

# IBM TechU

2021 Edition



IBM

Lab Exercise:

**Using IBM zUnit to Unit Test a  
COBOL/CICS/DB2 program using Local  
assets.(Portuguese/Spanish)**

Session ID:

**z203786**

Speaker Name:

**Reginaldo Barosa**

Room:

**?????...**

FOR LAB ROOM ONLY -- DO NOT REMOVE, DEFACE or WRITE ON  
THIS LAB BOOK

## Introduction

This lab will take you through the steps of using the automated unit testing (**zUnit**) capabilities of IBM Developer for z (**IDz**) to create a unit test case for a **COBOL CICS/DB2 program**. This enables a developer to test early without impacting other developers that share the same CICS environment and using batch jobs. In this lab you will record interaction with a COBOL CICS/DB2 program and run a test case where we add a bug in the program to be tested.

### Instructions to use the Windows + Linux + Z/OS on Cloud

There are 2 ways to access the Windows + z/OS + Linux cloud instances..

1. Via **Windows Remote Desktop** (Better performance, but firewalls might block.)
2. Via **Web Browser** (suggested Firefox or Chrome)

In any case be sure that you have the **provided link to access the cloud instance**, the userid and **password** to access the Windows client remotely.

Please always **Use COPY/PASTE for password**.

Some letters may be identical, example: **I** (uppercase i) and **l** (lowercase L).

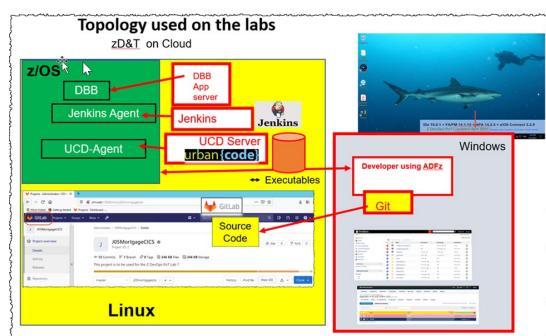
Example of provided links

IBM Z System DevOps Workshop		User ID for Web browser	IP Address for Remote Password	User ID for Remote Desktop	Domain	machine #
Serial No	URL	Administrator	169.63.141.246 Administrator	K5BE6Pep FPUhmG5	Wwin-5282\Administrator	5282
2	https://169.63.141.246-T-5282.ibmtrialmachines.com/	Administrator	169.60.90.69 Administrator	Wwin-5283\Administrator	Wwin-5283	5283

Below is what you will access using the cloud environment.

Be sure that you have an IP address, the userid ( **Userid will be different if using Remote**

**Desktop or Browser** ) and password to access the Windows client remotely.



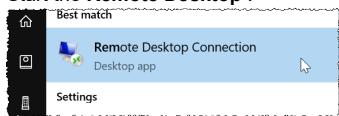
## Using Windows Remote Desktop (preferable way)

This is the preferable way to run the labs, but in some customer location this capability is blocked via Firewalls. If this is your case, use the Web Browser. Instructions are listed here as well..

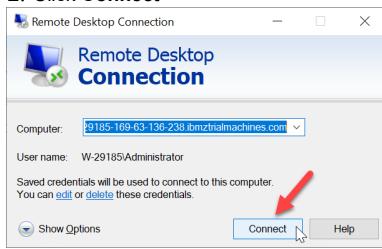
If you are a Mac user may consider downloading the Remote desktop from  
<https://itunes.apple.com/us/app/microsoft-remote-desktop-10/id1295203466?mt=12>

1. Here one example using Windows 10.

Start the **Remote Desktop**.

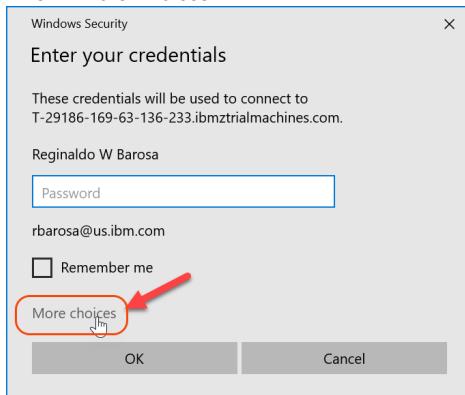


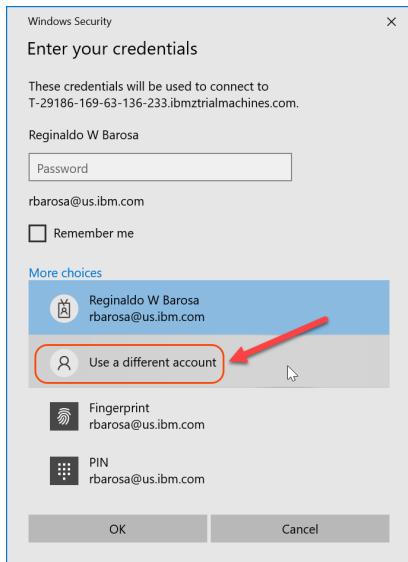
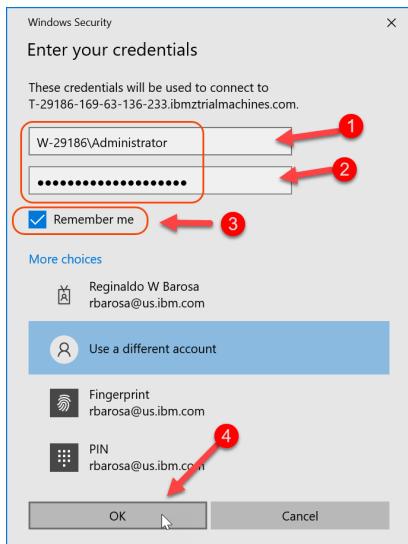
2. Click **Connect**



3. Click **Connect** if a dialog as to *trust the remote connection*

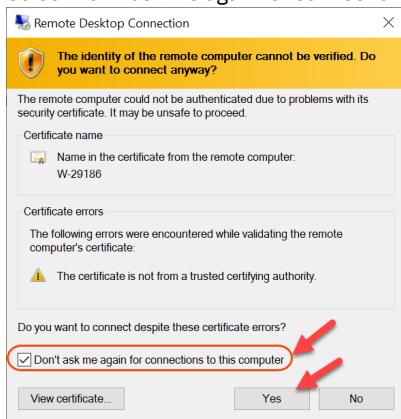
4. Click **More Choices**



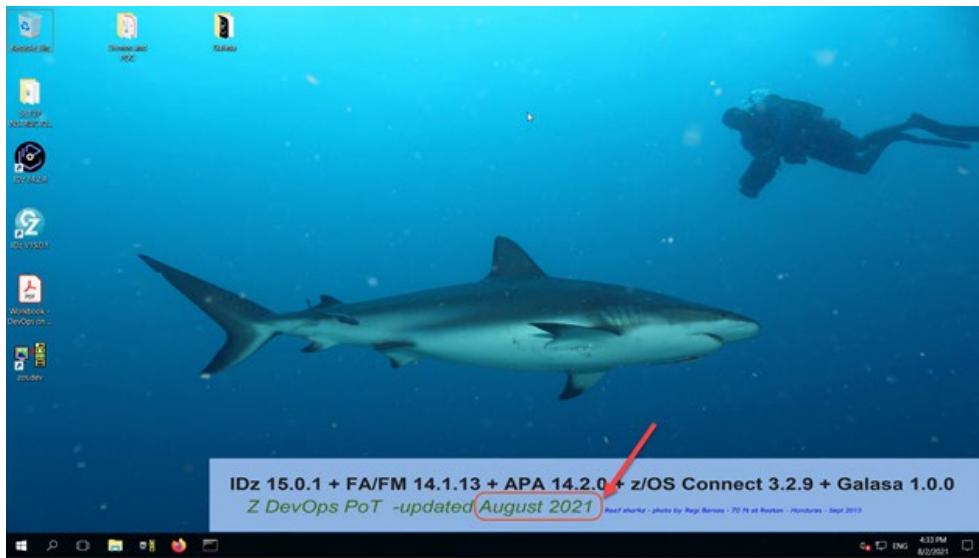
**5. Click Use a different account****6. Copy and paste the provided "User ID for Remote Desktop" and **Password**, select **Remember me** and click **OK**.**

7. You should get a dialog as below..

Select Don't ask me again for connections to this computer and click Yes



8. You should get a screen with a shark. That indicate that you have access to the Windows client on cloud.



On the windows desktop there is a PDF icon with the Labs workbook.. you will find this lab also there.  
It may help for copy/paste, etc..

But to follow the labs I suggest printing or use another display or iPhone/iPad to better follow the instructions or use another Monitor to follow the lab instructions.

## Using Web Browser (if using VPN or Firewalls that block Remote Desktop)

Commented [RWB1]:

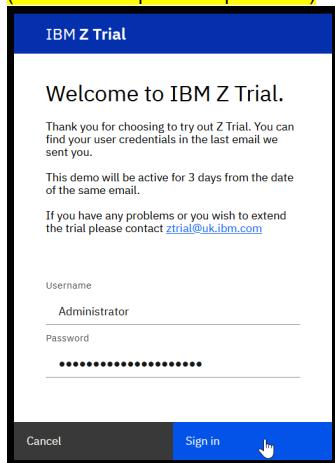
Be sure that you have the **provided link to access the cloud instance**, the userid (**Administrator**) and **password** to access the Windows client remotely. Always use **COPY/PASTE** for password.

Some letters may be identical, example: **I** (uppercase i) and **l** (lowercase L).

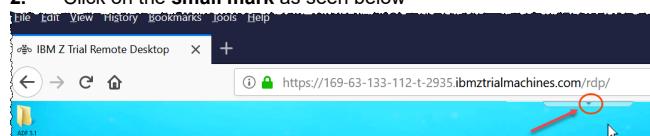
**Example**

twIBM Z System DevOps Workshop		User ID for Web browser	IP Address for Remote Password	User ID for Remote Desktop	Domain	machine #
Serial No	URL	Administrator	169.63.141.246	Wwin-5282\Administrator	Wwin-528	5282
	1 https://169-63-141-246-t-5282.ibmtrialmachines.com/		K58E6Pep			
	2 https://169-60-90-69-t-5283.ibmtrialmachines.com/	Administrator	169.60.90.69	Wwin-5283\Administrator	Wwin-528	5283
			FRBhuG15			

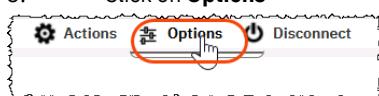
1. Use the link provided by the instructor and type **Administrator/password** provided and click **Sign in** (Remember to paste the password)



2. Click on the small mark as seen below



3. Click on Options

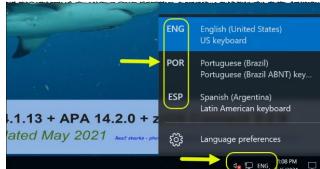


And select Full Screen

## Adjusting the keyboard for other languages than English

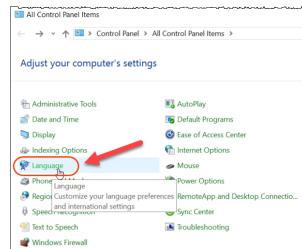
In some countries the keyboard must be mapped due language differences.

If you are in Brasil or any other Latin America country can select the language as below

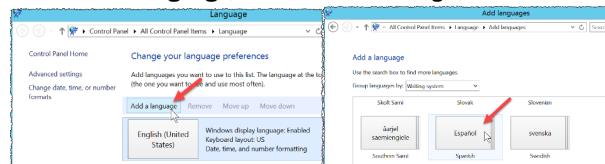


If you use another keyboard other than ENG, POR or ESP, you need to make updates..

1. Go to windows **Control Panel** and select **Language**



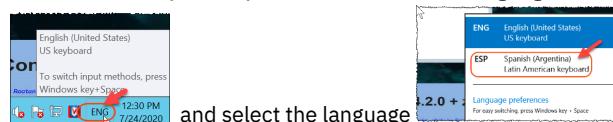
2. Click **Add a Language**, and follow the dialogs. See one example on the screen captures below



Click **Add**



To switch the keyboard, just select the desired language on the right corner of the screen



and select the language

## Exercise instructions

### Overview of development tasks

To complete this tutorial, you will perform the following tasks:

1. **Get familiar with the application using the 3270 terminal**  
→ You will start a 3270 emulation and execute a transaction named **HCAZ** to become familiar with the Application that you will be recording.
2. **Record interaction with the application.**  
→ You will record an interaction with the COBOL CICS/DB2 program.
3. **Generate, build and run the unit test**  
→ You will compile and link-edit the generated unit test program, followed by running the unit test.
4. **Introduce a bug in the program and rerun the unit test**  
→ You will modify the program under test, rerun the unit test, and observe the failure of the test case.
5. **Run the unit test from a batch JCL .**  
→ You will run the unit test from a Batch JCL and observe a similar test case result.

## Section 1. Get familiar with the application using the 3270 terminal

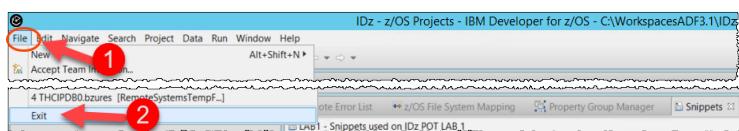
You will start a 3270 emulation and execute a transaction named **HCAZ** to become familiar with the Application that you will be interacting with.

### 1.1 Connect to z/OS and emulate a CICS 3270 terminal

You will use IDz to emulate a 3270 terminal to run the CICS transaction.

1.1.0 This Lab will use **IDz Version 15**, and if it is already running jump to step 1.1.2

► If IDz version 14 used on LAB 1 is running, you must close it using **File** and **Exit**.



1.1.1 Start *IBM Developer for z Systems* version 15

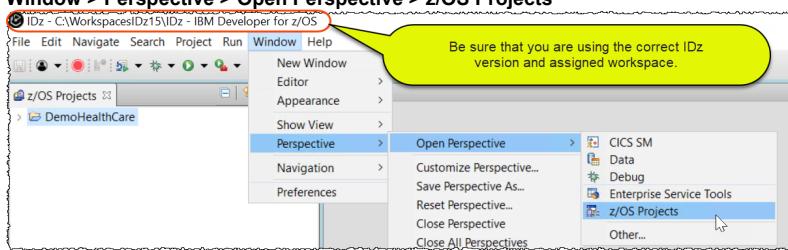
► Using the desktop double click on **IDz V15** icon.

► Verify that the message indicates that it is Version **15.0.1**

**IMPORTANT ->** This icon will start an eclipse workspace that has already some definitions required for this lab.  
PLEASE DO NOT start IDz using other way than this icon.



1.1.2 ► Open the **z/OS Projects** perspective by selecting  
**Window > Perspective > Open Perspective > z/OS Projects**

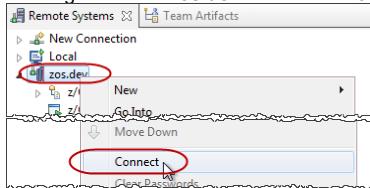


1.1.3 On this lab you will use userid **ibmuser**.

If you are already connected as **ibmuser**, jump to step 1.1.5 Otherwise disconnect from z/OS and reconnect

► Using **Remote Systems** view, right click on **zos.dev** and select **Disconnect**

► Right click on **zos.dev** and select **Connect**



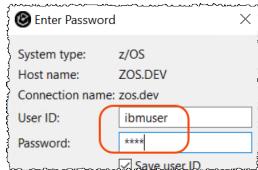
## Exercises Guide

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### 1.1.4 ► Type **ibmuser** as userid and **sys1** as password.

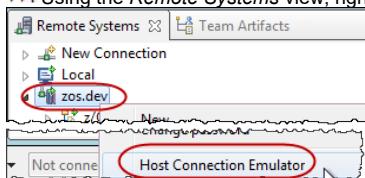
The userid and password can be any case; don't worry about having it in UPPER case.

Click **OK** to connect to z/OS.

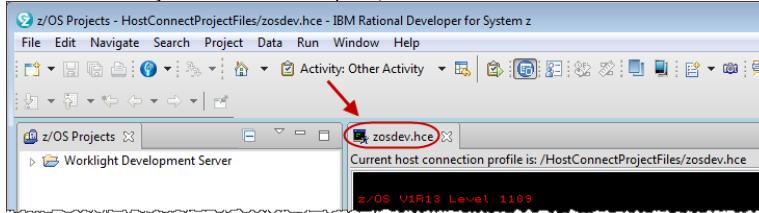


### 1.1.5 Wait until connection is complete (on the bottom and left until the green bar disappears)

► Using the *Remote Systems* view, right click on **zos.dev** and select **Host Connection Emulator**.



### 1.1.6 ► Since you will need more space, double-click on the **zos.dev.hce** title



### 1.1.7 ► Type **I cicsts54**. (where "I" is the lower case of letter "L") and press **Enter** key.



### 1.1.8 ► Logon using your z/OS user id **ibmuser** and password **sys1** and press **Enter**.



### 1.1.9 The sign-on message is displayed



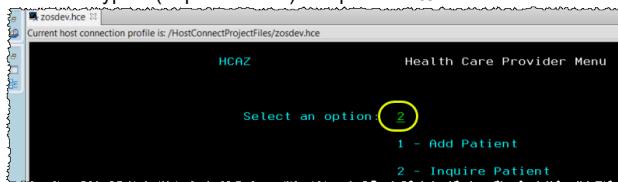
## **1.2 Run CICS transaction HCAZ**

You should now be in the z/OS CICS region named *CICSTS54*. This is the CICS instance where you will make the recording of your interaction.

- 1.2.1 ► Type the CICS transaction **hcaz** and press the **Enter** key.



- 1.2.2 ► Type 2 (Inquire Patient) and press Enter .

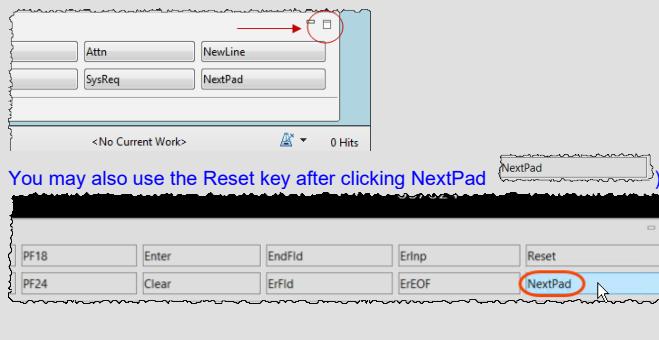


- 1.2.3 ► Type 1 for Patient ID and press Enter. The program will read the patient from a DB2 table and display the customer details. Remember the patient first name: **Ralph**



### **IF you need to use functions like Clear or Reset**

If you need to use the **clear** function use the key **Esc**.  
Also you may look in the right lower corner, select this icon . This will display possible keys, including the clear button.

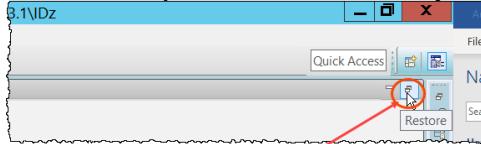


1.2.4 ► Press **F3** to end the application.



1.2.5 ► Close the terminal emulation clicking on → . Or pressing **CTRL + Shift + F4**.

1.2.6 ► You may need to restore the **z/OS Projects** perspective by clicking on the icon on top right:



#### What have you done so far?

You emulated a 3270 terminal using IBM Developer for System z.  
You also executed the CICS transaction **HCAZ** and verified a simple interaction with the Health Care application. The objective here was to show the code that you will update.

## Section 2 – Record data interaction using the CICS application.

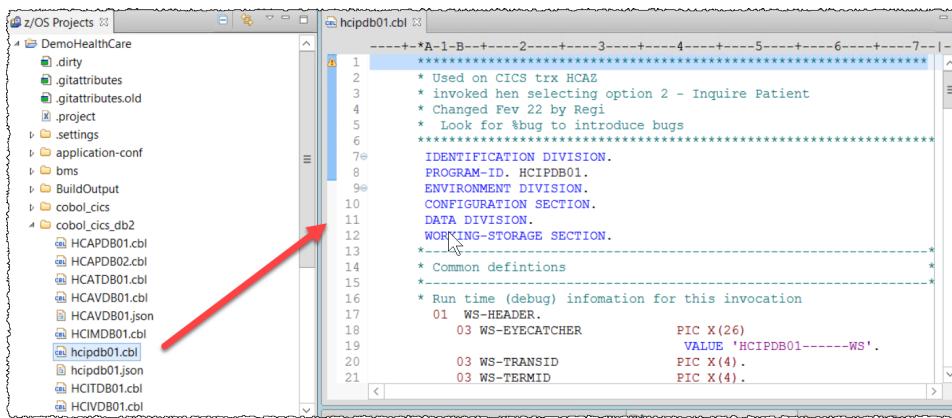
Using IDz you will record the interaction with the COBOL/DB2 program that reads a patient from a DB2 table.

### 2.1 Understanding the COBOL program that reads from DB2 table

The COBOL code that reads the patient from the DB2 tables is the program **HCIPDB01**

2.1.1 ► Using **z/OS Projects** view, expand **DemoHealthCare**  
double click on **hcipdb01.cbl** under **DemoHealthCare/cobol\_cics\_db2**.

This is the program that you will update later on. The name is lower case to make it easier to find it 😊 .



### 2.1.2 Using the Outline view on left expand PROCEDURE DIVISION and click on GET-PATIENT-INFO.

This is where the patient data is read from the DB2 table.

Later on you will introduce a bug in this program..

```

z/OS Projects : DemoHealthCare
  .dirty
  .gitattributes
  .gitattributes.old
  .project
  .settings
  application-conf
  bms
  BuildOutput
  cobol_cics
  cobol_cics_db2
    HCAPDB01.cbl
    HCAPDB02.cbl
    HCATDB01.cbl
    HCAVDB01.cbl
    HCIMDB01.cbl
    hcipdb01.cbl
    hcipdb01.json
    HCITDB01.cbl
    HCIVDB01.cbl
    HCMADB01.cbl
    HCMADB02.cbl
    HQMADR02.json

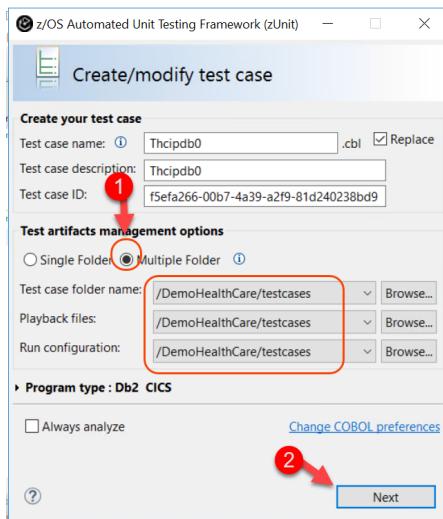
Properties Outline

PROGRAM: HCIPDB01
  IDENTIFICATION DIVISION.
  ENVIRONMENT DIVISION.
  DATA DIVISION.
  PROCEDURE DIVISION.
    MAINLINE SECTION.
      MAINLINE-END.
      MAINLINE-EXIT.
      GET-PATIENT-INFO.

hcipdb01.cbl : 1-B---2- + - 3 -+ - 4 -+
111          *
112          MAINLINE-END .
113          EXEC CICS RETURN END-EXEC .
114          MAINLINE-EXIT .
115          EXIT .
116          *
117          GET-PATIENT-INFO .
118          EXEC SQL
119          SELECT FIRSTNAME,
120          LASTNAME,
121          DATEOFBIRTH,
122          insCardNumber,
123          ADDRESS,
124          CITY,
125          POSTCODE,
126          PHONEMOBILE,
127          EMAILADDRESS,
128          USERNAME
129          INTO :CA-FIRST-NAME,
130          :CA-LAST-NAME,
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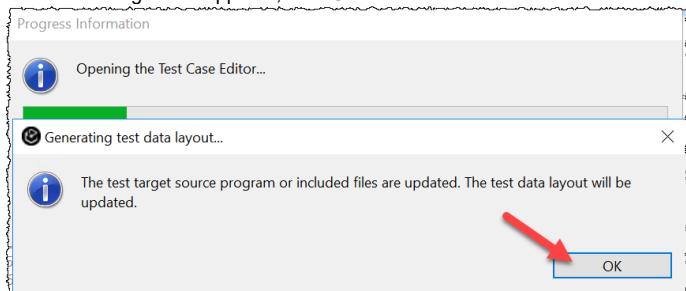
2.2.2 This opens a dialog where you can name your test case.

► Click on **Multiple Folder**, verify that the generated assets will be under **/DemoHealthCare/testcases** and click **Next**.



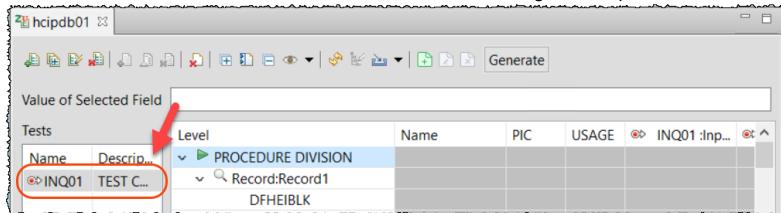
2.2.3 This operation will generate the test data layout on the local workspace.

► If the dialog below appears, click **OK**.



2.2.4 This will open the **Test Case Editor**, as shown below. **INQ01** may or may not be on your screen. If **INQ01** is there you will delete on next step.

The reason that this could be there is because we are reusing a workspace where this was created before.



**Understanding the test case editor**

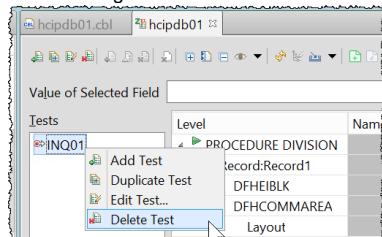


- The bottom left box summarizes all the input output variable structures – In this example, the program has a COMMAREA exchanged via the PROCEDURE DIVISION, five EXEC CICS statements and one EXEC SQL statement.
- The COMMAREA and the CICS statements are also accompanied by the CICS DFHEIBLK variables. To see those values you must select the icon



The variables that are returned by the program are the output from the program logic that a developer should be checking

2.2.5 ► Since we will be recording the test data, delete the **INQ01** or any other entry (if it exists) by right clicking and selecting **Delete Test**



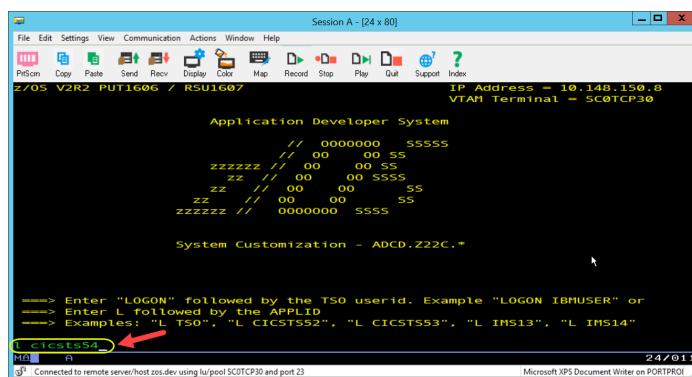
Notice that on section 1 we used the IDz emulator and now you will use the IBM PCOM emulator. Any 3270 emulator can be used.. We just show here a different way to emulate a 3270 terminal.

2.2.6 ► Bring up a 3270 terminal emulator clicking on the **host emulator icon** on the Windows task bar.



This opens the host emulator.

2.2.7 ► Type **I cicsts54.** (where I is L lower case) and press **Enter key**



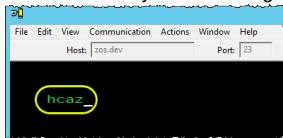
## Exercises Guide

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### 2.2.8 ► Sign on using **ibmuser** as the userid and **sys1** as the password.



### 2.2.9 ► Once you see the sign-on is complete message, enter **hcaz** and press the **Enter** key.



**IF you need to use functions like Clear or Reset**

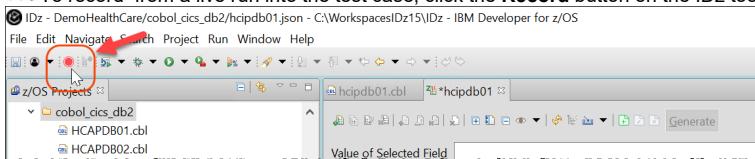
*If you need to use the clear or reset function right mouse click and select as below*



You are now ready to start recording and import data into the test case editor.

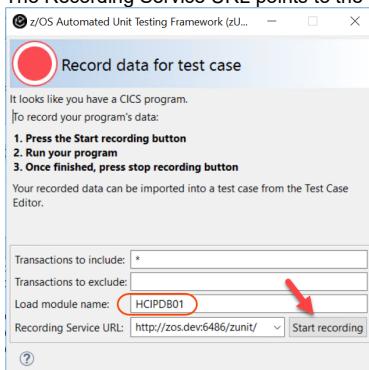
### 2.2.10 ► Minimize the terminal emulator and go back to IDz dialog.

### ► To record from a live run into the test case, click the **Record** button on the IDz toolbar.



### 2.2.11 ► In the dialog that comes up, click on **Start recording**.

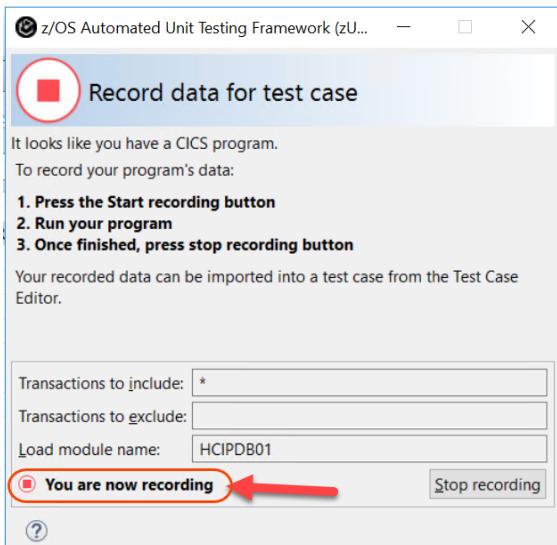
The Recording Service URL points to the CICS region where the live run is recorded.



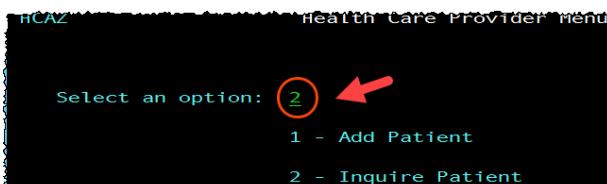
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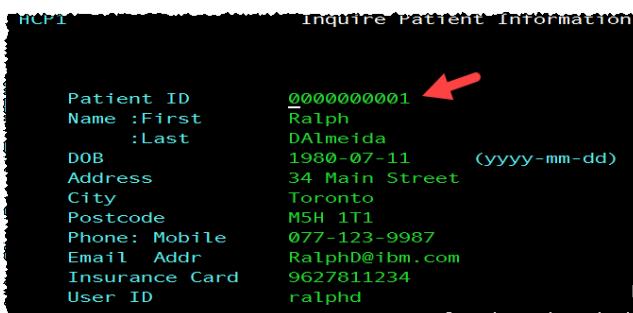
- 2.2.12 When recording is turned on, the message "You are now recording" appears.  
Verify that the Load module **HCIPDB01** is the one being recorded.



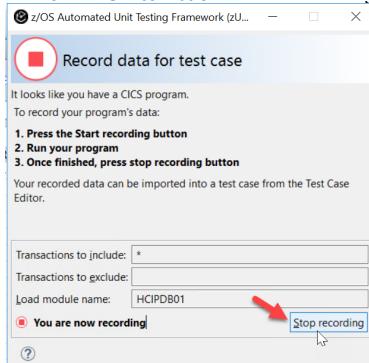
- 2.2.13 ► Switch to the 3270 terminal emulator (that is minimized), type **2** (Inquire Patient) and press **enter**. In case your transaction is not running just type **HCAZ** again.



- 2.2.14 ► Type **1** and press **enter**

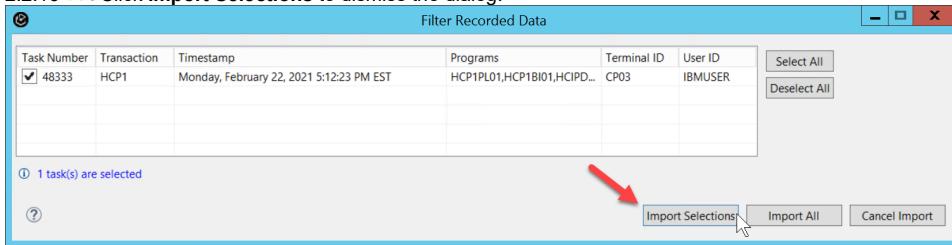


**2.2.15** ► Switch back to IDz minimizing the 3270 screen and click **Stop recording**.



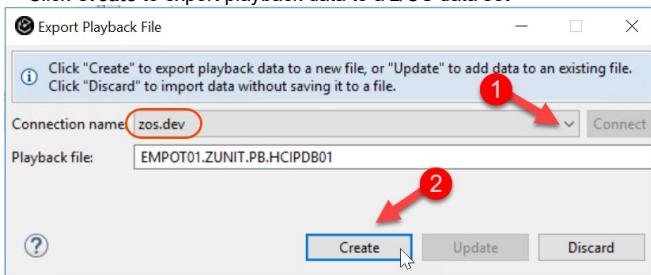
The dialog *Filter Recorded Data* is displayed.

**2.2.16** ► Click **Import Selections** to dismiss the dialog.

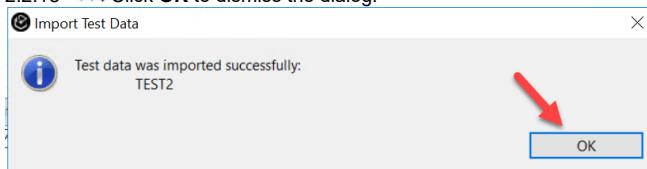


**2.2.17** ► Using drop down select the **zos.dev** as *Connection name*

► Click **Create** to export playback data to a z/OS data set



**2.2.18** ► Click **OK** to dismiss the dialog.



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- 2.2.19 ► Double click on the **hcipdb01** title to enlarge the view.  
**In case by mistake you close this editor will need to go back to step 2.2.1**



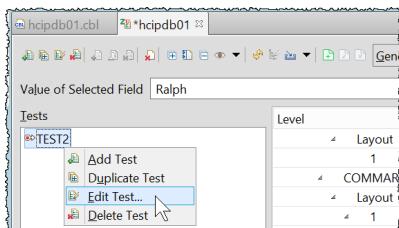
- 2.2.20 You now see a new test created in the editor and populated with the values from the live run.  
► Scroll down the editor and notice the data displayed on the screen that was captured..

Value of Selected Field					
Tests	Level	Name	PIC	USAGE	TEST2 :Inp... TEST2 :Exp...
► TEST2	5	CA-HOW-OFTEN	X(20)	DISPLAY	87 RalphD...
	5	CA-ADDITION...	X(3235)	DISPLAY	DAImeida
	4 3 (redefines CA-THRESHOL...	CA-HR-THRES...	X(10)	DISPLAY	9627811234
	5	CA-BP-THRES...	X(10)	DISPLAY	Ralph
	5	CA-MS-THRES...	X(10)	DISPLAY	DAImeida
	5	CA-ADDITION...	X(3245)	DISPLAY	1980-07-11
	4 3 (redefines CA-VISIT-REQU...	CA-VISIT-DATE	X(10)	DISPLAY	9627811234
	5	CA-VISIT-TIME	X(10)	DISPLAY	Ralph
	5	CA-HEART-RATE	X(10)	DISPLAY	DAImeida
	5	CA-BLOOD-PR...	X(10)	DISPLAY	
	5	CA-MENTAL-S...	X(10)	DISPLAY	
	5	CA-ADDITION...	X(3243)	DISPLAY	34 Main Street...
Layouts					
► Test procedure					
► PROCEDURE DIVISION					
► CICS					
► EXEC CICS ABEND					
► EXEC CICS RETURN					
► EXEC CICS ABEND					
► EXEC CICS RETURN					

- 2.2.21 ► 1 Click on **EXEC SQL SELECT INTO (PATIENT)** to position the data layout for this statement.  
2 Use the scroll bar to **scroll down** until the end,  
3 Click on **Ralph** . and notice that value is displayed on the line 4

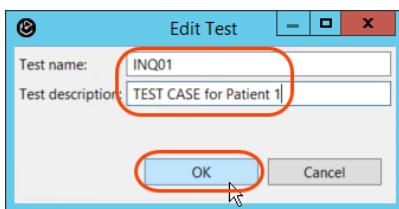
Value of Selected Field					
Tests	Level	Name	PIC	USAGE	TEST2 :Inp... TEST2 :Exp...
► TEST2	1	HCAZERRS	X(8)	DISPLAY	
	1 COMMAREA				
	Layout				
	1 CA-ERROR-MSG				
	3 FILLER	X(9)	DISPLAY		
	3 CA-DATA	X(90)	DISPLAY		
	► EXEC SQL SELECT INTO [PATIEN...				
	► Record:Record1				
	► LineNumber=117				
	► INTO				
	5 CA-FIRST-NAME	X(10)	DISPLAY	Ralph	3
	5 CA-LAST-NAME	X(20)	DISPLAY	DAImeida	
	5 CA-DOB	X(10)	DISPLAY	1980-07-11	
	5 CA-INS-CARD...	X(10)	DISPLAY	9627811234	
	5 CA-ADDRESS	X(20)	DISPLAY	34 Main Street ...	
	5 CA-CITY	X(20)	DISPLAY	Toronto	
	5 CA-POSTCODE	X(10)	DISPLAY	M5H 1T1	
	5 CA-PHONE-M...	X(20)	DISPLAY	077-123-9987	
	5 CA-EMAIL-AD...	X(50)	DISPLAY	RalphD@ibm.c...	
	5 CA-USERRID	X(10)	DISPLAY	ralphd	
	► WHERE				
	3 DB2-PATIENT-ID	S9(9)	BINARY	1	
	SQLCA				

2.2.23 ► Right click on **TEST2** and select **Edit Test**



2.2.24 It is a good practice give a name for the test case.

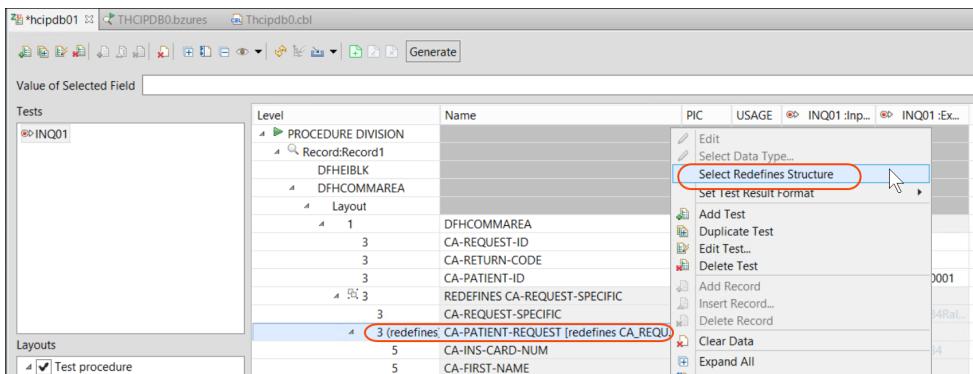
► Use a name like **INQ01** and a description like "**TEST CASE for Patient 1**". Click **OK**



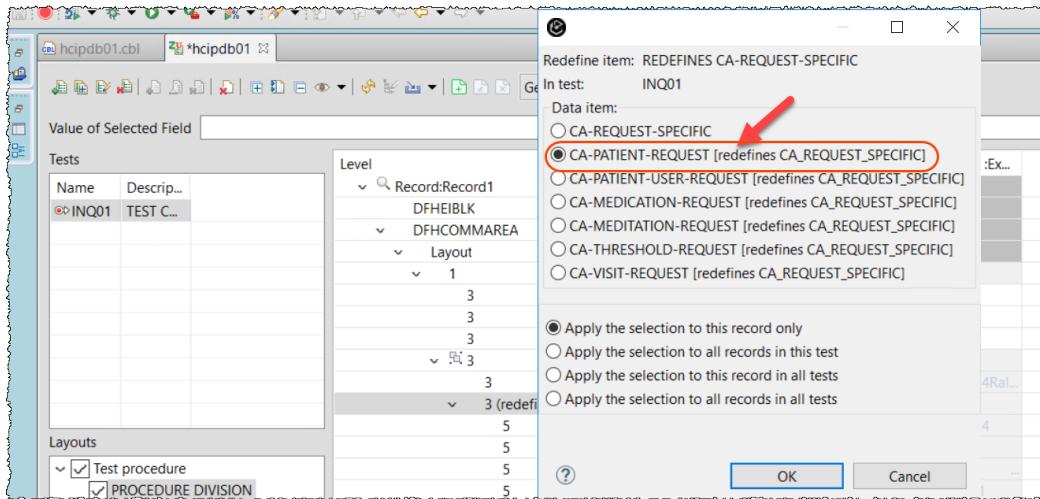
2.2.25 You may notice that this program has many redefines. You may need to identify which is the area being used on this program execution. In our example is the "inquiry patient" area being redefined.

► Scroll up until you find "(redefines) CA-PATIENT-REQUEST" (the first REDEFINES).

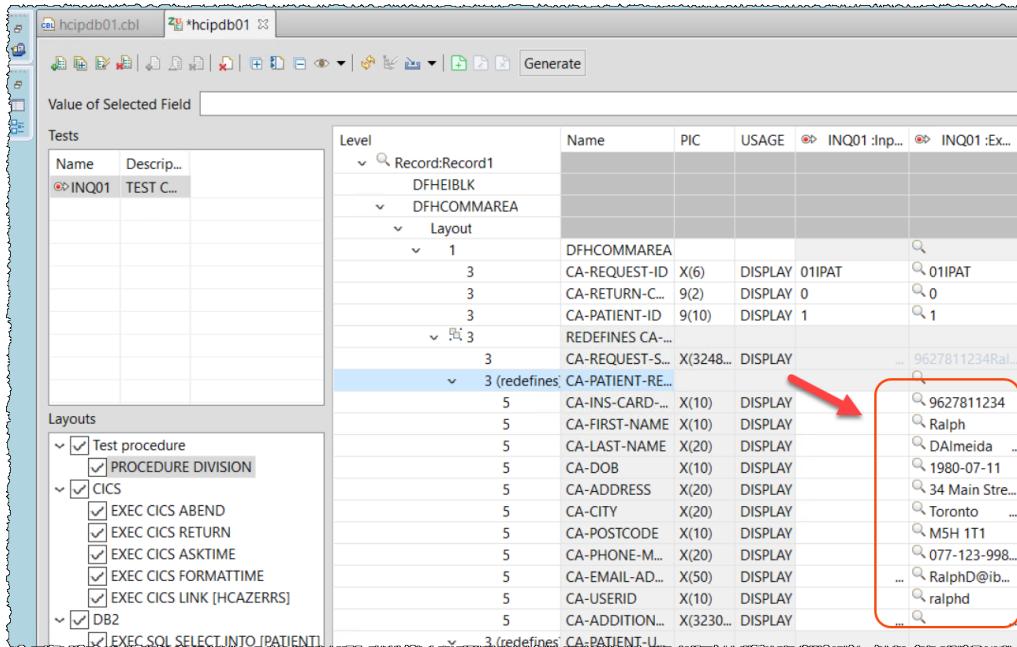
Right click on it and click **Select Redefines Structure**



## 2.2.26 Select CA-PATIENT-REQUEST and click OK



## 2.2.27 Notice that now the patient data recorded is displayed at the new redefines selected.



2.2.28 ► Press **Ctrl+S** to save any changes.

2.2.29 ► Double click again on the **hcipdb01** title to shrink the view.

In case by mistake you close this editor will can re-execute the step 2.2.1

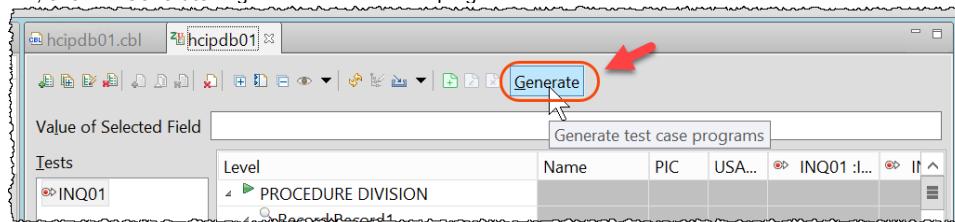


## Section 3. Generate, build, and run the unit test.

You will generate, build, and run the unit test for the test case created.

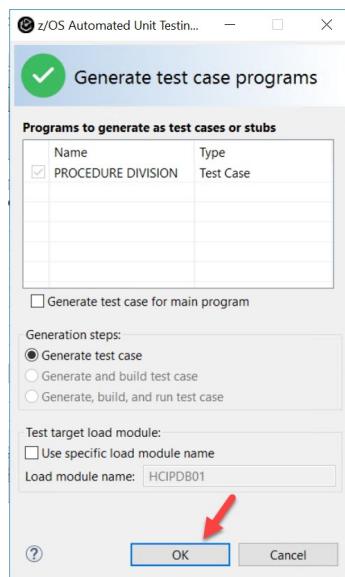
### 3.1 Generating the test case program.

3.1.1 ► Now that the expected input and output values have been set in the test case editor from the recorded run, click on **Generate** to generate the test case program.



On the **Generate test case programs** dialog,

3.1.2 ► Click **OK**.



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3.1.3 The COBOL program that will run the test case is generated under the folder **testcases**.

▶ Expand **testcases** and double click on **Hcipdb0.cbl** to verify the generated program.

Notice that in fact **9 COBOL programs** were generated from this test case . This can be seen on the **Outline** view. You could navigate to each program if time allows, **note that NONE of these programs will require CICS or DB2 to be executed**. All will be executed in batch using JCL.

The screenshot shows the Rational Developer for z/OS interface. In the center, the code editor displays a COBOL program named Thcipdb0.cbl. The code includes comments like \*! Thcipdb0, \*! PRODUCT: IBM DEVELOPER FOR Z/OS, and \*! PROGRAM: ENTERPRISE COBOL UNIT TEST CASE FOR DYNAMIC RUNNER. Below the code editor is the 'Outline' view, which lists several generated COBOL programs such as TEST\_INQ01, BZU\_TEST, BZU\_INIT, BZU\_ITRM, EVALOPT, GTMEMRC, AZU\_GENERIC\_CICS, AZU\_GENERIC\_DB2, and CICS\_0E8\_HCIPDB01. A red arrow points from the 'Outline' view towards the code editor. On the left, the 'z/OS Projects' sidebar shows various project files like HCMADB01.cbl, Jenkinsfile, and O.project. A red circle highlights the Thcipdb0.cbl file in the 'testcases' folder.

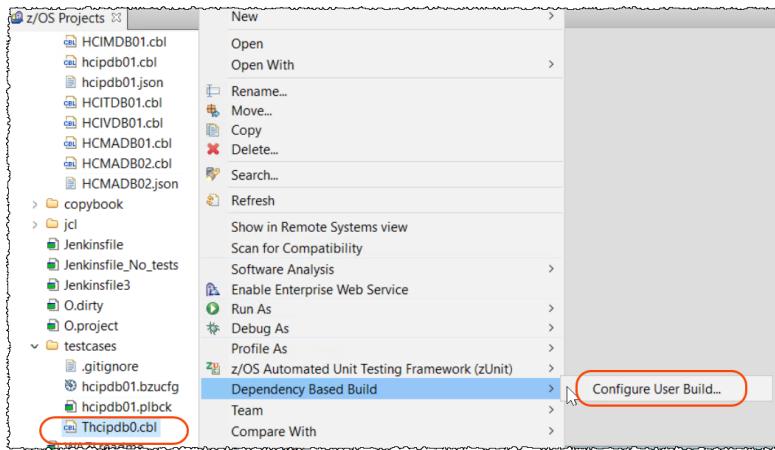
### 3.2 Building the generated test case programs using IBM DBB .

The 6 generated COBOL programs need to be compiled/link edited to be executed. This must be done on z/OS using the COBOL compiler.

To make this easier we will use the IBM DBB. We provided the required framework to make this possible. But note that this could be done using any other way, including via JCL normal compilation.

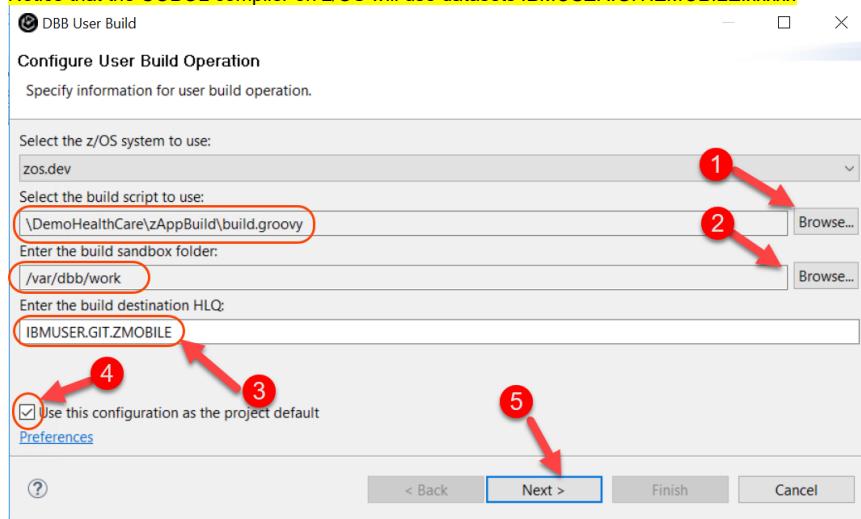
3.2.1 ▶ Use **Ctrl + Shift + F4** to close all opened editors.

3.2.2 ▶ Right click on **Hcipdb0.cbl** (under **testcases**) and select **Dependency Based Build > Configure User Build**.



3.2.3 ► Those values could be already there, otherwise use the **Browse...** buttons to specify the values as below. As build destination HLQ use **IBMUSER.GIT.ZMOBILE**, select **Use this configuration as the project default** and click **Next**

Notice that the COBOL compiler on z/OS will use datasets **IBMUSER.GIT.ZMOBILE.xxxxx**



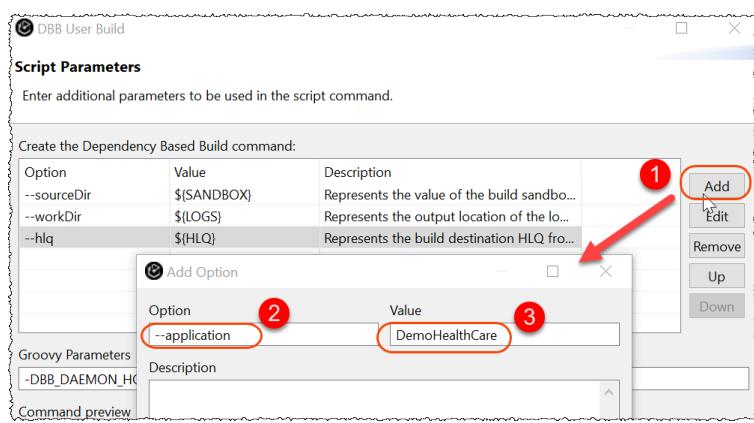
3.2.4 ► Click **Next** Twice

3.2.5 On dialog **Script Parameters**, if the "**--application**" and "**--debug**" are not there you must add

► Otherwise skip to 3.2.7

In case you need to add --application.

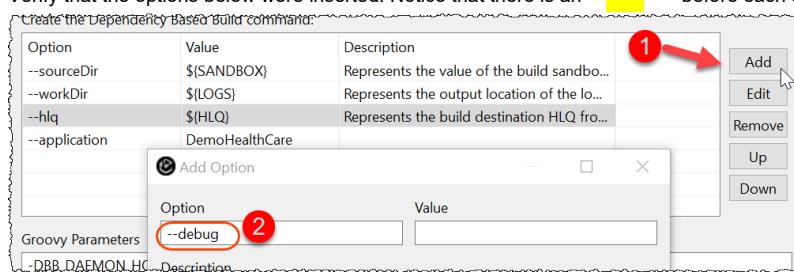
► Click **Add** to insert **--application** and **DemoHealthCare** (mixed case) and click **OK**



## 3.2.6 In case you need to add --debug.

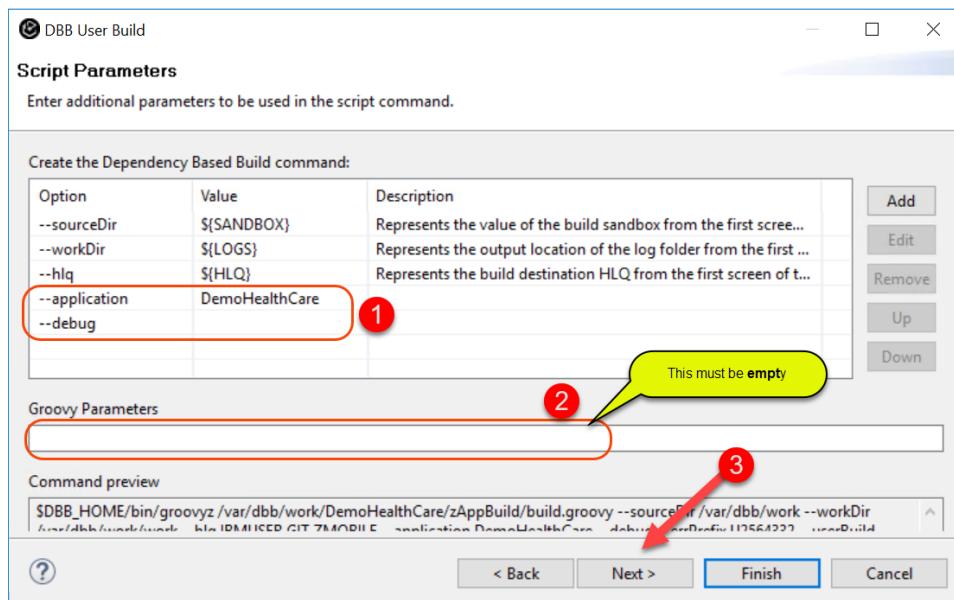
► Click Add to insert **--debug** and click OK

Verify that the options below were inserted. Notice that there is an “**--**” before each option.

3.2.7 The field **Groovy Parameters** should be cleared if there is something already specified there.

► Be sure that the Groovy parameters field is **empty**

► Click Next

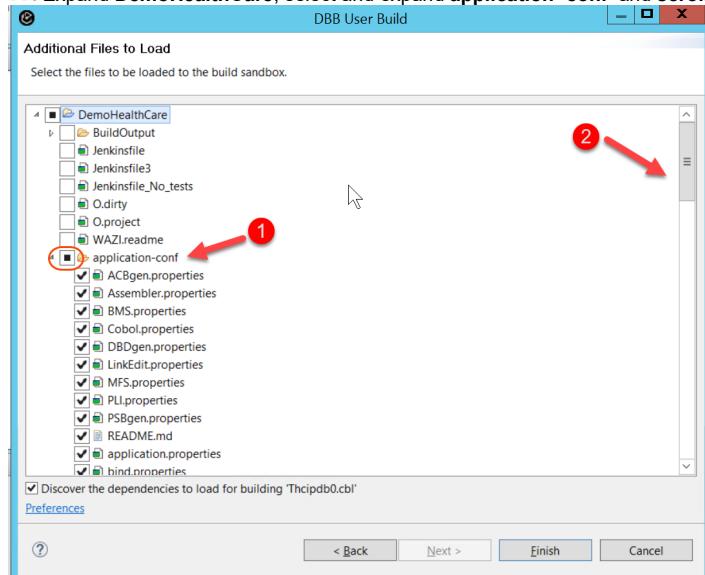


## Exercises Guide

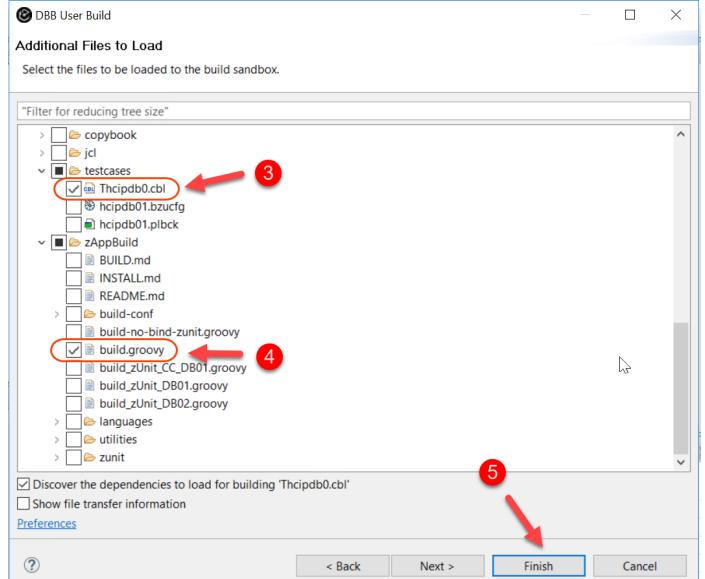
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### 3.2.8 You need to move the assets to z/OS UNIX Files

► Expand DemoHealthCare, select and expand application -conf and scroll down

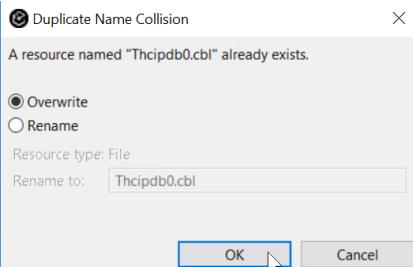


### 3.2.9 ► Be sure that Thcipdb01.cbl and build.groovy are selected and click Finish

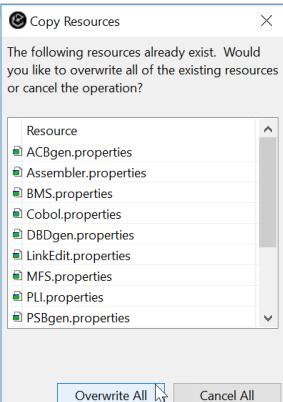


### 3.2.9 Those assets were once already moved to the z/OS UNIX files and will overwrite the old copies.

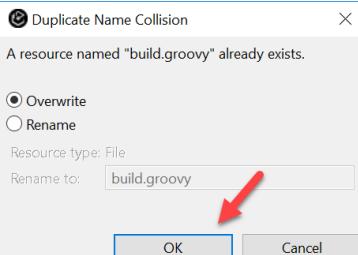
► Click OK



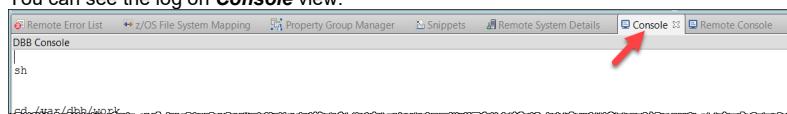
### ► Click Overwrite All



### ► For duplicate name collision click OK



The assets will be moved to **z/OS UNIX Files** and the **build.groovy** will start.  
You can see the log on **Console** view.



**If the DBB user build fails**  
*If you have errors as below: (Resources temporary unavailable)*



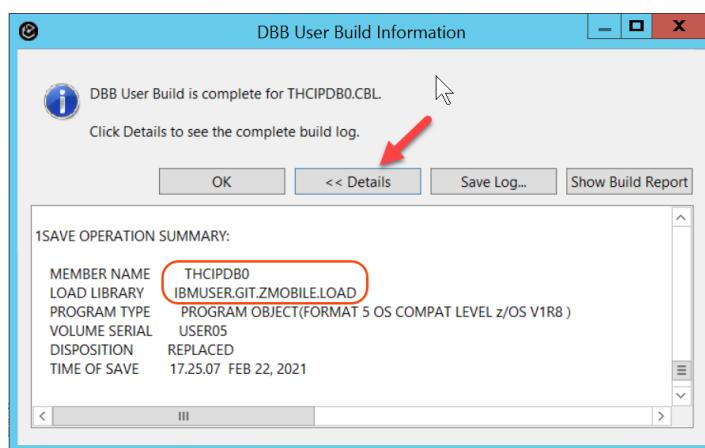
DBB Console

```
Cannot run program "sh" (in directory "/var/dbb/work"): EDC5112I Resource temporarily unavailable
$DBB_HOME/bin/groovyz -DBB_DAEMON_HOST 127.0.0.1 -DBB_DAEMON_PORT 8080 /var/dbb/work/DemoHealthCare/zAppBuild/build.groovy
```

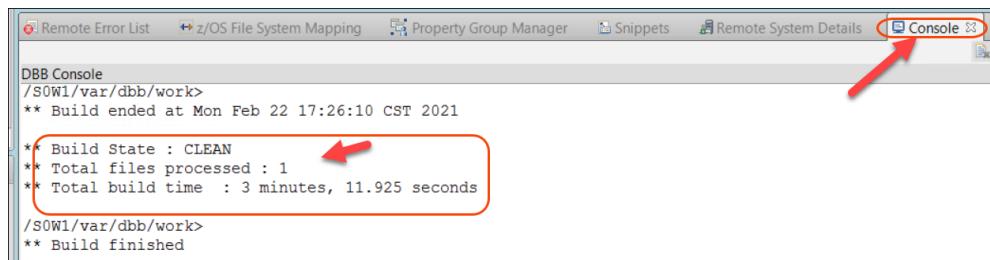
It's because your z/OS is stressed., One easy way to free the z/OS resources is logging on TSO as IBMUSER password **SYS1**, go to M.5 and issue **/C CICSTS53** And Try again

3.2.10 This operation will compile, and link the 9 generated COBOL programs **and it may take up to 3 minutes**. You can follow this using the **Console view** opened in the bottom.

► When finished the dialog below will be displayed and you can click on **Details** and **OK** after you scroll down and verify that the load module was created.



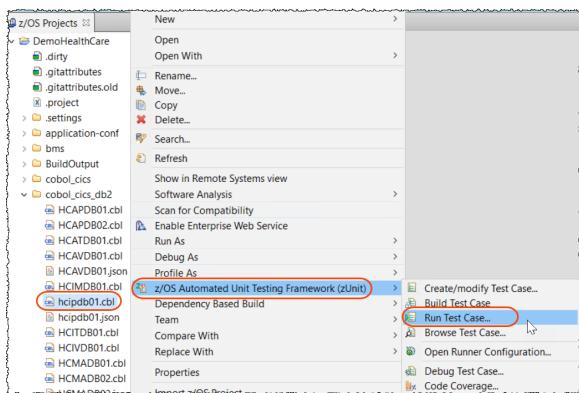
► The **Console view** also show the results as below:



### 3.3 Running the test case,

Once you have the test cases load module created you can run the test case against the COBOL program. Since you did not make changes to the program the return code must be zero and all tests should pass.

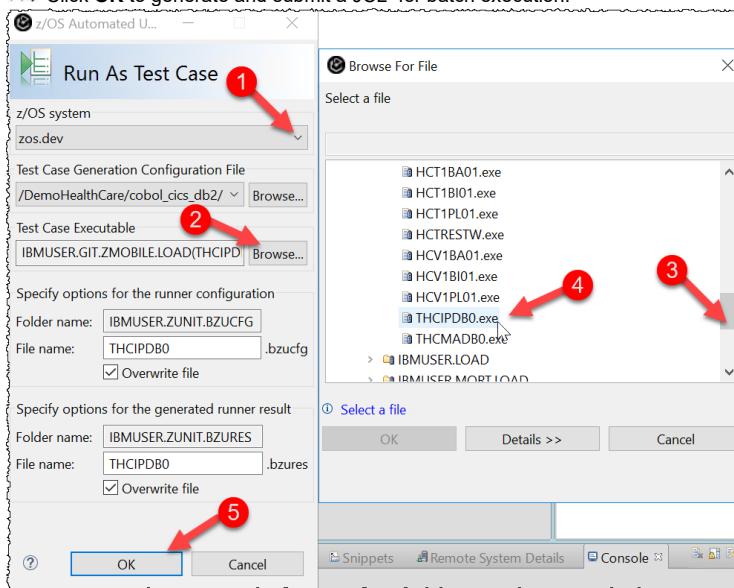
- 3.3.1 ► Using z/OS Projects view, scroll up, right click on **hcipdb01.cbl** and select **z/OS Automated Unit Testing Framework (zUnit) > Run Test Case...**



- 3.3.2 ► Select **zos.dev** and use the **Browse** button to select the PDS and load module where the test case was created.

You will find the PDS **IBMUSER.GIT.ZMOBILE.LOAD(THCIPDB0)** under **My Data Sets** ..

- Click **OK** to generate and submit a JCL for batch execution.



## Exercises Guide

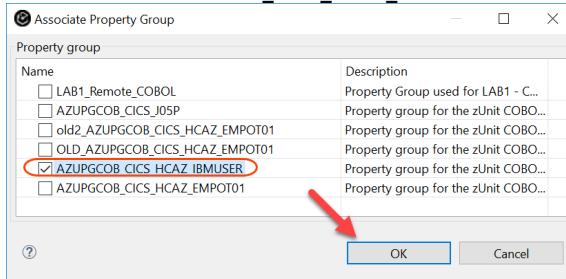
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3.3.3 If the *Missing Property Group* dialog will prompt:

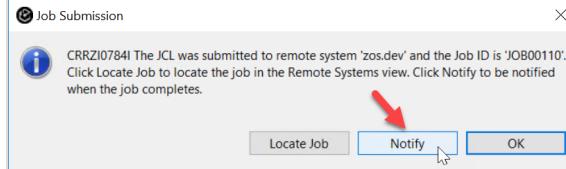
▶ Click **Associate an existing property group** otherwise go to 3.3.5



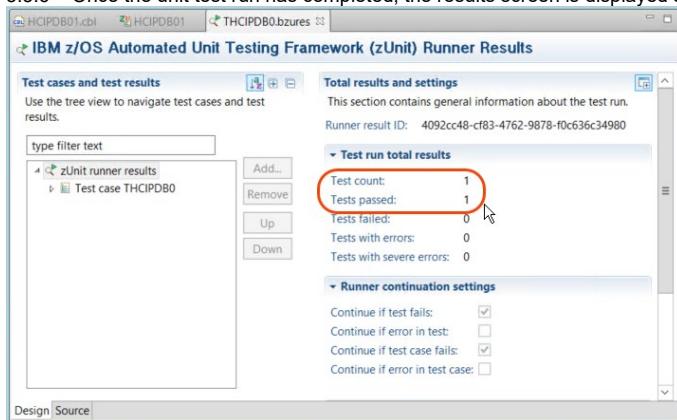
3.3.4 ▶ Select **AZUPGCOB\_CICS\_HCAZ\_IBMUSER** and click **OK**



3.3.5 ▶ A *Job Submission* dialog opens, click **Notify** to be notified of job completion.



3.3.6 Once the unit test run has completed, the results screen is displayed showing test cases ran and **passed**.



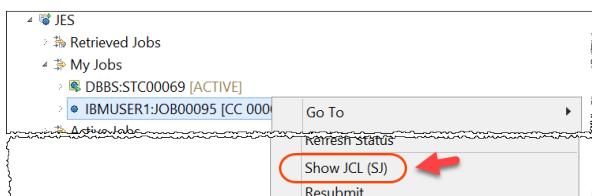
You have now created a test case with data imported from a recorded run and have been successful in testing a CICS program without the need of a CICS and DB2 environment.

3.3.7 ►| Use **Ctrl + Shift + F4** to close all opened editors.

### 3.4 Verify the JCL submitted

To see the JCL submitted on the previous execution

3.4.1 ►| Using **Remote Systems** view on right, under **JES** expand **My Jobs**, right click on the last executed that has **CC 000** (NOT the ACTIVE) and select **Show JCL (SJ)**



3.4.2 ►| The job submitted will be displayed. You could save it in a PDS member and use it when want to run the test cases for this program.

As you see there is no CICS or DB2 environments in that execution.

```

JOB00092.jcl:33
-----+---1---+---2---+---3---+---4---+---5---+---6---+---7---+---8---+
1 //IBMUSER1 JOB ,
2 // MSGLEVEL=(1,1),REGION=0M,COND=(16,LT)
3 // Action: Run Test Case...
4 //* Source: IBMUSER.GIT.ZMOBILE.LOAD(THCIPDB0)
5 //      SET FELJOB=ZUNITGO
6 // RUNNER EXEC PROC=BZUPLAY,
7 // BZUCBK=IBMUSER.ZUNIT.BZUCFG(THCIPDB0),
8 // BZUCFG=IBMUSER.GIT.ZMOBILE.LOAD,
9 // BZULOD=IBMUSER.GIT.ZMOBILE.LOAD,
10 // PRM='STOP=E,REPORT=XML'
11 // REPLAY.BZUPLAY DD DISP=SHR,
12 // DSN=IBMUSER.ZUNIT.PB1.HCIPDB01
13 // REPLAY.BZURPT DD DISP=SHR,
14 // DSN=IBMUSER.ZUNIT.BZURES(THCIPDB0)
15 // STEPLIB DD
16 //      DSN=IBMUSER.LOAD,DISP=SHR
17 //      DSN=IBMUSER.GIT.ZMOBILE.LOAD,DISP=SHR
18

```

3.4.3 ►| Use **Ctrl + Shift + F4** to close all opened editors.

### 3.5 Running zUnit test case Code Coverage

Code coverage analyzes a running program and generates a report of lines that are executed, compared to the total number of executable lines. Sometimes you need to be sure that your test is covering all capabilities of your program and that you are having the correct test cases.

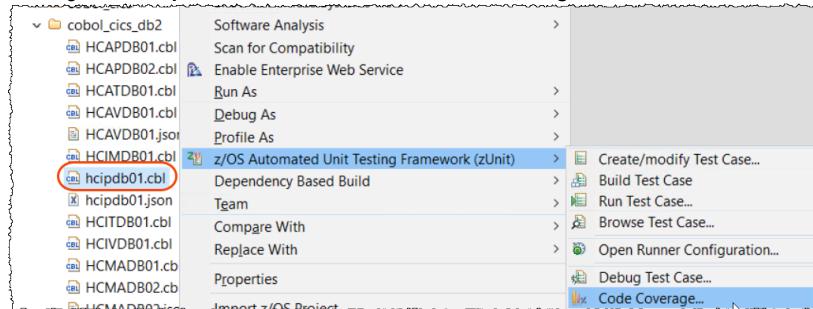
Notice that you are doing the code coverage using a batch job without need to have CICS and DB2 active, which is very handy.

## Exercises Guide

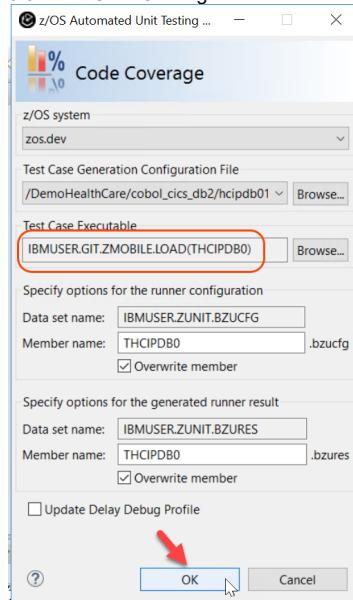
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3.5.1 ZUnit also provides the capability to run the test case using Code coverage or Debug.

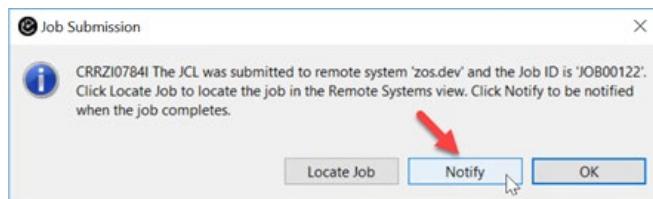
► Right click **hcidb01.cbl** and select **zUnit > Code Coverage...**



3.5.2 ► Click **OK** to generate and submit a JCL for batch execution.



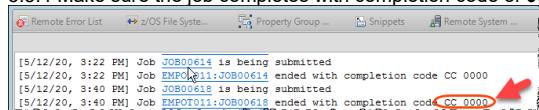
3.5.3 ► Click **Notify** on the Job Submission Confirmation dialog.



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### 3.5.4 Make sure the job completes with completion code of 0000.



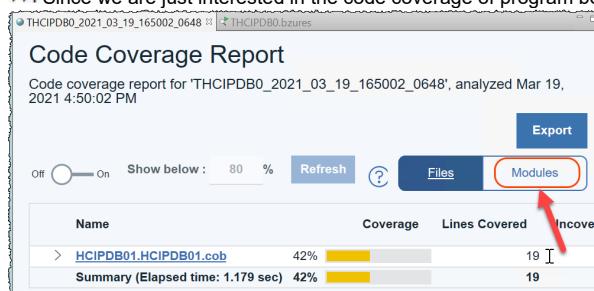
### 3.5.5 The code coverage report shows all COBOL programs executed for this specific test case.

► Click on title THCPDB0\_yyyy\_mm\_dd\_xxxxxxx to see the Code coverage report



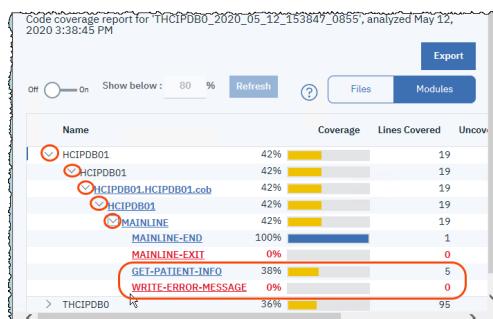
### 3.5.6 This code coverage report shows the coverage of the COBOL programs generated for zUnit to perform the test as well our HCIPDB01 COBOL program..

► Since we are just interested in the code coverage of program being tested click on Modules:

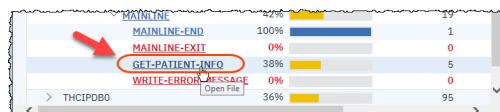


### 3.5.7 ► Expand the nodes as below to see the COBOL paragraphs.

Notice that GET-PATIENT-INFO has 38% of coverage and that WRITE-ERROR-MESSAGE was not covered at all on this test case.



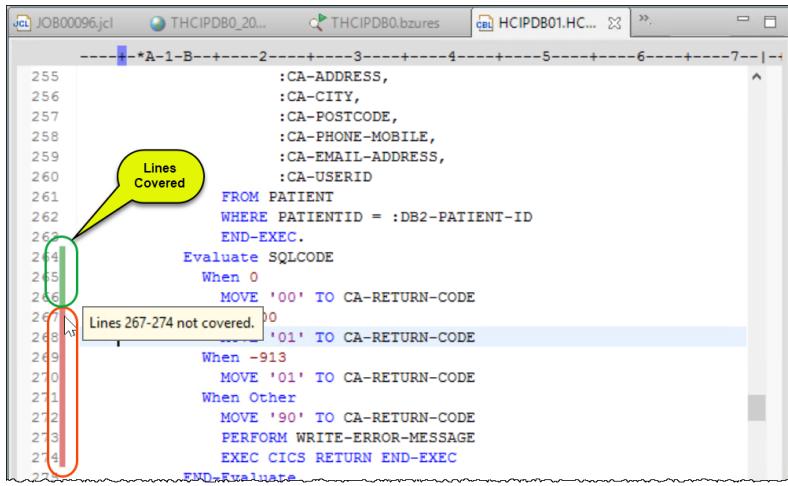
### 3.5.8 ► Click on GET-PATIENT-INFO to see more details



3.5.9 Scroll down and move the mouse to the colored areas on left.

The lines covered by this test case are in green and the lines not covered are in red.

Also from the previous image we can see the WRITE-ERROR\_MESSAGE paragraph is not covered at all. (you may have different values than the screen capture below).



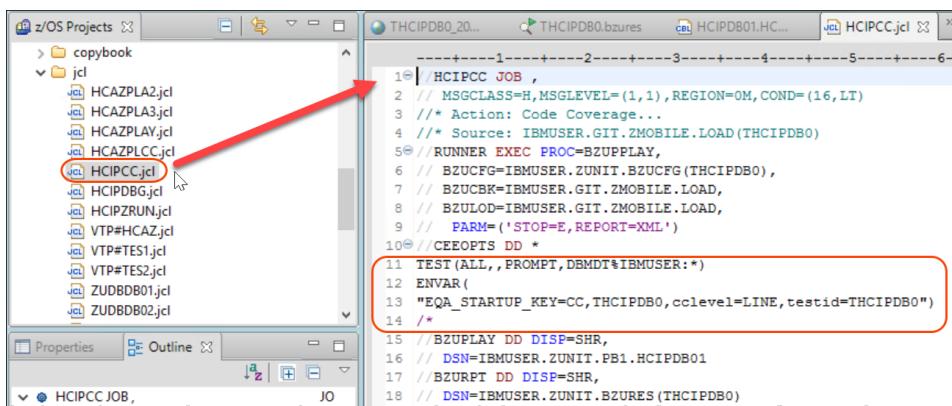
3.5.10 From this report we can see that the test cases created for this program are not sufficient ...

The developer could go back to the test cases editor (step 2.2.20 above) and manually add test cases that cover other paragraphs. Due to the lack of time we will not cover that here, but if you have extra time you can try it. Ask the instructor for guidance.

3.5.11 We also saved the JCL showed on step 3.4.2 and added the information to run the code coverage.

This JCL can be found at [jcl/HCIPIPCC.jcl](#)

Double click on **jcl/HCIPIPC.jcl** and verify this JCL. You could just submit this JCL to run the test case and the Code Coverage.



## Section 4. Introduce a bug in the program and rerun the unit test.

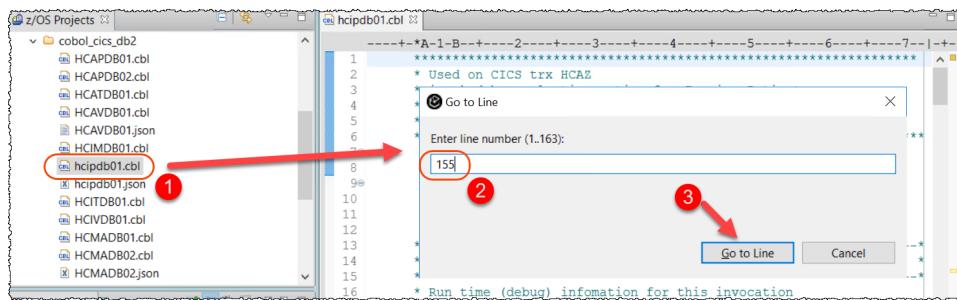
Using IDz you will modify the program and introduce a bug. Then you will rerun the unit test created in the previous section.

### 4.1 Modifying the program and introduce a bug

4.1.1 ► On IDz, close all active windows by pressing **Ctrl+Shift+F4**

► Open **hcipdb01.cbl** under **cobol\_cics\_db2** by double clicking on it in the z/OS Projects view.

4.1.2 ► On the editor, go to line 155 by pressing **Ctrl+L** and entering **155** and clicking **Go to Line**



4.1.3 ► Change the lines 156, 157 and 158 removing the \* from the statement that moves "BAD NAME",  
Tip -> Could use **Source > Toggle Comment** also **DO NOT** change line 159.

► Press **Ctrl+S** to save the changes. and **Ctrl + Shift + F4** to close all editors.

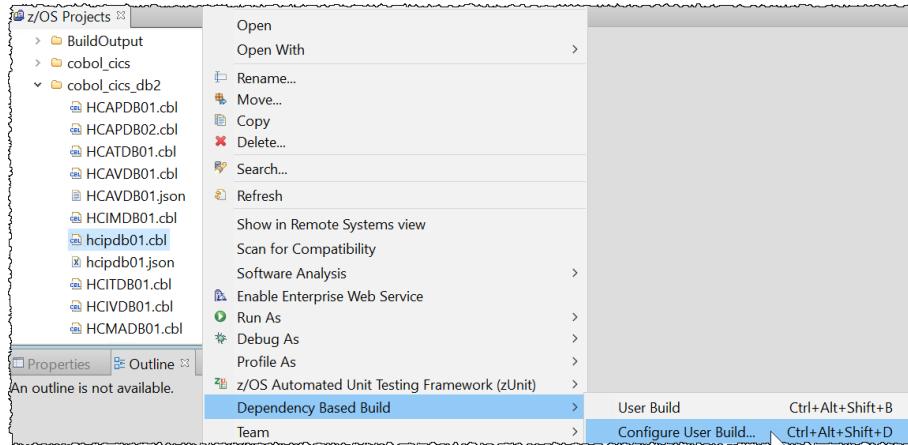
```

141      * *A-1-B-+---2---+---3---+---4---+---5---+---6---+---7---I-+
142      END-EXEC.
143      Evaluate SQLCODE
144      When 0
145          MOVE '00' TO CA-RETURN-CODE
146      When 100
147          MOVE '01' TO CA-RETURN-CODE
148      When -913
149          MOVE '01' TO CA-RETURN-CODE
150      When Other
151          MOVE '90' TO CA-RETURN-CODE
152          PERFORM WRITE-ERROR-MESSAGE
153          EXEC CICS RETURN END-EXEC
154      END-Evaluate.
155      * #bug2 -- the line below will introduce a BUG
156      * IF DB2-PATIENT-ID = 1
157          MOVE "BAD NAME" to CA-FIRST-NAME
158      END-IF
159      * MOVE "02" to CA-NEWFIELD
160
161      EXIT.
162
163      COPY HCERRSPD.

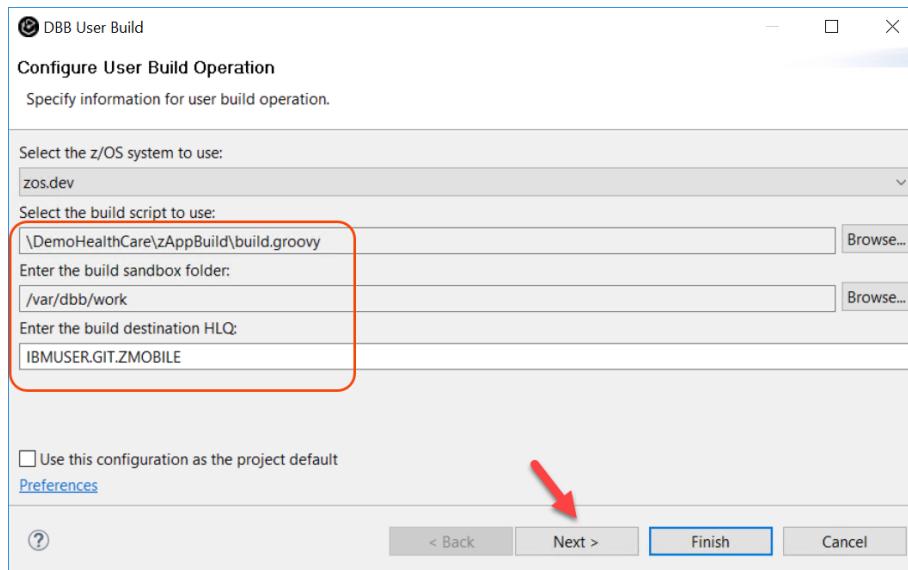
```

## 4.2 Rebuilding the changed program without deploying to CICS using DBB

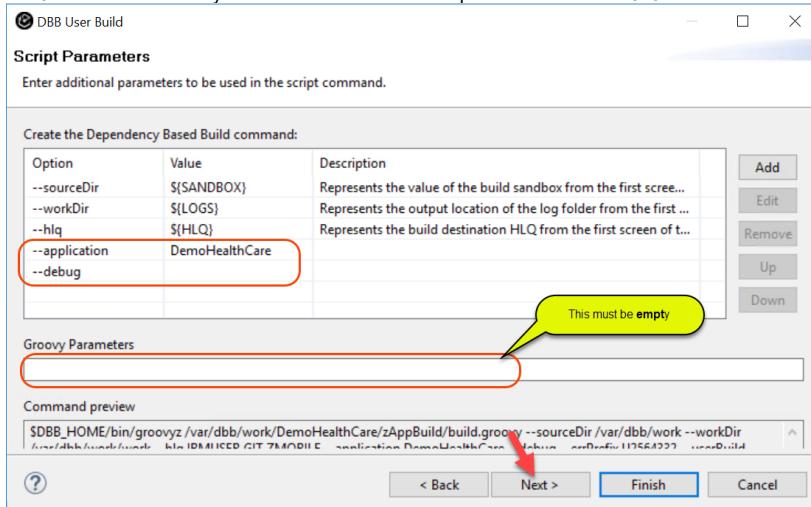
4.2.1 ► On the z/OS Projects view, right click on **hcipdb01.cbl** and select **Dependency Based Build > Configure User Build...**



4.2.2 ► If the values are not populated, use the Browse button and specify the values below and click Next 3 times

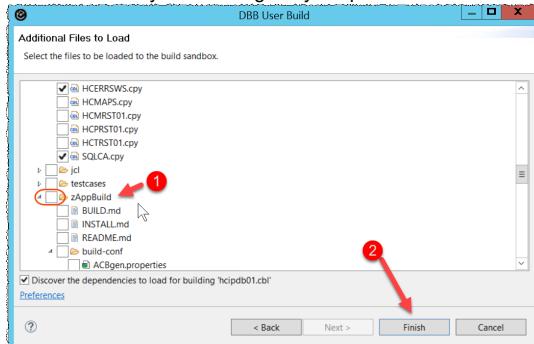


**4.2.3** Be sure that you have the values below specified and click **Next**

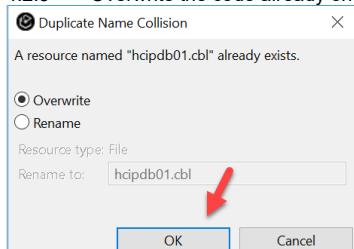


**4.2.4** Expand **DemoHealthCare**, Un-select **zAppBuild** and click **Finish**.

You have already moved all groovy scripts to z/OS before when compiled the Test case program.



**4.2.5** Overwrite the code already on z/OS as the example below

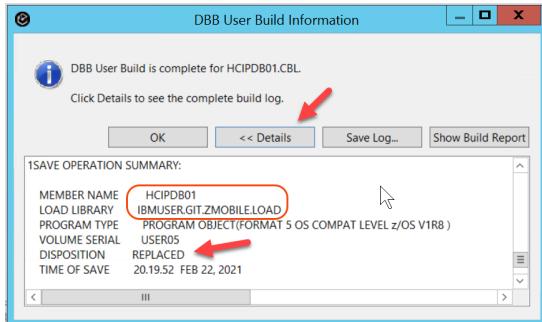


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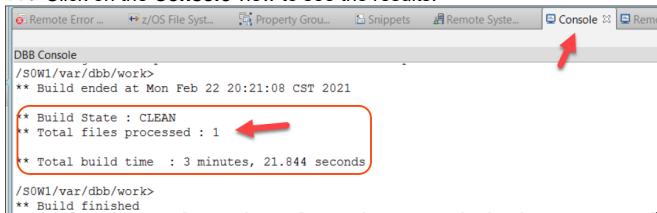
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4.2.6 This operation may take up to 2 minutes When finished the dialog below will be displayed.

► Click on **Details** and **OK** after you verified that the load module was replaced.



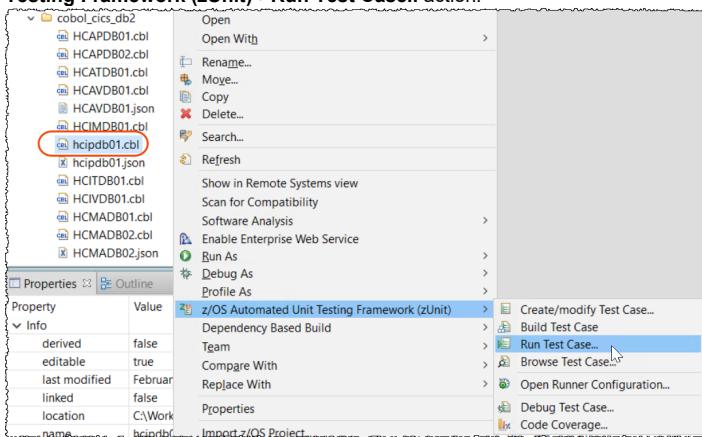
► Click on the **Console** view to see the results:



### 4.3 Running the test case again

Since we introduced a bug, now the test case must fail.

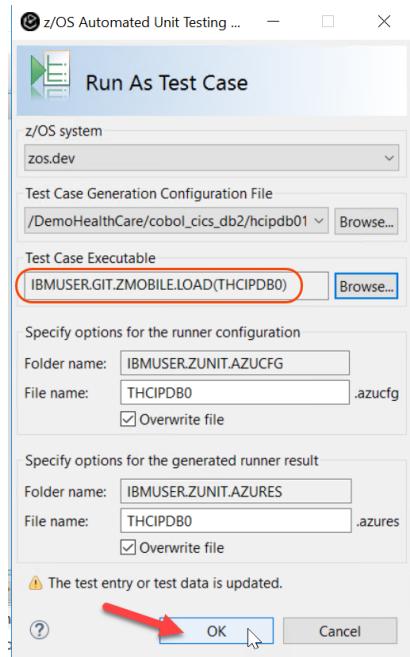
4.3.1 ► On the z/OS Projects view, select **hcipdb01.cbl**, right mouse click, and select the **z/OS Automated Unit Testing Framework (zUnit)**->**Run Test Case..** action.



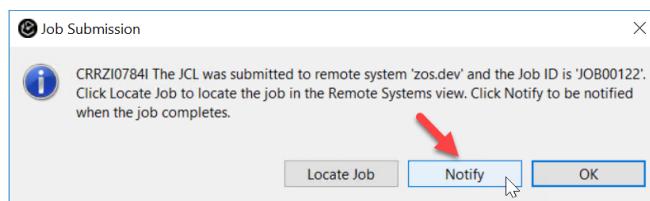
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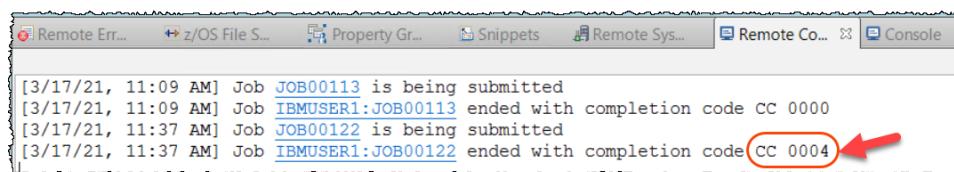
- 4.3.2 ► Be sure that the test case load module **IBMUSER.GIT.ZMOBILE LOAD(THCIPDB0)** is selected and click **OK** to submit the execution via JCL.



- 4.3.3 ► Click **Notify** on the Job Submission Confirmation dialog.



- 4.3.4 ► Notice that now you have a completion code of **0004** instead of 0000.



4.3.5 When the test run completes, the test results will be displayed, and it showed 1 test was ran and it failed.

► Click **Test case THCPDB0**. The failure is expected because the expected value of the error message is different from the actual value.

Test case details
Test case ID: e30e513c-140b-4176-b4f1-0b497de49f44
Module name: THCPDB0
Test case name: THCPDB0
Result: fail
Test count: 1
Tests passed: 0
Tests failed: 1
Tests with errors: 0
Tests with severe errors: 0

4.3.6 ► Double click on title **THCPDB0.bzures** to maximize the windows and better check the results

4.3.7 ► Expand **Test case THCPDB0, Test INQ01 (fail)** and click **Exception message number** to verify the value received versus the expected value and verify the failure

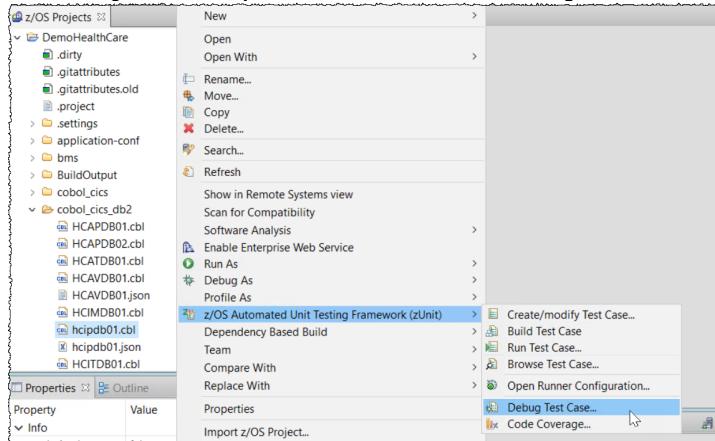
Exception details
If the result of the test is "fail" or "error", this section contains the details of the exception.
BZUPU00W ASSERT=COMPARE FAILED IN PROCEDURE DIVISION. BZUP220I TEST RUN TEST2 REGISTERED FOR SUBSYS=CICS FILTER ON=HCIPDB01 STUB CALL=Y BZUP400I STARTING TRANSACTION=HCP1 USING PROGRAM=TEST2 BZUPU00W ASSERT=COMPARE FAILED IN PROCEDURE DIVISION. BZUPT00I ITEM NAME=CA-VISIT-TIME OF CA-VISIT-REQUEST OF DFHCOMMAREA BZUPT00I VALUE=BAD NAME BZUPT00I EXPECTED VALUE=Ralph BZUP002I FINISHED EXECUTION RC=04
<b>Message:</b>
Component code: BZU
Message number: 3000
Message severity: 4

## 4.4 Running zUnit test case with debugging

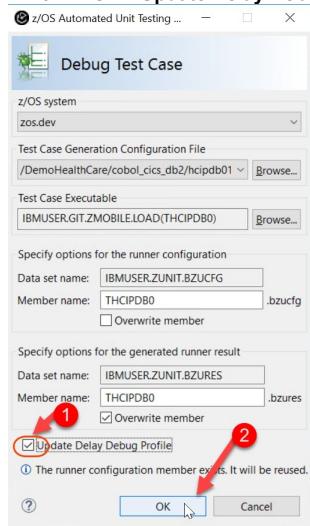
The Debug dialog will debug the test case. Note that will debug the zUnit programs, the generated COBOL and also the COBOL program that you are testing. Below one example. **Notice that you are debugging a batch job without need to have CICS and DB2 active, which is very handy.**

4.4.1 ► Close all active windows by pressing **Ctrl+Shift+F4**

4.4.2 ► Right click on **hcipdb01.cbl** and select **zUnit → Debug Test Case ...**



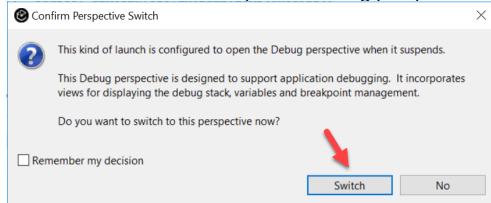
4.4.3 ► Click **Update Delay Debug Profile** and click **OK**



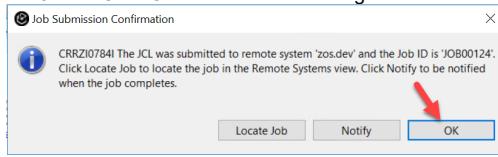
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4.4.4  Click **Switch** to open the debug perspective.



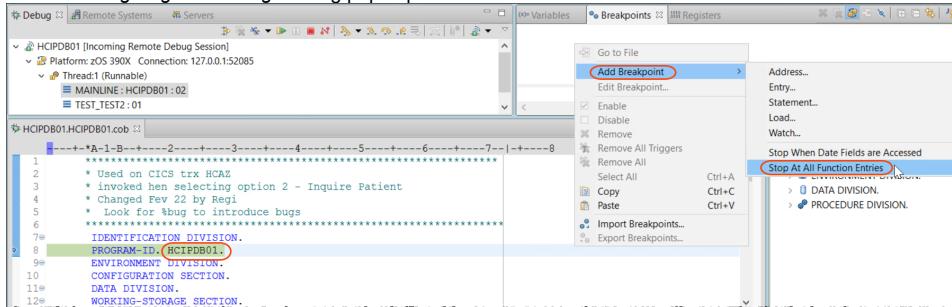
4.4.5 ►| Click **OK** to dismiss this dialog



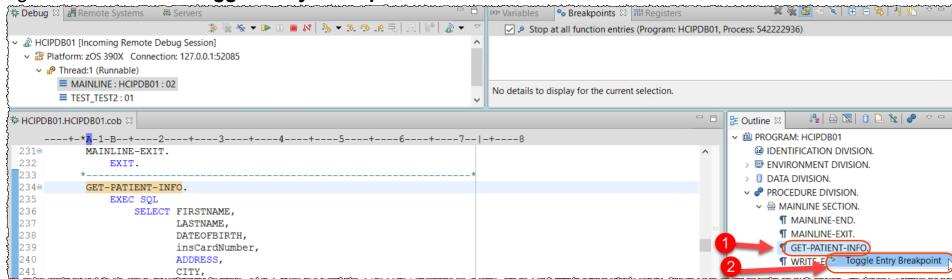
4.4.6 Notice that the first program being debugged is the program that you introduced the bug. (**Hcipdb01**)  
The execution is stopped BEFORE that program starts. You can add some breakpoints before running.

▶ Using the Breakpoints view, right click and select **Add Breakpoints > Stop At All Functions Entries**. This would allow you to reach the entry point of the source files by repeatedly clicking *resume*.

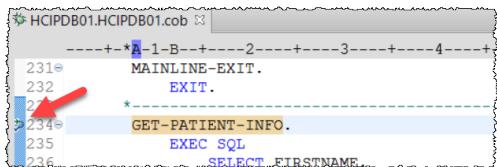
If a Debug Engine Message dialog pops up click **OK**



4.4.7 Using the **Outline** view to navigate to **GET-PATIENT-INFO**, right click and select **Toggle Entry Breakpoint**



4.4.8 A breakpoint is created on the **EXEC SQL SELECT** statement. When the program runs it will stop there.



```

Hcipdb01.Hcipdb01.cob
-----+-----+-----+-----+
231* 1-B-----2-----3-----4-----+
      MAINLINE-EXIT.
232*   EXIT.
233* 
234* GET-PATIENT-INFO.
235   EXEC SQL
      SELECT FIRSTNAME
236
237
238
239
240
241
242

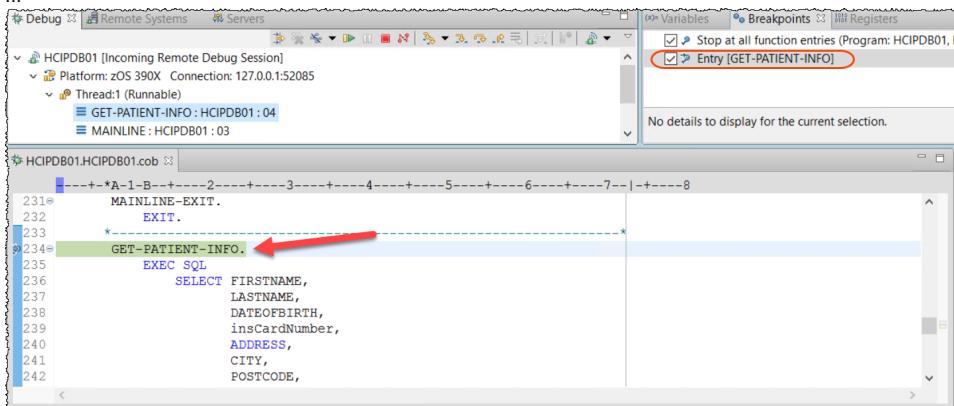
```

4.4.9 Click on icon or press F8 to resume the execution



4.4.10 The execution will halt at the **SQL SELECT** statement due the breakpoint you added.

Notice your program is now using "stubbed code data" instead of accessing the DB2 database..



The Breakpoints view shows a single entry: "Entry [GET-PATIENT-INFO]" with a checked checkbox. The COBOL code editor shows line 234 with a red arrow pointing to it, indicating where the breakpoint is located.

```

Hcipdb01.Hcipdb01.cob
-----+-----+-----+-----+
231* 1-B-----2-----3-----4-----+
      MAINLINE-EXIT.
232*   EXIT.
233* 
234* GET-PATIENT-INFO.
235   EXEC SQL
      SELECT FIRSTNAME,
      LASTNAME,
      DATEOFBIRTH,
      insCardNumber,
      ADDRESS,
      CITY,
      POSTCODE,
236
237
238
239
240
241
242

```

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4.4.11 ► Click on icon or press F5 to Step Into the code until you find the statement below.

► You can move the mouse to :DB2-PATIENT-ID and see its contents

Again, notice that we get DB2 data without going to the database, but using the stub recorded earlier (Play Back file).

```
256      FROM PATIENT
257      WHERE PATIENTID = :DB2-PATIENT-ID
258      END-EXEC.
259      Evaluate SQLCODE
When 0
  MOVE '00' TO CA-RET
When 100
  MOVE '01' TO CA-RET
When -913
  MOVE '01' TO CA-RET
When Other
  MOVE '90' TO CA-RET
```

4.4.12 ► Keep clicking on icon or press F5 to Step Into the code until you see the bug that you had introduced.

► You also can see the BUG that you introduced. Move the mouse to CA-FIRST-NAME to see the field content (Ralph), which will be replaced by "BAD NAME".

```
270      * %bug2 -- the line below will introduce a BUG
271      * 
272      * 
273      IF DB2-PATIENT-ID = 1
274          MOVE "BAD NAME" to CA-FIRST-NAME
275      END-IF
276      * MOVE "02" to CA-NEWFI
277      * EXIT.
278      * 
279      *COPY HCERRSPD.
280      * 
281      
```

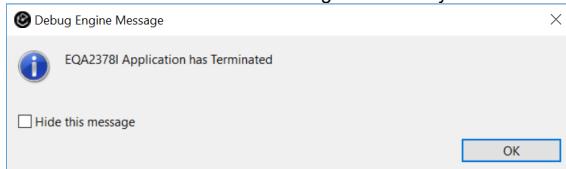
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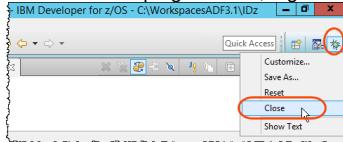
4.4.13 ► Click on icon or press F8 to resume.. Or if you prefer keep clicking on Step Into.



4.4.14 ► You will see that the debug ends when you have the dialog below. Click OK



4.4.15 ► On top right corner, right click on icon and select Close to close the debug perspective



## Section 5. (Optional )Run the unit test from a batch JCL.

Once a test case has been generated and built, it can be executed using a batch run via JCL.  
This would enable it to be ran as part of an automated process or pipeline..

### 5.1 Running the unit test from a batch JCL

5.1.1 ► Close any active windows by pressing Ctrl+Shift+F4.

5.1.2 ► On the IDz z/OS Projects view, double click HCIPZRUN.jcl to open it.  
This JCL will run the test case that you created using a batch job.

```
copybook
jcl
HCAZPLA2.jcl
HCAZPLA3.jcl
HCAZPLAY.jcl
HCAZPLCC.jcl
HCIPCC.jcl
HCIPDBG.jcl
HCIPZRUN.jcl
VTP#HCAZ.jcl
VTP#TEST1.jcl
VTP#TEST2.jcl
ZUDBDB01.jcl
ZUDBDB02.jcl

-----+---1---+---2---+---3---+---4---+---5---+---6---+
1 //>HCIPZRUN JOB ,MSGCLASS=H,MSGLEVEL=(1,1),REGION=0M,COND=(16,LT)
2 /* Action: Run ZUnit in batch...
3 //** Source: IBMUSER.GIT.ZMOBILE.LOAD(THCIPDB0)
4 // RUNNER EXEC PROC=B2UPPLAY,
5 // BZUCFG=IBMUSER.ZUNIT.BZUCFG(THCIPDB0),
6 // BZUCBP=IBMUSER.GIT.ZMOBILE.LOAD,
7 // BZULOD=IBMUSER.GIT.ZMOBILE.LOAD,
8 // PARM=(STOP=E,REPORT=XML')
9 //BZUPLAY DD DISP=SHR,
10 // DSN=IBMUSER.ZUNIT.PB1.HCIPDB01
11 //BZURPT DD DISP=SHR,
12 // DSN=IBMUSER.ZUNIT.BZURES(THCIPDB0)
13 //
```

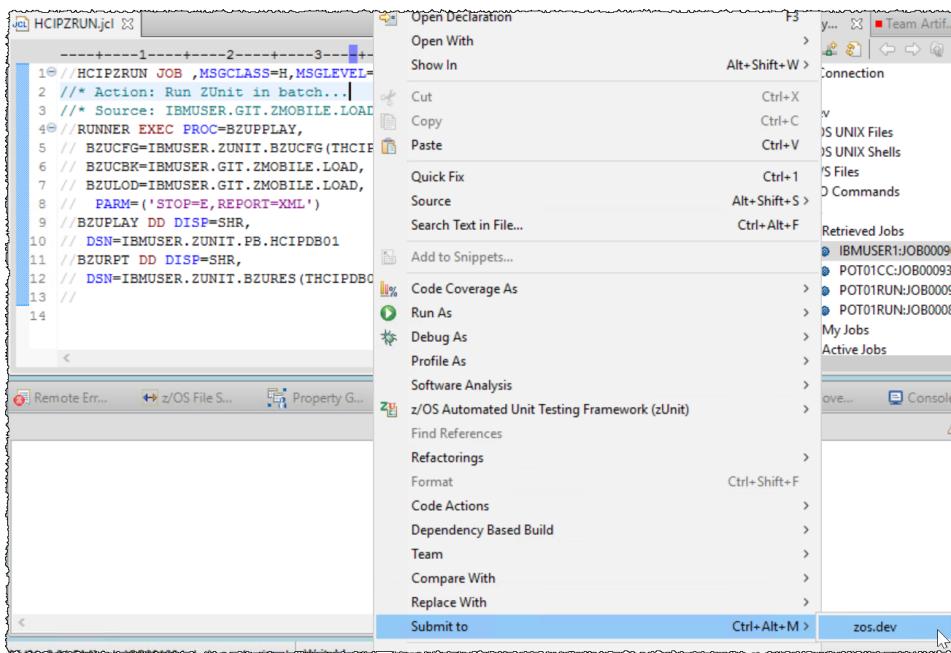
5.1.3 ► Be sure that on the line 10 the dataset name is IBMUSER.ZUNIT.PB.HCIPDB01 (instead of PB1). You may need to change this and then click Ctrl+S

```
9 //BZUPLAY DD DISP=SHR,
10 // DSN=IBMUSER.ZUNIT.PB.HCIPDB01
11 //BZURPT DD DISP=SHR,
12 // DSN=IBMUSER.ZUNIT.BZURES(THCIPDB0)
```

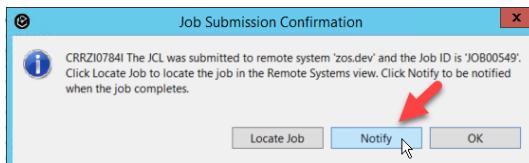
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### 5.1.4 ► Right click the editor and select Submit > zos.dev.

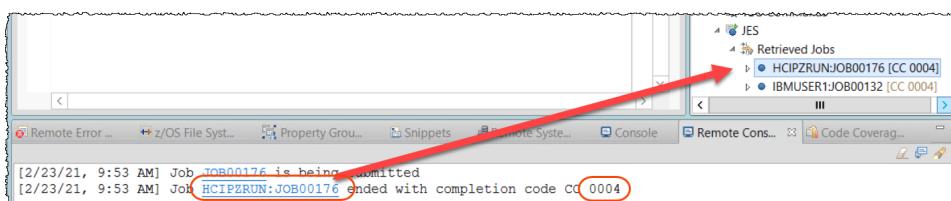


### 5.1.5 ► Click Notify on the Job Submission Confirmation dialog.



### 5.1.6 You MUST have 0004 as return code.

#### ► Click on HCIPZRUN:JOB00xxx



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5.1.7 ►| Expand **HCIPZRUN:JOB00xxx** and verify the results double clicking on **RUNNER:REPLAY:SYSOUT**

5.1.8 This JCL could be executed using DBB as part of a Jenkins Pipeline.

You may see an example of a groovy script used by DBB at the USS file below:

/var/jenkins/workspace/HealthCareAndUCD/HealthCareApp/build/ RunZUnitJCL.groovy

Under **zos.dev** and **z/OS UNIX Files** look for filter **groovy\_samples**

The screenshot shows the Rational Application Developer (RAD) interface. On the left, a code editor displays a Groovy script named `RunZUnitJCL.groovy`. The script uses the JCLEexec API to run a ZUnit test. It includes imports for `com.ibm.dbb.build.CopyToHFS`, `com.ibm.dbb.build.DBBConstants`, and `com.ibm.dbb.build.JCLEexec`. The script defines a `main` method that changes the current directory to `/tmp/zosdev`, copies the `ZUNIT.JCL` file to `/tmp/ZUNIT.JCL`, runs the JCL using `JCLEexec`, and then removes the temporary file. A note at the top indicates that the sample assumes the user has set up the ZUnit and a JCL to execute the ZUnit.

On the right, a file browser titled "Remote Systems" shows a tree view of the `zos.dev` system. The `z/OS UNIX Files` node is expanded, revealing sub-directories like `My Home`, `Root`, and `/var/zosconnect/servers/server1`. Within `/var/zosconnect/servers/server1`, the `groovy_samples` directory is also expanded, showing files such as `ADMIN.pw`, `BMSProcessing.groovy`, `build.groovy`, `build.properties`, `build.sh`, `CobolCompile.groovy`, `CobolCompile.groovy1.0.1`, `CobolCompile.OLD.groovy`, `Compile.groovy`, `datasets.properties`, `deploy.groovy`, `deploy.sh`, `deploy.OLD.groovy`, `file.properties`, `files.txt`, `imports.groovy`, `JCLGroovy`, `LinkEdit.groovy`, `MESGENTILITY.groovy`, `RunZUnitJCL.groovy`, and `zOSConnect.groovy`.

Notice that this capability allows you to invoke zUnit using pipelines like Jenkins.

**Congratulations!** You have completed the Exercise