Lab Exercise: **Using IBM zUnit to Unit Test a COBOL/CICS/DB2 program using Local assets.**

Session ID: z203783

Speaker Name: Reginaldo Barosa

Room: ?????…

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

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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 is 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

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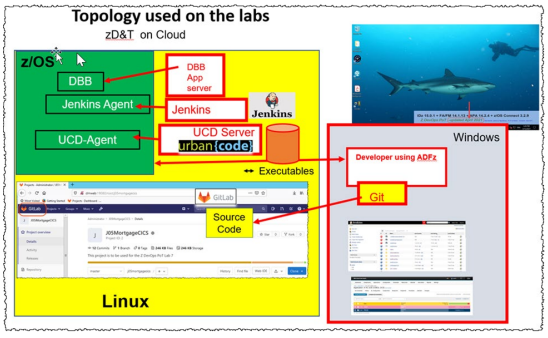
Serial No	URL	User ID for Web browser	IP Address for Remote	Password	User ID for Remote Desktop	Domain	machine #
1	https://169-63-141-246-T-5282.ibmztrialmachines.com/	Administrator	169.63.141.246	KS8E6Pep	Wwin-5282\Administrator	Wwin-528	5282
2	https://169-60-90-69-T-5283.ibmztrialmachines.com/	Administrator	169.60.90.69	FRthmGL5	Wwin-5283\Administrator	Wwin-528	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.



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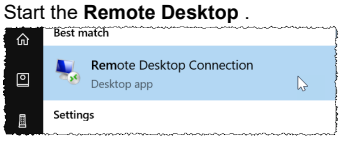
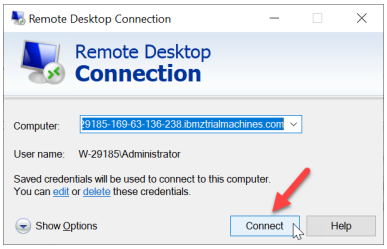
Using Windows Remote Desktop (preferable way)

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** .

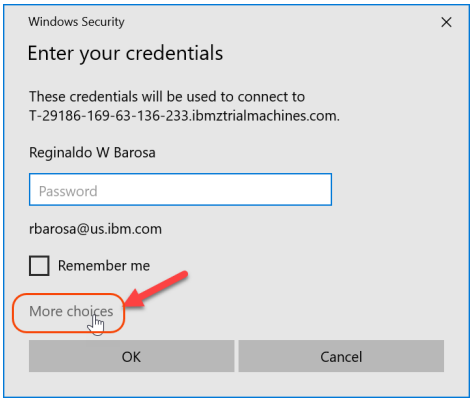


2. Click **Connect**



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

4. Click **More Choices**



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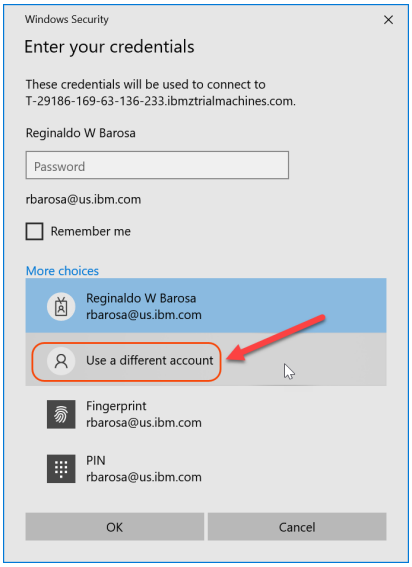
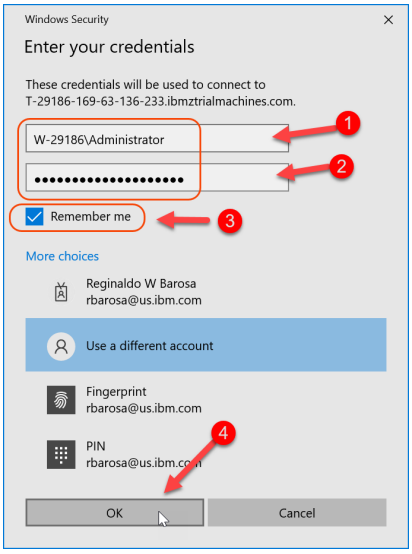
5. Click **Use a different account**



6. Copy and paste the provided "***User ID for Remote Desktop***" and ***Password***, select **Remember me** and click **OK**.



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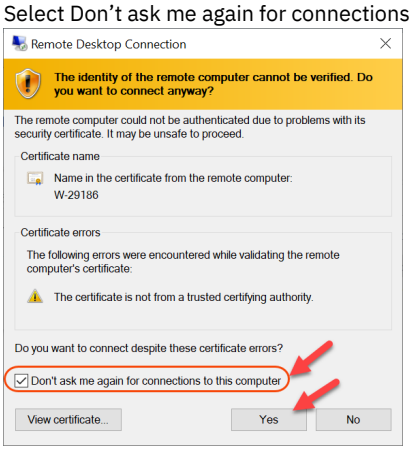
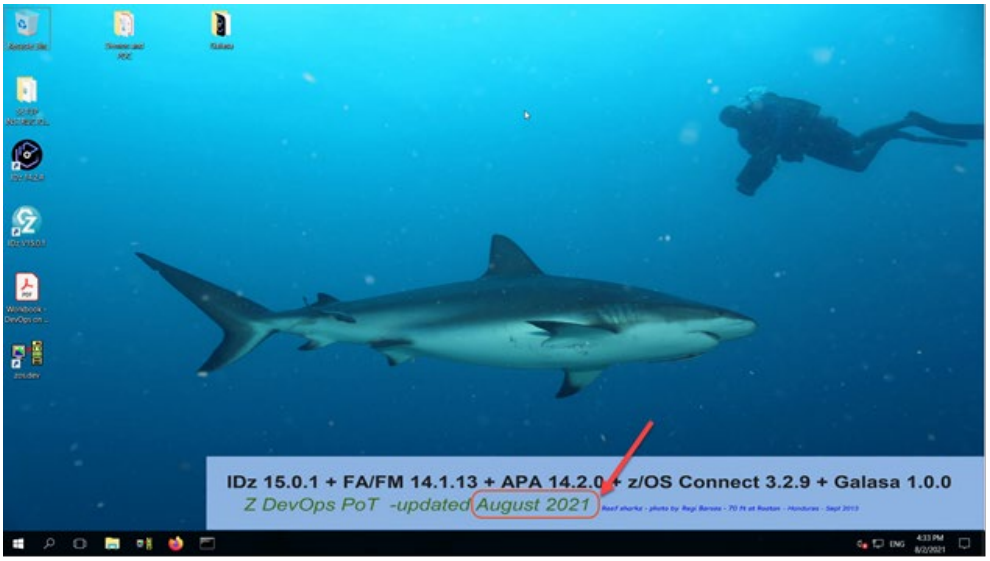
7. You should get a dialog as below..
Select Don't ask me again for connections to this computer and click Yes



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.

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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

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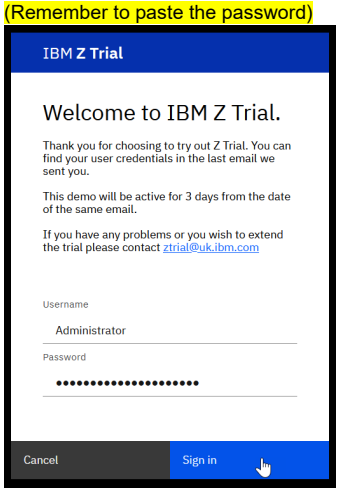
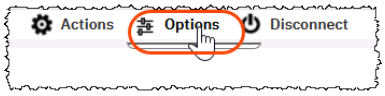
Serial No	URL	User ID for Web browser	IP Address for Remote	Password	User ID for Remote Desktop	Domain	machine #
1	https://169-63-141-246-T-5282.ibmztrialmachines.com/	Administrator	169.63.141.246	KS8E6Pep	Wwin-5282\Administrator	Wwin-528	5282
2	https://169-60-90-69-T-5283.ibmztrialmachines.com/	Administrator	169.60.90.69	ERthmGL5	Wwin-5283\Administrator	Wwin-528	5283

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**

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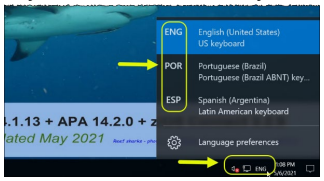
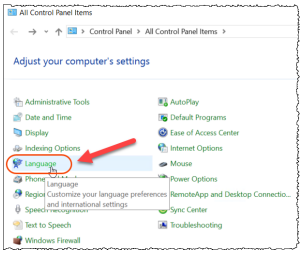
Adjusting the keyboard for other languages than English

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

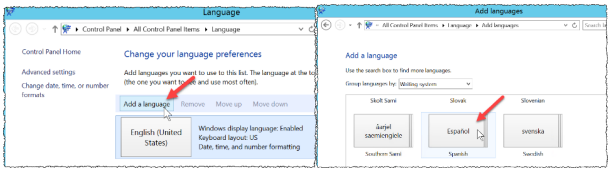


If you use another keyboard other than ENG, POR or ESP, you need to make updates..

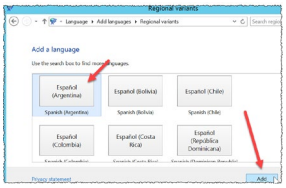
1. Go to windows **Control Panel** and select **Language**



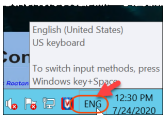
2. Click **Add a Language**, and follow the dialogs. See one example on the screen captures below



Click **Add**



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



and select the language

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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.

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

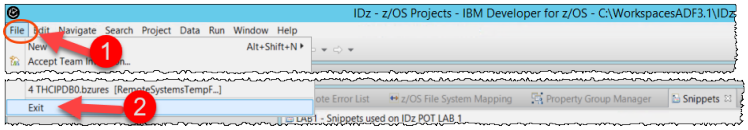
You will start a 3270 emulation and execute a transaction named **HCAZ** to become familiar with the Application that you will be interacting with.

___ 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**.

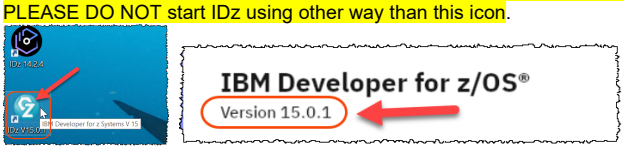


1.1.1 Start *IBM Developer for z Systems version 15*

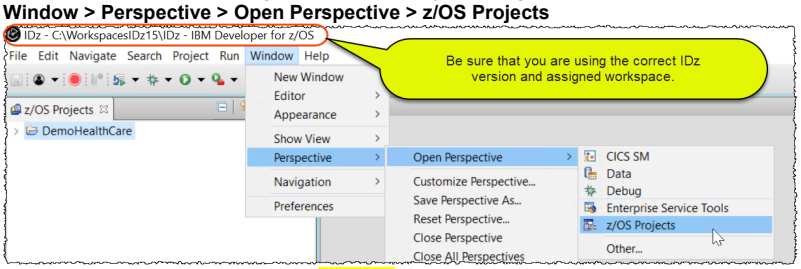
⏭ Using the desktop double click on **IDz V15** icon.

⏭ 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

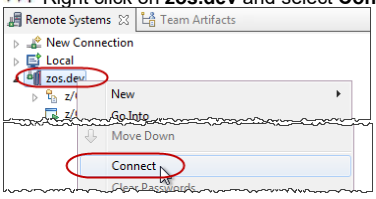


1.1.3 On this lab you will use userid **ibmuser** .

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**



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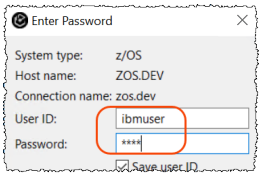
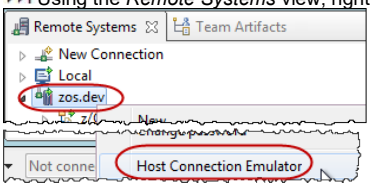
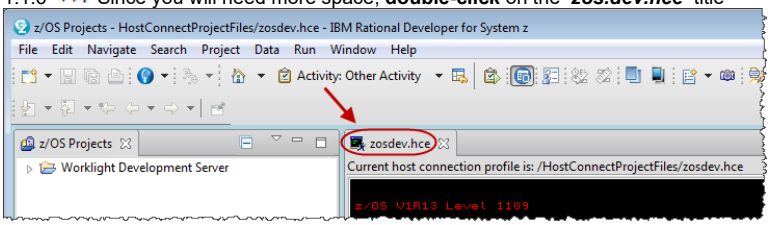
1.1.4 ⏭ Type **ibmuser** as userid and **sys1** as password.
The userid and password can be any case; don't worry about having it in UPPER case.
Click **OK** to connect to z/OS.



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.**

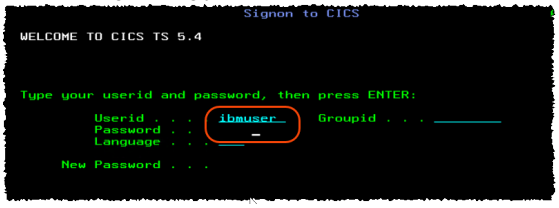


1.1.6 ⏭ Since you will need more space, **double-click** on the ***zos.dev.hce*** title

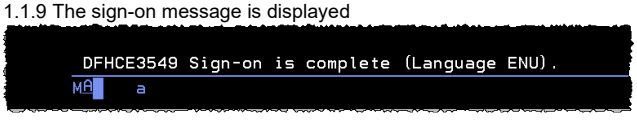


1.1.7 ⏭ Type **l cicsts54**. (where "l" is the lower case of letter "L") and press **Enter key**.

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



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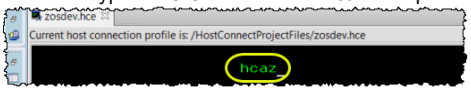
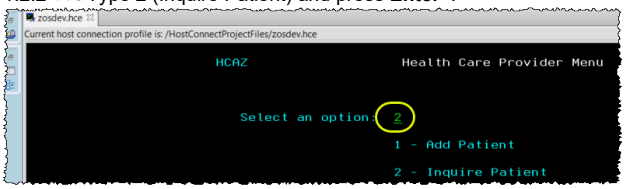
___ 1.2 Run CICS transaction HCAZ

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.

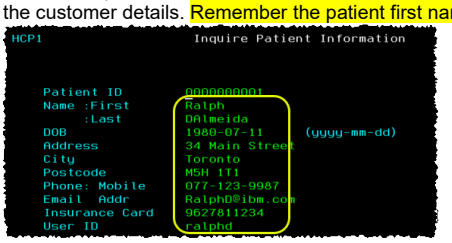
1.2.1 ⏭ Type the CICS transaction **hcaz** and press the **Enter** key.



1.2.2 ⏭ Type **2** (Inquire Patient) and press **Enter** .

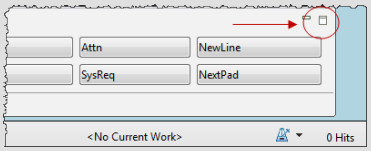


1.2.3 ⏭ Type **1** for Patient ID and press Enter. The program will read the patient from a DB2 table and display the customer details. Remember the patient first name: **Ralph**

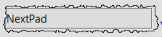


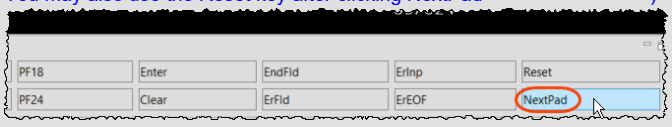
IF you need to use functions like Clear or Reset

*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.



You may also use the Reset key after clicking NextPad (





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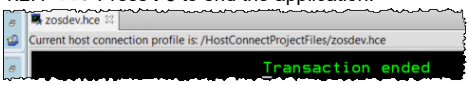
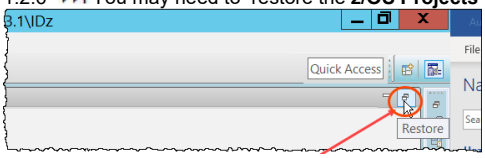
1.2.4 ⏭ Press **F3** to end the application.



1.2.5 ⏭ **Close** the terminal emulation clicking on → zosdev.hce. 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.

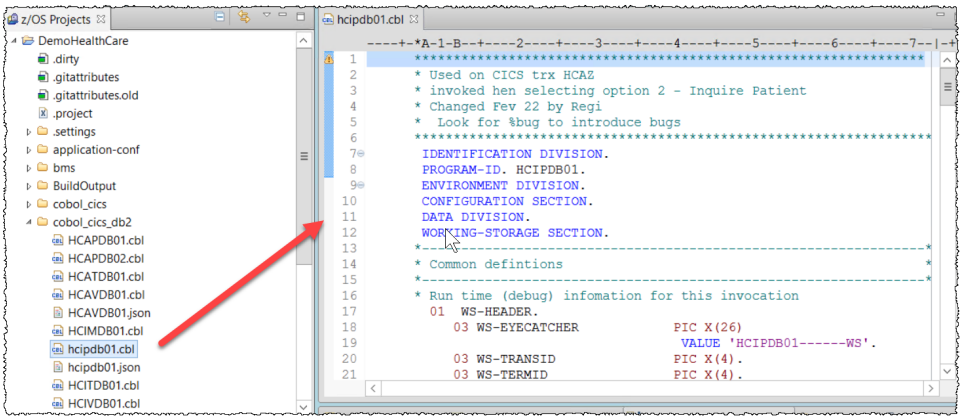
Using IDz you will record the interaction with the COBOL/DB2 program that reads a patient from a DB2 table.

___ 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 **hcipdb01cbl** 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 😊 .



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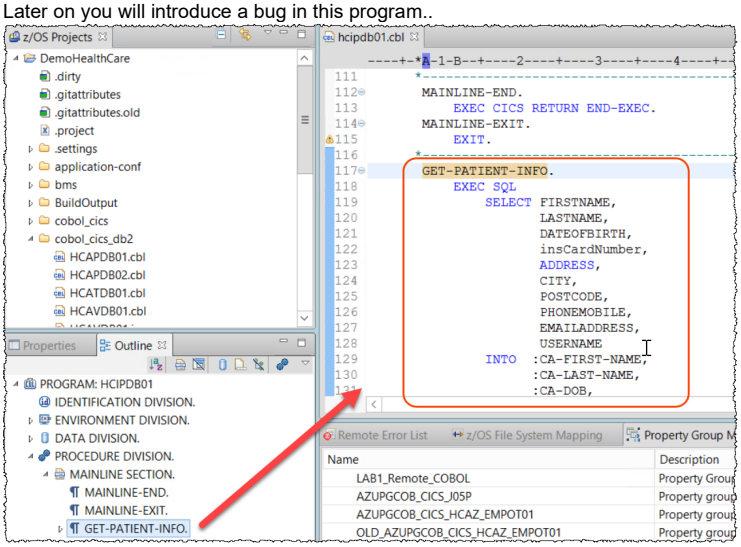
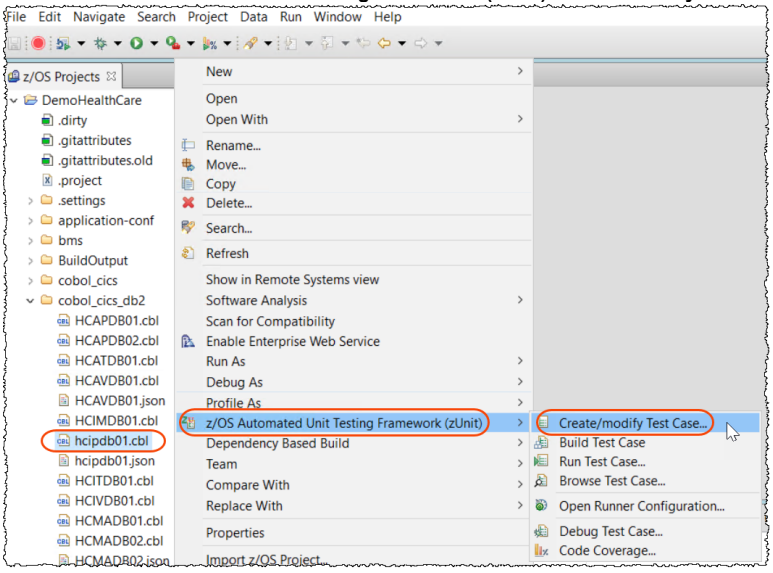
2.1.2 ⏭ Using the Outline view on left expand **PROCEDURE DIVISION** and click on **GET-PATIENT-INFO.**
This is where the patient data is read from the DB2 table.
Later on you will introduce a bug in this program..



___ 2.2 Recording the COBOL program that sends the message

2.2.1 ⏭ To start the recording, right click on **hcipdb01.cbl**
and select **z/OS Automated Unit Testing Framework (zUnit)->Create/modify Test Case..**



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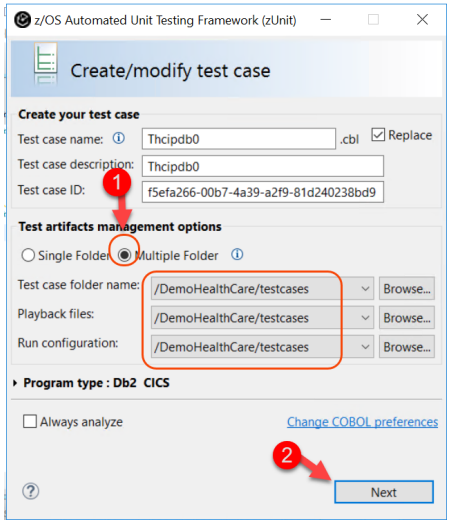
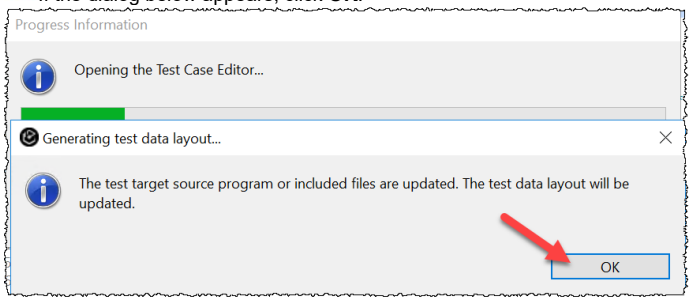
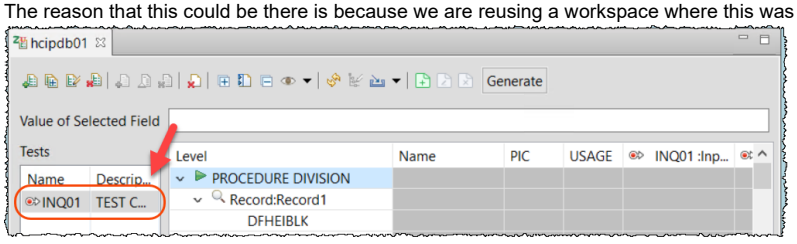
2.2.2 This opens a dialog where you can name your test case.
⏭ Click on **Multiple Folder,** verify that the generated assets will be under **/DemoHeathCare/testcases** and click **Next**.



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.



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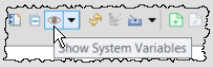
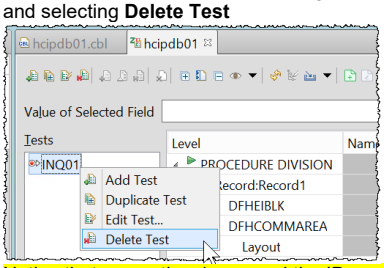
Understanding the test case editor

- 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



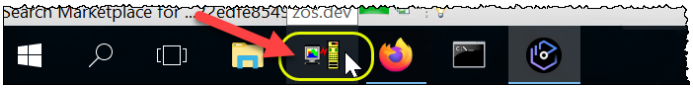
The variables that are returned by the program are the output from the program logic that a developer should be checking

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**



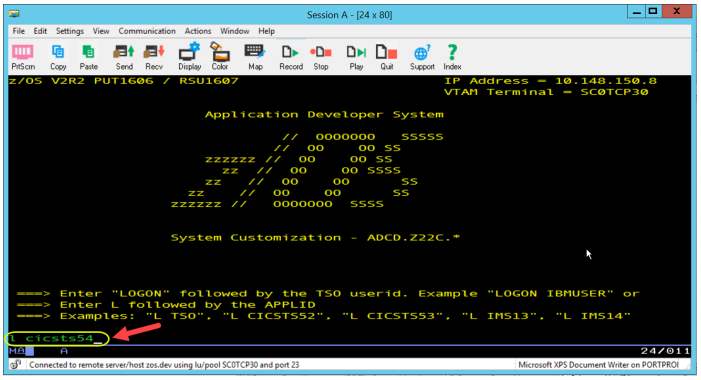
Notice that on section 1 we used the IDz emulator and now you will use the IBM PCOM emulator.
Any 3270 emulator can be used.. We just show here a different way to emulate a 3270 terminal.

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 **l cicsts54**. (where l is L lower case) and press **Enter key**



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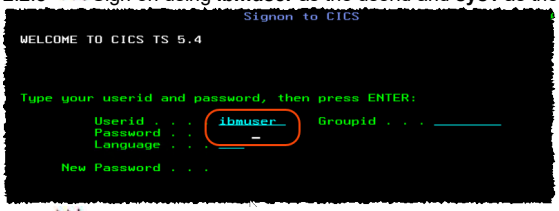
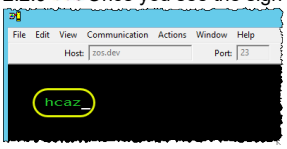
2.2.8 ⏭ Sign on using **ibmuser** as the userid and **sys1** as the password.

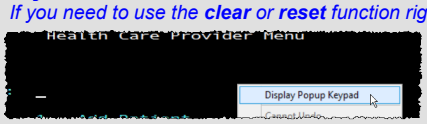


2.2.9 ⏭ Once you see the sign-on is complete message, enter **hcaz** and press the **Enter** key.

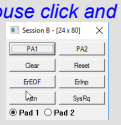


IF you need to use functions like Clear or Reset

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



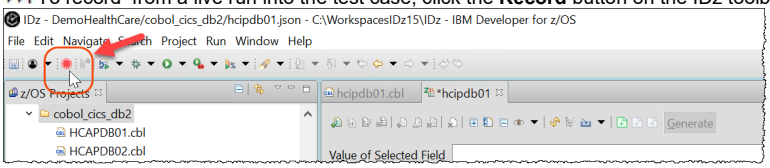
and



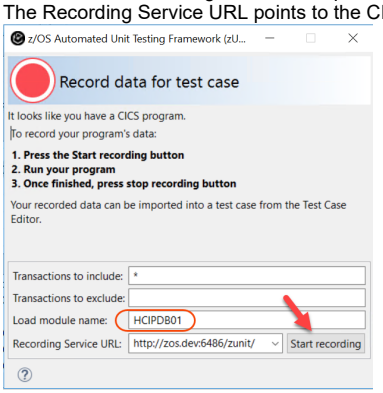
You are now ready to start recording and import data into the test case editor.

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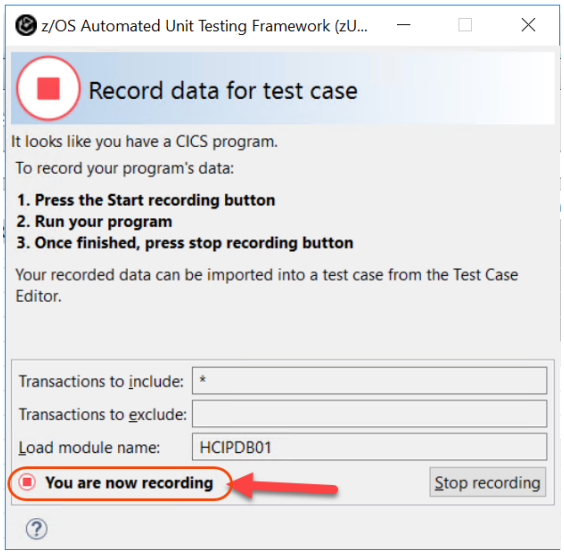
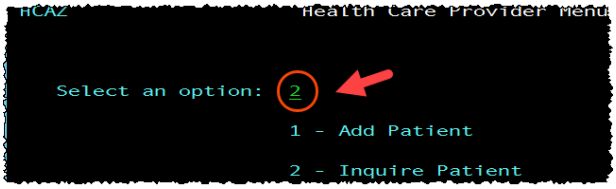
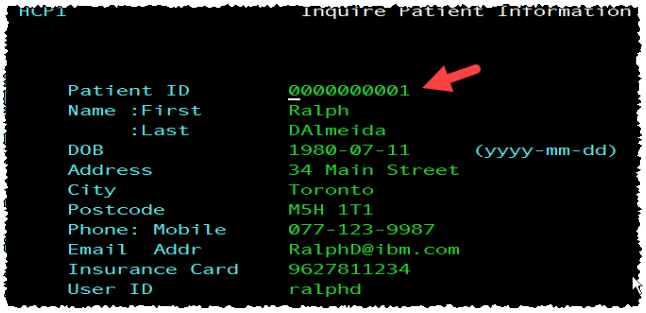
2.2.12 When recording is turned on, the message "**You are now recording**" appears.
Verify that the Load module **HCIPDB01** is the one being recorded.



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**



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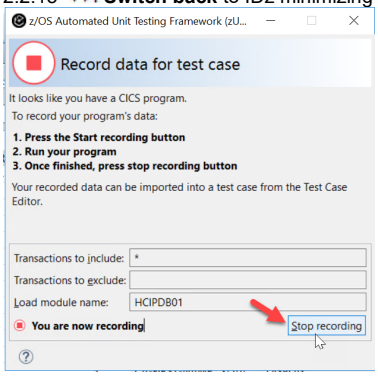
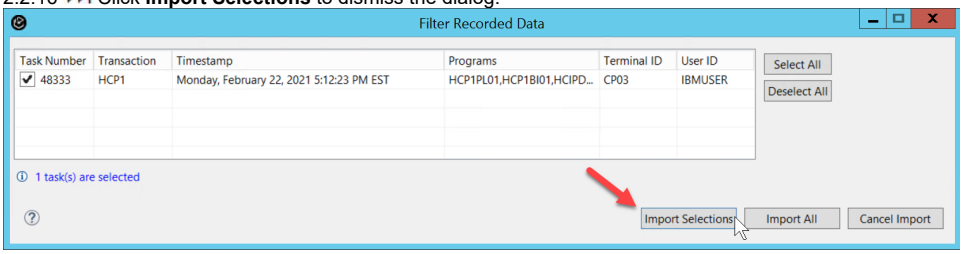
2.2.15 ⏭ **Switch back** to IDz minimizing the 3270 screen and click **Stop recording**.



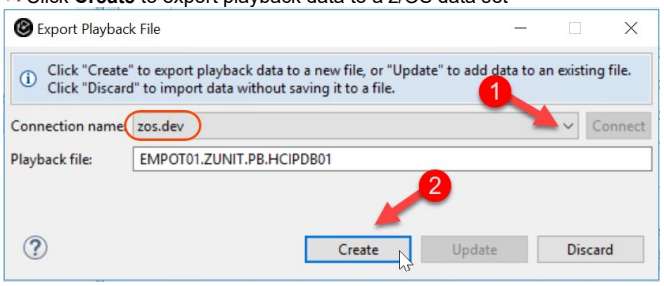
The dialog *Filter Recorded Data* is displayed.

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

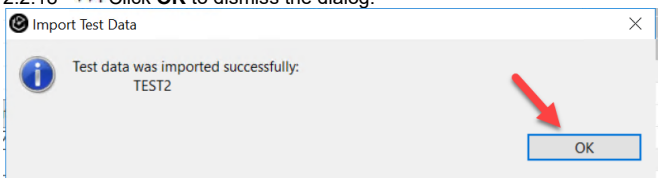


2.2.17 ⏭ Using drop down select the **zos.dev** as *Connection name*

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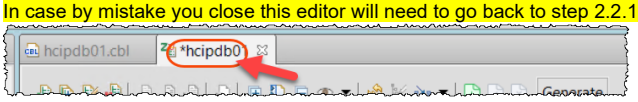
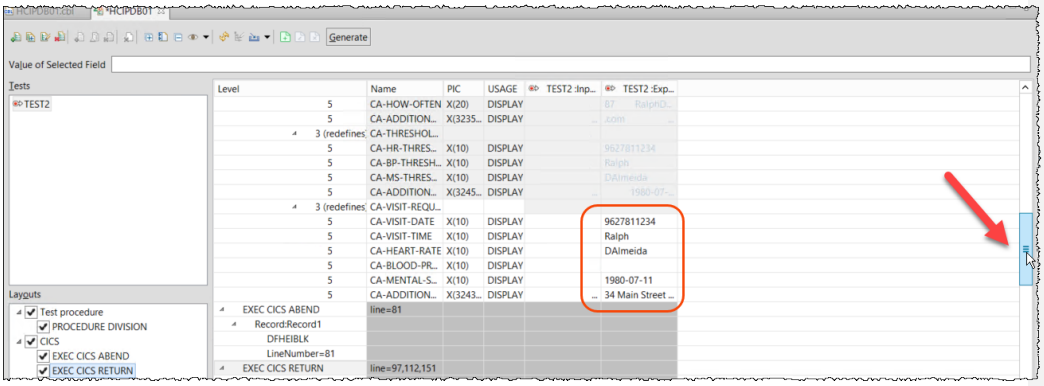
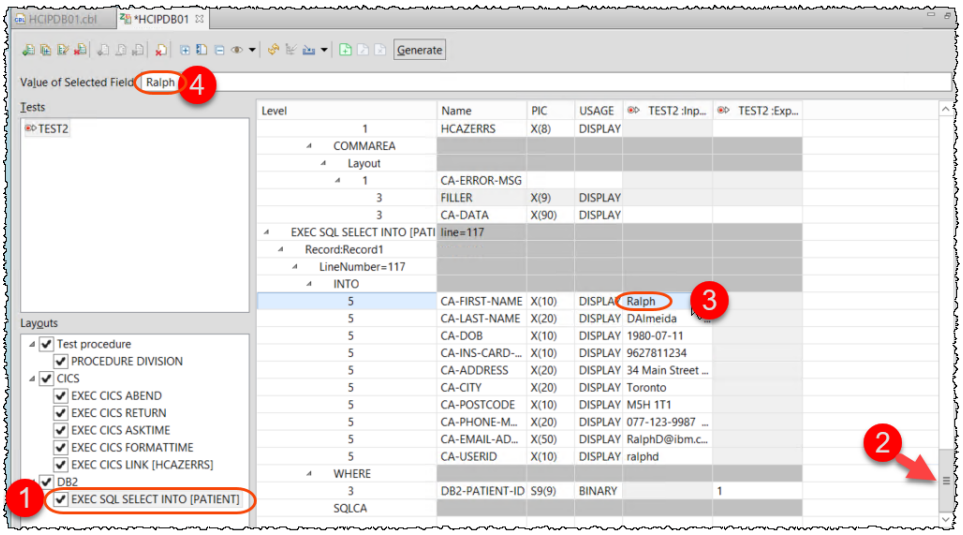
2.2.19 ⏭ Double click on the **hcipdb01** title to enlarge the view.
In case by mistake you close this editor will need to go back to step 2.2.1



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..



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 "



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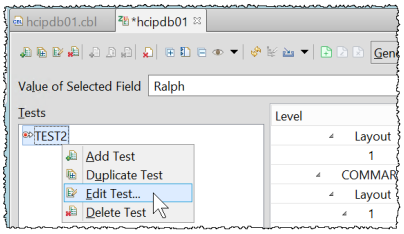
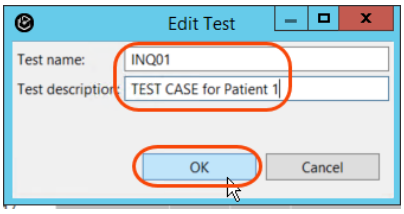
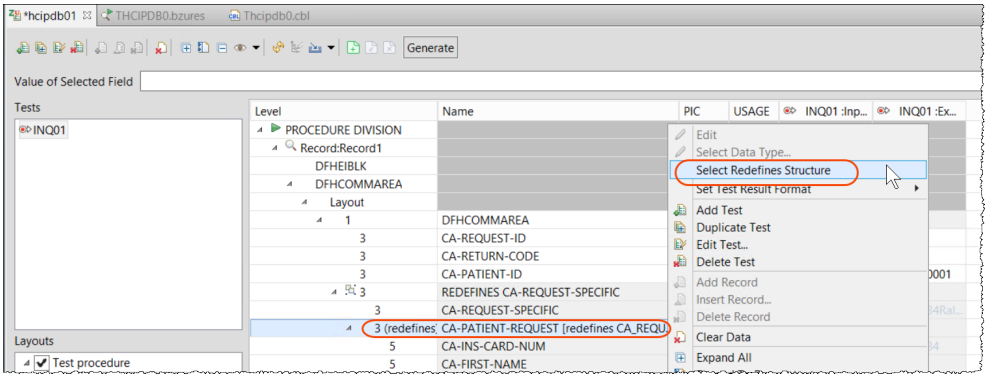
2.2.23 ⏭ Right click on **TEST2** and select **Edit Test**



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**



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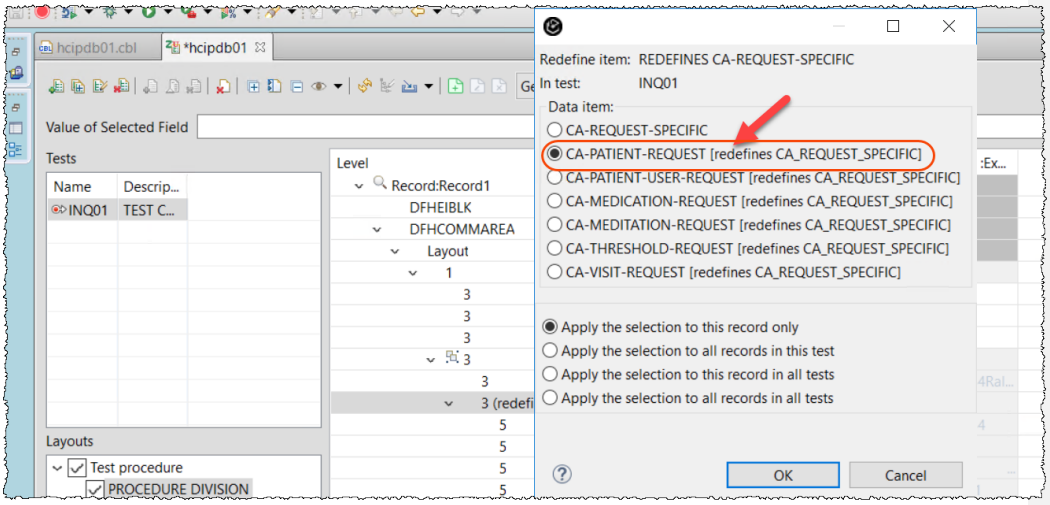
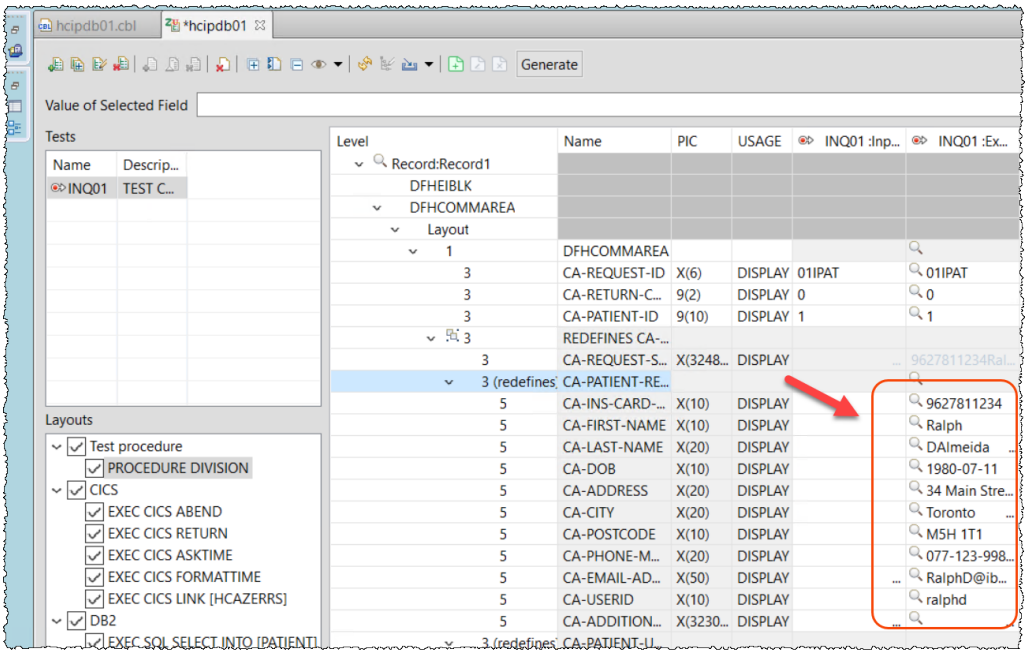
2.2.26 ⏭ Select **CA-PATIENT-REQUEST** and click **OK**



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



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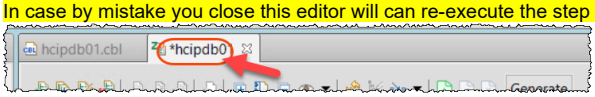
2.2.28 ⏭ Press **Ctrl+S** to save any changes.

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

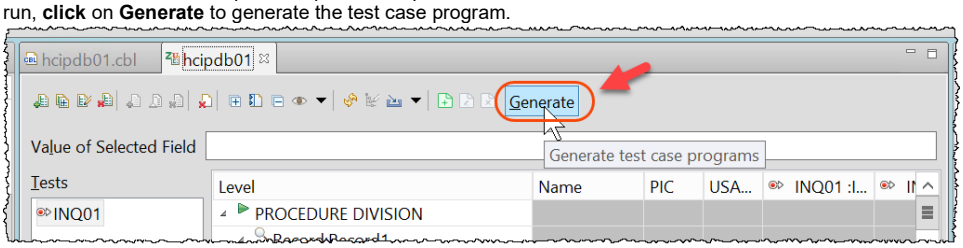


Section 3. Generate, build, and run the unit test.

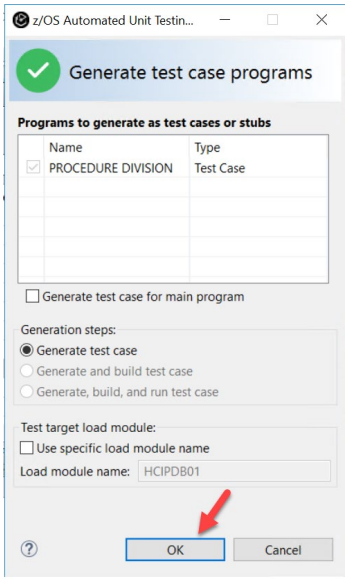
You will generate, build, and run the unit test for the test case created.

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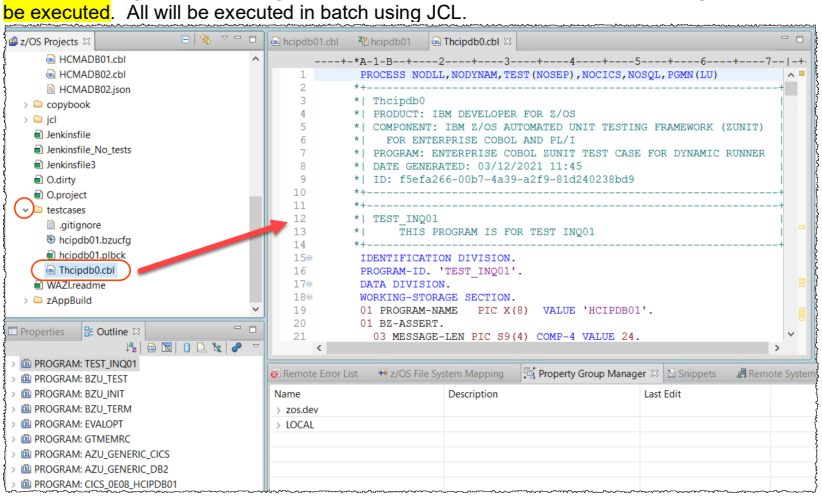
3.1.3 The COBOL program that will run the test case is generated under the folder *testcases*.

⏭ Expand **testcases** and double click on **Thcipdb0.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.



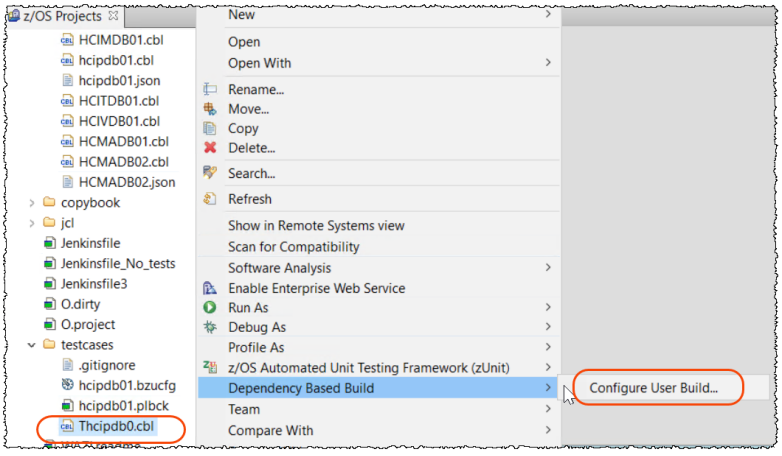
___ 3.2 Building the generated test case programs using IBM DBB .

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 **Thcipdb0.cbl** (under *testcases*) and select **Dependency Based Build > Configure User Build.**



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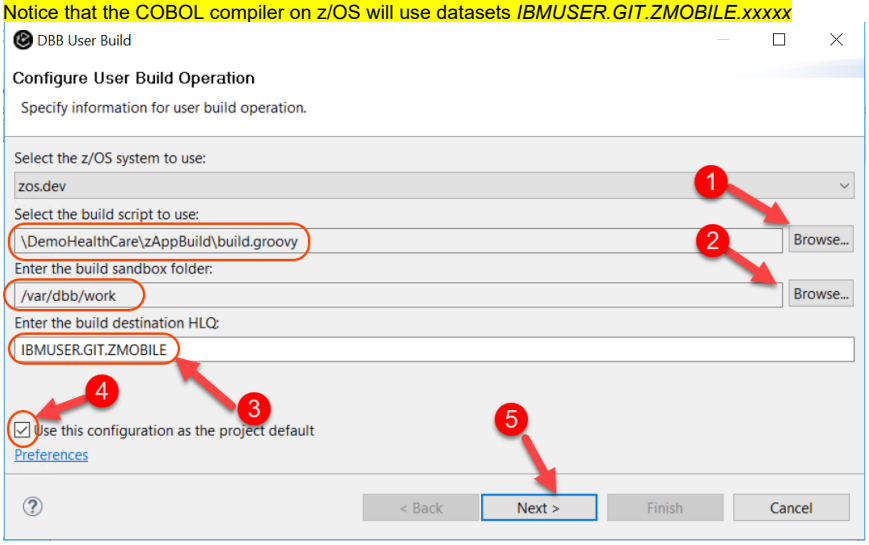
3.2.3 ⏭ Those values could be already there,otherwise use the **Browse…** buttons to specify the values as below. As build destination HLQ use **IBMUSER.GIT.ZMOBILE**, select **Use this configuration as the project default** and click **Next**

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

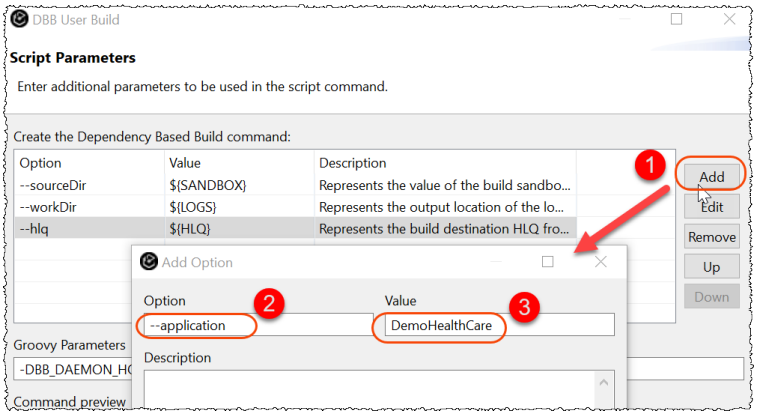


3.2.4 ⏭ Click **Next Twice**

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**



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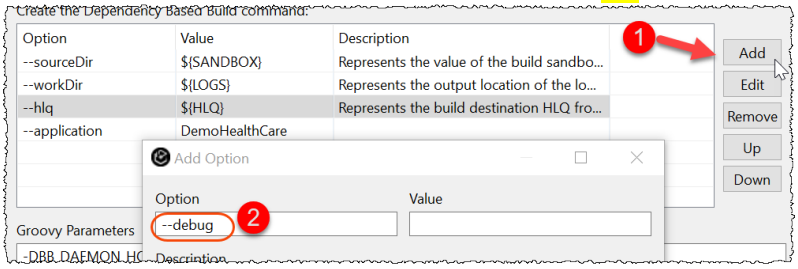
3.2.6 In case you need to add --debug.

⏭ Click **Add** to insert **`--debug`** and click **OK**

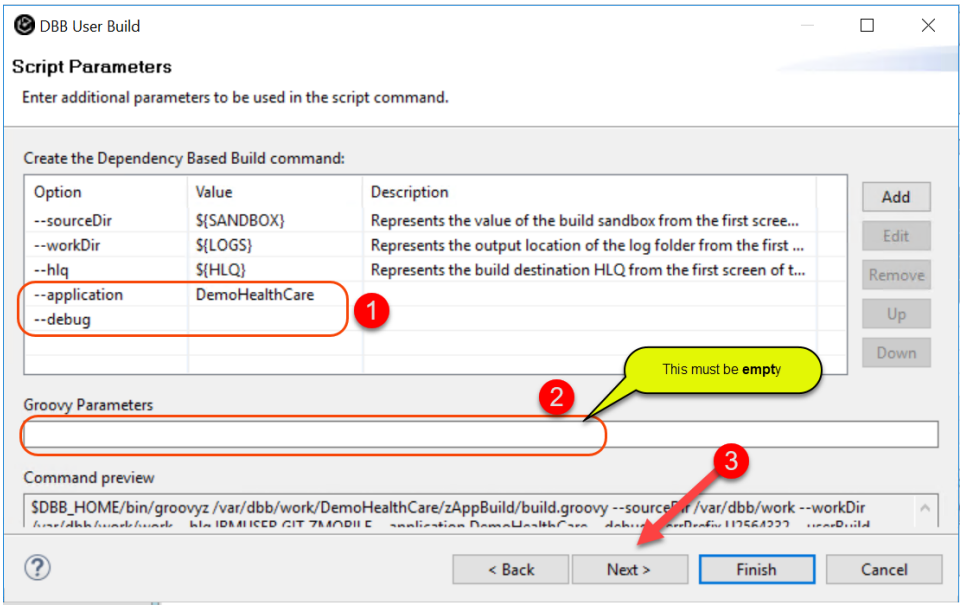
Verify that the options below were inserted. Notice that there is an "**`--`**" before each option.



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**



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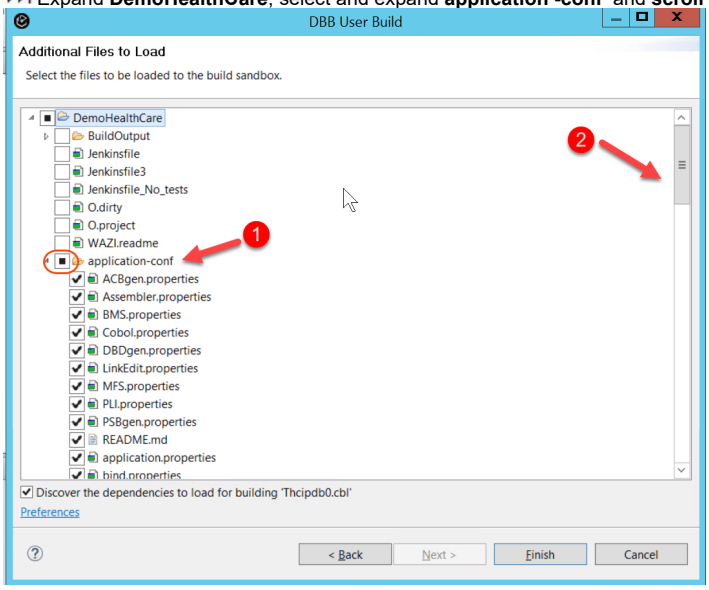
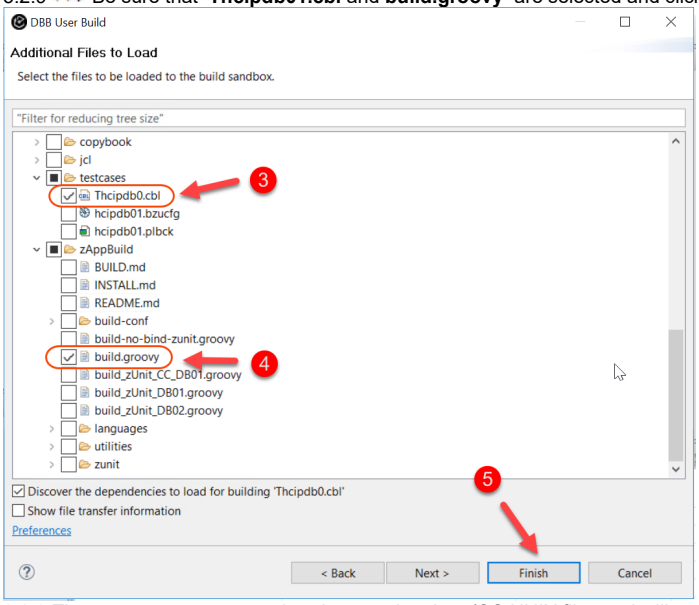
3.2.8 You need to move the assets to z/OS UNIX Files

⏭ 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**

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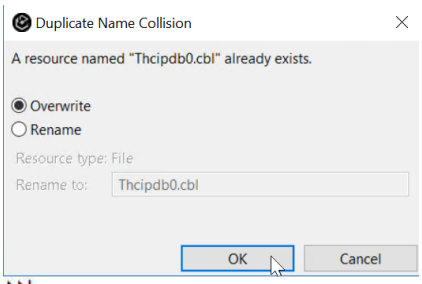
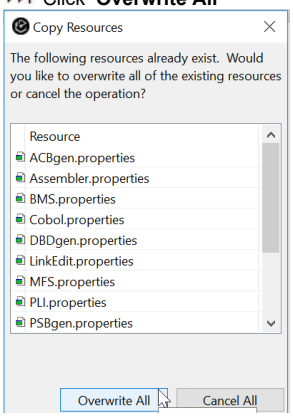
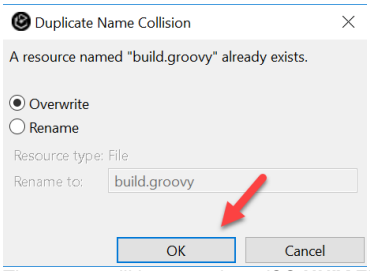


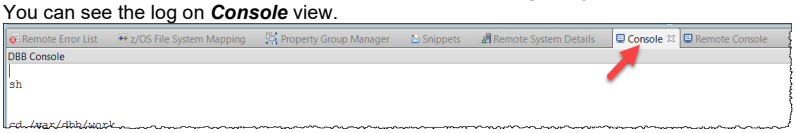
⏭ Click **Overwrite All**



⏭ 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.



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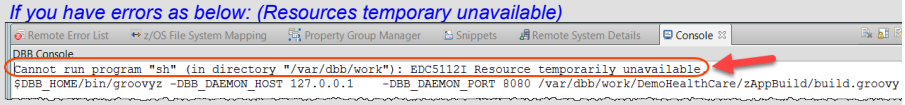
If the DBB user build fails

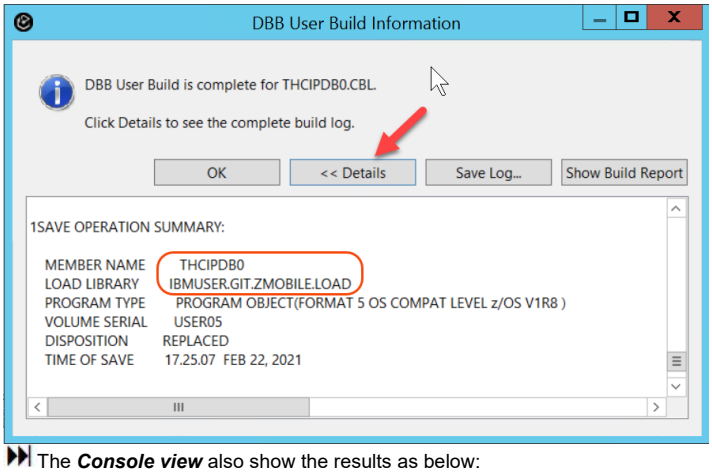
If you have errors as below: (Resources temporary unavailable)



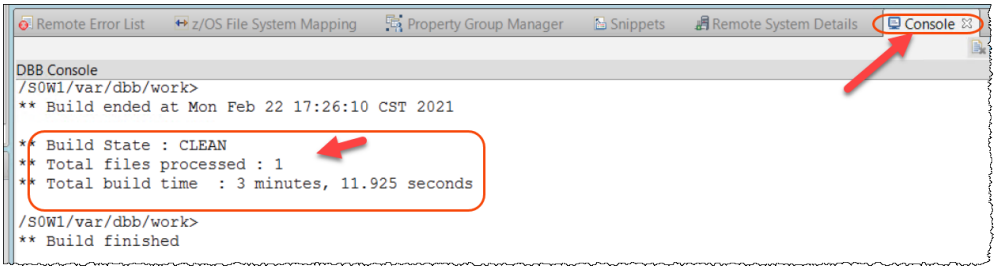
It's because your z/OS is stressed,, One easy way to free the z/OS resources is logging on TSO as **IBMUSER** password **SYS1** , go to M.5 and issue **/C CICSTS53** And Try again

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.

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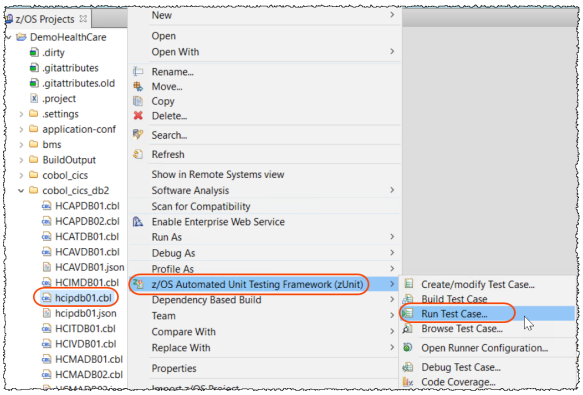
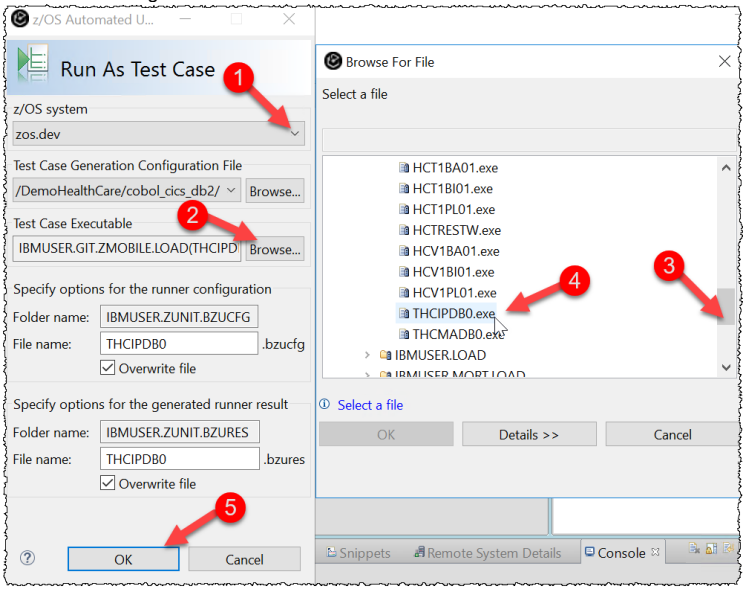
3.3.1 ⏭ Using *z/OS Projects* view, **scroll up**, right click on **hcipdb01.cbl** and select **z/OS Automated Unit Testing Framework (zUnit)->Run Test Case…**



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.



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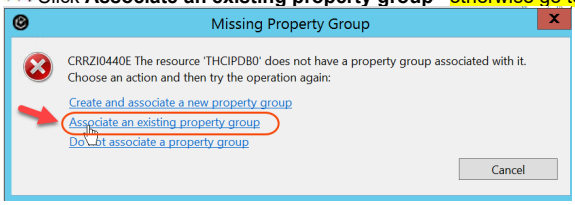
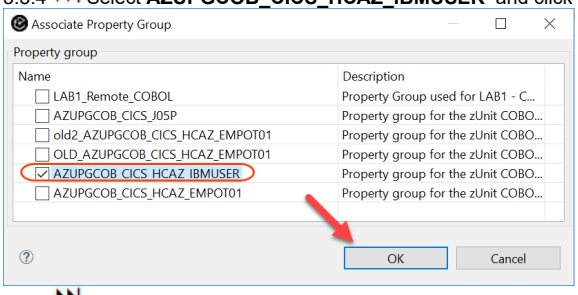
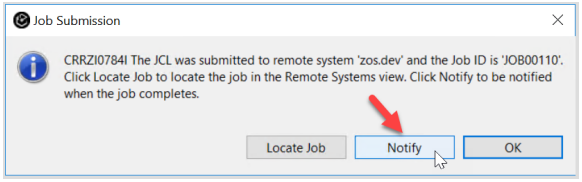
3.3.3 If the *Missing Property Group* dialog will prompt.
⏭ Click **Associate an existing property group** otherwise go to 3.3.5



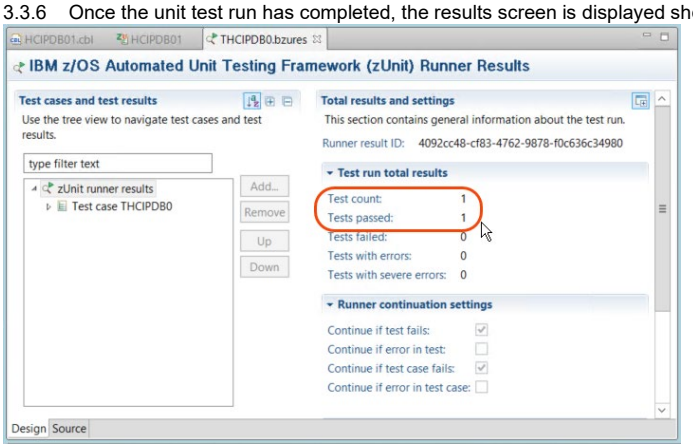
3.3.4 ⏭ Select **AZUPGCOB_CICS_HCAZ_IBMUSER** and click **OK**



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.



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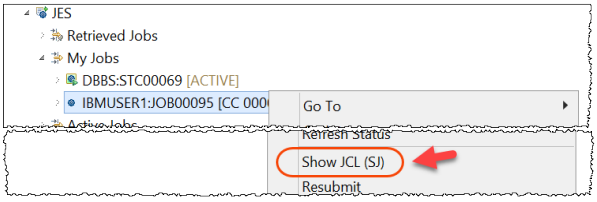
You have now created a test case with data imported from a recorded run and have been successful in testing a CICS program without the need of a CICS and DB2 environment.

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

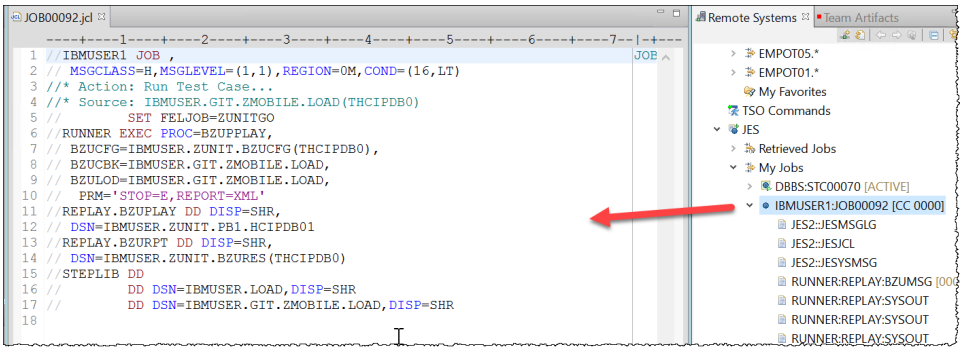
___ 3.4 Verify the JCL submitted

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.



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..

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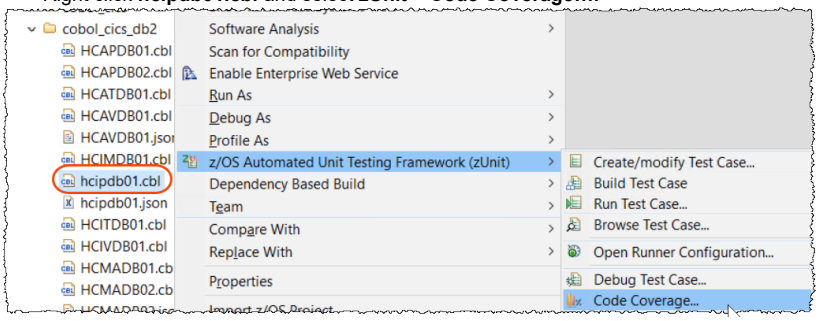
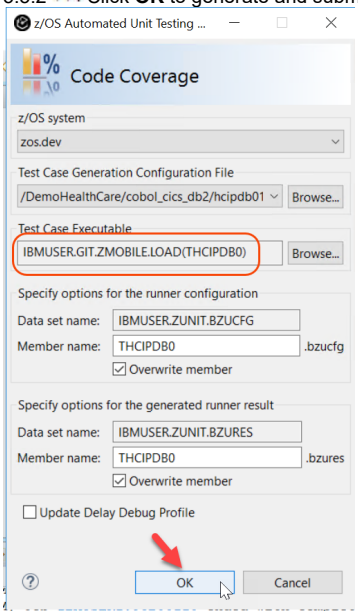
3.5.1 ZUnit also provides the capability to run the test case using Code coverage or Debug.

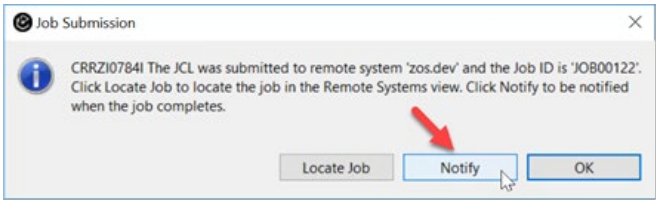
⏭ Right click **hcipdb01.cbl** and select **zUnit** > **Code Coverage….**



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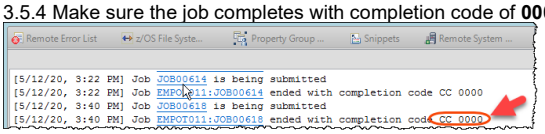
3.5.4 Make sure the job completes with completion code of **0000**.

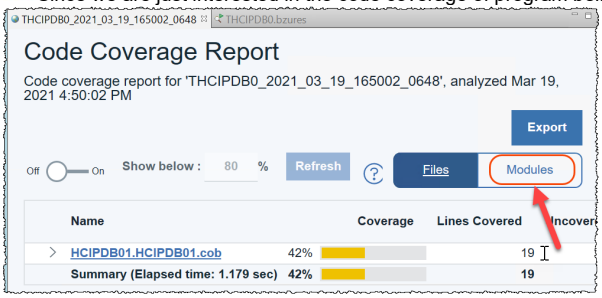


3.5.5 The code coverage report shows all COBOL programs executed for this specific test case.

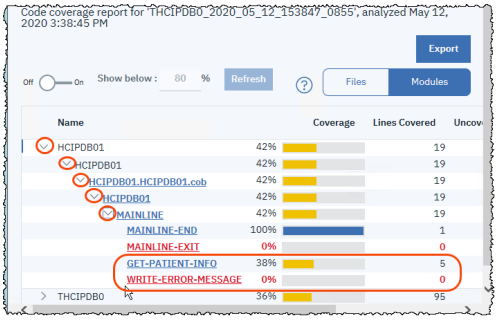
⏭ Click on title **THCIPDB0_yyyy_mm_dd_xxxxxxx** to see the Code coverage report

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..

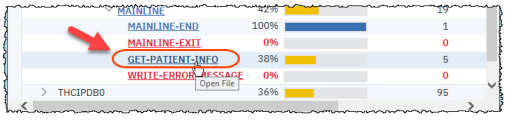
⏭ Since we are just interested in the code coverage of program being tested **click** on **Modules**:



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



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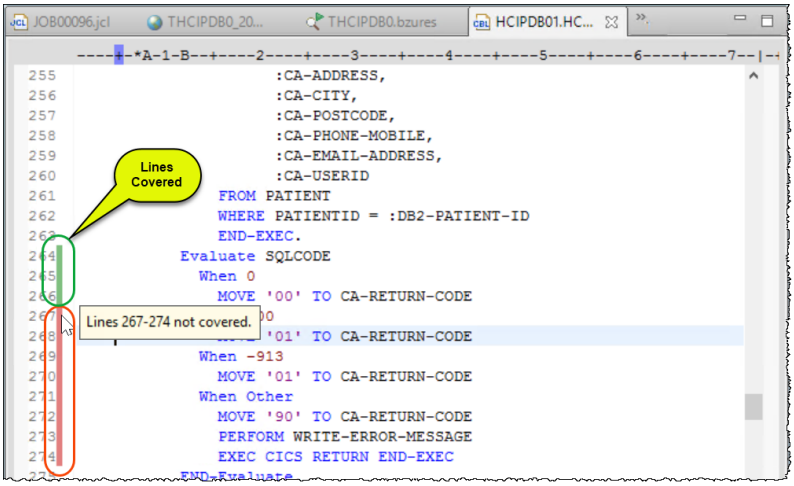
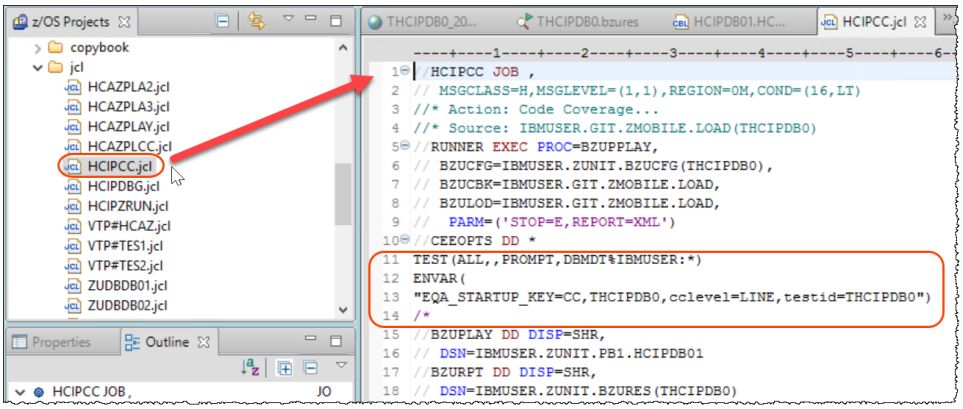
3.5.9 ⏭ **Scroll down** and **move the mouse to the colored areas on left**.
The lines covered by this test case are in **green** and the lines not covered are in **red.**
Also from the previous image we can see the WRITE-ERROR_MESSAGE paragraph is not covered at all.
(you may have different values than 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 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/HCIPCC.jcl`**

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



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

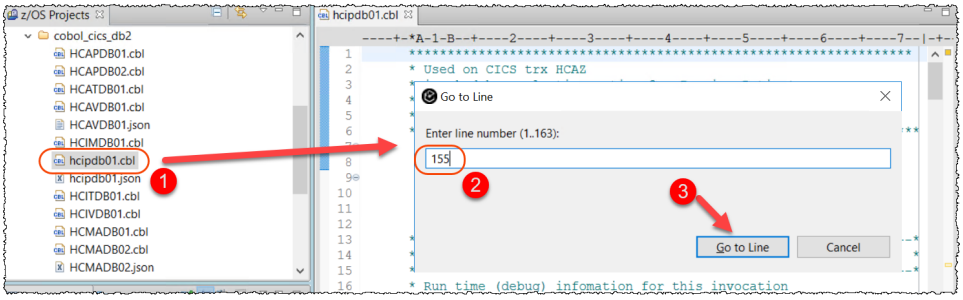
Using IDz you will modify the program and introduce a bug. Then you will rerun the unit test created in the previous section.

___ 4.1 Modifying the program and introduce a bug

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

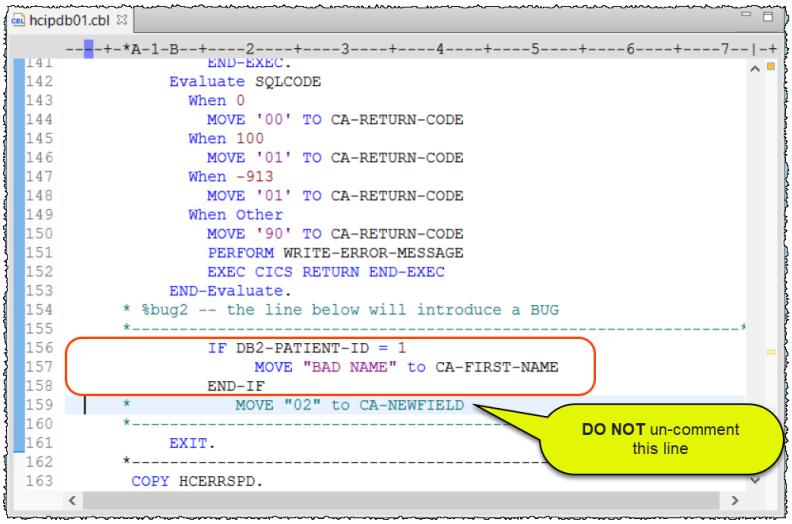
⏭ Open **hcipdb01.cbl** under **cobol_cics_db2** by double clicking on it in the z/OS Projects view.

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.



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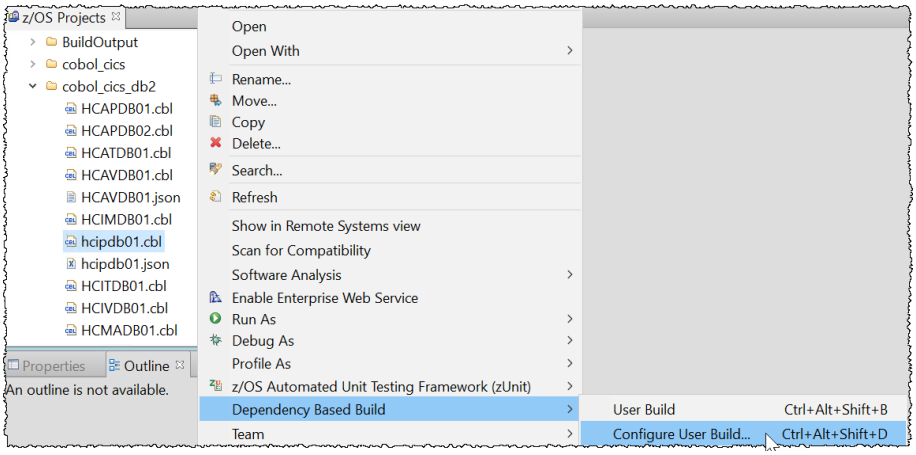
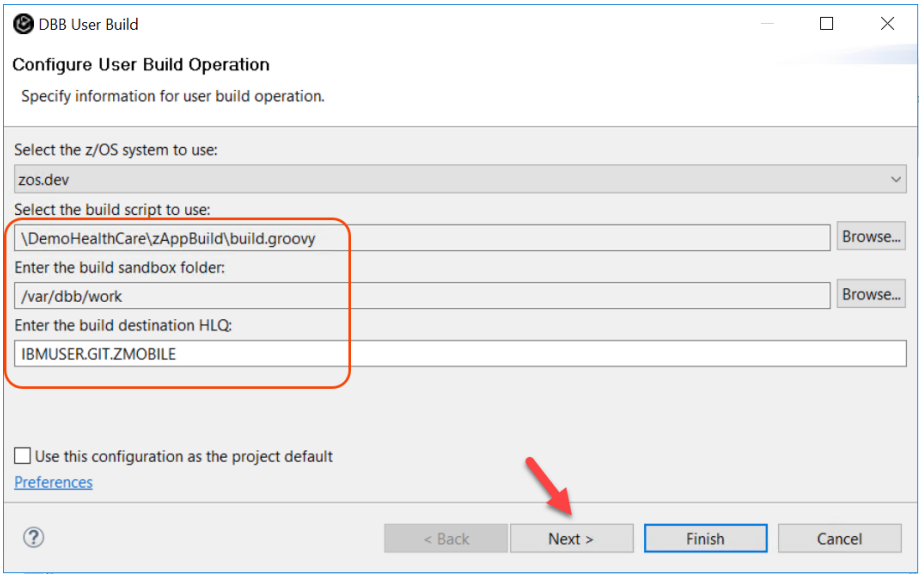
___ 4.2 Rebuilding the changed program without deploying to CICS using DBB

.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**



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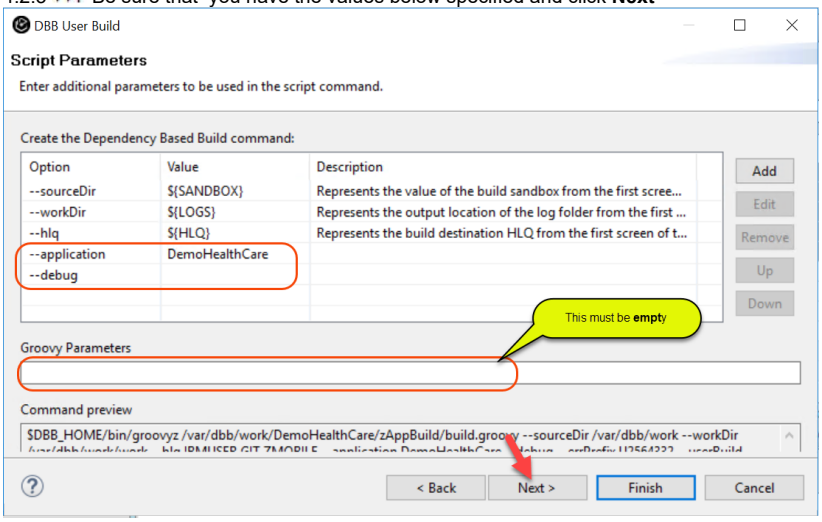
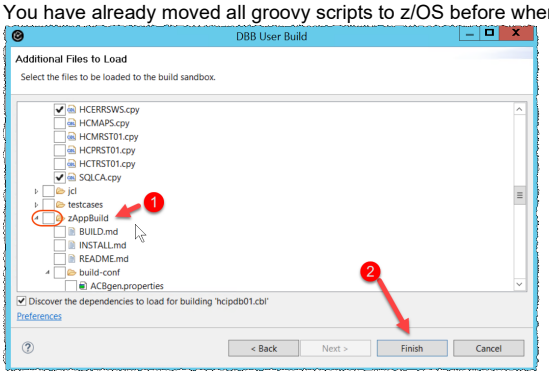
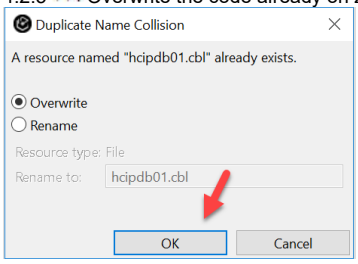
4.2.3 ⏭ Be sure that you have the values below specified and click **Next**



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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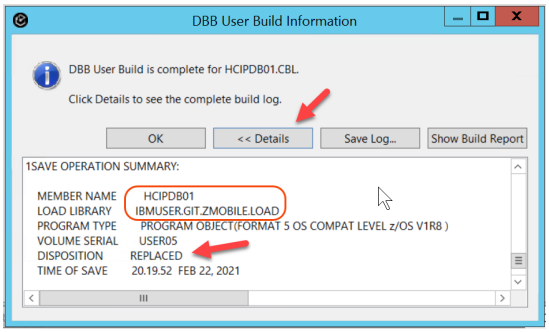
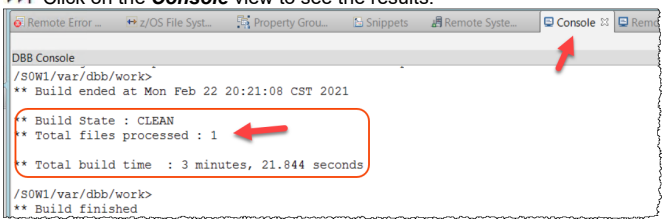
4.2.6 This operation may take up to 2 minutes When finished the dialog below will be displayed.
⏭ Click on **Details** and **OK** after you verified that the load module was replaced.



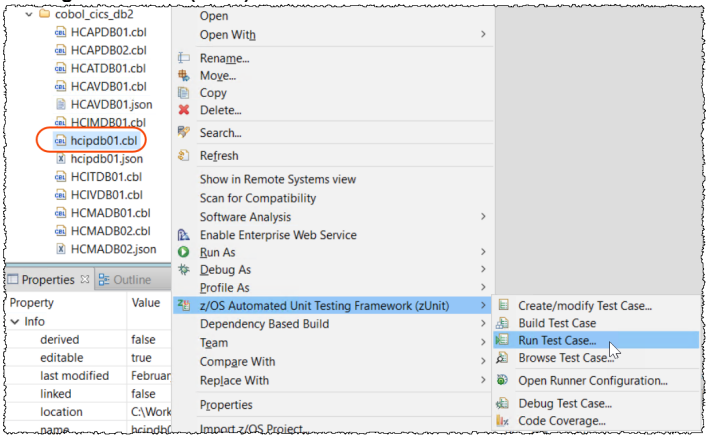
⏭ Click on the ***Console*** view to see the results:



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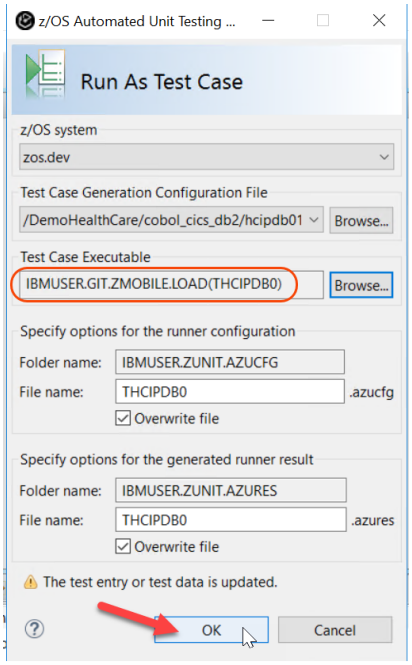
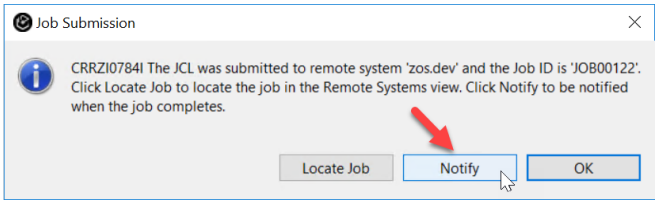
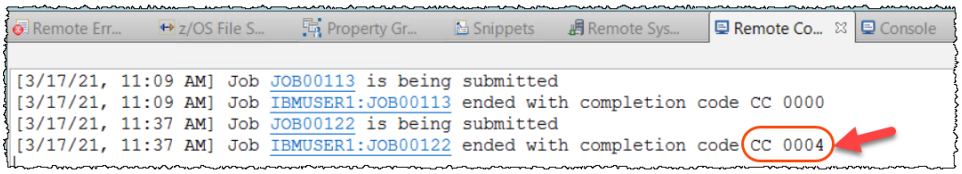
4.3.2 ⏭ Be sure that the test case load module **IBMUSER.GIT.ZMOBILE.LOAD(THCIPDB0)** is selected and click **OK** to submit the execution via JCL.



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.



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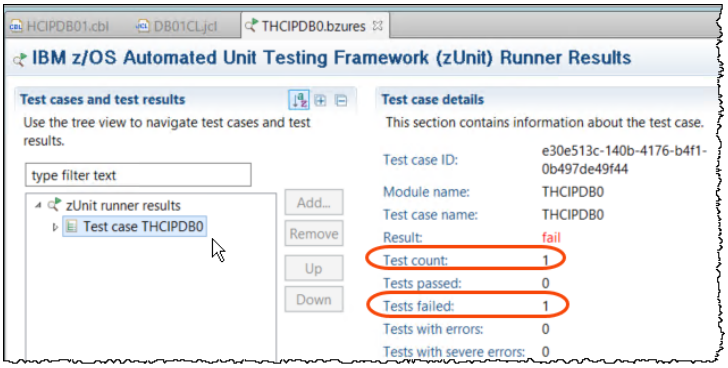
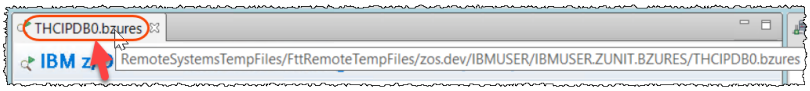
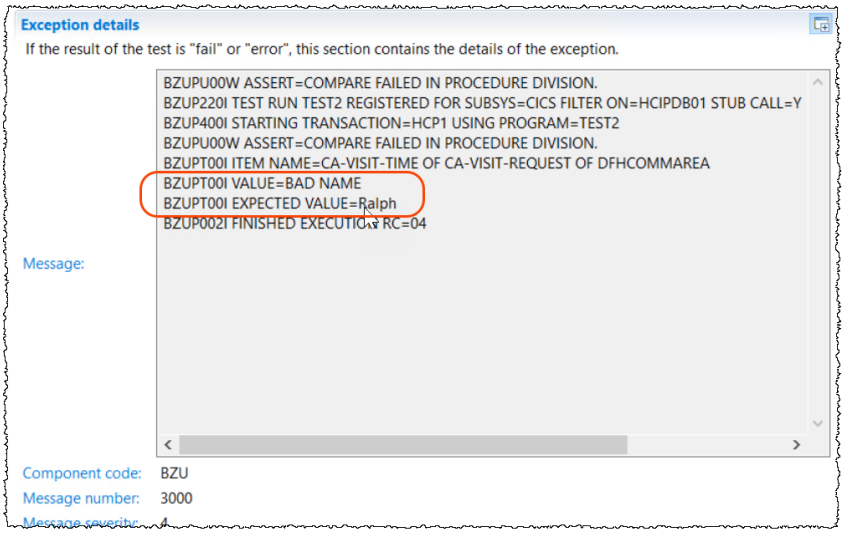
4.3.5 When the test run completes, the test results will be displayed, and it showed 1 test was ran and it failed.
⏭ Click **Test case THCIPDB0.** The failure is expected because the expected value of the error message is different from the actual value.



4.3.6 ⏭ Double click on title **THCIPDB0.bzures** to maximize the windows and better check the results



4.3.7 ⏭ Expand **Test case THCIPDB0, Test INQ01 (fail)** and click **Exception message number** to verify the value received versus the expected value and verify the failure



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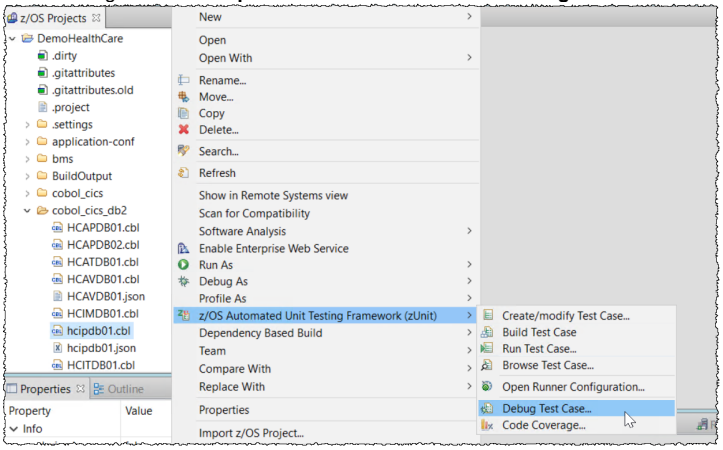
___ 4.4 Running zUnit test case with debugging

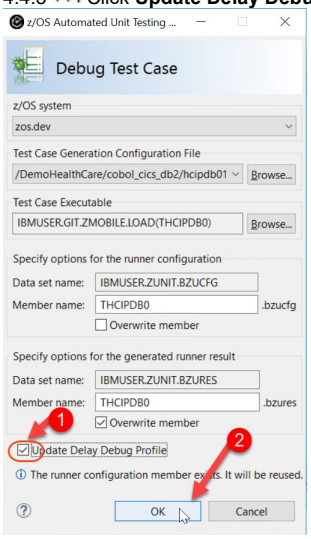
The Debug dialog will debug the test case. Note that will debug the zUnit programs, the generated COBOL and also the COBOL program that you are testing. Below one example. **Notice that you are debugging a batch job** without need to have CICS and DB2 active, which is very handy.

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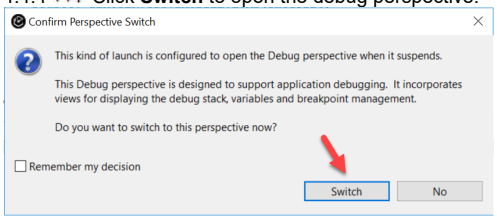
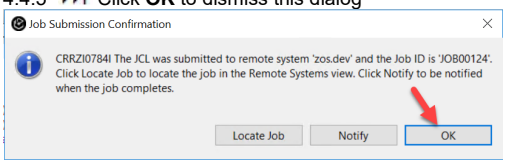
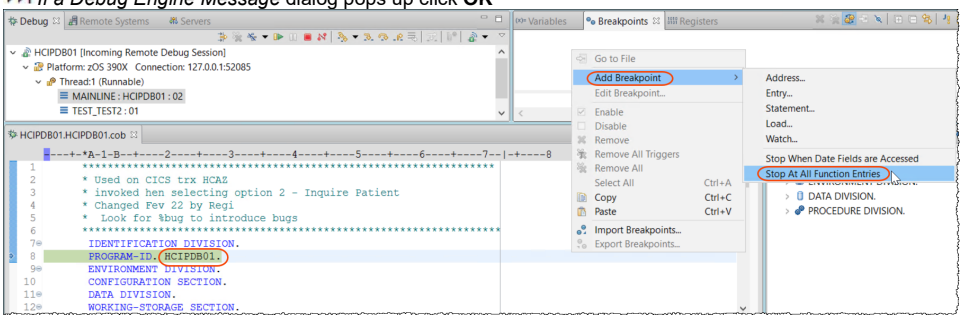
4.4.4 ⏭ Click **Switch** to open the debug perspective.



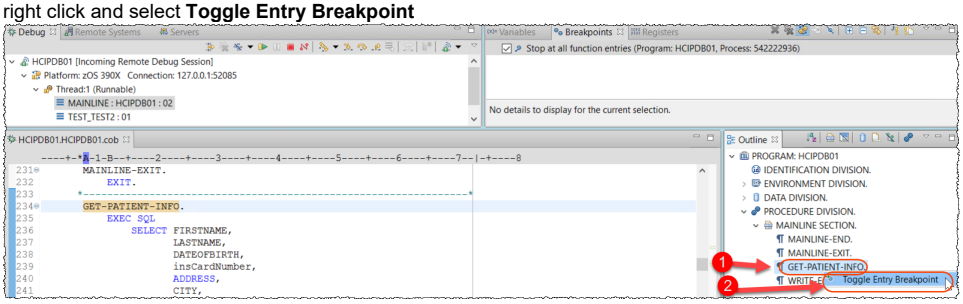
4.4.5 ⏭ Click **OK** to dismiss this dialog



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**



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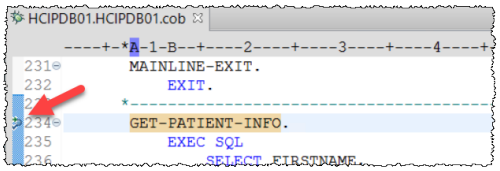
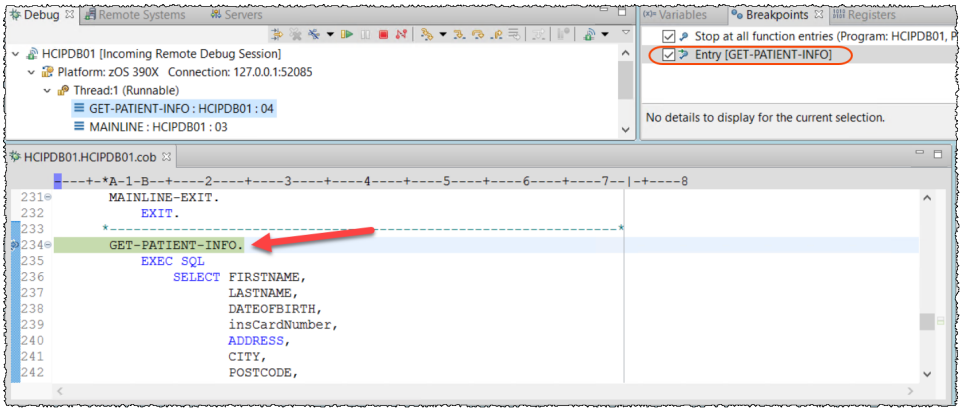
4.4.8 A breakpoint is created on the *EXEC SQL SELECT* statement. When the program runs it will stop there.



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..

…



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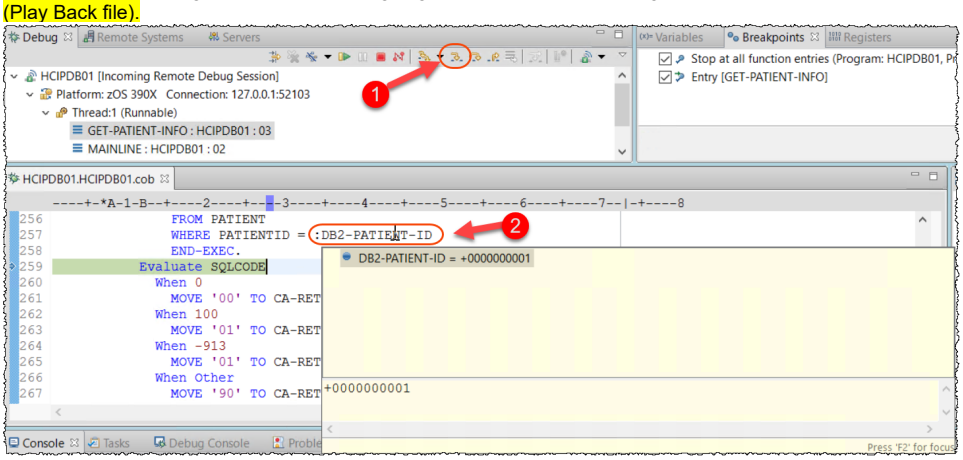
4.4.11 **Click** on icon or press **F5** to *Step Into* the code **until you find the statement below**.

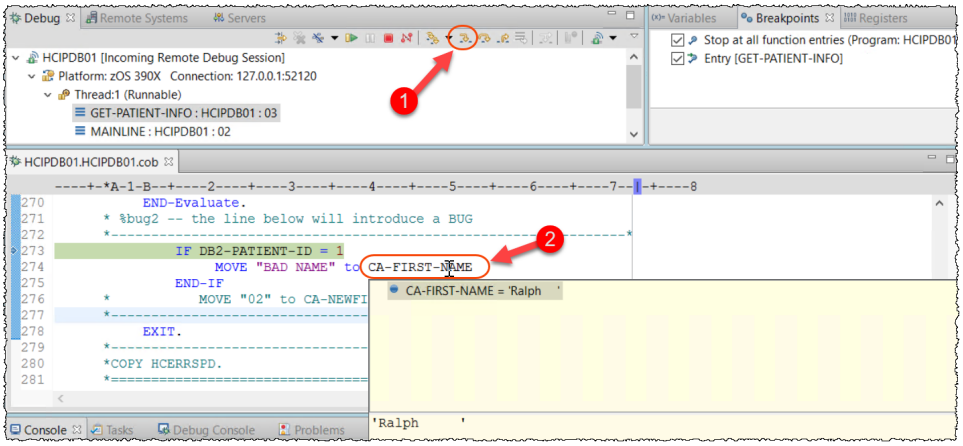
You can move the mouse to **: DB2-PATIENT-ID** and see it contents

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

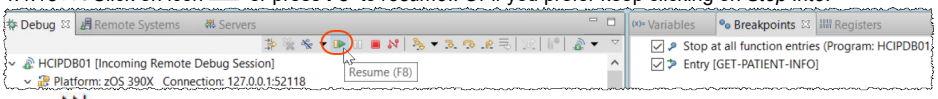


4.4.12 Keep clicking on icon or press **F5** to *Step Into* the code until you see the bug that you had introduced.

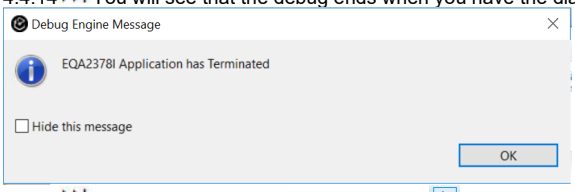
You also can see the BUG that you introduced. Move the mouse to **CA-FIRST-NAME** to see the field content (**`Ralph`**), which will be replaced by **`"BAD NAME"`**.



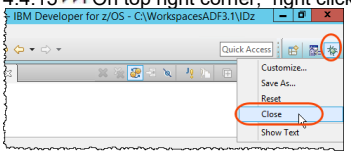
4.4.13 ⏭ Click on icon ▷ or press **F8** to *resume*.. Or if you prefer keep clicking on *Step Into*.



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



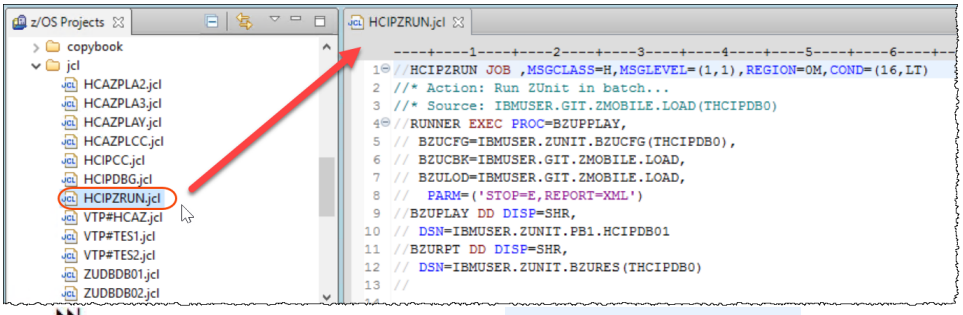
Section 5. (Optional)Run the unit test from a batch JCL.

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..

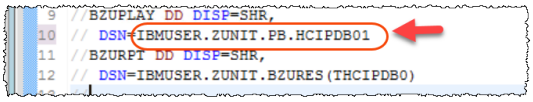
___ 5.1 Running the unit test from a batch JCL

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.



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**



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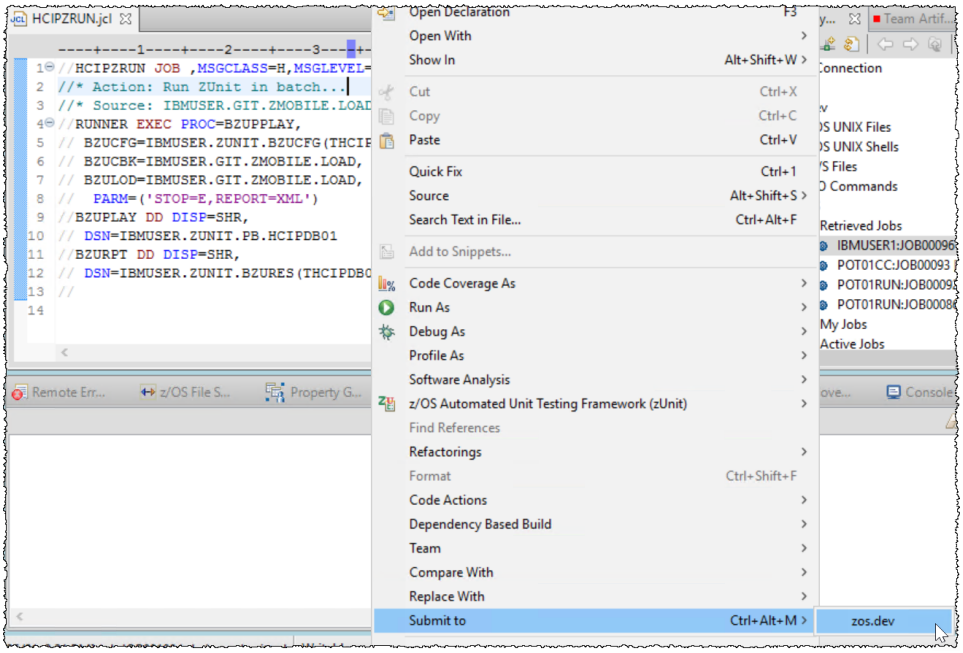
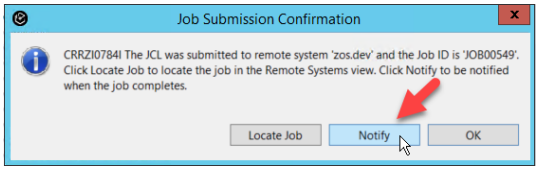
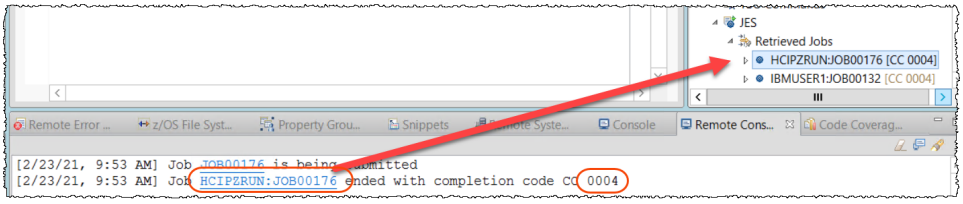
5.1.4 ⏭ Right click the editor and select **Submit > zos.dev**.



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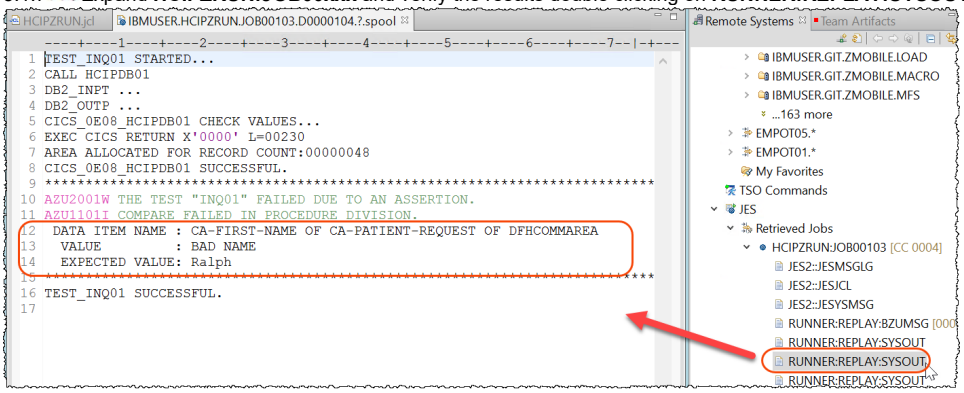
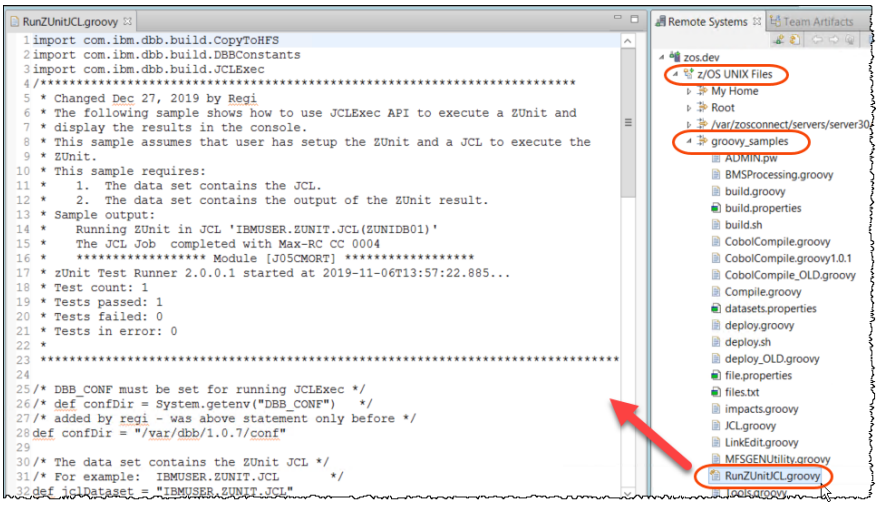
5.1.7 ⏭ Expand **HCIPZRUN:JOB00xxx** and verify the results double clicking on **RUNNER:REPLAY:SYSOUT.**



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/HealtCareAndUCD/HealthCareApp/build/ RunZUnitJCL.groovy`

⏭ Under **zos.dev** and **z/OS UNIX Files** look for filter **groovy_samples**



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

Congratulations! You have completed the Exercise

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