

Service Bus (12.1.3) Tutorial

Version 1.0

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Overview of Tutorial

The purpose of this tutorial is to get hands-on experience with Service Bus 12c development using JDeveloper.

The tutorial assumes a little conceptual understanding of Service Bus such as Proxy Service, Business Service and Message Flows. If you don't have this initial understanding, it is recommended to go through the section 'Service Bus Components' in this [link](#). By the time you finish this tutorial, you will learn:

- Creating Service Bus Application, Project, Proxy Service and Business services.
- Working with resources such as WSDL, XSD, XSLT, XQuery, Service Account etc.
- Sharing the OSB resources across Service Bus projects to enable reuse and modularity.
- Creating Pipelines, Pipeline Templates and using nodes like Pipeline Pair, Stage, Routing and Operational Branches.
- Using Domain Value Maps (DVM) for storing configuring properties and using them in message flow.
- Creating Service Accounts and accessing them in message flow at runtime.
- Enriching the messages using intermediate service calls in Pipelines.
- Routing messages to business services using Service Callout, Routing and Routing Table.
- Working with Split-Joins.
- Using service error handlers in Pipelines.
- Deploying and Testing Proxy and Business services.
- Securing Proxy service.

Scenario in Tutorial

XYZ Bank is a Financial Services organization operates in several countries having numerous branches. Very recently, the bank is recording disappointing results for the last few quarters and constantly losing customers satisfaction. The top brass management identified issues with current IT infrastructure lacking agility which is unable to meet growing business and customer needs. The recent acquisitions also had its share of new IT systems getting added to existing system landscape.

Because of this, the management has decided to go with revamp of existing IT infrastructure. As part of this, an integration strategy is being chalked out using SOA as the underlying architecture to improve agility and bring in more reusability as customers uses different channels to avail bank services. Added to this, a new portal is also been planned to improve user experience.

In the proposed architecture, an Enterprise Service Bus plays pivotal role providing virtualization layer to consumers and also takes care of Validation, Transformation and routing all incoming requests to the actual services provided by end (legacy) systems. And Oracle Service Bus (OSB) has been chosen meeting the requirements.

Business Requirements

For milestone 1, IT team wants to expose data services on different objects Customer, Accounts etc. These services will be exposed to consumers using Service Bus that provides features like Service Virtualization, Authentication, Validation, Transformation, Message Enrichment and

Routing. In this tutorial, we will develop such data services for Customer data object and the requirements are listed below.

Create a Service Bus Proxy Service exposing single interface to perform the following:

- CreateCustomer** - Creates a new customer.
- UpdateCustomer** - Updates an existing customer.
- DeleteCustomer** - Deletes an existing customer.
- MergeCustomer** - Updates an existing customer if exists or create a new customer.

Common Requirements

1. Single interface (WSDL) to be exposed for all above operations.
2. Transform the input request to the structure expected by the actual end system.
3. Route the input request to appropriate business service by selecting suitable operation.
4. In positive case, return the output containing **Customer ID** and **Status**.
5. In all negative cases, return the fault containing **Error Code** (in any) and **Error Message**.
6. **Secure** the proxy service using **OWSM policy** so that only valid users can invoke.

CreateCustomer

- The input structure should include the attributes First Name, Last Name, Email, Phone, Date of Birth, Customer Type and Address fields. Restrict the Customer Type values to 'Individual' and 'Corporate'.
- Validate the input against XSD definition and return fault on validation failure.
- Validate **Email** element for proper format and return fault on validation failure.
- Default **CustomerType** element to '**Individual**', if it's not sent in the input.
- Validate **Address** elements by calling the **Address Validation** service and return fault if address is not valid. Address validation should be performed based on a configurable property.
- The actual legacy system expects **CustomerID** element to be populated in the input. Call **Create User ID** service to get unique id and populate it as **CustomerID**.
- Create User ID service expects the consumers to send credentials in SOAP header in the following format. Use Service Accounts to store these credentials.

```
<usr:UserIDConfiguration  
xmlns:usr="http://xmlins.xyzbank.com/User/Configuration">  
    <usr:UserName>admin</usr:UserName>  
    <usr:Password>password1</usr:Password>  
</usr:UserIDConfiguration>
```

- Complete the common requirements 3-5 mentioned above.

UpdateCustomer

- The input structure should be same as **CreateCustomer** operation.
- Validate the input against XSD definition and return fault on validation failure.
- Complete the common requirements 3-5 mentioned above. Since the actual end system updates the fields for which values are sent, the elements with null values have to be removed from input before routing the request.

DeleteCustomer

- The input structure should have **CustomerID** as mandatory attribute.
- Validate the input against XSD definition and return fault on validation failure.

- Complete the common requirements 3-5 mentioned above.

MergeCustomer

- The input structure should be same as **CreateCustomer** operation.
- Call **find_customer** in **Customer** service to find existence of Customer using **CustomerID**. The service response element '**CustomerExists**' value 'Y' denotes existing customer and value 'N' denotes non-existing customer .
- For existing Customer, route request to perform **Update**.
- In case no Customer exists, route request to perform **Create**. Make sure that all of the above requirements mentioned for '**CreateCustomer**' are considered.
- Complete common requirements 3-5 mentioned above.

MigrateCustomer

- The input structure should have **CustomerID** as mandatory attribute.
- Validate the input against XSD definition and return fault on validation failure.
- Call **Customer**, **Customer Order** and **Customer Accounts** services in parallel to fetch Customer, Orders and Accounts information respectively.
- Call **migrate_customer** in **Customer** service to migrate customer information.
- Complete common requirements 3-5 mentioned above.

Error Handling

- Convert System or Application errors to the SOAP Fault structure as defined in WSDL.

Following are the WSDLs to be used for business services creation:

Purpose	Service WSDL
Unique ID Creation	CreateUserIDService.wsdl
Address Validation	AddrValidationService.wsdl
Customer Object operations	CustomerService.wsdl
Customer Order operations	CustomerOrderService.wsdl
Customer Account operations	CustomerAccountService.wsdl

You can create SOAP UI mock services using the above WSDLs or your own implementation to imitate behavior of the actual services exposed by service provider. This tutorial uses these mock services for demonstration. Refer to SOAP UI documentation [here](#) for more information on **Mock Services**.

The mock service used for this tutorial can be downloaded from [here](#). Modify the payload for different operations as required for both positive and negative test cases described later in this tutorial.

The Configuration jar of this tutorial can be downloaded from [here](#).

Installation

This tutorial uses Service Bus 12.1.3 for demonstration purpose and this is the first release of SOA Suite 12c and also the first release where Service Bus development is integrated into JDeveloper. For detailed installation steps of SOA Suite 12c, you can refer to this [link](#).

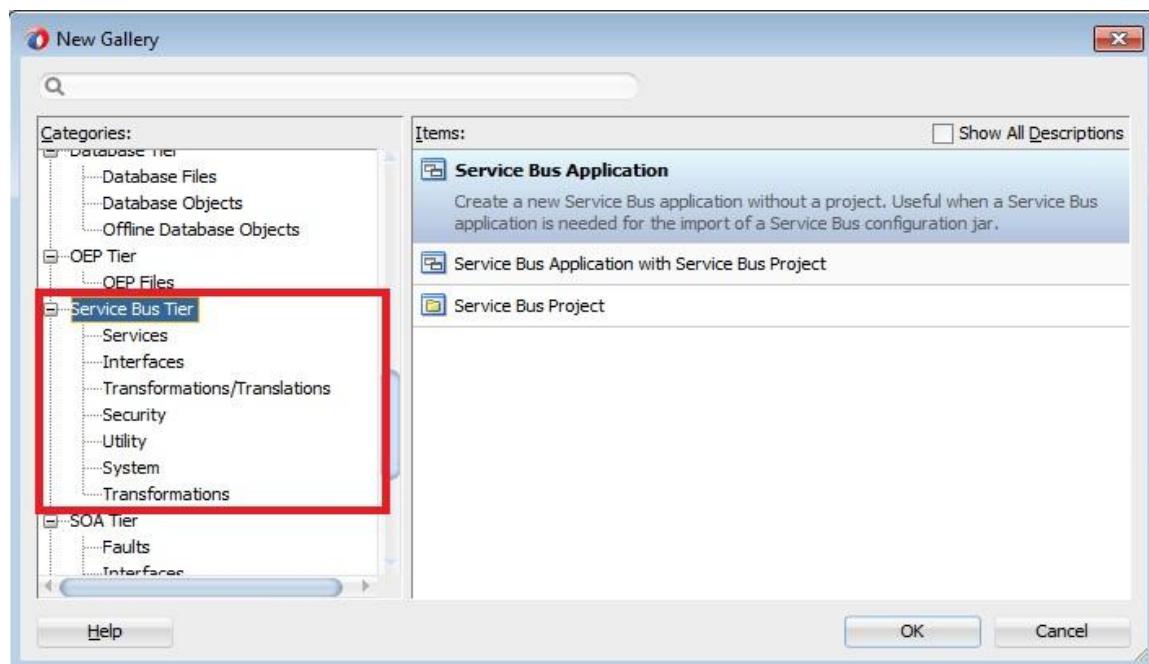
You will use **JDeveloper 12.1.3** for this tutorial, which gets automatically installed as part of SOA Suite 12c installation.

Verifying the Installation

Open JDeveloper IDE from SOA Suite 12c installation.

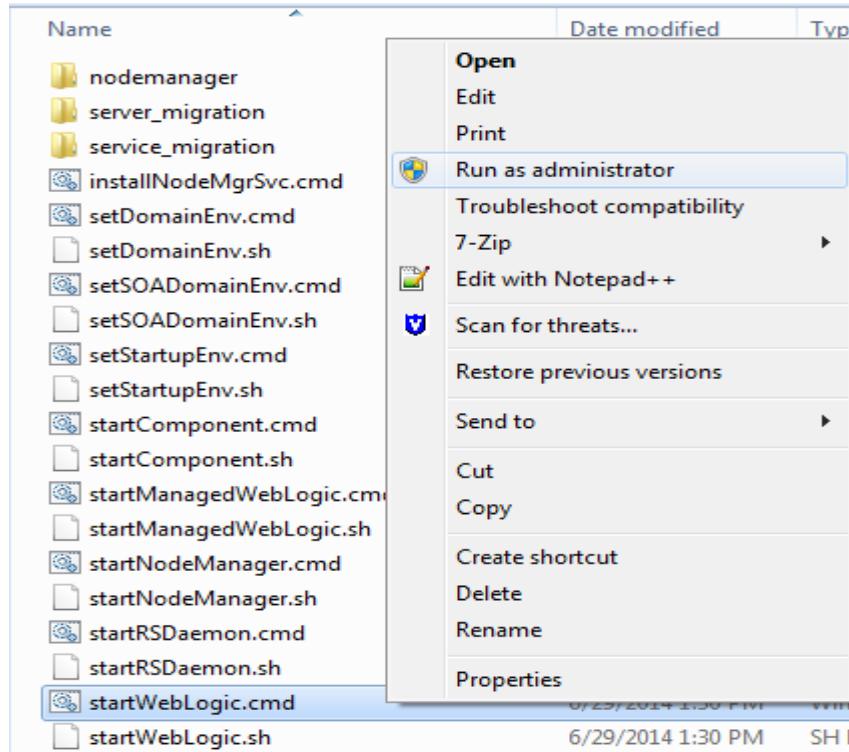


Go to **File -> New** and verify that **Service Bus Tier** is available.



Create a SOA domain using steps given [here](#). Navigate to **DOMAIN_HOME** and start WLS Admin server by executing **startWebLogic.cmd**.

Note: Going forward we will use the terms **DOMAIN_HOME**, **WLS_HOME**, and **MW_HOME** to refer to domain directory, WLS installation directory and Service Bus installation directory respectively.



```
11" is now listening on 192.168.2.5:7001 for protocols iiop, t3, ldap, snmp, http.
<Jul 27, 2014 12:30:08 PM IST> <Warning> <Server> <BEA-002611> <The hostname "SUGONUGU-LAP.oraclevcorp.com", maps to multiple IP addresses: 192.168.56.1, 192.168.2.5, 0:0:0:0:0:0:1.>
<Jul 27, 2014 12:30:08 PM IST> <Notice> <Server> <BEA-002613> <Channel "Default" is now listening on 192.168.56.1:7001 for protocols iiop, t3, ldap, snmp, http.>
<Jul 27, 2014 12:30:08 PM IST> <Notice> <Server> <BEA-002613> <Channel "Default[2]" is now listening on 127.0.0.1:7001 for protocols iiop, t3, ldap, snmp, http.>
<Jul 27, 2014 12:30:08 PM IST> <Notice> <Server> <BEA-002613> <Channel "Default[3]" is now listening on 0:0:0:0:0:0:1:7001 for protocols iiop, t3, ldap, snmp, http.>
<Jul 27, 2014 12:30:08 PM IST> <Notice> <WebLogicServer> <BEA-000331> <Started the WebLogic Server Administration Server "AdminServer" for domain "soa12c_domain" running in development mode.>
<Jul 27, 2014 12:30:08 PM IST> <Notice> <WebLogicServer> <BEA-000360> <The server started in RUNNING mode.>
<Jul 27, 2014 12:30:08 PM IST> <Notice> <WebLogicServer> <BEA-000365> <Server state changed to RUNNING.>
<Jul 27, 2014 12:30:08 PM IST> <warning> <EJB> <BEA-010061> <The message-driven EJB PolledMessageListenerMDBEJB is unable to connect to the JMS destination wlsb.internal.transport.task.queue.email. The Error was: The destination for the MessageDrivenBean PolledMessageListenerMDBEJB<Application: Service Bus Email Transport Provider, EJBComponent: poller-ejb.jar> could not be resolved at this time. Please ensure the destination is available at the JNDI name wlsb.internal.transport.task.queue.email. The EJB container will periodically attempt to resolve this MessageDrivenBean destination and additional warnings may be issued.>
<Jul 27, 2014 12:30:08 PM IST> <Warning> <EJB> <BEA-010061> <The Message-Driven EJB PolledMessageListenerMDBEJB is unable to connect to the JMS destination wlsb>
```

12c domain creation creates managed servers for both SOA and OSB by default, so you should start Managed server too. Navigate to DOMAIN_HOME and start managed server by executing **startManagedWebLogic.cmd** as shown below and give **weblogic** credentials on prompt.

```
C:\> Oracle\Middleware\FMW12.1.3\user_projects\domains\soa12c_domain\bin>startManagedWebLogic.cmd osb_server1
```

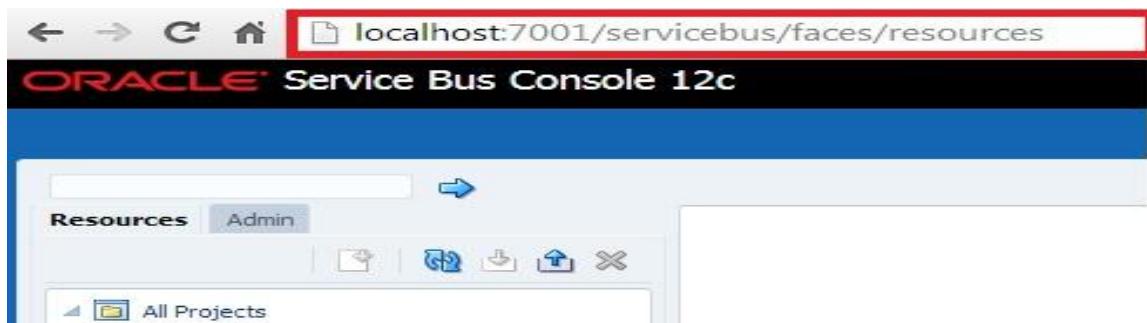


```
<Jul 27, 2014 12:51:36 PM IST> <Warning> <oracle.sdpinternal.messaging.driver.voicexml.VoiceXMLResourceAdapter> <SDP-26362> <No configuration was found for this VoiceXML Driver deployment: usermessagingdriver-voicexml. Driver disabled until a configuration is created.>
<Jul 27, 2014 12:51:36 PM IST> <Warning> <oracle.sdpinternal.messaging.driver.xmpp.XMPPResourceAdapter> <SDP-26249> <No configuration was found for this XMPP Driver deployment: usermessagingdriver-xmpp. Driver disabled until a configuration is created.>
<Jul 27, 2014 12:51:37 PM IST> <Warning> <weblogic-coherence-integration> <BEA-000007> <Could not find the JNDI resource [cache-config/servicebus/result-cache] referenced by cache-configuration-ref.>
<Jul 27, 2014 12:51:53 PM IST> <Notice> <Log Management> <BEA-170027> <The server has successfully established a connection with the Domain level Diagnostic Service.>
<Jul 27, 2014 12:51:53 PM IST> <Notice> <WebLogicServer> <BEA-000365> <Server state changed to ADMIN.>
<Jul 27, 2014 12:51:53 PM IST> <Notice> <WebLogicServer> <BEA-000365> <Server state changed to RESUMING.>
<Jul 27, 2014 12:51:53 PM IST> <Notice> <Server> <BEA-002613> <Channel "Default[3]" is now listening on 0:0:0:0:0:0:0:1:7004 for protocols iiop, t3, ldap, snmp, http.>
<Jul 27, 2014 12:51:53 PM IST> <Notice> <Server> <BEA-002613> <Channel "Default[1]" is now listening on 192.168.2.5:7004 for protocols iiop, t3, ldap, snmp, http.>
<Jul 27, 2014 12:51:53 PM IST> <Warning> <Server> <BEA-002611> <The hostname "SUGONUGU-LAP.oraclecorp.com", maps to multiple IP addresses: 192.168.56.1, 192.168.2.5, 0:0:0:0:0:0:1:>
<Jul 27, 2014 12:51:53 PM IST> <Notice> <Server> <BEA-002613> <Channel "Default[2]" is now listening on 127.0.0.1:7004 for protocols iiop, t3, ldap, snmp, http.>
<Jul 27, 2014 12:51:53 PM IST> <Notice> <Server> <BEA-002613> <Channel "Default" is now listening on 192.168.56.1:7004 for protocols iiop, t3, ldap, snmp, http.>
<Jul 27, 2014 12:51:53 PM IST> <Notice> <WebLogicServer> <BEA-000332> <Started the WebLogic Server M...
<Jul 27, 2014 12:51:54 PM IST> <Notice> <WebLogicServer> <BEA-000360> <The server started in RUNNING mode.>
<Jul 27, 2014 12:51:54 PM IST> <Notice> <WebLogicServer> <BEA-000365> <Server state changed to RUNNING.>
```

Verify that OSB server is up and you are able to access Service Bus console using URL <http://localhost:<port>/sbconsole> with credentials given during domain creation. Note that **sbconsole** is accessible even when just **AdminServer** is running but to test or deploy any Service Bus project you should start corresponding OSB managed server.

Servers (Filtered - More Columns Exist)						
	Name	Type	Cluster	Machine	State	Health
	AdminServer(admin)	Configured			RUNNING	OK
	osb_server1	Configured			RUNNING	OK
	soa_server1	Configured			SHUTDOWN	Not reachable

New	Clone	Delete	Showing 1 to 3 of 3 Previous Next



In 12c, **sbconsole** URL will be translated to url as shown above, when it's accessed.

You can also verify WLS **Admin** console by launching URL **http://localhost:<port>/console** with credentials given during domain creation.

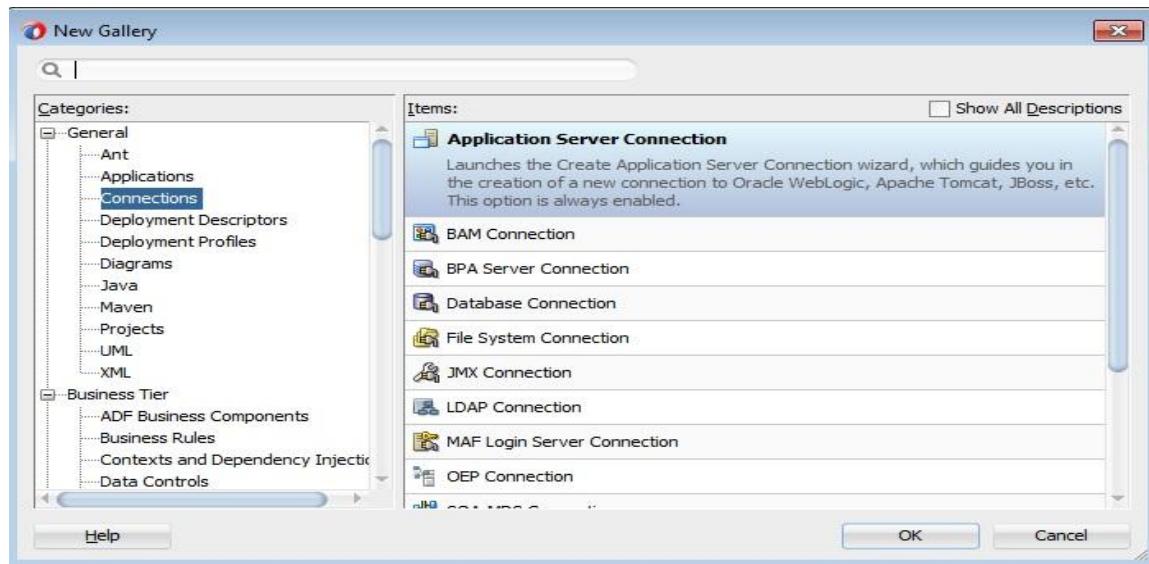
A screenshot of a web browser window titled "localhost:7001/console/console.portal?_nfpb=true&_pageLabel=CoreServerServerTablePage". The title bar has a red border. The main header says "ORACLE WebLogic Server Administration Console 12c". Below it is a toolbar with icons for back, forward, search, and other functions. A navigation bar at the top left shows "Change Center" and "View changes and restarts" sections, and "Domain Structure" with a tree view of "soa12c_domain" containing "Environment", "Deployments", "Services", "Security Realms", "Interoperability", and "Diagnostics". A "How do I..." sidebar on the left lists "Create Managed Servers", "Clone servers", and "Delete Managed Servers". The main content area is titled "Summary of Servers" and shows a table of servers. The table has columns: Name, Type, Cluster, Machine, State, and Health. It contains three rows: "AdminServer(admin)" (Configured, RUNNING, OK), "osb_server1" (Configured, RUNNING, OK), and "soa_server1" (Configured, SHUTDOWN, Not reachable). Below the table are "New", "Clone", and "Delete" buttons.

Getting Started

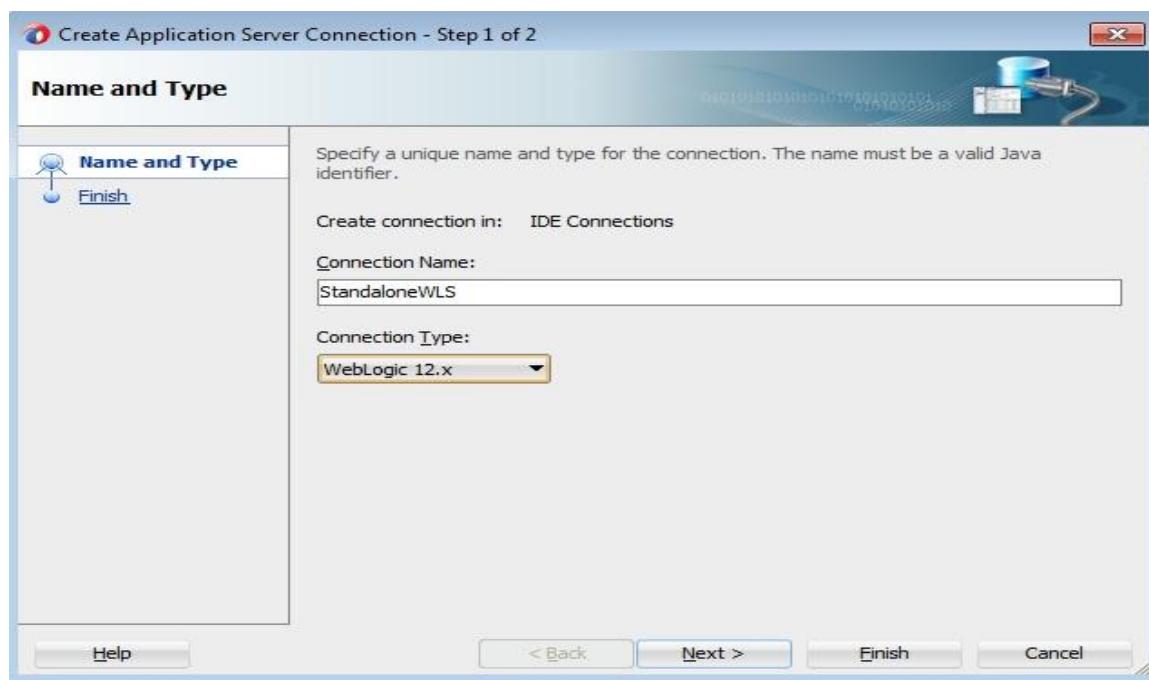
As mentioned, you will be using **JDeveloper IDE** for Service Bus development. You can create **Weblogic server connection** in JDeveloper itself to make the deployment easier or you can use integrated Weblogic server,

Adding Weblogic Server in IDE

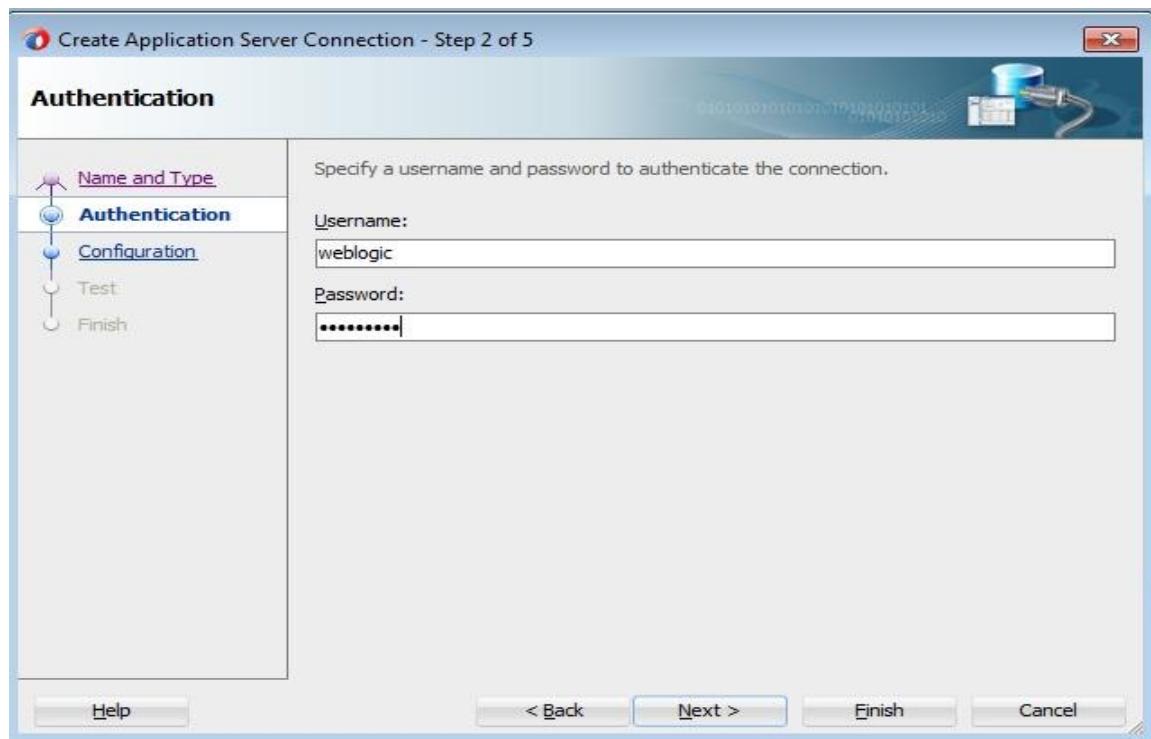
Go to **File -> New -> From Gallery** and navigate to **General -> Connections**. Select **Application Server Connection** and click **OK**.



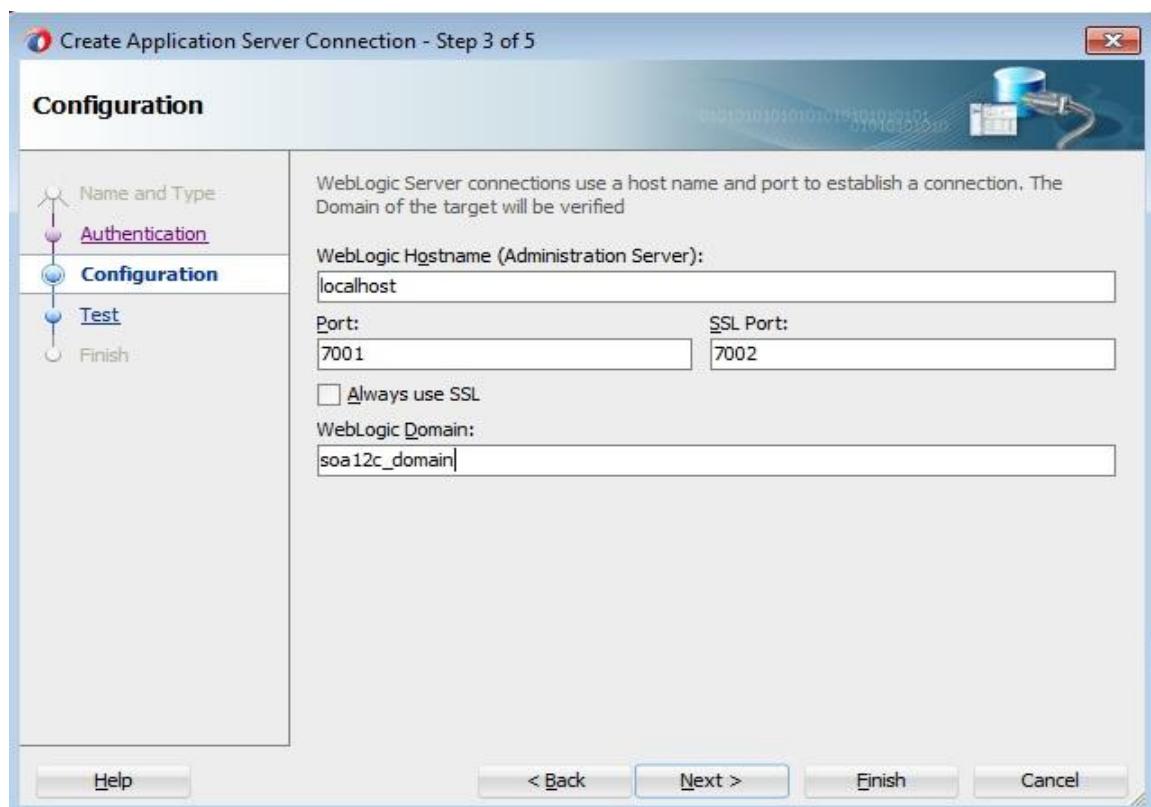
Enter **Connection Name** and select appropriate **Connection Type** as shown below.



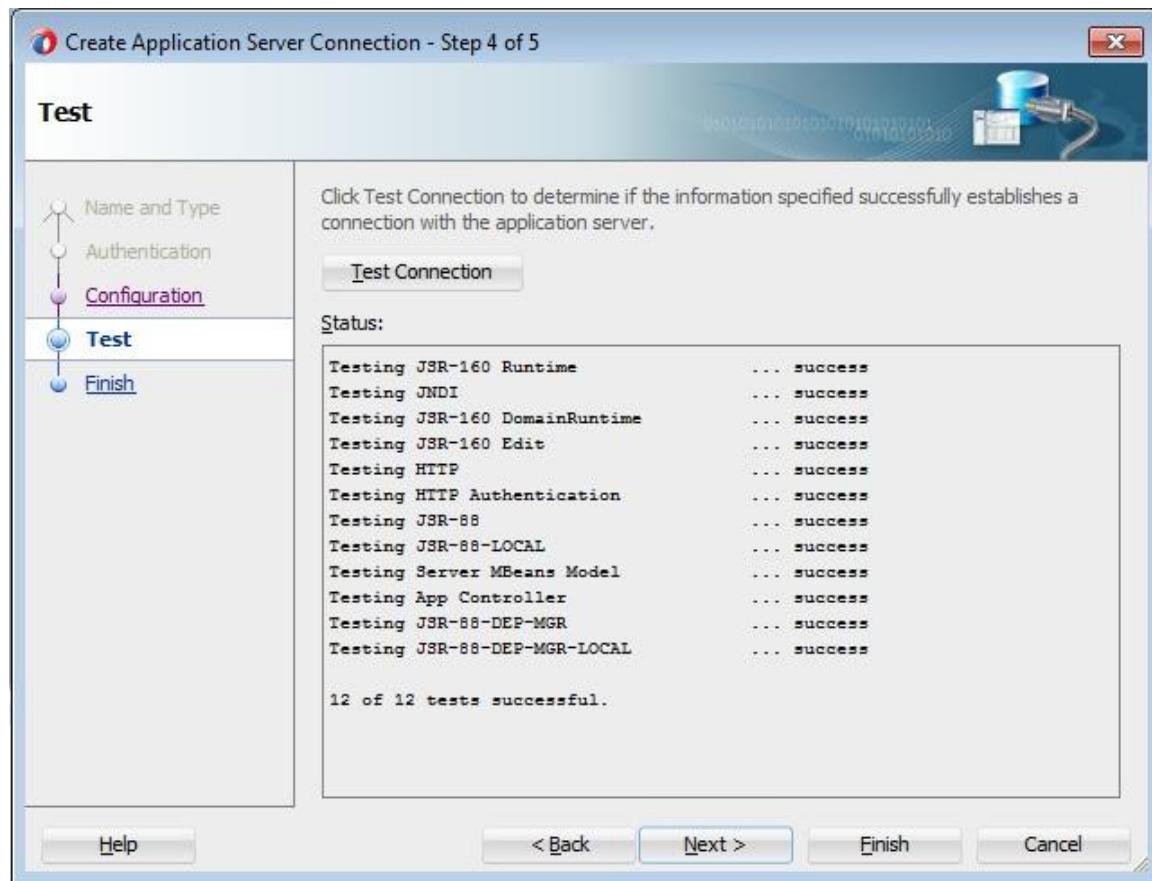
Click **Next** and give valid credentials.



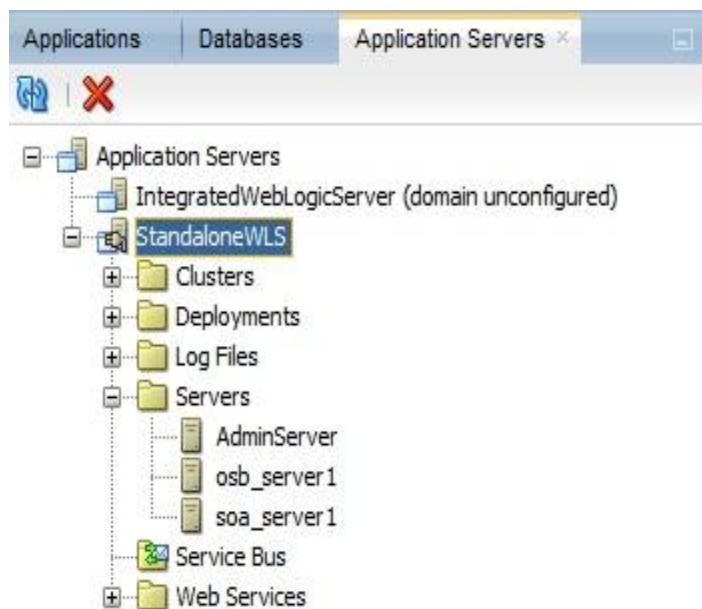
Click **Next** and give the server details and **Weblogic Domain** as shown below.



Click **Next** and do **Test Connection**.



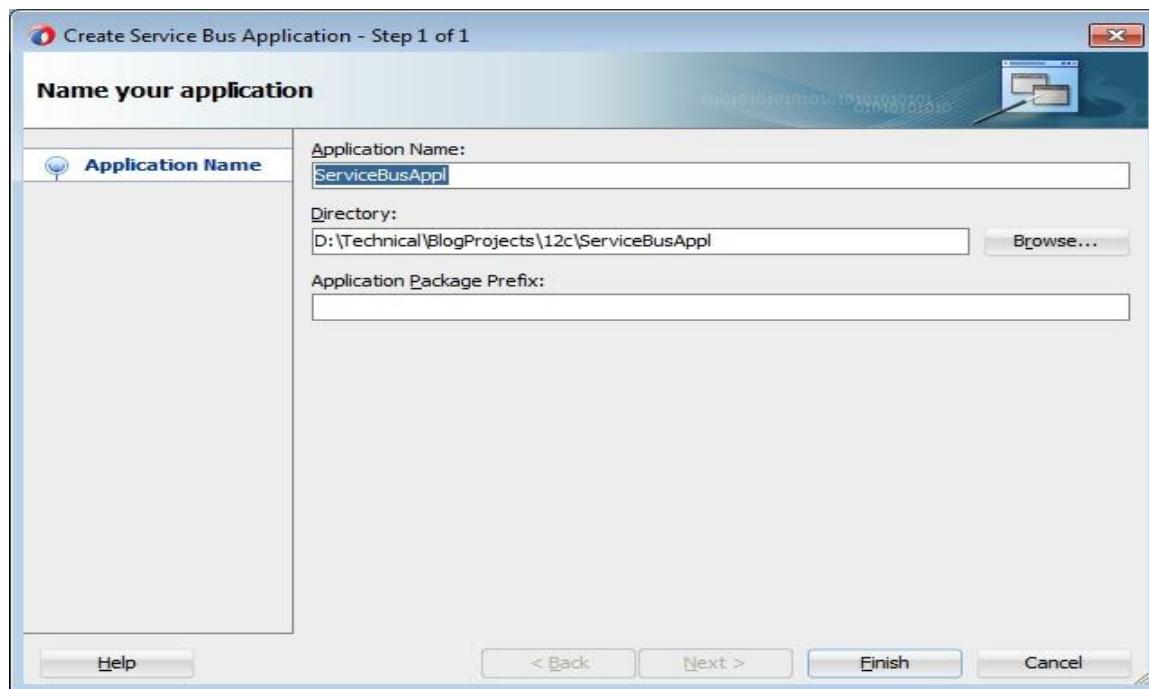
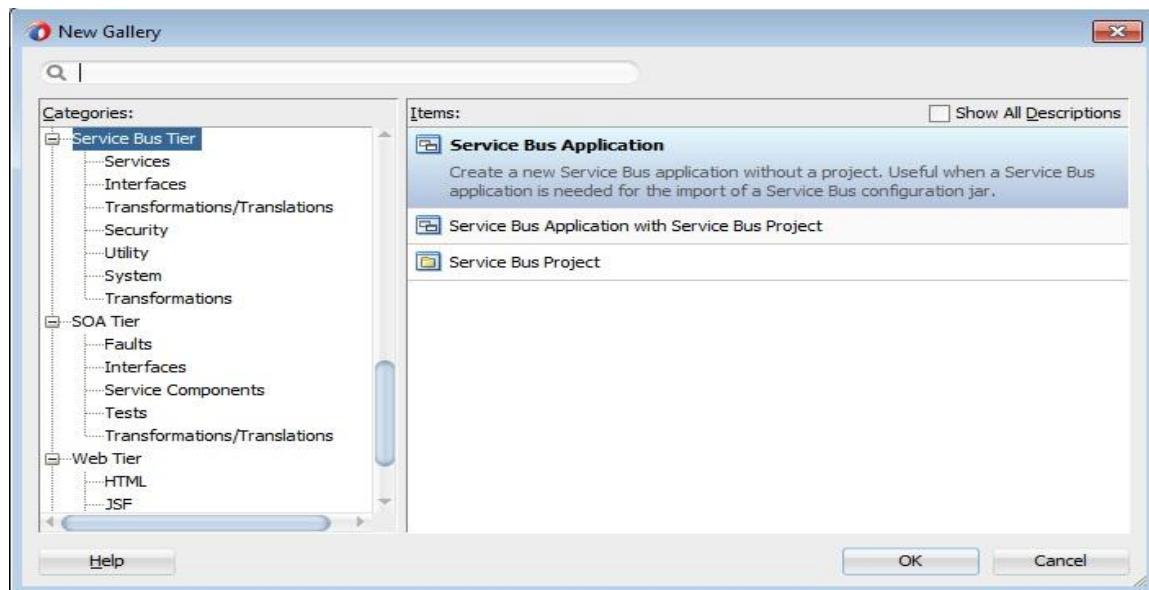
Click **Finish** and verify navigating to **Window -> Application Servers**.



Creating Service Bus Application

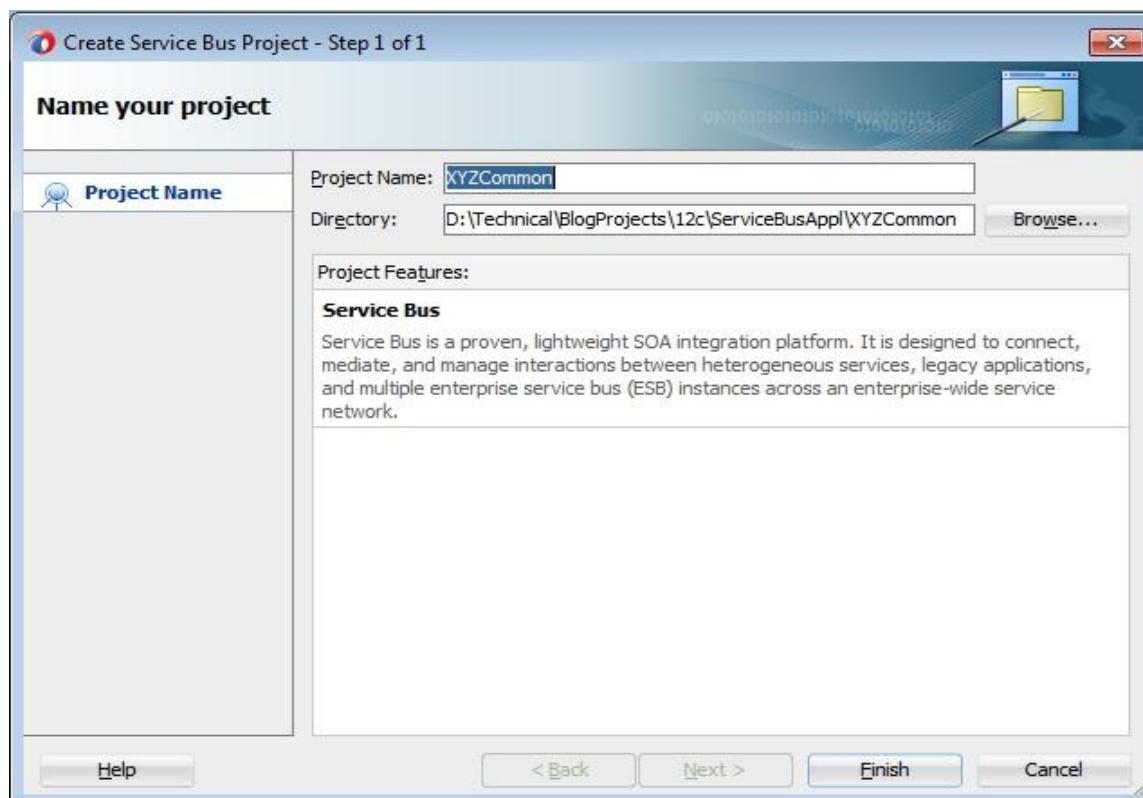
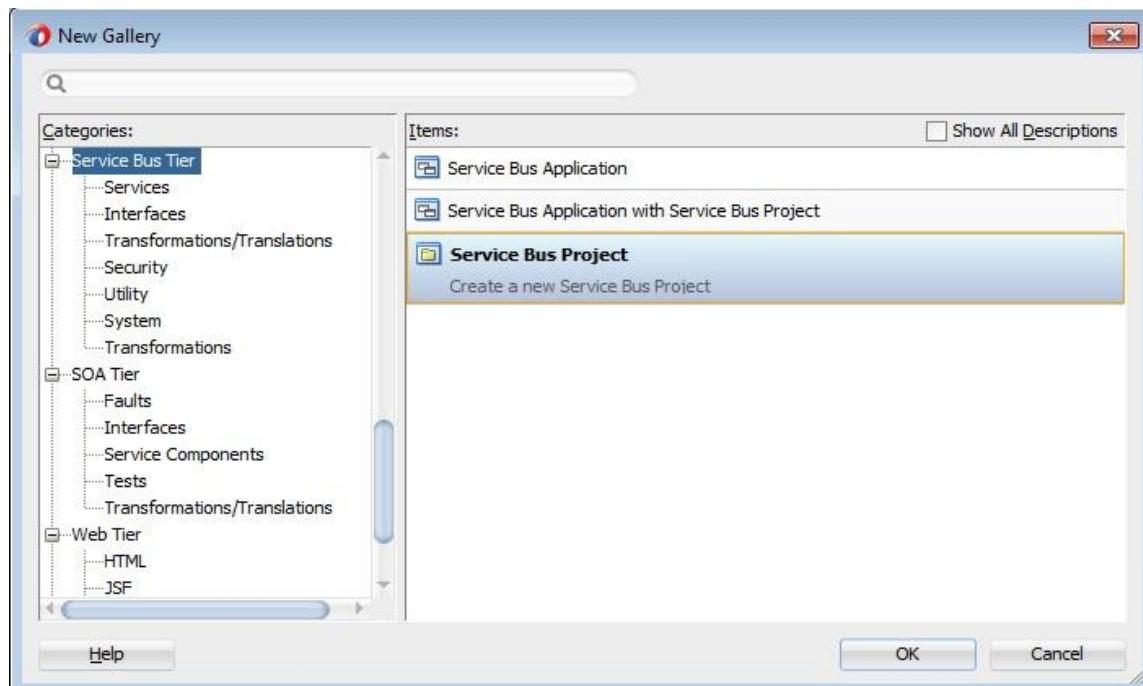
In Service Bus development, you make use of different resources like **Proxy Service**, **Business Service**, **WSDL**, **XSD**, **XQuery**, **XSLT** etc. Also there are other resources like **SMTP Server**, **JNDI Provider** called **Global resources**. **Service Bus Project** acts as a container for different resources and **Service Bus Application** is a high-level container for all these Service Bus projects and Global resources.

You usually start development activity with creation of new Service Bus Application. So create one by navigating to **File -> New -> From Gallery -> Service Bus Tier**. Select **Service Bus Application** and give name as **ServiceBusAppl** and click **Finish**.

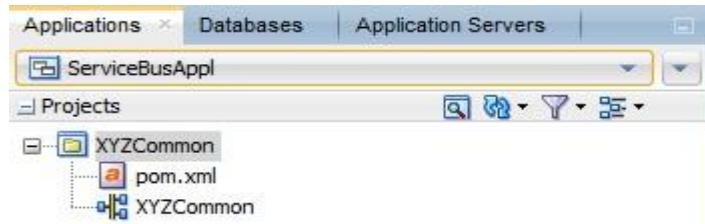


Creating Service Bus Projects

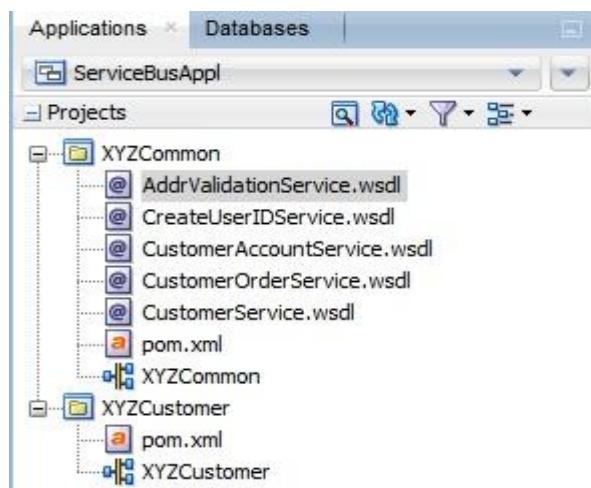
Now you proceed with creation of **Service Bus Projects** considering reusability and modularity. Create new Service Bus Project by navigating to **File -> New -> From Gallery -> Service Bus Tier**. Select **Service Bus Project** and give the name as **XYZCommon** and click **Finish**.



Now your **Project Explorer** should look like below showing **Service Bus Application** and **Service Bus Project** containing 2 files (**pom.xml** and **XYZCommon**). You will see a file with same name as your project called project overview file which opens up **Service Bus Overview editor** when opened.

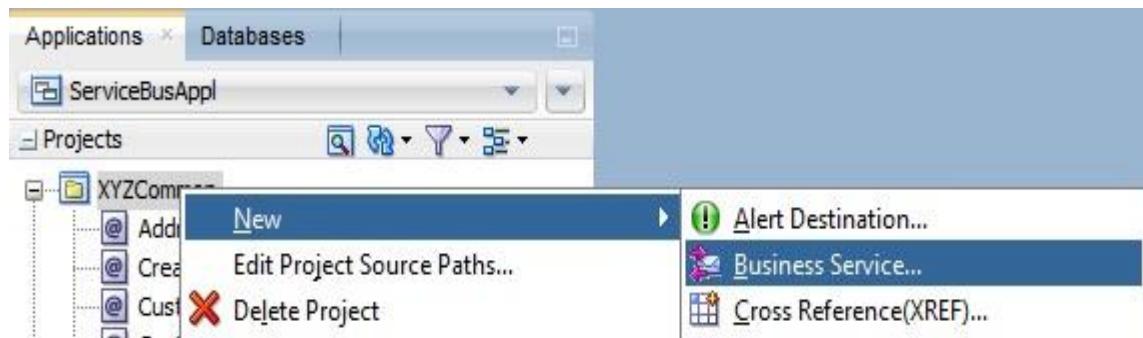


Copy all given WSDLs in **XYZCommon** Service Bus project. You can do this by copying WSDLs into project directory directly in file system. Click **Refresh** in **Project Explorer** so that these resources will be shown. Create another Service Bus Project **XYZCustomer** to be used later in the tutorial. Now your **Project Explorer** should look like below.

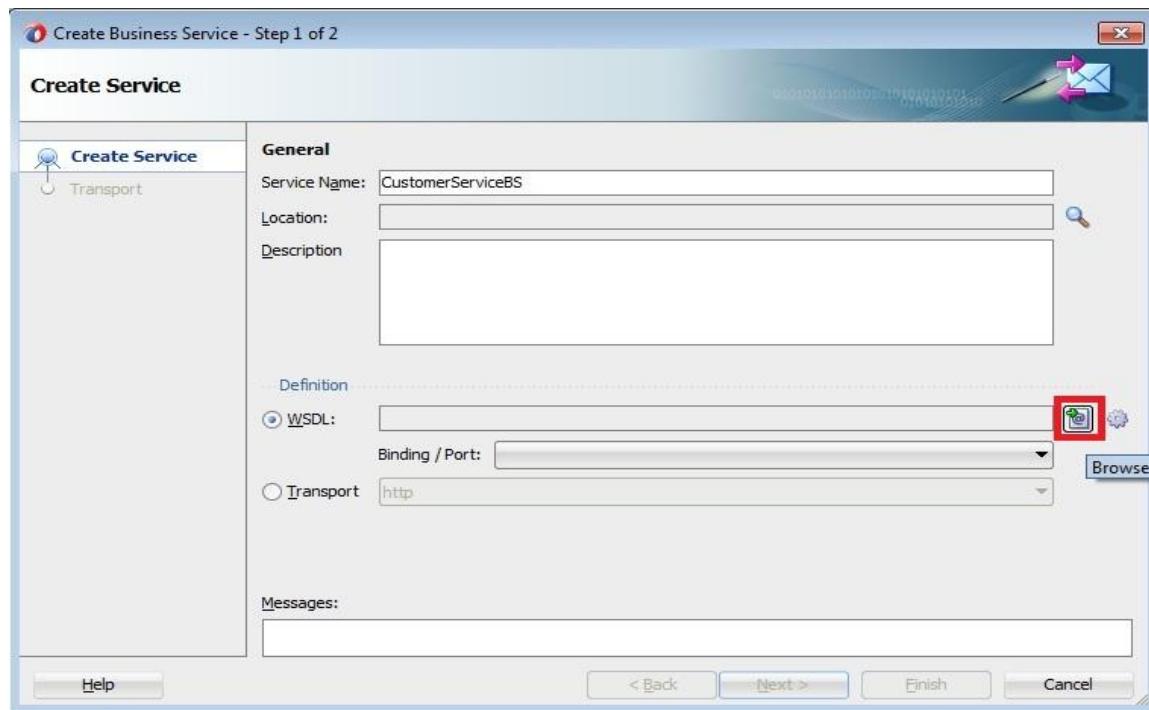


Creating Business Services

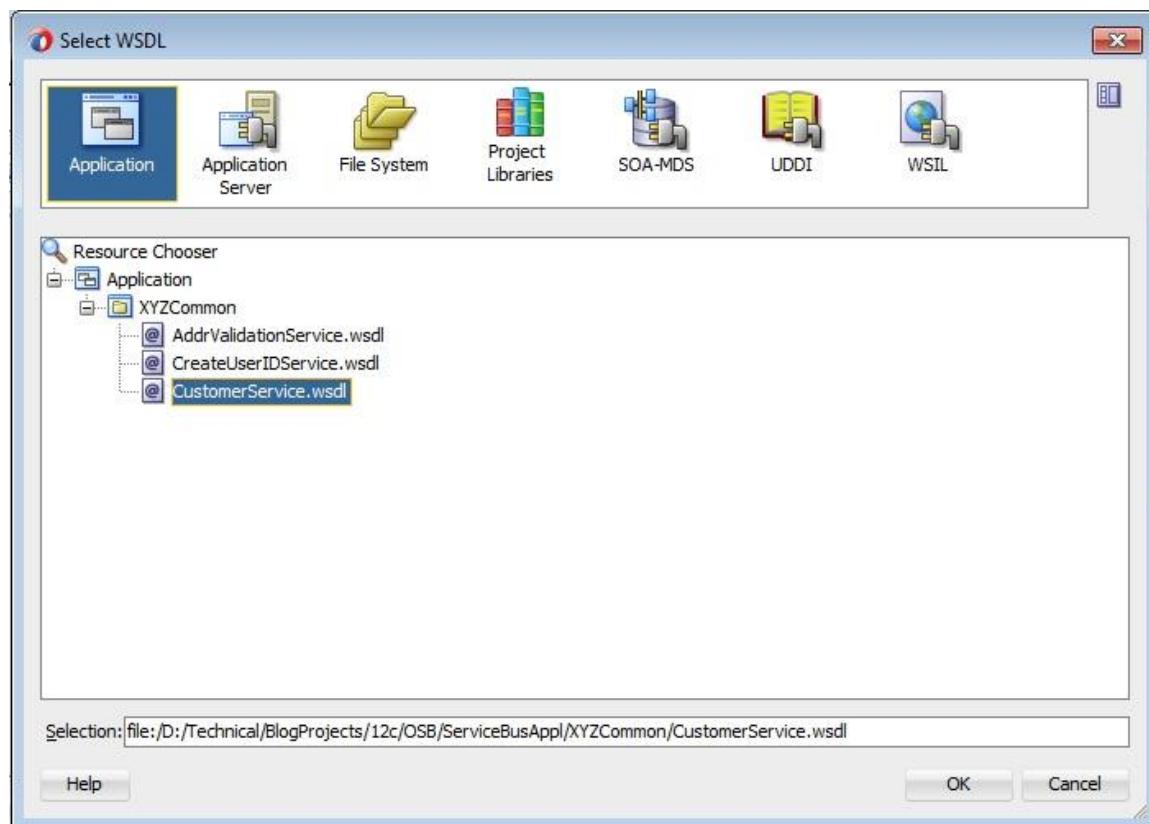
In Service Bus, Business Services provide abstraction layer and take care of communication with Service Providers. So you have to create 3 business services using the given 3 WSDLs. To create business service, right click on **XYZCommon** project and select **New -> Business Service**.



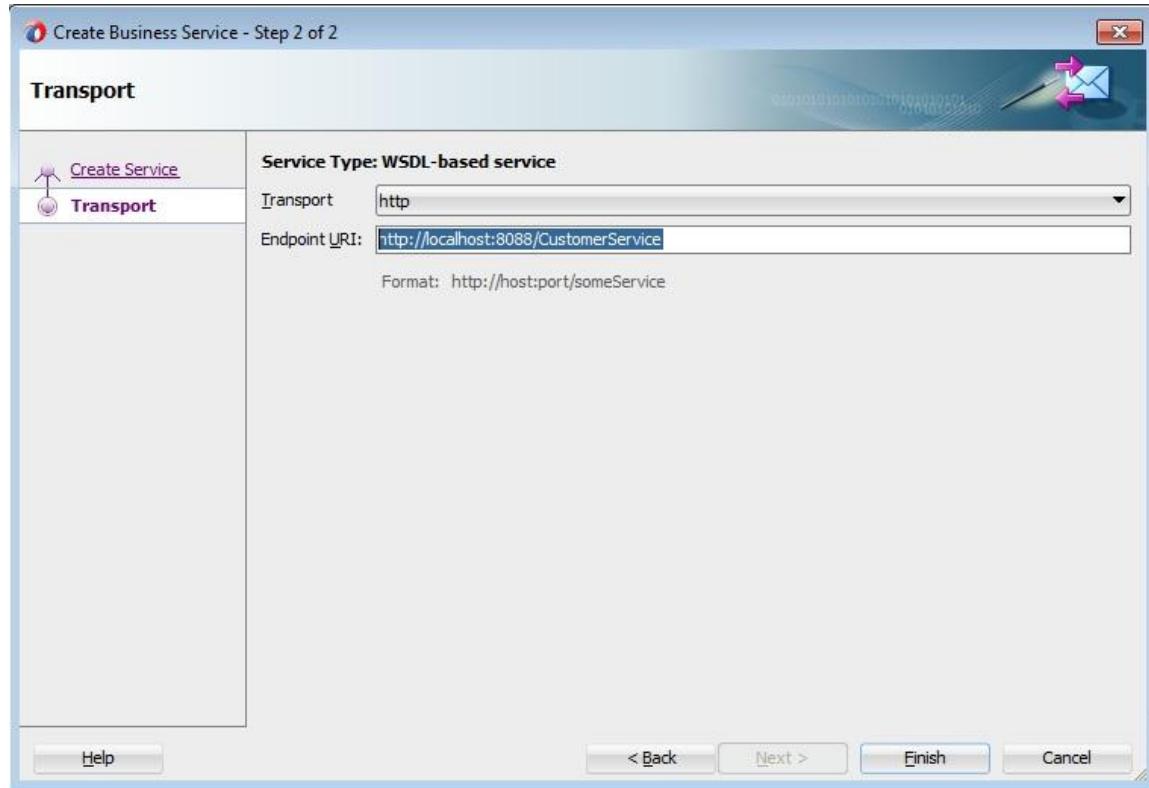
Give name as **CustomerServiceBS**.



Click **Browse WSDLs** icon (shown above) and choose **CustomerService** WSDL as shown below.



Go back to **Create Business Service** window by clicking **OK**. Click **Next** and enter **Endpoint URI** of SOAP UI Mock Service or any other service implementation.



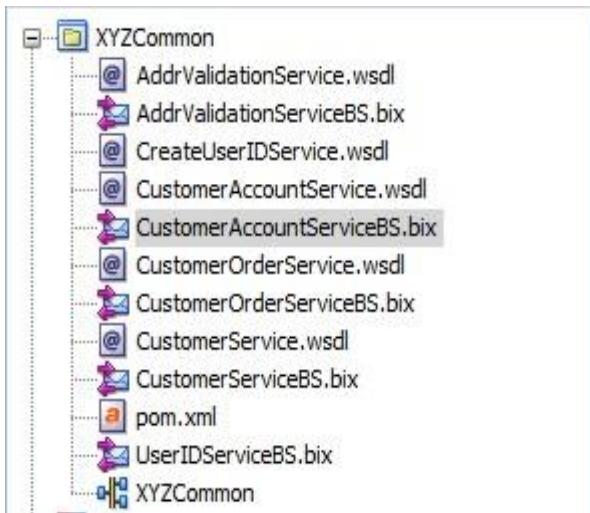
Click **Finish** to bring up window showing new business service **CustomerServiceBS.bix**.



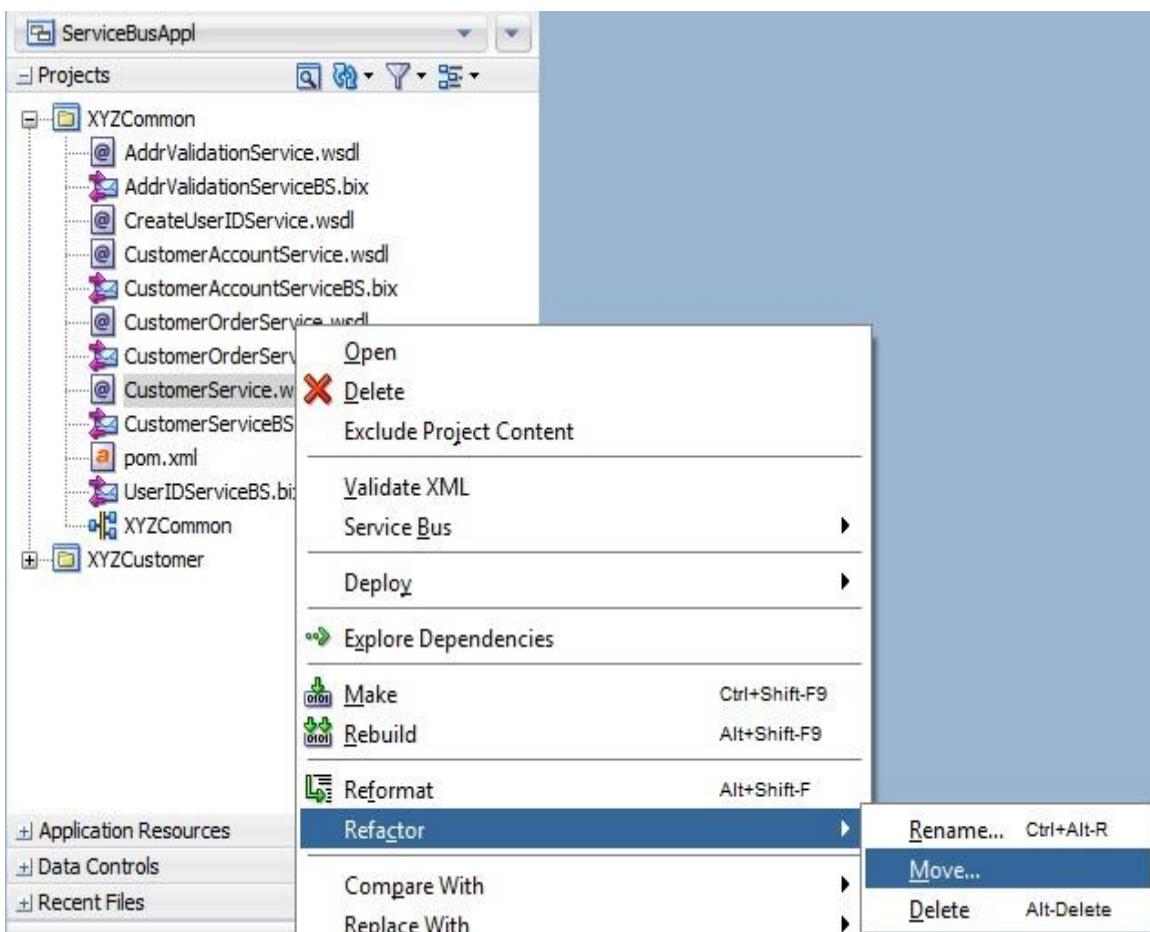
Retain default values for all parameters in all other tabs **Transport Details**, **Message Handling**, **Performance** and **Policies** of business service.

In similar fashion, create all other business services **AddrValidationServiceBS**, **UserIDServicEBS**, **CustomerOrderServiceBS** and **CustomerAccountServiceBS** within same service bus project using

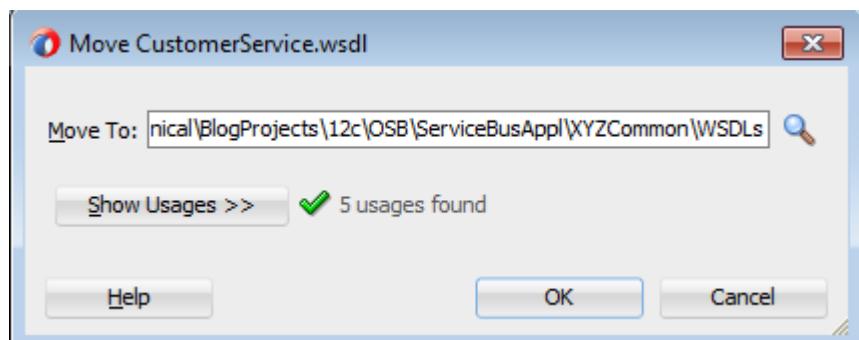
WSDLs **AddrValidationService.wsdl**, **CreateUserIDService.wsdl**, **CustomerOrderService.wsdl** and **CustomerAccountService.wsdl** respectively.



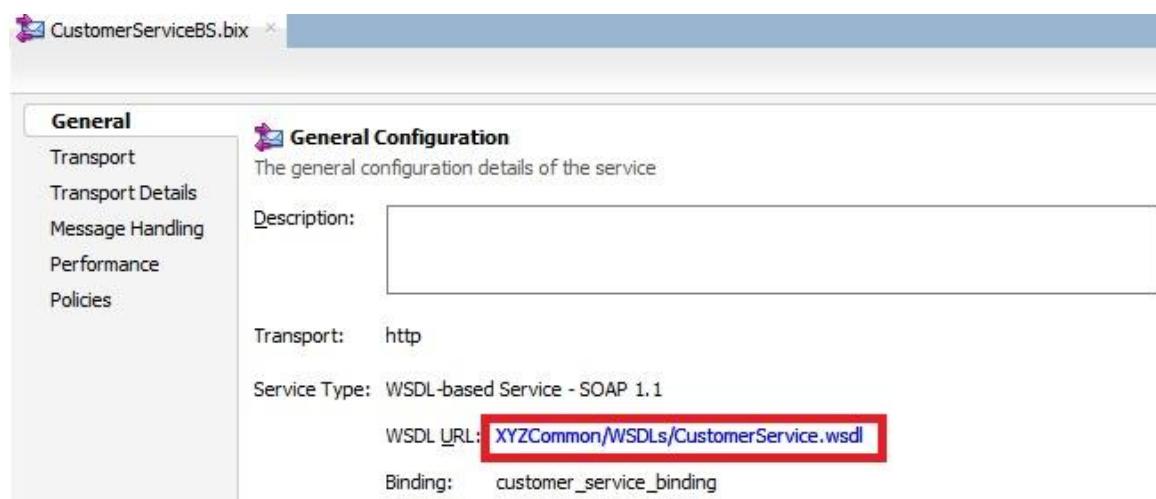
You can better organize WSDLs and business services in their respective folders in Service Bus project. Since you already created these resources, you can **Refactor** them into desired folders. Right click **CustomerService.wsdl** and select **Refactor -> Move** as shown below.



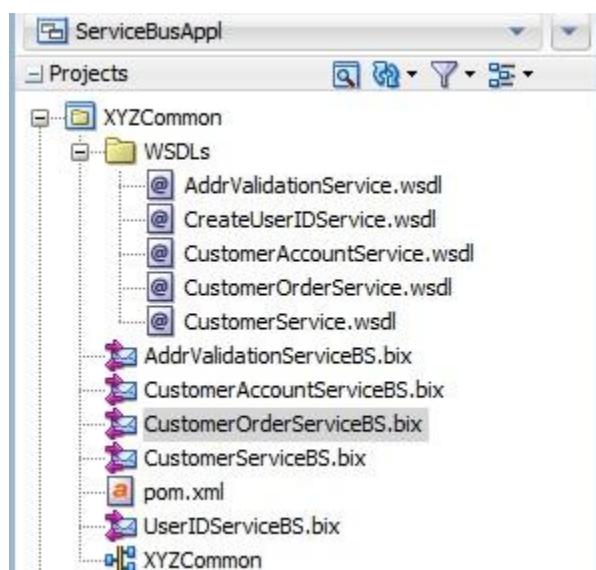
Give folder as WSDLs as shown below.



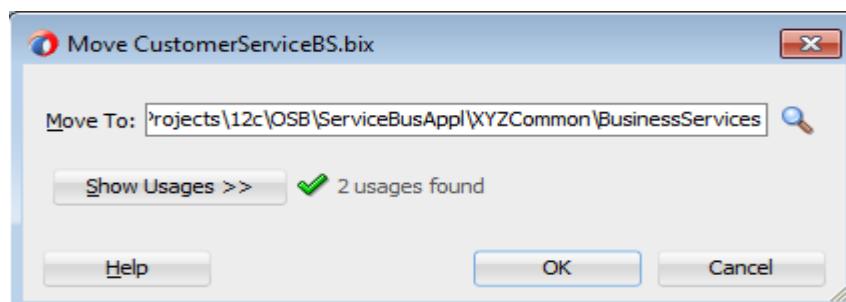
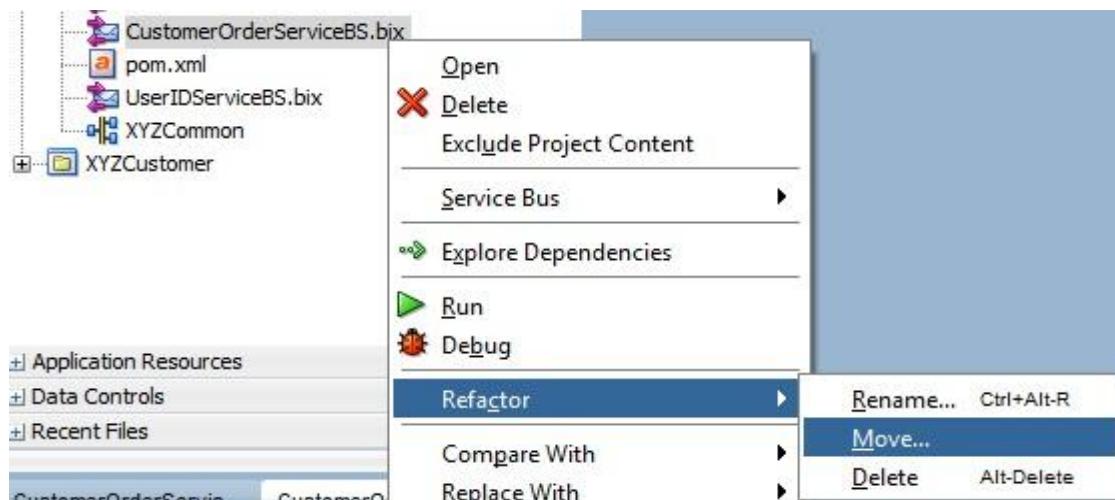
Click **OK** and verify that business service is updated with correct path of WSDL.



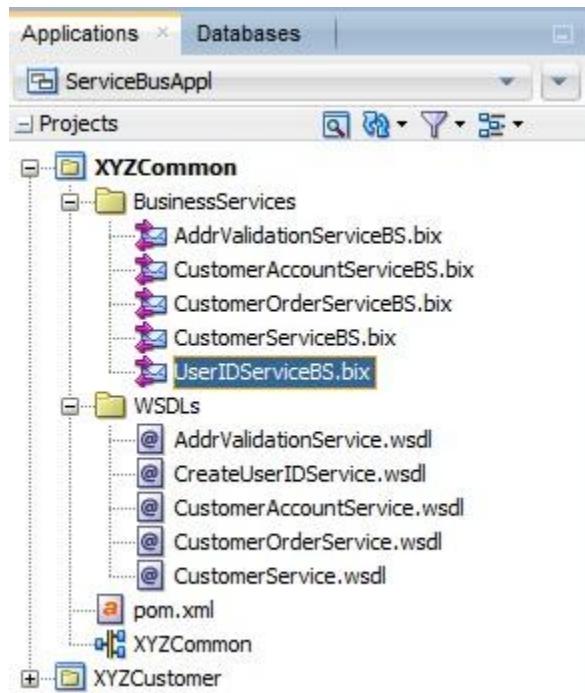
Similarly Refactor all other WSDLs. Now your **Project Explorer** should look like below.



Also **Refactor** all your business services using steps mentioned below.



Now your **Project Explorer** should look like below.

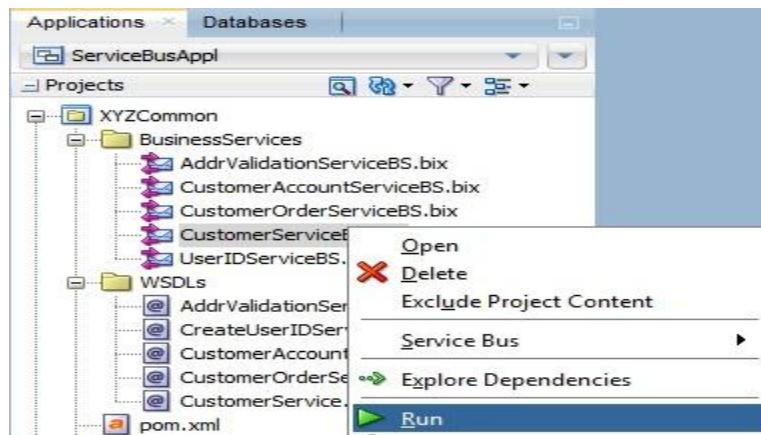


Deploying and Testing

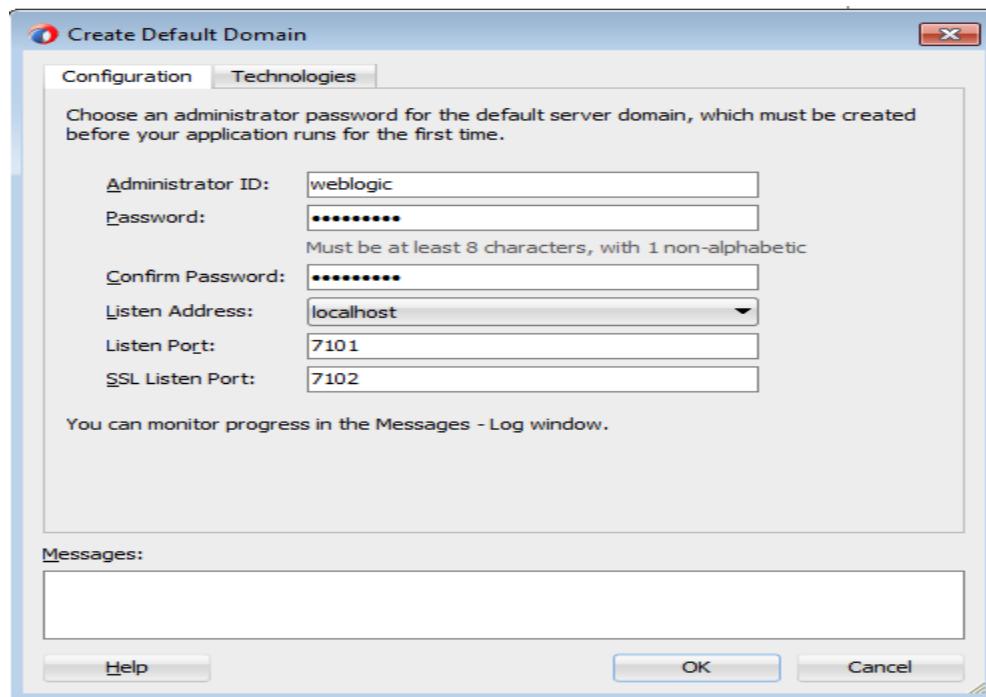
It's always recommended to run your Business/Proxy services to verify that you are able to send request and receive response as expected. Typically, if the service provider is external to your organization, then you have to configure business service to use HTTP proxy server. For this tutorial, you don't need any proxy server configuration.

*Note: HTTP Proxy Server is a global resource to be created in Service Bus Application and can be attached to business service in **Advanced Settings** of Transport Details tab.*

In 12c, you can use either **Integrated** or **Standalone** WLS to test business/proxy services. Right click your Business/Proxy service and select **Run**.



If **Default Domain** does not exist, it will prompt your for credentials to create an Integrated WLS. Enter credentials as shown below and click **OK** to start server.



After server starts, verify that test console is opened as shown below. The test console will show you all available operations (based on WSDL), Request Document section (to enter payload), Transport section (to enter transport headers) and Attachments section.

The screenshot shows the Oracle Service Bus Console interface for testing a business service named 'CustomerServiceBS'. The 'Execute' button is highlighted in red. The 'Request Document' tab is selected, displaying the XML schema for a customer payload. The schema is as follows:

```
<urn:customer xmlns:urn="urn:xyzbank:cust:schema:customer">
  <!--Optional:-->
  <customer_id>string</customer_id>
  <full_name>string</full_name>
  <customer_type>string</customer_type>
  <date_of_birth>2008-09-29</date_of_birth>
  <email>string</email>
  <phone>string</phone>
  <addr_line1>string</addr_line1>
  <!--Optional:-->
  <addr_line2>string</addr_line2>
  <!--Optional:-->
  <addr_line3>string</addr_line3>
  <!--Optional:-->
  <addr_line4>string</addr_line4>
</urn:customer>
```

Click **Execute** and observe that you are able to send request and response in test console as shown below. You can use **Back** button to repeat your test scenarios. In similar manner, you can verify all other business services.

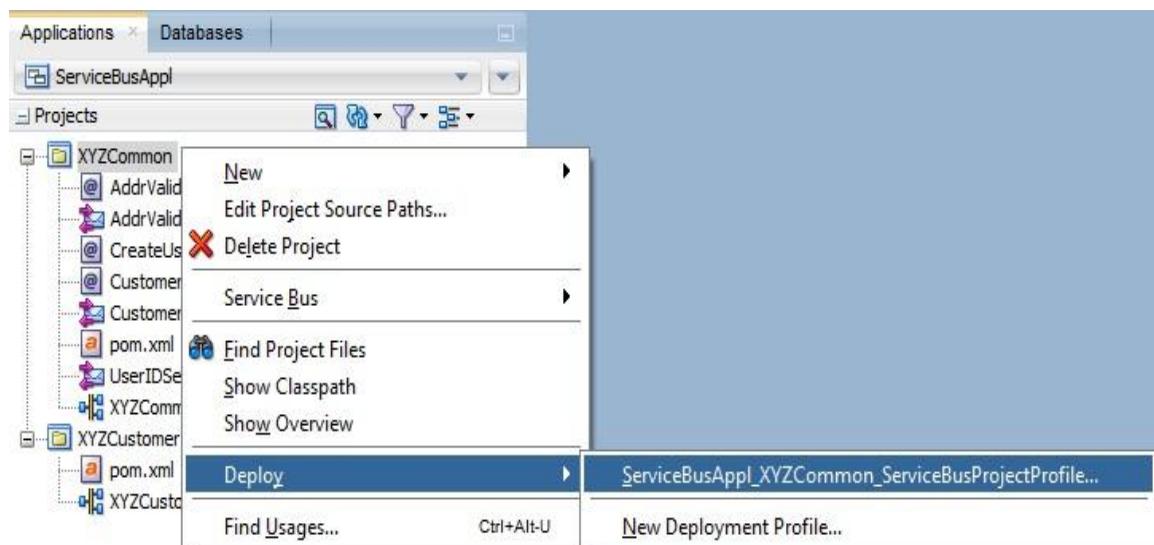
Request Document

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soap:Header xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
  </soap:Header>
  <soapenv:Body>
    <urn:customer xmlns:urn="urn:xyzbank:cust:schema:customer">
      <!--Optional:-->
      <customer_id>string</customer_id>
      <full_name>string</full_name>
      <customer_type>string</customer_type>
      <date_of_birth>2008-09-29</date_of_birth>
      <email>string</email>
      <phone>string</phone>
      <addr_line1>string</addr_line1>
      <!--Optional:-->
      <addr_line2>string</addr_line2>
      <!--Optional:-->
      <addr_line3>string</addr_line3>
      <!--Optional:-->
      <addr_line4>string</addr_line4>
    </urn:customer>
  </soapenv:Body>
</soapenv:Envelope>
```

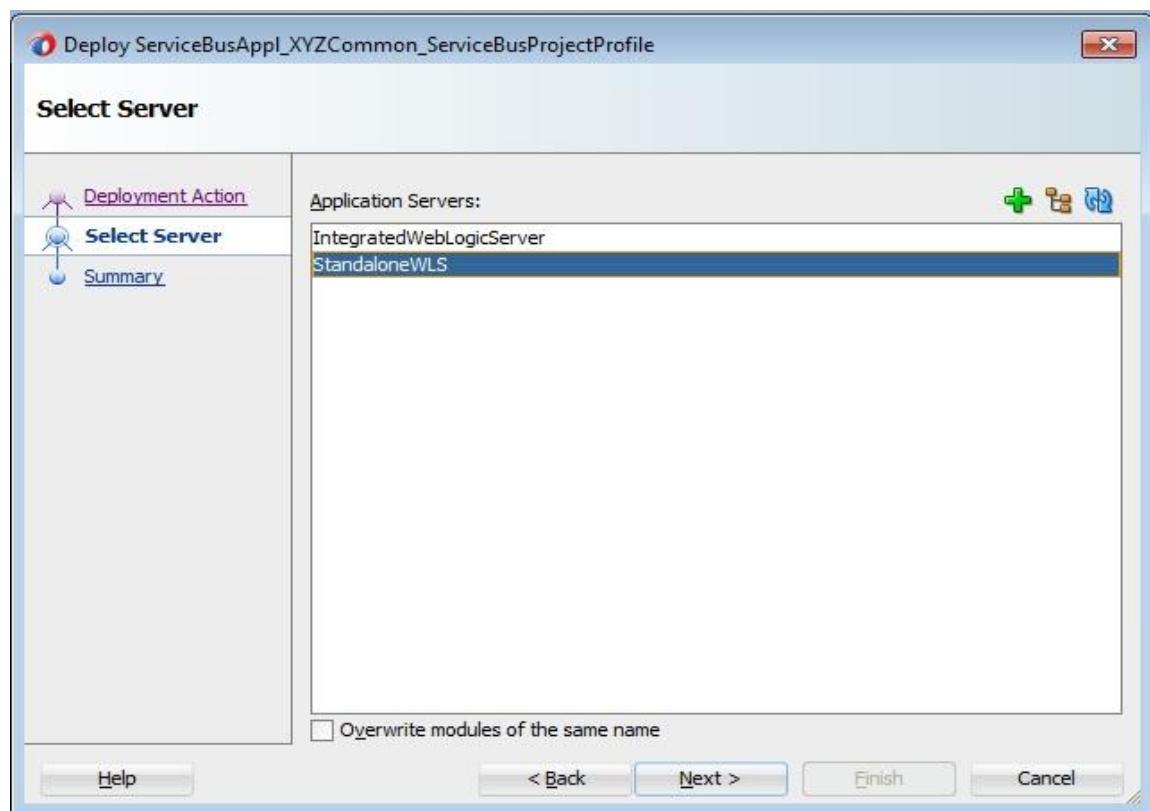
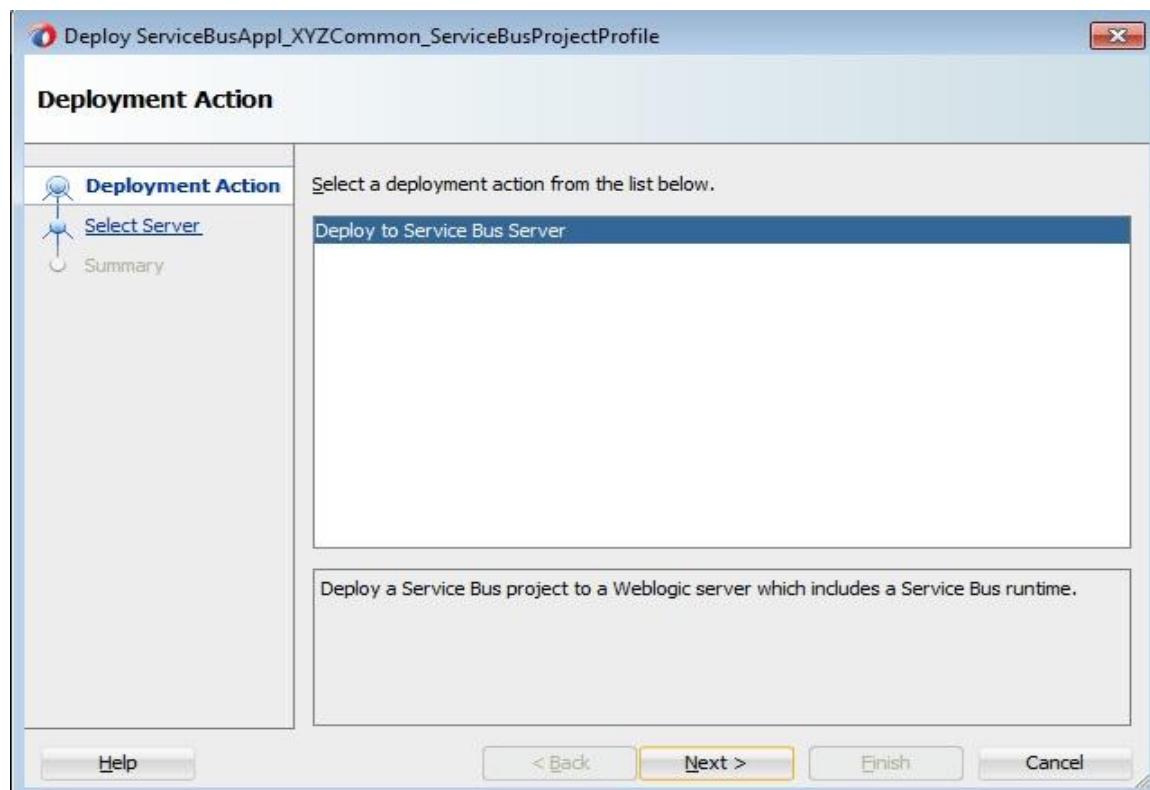
Response Document

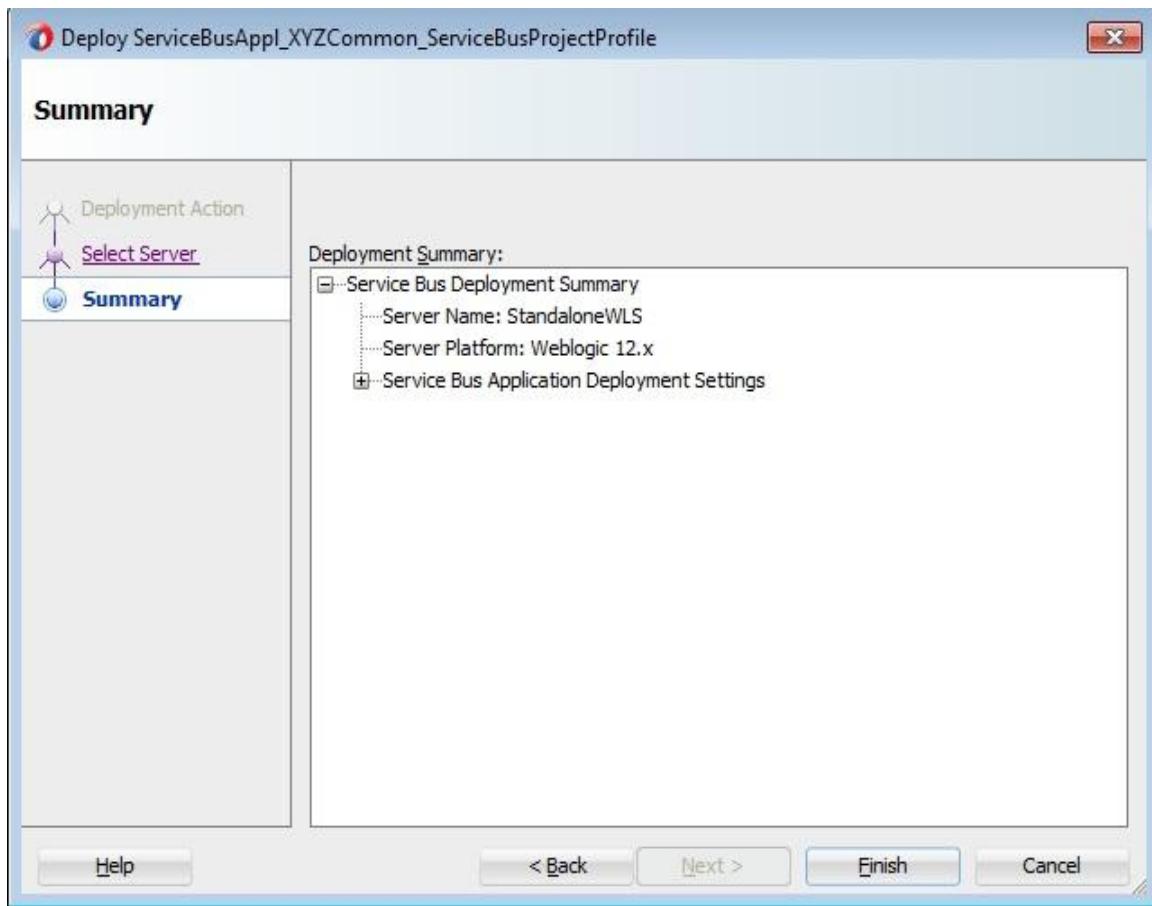
```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:urn="urn:xyzbank:cust:schema:customer">
  <soapenv:Header/>
  <soapenv:Body>
    <urn:status_msg>
      <customer_id>1234</customer_id>
      <status>5</status>
    </urn:status_msg>
  </soapenv:Body>
</soapenv:Envelope>
```

You can also deploy your Service Bus project to standalone WLS from JDeveloper and test from **sbconsole**. Right click **XYZCommon** project and choose deploy as shown below.



Finish the deployment as shown below.

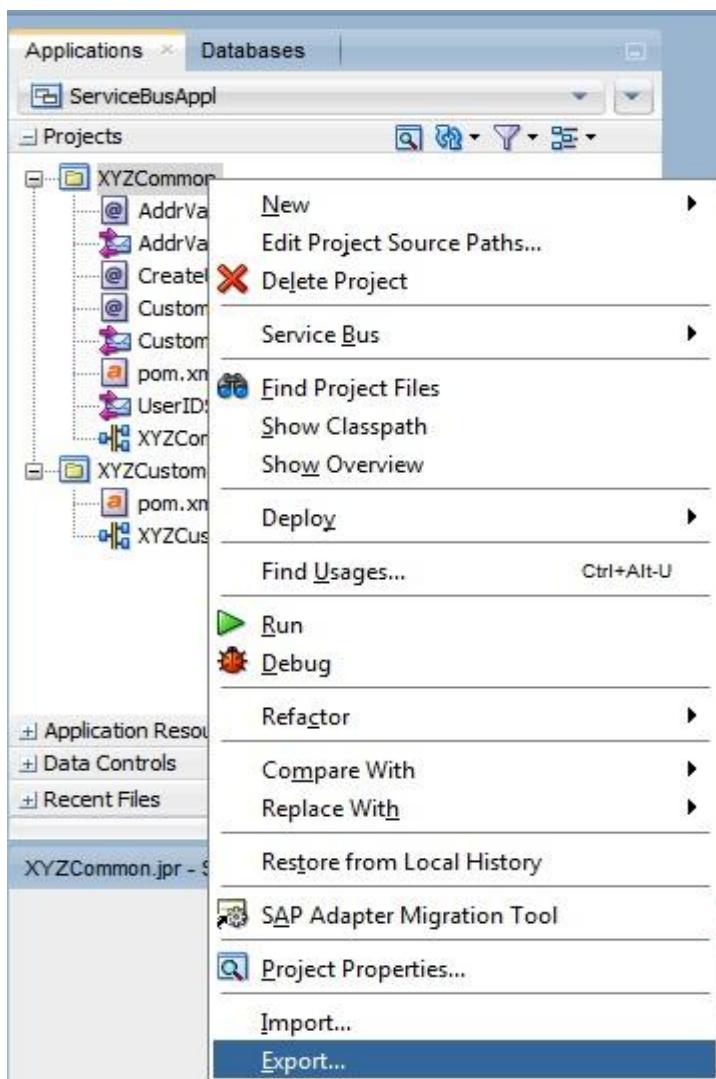




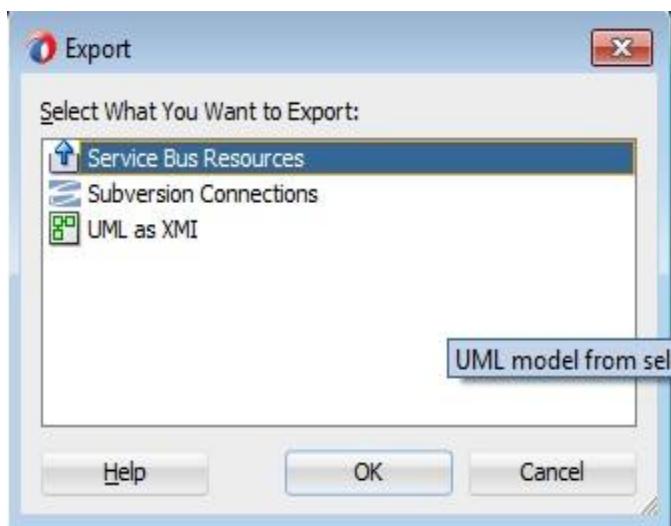
Once deployment is done, you can navigate to **sbconsole** and test your Business/Proxy services. Clicking arrow icon (highlighted below) will bring up the same test console shown earlier.

Name	Type	Actions
AddrValidationService	WSDL	
CreateUserIDService	WSDL	
CustomerService	WSDL	
CustomerServiceBS	Business Service	
UserIDServiceBS	Business Service	

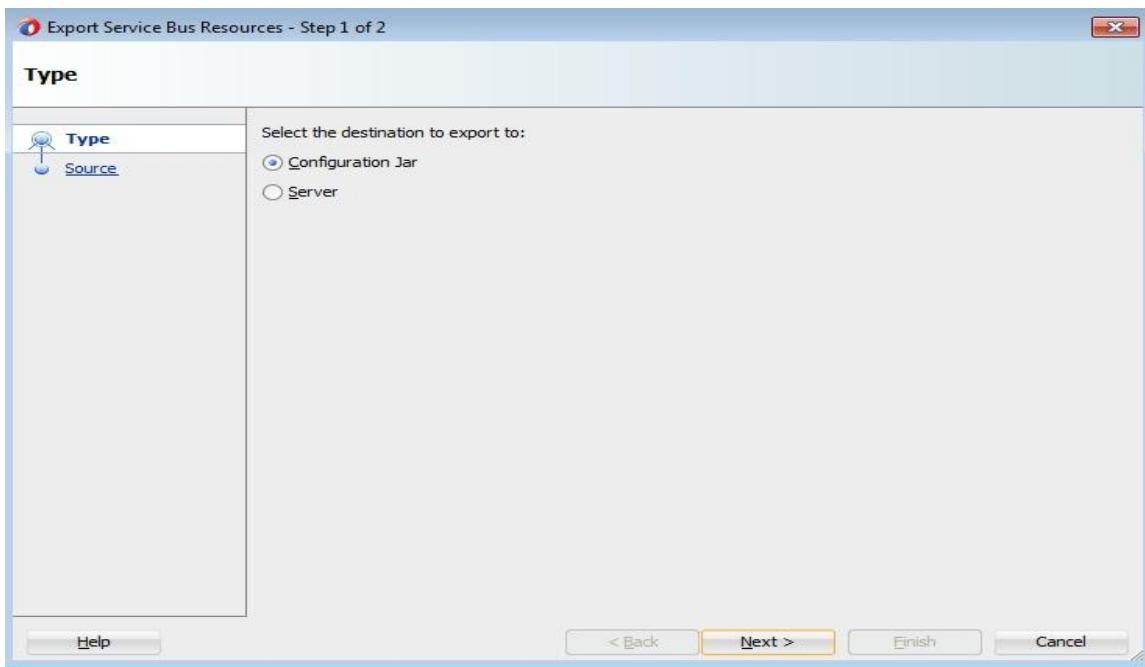
Another option is exporting your projects to **Configuration Jar** and deploy to either **Integrated** or **Standalone WLS**. Right click **XYZCommon** project and select **Export** as shown below.



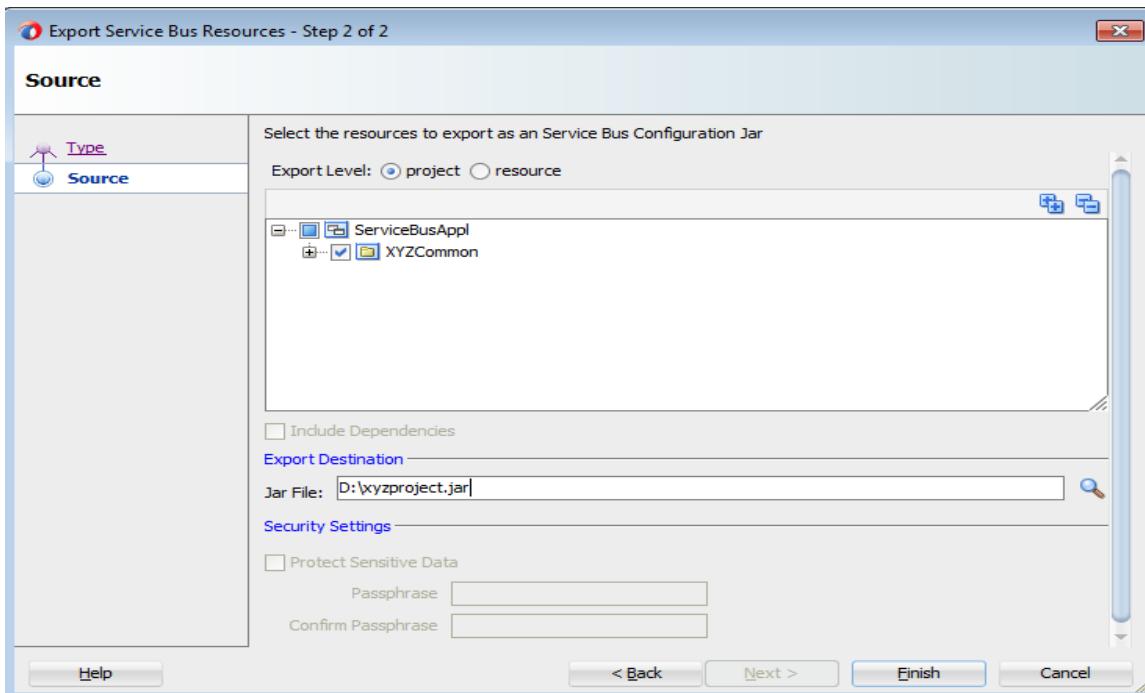
Select **Service Bus Resources** option as shown below.



Select **Configuration Jar** as destination.



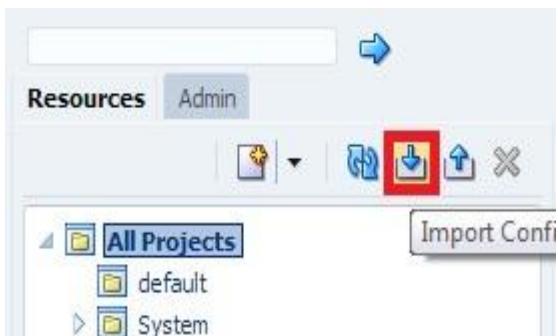
Click **Next** and give Jar file name including file system path as shown below and click **Finish**.



Open **sbconsole** and create new session by clicking **Create** to import configuration jar.



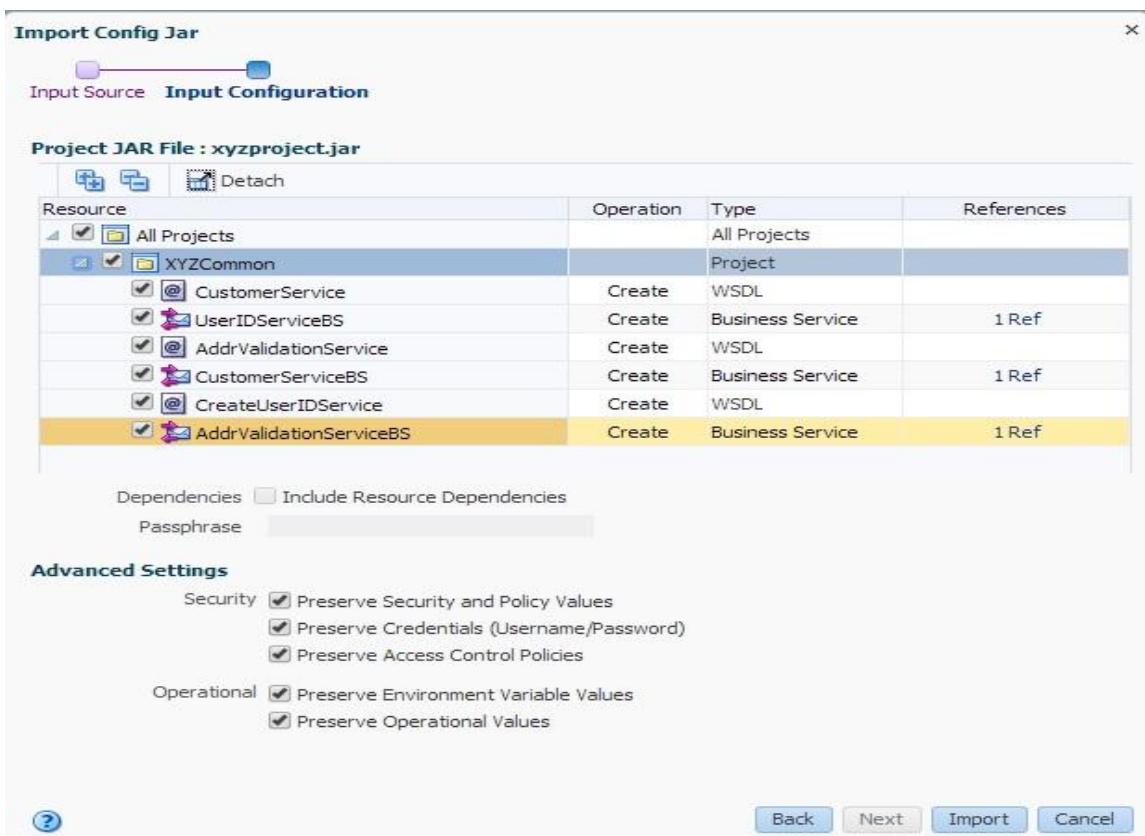
Click **Import** icon in **Resources** tab.



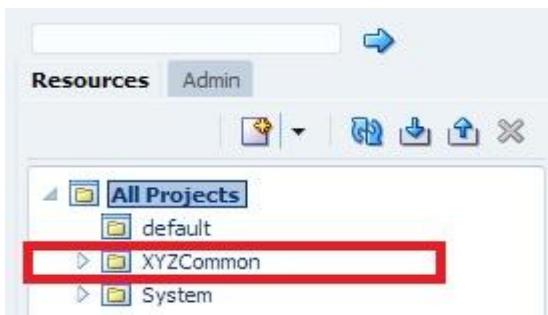
Select configuration jar using **Choose File** button as show below.



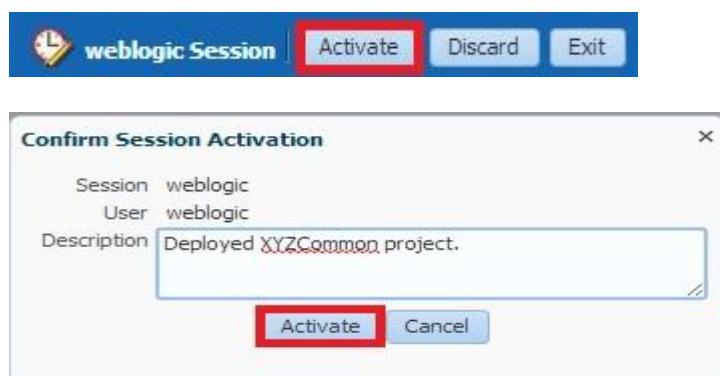
Click **Next**. Accept defaults and click **Import**.



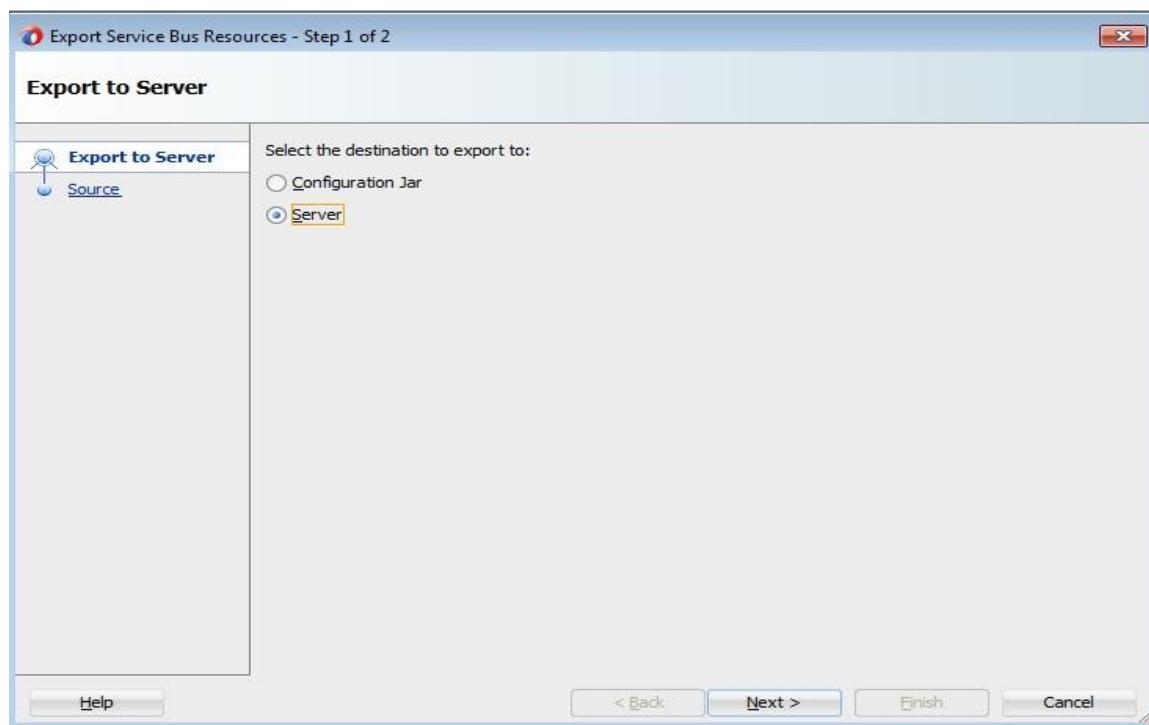
Click **Close** on confirmation screen and verify new project is shown as below in **Resources** tab.



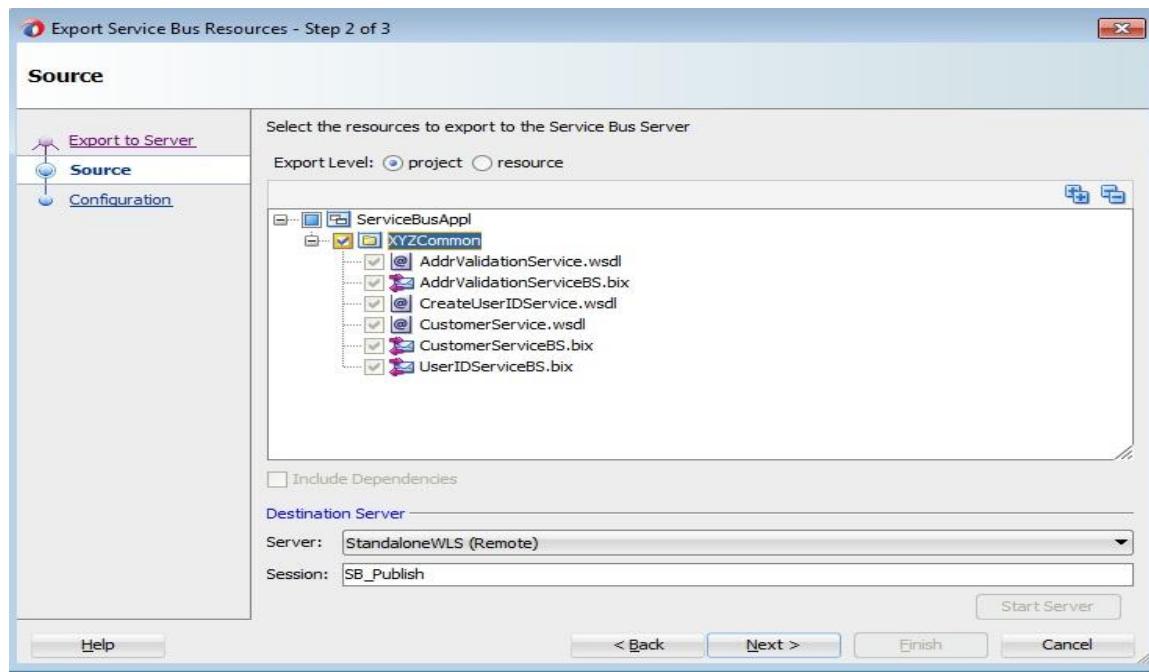
Click **Activate** and confirm the session so that your changes will be effective.



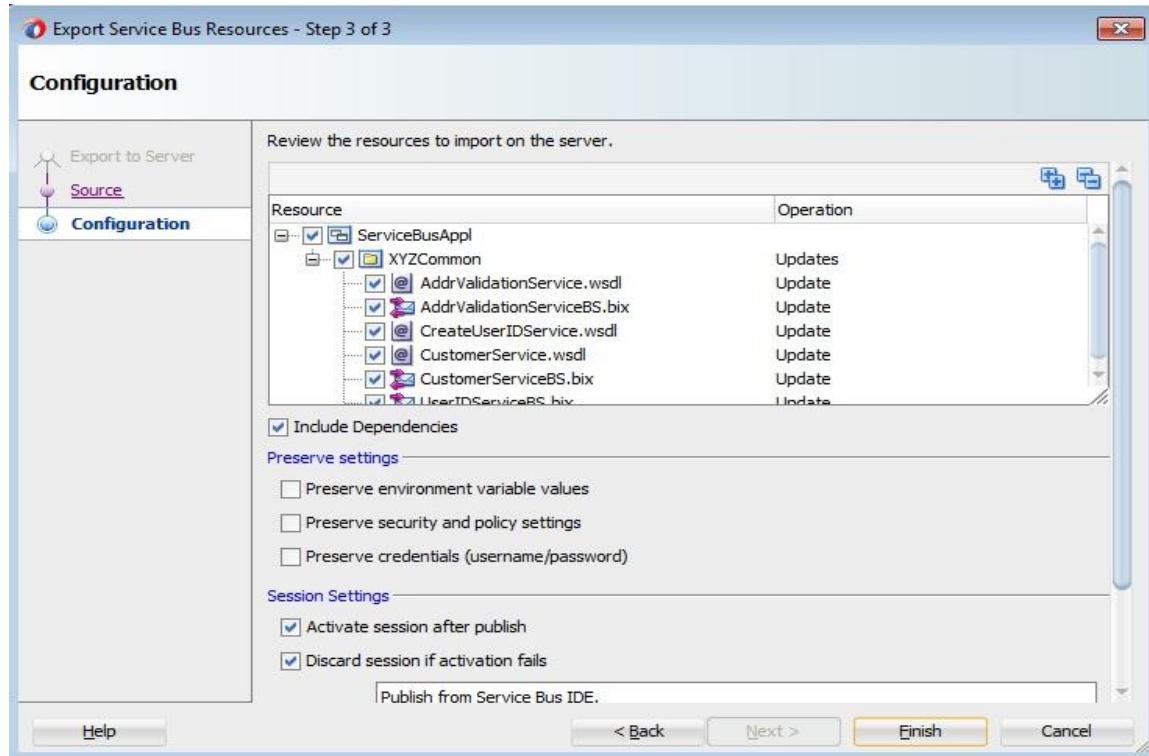
In the same way, to export Service Bus project directly to server choose **Server** as shown below in **Export Service Bus Resources** window shown earlier.



Click **Next** and choose **Destination Server** as shown below.



Click **Next**. Accept defaults and click **Finish**. Once export is successful, you can launch **sbconsole** and test your Business/Proxy services.

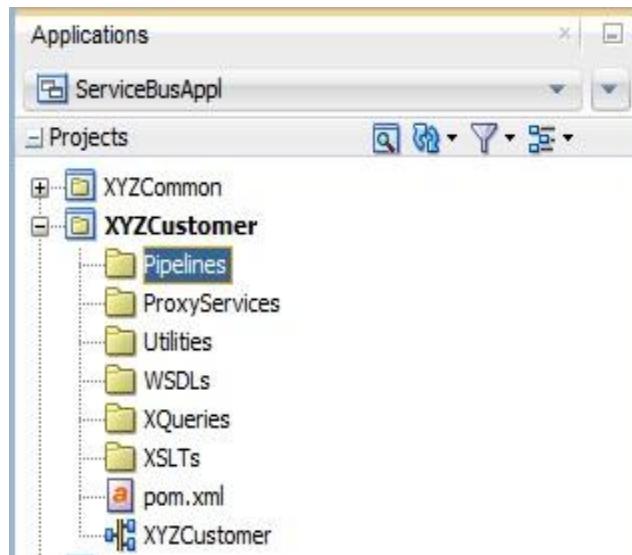


Note: Developer can choose any of above options to deploy and test business/proxy services.

Creating Pipeline Template

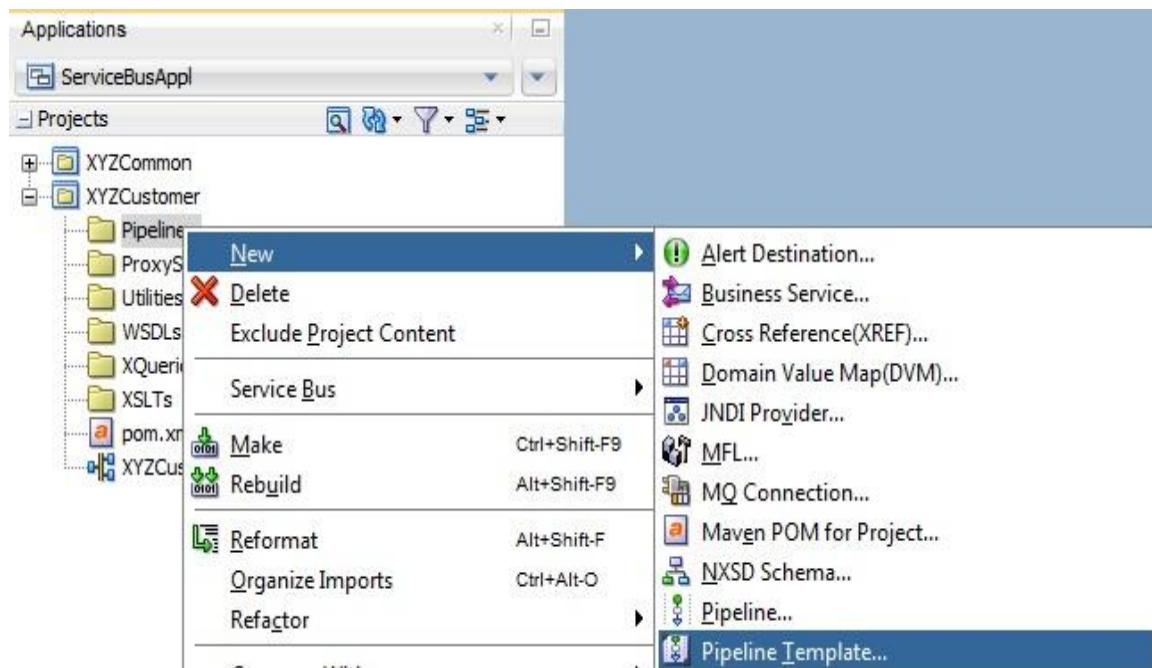
In this section, you will learn how to create pipeline templates considering requirements. A pipeline template defines the general shape or pattern of your message flow.

Use **XYZCustomer** project to create all of your resources unless explicitly mentioned. Before proceeding with Pipeline template creation, create different folders **Pipelines**, **XQueries**, **XSLTs**, **WSDLs** and **ProxyServices** as shown below. You can create new folders by navigating to **File -> New -> From Gallery -> General -> Folder**.

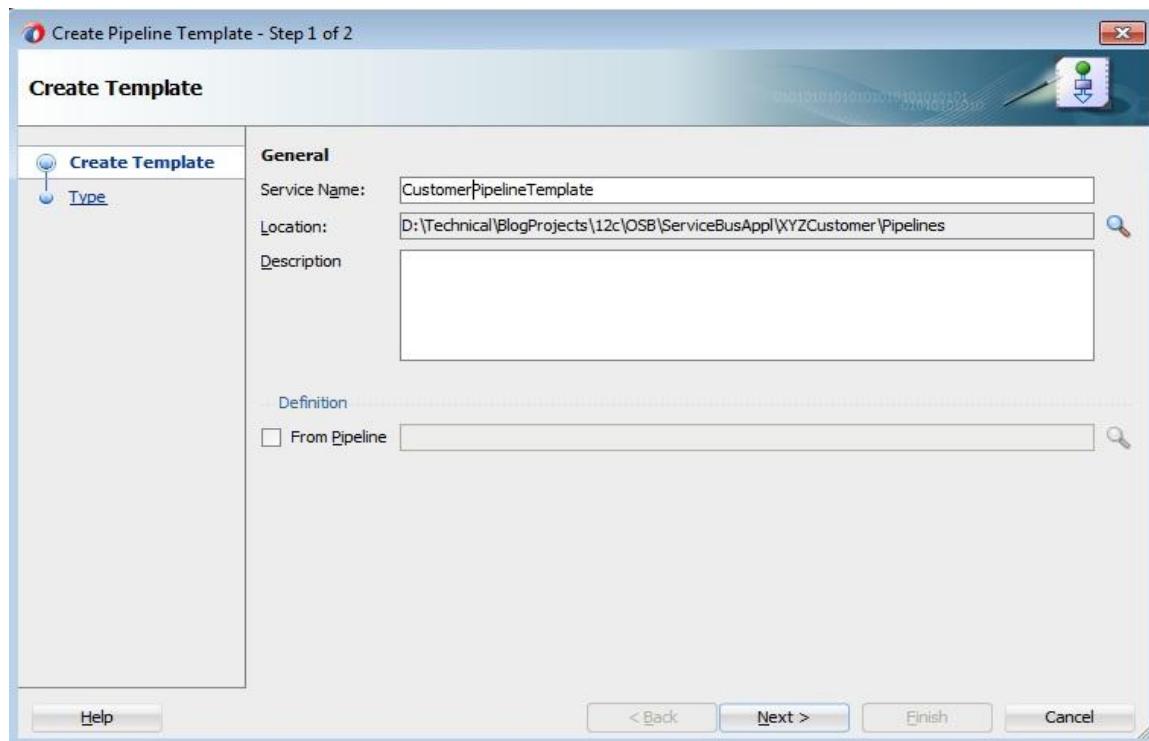


Section 2

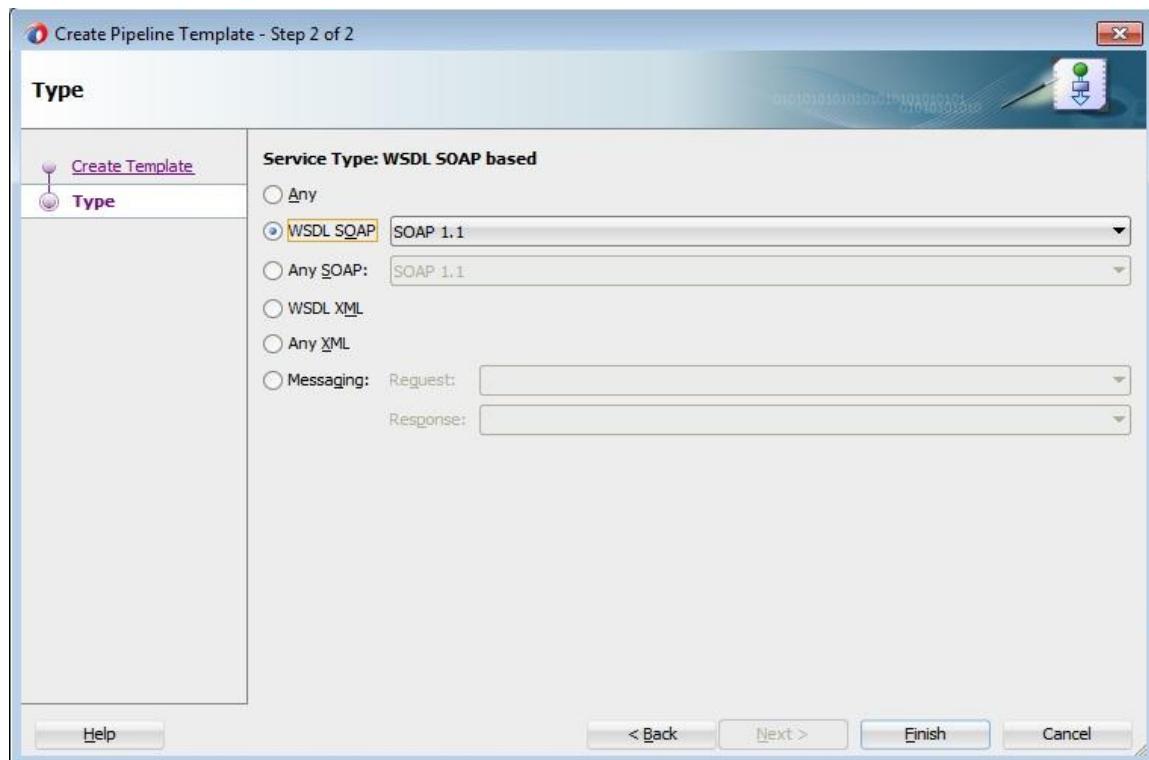
Right click Pipelines folder and select **New -> Pipeline Template**.



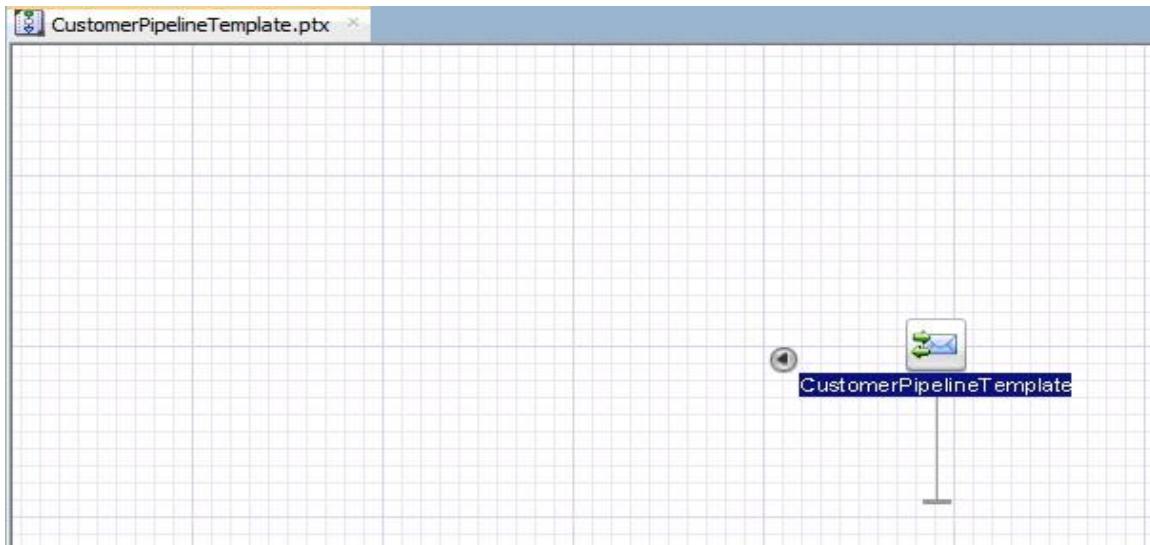
Give name as **CustomerPipelineTemplate**.



Click **Next** and choose **Service Type** as **WSDL SOAP** as shown below. You have to choose this option as you are going to create all of your Proxy Services based on a WSDL.



Click **Finish** and verify that new pipeline template has been created and is opened as a separate tab as shown below.



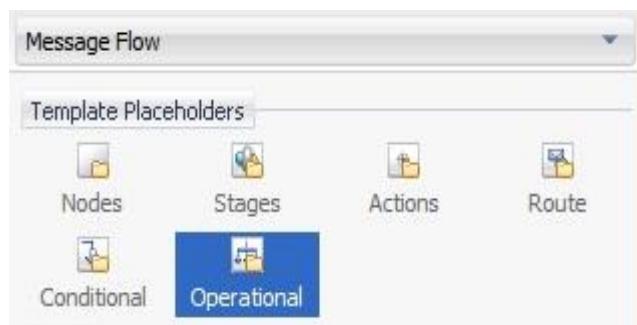
Pipeline templates are the right candidates to keep common logic or enforce pattern of message flow that should be followed across Proxy services. For this tutorial, you may not be creating number of Proxy Services but following are common activities for different operations that your Proxy Service should support. So we will incorporate the following functionality in this Pipeline template.

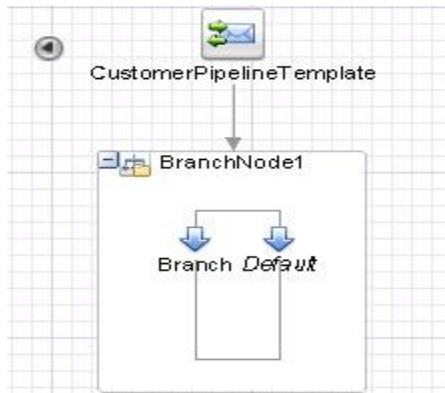
- Validation of Payload against schema
- Routing to **CustomerServiceBS** to perform CRUD operations
- Error Handling

Along with above functionalities, your Pipeline template needs to have nodes like Operational branch, Pipeline Pair, Stages etc... So let us get started with Pipeline template message flow suiting these requirements.

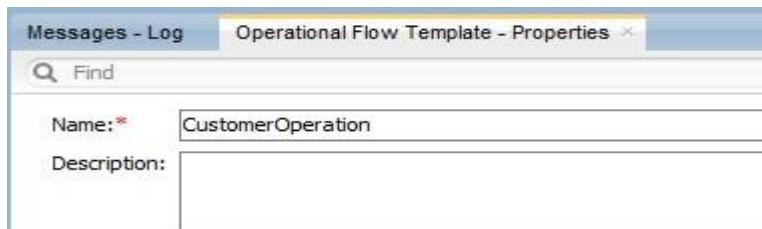
When consumers call proxy service, it has to take different execution paths based on operation being called. The Service Bus provides **Operational Branch** node serving this purpose. So drag **Operational** from **Template Placeholders** onto Pipeline template where yellow circle is shown.

*Note: All Nodes or activities used in message flow for Pipeline or Pipeline template are available in **Components** -> **Message Flow** under different sections. If you don't see **Components** window, make it visible by selecting **Window** -> **Components**.*

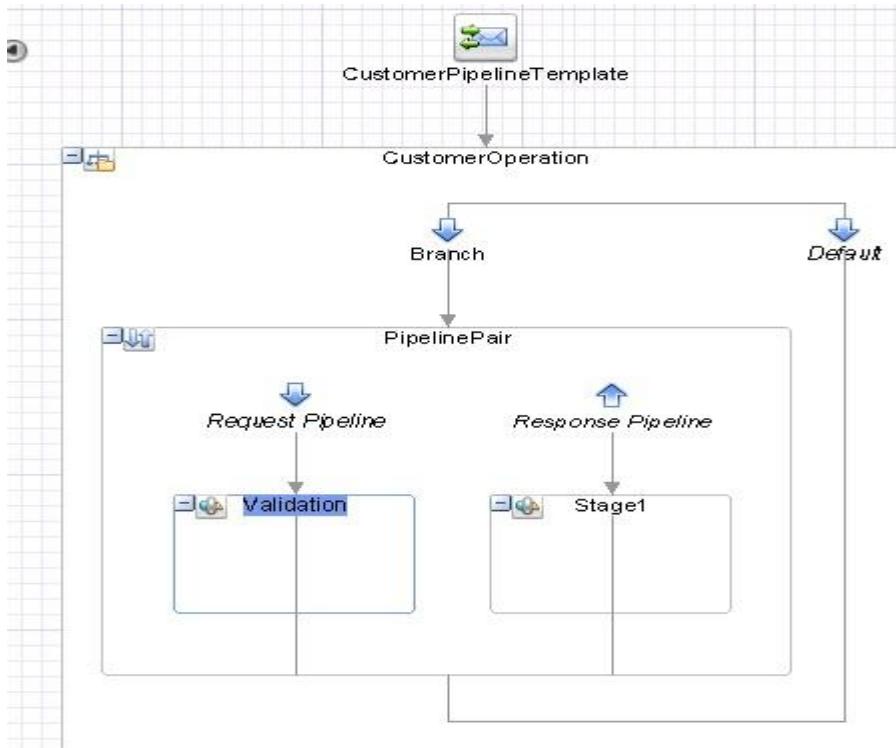




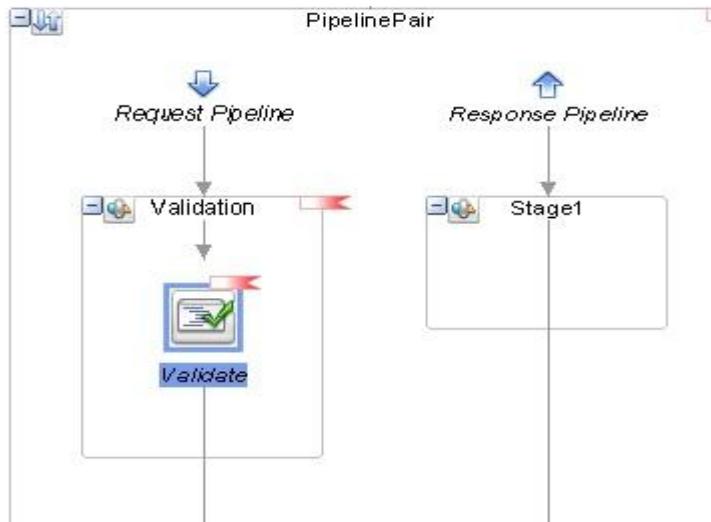
Click **BranchNode1** and set name as **CustomerOperation** in **Properties** tab as shown below. As a best practice, always give meaningful labels for Nodes and other activities (wherever applicable).



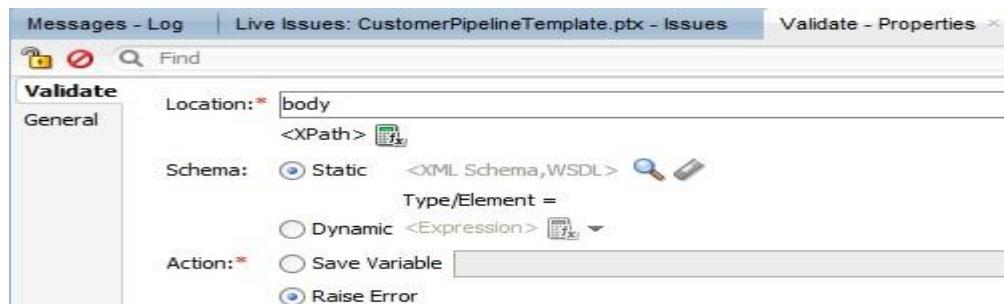
Now drag **Pipeline Pair** from **Nodes** into **Branch** and set name as **Pipeline** in **Properties** tab. Also rename **Stage1** node in **Request Pipeline** to **Validation** in **Properties** tab. Now your pipeline template should look like below.



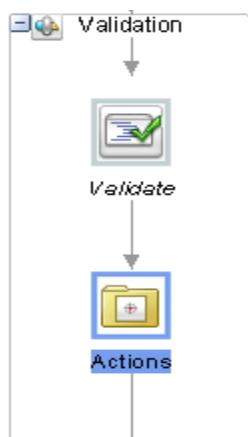
Service Bus provides **Validate** activity to do payload validation against schema. So drag **Validate** activity into **Validation** stage from **Message Processing**.



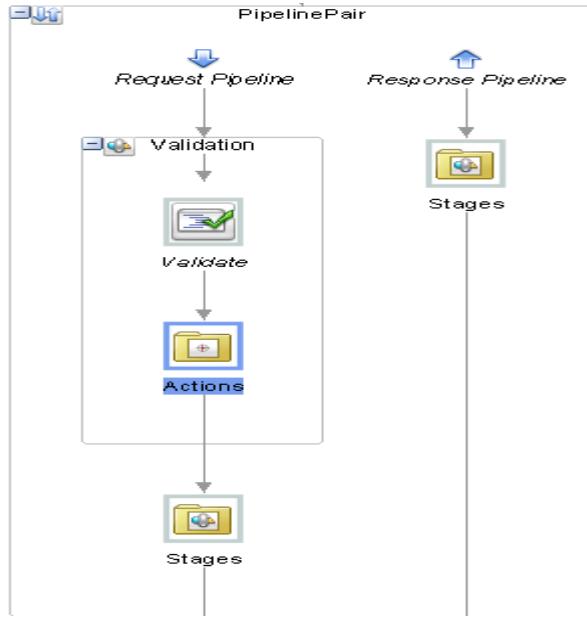
In **Properties** tab, set **Location** property value as **body** and other properties as shown below. Here we don't select any schema or WSDL for validate activity as it's just template and we will not have any payload available.



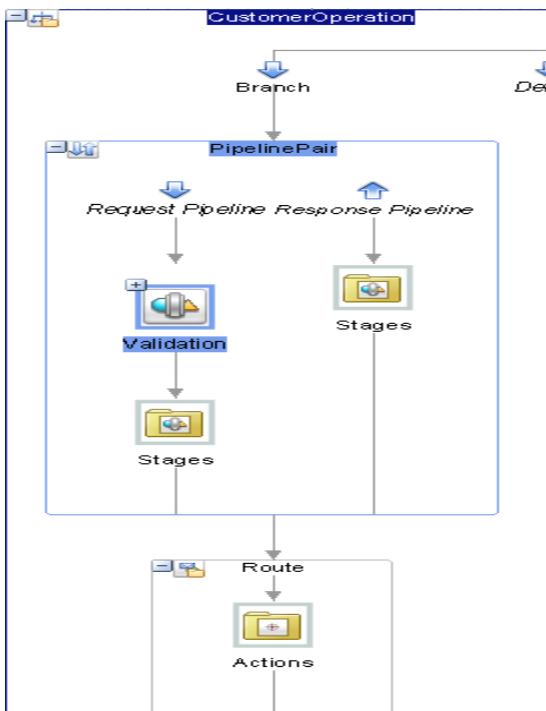
There may be additional validations to be performed while designing message flow for concrete pipelines and requires a place holder. So drag **Actions** into **Validation** stage as shown below from **Template Placeholders**.



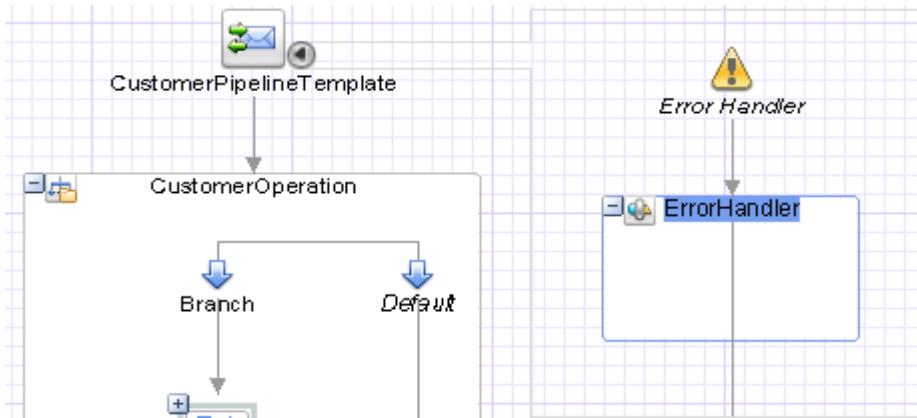
Delete **Stage1** in **Response Pipeline** by selecting **Delete** option on right click. Also you may need to create several Stage nodes in your concrete Pipeline's message flow. So create place holder for the same in template. Drag **Stages** into pipeline after **Validation** stage and in **Response Pipeline** from **Template Placeholders**. Now your Pipeline should look like below.



Routing node always depicts end of message flow and you can't place any other activities after this node. So drag and place **Route** after **PipelinePair** from **Template Placeholders** and set name as **Route** in **Properties** tab. Observe **Actions** placeholder which allows user to place any type of activity while designing message flow for your concrete pipelines.



Error handling is another aspect of message flow where you should follow similar approach for different Proxy Services that you create. So you can always create placeholder in your template. Drag **Error Handler** onto **CustomerPipelineTemplate** from **Nodes** and set name as **ErrorHandler** for **Stage1** as shown below in **Properties** tab.



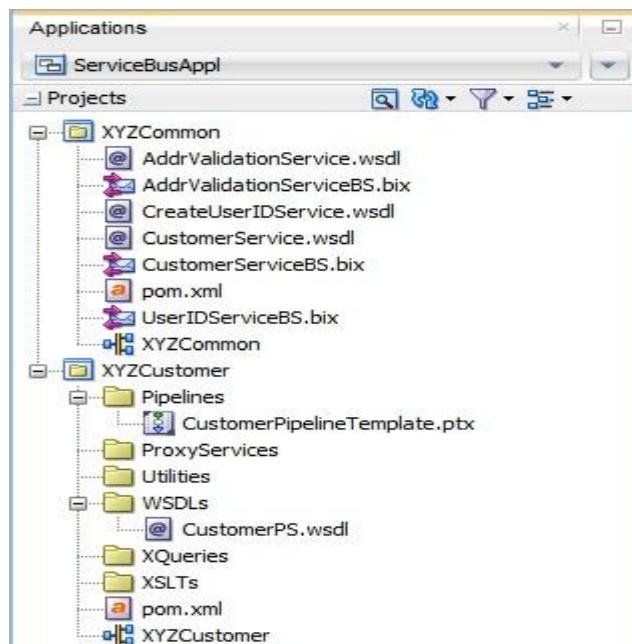
You will finish this **ErrorHandler** stage later in **Error Handling** section. With this, you are done with pipeline template and can proceed with creation of other pipelines using this template.

End Section 3

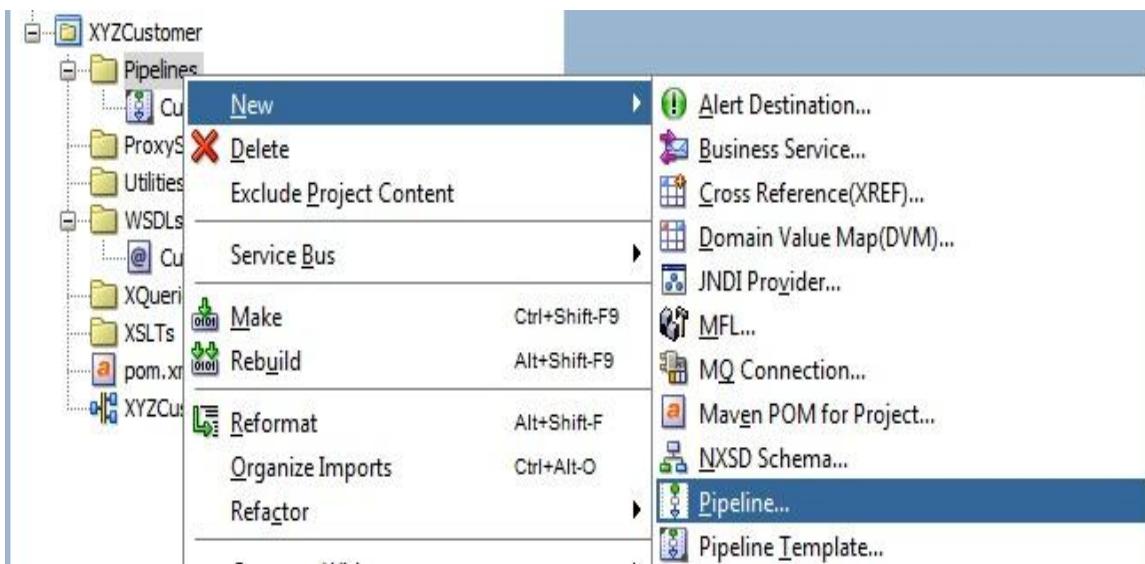
Creating Proxy Service

In this section, you will learn how to create pipeline using pipeline template and expose it as Proxy Service.

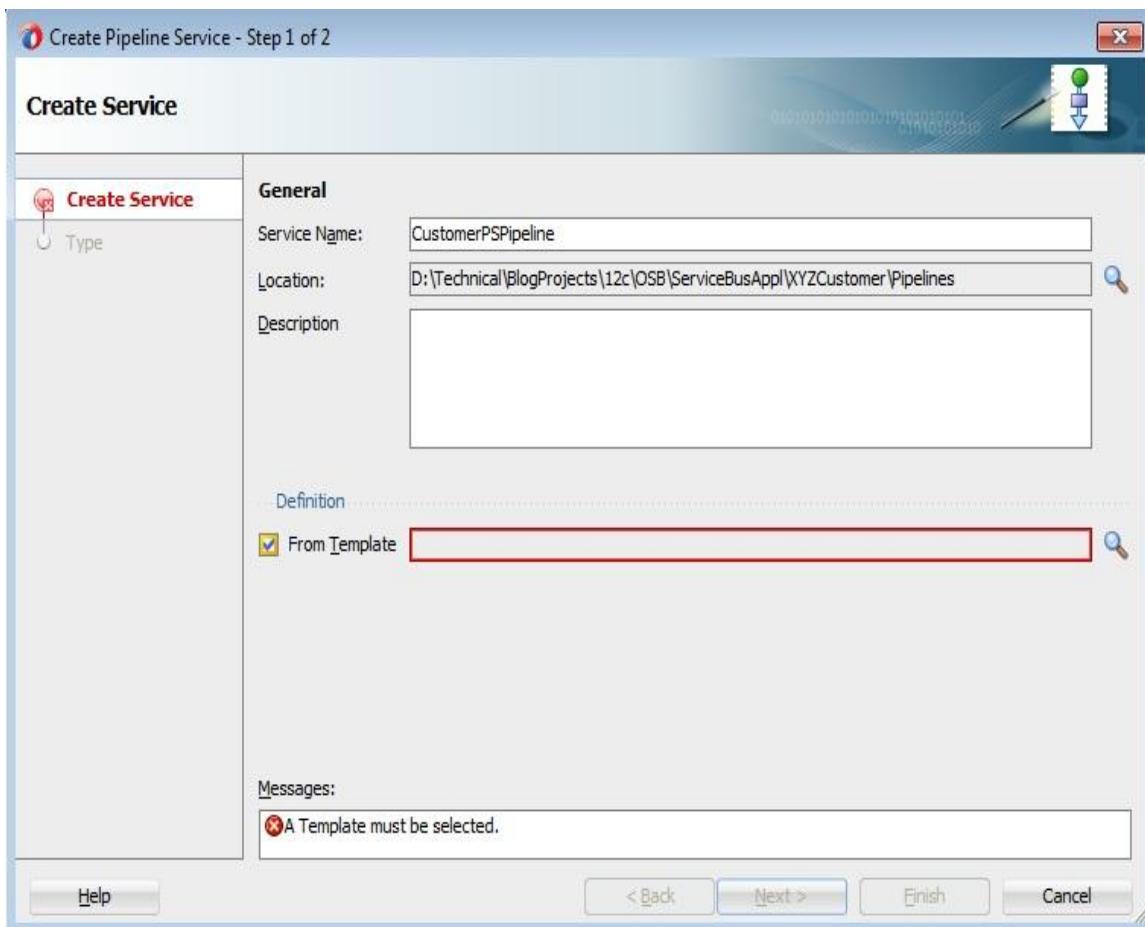
First things is, you should come up with a WSDL having **Create, Update, Delete and Merge** operations as mentioned in business requirements section that can be used for creating Proxy Service. You can come up with a WSDL or can get it from [here](#). Copy the WSDL in **WSDLs** folder of **XYZCustomer** project using steps mentioned earlier.



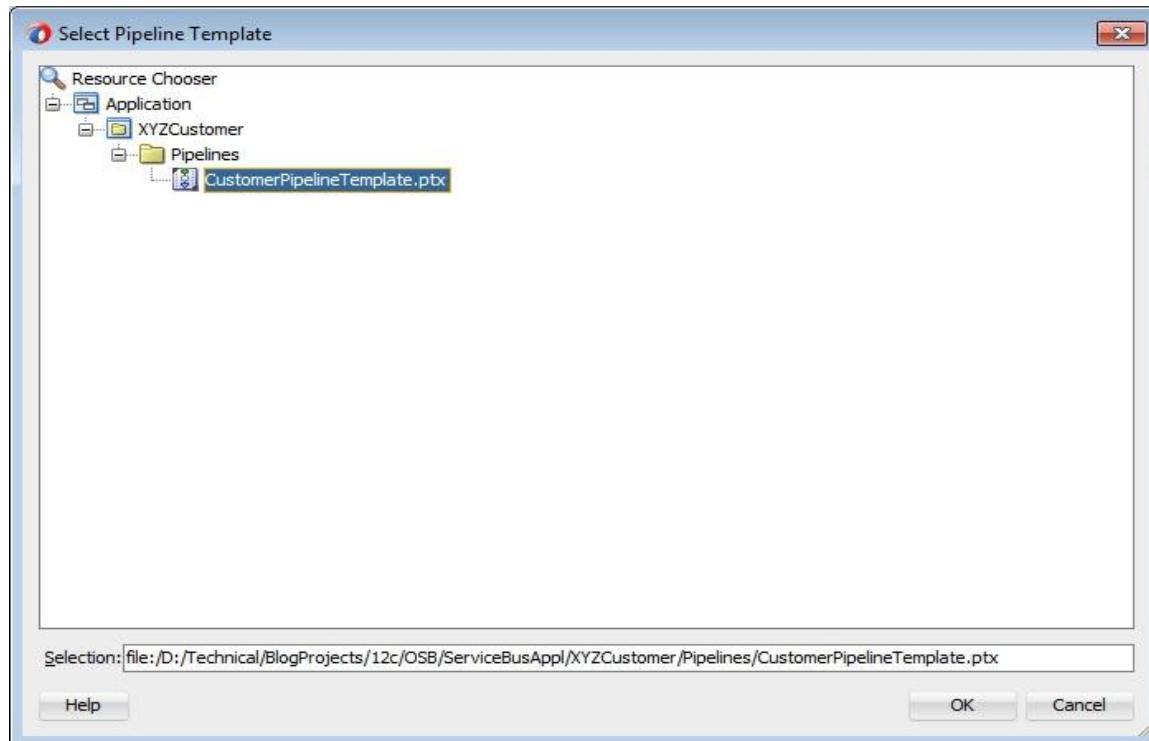
Right click **Pipelines** folder and select **New -> Pipeline**.



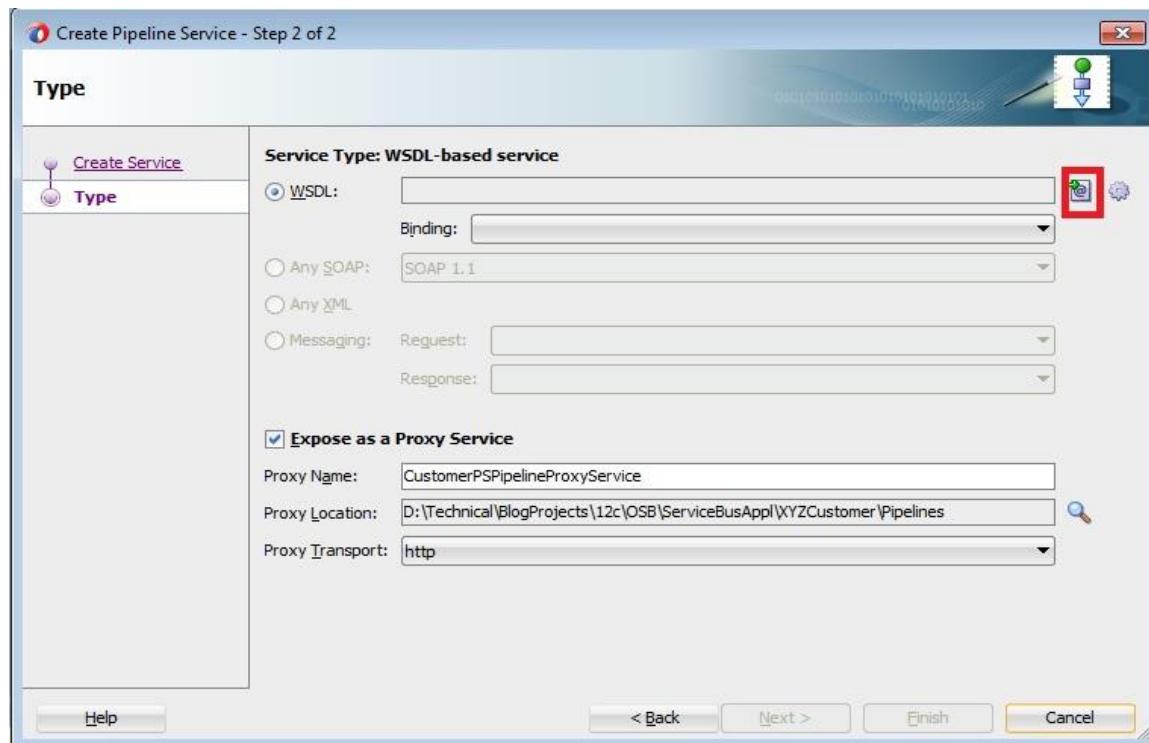
Give name as **CustomerPSPipeline** and select the option **From Template** as shown below.



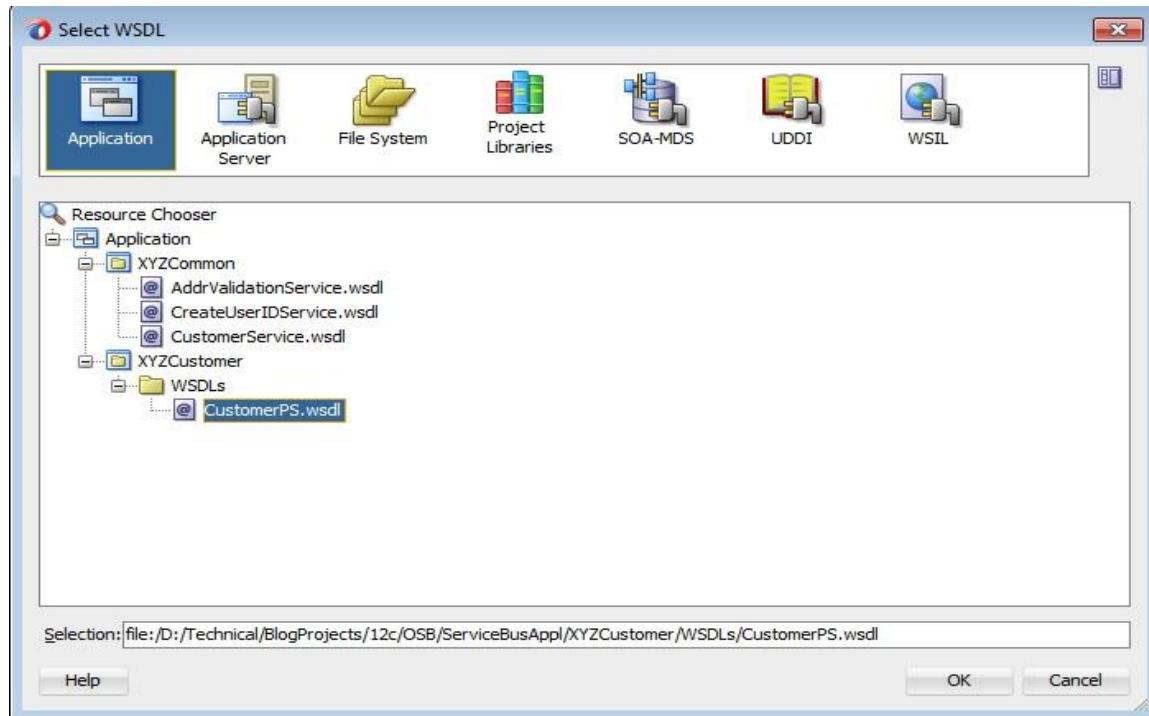
Click **Search** icon to bring up **Resource Chooser** and select pipeline template created in previous section.



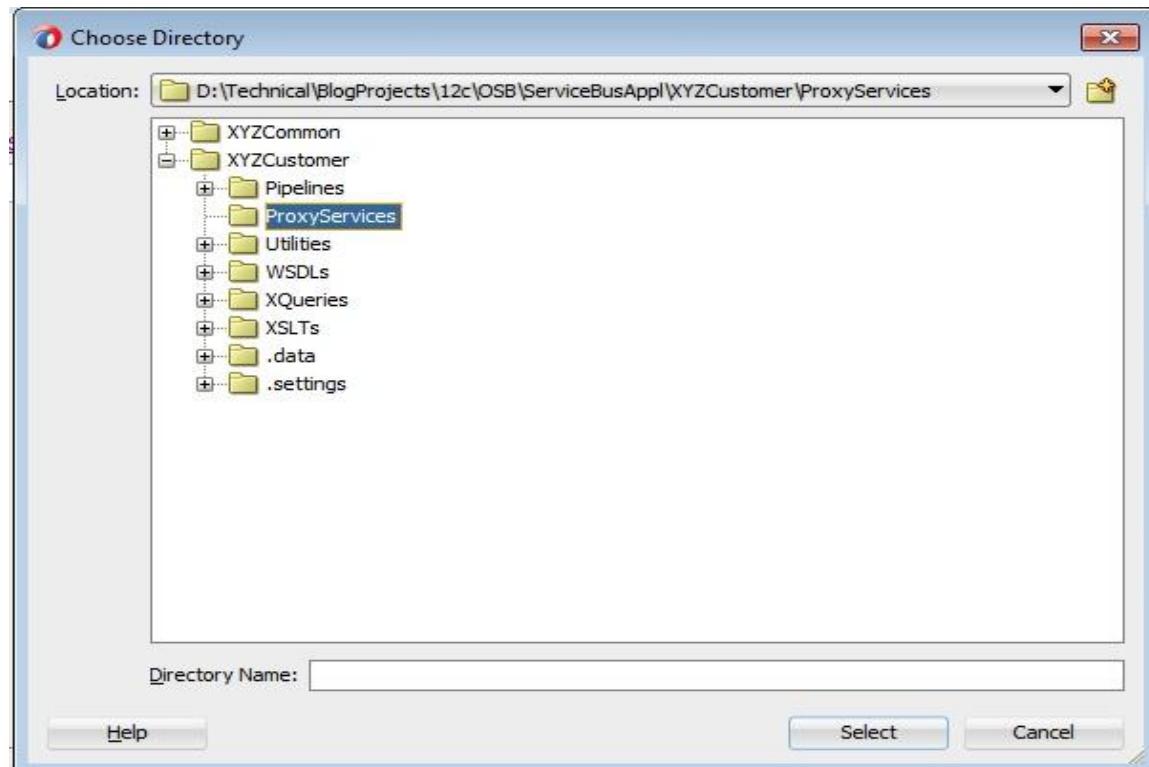
Click **OK** to go back to **Create Pipeline Service** window and click **Next**.



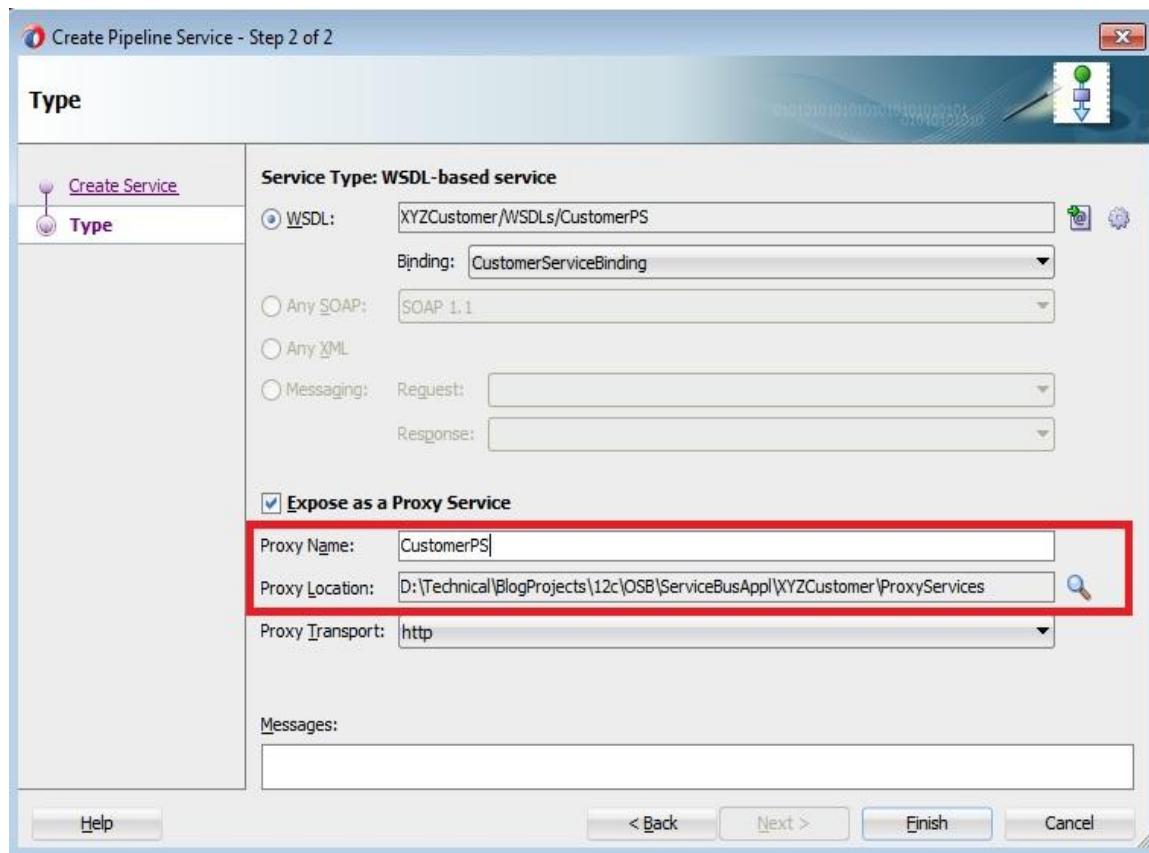
Click **Browse WSDLs** icon (highlighted above) to select WSDL defining your pipeline interface. Choose **CustomerPS.wsdl** from **XYZCustomer** project as shown below and click **OK**.



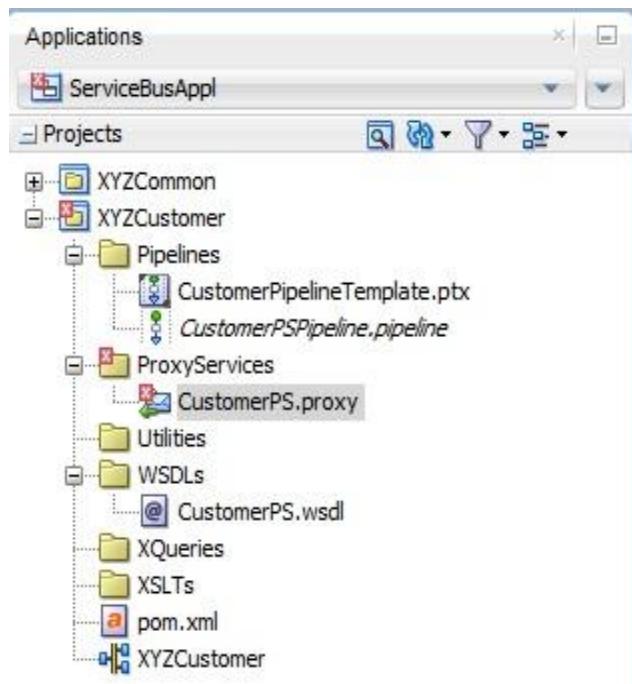
Verify that WSDL and binding is being selected. Click **Search** icon for **Proxy Location** and select **ProxyServices** folder as shown below.



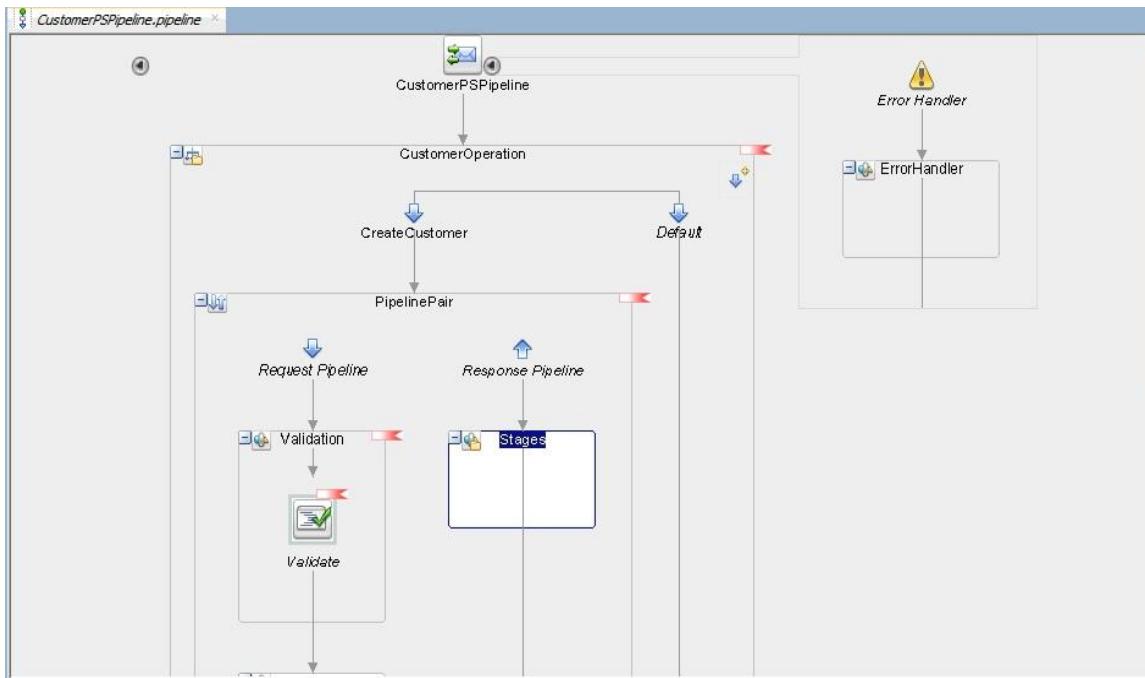
Click **Select** and modify **Proxy Name** to **CustomerPS**.



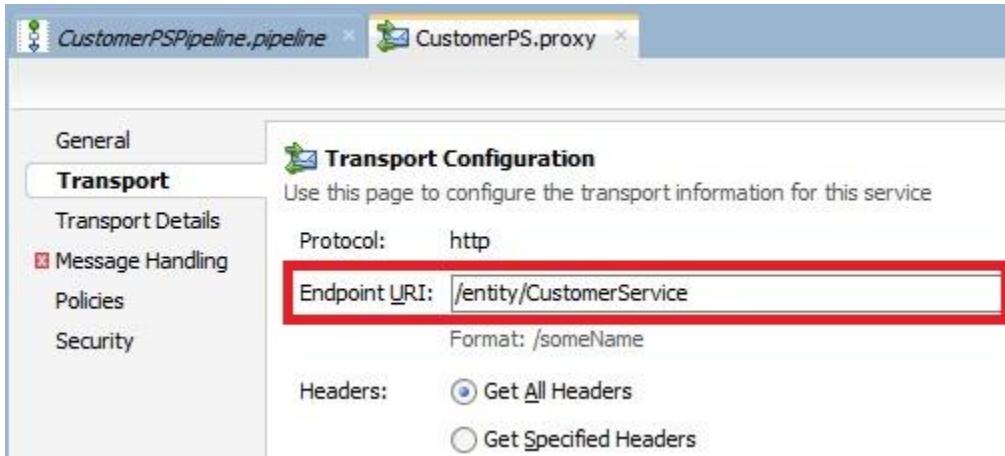
Click **Finish** and verify both **Pipeline** and **Proxy Service** are and shown in **Project Explorer**.



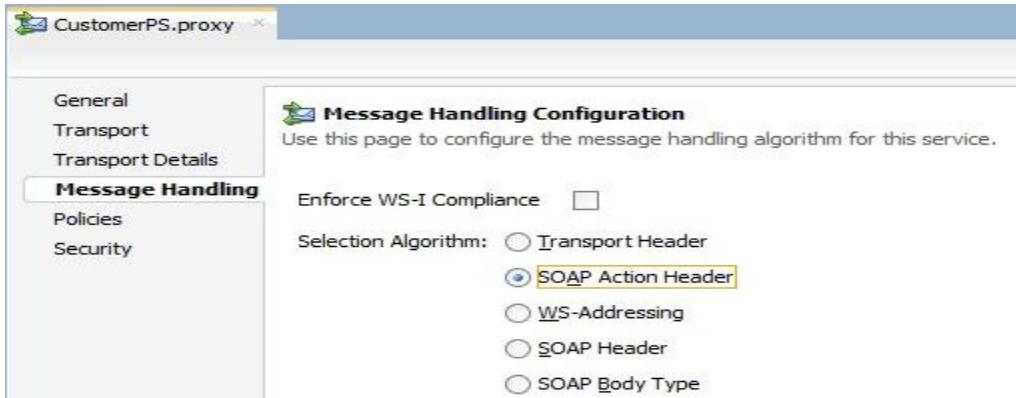
Also observe that new tab is opened showing **CustomerPSPipeline**. Observe that your pipeline had inherited all placeholders, names and properties from pipeline template. And you will be allowed to modify/add activities to placeholders and properties of the activities inherited from template. Since a few of the properties which are mandatory in concrete pipelines but not mentioned in template, you are seeing red marks both in editors and **Project Explorer**.



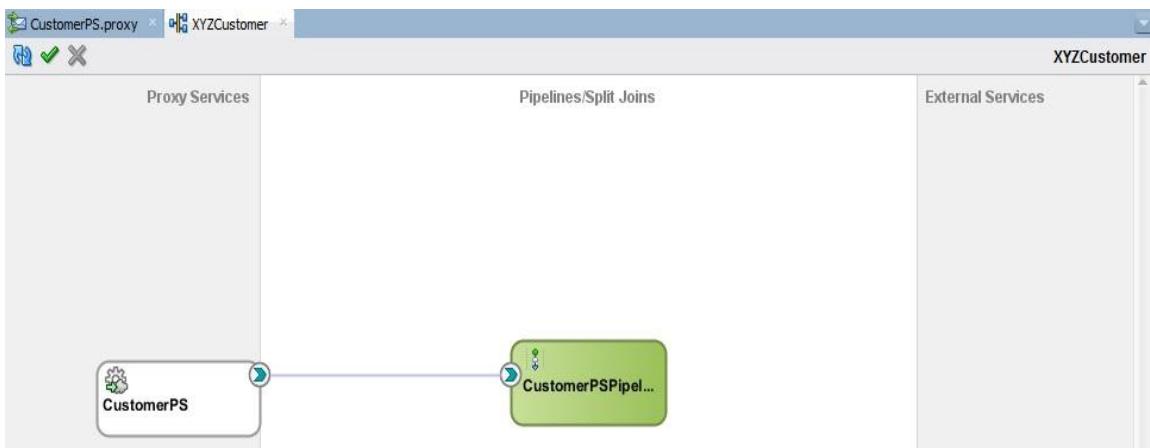
Open **CustomerPS** and navigate to **Transport** configuration as shown below. Modify Endpoint URI as **/entity/CustomerService**. So service consumers can access your proxy service using URL <http://<host>:<port>/entity/CustomerService>.



Go to **Message Handling** tab and select **SOAPAction Header** as **Selection Algorithm**. This would enable proxy service to determine operation at runtime based on **SOAP Action** in HTTP headers. These changes would resolve the errors in Proxy Service and observe all red marks are gone.



Now your **Service Bus Overview Editor** should look like below. Left swim lane is for services providing an entry point to application so limited to **Proxy Services**. Middle swim lane is for components providing routing and transformation so limited to **Pipelines** and **Split-joins**. Right swim lane is for references providing communication with actual service providers so limited to **Business Services** or **Proxy Services**. For more information refer to this [link](#).



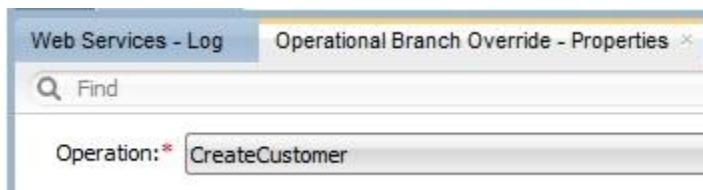
Creating Message Flow

End Section 4

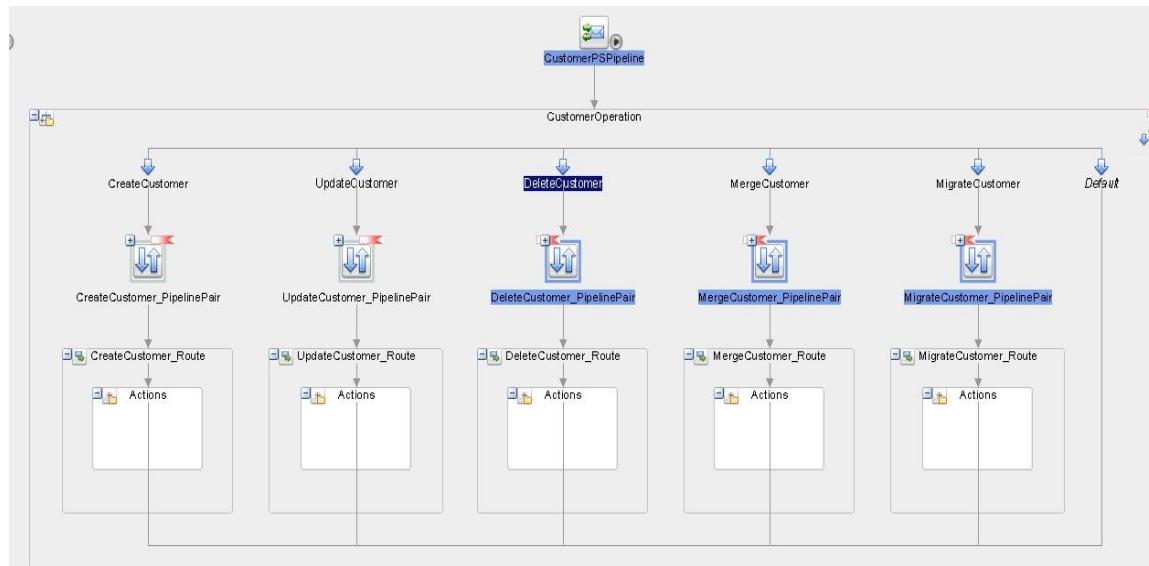
In 12c, message flow is separated from Proxy Service and incorporated in separate component called **Pipeline**. In this section, you will see creating message flow in Pipeline.

As observed in previous section, the **CustomerPSPipeline** already inherited the initial message flow from pipeline template. So in this section, you will start modifying this message flow and add more activities in placeholders provided by pipeline template.

Select **CreateCustomer** branch and set operation as **CreateCustomer** in Properties tab as shown below.



Click icon to add 4 more additional branches and select **UpdateCustomer**, **DeleteCustomer**, **MergeCustomer** and **MigrateCustomer** operations respectively. Now your message flow should look like below. You can also observe that each of these operational branches inherited same set of activities/placeholders as created in pipeline template.

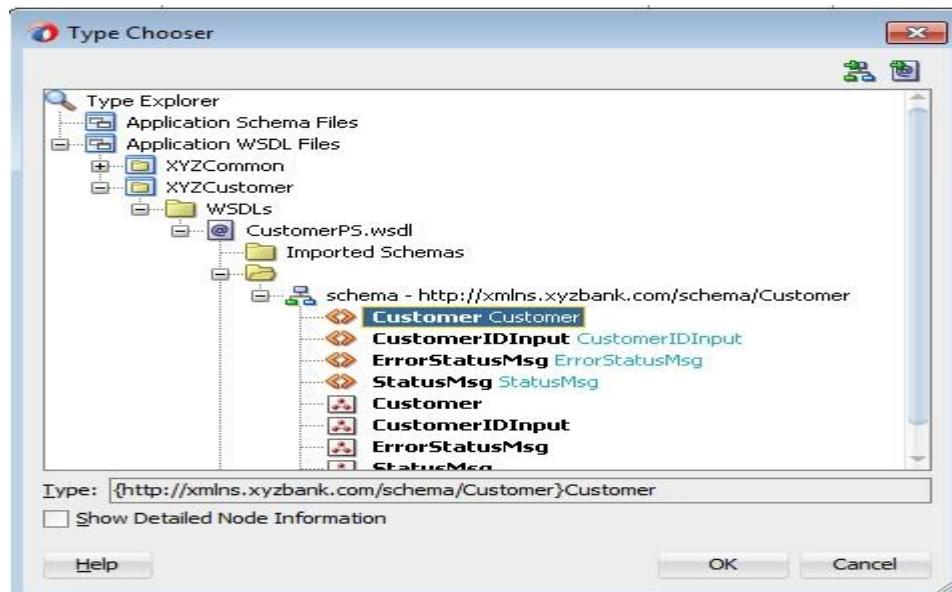


Create Customer

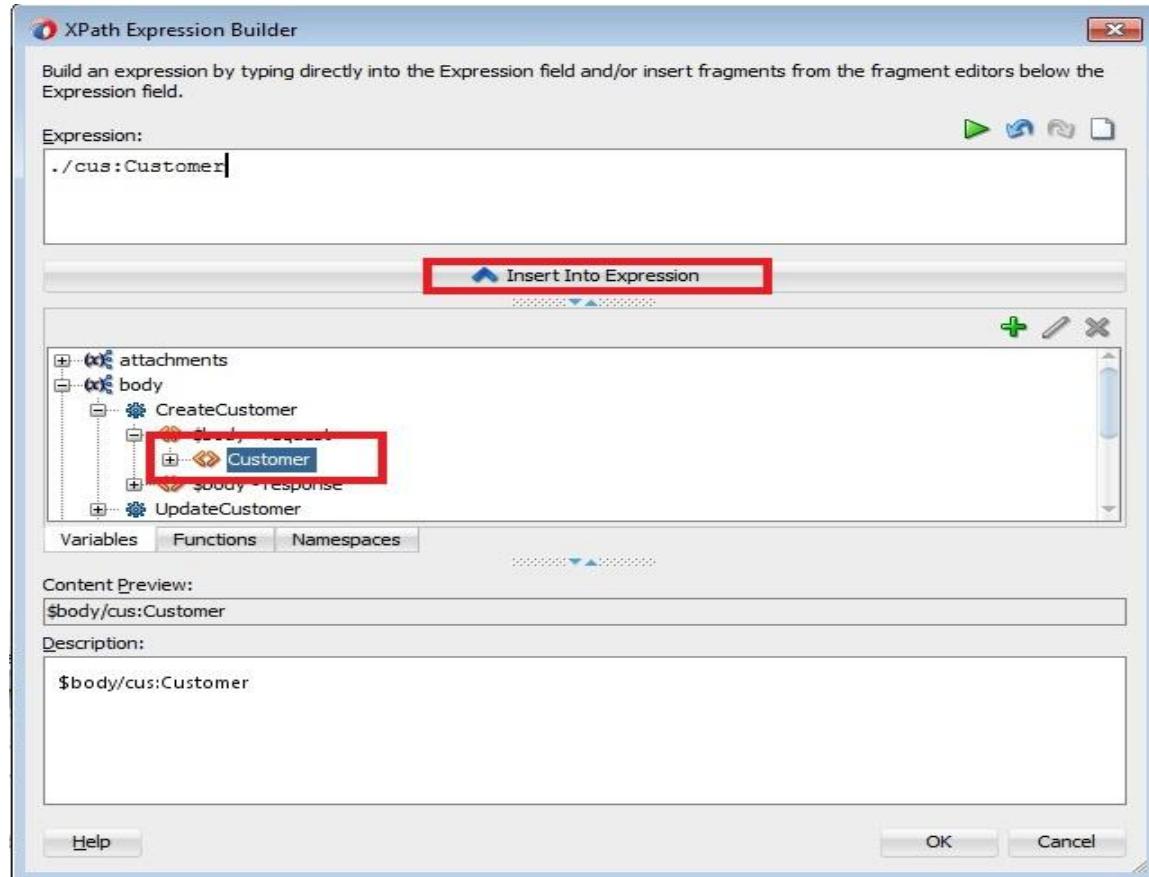
In this section, you will complete message flow for **CreateCustomer** branch.

Validating Payload

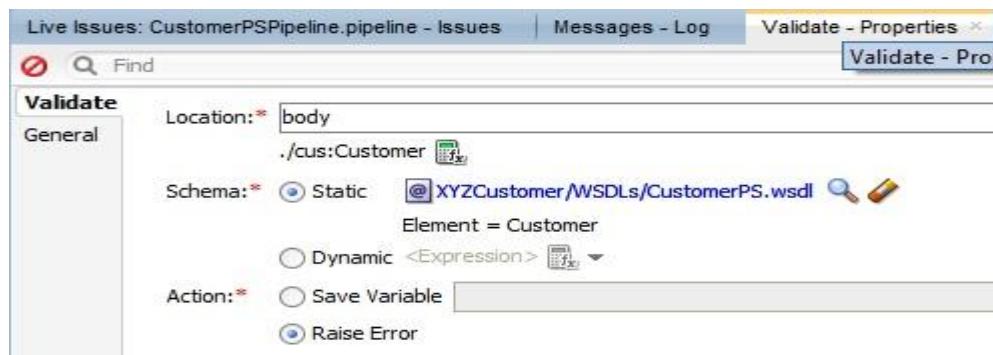
In this section, you will complete the **Payload** and **Email** format validation. In **Properties** tab of Validate activity, for **Schema** property click **Search** icon and select **Customer** element from proxy service WSDL as shown below.



For **Location** property bring up expression editor by clicking icon . Drag or shuttle **Customer** element into **Expression** field as shown below and click **OK**. Now you can observe all red marks are no longer visible for **CreateCustomer** branch as you set required properties.



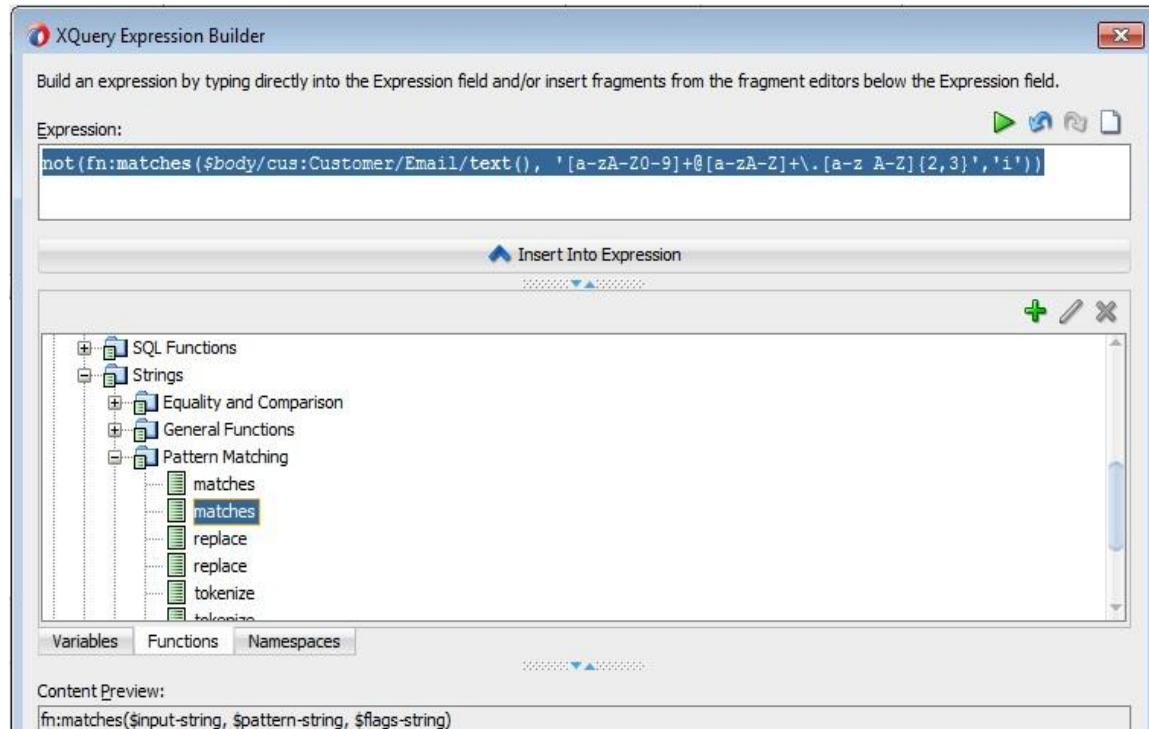
Now your properties tab for **Validate** activity should look like below.



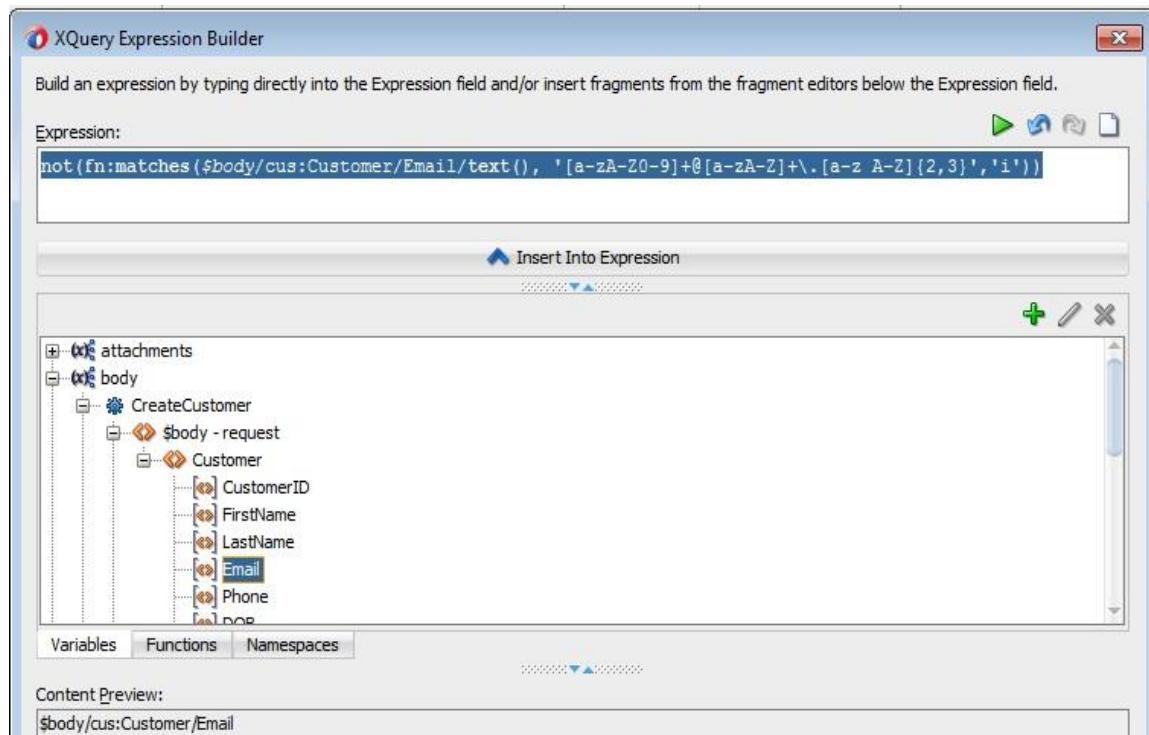
To validate **Email** element, drag **If-Then** activity into **Actions** placeholder of **Validation** stage from **Flow Control**. In **Properties** tab, bring up expression editor for **Condition** property and give the **Expression** as:

`not(fn:matches($body/cus:Customer/Email/text(), '[a-zA-Z0-9]+@[a-zA-Z]+\.[a-zA-Z]{2,3}', 'i'))`

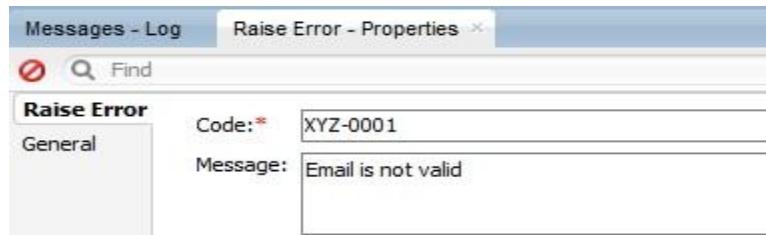
Alternatively, you can drag **fn:matches** function from **Functions->XQuery 1.0 Functions -> Strings > Pattern Matching -> matches** as shown below.



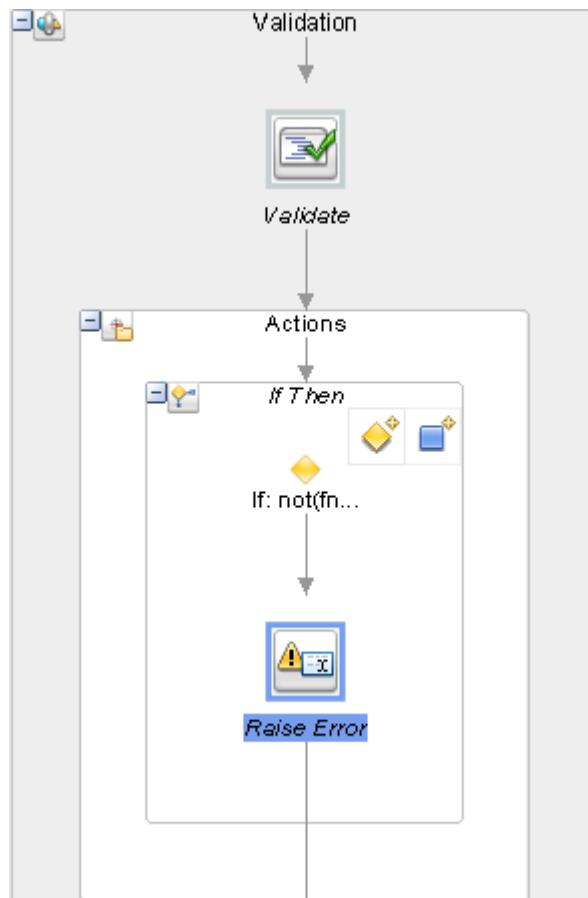
Also you can drag **Email** element from **Variables -> body -> CreateCustomer -> \$body - request -> Customer -> Email** as shown below and modify expression to above condition.



Drag **Raise Error** activity into **If** branch from **Flow Control**, and set properties as shown below. You can remove **Else** branch by selecting **Delete** on right click.



Now your **Validation** stage should look like below.



End Section 5

Validating Address

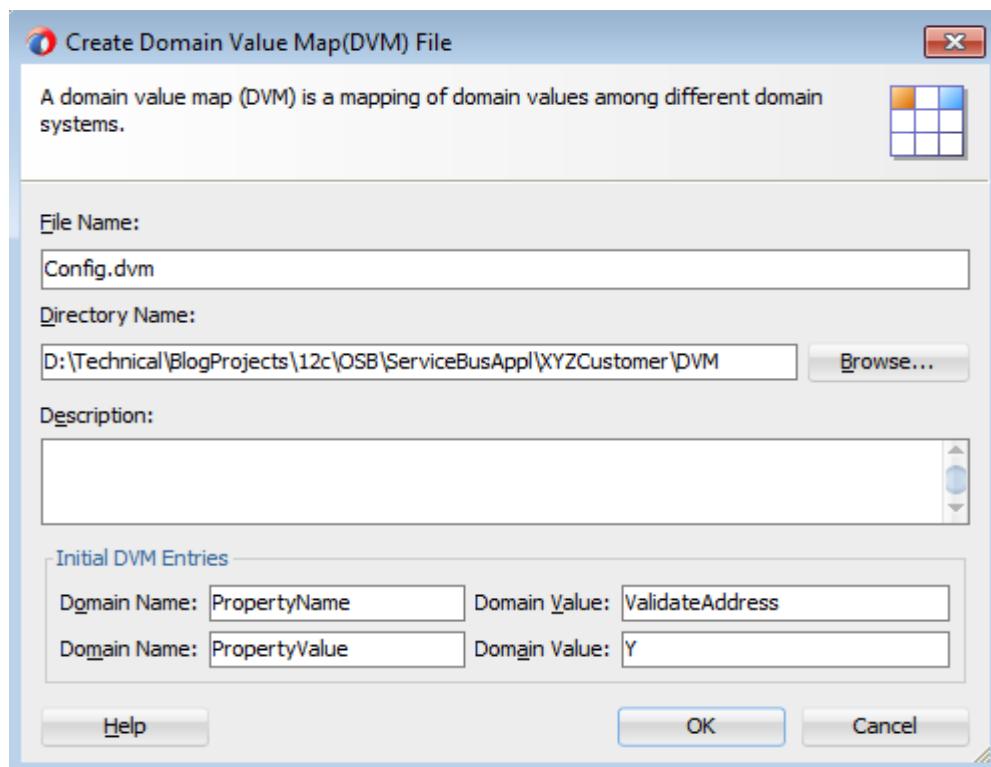
In this section, you will perform **Address Validation** by invoking **AddrValidationServiceBS** based on a configurable property.

You will use **Domain Value Map (DVM)** to store configurable properties. Create a new folder named **DVM** in **XYZCustomer** project. Right click **DVM** folder and select **New -> Domain Value Map**.



Give **Config** as **File Name** and give initial DVM entries as shown below. This way, basically you are defining different properties that can be used in Message Flow along with initial values. The domain names **PropertyName** represent configurable properties and **PropertyValue** represents property values respectively.

Using DVM, you can extend same logic to any number of configurable properties in your Service Bus Application. For current scenario, give property name as **ValidateAddress** and its value as **Y**.



Click **OK** to bring up DVM editor.

The screenshot shows the 'Domain Value Map (DVM)' editor window. At the top, there are fields for 'Name' (Config) and 'Description'. Below that is a 'Map Table' section with a single row:

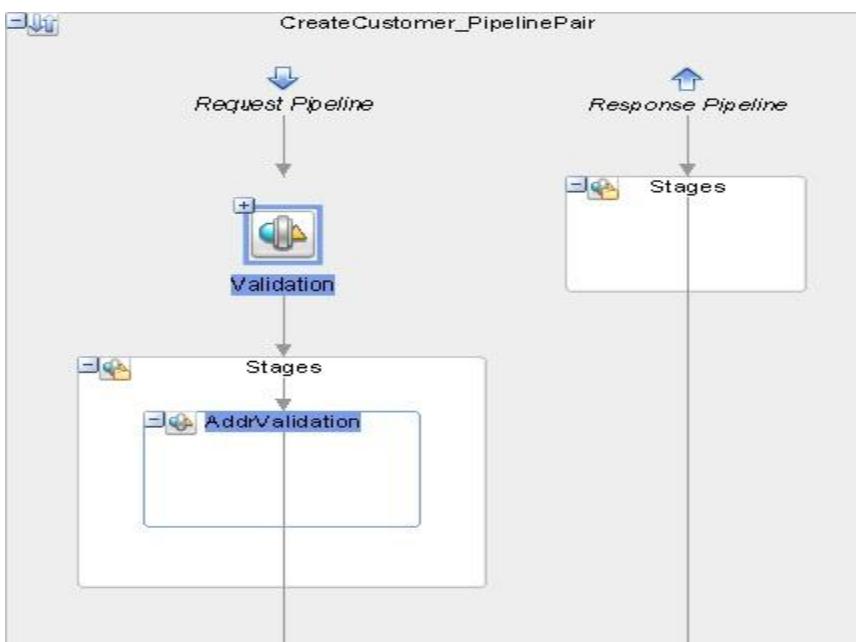
PropertyName	PropertyValue
ValidateAddress	Y

You can always modify DVM in your IDE and deploy to your server or you can also modify it in **sbconsole**. Remember you need to create a session before modifying anything.

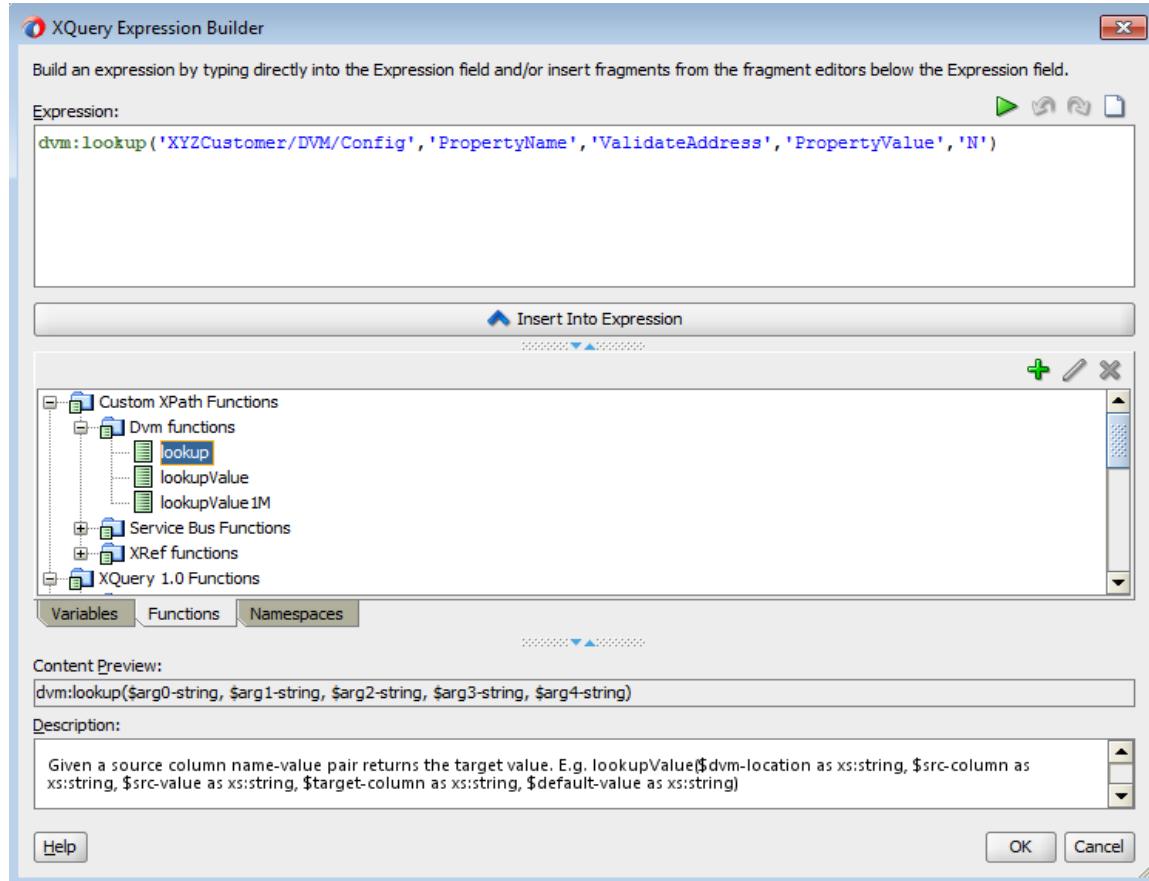
The screenshot shows the 'Config' screen in sbconsole. On the left is a tree view of projects and configurations. In the center, under 'DVM Definition', is a 'General' section with a 'Description' field and a 'Map Table' section. The 'Map Table' contains the same entry as the DVM editor:

PropertyName	PropertyValue
ValidateAddress	Y

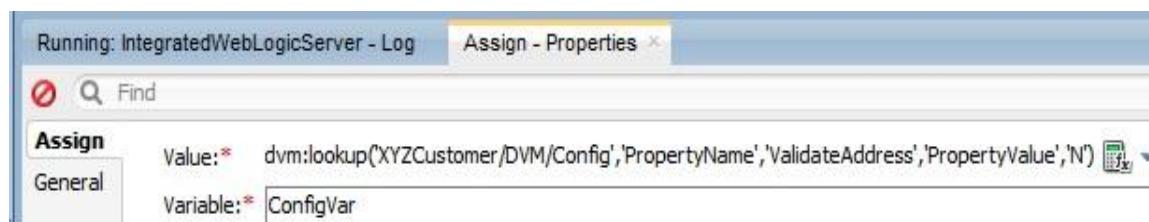
Drag **Stage** node into **Stages** placeholder of **Request Pipeline** and set name as **AddrValidation** in **Properties** tab.



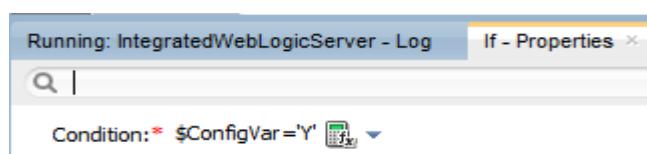
Drag **Assign** activity into **AddrValidation** stage from **Message Processing**. Bring up expression builder for **Value** property and give expression as shown below. Alternatively you can select the function from **Functions -> Custom XPath Functions -> Dvm functions**. Make sure that you give complete qualified path of DVM containing Service Bus Project name too.



Set **Variable** property as **ConfigVar**. Now your **Properties** tab should look like below.

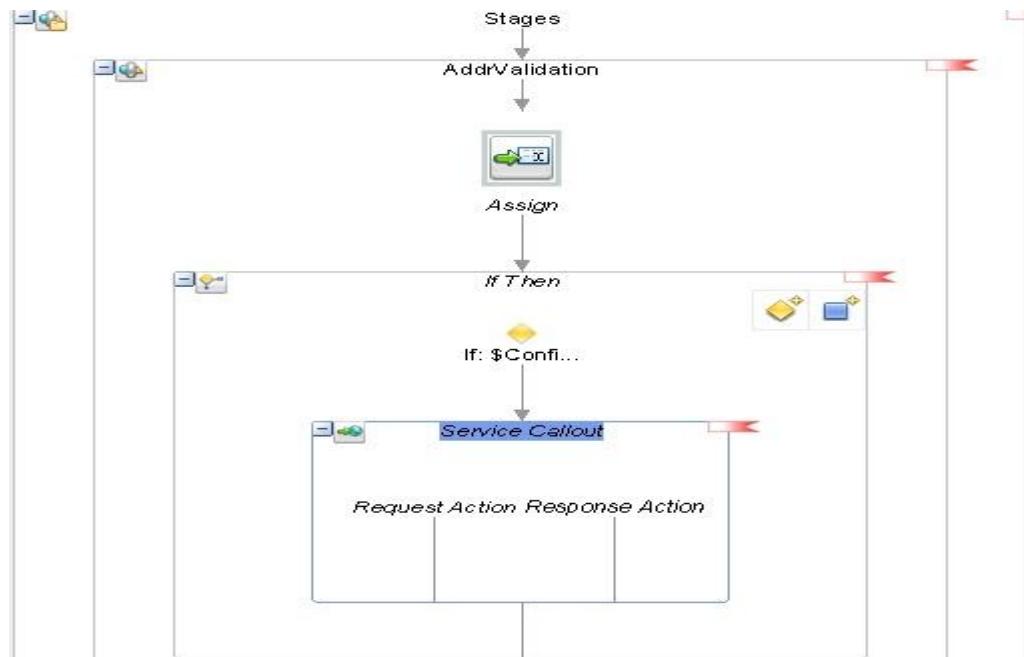


Address Validation business service should be invoked only when the value of this configuration property 'Y'. So drag **If Then** activity into **AddrValidation** stage after **Assign** from **Flow Control** and set condition as **\$ConfigVar='Y'**.

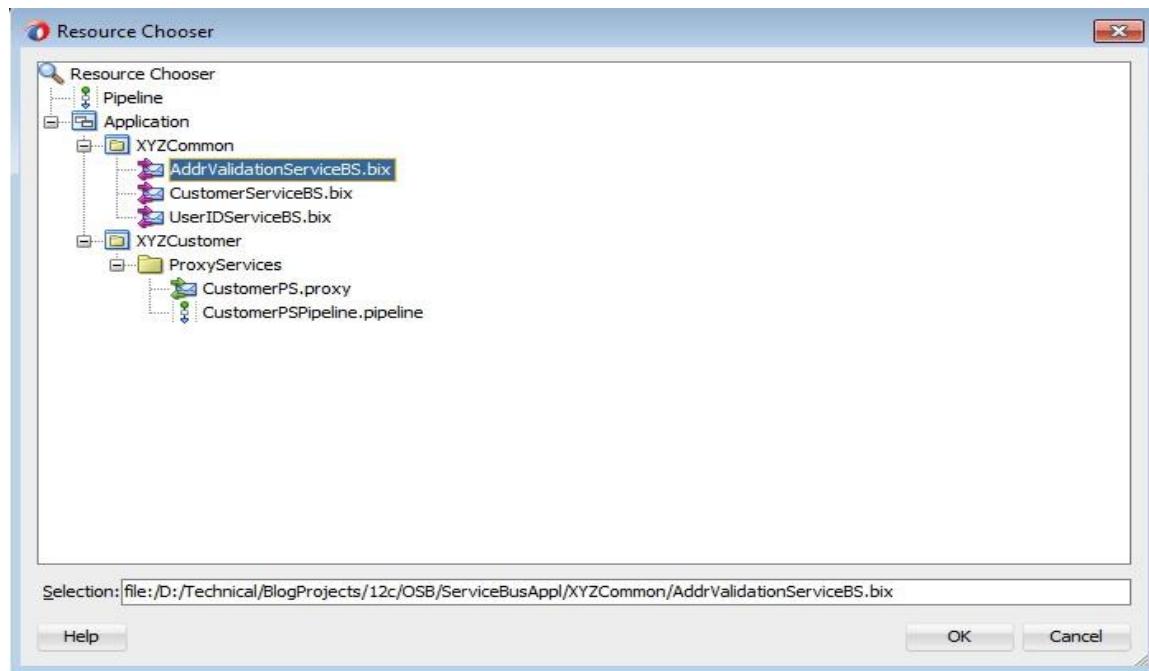


Service Bus provides **Service Callout**, **Routing** and **Publish** activities to route incoming request to an appropriate business service. **Routing** and **Service Callout** are used for Synchronous where as **Publish** activity is used for one-way communication.

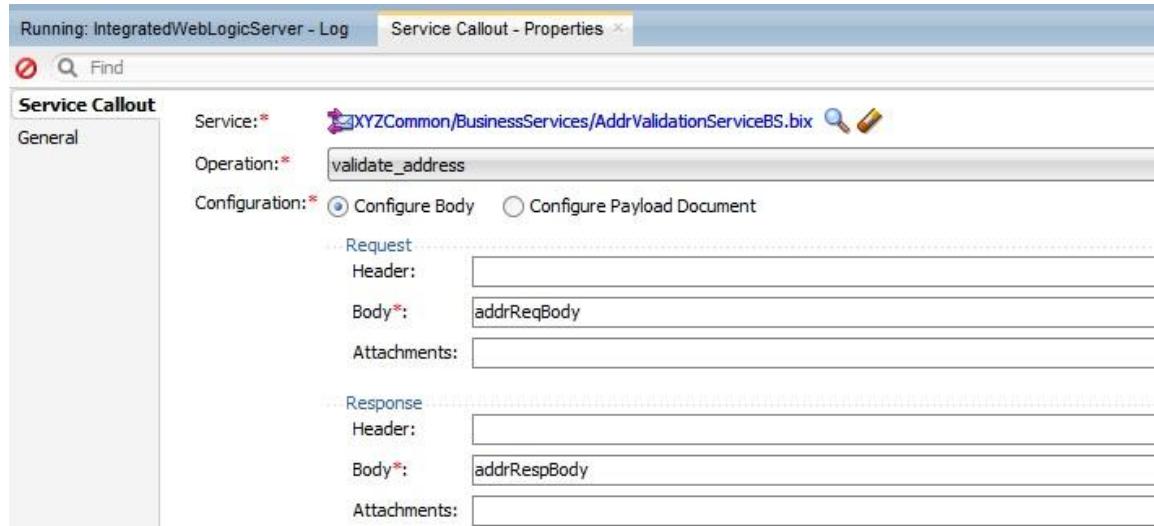
As mentioned earlier, **Routing** node always depicts end of message flow so you can't place any activities after **Routing** node. Hence we use **Service Callout** for all intermediate service calls in pipeline. So drag **Service Callout** from **Communication** into **If Then** branch as shown below.



In **Properties** tab, browse and select **AddrValidationServiceBS** for **Service** property.



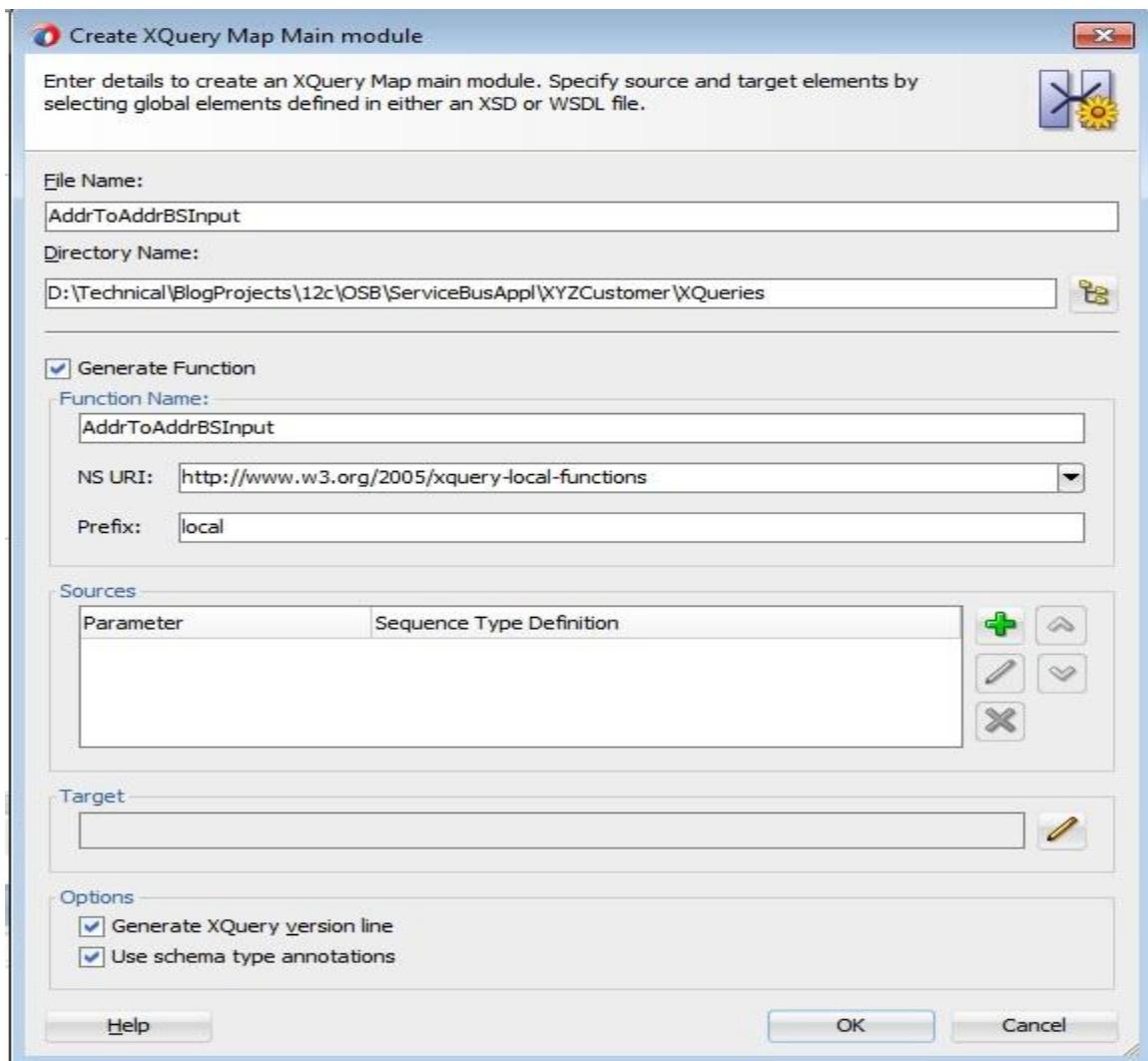
Select **validate_address** operation and set other properties of **Service Callout** as shown below.



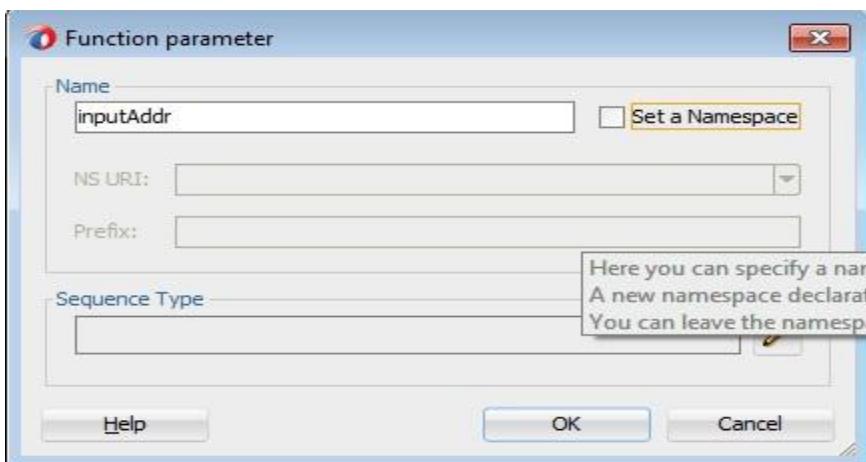
addrReqBody is variable to be populated with the payload for **valdate_address** operation and **addrResponseBody** is variable that contains response returned by business service after service call. Since you are using the '**Configure Soap Body**' option, make sure that request variable is populated with complete payload including SOAP Body element (**soap-env:Body**). In the same way, response variable contains SOAP Body element when response is received.

Next task is transforming the received payload to the structure expected by address validation business service. To achieve this, you can either use **XQuery** or **XSLT** maps. One of the added features in 12c is JDeveloper has complete design time support for XQuery as well. First we will get hands-on in using XQuery files so let us start creating one serving your purpose.

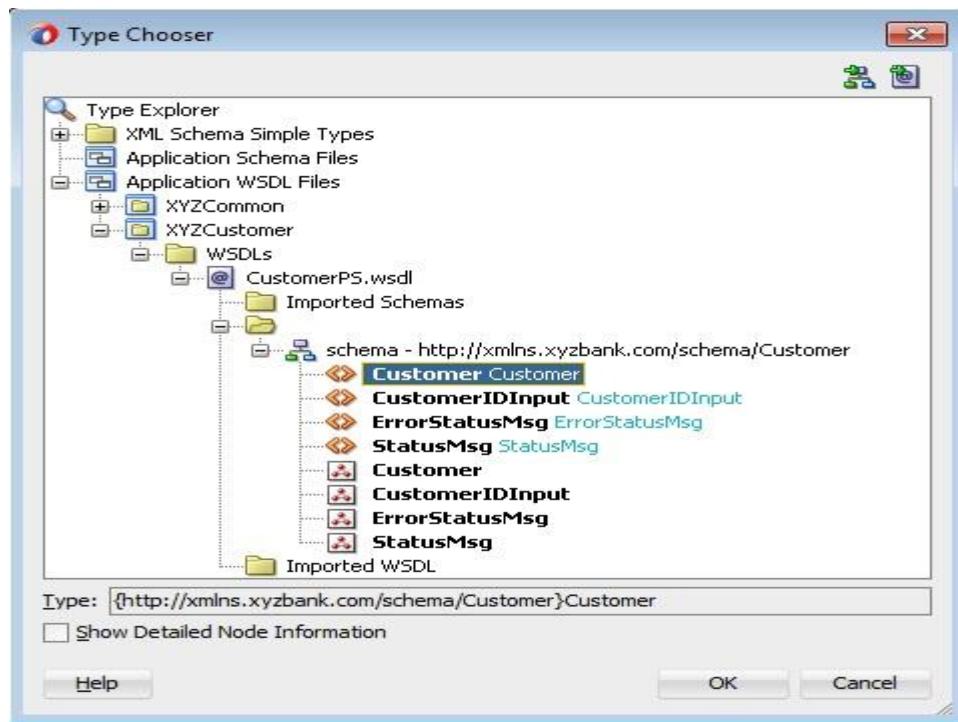
Right click on **XQueries** folder in **XYZCustomer** project and select **New -> XQuery File ver1.0** to create new **XQuery**. Give both file and function name as **AddrToAddrBSInput** as shown below.



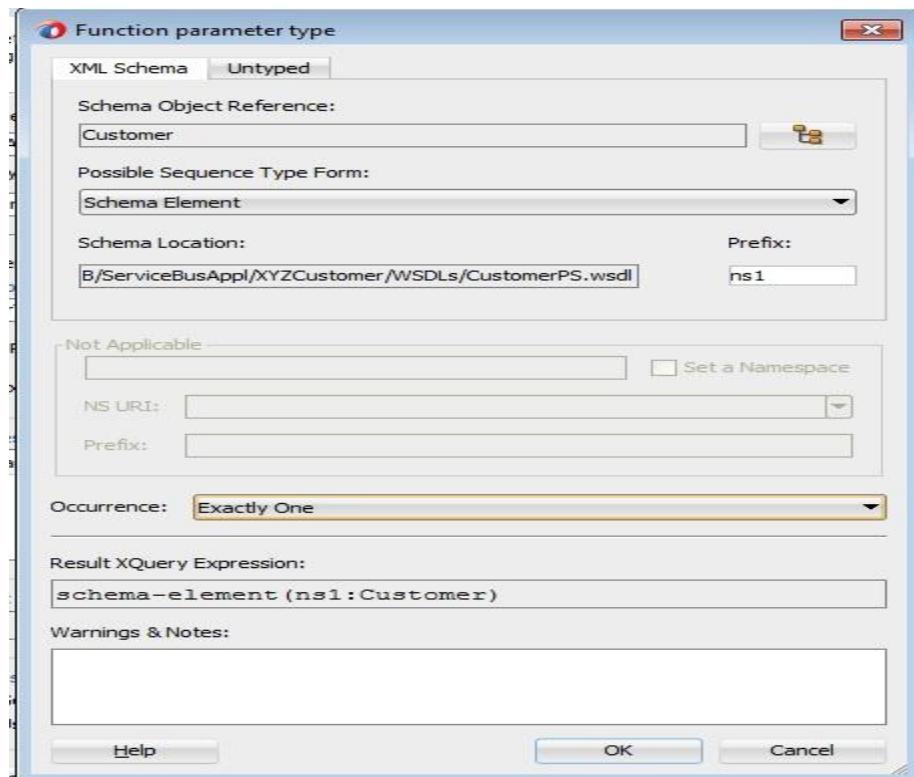
Click + icon to add Source parameter and give name as **inputAddr**.



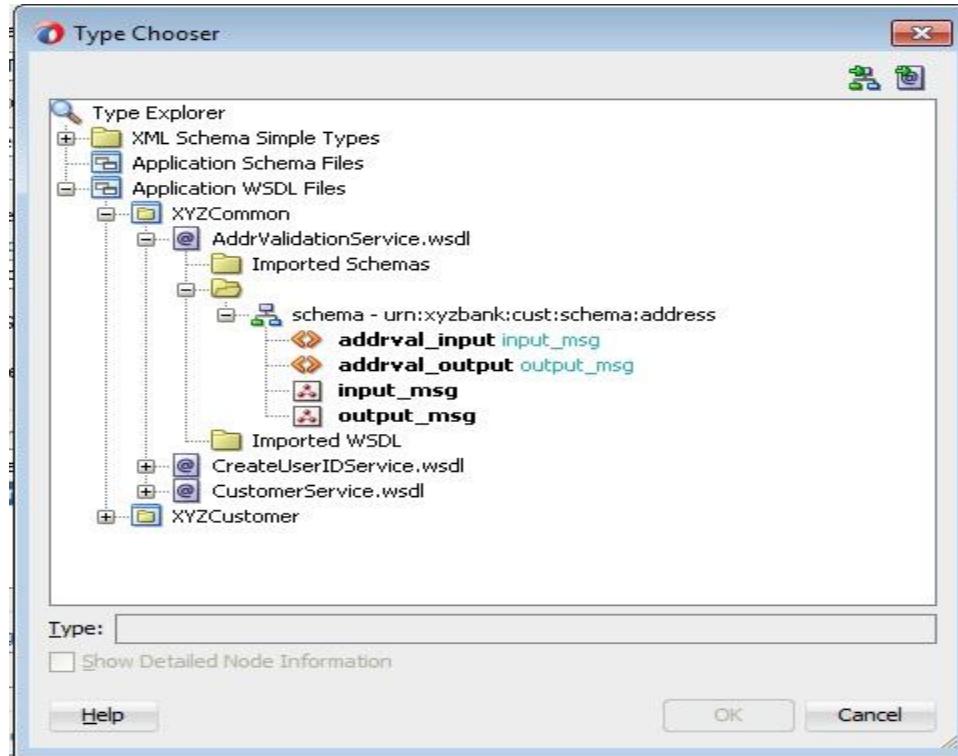
Click pencil icon for **Sequence Type** to bring up **Function Parameter Type** window. Click browse icon and select **Customer** element in **CustomerPS.wsdl** as shown below.



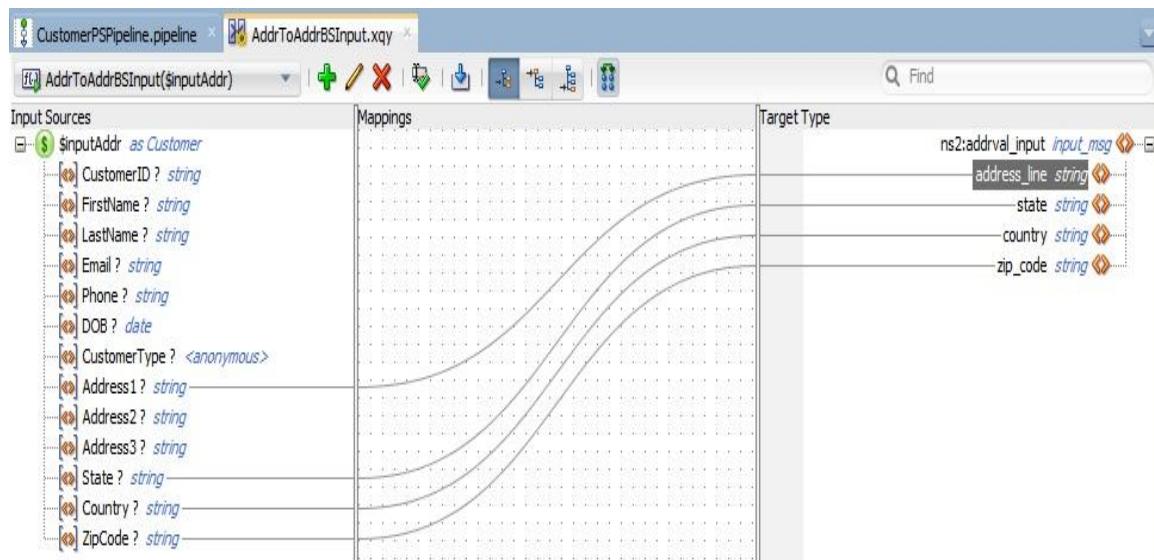
Click **OK** and retain default values for all other properties in **Function Parameter Type** window.



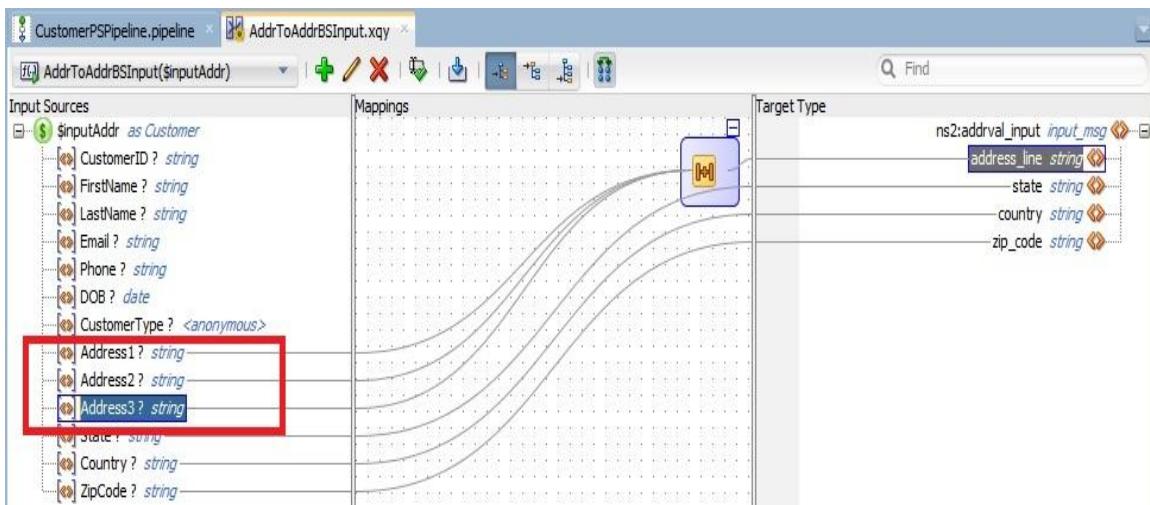
Go back to **Create XQuery Map** window by clicking **OK** twice. Now click pencil icon for **Target** to bring up **Function Result Type** window. Click browse icon and select **addrval_input** element as shown below.



Click **OK** thrice to bring up transformation editor. Do the initial mapping of attributes as shown below. You can map the fields by connecting source element to target element.



Drag **concat** function from **Components -> XQuery Functions -> String Functions** into **Mappings** swim lane as shown below and connect **Address2** and **Address3** input elements to this function.



Address Validation service expects address lines with ',' as delimiter, so go to **XQuery Source** tab and modify **concat** function as shown below.

```

xquery version "1.0" encoding "utf-8";

(: OracleAnnotationVersion "1.0" ::)

declare namespace ns1="http://xmlns.xyzbank.com/schema/Customer";
(: import schema at "../WSDLs/CustomerPS.wsdl" ::)
declare namespace ns2="urn:xyzbank:cust:schema:address";
(: import schema at "../../../../XYZCommon/AddrValidationService.wsdl" ::)

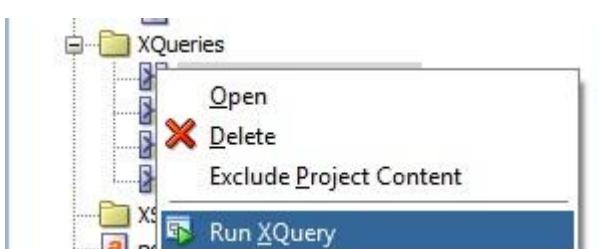
declare variable $inputAddr as element() (: schema-element(ns1:Customer) :) external;

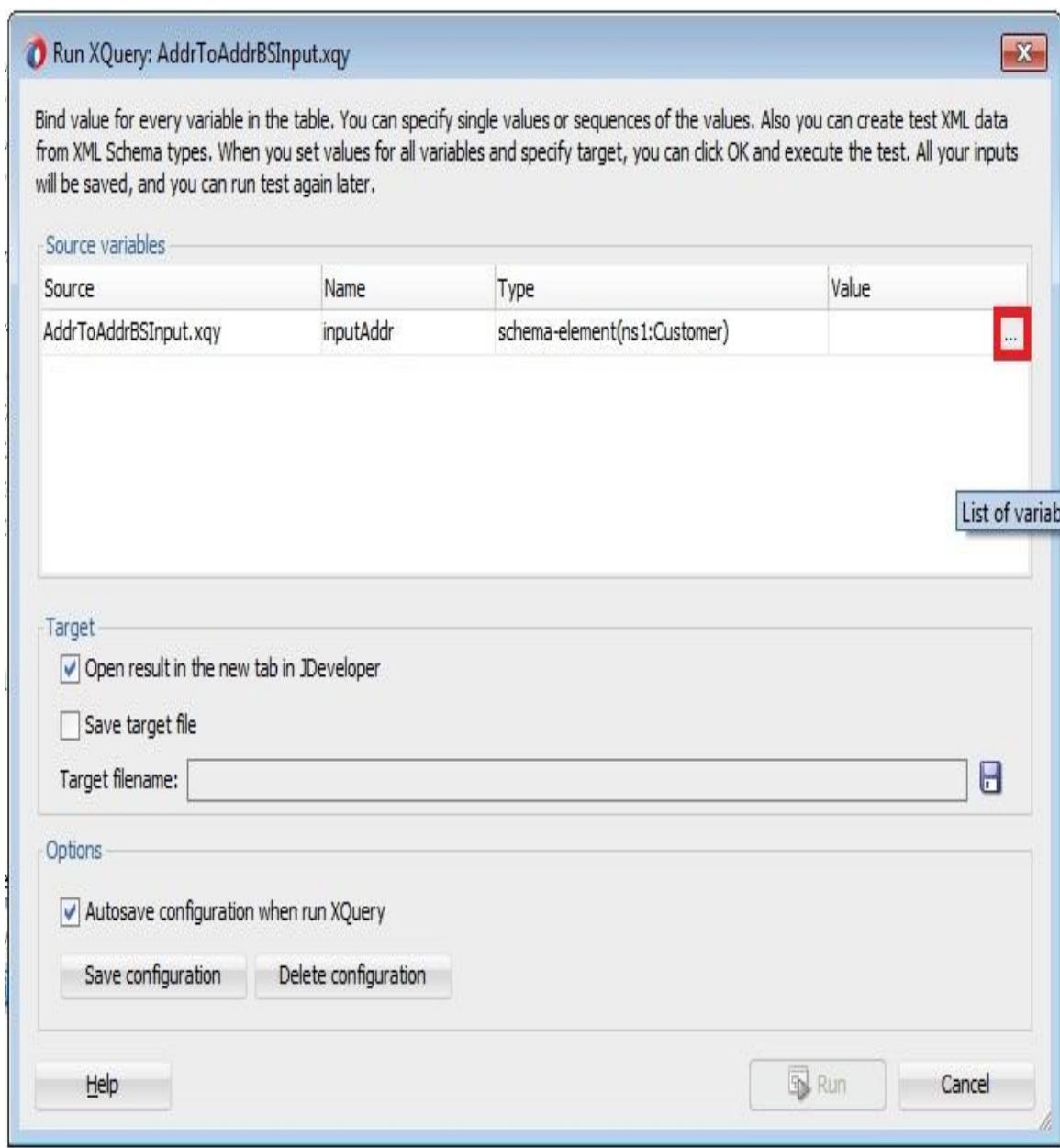
declare function local:AddrToAddrBSInput($inputAddr as element() (: schema-element(ns1:Customer) :)) as element() (: schema-element(ns2:addrval_input) :) {
<ns2:addrval_input>
  <address_line>{fn:concat(fn:data($inputAddr/Address1), ", ", fn:data($inputAddr/Address2), ", ", fn:data($inputAddr/Address3))}</address_line>
  <state>{fn:data($inputAddr/State)}</state>
  <country>{fn:data($inputAddr/Country)}</country>
  <zip_code>{fn:data($inputAddr/ZipCode)}</zip_code>
</ns2:addrval_input>
};

}

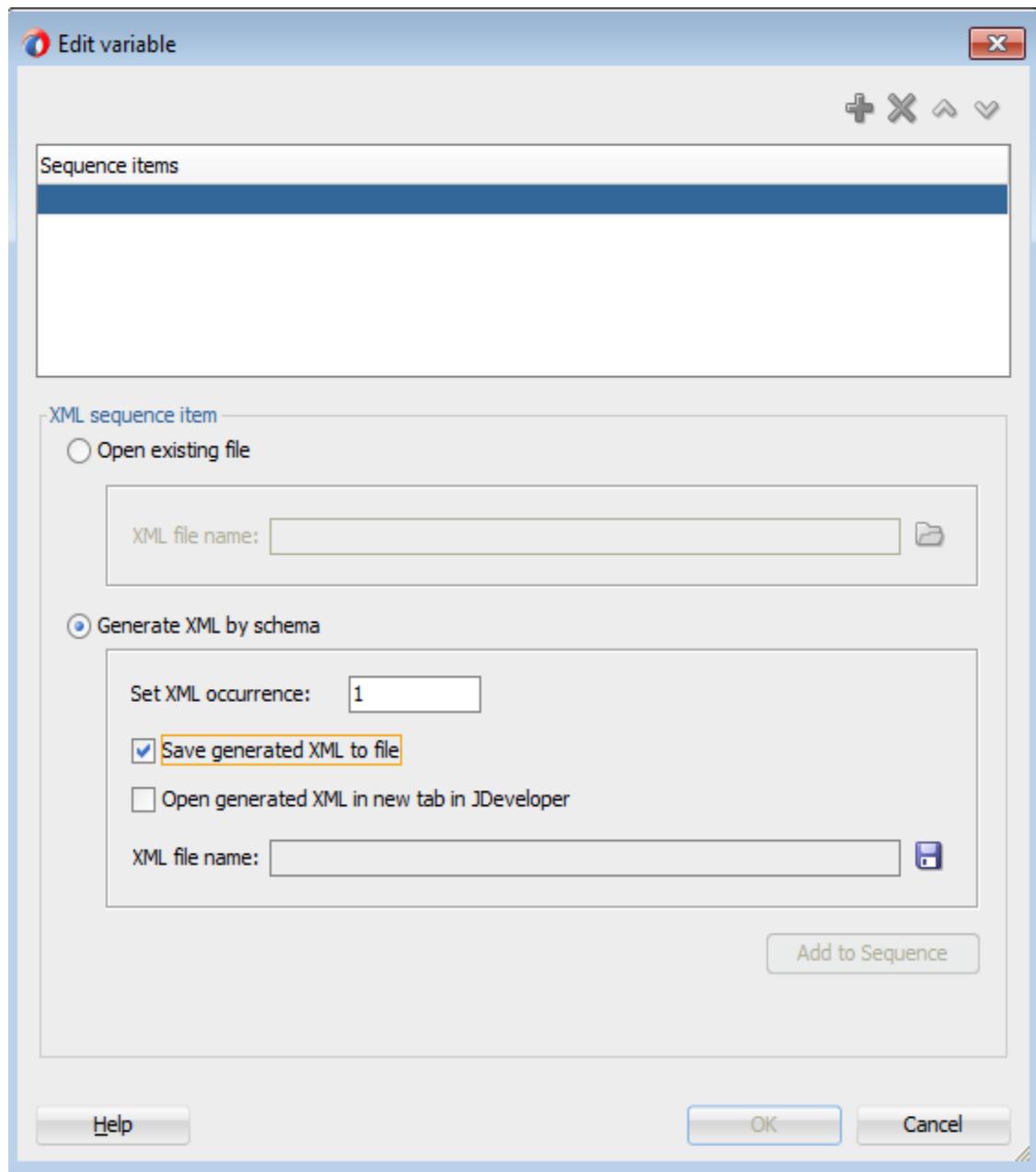
```

It's always advisable to test your **XQuery** mapping to verify that mapping is working as expected. Right click **XQuery** file in **XYZCustomer** project and select **Run XQuery**.

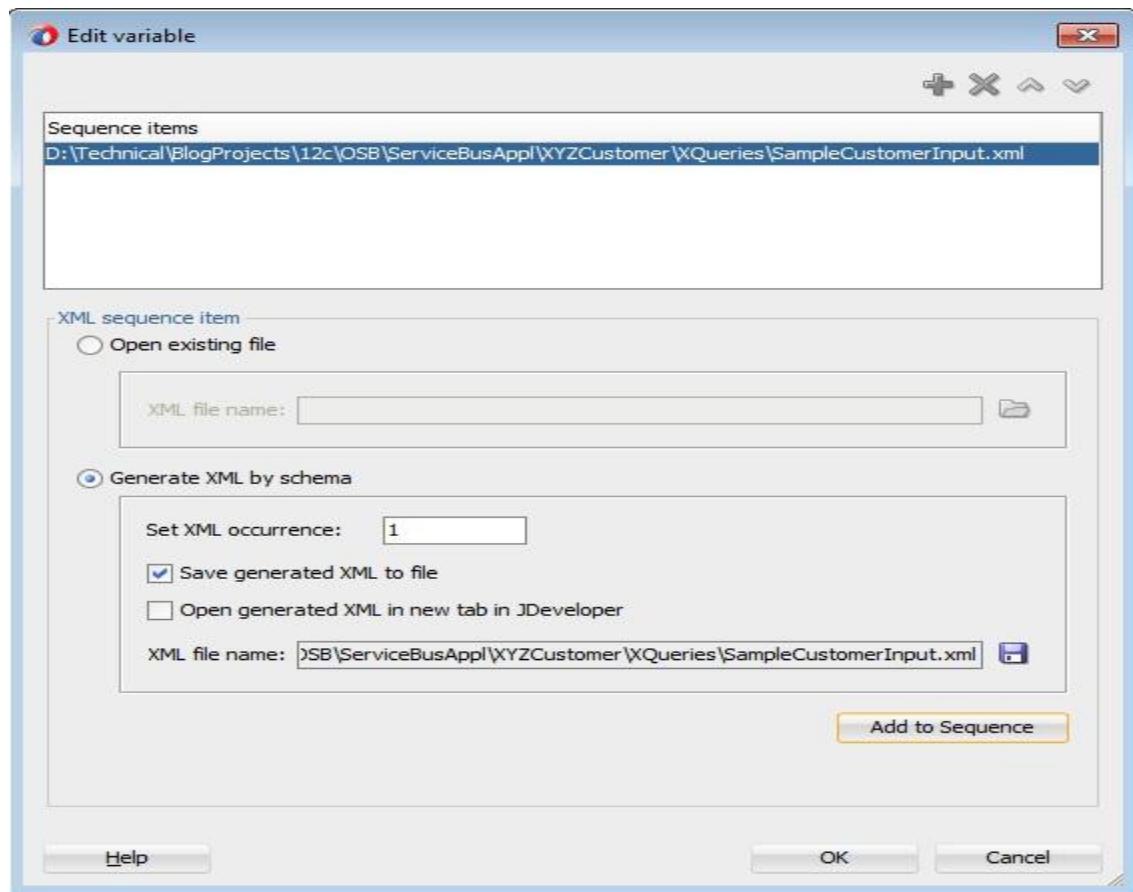




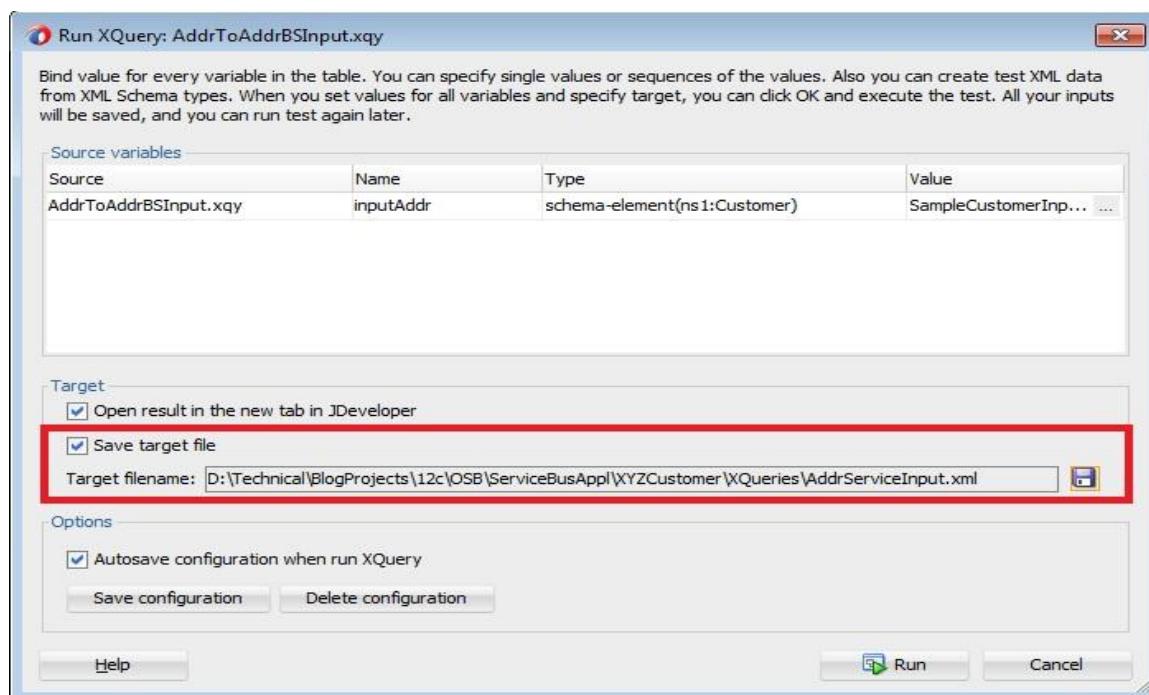
Click **List of variables** button (highlighted above) to bring **Edit Variable** window and select the options as shown below so that sample input will be generated automatically.



Click **save** icon and give file name as **SampleCustomerInput.xml** and click **Add to Sequence**.



Go back to **Run XQuery** window by clicking **OK**. Now give **Target file name** as **AddrServiceInput** by clicking **Save** icon.



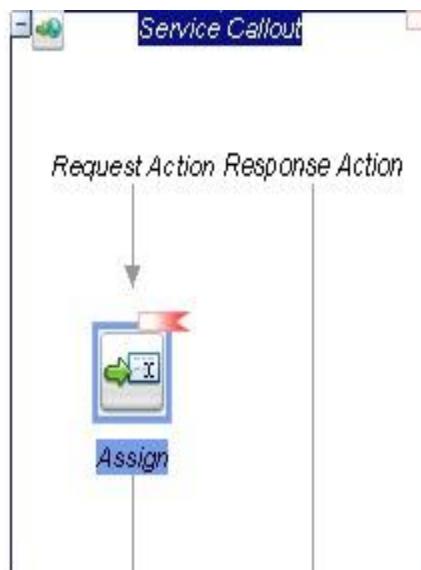
Click **Run** and verify the mapping is working as expected. You can also verify sample source and target files created in your **XQueries** folder.



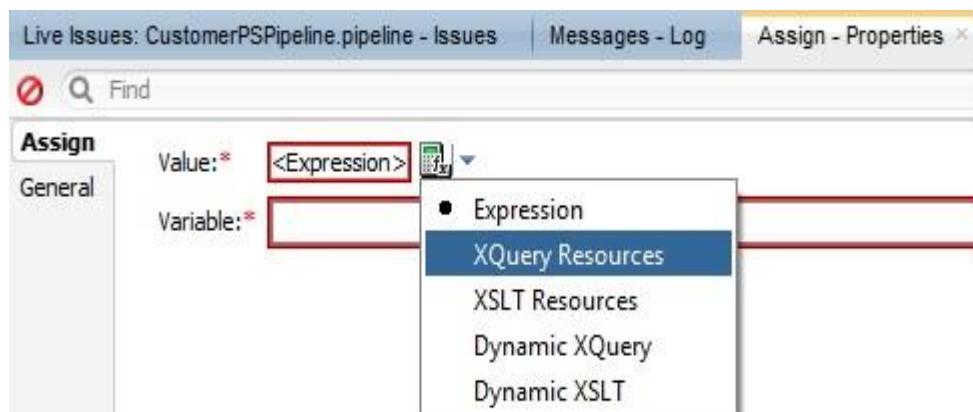
The screenshot shows the Oracle SOA Studio interface with three tabs at the top: 'CustomerPSPipeline.pipeline', 'AddrToAddrBSInput.xqy', and 'AddrServiceInput.xml'. The 'AddrToAddrBSInput.xqy' tab is active, displaying an XQuery code block. The code defines an input element 'ns2:addrval_input' with namespace 'urn:xyzbank:cust:schema:address'. It contains five child elements: 'address_line' with value 'Address119,Address220,Address321', 'state' with value 'State22', 'country' with value 'Country23', 'zip_code' with value 'ZipCode24', and the closing tag '/ns2:addrval_input'.

```
?ns2:addrval_input xmlns:ns2="urn:xyzbank:cust:schema:address">
  <address_line>Address119,Address220,Address321</address_line>
  <state>State22</state>
  <country>Country23</country>
  <zip_code>ZipCode24</zip_code>
</ns2:addrval_input>
```

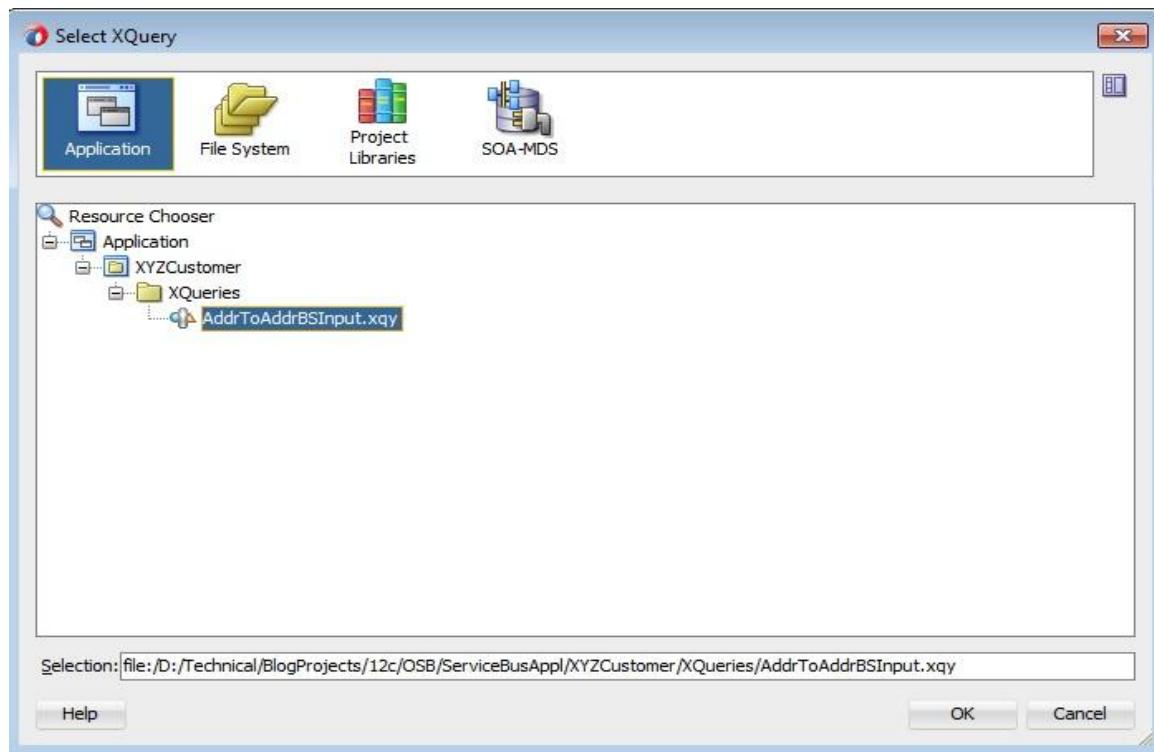
To use this **XQuery** mapping, drag **Assign** activity into **Service Callout** from **Message Processing**.



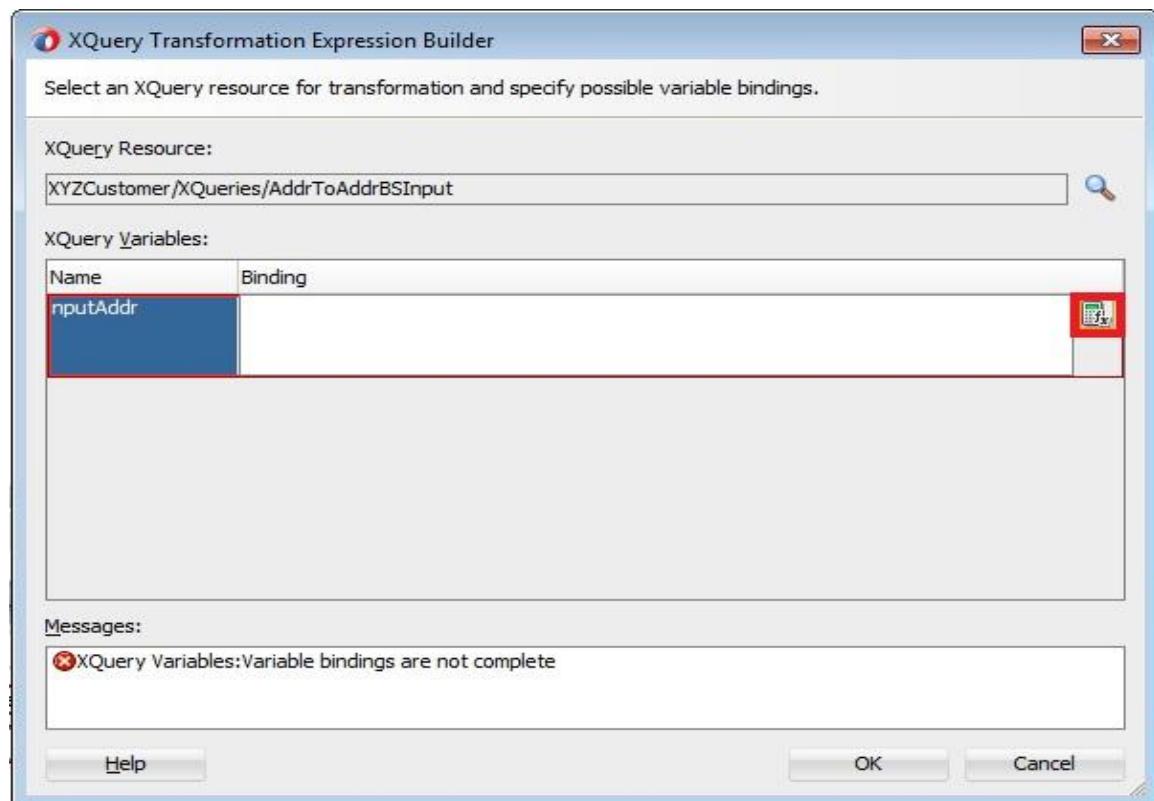
In **Properties** tab, select **XQuery Resources** for Value property as shown below.

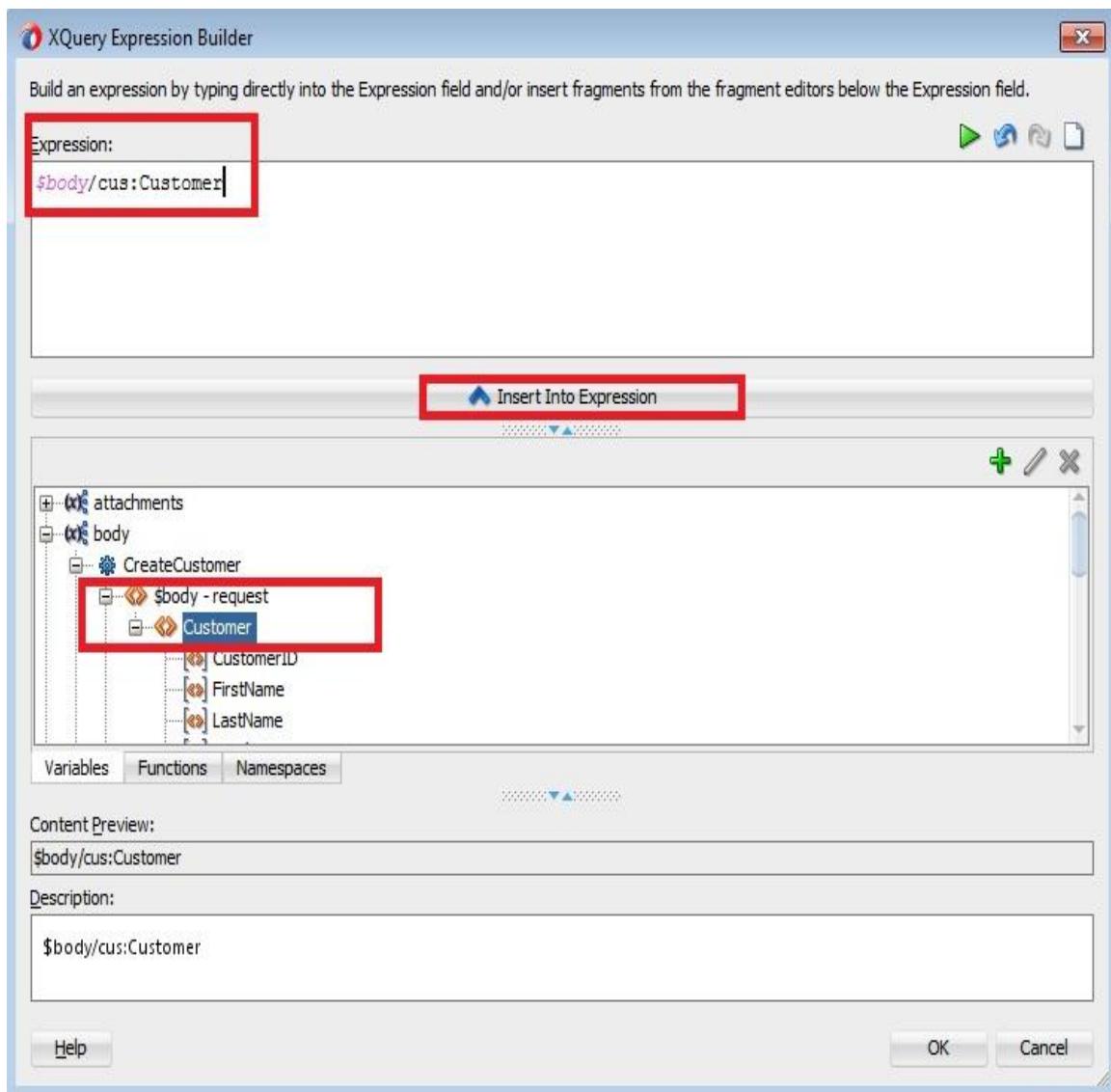


In expression builder, click **Browse** icon and select above XQuery mapping.



Click **OK** and use following steps to set value for **Binding** property.

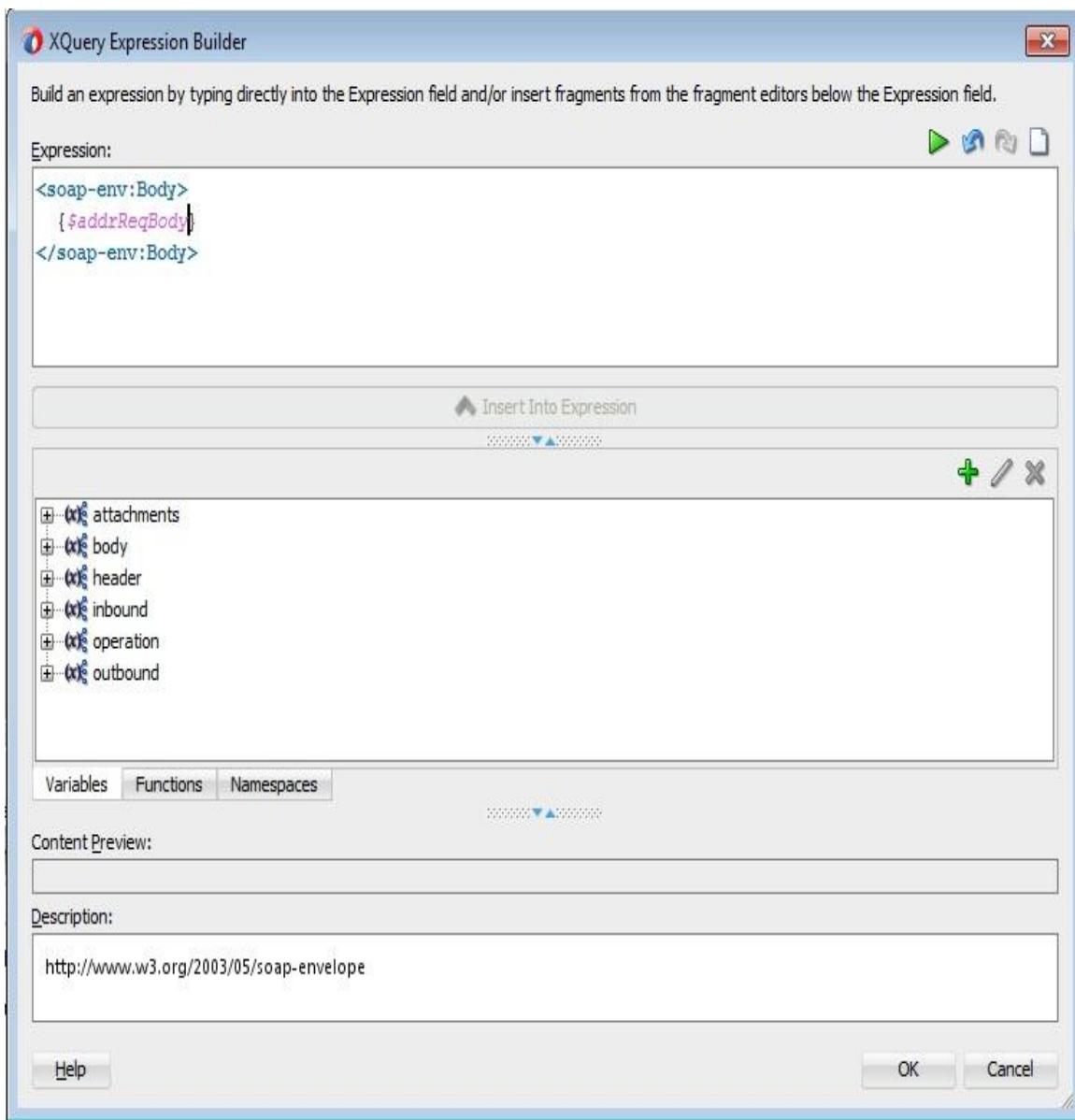




Click **OK** twice and set **addrReqBody** as value for **Variable** property.



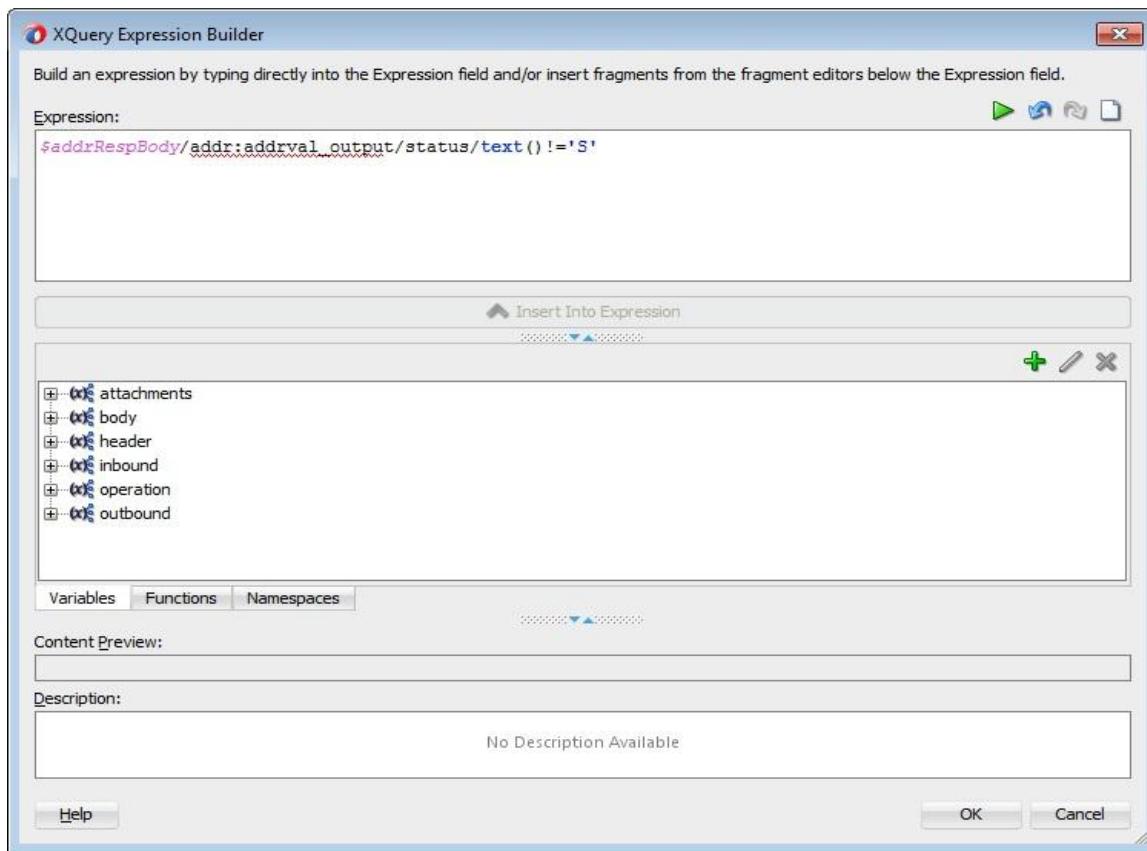
Now use another **Assign** activity to enclose the payload in **soap-env:Body** element. Bring up expression builder for **Value** property and give the expression as shown below.



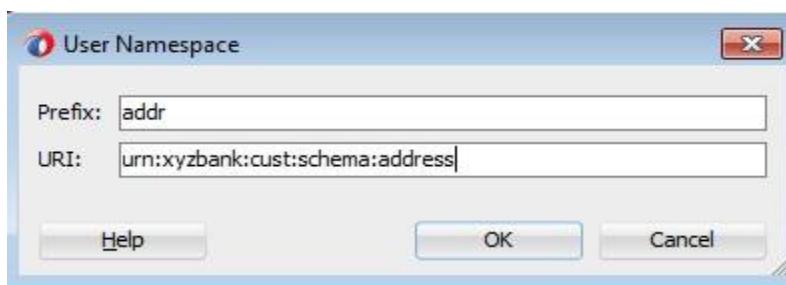
Click **OK** and set **addrReqBody** as value for **Variable** property.

Assign	Value: * <soap-env:Body>
General	Variable: * addrReqBody

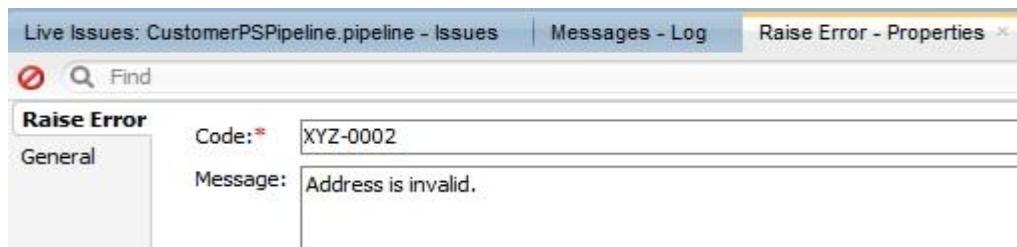
Once response is received, you have to raise error or proceed with message flow depending on status. So drag **If-Then** activity into **AddrValidation** stage after **Service Callout** from **Flow Control** and give condition as shown below.



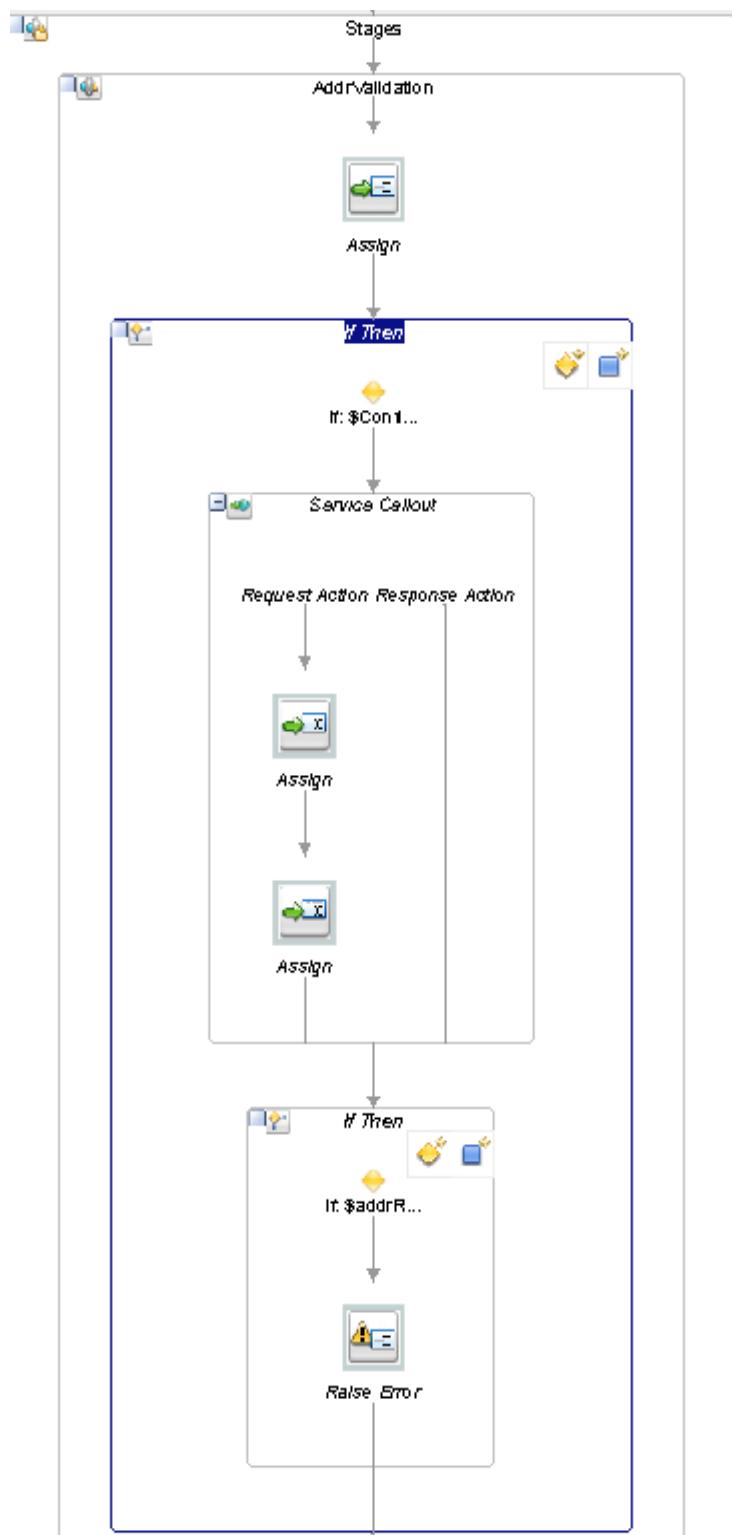
The red line denotes namespace alias **addr** is not a valid one. To register new namespace, go to **Namespaces** tab and click + icon and fill in the details as shown below. Here you need to give the namespace used by response schema of address validation service.



Click **OK** and observe red line is no longer visible. Now drag **Raise Error** activity into **If** branch from **Flow Control** and set properties as below.



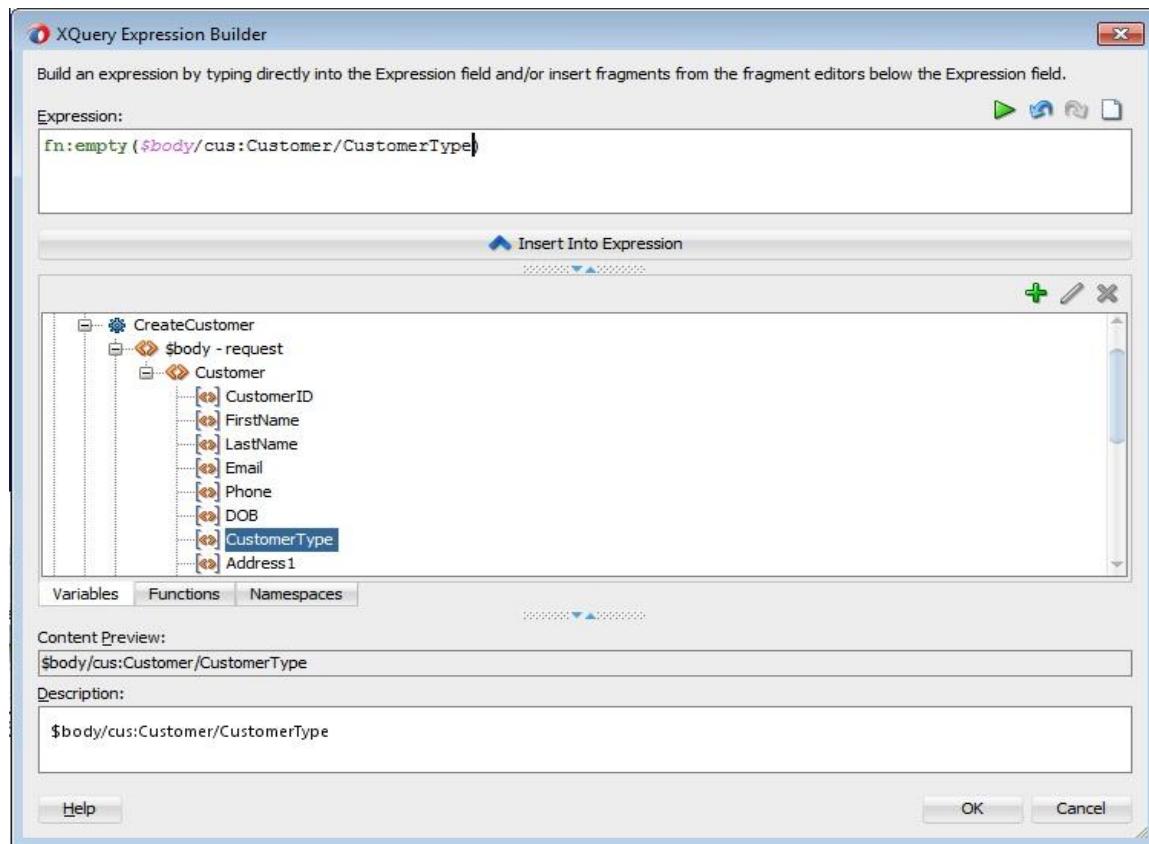
Now your **AddrValidation** stage should look like below.



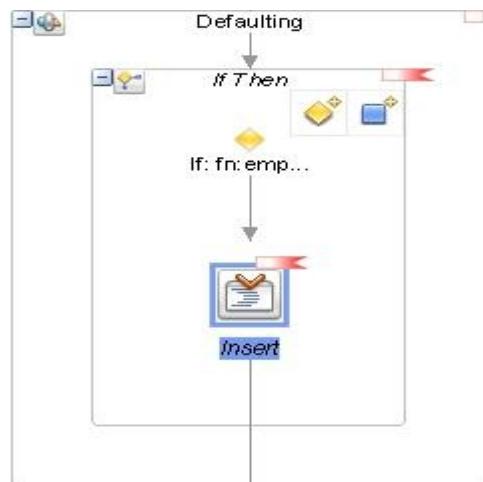
Defaulting

In this section, you will default **CustomerType** element if the value is not sent.

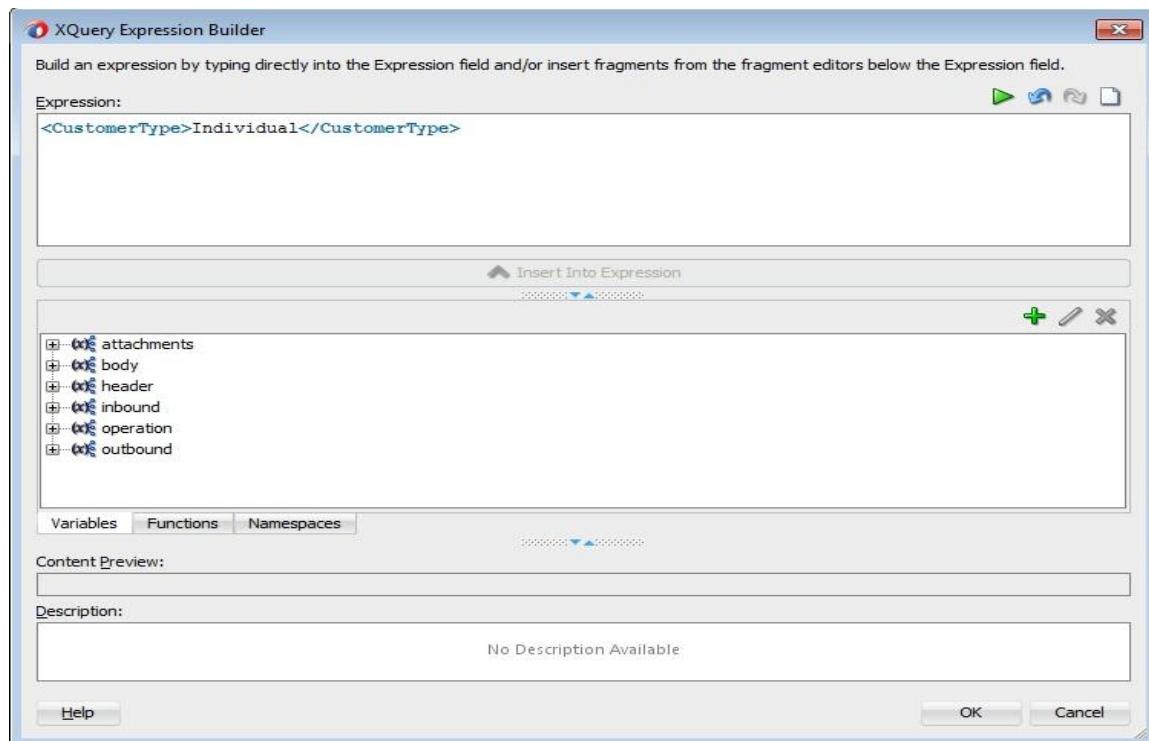
Create another **Stage** after **AddrValidation** stage and set name as **Defaulting** in Properties tab. Drag **If-Then** activity into this stage from **Flow Control** and give condition as shown below. Alternatively, you can select **fn:empty** function from **Functions -> XQuery 1.0 Functions -> Sequences -> General Functions**.



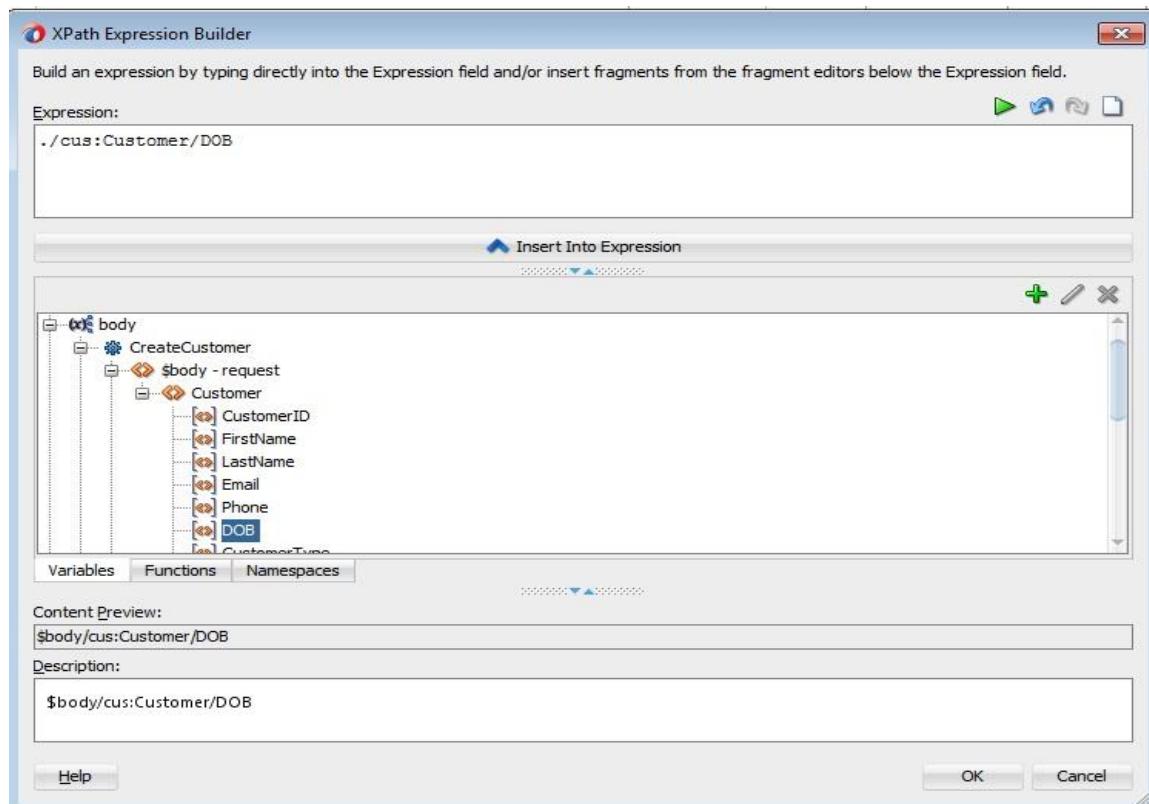
Drag **Insert** activity into **If** branch from **Message Processing**.



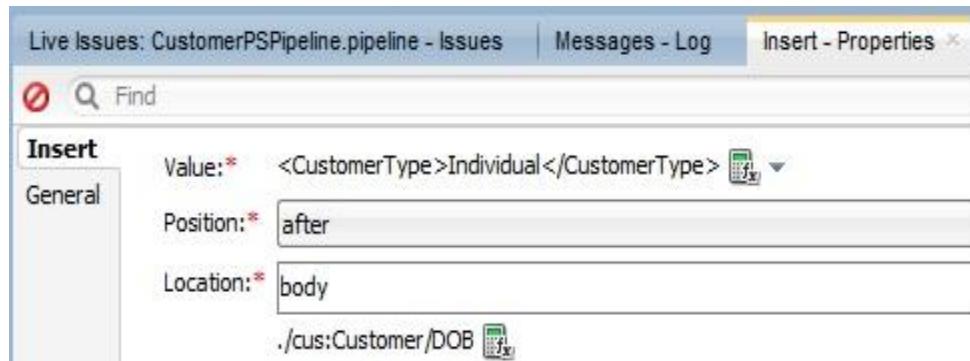
Bring up expression builder for **Value** property and set **expression** as shown below.



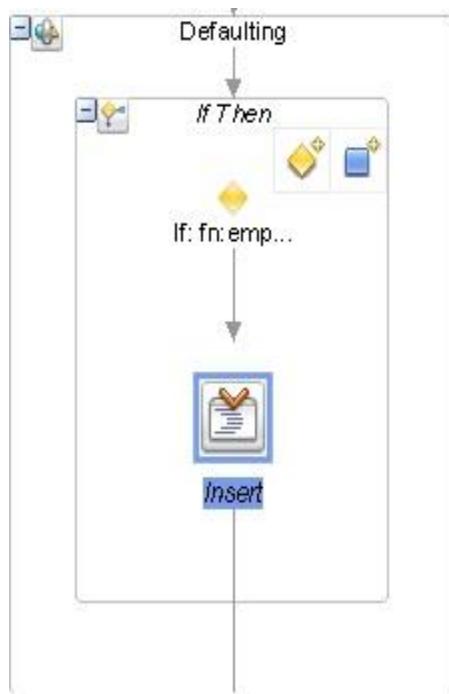
Bring up expression builder for **Location** property and set **expression** as shown below.



Set other properties as shown below so that **CustomerType** element will be inserted in **body** context variable after DOB element in request payload.



Now your **Defaulting** stage should look like below.

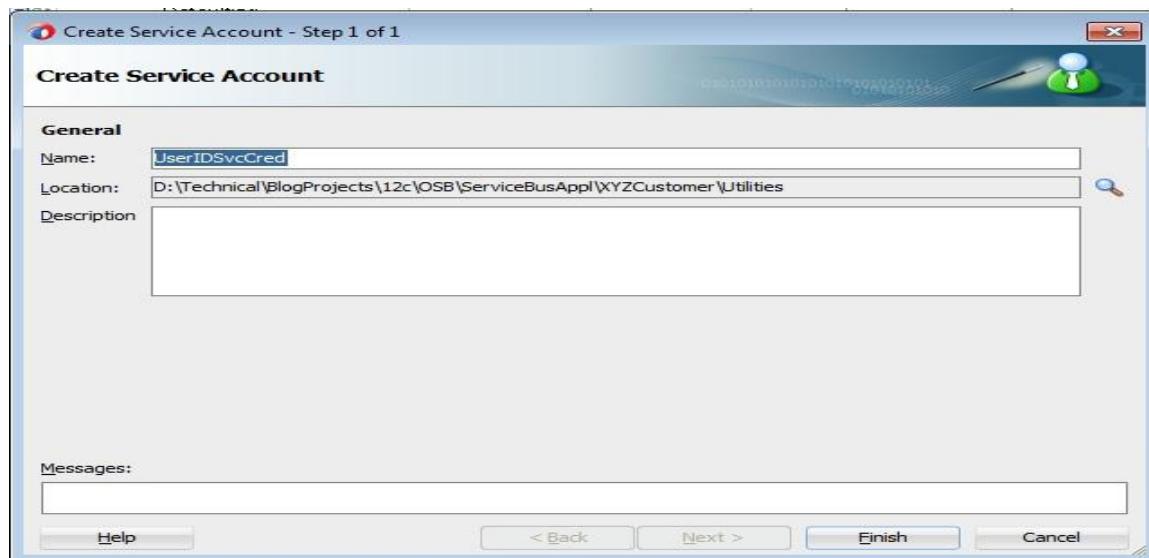


Getting User ID

In this section, you will invoke **CreateUserID** service to generate Unique ID for **CustomerID**.

CreateUserID service expects credential information in SOAP header. Instead of hard-coding these values in your message flow, you can use **Service Account** feature provided by Service Bus to store credentials which can be referenced in message flow using XQuery function.

Create a new folder named **Utilities** in **XYZCustomer** project. Right click this folder and select **New->Service Account**. Give name as **UserIDSvcCred** and click **Finish**.



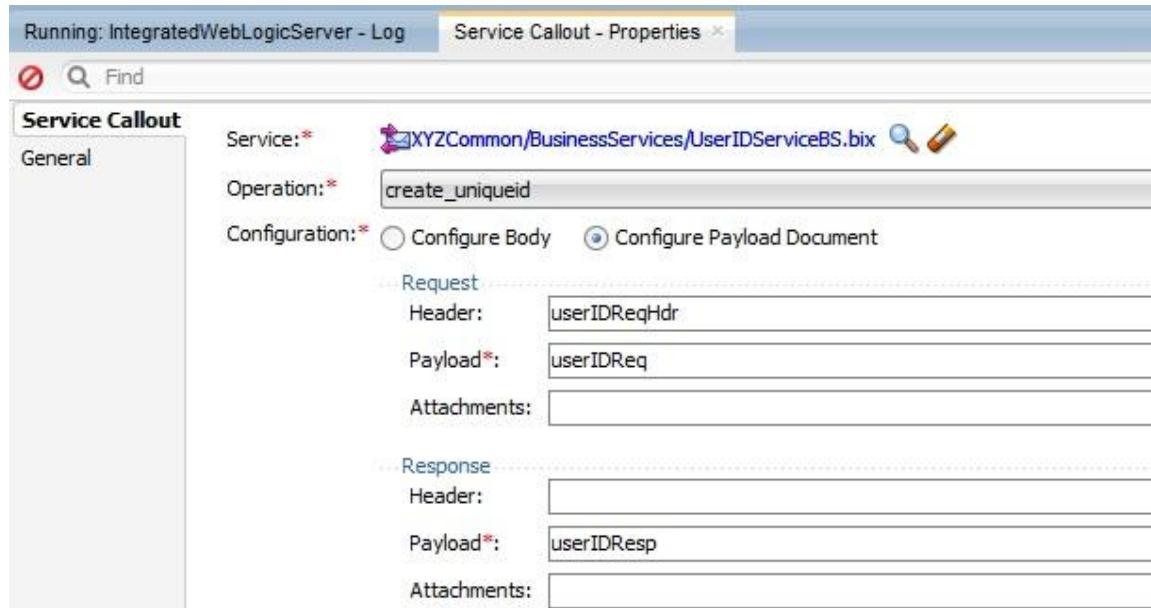
Select **Resource Type** as **Static** and give your username and password as shown below.

The screenshot shows the Oracle Service Bus interface with the following details:

- CustomerPSPipeline.pipeline** is the selected pipeline.
- A new service account **UserIDSvcCred.sa** is being created.
- Service Account** configuration page is open.
- Description:** (Empty text area)
- Resource Type:** Static (The other options are Pass Through and Mapping.)
- Static User Configuration:**
 - User Name:** admin
 - Password:** *****
 - Confirm Password:** *****

Drag a **Service Callout** into **Defaulting** stage after **If-Then** activity from **Communication**. And in **Properties** tab, browse and select **UserIDServiceBS** and select **create_uniqueid** as operation.

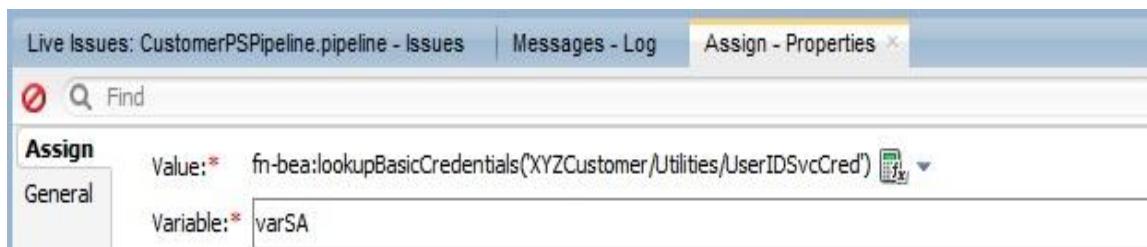
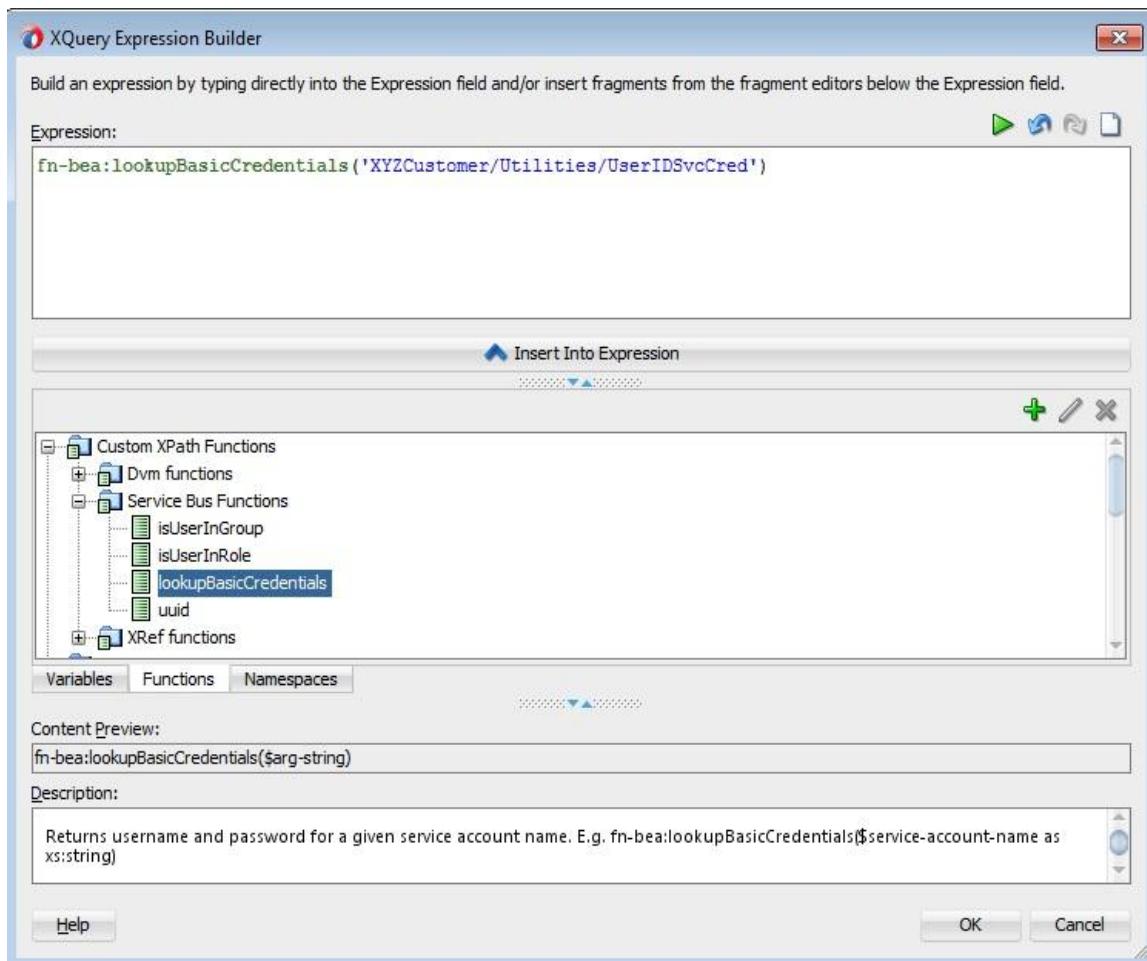
Set other properties as shown below including **Request Header** property as you need to send credential information in SOAP Header. Choosing the option '**Configure Payload Document**' allows you to send request and receive response payload without **soap-env:Body** tag. In this case, Service Bus will add SOAP Body element at runtime while calling business service.



The XQuery function **fn-bea:lookupBasicCredentials()** can be used to get credentials stored in your service account. This function returns following XML fragment.

```
<con:UsernamePasswordCredential xmlns:con="http://www.bea.com/wli/sb/services/security/config">
    <con:username>Username value given in service account</con:username>
    <con:password>Password value given in service account</con:password>
</con:UsernamePasswordCredential>
```

Drag **Assign** activity into **Request Action** of **Service Callout** from **Message Processing** and set properties as shown below. Alternatively, you can select this **XQuery** function by navigating to **Functions -> Custom XPath Functions -> Service Bus Functions**.



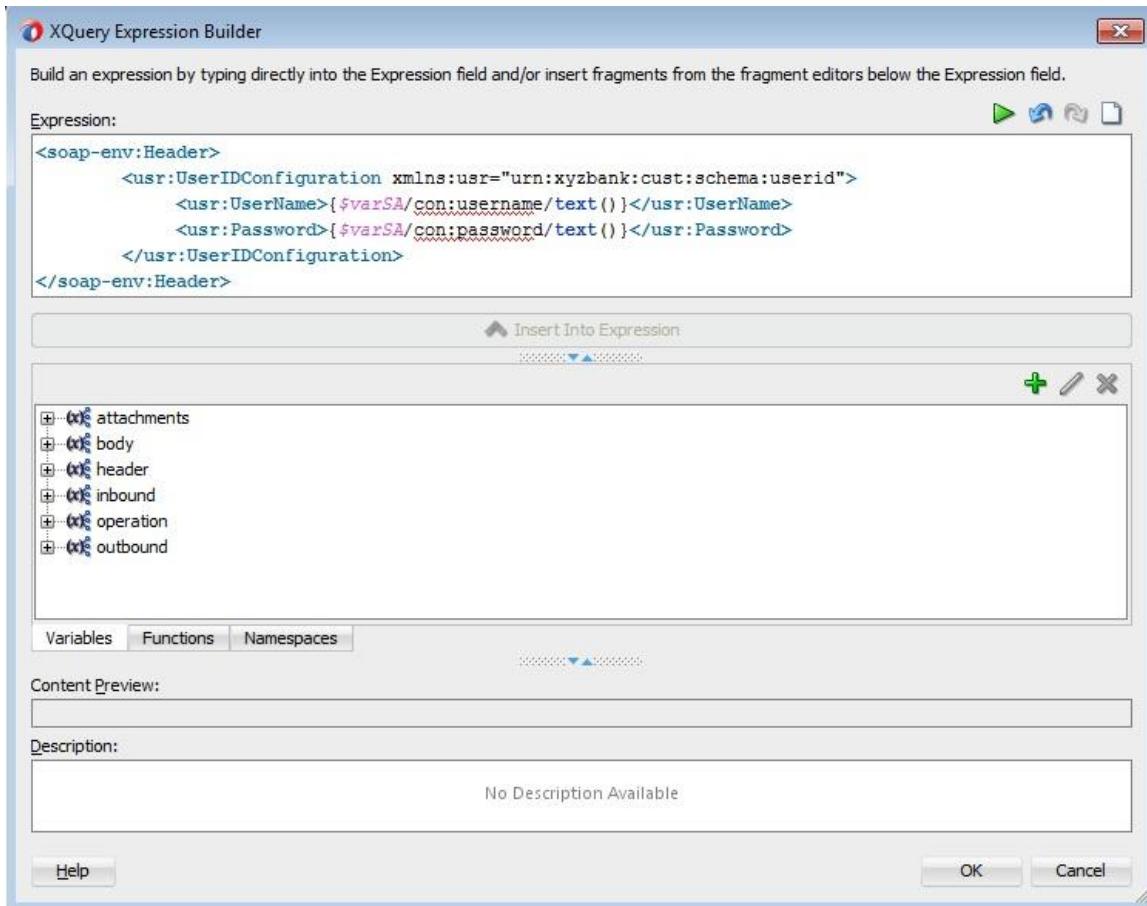
Drag **Assign** activity and set properties as given below populating the SOAP header. Note the inclusion of **<soap-env:Header>** tag in expression and has to be included always irrespective of the **Configure** option selected for **Service Callout**.

Value:

```
<soap-env:Header>
  <usr:UserIDConfiguration xmlns:usr="urn:xyzbank:cust:schema:userid">
    <usr:UserName>{$varSA/con:username/text()}</usr:UserName>
    <usr:Password>{$varSA/con:password/text()}</usr:Password>
  </usr:UserIDConfiguration>
</soap-env:Header>
```

Variable:

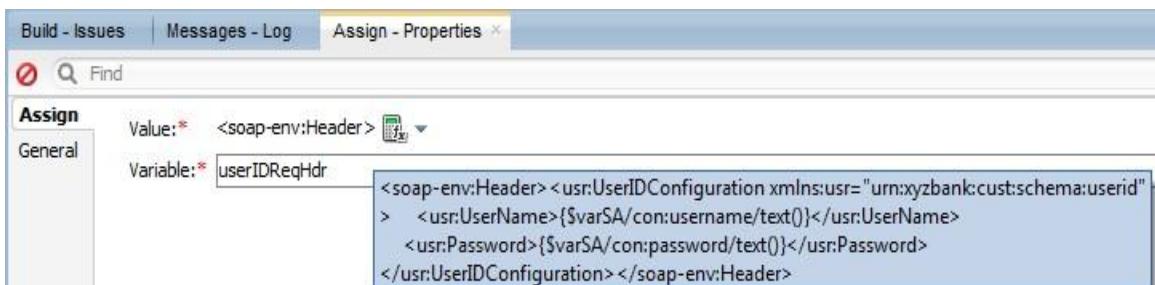
userIDReqHdr



If you observe red lines, register new namespace <http://www.bea.com/wli/sb/services/security/config> with alias **con** as shown below.



Now your properties window should be shown like below.



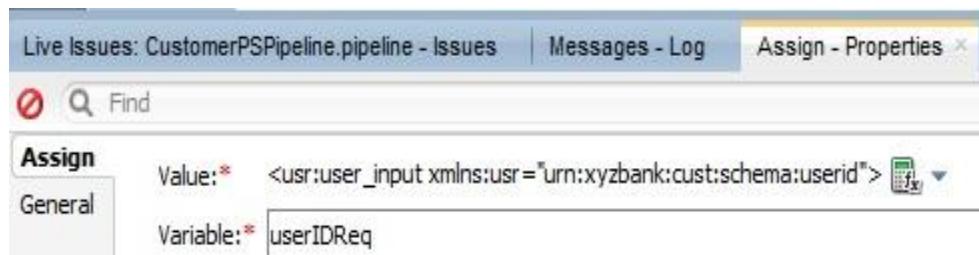
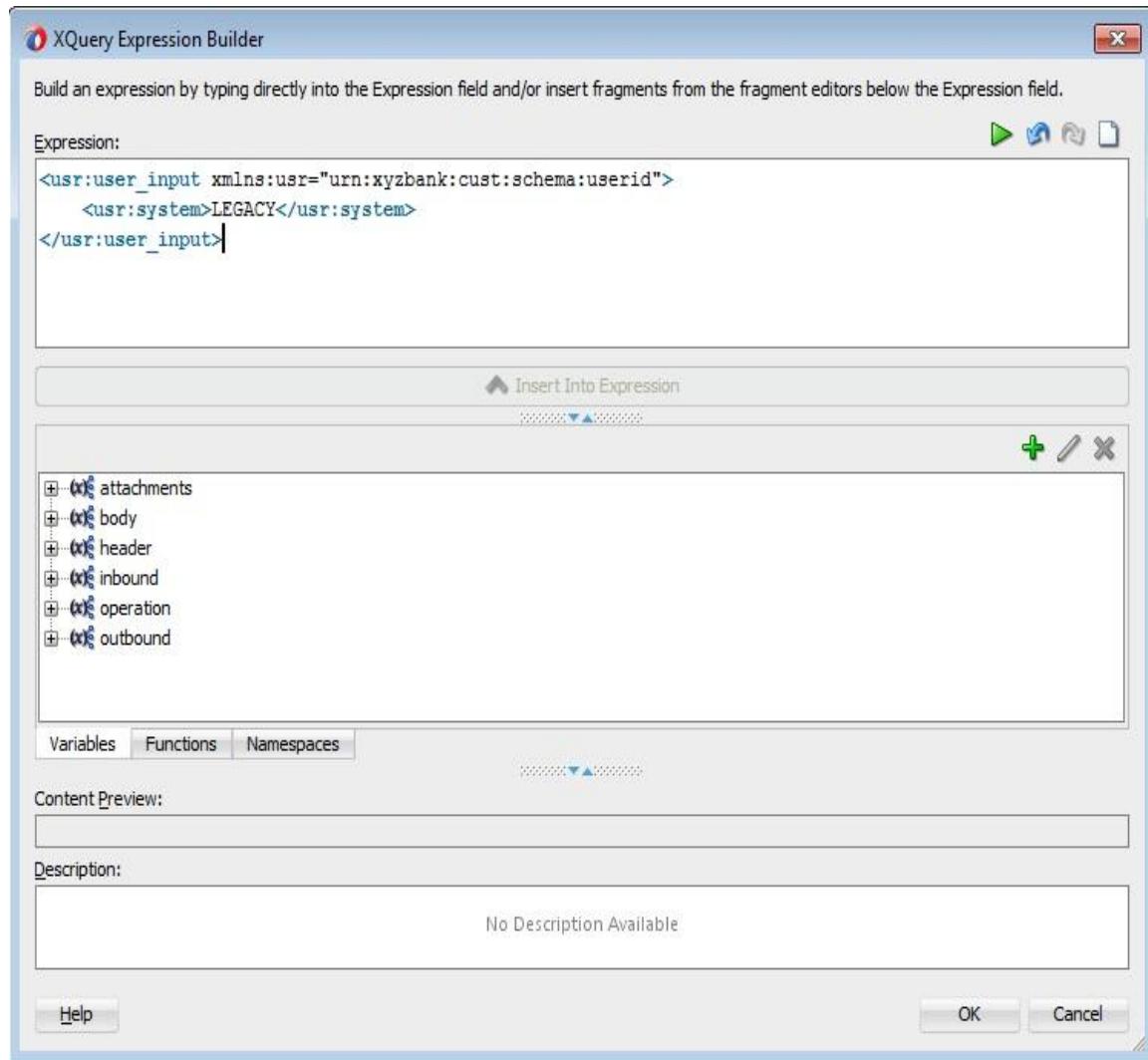
Drag another **Assign** activity and set properties as given below to populate payload for business service.

Expression:

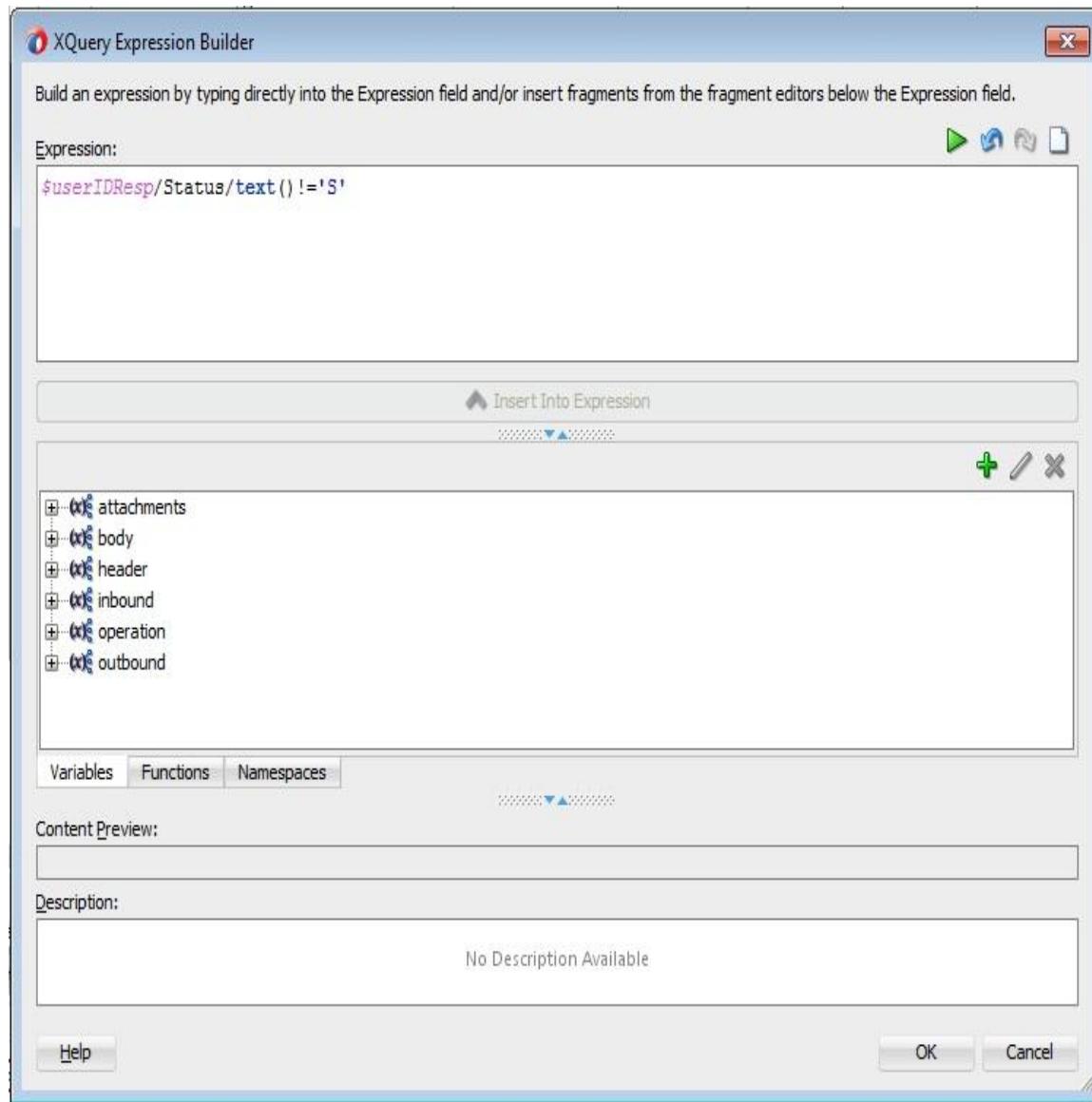
```
<usr:user_input xmlns:usr="urn:xyzbank:cust:schema:userid">
    <usr:system>LEGACY</usr:system>
</usr:user_input>
```

Variable:

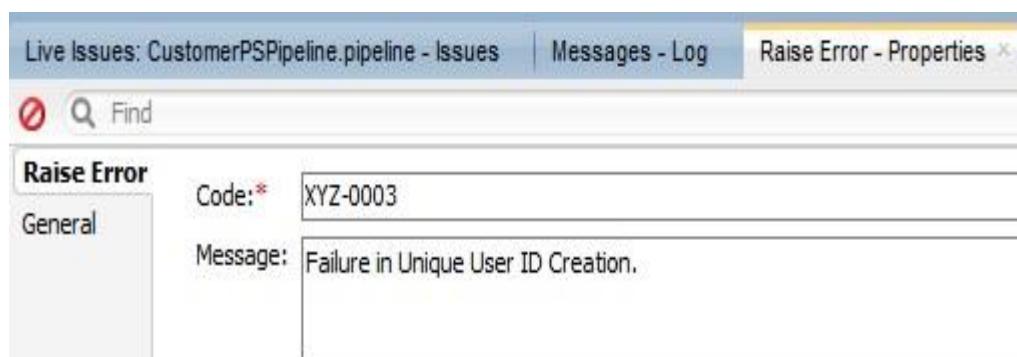
userIDReq



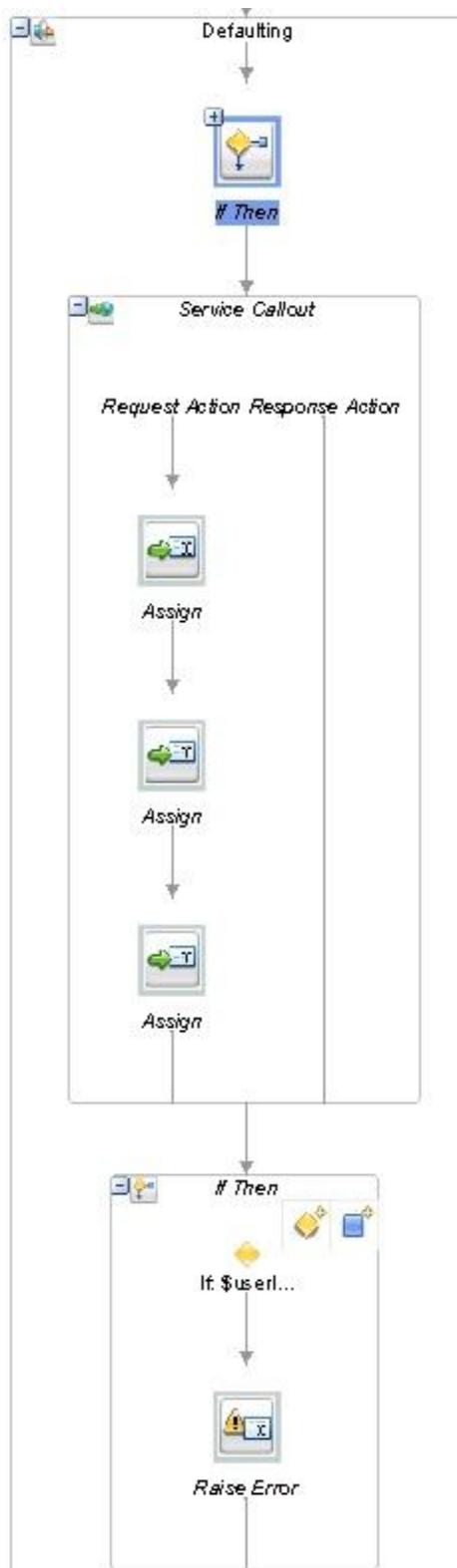
Drag **If-Then** activity after **Service Callout** from **Flow Control** and set condition as shown below to verify status of **UserID Creation**.



Drag **RaiseError** activity into **If** branch from **Flow Control** and set properties as shown below.



Now your **Defaulting** stage should look like below.



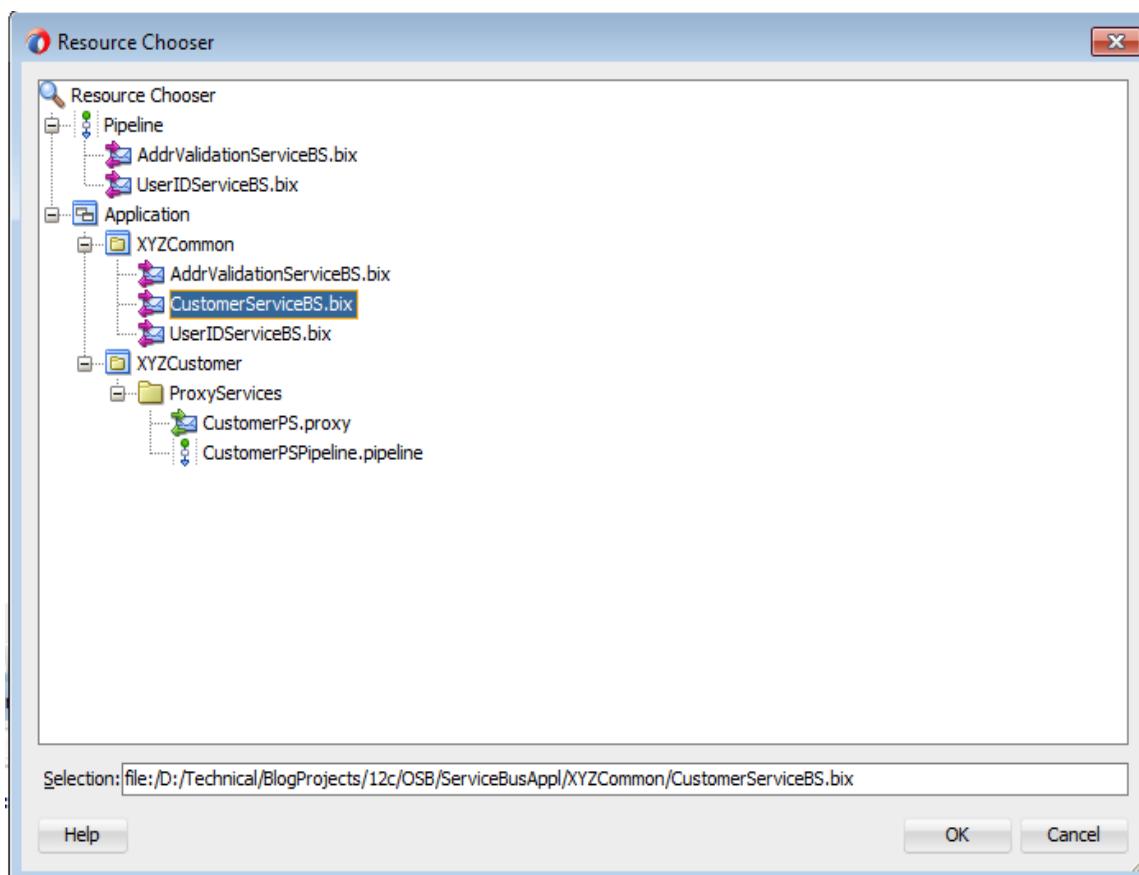
Routing

In this section, you will invoke **CustomerServiceBS** to finish message flow for **Create Customer**.

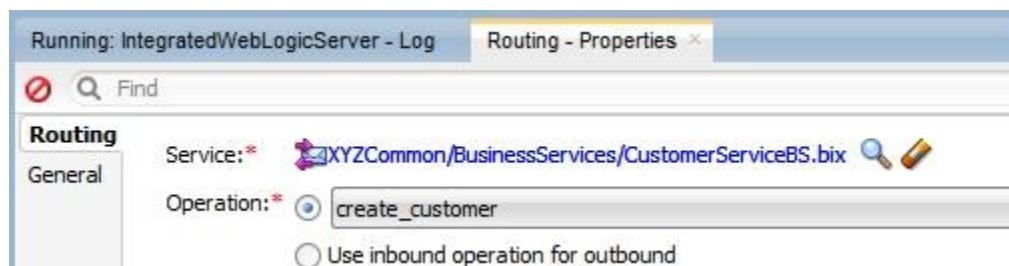
Drag **Routing** activity into **Actions** placeholder of **CreateCustomer_Route**.



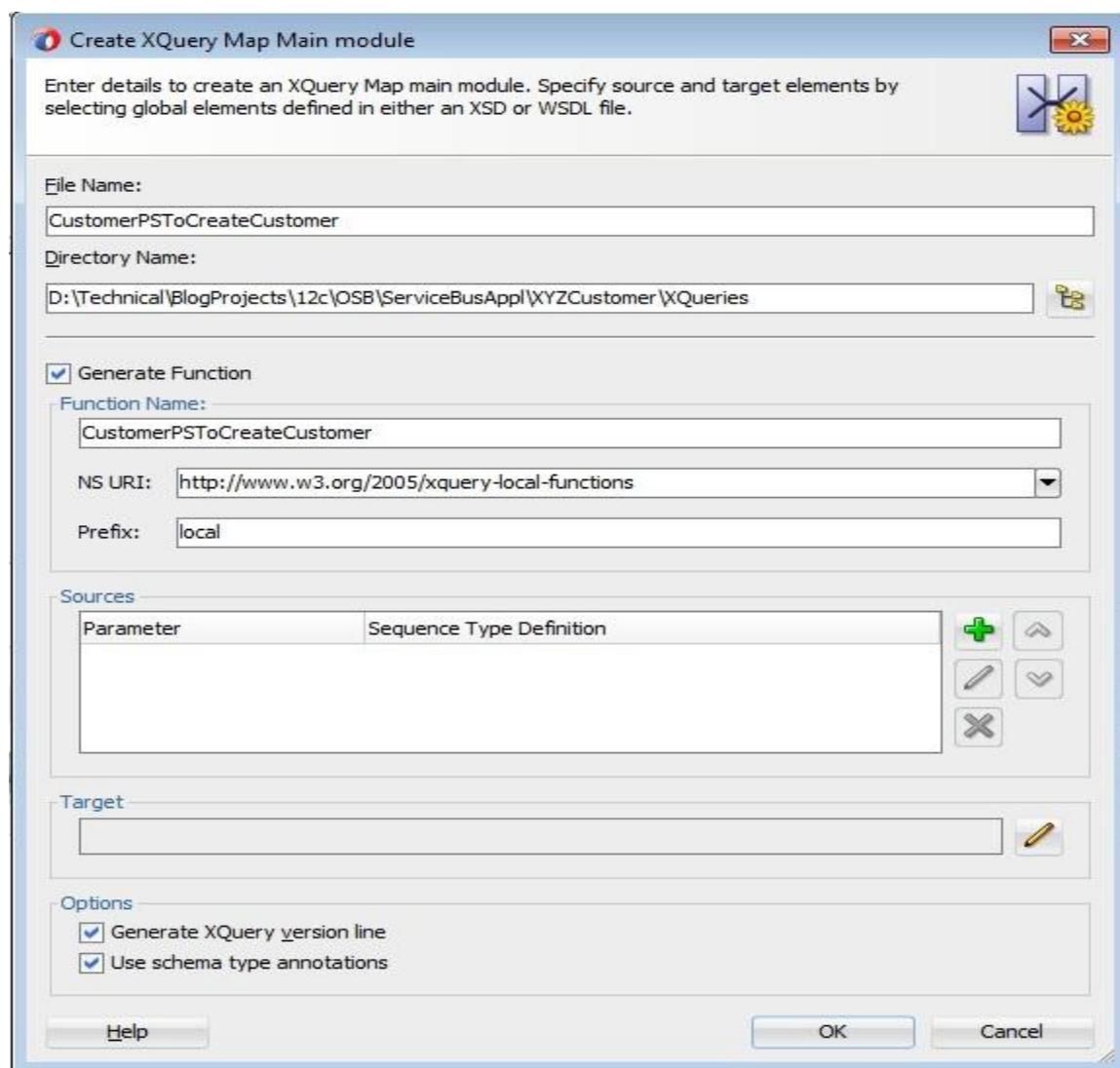
In **Properties** tab, click browse and select **CustomerServiceBS** as shown below.



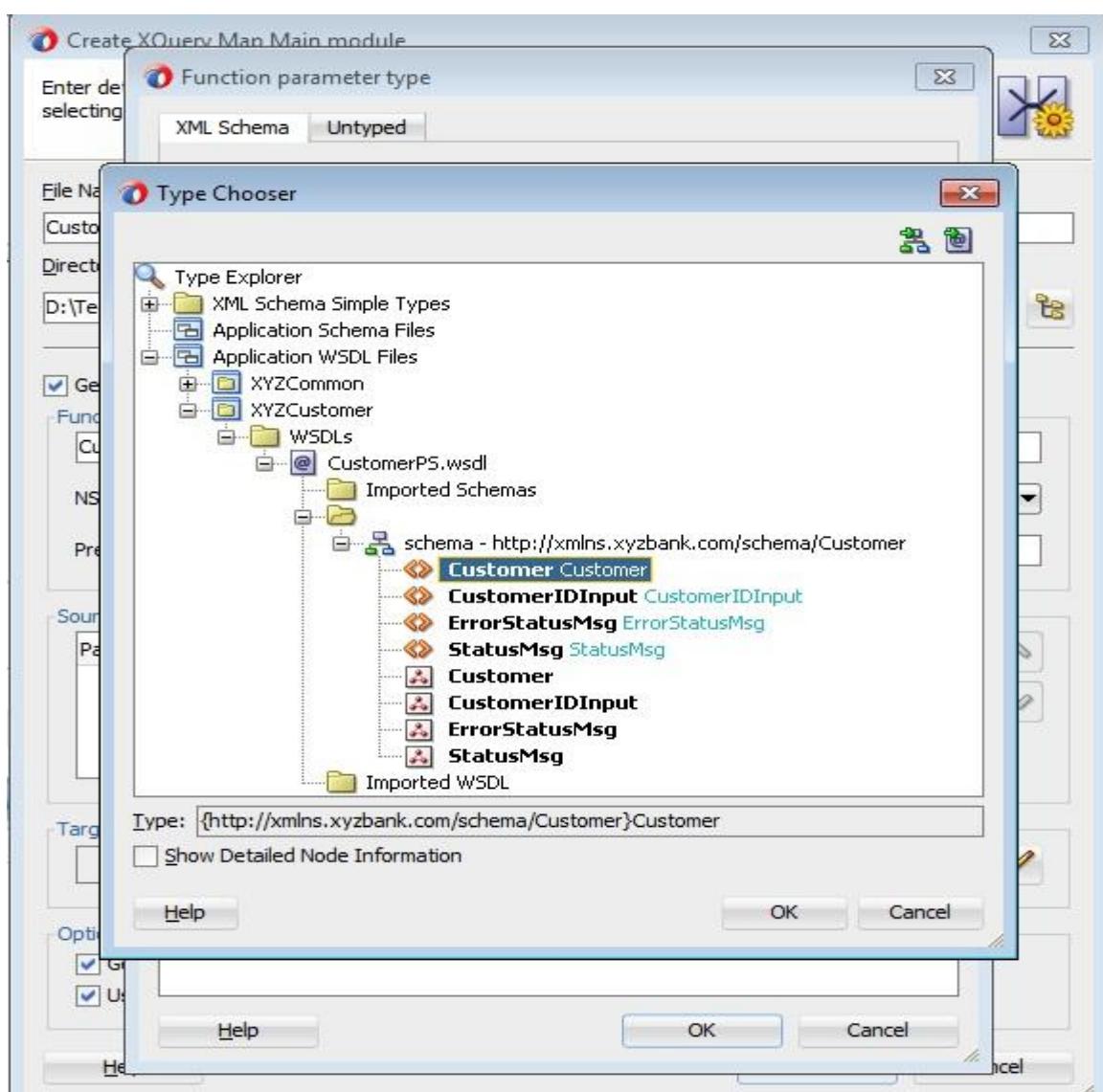
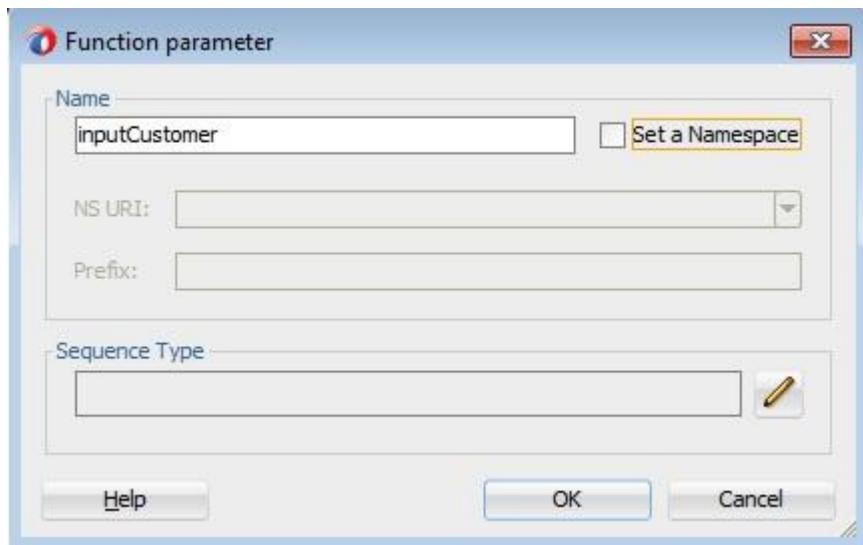
Select **create_customer** as Operation.



Next task is transforming the received payload to the structure expected by **CustomerService** business service. So create a new XQuery map in **XQueries** folder of **XYZCustomer** project and give both **File Name** and **Function Name** as **CustomerPSToCreateCustomer**.



Complete **Source** parameter selection as shown below and you can refer to previous sections for actual navigation steps.



Function parameter type

XML Schema **Untyped**

Schema Object Reference:
Customer 

Possible Sequence Type Form:
Schema Element

Schema Location: B/ServiceBusAppl/XYZCustomer/WSDLs/CustomerPS.wsdl **Prefix:** ns1

Not Applicable
 Set a Namespace

NS URI:

Prefix:

Occurrence: Exactly One

Result XQuery Expression:
`schema-element(ns1:Customer)`

Warnings & Notes:

Help **OK** **Cancel**

Function parameter

Name: inputCustomer Set a Namespace

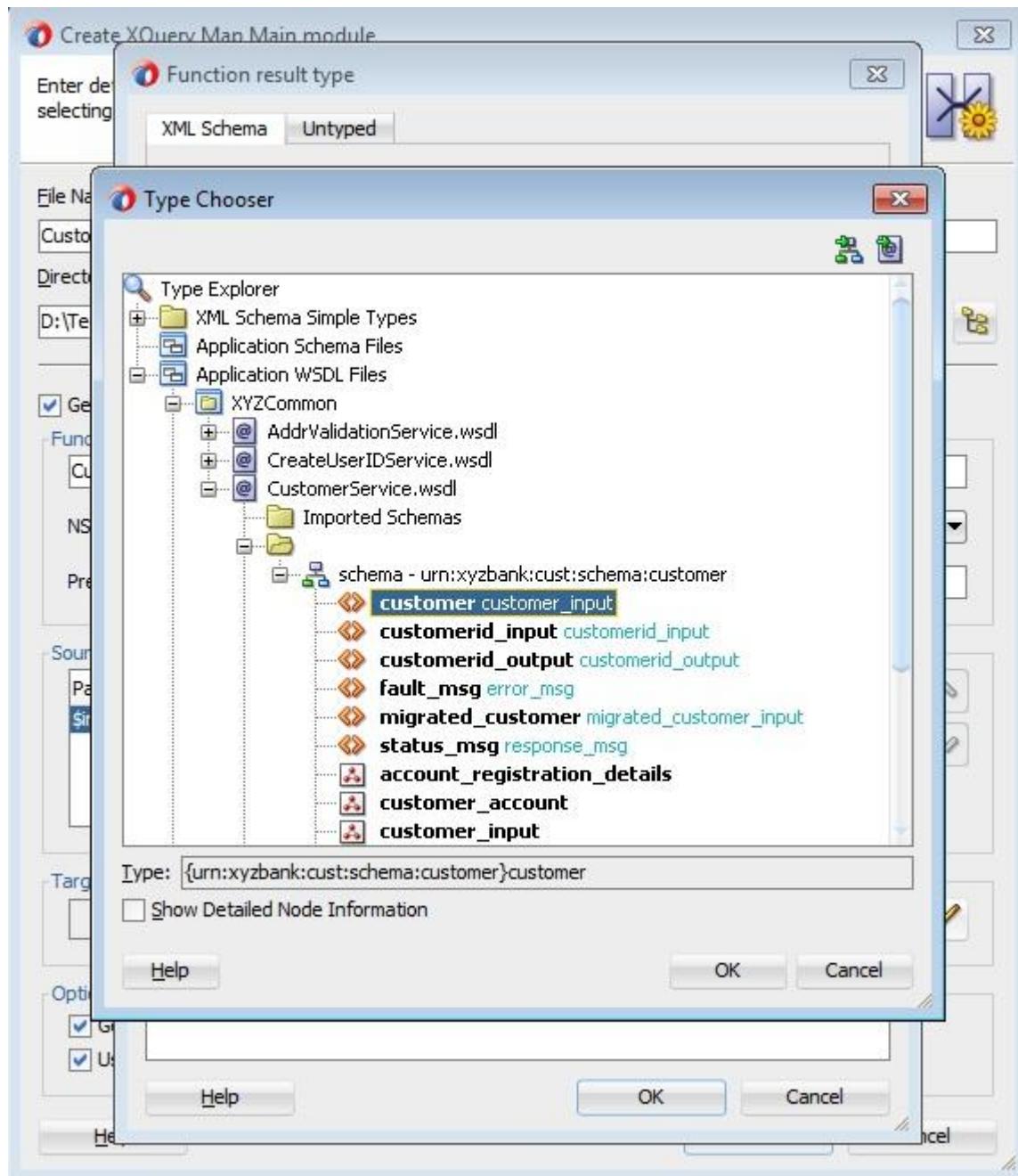
NS URI:

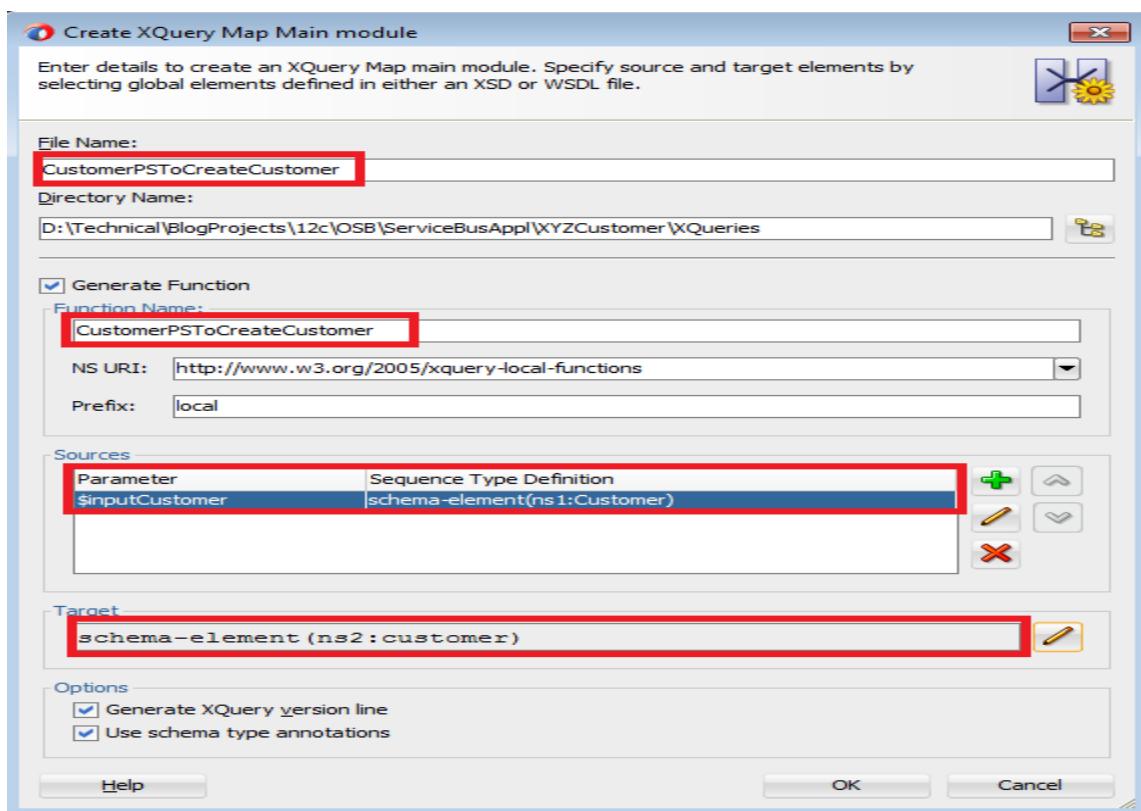
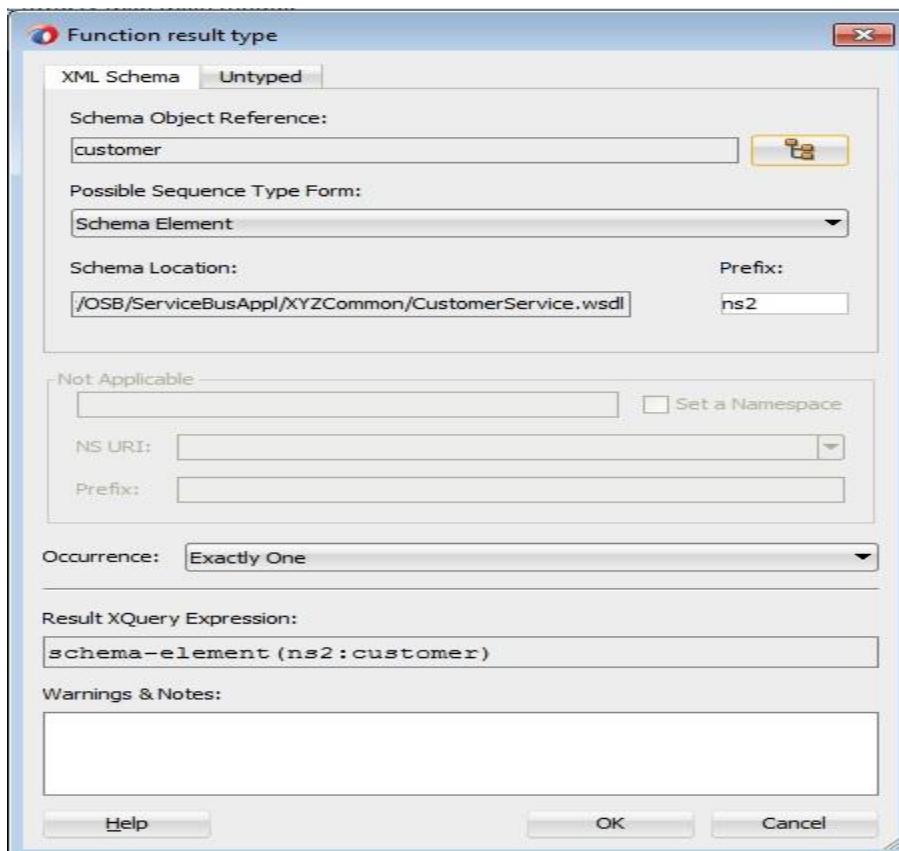
Prefix:

Sequence Type:
`schema-element(ns1:Customer)` 

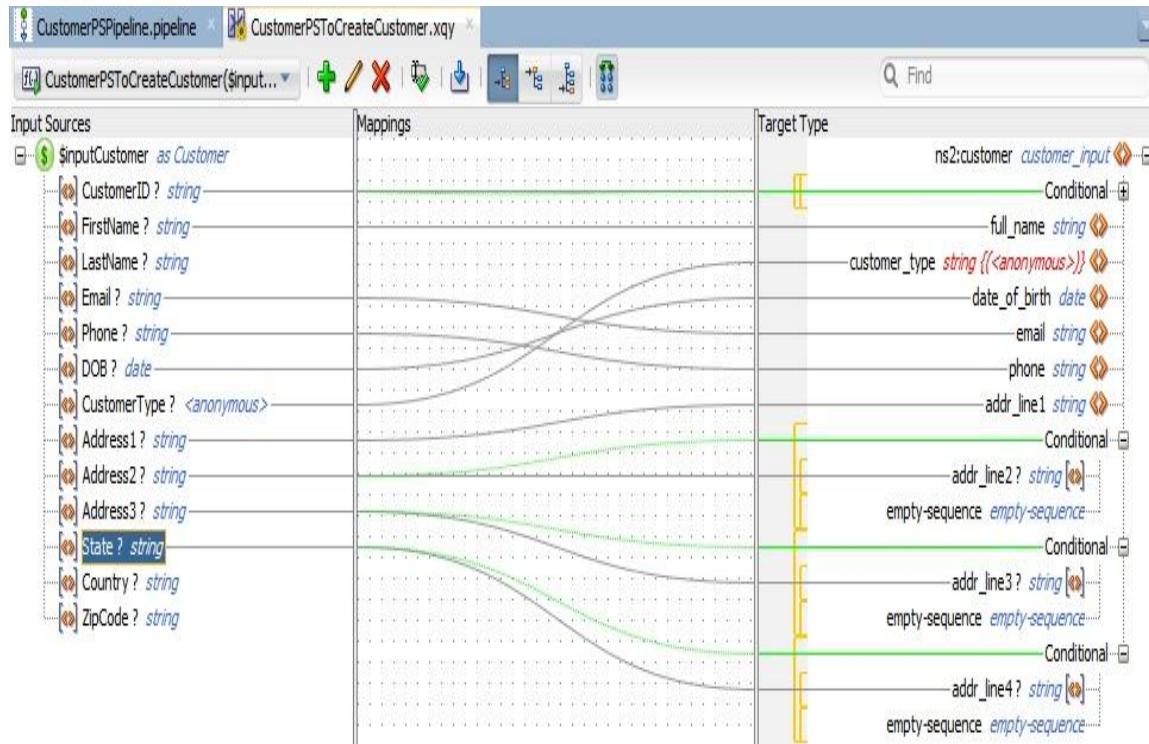
Help **OK** **Cancel**

Complete **Target** selection as shown below and you can refer to previous sections for actual navigation steps.

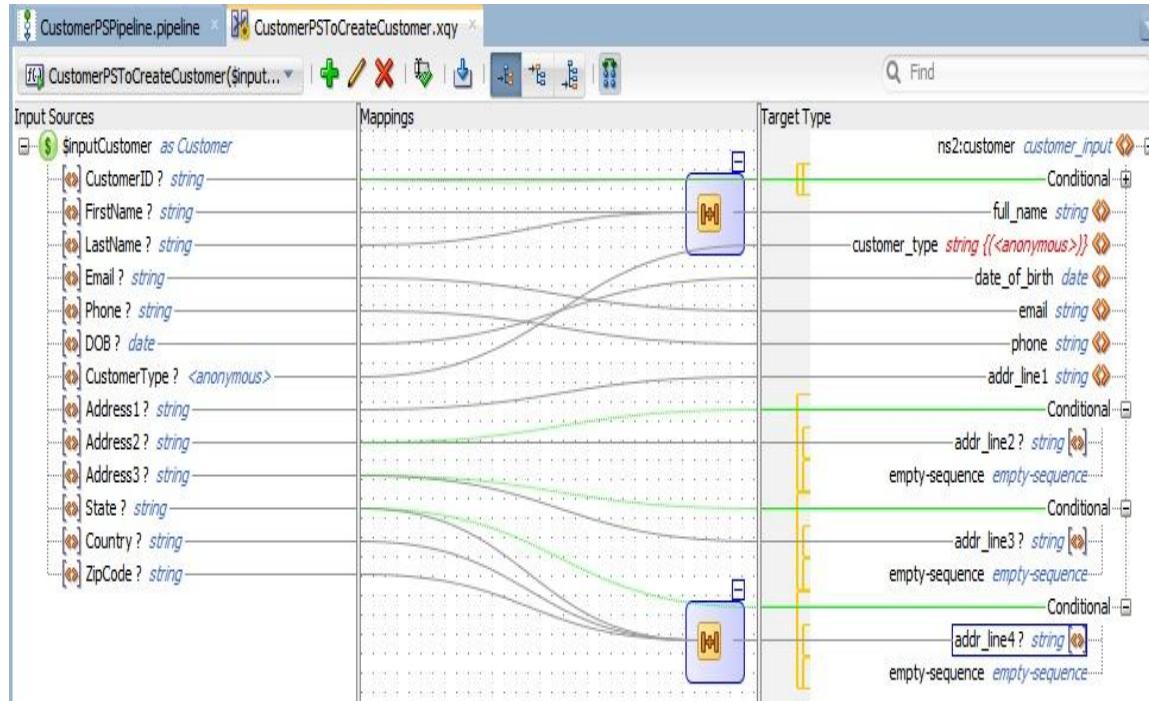




Click **OK** and do initial mappings as shown below.



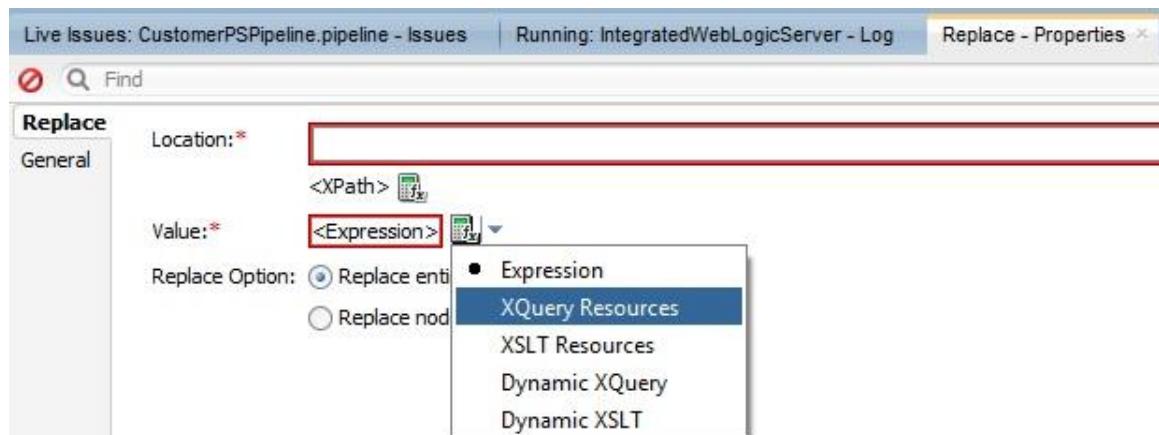
Drag **concat** function on to mapping as shown below from **Components -> XQuery Functions -> String Functions** to concatenate elements **FirstName/LastName** and **State/Country/ZipCode** to map to **full_name** and **addr_line4** respectively.

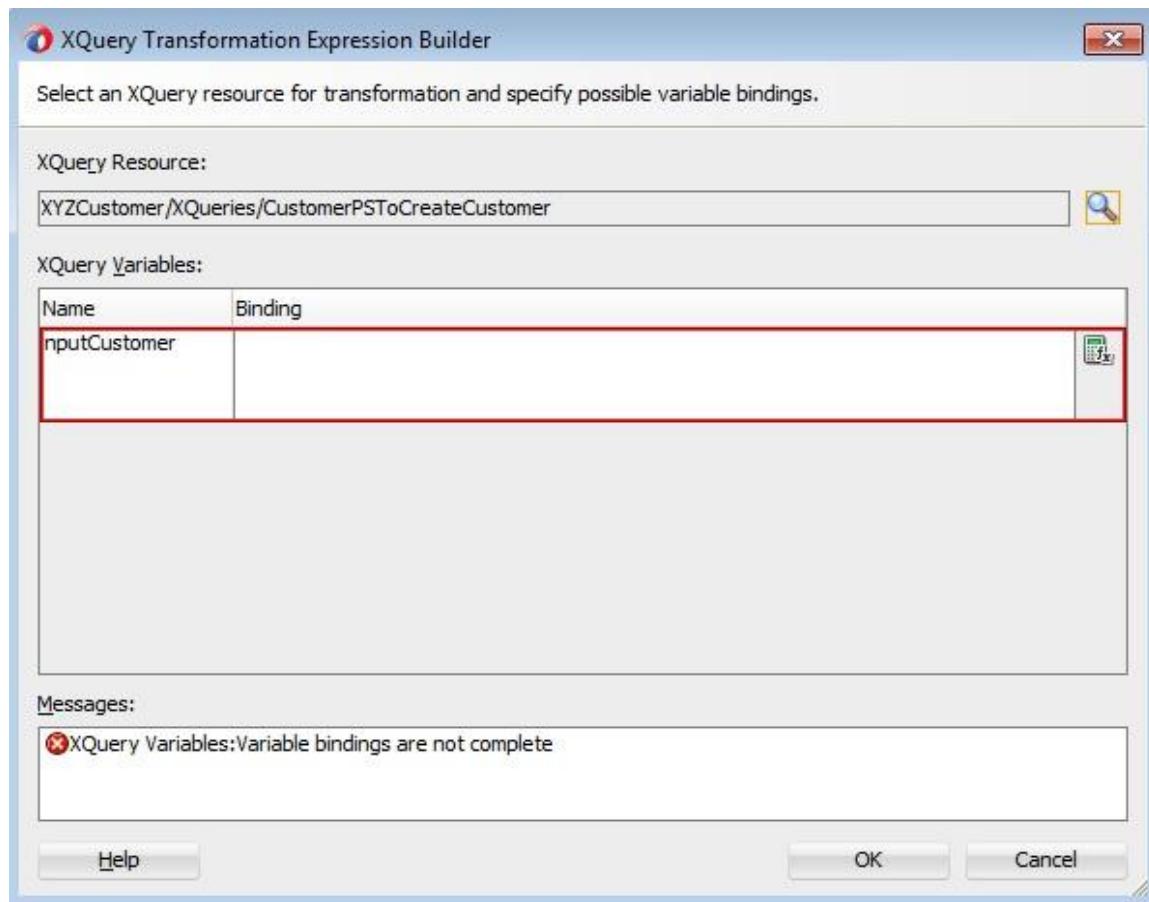
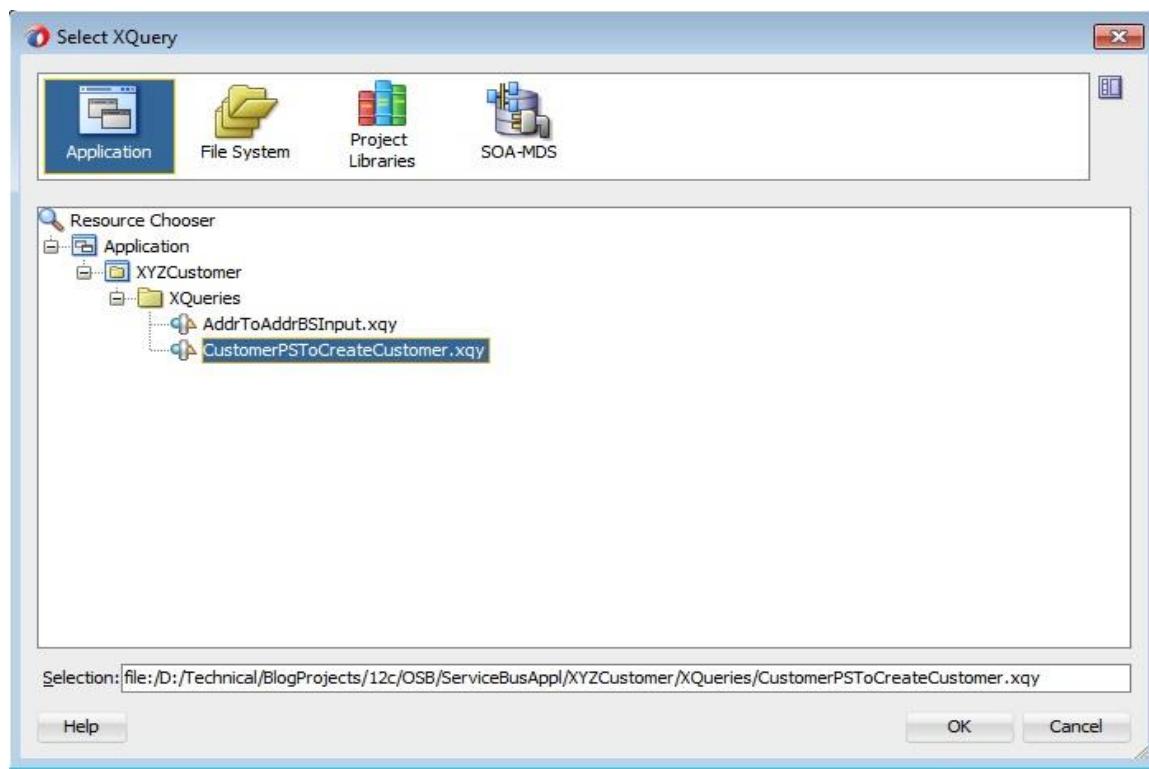


Go to **Source** tab and do modifications as highlighted below.

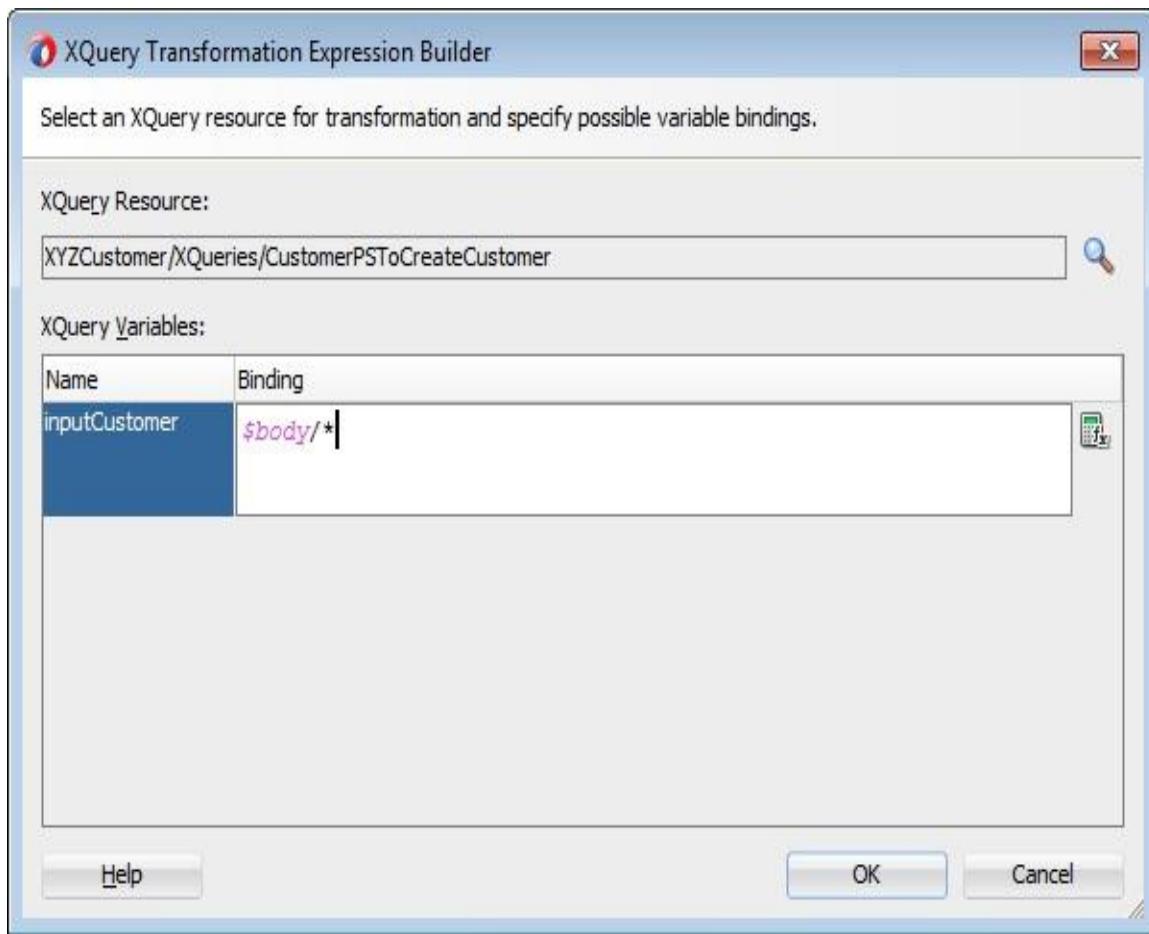
```
declare function local:CustomerPSToCreateCustomer($inputCustomer as element() (:: schema-element(ns1:Customer) ::)) as element() (:: schema-element(ns2:  
<ns2:customer>  
{  
    if ($inputCustomer/CustomerID)  
        then <customer_id>fn:data($inputCustomer/CustomerID)</customer_id>  
    else ()  
}  
<full name>fn:concat(fn:data($inputCustomer/FirstName),',', $inputCustomer/LastName)</full name>  
<customer_type>fn:data($inputCustomer/CustomerType)</customer_type>  
<date_of_birth>fn:data($inputCustomer/DOB)</date_of_birth>  
<email>fn:data($inputCustomer/Email)</email>  
<phone>fn:data($inputCustomer/Phone)</phone>  
<addr_line1>fn:data($inputCustomer/Address1)</addr_line1>  
{  
    if ($inputCustomer/Address2)  
        then <addr_line2>fn:data($inputCustomer/Address2)</addr_line2>  
    else ()  
}  
{  
    if ($inputCustomer/Address3)  
        then <addr_line3>fn:data($inputCustomer/Address3)</addr_line3>  
    else ()  
}  
{  
    if ($inputCustomer/State or $inputCustomer/Country or $inputCustomer/ZipCode )  
        then <addr_line4>fn:concat(fn:data($inputCustomer/State),',', $inputCustomer/Country,',', fn:data($inputCustomer/ZipCode))</addr_line4>  
    else ()  
}  
}</ns2:customer>  
};  
  
local:CustomerPSToCreateCustomer($inputCustomer)
```

Drag **Replace** activity into **Request Action of Routing** from **Message Processing**. In **Properties** tab, bring up expression editor for **Value** property and choose above transformation.

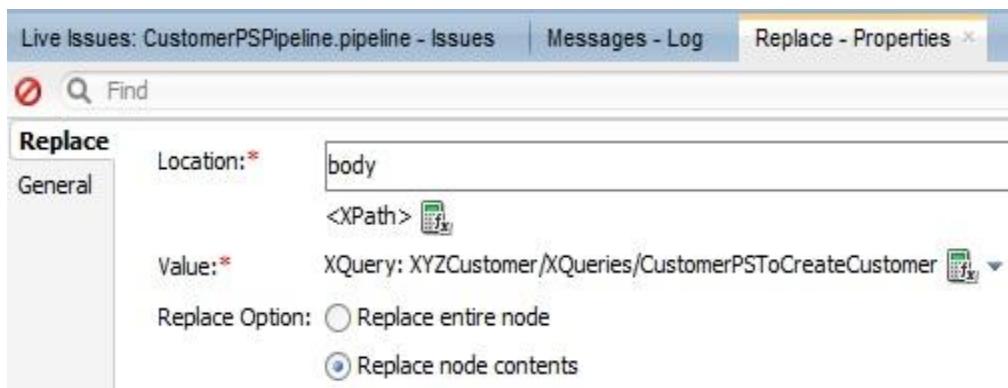




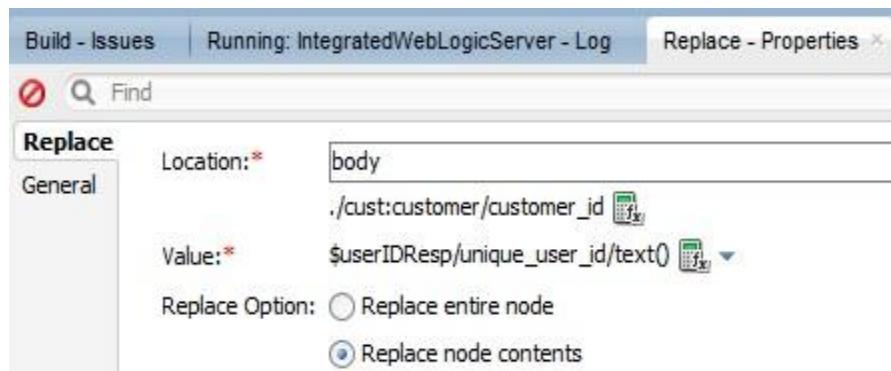
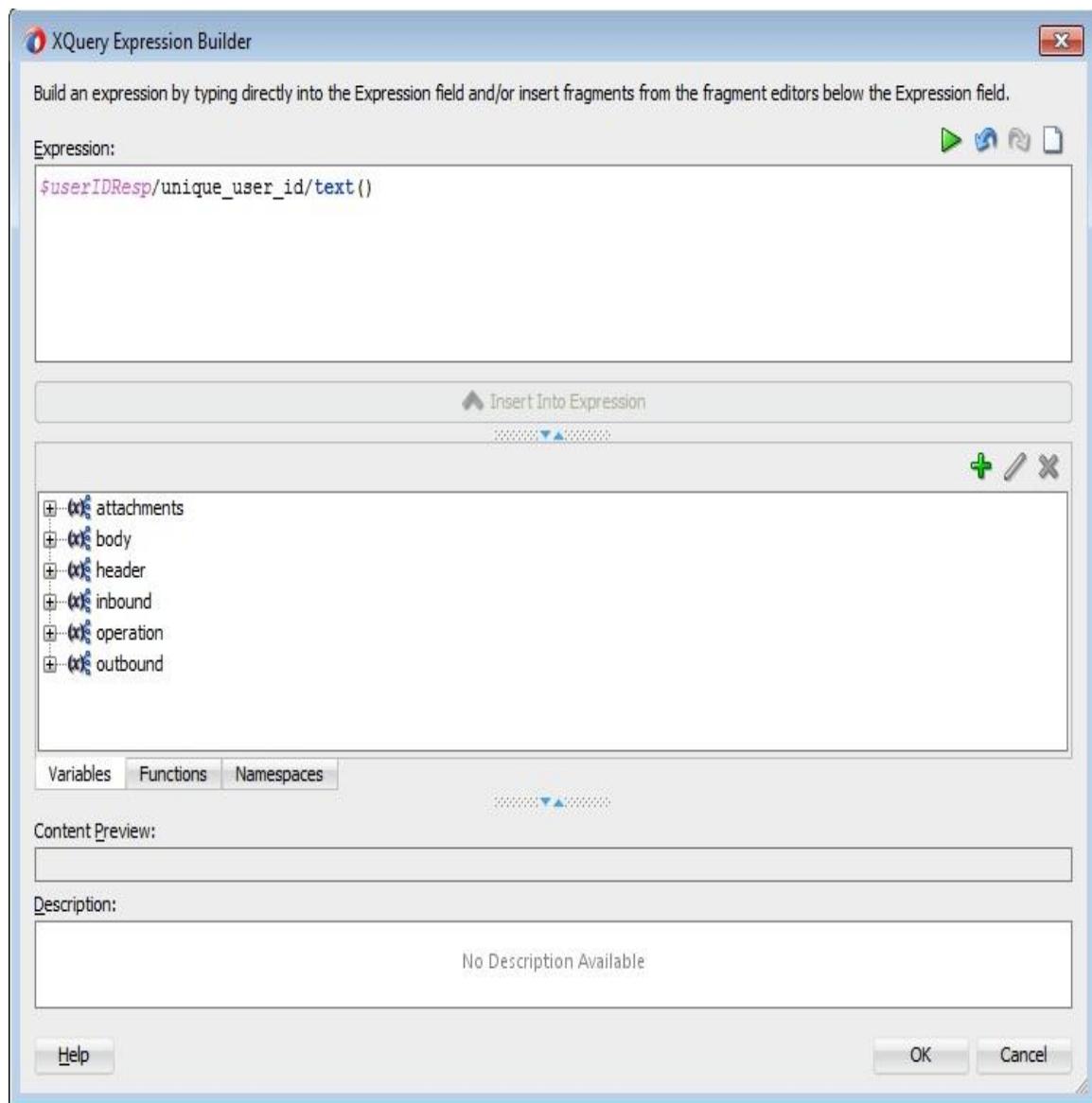
Give bind variable value as **\$body/***.



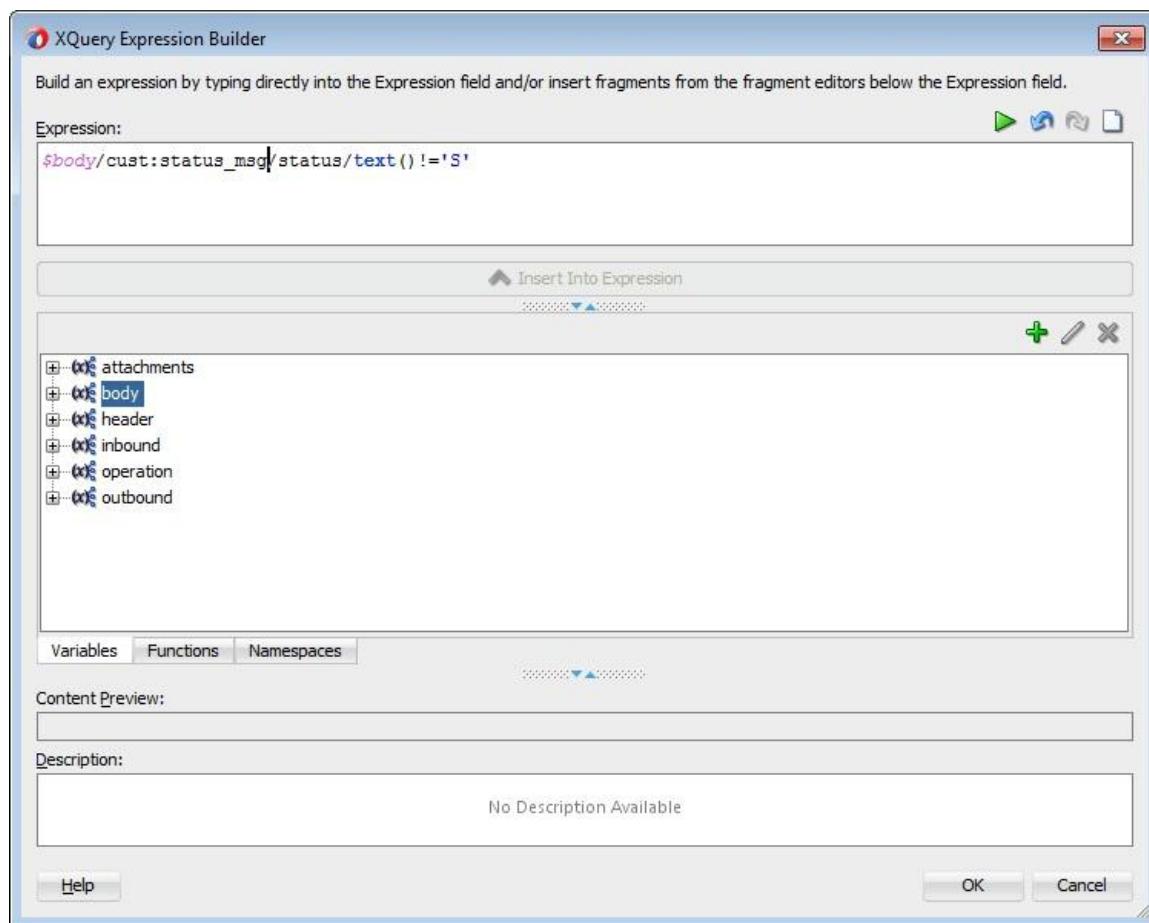
Set other properties as shown below. This action will replace contents of **\$body** context variable with transformed payload as expected by business service.



Drag another **Replace** activity into **Request Action of Routing** to replace contents of **Customer ID** with Unique ID got it from **UserIDServiceBS**. In **Properties** tab, bring up expression editor for Value property and give expression as `$userIDResp/unique_user_id/text()`. Set other properties as shown below.



Drag **If-Then** activity into **Response Action of Routing** activity from **Flow Control** to verify status returned by business service. Set condition as shown below and add namespace alias **cust** with namespace **urn:xyzbank:cust:schema:customer** in **Namespaces** tab.

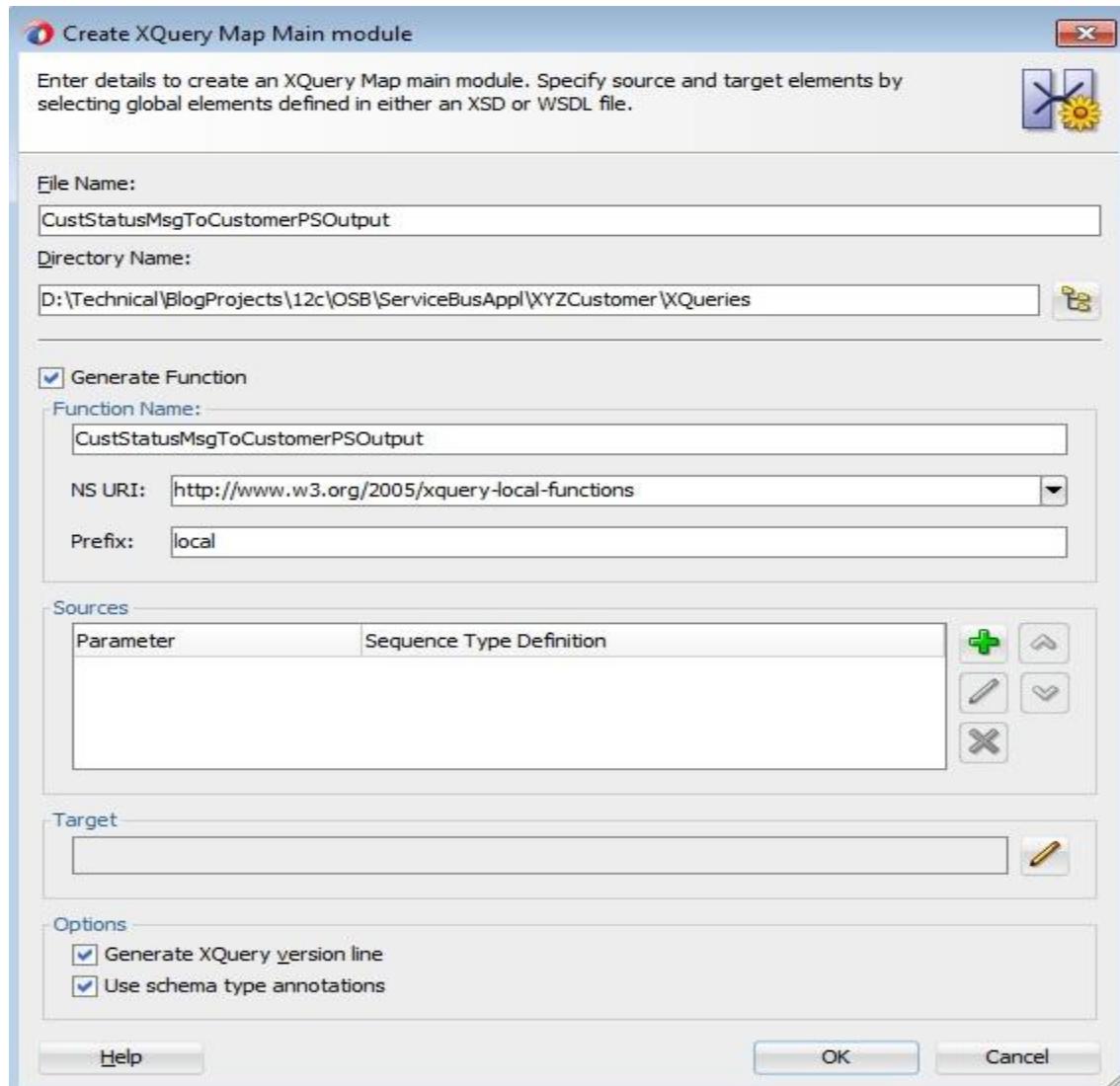


Drag **Assign** activity into **If** branch from **Message Processing** and set properties as shown below to store unsuccessful response in **faultVar** variable. Drag **RaiseError** activity from **Flow Control** and give error code as **XYZ-0004**. The actual Fault Response will be sent from Proxy Service Error Handler that will be discussed later in this tutorial.

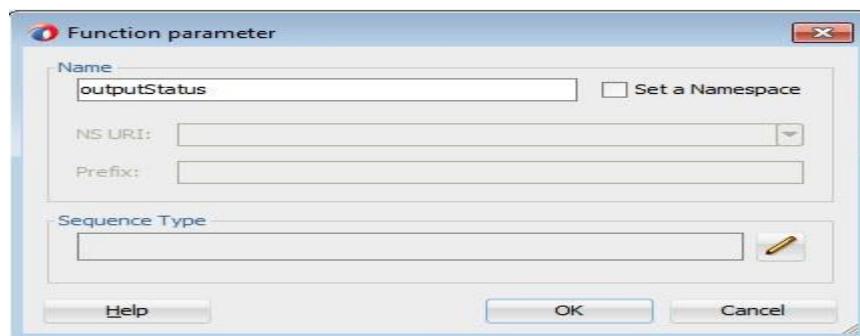
Assign	Value: * <input style="width: 20px; height: 20px; vertical-align: middle;" type="button" value="..."/>
General	Variable: * <input type="text" value="faultVar"/>

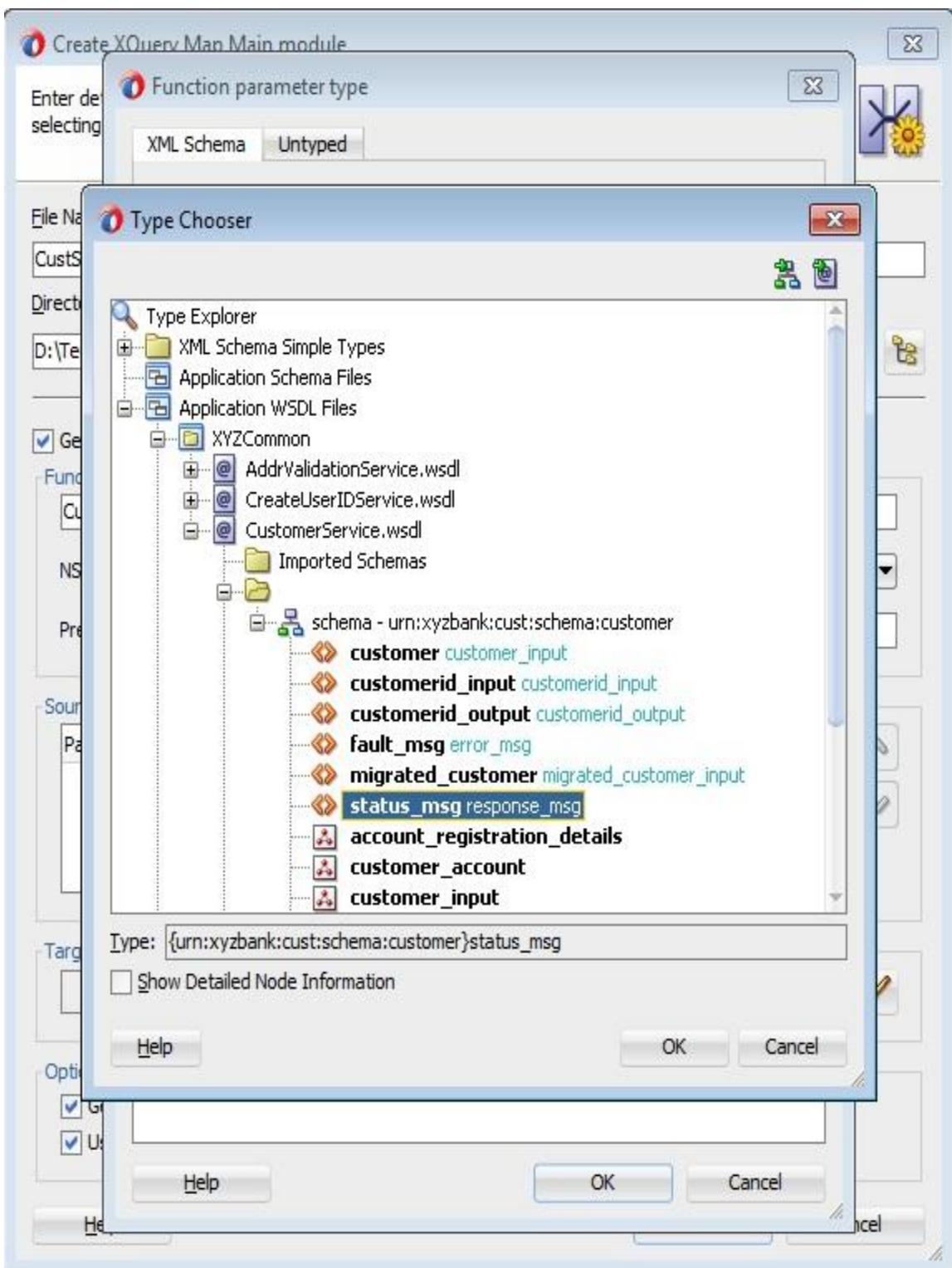
Raise Error	Code: * <input type="text" value="XYZ-0004"/>
General	Message: <input type="text" value="Error in Customer Creation."/>

Now create another **XQuery** map in **XQueries** folder of **XYZCustomer** project and give both **File Name** and **Function Name** as **CustStatusMsgToCustomerPSOutput**, to transform response structure of Business Service to response structure of Proxy Service on successful customer creation.



Complete **Source** parameters selection as shown below and you can refer to previous sections for actual navigation steps.





Function parameter type

XML Schema **Untyped**

Schema Object Reference:
status_msg 

Possible Sequence Type Form:
Schema Element 

Schema Location: /OSB/ServiceBusAppl/XYZCommon/CustomerService.wsdl **Prefix:** ns1

Not Applicable Set a Namespace

NS URI: 

Prefix: 

Occurrence: Exactly One

Result XQuery Expression:
`schema-element(ns1:status_msg)`

Warnings & Notes:


Help **OK** **Cancel**

Function parameter

Name: outputStatus Set a Namespace

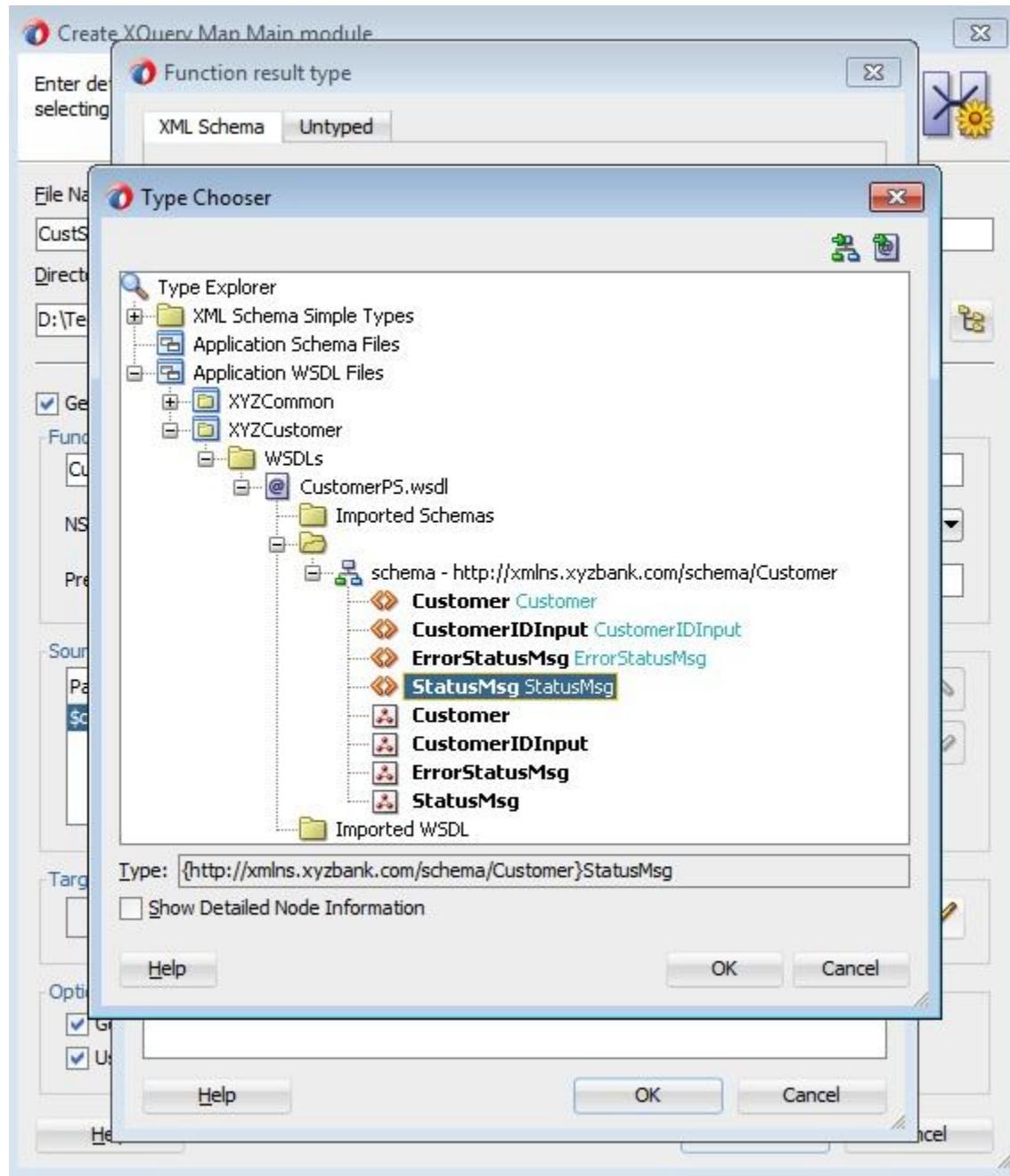
NS URI: 

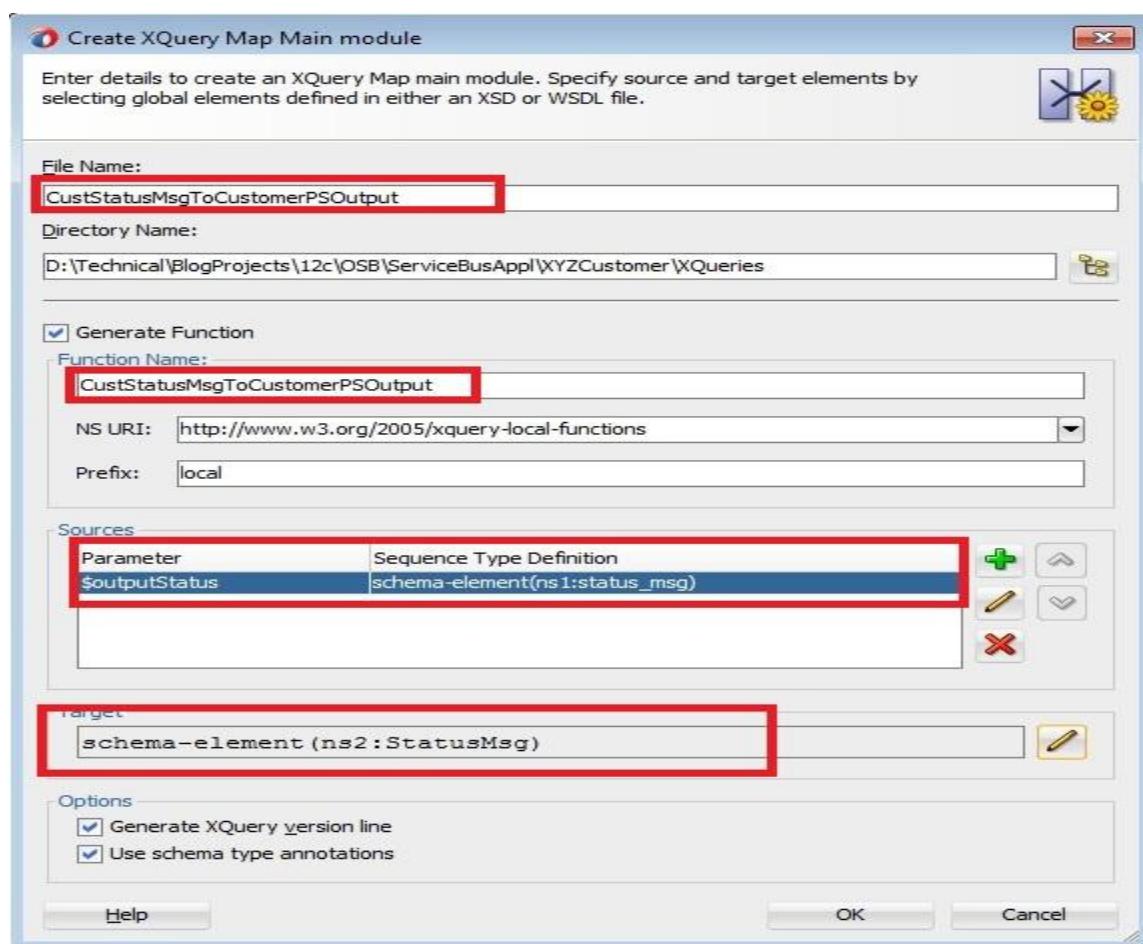
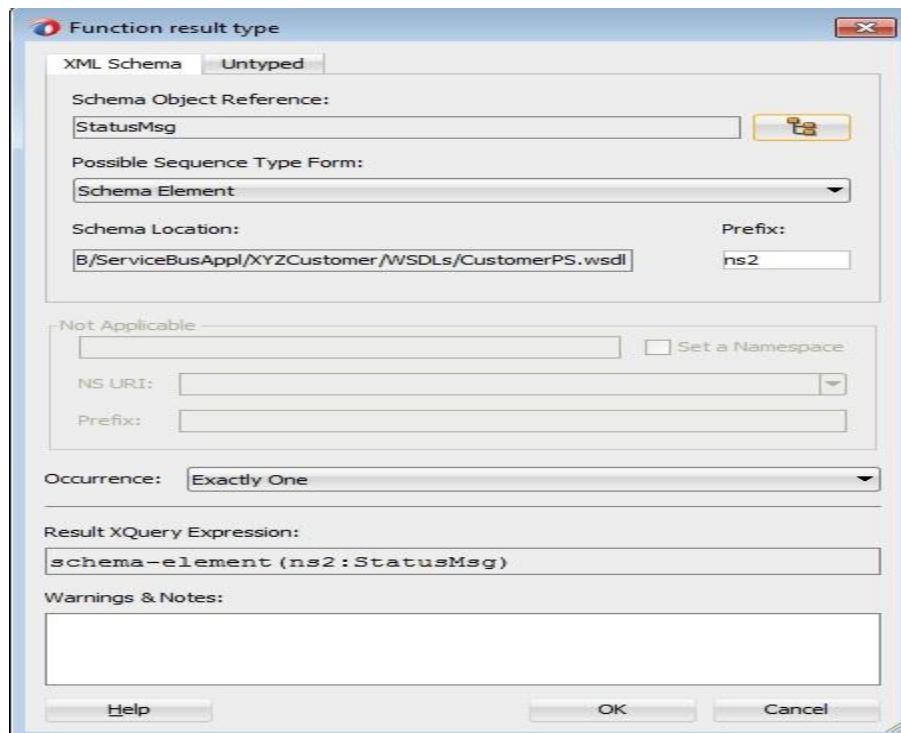
Prefix: 

Sequence Type:
`schema-element(ns1:status_msg)` 

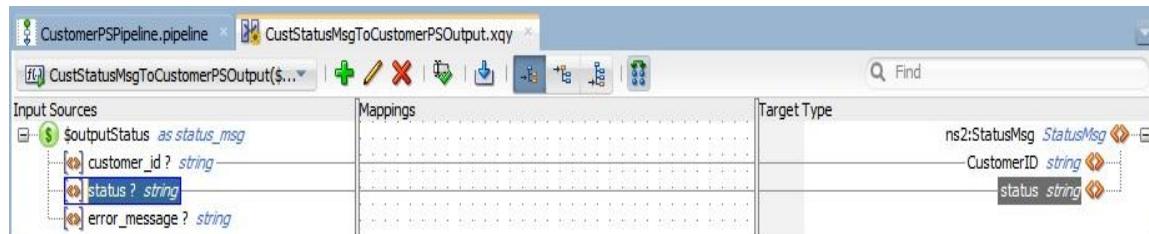
Help **OK** **Cancel**

Complete **Target** selection as shown below and you can refer to previous sections for actual navigation steps.

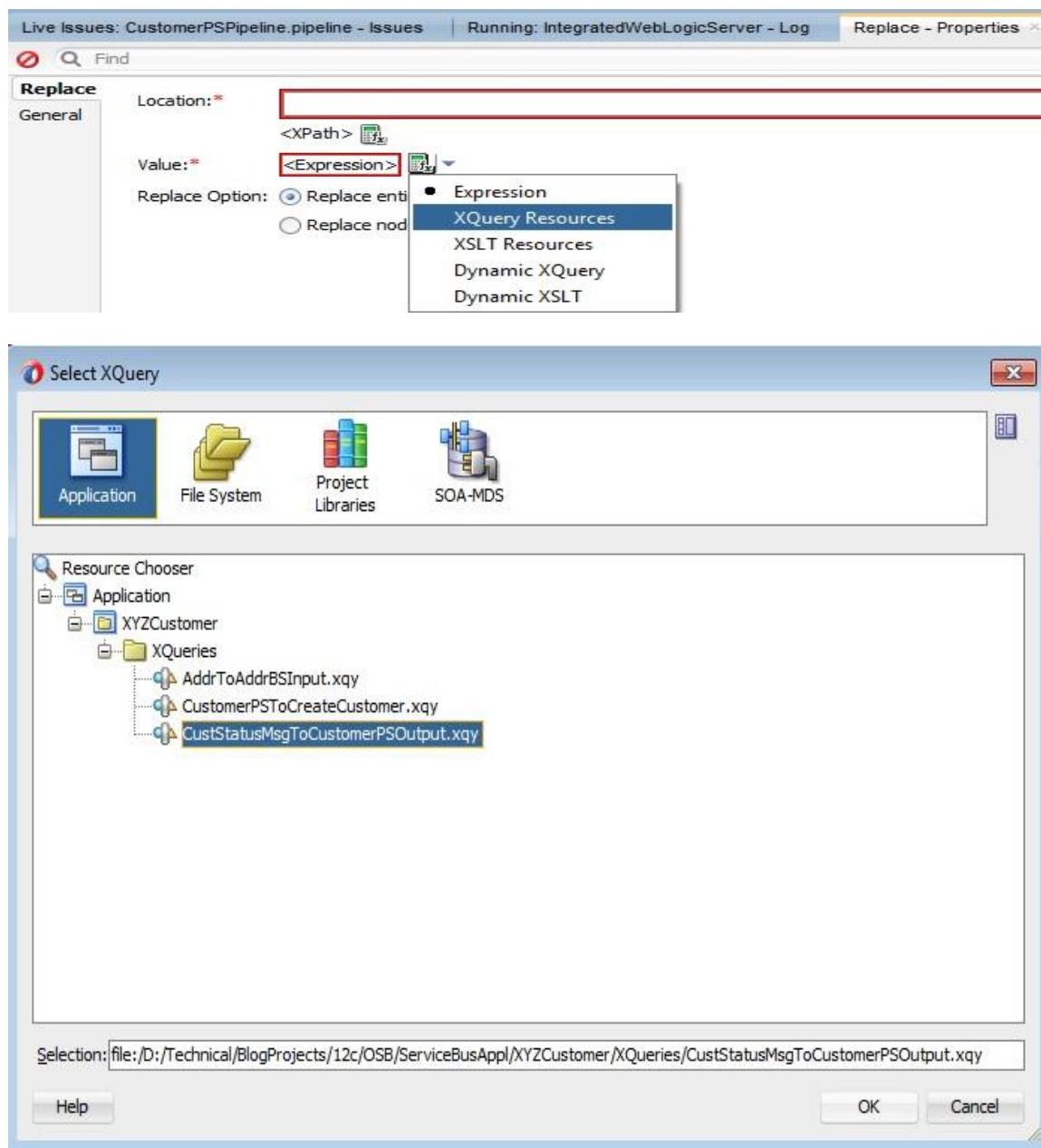




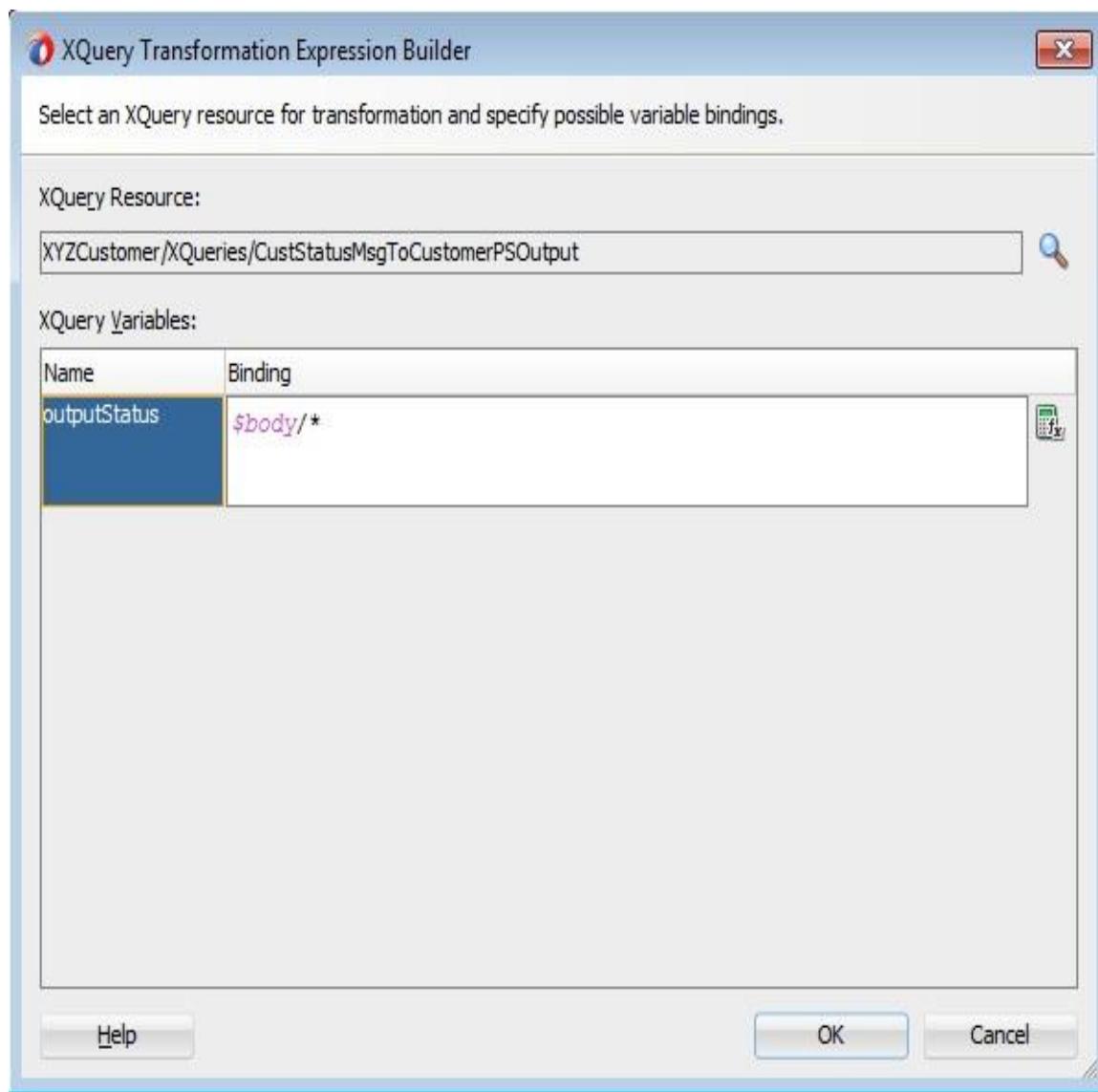
Click **OK** and finish the mapping as shown below.



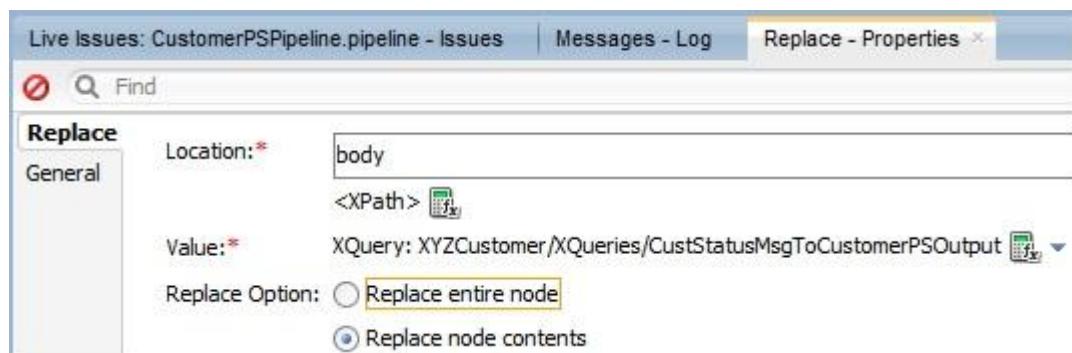
Drag **Replace** activity into **Response Action of Routing** after **If-Then** from **Message Processing**. Bring up expression builder for **Value** property and select above XQuery map as shown below.



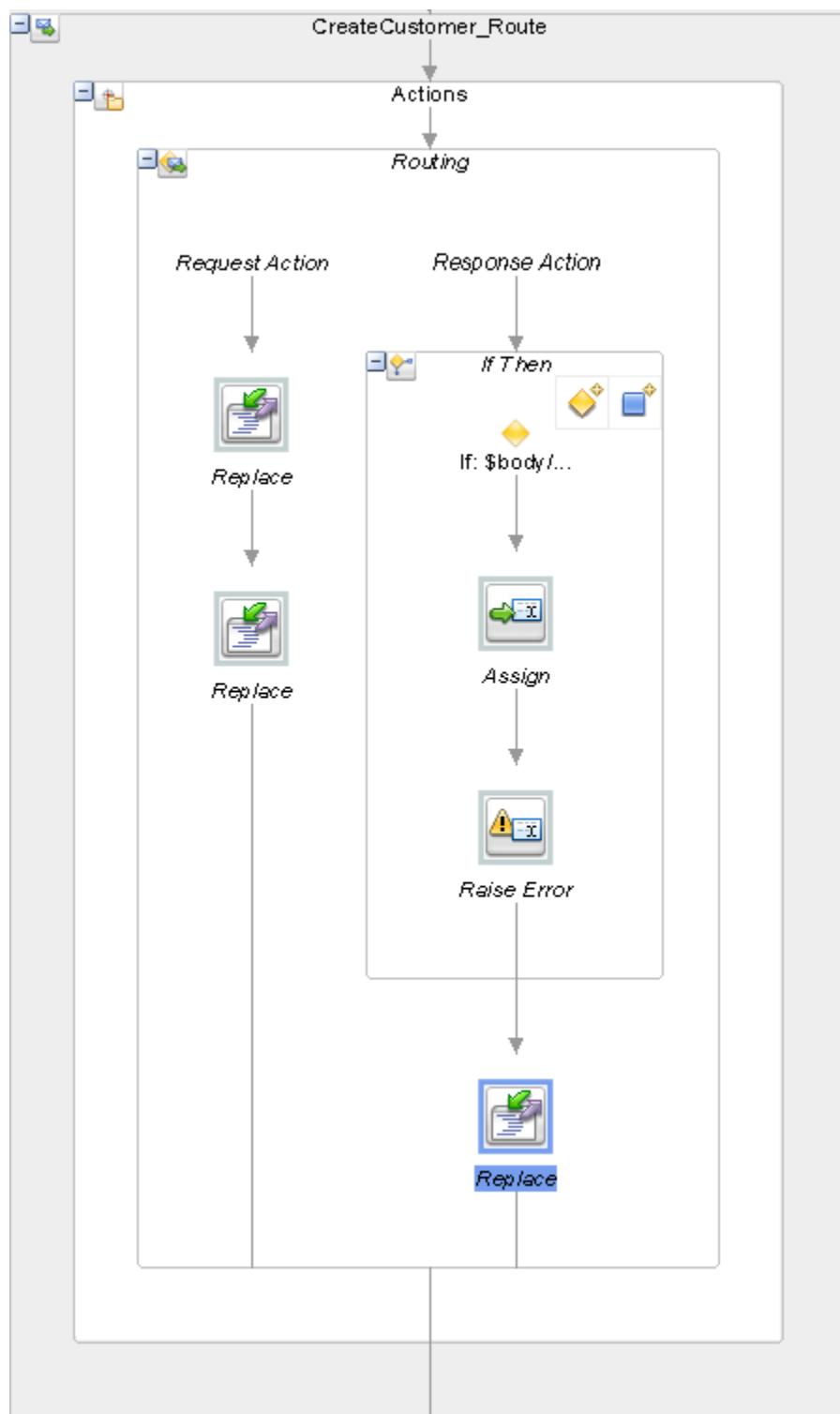
Give **\$body/*** as value for **Binding**.



Set other properties as shown below. This action will replace contents of **\$body** context variable which will be ultimately send to your Proxy service consumer.



Now your **Routing** node should look like below.



Testing

Deploy both projects or run **Pipeline** directly as shown in **Deploying and Testing** section. You may want to frequently test your proxy service/pipeline during development. Run your **pipeline** with sample payloads given [here](#) and observe **Flow Trace and Variables** as shown below. You can also run Proxy Service but you will not observe any **Flow Trace**.

CustomerType element Validation:

Response Document

The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>soapenv:Server</faultcode>
      <faultstring>
        OSB-382505: OSB Validate action failed validation
      </faultstring>
      <detail>
        <con:Fault xmlns:con="http://www.bea.com/wli/sb/context">
          <con:errorCode>OSB-382505</con:errorCode>
          <con:reason>OSB Validate action failed validation</con:reason>
          <con:details>
            <con1:ValidationFailureDetail xmlns:con1="http://www.bea.com/wli/sb/stages/transform/config">
              <con1:message>
                string value 'Invalid Cust Type' is not a valid enumeration value for type of CustomerType element in Customer in namespace http://xmlns.xyzbank.com/schema/Customer
              </con1:message>
              <con1:xmlLocation>
                <CustomerType>Invalid Cust Type</CustomerType>
              </con1:xmlLocation>
            </con1:ValidationFailureDetail>
          </con:details>
        </con:location>
        <con:node>CreatePipeline</con:node>
        <con:pipeline>
          request-N3f57c7ff.N507ee17b.0.147a71ddac0.N8000
        </con:pipeline>
        <con:stage>Validation</con:stage>
        <con:path>request-pipeline</con:path>
      </con:location>
      </con:fault>
    </soapenv:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

Email element Validation:

Response Document

The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>soapenv:Server</faultcode>
      <faultstring>XYZ-0001: Email is not valid</faultstring>
      <detail>
        <con:Fault xmlns:con="http://www.bea.com/wli/sb/context">
          <con:errorCode>XYZ-0001</con:errorCode>
          <con:reason>Email is not valid</con:reason>
          <con:location>
            <con:node>CreatePipeline</con:node>
            <con:pipeline>
              request-N3f57c7ff.N507ee17b.0.147a71ddac0.N8000
            </con:pipeline>
            <con:stage>Validation</con:stage>
            <con:path>request-pipeline</con:path>
          </con:location>
        </con:fault>
      </detail>
    </soapenv:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

Positive Case - ValidateAddress with configuration property value as Y:



AddrValidation

Invoked Services

- Service Callout to: "AddrValidationServiceBS"
 - \$outbound:**
 - \$body (request):**
 - \$header (request):**
 - \$body (response):**
 - \$header (response):**

Message Context Changes

- + added \$ConfigVar
- + added \$addrRespBody


```
<soapenv:Body xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:urn="urn:xyzbank:cust:schema:address">
    <urn:addrval_output>
      <status>S</status>
      <error_msg/>
    </urn:addrval_output>
  </soapenv:Body>
```
- + added \$addrReqBody


```
<soap-env:Body xmlns:soap-env="http://schemas.xmlsoap.org/soap/envelope/">
    <ns2:addrval_input xmlns:ns2="urn:xyzbank:cust:schema:address">
      <address_line>Hi-Tech City,Mdahapur,Hyderabad</address_line>
      <state>Andhra Pradesh</state>
      <country>India</country>
      <zip_code>500031</zip_code>
    </ns2:addrval_input>
  </soap-env:Body>
```
- △ changed \$body
- △ changed \$inbound

Service Callout to: "UserIDServiceBS"

- \$outbound:**
- \$body (request):**

```
<soapenv:Body xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <usr:user_input xmlns:usr="urn:xyzbank:cust:schema:userid">
    <usr:system>LEGACY</usr:system>
  </usr:user_input>
</soapenv:Body>
```
- \$header (request):**

```
<soapenv:Header xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <usr:UserIDConfiguration xmlns:usr="urn:xyzbank:cust:schema:userid">
    <usr:UserName>admin</usr:UserName>
    <usr:Password>password1</usr:Password>
  </usr:UserIDConfiguration>
</soapenv:Header>
```
- \$body (response):**

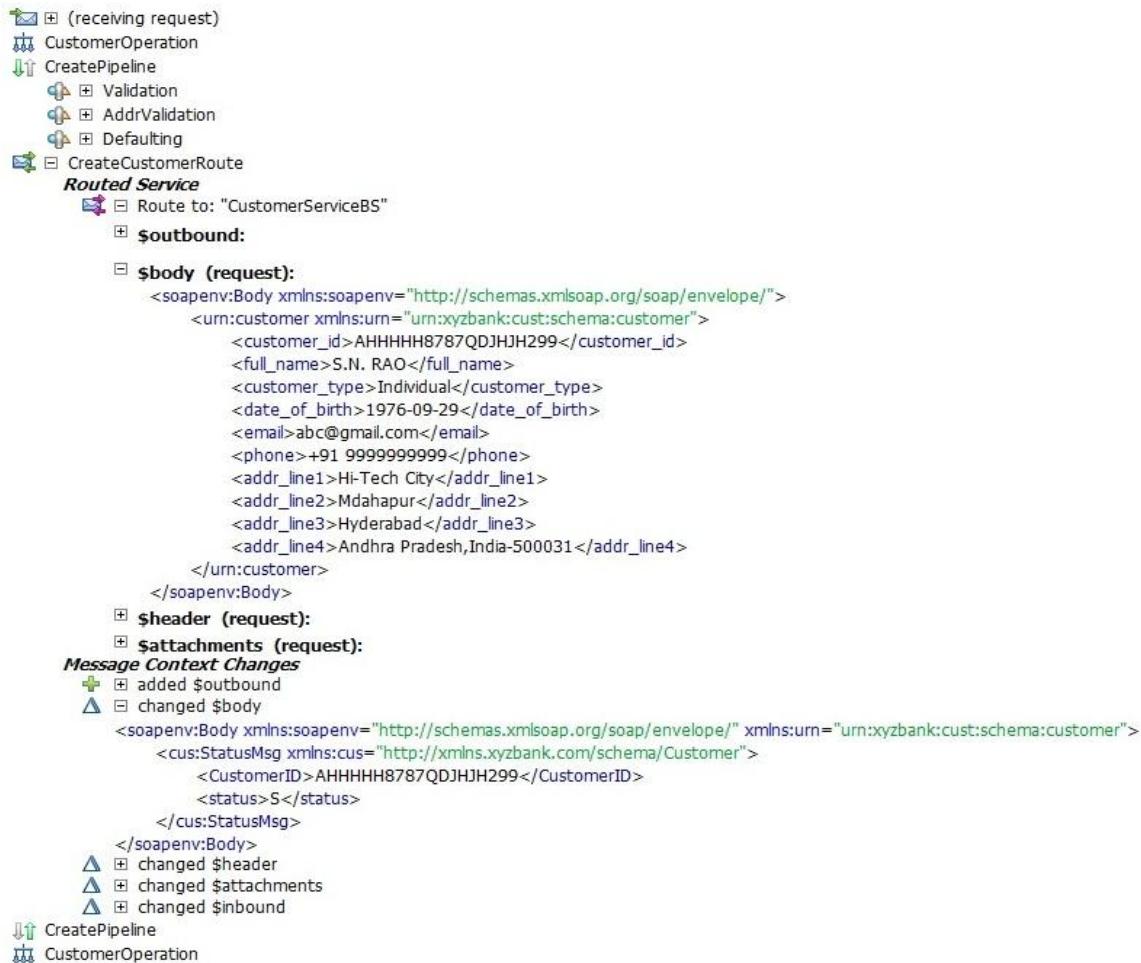
```
<soapenv:Body xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:urn="urn:xyzbank:cust:schema:userid">
  <urn:user_output>
    <unique_user_id>AHHHHH8787QDJHJH299</unique_user_id>
    <status>S</status>
    <error_msg/>
  </urn:user_output>
</soapenv:Body>
```
- \$header (response):**

Message Context Changes

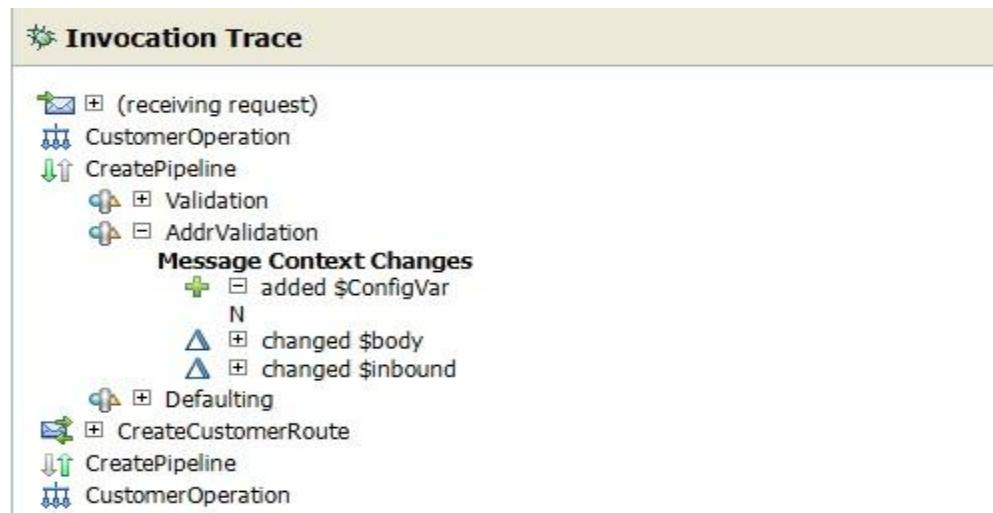
```

+ [+] added $userIDResp
<urn:user_output xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:urn="urn:xyzbank:cust:schema:userid">
    <unique_user_id>AHHHHH8787QDJHJH299</unique_user_id>
    <status>S</status>
    <error_msg/>
</urn:user_output>
+ [+] added $varSA
<con:UsernamePasswordCredential xmlns:con="http://www.bea.com/wli/sb/services/security/config">
    <con:username>admin</con:username>
    <con:password>password1</con:password>
</con:UsernamePasswordCredential>
+ [+] added $userIDReq
<usr:user_input xmlns:usr="urn:xyzbank:cust:schema:userid">
    <usr:system>LEGACY</usr:system>
</usr:user_input>
+ [+] added $userIDReqHdr
<soapenv:Header xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
    <usr:UserIDConfiguration xmlns:usr="urn:xyzbank:cust:schema:userid">
        <usr:UserName>admin</usr:UserName>
        <usr:Password>password1</usr:Password>
    </usr:UserIDConfiguration>
</soapenv:Header>
△ [+] changed $body
△ [+] changed $inbound

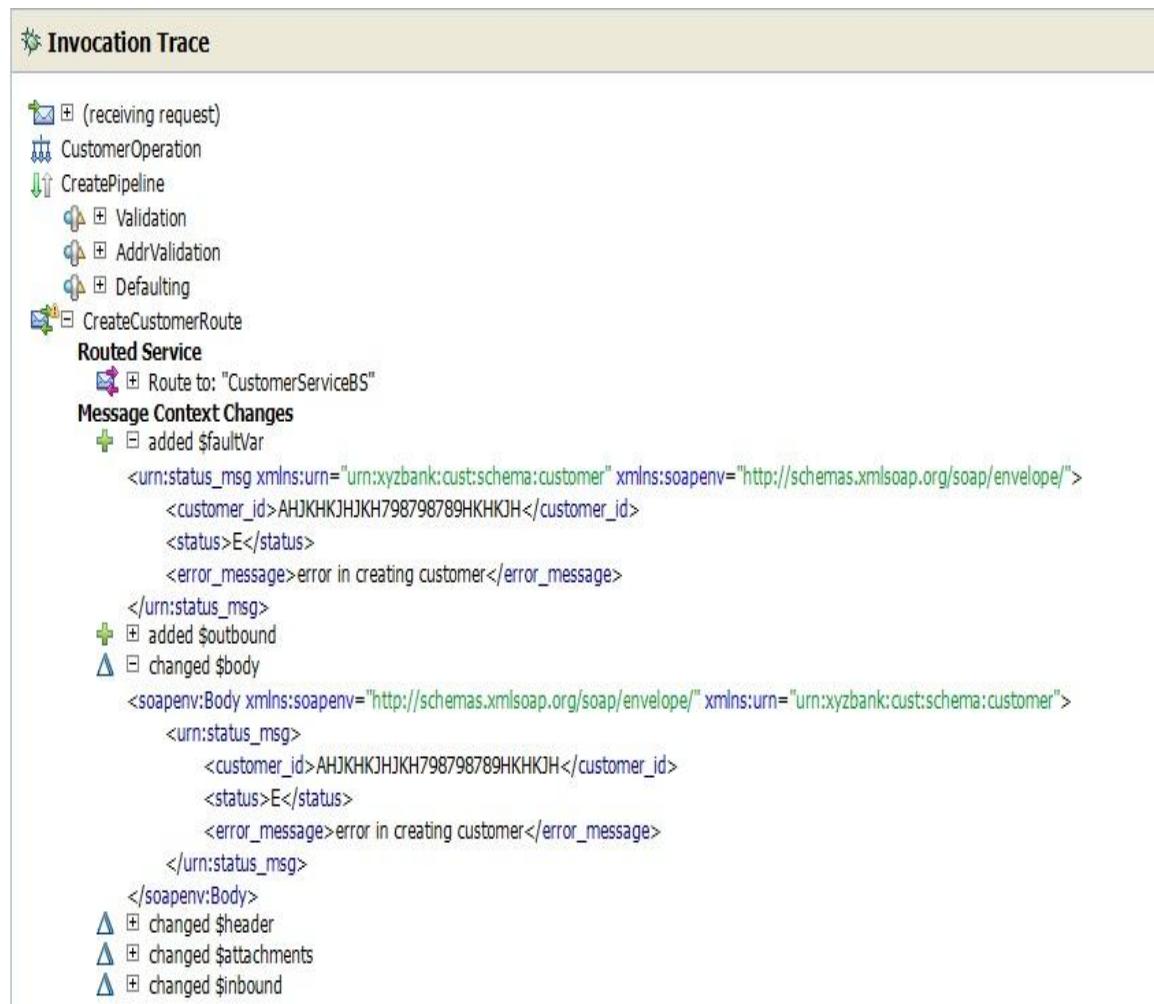
```



Positive Case - ValidateAddress configuration property value as N:



Negative Case - Status E in business service response:



Response Document

 The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>soapenv:Server</faultcode>
      <faultstring>XYZ-0004: Error in Customer Creation.</faultstring>
      <detail>
        <con:fault xmlns:con="http://www.bea.com/wli/sb/context">
          <con:errorCode>XYZ-0004</con:errorCode>
          <con:reason>Error in Customer Creation.</con:reason>
          <con:location>
            <con:node>CreateCustomerRoute</con:node>
            <con:path>response-pipeline</con:path>
          </con:location>
        </con:fault>
      </detail>
    </soapenv:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

Update Customer

In this section, you will complete message flow for **UpdateCustomer** operation. Since we have discussed each and every step in detail and extensive manner in previous sections, we will go with brief explanation from here onwards.

Validating Payload

Finish **Validation** stage in **UpdateCustomer** operational branch similar to **CreateCustomer** for validating **Payload Structure** using **Validate** activity. But you should select **Customer** element from **\$body/UpdateCustomer** in expression builder for **Location** property.

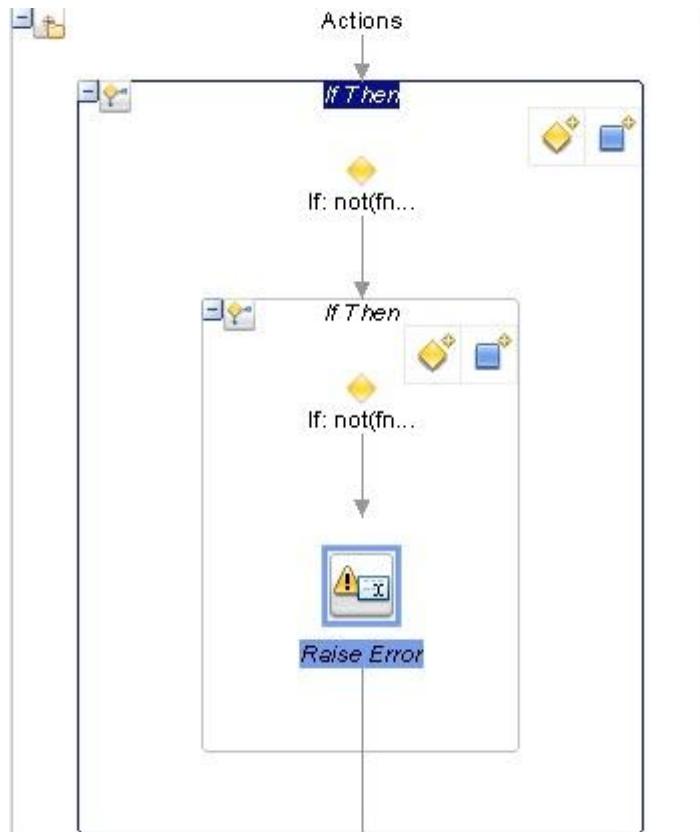
In this case, **Email** element validation has to be done only when it's sent in request. Use **Actions** placeholder in **Validation** stage to do this. Drag two **If-Then** activities as shown below in **Actions** placeholder from **Flow Control**. Give the following expression in top-level **If-Then** condition to find whether **Email** element is available and length is greater than zero.

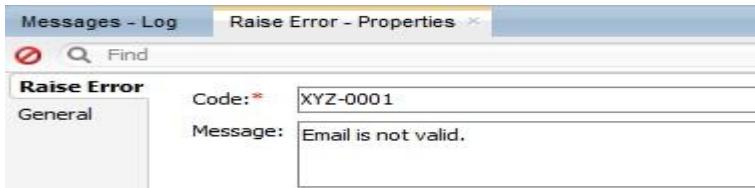
```
not(fn:empty($body/cus:Customer/Email)) and  
fn:string-length(fn:bea:trim($body/cus:Customer/Email/text()))>0
```

Give the following expression in inner **If-Then** condition to validate against regular expression:

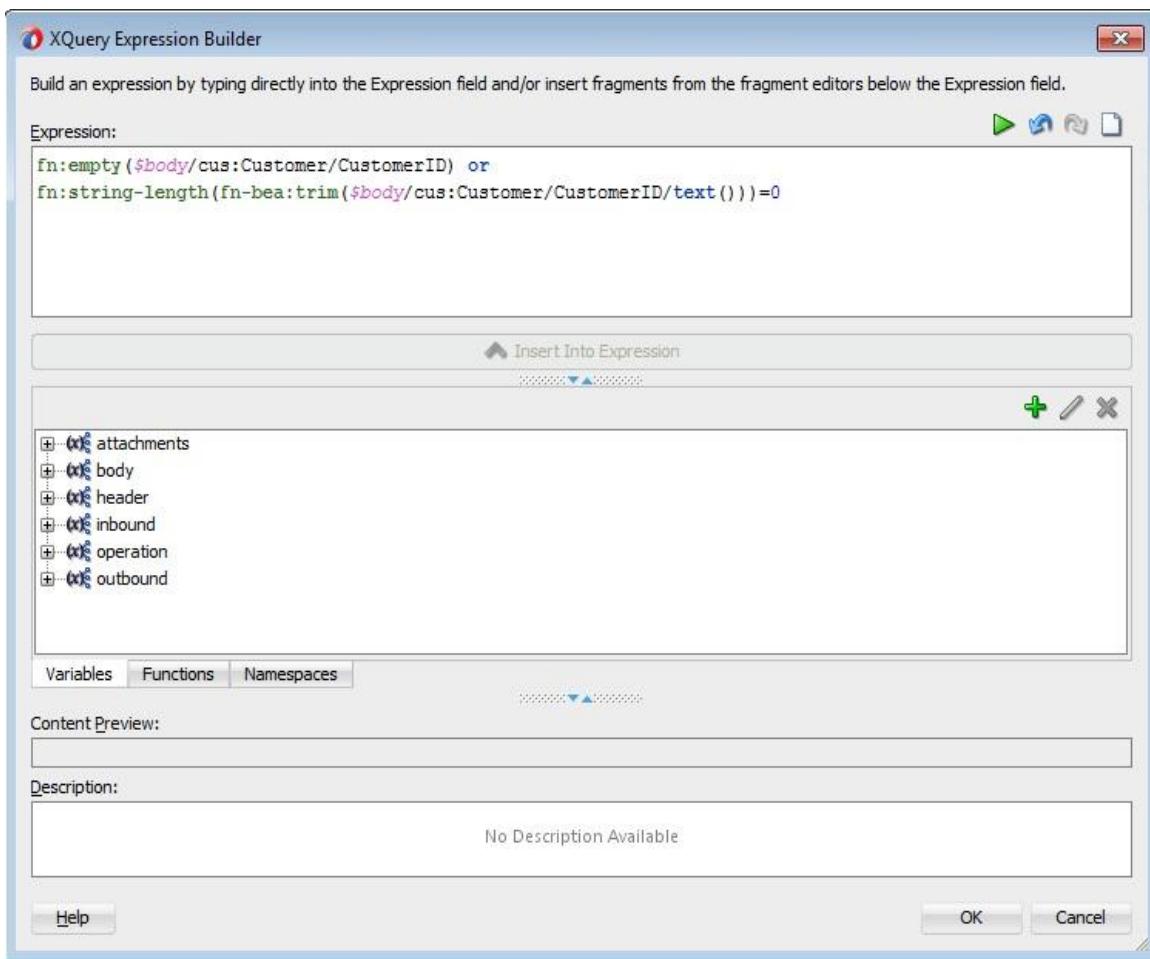
```
not(fn:matches($body/cus:Customer/Email/text(),  
'[a-zA-Z0-9]+@[a-zA-Z]+\.[a-zA-Z]{2,3}\.[tT]'))
```

Also drag **Raise Error** activity into **If** branch from **Flow Control** and set properties as shown below.

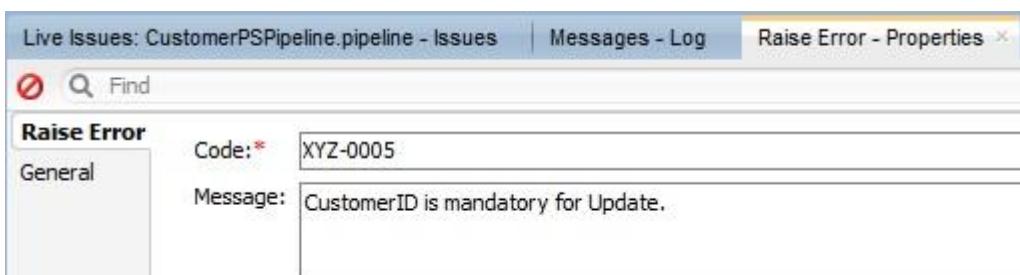




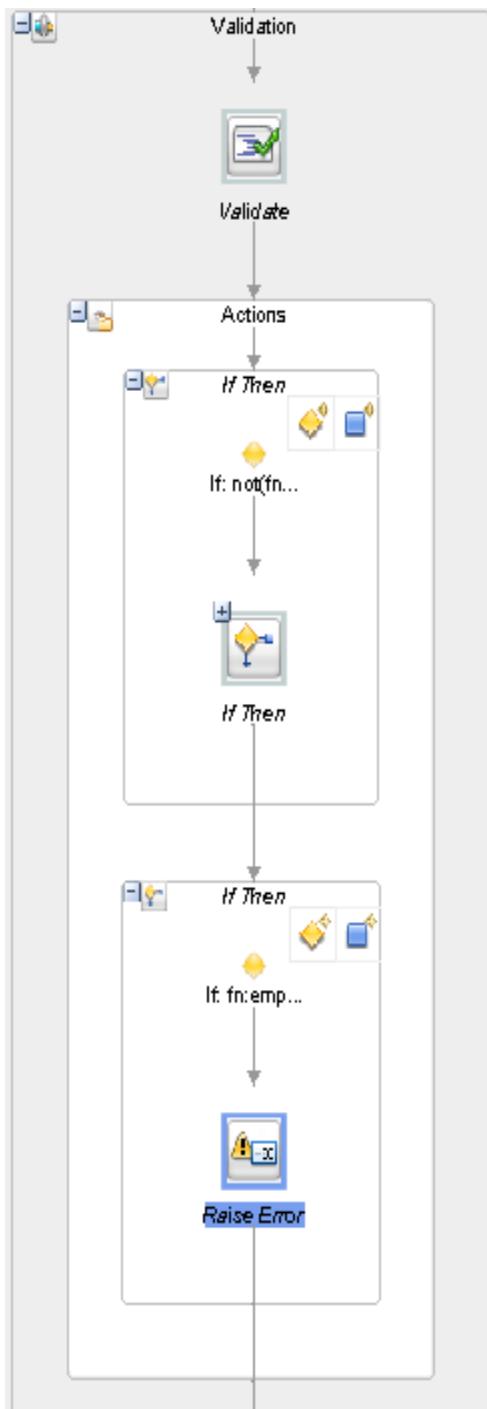
Since this is **Update** operation, service consumer should send **CustomerID** mandatorily in input and your message flow should enforce the same. So drag **If-Then** activity into **Validation** stage from **Flow Control** and set condition as shown below. Alternatively, you can select these string functions from **Functions > XQuery 1.0 Functions -> Strings -> General Functions**.



Drag **Raise Error** activity into **If** branch from **Flow Control** and set properties as shown below.



Now your **Validation** stage should look like below.



You can also do the **Address Validation** similar to **CreateCustomer** operation, as user can always update the address. But we are not going to discuss this again in this section.

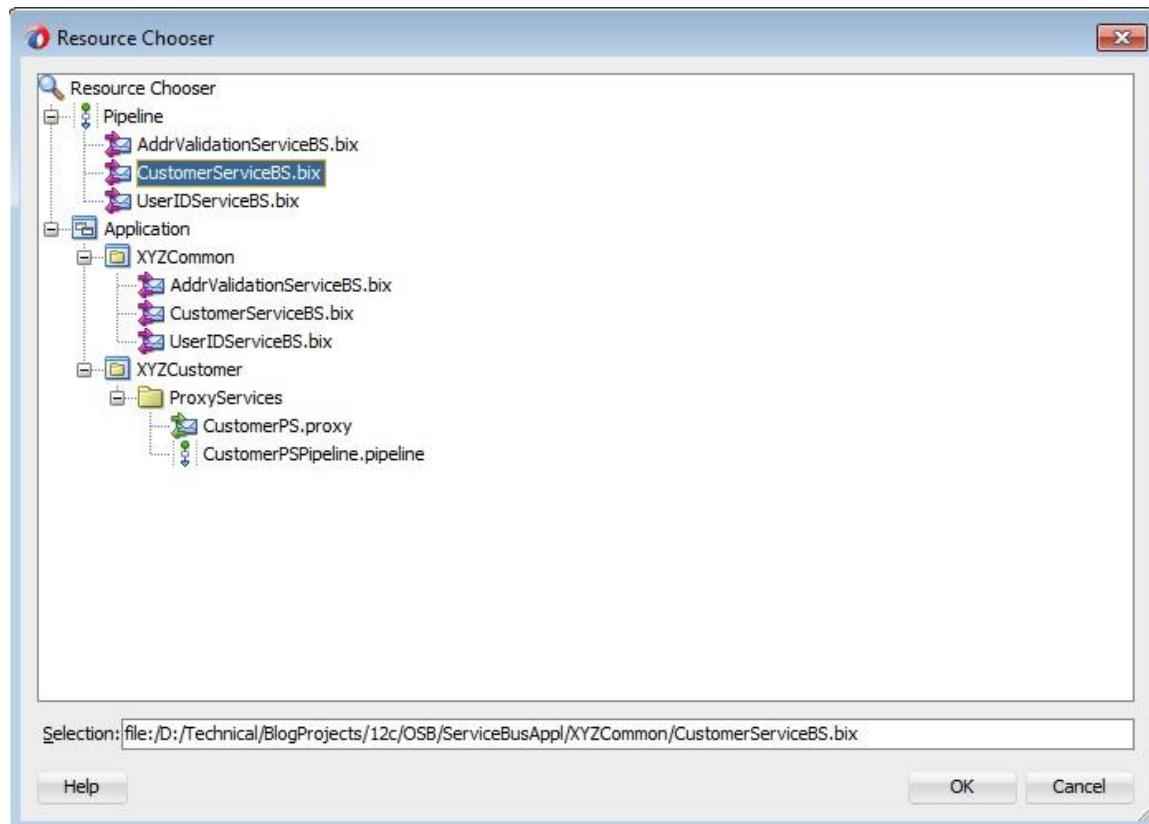
Routing

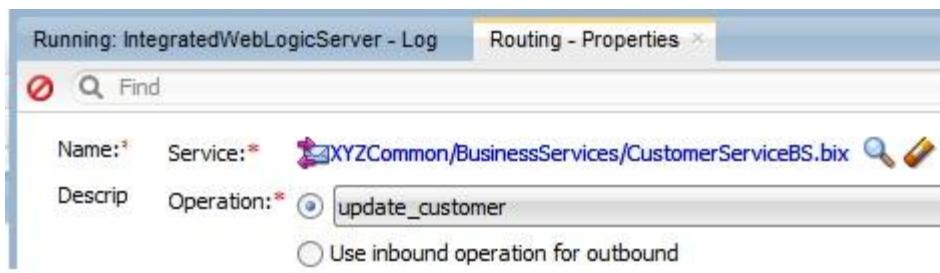
In this section, you will invoke **CustomerServiceBS** to finish message flow for **Update Customer**.

Drag **Routing** activity into **Actions** placeholder of **UpdateCustomer_Route**.

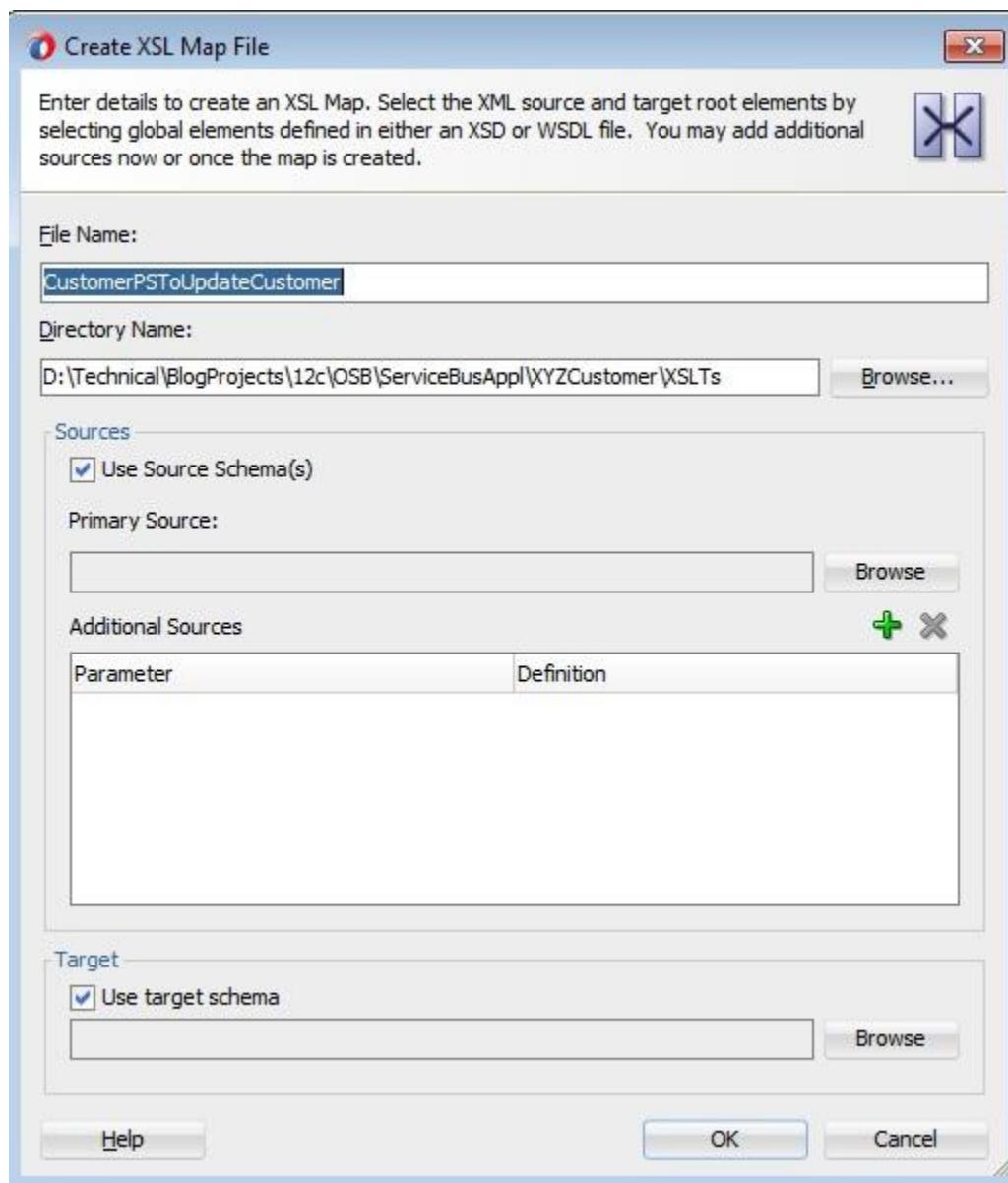


In **Properties** tab, browse and select **CustomerServiceBS** and **update_customer** operation.





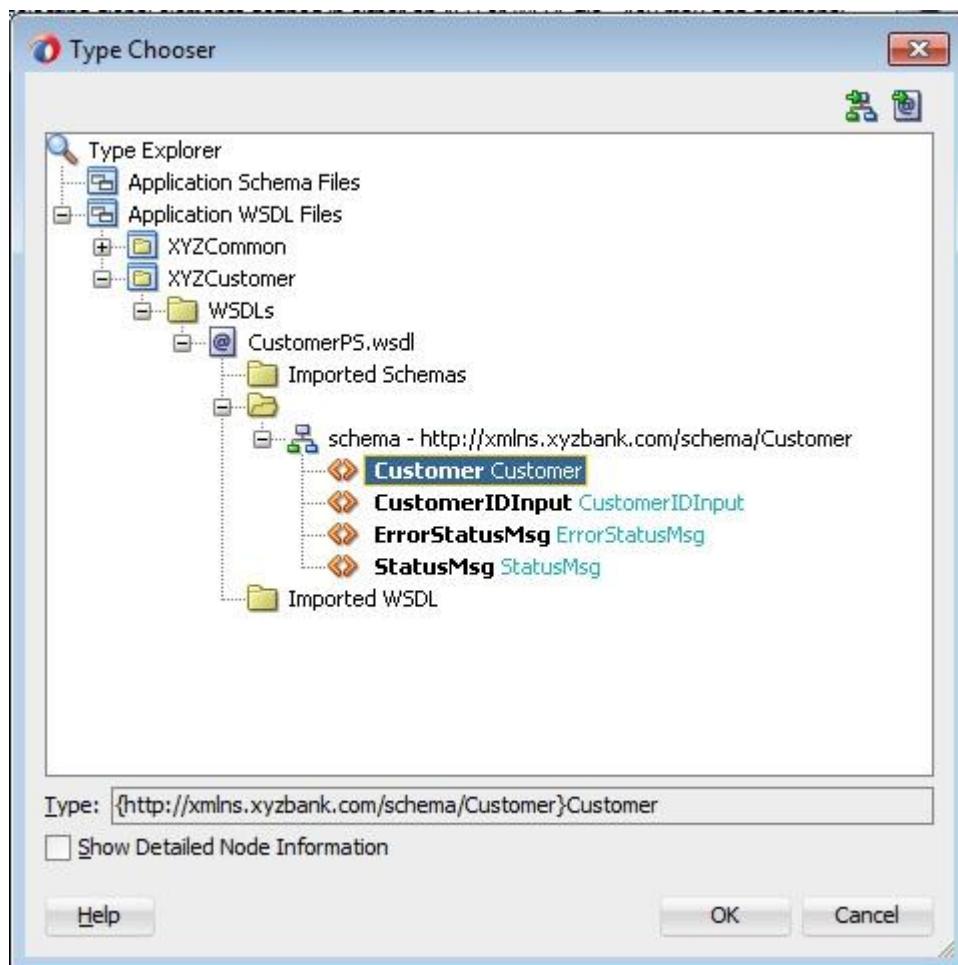
In this section, you will use XSLT Map instead of XQuery for payload transformation. Right click **XSLTs** folder in **XYZCustomer** project and select **New -> XSL Map**. In Create XSL Map File window give **File Name** as **CustomerPSToUpdateCustomer**.



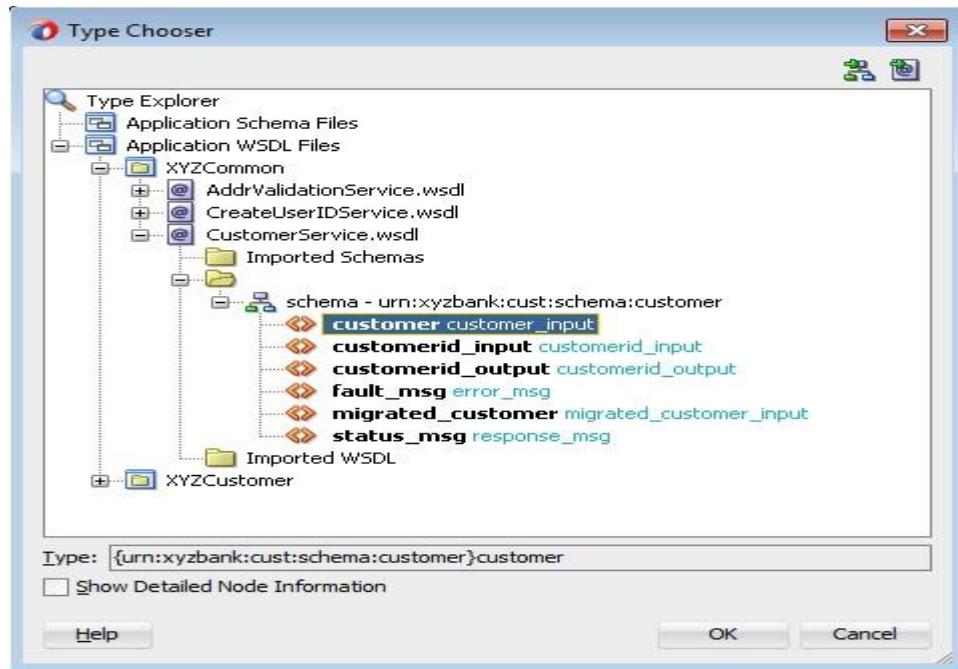
Click **Browse** for Primary Source to bring up **Select Schema** screen.



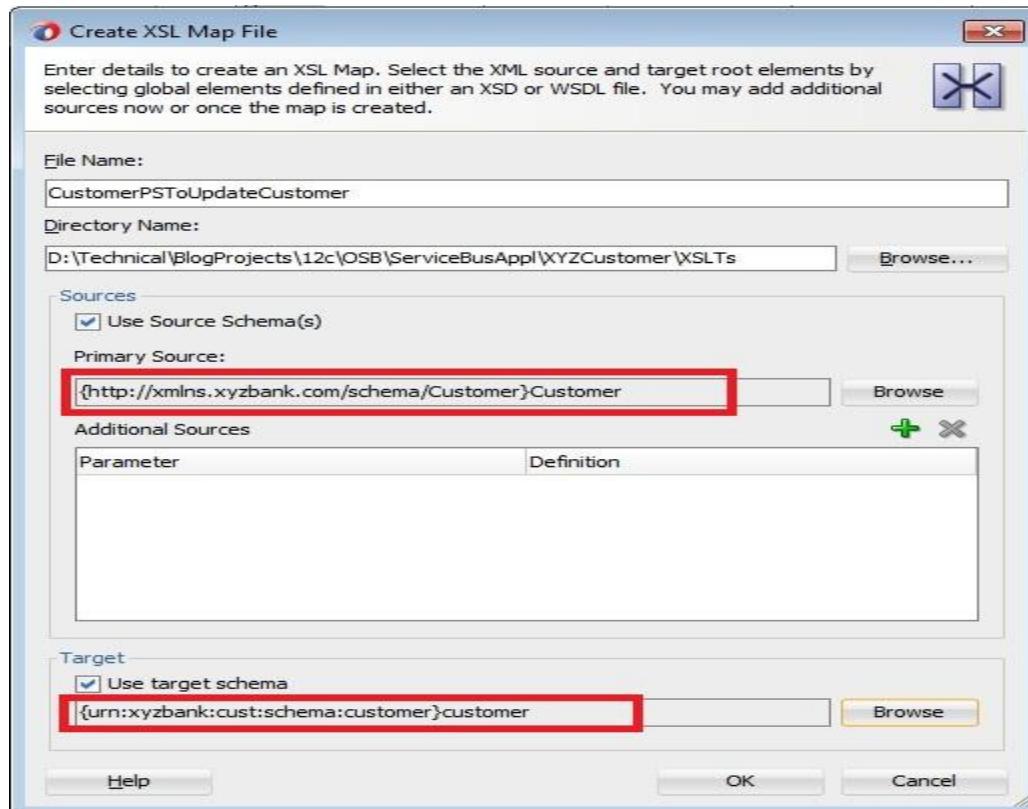
Retain the default selection and click **Browse** to select primary source element as shown below.



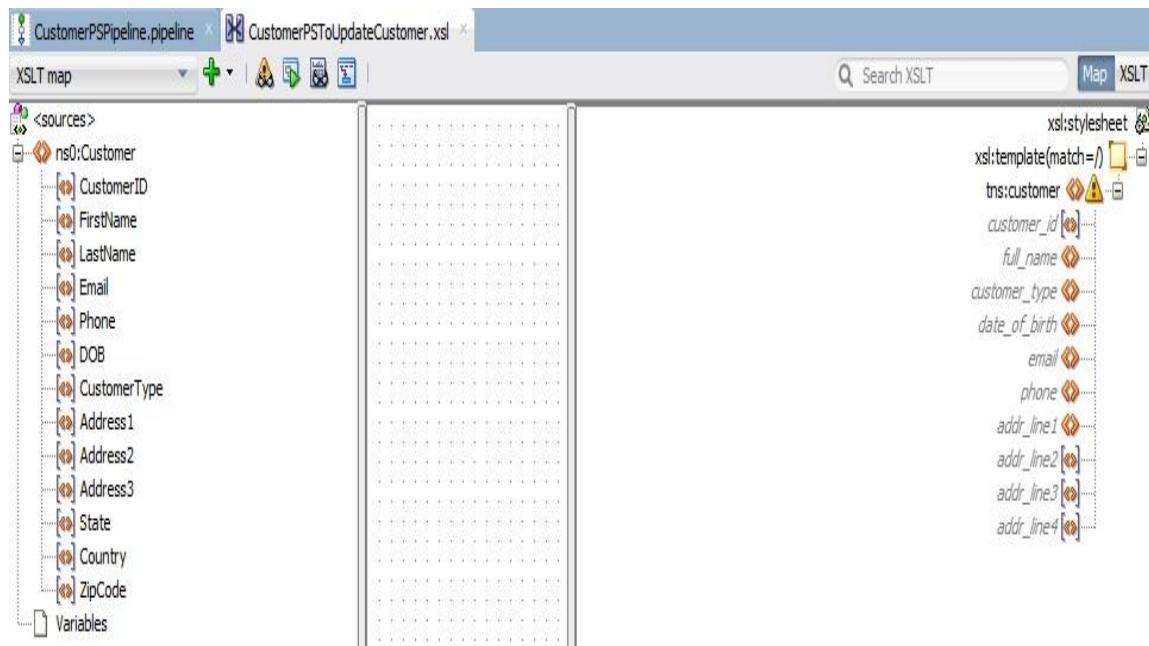
Go back to **Create XSL Map** window by clicking **OK** twice. Now click **Browse** for **Target** to bring up **Select Schema** screen. And click **Browse** for **Select Schema** and select the target element as shown below.



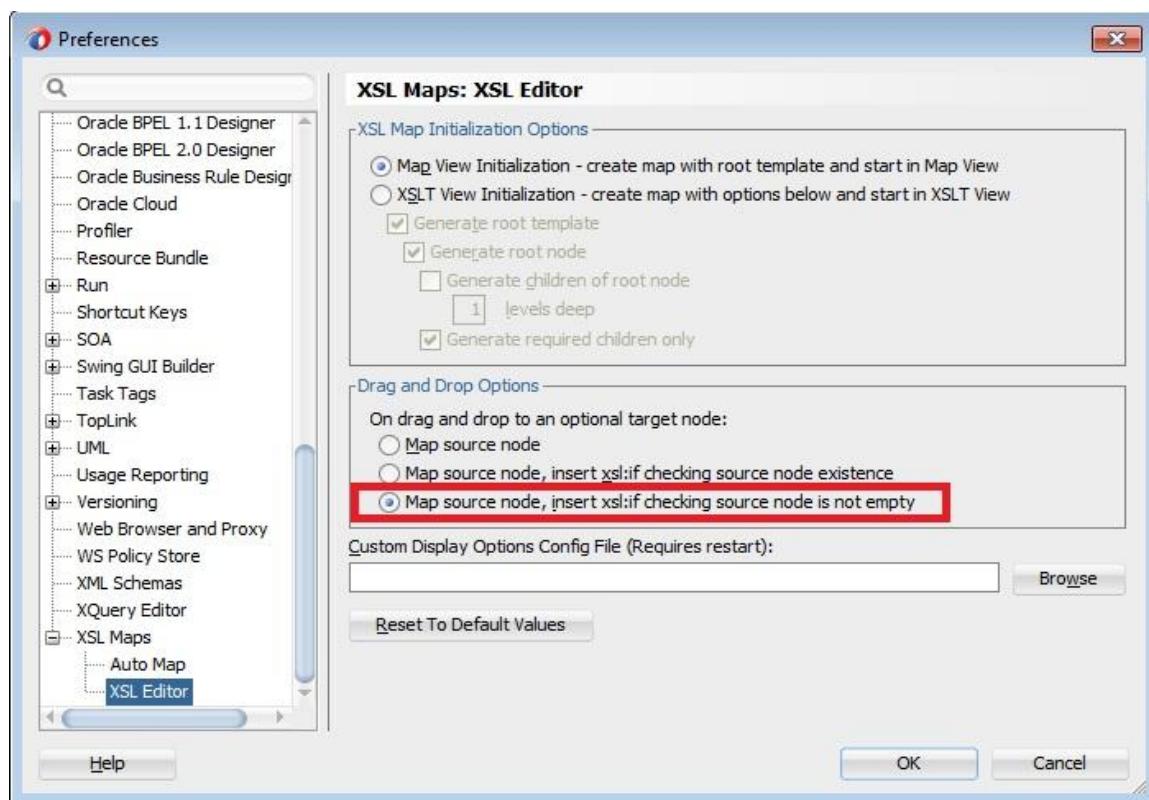
Go back to **Create XSL Map** screen by click **OK** twice and observe Source and Target elements.



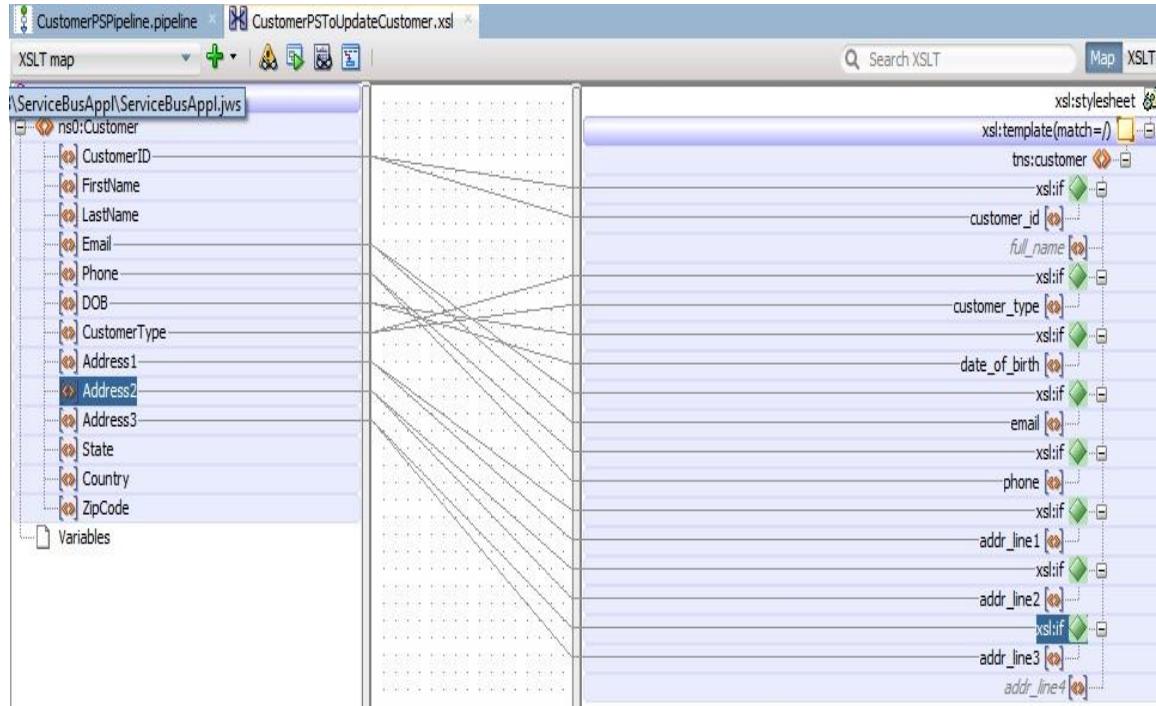
Click **OK** to finish the creation which brings up XSLT Transformation editor as shown below.



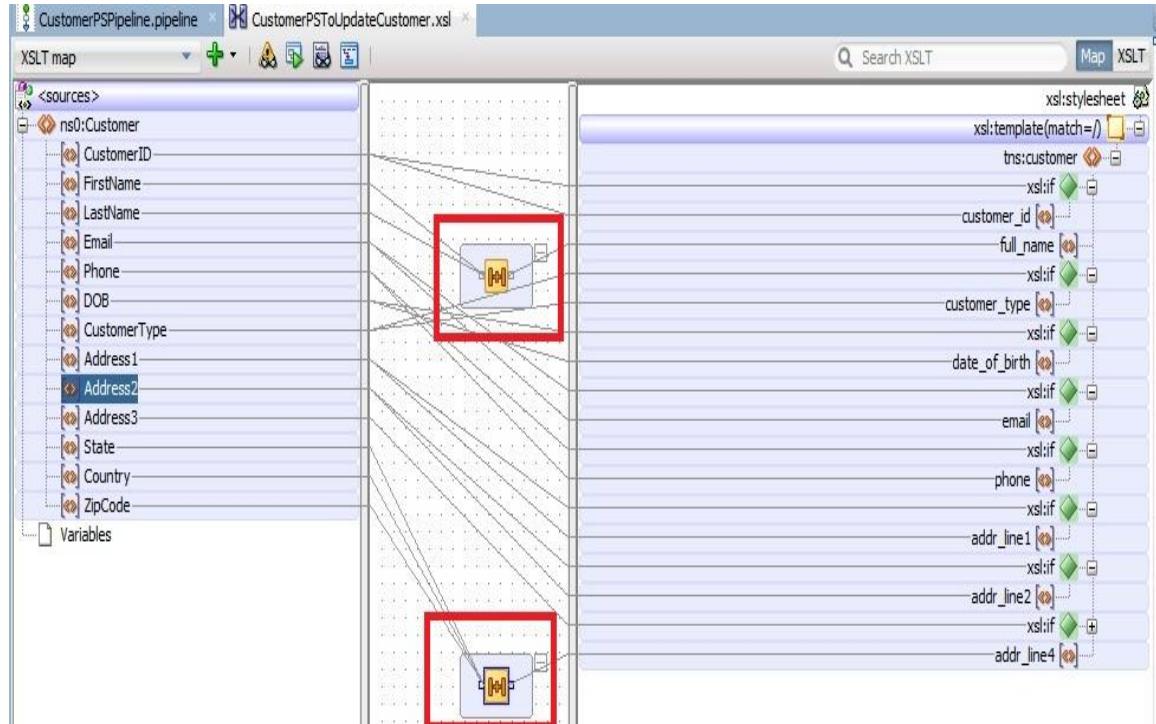
Since we are doing update of customer information, you should not send null values to business service; hence target elements should be mapped only when corresponding source element is available. You can achieve this behavior automatically in **XSL Map editor** by setting a preference. Go to **Tools -> Preferences** and set property as shown below.



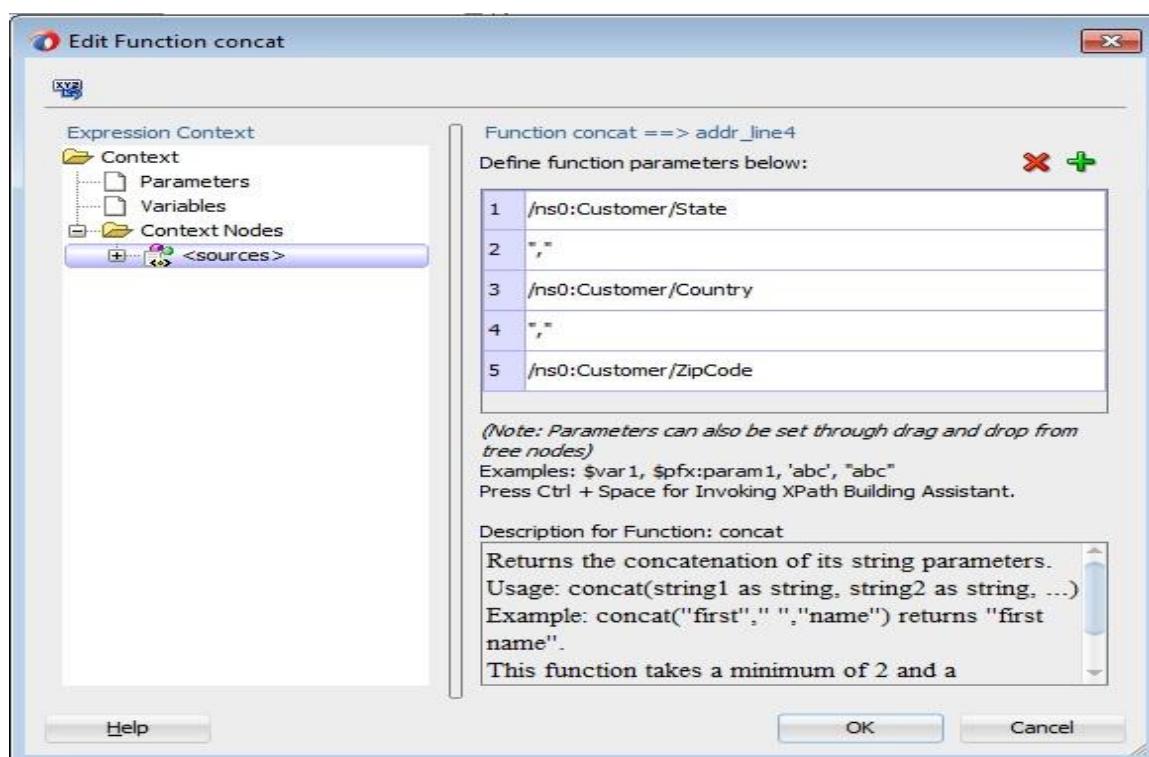
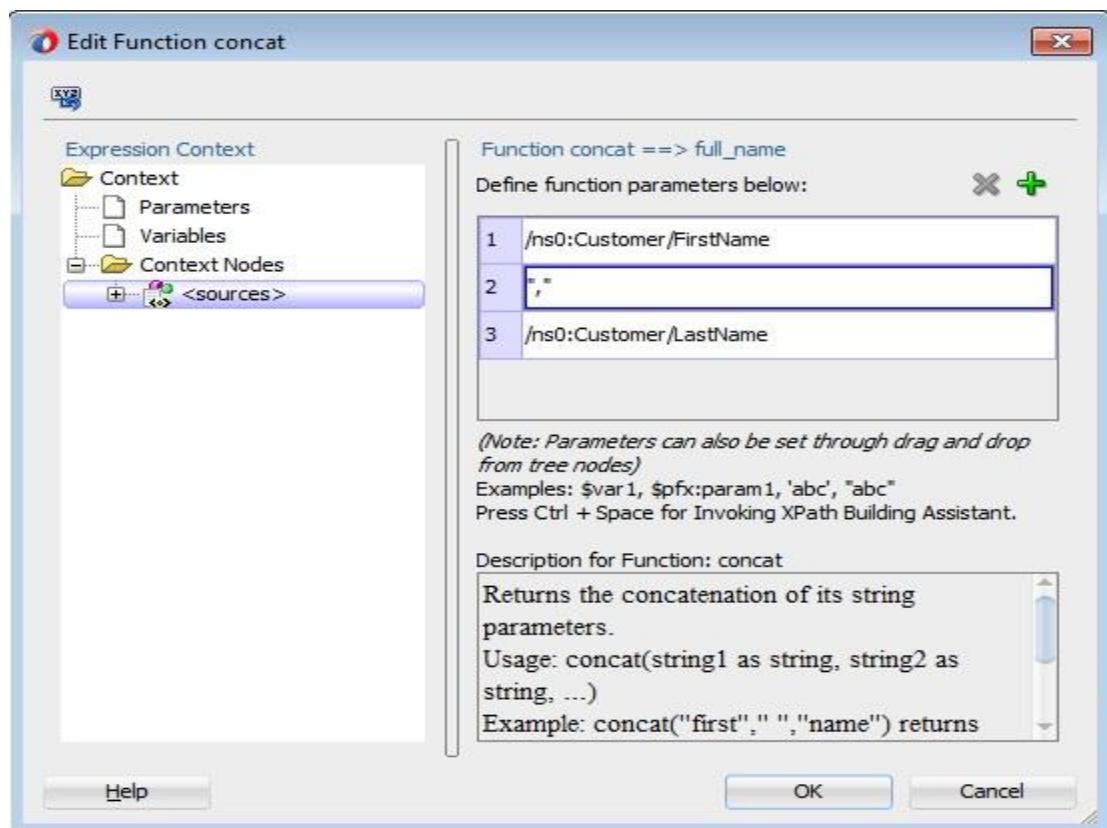
Go back to **XSL Map editor** and finish the initial mapping by mapping respective source and target elements as shown below. Observe that **xsl:if** condition gets added automatically.



Drag **concat** function into middle swim lane from **Components-> General XPath -> String Functions** to concatenate **FirstName**, **Lastame** and map to **full_name**. Also concatenate **State**, **Country** and **ZipCode** and map to **addr_line4** as shown below.



Click on **concat** functions and modify them as shown below by adding new elements. This would append ',' between the elements and is expected by business service.



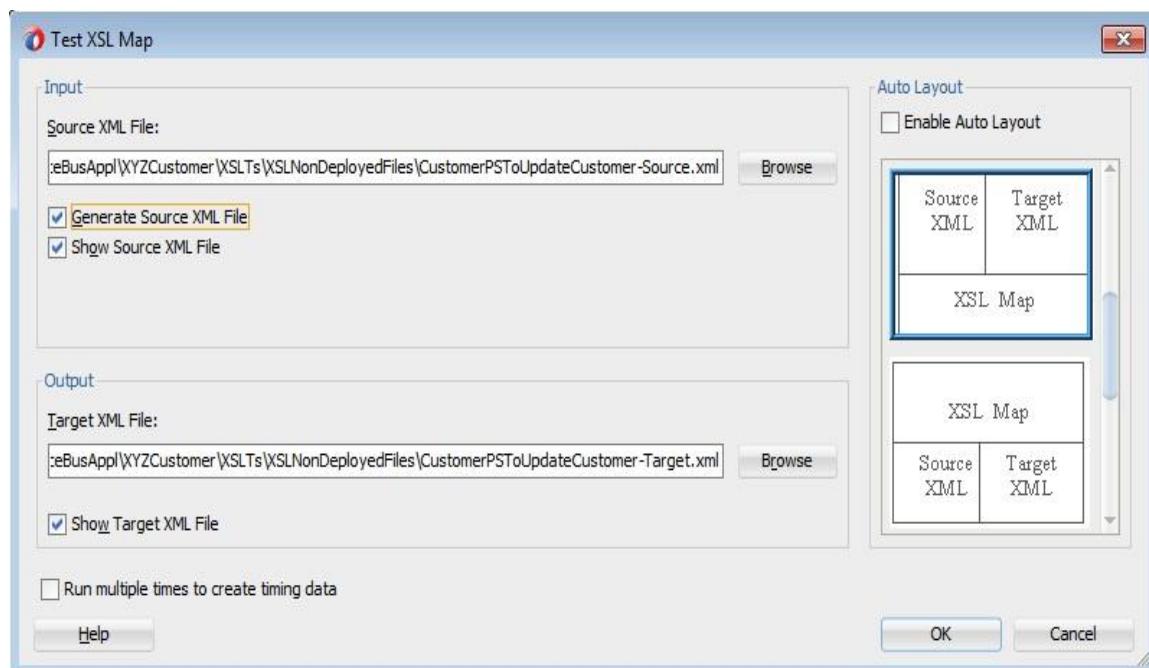
Now go to **Source** for XSL map. Modify **full_name** and **addr_line4** elements mapping to include **xsl:if** condition so that target will be mapped only when all of corresponding source elements are present.

```

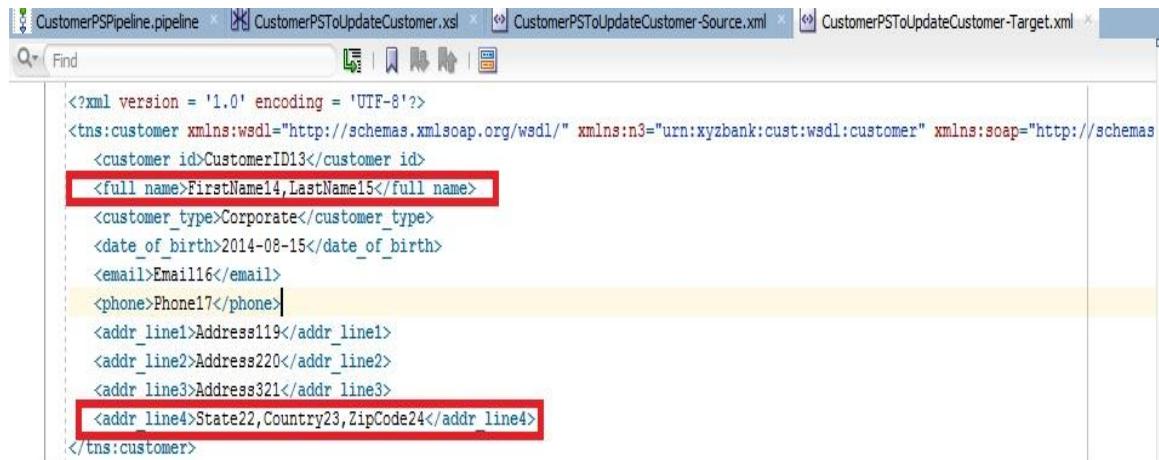
<xsl:template match="/">
  <tns:customer>
    <xsl:if test="/ns0:Customer/CustomerID">
      <customer_id>
        <xsl:value-of select="/ns0:Customer/CustomerID"/>
      </customer_id>
    </xsl:if>
    <xsl:if test="/ns0:Customer/FirstName and /ns0:Customer/LastName">
      <full_name>
        <xsl:value-of select='concat (/ns0:Customer/FirstName, "", /ns0:Customer/LastName )' />
      </full_name>
    </xsl:if>
    <xsl:if test="/ns0:Customer/CustomerType">
      <customer_type>
        <xsl:value-of select="/ns0:Customer/CustomerType"/>
      </customer_type>
    </xsl:if>
  </tns:customer>
</xsl:template>
</xsl:stylesheet>

```

It's always advisable to test your XSL map to see whether mapping is working as expected. Click **Test XSL Map** icon in editor to bring up the following screen.

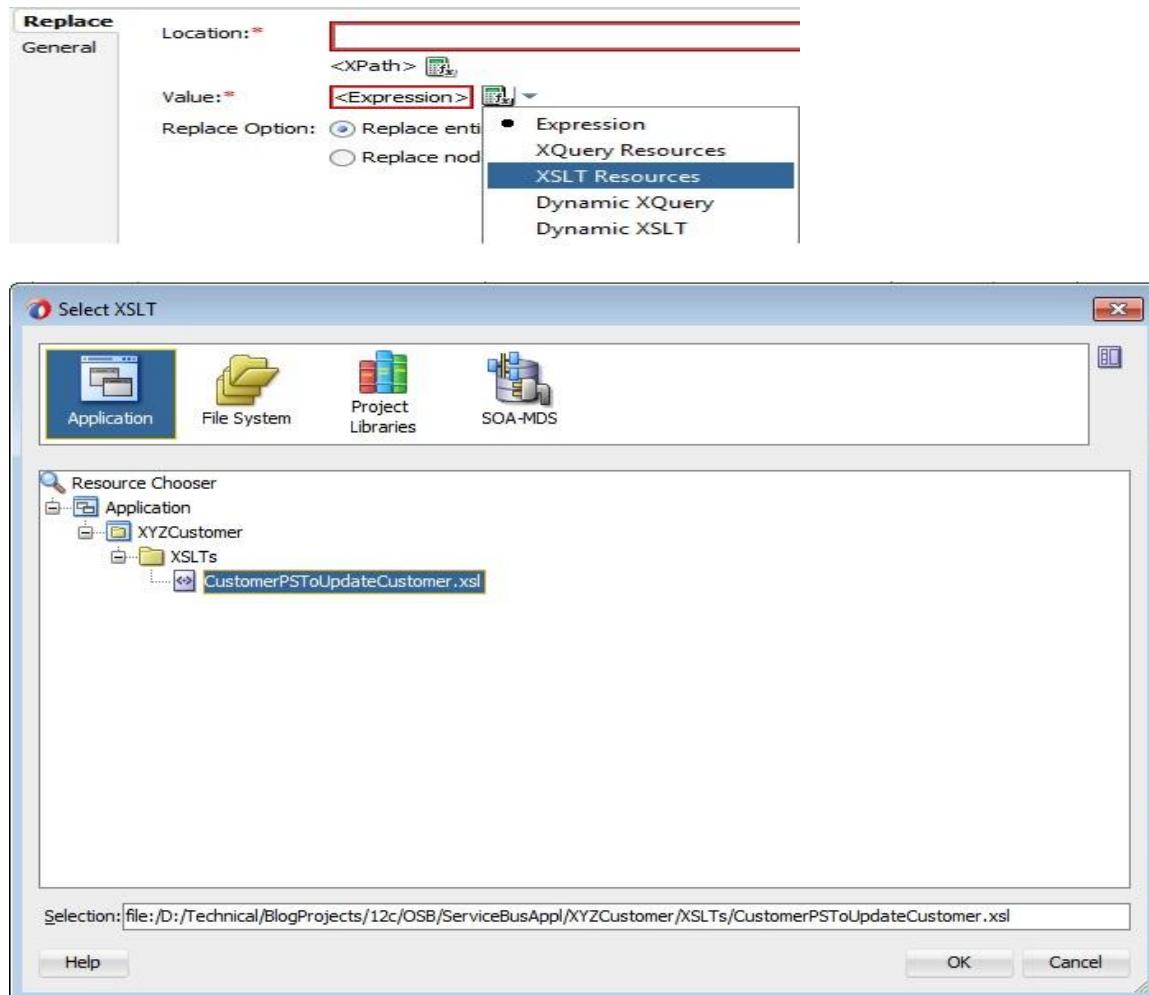


Click **OK** and observe both source and target xml files get created. You can also modify source xml and retest your XSL map again.

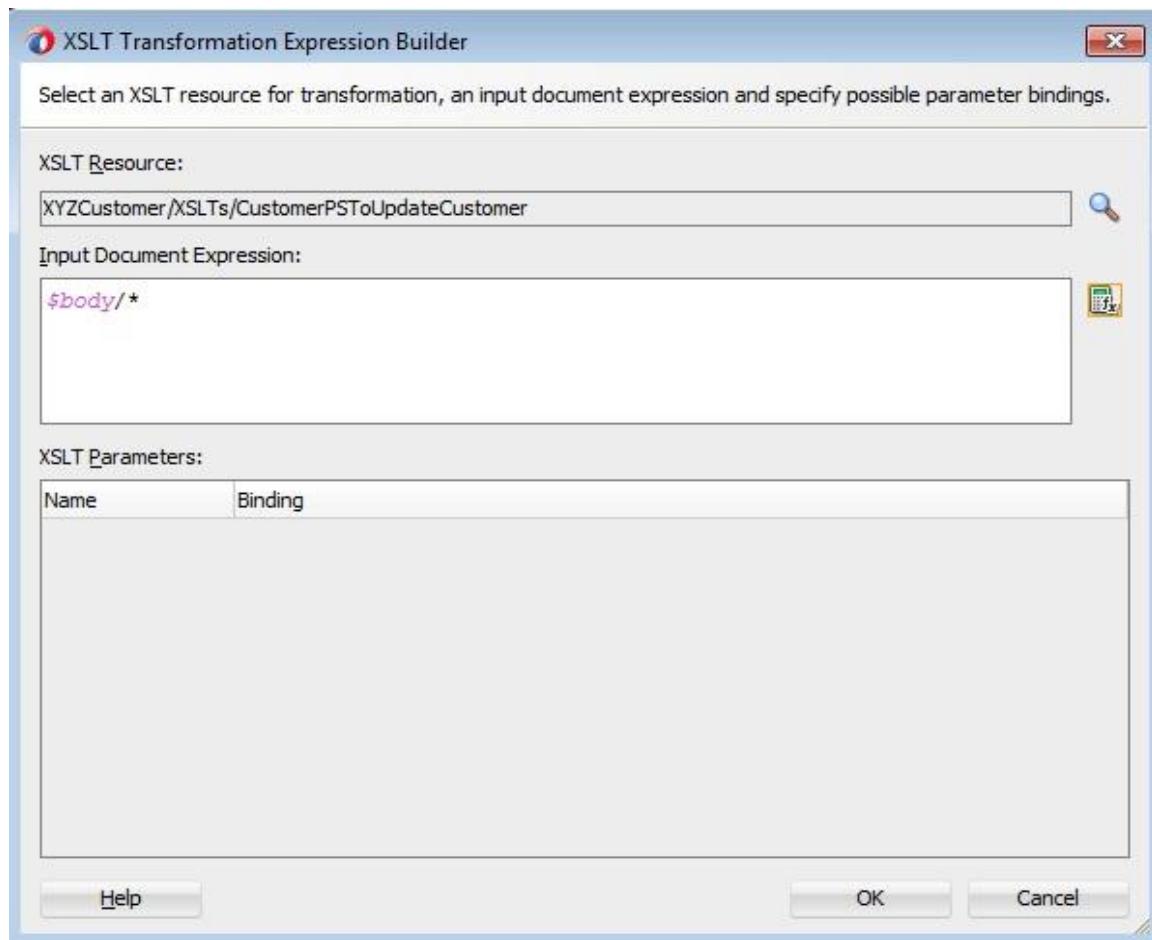


```
<?xml version = '1.0' encoding = 'UTF-8'?>
<tns:customer xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/" xmlns:n3="urn:xyzbank:cust:wsdl:customer" xmlns:soap="http://schemas
<customer id>CustomerID13</customer id>
<full name>FirstName14,LastName15</full name>
<customer_type>Corporate</customer_type>
<date_of_birth>2014-08-15</date_of_birth>
<email>Email16</email>
<phone>Phone17</phone>
<addr_line1>Address119</addr_line1>
<addr_line2>Address220</addr_line2>
<addr_line3>Address321</addr_line3>
<addr_line4>State22,Country23,ZipCode24</addr_line4>
</tns:customer>
```

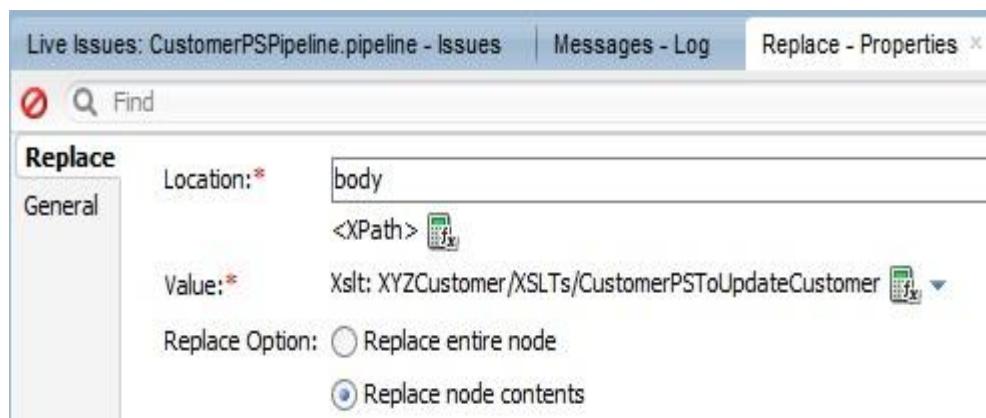
Drag **Replace** activity into **Request Action** of **Routing** from **Message Processing**. In **Properties** tab, bring up expression editor for **Value** property and choose XSL map as shown below.



Click **OK** and give **Input Document Expression** as **\$body/***.

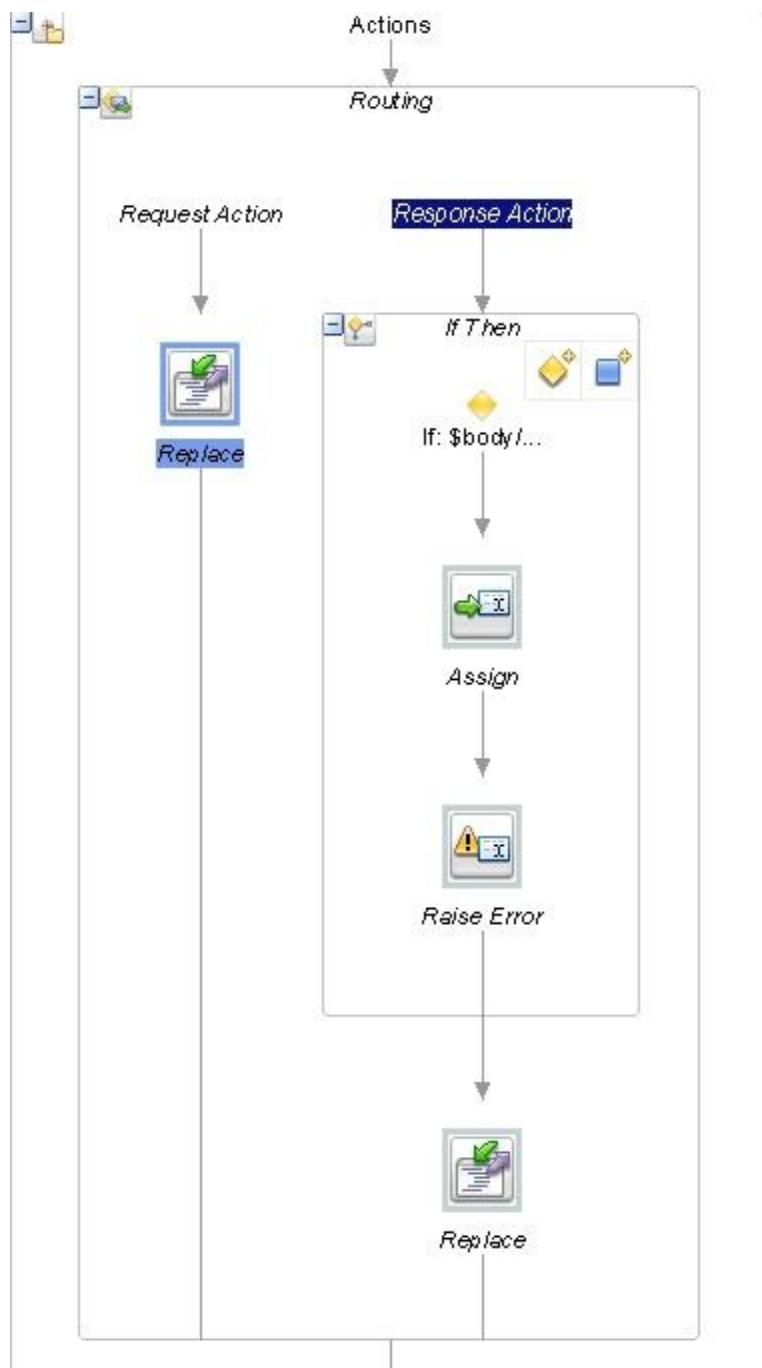


Set other properties as shown below. This action will replace contents of **\$body** context variable with payload structure required by business service.



Finish **Response Action** in **Routing** similar to **CreateCustomer** as response structure of business service is same for all the operations. So you can reuse **CustStatusMsgToCustomerPSOutput XQuery Map**.

Now your **Routing** node should look like below.



Testing

Deploy both projects or run **Pipeline** directly as shown in **Deploying and Testing** section. You may want to frequently test your proxy service/pipeline during development. Run your **pipeline** with sample payloads given [here](#) and observe **Flow Trace and Variables** as shown below. You can also run Proxy Service but you will not observe any **Flow Trace**.

CustomerType element validation:

Response Document

```
<?xml version="1.0"?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>soapenv:Server</faultcode>
      <faultstring>
        OSB-382505: OSB Validate action failed validation
      </faultstring>
      <detail>
        <con:Fault xmlns:con="http://www.bea.com/wli/sb/context">
          <con:errorCode>OSB-382505</con:errorCode>
          <con:reason>OSB Validate action failed validation</con:reason>
          <con:details>
            <con1:ValidationFailureDetail xmlns:con1="http://www.bea.com/wli/sb/stages/transform/config">
              <con1:message>
                string value 'Invalid Cust Type' is not a valid enumeration value for type of CustomerType element in Customer in namespace http://xmlns.xyzbank.com/schema/Customer
              </con1:message>
              <con1:xmlLocation>
                <CustomerType>Invalid Cust Type</CustomerType>
              </con1:xmlLocation>
            </con1:ValidationFailureDetail>
          </con:details>
          <con:location>
            <con:node>UpdatePipeline</con:node>
            <con:pipeline>
              request-N3f57c7ff.167ac282.0.147cb134053.N7f02
            </con:pipeline>
            <con:stage>Validation</con:stage>
            <con:path>request-pipeline</con:path>
          </con:location>
        </con:Fault>
      </detail>
    </soapenv:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

Email element validation:

Response Document

```
<?xml version="1.0"?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>soapenv:Server</faultcode>
      <faultstring>XYZ-0001: Email is not valid.</faultstring>
      <detail>
        <con:Fault xmlns:con="http://www.bea.com/wli/sb/context">
          <con:errorCode>XYZ-0001</con:errorCode>
          <con:reason>Email is not valid.</con:reason>
          <con:location>
            <con:node>UpdatePipeline</con:node>
            <con:pipeline>
              request-N3f57c7ff.167ac282.0.147cb134053.N7f02
            </con:pipeline>
            <con:stage>Validation</con:stage>
            <con:path>request-pipeline</con:path>
          </con:location>
        </con:Fault>
      </detail>
    </soapenv:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

CustomerID element validation:

Response Document

The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>soapenv:Server</faultcode>
      <faultstring>
        XYZ-0005: CustomerID is mandatory for Update.
      </faultstring>
      <detail>
        <con:fault xmlns:con="http://www.bea.com/wli/sb/context">
          <con:errorCode>XYZ-0005</con:errorCode>
          <con:reason>CustomerID is mandatory for Update.</con:reason>
          <con:location>
            <con:node>UpdatePipeline</con:node>
            <con:pipeline>
              request-N3f57c7ff.167ac282.0.147cb134053.N7f02
            </con:pipeline>
            <con:stage>Validation</con:stage>
            <con:path>request-pipeline</con:path>
          </con:location>
        </con:fault>
      </detail>
    </soapenv:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

Positive Case - FirstName, LastName, Phone, DOB and Email:

UpdateCustomerRoute
Routed Service

Route to: "CustomerServiceBS"

\$outbound:

\$body (request):

```
<soapenv:Body xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <ns0:customer xmlns:ns0="urn:xyzbank:cust:schema:customer">
    <customer_id>AHHHHH8787QDJHJH299</customer_id>
    <full_name>S.N.R. RAO</full_name>
    <date_of_birth>1986-09-29</date_of_birth>
    <email>abcnew@gmail.com</email>
    <phone>+91 8888888888</phone>
  </ns0:customer>
</soapenv:Body>
```

\$header (request):

\$attachments (request):

Message Context Changes

+ added \$outbound

△ changed \$body

```
<soapenv:Body xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:urn="urn:xyzbank:cust:schema:customer">
  <cus>StatusMsg xmlns:cus="http://xmlns.xyzbank.com/schema/Customer">
    <CustomerID>AHHHHH8787QDJHJH299</CustomerID>
    <status>S</status>
  </cus>StatusMsg>
</soapenv:Body>
```

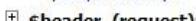
△ changed \$attachments

△ changed \$inbound

△ changed \$header

Positive Case - Address fields update:

```

 UpdateCustomerRoute
Routed Service
 Route to: "CustomerServiceBS"
 $outbound:
 $body (request):
<soapenv:Body xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
    <ns0:customer xmlns:ns0="urn:xyzbank:cust:schema:customer">
        <customer_id>AHHHHH8787QDJHJH299</customer_id>
        <addr_line1>Hi-Tech City, 2nd Phase</addr_line1>
        <addr_line2>Malahapur</addr_line2>
        <addr_line3>Hyderabad</addr_line3>
        <addr_line4>Andhra Pradesh India 500081</addr_line4>
    </ns0:customer>
</soapenv:Body>
 $header (request):
 $attachments (request):
Message Context Changes
  added $outbound
  changed $body
<soapenv:Body xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:urn="urn:xyzbank:cust:schema:customer">
    <cus:StatusMsg xmlns:cus="http://xmls.xyzbank.com/schema/Customer">
        <CustomerID>AHHHHH8787QDJHJH299</CustomerID>
        <status>S</status>
    </cus:StatusMsg>
</soapenv:Body>
  changed $attachments
  changed $inbound
  changed $header

```

Negative Case - Status in business service response:

 **Invocation Trace**

```

  (receiving request)
 CustomerOperation
 UpdatePipeline
  Validation
 UpdateCustomerRoute
Routed Service
 Route to: "CustomerServiceBS"
 $outbound:
 $body (request):
 $header (request):
 $attachments (request):
Message Context Changes
  added $faultVar
<urn:status_msg xmlns:urn="urn:xyzbank:cust:schema:customer" xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
    <customer_id>AHHHHH8787QDJHJH299</customer_id>
    <status>E</status>
    <error_message>Error in updating customer</error_message>
</urn:status_msg>
  added $outbound
  changed $body
<soapenv:Body xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:urn="urn:xyzbank:cust:schema:customer">
    <urn:status_msg>
        <customer_id>AHHHHH8787QDJHJH299</customer_id>
        <status>E</status>
        <error_message>Error in updating customer</error_message>
    </urn:status_msg>
</soapenv:Body>
  changed $attachments
  changed $inbound
  changed $header

```

Response Document

 The invocation resulted in an error: .

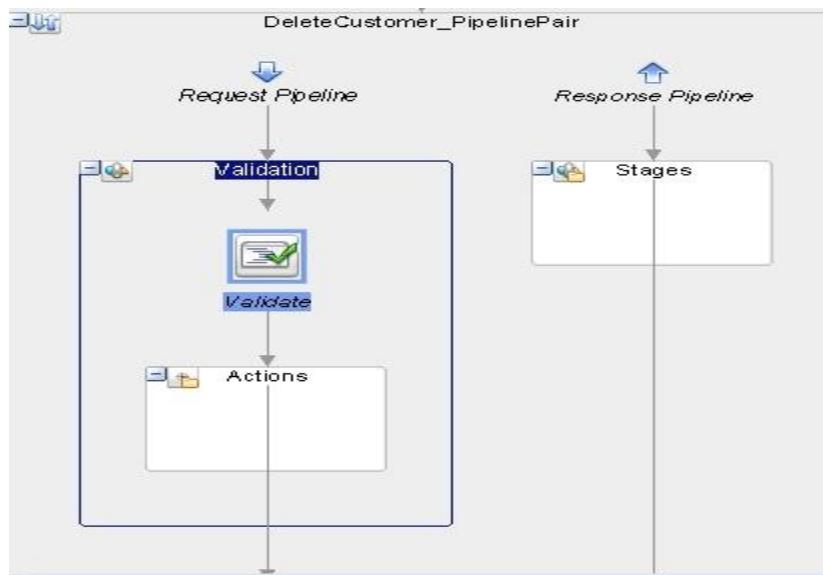
```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>soapenv:Server</faultcode>
      <faultstring>XYZ-0004: Error in Customer Update.</faultstring>
      <detail>
        <con:fault xmlns:con="http://www.bea.com/wli/sb/context">
          <con:errorCode>XYZ-0004</con:errorCode>
          <con:reason>Error in Customer Update.</con:reason>
          <con:location>
            <con:node>UpdateCustomerRoute</con:node>
            <con:path>response-pipeline</con:path>
          </con:location>
        </con:fault>
      </detail>
    </soapenv:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

Delete Customer

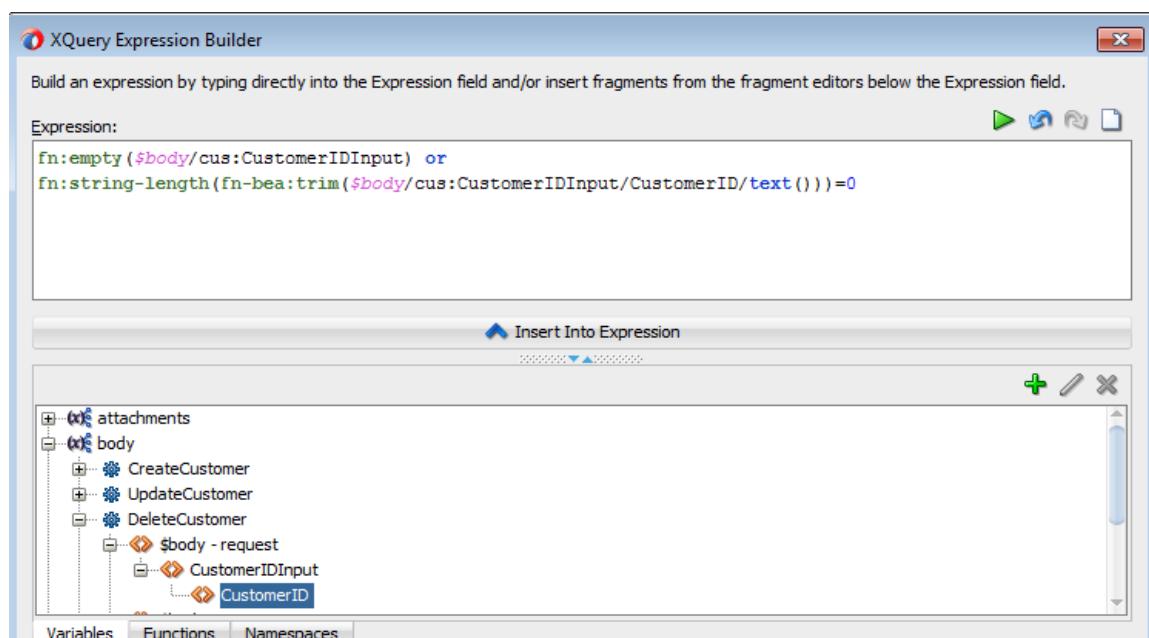
In this section, you will complete message flow for **DeleteCustomer** operation.

Validating Payload

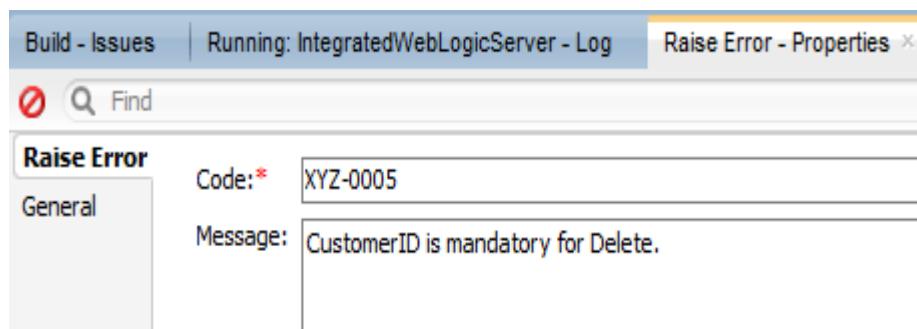
Finish **Validation** stage in **DeleteCustomer** operational branch similar to **CreateCustomer** for validating **Payload Structure** using **Validate** activity. But you should select **CustomerIDInput** element from **\$body/DeleteCustomer** in expression builder for **Location** property.



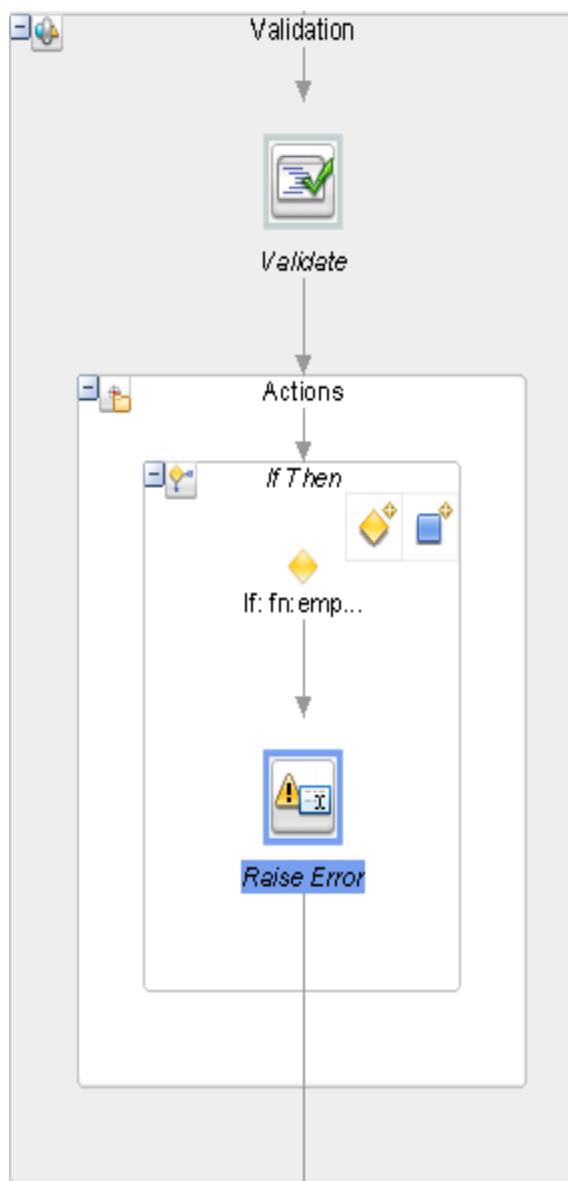
Since this is **Delete** operation, service consumer should send **CustomerID** mandatorily in input and your message flow should enforce the same. So drag **If-Then** activity into **Validation** stage from **Flow Control** and set condition as shown below. Alternatively, you can select these string functions from **Functions -> XQuery 1.0 Functions -> Strings -> General Functions**.



Drag **Raise Error** activity into **If** branch from **Flow Control** and set properties as shown below.



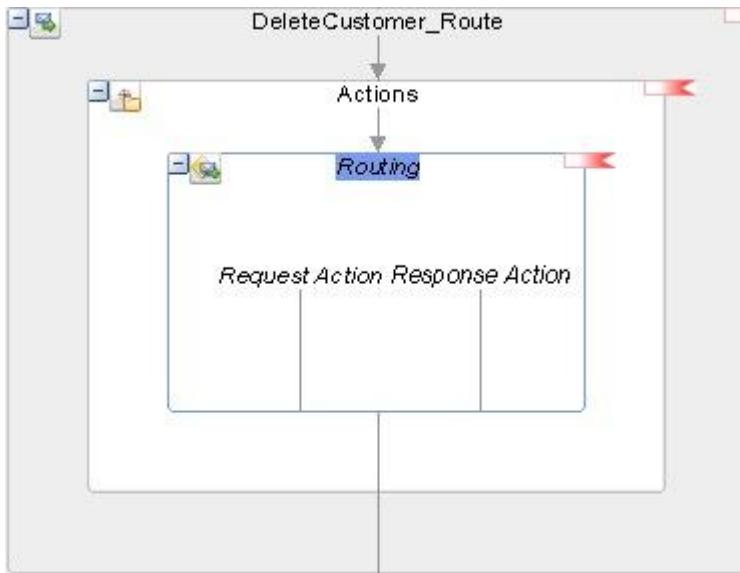
Now your **Validation** stage should look like below.



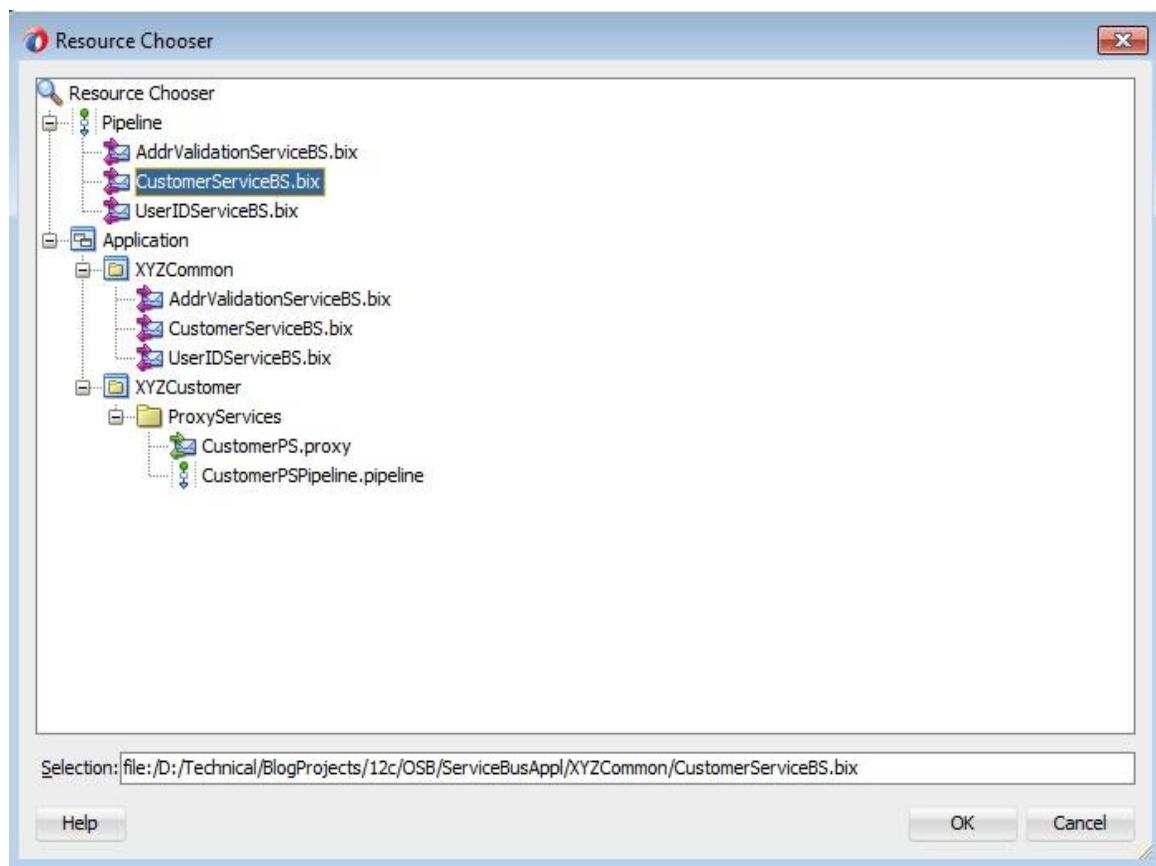
Routing

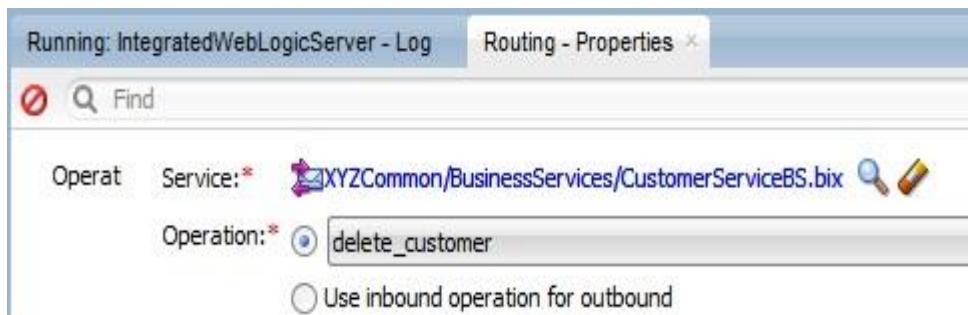
In this section, you will invoke **CustomerServiceBS** to finish message flow for **Delete Customer**.

Drag Routing activity into Actions placeholder of **DeleteCustomer_Route**.

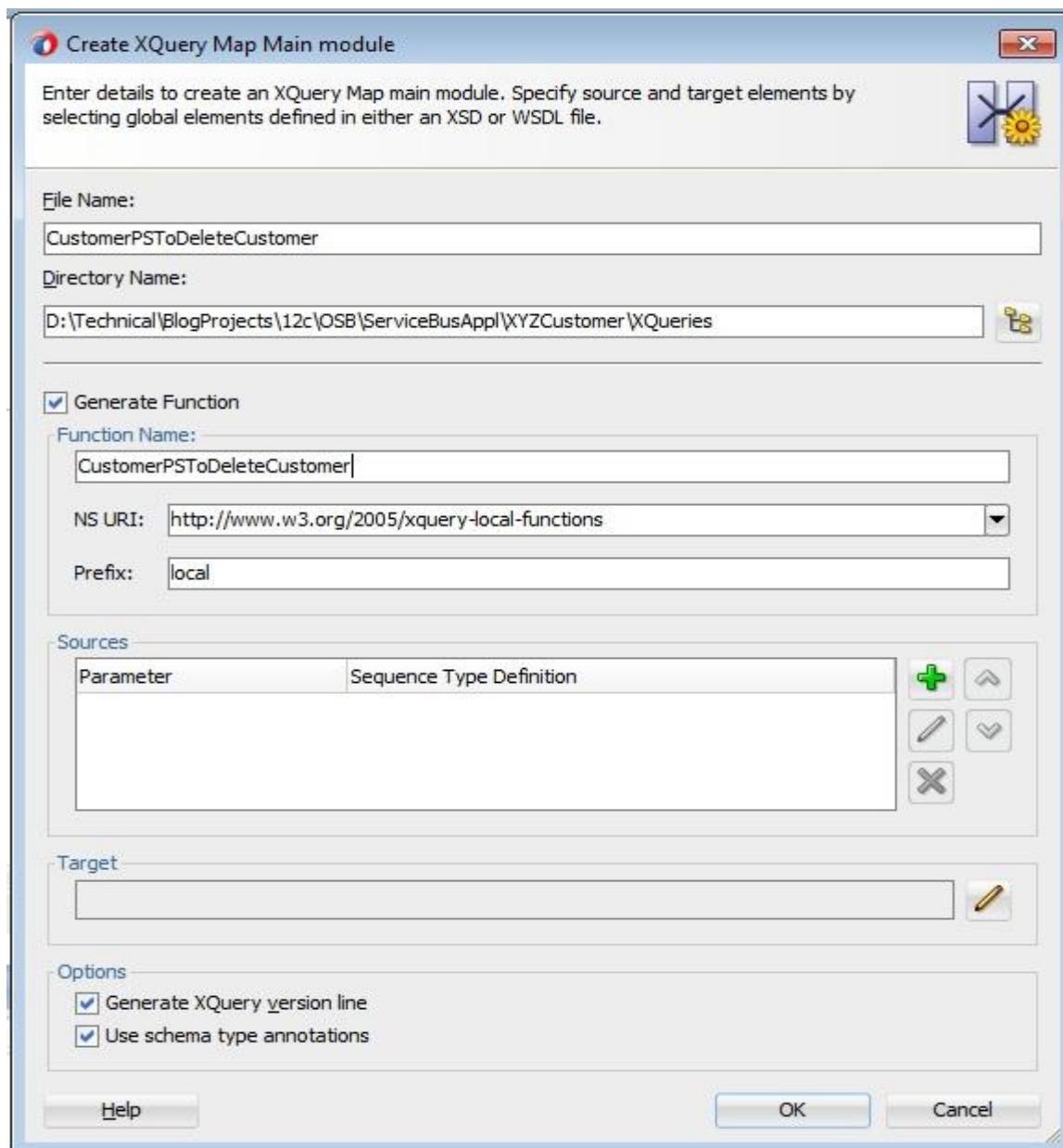


In **Properties** tab, browse and select **CustomerServiceBS** and **delete_customer** operation.

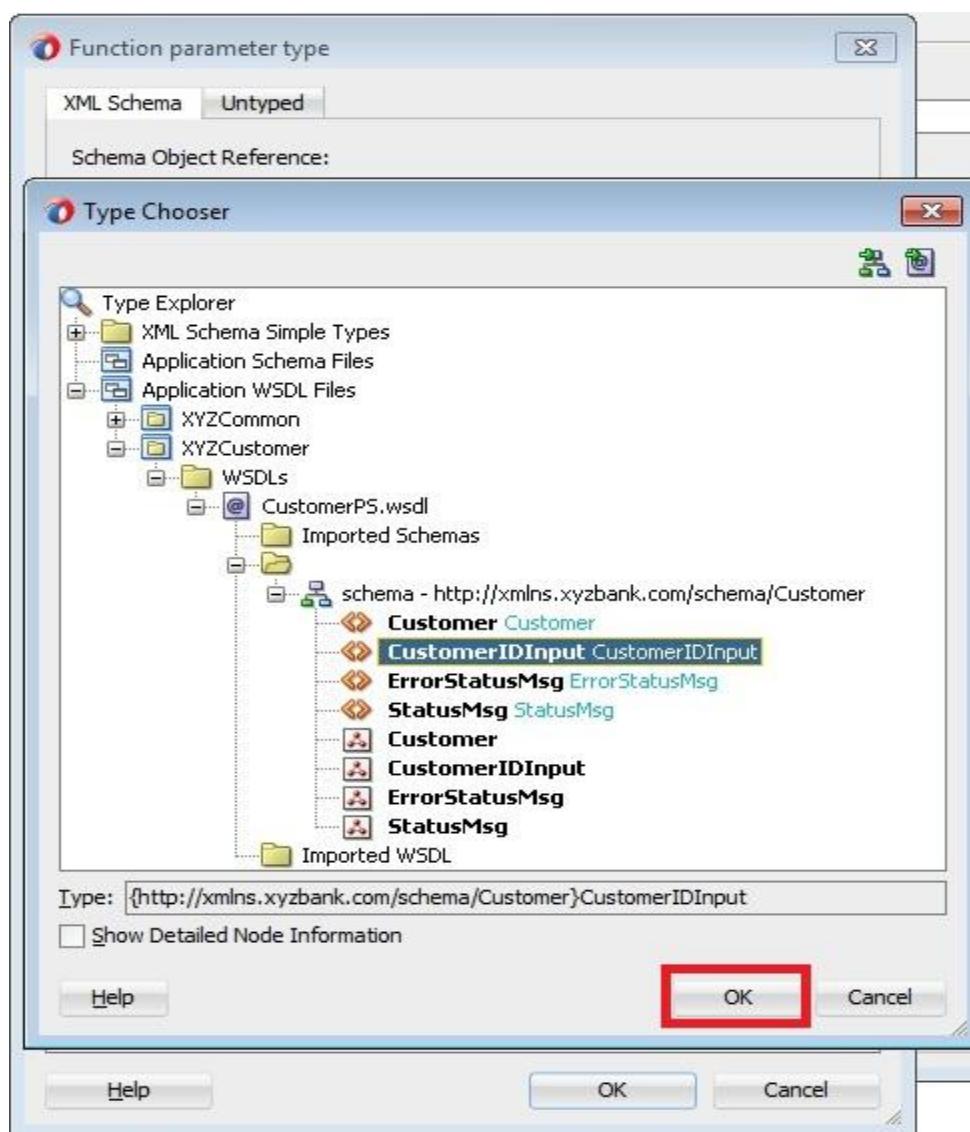
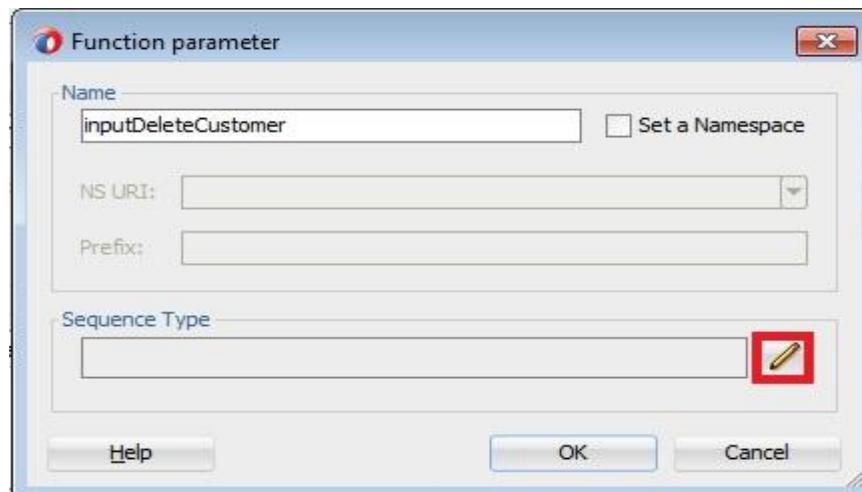


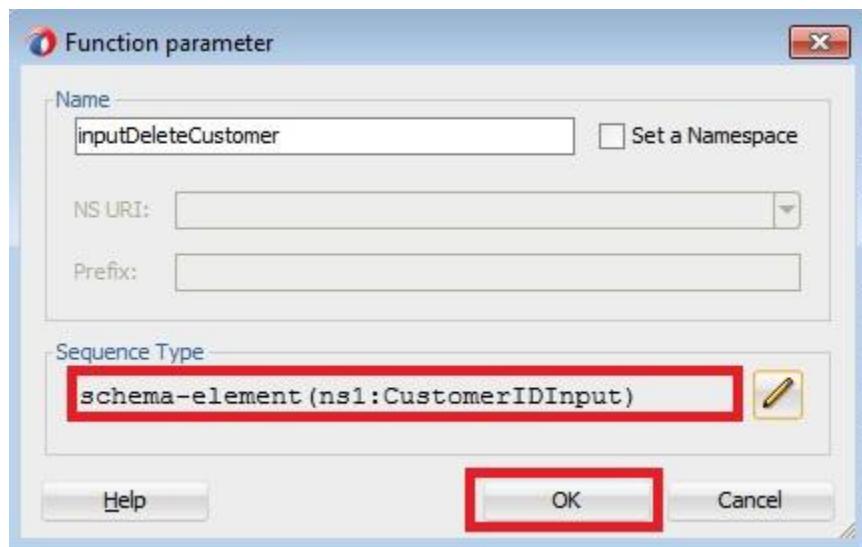
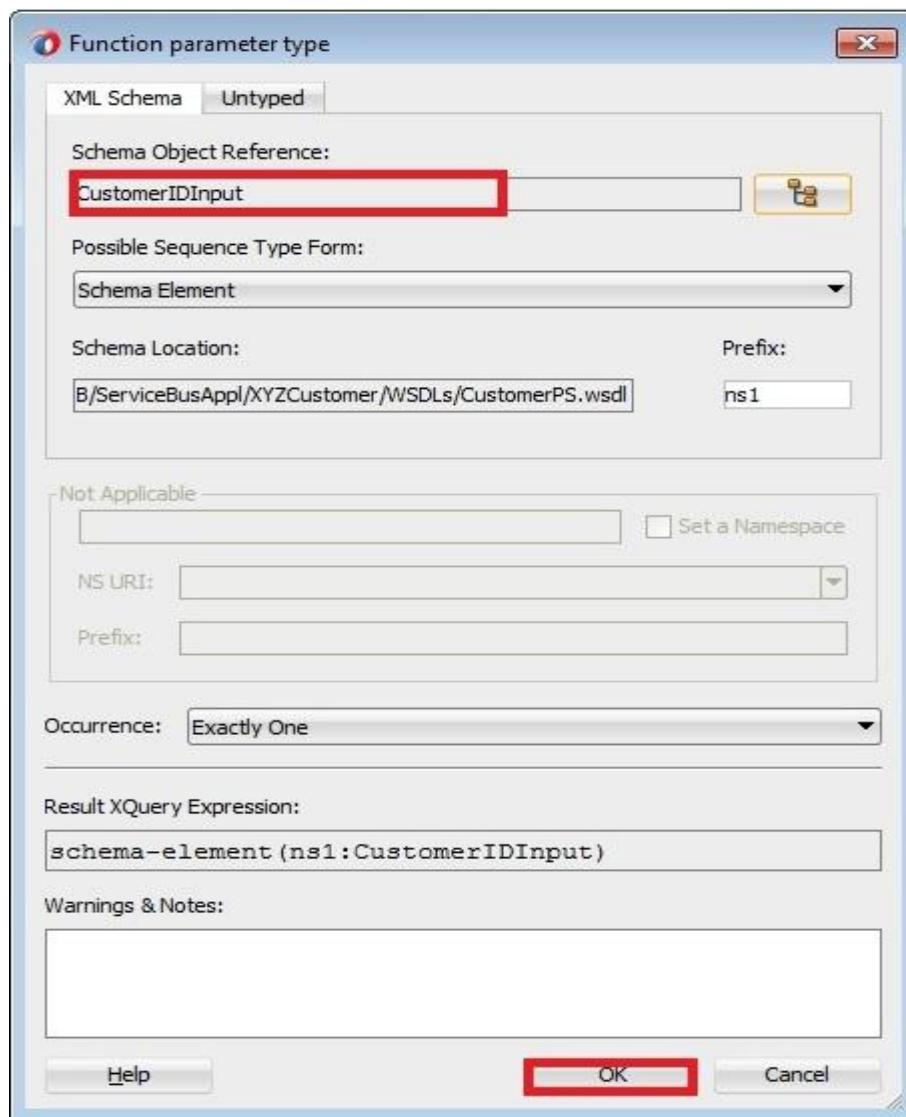


Create a new XQuery map in **XQueries** folder of **XYZCustomer** project and give both **File Name** and **Function Name** as **CustomerPSToDeleteCustomer**.

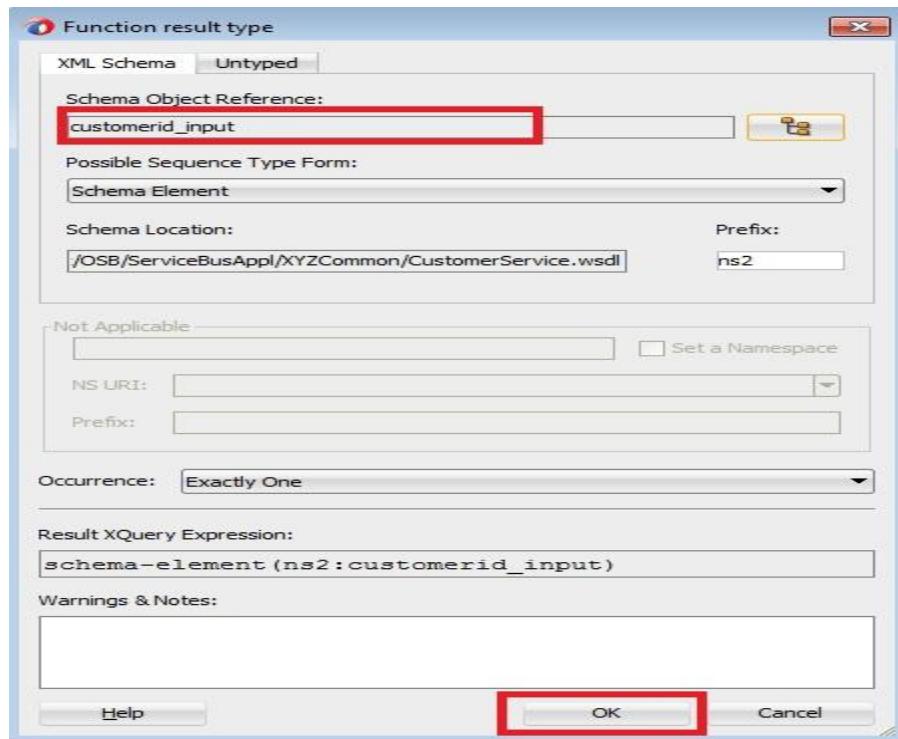
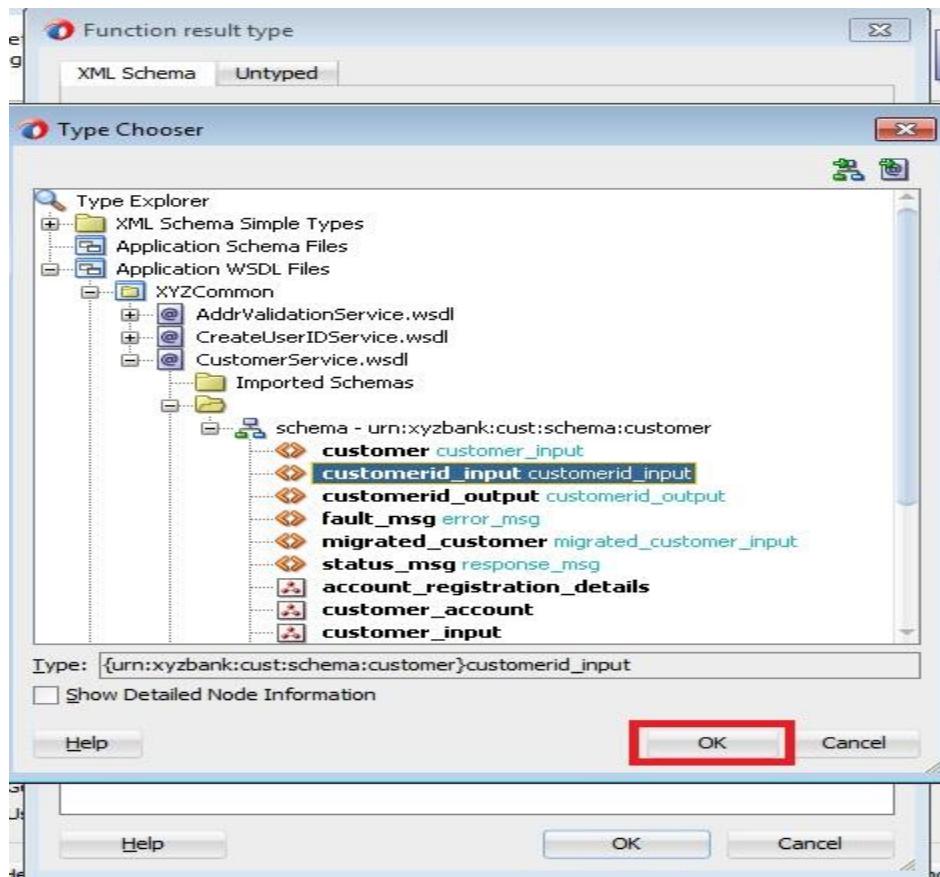


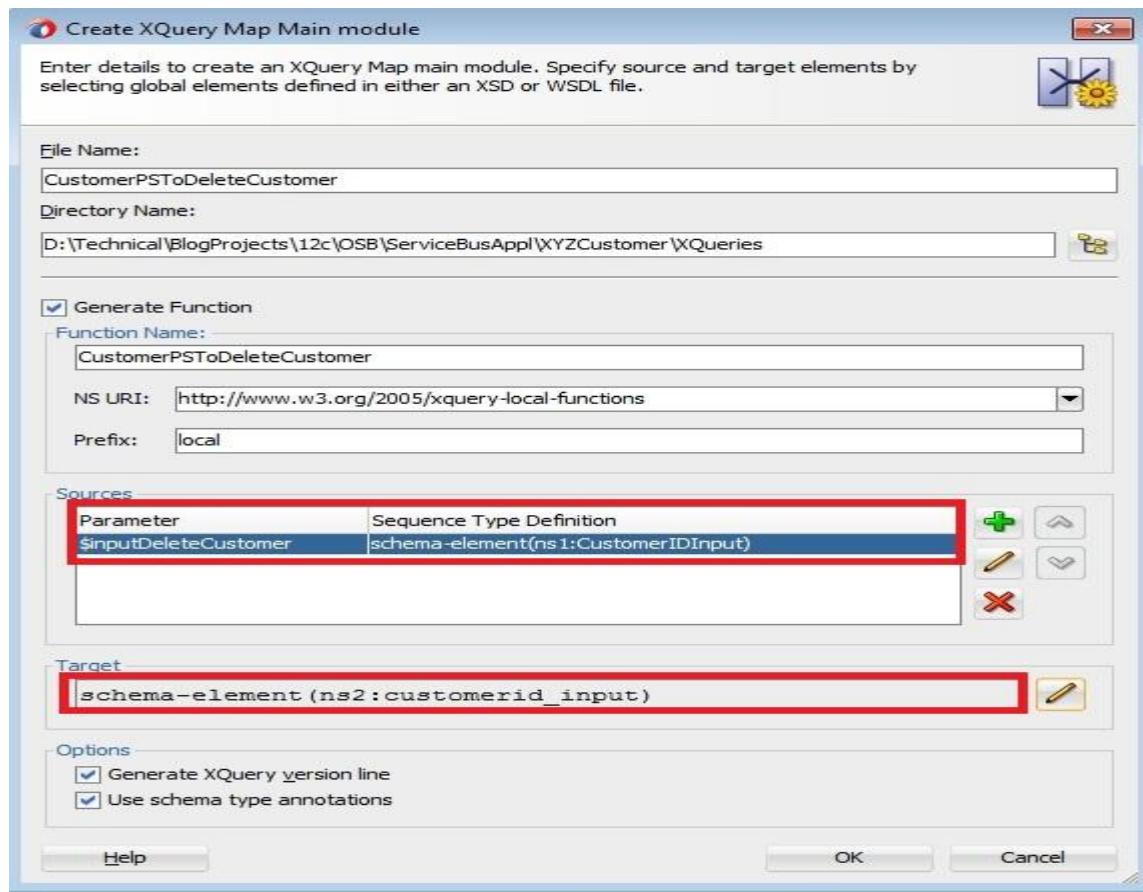
Complete **Source Parameters** selection as shown below.



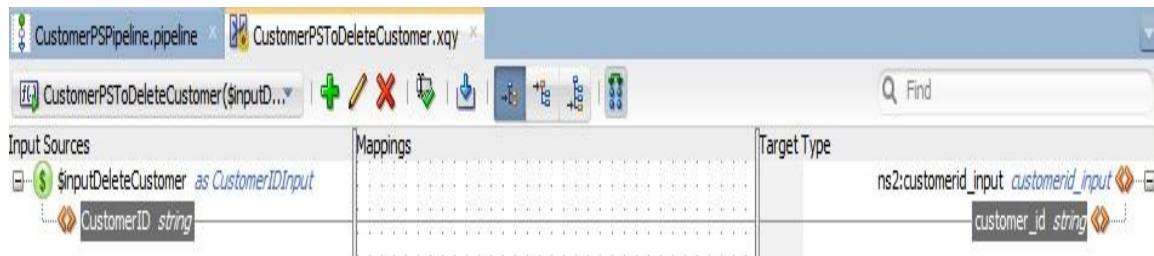


Complete **Target** selection as shown below.

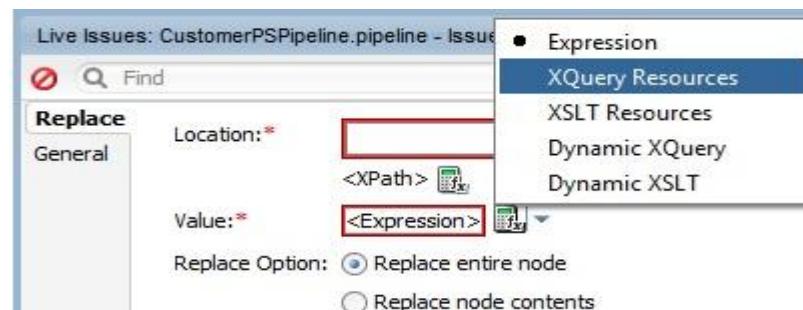


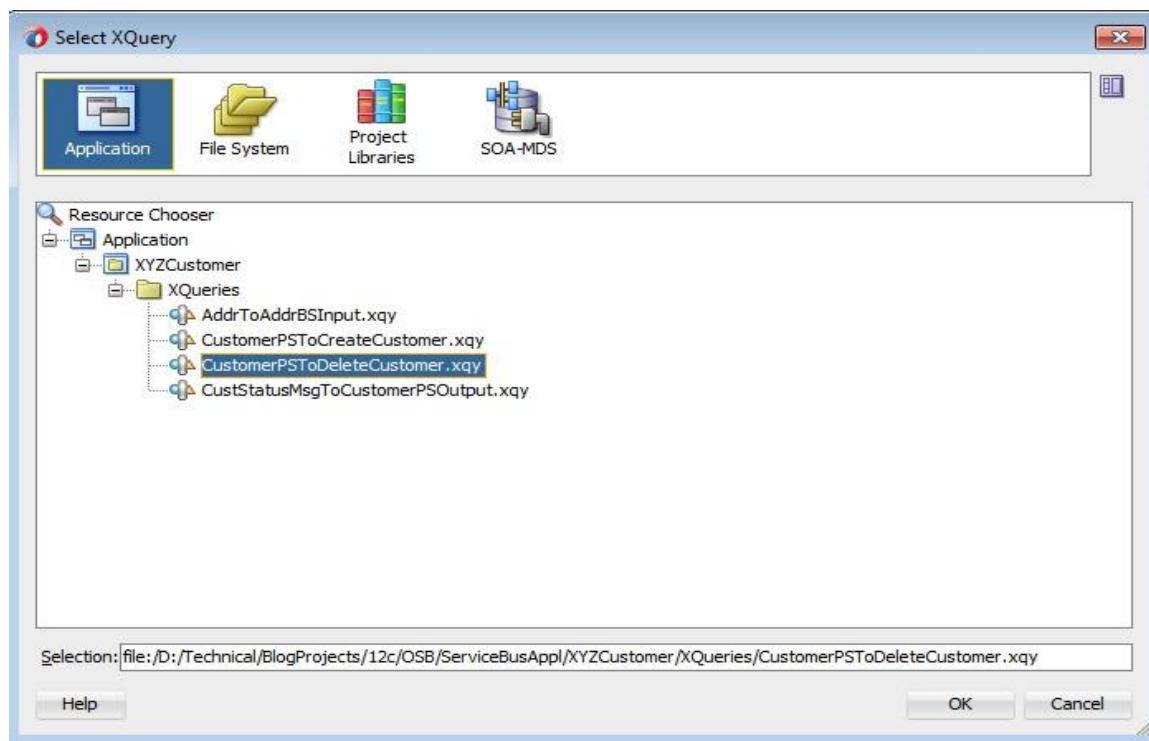


Both source and targets have single element **CustomerID** and finish mapping as shown below.

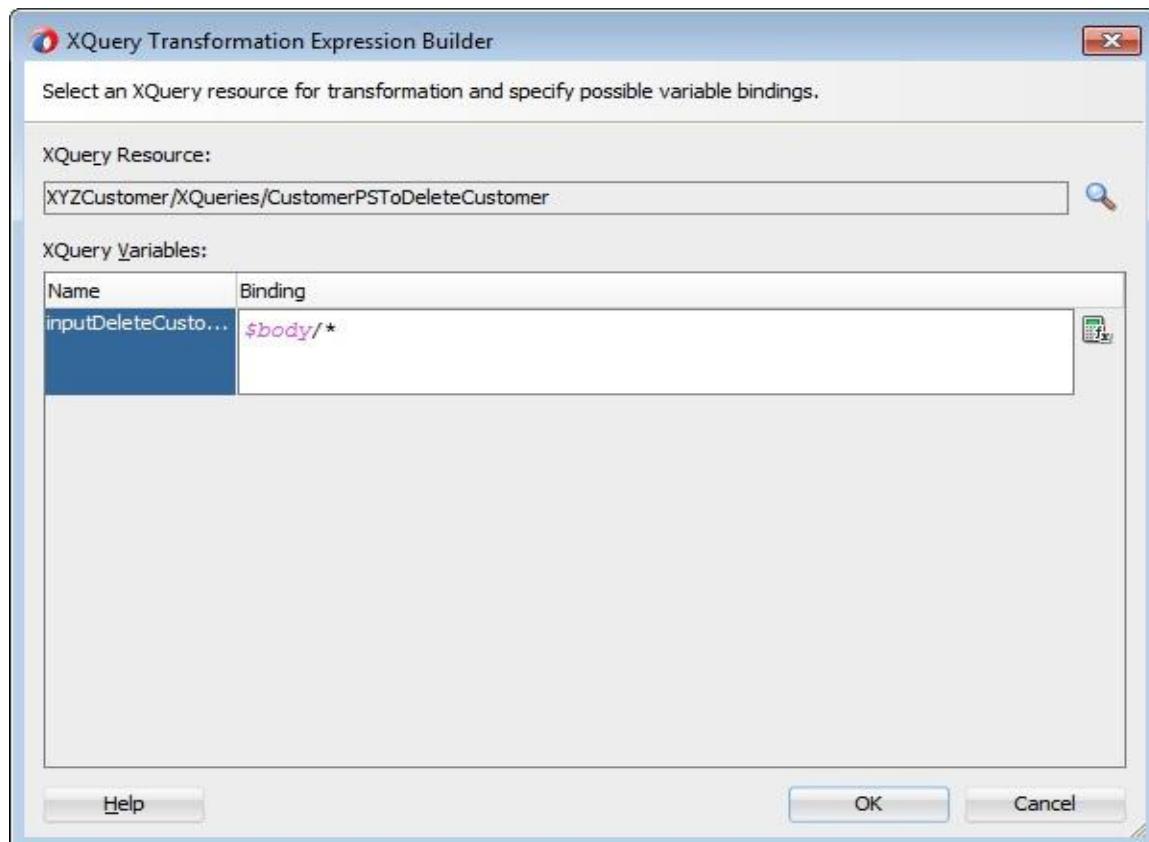


Drag **Replace** activity into **Request Action** of Routing from **Message Processing**. In **Properties tab**, bring up expression builder for **Value** property and choose above XQuery map.

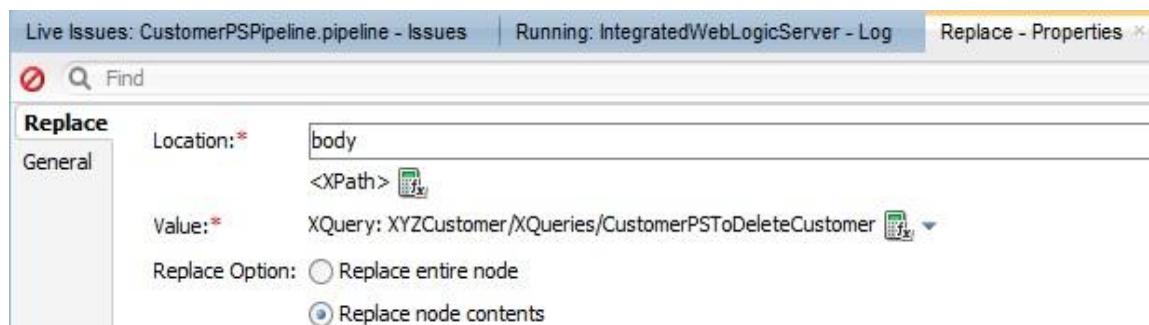




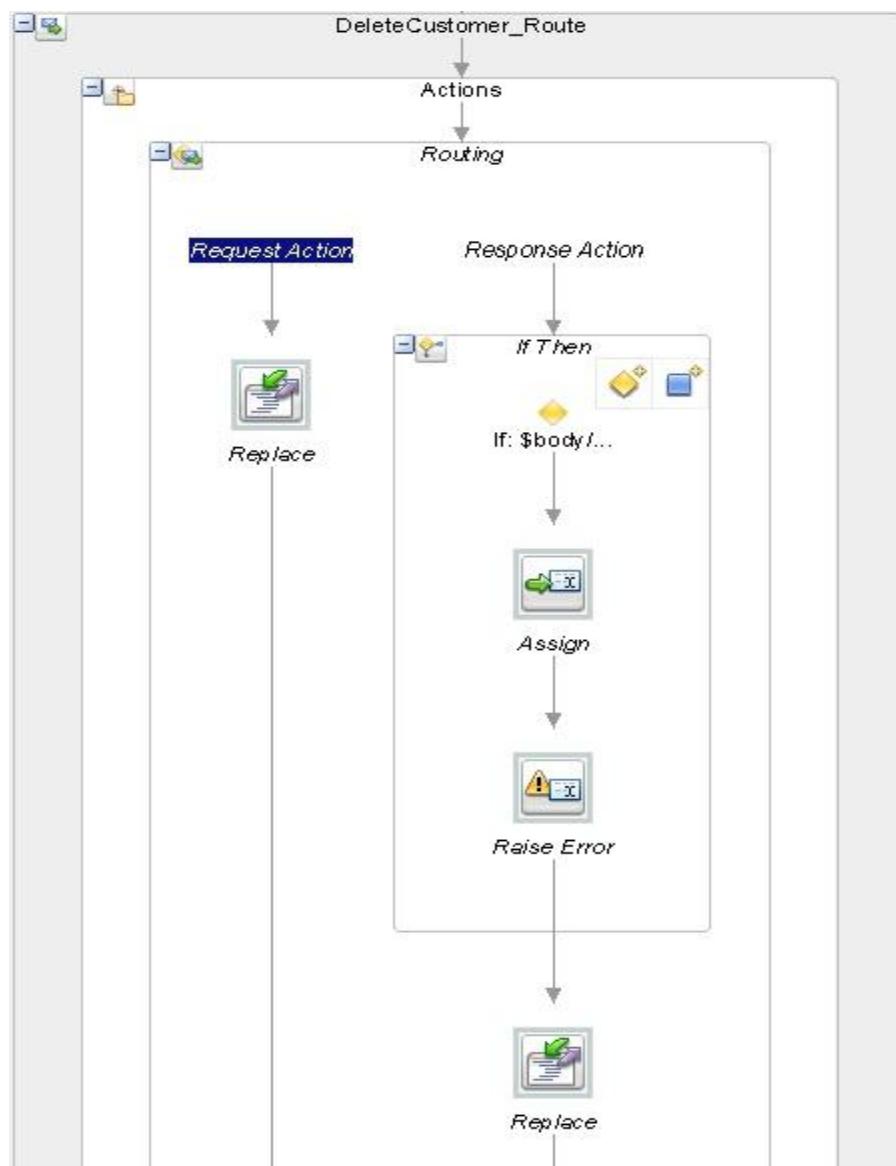
Click **OK** and give bind variable value as **\$body/***.



Set other properties as shown below.



Finish **Response Action** in **Routing** similar to **CreateCustomer** as response structure of business service is same for all the operations. So you can reuse **CustStatusMsgToCustomerPSOutput XQuery Map**. Now your **Routing** node should look like below.



Testing

Deploy both projects or run **Pipeline** directly as shown in **Deploying and Testing** section. You may want to frequently test your proxy service/pipeline during development. Run your pipeline with sample payloads given [here](#) and observe **Flow Trace and Variables** as shown below. You can also run Proxy Service but you will not observe any **Flow Trace**.

No CustomerID element:

 Response Document

⚠ The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>soapenv:Server</faultcode>
      <faultstring>
        OSB-382505: OSB Validate action failed validation
      </faultstring>
      <detail>
        <con:fault xmlns:con="http://www.bea.com/wli/sb/context">
          <con:errorCode>OSB-382505</con:errorCode>
          <con:reason>OSB Validate action failed validation</con:reason>
          <con:details>
            <con1:ValidationFailureDetail xmlns:con1="http://www.bea.com/wli/sb/stages/transform/config">
              <con1:message>
                Expected element 'CustomerID' before the end of the content in element CustomerIDInput@http://xmlns.xyzbank.com/schema/Customer
              </con1:message>
              <con1:xmlLocation>
                <cus:CustomerIDInput xmlns:cus="http://xmlns.xyzbank.com/schema/Customer">
                  </cus:CustomerIDInput>
                </con1:xmlLocation>
              </con1:ValidationFailureDetail>
            </con:details>
            <con:location>
              <con:node>DeletePipeline</con:node>
              <con:pipeline>
                request-N3f57c7ff.N4e34e601.0.147d5484396.N7ee7
              </con:pipeline>
              <con:stage>DeletePipeline</con:stage>
              <con:path>request-pipeline</con:path>
            </con:location>
          </con:fault>
        </detail>
      </soapenv:Fault>
    </soapenv:Body>
  </soapenv:Envelope>
```

No value for CustomerID:

 Response Document

⚠ The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>soapenv:Server</faultcode>
      <faultstring>
        XYZ-0005: CustomerID is mandatory for Delete.
      </faultstring>
      <detail>
        <con:fault xmlns:con="http://www.bea.com/wli/sb/context">
          <con:errorCode>XYZ-0005</con:errorCode>
          <con:reason>CustomerID is mandatory for Delete.</con:reason>
          <con:location>
            <con:node>DeleteCustomer_PipelinePair</con:node>
            <con:pipeline>
              DeleteCustomer_request-N3f57c7ff.155d987b.0.148031976cd.N7ffd
            </con:pipeline>
            <con:stage>Validation</con:stage>
            <con:path>request-pipeline</con:path>
          </con:location>
        </con:fault>
      </detail>
    </soapenv:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

Positive Case:

```
+ (receiving request)
CustomerOperation
DeletePipeline
Validation
DeleteCustomerRoute
Routed Service
  Route to: "CustomerServiceBS"
    $outbound:
      $body (request):
        <soapenv:Body xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
          <urn:customerid_input xmlns:urn="urn:xyzbank:cust:schema:customer">
            <customer_id>AHHHHH8787QDJHJH299</customer_id>
          </urn:customerid_input>
        </soapenv:Body>
      $header (request):
      $attachments (request):
Message Context Changes
  + added $outbound
  △ changed $body
    <soapenv:Body xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:urn="urn:xyzbank:cust:schema:customer">
      <cus:StatusMsg xmlns:cus="http://xmlns.xyzbank.com/schema/Customer">
        <CustomerID>AHHHHH8787QDJHJH299</CustomerID>
        <status>S</status>
      </cus:StatusMsg>
    </soapenv:Body>
  △ changed $attachments
  △ changed $inbound
  △ changed $header
DeletePipeline
CustomerOperation
```

Negative Case - Status E in business service response:

Invocation Trace

```
+ (receiving request)
CustomerOperation
DeletePipeline
DeletePipeline
DeleteCustomerRoute
Routed Service
  Route to: "CustomerServiceBS"
Message Context Changes
  + added $faultVar
    <urn:status_msg xmlns:urn="urn:xyzbank:cust:schema:customer" xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
      <customer_id>AHHHHH8787QDJHJH299</customer_id>
      <status>E</status>
      <error_message>Error in deleting customer.</error_message>
    </urn:status_msg>
  + added $outbound
  △ changed $body
    <soapenv:Body xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:urn="urn:xyzbank:cust:schema:customer">
      <urn:status_msg>
        <customer_id>AHHHHH8787QDJHJH299</customer_id>
        <status>E</status>
        <error_message>Error in deleting customer.</error_message>
      </urn:status_msg>
    </soapenv:Body>
  △ changed $attachments
  △ changed $inbound
  △ changed $header
```

Response Document

 The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>soapenv:Server</faultcode>
      <faultstring>XYZ-0004: Error in Customer Deletion.</faultstring>
      <detail>
        <con:fault xmlns:con="http://www.bea.com/wli/sb/context">
          <con:errorCode>XYZ-0004</con:errorCode>
          <con:reason>Error in Customer Deletion.</con:reason>
          <con:location>
            <con:node>DeleteCustomerRoute</con:node>
            <con:path>response-pipeline</con:path>
          </con:location>
        </con:fault>
      </detail>
    </soapenv:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

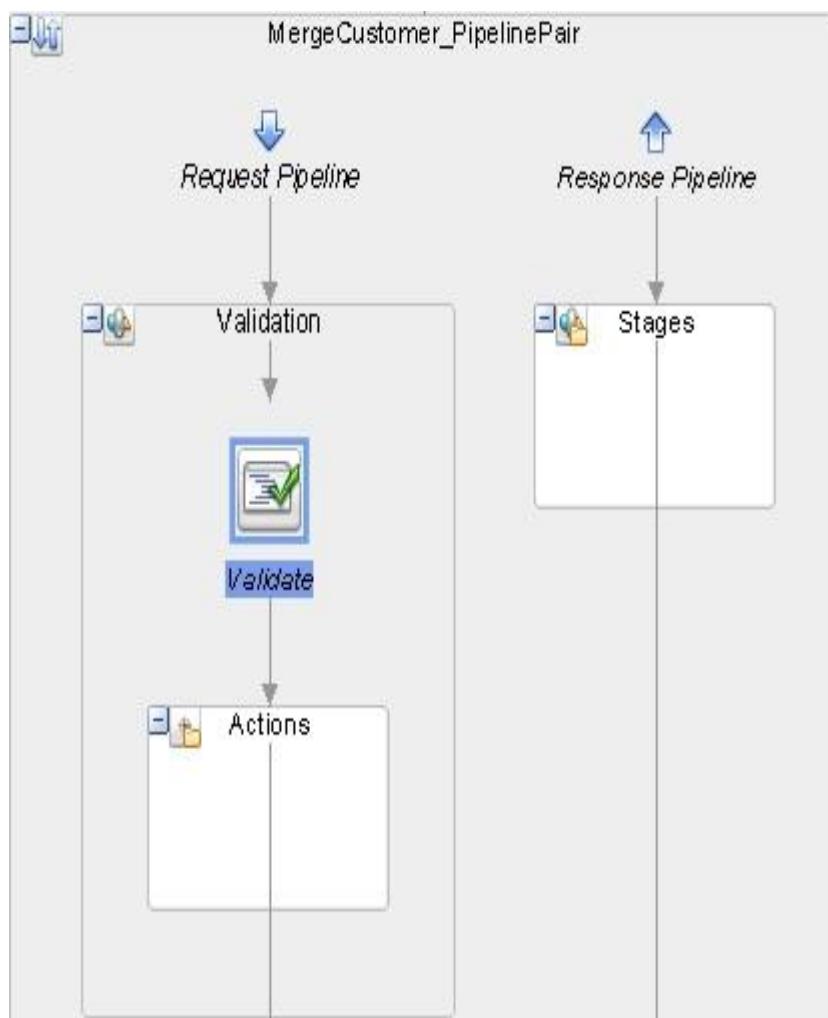
Merge Customer

In this section, you will complete message flow for **MergeCustomer** operation. As per business requirements, merge operation should create customer if it does not exist in system otherwise update existing customer. So you should reuse the existing message flow created for **Create** and **Update** customer operations. The message flow should perform following:

- Call **find_customer** operation of business service to find whether customer exists or not. This operation returns **Y** for existing customer and **N** otherwise.
- Create a new pipeline **CustomerCmnPipeline** using same wsdl as **CustomerPS**.
- Move **CreateCustomer** and **UpdateCustomer** message flows into this new pipeline.
- Modify **CreateCustomer** and **UpdateCustomer** pipelines to call respective operations of new pipeline.
- Modify **MergeCustomer** operational branch to call **CreateCustomer** or **UpdateCustomer** operations of new pipeline based on customer existence.

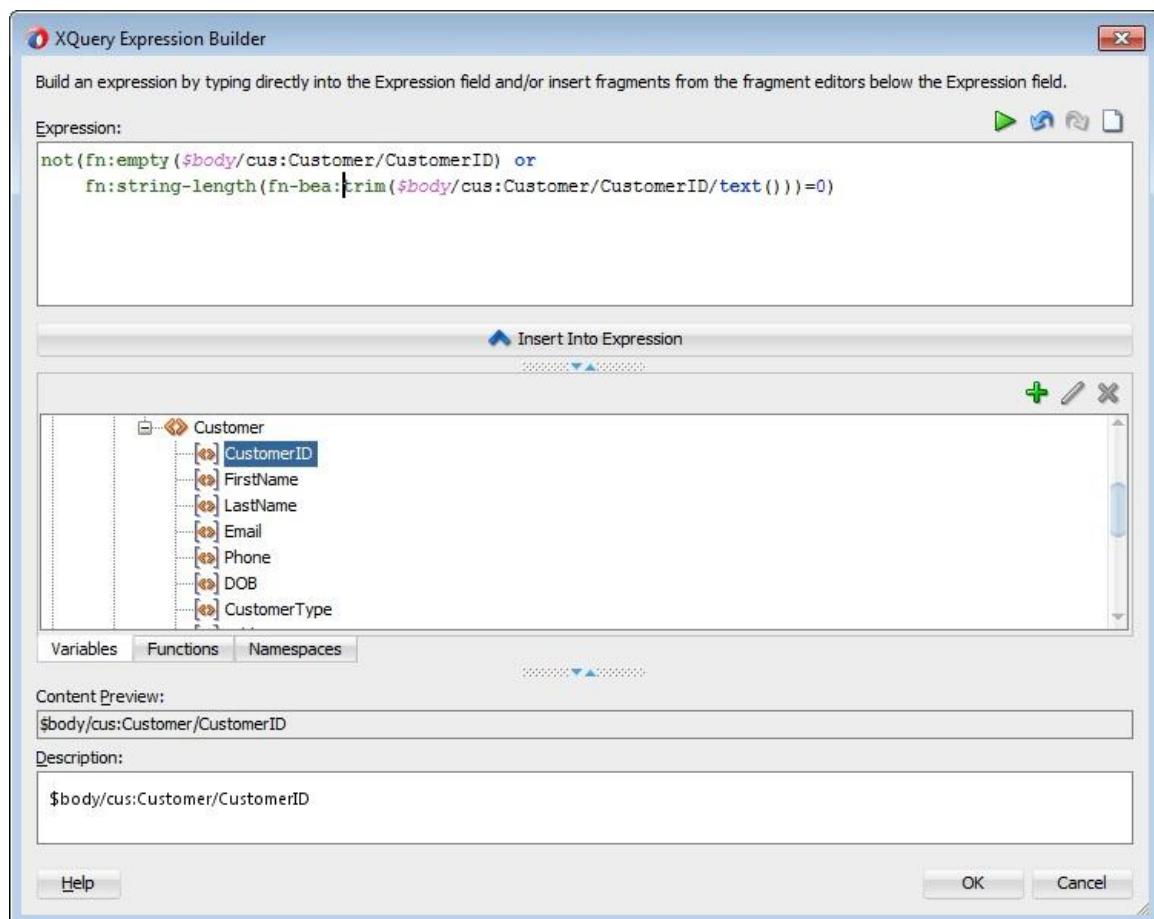
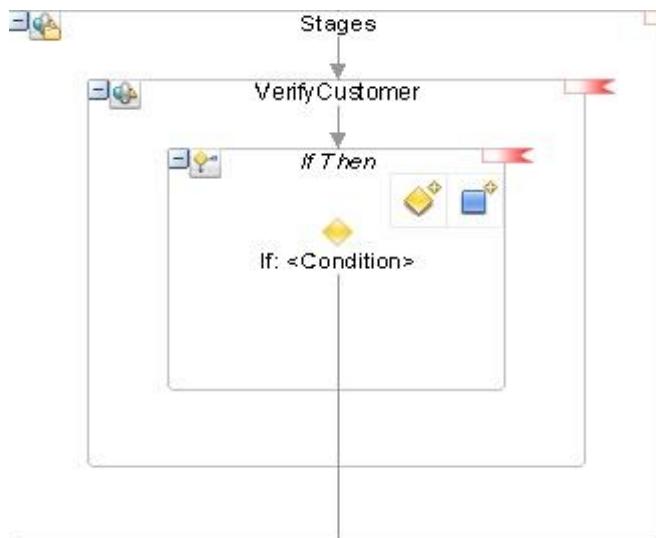
Validating Payload

Finish **Validation** stage in **MergeCustomer** operational branch similar to **CreateCustomer** for validating **Payload Structure** using **Validate** activity. But you should select **Customer** element from **\$body/MergeCustomer** in expression builder for **Location** property.

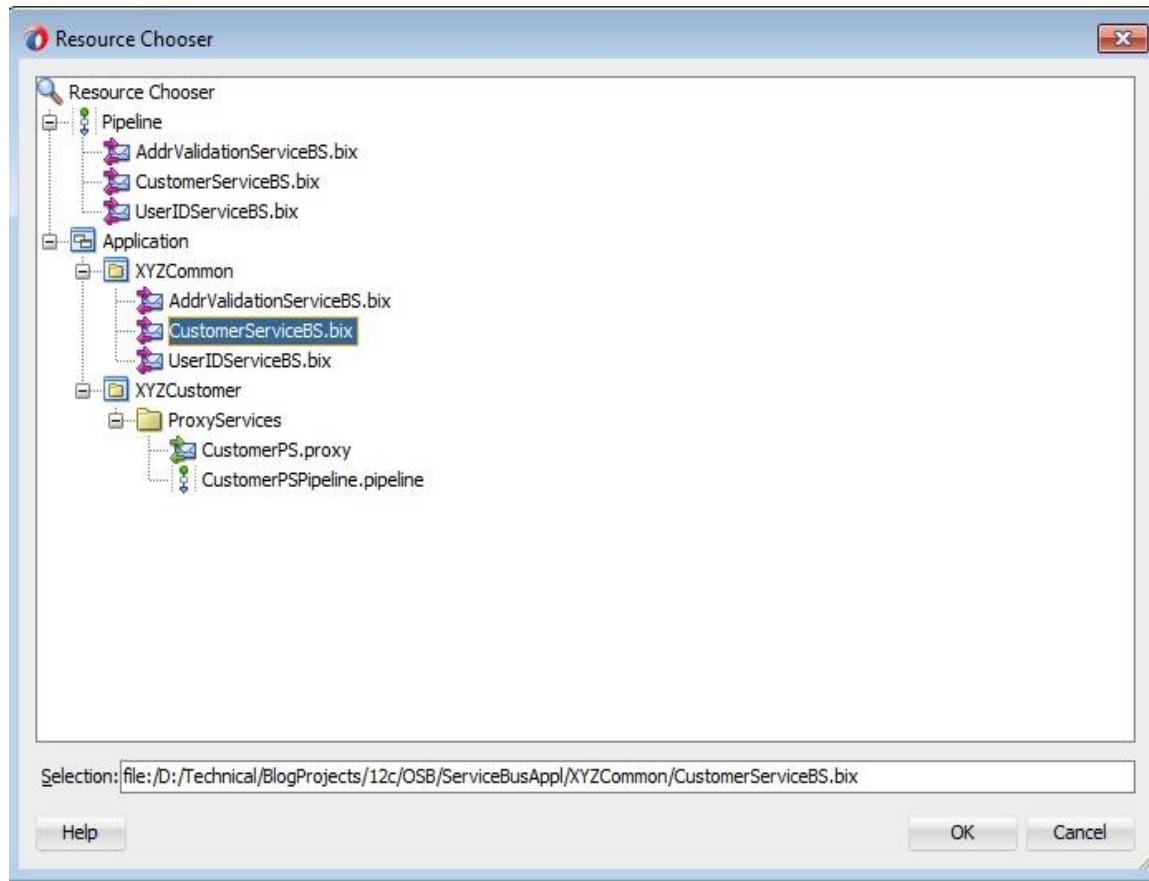


Verifying Customer Existence

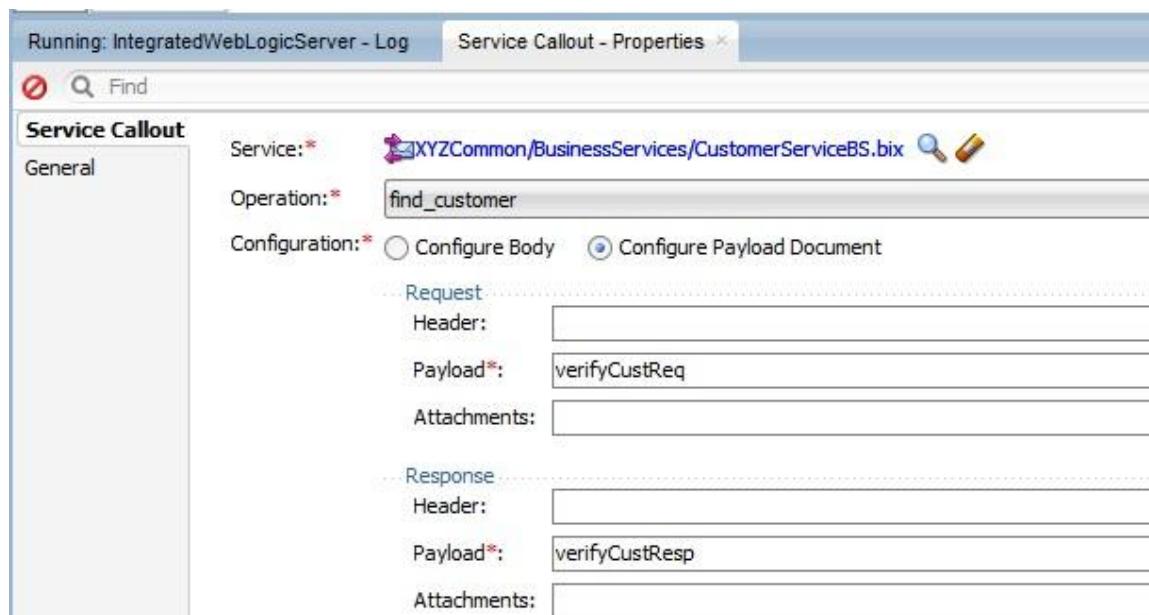
Drag **stage** node into **Stages** placeholder in **Request Pipeline** of **MergeCustomer_PipelinePair** from **Nodes** and name it as **VerifyCustomer**. You can verify customer existence only when **CustomerID** is present in input payload. So drag **If-Then** activity from **Flow Control** and set condition as shown below.



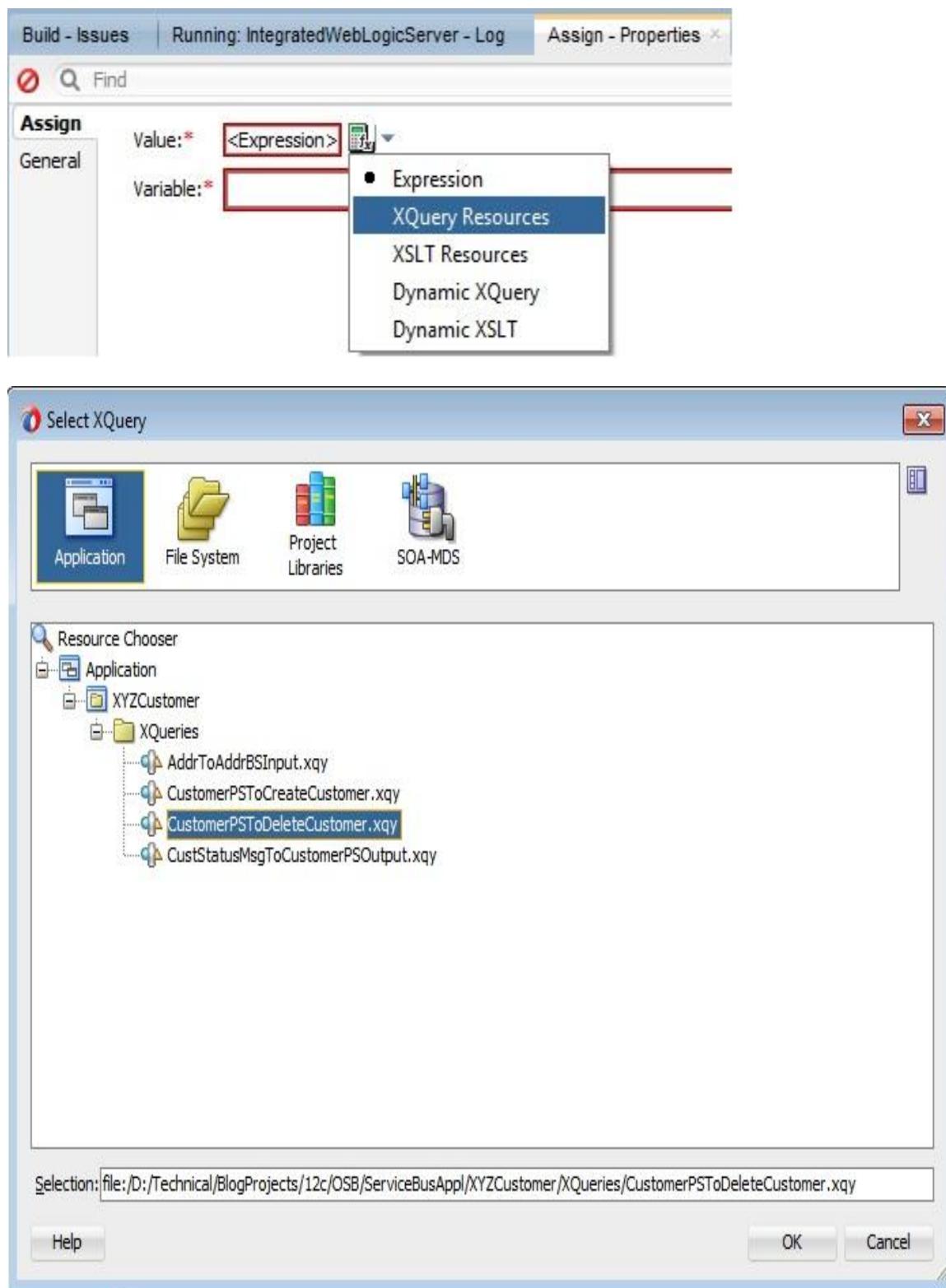
Drag a **Service Callout** into If branch from **Communication**. In **Properties** tab, browse and select business service **CustomerServiceBS** and **find_customer** as operation.



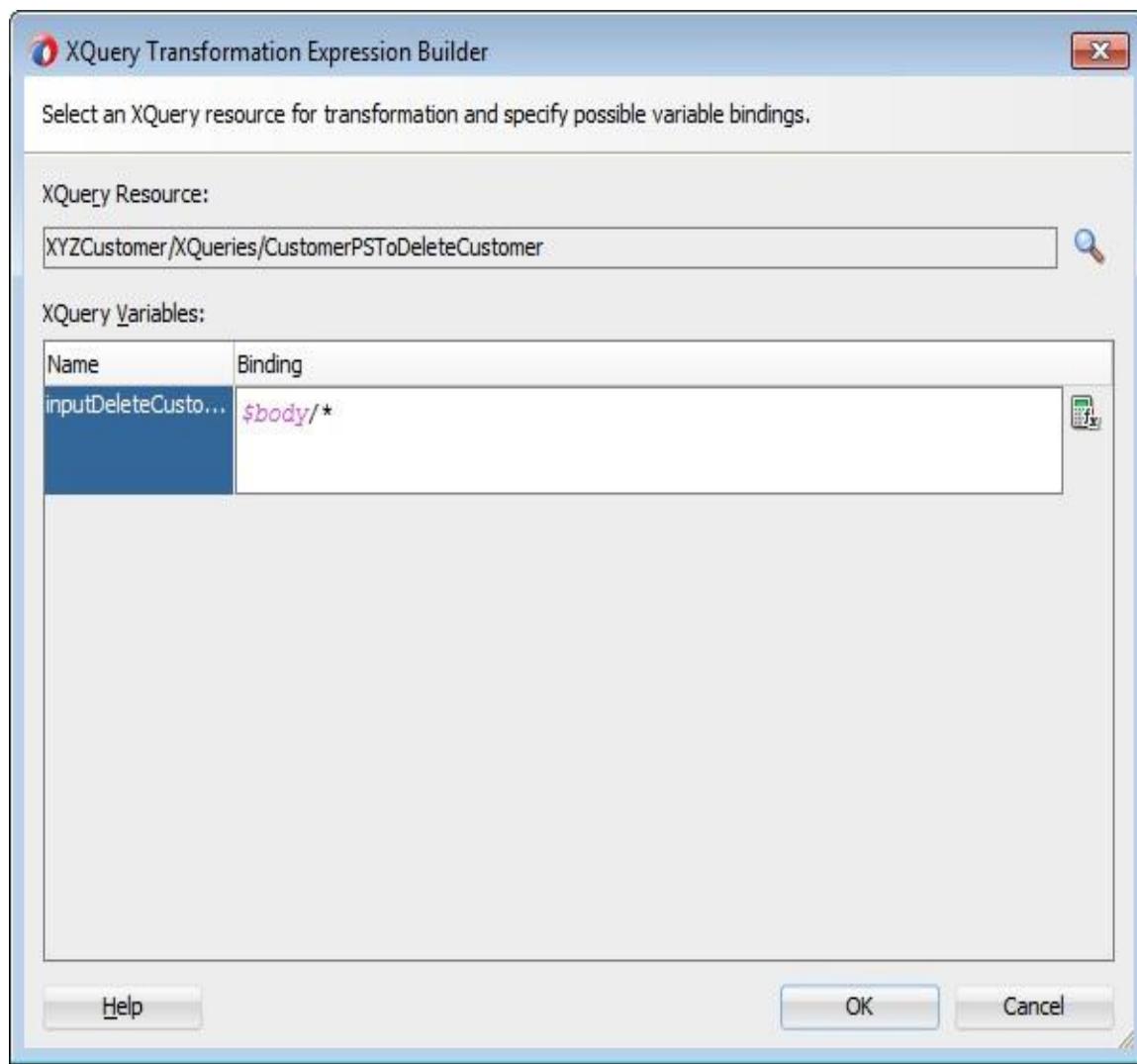
Set other properties as shown below and choose '**Configure Payload Document**' option.



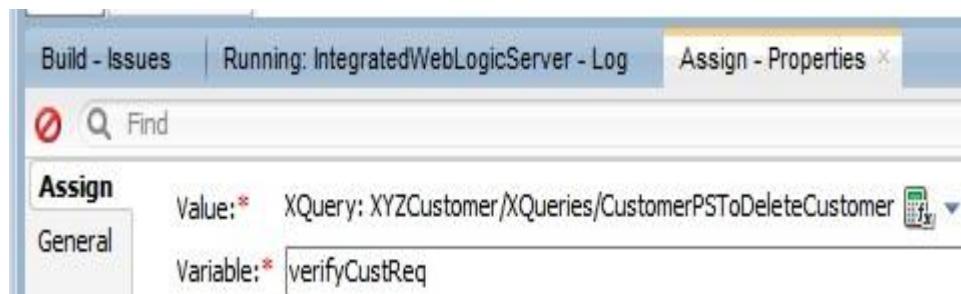
You can reuse XQuery map **CustomerPSToDeleteCustomer** as input structure of **Delete** and **Find** operations is same. So drag **Assign** activity into **Request Action** of **Service Callout** from **Message Processing** and select this XQuery map as shown below.



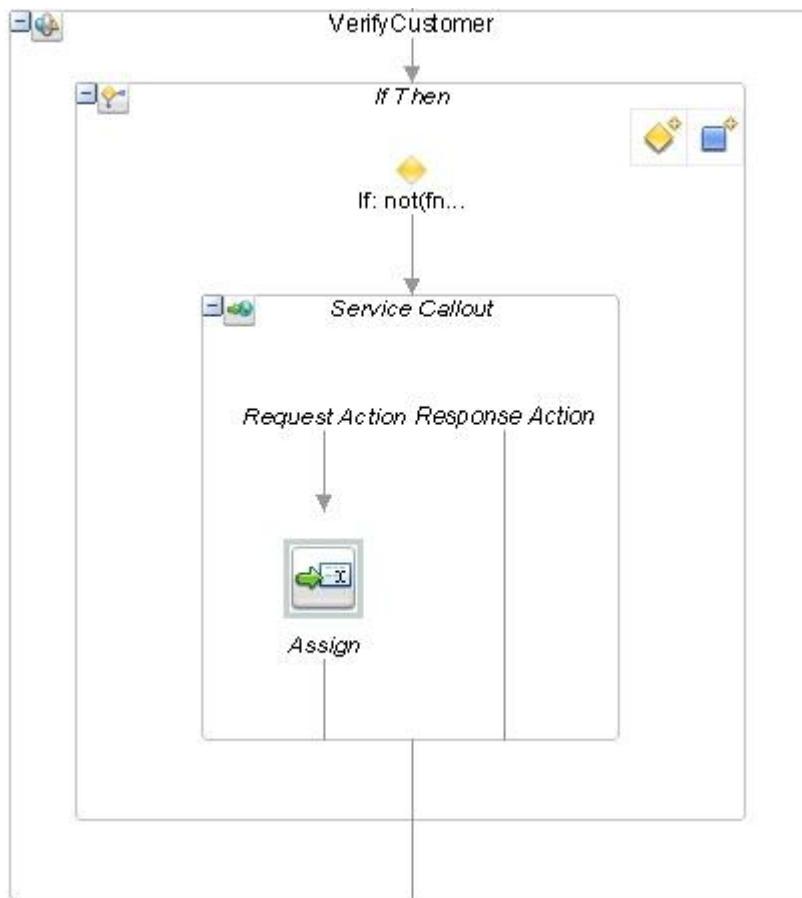
Give **\$body/*** as value for **Binding** as shown below.



Give **verifyCustReq** as value for Variable property.



Now your **VerifyCustomer** stage should look like below.

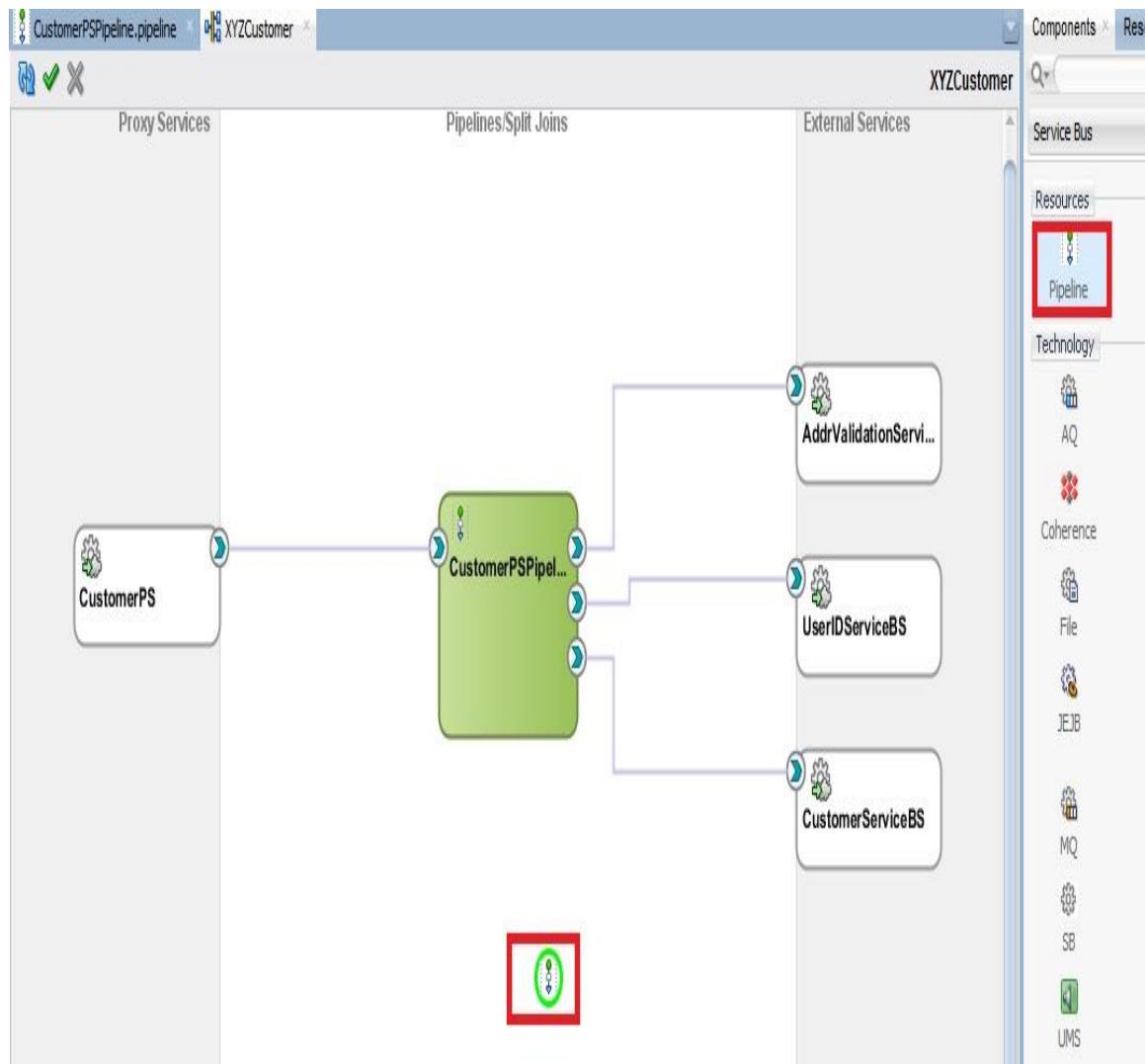


Creating CustomerCmnPipeline

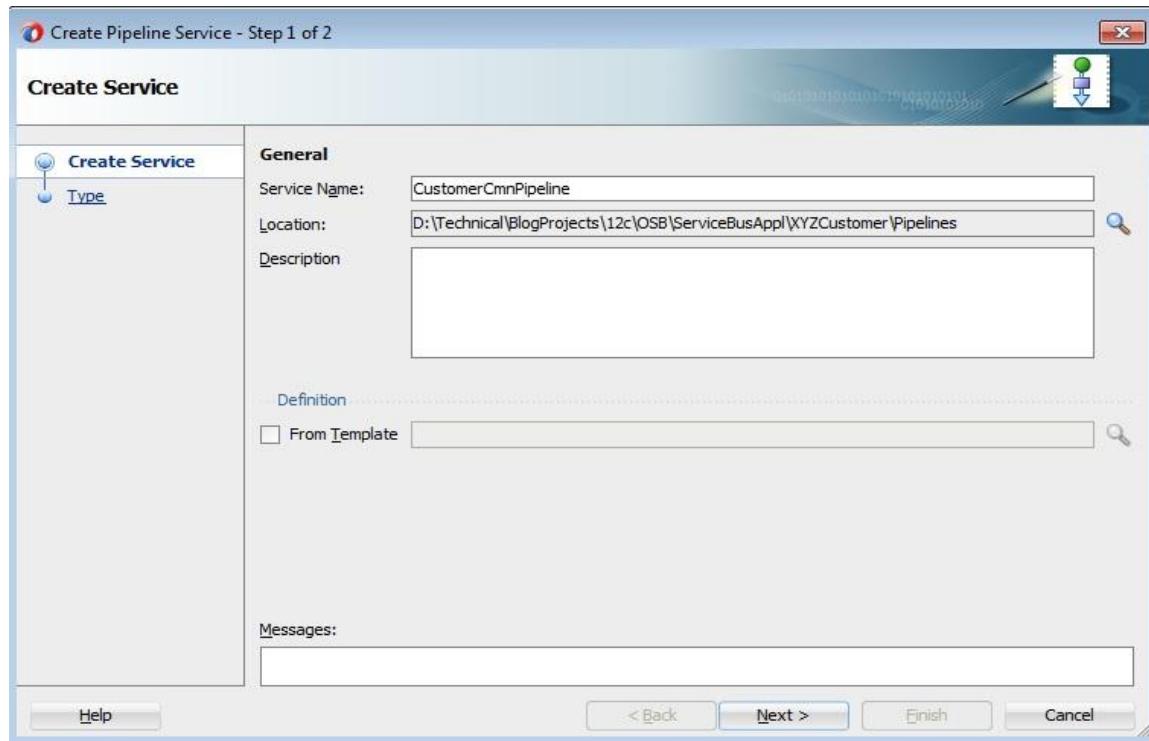
Depending on response of **find_customer** call in previous step, you have to **Create or Update** customer information. And you already completed these actions as part of **CreateCustomer** and **UpdateCustomer** operational branches. So it's not a good idea to repeat all of this logic again for this merge operation.

To overcome this, you can create a new Pipeline/Proxy Service having common logic for Create and Update. If your requirement is just within Service Bus project you can create Pipeline having common message flow and call from main Pipeline or ProxyService. If you require this across projects you can create Proxy Service having common message flow with **local** transport. This way, your common proxy service will not be exposed to external consumers and can only be invoked internally in message flow. In this section, you will create new pipeline having common message flow using **Service Bus Overview editor**.

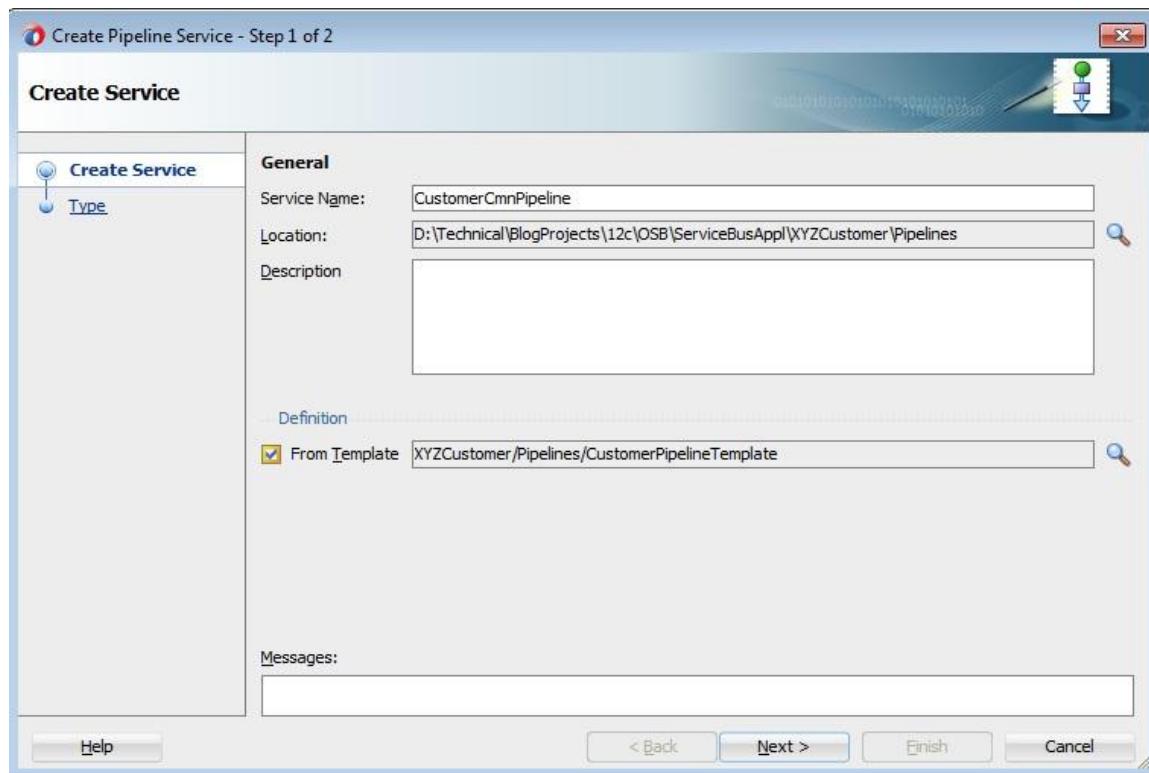
So open Service Bus Overview editor by opening file having same name as Service Bus project. Drag **Pipeline** from **Components -> Service Bus -> Resources** into middle swim lane as shown below.



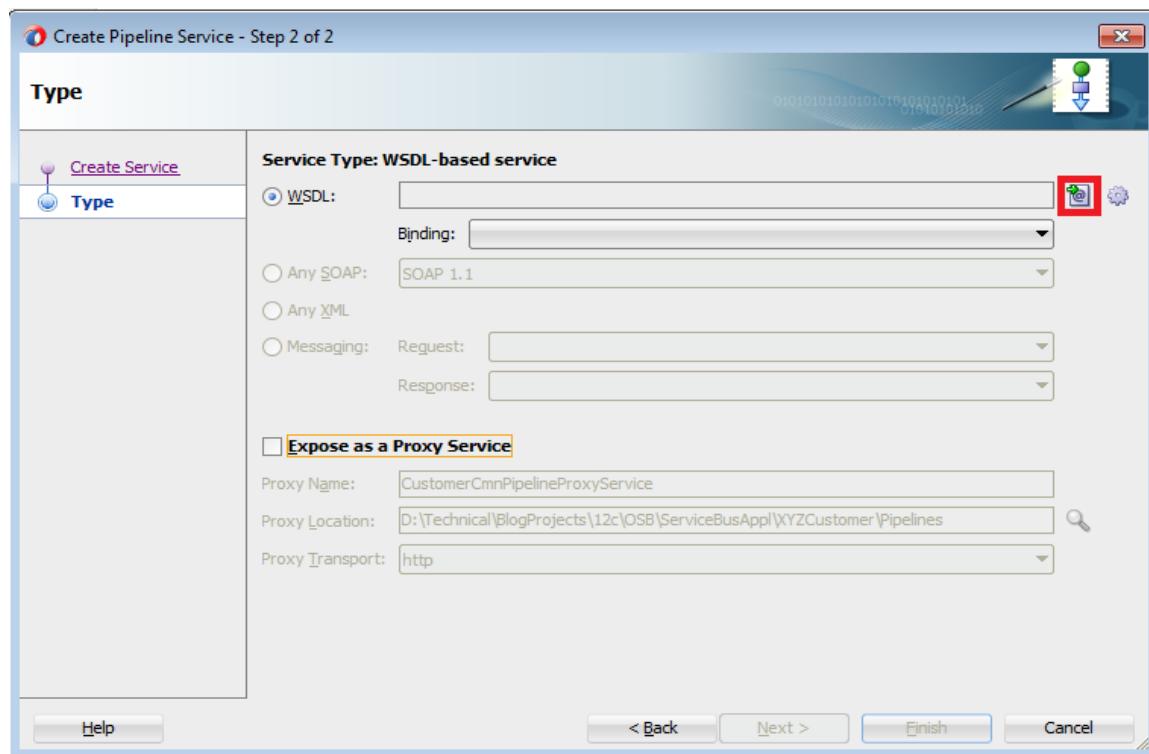
Give **Service Name** as **CustomerCmnPipeline** and select **Pipelines** folder using browse icon for **Location**.



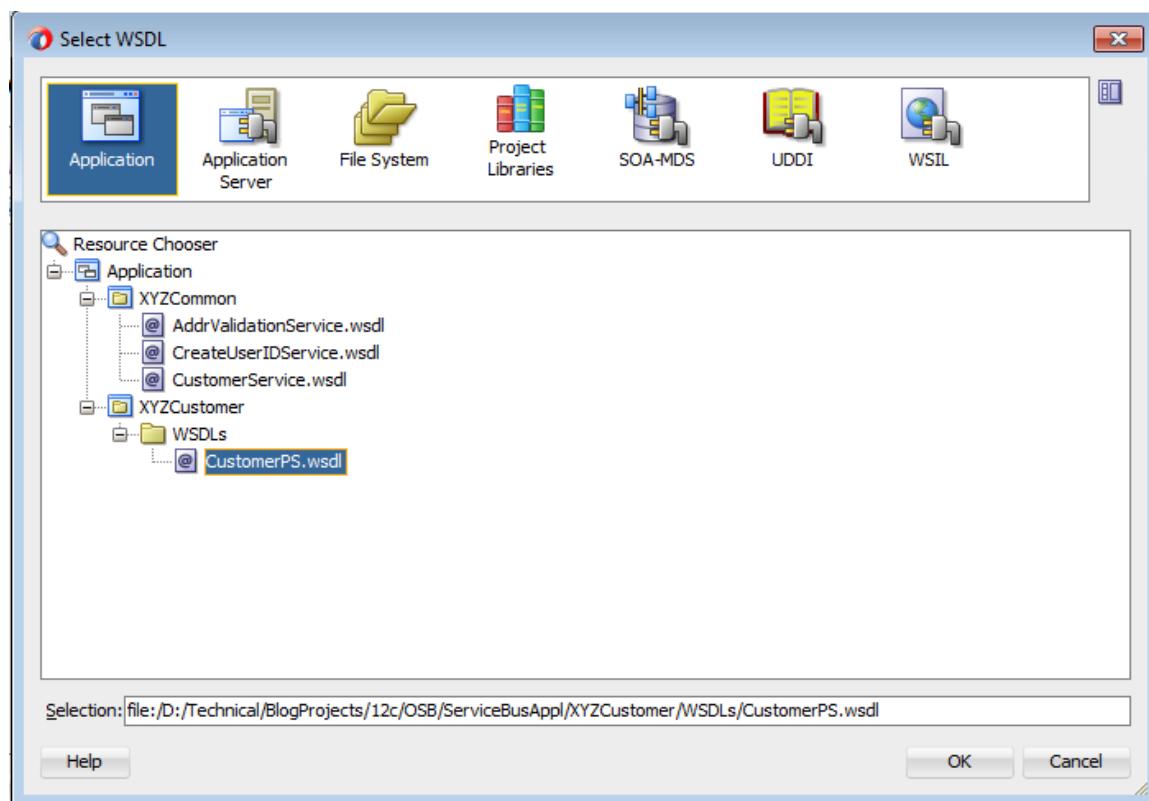
Choose the option **From Template** and select **CustomerPipelineTemplate** using browse icon.



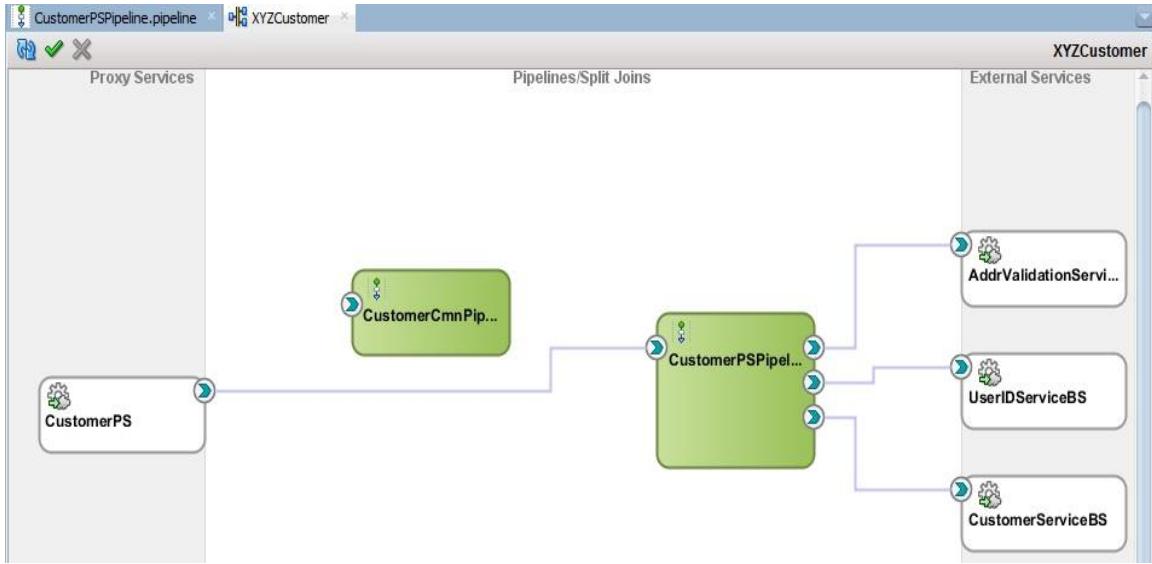
Click **Next**. Retain Service Type as **WSDL** and unselect the option **Expose as a Proxy Service**.



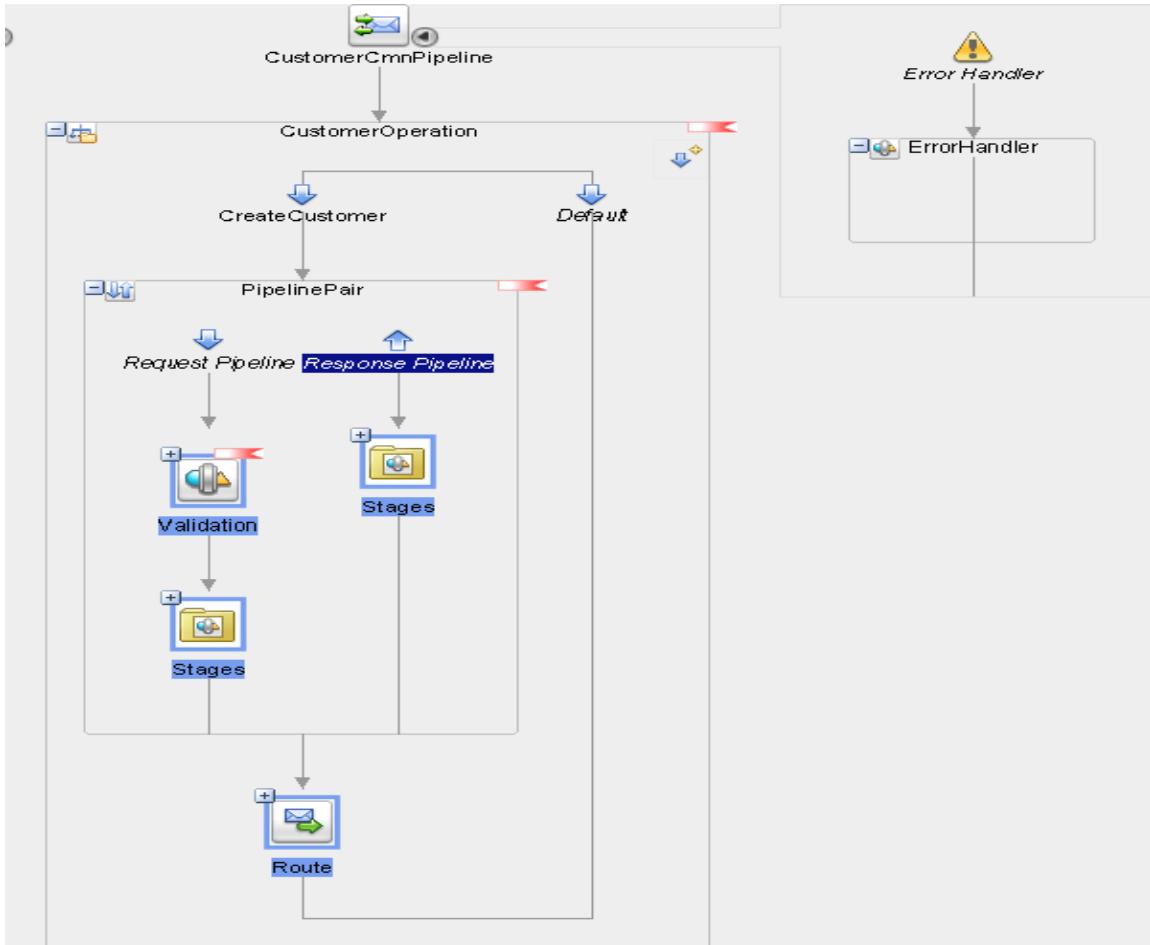
Click **Browse WSDLs** (highlighted above) and select same WSDL used for **CustomerPSPipeline**.



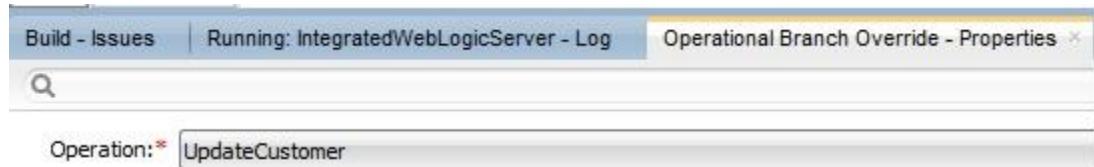
Go back to **Service Bus Overview editor** by finishing pipeline creation wizard and it should look like below. You can also verify new pipeline got created in **Pipelines** folder.



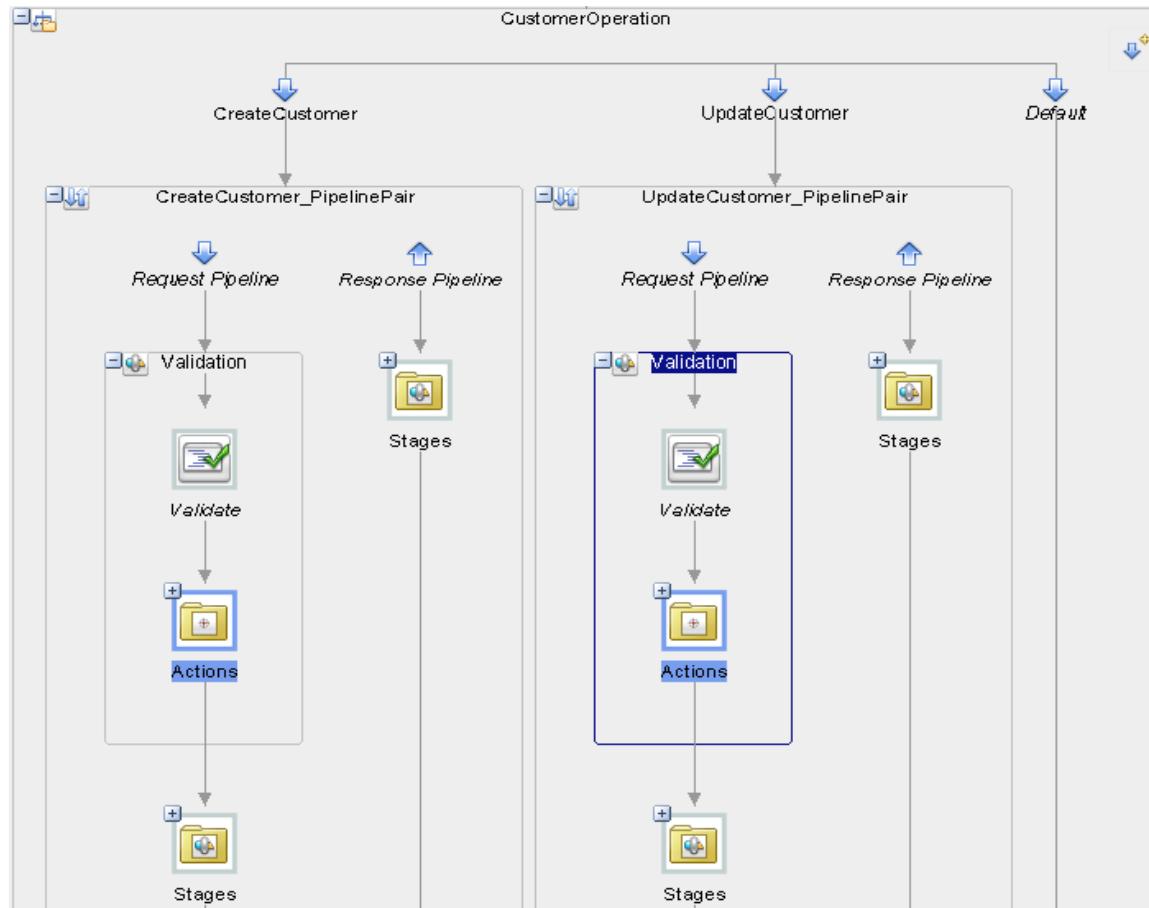
Verify that your new pipeline also inherited the activities from pipeline template as expected.



Add another operational branch and select operation as **UpdateCustomer** in **Properties** tab.



Finish **Validate** activity in both branches as shown previously in respective sections. This would resolve build issues and your message flow should look like below.



Next task is moving the activities from **CustomerPSPipeline** to here. Service Bus allows **Cut** and **Paste** options on activities so that you can move your activities across/within message flow. So move the following activities and nodes to their respective placeholders in this pipeline.

Create Customer:

Validation Stage - Actions placeholder contents

AddrValidation Stage

Defaulting Stage

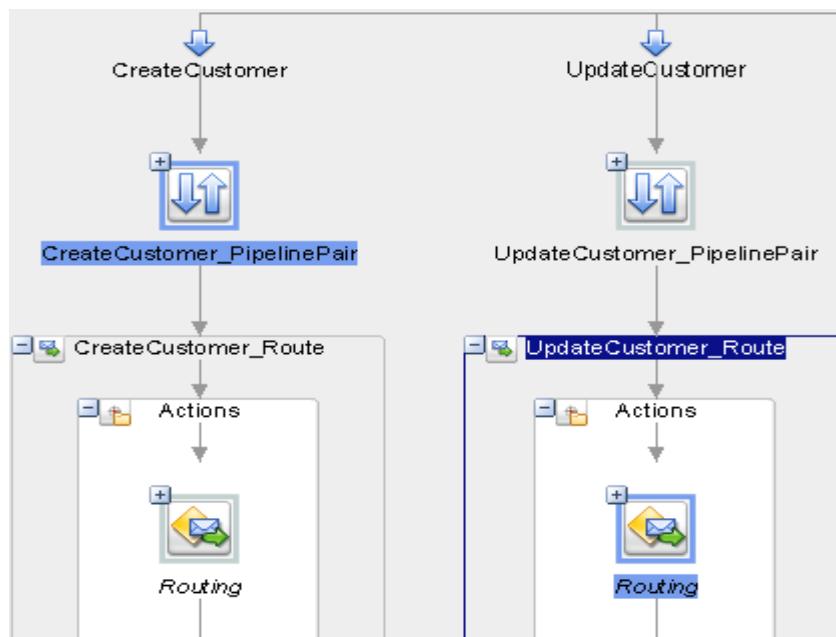
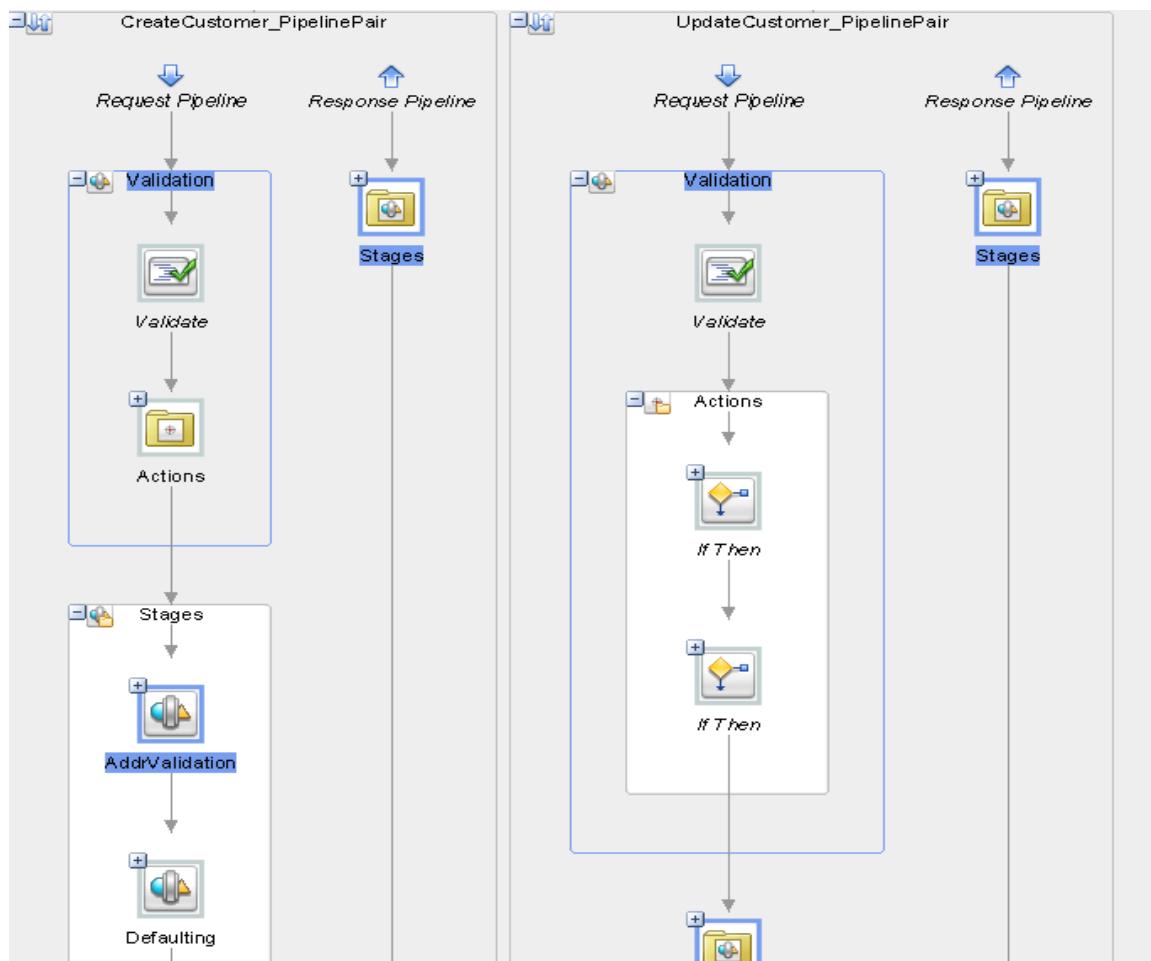
CreateCustomer_Route - Actions placeholder contents

Update Customer:

Validation Stage - Actions placeholder contents

UpdateCustomer_Route - Actions placeholder contents

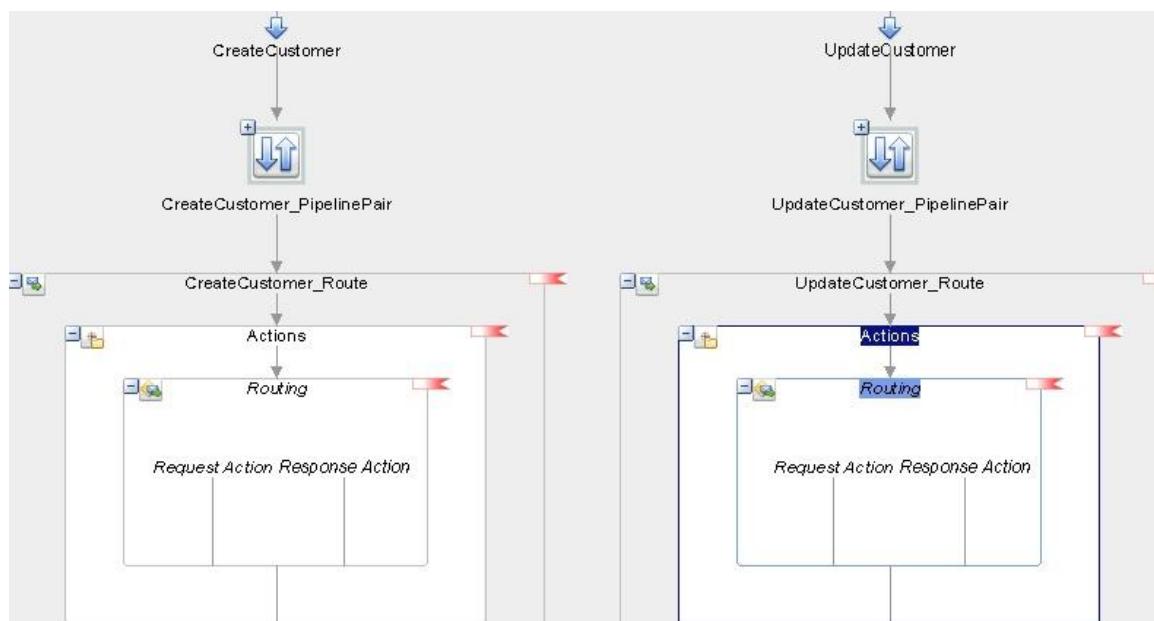
Now your message flow should look like below.



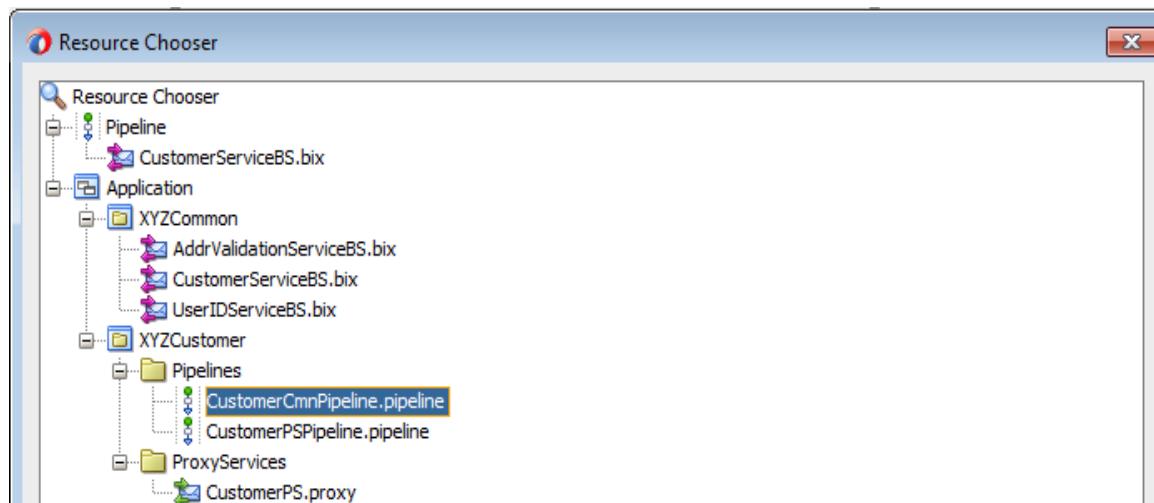
If you see redlines for **If** condition in **Response Action** of the routing activity, add namespace `urn:xyzbank:cust:schema:customer` with alias `cust` as shown in previous sections.

Also observe that, you are unable to copy any of the activities inherited from pipeline templates like **Validate** activity. Because of this, validation will happen twice in **CustomerPSPipeline** and in this pipeline. In your actual development, you should take care of this by creating new pipeline template for common pipelines or some other means. Here, we did this way to demonstrate the features of pipeline template like having common functionality in template.

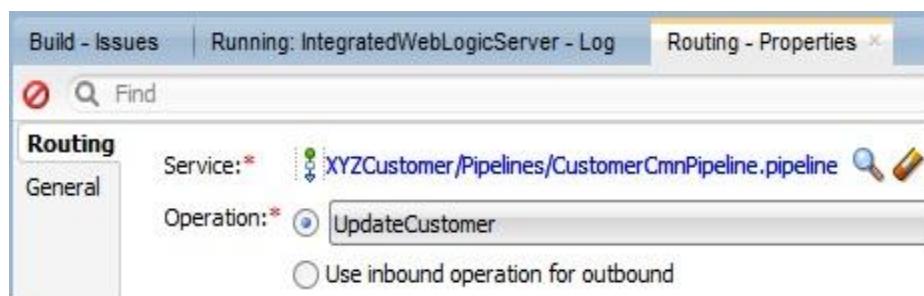
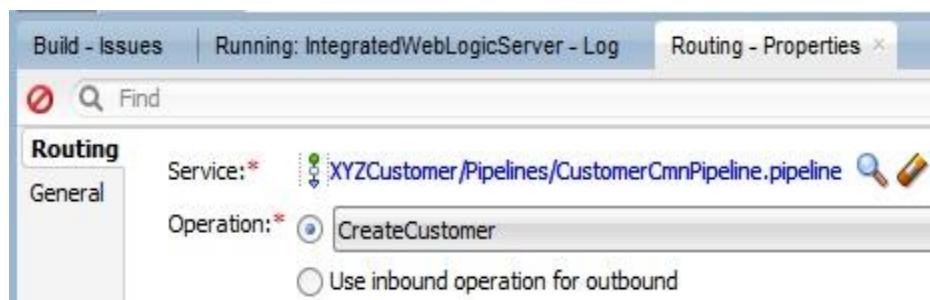
Now let us make changes in **CustomerPSPipeline** to call **CreateCustomer** and **UpdateCustomer** operations of **CustomerCmnPipeline**. Drag **Routing** activity into **Actions** placeholder in both **CreateCustomer_Route** and **UpdateCustomer_Route** as shown below.



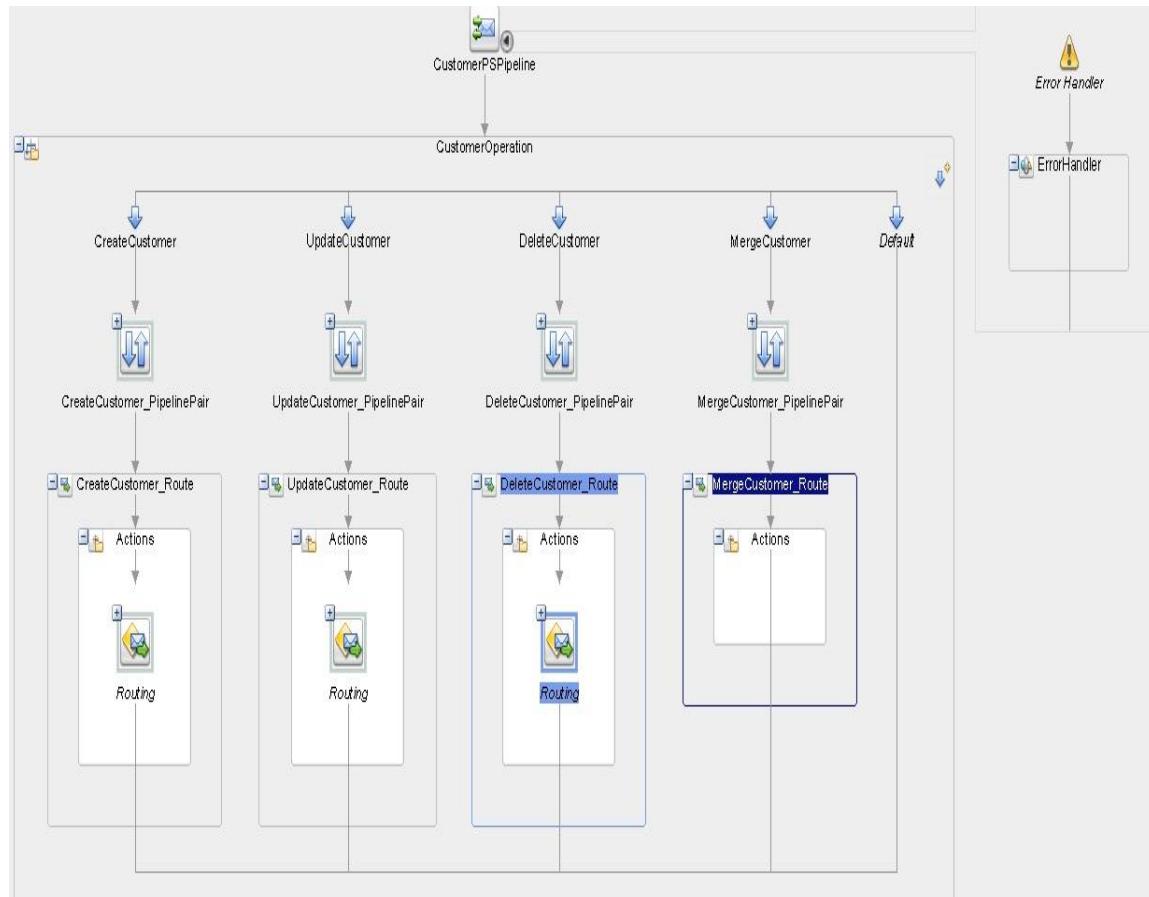
In **Properties** tab, browse and select pipeline **CustomerCmnPipeline** for **Service** property of both **Routing** activities.



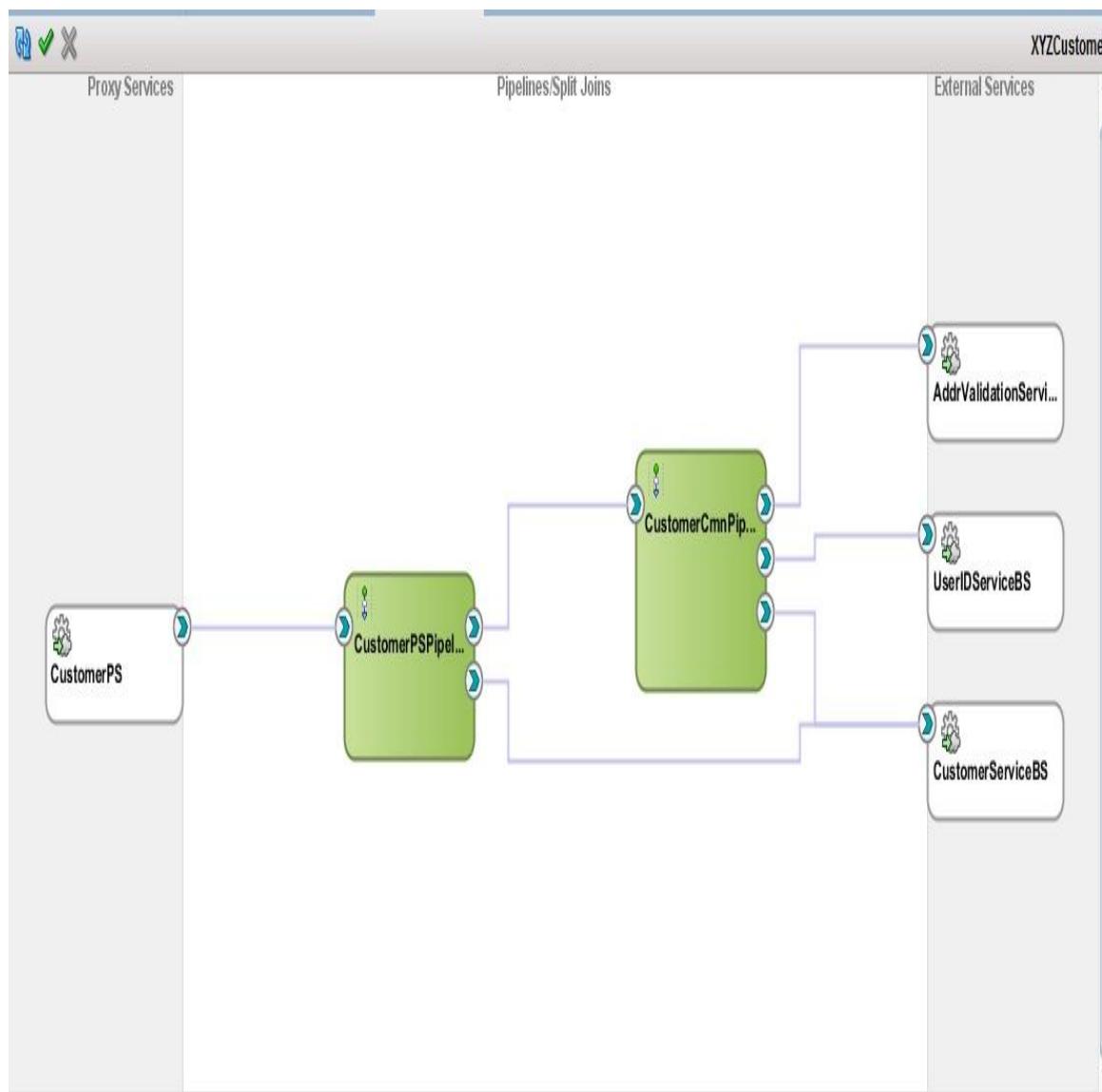
In **Properties** tab, select **operation** as **CreateCustomer** and **UpdateCustomer** respectively.



Now your **CustomerPSPipeline** message flow should look like below.



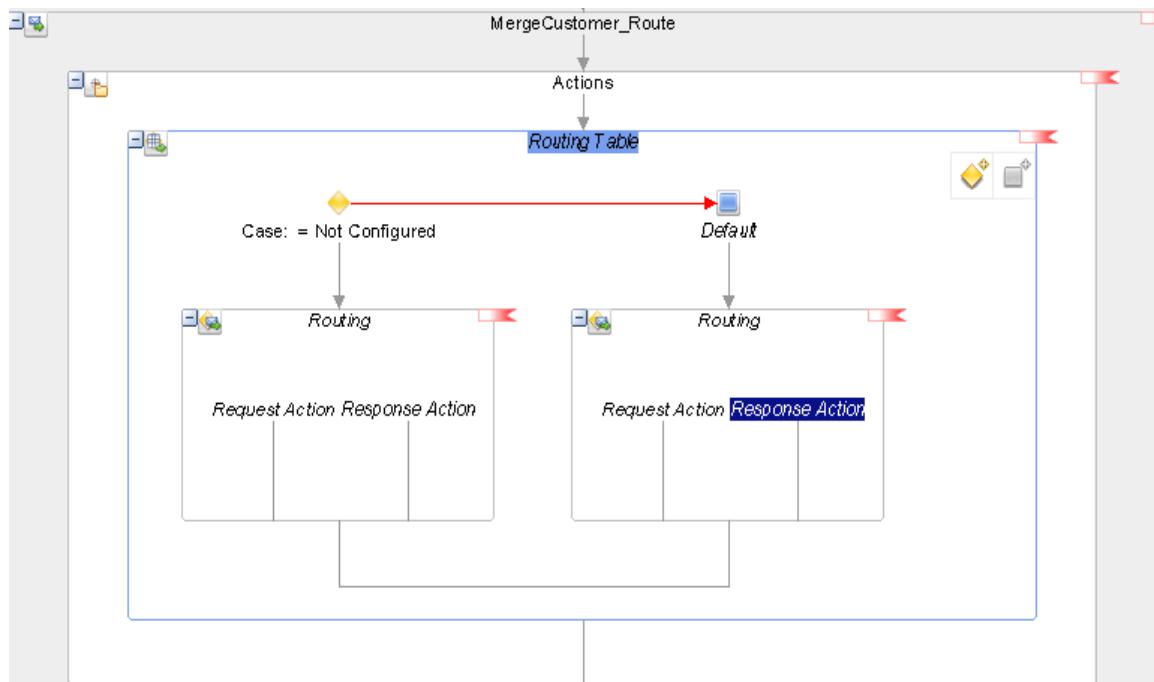
Also your service bus overview should look like as shown below showing different interactions and interfaces exposed to consumers.



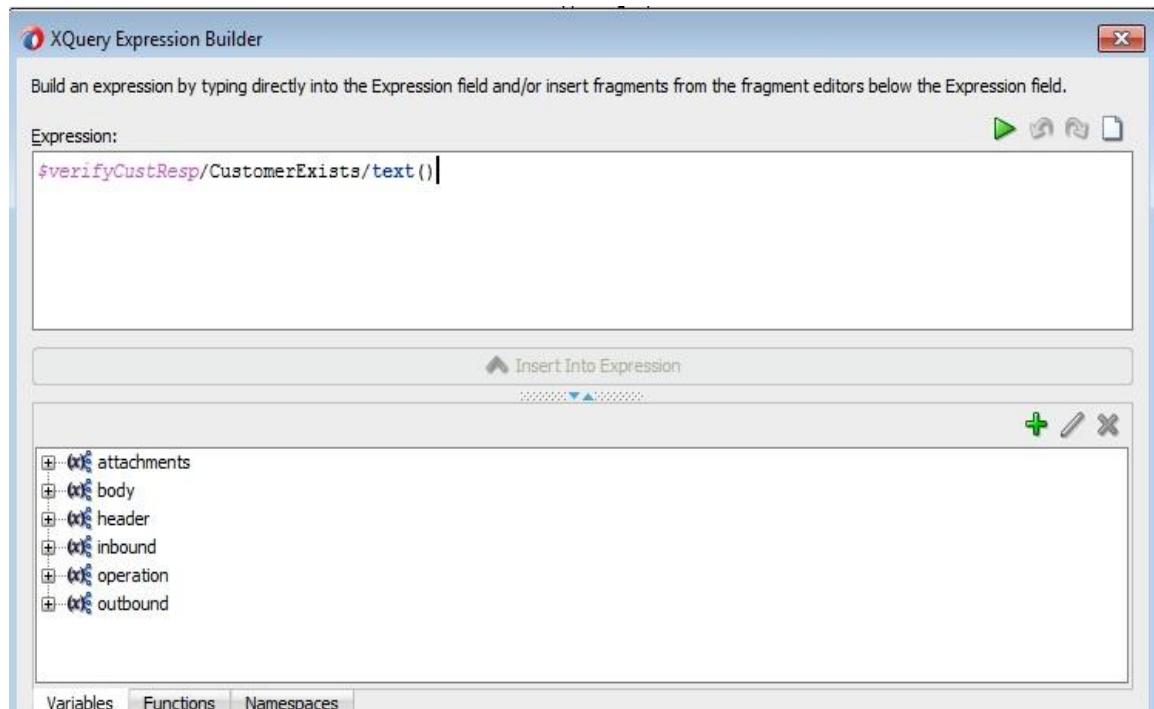
Routing

In this section, you will invoke **CustomerServiceBS** to finish message flow for **Merge Customer**.

Merge operation has 2 possible routings based on Customer existence. So drag **Routing Table** activity into **Actions** placeholder of **MergeCustomer_Route**.



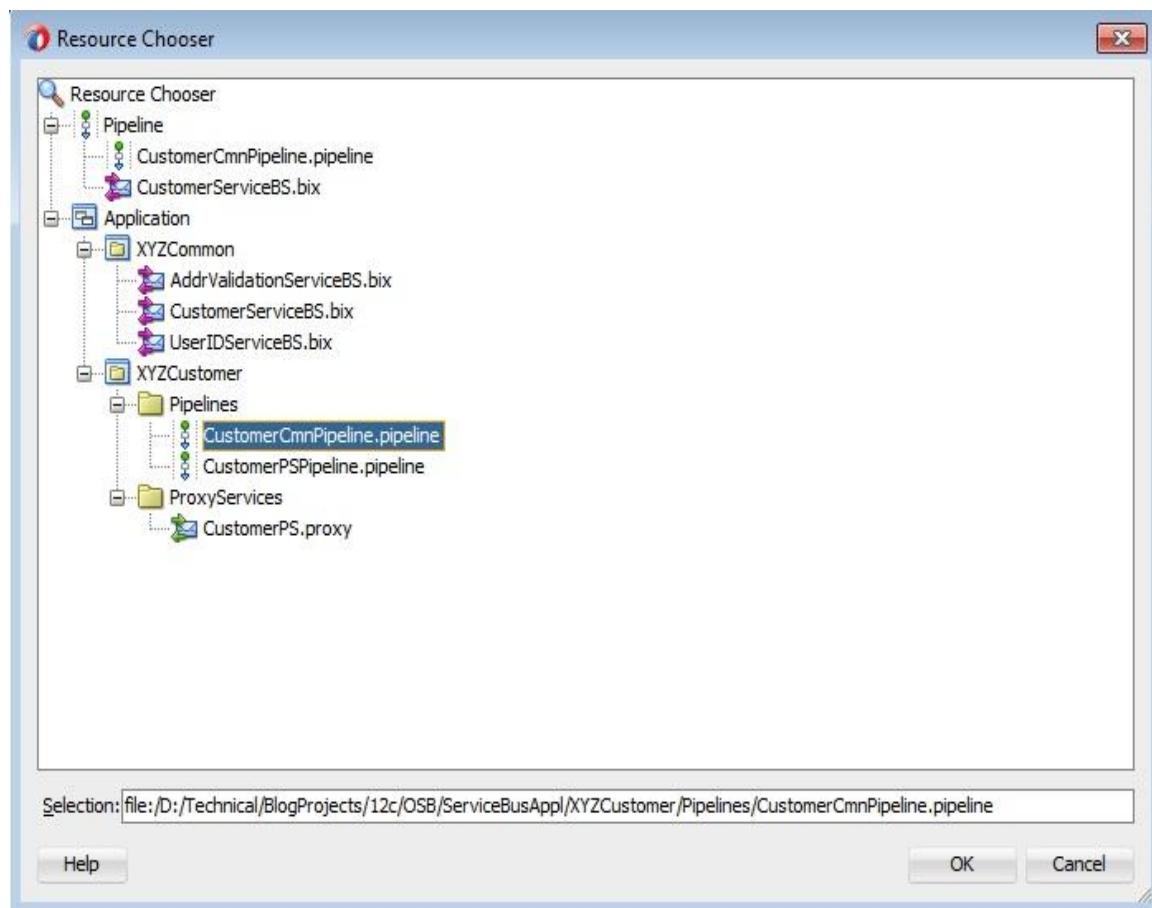
In **Properties** tab, set **Value** in expression builder as shown below to verify customer existence.



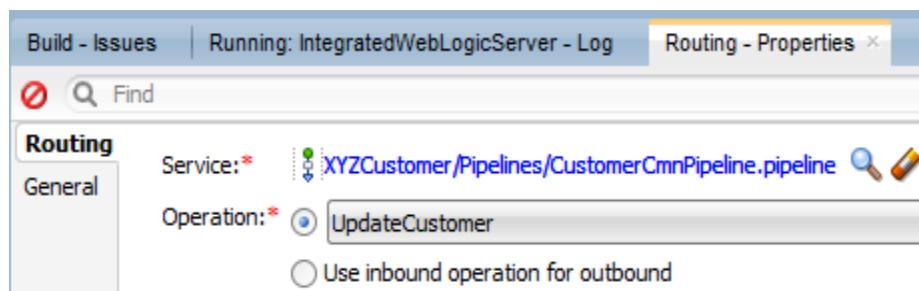
Click **Case** in **Routing Table** and set properties as shown below in **Properties** tab.

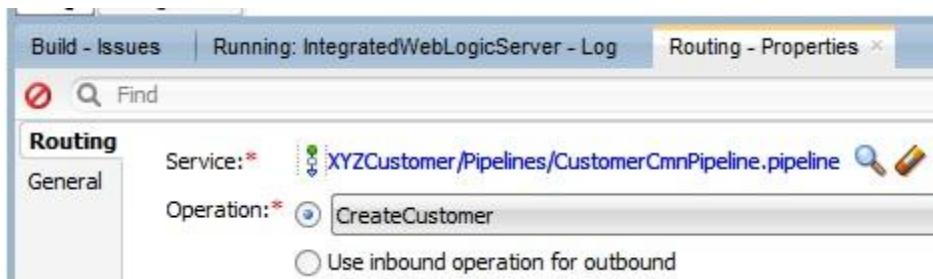


For both **Routings** in **Case** and **Default** branches, in **Properties** tab browse and select pipeline **CustomerCmnPipeline** for **Service** property.

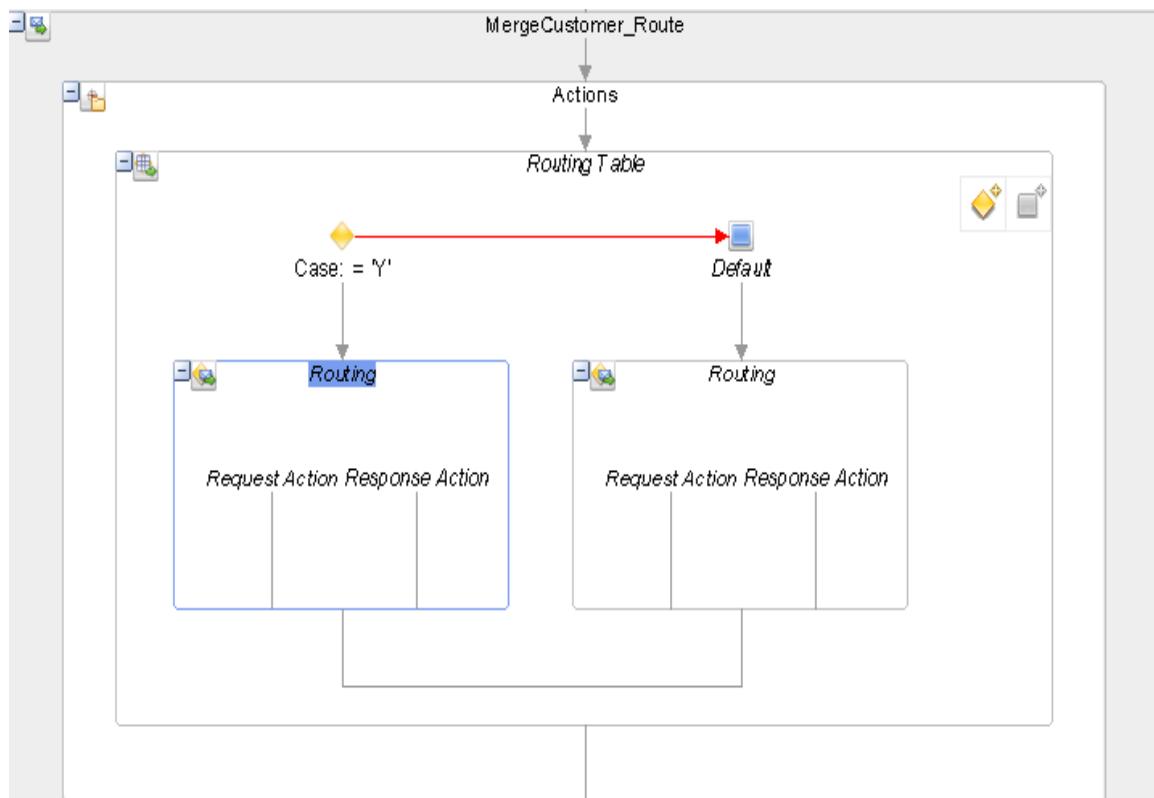


Now select operation as **UpdateCustomer** and **CreateCustomer** for **Case** and **Default** branches respectively as shown below.





Now your **Routing** node should look like as shown below.



Testing

Deploy both projects or run **Pipeline** directly as shown in **Deploying and Testing** section. You may want to frequently test your proxy service/pipeline during development. Run your pipeline with sample payloads given for **CreateCustomer** and **UpdateCustomer** operations and observe **Flow Trace and Variables** as shown below. You can also run Proxy Service but you will not observe any **Flow Trace**. You can always verify **outbound** context variable in **Flow Trace** to determine operation being called in **Routing/Service Callout**.

Invalid Customer Type:

 Response Document

The invocation resulted in an error:

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>soapenv:Server</faultcode>
      <faultstring>
        OSB-382505: OSB Validate action failed validation
      </faultstring>
      <detail>
        <con:fault xmlns:con="http://www.bea.com/wli/sb/context">
          <con:errorCode>OSB-382505</con:errorCode>
          <con:reason>OSB Validate action failed validation</con:reason>
          <con:details>
            <con1:ValidationFailureDetail xmlns:con1="http://www.bea.com/wli/sb/stages/transform/config">
              <con1:message>
                string value 'Invalid Cust Type' is not a valid enumeration value for type of CustomerType element in Customer in namespace http://xmlns.xyzbank.com/schema/Customer
              </con1:message>
            <con1:xmlLocation>
              <CustomerType>Invalid Cust Type</CustomerType>
            </con1:xmlLocation>
          </con1:ValidationFailureDetail>
        </con:details>
        <con:location>
          <con:node>MergePipeline</con:node>
          <con:pipeline>
            request-N3f57c7ff.l14e34e601.0.147d5484396.N7d39
          </con:pipeline>
          <con:stage>Validation</con:stage>
          <con:path>request-pipeline</con:path>
        </con:location>
      </con:fault>
    </detail>
  </soapenv:Fault>
</soapenv:Body>
</soapenv:Envelope>
```

Invalid E-mail and no Customer ID:

Message Context Changes

- ✚ added \$outbound
 - <con:endpoint name="Pipeline\$XYZCustomer\$Pipelines\$CustomerCmnPipeline" xmlns:con="http://www.bea.com/wli/sb/context">
 - <>
 - <con:service>
 - <con:operation>CreateCustomer /con:operation>
 - </con:service>
 - <con:transport>
 - <con:mode>request-response</con:mode>
 - <con:qualityOfService>best-effort</con:qualityOfService>
 - <con:request>
 - <tran:headers xsi:type="con:PipelineRequestHeadersXML" xmlns:con="http://www.bea.com/wli/sb/pipeline/config" xmlns:tran="http://www.bea.com/wli/sb/transports" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
 - <tran:encoding xmlns:tran="http://www.bea.com/wli/sb/transports">utf-8</tran:encoding>
 - </con:request>
 - <con:response>
 - <tran:headers xsi:type="con:PipelineResponseHeadersXML" xmlns:con="http://www.bea.com/wli/sb/pipeline/config" xmlns:tran="http://www.bea.com/wli/sb/transports" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
 - <tran:response-code xmlns:tran="http://www.bea.com/wli/sb/transports">1</tran:response-code>
 - <tran:encoding xmlns:tran="http://www.bea.com/wli/sb/transports">utf-8</tran:encoding>
 - </con:response>
 - </con:transport>
 - <con:security>
 - <con:doOutboundWs>true</con:doOutboundWs>
 - </con:security>
- △ □ changed \$body
 - <soapenv:Body xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope">
 - <soapenv:Fault>
 - <faultcode>soapenv:Server</faultcode>
 - <faultstring>XYZ-0001: Email is not valid.</faultstring>
 - <detail>
 - <con:fault xmlns:con="http://www.bea.com/wli/sb/context">
 - <con:errorCode>XYZ-0001</con:errorCode>
 - <con:reason>Email is not valid.</con:reason>
 - <con:location>
 - <con:node>CreateCustomer_PipelinePair</con:node>
 - <con:pipeline>
 - CreateCustomer_request-N3f57cff.155d987b.0.148031976cd.l07ff
 - </con:pipeline>
 - <con:stage>Validation</con:stage>
 - <con:path>request-pipeline</con:path>
 - </con:location>
 - </con:fault>
 - </detail>

Valid Payload and non-existing Customer ID:

Invocation Trace

```

✉ (receiving request)
CustomerOperation
MergePipeline
  ↴ Validation
  ↴ VerifyCustomer
    ↴ Invoked Services
      📡 Service Callout to: "CustomerServiceBS"
    ↴ Message Context Changes
      + added $verifyCustReq
        <ns2:customerid_input xmlns:ns2="urn:xyzbank:cust:schema:customer">
          <customer_id>AFGFHGF66767HGFHF</customer_id>
        </ns2:customerid_input>
      + added $verifyCustResp
        <urn:customerid_output xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:urn=">
          <CustomerExists>N</CustomerExists>
        </urn:customerid_output>
      ⚠ changed $body
      ⚠ changed $inbound
  ↴ MergeCustomerRoute
  ↴ Routed Service
    ↴ Route to: "CustomerCmnPipeline"
      ↴ $outbound:
        <con:endpoint name="Pipeline$XYZCustomer$ProxyServices$CustomerCmnPipeline" xmlns:con="http://www.bea.com/wli/sb/context">
          <con:service>
            <con:operation>CreateCustomer</con:operation>
          </con:service>
          <con:transport>
            <con:mode>request-response</con:mode>
            <con:qualityOfService>best-effort</con:qualityOfService>
            <con:request>
              <tran:headers xsi:type="con:PipelineRequestHeadersXML" xmlns:con="http://www.bea.com/wli/sb/pipeline/config" xmlns:tran="http:>
            </con:request>
          </con:transport>
          <con:security>
            <con:doOutboundWss>true</con:doOutboundWss>
          </con:security>
        </con:endpoint>
      ⚡ $body (request):
      ⚡ $header (request):
      ⚡ $attachments (request):
  
```

Response Document

```

<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Header xmlns:urn="urn:xyzbank:cust:schema:customer"/>
  <soapenv:Body xmlns:urn="urn:xyzbank:cust:schema:customer">
    <ns2:StatusMsg xmlns:ns2="http://xmlins.xyzbank.com/schema/Customer">
      <CustomerID>AHJKHKJHJKH798798789HKHKJH</CustomerID>
      <status>S</status>
    </ns2:StatusMsg>
  </soapenv:Body>
</soapenv:Envelope>

```

Valid Payload and non-existing Customer ID -Negative Case:

The screenshot shows a software interface for monitoring or analyzing a service route. The main pane displays a tree structure under the heading "MergeCustomerRoute". One node, "Routed Service", has a sub-node "Route to: "CustomerCmnPipeline"" indicated by a purple icon. Another node, "Message Context Changes", is expanded, showing three items: "added \$outbound" (green plus), "changed \$body" (blue triangle), and a detailed XML representation of the fault message. The XML is as follows:

```
<soapenv:Body xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
<soapenv:Fault>
    <faultcode>soapenv:Server</faultcode>
    <faultstring>XYZ-0004: Error in Customer Creation.</faultstring>
    <detail>
        <con:Fault xmlns:con="http://www.bea.com/wli/sb/context">
            <con:errorCode>XYZ-0004</con:errorCode>
            <con:reason>Error in Customer Creation.</con:reason>
            <con:location>
                <con:node>CreateCustomerRoute</con:node>
                <con:path>response-pipeline</con:path>
            </con:location>
        </con:Fault>
    </detail>
</soapenv:Fault>
</soapenv:Body>
```

Below the "Message Context Changes" node, there are three more blue triangle icons: "changed \$attachments", "changed \$inbound", and "changed \$header".

Response Document

The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
<soapenv:Body>
    <soapenv:Fault>
        <faultcode>soapenv:Server</faultcode>
        <faultstring>OSB-380000</faultstring>
        <detail>
            <con:Fault xmlns:con="http://www.bea.com/wli/sb/context">
                <con:errorCode>OSB-380000</con:errorCode>
                <con:location>
                    <con:node>MergeCustomerRoute</con:node>
                    <con:path>response-pipeline</con:path>
                </con:location>
            </con:Fault>
        </detail>
    </soapenv:Fault>
</soapenv:Body>
</soapenv:Envelope>
```

You can repeat test cases for **UpdateCustomer** operation. Remember that you need to send **CustomerID** in input and modify your mock service for **find_customer** to return response **Y**.

Valid Payload and existing Customer ID:

```

<ns2:customerid_input xmlns:ns2="urn:xyzbank:cust:schema:customer">
    <customer_id>AHHHHH8787QDJHJH299</customer_id>
</ns2:customerid_input>
<urn:customerid_output xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:urn="urn:xyzbank:cust:schema:customer">
    <CustomerExists>Y</CustomerExists>
</urn:customerid_output>

```

Response Document

```

<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
    <soapenv:Header xmlns:urn="urn:xyzbank:cust:schema:customer"/>
    <soapenv:Body xmlns:urn="urn:xyzbank:cust:schema:customer">
        <ns2:StatusMsg xmlns:ns2="http://xmlins.xyzbank.com/schema/Customer">
            <CustomerID>AHHHHH8787QDJHJH299</CustomerID>
            <status>5</status>
        </ns2:StatusMsg>
    </soapenv:Body>
</soapenv:Envelope>

```

Valid Payload and non-existing Customer ID -Negative Case:

✉️ MergeCustomerRoute
Routed Service
✉️ Route to: "CustomerCmnPipeline"
Message Context Changes
✚ added \$outbound
⚠ changed \$body

```
<soapenv:Body xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Fault>
    <faultcode>soapenv:Server</faultcode>
    <faultstring>XYZ-0004: Error in Customer Update.</faultstring>
    <detail>
      <con:fault xmlns:con="http://www.bea.com/wli/sb/context">
        <con:errorCode>XYZ-0004</con:errorCode>
        <con:reason>Error in Customer Update.</con:reason>
        <con:location>
          <con:node>UpdateCustomerRoute</con:node>
          <con:path>response-pipeline</con:path>
        </con:location>
      </con:fault>
    </detail>
  </soapenv:Fault>
</soapenv:Body>
```

Response Document

⚠ The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>soapenv:Server</faultcode>
      <faultstring>OSB-380000</faultstring>
      <detail>
        <con:fault xmlns:con="http://www.bea.com/wli/sb/context">
          <con:errorCode>OSB-380000</con:errorCode>
          <con:location>
            <con:node>MergeCustomerRoute</con:node>
            <con:path>response-pipeline</con:path>
          </con:location>
        </con:fault>
      </detail>
    </soapenv:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

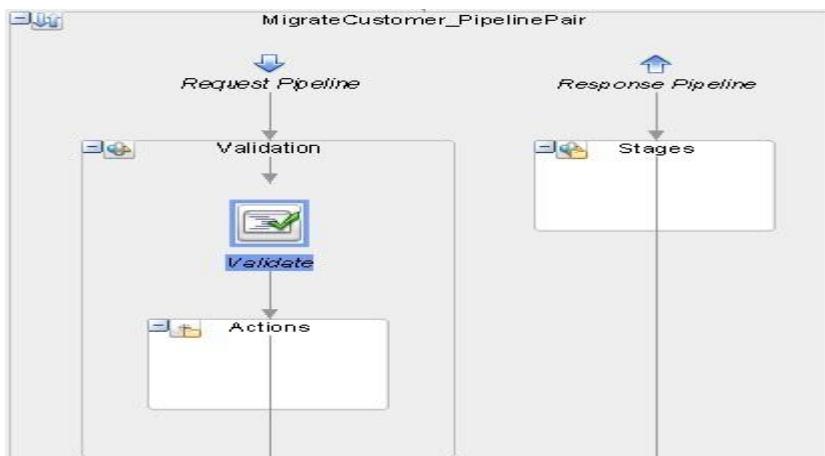
Migrate Customer

In this section, you will complete message flow for **MigrateCustomer** operation.

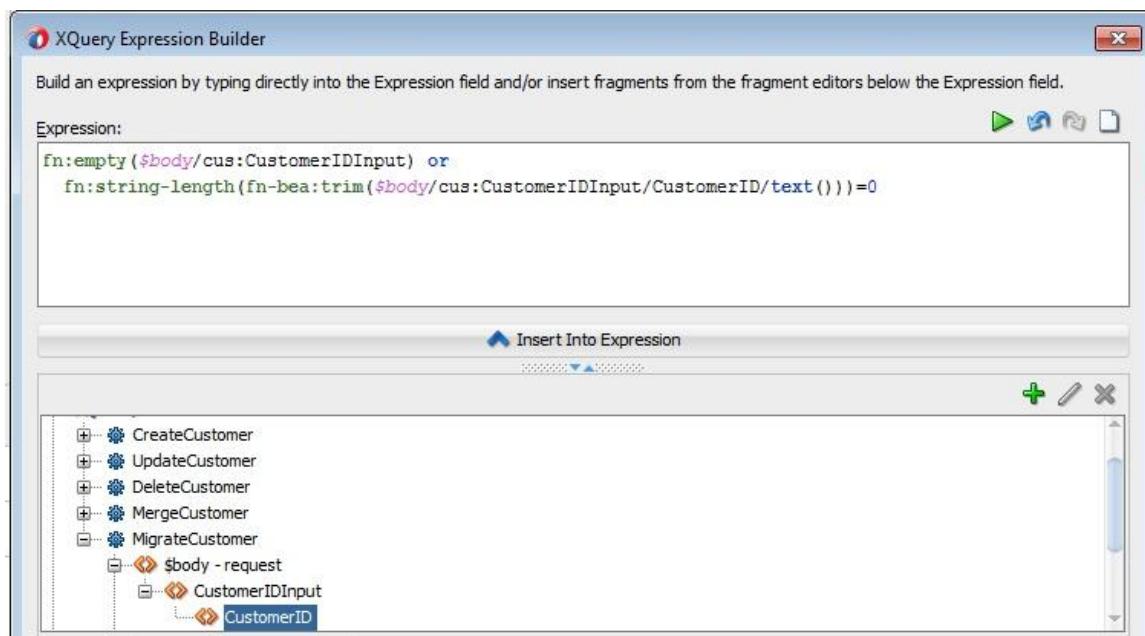
Please note that, migration will not happen this way in real world, and Service Bus may not be the right candidate to perform data migration. Here we consider this case only to demonstrate the parallel processing capabilities of Service Bus.

Validating Payload

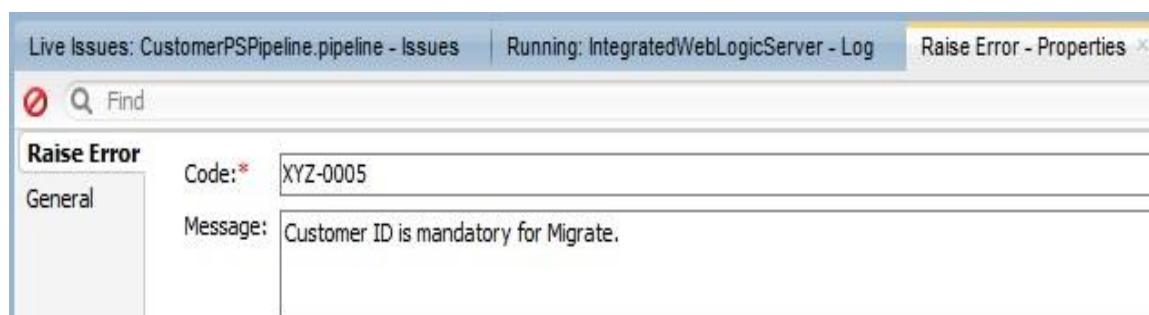
Finish **Validation** stage in **MigrateCustomer** operational branch similar to **DeleteCustomer** for validating **Payload Structure** using **Validate** activity. But you should select **CustomerIDInput** element from **\$body/MigrateCustomer** in expression builder for **Location** property.



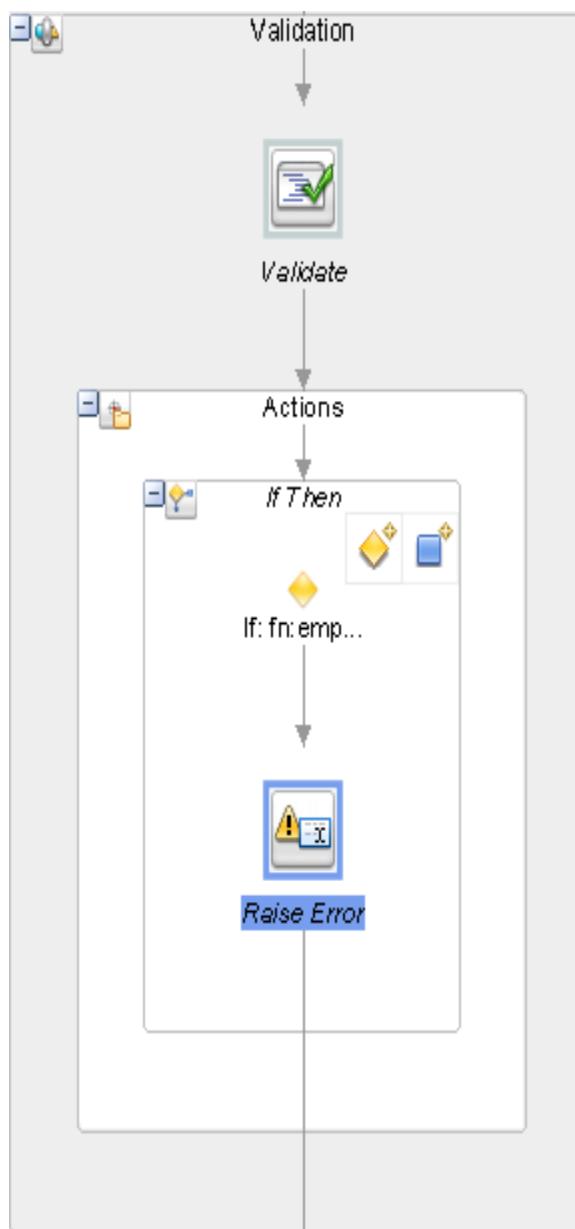
Since this is **Migrate** operation, service consumer should send **CustomerID** mandatorily in input and your message flow should enforce the same. So drag **If-Then** activity into **Validation** stage from **Flow Control** and set condition as shown below. Alternatively, you can select these string functions from **Functions -> XQuery 1.0 Functions -> Strings -> General Functions**.



Drag **Raise Error** activity into **If** branch from **Flow Control** and set properties as shown below.



Now your **Validation** stage should look like below.



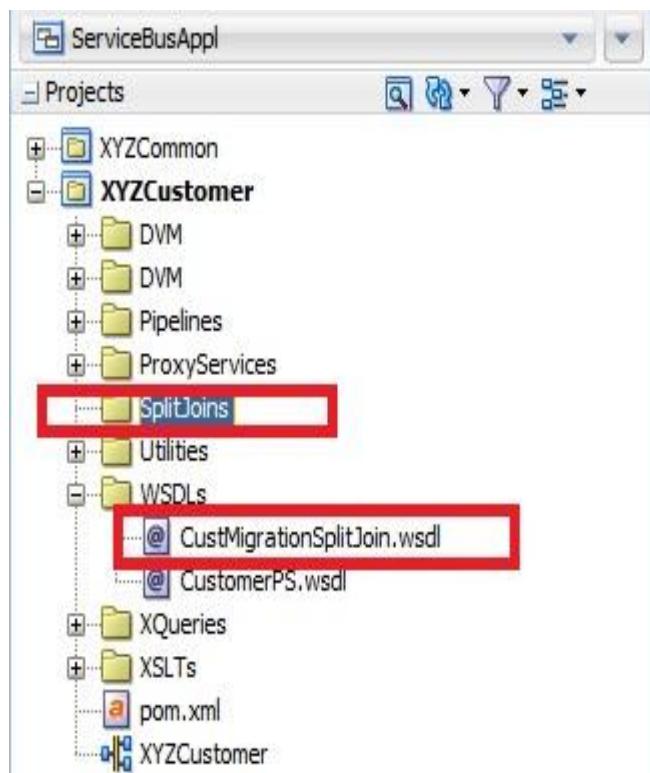
Creating Split Join

In this section, you will aggregate customer information using Split Join by invoking appropriate Business Services in parallel.

Split join allows you to split request payload so that you can call multiple services concurrently as opposed to sequential processing. This way, you will achieve improved service performance. Split join can only be created based on WSDL so create a new one in WSDLs folder, having single operation with following. You can come up with your own WSDL or use the one provided with this tutorial from [here](#).

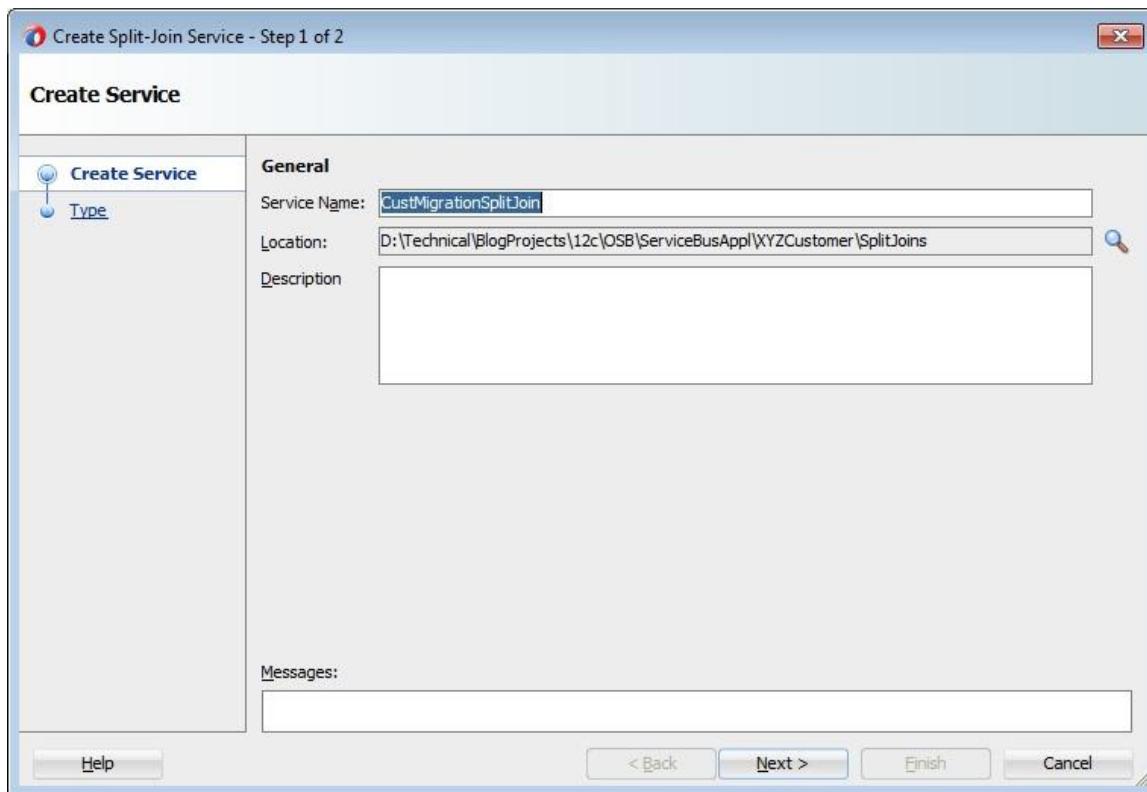
- **Customer ID** as input.
- Customer information including **Customer, Orders and Accounts Info** as output.

Copy **CustMigrationSplitJoin.wsdl** into **WSDLs** folder of **XYZCustomer** project from here and create a new folder **SplitJoins** as shown below.

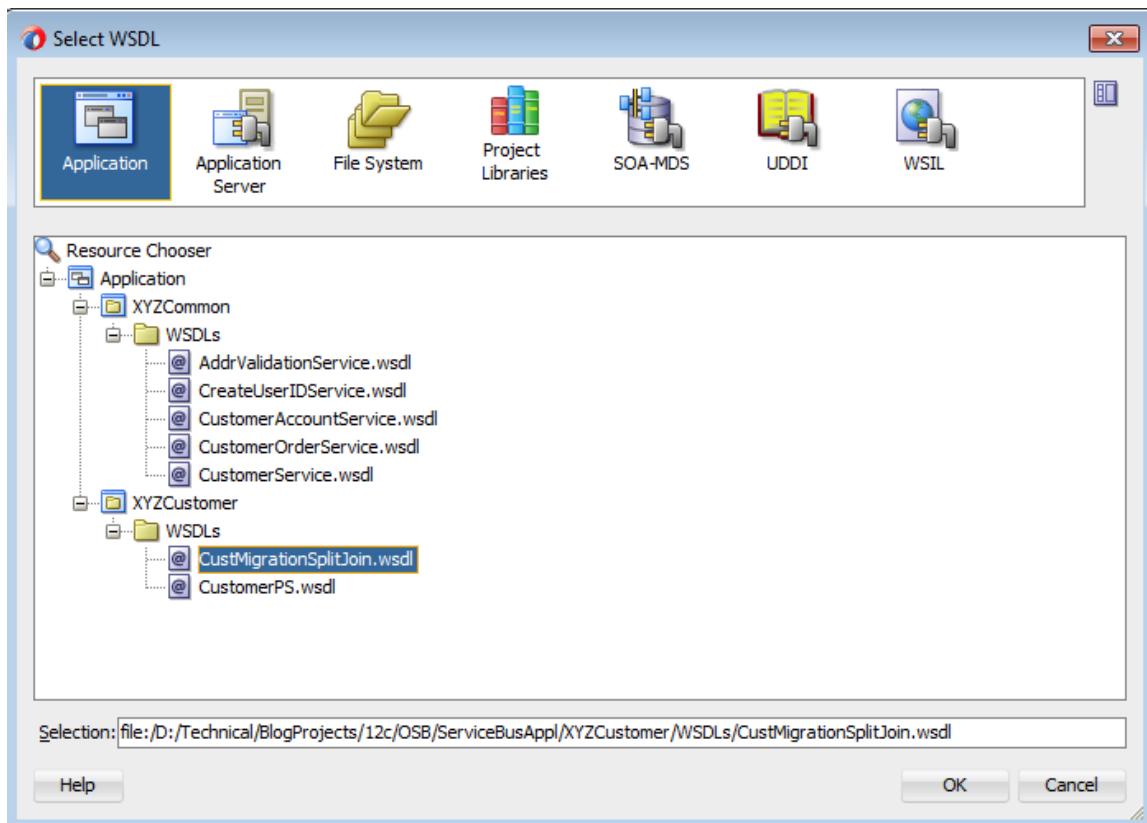


Open Service Bus overview editor and drag **Split Join** into middle swim lane from **Components - > Service Bus -> Resources** and finish the creation using wizard as shown below. Make sure that you select **SplitJoins** folder as the location in wizard.

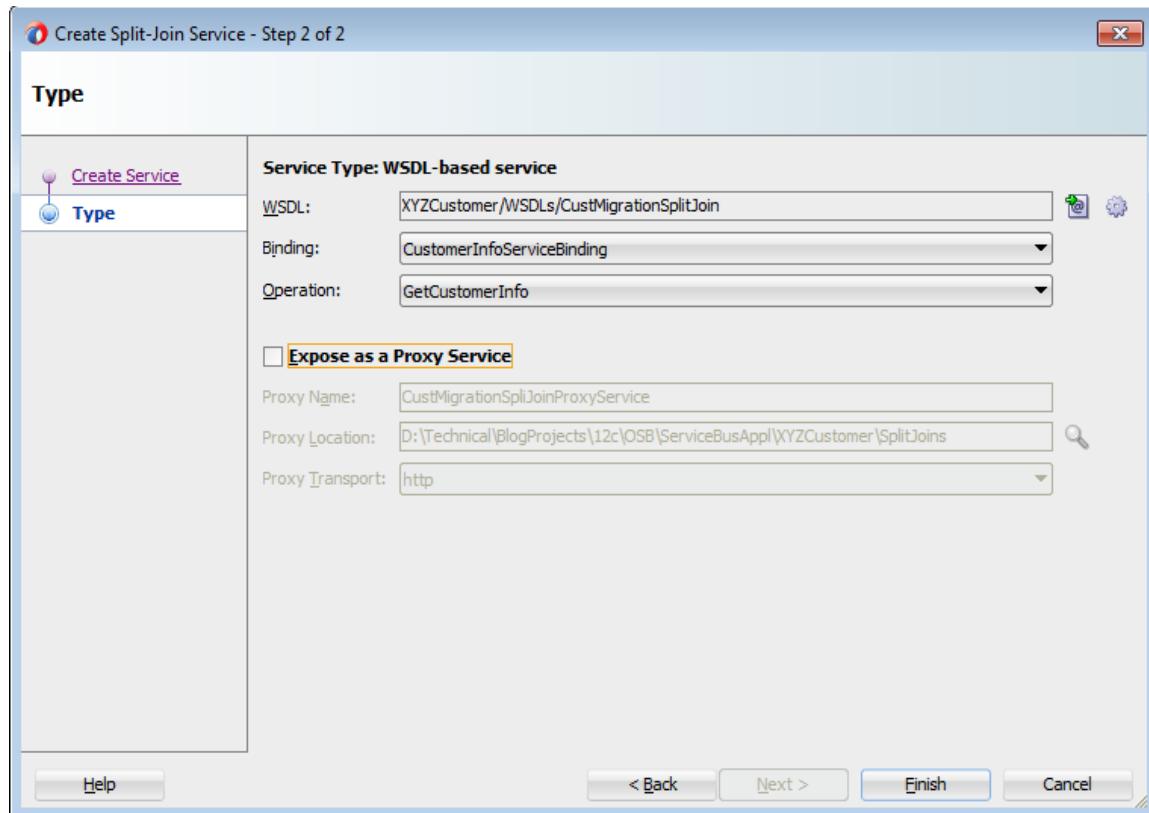




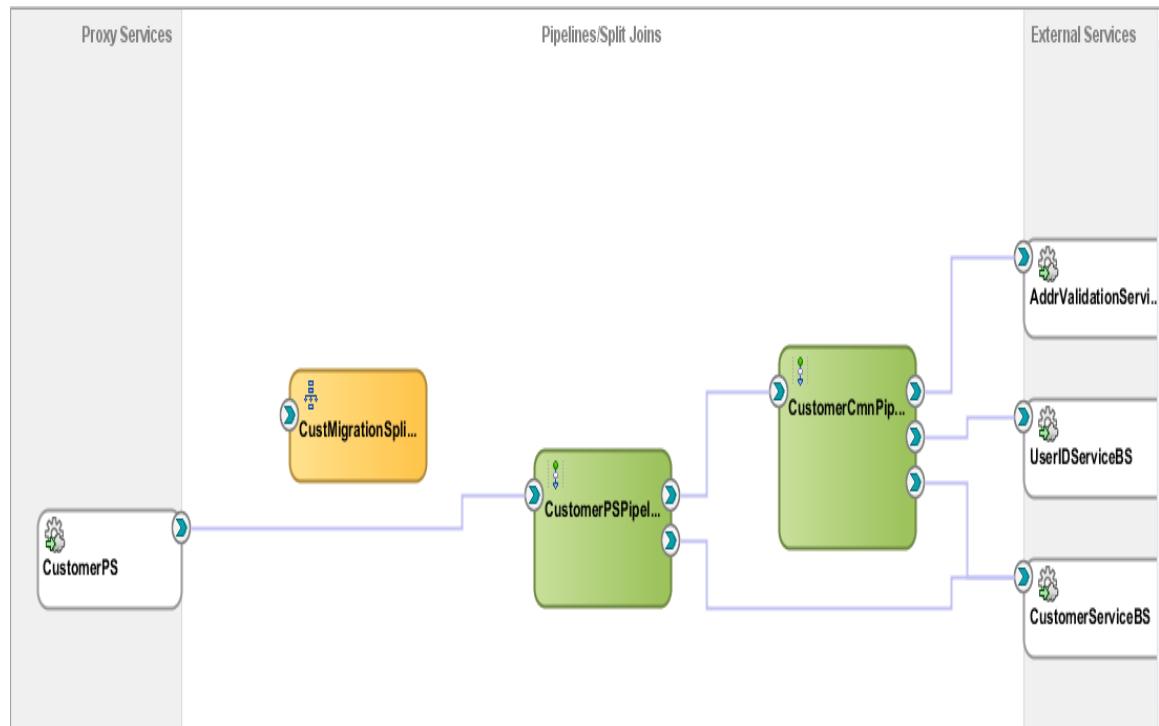
Click **Next** and select WSDL **CustMigrationSplitJoin.wsdl**.



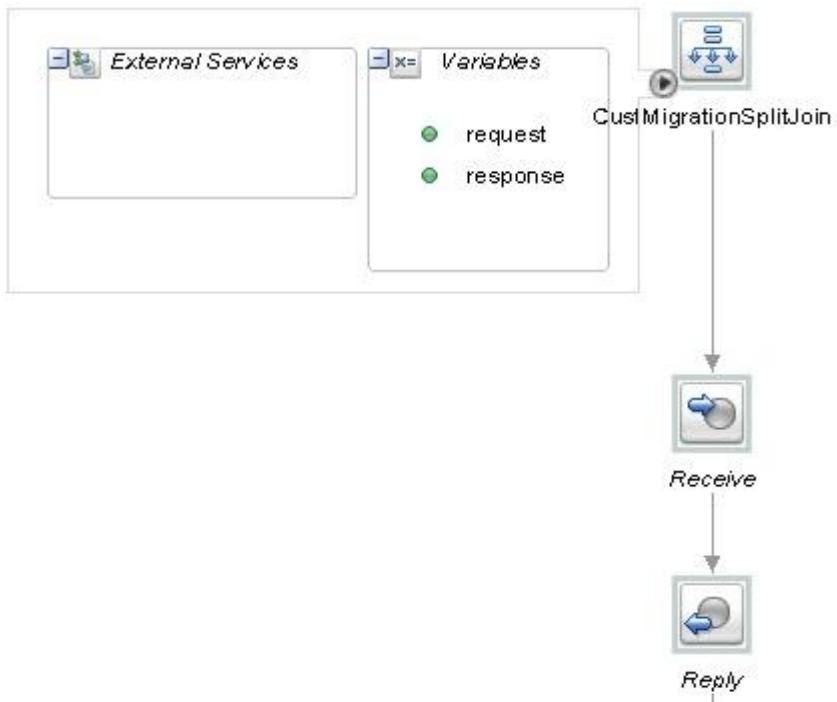
Click **OK** and uncheck **Expose as a Proxy Service**.



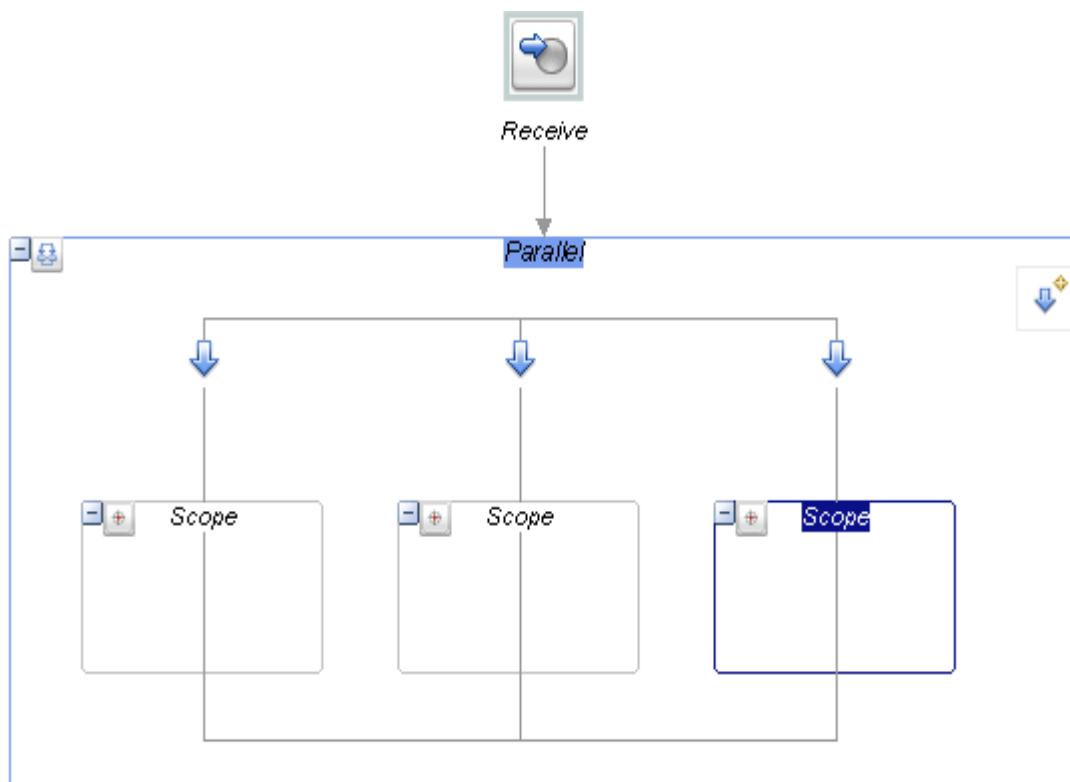
Now your Service Bus overview editor should look like below.



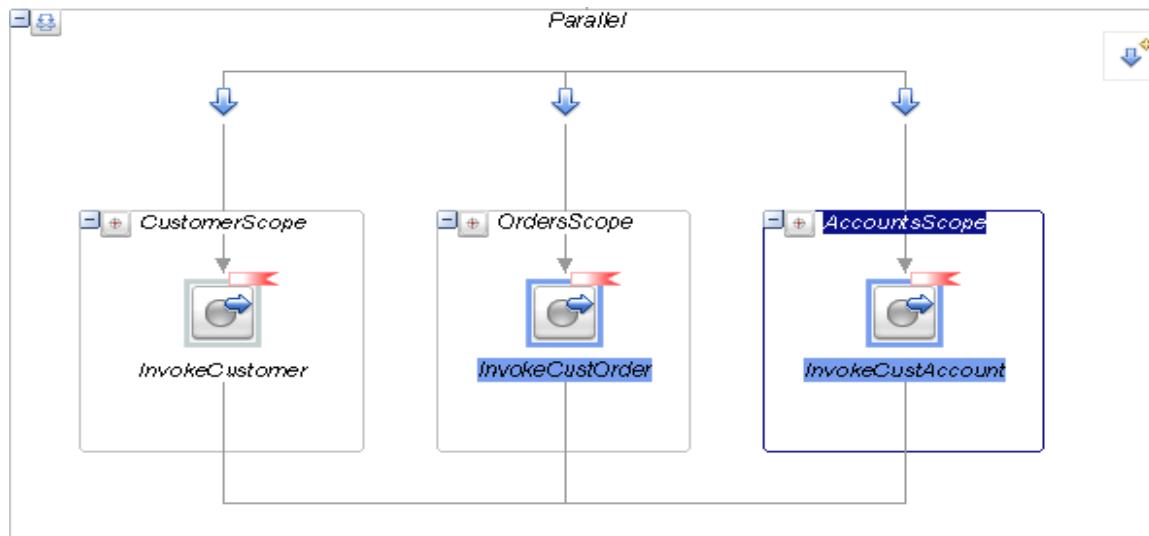
Also your initial split join flow should look like below.



Drag **Parallel** activity after **Receive** as shown below from **Flow Control** and add another branch by clicking . The **Parallel** activity allows you to invoke different services concurrently.



In **Properties** tab, modify **Name** for all the **Scope** activities as shown below. Drag **Invoke Service** activity into each of these **Scope** activities in all 3 parallel branches from **Communication** so that you can invoke Business services. Also modify **Name** property for **Invoke** activities in **Properties** tab.



In **Properties** tab, browse and select **CustomerServiceBS**, **CustomerOrderServiceBS** and **CustomerAccountServiceBS** for **Service** property of **InvokeCustomer**, **InvokeCustOrder**, **InvokeCustAccount** activities respectively.

The screenshot shows the 'Invoke - Properties' tab and the 'Resource Chooser' dialog.

Invoke - Properties Tab:

- General:**
 - Service:** A dropdown menu showing options like <Split-Join, Pipeline, Proxy Service, Business Service> is highlighted with a red box.
 - Operation:** [Empty field]
 - Request Variable:** [Empty field]
 - Response Variable:** [Empty field]
 - QoS:** Best Effort

Resource Chooser Dialog:

- The tree view shows the application structure:
 - Application
 - XYZCommon
 - BusinessServices
 - CustomerServiceBS.bix
 - CustomerOrderServiceBS.bix
 - CustomerAccountServiceBS.bix
 - UserIDServiceBS.bix
 - AddrValidationServiceBS.bix

Select **Operation** as shown below for **InvokeCustomer**, **InvokeCustOrder** , **InvokeCustAccount** activities respectively.

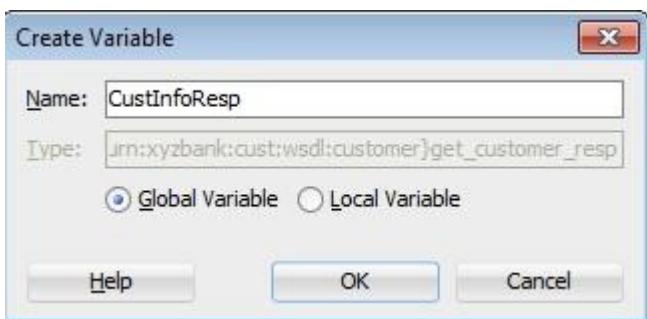
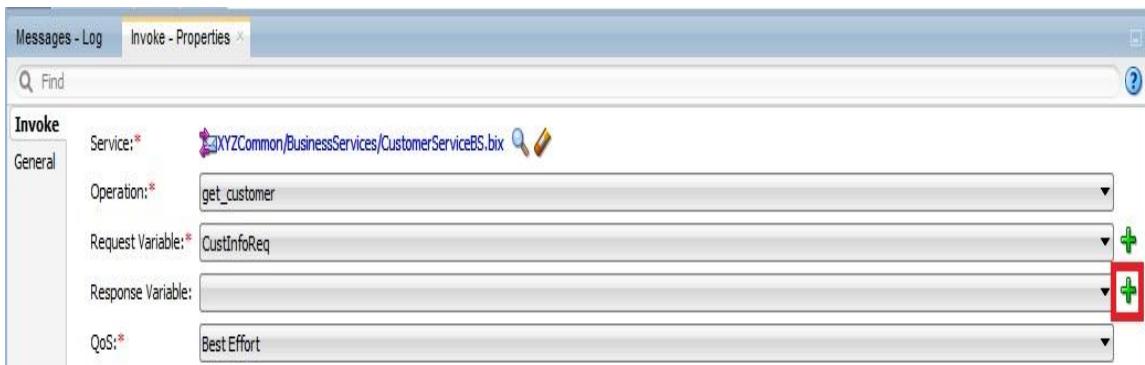
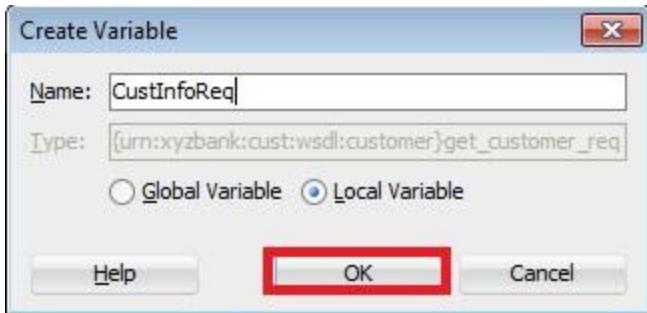
The screenshot shows the 'Invoke - Properties' dialog for an 'Invoke' activity. The 'General' tab is selected. The 'Service:' field contains 'XYZCommon/BusinessServices/CustomerServiceBS.bix'. The 'Operation:' field contains 'get_customer'. The 'Request Variable:' field is highlighted with a red border. The 'Response Variable:' field is empty. The 'QoS:' field contains 'Best Effort'. There are standard edit controls (find, search, edit) at the top right of the dialog.

The screenshot shows the 'Invoke - Properties' dialog for an 'Invoke' activity. The 'General' tab is selected. The 'Service:' field contains 'XYZCommon/BusinessServices/CustomerOrderServiceBS.bix'. The 'Operation:' field contains 'get_customer_orders'. The 'Request Variable:' field is highlighted with a red border. The 'Response Variable:' field is empty. The 'QoS:' field contains 'Best Effort'. There are standard edit controls at the top right of the dialog.

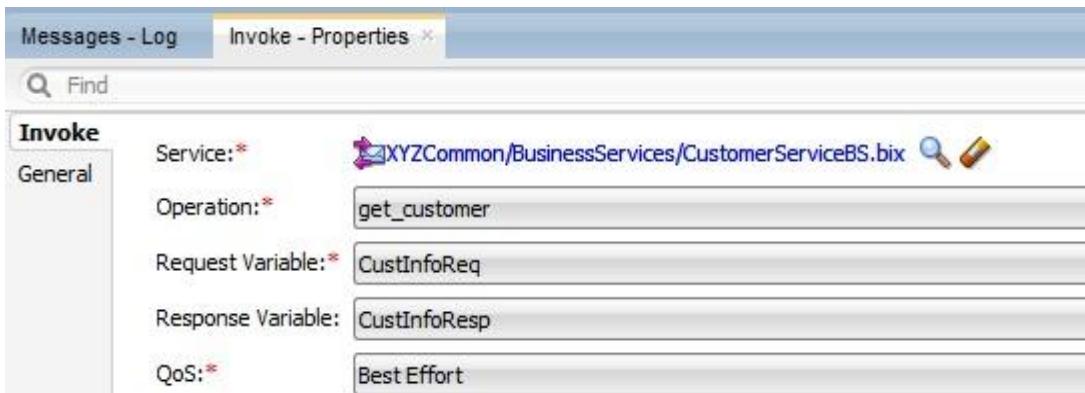
The screenshot shows the 'Invoke - Properties' dialog for an 'Invoke' activity. The 'General' tab is selected. The 'Service:' field contains 'XYZCommon/BusinessServices/CustomerAccountServiceBS.bix'. The 'Operation:' field contains 'get_customer_accounts'. The 'Request Variable:' field is highlighted with a red border. The 'Response Variable:' field is empty. The 'QoS:' field contains 'Best Effort'. There are standard edit controls at the top right of the dialog.

For **InvokeCustomer**, create **Request** and **Response** variables as shown below. **Request Variable** can be created as local variable as you don't use it outside the scope.

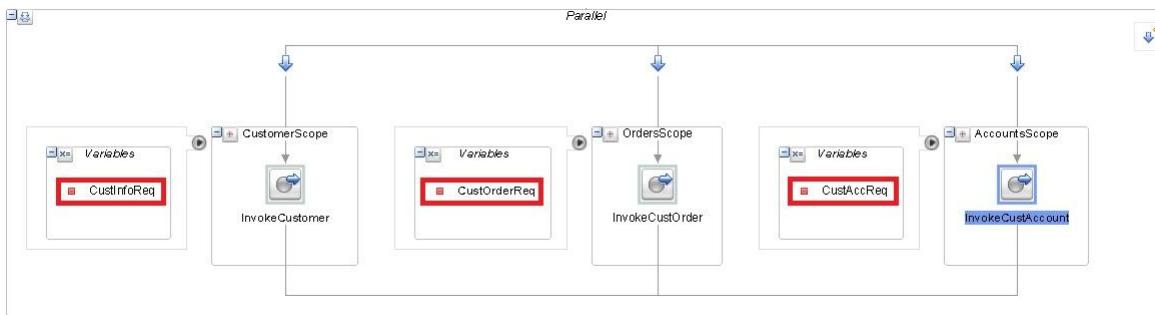
The screenshot shows the 'Invoke - Properties' dialog for an 'Invoke' activity. The 'General' tab is selected. The 'Service:' field contains 'XYZCommon/BusinessServices/CustomerServiceBS.bix'. The 'Operation:' field contains 'get_customer'. The 'Request Variable:' field is highlighted with a red border and has a '+' icon at its right end. The 'Response Variable:' field has a '+' icon at its right end. The 'QoS:' field contains 'Best Effort'. There are standard edit controls at the top right of the dialog.



Now your properties tab for **InvokeCustomer** should look like below.



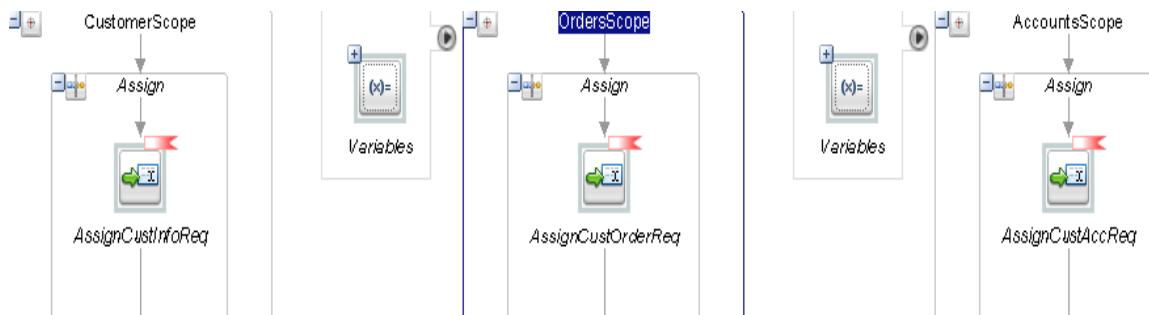
Similarly create variables **CustOrderReq**, **CustOrderResp** for **InvokeCustOrder** and **CustAccReq**, **CustAccResp** for **InvokeCustAccount** respectively. Now local variables created for each **Scope** activity should look like below.



Your **global** variables would be shown at Split Join level.



Drag **Assign** activity from **Assign Operations** into each of the scope activity and name them as **AssignCustInfoReq**, **AssignCustOrderReq** and **AssignCustAccReq** respectively in **Properties** tab.



In **Properties** tab, set properties for **AssignCustInfoReq** as shown below. This will populate the request variable with the payload expected by **CustomerServiceBS**. Since there are not many fields to map, we have chosen this way to populate the payload avoiding new transformations.

Value:

```
<cust:customerid_input xmlns:cust="urn:xyzbank:cust:schema:customer">
    <customer_id>${request.parameters/customer_id/text()}</customer_id>
</cust:customerid_input>
```

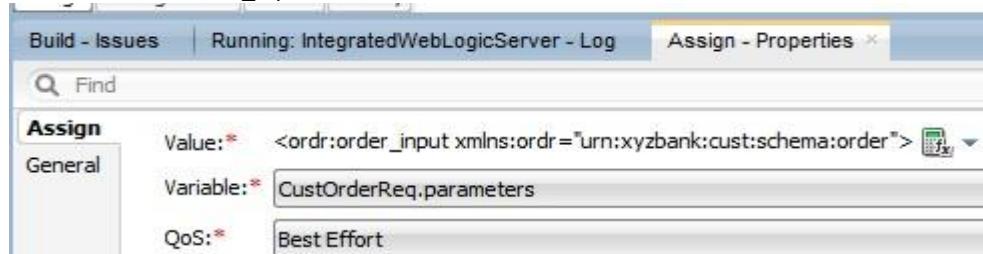
Build - Issues Running: IntegratedWebLogicServer - Log Assign - Properties

Assign	Value: General	<cust:customerid_input xmlns:cust="urn:xyzbank:cust:schema:customer"> <input style="width: 20px; height: 15px;" type="button" value="..."/>
	Variable: General	CustInfoReq.payload
	QoS: General	Best Effort

In **Properties** tab, set properties for **AssignCustOrderReq** as shown below. This will populate the request variable with the payload expected by **CustomeOrderServiceBS**.

Value:

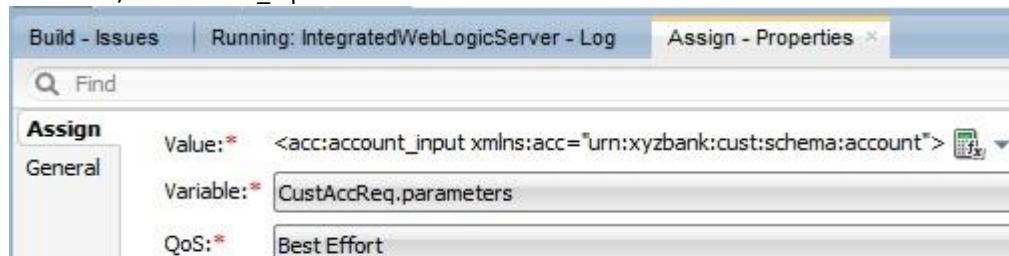
```
<ordr:order_input xmlns:ordr="urn:xyzbank:cust:schema:order">
    <ordr:customer_id>${request.parameters/customer_id/text()}</ordr:customer_id>
</ordr:order_input>
```



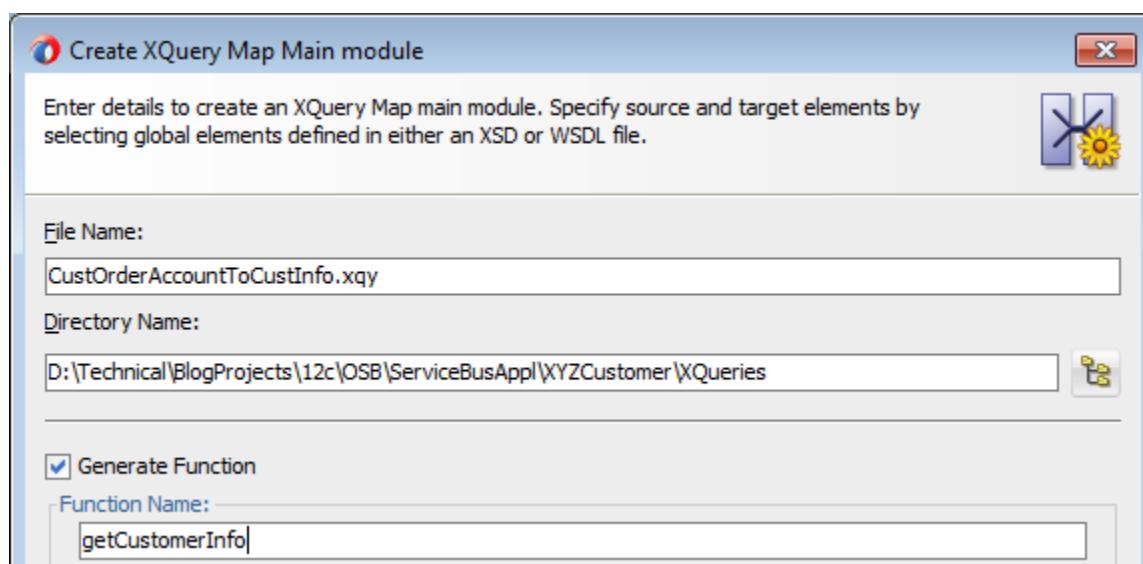
In **Properties** tab, set properties for **AssignCustAccReq** as shown below. This will populate the request variable with the payload expected by **CustomeAccountServiceBS**.

Value:

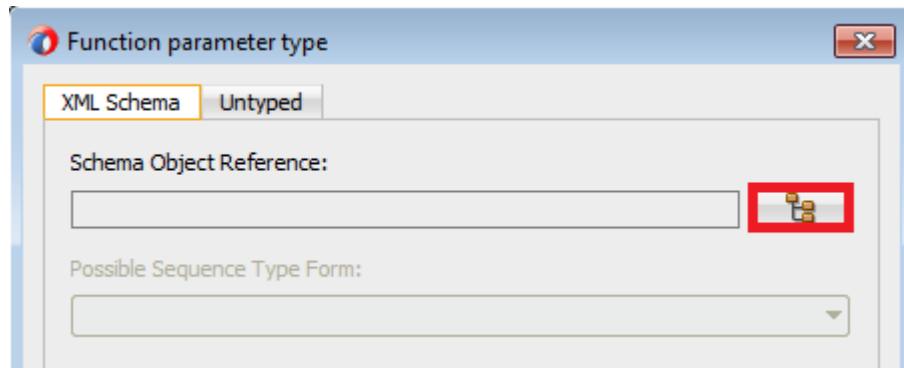
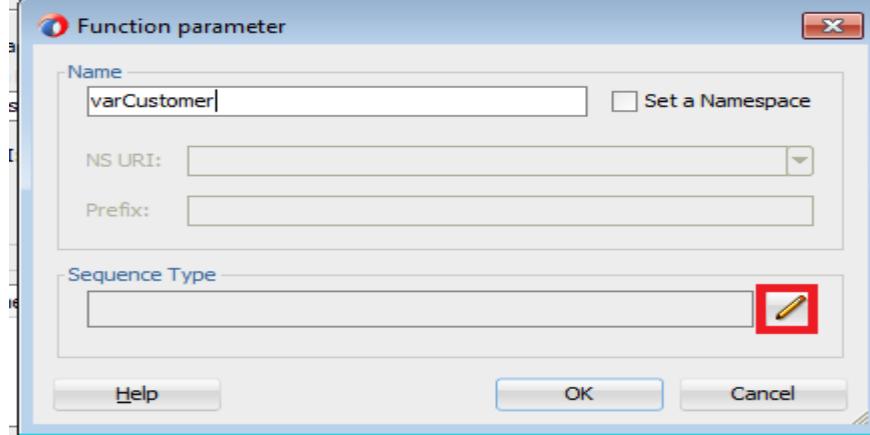
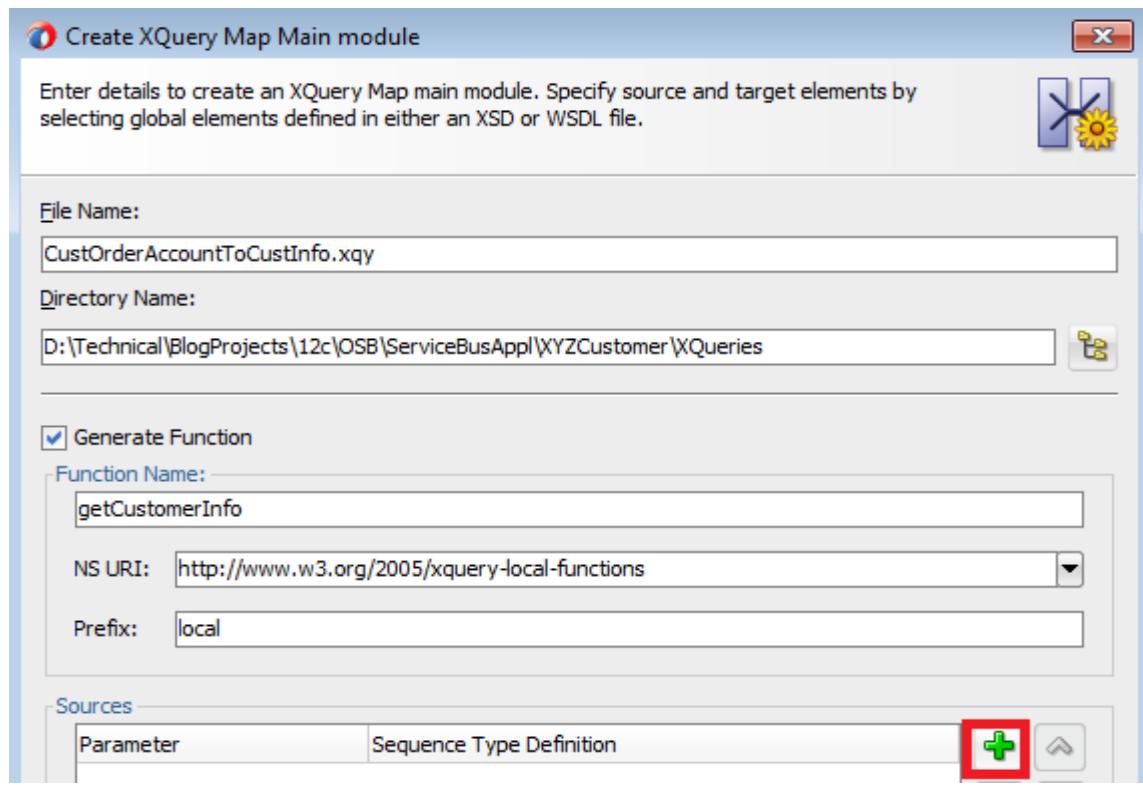
```
<acc:account_input xmlns:acc="urn:xyzbank:cust:schema:account">
    <acc:customer_id>${request.parameters/customer_id/text()}</acc:customer_id>
</acc:account_input>
```

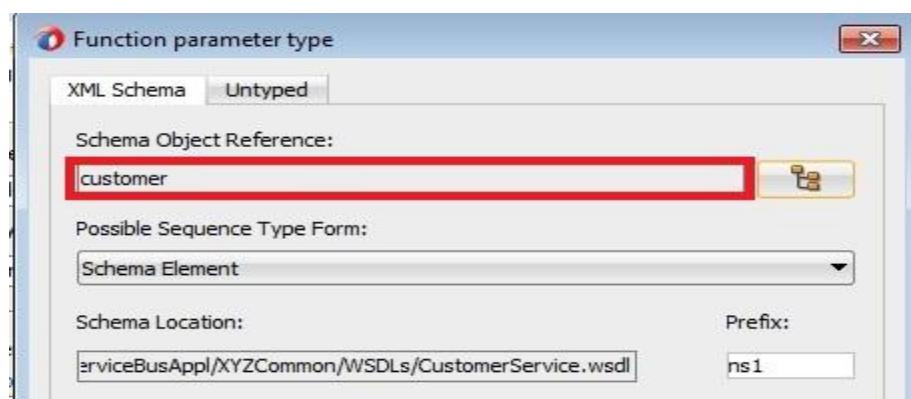
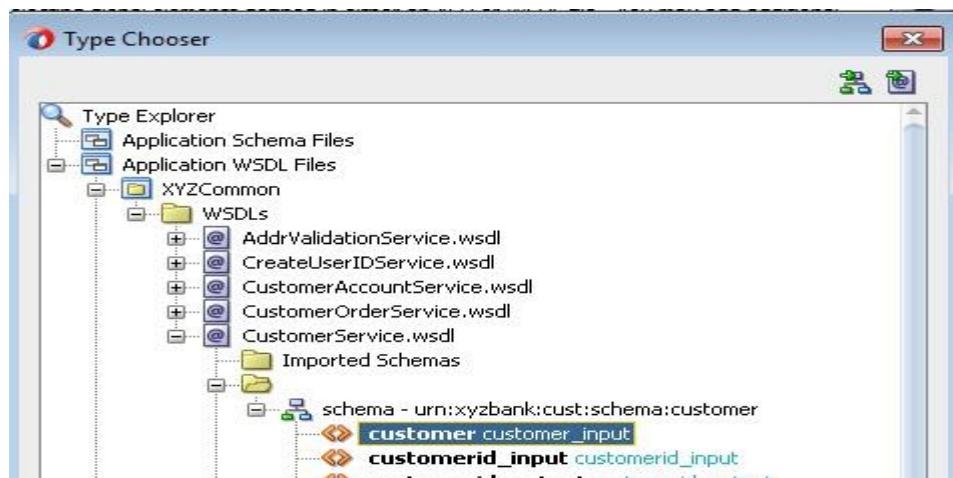


This would fetch **Customer**, **Order** and **Account** information concurrently by invoking respective business services. You need to transform all these responses into one before returning back to caller. So you need a transformation to do this. Create a XQuery map in **XQueries** folder of **XYZCustomer** project as shown below. Give name as **CustOrderAccountToCustInfo.xqy**.

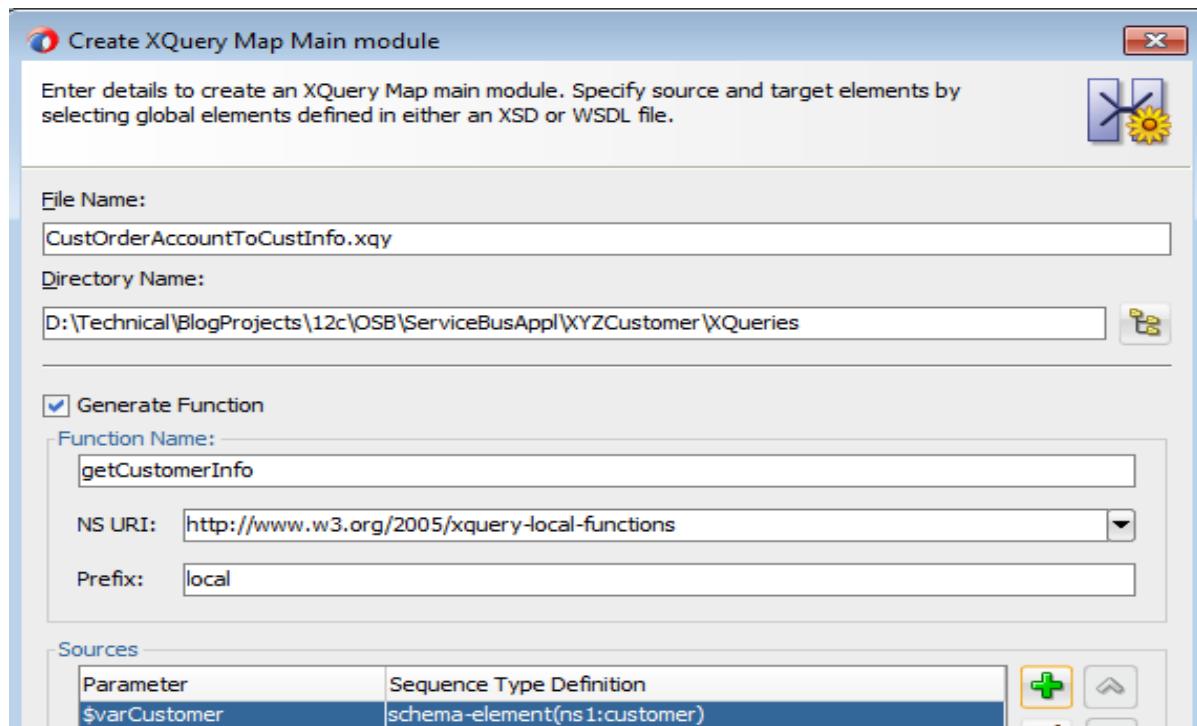


Choose the **Source** for XQuery map using steps shown below.

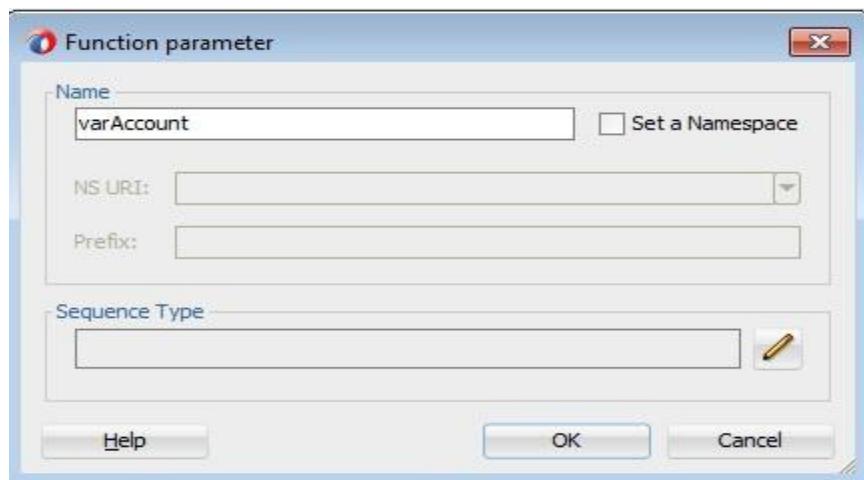
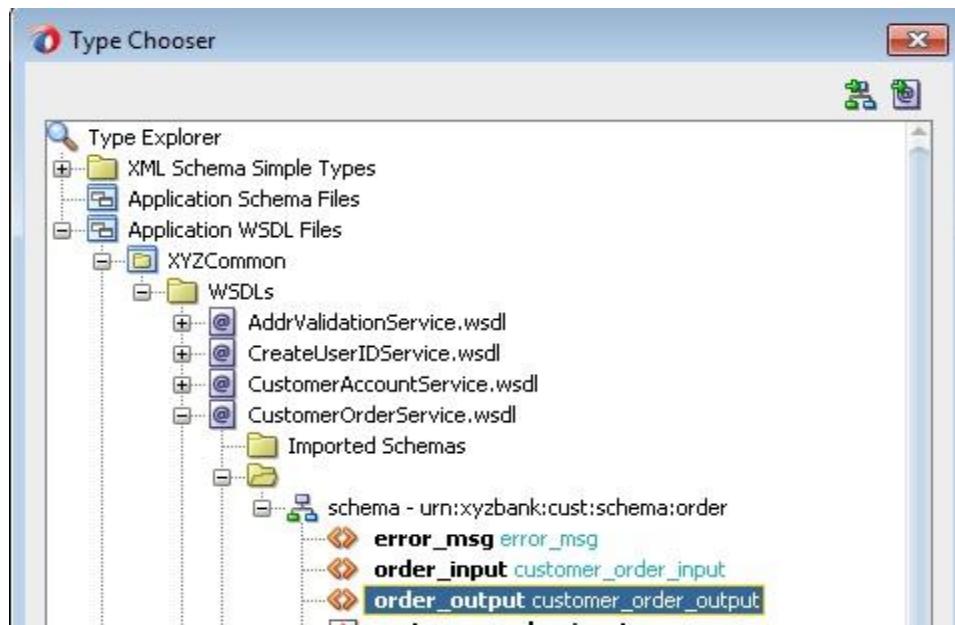
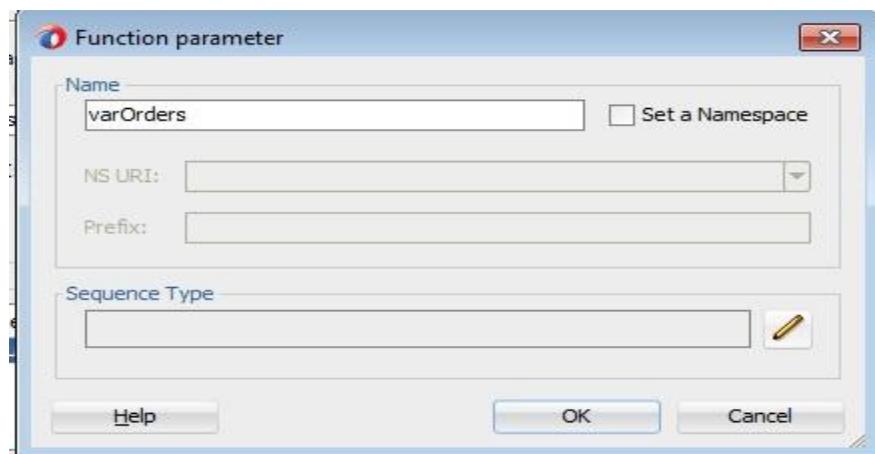


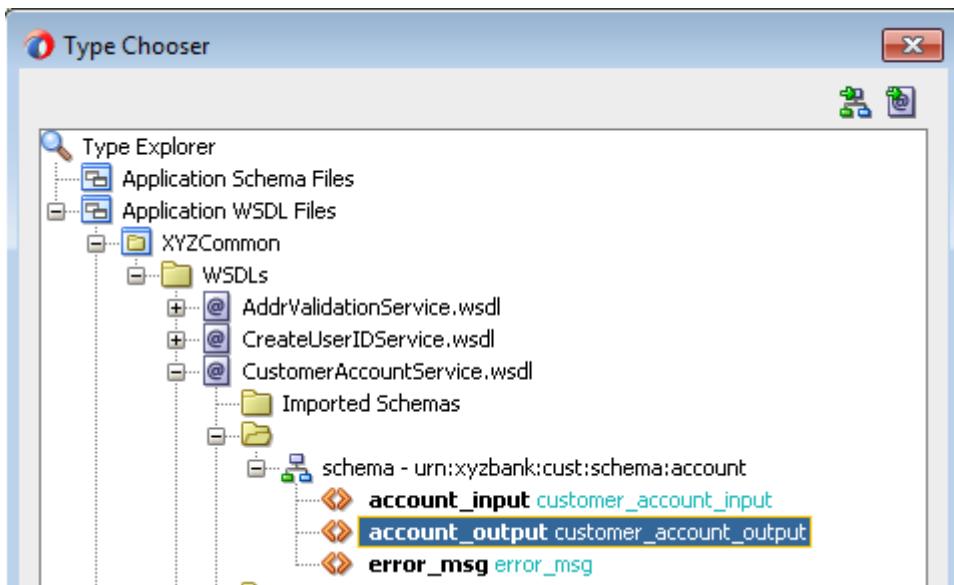


Go back to **Create XQuery Map** window by clicking **OK** twice.

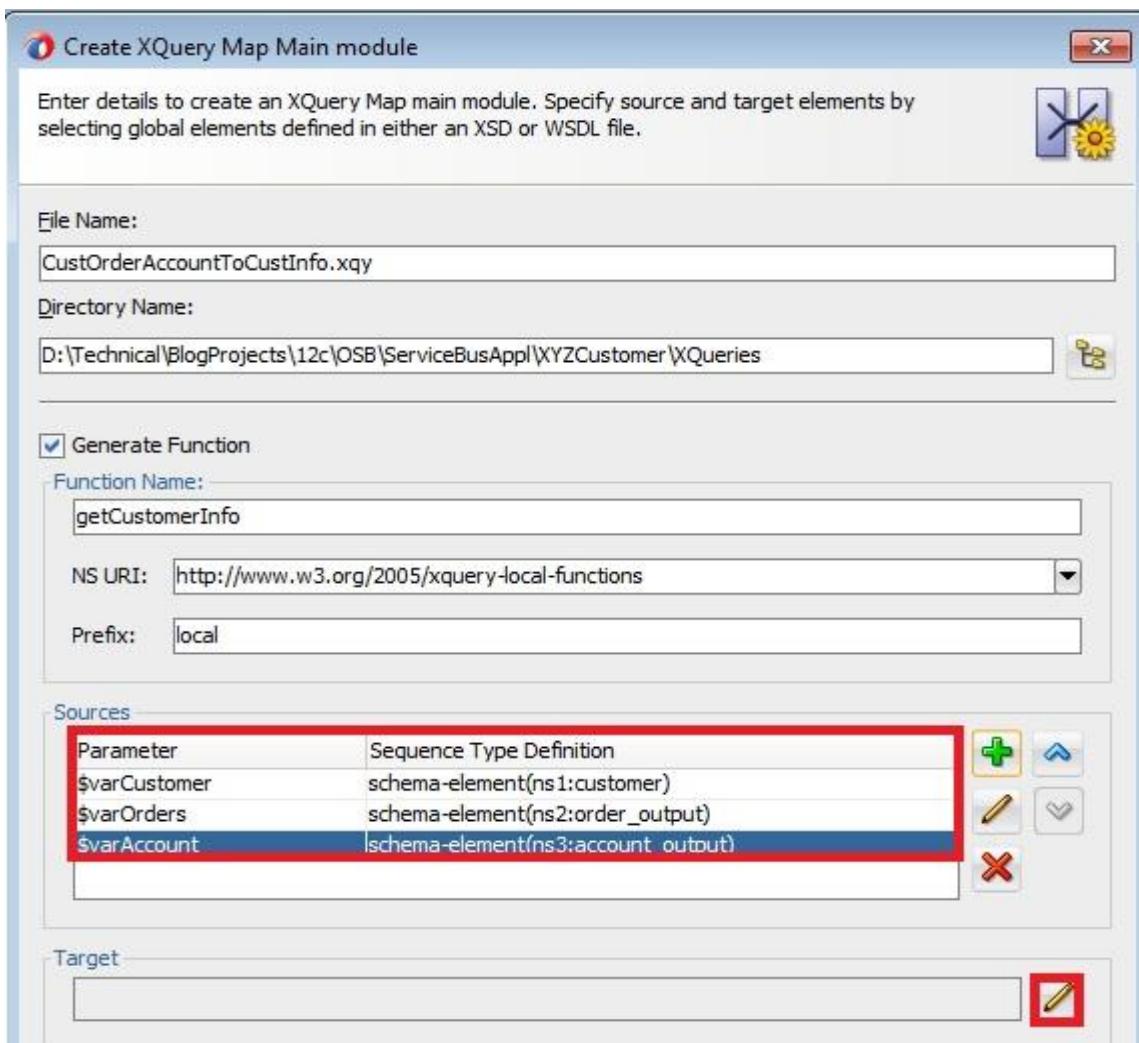


Similarly add 2 more parameters as shown below to accept **Account** and **Orders** information as the input.

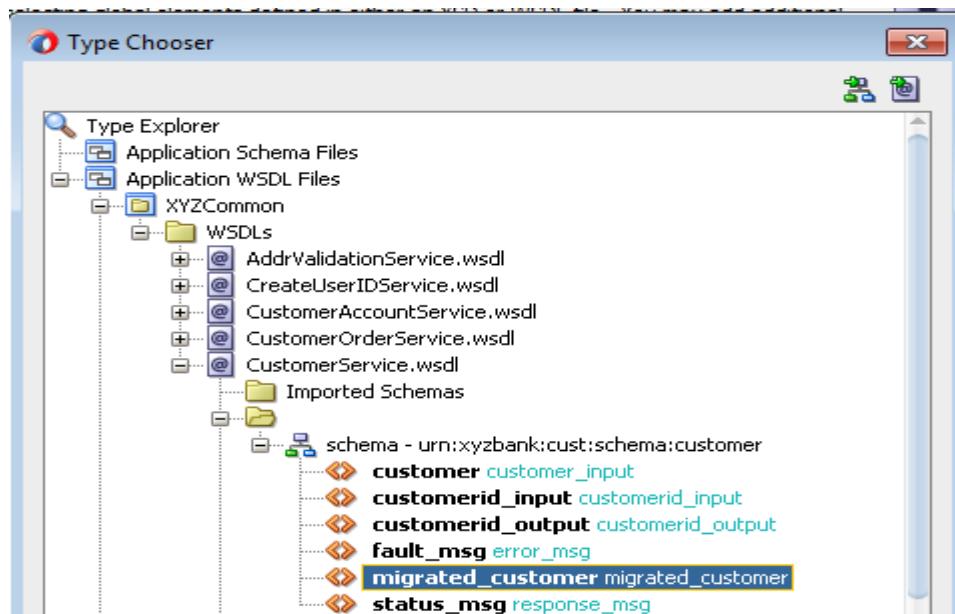




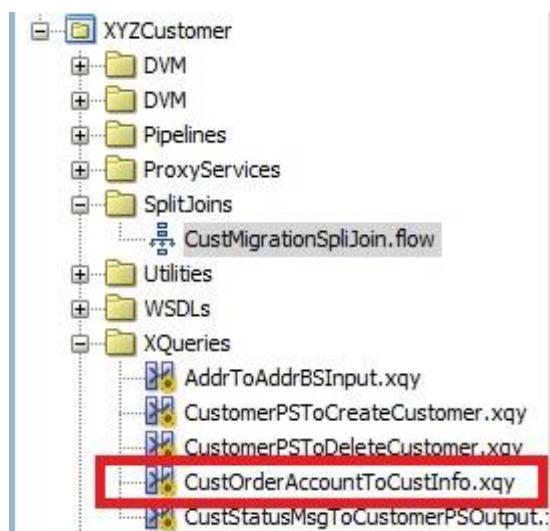
Your Create XQuery Map window should look like below.



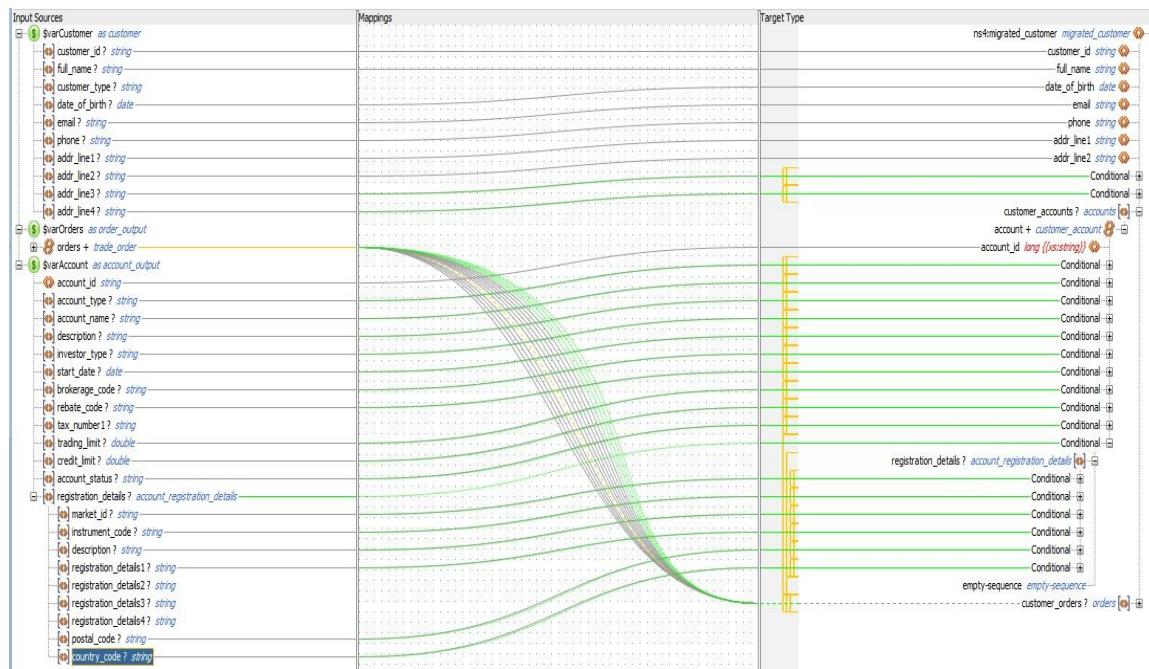
Select **Target** using steps mentioned below.



Click **OK** twice to finish XQuery map creation and should be visible in **XQueries** folder as shown below.

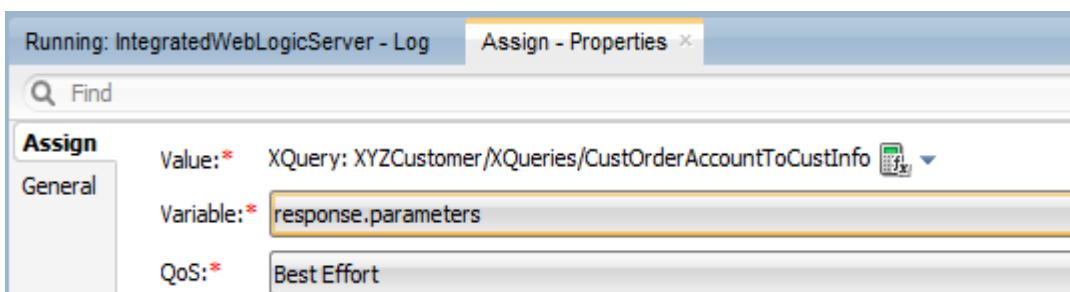
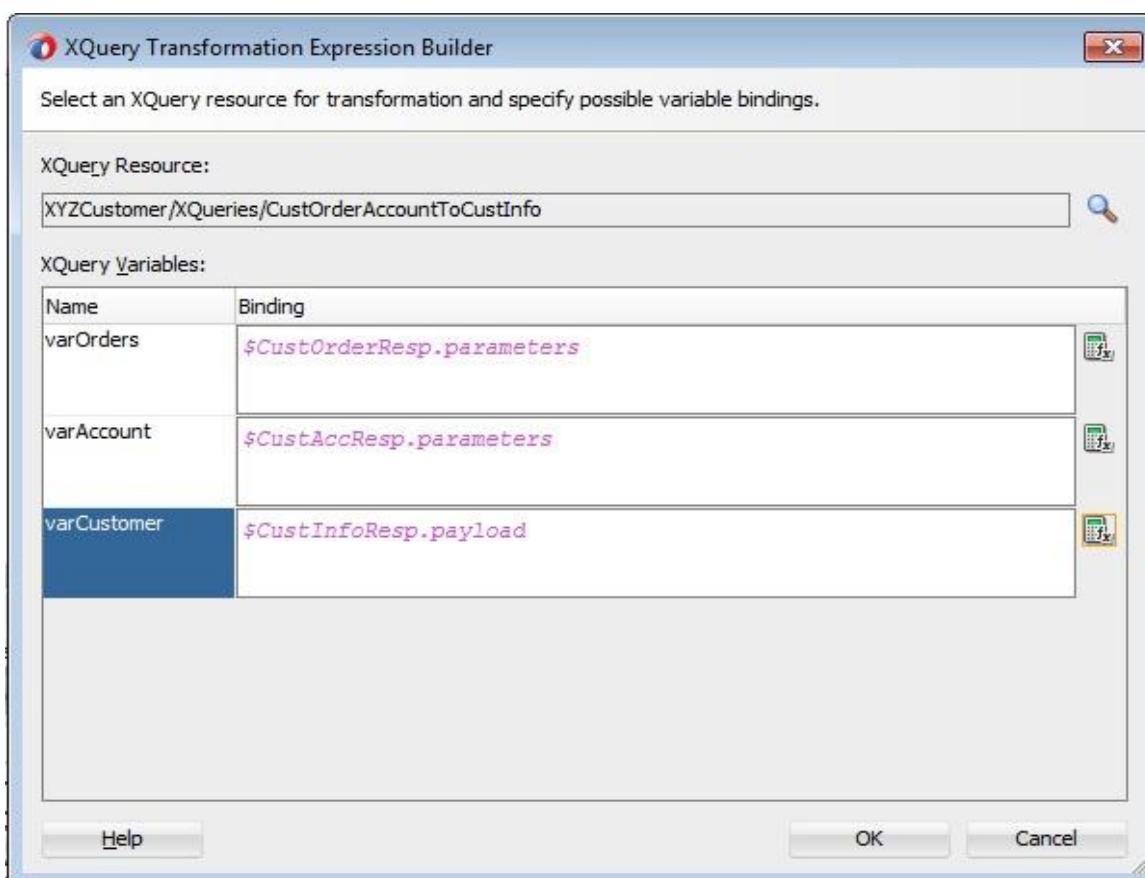
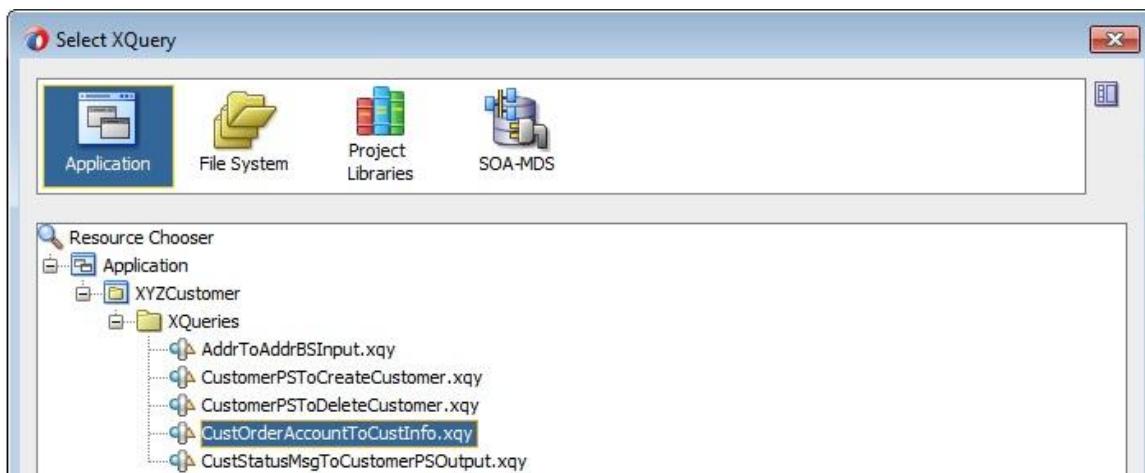


Finish the mapping as required and shown below. Observe the sources and target structures. You may want to test your XQuery using steps mentioned in previous sections.

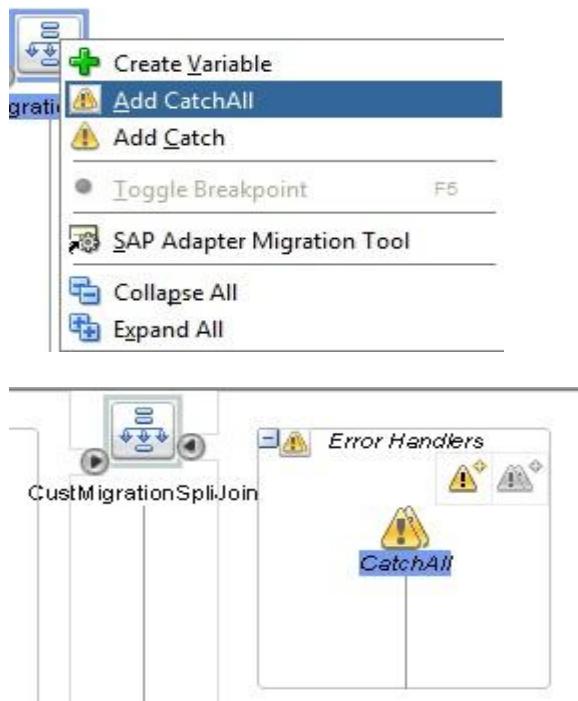


Now you have to use this XQuery map in Split join to merge 3 different responses into one and reply with merged payload. So drag **Assign** after **Parallel** activity from **Assign Operations** and set properties as shown below.

The screenshot shows the Oracle BPM Studio interface. In the center, there is an "Assign" operation configuration window. The "Value:" field is set to "<Expression>" and the "Variable:" field is empty. A dropdown menu is open over the "Value:" field, with "XQuery Resources" selected. Below this, the "XQuery Transformation Expression Builder" dialog is open, showing fields for "XQuery Resource:" and "XQuery Variables:". The "XQuery Resource:" field is empty, and the "XQuery Variables:" table is also empty.



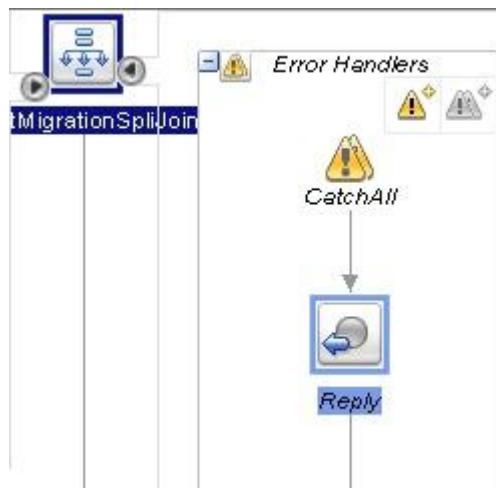
With this, you have finished message flow for Split Join and let us finish error handling before proceeding with testing. The WSDL used for split join has generic fault structure and you will use the same structure to return all type of faults to caller. So we will do the fault handling at complete split join level. Right click **CustMigrationSplitJoin** and select **CatchAll** as shown below.



In Properties tab, give the fault variable name as shown below.



Drag **Reply** activity into **Catch All** branch from **Communication**.



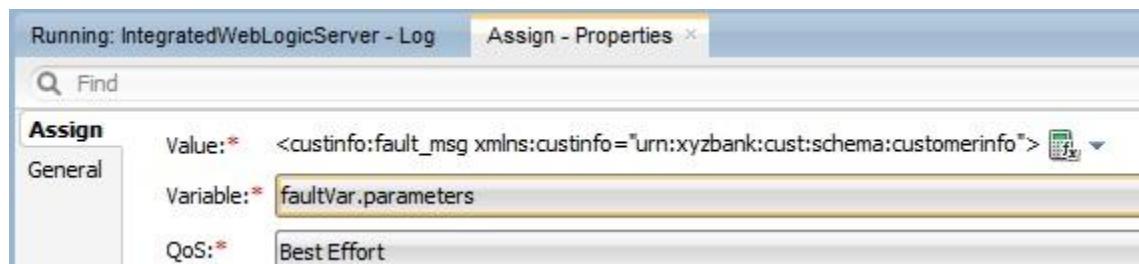
In **Properties** tab, set the properties as shown below by creating new fault variable. This enables split join to return a fault in case of any error to Pipeline.



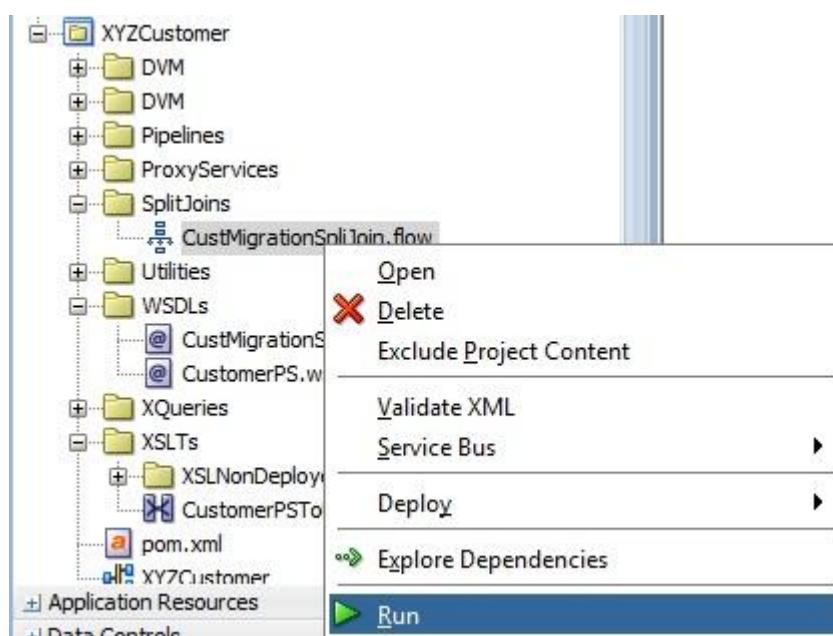
Drag **Assign** activity into **Catch All** branch before **Reply** activity from **Assign Operations**. Modify name to **AssignFault** and set properties as shown below.

Value:

```
<custinfo:fault_msg xmlns:custinfo="urn:xyzbank:cust:schema:customerinfo">
    <custinfo:error_code>XYZ-0009</custinfo:error_code>
    <custinfo:error_message>Error in join operation.</custinfo:error_message>
</custinfo:fault_msg>
```



Test your Split join in similar to Proxy service/Pipeline and observe positive and negative cases.



Positive Case:

Split-Join Testing - CustMigrationSplJoin

Execute | Execute-Save | Reset | Close

Service Operation

Operation: **GetCustomerInfo▼**

Request Document

Form | XML **XML**

SOAP Header:

```
<soap:Header xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
</soap:Header>
```

*** Payload:**

Choose File No file selected

```
<urn:customerid_input xmlns:urn="urn:xyzbank:cust:schema:customerinfo">
  <customer_id>1234</customer_id>
</urn:customerid_input>
```

Split-Join Testing - CustMigrationSplJoin

Back | Close

Request Document

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soap:Header xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
    </soap:Header>
  <soapenv:Body>
    <urn:customerid_input xmlns:urn="urn:xyzbank:cust:schema:customerinfo">
      <customer_id>1234</customer_id>
    </urn:customerid_input>
  </soapenv:Body>
</soapenv:Envelope>
```

Response Document

```
<soap-env:Envelope xmlns:soap-env="http://schemas.xmlsoap.org/soap/envelope/">
  <soap-env:Body>
    <ns4:migrated_customer xmlns:ns4="urn:xyzbank:cust:schema:customerinfo">
      <customer_id>1234</customer_id>
      <full_name>FName.LName</full_name>
      <date_of_birth/>
      <email>abc@gmail.com</email>
      <phone>+911234567890</phone>
      <addr_line1>Madhapur</addr_line1>
      <addr_line2>Hyd</addr_line2>
      <addr_line3>Andhra Pradesh,India,500081</addr_line3>
      <customer_accounts>
        <account>
          <account_id>ACT87878HKJHKJ</account_id>
          <account_type>SAVINGS</account_type>
          <account_name>svgonugu</account_name>
          <description>desc</description>
          <investor_type>Individual</investor_type>
          <brokerage_code>FLEXI</brokerage_code>
          <rebate_code>REB</rebate_code>
          <trading_limit>15000</trading_limit>
          <credit_limit>10000</credit_limit>
          <account_status>ACTIVE</account_status>
          <registration_details>
            <market_id>BSE</market_id>
            <instrument_code>CHECK</instrument_code>
            <description>desc1</description>
            <registration_details1>Madhapur</registration_details1>
            <postal_code>500081</postal_code>
            <country_code>IND</country_code>
          </registration_details>
        </account>
      </customer_accounts>

      <customer_orders>
        <order>
          <account_id>ACT87878HKJHKJ</account_id>
          <instrument_code>CHECK</instrument_code>
          <order_action>BUY</order_action>
          <price>2345</price>
          <currency_code>INR</currency_code>
          <quantity>20</quantity>
          <date_created/>
          <brokerage_amount>70</brokerage_amount>
          <brokerage_code>FLEXI</brokerage_code>
          <brokerage_perc>10</brokerage_perc>
        </order>
      </customer_orders>
    </ns4:migrated_customer>
  </soap-env:Body>
</soap-env:Envelope>
```

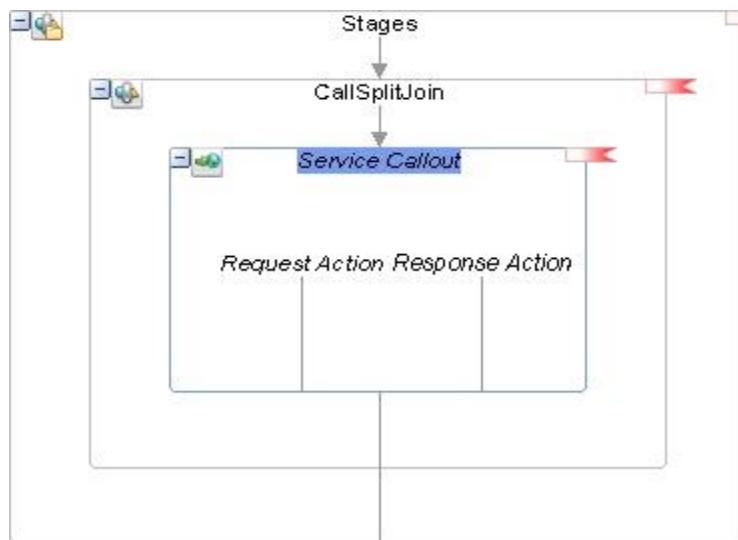
Negative Case:

Request Document
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"> <soap:Header xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/"> </soap:Header> <soapenv:Body> <urn:customerid_input xmlns:urn="urn:xyzbank:cust:schema:customerinfo"> <customer_id>1234</customer_id> </urn:customerid_input> </soapenv:Body> </soapenv:Envelope>
Response Document
<p>⚠ The invocation resulted in an error: [[http://xmlns.xyzbank.com/wsdl/Customer]FaultMsg] {http://xmlns.xyzbank.com/wsdl/Customer}FaultMsg <bind:GenericFault xmlns:bind="http://xmlns.xyzbank.com/wsdl/Customer"> <custinfo:fault_msg xmlns:custinfo="urn:xyzbank:cust:schema:customerinfo"> <custinfo:error_code>XYZ-0009</custinfo:error_code> <custinfo:error_message>Error in join operation.</custinfo:error_message> </custinfo:fault_msg> </bind:GenericFault>.</p> <soap-env:Envelope xmlns:soap-env="http://schemas.xmlsoap.org/soap/envelope/"> <soap-env:Body> <soap-env:Fault xmlns:bind="http://xmlns.xyzbank.com/wsdl/Customer"> <faultcode>bind:FaultMsg</faultcode> <faultstring> {http://xmlns.xyzbank.com/wsdl/Customer}FaultMsg </faultstring> <detail> <custinfo:fault_msg xmlns:custinfo="urn:xyzbank:cust:schema:customerinfo"> <custinfo:error_code>XYZ-0009</custinfo:error_code> <custinfo:error_message>Error in join operation.</custinfo:error_message> </custinfo:fault_msg> </detail> </soap-env:Fault> </soap-env:Body> </soap-env:Envelope>

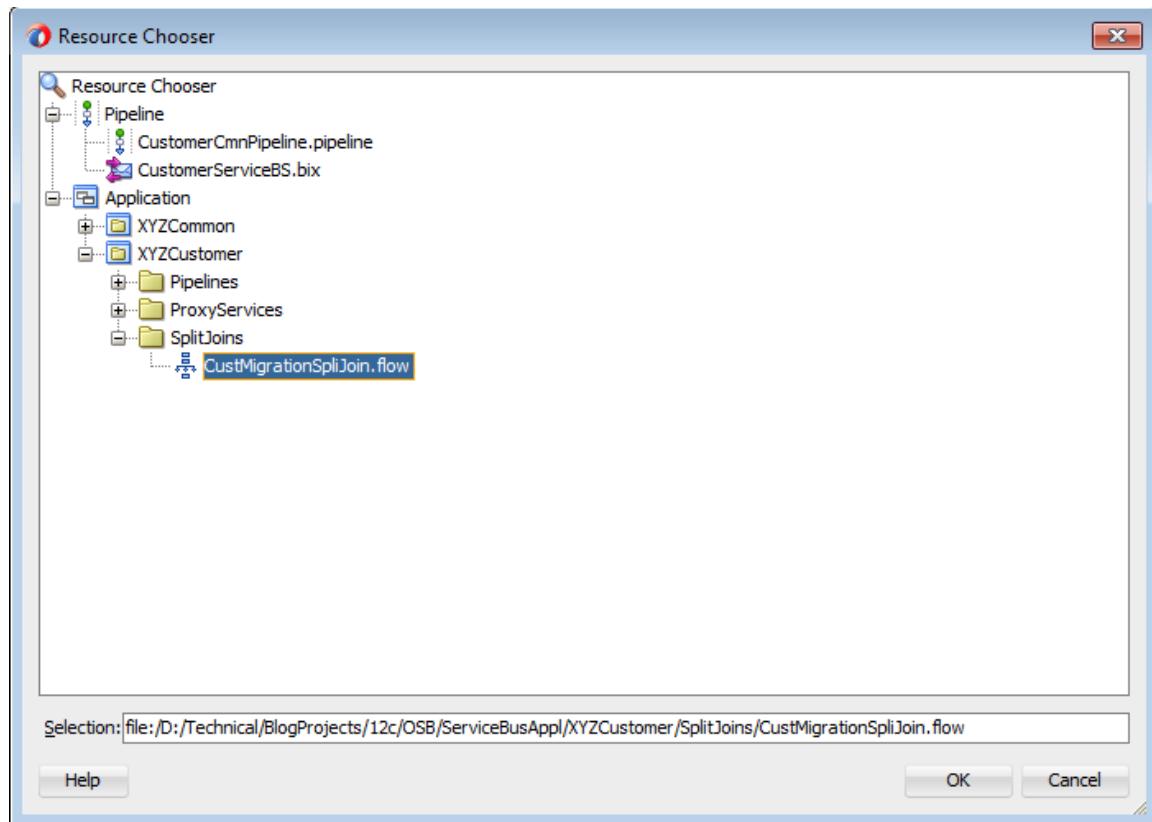
Invoking Split Join

In this section, you will invoke Split Join created in the previous section to fetch the Customer Information.

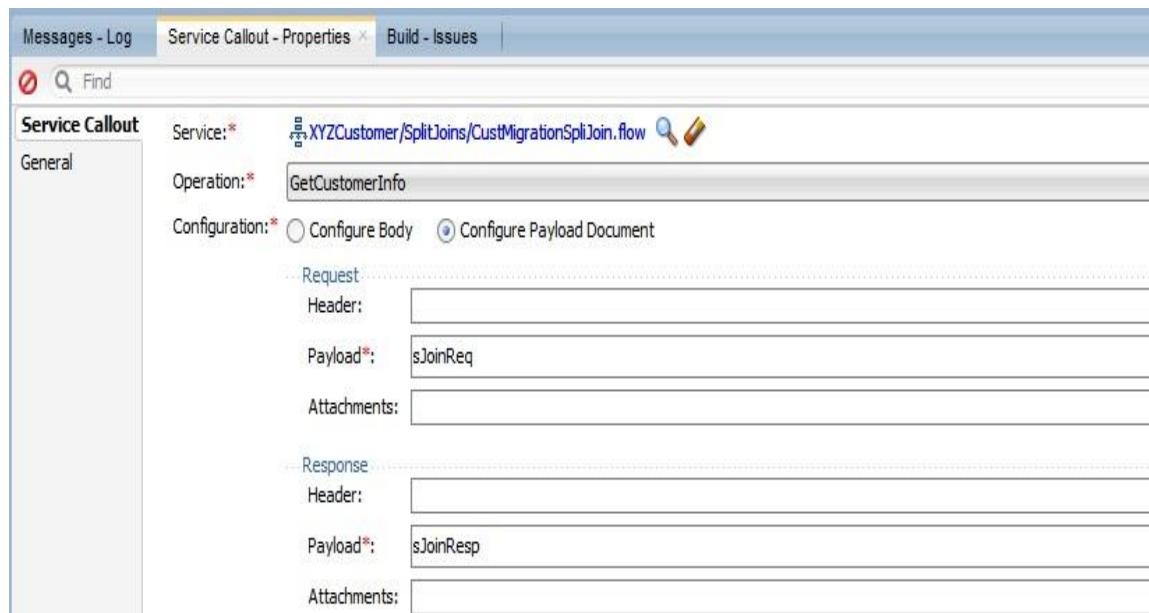
Drag **Stage** node into **Stages** placeholder from **Nodes into Request Pipeline** and set the name as **CallSplitJoin** and drag **Service Callout** into this stage from Communication shown below.



In **Properties** tab, browse and select **CustMigrationSplitJoin** for **Service** property.



Select **GetCustomerInfo** operation and set other properties of **Service Callout** as shown below.



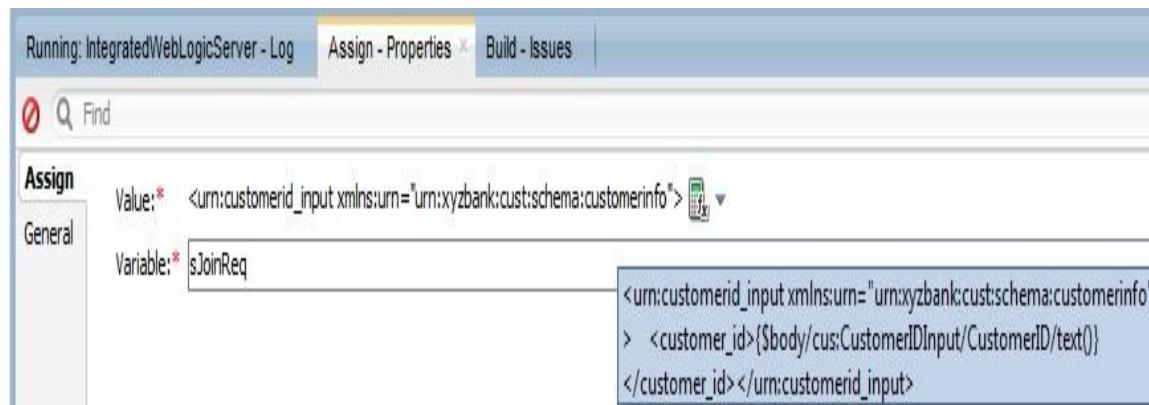
The screenshot shows the 'Service Callout - Properties' tab selected in a software interface. The 'General' section is active. The 'Service:' field is set to 'XYZCustomer/SplitJoins/CustMigrationSplJoin.flow'. The 'Operation:' field is set to 'GetCustomerInfo'. Under 'Configuration:', the 'Configure Payload Document' option is selected. The 'Request' section contains fields for 'Header' (empty), 'Payload': 'sJoinReq', and 'Attachments' (empty). The 'Response' section contains fields for 'Header' (empty), 'Payload': 'sJoinResp', and 'Attachments' (empty).

sJoinReq is variable to be populated with the payload for **GetCustomerInfo** operation and **sJoinResp** is variable that contains response returned by split join after service call. Since you are using '**Configure Payload Document**' option, you just need to populate the request variable with required payload.

Drag **Assign** activity from **Message Processing** into **Request Action** of **Service Callout** and set properties as shown below.

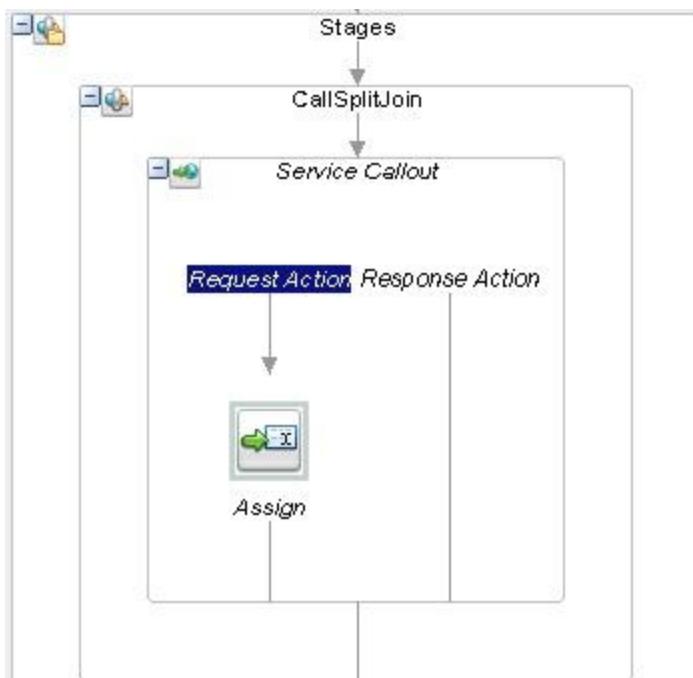
Value:

```
<urn:customerid_input xmlns:urn="urn:xyzbank:cust:schema:customerinfo">
    <customer_id>{$body/cus:CustomerIDInput/CustomerID/text()}</customer_id>
</urn:customerid_input>
```

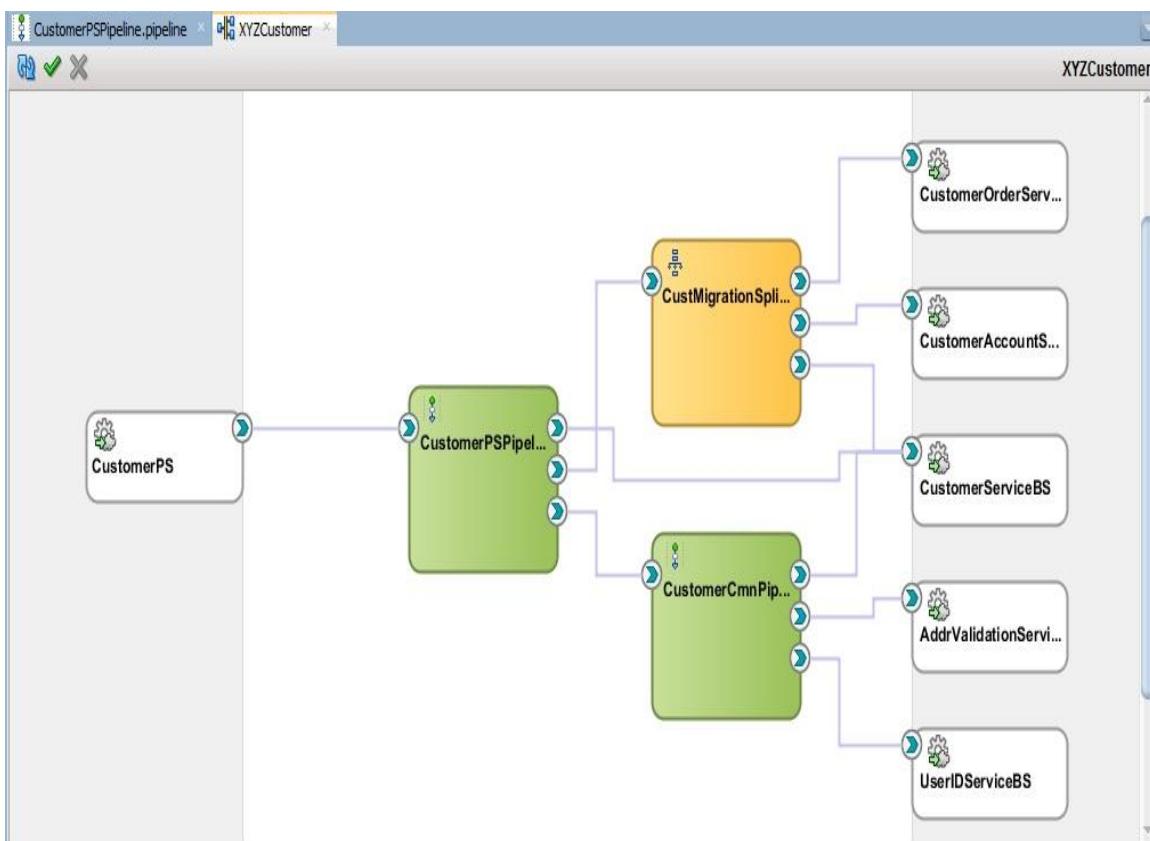


The screenshot shows the 'Assign - Properties' tab selected in a software interface. The 'General' section is active. The 'Value:' field contains the XML snippet: '<urn:customerid_input xmlns:urn="urn:xyzbank:cust:schema:customerinfo">' followed by a dropdown arrow. The 'Variable:' field is set to 'sJoinReq'. A tooltip or preview window is open over the 'Value:' field, showing the full XML structure: '<urn:customerid_input xmlns:urn="urn:xyzbank:cust:schema:customerinfo"> <customer_id>{\$body/cus:CustomerIDInput/CustomerID/text()} </customer_id></urn:customerid_input>'.

Now your **CallSplitJoin** stage should look like below.



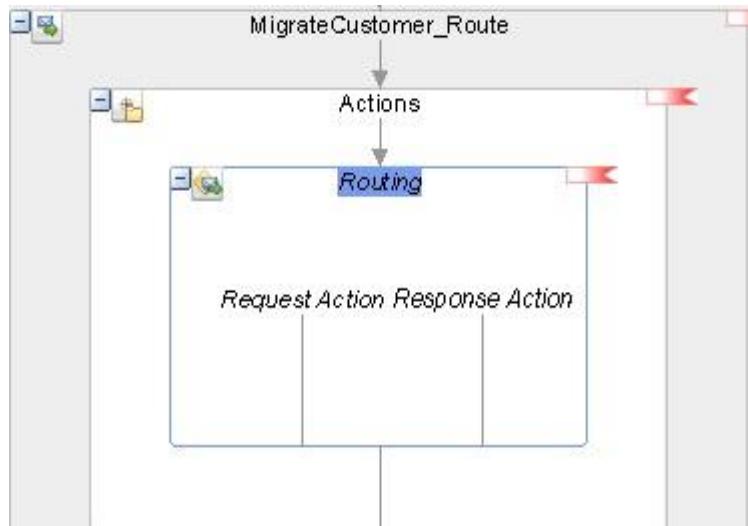
And your Service Bus Overview editor should look like below.



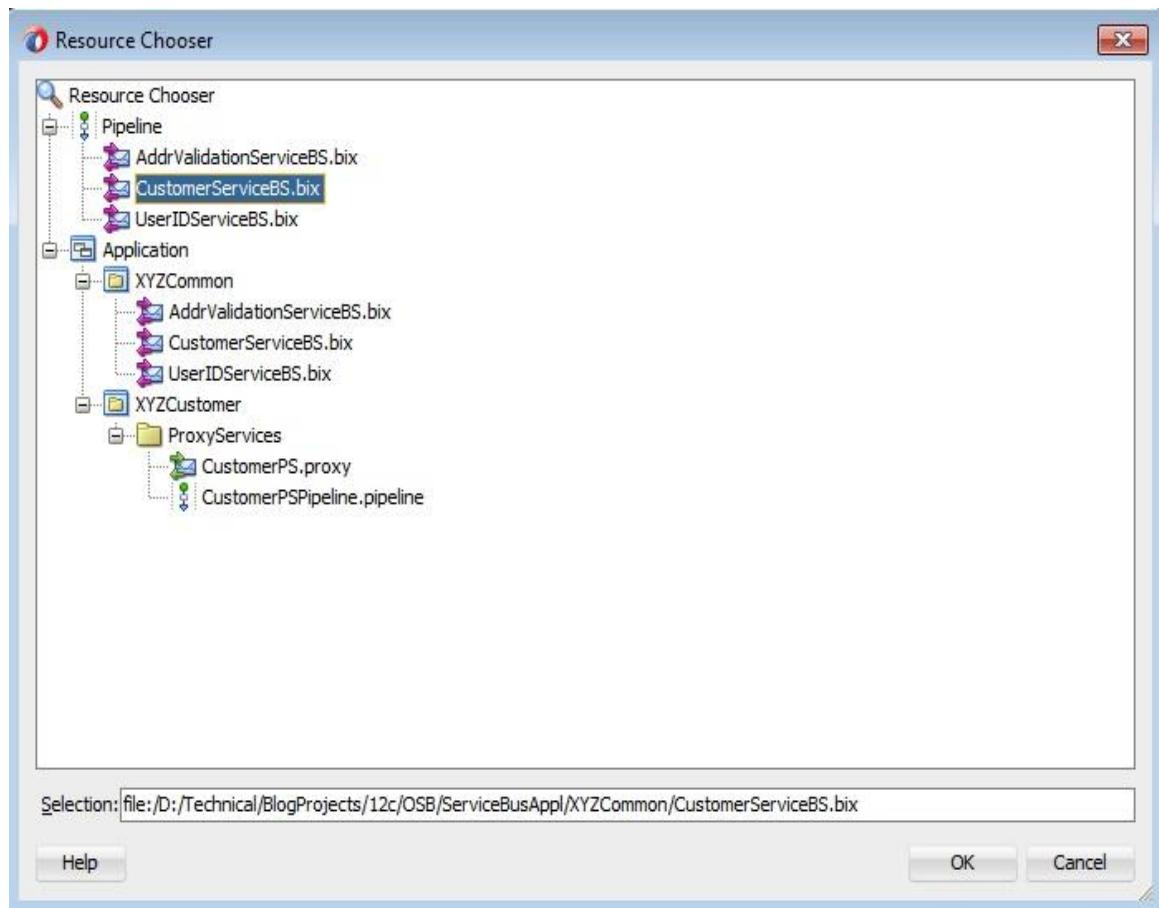
Routing

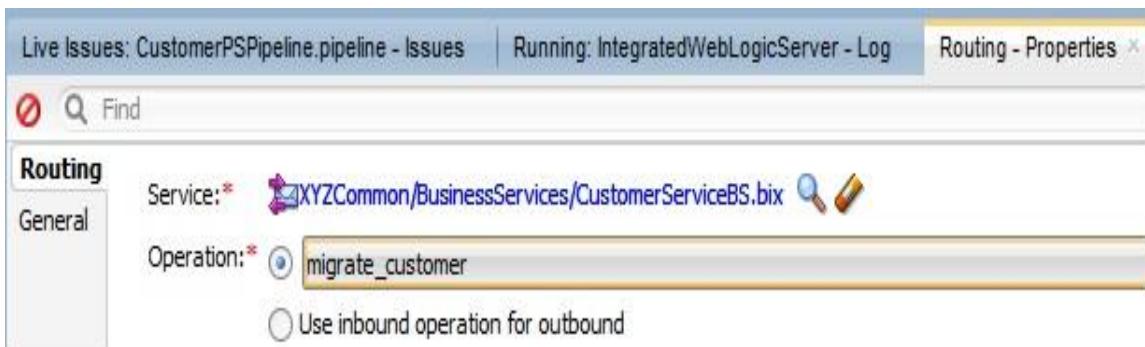
In this section, you will invoke **CustomerServiceBS** to finish message flow for **Migrate Customer**.

Drag **Routing** activity into **Actions** placeholder of **MigrateCustomer_Route**.

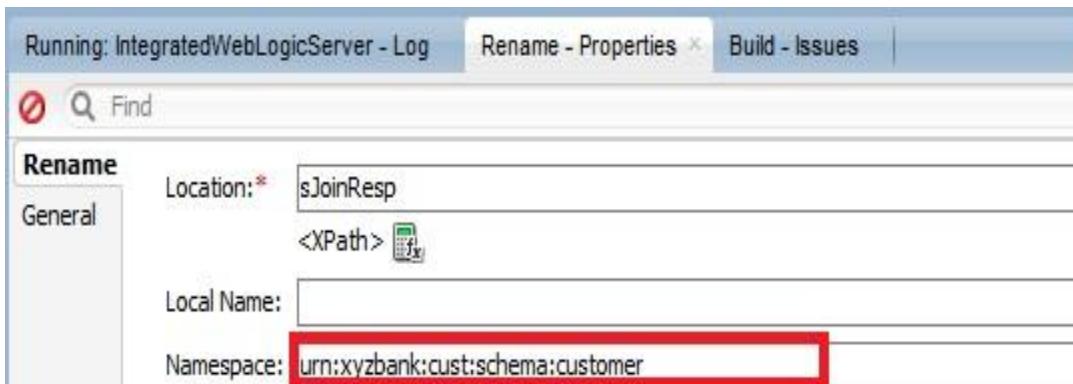


In **Properties** tab, browse and select **CustomerServiceBS** and **migrate_customer** operation.

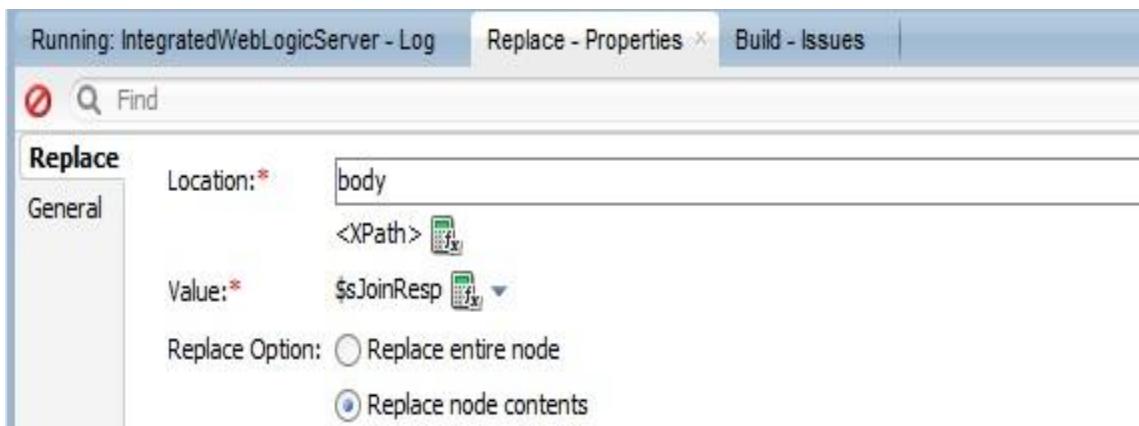




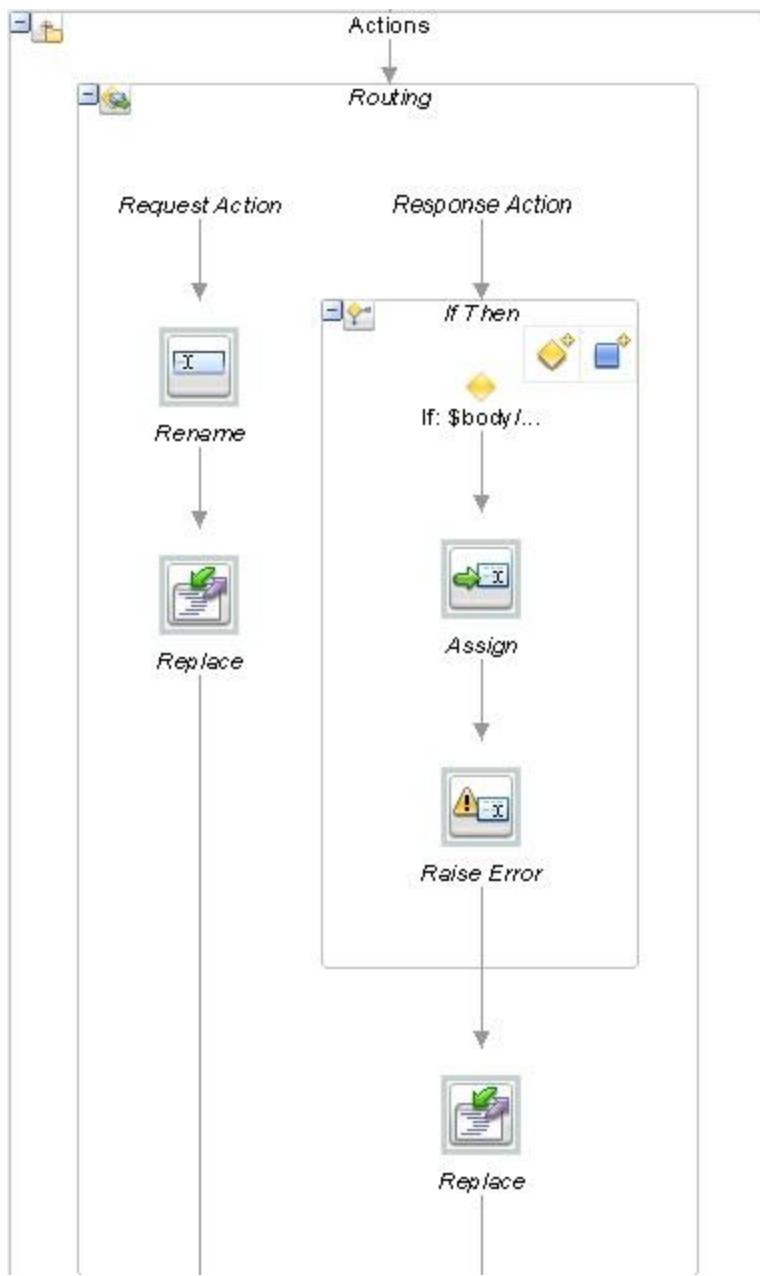
The response of Split Join is same as the payload required by **CustomerServiceBS** with different namespace so you could use **Rename** activity instead of another transformation. Drag **Rename** activity from **Message Processing** into **Request Action** of **Routing** and set properties as shown below.



Now you need to replace **\$body** with this payload. So drag **Replace** activity after **Rename** from **Message Processing** and set properties as shown below.



Finish **Response Action** in **Routing** similar to **CreateCustomer** as response structure of business service is same for all the operations. So you can reuse **CustStatusMsgToCustomerPSOutput** XQuery Map. Now your Routing node should look like below.



Testing

Deploy both projects or run Pipeline directly as shown in **Deploying and Testing** section. You may want to frequently test your proxy service/pipeline during development. Run your pipeline with sample payloads given [here](#) and observe **Flow Trace and Variables** as shown below. You can also run Proxy Service but you will not observe any **Flow Trace**.

No CustomerID element:

 Response Document

⚠ The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>soapenv:Server</faultcode>
      <faultstring>
        OSB-382505: OSB Validate action failed validation
      </faultstring>
      <detail>
        <con:Fault xmlns:con="http://www.bea.com/wli/sb/context">
          <con:errorCode>OSB-382505</con:errorCode>
          <con:reason>OSB Validate action failed validation</con:reason>
          <con:details>
            <con1:ValidationFailureDetail xmlns:con1="http://www.bea.com/wli/sb/stages/transform/config">
              <con1:message>
                Expected element 'CustomerID' before the end of the content in element CustomerIDInput@http://xmlns.xyzbank.com/schema/Customer
              </con1:message>
              <con1:xmlLocation>
                <cus:CustomerIDInput xmlns:cus="http://xmlns.xyzbank.com/schema/Customer">
                  </cus:CustomerIDInput>
                </con1:xmlLocation>
              </con1:ValidationFailureDetail>
            </con1:details>
          <con:location>
            <con:node>MigrateCustomer_PipelinePair</con:node>
            <con:pipeline>
              MigrateCustomer_request-N3f57c7ff.155d987b.0.148031976cd.N7ffd
            </con:pipeline>
            <con:stage>Validation</con:stage>
            <con:path>request-pipeline</con:path>
            </con:location>
          </con:details>
        </con:Fault>
      </detail>
    </soapenv:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

No value for CustomerID:

 Response Document

⚠ The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>soapenv:Server</faultcode>
      <faultstring>
        XYZ-0005: Customer ID is mandatory for Migrate.
      </faultstring>
      <detail>
        <con:Fault xmlns:con="http://www.bea.com/wli/sb/context">
          <con:errorCode>XYZ-0005</con:errorCode>
          <con:reason>Customer ID is mandatory for Migrate.</con:reason>
          <con:location>
            <con:node>MigrateCustomer_PipelinePair</con:node>
            <con:pipeline>
              MigrateCustomer_request-N3f57c7ff.155d987b.0.148031976cd.N7ffd
            </con:pipeline>
            <con:stage>Validation</con:stage>
            <con:path>request-pipeline</con:path>
            </con:location>
          </con:details>
        </con:Fault>
      </detail>
    </soapenv:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

Positive Case:

Invocation Trace

```

✉ (receiving request)
CustomerOperation
MigrateCustomer_PipelinePair
Validation
CallSplitJoin
Invoked Services
  Service Callout to: "CustMigrationSplJoin"
$outbound:
  $body (request):
    <soapenv:Body xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
      <urn:customerid_input xmlns:urn="urn:xyzbank:cust:schema:customerinfo">
        <customer_id>AHHHHH8787299</customer_id>
      </urn:customerid_input>
    </soapenv:Body>
  $header (request):
    $body (response):
    $header (response):
Message Context Changes
  + added $sJoinReq
    <urn:customerid_input xmlns:urn="urn:xyzbank:cust:schema:customerinfo">
      <customer_id>AHHHHH8787299</customer_id>
    </urn:customerid_input>

  + added $sJoinResp
    <ns4:migrated_customer xmlns:ns4="urn:xyzbank:cust:schema:customerinfo" xmlns:soap-env="http://schemas.xmlsoap.org/soap/envelope/">
      <customer_id>1234</customer_id>
      <full_name>FName.LName</full_name>
      <date_of_birth/>
      <email>abc@gmail.com</email>
      <phone>+911234567890</phone>
      <addr_line1>Madhapur</addr_line1>
      <addr_line2>Hyd</addr_line2>
      <addr_line3>Andhra Pradesh,India,500081</addr_line3>
      <customer_accounts>
        <account>
          <account_id>ACTB7878HKJHKJ</account_id>
          <account_type>SAVINGS</account_type>
          <account_name>svgonugu</account_name>
          <description>desc</description>
          <investor_type>Individual</investor_type>
          <brokeage_code>FLEXI</brokeage_code>
          <rebate_code>REB</rebate_code>
          <trading_limit>15000</trading_limit>
          <credit_limit>10000</credit_limit>
          <account_status>ACTIVE</account_status>
          <registration_details>
            <market_id>BSE</market_id>
            <instrument_code>CHECK</instrument_code>
            <description>desc1</description>
            <registration_details1>Madhapur</registration_details1>
            <postal_code>500081</postal_code>
            <country_code>IND</country_code>
          </registration_details>
        </account>
      </customer_accounts>
      <customer_orders>
        <order>
          <account_id>ACTB7878HKJHKJ</account_id>
          <instrument_code>CHECK</instrument_code>
          <order_action>BUY</order_action>
          <price>2345</price>
          <currency_code>INR</currency_code>
          <quantity>20</quantity>
          <date_created/>
          <brokeage_amount>70</brokeage_amount>
        </order>
      </customer_orders>
    </ns4:migrated_customer>
  
```

```

        </customer_orders>
    </ns4:migrated_customer>
    △ □ changed $body
    △ □ changed $inbound
    ⚒ MigrateCustomer_Route
    Routed Service
    □ Route to: "CustomerServiceBS"
    □ $outbound:
    □ $body (request):
        <soapenv:Body xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
            <urn:migrated_customer xmlns:ns4="urn:xyzbank:cust:schema:customerinfo" xmlns:soap-env="http://schemas.xmlsoap.org/soap/envelope/" xmlns:urn="urn:xyzbank:cust:schema:customer">
                <customer_id>1234</customer_id>
                <full_name>fname,LName</full_name>
                <date_of_birth/>
                <email>abc@gmail.com</email>
                <phone>+911234567890</phone>
                <addr_line1>Madhapur</addr_line1>
                <addr_line2>Hyd</addr_line2>
                <addr_line3>Andhra Pradesh,India,500081</addr_line3>
                <customer_accounts>
                    <account>
                        <account_id>ACT87878HKJHKJ</account_id>
                        <account_type>SAVINGS</account_type>
                        <account_name>svgonugu</account_name>
                        <description>desc</description>
                        <investor_type>Individual</investor_type>
                        <brokerage_code>FLEXI</brokerage_code>
                        <rebate_code>REB</rebate_code>
                        <trading_limit>15000</trading_limit>
                        <credit_limit>10000</credit_limit>
                        <account_status>ACTIVE</account_status>
                        <registration_details>
                            <market_id>BSE</market_id>
                            <instrument_code>CHECK</instrument_code>
                            <description>desc1</description>
                            <registration_details1>Madhapur</registration_details1>
                            <postal_code>500081</postal_code>
                            <country_code>IND</country_code>
                        </registration_details>
                    </account>
                </customer_accounts>
            </urn:migrated_customer>
        </soapenv:Body>
    
```

□ \$header (request):

□ \$attachments (request):

Message Context Changes

✚ □ added \$outbound

△ □ changed \$body

```

        <soapenv:Body xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:urn="urn:xyzbank:cust:schema:customer">
            <ns2:StatusMsg xmlns:ns2="http://xmlns.xyzbank.com/schema/Customer">
                <CustomerID>1234</CustomerID>
                <status>S</status>
            </ns2:StatusMsg>
        </soapenv:Body>
    
```

△ □ changed \$joinResp

△ □ changed \$attachments

△ □ changed \$inbound

△ □ changed \$header

⬇️ MigrateCustomer_PipelinePair

⚡ CustomerOperation

Negative Case - Status E in business service response:

Invocation Trace

(receiving request)
CustomerOperation
MigrateCustomer_PipelinePair
Validation
CallSplitJoin
MigrateCustomer_Route
Routed Service
Route to: "CustomerServiceBS"
Message Context Changes
added \$faultVar
<urn:status_msg xmlns:urn="urn:xyzbank:cust:schema:customer" xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
 <customer_id>AHHHHH8787299</customer_id>
 <status>E</status>
 <error_message>Unexpected error in migrating user.</error_message>
</urn:status_msg>
added \$outbound
changed \$body
changed \$sJoinResp
changed \$attachments
changed \$inbound
changed \$header
Service Error Handler
\$fault: <con:fault xmlns:con="http://www.bea.com/wli/sb/context">
 <con:errorCode>XYZ-0006</con:errorCode>
 <con:reason>Error in Customer Migration.</con:reason>
 <con:location>
 <con:node>MigrateCustomer_Route</con:node>
 <con:path>response-pipeline</con:path>
 </con:location>
</con:fault>

Response Document

The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>soapenv:Server</faultcode>
      <faultstring>XYZ-0006: Error in Customer Migration.</faultstring>
      <detail>
        <con:fault xmlns:con="http://www.bea.com/wli/sb/context">
          <con:errorCode>XYZ-0006</con:errorCode>
          <con:reason>Error in Customer Migration.</con:reason>
          <con:location>
            <con:node>MigrateCustomer_Route</con:node>
            <con:path>response-pipeline</con:path>
          </con:location>
        </con:fault>
      </detail>
    </soapenv:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

Negative Case – Error in Split Join, Service Down:

Response Document

The invocation resulted in an error:

```

<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>soapenv:Server</faultcode>
      <faultstring>
        OSB-382500: OSB Service Callout action received SOAP Fault response
      </faultstring>
      <detail>
        <con:Fault xmlns:con="http://www.bea.com/wli/sb/context">
          <con:errorCode>OSB-382500</con:errorCode>
          <con:reason>
            OSB Service Callout action received SOAP Fault response
          </con:reason>
          <con:details>
            <con1:ReceivedFaultDetail xmlns:con1="http://www.bea.com/wli/stages/transform/config">
              <con1:faultcode xmlns:cus="http://xmlns.xyzbank.com/wsd/Customer">cus:FaultMsg</con1:faultcode>
              <con1:faultstring>
                {http://xmlns.xyzbank.com/wsd/Customer}FaultMsg
              </con1:faultstring>
              <con1:detail>
                <custinfo:fault_msg xmlns:custinfo="urn:xyzbank:cust:schema:customerinfo" xmlns:bind="http://xmlns.xyzbank.com/wsd/Customer" xmlns:soap-env="http://schemas.xmlsoap.org/soap/envelope">
                  <custinfo:error_code>XYZ-0009</custinfo:error_code>
                  <custinfo:error_message>Error in join operation.</custinfo:error_message>
                </custinfo:fault_msg>
              </con1:detail>
            </con1:ReceivedFaultDetail>
          </con:details>
          <con:location>
            <con:node>MigrateCustomer_PipelinePair</con:node>
            <con:pipeline>
              MigrateCustomer_request-N3f57c7ff.155d987b.0.148031976cd.N7ffd
            </con:pipeline>
            <con:stage>CallSplitJoin</con:stage>
            <con:path>request-pipeline</con:path>
          </con:location>
        </con:Fault>
      </detail>
    </soapenv:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

(receiving request)

CustomerOperation

MigrateCustomer_PipelinePair

Validation

CallSplitJoin

Invoked Services

- Service Callout to: "CustMigrationSplitJoin"
- \$outbound:
- \$body (request):
- \$header (request):

Message Context Changes

- + added \$joinReq
- △ changed \$body
- △ changed \$inbound

Service Error Handler

\$fault:

```

<con:Fault xmlns:con="http://www.bea.com/wli/sb/context">
  <con:errorCode>OSB-382500</con:errorCode>
  <con:reason>
    OSB Service Callout action received SOAP Fault response
  </con:reason>
  <con:details>
    <con1:ReceivedFaultDetail xmlns:con1="http://www.bea.com/wli/stages/transform/config">
      <con1:faultcode xmlns:cus="http://xmlns.xyzbank.com/wsd/Customer">cus:FaultMsg</con1:faultcode>
      <con1:faultstring>
        {http://xmlns.xyzbank.com/wsd/Customer}FaultMsg
      </con1:faultstring>
      <con1:detail>
        <custinfo:fault_msg xmlns:custinfo="urn:xyzbank:cust:schema:customerinfo" xmlns:bind="http://xmlns.xyzbank.com/wsd/Customer" xmlns:soap-env="http://schemas.xmlsoap.org/soap/envelope">
          <custinfo:error_code>XYZ-0009</custinfo:error_code>
          <custinfo:error_message>Error in join operation.</custinfo:error_message>
        </custinfo:fault_msg>
      </con1:detail>
    </con1:ReceivedFaultDetail>
  </con:details>
  <con:location>
    <con:node>MigrateCustomer_PipelinePair</con:node>
    <con:pipeline>
      MigrateCustomer_request-N3f57c7ff.155d987b.0.148031976cd.N7ffd
    </con:pipeline>
    <con:stage>CallSplitJoin</con:stage>
    <con:path>request-pipeline</con:path>
  </con:location>
</con:Fault>
```

Error Handling

In this section, you will learn how to do error handling in Pipeline. As shown in previous sections, the pipeline is not returning any fault message with fault structure defined in WSDL for both application/business and system errors.

As you know, service provider can send error to consumer in following ways:

- As a normal response, by populating fields like “**ErrorNumber**” and “**ErrorMessage**” (assuming that these fields are defined in response message of operation in WSDL).
- As a SOAP fault

Typically when Service Bus is mediating, you might have to transform error or fault response to the fault structure defined in WSDL. So you need to understand the message context variables that can be used for this transformation.

As per WS-I BP, the service provider should send the HTTP response code as 200 when the error is sent as normal response and 500 should be sent when the error is sent as SOAP fault.

When HTTP response code 200 is received, Service Bus treats it as a normal response and proceeds further with message flow. When response code 500 is received, Service Bus runtime control goes to **Service Error Handler** if it exists or any other low level **Error Handlers** depending on where you received. That means Service Bus treats even Fault response as normal response when HTTP response code is 200. In message flow, **Error Handler** can be defined for **Stage** node, **Pipeline Pair** node (both Request Pipeline and Response Pipeline individually), **Routing** node and for entire **Pipeline** (called Service Error Handler).

Service Bus populates different message context variables with error/fault messages and is accessible in **Error Handler** depending on whether you used **Routing** or **Service Callout**. When **Routing** is used, the variable **\$body** will have Fault response and when **Service Callout** is used, variable **\$fault** will have Fault response. The following table summarizes this discussion:

Activity	Scenario	Context Variable
Routing	Raise Error activity	\$fault
Routing	Fault Response from business service	\$body
Routing	System fault while calling business service	\$fault
Service Callout	Raise Error activity	\$fault
Service Callout	Fault Response from business service	\$fault
Service Callout	System fault while calling business service	\$fault

With this background, let us go back to Pipeline to add required **Error Handlers**. In this case, the business service WSDL does not define any Fault structure and all errors will be sent as normal response with status **E**. But you should consider all possible cases for Error Handling. So there is a possibility of 3 variables having error/fault information and they are **\$body**, **\$fault** and **\$faultVar** (populated in your message flow on receiving status **E** in **Routing**).

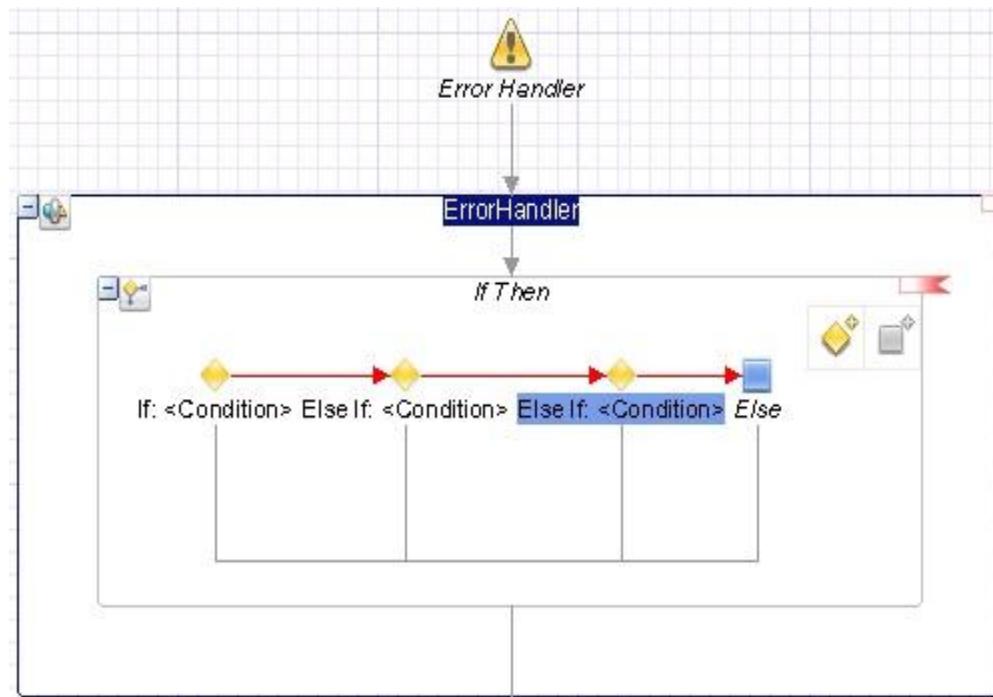
Your Pipeline uses both **Service Callout** and **Routing** in message flow so you can do the fault handling in following manner in pipeline template **CustomerPipelineTemplate** so that concrete pipelines would inherit the message flow.

- Add **Service Error Handler**. Note that you can add error handler for Routing node, Stage, Request Pipeline and Response Pipeline of Pipeline Pair nodes.
- Add conditional branches in error handler to verify **\$body** is populated with SOAP Fault, or **faultVar** or **\$fault** is populated. Based on this, you have to extract **Error Code** and **Error Message** from **\$body**, **\$faultVar** and **\$fault** variables.
- Populate **\$body** variable with fault structure as defined in WSDL.

CustomerPipelineTemplate

In this section, you will finish error handling in pipeline template.

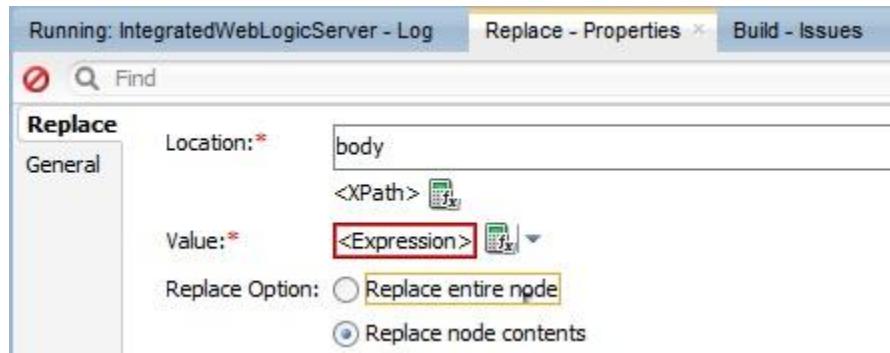
Drag **If-Then** activity into **ErrorHandler** stage from **Flow Control** and add 2 conditional branches (Else If branch) as shown below.



In **Properties** tab, set **Condition** property for all branches as shown below in expression builder. Remember adding the namespace <http://www.bea.com/wli/sb/stages/transform/config> with **con1** as alias in **Namespaces**.

Branch	Condition	Purpose
If	not(fn:empty(\$body/soap-env:Fault))	To handle fault received in Routing.
Else If	not(fn:empty(\$faultVar))	To handle error response received in Routing.
Else If	not(fn:empty(\$fault/ctx:details/con1:ReceivedFaultDetail))	To handle fault received in Service Callout or Raise Error cases.
Else	-NA-	All other possible cases.

Drag **Replace** activity into each of these branches from **Message Processing** and set properties as shown below.



Set expression in expression builder with the following SOAP Fault structure for **Replace** activity in **If** branch. Here you are extracting the error code and error message from received SOAP fault received in **Routing**, this way you are forwarding actual error from service provider to consumer of your proxy service.

```
<soap-env:Fault>
  <faultcode>env:Server</faultcode>
  <faultstring>{$body/soap-env:Fault/faultstring/text()}</faultstring>
  <detail>
    <cust:ErrorStatusMsg xmlns:cust="http://xmlns.xyzbank.com/schema/Customer">
      <ErrorCode>{$body/soap-env:Fault/faultcode/text()}</ErrorCode>
      <ErrorMsg>{$body/soap-env:Fault/faultstring/text()}</ErrorMsg>
    </cust:ErrorStatusMsg>
  </detail>
</soap-env:Fault>
```

Set expression in expression builder with the following SOAP Fault structure for **Replace** activity in **Else If** branch. Here you are extracting the error code and error message from error response received in **Routing**, this way you are forwarding actual error from service provider to consumer of your proxy service. Observe the usage of **\$fault** variable to get error code given in **RaiseError** activity.

```
<soap-env:Fault>
  <faultcode>env:Server</faultcode>
  <faultstring>{$faultVar/error_message/text()}</faultstring>
  <detail>
    <cust:ErrorStatusMsg xmlns:cust="http://xmlns.xyzbank.com/schema/Customer">
      <ErrorCode>{$fault/ctx:errorCode/text()}</ErrorCode>
      <ErrorMsg>{$faultVar/error_message/text()}</ErrorMsg>
    </cust:ErrorStatusMsg>
  </detail>
</soap-env:Fault>
```

Set expression in expression builder with the following SOAP Fault structure for **Replace** activity in second **Else If** branch. Here you are extracting the error code and error message from SOAP Fault received in **Service Callout**, this way you are forwarding actual error from service provider to the consumer of proxy service.

```
<soap-env:Fault>
```

```

<faultcode>env:Server</faultcode>
<faultstring>{$fault/ctx:reason/text()}</faultstring>
<detail>
  <cust:ErrorStatusMsg xmlns:cust="http://xmlns.xyzbank.com/schema/Customer">
    <ErrorCode>{$fault/ctx:details/con1:ReceivedFaultDetail/con1:faultcode/text()}</ErrorCode>
    <ErrorMsg>{$fault/ctx:details/con1:ReceivedFaultDetail/con1:faultstring/text()}</ErrorMsg>
  </cust:ErrorStatusMsg>
</detail>
</soap-env:Fault>

```

Set expression in expression builder with the following SOAP fault structure for **Replace** activity in **Else** branch. Here you are extracting error code and error message from **\$fault** to take care of other error scenarios.

```

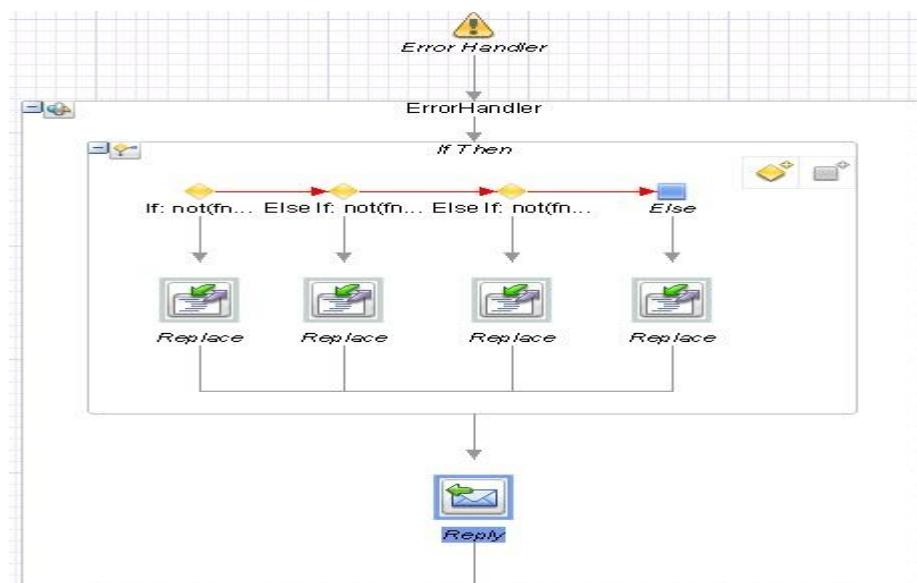
<soap-env:Fault>
<faultcode>env:Server</faultcode>
<faultstring>{$fault/ctx:reason/text()}</faultstring>
<detail>
  <cust:ErrorStatusMsg xmlns:cust="http://xmlns.xyzbank.com/schema/Customer">
    <ErrorCode>{$fault/ctx:errorCode/text()}</ErrorCode>
    <ErrorMsg>{$fault/ctx:reason/text()}</ErrorMsg>
  </cust:ErrorStatusMsg>
</detail>
</soap-env:Fault>

```

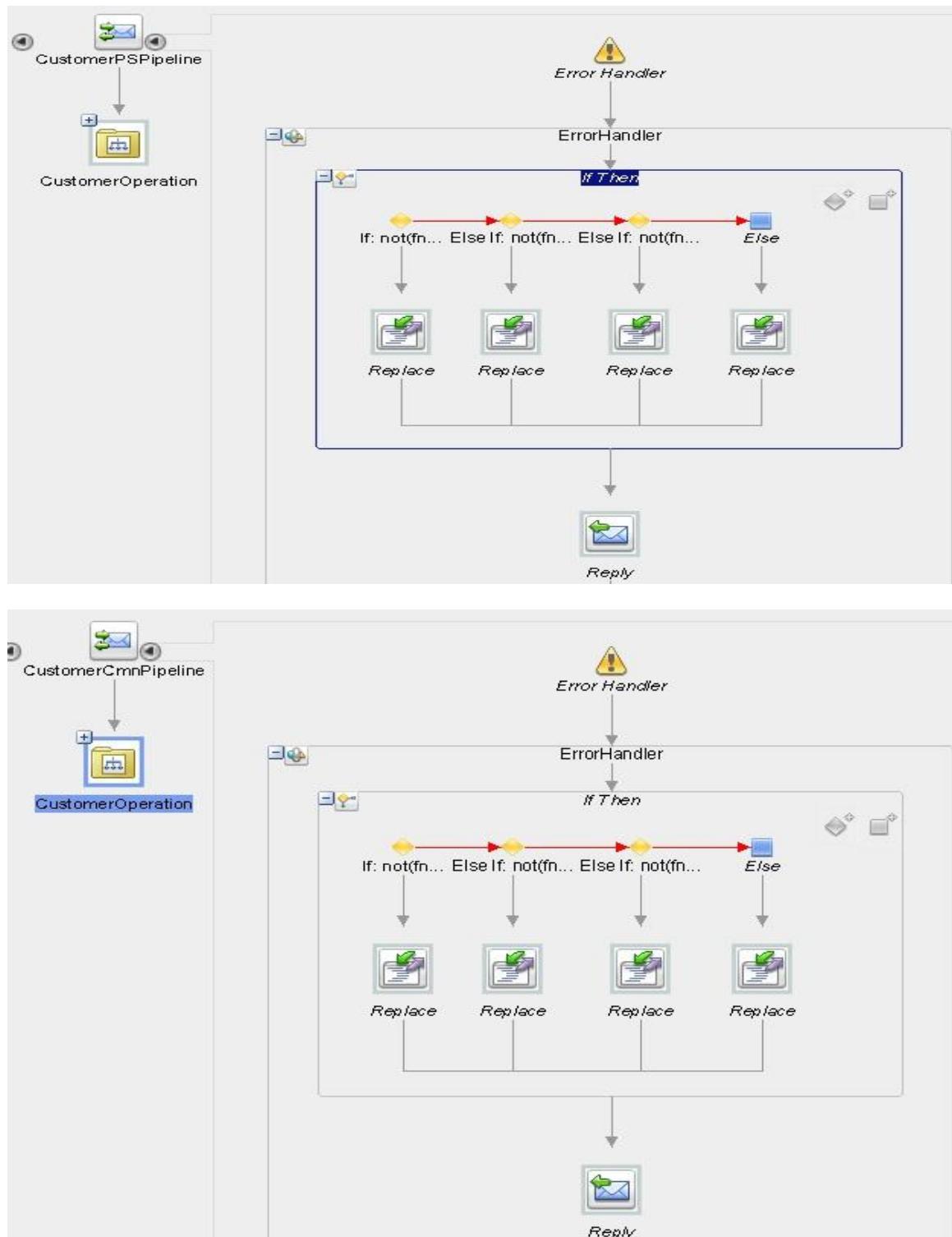
Now drag **Reply** activity into **ErrorHandler** stage from **Flow Control** after **If-then**. In **Properties** tab, select property as **With Failure**. This would send HTTP response code as 500 along with SOAP fault. Selecting **With Success** will send HTTP response code as 200.



Alternatively, you can come up with XQuery map accepting these parameters to take care of all these scenarios and return SOAP fault. Now your **ErrorHandler** stage should look like below.



Observe that **CustomerPSPipeline** and **CustomerCmnPipeline** had inherited ErrorHandler stage as shown below.



Testing

Deploy both projects or run **Pipeline** directly as shown in **Deploying and Testing** section. You may want to frequently test your proxy service/pipeline during development. Run your pipeline with sample payloads given in previous sections and observe **Flow Trace and Variables** as shown below. Observe the error response from your pipeline/proxy service and always contains **SOAP Fault** containing error message. Following screenshots show response of **CustomerCmnPipeline** for different error scenarios.

Routing – System Error (Update Customer):

 Response Document

⚠ The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soap:Header xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
  </soap:Header>
  <soapenv:Body>
    <soap-env:Fault xmlns:soap-env="http://schemas.xmlsoap.org/soap/envelope/">
      <faultcode>env:Server</faultcode>
      <faultstring>
        Tried all: '2' addresses, but could not connect over HTTP to server: 'localhost', port: '8088'
      </faultstring>
      <detail>
        <cust:ErrorStatusMsg xmlns:cust="http://xmlns.xyzbank.com/schema/Customer">
          <ErrorCode>OSB-380002</ErrorCode>
          <ErrorMsg>
            Tried all: '2' addresses, but could not connect over HTTP to server: 'localhost', port: '8088'
          </ErrorMsg>
        </cust:ErrorStatusMsg>
      </detail>
    </soap-env:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

Routing – Error Response (Update Customer):

 Response Document

⚠ The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Header xmlns:urn="urn:xyzbank:cust:schema:customer"/>
  <soapenv:Body xmlns:urn="urn:xyzbank:cust:schema:customer">
    <soap-env:Fault xmlns:soap-env="http://schemas.xmlsoap.org/soap/envelope/">
      <faultcode>env:Server</faultcode>
      <faultstring>
        unknown error occurred during customer update
      </faultstring>
      <detail>
        <cust:ErrorStatusMsg xmlns:cust="http://xmlns.xyzbank.com/schema/Customer">
          <ErrorCode>XYZ-0004</ErrorCode>
          <ErrorMsg>
            unknown error occurred during customer update
          </ErrorMsg>
        </cust:ErrorStatusMsg>
      </detail>
    </soap-env:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

Routing – Fault Response (Create Customer):

Response Document

 The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Header xmlns:urn="urn:xyzbank:cust:schema:customer"/>
  <soapenv:Body xmlns:urn="urn:xyzbank:cust:schema:customer">
    <soap-env:Fault xmlns:soap-env="http://schemas.xmlsoap.org/soap/envelope/">
      <faultcode>env:Server</faultcode>
      <faultstring>Error in Create Customer</faultstring>
      <detail>
        <cust:ErrorStatusMsg xmlns:cust="http://xmlns.xyzbank.com/schema/Customer">
          <ErrorCode>soapenv:Server</ErrorCode>
          <ErrorMsg>Error in Create Customer</ErrorMsg>
        </cust:ErrorStatusMsg>
      </detail>
    </soap-env:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

Invalid CustomerType Validation Error (Create Customer):

Response Document

 The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soap:Header xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
  </soap:Header>
  <soapenv:Body>
    <soap-env:Fault xmlns:soap-env="http://schemas.xmlsoap.org/soap/envelope/">
      <faultcode>env:Server</faultcode>
      <faultstring>OSB Validate action failed validation</faultstring>
      <detail>
        <cust:ErrorStatusMsg xmlns:cust="http://xmlns.xyzbank.com/schema/Customer">
          <ErrorCode>OSB-382505</ErrorCode>
          <ErrorMsg>OSB Validate action failed validation</ErrorMsg>
        </cust:ErrorStatusMsg>
      </detail>
    </soap-env:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

Email Validation Error (Update Customer):

 Response Document

⚠ The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
    <soap:Header xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
        </soap:Header>
    <soapenv:Body>
        <soap-env:Fault xmlns:soap-env="http://schemas.xmlsoap.org/soap/envelope/">
            <faultcode>env:Server</faultcode>
            <faultstring>Email is not valid.</faultstring>
            <detail>
                <cust:ErrorStatusMsg xmlns:cust="http://xmlns.xyzbank.com/schema/Customer">
                    <ErrorCode>XYZ-0001</ErrorCode>
                    <ErrorMsg>Email is not valid.</ErrorMsg>
                </cust:ErrorStatusMsg>
            </detail>
        </soap-env:Fault>
    </soapenv:Body>
</soapenv:Envelope>
```

Service Callout – System Error (CreateCustomer):

 Response Document

⚠ The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
    <soap:Header xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
        </soap:Header>
    <soapenv:Body>
        <soap-env:Fault xmlns:soap-env="http://schemas.xmlsoap.org/soap/envelope/">
            <faultcode>env:Server</faultcode>
            <faultstring>
                Tried all: '2' addresses, but could not connect over HTTP to server: 'localhost', port: '8088'
            </faultstring>
            <detail>
                <cust:ErrorStatusMsg xmlns:cust="http://xmlns.xyzbank.com/schema/Customer">
                    <ErrorCode>OSB-380002</ErrorCode>
                    <ErrorMsg>
                        Tried all: '2' addresses, but could not connect over HTTP to server: 'localhost', port: '8088'
                    </ErrorMsg>
                </cust:ErrorStatusMsg>
            </detail>
        </soap-env:Fault>
    </soapenv:Body>
</soapenv:Envelope>
```

Service Callout – Error Response (CreateCustomer):

Response Document

 The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soap:Header xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
  </soap:Header>
  <soapenv:Body>
    <soap-env:Fault xmlns:soap-env="http://schemas.xmlsoap.org/soap/envelope/">
      <faultcode>env:Server</faultcode>
      <faultstring>Address is invalid.</faultstring>
      <detail>
        <cust:ErrorStatusMsg xmlns:cust="http://xmlns.xyzbank.com/schema/Customer">
          <ErrorCode>XYZ-0002</ErrorCode>
          <ErrorMsg>Address is invalid.</ErrorMsg>
        </cust:ErrorStatusMsg>
      </detail>
    </soap-env:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

Service Callout – Fault Response (CreateCustomer):

Response Document

 The invocation resulted in an error: .

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soap:Header xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
  </soap:Header>
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>env:Server</faultcode>
      <faultstring>
        OSB Service Callout action received SOAP Fault response
      </faultstring>
      <detail>
        <cust:ErrorStatusMsg xmlns:cust="http://xmlns.xyzbank.com/schema/Customer">
          <ErrorCode>XYZLEGACY-789</ErrorCode>
          <ErrorMsg>Error in performing operation</ErrorMsg>
        </cust:ErrorStatusMsg>
      </detail>
    </soapenv:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

CustomerPSPipeline

Similarly, run this pipeline with sample payloads given in previous sections and observe that you always receive fault message as the response.

Securing Proxy Service

Security is one of the main aspects while developing any service and is no different from our regular web applications. Also these services are reusable and can be invoked by either internal or external customers, so you should consider securing your Service Bus Proxy Services so that only valid users will be able to invoke.

Service Bus is completely integrated with **Oracle Webservices Manager** (OWSM) which provides several out of the box security policies. You can use these any of these OWSM policies to secure your proxy services based on your service security requirements. In this tutorial, you will use the policy **oracle/wss_username_token_service_policy** to secure your Proxy Service.

First step is creating users. Here you will see how to create users using **sbconsole**. But this is not the recommended way and typically an Organization will have a list of valid users in some LDAP directory and you have to configure one of the Authenticators in Weblogic to access that LDAP for authentication purpose. This configuration will not be discussed here in this tutorial.

Creating User

Login to **Admin Console** and click **Security Realms** in Domain Structure.



Click **myrealm** as shown below.

Name		Default Realm
<input type="checkbox"/>	myrealm	true

Navigate to Users by clicking on **Users and Groups** tab.

Users **Groups**

This page displays information about each user that has been configured in this security realm.

Customize this table

Users (Filtered - More Columns Exist)

New **Delete**

	Name	Description
	alsb-system-user	The ALSB system user is a built-in system account which belongs to the system group and boots to prevent direct access to this account.
	OracleSystemUser	Oracle application software system user.
	weblogic	This user is the default administrator.

New **Delete**

Click **New** and enter credentials as shown below.

Create a New User

OK | **Cancel**

User Properties

The following properties will be used to identify your new User.
* Indicates required fields

What would you like to name your new User?

*** Name:** xyzcustomer

How would you like to describe the new User?

Description:

Please choose a provider for the user.

Provider: DefaultAuthenticator ▾

The password is associated with the login name for the new User.

*** Password:**

*** Confirm Password:**

OK | **Cancel**

Click **OK** and observe new user got created. You can use this user to invoke your Proxy Services.

Users (Filtered - More Columns Exist)

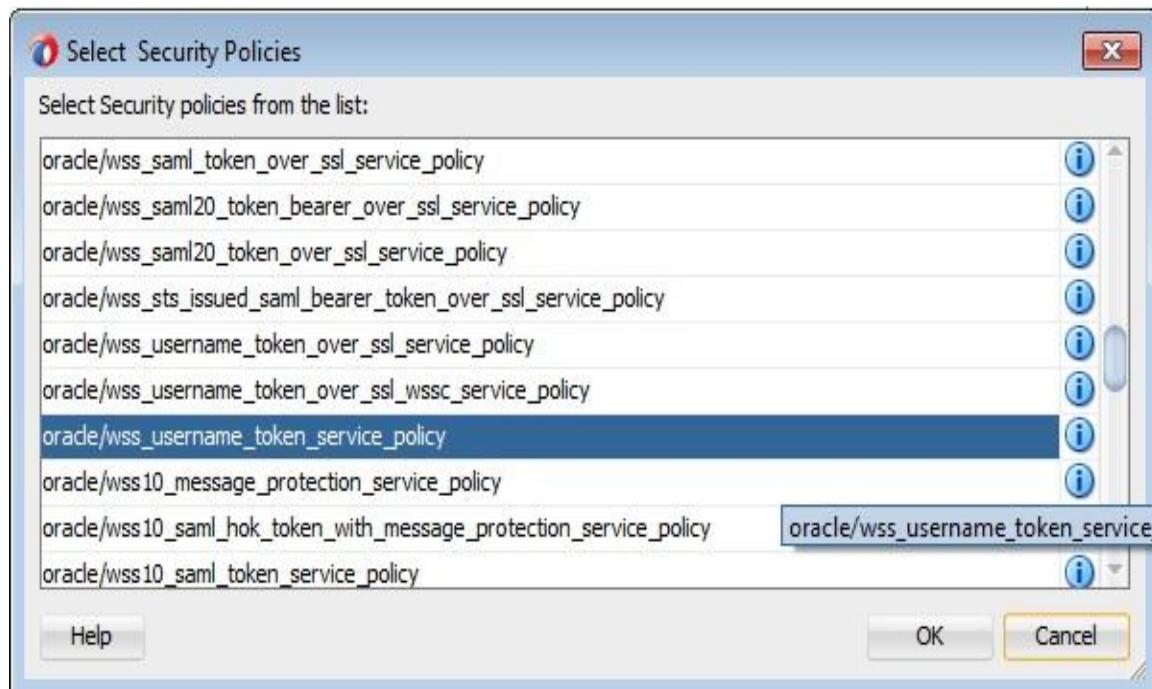
	Name	Description
<input type="checkbox"/>	alsb-system-user	The ALSB system user is a built-in system account which belongs to boots to prevent direct access to this account.
<input type="checkbox"/>	OracleSystemUser	Oracle application software system user.
<input type="checkbox"/>	weblogic	This user is the default administrator.
<input type="checkbox"/>	xyzcustomer	

Attaching OWSM Policy

Open **CustomerPS**. Navigate to **Policies** tab and select option as shown below.

The screenshot shows the 'CustomerPS.proxy' configuration page. On the left, there is a sidebar with tabs: General, Transport, Transport Details, Message Handling, **Policies** (which is selected and highlighted with a red box), and Security. The main content area is titled 'Policy Configuration' with the sub-section 'Policies'. It contains two radio button options: 'No Policies' and 'From OWSM Policy Store', with 'From OWSM Policy Store' being selected (also highlighted with a red box). Below this is the 'OWSM Policy Configuration' section, which includes four policy categories: MTOM, Reliability, Addressing, and Security. Each category has a text input field and a set of icons for adding (+), removing (X), and modifying (shield) policies.

Click **+** icon in **Security** section and select policy **oracle/wss_username_token_service_policy**.



Click **OK** and observe that selected policy is shown up in **Security** section as shown below.

The screenshot shows the "Policy Configuration" page. Under the "Policies" section, the radio button "From OWSM Policy Store" is selected. In the "OWSM Policy Configuration" section, the "Security" row is highlighted with a blue selection bar. It contains a shield icon with a green checkmark, a pencil icon, a red X icon, a shield icon, and a yellow shield icon with a red X. The text "oracle/wss_username_token_service_policy" is displayed next to the shield icon.

You can also attach OWSM policies to Proxy Service in **sbconsole**. Launch **sbconsole** and create a new session. Navigate to **All Projects -> XYZ Customer -> ProxyServices** and open **CustomerPS** which brings up a new tab as shown below.

Click **Security** and choose the option as shown below.

Click **Attach Policies** icon (highlighted above). Select required policy as shown below and click **Attach**.

Security Policies - CustomerPS

Available Policies

Name	Category	Status	Description
oracle/wss_saml_token_bearer_over_ssl_service_...	Security	Enabled	[...]
oracle/wss_saml_token_over_ssl_service_policy	Security	Enabled	[...]
oracle/wss_saml20_token_bearer_over_ssl_servic...	Security	Enabled	[...]
oracle/wss_saml20_token_over_ssl_service_policy	Security	Enabled	[...]
oracle/wss_sts_issued_saml_bearer_token_over_...	Security	Enabled	[...]
oracle/wss_username_token_over_ssl_service_po...	Security	Enabled	[...]
oracle/wss10_message_protection_service_policy	Security	Enabled	[...]
oracle/wss10_saml_hok_token_with_message_pro...	Security	Enabled	[...]
oracle/wss10_saml_token_service_policy	Security	Enabled	[...]
oracle/wss10_saml_token_with_message_integrity...	Security	Enabled	[...]

Attach [+] **Detach** [x]

Directly Attached Policies

Name	Category	Status	Description
oracle/wss_username_token_service_policy	Security	Enabled	[...]

OK **Cancel**

Click **OK** and observe that selected policy is shown up and enabled as shown below.

Policies

No Policies

From OWSM Policy Store

Service Level Policies

Name	oracle/wss_username_token_service_policy
------	------------------------------------------

Policy Overrides

Policy Name	oracle/wss_username_token_service_policy
-------------	------------------------------------------

Save your changes in current tab and activate the session.



Testing

You can use **SOAP UI** for testing. Create a test suite in SOAP UI using your proxy service WSDL. Refer to <http://soapui.org> for any additional help.

Open request editor for any operation and paste the following as one of the SOAP headers. This represents **WS-Security** header and is required by OWSM policy attached to your Proxy Service above. You can also observe **username** and **password** fields.

```
<wsse:Security soapenv:mustUnderstand="1" xmlns:wsse="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd">
    <wsse:UsernameToken>
        <wsse:Username>UNAME1</wsse:Username>
        <wsse:Password Type="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0#PasswordText">Welcome1</wsse:Password>
    </wsse:UsernameToken>
</wsse:Security>
```

The screenshot shows the SoapUI interface with a test case named "DeleteCustomer". The URL is set to <http://SVGONUGU-LAP:7001/entity/CustomerService>. The XML request pane displays a SOAP message. A red box highlights the `<wsse:Security>` element under the `<soapenv:Header>` section. The XML code for the highlighted section is:

```
<wsse:Security soap:mustUnderstand="1" xmlns:wsse="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd">
    <wsse:UsernameToken>
        <wsse:Username>UNAME1</wsse:Username>
        <wsse:Password Type="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0#PasswordText">Welcome1</wsse:Password>
    </wsse:UsernameToken>
</wsse:Security>
```

Test using wrong credentials and observe the output showing security error.

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>soapenv:Server</faultcode>
      <faultstring>OSB-386200: General web service security error</faultstring>
      <detail>
        <con:stack-trace xmlns:con="http://www.bea.com/wli/sb/context">com.bea.wli.sb.service.handlerchain.HandlerException: General web service security error
at com.bea.wli.sb.service.handlerchain.handlers.AbstractWssHandler.handleWssException(AbstractWssHandler.java:97)
at com.bea.wli.sb.service.disi.handlerchain.handlers.InboundWssPhase1DISIHandler.dispatch(InboundWssPhase1DISIHandler.java:113)
at com.bea.wli.sb.service.handlerchain.handlers.AbstractHandler.dispatch(AbstractHandler.java:131)
at com.bea.wli.sb.service.handlerchain.handlers.InboundMessageContentHandler.dispatch(InboundMessageContentHandler.java:169)
at com.bea.wli.sb.service.handlerchain.handlers.AbstractHandler.dispatch(AbstractHandler.java:131)
at com.bea.wli.sb.service.handlerchain.handlers.CheckAccessControl.dispatch(CheckAccessControl.java:65)
at com.bea.wli.sb.service.handlerchain.handlers.AbstractHandler.dispatch(AbstractHandler.java:131)
```

Test using credentials created in previous section and observe the output.

The screenshot shows a SOAP UI interface with the following details:

- Service: DeleteCustomer
- Address: http://SVGONUGU-LAP:7001/entity/CustomerService
- Request Type: XML
- Request Body (Raw XML):

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:wsse="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0#>
  <soapenv:Header>
    <wsse:Security soap:mustUnderstand="1" xmlns:wsse="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0#">
      <wsse:UsernameToken>
        <wsse:Username>xyzcustomer</wsse:Username>
        <wsse:Password type="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0#PasswordText"></wsse:Password>
      </wsse:UsernameToken>
    </wsse:Security>
  </soapenv:Header>
  <soapenv:Body>
    <cus:CustomerIDInput>
      <CustomerID>12</CustomerID>
    </cus:CustomerIDInput>
  </soapenv:Body>
</soapenv:Envelope>
```

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Header xmlns:urn="urn:xyzbank:cust:schema:customer"/>
  <soapenv:Body xmlns:urn="urn:xyzbank:cust:schema:customer">
    <cus>StatusMsg xmlns:cus="http://xmlns.xyzbank.com/schema/Customer">
      <CustomerID>12</CustomerID>
      <status>S</status>
    </cus>StatusMsg>
  </soapenv:Body>
</soapenv:Envelope>
```

Response