR)

The screenshot shows a TSO session window titled "Session A - [43x80]". The menu bar includes File, Edit, View, Communication, Actions, Window, Help, and Utilities. The Utilities menu is open, showing options like BROWSE, EDIT, and FIND. The main area displays a command-line interface for viewing the RACFKEYR member dataset:

```
-DSC--BROWSE L1---- IBMUSER.SDISETUP ----- ROW 00001 OF 00021
COMMAND ===> SCROLL ===> CSR
HOTBAR?
*SOR*T*SHOW*
NAME      PROMPT    LIB VV.MM     CHANGED      SIZE  INIT  MOD  USERID
CBPDO      1 01.01 2023/03/07 15:45       25    2    0  IBMUSER
CRTZFS    1 01.01 2023/03/07 14:08       52    52   0  IBMUSER
DSNTIJAI  1 01.01 2023/03/07 17:20      1187  1185  0  IBMUSER
DSNTIJAV  1 01.01 2023/03/07 17:24      45016 45014 0  IBMUSER
NEWTIJAI  1 01.01 2023/05/28 21:09      1255  1258  0  IBMUSER
RACFCHK   1 01.03 2023/03/14 13:18       19     7    0  IBMUSER
RACFDELT  1 01.02 2023/03/14 13:16       21    19   0  IBMUSER
RACFKEYR  1 01.02 2023/03/14 13:07       56     2    0  IBMUSER
RENZFS    1 01.02 2025/05/19 23:47        9    16   0  IBMUSER
RIMLIB    1 01.01 2023/03/07 15:43       25     2    0  IBMUSER
```

Figure 24: RACFKEYR member

And then submit the job:

You can check the status of the RACF objects by submitting IBMUSER.SDISETUP(RACFCHK):

```

-DSC- BROWSE IBMUSER.SDISETUP(RACFKEYR) - 01.02      Line 00000000 Col 001 080
Command ==> sub                                         Scroll ==> PAGE
***** Top of Data *****
//IBMUSERJ JOB (USR),'ADD USER',CLASS=A,MSGCLASS=H,
//          NOTIFY=&SYSUID,MSGLEVEL=(1,1),REGION=0M
//*****
//** CREATE RACF KEYRING FOR SQLDI V12
//**
//*****
//S1 EXEC PGM=IKJEFT01
//SYSTSPRT DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSTSIN DD *
RACDCERT ADDRING(WMLZRING) ID(AIDBADM)

RACDCERT GENCERT CERTAUTH +
SUBJECTSDN( +
  CN('STLAB41') +
  C('US') +
  SP('CA') +
  L('SAN JOSE') +
  O('IBM') +
  OU('WMLZ') +
) +
ALTNAMES( +
  EMAIL('nmarion@us.ibm.com') +
) +
WITHLABEL('WMLZCACert') +
NOTAFTER(DATE(2025/01/01))

RACDCERT GENCERT ID(AIDBADM) +
SUBJECTSDN( +
  CN('STLAB41') +
  C('US') +
  SP('CA') +
  L('SAN JOSE') +
  O('IBM') +
  OU('WMLZ') +
)

```

F1=Help F3=Exit F5=Rfind F12=Cancel

MA A 04/018

Connected to remote server/host wg31 using lu/pool TCP00003 and port 23 Microsoft Print to PDF on PORTPROMPT:

Figure 25: RACFKEYR execution

*SORT*SHOW*								
	PROMPT	LIB	VV.MM	CHANGED	SIZE	INIT	MOD	USERID
-	CBPDO		1 01.01	2023/03/07 15:45	25	2	0	IBMUSER
-	CRTZFS		1 01.01	2023/03/07 14:08	52	52	0	IBMUSER
-	DSNTIJAI		1 01.01	2023/03/07 17:20	1187	1185	0	IBMUSER
-	DSNTIJAV		1 01.01	2023/03/07 17:24	45016	45014	0	IBMUSER
-	NEWTIJAI		1 01.01	2023/05/28 21:09	1255	1258	0	IBMUSER
b	RACFCHK		1 01.03	2023/03/14 13:18	19	7	0	IBMUSER
-	RACFDELT		1 01.02	2023/03/14 13:16	21	19	0	IBMUSER

ROW 00001 OF 00021 SCROLL ==> CSR

04/018

Figure 26: RACFCHK member

```

Session A - [43x80]
File Edit View Communication Actions Window Help
Menu Utilities Compilers Help
-DSC- BROWSE IBMUSER.SDISETUP(RACFCHK) - 01.03 Line 00000000 Col 001 080
Command ==> sub Scroll ==> PAGE
***** Top of Data *****
//IBMUSERJ JOB '(USR)', 'ADD USER', CLASS=A, MSGCLASS=H,
// NOTIFY=&SYSUID, MSGLEVEL=(1,1), REGION=0M
//*****
//*
//** CHECK RACF KEYRING FOR SQLDI V12
//**
//*****
//S1 EXEC PGM=IKJEFT01
//SYSTSPRT DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSTSIN DD *
RACDCERT LISTRING(WMLZRING) ID(AIDBADM)
RACDCERT CERTAUTH LIST(LABEL('WMLZCACert'))
RACDCERT LIST(LABEL('WMLZCert_WMLZID')) ID(AIDBADM)
/*
***** Bottom of Data *****

```

Figure 27: RACFCHK member

The output of the job should look like this:

---

## 6. Prepare network ports

SQLDI makes use of several TCPIP ports for communication between the various Spark and SQLDI components. You can control the values of all of these ports during the SQLDI instance create process if you need to.

For this HOL environment, all the default ports are free, meaning that you should not suffer port conflicts. However, in a customer environment you should communicate with the z/OS network administrator to check port availability. Commands like NETSTAT are available in USS and TSO to check reserved ports.

---

### TASK

Check whether any of the default ports are already assigned. If they are you will need to choose a different free port when you create the SQLDI Server.

The default ports used by SQLDI are documented here [SQLDI Pre-Requisites](#)

- SQLDI Web UI on 15001
  - z/OS Spark Master on 7077
  - z/OS Spark Master REST API on 6066
  - z/OS Spark Master UI on 8080
  - z/OS Spark Worker UI on 8081
  - Other Spark ports can be system assigned or manually defined
- 

## 7. Create the SQLDI Server Instance

The installation of SQLDI has placed a script file (sqldi.sh) in /u/aidbadm/sql-data-insights/bin

```

Session A - [43x80]
File Edit View Communication Actions Window Help
Display Filter View Print Options Search Help
SDSF OUTPUT DISPLAY IBMUSERJ JOB01537 DSID 102 LINE 2
COMMAND INPUT ==> SCROLL ==> CSR
READY
RACDCERT LISTSTRING(WMLZRING) ID(AIDBADM)
Digital ring information for user AIDBADM:
Ring:
>WMLZRING<
Certificate Label Name Cert Owner Usage Default
----- ----- -----
WMLZCACert CERTAUTH CERTAUTH NO

READY
READY
RACDCERT CERTAUTH LIST(LABEL('WMLZCACert'))
Digital certificate information for CERTAUTH:
Label: WMLZCACert
Certificate ID: 2QiJmZmDhZmjgebU0+nDwcOFmaNA
Status: TRUST
Start Date: 2023/08/16 00:00:00
End Date: 2025/01/01 23:59:59
Serial Number:
>00<
Issuer's Name:
>CN=STLAB41.OU=WMLZ.O=IBM.L=SAN JOSE.SP=CA.C=US<
Subject's Name:
>CN=STLAB41.OU=WMLZ.O=IBM.L=SAN JOSE.SP=CA.C=US<
Subject's AltNames:
Email: nmarion at us.ibm.com
Signing Algorithm: sha256RSA
Key Usage: CERTSIGN
Key Type: RSA
Key Size: 2048
Private Key: YES
F1=HELP F2=SPLIT F3=END F4=RETURN F5=RFIND F6=RCHANGE
F7=UP F8=DOWN F9=SWAP LIS F10=LEFT F11=RIGHT F12=RETRIEVE
MA A 05/021
Connected to remote server/host wg31 using lu/pool TCP00003 and port 23 Microsoft Print to PDF on PORTPROMPT:

```

Figure 28: RACFCHK output

```

Menu List Mode Functions Utilities Help
ISPF Command Shell
Enter TSO or Workstation commands below:
==> netstat portlist
Place cursor on choice and press enter to Execute command
=>

```

Figure 29: Command to see the ports

```

EZZ22350I MVS TCP/IP NETSTAT CS V2R4      TCPIP Name: TCPIP          08:27:20
EZZ22795I Port# Prot User   Flags     Range      IP Address      SAF Name
EZZ22796I ----- -----
EZZ22797I 7   TCP  MISCSERV DA
EZZ22797I 9   TCP  MISCSERV DA
EZZ22797I 19  TCP  MISCSERV DA
EZZ22797I 20  TCP  OMVS   D
EZZ22797I 21  TCP  OMVS   DA
EZZ22797I 22  TCP  SSHDX* DA
EZZ22797I 23  TCP  TN3270 DA
EZZ22797I 25  TCP  SMTP   DA
EZZ22797I 53  TCP  NAMESRV DA
EZZ22797I 80  TCP  OMVS   DA
EZZ22797I 111 TCP  PORTMAP DA
EZZ22797I 433 TCP  OMVS   DA
EZZ22797I 443 TCP  OMVS   DA
EZZ22797I 512 TCP  RXSERVE DA
EZZ22797I 514 TCP  RXSERVE DA
EZZ22797I 515 TCP  LPSERVE DA
EZZ22797I 750 TCP  MVSKERB DA
EZZ22797I 751 TCP  ADM@SRV DA
EZZ22797I 1023 TCP  OMVS   DA
EZZ22797I 1024 TCP  OMVS   DA
EZZ22797I 1416 TCP  CSQ9CHIN DA
EZZ22797I 2023 TCP  TN3270 DA
EZZ22797I 3000 TCP  CICSTS53 DA
EZZ22797I 3001 TCP  CICSTS52 DA
EZZ22797I 3002 TCP  CICSTS51 DA
EZZ22797I 3003 TCP  CICSTS42 DA
EZZ22797I 3004 TCP  CICSTS41 DA
EZZ22797I 3080 TCP  ZOSCSRV* DAR    03080-03082
EZZ22797I 3443 TCP  ZOSCSRV* DAR    03443-03445
EZZ22797I 16000 TCP  ZCICS000
EZZ22797I 16001 TCP  ZCICS000
EZZ22797I 16002 TCP  ZCICS000
EZZ22797I 16003 TCP  ZCICS001
EZZ22797I 16004 TCP  ZCICS001
EZZ22797I 16005 TCP  ZCICS001
EZZ22797I 16310 TCP  PAGENT   D
EZZ22797I 32200 TCP  BBN7ACRS DA
EZZ22797I 32201 TCP  BBN7ACRS A
EZZ22797I 32202 TCP  BBN8001 DA
***_

```

Figure 30: Ports

Assuming that you setup the PATH variable correctly (to include /u/aidbadm/sql-data-insights/bin) then sqldi.sh can be invoked from any path.

Open a putty session to USS, logon as **aidbadm**, and just type command **sqldi.sh** in order to get the command parameters returned to you

```
/u/aidbadm >sqldi.sh
```

This script installs, starts, and stops SQL Data Insights. Before running the script, make sure that you allocate a minimum of 4GB disk space to your zFS file system and meet other system requirements. In case of an error, resolve the error and then rerun the script.

Usage:

```
sqldi.sh [action] [-Xms <value>] [-Xmx <value>]
```

Action:

create	Installs the SQL Data Insights application.
start	Starts the SQL Data Insights application.
stop	Stops the SQL Data Insights application.
start_spark	Starts the embedded Spark cluster.
stop_spark	Stops the embedded Spark cluster.

JVM Options:

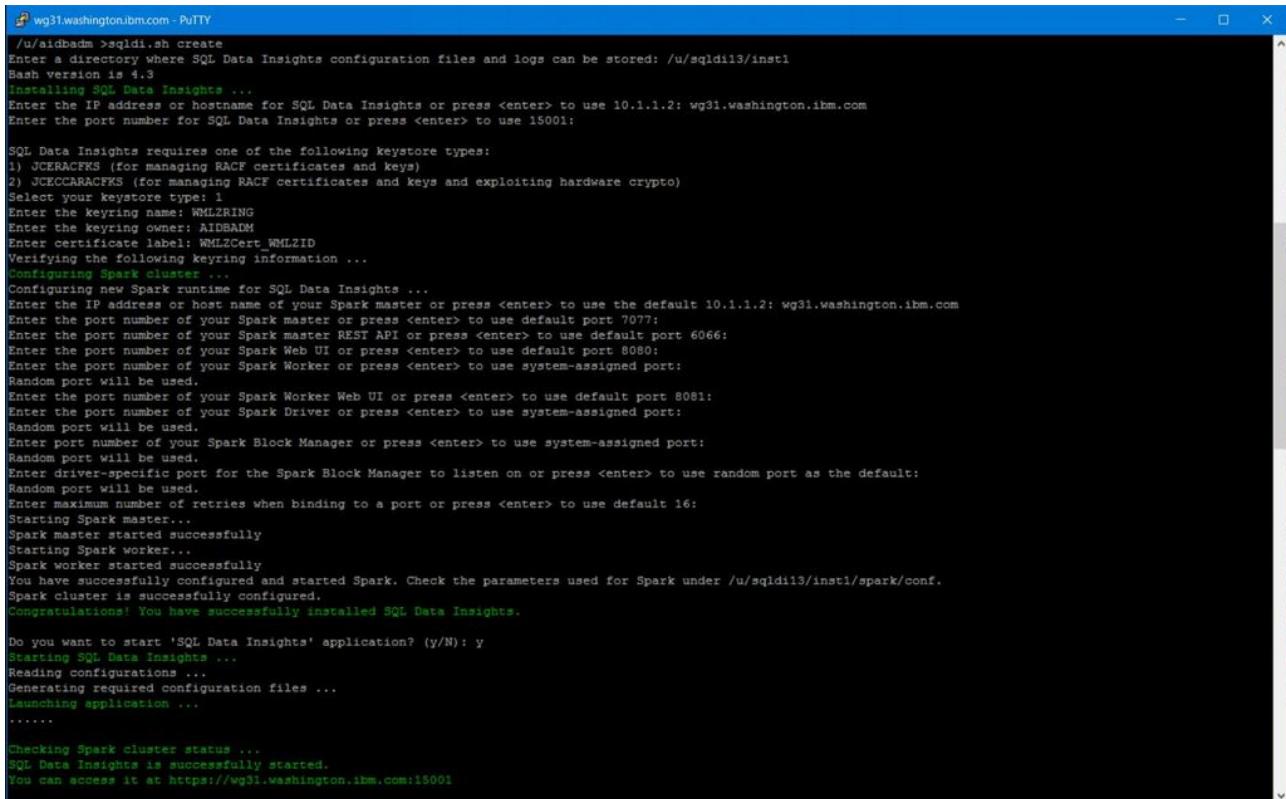
-Xms ..	Specifies the initial memory allocation for JVM in the format of [Optional]. e.g. 512M (Optional).
-Xmx ..	Specifies the maximum memory allocation for JVM in the format of [Optional]. e.g. 1G (Optional).

Examples:

```
./sqldi.sh create  
./sqldi.sh create -Xms 512M -Xmx 1024M  
./sqldi.sh start  
./sqldi.sh stop  
./sqldi.sh start_spark  
./sqldi.sh stop_spark
```

```
/u/aidbadm >
```

You should use the bash shell for SQLDI work. This was installed to /u/aidbadm/tools/ when you installed the SQLDI package, and was added to your path when you edited the .profile file, so you can enter the bash shell by simply typing **bash** inside your putty USS shell.



```
wg31.washington.ibm.com - PuTTY  
/u/aidbadm>sqldi.sh create  
Enter a directory where SQL Data Insights configuration files and logs can be stored: /u/sqldi13/inst1  
Bash Version is 4.3  
Installing SQL Data Insights ...  
Enter the IP address or hostname for SQL Data Insights or press <enter> to use 10.1.1.2: wg31.washington.ibm.com  
Enter the port number for SQL Data Insights or press <enter> to use 15001:  
  
SQL Data Insights requires one of the following keystore types:  
1) JCERACFKS (for managing RACF certificates and keys)  
2) JCECCARACFKS (for managing RACF certificates and keys and exploiting hardware crypto)  
Select your keystore type: 1  
Enter the keyring name: WMLRING  
Enter the keyring owner: AIDBADM  
Enter certificate label: WMLCert_WMLZID  
Verifying the following keyring information ...  
Configuring Spark cluster ...  
Configuring new Spark runtime for SQL Data Insights ...  
Enter the IP address or host name of your Spark master or press <enter> to use the default 10.1.1.2: wg31.washington.ibm.com  
Enter the port number of your Spark master or press <enter> to use default port 7077:  
Enter the port number of your Spark master REST API or press <enter> to use default port 6066:  
Enter the port number of your Spark Web UI or press <enter> to use default port 8080:  
Enter the port number of your Spark Worker or press <enter> to use system-assigned port:  
Random port will be used.  
Enter the port number of your Spark Worker Web UI or press <enter> to use default port 8081:  
Enter the port number of your Spark Driver or press <enter> to use system-assigned port:  
Random port will be used.  
Enter port number of your Spark Block Manager or press <enter> to use system-assigned port:  
Random port will be used.  
Enter driver-specific port for the Spark Block Manager to listen on or press <enter> to use random port as the default:  
Random port will be used.  
Enter maximum number of retries when binding to a port or press <enter> to use default 16:  
Starting Spark master...  
Spark master started successfully  
Starting Spark worker...  
Spark worker started successfully  
You have successfully configured and started Spark. Check the parameters used for Spark under /u/sqldi13/inst1/spark/conf.  
Spark cluster is successfully configured.  
Congratulations! You have successfully installed SQL Data Insights.  
  
Do you want to start 'SQL Data Insights' application? (y/N): y  
Starting SQL Data Insights ...  
Reading configurations ...  
Generating required configuration files ...  
Launching application ...  
....  
  
Checking Spark cluster status ...  
SQL Data Insights is successfully started.  
You can access it at https://wg31.washington.ibm.com:15001
```

Figure 31: bash

You are now ready to create the SQLDI instance because

1. you know the default ports are available
2. you know the path where you want to install the instance ( /u/sqldi13 )
3. you know the name of the RACF keyring and the certificate to reference

---

## TASK

**Notes on TCPIP Addressing to Use.** When running the sqldi.sh script to create the instance in this lab, you should **always** use the hostname **wg31.washington.ibm.com**, and never use the TCPIP Address.

In a customer environment it would be fine to use the TCPIP Address. But the cloning process used to provision the z/OS images has not customised TCPIP address in the z/OS TCPIP stack. The hosts file in the Windows client image has been edited so that both `wg31` and `wg31.washington.ibm.com` point at the actual z/OS image. And within the z/OS USS environment `wg31.washington.ibm.com` points at the actual z/OS image.

Do not be tempted to use the shortened hostname alias in windows (`wg31`) because this is not defined in USS.

1. Use `wg31.washington.ibm.com` for the `sqlidi.sh create` script.
2. Use `wg31.washington.ibm.com` to access it from Windows later on in the HOL.

Please also note that some of the screenshots in this workbook may point to an actual IP address. Please ignore this, and use `hostname wg31.washington.ibm.com` consistently.

**Invoke the `sqlidi.sh` Script** Execute the script, fill in the variables requested and wait until completion.

When you invoke the `sqlidi.sh create` script, the dialog should look like the screenshot below. User prompts and responses have been highlighted with yellow arrows.

Note, there are several examples of informational messages not being retrieved from a missing message catalog. At time of writing this instrumentation problem has not been resolved, but the script still succeeds.

You will be prompted for many decisions, as follows.

Enter a directory where SQL Data Insights configuration files and logs can be stored: /u/  
>>> specify a path underneat /u/aidbadm ( the big ZFS mountpoint)

Enter the IP address or hostname for SQL Data Insights or press <enter> to use 10.1.1.2:  
>>> We're using wg31.washington.ibm.com !!!!!!!

Enter the port number for SQL Data Insights or press <enter> to use 15001:  
>>> Accept the default port

SQL Data Insights requires one of the following keystore types:

1) JCERACFKS (for managing RACF certificates and keys)

2) JCECCARACFKS (for managing RACF certificates and keys and exploiting hardware crypto)

Select your keystore type: 1

>>> The keystore type is 1

Enter the keyring name: WMLZRING  
>>> Enter the name of the Keyring you created

Enter the keyring owner: AIDBADM  
>>> Enter the name of the keyring owner

Enter certificate label: WMLZCert\_WMLZID  
>>> Enter the label of the Certificate you created. (The user certificate, NOT the CA ce

Enter the IP address or host name of your Spark master or press <enter> to use the defau

```

/u/aidb0020 >sqldi.sh create ←
EZ8341I Error 0081/C90F001E was returned from catopen("ezaitmsg.cat"): EDC5129I No such file or directory.
EZ8345I Message catalog ezaitmsg.cat could not be opened - Default messages will be used
EZ8341I Error 0081/C90F001E was returned from catopen("ezahomsg.cat"): EDC5129I No such file or directory.
EZ8345I Message catalog ezahomsg.cat could not be opened - Default messages will be used
EZ8342I SOW1: Unknown host
Setup for SQL Data Insights Beta 2.11
Enter a directory where SQL Data Insights configuration files and logs can be stored: /u/aidb0020/holinstance ←
Bash version is 4.3
Installing SQL Data Insights ...
Enter the IP address or hostname for SQL Data Insights or press <enter> to use 10.1.1.2: wg31.washington.ibm.com ←
EZ3108I Unable to open message catalog "pingmsg.cat" - EDC5129I No such file or directory.
Enter the port number for SQL Data Insights or press <enter> to use 15001:
SQL Data Insights requires one of the following keystore types:
1) JCERACFKS (for managing RACF certificates and keys)
2) JCECCARACFKS (for managing RACF certificates and keys and exploiting hardware crypto)
Select your keystore type: 1 ←
Enter the keyring name: WMLZRING ←
Enter the keyring owner: AIDBADM ←
Enter certificate label: WMLZCert_WMLZID ←
Verifying the following keyring information ...
Configuring Spark cluster ...
Configuring new Spark runtime for SQL Data Insights ...
Enter the IP address or host name of your Spark master or press <enter> to use the default 10.1.1.2: wg31.washington.ibm.com ←
EZ3108I Unable to open message catalog "pingmsg.cat" - EDC5129I No such file or directory.
Enter the port number of your Spark master or press <enter> to use default port 7077: ←
Enter the port number of your Spark master REST API or press <enter> to use default port 6066: ←
Enter the port number of your Spark Web UI or press <enter> to use default port 8080: ←
Enter the port number of your Spark Worker or press <enter> to use system-assigned port: ←
Random port will be used.
Enter the port number of your Spark Worker Web UI or press <enter> to use default port 8081: ←
Enter the port number of your Spark Driver or press <enter> to use system-assigned port: ←
Random port will be used.
Enter port number of your Spark Block Manager or press <enter> to use system-assigned port: ←
Random port will be used.
Enter driver-specific port for the Spark Block Manager to listen on or press <enter> to use random port as the default: ←
Random port will be used.
Enter maximum number of retries when binding to a port or press <enter> to use default 16: ←
EZ8341I Error 0081/C90F001E was returned from catopen("ezaitmsg.cat"): EDC5129I No such file or directory.
EZ8345I Message catalog ezaitmsg.cat could not be opened - Default messages will be used
EZ8341I Error 0081/C90F001E was returned from catopen("ezahomsg.cat"): EDC5129I No such file or directory.
EZ8345I Message catalog ezahomsg.cat could not be opened - Default messages will be used
EZ8342I SOW1: Unknown host
Setup for SQL Data Insights Beta 2.11
Starting Spark master...
Spark master started successfully
Starting Spark worker...
Spark worker started successfully
You have successfully configured and started Spark. Check the parameters used for Spark under /u/aidb0020/holinstance/spark/conf.
Spark cluster is successfully configured.
EZ8341I Error 0081/C90F001E was returned from catopen("ezaitmsg.cat"): EDC5129I No such file or directory.
EZ8345I Message catalog ezaitmsg.cat could not be opened - Default messages will be used
EZ8341I Error 0081/C90F001E was returned from catopen("ezahomsg.cat"): EDC5129I No such file or directory.
EZ8345I Message catalog ezahomsg.cat could not be opened - Default messages will be used
EZ8342I SOW1: Unknown host
Setup for SQL Data Insights Beta 2.11
Congratulations! You have successfully installed SQL Data Insights.

Do you want to start 'SQL Data Insights' application? (y/N): [y] ←

```

Figure 32: sqldicreate

```
>>> Use wg31.washington.ibm.com !!!!!!!
```

```
>>> And then specify your chosen ports.
```

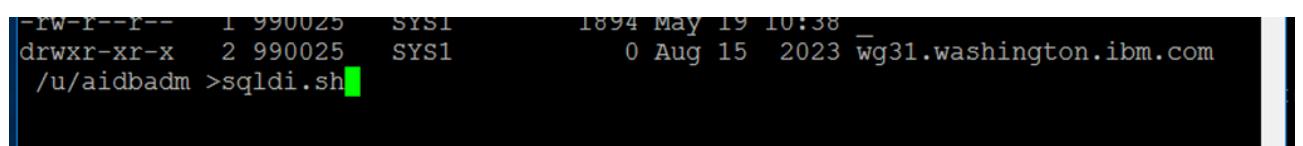
You have successfully configured and started Spark. Check the parameters used for Spark  
>>> Remember this location

```
Do you want to start 'SQL Data Insights' application? (y/N):
```

```
>>> No
```

## TASK

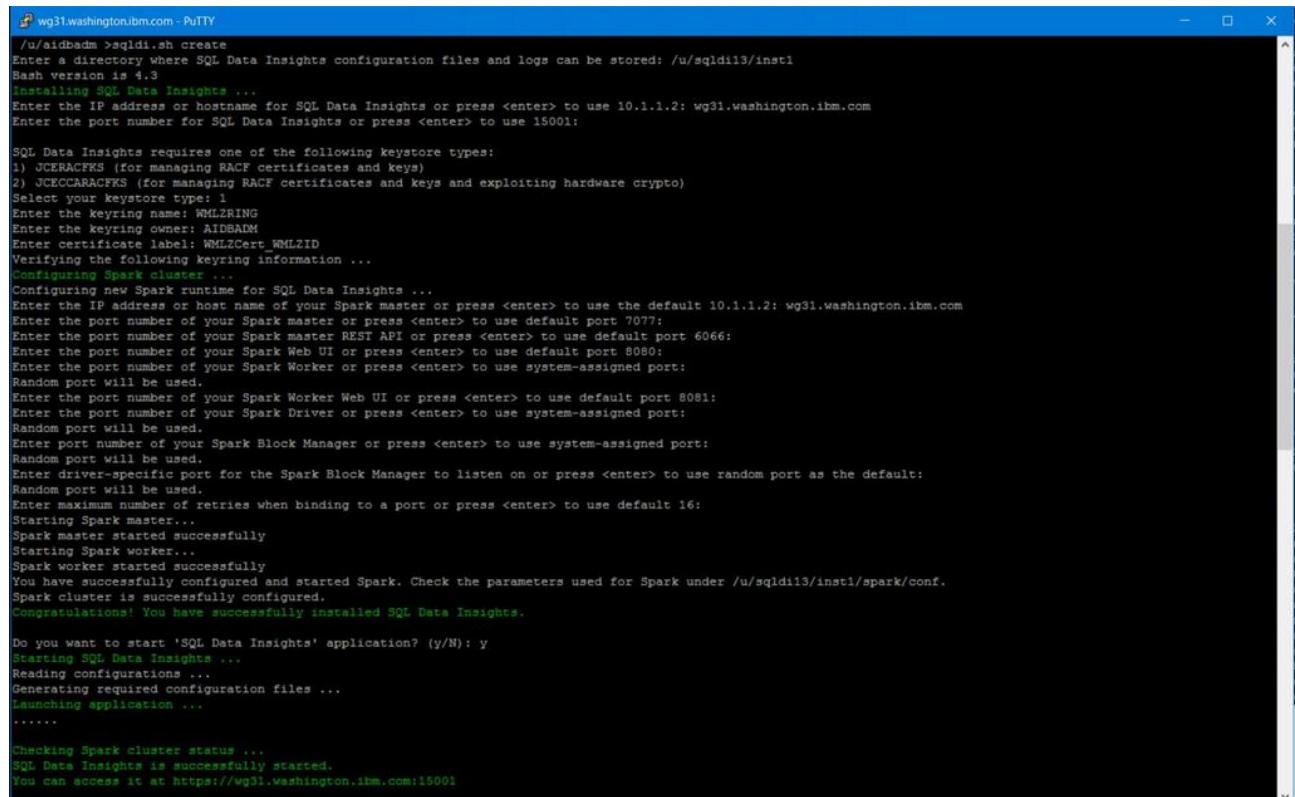
Run the `sqldi.sh create` from **AIDBADM** user (not IBMUSER). But when prompted enter N to avoid starting the server.



```
-rw-r--r-- 1 990025  SYS1      1894 May 19 10:38
drwxr-xr-x 2 990025  SYS1          0 Aug 15 2023 wg31.washington.ibm.com
/u/aidbadm >sqldi.sh
```

Figure 33: Create instance script

This is the example output in our test system.



```
wg31.washington.ibm.com - PuTTY
/u/aidbadm >sqldi.sh create
Enter a directory where SQL Data Insights configuration files and logs can be stored: /u/sqldi13/inst1
Bash version is 4.3
Installing SQL Data Insights ...
Enter the IP address or hostname for SQL Data Insights or press <enter> to use 10.1.1.2: wg31.washington.ibm.com
Enter the port number for SQL Data Insights or press <enter> to use 15001:
SQL Data Insights requires one of the following keystore types:
1) JCERACFKS (for managing RACF certificates and keys)
2) JCECCARACFKS (for managing RACF certificates and keys and exploiting hardware crypto)
Select your keystore type: 1
Enter the keyring name: WMLZRING
Enter the keyring owner: AIDBADM
Enter certificate label: WMLZCert_WMLZID
Verifying the following keyring information ...
Configuring Spark cluster ...
Configuring new Spark runtime for SQL Data Insights ...
Enter the IP address or host name of your Spark master or press <enter> to use the default 10.1.1.2: wg31.washington.ibm.com
Enter the port number of your Spark master or press <enter> to use default port 7077;
Enter the port number of your Spark master REST API or press <enter> to use default port 6066;
Enter the port number of your Spark Web UI or press <enter> to use default port 8080;
Enter the port number of your Spark Worker or press <enter> to use system-assigned port;
Random port will be used.
Enter the port number of your Spark Worker Web UI or press <enter> to use default port 8081;
Enter the port number of your Spark Driver or press <enter> to use system-assigned port;
Random port will be used.
Enter port number of your Spark Block Manager or press <enter> to use system-assigned port;
Random port will be used.
Enter driver-specific port for the Spark Block Manager to listen on or press <enter> to use random port as the default;
Random port will be used.
Enter maximum number of retries when binding to a port or press <enter> to use default 16;
Starting Spark master...
Spark master started successfully
Starting Spark worker...
Spark worker started successfully
You have successfully configured and started Spark. Check the parameters used for Spark under /u/sqldi13/inst1/spark/conf.
Spark cluster is successfully configured.
Congratulations! You have successfully installed SQL Data Insights.

Do you want to start 'SQL Data Insights' application? (y/N): y
Starting SQL Data Insights ...
Reading configurations ...
Generating required configuration files ...
Launching application ...
.....
Checking Spark cluster status ...
SQL Data Insights is successfully started.
You can access it at https://wg31.washington.ibm.com:15001
```

Figure 34: Example input/output

Take a moment to review some updates that the `sqldi.sh create` script added to .profile

```

000087 # Generated by SQL Data Insights installation script
000088 export SQLDI_HOME=/u/aidbadm/holinstance
000089
000090
000091 export SPARK_CONF_DIR=/u/aidbadm/holinstance/spark/conf
000092 export SPARK_LOCAL_IP=10.1.1.2
000093 export SPARK_MASTER_PORT=7077
000094
000095 # aliases for SQL DI lifecycle management.
000096 alias start_sqldi="/u/aidbadm/sql-data-insights/bin/sqldi.sh start"
000097 alias stop_sqldi="/u/aidbadm/sql-data-insights/bin/sqldi.sh stop"
000098
000099 alias start_spark="/u/aidbadm/sql-data-insights/bin/sqldi.sh start_spark"
000100 alias stop_spark="/u/aidbadm/sql-data-insights/bin/sqldi.sh stop_spark"
000101
***** ***** Bottom of Data *****

```

List the processes running under user AIDBADM, by using command ps -ef.

You should see the spark Master and Worker nodes using the ports you specified.

And Check the Spark Server by opening your browser on the Spark Web UI port <http://wg31.washington.ibm.com:8080/>. You should see a display like the screenshot below.

The screenshot shows the Spark Web UI interface. At the top, it says "Spark Master at spark://wg31.washington.ibm.com:7077". Below this, there are sections for "Workers (1)" and "Running Applications (0)". The "Workers (1)" section shows one worker with the ID "worker-20220830004402-10.1.1.2-1221", which is "ALIVE" with 4 cores and 32.0 GB memory. The "Running Applications (0)" and "Completed Applications (0)" sections both show an empty table with columns: Application ID, Name, Cores, Memory per Executor, Submitted Time, User, State, and Duration.

Worker Id	Address	State	Cores	Memory
worker-20220830004402-10.1.1.2-1221	10.1.1.2:1221	ALIVE	4 (0 Used)	32.0 GB (0.0 B Used)

Application ID	Name	Cores	Memory per Executor	Submitted Time	User	State	Duration

Application ID	Name	Cores	Memory per Executor	Submitted Time	User	State	Duration

Figure 35: Spark UI

At this point, no training jobs will be executing, but you will use this Web UI to check on Spark progress later on.

The sqldi.sh script will automatically check whether spark is running, and start it if it is not running. As you get are gaining familiarity with SQLDI, it is good practice to start Spark and SQLDI separately.

---

## TASK

The procedure to start SQLDI would be

1. `sqldi.sh start_spark`
2. check spark is up and running
3. `sqldi.sh start`

Likewise, the procedure to stop SQLDI would be

1. `sqldi.sh stop`
2. `sqldi.sh stop_spark`

Assuming spark is started, lets start SQLDI itself with the command `sqldi.sh start`

And Check the SQLDI Server by opening your browser on the SQLDI listener port <https://wg31.washington.ibm.com:15001/>.

Be sure to specify the URL exactly. Browsers will normally figure out whether an IP address is http or https , but this one doesn't.

---

### Security Notes:

1. the first time you open this port there will be a privacy error.
2. The browser indicates that the session is “not secure”, which is expected because the browser does not know about the CA that signed the certificate.
3. Just click proceed to accept the certificate.

Now you could logon to to the SQLDI Server. You would need to use a RACF userid that

1. has appropriate privileges to connect to Db2
2. has access the Db2 tables that you wish to use for SQL Data Insights
3. has access all the Db2 artefacts that support SQLDI
4. is a member of RACF Group SQLDIGRP

But you need to create the necessary Db2 artefacts first.

## 8 Create some SQLDI artefacts

The necessary functions required to run AI queries and to exploit SQLDI are installed with the **SQLDI FMID HDBDD18**. During this installation process there are just two steps to be run in order to complete SQLDI functions.

One of them is the pseudo-catalog that was already created in step 4.

The other one is a table sample that you can use to test SQLDI.

### 8.1 Create CHURN table for testing

---

## TASK

Create the CHURN table using JCL IBMUSER.SDISETUP(DSNTIJAV).

Session A - [43 x 80]

*SORT*SHOW*								ON VOLUME: USER0A
NAME	PROMPT	LIB	VV.MM	CHANGED	SIZE	INIT	MOD	USERID
DSNTIJAI	BROWSED	1	01.01	2023/05/28 21:09	1255	1258	0	IBMUSER
DSNTIJAV		1	01.01	2023/03/07 17:24	45016	45014	0	IBMUSER
RACFCHK		1	01.03	2023/03/14 13:18	19	7	0	IBMUSER
RACFDELT		1	01.02	2023/03/14 13:16	21	19	0	IBMUSER
DSNTIEXP		1	01.03	2023/03/14 13:07	55	0	0	IBMUSER

Figure 36: Member DSNTIJAV

Session A - [43 x 80]

```

File Edit View Communication Actions Window Help
Menu Utilities Compilers Help

-DSC- BROWSE IBMUSER.SDISETUP(DSNTIJAV) - 01.01 Line 00000000 Col 001 080
Command ==> sub
***** Top of Data *****
//IBMUSERJ JOB (SDI), 'SDI CSI ALA',CLASS=A,MSGCLASS=H,
// NOTIFY=&SYSPID,MSGLEVEL=(1,1)
//*****
//** JOB NAME = DSNTIJAV
//**
//** DESCRIPTIVE NAME = SQL DATA INSIGHTS INSTALL VERIFICATION SAMPLE
//**
//** Licensed Materials - Property of IBM
//** 5698-DB2
//** COPYRIGHT IBM CORP 2022.
//**
//** STATUS = Version 13
//**
//** FUNCTION = CREATE SQL DATA INSIGHTS INSTALL VERIFICATION SAMPLE
//**
//** PSEUDOCODE =
//** DSNTIAV0 STEP Optional: DROP objects created in this job
//** DSNTIAV1 STEP Create the sample objects
//** DSNTIAV2 STEP Insert data into the sample objects
//**
//** DEPENDENCIES = None
//**
//** NOTES =
//** PRIOR TO RUNNING THIS JOB, customize it for your system:
//** (1) Add a valid job card.
//** (2) Change all occurrences of the following strings:
//**     (A) Change the subsystem name '!DSN!' to the SSID of your
//**         DB2.
//**     (B) Change 'DSN!!0' to the prefix of the target library
//**         for DB2.
//**     (C) Change 'DSNTIA!!' to the plan name for DSNTIAD on your
//**         DB2.
//** (3) Review the bufferpool and storage group settings for the

```

Figure 37: DSNTIJAV submit

The contents of the CHURN table can be viewed in Db2 Admin Tool (ISPF Option m.16).

Access the System Catalog Browser, use a Database Mask of DSNAI\* and use a b command to browse the table if you are curious.

DSN2 Tables, Views, and Aliases							Row 544 from 554		
							Scroll ==> PAGE		
							More: >		
<b>Commands:</b> GRANT MIG ALL									
<b>Line commands:</b>									
C - Columns	A - Auth	L - List	X - Indexes	S - Table space	D - Database				
V - Views	T - Tables	P - Plans	Y - Synonyms	SEL - Select prototyping					
? - Show all line commands									
Sel	Name	Schema	T	DB Name	TS Name	Cols	Rows	Chks	C
*	*	*	*	DSNAI*	*	*	*	*	*
----->								-----	
b_	SYSAICONFIGURATION	SYSAIDB	T	DSNAIDB1	SYSTSAC	10	-1	1	
	SYSAICOLUMNCONFIG	SYSAIDB	T	DSNAIDB1	SYSTSAD	5	-1	2	
	SYSAIMODELS	SYSAIDB	T	DSNAIDB1	SYSTSAIM	19	-1	1	
	SYSAIMODELS_INTERP	SYSAIDB	X	DSNAIDB1	SYSTSAMI	3	-1	0	
	CHURN	DSNAIDB	T	DSNAIDB3	DSNAITS1	21	-1	0	
	SYSAITRAININGJOBS	SYSAIDB	T	DSNAIDB1	SYSTSAIT	15	-1	1	
	SYSAICOLUMNCENTERS	SYSAIDB	T	DSNAIDB1	SYSTSAAE	4	-1	0	
	SYSAIMODELS_METRIC	SYSAIDB	X	DSNAIDB1	SYSTSAML	3	-1	0	
	SYSAIOBJECTS	SYSAIDB	T	DSNAIDB1	SYSTSAAIO	13	-1	1	
	SYSAITRAININGJOBS_	SYSAIDB	X	DSNAIDB1	SYSTSATL	3	-1	0	
	AIDB_DSNAIDB_CHURN	DSNAIDB	T	DSNAIDB2	AIDBRDSN	3	-1	0	
***** END OF DB2 DATA *****								*****	

Figure 38: Access to CHURN table

DSN2 BROWSE DSNAIDB.CHURN							----- Line 000000000 Col 001 080
							Scroll ==> CSR
Max no of rows reached							
***** Top of Data *****							
CUSTOMERID	GENDER	SENIORCITIZEN	PARTNER	DEPENDENTS	TENURE	PHONESERVICE	MUL
7590-VHVEG	Female	0	Yes	No	1	No	No
5575-GNVDE	Male	0	No	No	34	Yes	No
3668-QPYBK	Male	0	No	No	2	Yes	No
7795-CFOCW	Male	0	No	No	45	No	No
9237-HQITU	Female	0	No	No	2	Yes	No
9305-CDSKC	Female	0	No	No	8	Yes	Yes
1452-KIOVK	Male	0	No	Yes	22	Yes	Yes
6713-OKOMC	Female	0	No	No	10	No	No
7892-POOKP	Female	0	Yes	No	28	Yes	Yes
6388-TABGU	Male	0	No	Yes	62	Yes	No
9763-GRSKD	Male	0	Yes	Yes	13	Yes	No
7469-LKBCI	Male	0	No	No	16	Yes	No
8091-TTVAX	Male	0	Yes	No	58	Yes	Yes
0280-XTGEY	Male	0	No	No	49	Yes	Yes

Figure 39: Browsing CHURN table

## 9 Test the installation with the IVP

Perform each of the tasks in the screenshot below to run an IVP test of SQLDI.

### 9.1 Get Connected to the SQLDI Server

Open the Chrome browser at <https://wg31.washington.ibm.com:15001> and logon with **IB-MUSER/SYS1** (despite what you see in the image, YOUR USER IS NOT **USER1**).

Oops ... did you get an error like the one below ?

We know that IBMUSER has access to Db2 because we used it to perform the setup of all the Db2 objects required for SQLDI.

So we need to get a more detailed error message.

SQLDI and Spark each write logfiles in USS. The SQLDI Server writes its logs to the logs directory in the instance. Check the SQLDI Server log for additional information



Figure 40: SQLDI Console



Figure 41: signon\_error01

```
/u/aidb0020/holinstance/logs >ls -al
total 48
drwxr-xr-x  2 AIDBADM  SYS1          8192 Aug 15 23:17 .
drwxr-xr-x 10 AIDBADM  SYS1          8192 Aug 15 23:12 ..
-rw-r--r--  1 AIDBADM  SYS1          441 Aug 15 23:38 sql-data-insights_2022-08-15.0.log
/u/aidb0020/holinstance/logs >cat sql-data-insights_2022-08-15.0.log
[2022-08-15 23:38:15.450] [application-akka.actor.default-dispatcher-44] [ERROR] [managements.UserManagement:49] -- User user1 can
not login SQL DI with error: {"errnoMsg":"unauthorized user","success":false}
[2022-08-15 23:38:15.453] [application-akka.actor.default-dispatcher-44] [ERROR] [controllers.LoginController:58] -- Failed to log
in, User "user1" does not have the required authority. Ask your system administrator for assistance.
/u/aidb0020/holinstance/logs >
```

Figure 42: signon\_error02

In this case, we didn't get a lot more helpful diagnostic information, but it serves to illustrate the fact that much of the SQLDI diagnostic data will be surfaced in the USS environment. Section 11 provides guidance on how to increase the level of diagnostic information by editing the deploy.cfg file.

For now, just accept that the missing authority was membership of the RACF Group SQLDIGRP.

---

## TASK

Edit the RACF job from earlier, or issue the following command from TSO option 6 to rectify the problem.

```
CONNECT (IBMUSER) GROUP(SQLDIGRP) OWNER(IBMUSER)
```

Now you should be able to logon to the SQLDI Web UI with IBMUSER.

---

## 9.2 Define a Db2 Subsystem Connection

Observe there are currently no Db2 systems Connections. Press the “Add Connection” button.

Figure 43: Connections

Fill in the details for the DBDG subsystem

- Name: DBDG
- Hostname: `wg31.washington.ibm.com`
- Port: 5045 (secport: 5046)
- Location Name: DALLASD
- User/Password: IBMUSER/SYS1

See the newly defined connection, and Press the “Connect” button

## 9.3 Work with “AI-Enabled” Tables

Once connected, select “List AI Objects” and observe that there are no AI-Enabled objects. Press the “Add Object” button.

SQL Data Insights

Connections /

## Add connection

**Connection overview**

Name  
DSN2

Description (optional)  
Enter description

**Connection details**

Host name or IP address  
wg31.washington.ibm.com

Port  
2446

Location ①  
DALLASC

JDBC properties (optional) ①  
clientappCompat=v12R1M503

Db2 special registers (optional) ①  
CURRENT CLIENT\_USERID=test

**Certificates ①**

Port enabled for SSL connections

SSL Certificate (optional) ①

Enter or copy and paste your certificate in PEM format.  
The PEM file must start with -  
-----BEGIN CERTIFICATE-----  
and end with -----END-----

**Credentials**

Username  
USER1

Password  
.....

Cancel
Add

Figure 44: Add connection

SQL Data Insights

Connections

Name Host/Location Type Updated on				Add connection +
▼ DSN2	wg31.washington.ibm.com/DALLASC	Db2 v12	Jul 28, 2022 5:45 AM	<span style="border: 1px solid #ccc; padding: 2px;">⋮</span> <div style="margin-top: 5px; background-color: #fff; border: 1px solid #ccc; padding: 5px; width: fit-content;"> <span style="border: 1px solid #0078d4; color: #0078d4; padding: 2px 10px; display: inline-block;">Connect</span> <span style="margin-left: 10px;">Edit</span> <span style="margin-left: 10px;">List AI objects</span> <span style="margin-left: 10px;">Delete</span> </div>

Figure 45: Connections

DSN2

Find object

Add object + Run query

Name	Schema	Type	Status	Last updated
No AI object is found for this connection.				

Resources per page: 10 0–0 of 0 items 1 of 1 page

Figure 46: AI objects

Select the Table Schema “**DSNNNAIDB**” and press the **Search Icon** to the right hand side of the window.

Select the Table **DSNAIDB.CHURN**

Select all the columns. (Note that SQLDI allows you to overwrite it's default choice of whether a column is Categorical or Numeric.)

Push the “**Enable AI**” button.

Note the caution that column selections cannot be changed after the model is build, and Push “**Enable AI**”

#### 9.4 Be patient during Model Training and Observe Progress

Wait a few seconds to see the Browser showing the “**Enabling**” status.

Select the **Expansion** button to the left to get a more detailed view. If the model training fails for any reason, the SQL Error code will be visible here.

The image below is an example of a model training job that failed.

In this case a clear Db2 error code was returned, indicating that the WLM environment for DSNUUTILU had not been correctly setup.

Sometimes the error messages are less clear.

In such cases you need to look at the SQLDI and Spark execution logs to discover what went wrong. Step 10 covers problem determination steps.

Training a model can take a while, especially if you are not running on a Z16 with a Telum AIU.

SQL Data Insights

Connections / Add object

**DSN2**  
Choose one or more schemas to list associated Db2 objects. From the list, select the Db2 objects to add as new AI objects or enable for AI query.

Schema: 1 X Select schema ▾

Name	Schema	Last activity
DSN8BQRY		
DSN812SA		
DSN81210		
DSNACC		
<input checked="" type="checkbox"/> DSNAIDB		
DSNPCCOL		

No object available. Select one or more schemas to list available objects.



Figure 47: Add object

SQL Data Insights

Connections / Add object

**DSN2**  
Choose one or more schemas to list associated Db2 objects. From the list, select the Db2 objects to add as new AI objects or enable for AI query.

Schema: 1 X Select schema ▾ Q Find table/view

Name	Schema	Last activity
<input checked="" type="checkbox"/> CHURN	DSNAIDB	①

Items per page: 10 ▾ 1-1 of 1 items 1 ▾ of 1 page ◀ ▶

Cancel Add object Enable AI query

Figure 48: Add object

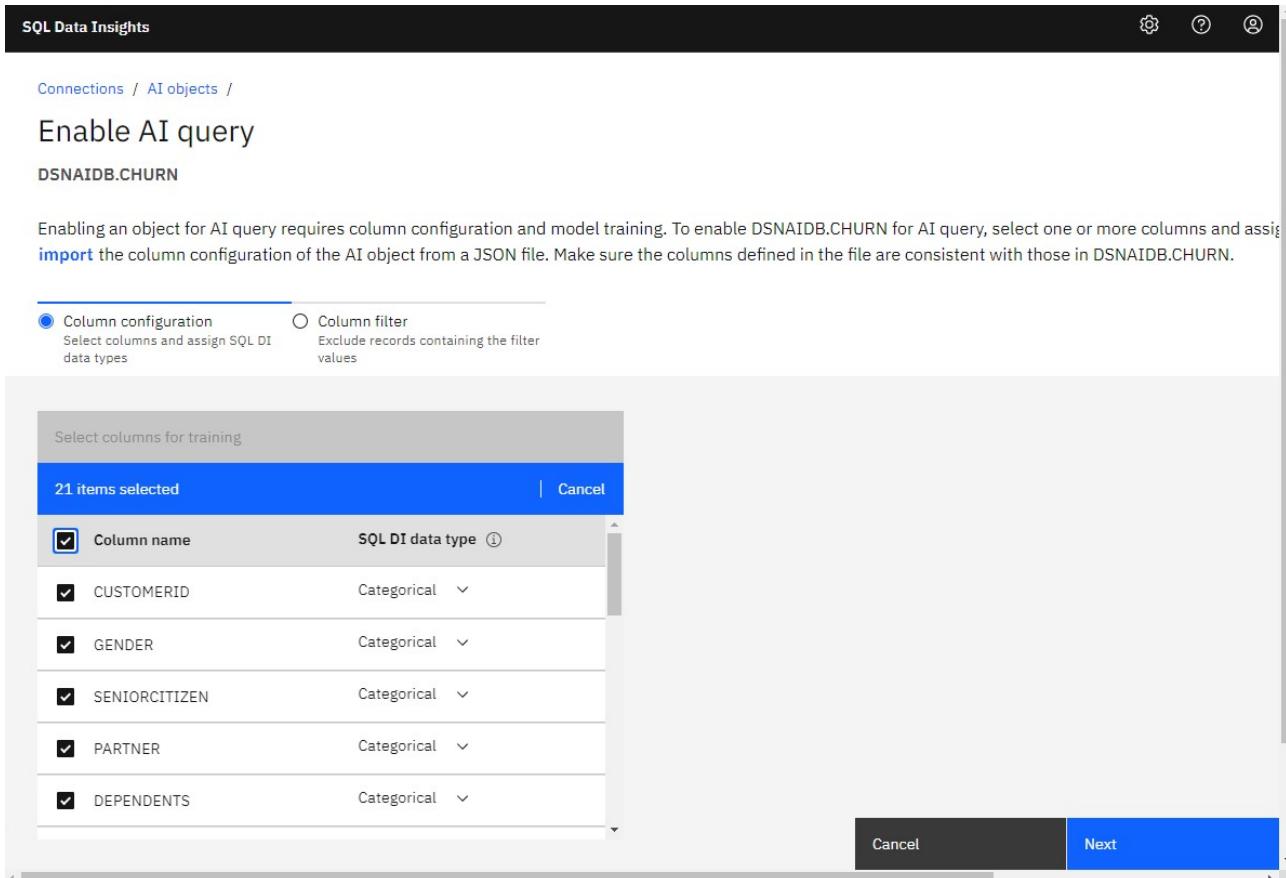


Figure 49: Enable AI query

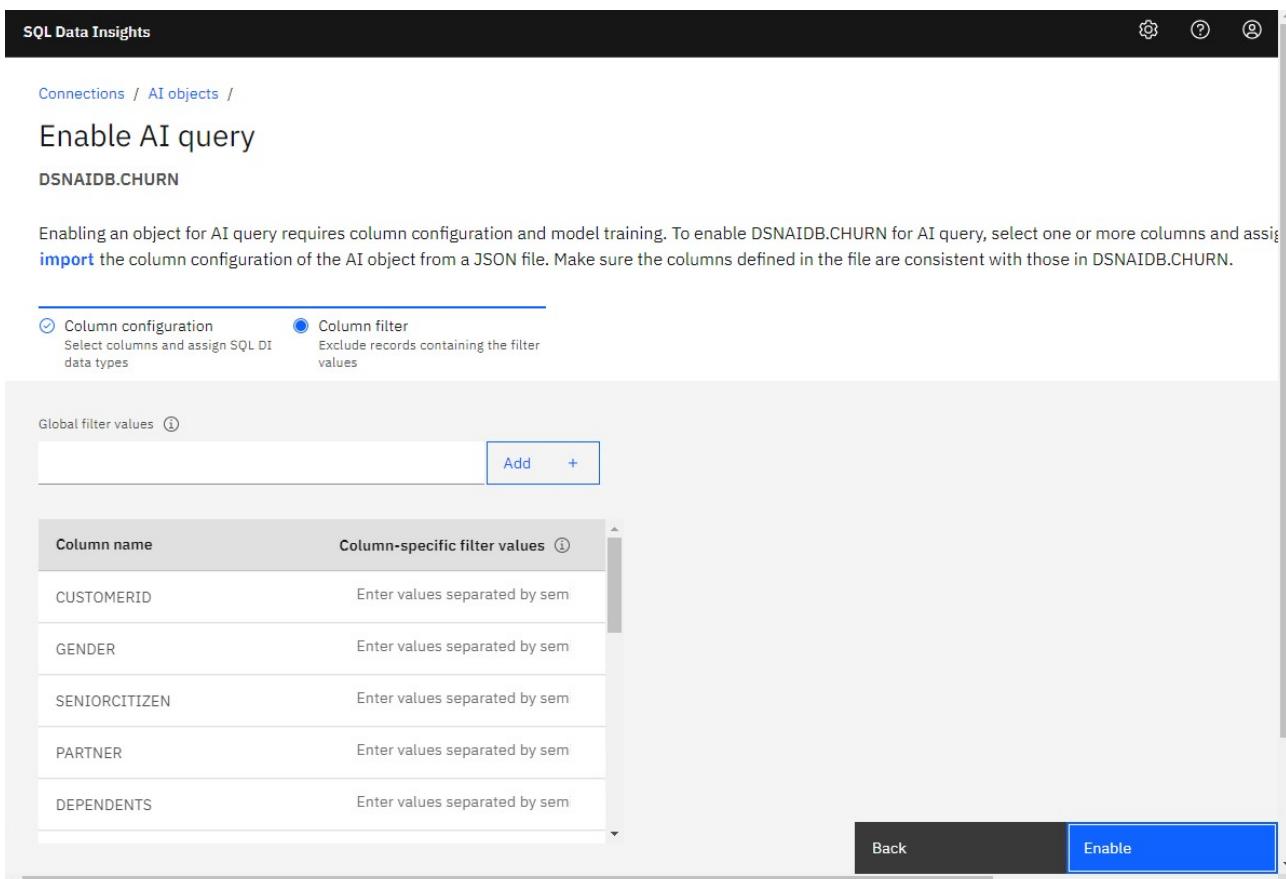


Figure 50: Enable AI query

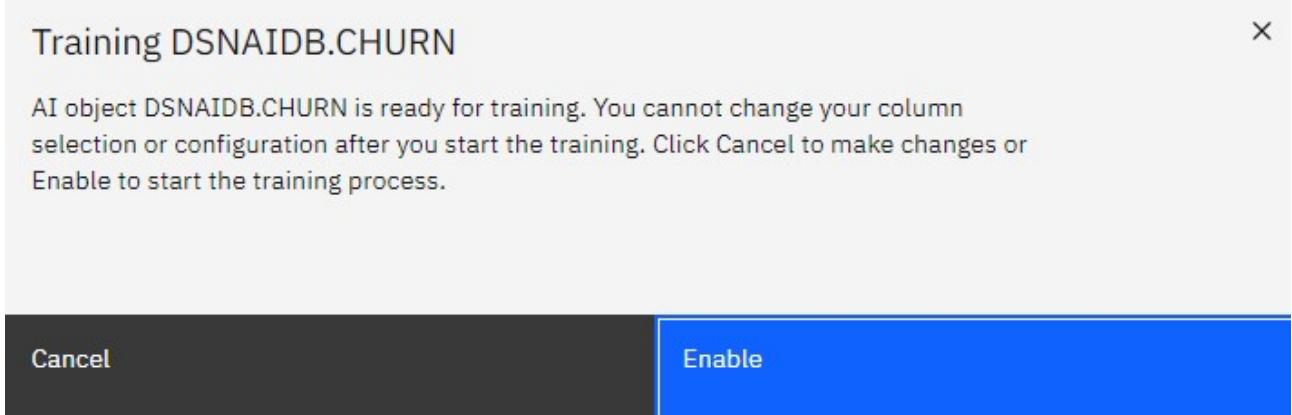


Figure 51: Enable training

SQL Data Insights

AI objects

DSN2

Name	Schema	Type	Status	Last updated
CHURN	DSNAIDB	Table	Enabling	Jul 28, 2022 6:50 AM

Resources per page: 10 1–1 of 1 items

Figure 52: AI Objects

SQL Data Insights

AI objects

DSN2

Name	Schema	Type	Status	Last updated
CHURN	DSNAIDB	Table	Enabled	Jul 28, 2022 6:50 AM

Created on	Jul 28, 2022	Current status	Last activity
		Initializing	Jul 28, 2022 6:50 AM Enabling

Resources per page: 10 1–1 of 1 items

Figure 53: AI Objects

## AI objects

The screenshot shows two stacked tables of AI object details. The top table has columns: Name, Schema, Type, Status, and Last updated. It shows one row for 'CHURN' in the 'DSNAIDB' schema, which is a Table type, failed, and last updated on Jul 22, 2022 at 10:09 PM. A red arrow points from the 'CHURN' row in the first table to the second table below it. The second table has columns: Name, Schema, Type, Status, Last updated, Created on, Current status, and Last activity. It also shows the 'CHURN' row with the same details. Below the second table, there is an 'Explanation:' section containing the error message: 'failed to train model: DB2 SQL Error: SQLCODE=-471, SQLSTATE=55023, SQLERRMC=SYSPROC.DSNUTILU;00E7900C, DRIVER=4.31.10'.

Name	Schema	Type	Status	Last updated
CHURN	DSNAIDB	Table	⚠ Failed	Jul 22, 2022 10:09 PM

Name	Schema	Type	Status	Last updated
CHURN	DSNAIDB	Table	⚠ Failed	Jul 22, 2022 10:09 PM
			Created on	Jul 22, 2022
			Current status	Failed
			Last activity	Jul 22, 2022 10:09 PM Failed

**Explanation:**  
failed to train model: DB2 SQL Error: SQLCODE=-471, SQLSTATE=55023, SQLERRMC=SYSPROC.DSNUTILU;00E7900C, DRIVER=4.31.10

Figure 54: SQLDI\_dropdown

Open a new browser tab and access `wg31.washington.ibm.com:8080` to see what the Spark environment is doing.

Once the Running Application has finished, if you pop back to the SQLDI portal, you should see the Table “Enabled” for AI. Be aware that the automated refresh of this URL is several minutes, so you may choose to refresh the browser manually.

## 9.5 Use SQLDI Dashboards

Note the available actions by pressing the elipses button on the right hand side. ( DISABLE, ANALYZE DATA etc... )

Select Analyze Data, and you will see the first of 3 tabs with information. This first tab shows the object details.

The second tab shows data statistics. These are essential data points for a data scientist performing data wrangling.

The third tab shows the column influence of the model that SQLDI has established. This immediately tells the data scientist which columns are likely to be required when building scoring models.

**NOTE.** The column influence dashboard needs to be modified, because the influencing columns are dwarfed by the discriminator column (the unique key value). A future update should see changes to this chart.

## 9.6 Write AI queries

The next thing to do in the IVP test is to run an AI Query. Select “Run Query” button for the selected AI-Enables Table.

Use the Query Type Pulldown to obtain an SQL template that you will need to edit. Lets start with a “Semantic Similarity” query.

Note. These are static templates for the kind of query that SQLDI supports. they do not reflect the selected table at all. They are nothing more than a template for editing.

**Spark Master at spark://wg31.washington.ibm.com:7077**

URL: spark://wg31.washington.ibm.com:7077  
REST URL: spark://wg31.washington.ibm.com:6066 (cluster mode)

Alive Workers: 1  
Cores in use: 4 Total, 0 Used  
Memory in use: 32.0 GB Total, 0.0 B Used  
Applications: 0 Running, 6 Completed  
Drivers: 0 Running, 6 Completed  
Status: ALIVE

**Workers (1)**

Worker Id	Address	State	Cores	Memory
worker-20220901005521-10.1.1.2-1025	10.1.1.2:1025	ALIVE	4 (0 Used)	32.0 GB (0.0 B Used)

**Running Applications (0)**

Application ID	Name	Cores	Memory per Executor	Submitted Time	User	State	Duration

**Running Drivers (0)**

Submission ID	Submitted Time	Worker	State	Cores	Memory	Main Class

**Completed Applications (6)**

Application ID	Name	Cores	Memory per Executor	Submitted Time	User	State	Duration
app-20220906203712-0005	AI Model Training Application: Q.CLIMATE_10YR	4	2.0 GB	2022/09/06 20:37:12	AIDBADM	FINISHED	1.4 min
app-20220906194218-0004	AI Model Training Application: Q.CLIMATE_10YR	4	2.0 GB	2022/09/06 19:42:18	AIDBADM	FINISHED	1.6 min
app-20220906190300-0003	AI Model Training Application: Q.CLIMATE_10YR	4	2.0 GB	2022/09/06 19:03:00	AIDBADM	FINISHED	1.4 min
app-20220906185647-0002	AI Model Training Application: Q.CLIMATE_USA	4	2.0 GB	2022/09/06 18:56:47	AIDBADM	FINISHED	1.8 min
app-20220906185421-0001	AI Model Training Application: Q.CLIMATE_10YR	4	2.0 GB	2022/09/06 18:54:21	AIDBADM	FINISHED	1.4 min
app-20220901030207-0000	AI Model Training Application: DSNAIDB.CHURNV	4	2.0 GB	2022/09/01 03:02:07	AIDBADM	FINISHED	2.6 min

**Completed Drivers (6)**

Submission ID	Submitted Time	Worker	State	Cores	Memory	Main Class
driver-20220906203707-0005	2022/09/06 20:37:07	worker-20220901005521-10.1.1.2-1025	FINISHED	1	2.0 GB	com.ibm.analytics.sqldi.app.TrainingSparkApp
driver-20220906194212-0004	2022/09/06 19:42:12	worker-20220901005521-10.1.1.2-1025	FINISHED	1	2.0 GB	com.ibm.analytics.sqldi.app.TrainingSparkApp
driver-20220906190255-0003	2022/09/06 19:02:55	worker-20220901005521-10.1.1.2-1025	FINISHED	1	2.0 GB	com.ibm.analytics.sqldi.app.TrainingSparkApp
driver-20220906185642-0002	2022/09/06 18:56:42	worker-20220901005521-10.1.1.2-1025	FINISHED	1	2.0 GB	com.ibm.analytics.sqldi.app.TrainingSparkApp
driver-20220906185415-0001	2022/09/06 18:54:15	worker-20220901005521-10.1.1.2-1025	FINISHED	1	2.0 GB	com.ibm.analytics.sqldi.app.TrainingSparkApp
driver-20220901030200-0000	2022/09/01 03:02:00	worker-20220901005521-10.1.1.2-1025	FINISHED	1	2.0 GB	com.ibm.analytics.sqldi.app.TrainingSparkApp

Figure 55: Spark master

**SQL Data Insights**

[Connections](#) / [AI objects](#)

**DSN2**

Name	Schema	Type	Status	Last updated
CHURN	DSNAIDB	Table	Enabled	Jul 28, 2022 6:52 AM

Resources per page: 10 1-1 of 1 items

Figure 56: AI objects

The screenshot shows the 'AI objects' section of the SQL Data Insights interface for a connection named 'DSN2'. A table lists an AI object named 'CHURN' with details like Schema (DSNAIDB), Type (Table), Status (Enabled), and Last updated (Jul 28, 2022 6:52 AM). A context menu is open over the 'CHURN' row, with the 'Disable AI query' option highlighted. Other options in the menu include 'Analyze data', 'View model', 'Remove', and 'Export column co'.

Name	Schema	Type	Status	Last updated
CHURN	DSNAIDB	Table	Enabled	Jul 28, 2022 6:52 AM

Figure 57: AI objects

The screenshot shows the 'Analyze data' page for the 'CHURN' object in the 'DSNAIDB' schema. It displays basic information like 'Last updated: Jul 28, 2022 5:53 AM'. Below this, there are tabs for 'Object details' (selected), 'Data statistics', and 'Column influence'. A table titled 'Total rows: 7043' lists columns with their Db2 data type and SQL DI data type. The columns listed are CUSTOMERID, GENDER, SENIORTCITIZEN, PARTNER, DEPENDENTS, TENURE, and PHONESERVICE.

Column name	Db2 data type	SQL DI data type
CUSTOMERID	VARCHAR	Categorical
GENDER	VARCHAR	Categorical
SENIORTCITIZEN	VARCHAR	Categorical
PARTNER	VARCHAR	Categorical
DEPENDENTS	VARCHAR	Categorical
TENURE	INTEGER	Numeric
PHONESERVICE	VARCHAR	Categorical

Figure 58: Analyze data

SQL Data Insights

Connections / AI objects /

## Analyze data

DSNAIDB.CHURN Last updated: Jul 28, 2022 5:53 AM ⏺

Object details	Data statistics	Column influence						
Column name	Db2 data type	# of unique values	Most common value	# of most common values	Mean value	Standard deviation	Min value	Max value
MONTHLYCHARGES	DECIMAL	1585	20.05	61	64.76	30.09	18.25	118.75
TENURE	INTEGER	73	1	613	32.00	24.56	0.0	72.0
TOTALCHARGES	DECIMAL	6531	.00	11	2279.73	2266.63	0.0	8684.8
CUSTOMERID	VARCHAR	7043	0002-ORFBO	1	-	-	-	-
GENDER	VARCHAR	2	Male	3555	-	-	-	-
SENIORCITIZEN	VARCHAR	2	0	5901	-	-	-	-
PARTNER	VARCHAR	2	No	3641	-	-	-	-
DEPENDENTS	VARCHAR	2	No	4933	-	-	-	-

Figure 59: Analyze data



Figure 60: Analyze Data

## SQL Data Insights

Connections / AI objects /

### Run query

Choose a query type to populate the query editor and then edit and run the query.

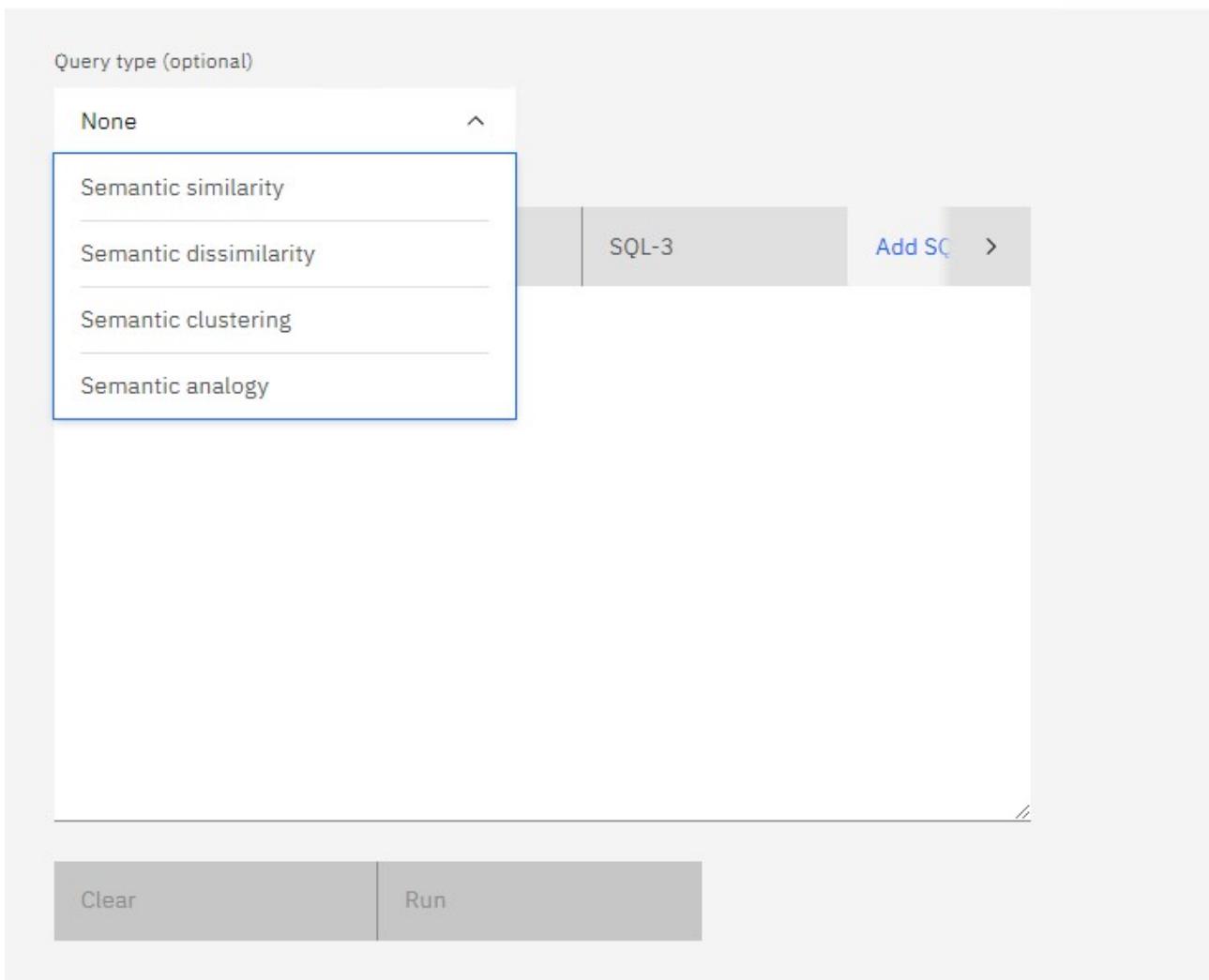


Figure 61: Run query

This is the SQL template that is provided. It is based on the CHURN Table in a different schema. You need to edit the schema to make the query run.

However, before editing the SQL, press “Run” to get a feel for what happens when an AI SQL query fails.

The screenshot shows the 'Run query' interface in SQL Data Insights. At the top, there's a navigation bar with 'SQL Data Insights' and a path 'Connections / AI objects / Run query'. Below that is a sub-header 'Choose a query type to populate the query editor and then edit and run the query.' A dropdown menu labeled 'Query type (optional)' has 'Semantic similarity' selected. Below the dropdown, there are tabs for 'SQL-1', 'SQL-2', and 'SQL-3', with 'SQL-1' currently active. An 'Add SC' button with a right arrow is also present. The main area contains a SQL query:

```
SELECT * FROM
(SELECT C.*,
SYSFUN.AI_SIMILARITY('CUSTOMERID', CUSTOMERID,
'CUSTOMERID', '3668-QPYBK', 'ADMF001', 'CHURN') AS SIMILARITY
FROM DSNAIDB.CHURN C
WHERE CUSTOMERID <> '3668-QPYBK'
WHERE SIMILARITY > 0.5
ORDER BY SIMILARITY DESC
FETCH FIRST 20 ROWS ONLY;
```

At the bottom, there are two buttons: 'Clear' and a large blue 'Run' button.

Figure 62: Run query

SQLCODE -443 with a return code of +100 against AIOBJECTS and AIMODEL seems strange at first. What this actually means is that the UDF could not find the model table in the pseudo catalog. No surprise really because the table has been incorrectly identified.

Correct the error by overtyping the schema in the UDF call to “DSNAIDB”. Run the Query.

```
SELECT * FROM
(SELECT C.*,
```

The screenshot shows the SQL Data Insights interface. At the top, there are connection and AI object selection dropdowns, and a toolbar with icons for settings, help, and user profile. Below this is a "Run query" section with a sub-instruction: "Choose a query type to populate the query editor and then edit and run the query." A "Query type (optional)" dropdown is set to "Semantic similarity". The main area contains a query editor with three tabs: "SQL-1" (selected), "SQL-2", and "SQL-3". The "SQL-1" tab displays the following SQL code:

```

SELECT * FROM
(SELECT C.*
SYSFUN.AI_SIMILARITY('CUSTOMERID', CUSTOMERID,
'CUSTOMERID', '3668-QPYBK', 'ADMF001', 'CHURN') AS SIMILARITY
FROM DSNAIDB.CHURN C
WHERE CUSTOMERID <> '3668-QPYBK'
WHERE SIMILARITY > 0.5
ORDER BY SIMILARITY DESC
FETCH FIRST 20 ROWS ONLY;

```

Below the editor are "Clear" and "Run" buttons. A status bar at the bottom indicates a DB2 SQL Error: SQLCODE=-443, SQLSTATE=38352, SQLERRMC=AI\_SIMILARITY;AI\_SIMILARITY;Querying AIOBJECTS,AIMODELS,SQLCODE=100, DRIVER=4.31.10.

Figure 63: Run query

```

SYSFUN.AI_SIMILARITY('CUSTOMERID', CUSTOMERID,
'CUSTOMERID', '3668-QPYBK', 'DSNAIDB', 'CHURN') AS SIMILARITY
FROM DSNAIDB.CHURN C
WHERE CUSTOMERID <> '3668-QPYBK')
WHERE SIMILARITY > 0.5
ORDER BY SIMILARITY DESC
FETCH FIRST 20 ROWS ONLY;

```

Scroll down to see the results.

The screenshot shows the results of the query from Figure 63. The results are presented as a "Result set" table with 13 columns: CUSTOMERID, GENDER, SENIORTCITIZEN, PARTNER, DEPENDENTS, TENURE, PHONESERVICE, MULTIPLELINES, INTERNETSERVICE, ONLINESECURITY, ONLINEBACKUP, and DEVICEPROTECTION. The table contains 5 rows of data, each representing a customer record with their details and the calculated similarity score.

CUSTOMERID	GENDER	SENIORTCITIZEN	PARTNER	DEPENDENTS	TENURE	PHONESERVICE	MULTIPLELINES	INTERNETSERVICE	ONLINESECURITY	ONLINEBACKUP	DEVICEPROTECTION
2207-OBZNX	Male	0	No	No	7	Yes	No	DSL	Yes	No	No
6304-IJFSQ	Male	0	No	No	3	Yes	No	DSL	No	Yes	No
2108-XWMPY	Male	0	No	No	3	No	No phone service	DSL	Yes	Yes	No
5493-SDRDQ	Male	0	No	No	2	Yes	No	DSL	Yes	No	Yes
1251-KRREG	Male	0	No	No	2	Yes	Yes	DSL	No	Yes	No

Figure 64: Run result

Scroll to the right to retrieve the similarity score. This is the mode's similarity rating against customer\_id 3668-QPYBK for each row in the result set.

You can experiment with the other SQL templates to get an understanding of the purpose of each of the AI functions. Then you will be ready to write your own AI queries.

Result set ↑

TECTION	TECHSUPPORT	STREAMINGTV	STREAMINGMOVIES	CONTRACT	PAPERLESSBILLING	PAYMENTMETHOD	MONTHLYCHARGES	TOTALCHARGES	CHURN	SIMILARITY
No	No	No		Month-to-month	Yes	Mailed check	51.00	354.05	Yes	0.8608058094978333
No	No	No		Month-to-month	Yes	Mailed check	49.90	130.10	Yes	0.8441522121429443
No	No	No		Month-to-month	Yes	Mailed check	35.45	106.85	Yes	0.8313751220703125
No	No	No		Month-to-month	Yes	Mailed check	55.10	113.35	Yes	0.8072283864021301
No	No	No		Month-to-month	Yes	Mailed check	54.40	114.10	Yes	0.7862904071807861

Figure 65: Run result

## 10. Problem Determination Steps

Hopefully you completed your Hands on Learning workshop first time, before you had any reason to review this section on problem determination steps. Even if you did, please take a moment to review this section, so that you know where to look for execution logs in future.

This section covers the following topics

1. Where to find execution logs
2. How to increase the amount of diagnostic information that is available
3. An insight into the SQLDI workflow that happens after you press the blue “Enable AI” button

### 10.1 Where to find execution logs.

When you create an SQLDI instance (holinstance) at path /u/aidbadm/holinstance the following subdirectories are created.

```
/u/aidbadm/holinstance >ls -al
total 178
drwxr-xr-x 10 AIDBADM  SYS1          8192 Aug  8 04:14 .
drwxrwxrwx 10 990027  SYS1          8192 Aug  8 04:17 ..
drwxr-xr-x  2 AIDBADM  SYS1          8192 Aug  9 21:37 conf
drwxr-xr-x  2 AIDBADM  SYS1          8192 Aug  7 17:08 db
drwxr-xr-x  2 AIDBADM  SYS1          8192 Aug  7 16:58 db2jcc.driver
-rw-r--r--  1 AIDBADM  SYS1          442  Aug  9 21:32 deploy.cfg
drwxr-xr-x  2 AIDBADM  SYS1          8192 Aug  7 16:58 diag
-rw-r--r--  1 AIDBADM  SYS1          5  Aug  8 04:14 fred.cat
drwxr-xr-x  2 AIDBADM  SYS1          8192 Aug  9 21:37 logs
drwxr-xr-x  2 AIDBADM  SYS1          8192 Aug  9 21:37 pid
drwxr-xr-x  7 AIDBADM  SYS1          8192 Aug  7 16:59 spark
drwxr-xr-x  4 AIDBADM  SYS1          8192 Aug  7 16:58 temp
```

The /u/aidbadm/holinstance/logs path is where SQLDI logs are written.

Inside that directory you will find a new SQLDI log file written every day. Each day’s log will be appended until midnight passes, whereupon a new log file will be created for further messages.

```
/u/aidbadm/holinstance/logs >ls -al
total 80
drwxr-xr-x  2 AIDBADM  SYS1          8192 Aug  9 21:37 .
drwxr-xr-x 10 AIDBADM  SYS1          8192 Aug  8 04:14 ..
```

```
-rw-r--r--  1 AIDBADM  SYS1          0 Aug  7 17:08 sql-data-insights_2022-08-07.0.log
-rw-r--r--  1 AIDBADM  SYS1         663 Aug  8 05:26 sql-data-insights_2022-08-08.0.log
-rw-r--r--  1 AIDBADM  SYS1        10420 Aug  9 21:40 sql-data-insights_2022-08-09.0.log
```

These log files might be quite small, because by default they only get written when errors occur. The next section explains how to expand the level of logging if you need it.

The bulk of the work performed by SQLDI is executed in the spark environment. The spark directory contains 5 further subdirectories.

```
/u/aidbadm/holinstance/spark >ls -al
total 112
drwxr-xr-x  7 AIDBADM  SYS1      8192 Aug  7 16:59 .
drwxr-xr-x 10 AIDBADM  SYS1      8192 Aug  8 04:14 ..
drwxr-xr-x  2 AIDBADM  SYS1      8192 Aug  7 16:59 conf
drwxrwxr-x  9 AIDBADM  SYS1      8192 Aug  9 21:42 local
drwxr-xr-x  2 AIDBADM  SYS1      8192 Aug  9 21:33 log
drwxr-xr-x  2 AIDBADM  SYS1      8192 Aug  9 21:33 pid
drwxr-xr-x 16 AIDBADM  SYS1      8192 Aug  9 21:40 worker
```

The conf directory contains some configuration files, including the spark-env.sh script. Some of the parameters in this script were set directly during the instance creation dialog.

Other parameters (memory, number of cores, paths etc...) are set automatically by the instance creation script. They include the directories

```
/u/aidbadm/holinstance/spark/conf >cat spark-env.sh
```

```
SPARK_MASTER_HOST=10.1.1.2
SPARK_LOCAL_IP=10.1.1.2
SPARK_MASTER_PORT=7077
SPARK_MASTER_WEBUI_PORT=8080
SPARK_WORKER_WEBUI_PORT=8081
SPARK_DAEMON_MEMORY=1G
SPARK_WORKER_INSTANCES=1
SPARK_LOG_DIR=/u/aidbadm/monday/spark/log
SPARK_LOCAL_DIRS=/u/aidbadm/monday/spark/local
SPARK_WORKER_DIR=/u/aidbadm/monday/spark/worker
SPARK_PID_DIR=/u/aidbadm/monday/spark/pid
SPARK_WORKER_MEMORY=32G
SPARK_WORKER_CORES=4
```

The log subdirectory contains the most helpful spark output logs. The worker logs are likely to be the most informative source of information about the work that has been performed.

```
/u/aidbadm/holinstance/spark/log >ls -al
total 352
drwxr-xr-x  2 AIDBADM  SYS1      8192 Aug  9 21:33 .
drwxr-xr-x  7 AIDBADM  SYS1      8192 Aug  7 16:59 ..
-rw-r--r--  1 AIDBADM  SYS1      3911 Aug  9 21:42 spark-AIDBADM-org.apache.spark.dep...
-rw-r--r--  1 AIDBADM  SYS1     12640 Aug  8 06:06 spark-AIDBADM-org.apache.spark.dep...
-rw-r--r--  1 AIDBADM  SYS1     16464 Aug  9 21:42 spark-AIDBADM-org.apache.spark.dep...
-rw-r--r--  1 AIDBADM  SYS1     87693 Aug  8 06:06 spark-AIDBADM-org.apache.spark.dep...
-rw-r--r--  1 AIDBADM  SYS1       170 Aug  7 16:59 spark-configuration-master-stdout.1
```

## 10.2 How to increase the amount of diagnostic information that is available

Review /u/aidbadm/holinstance/deploy.cfg

VERSION="1.0.0.0"

SERVICE\_HOST=10.1.1.2

SERVICE\_PORT=15001

# keyring path and label

KEYSTORE\_TYPE=JCERACFKS

KEYSTORE\_PATH=safkeyring://QU1EQkFETS9XTUxaUk1ORw==

CERTIFICATE\_LABEL=WMLZCert\_WMLZID

# overall log level for SQL DI application and Spark job

log4j\_level=ERROR

# minimum JVM heap size for SQL DI application

Xms=-Xms512M

# maximum JVM heap size for SQL DI application

Xmx=-Xmx2048M

# ALL, NONE, ON\_FAILURE

KEEP\_TRAINING\_FILES=ON\_FAILURE

SQLDI uses log4j for logging (a current version of log4j that is not affected to the infamous security exposure).

By default, SQLDI is configured to log ERRORS only.

You can google the org.apache.log4j.Level levels and select a different level (such as OFF, INFO, DEBUG, TRACE etc..).

## 10.3 An insight into the SQLDI workflow that happens after you press the blue “Enable AI” button

Another interesting value in the deploy.cfg file is KEEP\_TRAINING\_FILES=ON\_FAILURE.

When you “Enable AI” for a table or view, the high-level sequence of steps performed by SQLDI is

1. Connect to Db2 via JDBC T4 driver.
2. Gather Db2 catalog metadata about the object for which model training is to be performed.
3. Perform a SELECT against all the in-scope columns to bring the result set down to USS.
4. Start a Spark application to perform model training (initialize, pre-process data, train model).
5. Save the outputs of the model training are written as temporary files to a temporary directory.
6. Load the model table with these outputs (call a LOAD utility via SYSPROC.DSNUTILU)

If the training succeeds, and the model table is loaded, all these temporary datasets are deleted. This is a good default, because the load datasets can be quite large.

If the training fails (or if you set KEEP\_TRAINING\_FILES=ALL), the temporary datasets will be left in a temporary USS directory as shown below.

```
/u/aidbadm/holinstance/temp/training/DSNAIDB_AIDB_DSNAIDB_CHURN_1660099214960 >ls -al
total 52448
drwxr-xr-x  2 AIDBADM  SYS1      8192 Aug  9 21:42 .
drwxr-xr-x  7 AIDBADM  SYS1      8192 Aug  9 21:40 ..
-rw-r--r--  1 AIDBADM  SYS1  23350848 Aug  9 21:42 DSNAIDB_AIDB_DSNAIDB_CHURN-320-10
-rw-r--r--  1 AIDBADM  SYS1  3034542 Aug  9 21:40 DSNAIDB_AIDB_DSNAIDB_CHURN.txt
-rw-r--r--  1 AIDBADM  SYS1  62718 Aug  9 21:40 MONTHLYCHARGES.csv
-rw-r--r--  1 AIDBADM  SYS1   125 Aug  9 21:40 MONTHLYCHARGES_output_minimums
-rw-r--r--  1 AIDBADM  SYS1  33361 Aug  9 21:40 TENURE.csv
-rw-r--r--  1 AIDBADM  SYS1   150 Aug  9 21:40 TENURE_output_minimums
-rw-r--r--  1 AIDBADM  SYS1  67932 Aug  9 21:40 TOTALCHARGES.csv
-rw-r--r--  1 AIDBADM  SYS1   125 Aug  9 21:40 TOTALCHARGES_output_minimums
-rw-r--r--  1 AIDBADM  SYS1   592 Aug  9 21:42 load_emp_delim_ctl
-rw-r--r--  1 AIDBADM  SYS1  177619 Aug  9 21:40 vocab.txt
```

Inspecting the contents of these datasets (where possible) gives further insight into the workings of SQLDI.

The binary load dataset and the load control statement are fairly obvious. The .csv and minimums files contain additional information that is also stored in the model table, and is the source of some of the SQLDI analysis reports available in the SQLDI Web UI.

**That concludes the Setup and Basic IVP.**