

IBM z/OS Connect EE V3.0

Developing RESTful APIs for CICS

Channel Service Lab



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Important: On the desktop there is a file named *Developing APIs CopyPaste.txt*. This file contains commands and other text used in this workshop. Locate that file and open it. Use the copy-and-paste function (**Ctrl-C** and **Ctrl-V**) to enter commands or text. It will save time and help avoid typo errors. As a reminder text that appears in this file will be highlighted in yellow.

Overview

Important – You do not need any skills with CICS to perform this exercise. Even if CICS is not relevant to your current plans performing this exercise will give additional experience using the Toolkit to develop services and APIs.

The objective of these exercises is to gain experience with working with z/OS Connect EE and the API Toolkit. These two products allow the exposure of z/OS resources to JSON clients. More in-depth information about the customization of z/OS Connect EE, z/OS Connect EE security, the use of the API Toolkit and other topics is provided by the 1 day *ZCONNEE – z/OS Connect Workshop*. For information about scheduling this workshop in your area contact your IBM representative.

If you have completed either the developing APIs exercise for Db2 or MQ and Batch you can start with section *z/OS Connect EE APIs and a CICS Containers program* on page 7.

General Exercise Information and Guidelines

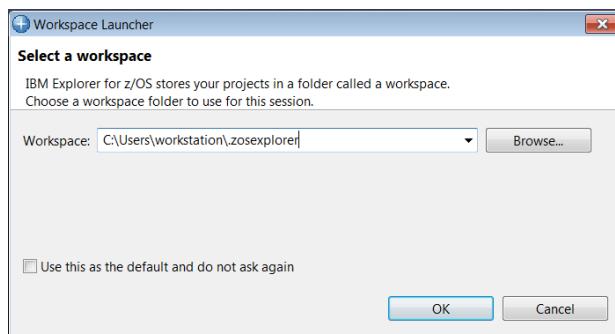
- ✓ This exercise requires using z/OS user identity *USER1*. The password for this user will be provided by the lab instructor.
- ✓ Any time you have any questions about the use of IBM z/OS Explorer, 3270 screens, features or tools do not hesitate to ask the instructor for assistance.
- ✓ The exercises for CICS CONTAINER and COMMAREA are independent of each other and can be completed in any sequence
- ✓ Text in **bold** and highlighted in **yellow** in this document should be available for copying and pasting in a file named *Development APIs CopyPaste* file on the desktop.

Connect the IBM z/OS Explorer to the z/OS Connect EE Server

Begin by establishing a connection to your z/OS Connect server from IBM z/OS Explorer. If you have performed one of the other exercises in this series of exercises this step may not be required.

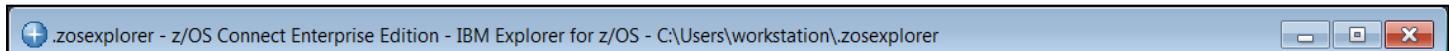
Tech-Tip: Windows desktop tools can be opened either by double clicking the icon or by selecting the icon and right mouse button clicking and then selecting the *Open* option.

1. On the workstation desktop, locate the *z/OS Explorer* icon and double click on it to open the Explorer.
2. You will be prompted for a workspace:



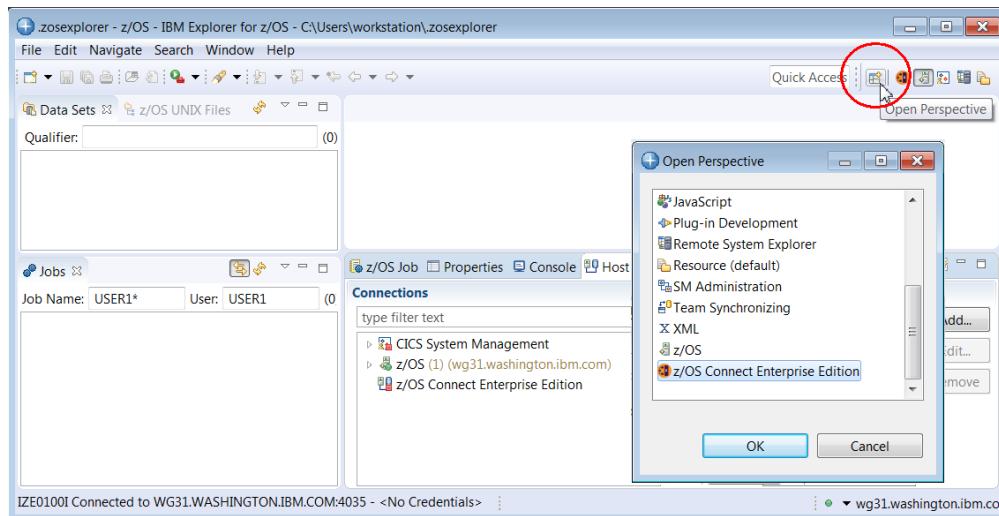
Take the default value by clicking **OK**.

3. The Explorer should open in the *z/OS Connect Enterprise Edition* perspective. Verify this by looking in the upper left corner. You should see:

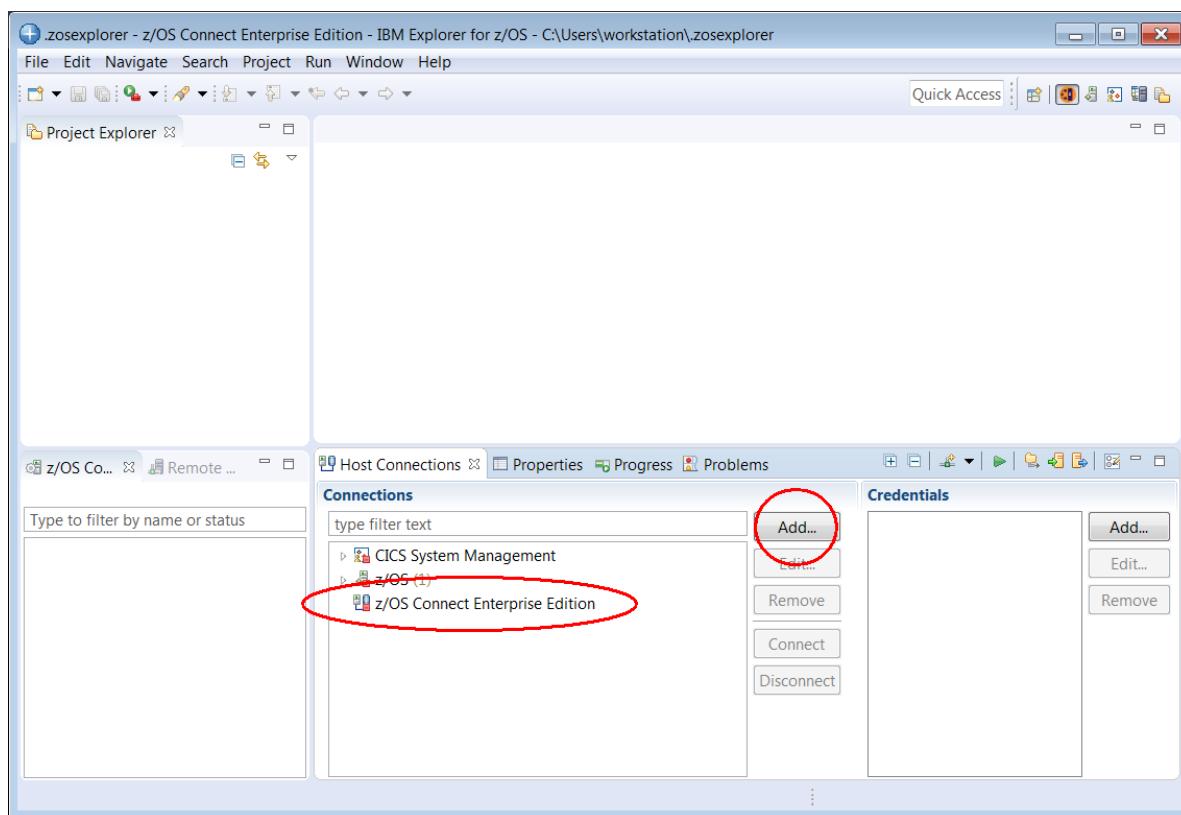


N.B. If a *Welcome* screen is displayed then click the white X beside *Welcome* to close this view.

4. If the current perspective is not *z/OS Connect Enterprise Edition*, select the *Open Perspective* icon on the top right side to display the list of available perspectives, see below. Select **z/OS Connect Enterprise Edition** and click the **OK** button to switch to this perspective.



5. To add a connection to the z/OS Connect Server select *z/OS Connect Enterprise Edition* connection in the *Host connections* tab in the lower view and then click the **Add** button.



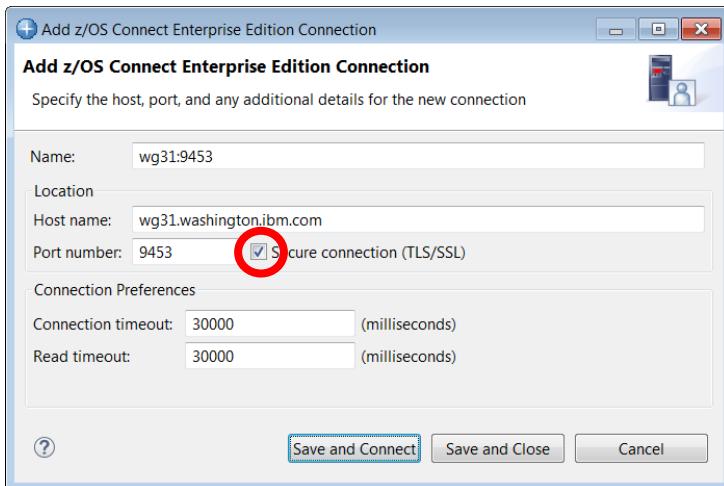
Tech-Tip: Eclipse based development tools like z/OS Explorer; provide a graphical interface consisting of multiple views within a single window.

A view is an area in the window dedicated to providing a specific tool or function. For example, in the window above, *Host Connections* and *Project Explorer* are views that use different areas of the window for displaying information. At bottom on the right there is a single area for displaying the contents of four views stacked together (commonly called a *stacked views*), *z/OS Host Connections*, *Properties*, *Progress* and *Problems*. In a stacked view, the contents of each view can be displayed by clicking on the view tab (the name of the view).

At any time, a specific view can be enlarged to fill the entire window by double clicking in the view's title bar. Double clicking in the view's title bar will restore the original arrangement. If a z/OS Explorer view is closed or otherwise disappears, the original arrangement can be restored by selecting Windows → Reset Perspective in the window's tool bar.

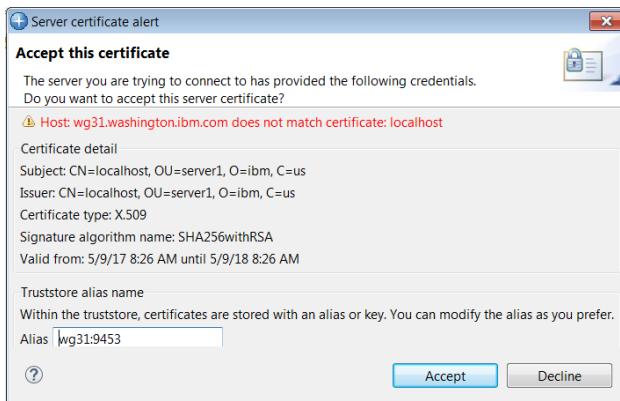
Eclipse based tools also can display multiple views based on the current role of the user. In this context, a window is known as a perspective. The contents (or views) of a perspective are based on the role the user, i.e., developer or administrator.

6. In the pop-up list displayed select *z/OS Connect Enterprise Edition* and on the *Add z/OS Connect Enterprise Edition Connection* screen enter **wg31.washington.ibm.com** for the *Host name*, **9453** for the *Port Number*, check the box for *Secure connection (TLS/SSL)* and then click the **Save and Connect** button.



7. On the *z/OS Connect Enterprise Edition – User ID* required screen create new credentials for a *User ID* of **Fred** and a *Password or Passphrase* of **fredpwd** (case matters). Remember the server is configured to use basic security. If SAF security had been enabled, then a valid RACF User ID and password will have to be used instead. Click **OK** to continue.

8. Click the **Accept** button on the *Server certificate alert – Accept this certificate* screen. You may be presented with another prompt for a userid and password, enter **Fred** and **fredpwd** again.



9. The status icon beside *wg31:9453* should now be a green circle with a lock. This shows that a secure connection has been established between the z/OS Explorer and the z/OS Connect server. A red box indicates that no connection exists.

A connection to the remote z/OS system was previously added. In the *Host Connection* view expand *z/OS Remote System* under *z/OS* and select *wg31.washington.ibm.com*. If the connection is not active the **Connect** button will be enabled. Click the **Connect** button and this will establish a session to the z/OS system. This step is required when submitting job for execution and viewing the output of these jobs later in this exercise

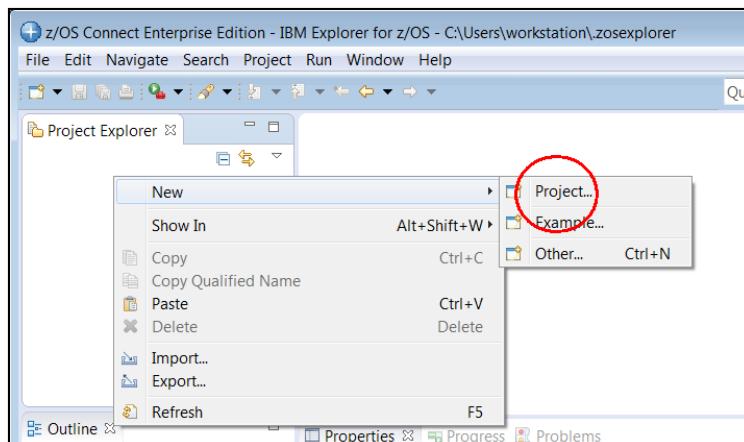
z/OS Connect EE APIs and a CICS Containers program

This section provides an opportunity to compose and deploy an API that invokes a CICS program using CICS Channels and Containers. The target CICS program, CSCVINC is a simple CICS program that based on a field in a container passed to the program accesses a VSAM file. The request could be insert a new record, replace an existing record, delete or record or retrieve an existing record.

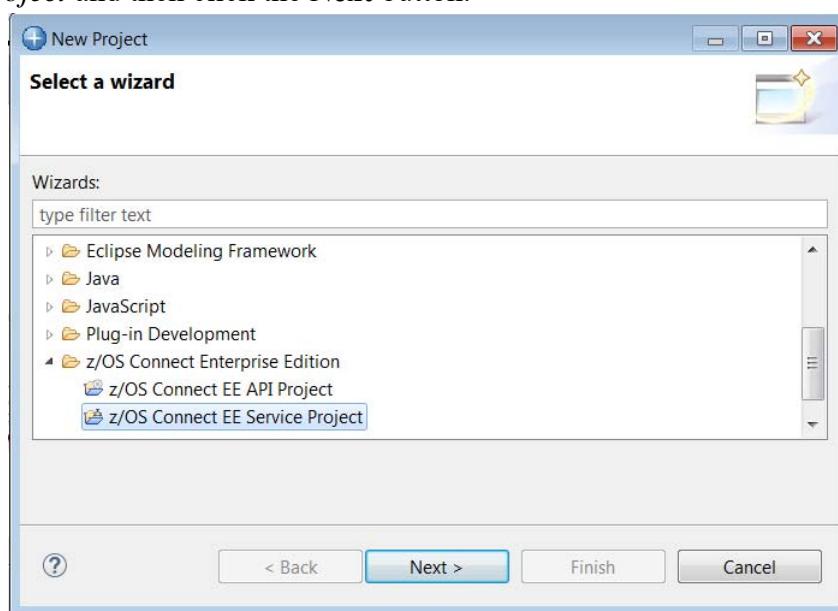
Create the service

The first step is to create the service which describes the interaction with the CICS program CSCVINC. Switch to the *z/OS Connect Enterprise Edition* perspective.

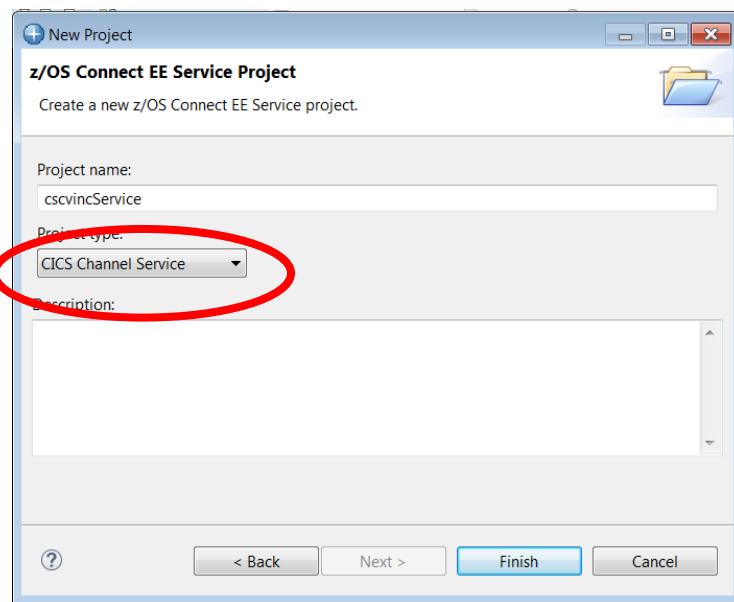
1. In the upper left, position your mouse anywhere in the *Project Explorer* view and right-mouse click, then select **New → Project:**



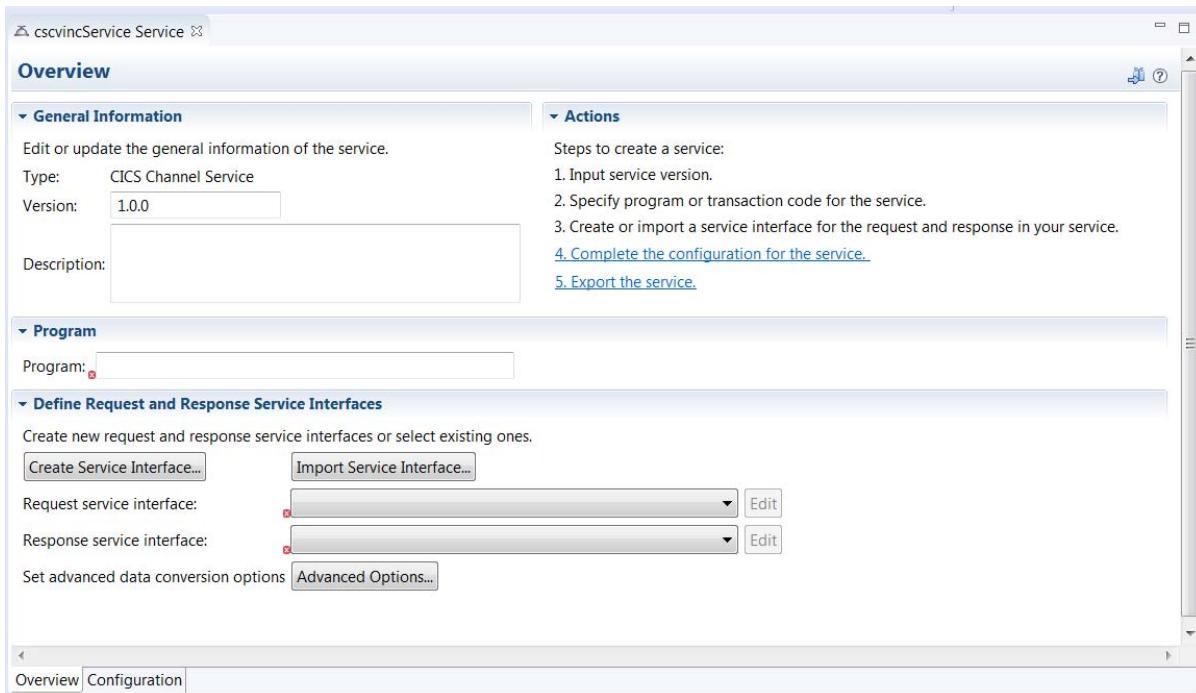
2. In the *New Project* window, scroll down and open the *z/OS Connect Enterprise Edition* folder and select *z/OS Connect EE Service Project* and then click the **Next >** button.



3. On the new *New Project* window enter **cscvincService** the *Project name* and use the pull-down arrow to select **CICS Channel Service** as the *Project type*. Click **Finish** to continue



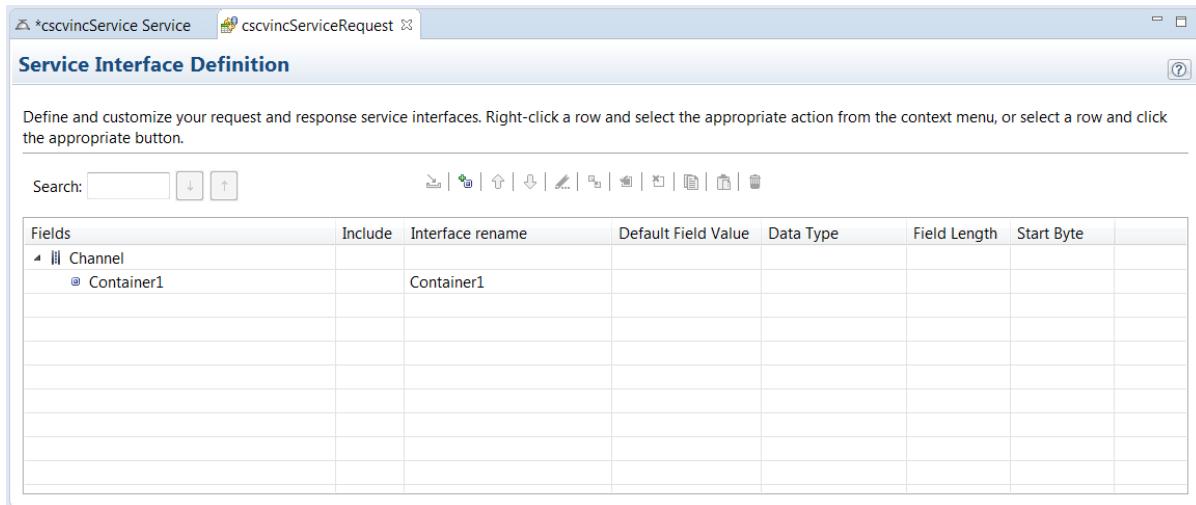
4. This will open the *Overview* window for the *cscvincService*. For now, disregard the message about the 3 errors detected, they will be addressed shortly.



5. Next enter the target CICS program name **CSCVINC** in the area beside *Program*.

6. Click the **Create Service Interface** button to create the first service interface required by this API and enter a *Service interface name* of **cscvincServiceRequest**. Click **OK** to continue.

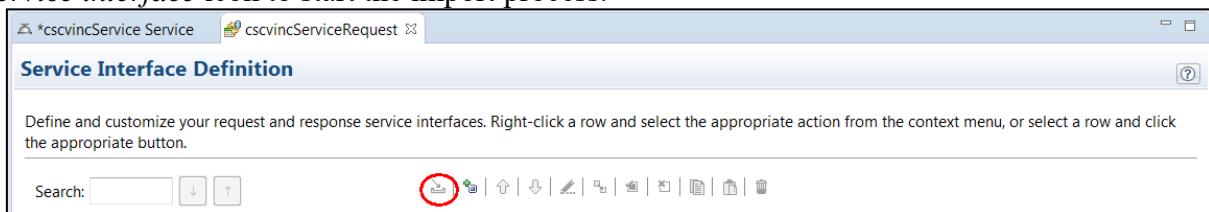
7. This will open a *Service Interface Definition* window.



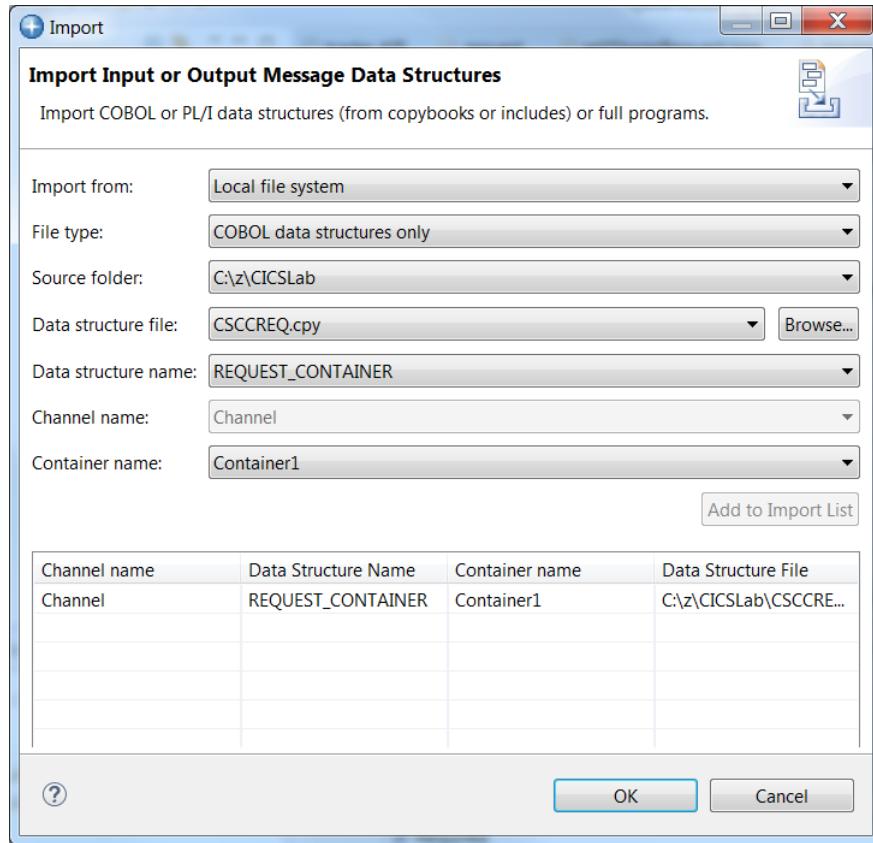
8. The first step is to import the COBOL copy book that represents the inbound or request CONTAINER.

```
01 Request-Container.
  03 ACTION          PIC X(1).
  03 USERID         PIC X(8).
  03 FILEA-AREA.
    05 STAT            PIC X.
    05 NUMB            PIC X(6).
    05 NAME            PIC X(20).
    05 ADDRX           PIC X(20).
    05 PHONE           PIC X(8).
    05 DATEX           PIC X(8).
    05 AMOUNT          PIC X(8).
    05 COMMENT         PIC X(9).
```

9. On the *Service Interface Definition* window, there is a tool bar near the top. If you hover over an icon its function will be displayed as below. Select *Container1* and click the *Import COBOL or PL/I data structure into the service interface* icon to start the import process.



10. This will open the *Import* window. On this window select *Local file system* as source of the import and *COBOL data structure only* as the *File type*. Press the **Browse** button and **Open** directory *C:\z\ICSLAB* and then select file *CSCCREQ.cpy* and click **Open** to import this file into this project. Click the **Add to Import List** button to continue.

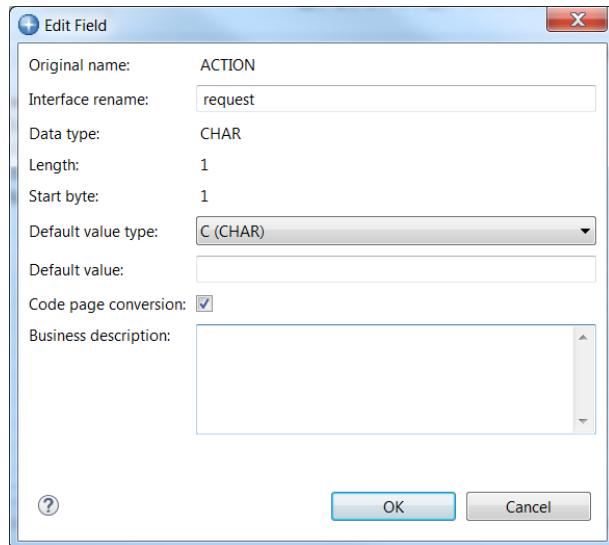


11. Click **OK** and when you expand *Container1* you will see the COBOL ‘variables’ that have been imported into the service project.

Service Interface Definition						
Define and customize your request and response service interfaces. Right-click a row and select the appropriate action from the context menu, or select a row and click the appropriate button.						
Fields	Include	Interface rename	Default Field Value	Data Type	Field Length	Start Byte
Channel						
Container1	<input checked="" type="checkbox"/>	Container1				
REQUEST_CONTAINER						
ACTION	<input checked="" type="checkbox"/>	ACTION		CHAR	1	1
USERID	<input checked="" type="checkbox"/>	USERID		CHAR	8	2
FILEA_AREA	<input checked="" type="checkbox"/>	FILEA_AREA		STRUCT	80	10
STAT	<input checked="" type="checkbox"/>	STAT		CHAR	1	10
NUMB	<input checked="" type="checkbox"/>	NUMB		CHAR	6	11
NAME	<input checked="" type="checkbox"/>	NAME		CHAR	20	17
ADDRX	<input checked="" type="checkbox"/>	ADDRX		CHAR	20	37
PHONE	<input checked="" type="checkbox"/>	PHONE		CHAR	8	57
DATEX	<input checked="" type="checkbox"/>	DATEX		CHAR	8	65
AMOUNT	<input checked="" type="checkbox"/>	AMOUNT		CHAR	8	73
COMMENT	<input checked="" type="checkbox"/>	COMMENT		CHAR	9	81

N.B. the interface names were derived from the COBOL source shown earlier.

12. In this window, you can edit and change the property name (e.g. *Interface name*) or exclude specific fields entirely from the interface. Either can be done by selecting a field and right mouse button clicking or by selecting a field and using the desired tool icon in the Service Interface toolbar. Let's try both techniques to remove the STAT and COMMENT fields.
13. Select field *STAT* and right mouse button click and select the *Exclude field from interface* option on the list of options.
14. Next select field *COMMENT* and use the *Exclude selected fields(s) from the interface* tool icon.
15. Notice that the check boxes besides these two fields are now unchecked. (You could have simply unchecked the box to accomplish the same results.)
16. Next select field *ACTION* and rename it's interface to ***request*** using the right mouse button technique or the *Edit selected field* icon in the tool bar.



When finished your service definition interface should look like this.

The screenshot shows the 'Service Interface Definition' window for the 'cscvincService Service'. The 'Fields' table lists the request fields defined in the 'REQUEST_CONTAINER' container. The table includes columns for Field Name, Include, Interface rename, Default Field Value, Data Type, Field Length, and Start Byte. The fields listed are ACTION, USERID, FILEA_AREA, STAT, NUMB, NAME, ADDRX, PHONE, DATEX, AMOUNT, and COMMENT.

Fields	Include	Interface rename	Default Field Value	Data Type	Field Length	Start Byte
ACTION	<input checked="" type="checkbox"/>	request		CHAR	1	1
USERID	<input checked="" type="checkbox"/>	USERID		CHAR	8	2
FILEA_AREA	<input checked="" type="checkbox"/>	FILEA_AREA		STRUCT	80	10
STAT	<input type="checkbox"/>	STAT		CHAR	1	10
NUMB	<input checked="" type="checkbox"/>	NUMB		CHAR	6	11
NAME	<input checked="" type="checkbox"/>	NAME		CHAR	20	17
ADDRX	<input checked="" type="checkbox"/>	ADDRX		CHAR	20	37
PHONE	<input checked="" type="checkbox"/>	PHONE		CHAR	8	57
DATEX	<input checked="" type="checkbox"/>	DATEX		CHAR	8	65
AMOUNT	<input checked="" type="checkbox"/>	AMOUNT		CHAR	8	73
COMMENT	<input type="checkbox"/>	COMMENT		CHAR	9	81

17. Close the Service Interface Definition window by clicking on the white X in the tab being sure to save the changes. Note now that the *Request service interface* and the *Response service interface* areas have now been populated with *cscvincServiceRequest.si*. Also note that you can use their respective **Edit** buttons to return to the *Service Interface Definition* window for each interface.
18. The response container from CSCVINC is different from the request container so the Response service interface needs to be created.

The screenshot shows the 'Overview' window for the 'cscvincService Service'. The 'General Information' section shows the service type as 'CICS Channel Service' and version as '1.0.0'. The 'Actions' section provides steps to create a service: 1. Input service version, 2. Specify program or transaction code for the service, 3. Create or import a service interface for the request and response in your service, 4. Complete the configuration for the service, and 5. Export the service. The 'Program' section shows the program as 'CSCVINC'. The 'Define Request and Response Service Interfaces' section shows the request service interface as 'cscvincServiceRequest.si' and the response service interface as 'cscvincServiceRequest.si'.

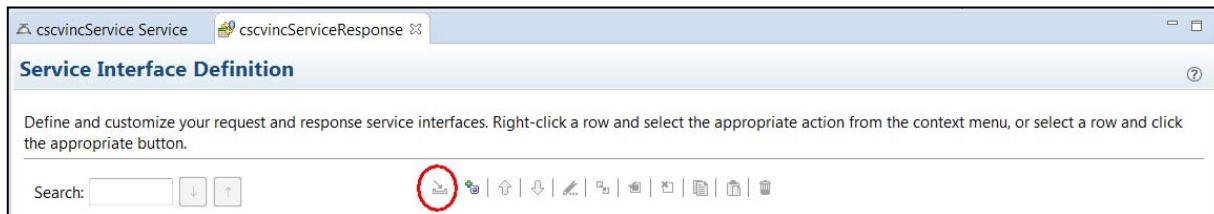
19. Click the **Create Service Interface** button to create the response service interface required by this API and enter a *Service interface name* of **cscvincServiceResponse**. Click **OK** to continue.
20. This will open a *Service Interface Definition* window.
21. The first step is to import the COBOL copy book that represents the outbound or response CONTAINER.

```

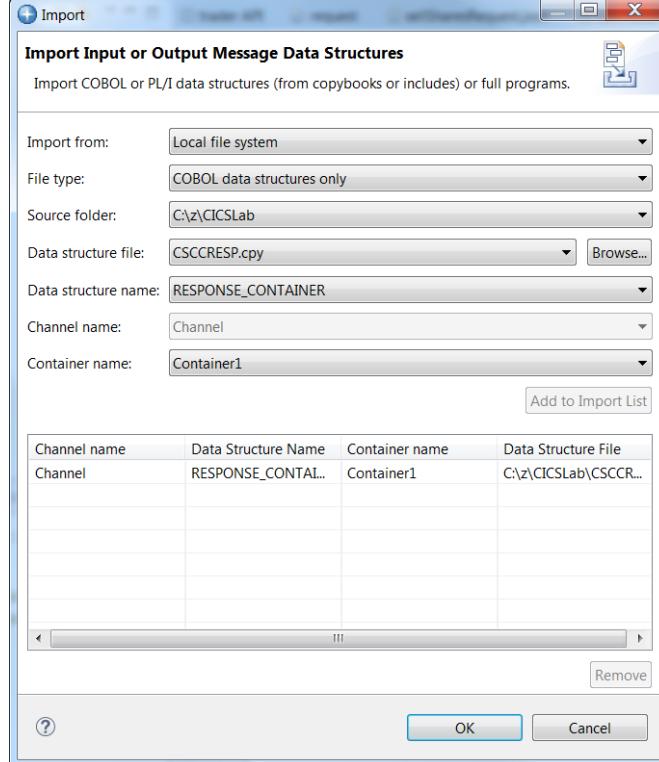
01 Response-Container.
  03 ACTION          PIC X(1).
  03 CEIBRESP        PIC S9(8) COMP.
  03 CEIBRESP2       PIC S9(8) COMP.
  03 USERID         PIC X(8).
  03 FILEA-AREA.
    05 STAT           PIC X.
    05 NUMB           PIC X(6).
    05 NAME           PIC X(20).
    05 ADDRX          PIC X(20).
    05 PHONE          PIC X(8).
    05 DATEX          PIC X(8).
    05 AMOUNT         PIC X(8).
    05 COMMENT        PIC X(9).

```

22. On the *Service Interface Definition* window select **CONTAINER1** and click the *Import COBOL or PL/I data structure into the service interface* icon to start the import process.



23. This will open the *Import* window. On this window select *Local file system* as source of the import and *COBOL data structure only* as the *File type*. Press the **Browse** button and **Open** directory *C:\z\CICSLAB* and then select file *CSCCRESP.cpy* and click **Open** to import this file into this project. Click the **Add to Import List** button to continue.

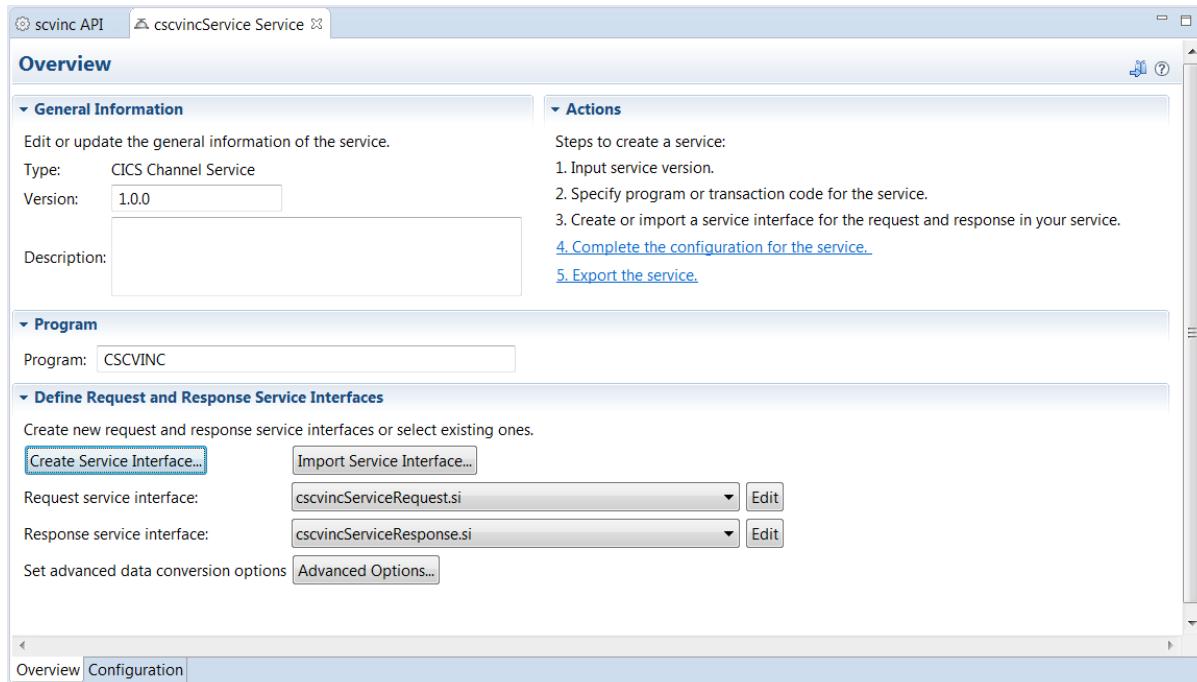


24. Click **OK** and when you expand *Container1* you will see the COBOL ‘variables’ that have been imported into the service project.

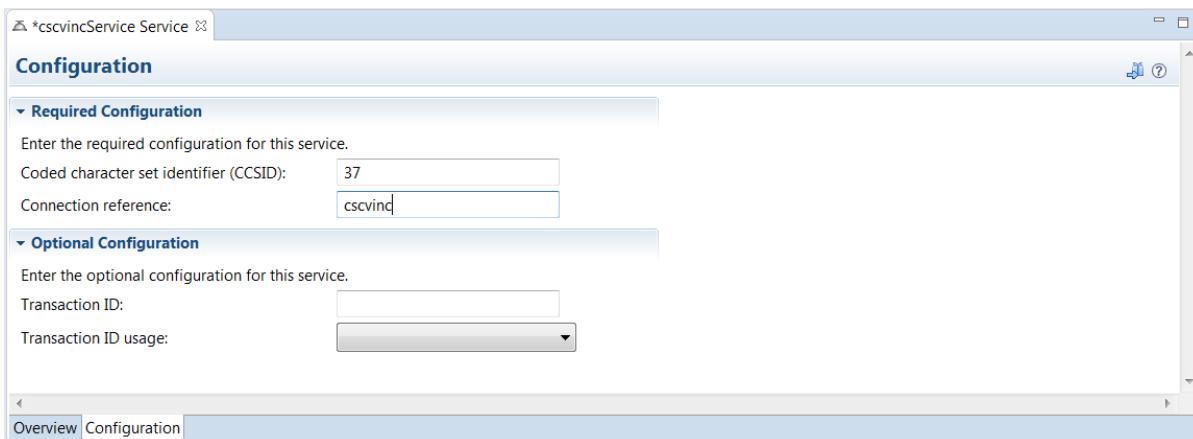
Fields	Include	Interface rename	Default Field Value	Data Type	Field Length	Start Byte
Channel						
Container1		Container1				
RESPONSE_CONTAINER	<input checked="" type="checkbox"/>					
ACTION	<input checked="" type="checkbox"/>	ACTION		CHAR	1	1
CEIBRESP	<input checked="" type="checkbox"/>	CEIBRESP		INT	4	2
CEIBRESP2	<input checked="" type="checkbox"/>	CEIBRESP2		INT	4	6
USERID	<input checked="" type="checkbox"/>	USERID		CHAR	8	10
FILEA_AREA	<input checked="" type="checkbox"/>	FILEA_AREA		STRUCT	80	18
STAT	<input checked="" type="checkbox"/>	STAT		CHAR	1	18
NUMB	<input checked="" type="checkbox"/>	NUMB		CHAR	6	19
NAME	<input checked="" type="checkbox"/>	NAME		CHAR	20	25
ADDRX	<input checked="" type="checkbox"/>	ADDRX		CHAR	20	45
PHONE	<input checked="" type="checkbox"/>	PHONE		CHAR	8	65
DATEX	<input checked="" type="checkbox"/>	DATEX		CHAR	8	73
AMOUNT	<input checked="" type="checkbox"/>	AMOUNT		CHAR	8	81
COMMENT	<input checked="" type="checkbox"/>	COMMENT		CHAR	9	89

N.B. the interface names were derived from the COBOL source shown earlier.

25. Again, in this view we could exclude fields from the interface or rename fields. To save time, excluding and renaming fields will not be done in the response message in this exercise.
26. Close the *cscvincServiceResponse* view by clicking on the white X.
27. Use the pull-down arrow beside *Response service interface* to select *cscvincServiceResponse.si*.



28. Next, we need to identify a connection reference for which CICS region will be used. Click on the Configuration tab at the bottom of the *Overview* window to display the *Configuration* window. Enter *cscvinc* in the area beside *Connection reference*.



Tech-Tip: The *Connection reference* identifies the *cicsIpicConnection* element or *cicsLocalConnection* element to be used to access a CICS region in the z/OS Connect EE configuration, see *cscvinc.xml* on page 34.

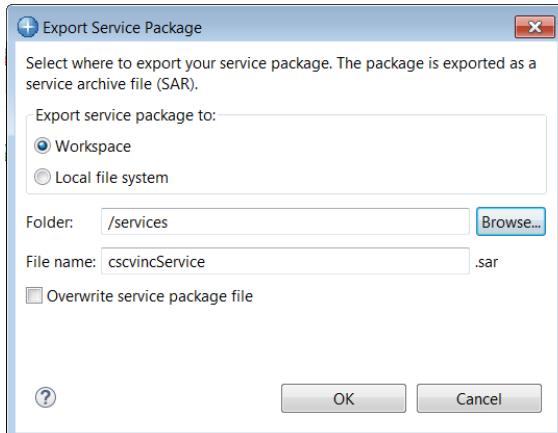
28. Save the *cscvincService* service either by closing the tab or using the **Ctrl-S** key sequence.

The service now needs to be made available for developing the API and for deployment to the z/OS Connect EE server.

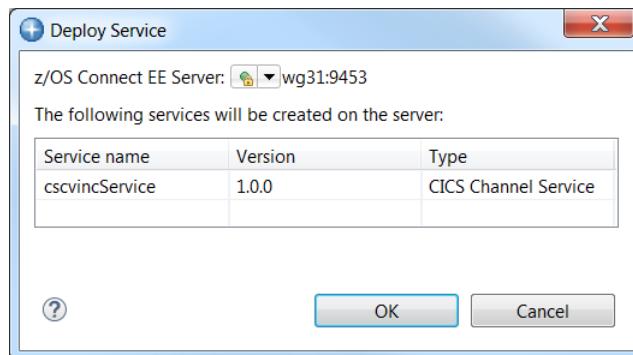
Export and deploy the Service Archive files

Before a service interface can be used it must be exported to create Service Archive (SAR) file and deployed as a SAR file to the server. The exported SAR is used in developing an API in the z/OS Connect EE Toolkit. This section describes the process for exporting and deploying SAR files.

1. First ‘export’ the service interface as a SAR into another project in the z/OS Connect EE Toolkit. Select **File** on the tool bar and then on the pop up select **New → Project**. Expand the *General* folder and select *Project* to create a target project for exporting the Service Archive (SAR) files. Click **Next** to continue.
2. On the *New Project* window enter **Services** as the *Project name*. Click **Finish** to continue. This action will add a new project in the *Project Explorer* named *Services*. If this project already exists continue with Step 3.
3. Select the *cscvincService* service project and right mouse button click. On the pop-up selection select **z/OS Connect EE → Export z/OS Connect EE Service Archive**. On the *Export Services Package* window select the radio button beside *Workspace* and use the **Browse** button to select the *Services* folder. Click **OK** to continue.

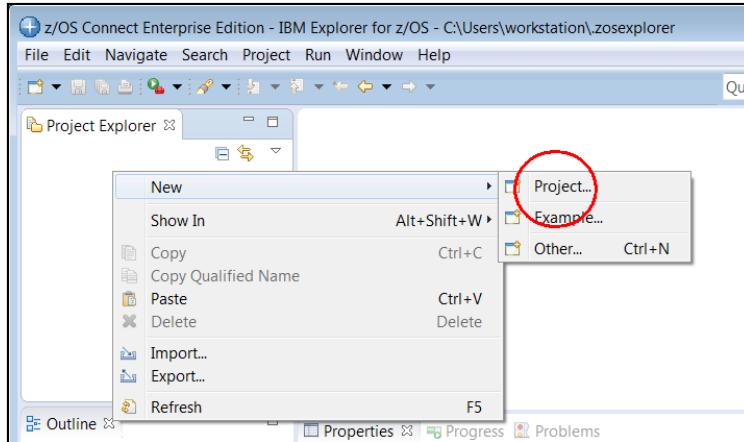


4. Select the *cscvincService* service project and right mouse button click again and on the pop-up selection select **z/OS Connect EE → Deploy Service to z/OS Connect EE Server**. On the *Deploy Service* window select the target server (*wg31:9453*) and click **OK** twice to continue.

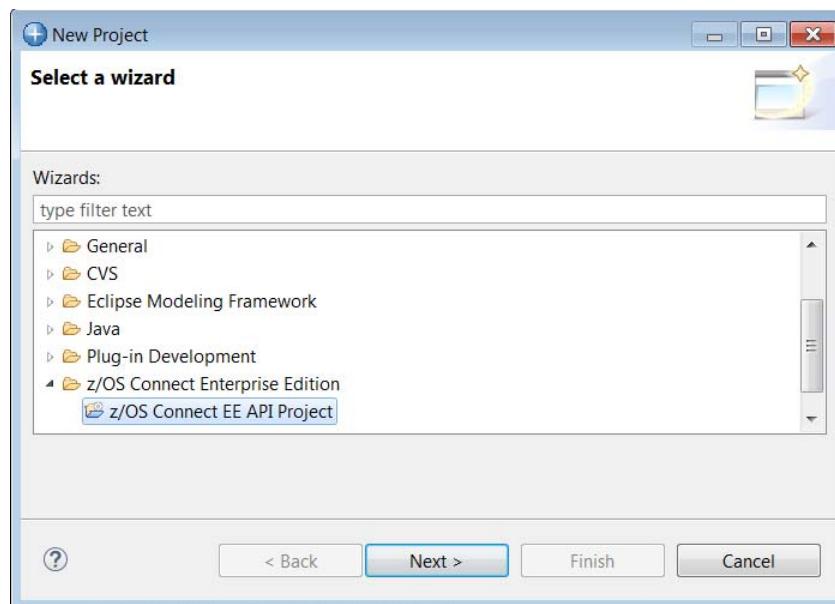


Create the Cscvinc API project

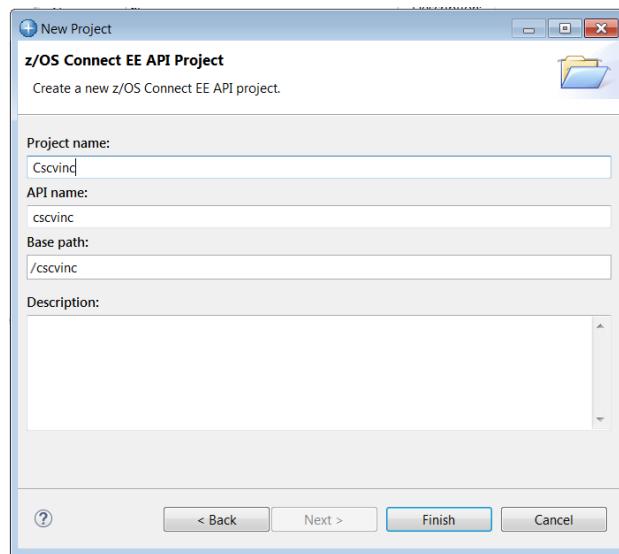
1. In the *z/OS Connect Enterprise Edition* perspective of the *z/OS Explorer* create a new API project by clicking the right mouse button and selecting *New → Project*:



2. In the *New Project* screen, scroll down and open the *z/OS Connect Enterprise Edition* folder and select *z/OS Connect EE API Project* and then click the **Next** button.

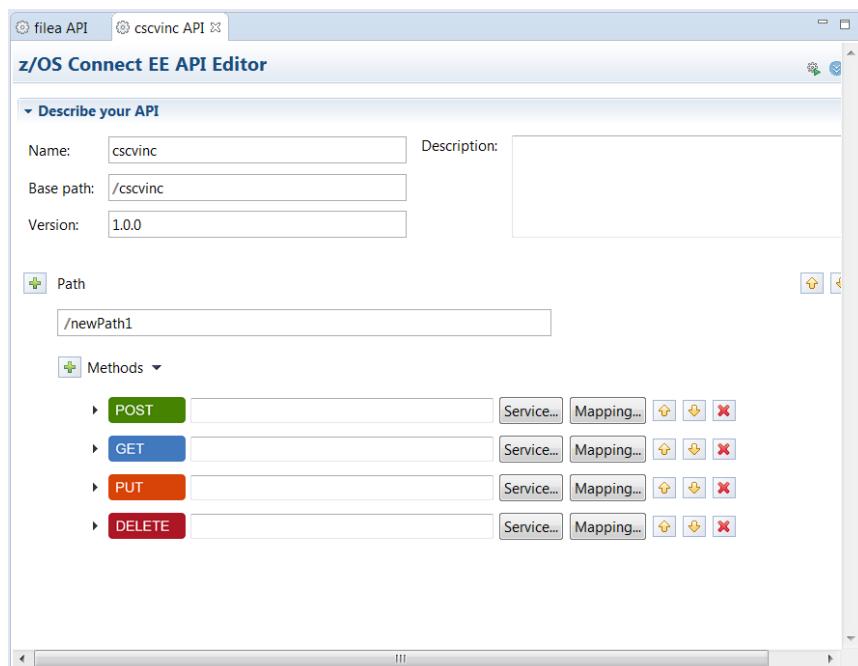


3. Enter **Cscvinc** for the *Project name*. Be sure the *API name* is set to **cscvinc** and the *Base path* is set to **/cscvinc**. Click **Finish** to continue.



Important: The values are somewhat arbitrary, but they do relate to later tasks. If you use the values and cases as supplied, then the subsequent commands and the use of subsequent URLs will work seamlessly.

4. You should now see something like the view below. The view may need to be adjusted by dragging the view boundary lines.



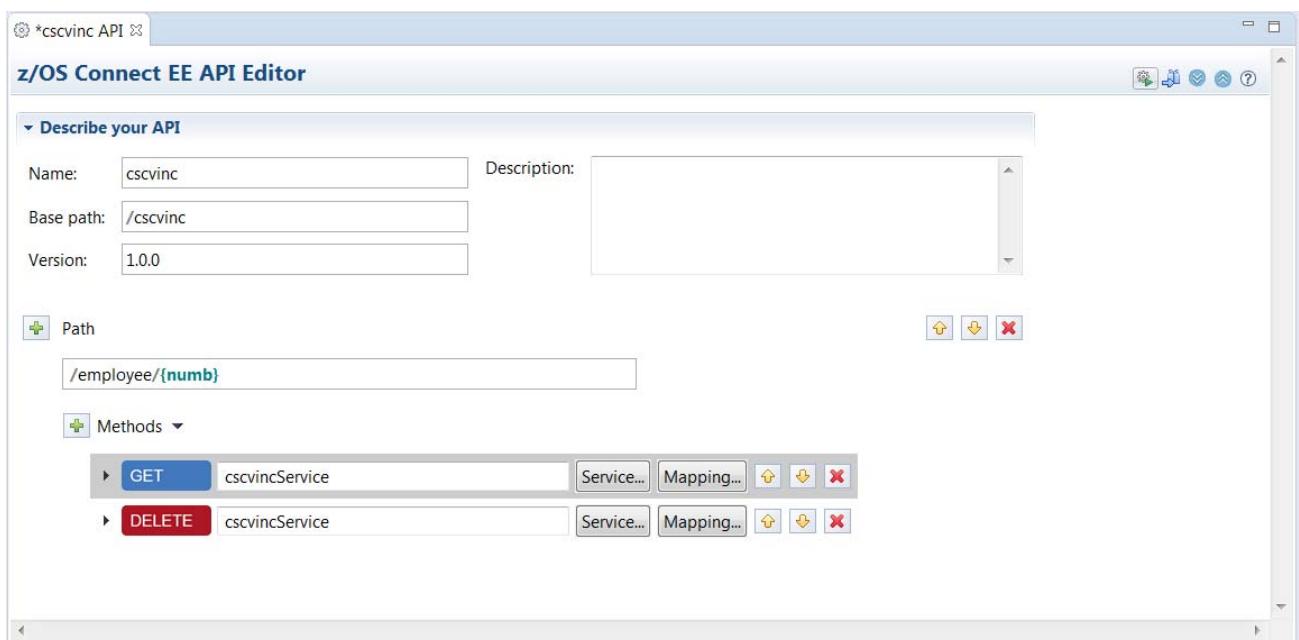
Summary

This created the basic framework for the API project in the API editor.

Compose the API for the CICS Container Application

The API for the CICS container application will have two paths. One path which includes a path parameter which identifies the key of the record to be retrieved or deleted and another path with no path parameter for inserting and/or updating a record. In this case the key is one of the fields in the request message.

1. Start by entering a *Path* of **/employee/{numb}** in the *z/OS Connect EE API Editor* view. Remove the *POST* and *PUT* methods by the red X's next to each.
2. Click the **Service** button beside the *GET* method and on the *Select a z/OS Connect EE Service* window click the **Workspace button**. On the *Import z/OS Connect EE Services* window expand the *services* folder and select *cscvincService.sar*. Click OK three times to import this SAR into this project.
3. Click the **Service** button beside the *Delete* method and on the *Select a z/OS Connect EE Service* window select *cscvincService.sar* and click **OK**.



4. Next, click on the **Mapping** button beside the **GET** method and then select *Open Request Mapping*:



5. In the mapping view that opens, go to the right side of the mapping (which represents the COPYBOOK fields), and click the little + signs to expand *Request_Container*. You should see fields that correspond to the fields defined in the original COBOL copy book *CSCCREQ* in *USER1.ZCEE.CNTL*.

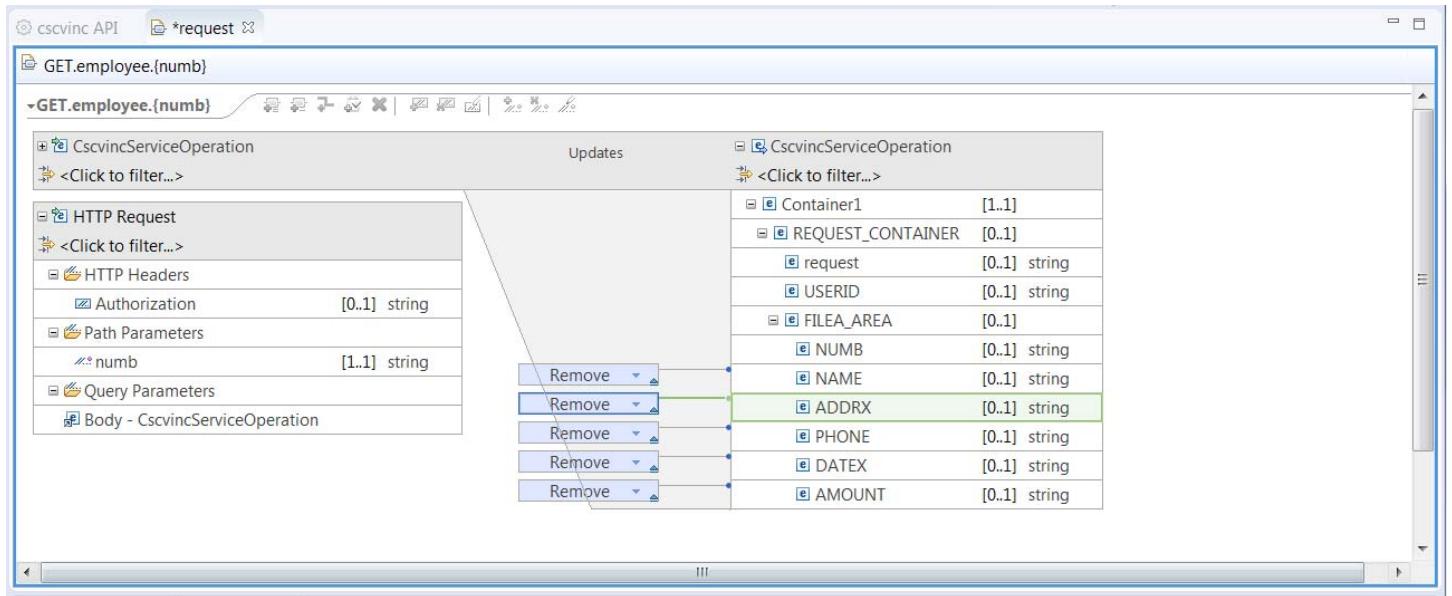
```

01 Request-Container.
  03 ACTION          PIC X(1).
  03 USERID         PIC X(8).
  03 FILEA-AREA.
    05 STAT            PIC X.
    05 NUMB           PIC X(6).
    05 NAME            PIC X(20).
    05 ADDRX          PIC X(20).
    05 PHONE           PIC X(8).
    05 DATEX          PIC X(8).
    05 AMOUNT          PIC X(8).
    05 COMMENT         PIC X(9).
.
.
```

6. Use the slider bar to fully expose the *Request_Container* structure. Use the left mouse button and draw a dotted line box that fully includes the *name*, *addrx*, *phone*, *datex* and *amount* and fields. When you release the button, these fields should be selected (the background should be blue).

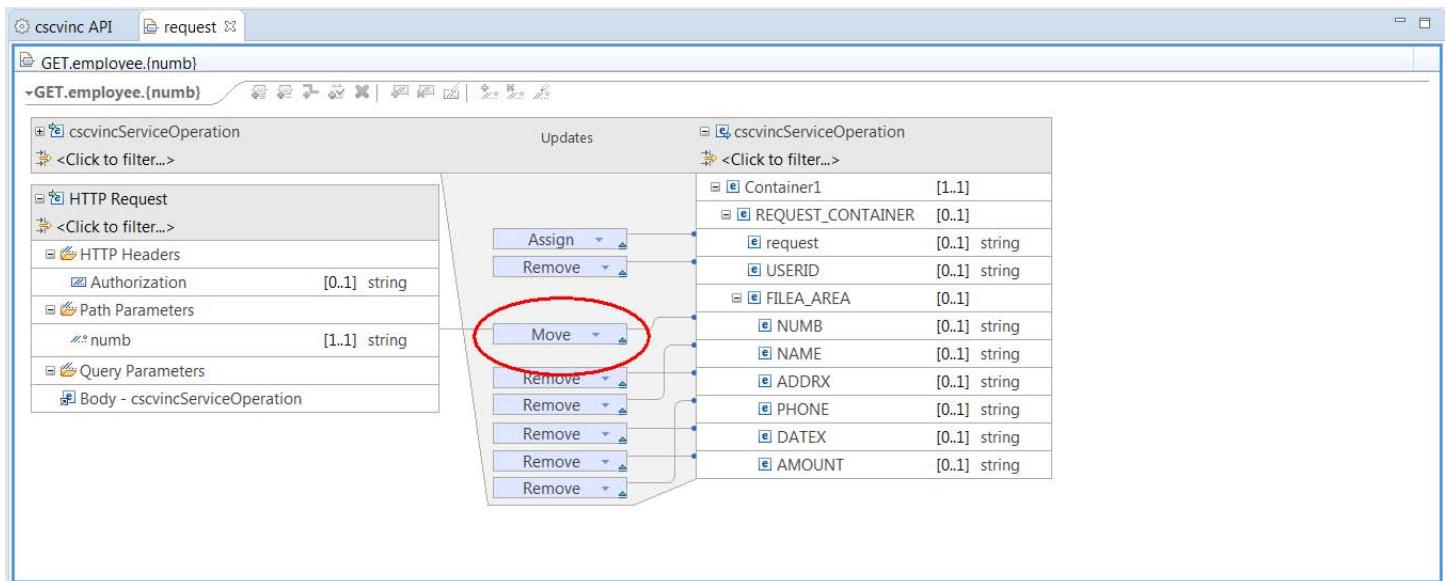
7. Right mouse button click on any of the selected fields and select the *Add Remove transform* from the list of options.

7. This action generates multiple “remove” requests (see below) for the selected fields. These fields are not required for a GET method, so these will not be exposed to the REST clients using this method.

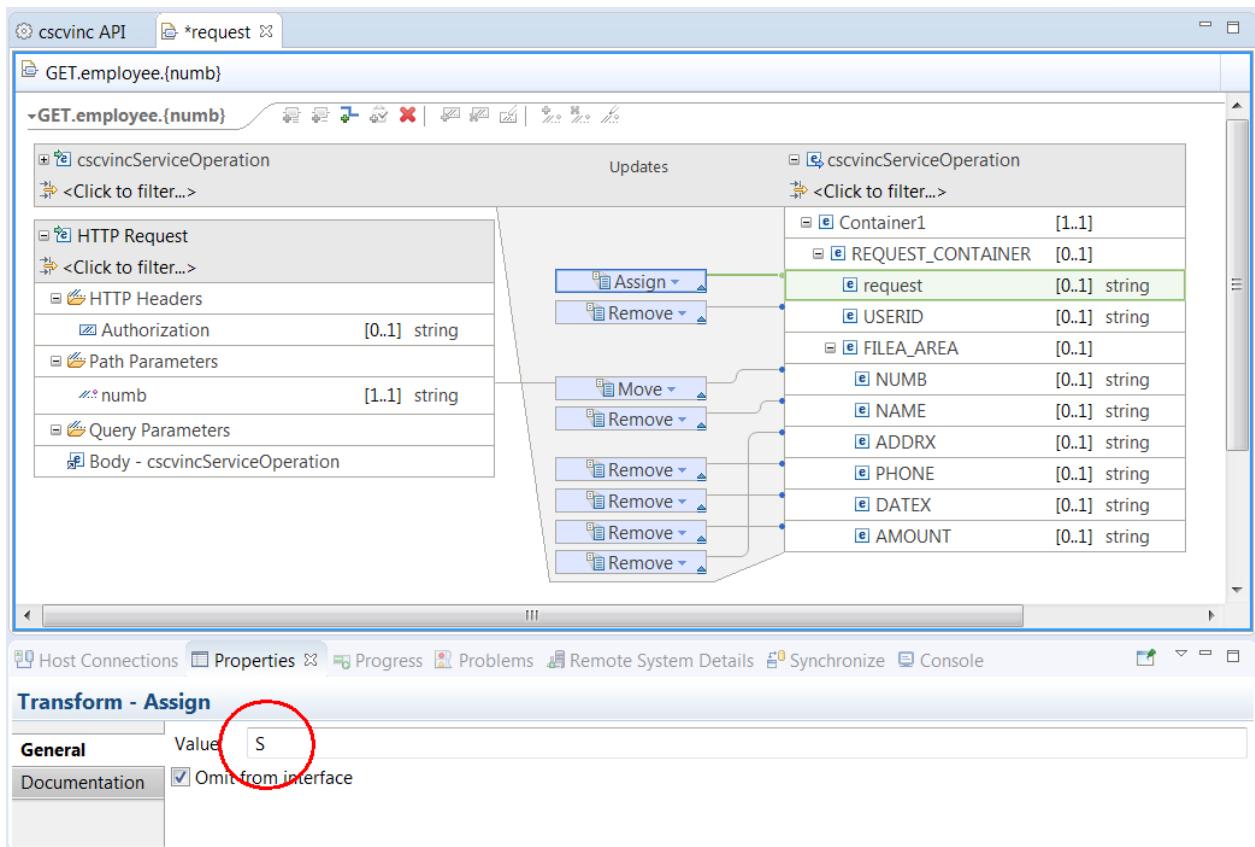


8. Right mouse button click USERID and select *Add Remove transform* to remove this field from the interface.

9. This leaves two fields in the *Request_Container* structure, *request* and *numb*. The contents of the *numb* field should be provided by the *numb* path parameter from the URL. On the left-hand side of the view select the *numb* path parameter with the left mouse button and drag it without releasing the mouse button) to the *numb* field on the right-hand side to create a “move” connection from the *numb* path parameter to the *numb* field in the *Request_Container* structure.



10. The only *Request_Container* field left unhandled now is the *request* field. The target application uses this field to determine what action should be performed. For a **GET** method request this field should be set to a value of **S**. Select the *request* field and right button click and select the *Add Assign transform* option. This action opens a *Properties* tab in the lower view. In this tab, a value can be entered which will be used to populate this field when a **GET** method is invoked. Enter **S** in the area beside *Value* in the *Properties* tab.



Remember: The *request* field determines which function the application performs. The valid values for *request* are I(insert) for the POST method, S(select) for the GET method, U(update) for the PUT method and D(delete) for the DELETE method. Creating another service. This API can be extended to support PUT, DELETE and POST by simply remapping the request message as appropriate.

11. Use the **Ctrl-S** key sequence to save all changes and close the *GET.employee.{numb}* view.

12. For **GET** methods we want all fields exposed to the REST client. The default response mapping will return all fields so no special mapping is required for this method. To review the fields that will be returned click the **Mapping** button beside the **GET** method and select the *Open Default Response Mapping* option.

Field	Type	Description
Container1	[0..1]	
RESPONSE_CONTAINER	[0..1]	
ACTION	[0..1] string	
CEIBRESP	[0..1] integer	
CEIBRESP2	[0..1] integer	
USERID	[0..1] string	
FILEA_AREA	[0..1]	
STAT	[0..1] string	
NUMB	[0..1] string	
NAME	[0..1] string	
ADDRX	[0..1] string	
PHONE	[0..1] string	
DATEX	[0..1] string	
AMOUNT	[0..1] string	
COMMENT	[0..1] string	

The Response _Container structure was built using the contents of the CSCCRESP COPYBOOK

```

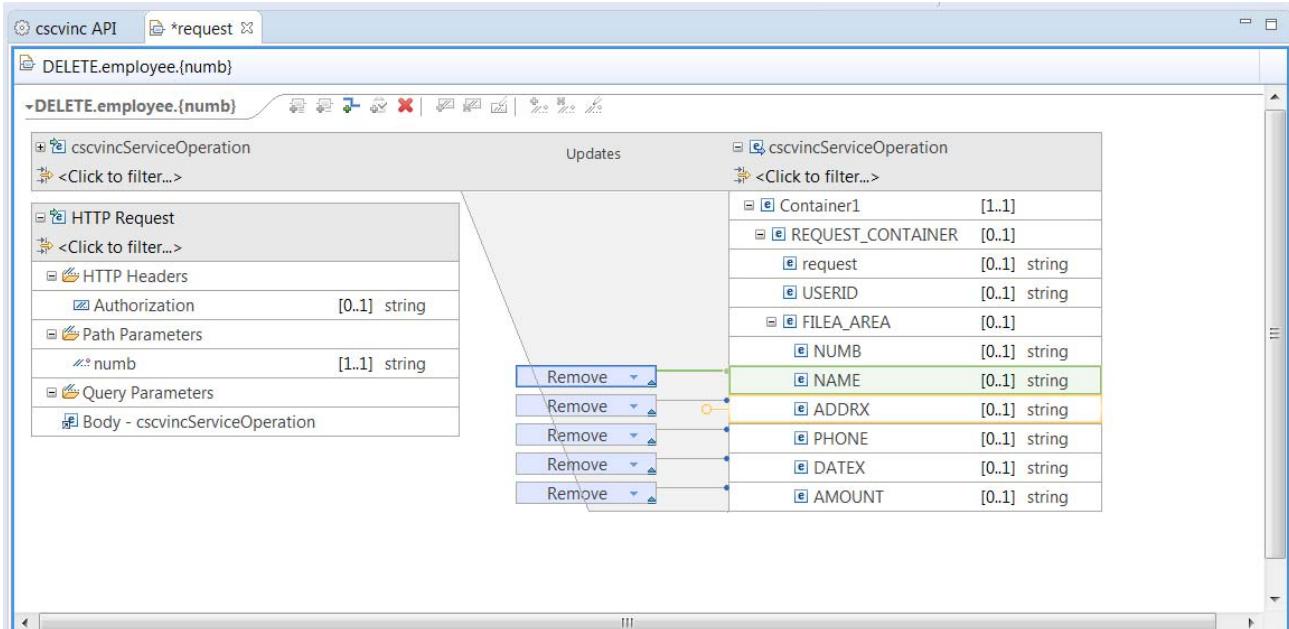
01 Response-Container.
 03 ACTION      PIC X(1).
 03 CEIBRESP    PIC S9(8) COMP.
 03 CEIBRESP2   PIC S9(8) COMP.
 03 USERID      PIC X(8).

03 FILEA-AREA.
 05 STAT        PIC X.
 05 NUMB        PIC X(6).
 05 NAME        PIC X(20).
 05 ADDRX       PIC X(20).
 05 PHONE       PIC X(8).
 05 DATEX       PIC X(8).
 05 AMOUNT      PIC X(8).
 05 COMMENT     PIC X(9).

```

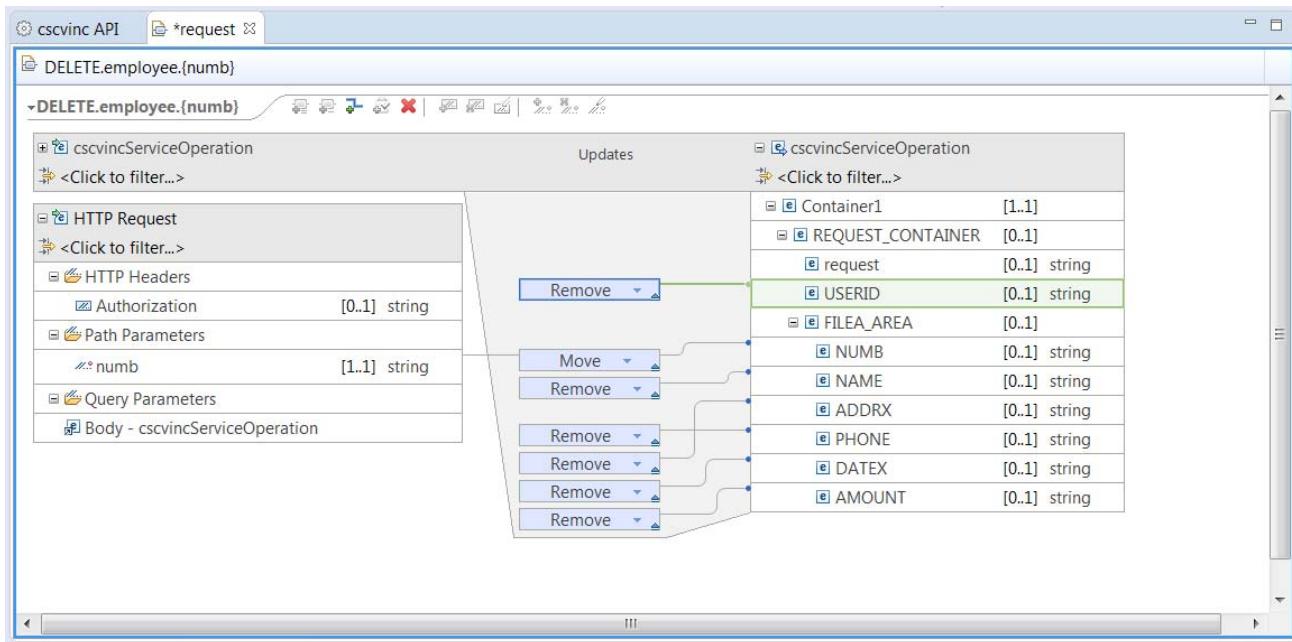
13. Next, click on the **Mapping** button beside the **DELETE** method and then select *Open Request Mapping*:

- ___ 14. In the mapping view that opens, go to the right side of the mapping (which represents the COPYBOOK fields), and click the little + signs to expand *Request_Container*. You should see fields that correspond to the fields defined in the original COBOL copy book *CSCCREQ* in *USER1.ZCEE.CNTL*.
- ___ 15. Use the slider bar to fully expose the *Request_Container* structure. Use the left mouse button and draw a dotted line box that fully includes the *name*, *addrx*, *phone*, *datex* and *amount* fields. When you release the button, these fields should be selected (the background should be blue). Right mouse button click on any of the selected fields and select the *Add Remove transform* from the list of options.

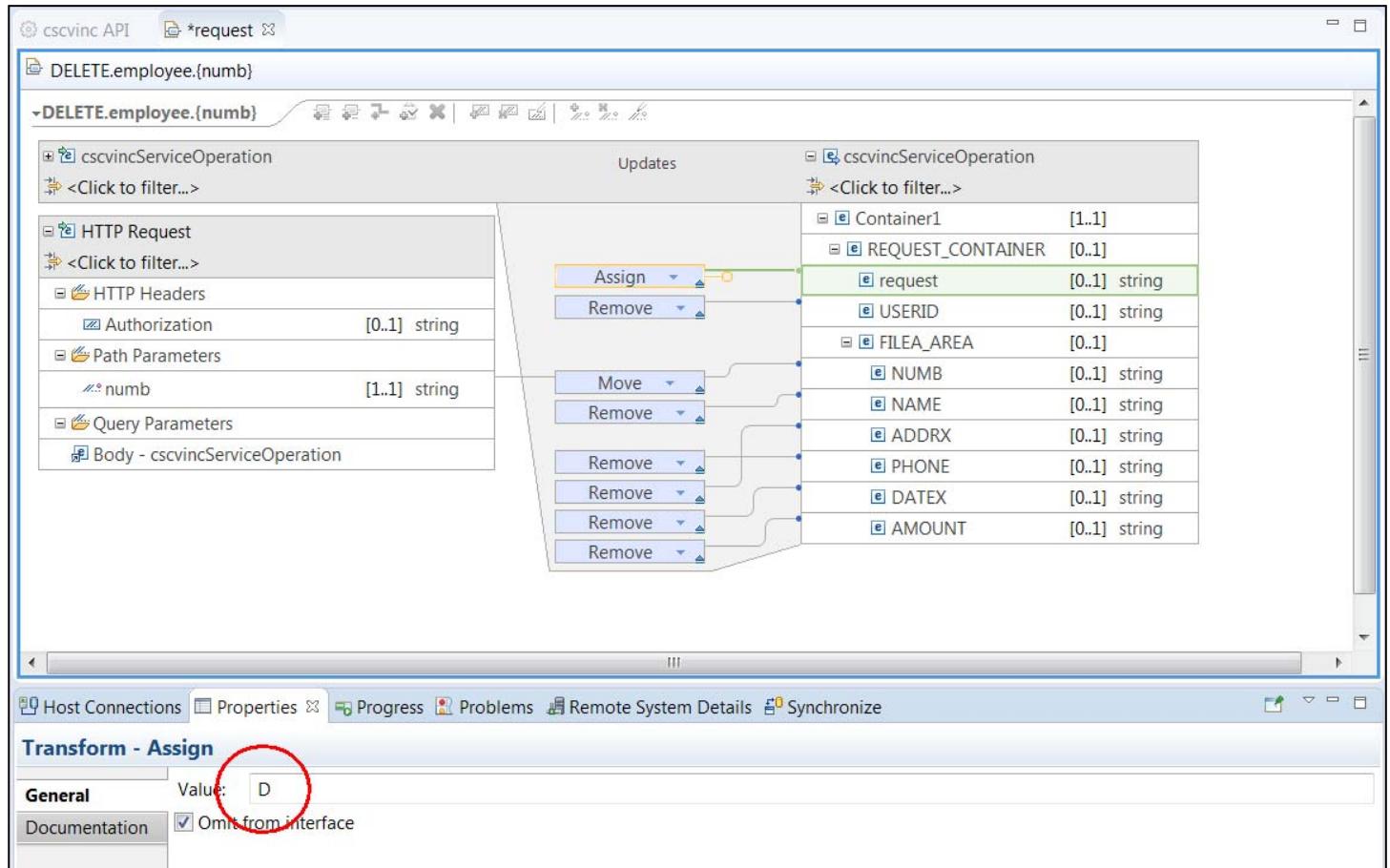


- ___ 13. This action generates multiple “remove” requests (see below) for the selected fields. These fields are not required for a **DELETE** method so these will not be exposed to the REST clients using this method.
- ___ 14. Right mouse button click **USERID** and select *Add Remove transform* to remove this field from the interface.

15. This leaves two fields in the *Request_Container* structure, *request* and *numb*. The contents of the *numb* field should be provided by the *numb* path parameter from the URL. On the left-hand side of the view select the *numb* path parameter with the left mouse button and drag it without releasing the mouse button) to the *numb* field on the right-hand side to create a “move” connection from the *numb* path parameter to the *numb* field in the *Request_Container* structure.

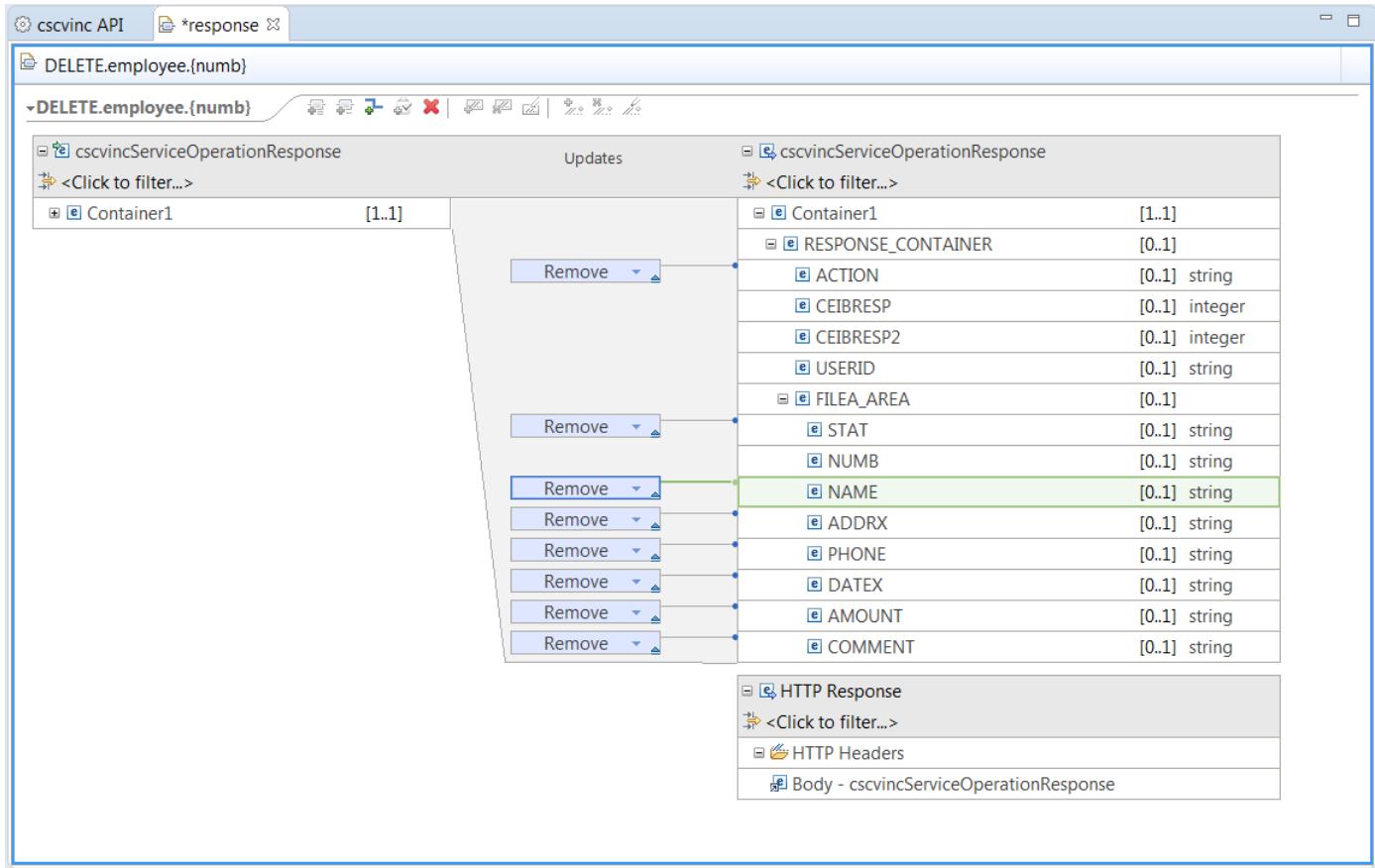


16. The only *Request_Container* field left unhandled now is the *request* field. The target application uses this field to determine what action should be performed. For a **DELETE** method request this field should be set to a value of **D**. Select the *request* field and right button click and select the *Add Assign transform* option. This action opens a *Properties* tab in the lower view. In this tab, a value can be entered which will be used to populate this field when a **DELETE** method is invoked. Enter **D** in the area beside *Value* in the *Properties* tab.



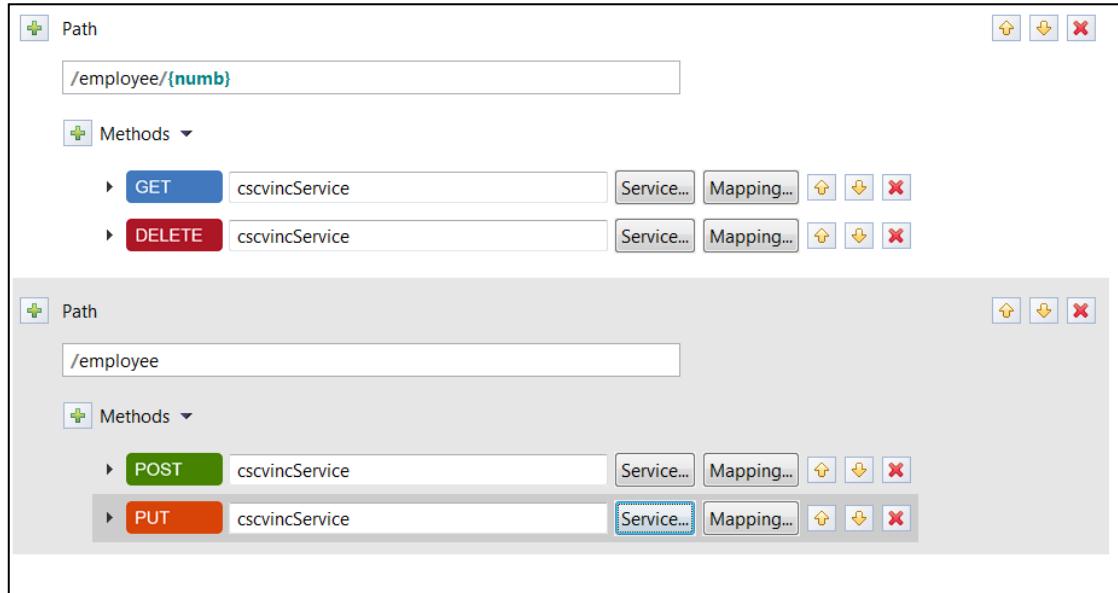
17. Use the **Ctrl-S** key sequence to save all changes and close the `DELETE.employee.{numb}` view.

18. For the **DELETE** method we only want to expose the CEIBRESP, CEIBRESP2, USERID and NUMB fields to the REST client. To make changes to the fields that will be returned click the **Mapping** button beside the **DELETE** method and select the *Open Default Response Mapping* option. Add Remove transformations to the other fields in the response container.



The Response_Container structure was built using the contents of the CSCCRESP copy book.

19. Next, we want to add a new *Path* for the **POST** and **PUT** methods. Click the plus sign beside PATH and enter a *Path* of **/employee** in the *z/OS Connect EE API Editor* view. Remove the **DELETE** and **GET** methods by the red X's next to each.
20. Click the **Service** button beside the **POST** method and on the *Select a z/OS Connect EE Service* window select **cscvincService.sar** and click **OK**. Repeat these steps for the **PUT** method.

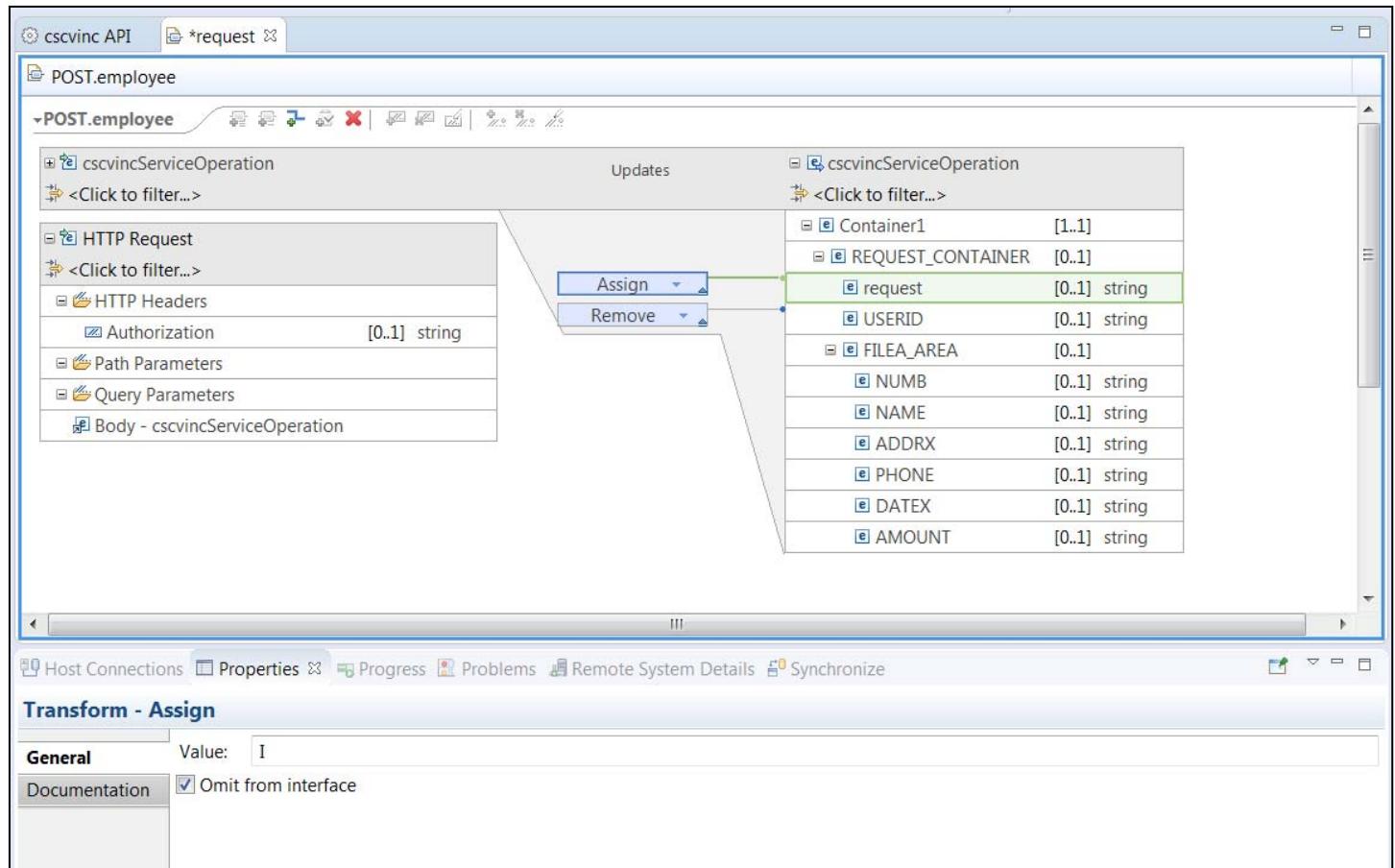


21. Next, click on the **Mapping** button beside the **POST** method and then select *Open Request Mapping*:



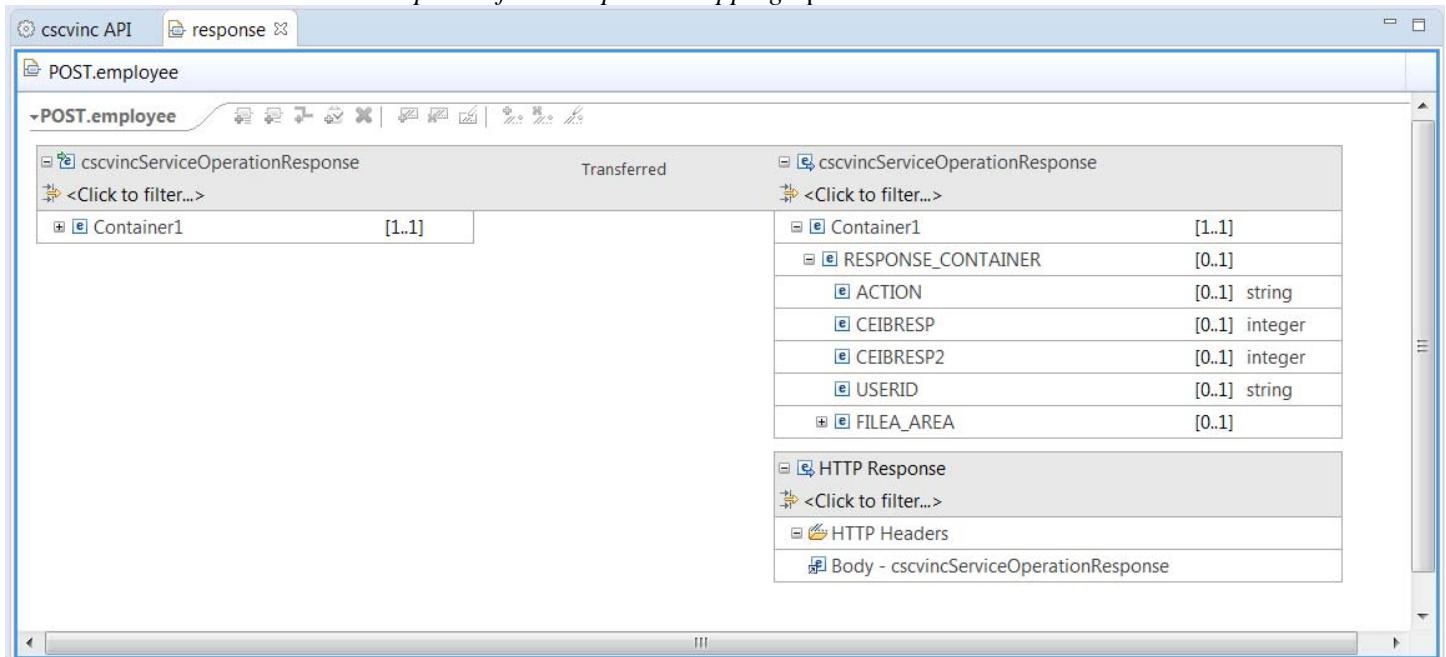
22. In the mapping view that opens, go to the right side of the mapping (which represents the COPYBOOK fields), and click the little + signs to expand *Request_Container*. You should see fields that correspond to the fields defined in the original COBOL copy book *CSCCREQ* in *USER1.ZCEE.CNTL*.

19. Use the slider bar to fully expose the *Request_Container* structure. Right mouse button click USERID and select *Add Remove transform* to remove this field from the interface. Select the *action* field and right button click and select the *Add Assign transform* option. This action opens a *Properties* tab in the lower view. In this tab, a value can be entered which will be used to populate this field when a **POST** method is invoked. Enter **I** (letter I) in the area beside *Value* in the *Properties* tab



20. Use the **Ctrl-S** key sequence to save all changes and close the *POST.employee.{numb}* view.

21. For **POST** methods we want all fields exposed to the REST client. The default response mapping will return all fields so no special mapping is required for this method. To review the fields that will be returned click the **Mapping** button beside the **POST** method and select the *Open Default Response Mapping* option.

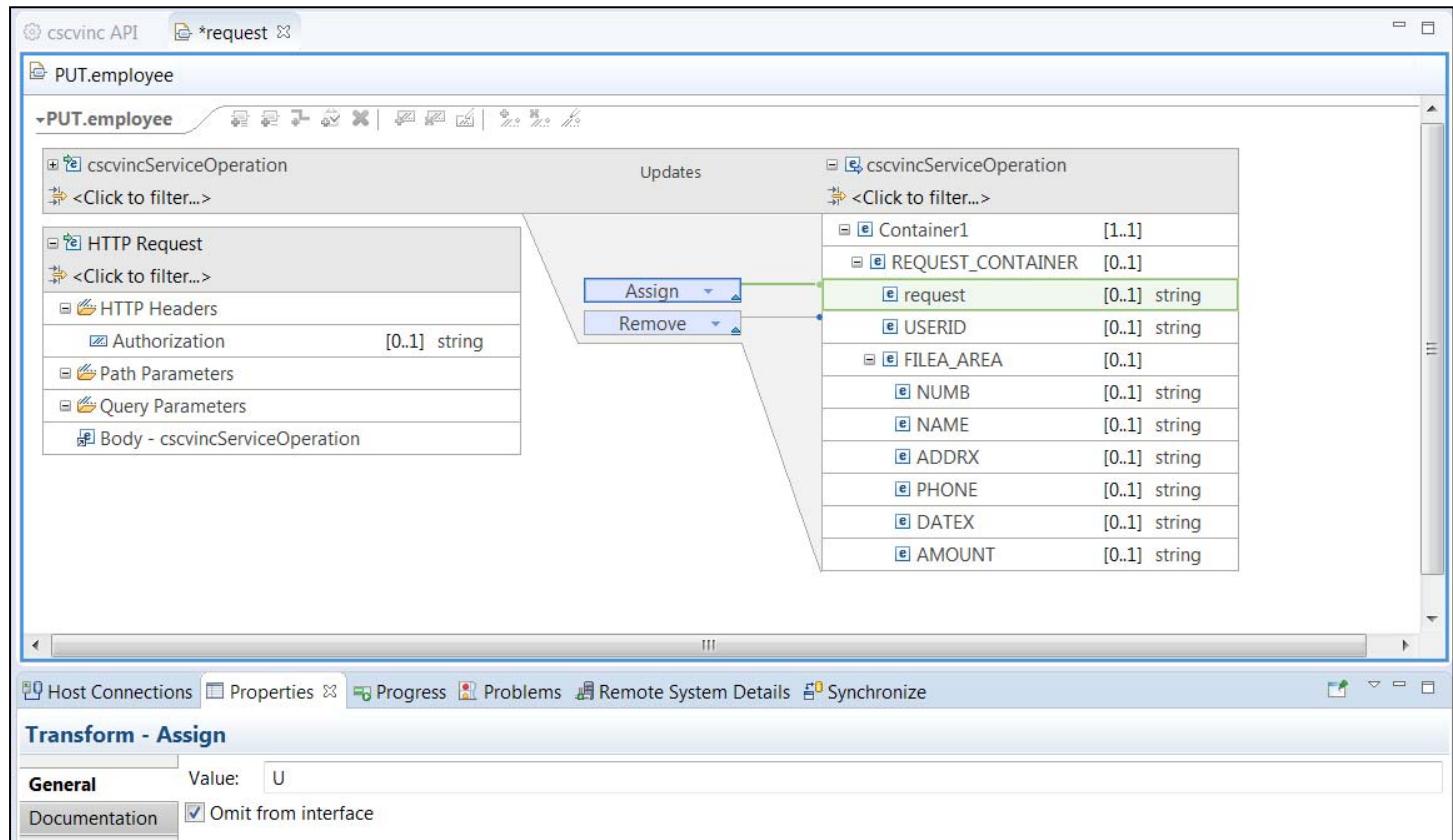


23. Next, click on the **Mapping** button beside the **PUT** method and then select *Open Request Mapping*:



24. In the mapping view that opens, go to the right side of the mapping (which represents the COPYBOOK fields), and click the little + signs to expand *Request_Container*. You should see fields that correspond to the fields defined in the original COBOL copy book *CSCCREQ* in *USER1.ZCEE.CNTL*.

22. Use the slider bar to fully expose the *Request_Container* structure. Right mouse button click USERID and select *Add Remove transform* to remove this field from the interface. Select the *request* field and right button click and select the *Add Assign transform* option. This action opens a *Properties* tab in the lower view. In this tab, a value can be entered which will be used to populate this field when a **PUT** method is invoked. Enter **U** in the area beside *Value* in the *Properties* tab



23. Use the **Ctrl-S** key sequence to save all changes and close the *PUT.employee.{numb}* view.

24. For **PUT** methods we want all fields exposed to the REST client. The default response mapping will return all fields so no special mapping is required for this method. To review the fields that will be returned click the **Mapping** button beside the **PUT** method and select the *Open Default Response Mapping* option.
25. Close all open tabs.

The screenshot shows the z/OS Connect API designer interface. The title bar says "cscvinc API" and the tab is "response". The main area displays the mapping for the PUT.employee operation. It shows two main sections: "cscvincServiceOperationResponse" and "Body - cscvincServiceOperationResponse". The "cscvincServiceOperationResponse" section contains a "Container1" element with a multiplicity of [1..1]. The "Body - cscvincServiceOperationResponse" section contains several fields: Container1 [1..1], RESPONSE_CONTAINER [0..1], ACTION [0..1] string, CEIBRESP [0..1] integer, CEIBRESP2 [0..1] integer, USERID [0..1] string, and FILEA_AREA [0..1]. There are also sections for "HTTP Response" and "HTTP Headers".

Summary

You created the API, which consists of two paths and the HTTP methods and request and response mapping associated with each. That API will now be deployed into z/OS Connect EE V3.0. Note in this scenario there was one service and the API developer used this one service to support a RESTful API with PUT, POST, GET and DELETE HTTP methods.

Deploy the API to a z/OS Connect EE Server

1. The **cscvinc** API and **cscvincService** service were defined by the inclusion of the *cscvinc.xml* file in the *server.xml*.

```
<server description="CICS FILEA">

    <featureManager>
        <feature>zosconnect:cicsService-1.0</feature>
    </featureManager>

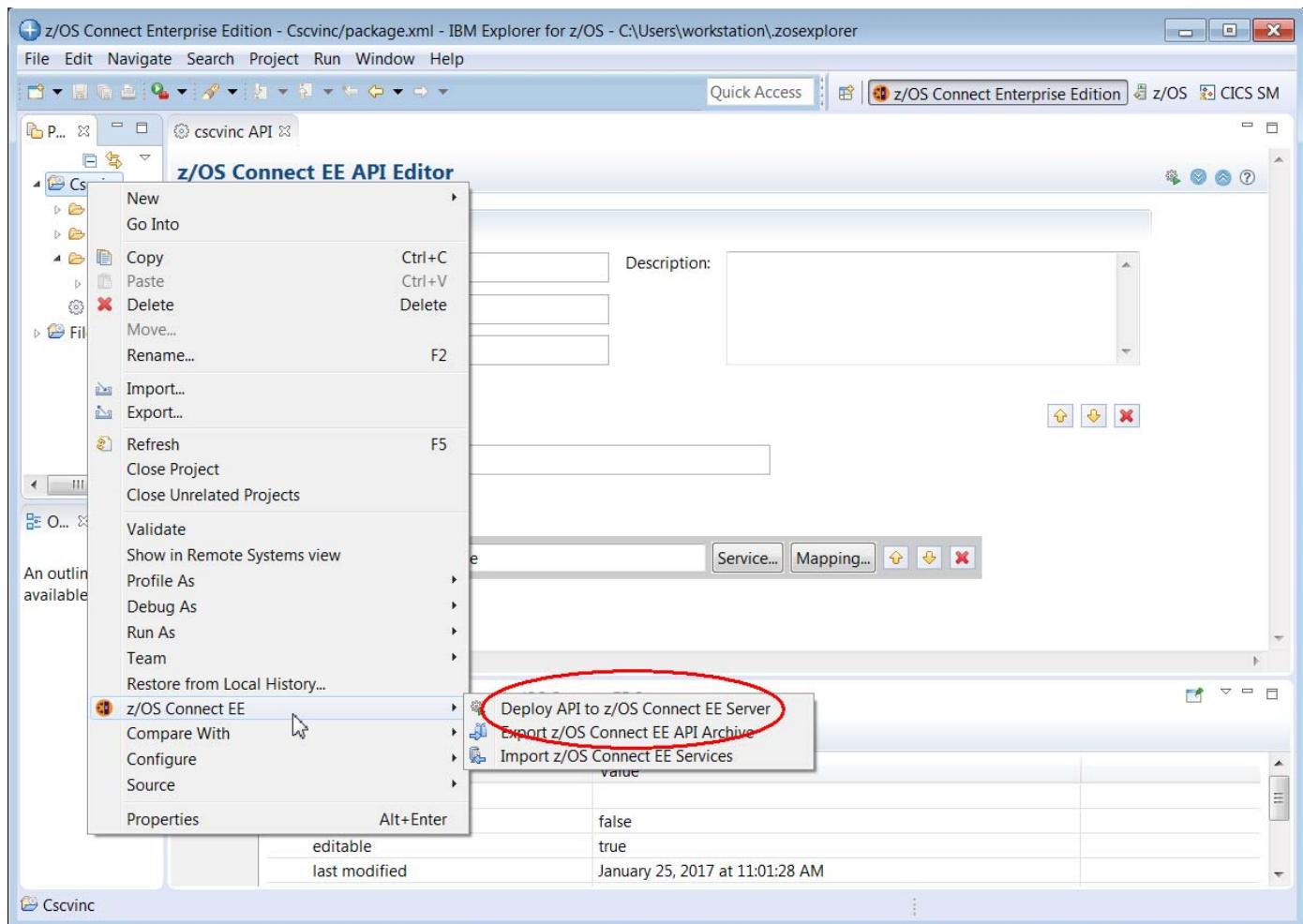
    <zosconnect_cicsIpicConnection id="cscvinc"
        host="wg31.washington.ibm.com"
        port="1491"/>

</server>
```

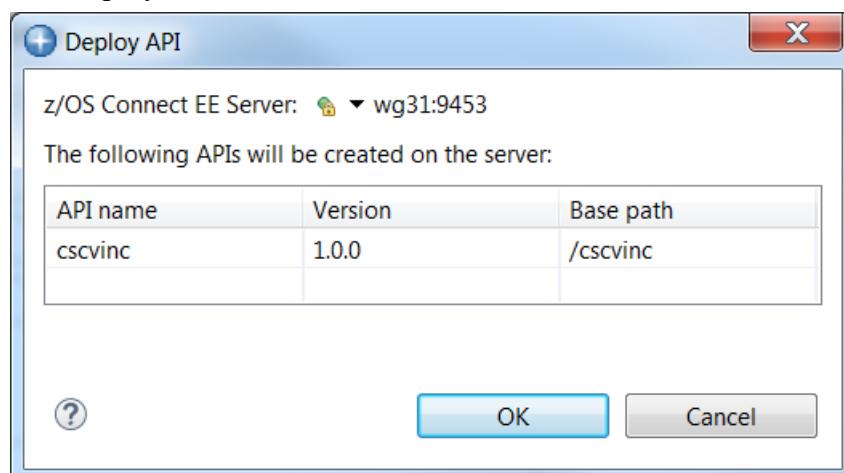
Figure 1 - *cscvinc.xml*

The *zosconnect_cicsIpicConnection* element provides the CICS IPIC information that will be used for communications with the CICS region,

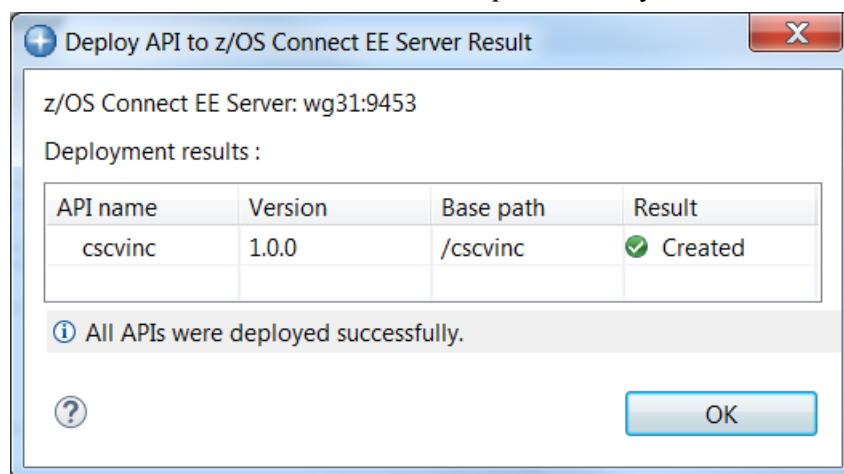
2. In the *Project Explorer* view (upper left), right-mouse click on the *Cscvinc* folder, then select *z/OS Connect EE* → *Deploy API to z/OS Connect EE Server*.



3. Since z/OS Explorer is connected to only one z/OS Connect server there is only one choice (wg31:9453). If z/OS Explorer had multiple host connections to z/OS Connect servers then the pull down arrow would allow a selection to which server to deploy. Click **OK** on this screen to continue.



4. The API artifacts will be transferred to z/OS and copied into the
`/var/ats//zosconnect/servers/zceesrv1/resources/zosconnect/apis` directory.

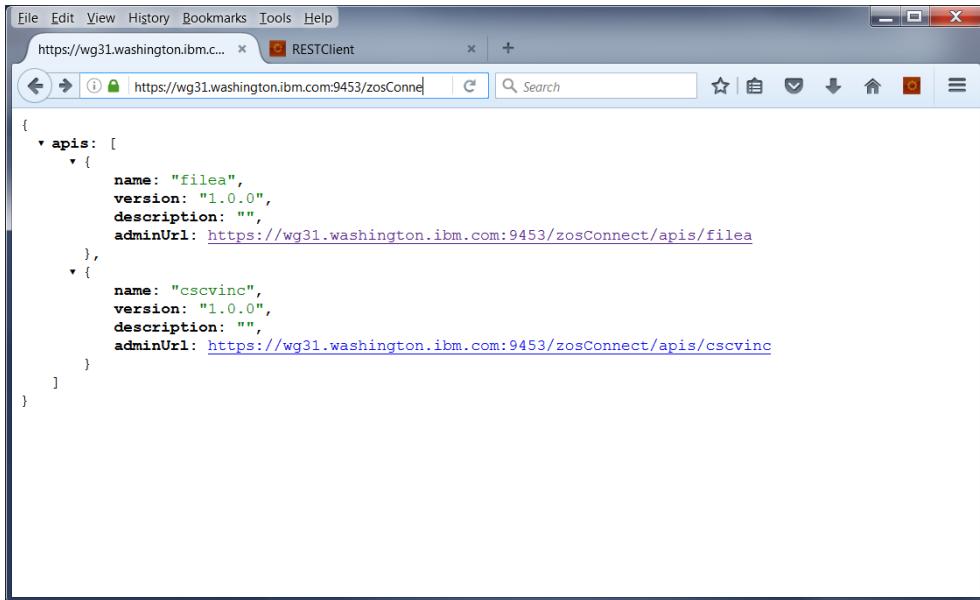


Test the APIs with a CICS Container Application

The CICS application used to test the API accesses the same VSAM file used in the previous section. It supports 4 RESTful APIs by provide a *request* field in the request, adding a record (**I** for **POST**), updating a record (**U** for **PUT**), retrieving a record (**S** for **GET**) and deleting a record (**D** for **DELETE**). To test the z/OS Connect API with this CICS application we will use the same browser plugin used earlier to test the API to the batch application.

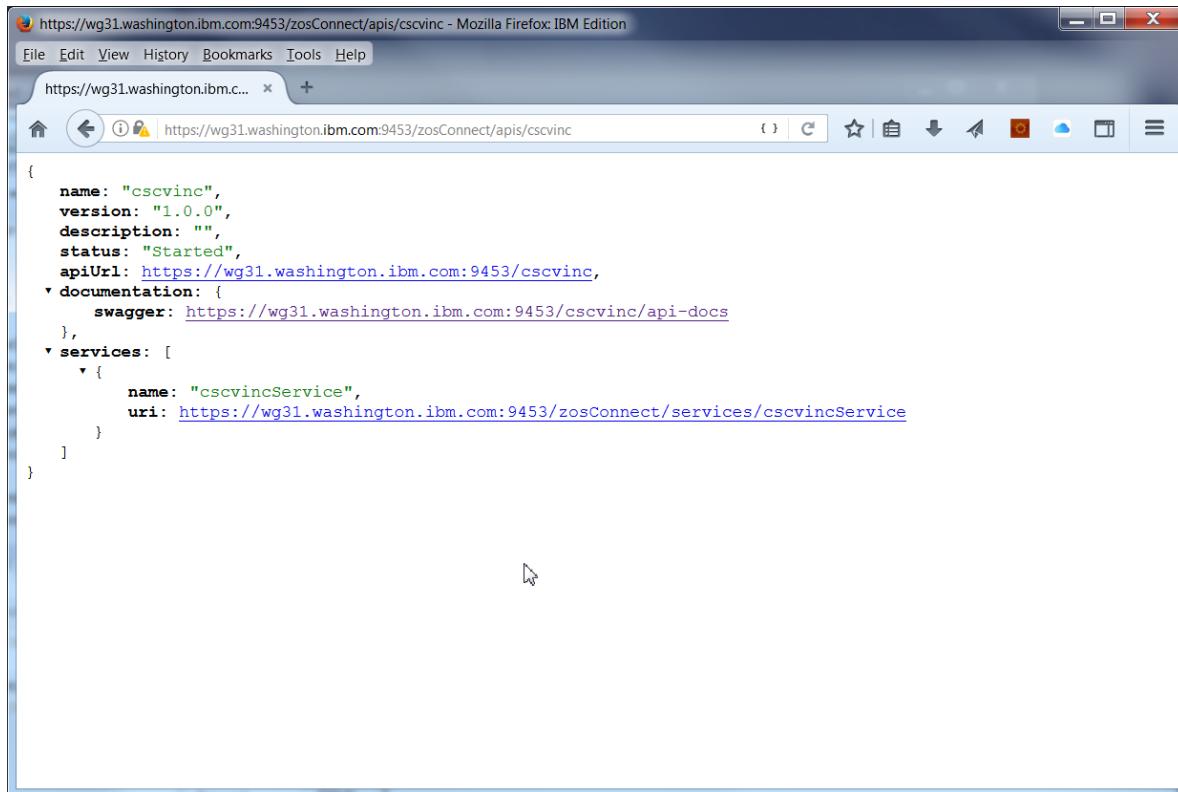
1. First enter URL <https://wg31.washington.ibm.com:9453/zosConnect/apis> in the Firefox browser and you should see the window below. The API *cscvinc* is now displayed. This is because this API was just deployed to this server.

Tech Tip: You may be challenged by Firefox because the digital certificate used by the Liberty z/OS server is self-signed Click the **Add Exception** button to continue. If the **Add Exception** button is not displayed click the **Advanced** button. Then click on the **Confirm Security Exception** button. Next you may see a prompt you for a userid and password. If you do see the prompt, enter the username **Fred** and password **fredpwd** (case matters) and click **OK**. Remember we are using basic security and this is the user identity and password defined in the server.xml file.



Tech Tip: It is very important to access the z/OS Connect server from a browser prior to any testing using the Swagger UI. Accessing a z/OS Connect URL from a browser starts an SSL handshake between the browser and the server. If this handshake has not performed prior to performing any test the test will fail with no message in the browser and no explanation. Ensuring this handshake has been performed is why you may be directed to access a z/OS Connect URL prior to using the Swagger UI during this exercise.

4. If you click on *adminUrl* URL the window below should be displayed.

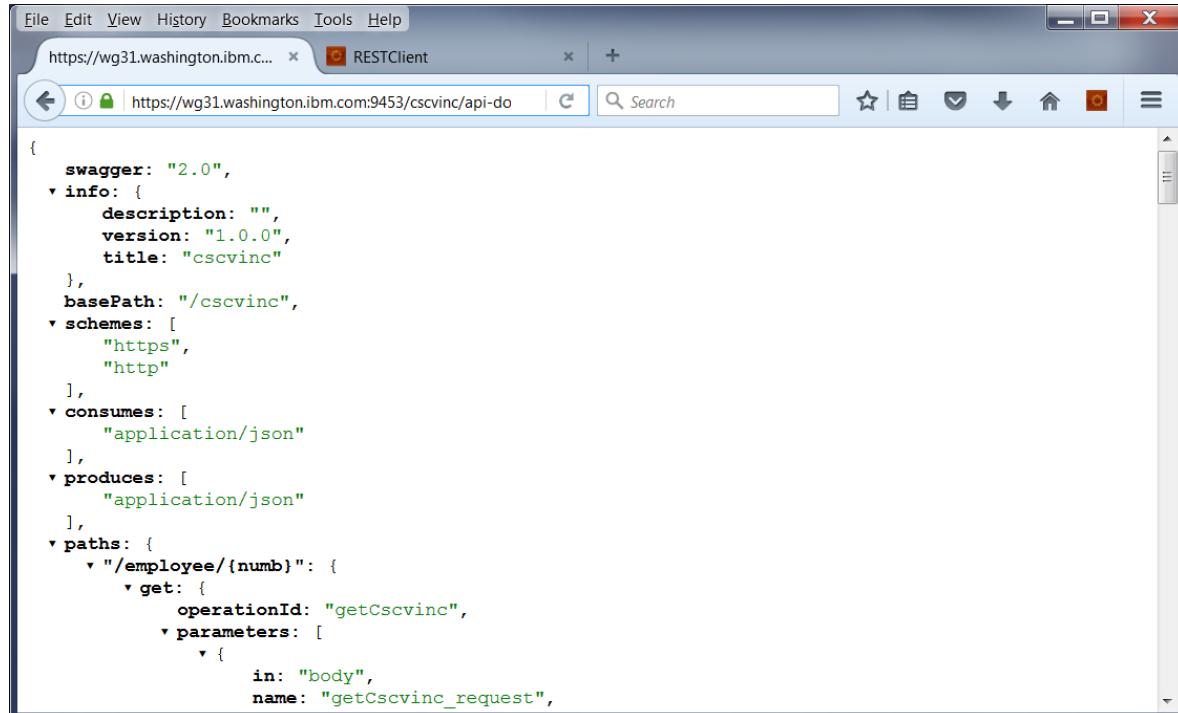


```

{
  "name": "cscvinc",
  "version": "1.0.0",
  "description": "",
  "status": "Started",
  "apiUrl": "https://wg31.washington.ibm.com:9453/cscvinc",
  "documentation": {
    "swagger": "https://wg31.washington.ibm.com:9453/cscvinc/api-docs"
  },
  "services": [
    {
      "name": "cscvincService",
      "uri": "https://wg31.washington.ibm.com:9453/zosConnect/services/cscvincService"
    }
  ]
}

```

3. Finally click on the *swagger* URL and you should see the Swagger document associated with this API.

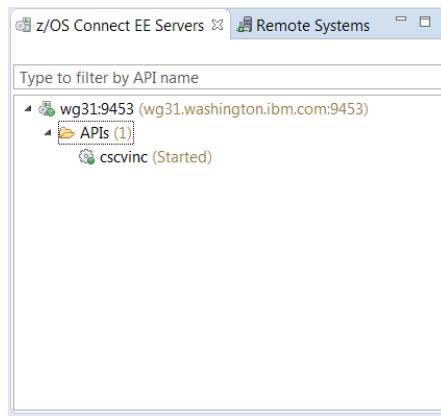


```

{
  "swagger": "2.0",
  "info": {
    "description": "",
    "version": "1.0.0",
    "title": "cscvinc"
  },
  "basePath": "/cscvinc",
  "schemes": [
    "https",
    "http"
  ],
  "consumes": [
    "application/json"
  ],
  "produces": [
    "application/json"
  ],
  "paths": {
    "/employee/{numb)": {
      "get": {
        "operationId": "getCscvinc",
        "parameters": [
          {
            "in": "body",
            "name": "getCscvinc_request",
            "schema": {
              "type": "object",
              "properties": {
                "numb": {
                  "type": "string"
                }
              }
            }
          }
        ]
      }
    }
  }
}

```

- ___ 4. Explore this Swagger document and you will see the results of the request and response mapping performed earlier. This document can be used by a developer or other tooling to develop REST clients for this specific API.
- ___ 5. In the lower left-hand side of the *z/OS Connect Explorer* perspective there is view entitled *z/OS Connect EE Servers*. Expand *wg31:9453* and the expand the *APIs* folder. You should see a list of the APIs installed in the server.



- ___ 6. Right mouse button click on *cscvinc* and select *Open in Swagger UI*. Click OK if an informational prompt appears. This will open a Firefox window showing a *Swagger* test client (see below).

The screenshot shows a Firefox browser window with the address bar set to `https://wg31.washington.ibm.c... /api-docs/wg31.washington.ibm.com_9453`. The page title is 'Swagger UI'. The main content area has a green header bar with the text 'swagger'. Below it, the text 'cscvinc' is displayed. Underneath, the word 'default' is followed by '[BASE URL: /cscvinc , API VERSION: 1.0.0]'. At the bottom right of the content area, there are links for 'Show/Hide', 'List Operations', and 'Expand Operations'.

7. Click the *List Operations* and the browser should show a list of the available HTTP methods like this:

8. Expand the GET operation by clicking on *Get* box and scroll down until the method *Parameters* are displayed as shown below:

Parameter	Value	Description	Parameter Type	Data Type
numb	(required)		path	string
Authorization			header	string

9. Enter **000100** in the area beside numb and click the **Try it Out!** button. Scroll down and you see the response.

Response Body

```
"Container1": {  
    "RESPONSE_CONTAINER": {  
        "CEIBRESP2": 0,  
        "FILEA_AREA": {  
            "STAT": "",  
            "ADDRX": "SURREY, ENGLAND",  
            "AMOUNT": "$0100.11",  
            "PHONE": "32156778",  
            "DATEX": "26 11 81",  
            "NUMB": "000100",  
            "COMMENT": "*****",  
            "NAME": "S. D. BORMAN"  
        },  
        "ACTION": "S",  
        "USERID": "CICSUSER",  
        "CEIBRESP": 0  
    }  
}
```

Response Code

```
200
```

10. In a new or existing 3270 session start a session with CICS, clear the screen and enter CICS transaction **CEDX CSMI** to start a CICS execution diagnostic facility (EDF) on transaction CSMI.
11. Send another GET API request and you should see the EDF session start in the 3270 session.

```

Session A
File Edit View Communication Actions Window Help
TRANSACTION: CSMI PROGRAM: DFHMIRS TASK: 0000857 APPLID: CICS53Z DISPLAY: 00
STATUS: PROGRAM INITIATION

EIBTIME      = 152920
EIBDATE      = 0117236
EIBTRNID     = 'CSMI'
EIBTASKN     = 857
EIBTRMID     = '/AC3'

EIBCPOSN    = 0
EIBCALEN    = 0
EIBAID      = X'00'
EIBFN       = X'0000'
EIBRCODE    = X'0000000000000000'
EIBDS       = '.....'
+ EIBREQID   = '.....'

ENTER: CONTINUE
PF1 : UNDEFINED      PF2 : SWITCH HEX/CHAR      PF3 : END EDF SESSION
PF4 : SUPPRESS DISPLAYS PF5 : WORKING STORAGE    PF6 : USER DISPLAY
PF7 : SCROLL BACK     PF8 : SCROLL FORWARD     PF9 : STOP CONDITIONS
PF10: PREVIOUS DISPLAY PF11: EIB DISPLAY        PF12: UNDEFINED
MA A
Connected to remote server/host wg31b using lu/pool TCP00111 and port 23
12/043

```

12. Use the **F9** key to set a stop condition. Set a stop on **EXEC CICS LINK** commands.

```

Session A - [24 x 80]
File Edit View Communication Actions Window Help
TRANSACTION: ABC1 PROGRAM: BBOACLNK TASK: 0001572 APPLID: CICS53Z DISPLAY: 00
DISPLAY ON CONDITION:-

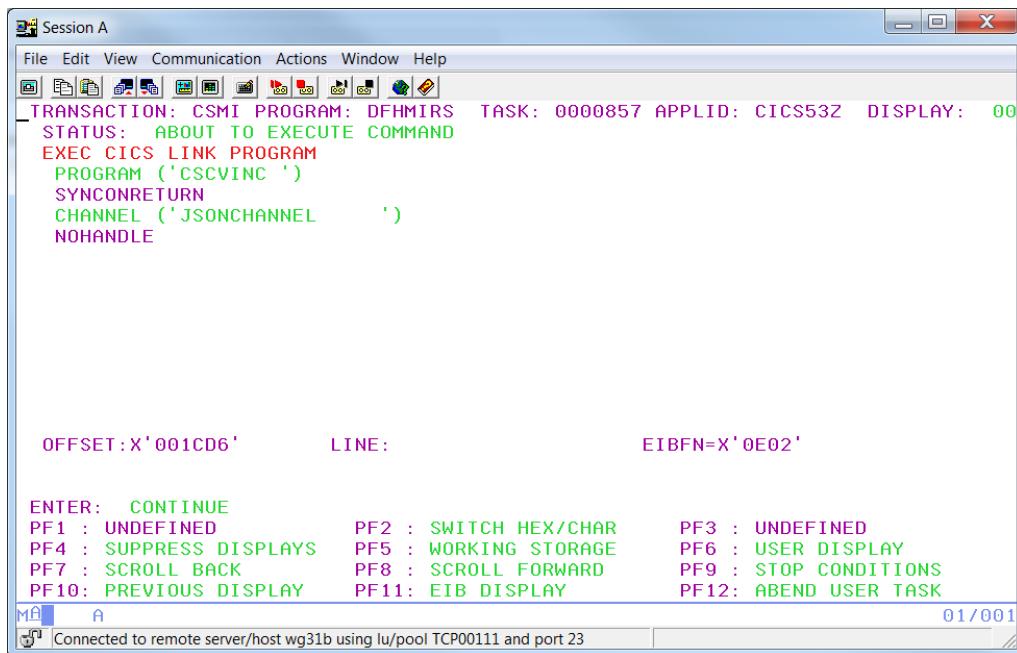
COMMAND:          EXEC CICS LINK_
OFFSET:           X'.....'
LINE NUMBER:      .....
CICS EXCEPTIONAL CONDITION: ERROR
ANY CICS CONDITION: NO
TRANSACTION ABEND: YES
NORMAL TASK TERMINATION: YES
ABNORMAL TASK TERMINATION: YES

DLI ERROR STATUS: ..
ANY DLI ERROR STATUS: ..

ENTER: CURRENT DISPLAY
PF1 : UNDEFINED      PF2 : UNDEFINED      PF3 : UNDEFINED
PF4 : SUPPRESS DISPLAYS PF5 : WORKING STORAGE PF6 : USER DISPLAY
PF7 : UNDEFINED      PF8 : UNDEFINED      PF9 : UNDEFINED
PF10: UNDEFINED     PF11: UNDEFINED     PF12: REMEMBER DISPLAY
MA A
Connected to remote server/host wg31 using lu/pool TCP00107 and port 23
04/044

```

13. Use the F4 key to suppress the intervening EDF displays. Eventually EDF will stop on an EXEC CICS LINK request.



```

Session A
File Edit View Communication Actions Window Help
TRANSACTION: CSMI PROGRAM: DFHMIRS TASK: 0000857 APPLID: CICS53Z DISPLAY: 00
STATUS: ABOUT TO EXECUTE COMMAND
EXEC CICS LINK PROGRAM
PROGRAM ('CSCVINC')
SYNCONRETURN
CHANNEL ('JSONCHANNEL')
NOHANDLE

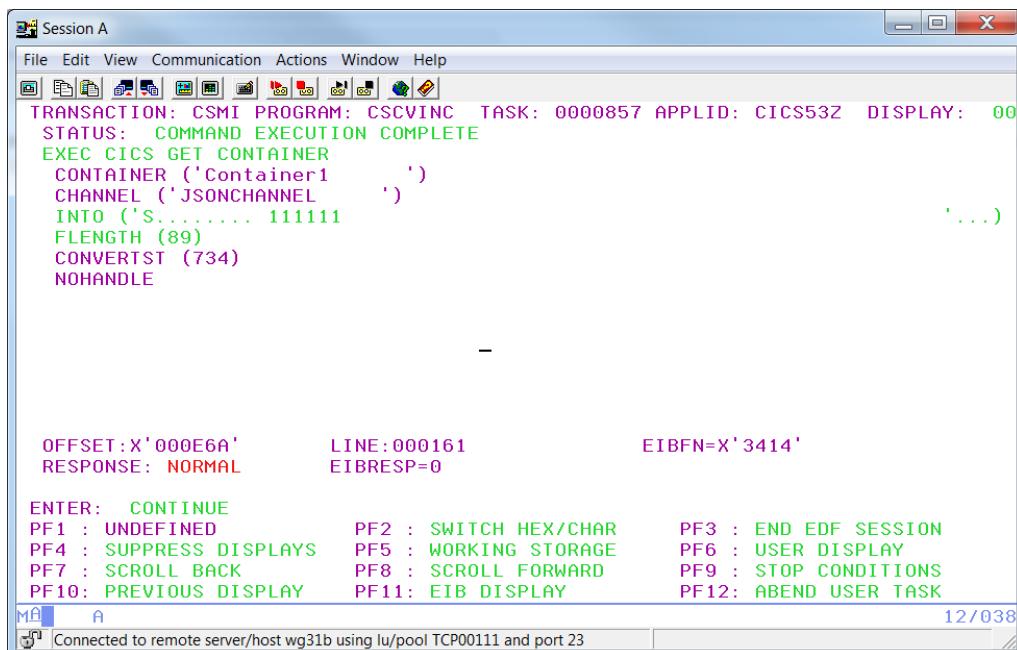
OFFSET:X'001CD6' LINE: EIBFN=X'0E02'

ENTER: CONTINUE
PF1 : UNDEFINED PF2 : SWITCH HEX/CHAR PF3 : UNDEFINED
PF4 : SUPPRESS DISPLAYS PF5 : WORKING STORAGE PF6 : USER DISPLAY
PF7 : SCROLL BACK PF8 : SCROLL FORWARD PF9 : STOP CONDITIONS
PF10: PREVIOUS DISPLAY PF11: EIB DISPLAY PF12: ABEND USER TASK
M A 01/001
Connected to remote server/host wg31b using lu/pool TCP00111 and port 23

```

Note that the channel name is not the one specified in the LS2JSCSC input. z/OS Connect will override that channel name and use its own name for the channel and container.

14. Keep pressing **ENTER** and eventually you will see the target program receive a NORMAL response to an **EXEC CICS GET CONTAINER** request.



```

Session A
File Edit View Communication Actions Window Help
TRANSACTION: CSMI PROGRAM: CSCVINC TASK: 0000857 APPLID: CICS53Z DISPLAY: 00
STATUS: COMMAND EXECUTION COMPLETE
EXEC CICS GET CONTAINER
CONTAINER ('Container1')
CHANNEL ('JSONCHANNEL')
INTO ('$..... 111111'...)
FLENGTH (89)
CONVERTST (734)
NOHANDLE

OFFSET:X'000E6A' LINE:000161 EIBFN=X'3414'
RESPONSE: NORMAL EIBRESP=0

ENTER: CONTINUE
PF1 : UNDEFINED PF2 : SWITCH HEX/CHAR PF3 : END EDF SESSION
PF4 : SUPPRESS DISPLAYS PF5 : WORKING STORAGE PF6 : USER DISPLAY
PF7 : SCROLL BACK PF8 : SCROLL FORWARD PF9 : STOP CONDITIONS
PF10: PREVIOUS DISPLAY PF11: EIB DISPLAY PF12: ABEND USER TASK
M A 12/038
Connected to remote server/host wg31b using lu/pool TCP00111 and port 23

```

15. Keep pressing ENTER and the EXEC CICS APIs in the target program will be traced in EDF. Eventually there will be EXEC CICS PUT CONTAINER execution which places the results container into the channel for return back to z/OS Connect for conversion to a JSON message.

```

Session A
File Edit View Communication Actions Window Help
TRANSACTION: CSMI PROGRAM: CSCVINC TASK: 0000857 APPLID: CICS53Z DISPLAY: 00
STATUS: COMMAND EXECUTION COMPLETE
EXEC CICS PUT CONTAINER
CONTAINER ('Container1      ')
FROM ('S.....CICSUSER 111111C. BAKER          OTTAWA, ONTARIO      ')
FLENGTH (97)
NOHANDLE

-
OFFSET:X'0014C2'           LINE:000259           EIBFN=X'3416'
RESPONSE: NORMAL          EIBRESP=0

ENTER: CONTINUE
PF1 : UNDEFINED           PF2 : SWITCH HEX/CHAR   PF3 : END EDF SESSION
PF4 : SUPPRESS DISPLAYS   PF5 : WORKING STORAGE   PF6 : USER DISPLAY
PF7 : SCROLL BACK         PF8 : SCROLL FORWARD   PF9 : STOP CONDITIONS
PF10: PREVIOUS DISPLAY    PF11: EIB DISPLAY       PF12: ABEND USER TASK
M A
Connected to remote server/host wg31b using lu/pool TCP00111 and port 23 10/041

```

16. Use the **F3** key to terminate the EDF tracing.

17. Back in the Swagger-UI browser session scroll up to the list of operations and select the *Delete* operation.

Method	Path
POST	/employee
PUT	/employee
DELETE	/employee/{numb}
GET	/employee/{numb}

[BASE URL: /cscvinc , API VERSION: 1.0.0]

18. Scroll down to display the details of the DELETE parameters. Enter **666666** in the area beside *numb* and **Basic RnJIZDpmcmVkcHdk** in the area beside *Authorization*.

DELETE /employee/{numb}

Response Class (Status 200)
normal response

Model Example Value

```
{
  "cscvincServiceOperationResponse": {
    "Container1": {
      "RESPONSE_CONTAINER": {
        "CEIBRESP": 0,
        "CEIBRESP2": 0,
        "USERID": "string",
        "FILEA_AREA": {
          "NUMB": "string"
        }
      }
    }
  }
}
```

Response Content Type application/json ▾

Parameters

Parameter	Value	Description	Parameter Type	Data Type
numb	666666		path	string
Authorization	Basic RnJIZDpmcmVkcHdk		header	string

Try it out!

19. Press the **Try it out!** Button and you see the results in the response body. (Both CEIBRESP and CEIBRESP2 set to zero indicates the CICS program was able to delete the record successfully).

Response Body

```
{
  "cscvincServiceOperationResponse": {
    "Container1": {
      "RESPONSE_CONTAINER": {
        "CEIBRESP2": 0,
        "FILEA_AREA": {
          "NUMB": "666666"
        },
        "USERID": "CICSUMER",
        "CEIBRESP": 0
      }
    }
  }
}
```

Response Code

```
200
```

Response Headers

```
{
  "content-type": "application/json",
  "content-language": "en-US",
  "expires": "Thu, 01 Dec 1994 16:00:00 GMT",
  "cache-control": "no-cache=\"set-cookie, set-cookie2\""
}
```

20. Try using the Swagger-UI to test the other operations (PUT and POST) with the other records

l. stat	numb	name	addrx	Phone	datex	amount	comment
Y	000100	S. D. BORMAN	SURREY, ENGLAND	32156778	26 11 81	\$0100.11	*****
Y	000102	J. T. CZAYKOWSKI	WARWICK, ENGLAND	98356183	26 11 81	\$1111.11	*****
Y	000104	M. B. DOMBEY	LONDON, ENGLAND	12846293	26 11 81	\$0999.99	*****
Y	000106	A. I. HICKSON	CROYDON, ENGLAND	19485673	26 11 81	\$0087.71	*****
Y	000111	ALAN TULIP	SARATOGA, CALIFORNIA	46120753	01 02 74	\$0111.11	*****
Y	000762	SUSAN MALAIKA	SAN JOSE, CALIFORNIA	22312121	01 06 74	\$0000.00	*****
Y	000983	J. S. TILLING	WASHINGTON, DC	34512120	21 04 75	\$9999.99	*****
Y	001222	D.J.VOWLES	BOBLINGEN, GERMANY	70315551	10 04 73	\$3349.99	*****
Y	001781	TINA J YOUNG	SINDELFINGEN, GERMANY	70319990	21 06 77	\$0009.99	*****
Y	003210	B.A. WALKER	NICE, FRANCE	12345670	26 11 81	\$3349.99	*****
N	003214	PHIL CONWAY	SUNNYVALE, CAL.	34112120	00 06 73	\$0009.99	*****
N	003890	BRIAN HARDER	NICE FRANCE	00000000	28 05 74	\$0009.99	*****
N	004004	JANET FOUCHE	DUBLIN, IRELAND	71112121	02 11 73	\$1259.99	*****
N	004445	DR. P. JOHNSON	SOUTH BEND, S.DAK.	61212120	26 11 81	\$0009.99	*****
N	004878	ADRIAN JONES	SUNNYVALE, CALIF.	32212120	10 06 73	\$5399.99	*****
N	005005	A. E. DALTON	SAN FRANCISCO, CA.	00000001	01 08 73	\$0009.99	*****
N	005444	ROS READER	SARATOGA, CALIF.	67712120	20 10 74	\$0809.99	*****
N	005581	PETE ROBBINS	BOSTON, MASS.	41312120	11 04 74	\$0259.99	*****
Y	006016	SIR MICHAEL ROBERTS	NEW DELHI, INDIA	70331211	21 05 74	\$0009.88	*****
N	006670	IAN HALL	NEW YORK, N.Y.	21212120	31 01 75	\$3509.88	*****
Y	006968	J.A.L. STAINFORTH	WARWICK, ENGLAND	56713821	26 11 81	\$0009.88	*****
N	007007	ANDREW WHARMBY	STUTTGART, GERMANY	70311000	10 10 75	\$5009.88	*****
N	007248	M. J. AYRES	REDWOOD CITY, CALF.	33312121	11 10 75	\$0009.88	*****
Y	007779	MRS. A. STEWART	SAN JOSE, CALIF.	41512120	03 01 75	\$0009.88	*****
Y	009000	P. E. HAVERCAN	WATERLOO, ONTARIO	09876543	21 01 75	\$9000.00	*****
Y	100000	M. ADAMS	TORONTO, ONTARIO	03415121	26 11 81	\$0010.00	*****
Y	111111	C. BAKER	OTTAWA, ONTARIO	51212003	26 11 81	\$0011.00	*****
Y	200000	S. P. RUSSELL	GLASGOW, SCOTLAND	63738290	26 11 81	\$0020.00	*****
Y	222222	DR E. GRIFFITHS	FRANKFURT, GERMANY	20034151	26 11 81	\$0022.00	*****
Y	300000	V. J. HARRIS	NEW YORK, U.S.	64739801	26 11 81	\$0030.00	*****
Y	333333	J.D. HENRY	CARDIFF, WALES	78493020	26 11 81	\$0033.00	*****
Y	400000	C. HUNT	MILAN, ITALY	25363738	26 11 81	\$0040.00	*****
Y	444444	D. JACOBS	CALGARY, ALBERTA	77889820	26 11 81	\$0044.00	*****
Y	500000	P. KINGSLEY	MADRID, SPAIN	44454640	26 11 81	\$0000.00	*****
Y	555555	S.J. LAZENBY	KINGSTON, N.Y.	39944420	26 11 81	\$0005.00	*****
Y	600000	M.F. MASON	DUBLIN, IRELAND	12398780	26 11 81	\$0010.00	*****
Y	666666	R. F. WALLER	LA HULPE, BRUSSELS	42983840	26 11 81	\$0016.00	*****
Y	700000	M. BRANDON	DALLAS, TEXAS	57984320	26 11 81	\$0002.00	*****
Y	777777	L.A. FARMER	WILLIAMSBURG, VIRG.	91876131	26 11 81	\$0027.00	*****
Y	800000	P. LUPTON	WESTEND, LONDON	24233389	26 11 81	\$0030.00	*****
Y	888888	P. MUNDY	NORTHAMPTON, ENG.	23691639	26 11 81	\$0038.00	*****
Y	900000	D.S. RENSHAW	TAMPA, FLA.	35668120	26 11 81	\$0040.00	*****
Y	999999	ANJI STEVENS	RALEIGH, N.Y.	84591639	26 11 81	\$0049.00	*****

Summary

You have verified the API. The service layer is what does the data conversion and mapping and the IPIC connection to the backend program. The API layer provides a further level of abstraction and allows a more flexible use of HTTP verbs, and better mapping of data via the API editor function.