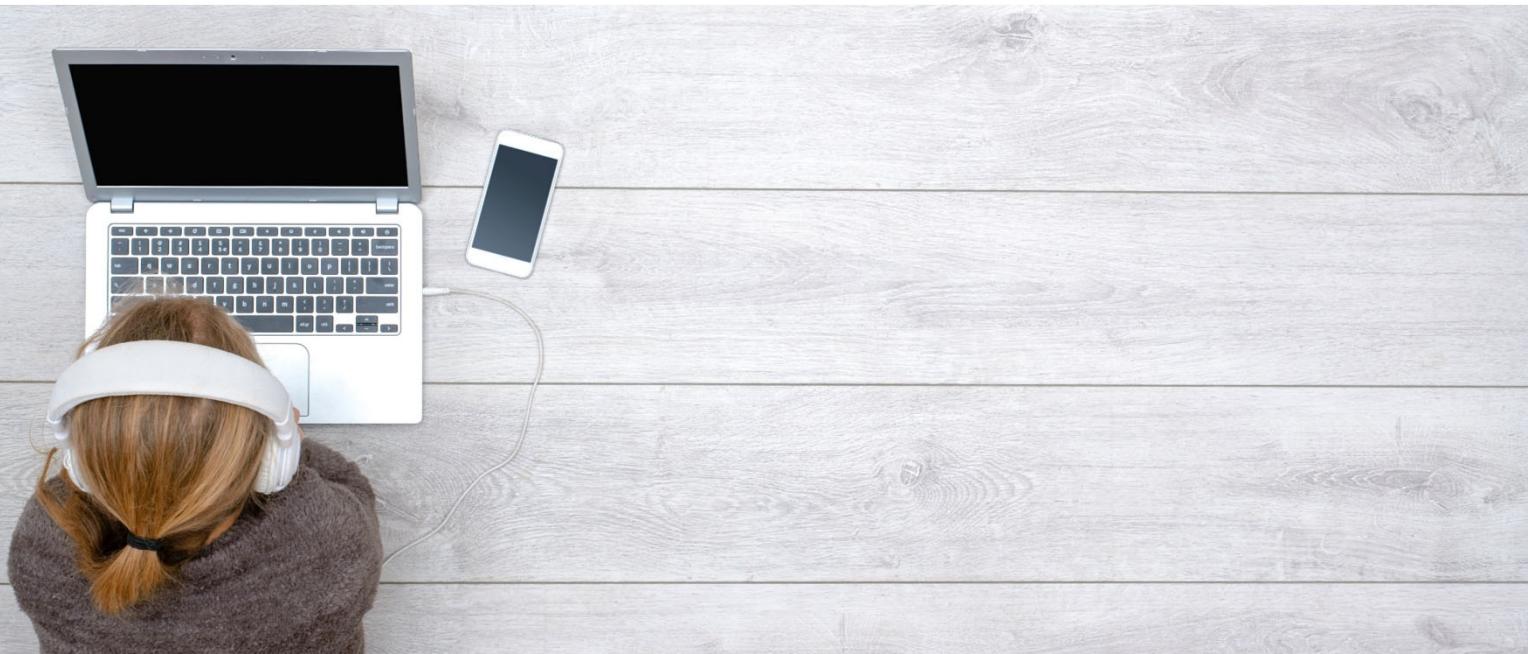


Exercise Guide

IBM App Connect Enterprise 12 Application Development I

Course code WM686 / ZM686 ERC 2.0



IBM Training

IBM

May 2024 edition

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Exercise description

After completing the exercises, students should be able to:

- Describe the features and uses of IBM App Connect Enterprise. Develop, deploy, and test message flow applications.
- Generate message flow applications from predefined patterns.
- Use the IBM App Connect Enterprise web user interface to monitor an integration server and message flow.
- Describe the function and appropriate use of IBM App Connect Enterprise processing nodes.
- Add flow control to a message flow application.
- Create reusable subflows.
- Process file data in message flows.
- Test message flows using the message flow debugger.
- Develop and test REST APIs.

Exercise list

This course includes the following exercises:

- [Exercise 1, "Importing and testing a message flow"](#)
- [Exercise 2, "Create a message flow application"](#)
- [Exercise 3, "Adding flow control to a message flow application"](#)
- [Exercise 4, "Processing file data"](#)
- [Exercise 5, "Developing a REST API"](#)
- [Exercise 6, "Invoking a REST API"](#)
- [Exercise 7, "Testing message flows"](#)

The exercises in this course use a set of lab files that include scripts, files, solution files, and others. The course lab files can be found in the following directory:

C:\labfiles

The exercises point you to the lab files as you need them.

User accounts

Type	User ID	Password
Operating System	Administrator	passw0rd
Developer user	aceadmin	passw0rd

Checking for course corrections



Important

Online course material updates might exist for this course. To check for updates and course abstracts, go to the IBM Cloud Course Information home page: <https://ibm.biz/CourseInfo>

Exercise structure

Each exercise is divided into sections with a series of numbered steps and lettered substeps:

- The numbered steps (1, 2, 3) describe what actions to do.
- The lettered substeps (a, b, c) provide detailed guidance on how to complete the action.

As shown in this example, the numbered step (“3”) tells you to change the value in a rule. Substeps “a” and “b” provide details on how to edit.

3. Edit the rule and change the debt-to-income ratio from 0.3 to 0.5.

a. Click **Edit this rule** (the pencil icon) to open the rule editor.



b. In the **if** part of the rule, change 0.3 to: 0.5

if
the yearly repayment of '**the loan**' is more than the yearly income of '**the borrower**' * **0.5**

If you already know how to edit rules and change values, you can skip the details in substeps 3a and 3b.

Text highlighting in exercises

Different text styles indicate various elements in the exercises.

Words that are highlighted in **bold font** represent GUI items that you interact with, such as:

- Menu items
- Field names
- Icons

Words that are highlighted with a `code font` include the following items:

- Text that you type or enter as a value
- System messages
- Directory paths
- Code

Tracking your progress

As shown in the example step, you can see that an underscore precedes each numbered step and lettered substep.

You are encouraged to use these markers to track your progress by checking off each step as you complete it. Tracking your progress in this manner might be useful if you are interrupted while working on an exercise.

Required exercise sections

Most exercises include required sections that should always be completed. It might be necessary to complete these sections before you can start subsequent exercises.

Dependencies between exercises are listed in the exercise introduction.

Exercise 1. Importing and testing a message flow

Estimated time

01:00

Overview

This exercise introduces you to the IBM App Connect development environment. To become familiar with the IBM App Connect Enterprise Toolkit views and navigator, you import a simple message flow project and examine the message flow components and properties. You also use the IBM App Connect Enterprise Toolkit Flow exerciser to test the message flow. Before importing the message flow, you create and start an integration server.

Objectives

After completing this exercise, you should be able to:

- Create and start an integration server
- Import an IBM App Connect Enterprise project interchange file
- Use the Message Flow editor to examine the message flow components and properties
- Test the message flow by using the IBM App Connect Enterprise Toolkit Flow exerciser

Introduction

The Auto Sport company would like to know how they can design their message flows so they can be run in either on-premises or in the cloud. This exercise creates an independent integration server and imports and tests a basic message flow. It also shows the differences between deploying to independent integration servers versus integration nodes.

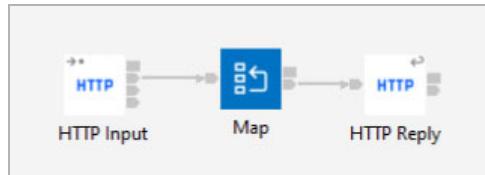
Using an independent integration server has the following benefits:

- Natural choice for running docker containers
- Run directly from a command console environment
- Controlled through their administrative REST API
- Receive configuration at start-up time

In the first part of this exercise, you use the command prompt utility to create an independent integration server. Independent integration servers are quick to start in IBM App Connect Enterprise software. The ability to quickly start an Independent integration server is important when you are working in a development phase of your project or trying out the product for the first time. You can configure multiple integration servers, each with their own identity, and deploy

them either to containers in the cloud or in an on-premises environment. After the integration server is running, you access it from the IBM App Connect Enterprise Toolkit.

In the second part of this exercise, you import an IBM App Connect Enterprise project interchange (.zip) file that contains a simple application. The application contains a simple message flow that receives XML data over HTTP. The flow transforms the input XML structure into a different output XML structure by using a Mapping node, and sends this back to the HTTP request.



The message flow contains three nodes.

- An HTTP Input that receives the message
- A Mapping node that is named Map that transforms the message.
- An HTTP Reply node the returns the message

You learn more about these nodes later in the course.

In the third part of this exercise, you examine the message flow and learn how to access message flow node properties, terminal information, and connection information. You also use the XML Schema editor to examine an XML schema and the Graphical Map editor to examine an App Connect Enterprise map.

In the fourth part of this exercise, you use the Flow exerciser to deploy and test a message flow application. The project interchange file contains a sample XML that you use to test the message flow by using the IBM App Connect Enterprise Toolkit Flow exerciser.

The `<SalesEnvelope>` portion of the message is shown here. It contains a header, sales list, and trailer.

```

<SaleEnvelope>
  <Header>
    <SaleListCount>1</SaleListCount>
    <TransformationType>xsl</TransformationType> <
  /Header>
  <SaleList>
    <Invoice>
      <Initial>K</Initial>
      <Initial>A</Initial>
      <Surname>Braithwaite</Surname>
      <Item>
        <Code>00</Code>
        <Code>01</Code>
        <Code>02</Code>
        <Description>Dodge Dart</Description>
        <Category>Used Cars</Category>
        <Price>12800.00</Price>
        <Quantity>01</Quantity>
      </Item>
      <Item>
        <Code>02</Code>
        <Code>03</Code>
        <Code>01</Code>
        <Description>Chevrolet Corvette</Description>
        <Category>New Cars</Category>
        <Price>68500.00</Price>
        <Quantity>01</Quantity>
      </Item>
      <Balance>12500.00</Balance>
      <Currency>USD</Currency>
    </Invoice>
    ...Another invoice
  </SaleList>
  <Trailer>
    <CompletionTime>12.00.00</CompletionTime>
  </Trailer>
</SaleEnvelope>

```

The Mapping node in the message flow transforms the input message. The <SalesEnvelopeA> portion of the output message is shown here.

```

<SaleEnvelopeA>
  <SaleListA>
    <Statement>
      <Customer>
        <Initials>KA</Initials>
        <Name>Braithwaite</Name>
        <Balance>12500.00</Balance>
      </Customer>
      <Purchases>
        <Article>
          <Desc>Dodge Dart</Desc>
          <Cost>20480</Cost>
          <Qty>01</Qty>
        </Article>
        <Article>
          <Desc>Chevrolet Corvette</Desc>
          <Cost>109600</Cost>
          <Qty>01</Qty>
        </Article>
      </Purchases>
      <Amount> 130080
        <Currency>USD</Currency>
      </Amount>
      <Style>Full</Style>
      <Type>Monthly</Type>
    </Statement>
    ...Another Statement
  </SaleListA>
</SaleEnvelopeA>
```

Requirements

This lab requires the following elements:

- A lab environment with the IBM App Connect Enterprise Toolkit
- The lab files in the C:\labfiles\Lab01-TestSimpleFlow directory

Exercise instructions

Part 1: Create the integration server by using the Console

In this part of the exercise, you create and start an integration server. Then, you access the server in the IBM App Connect Enterprise Toolkit so that you can develop and test a simple message flow.

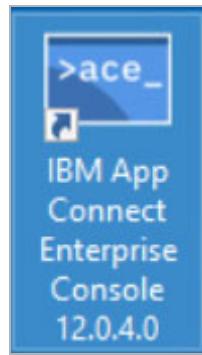
- __ 1. Create and start an integration server.

- __ a. You should be logged in with username `aceadmin`. If not, Log in to the course image by using the following credentials

User name: `aceadmin`

Password: `passw0rd`

- __ b. Open the IBM App Connect Enterprise Console.



Before you start an integration server for the first time, you create a working directory

- __ c. Create a work directory for your integration server, by running the `mqsicreateworkdir` command, specifying the full path to the directory that you want to create. Enter the following command in the App Connect Enterprise Console:

```
mqsicreateworkdir C:\aceserver
```

- __ d. Start the integration server by running the `IntegrationServer` command. Enter the following command in the Console:

```
IntegrationServer --name server1 --work-dir C:\aceserver
```

When the integration server is ready, a message appears announcing that the initialization is complete.

You can now interact with the running integration server; for example, by using the Enterprise Toolkit or the web username interface. You can minimize this window, but do not close it.



Information

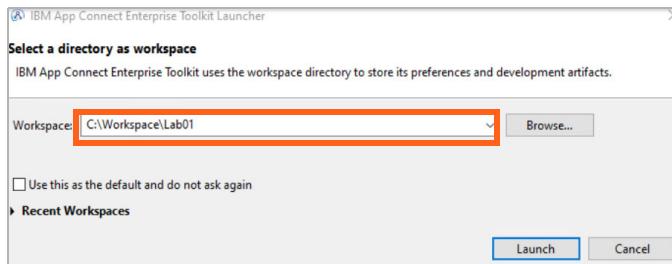
You must create an integration server before you can deploy integration solutions and related resources. You can create integration servers by using the IBM App Connect Enterprise Toolkit, the web user interface, or commands.

In this exercise, you create an independent integration server in the App Connect Enterprise Console. In the remaining exercises, you create the integration server from the App Connect Toolkit.

- __ 2. Use the IBM App Connect Enterprise Toolkit to connect to the integration server.
 - __ a. Start the IBM App Connect Enterprise Toolkit by double-clicking the **IBM App Connect Enterprise Toolkit 12.0.4.0** shortcut on the desktop.



- __ b. You can also start the IBM App Connect Enterprise Toolkit by clicking **Start > All Programs > IBM App Connect Enterprise Toolkit 12.0.4.0 > IBM App Connect Enterprise Toolkit 12.0.4.0** from the Windows desktop.
- __ c. For the Workspace, enter `C:\Workspace\Lab01`



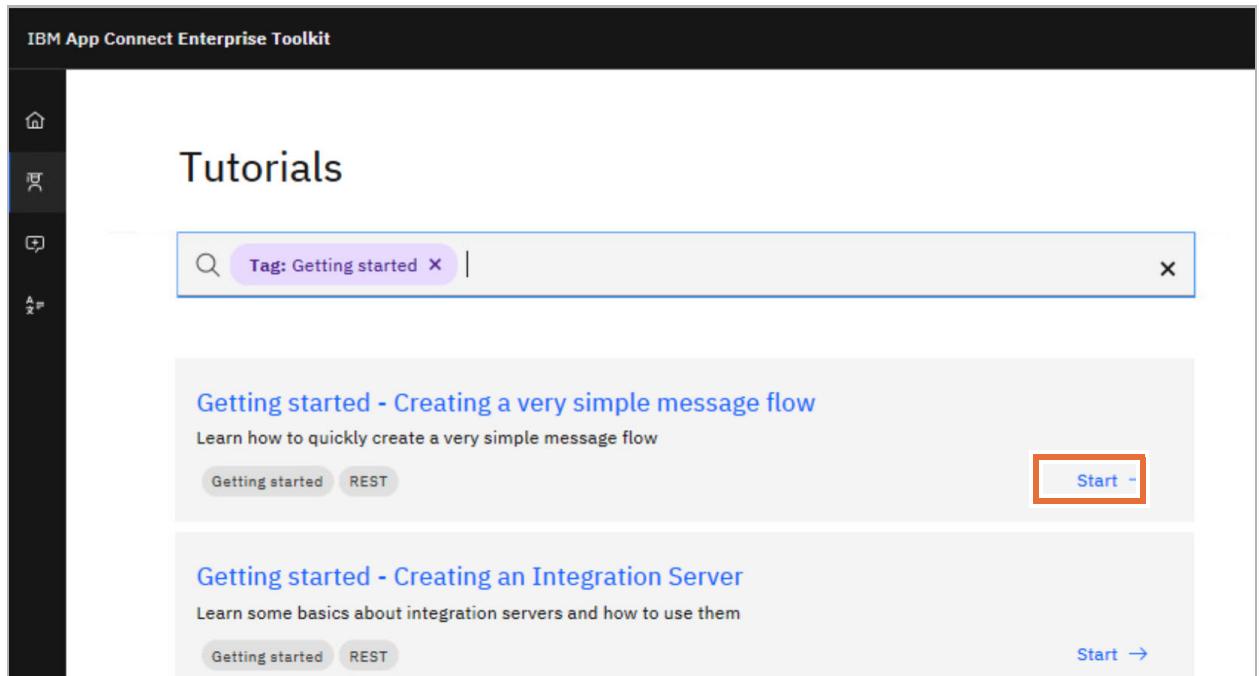
At the beginning of each lab, you create a new folder that contains the exercises artifacts.

- __ d. Click **Launch**. After several moments, the IBM App Connect Enterprise Toolkit starts and the Welcome page displays.

Part 2: Explore the Welcome page and perspectives

- __ 1. Explore the Tutorials.
 - __ a. On the Welcome page, click the **Tutorials** tile.
 - __ b. In the Search bar, enter Getting started and press **Enter**.

- __ c. IBM App Connect Enterprise lists all the **Getting started Tutorials**. Click **Start** on the first tutorial titled: **Getting started - Creating a very simple message flow**.

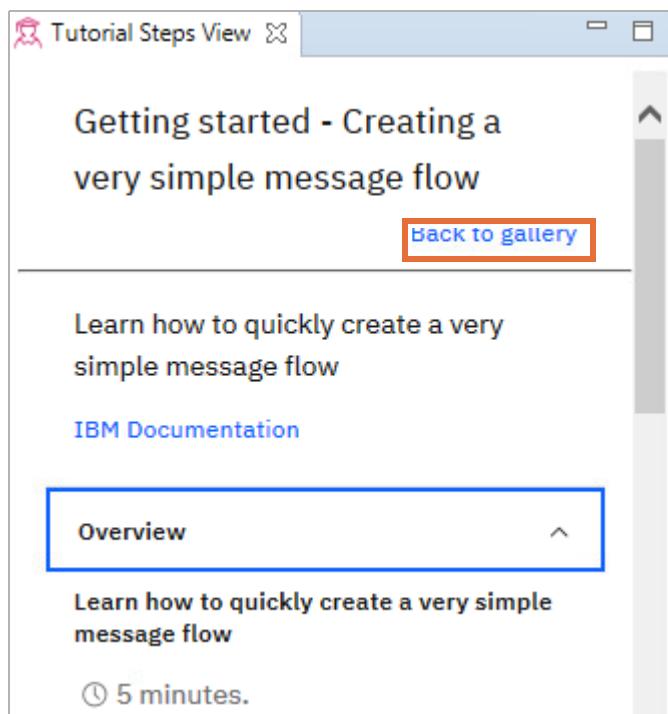


IBM App Connect Enterprise opens with the **Tutorial Steps View** panel on the right.

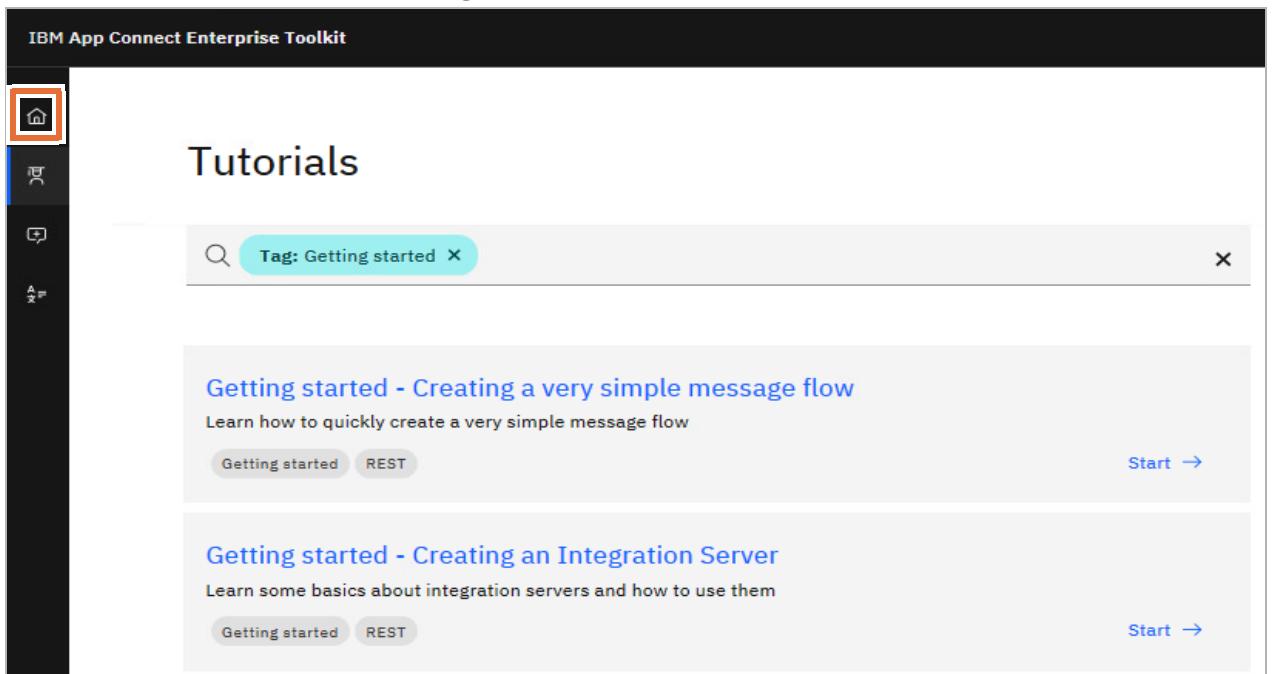
- __ d. Expand the **Overview** section.

IBM App Connect Enterprise provides the details that are related to the tutorial. You can use tutorials to improve your skills and try different features of the product.

- __ e. Click **Back to gallery**.



- 2. Explore what is new in the current version. Click **Welcome** in the navigation bar to the left to return to the Welcome page.



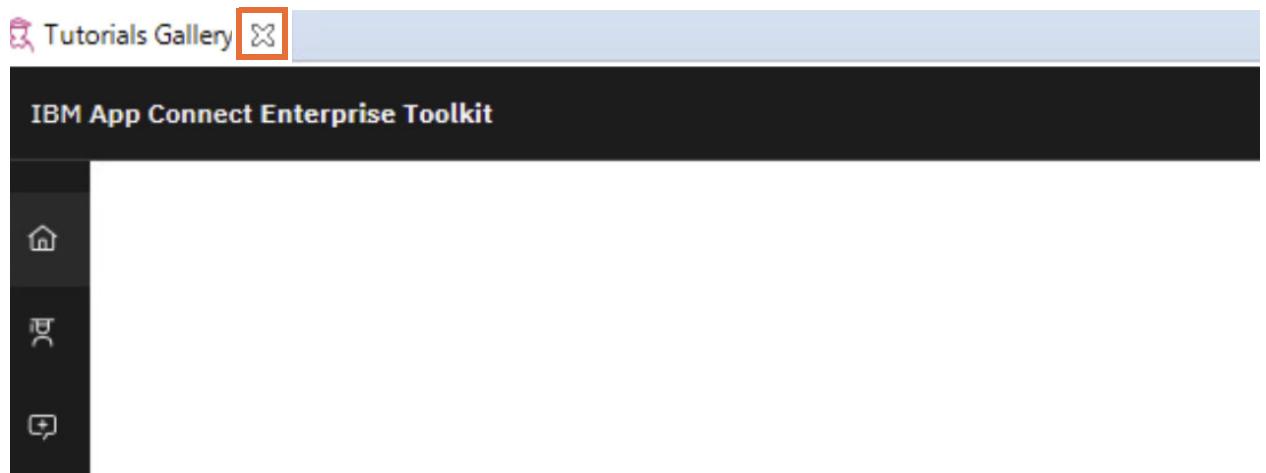
- f. Click the **What's new?** panel.

IBM App Connect Enterprise opens a new window with Help contents that are related to what is new in the current version.

If you are a user of a previous version of IBM App Connect Enterprise or IBM Integration Bus, you can find out what is new in IBM App Connect Enterprise 12.0

- g. Close the window.

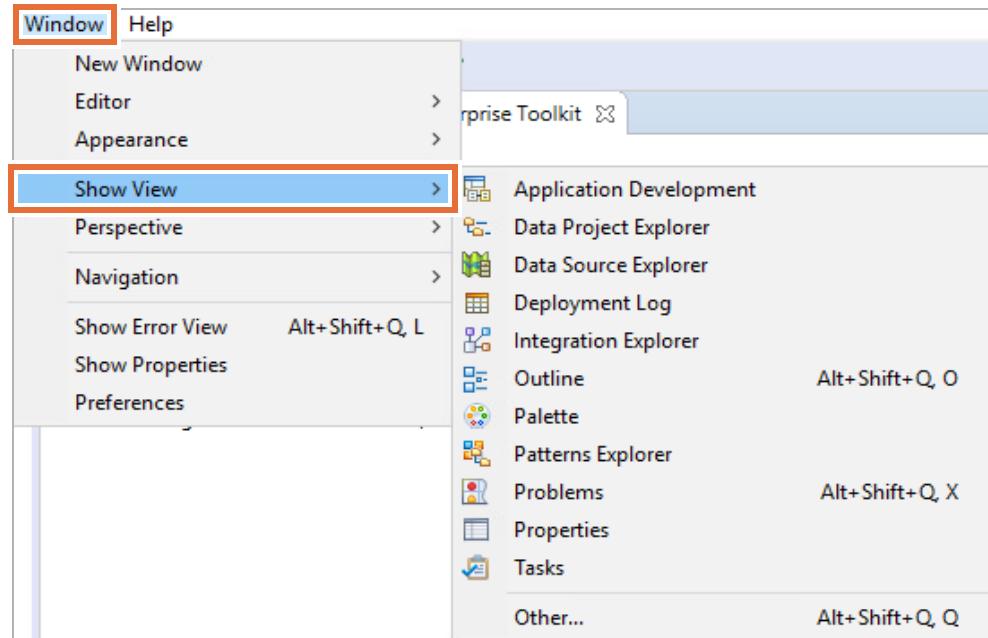
- h. Close the Tutorials Gallery tab.



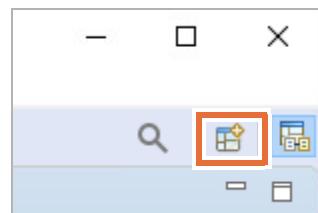
- 3. Explore perspectives.

A perspective is a group of views and editors that show various aspects of the resources in the **IBM App Connect Enterprise Toolkit**.

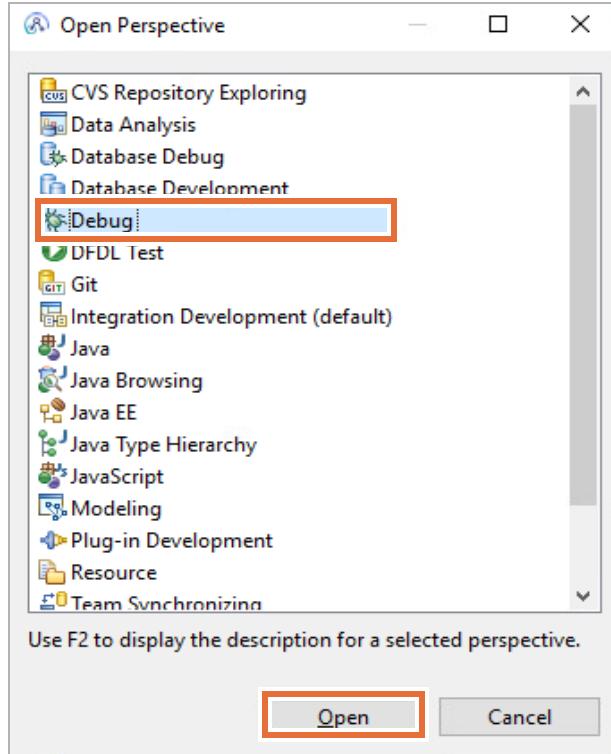
- a. To display the views that make up the current perspective, click **Window > Show View**



- b. To change the perspective, click **Open Perspective** in the upper right.

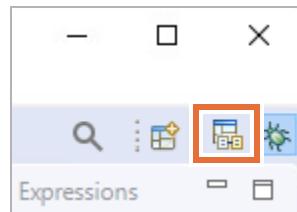


- c. In the **Open Perspective** window, select **Debug** and click **Open**.



IBM App Connect Enterprise opens the new perspective and places the **Debug** perspective icon next to the **Integration Development** perspective icon in the upper right. You use this perspective later in the course.

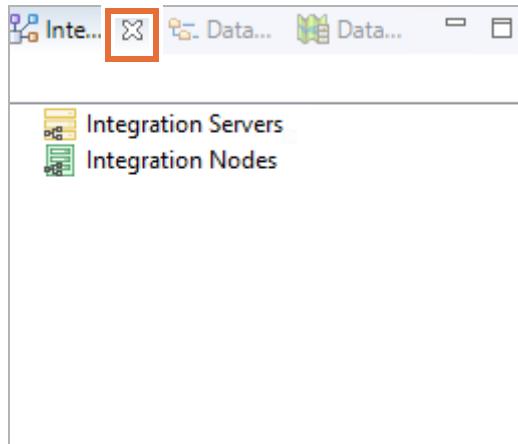
- d. Return to the **Integration Development** perspective by clicking the icon in the upper right corner.



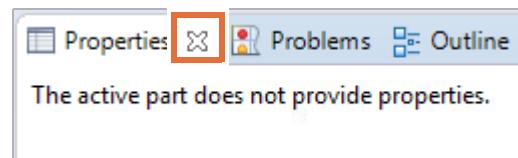
-- 4. Reset the perspective.

If you inadvertently close a view or alter your perspective, you can reset it back to the default layout.

-- a. In the lower left corner, close the **Integration Explorer** by clicking the X in the tab.

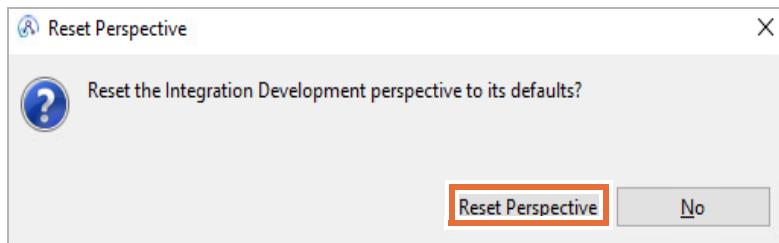


-- b. Close the **Properties** tab.



-- c. Reset the perspective by expanding **Window > Perspective > Reset Perspective**.

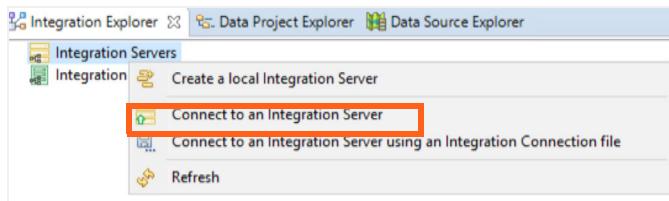
-- d. Click **Reset Perspective**.



-- e. IBM App Connect Enterprise resets the perspective. The two tabs you closed are now displaying in their default position.

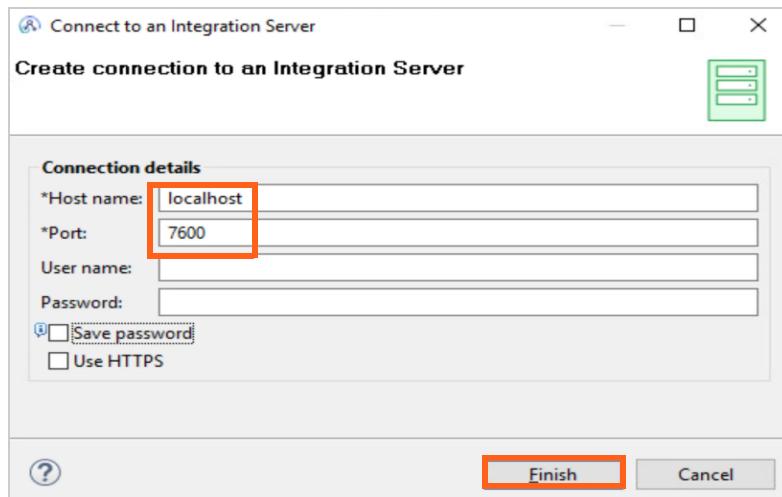
Part 3: Connect to integration server

- __ 1. Use the **IBM App Connect Enterprise Toolkit** to connect to the **Integration Servers**.
 - __ a. Right-click **Integration Servers** in the **Integration Explorer** view in the lower left corner and then select **Connect to an Integration Server**. For the connection details,



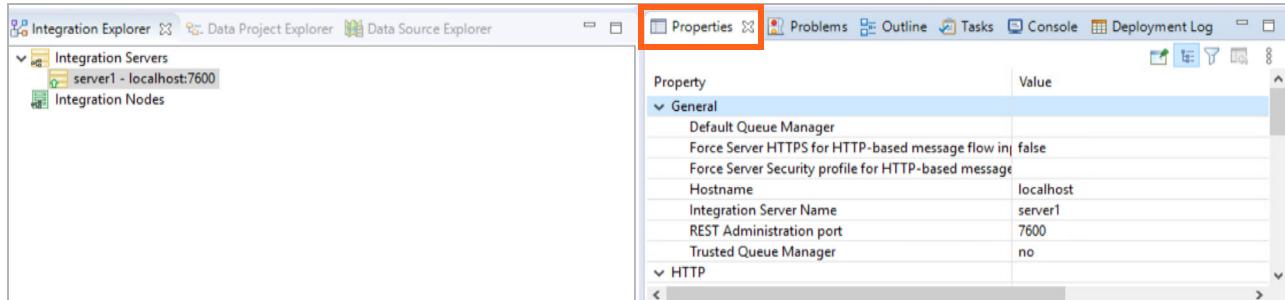
enter `localhost` for the **Host name** and `7600` for the **Port** of the **Integration Server**. Because the **Integration Server** is not secured, you do not need to specify the user name and password.

- __ b. Click **Finish**.



- __ c. Expand **Integration Servers** to view the status of the server. A green up arrow indicates the server is running.
- __ 2. Examine the properties of the **server1 - localhost: 7600**.
 - __ a. Expand **Integration Servers** and select **server1** in the **Integration Explorer** pane.
 - __ b. Click the **Properties** tab to the right to show the integration server properties.

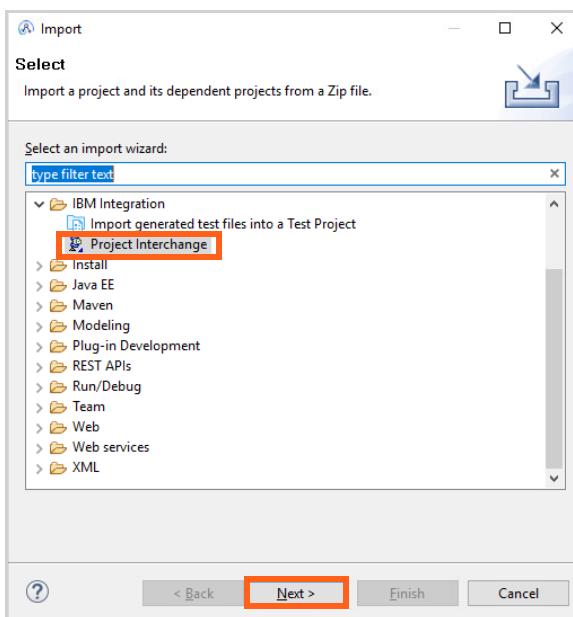
Scroll through the properties to view information about the **server1 - localhost:7600** local server.



Part 4: Import a project interchange file

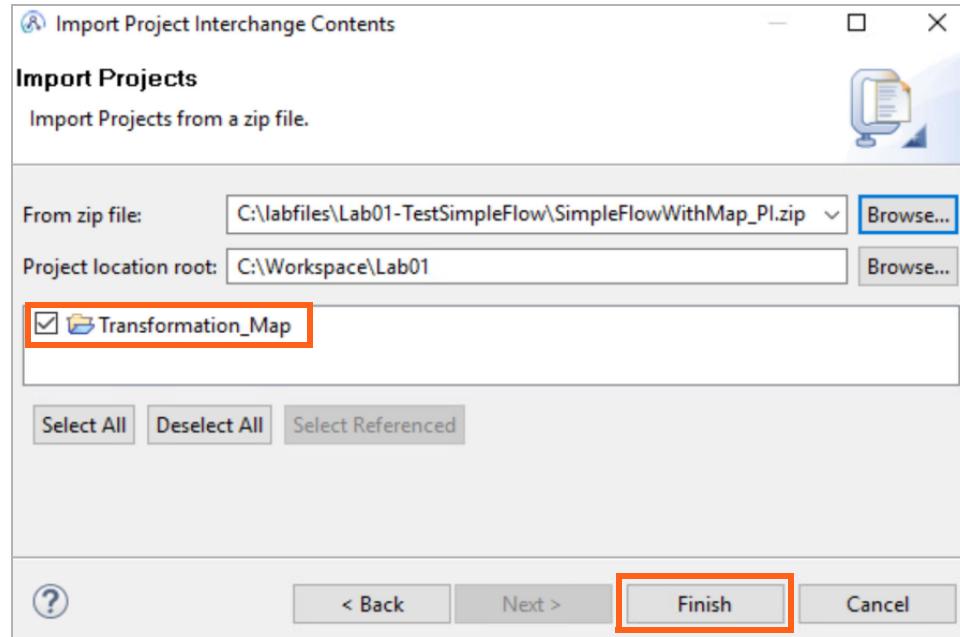
In this part of the exercise, you import an IBM App Connect Enterprise **Project Interchange** file that contains an application with a simple message flow.

- 1. Import the IBM App Connect Enterprise **Project Interchange** file that is named `SimpleFlowWithMap_PI.zip` from the `C:\labfiles\Lab01-TestSimpleFlow` directory into the **IBM App Connect Enterprise Toolkit**.
 - a. From the **IBM App Connect Enterprise Toolkit**, click **File > Import**.
 - b. Click **Project Integration** under **IBM Integration** and then click **Next**.

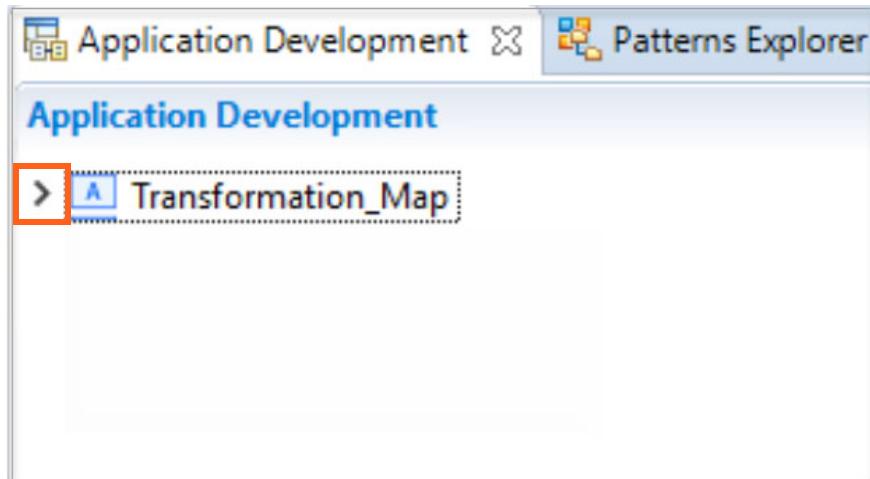


- c. To the right of **From zip file**, click **Browse** to locate the **Project Interchange** file.
- d. Browse to the `C:\labfiles\Lab01-TestSimpleFlow` directory, select the `SimpleFlowWithMap_PI.zip` file, and then click **Open**.
- e. Ensure that the **Project location root** is set to the current workspace of `C:\Workspace\Lab01`.

- __ f. This **Project Interchange** file contains one application that is named Transformation_Map.
- __ g. Click **Finish**.



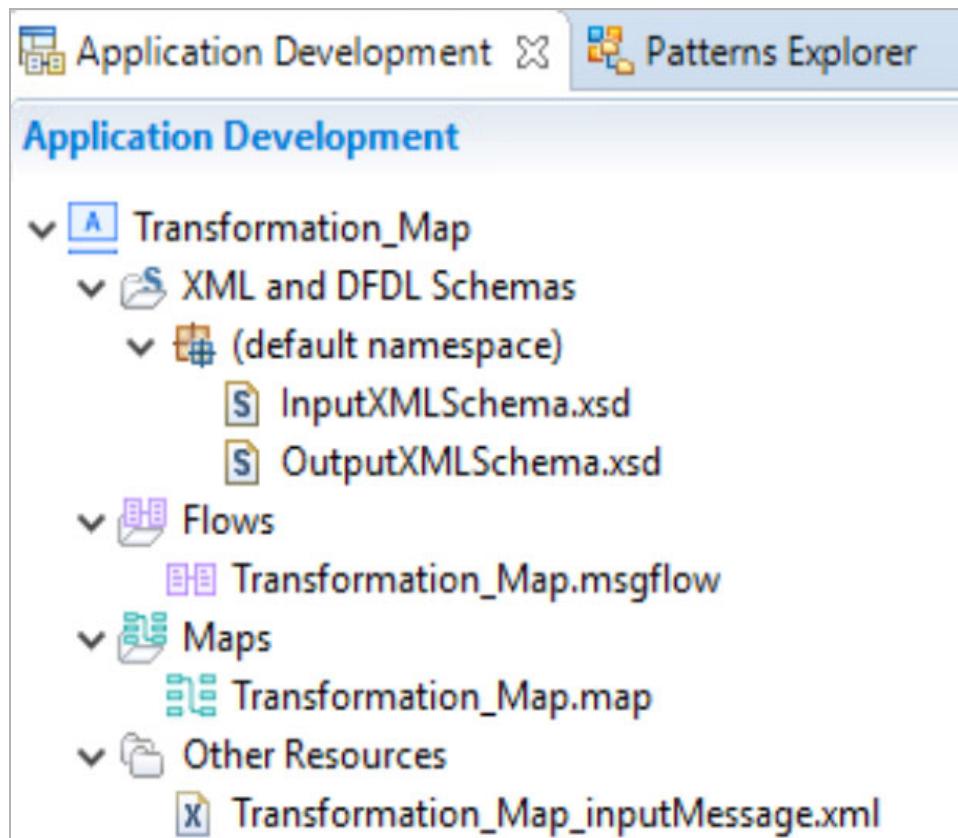
- __ h. Verify that the **Transformation_Map** application is imported into the **Application Development** navigator by expanding it.



- __ i. Examine the application objects and message flow components

-- 2. View the **Transformation_Map** objects.

-- a. In the **Application Development** view, expand the application folders to show the contents of the application.

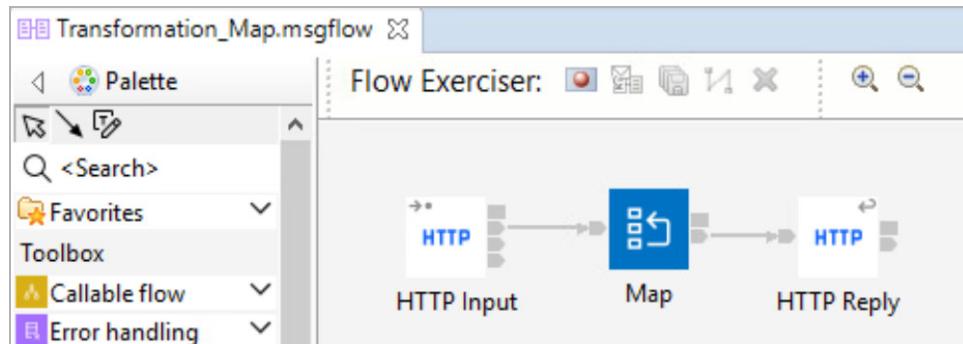


The figure shows the objects that are included in the **Transformation_Map** application. The application includes the following files:

- The XML schema definition files that define the input message (`InputXMLSchema.xsd`) and the output message (`OutputXMLSchema.xsd`)
- The message flow (`Transformation_Map.msgflow`)
- The **Transformation Map** (`Transformation_Map.map`) that the **Mapping** node references
- A sample input file (`Transformation_Map_inputMessage.xml`)

__ 3. View the properties for the **HTTP Input** node.

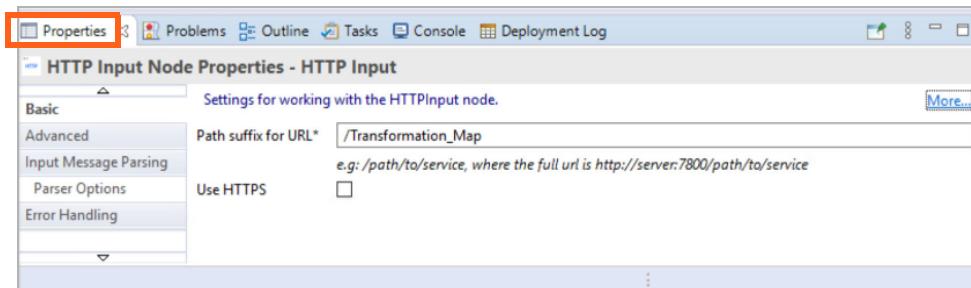
__ a. Double-click **Transformation_map.msgflow** in the Application Development view to open it in the **Message Flow** editor.



The message flow contains three nodes:

- o An **HTTP Input** node
- o A **Mapping** node that is named Map
- o An **HTTP Reply** node

__ b. In the **Message Flow** editor, click the **HTTP Input** node to display the node properties. The node properties are shown in the **Properties** view at the bottom of the **IBM App Connect Enterprise Toolkit**.



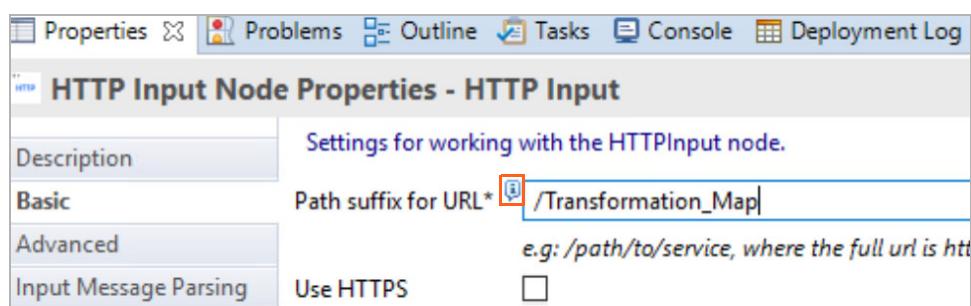
Several properties tabs are shown. By default, the **Basic** tab is selected.

The **IBM App Connect Enterprise Toolkit** provides context-sensitive help for node properties.

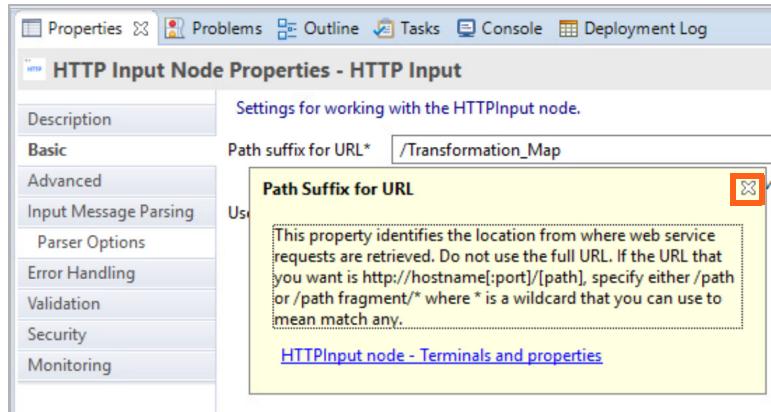
__ 4. Display the context-sensitive help for the **Path suffix for URL** field:

__ a. Click in the **Path suffix for URL** field that is located in **Basic Properties**.

__ b. Click the “**Information**” icon that appears to the left of the **Path suffix for URL** field.



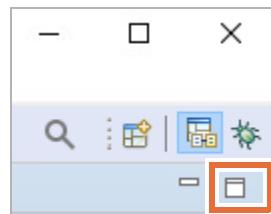
__ c. Close the **Path Suffix for URL** help window.



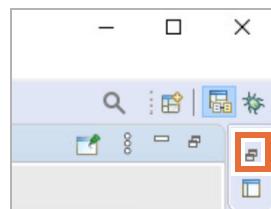
__ 5. Explore the layout capabilities

IBM App Connect Enterprise has capabilities to help you in laying out the nodes in various manners. The default layout for the nodes' alignment and arrangement is left-to-right.

__ a. If the canvas is not large enough, you can increase the size by clicking **Maximize**.

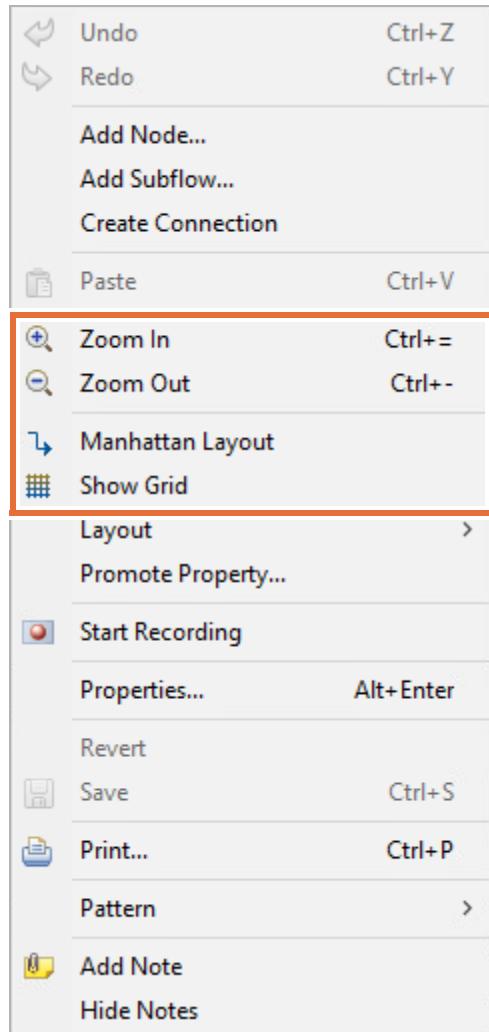


__ b. Click **Restore** to reset the view.



__ c. Right-click on the canvas.

- __ d. Note from this menu you can zoom in and out, show a grid, or change to **Manhattan Layout** (horizontal and vertical command-lines joined at right angles).

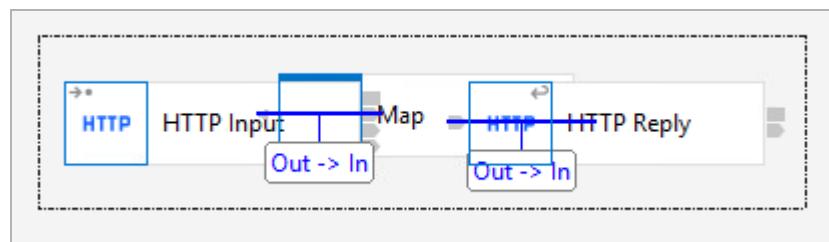


You can also change the layout of the nodes by selecting Layout.

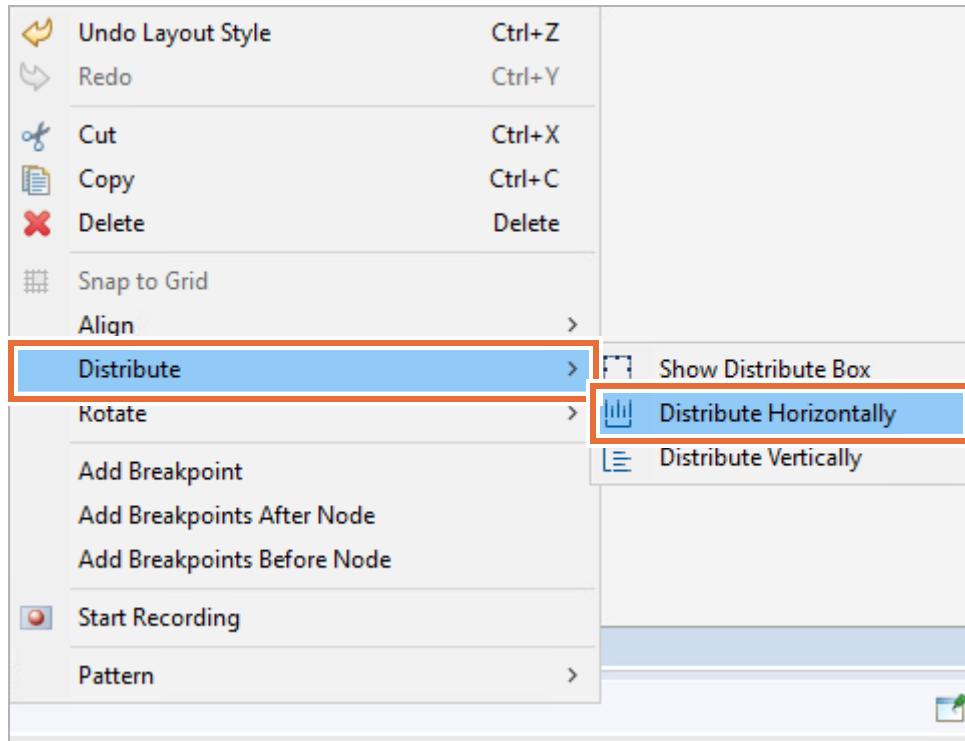
- __ e. Select **Layout > Name inside the node**.

IBM App Connect Enterprise updates the node layout.

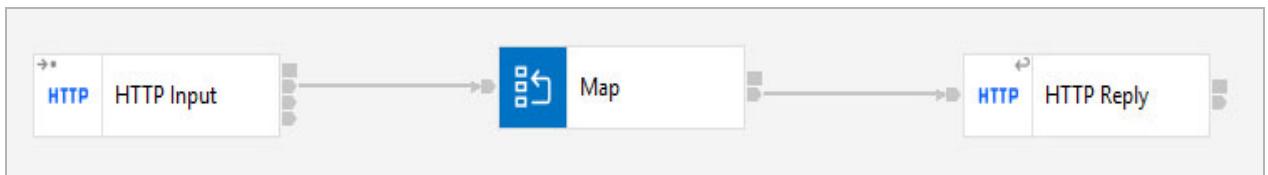
- __ f. Lasso all nodes by holding down the left mouse button and highlighting all nodes.



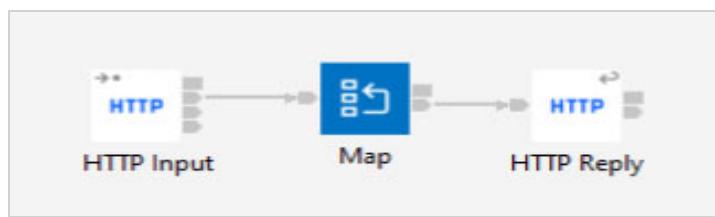
- __ g. Right-click one of the highlighted nodes and select **Distribute > Distribute Horizontally**.



IBM App Connect Enterprise distributes the nodes evenly along a horizontal line.

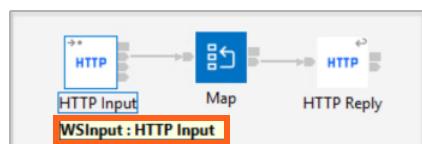


- __ h. Reset the layout to the original by setting the layout to display the node name under the icon and space them out to become easier to read.

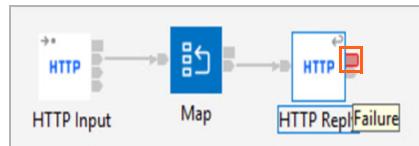


- __ 6. Examine the node properties for the other nodes in the message flow.

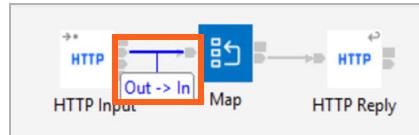
- __ a. In the **Message Flow** editor, hover the mouse pointer over each of the nodes. The node type and node name are displayed in the format **NodeType : NodeName**.



- __ b. In the **Message Flow** editor, hover the mouse pointer over the node terminals to display the terminal names.

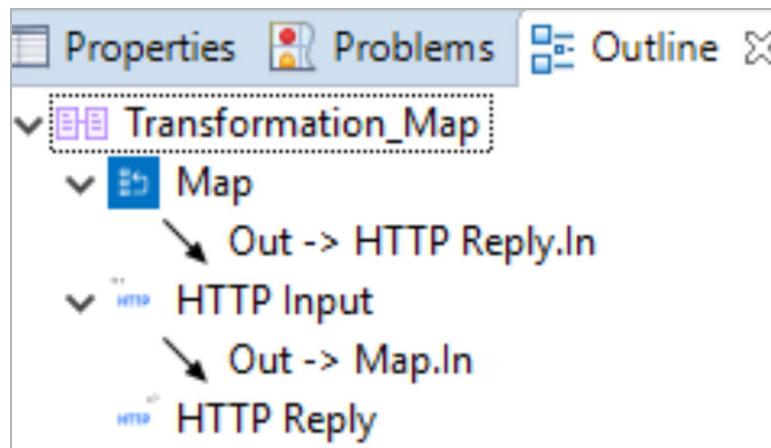


- __ c. In the **Message Flow** editor, hover the mouse pointer over the wires that connect the nodes to display the connection information.



The names of the terminals to which the wire is connected are displayed in the format SourceTerminal → TargetTerminal.

- __ d. Click the **Outline** tab (in the same section as the **Properties** view) to display the connection information.
 __ e. Expand the **Map** and **HTTP Input** node entries in the **Outline** view.



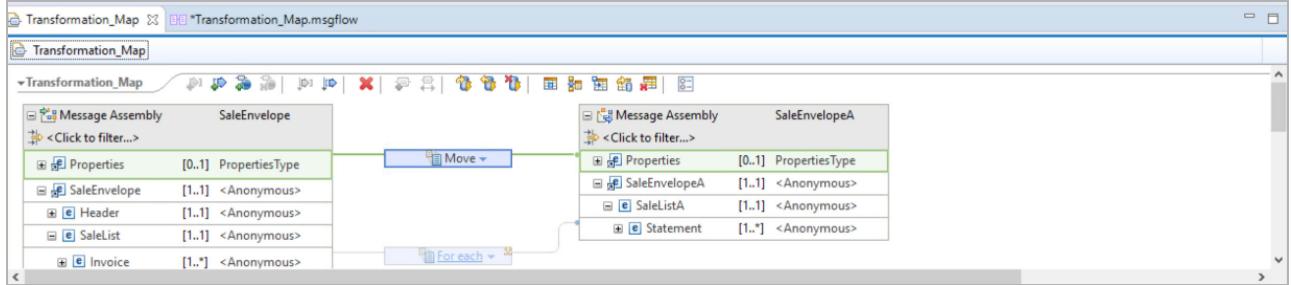
The **Outline** view shows that the **Out** terminal of the **Map** node is wired to the **In** terminal of the **HTTP Reply** node as denoted by **HTTP Reply.In**.

The **Out** terminal of the **HTTP Input** node is wired to the **In** terminal of the **Map** node as denoted by **Map.In**.

- __ 7. Examine the **Transformation Map**.

- __ a. Double-click the **Map** node in the **Message Flow** editor to display the Graphical Map editor view of the **Transformation_Map**.

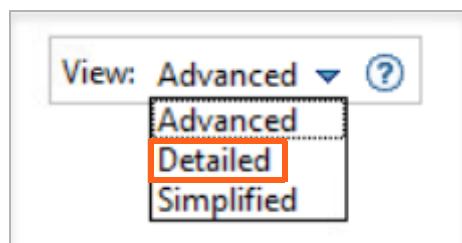
- __ b. Double-click the **Transformation_Map** tab to expand the Graphical Map editor view so that you can see the entire map.



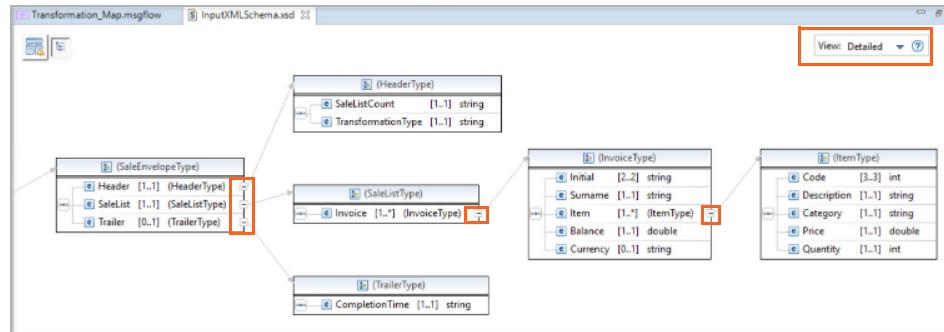
- __ c. Double-click the **Transformation_Map** tab again so that it resizes the view back to its original size.
- __ d. You learn more about message transformation and the Mapping node later in this course. Close the **Transformation_Map** tab by clicking the X on the tab.
8. Examine the XML schema that defines the message flow input.
- __ a. In the Application Development view on the left, double-click the **InputXMLSchema.xsd** file under the **XML and DFDL Schemas > (default namespace)** package to open it in the XML Schema editor.
- __ b. In the XML Schema editor, double-click **SaleEnvelope** to display the schema details.

The screenshot shows the XML Schema editor. At the top, it says 'Schema : (no target namespace specified)'. Below that is a 'Directives' section. In the main area, there is a 'Elements' section containing a single item labeled 'SaleEnvelope', which is highlighted with a red border. To the right of the elements section is a blank vertical panel.

- __ c. Ensure that **View** is set to **Detailed**.



- __ d. Click the plus signs to expand the XML schema.



- __ e. Close the **InputXMLSchema.xsd** tab.

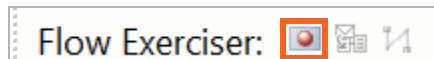
- __ f. Save message flow.

Part 5: Test with the Flow exerciser

In this part of the exercise, you test the message flow with the **IBM App Connect Enterprise Toolkit Flow Exerciser** and a test message.

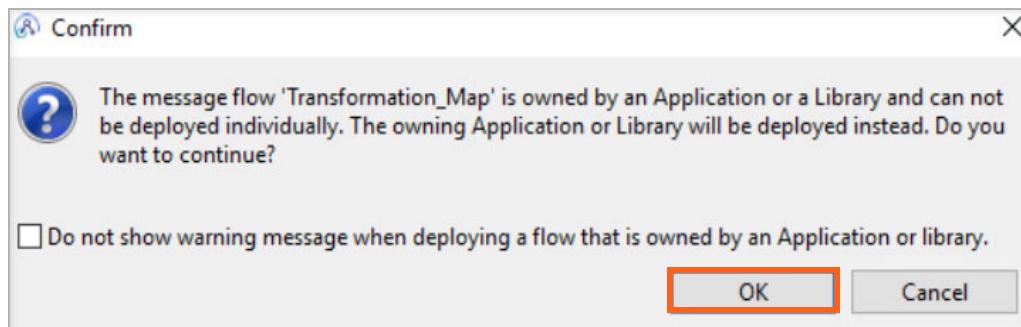
- __ 1. Start the **Flow Exerciser**

- __ a. Return to the message flow and click the **Flow Exerciser** icon at the top of the **Message Flow** editor.



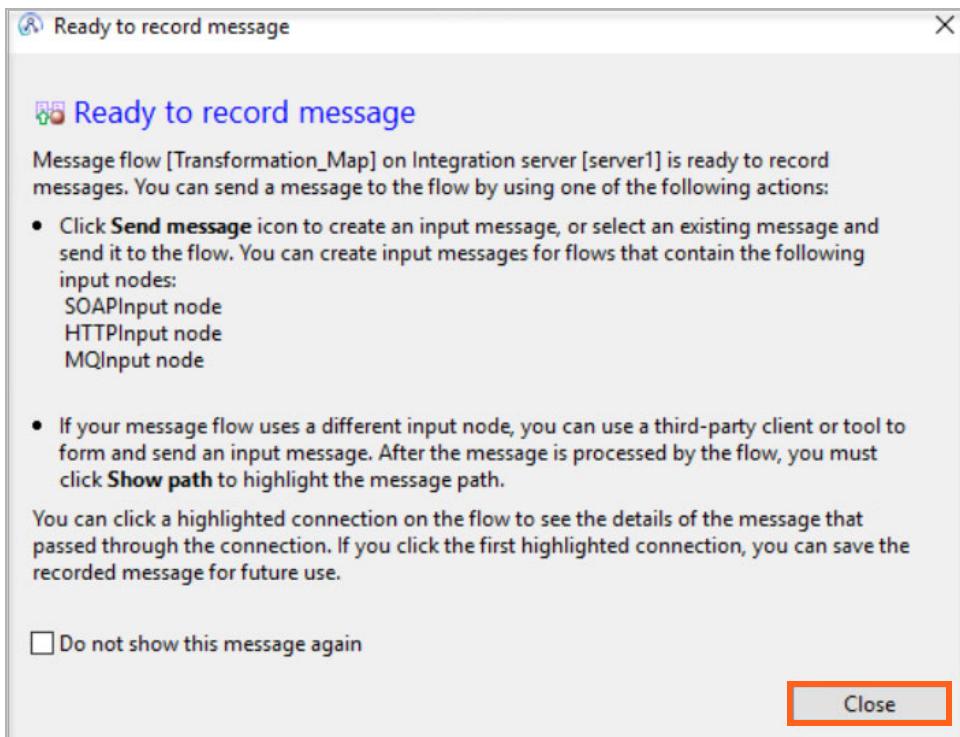
The **Flow Exerciser** icon is a toggle with which you can switch between **Flow Exerciser mode** and **edit mode**.

- __ b. Click **OK** in the **Confirm** message box.

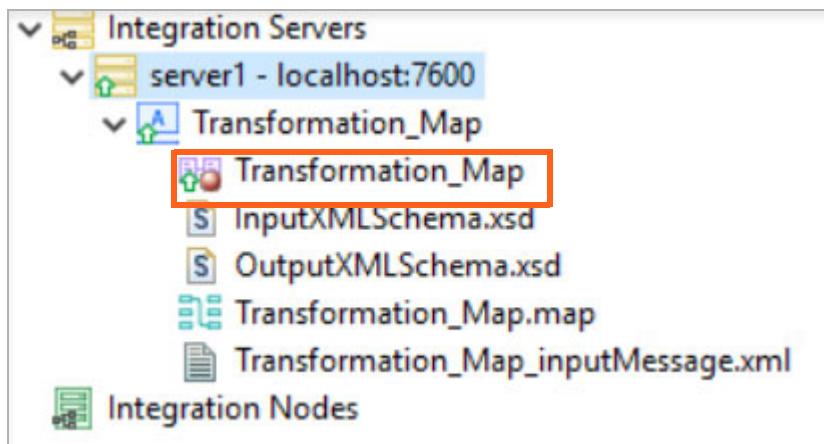


The **Flow Exerciser** creates the BAR file and deploys it to the **Integration Server**. If any messages are displayed while the **Flow Exerciser** is running, ignore them; they are information messages and disappear on their own.

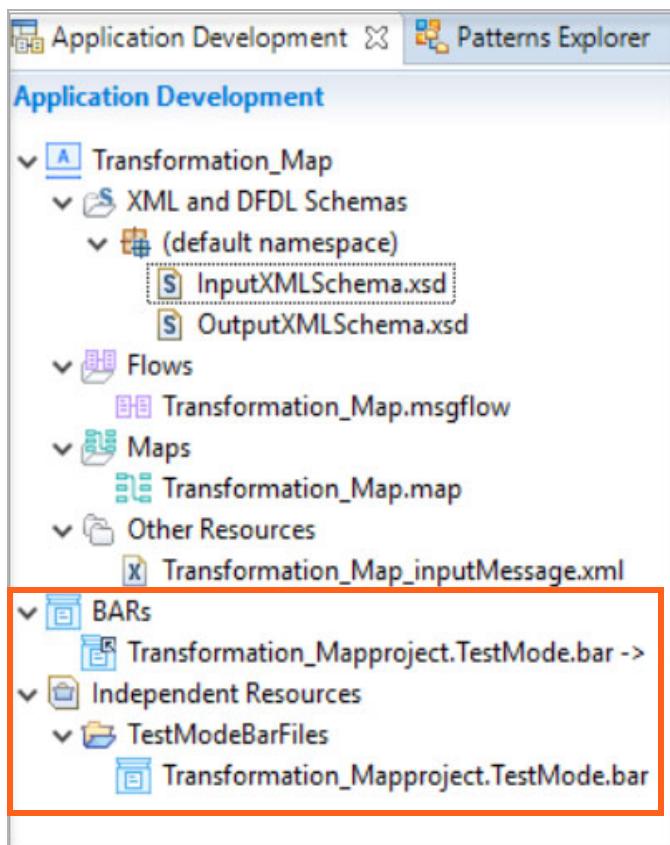
- c. After a few seconds, you will see a window that indicates that the **Flow Exerciser** is ready to record a message. When you see this information window, click **Close**.



- 2. Verify that the **Flow Exerciser** Record mode started and that the application was deployed.
- a. In the **Integration Explorer** view, expand the server to display the contents. Verify that **Transformation_Map** is in record mode (signified by the Recording icon red circle).



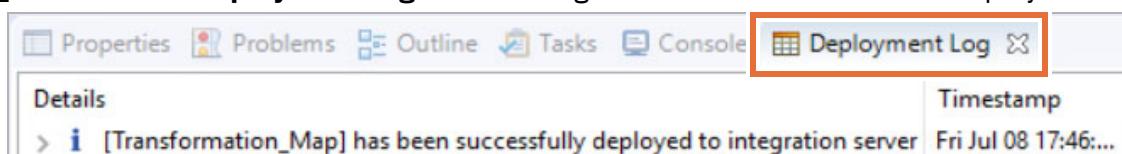
- __ b. Examine the **Application Development** navigator. A project named **Transformation_Mapproject.Testmode.bar** is in the **BARs** directory. Additionally, a file in the **Independent Resources** directory called **Transformation_Mapproject.TestMode.bar** is present.



These projects contain the BAR file (with a `.bar` extension) that the Flow exerciser built and deployed to the integration server.

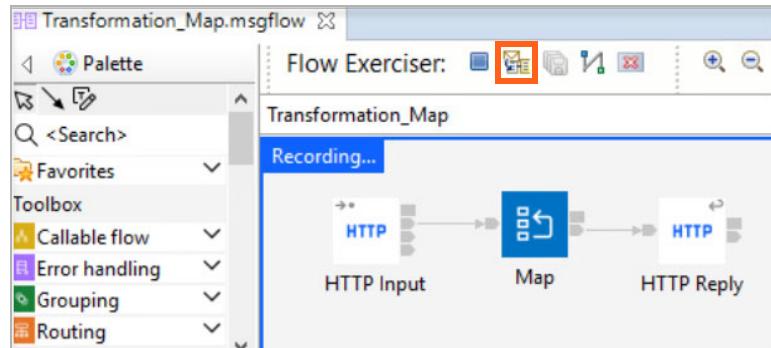
You use the BAR File editor to examine a BAR file in the next exercise.

- __ c. Click the **Deployment Log** tab to the right to view the details of the deployment log.



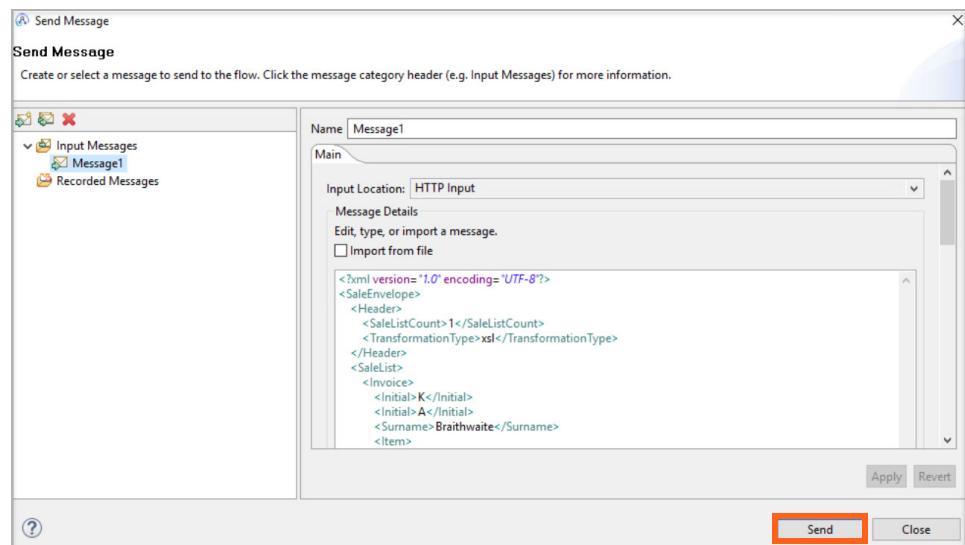
__ 3. Send a test message to the Transformation_Map message flow.

__ a. In the **Message Flow** editor, click the **Send a message to the flow** icon.



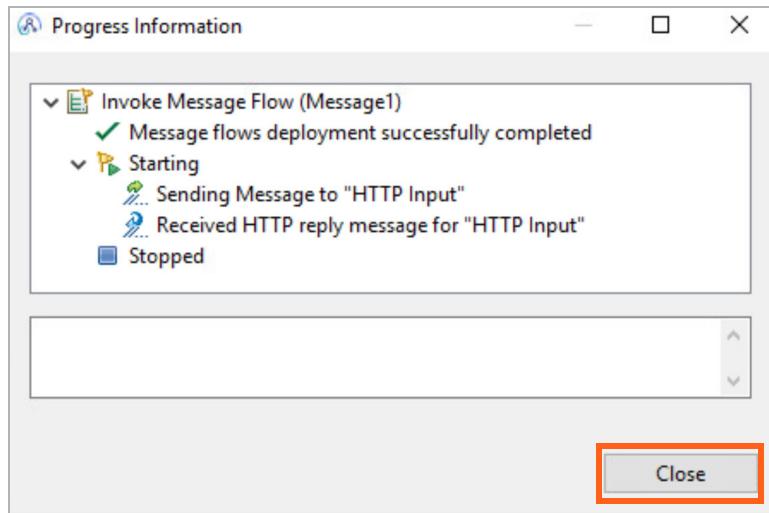
__ b. In the **Send Message** window, click **Message1**. Take a moment to examine the message.

__ c. Click **Send**

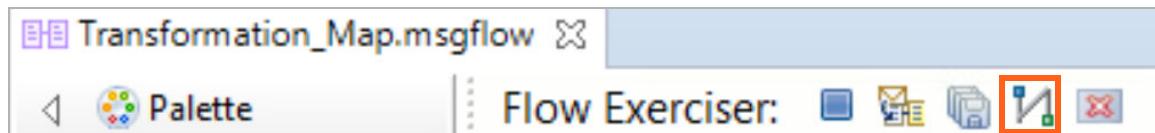


After some moments, the test runs. The **Progress Information** window shows you the status of the message flow test. In this exercise, the **Progress Information** window shows that the message was sent to the **HTTP Input** node and that the reply message was received.

-- d. Click **Close**.

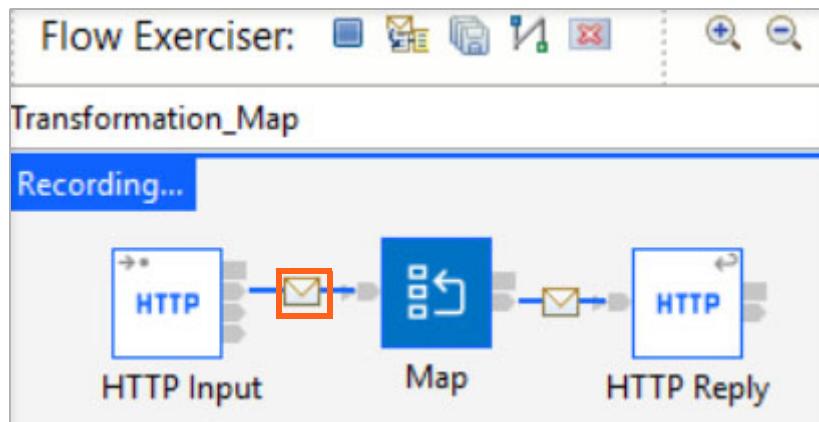


-- e. Click on the **View path** icon.

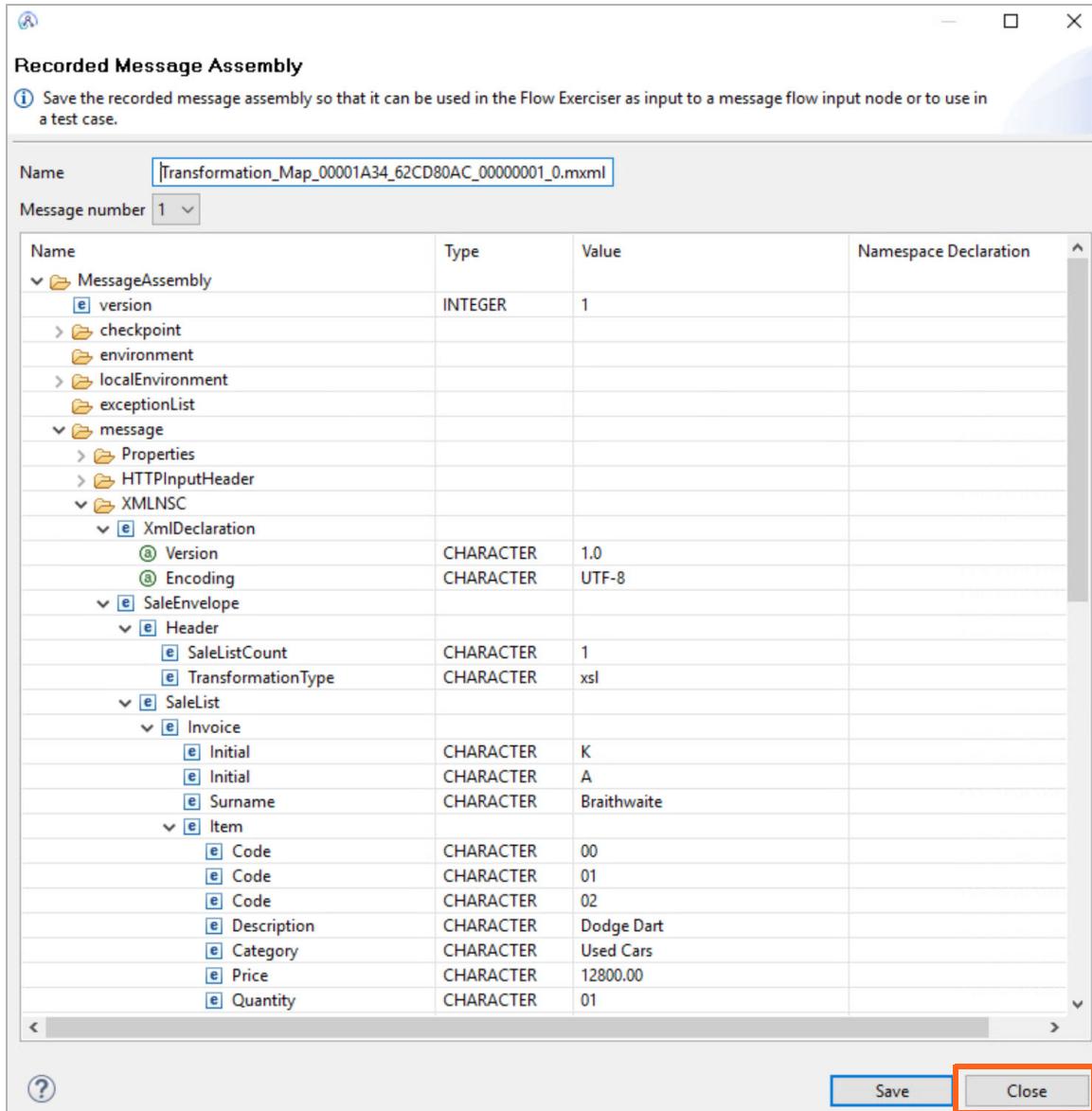


-- 4. View the test message.

-- a. Click the **message icon** that is between the **HTTP Input** node and the **Map** node to view the input message.

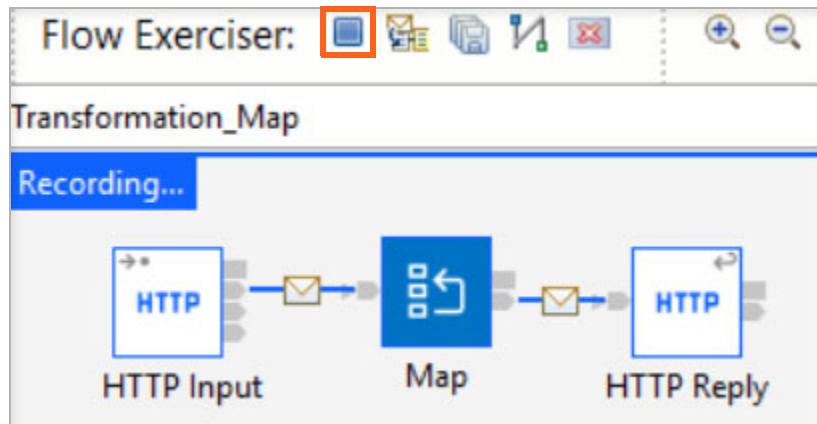


- __ b. After you review the **Recorded Message Assembly**, click **Close**.



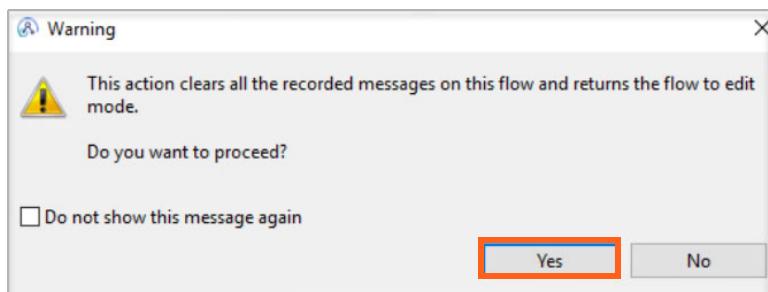
- c. Click the **message icon** that is between the **Map** node and the **HTTP Reply** node to view the message after the Map node transforms it.
- d. After you review the output message, close the message window.

- __ 5. Return to the edit mode and stop the **Flow** Editor
 __ a. Click the **Return flow to edit mode** icon at the top of the **Message Flow** editor.

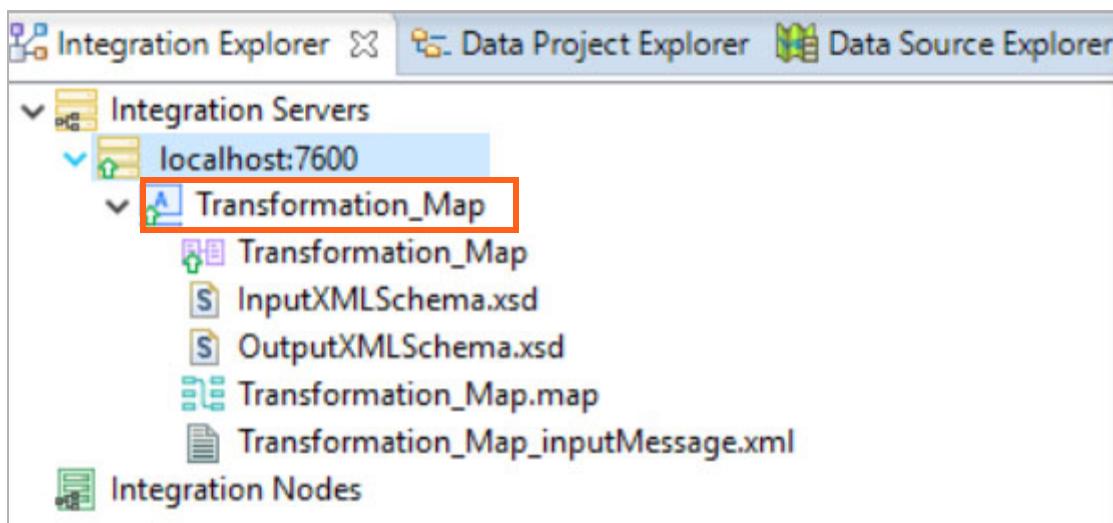


A warning message reminds you that changing back to edit mode clears all the recorded messages on this flow. It also reminds you to stop recording mode on the integration server if you are finished with testing,

- __ b. Click **Yes**.



- __ c. In the **Integration Explorer** view, expand the server to display the contents. Verify that **Transformation_Map** is no longer in record mode.

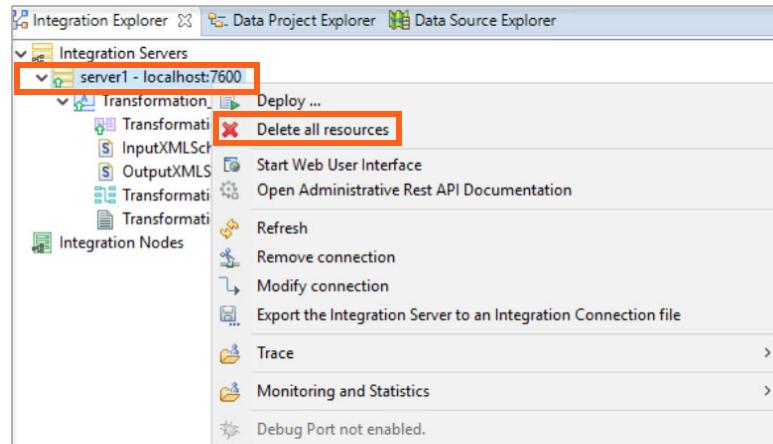


- __ d. Close the **Transformation_Map** message flow in the **Message flow** editor.

Part 6: Exercise clean-up

At the end of each exercise, an environment clean-up ensures that no potential conflicts occur with the exercises.

- __ 1. Remove the Transformation_Map application from the **Integration Server**.
- __ a. Right-click **server1-localhost :7600** and then click **Delete all resources**.



- __ b. Click **OK** on the confirmation window.
- Transformation_Map is removed from the **server1-localhost:7600**.

2. Close the **IBM App Connect Enterprise** console.

End of exercise

Exercise review and wrap-up

In the first part of this exercise, you created and started an independent integration server by using the IBM App Connect Enterprise Console. Then, you connected to the server in the IBM App Connect Enterprise Toolkit.

In the second part of this exercise, you imported an IBM App Connect Enterprise project interchange file that contained a message flow application.

In the third part of this exercise, you examined the message flow and saw how to access message flow node properties, terminal information, and connection information. You also used the XML Schema editor to examine an XML schema and the Graphical Map editor to view the message flow.

In the fourth part of this exercise, you used the Flow exerciser to deploy and test the message flow application.