

# Exercise 8

*Mediate a service interaction using an ESB to convert from an inbound REST call into an existing SOAP call.*

## Prior Knowledge

Basic understanding HTTP verbs, REST architecture, SOAP and XML

## Objectives

Understand the basic ESB flow, create a flow using the ESB tooling in Eclipse, upload to the ESB using Eclipse Remote Server model, mediate between REST and SOAP.

## Software Requirements

(see separate document for installation of these)

- Java Development Kit 7
- Apache Maven 3.0.5 or later
- WSO2 Developer Studio 3.7.0
- WSO2 App Server 5.2.1
- WSO2 ESB 4.8.1

1. Before we install the ESB we need to host some services to interact with. To do this we are going to use the WSO2 Application Server.
2. `cd ~/servers/wso2as-5.2.1/`
3. Start up the server:  
`bin/wso2server.sh`
4. In Chrome, browse to  
<https://localhost:9443> [Note the SSL URL]

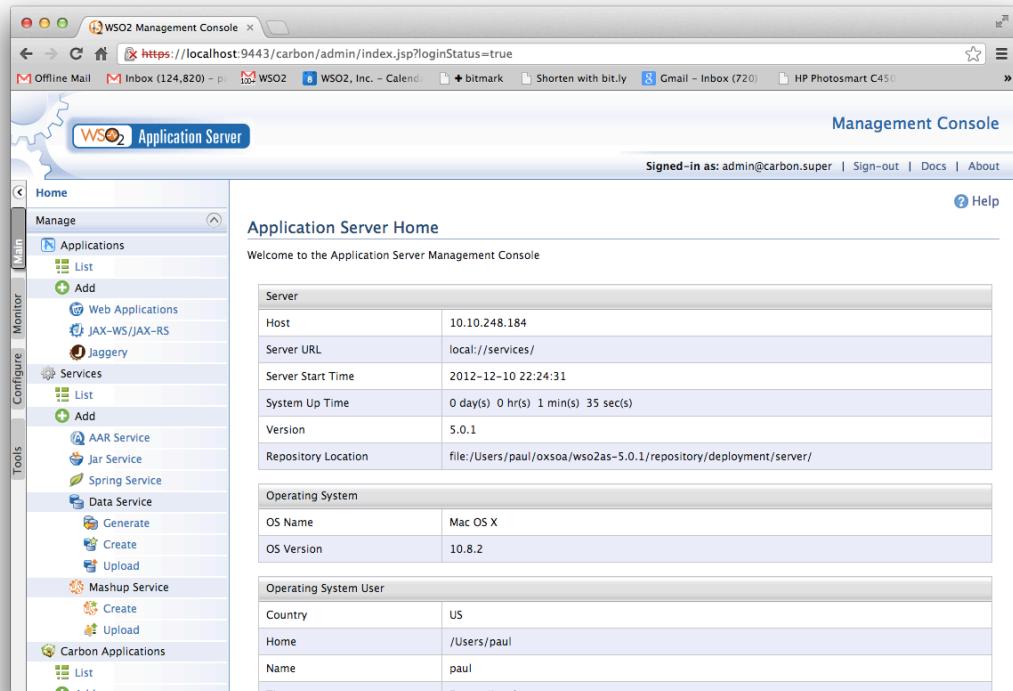
Because we haven't installed a "proper" certificate into the server you will get a warning. You need to proceed past this.

5. Use **admin/admin** as username and password. Click **Remember Me** and sign in:



The screenshot shows the WSO2 Management Console Sign-in page. It has fields for 'Username' (admin) and 'Password' (\*\*\*\*\*), a checked 'Remember Me' checkbox, and a 'Sign-in' button. Below the form is a link to 'Sign-in Help'.

6. You should see a Web Console like this:



The screenshot shows the WSO2 Management Console Application Server Home page. The left sidebar menu includes Home, Manage (Applications, Services, Data Service, Mashup Service, Carbon Applications), Main (Configure, Monitor, Tools), and Help. The main content area displays the Application Server Home with the following details:

Server	
Host	10.10.248.184
Server URL	local://services/
Server Start Time	2012-12-10 22:24:31
System Up Time	0 day(s) 0 hr(s) 1 min(s) 35 sec(s)
Version	5.0.1
Repository Location	file:/Users/paul/oxsoa/wso2as-5.0.1/repository/deployment/server/

Operating System	
OS Name	Mac OS X
OS Version	10.8.2

Operating System User	
Country	US
Home	/Users/paul
Name	paul

7. Click on **Services->List** in the left hand menu. You should see something like this:

The screenshot shows the WSO2 Management Console interface. On the left, there is a navigation sidebar with tabs for Home, Manage, Monitor, Configure, and Tools. Under the Manage tab, the Services section is selected, showing a list of services. The main content area is titled "Deployed Services" and displays a table of active services. The table includes columns for Service Name, Service Type, Status, and various actions like Try this service and Download. The services listed are admin/RESTSample, echo, HelloService, Version, and wso2carbon-sts.

Service	Type	Status	Action
admin/RESTSample	js_service	Unsecured	WSDL1.1 WSDL2.0 Try this service Download
echo	axis2	Unsecured	WSDL1.1 WSDL2.0 Try this service Download
HelloService	axis2	Unsecured	WSDL1.1 WSDL2.0 Try this service Download
Version	axis2	Unsecured	WSDL1.1 WSDL2.0 Try this service Download
wso2carbon-sts	sts	Unsecured	WSDL1.1 WSDL2.0

8. To see if the basic “echo” service is working click on “Try this service” next to echo.  
 9. You will see a “test” client.

The screenshot shows the WSO2 Management Console interface for the echo service. The left sidebar lists operations: echoInt, echoOMElement, echoString, echoStringArrays, and throwAxisFault. The main area shows the "echo" service details, including its endpoint information and a "Send" button. Below this, there are two panes: "Request" and "Response". The Request pane contains a SOAP message with the string "Hello Paul" in the echoString element. The Response pane shows the resulting XML response, which includes the same string "Hello Paul".

10. Select the **echoString** operation, modify the XML (**replace the ?**) and click **Send**. If it didn't work, you might have an odd network setup with VMWare. Try changing the URL to use 127.0.0.1.
11. Close that tab to get back to the main console.
12. The Starbucks Outlet Service application (StarbucksOutletService.aar) should be in your Downloads directory.  
[If not then download the Starbucks Outlet Service:  
Browse to <http://freo.me/UtN4Mj> ]
13. Click on **Services/Add/AAR Service**.
14. Click on **Choose File**. Browse to the saved **StarbucksOutletService.aar**  
This is an Axis2 Web Service application. Click **Upload**
15. Wait a minute for this to deploy, then Click on **Services>List** again.
16. Now Click on **Try this service** for the StarbucksOutletService.
17. Create an order, list orders, pay for it, etc. Get a feel for the SOAP API.
18. Go to the Monitor tab and look at some stats, logs, etc.
19. Now start a new Terminal window  
`cd ~servers/wso2esb-4.8.1`
20. Start the server up  
`bin/wso2server.sh`
21. In Chrome, browse to  
<https://localhost:9444> [Note the SSL URL]

This is one port higher. By default the ESB and AppServer share the same port (which means you can't run them on the same machine). To solve this we changed the default ports by editing the offset parameter in the ESB's repository/conf/carbon.xml file.

22. Login as before. You should see a similar (but different) console. Compare to the App Server screens.

The screenshot shows the WSO2 Management Console interface. The title bar reads "Search results - paul@wso2" and "WSO2 Management Console". The URL in the address bar is "https://localhost:9443/carbon/admin/index.jsp?loginStatus=true". The left sidebar has tabs for Main, Monitor, Configure, and Tools. Under Main, the "Manage" section is expanded, showing "Services" (with "List" and "Add" options), "Proxy Service", "Service Bus", "Sequences", "Scheduled Tasks", "Templates", "Endpoints", "Local Entries", "Message Processors", "Message Stores", "Priority Executors", "APIs", "Source View", and "Mediation Libraries" (with "List" and "Add" options). Under Tools, there is a "Carbon Applications" section. The main content area is titled "WSO2 Enterprise Service Bus Home" and displays the "Welcome to the WSO2 Enterprise Service Bus Management Console". It contains three tables of system information:

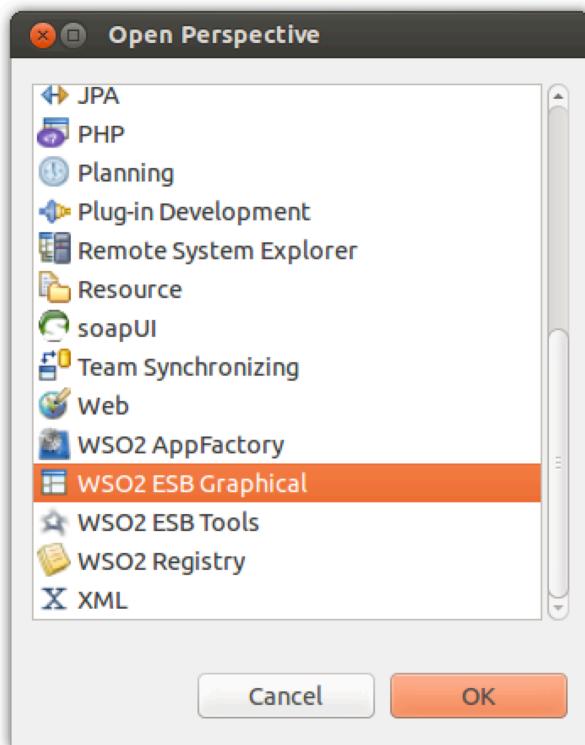
Server	
Host	10.12.167.85
Server URL	local://services/
Server Start Time	2012-12-10 20:51:35
System Up Time	0 day(s) 0 hr(s) 4 min(s) 26 sec(s)
Version	4.5.1
Repository Location	file:/Users/paul/oxsoa/wso2esb-4.5.1/repository/deployment/server/

Operating System	
OS Name	Mac OS X
OS Version	10.8.2

Operating System User	
Country	US
Home	/Users/paul

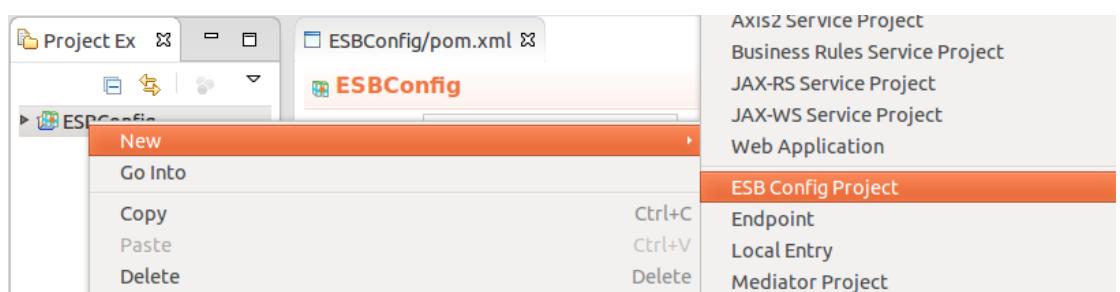
23. We are going to create a simple RESTful API that bridges the App Server's echo service. We want the parameter to be grabbed from the URL using a URL template, and then transformed into an XML document, sent to the SOAP service, and then we will grab the response from the XML and transform into a JSON payload.

24. In Eclipse, first open the WSO2 ESB graphical perspective:  
Window->Open Perspective->Other:

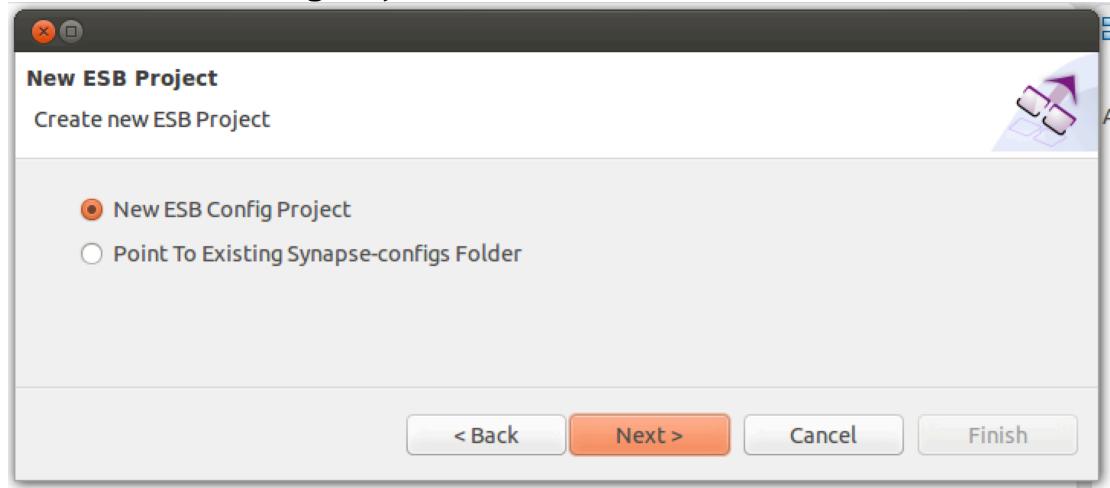


25. Now create a “Composite Application Project”:  
File -> New -> Composite Application Project  
Call it **ESBConfig** and click **Finish**.

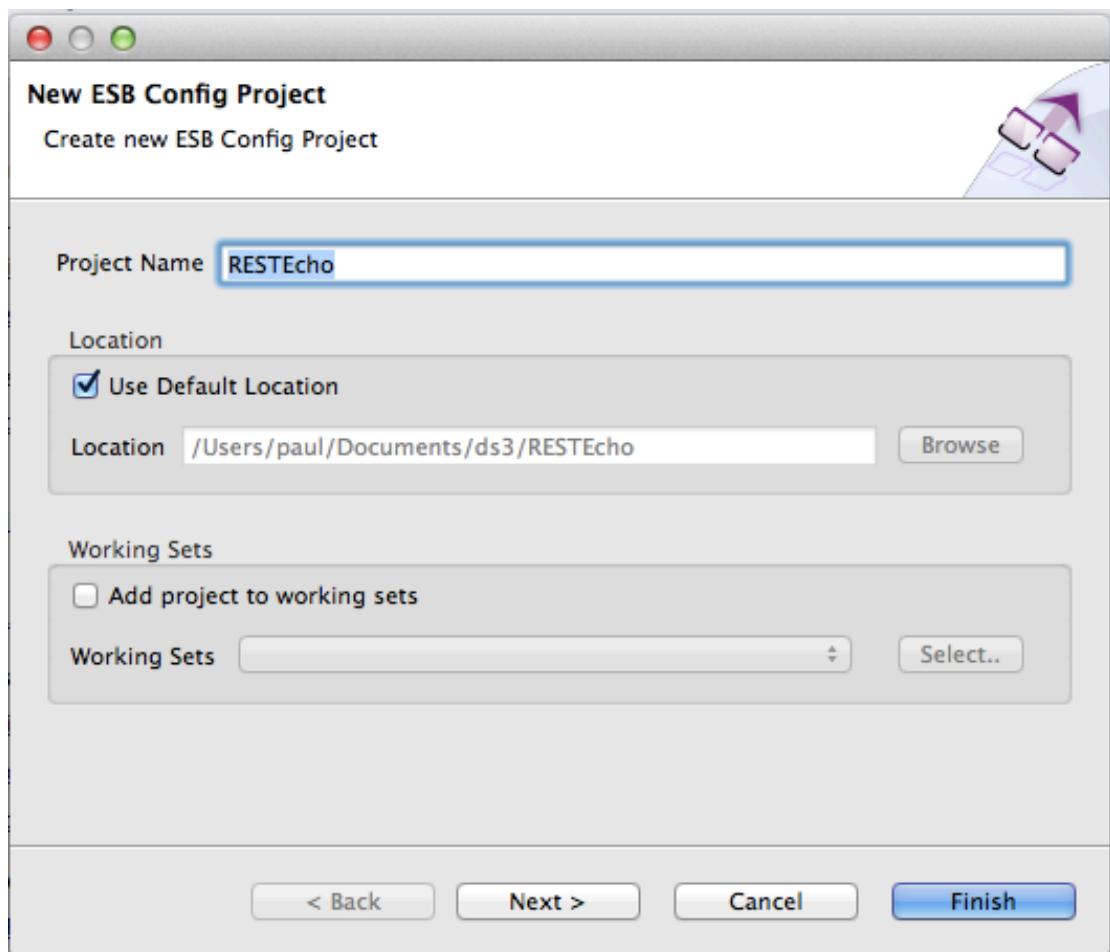
26. Now **right click on the new project** and choose New->ESB Config Project



### Select New ESB Config Project

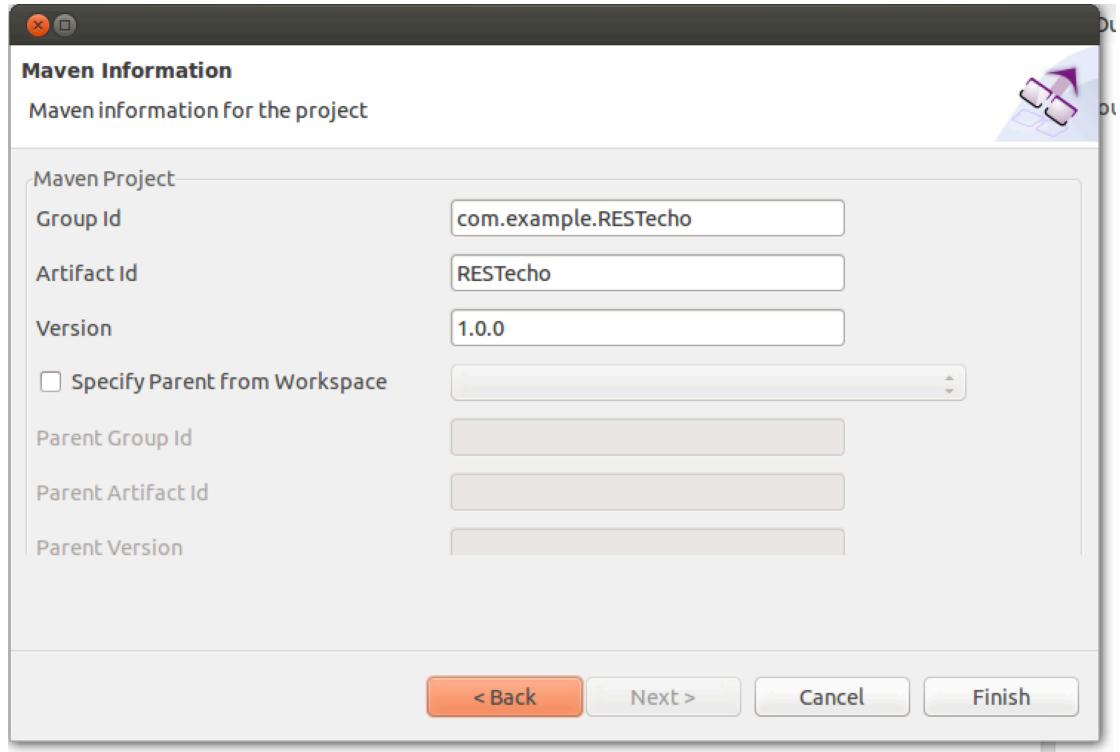


27. Now Use the name RESTEcho



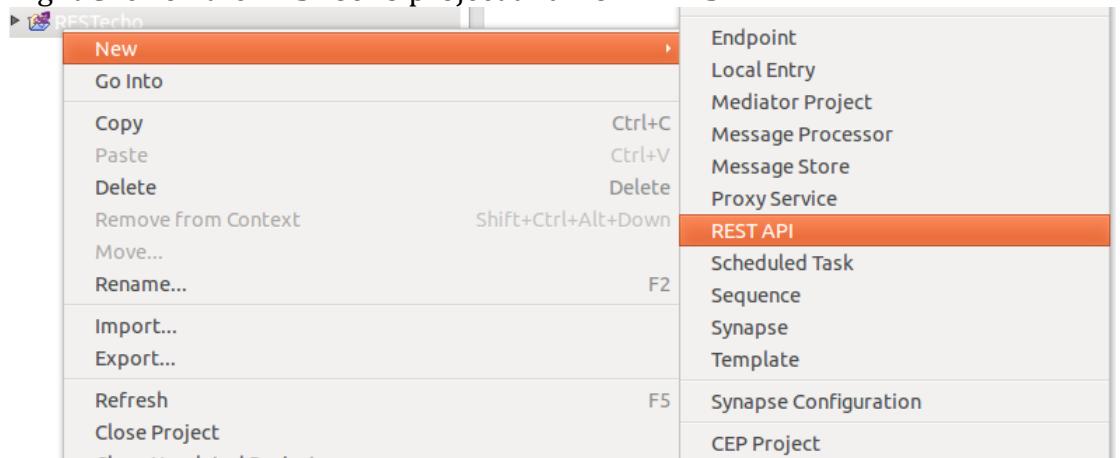
28. Click Next

29. Leave the Maven info the same:



30. Click Finish

31. Right Click on the **RESTech** project and **New->REST API**

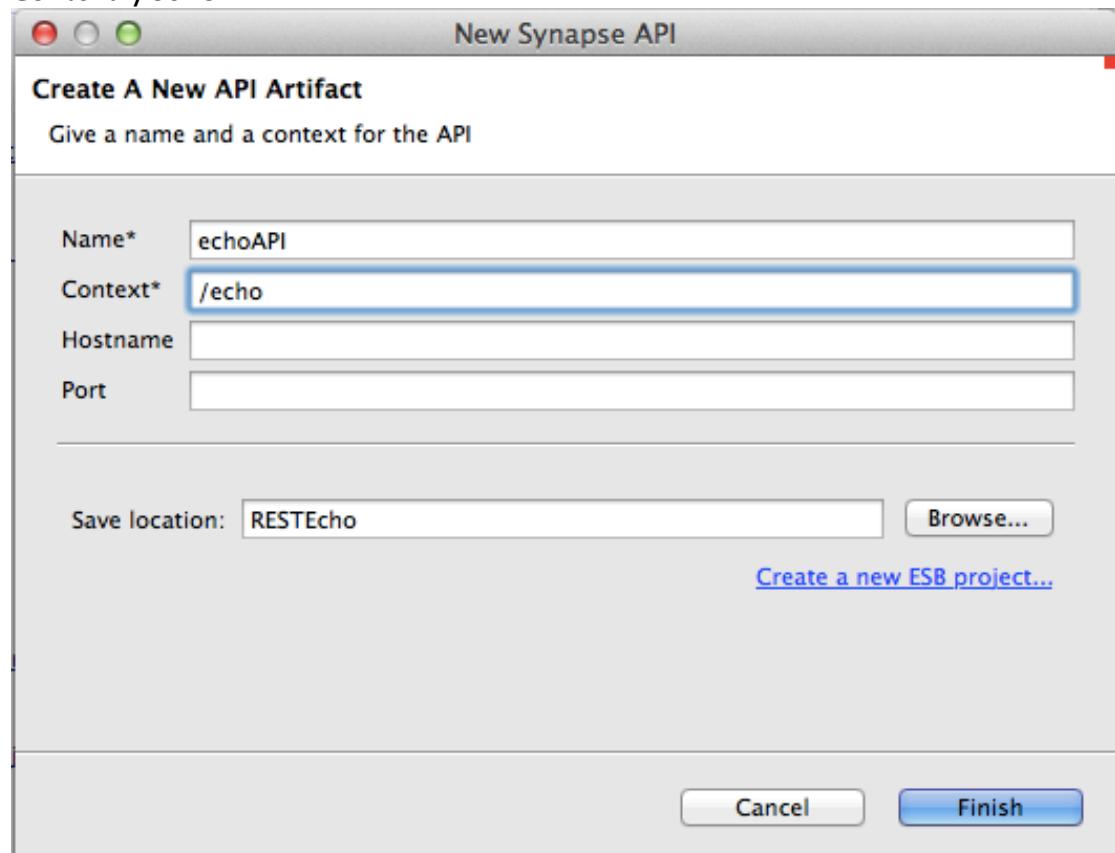


32. Select **Create a New API Artefact** and then **Next**.

33. Use:

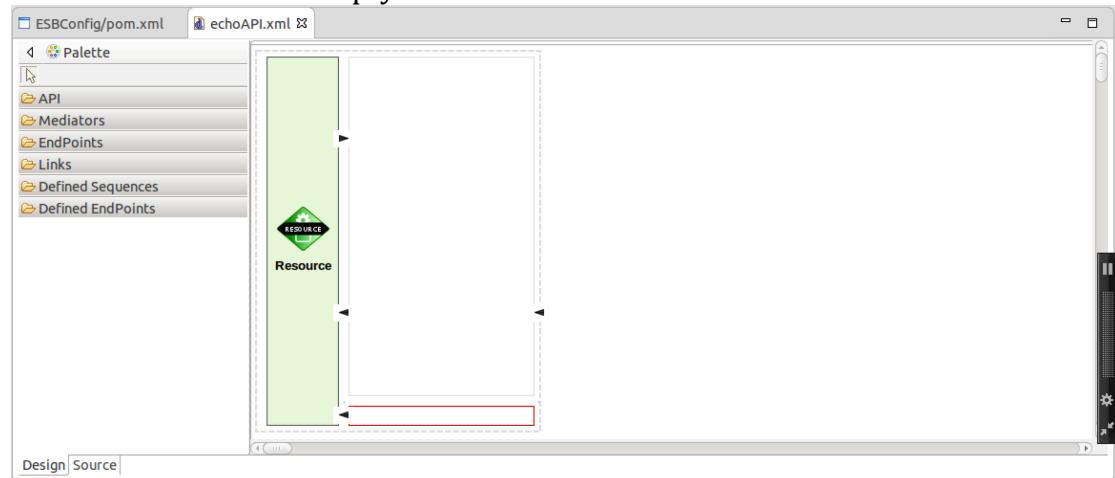
Name: **echoAPI**

Context: **/echo**

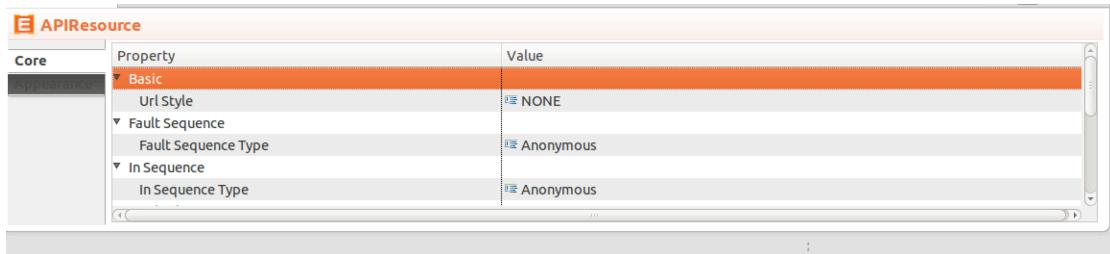


34. Finish

35. You should see a nice empty ESB flow like this:



36. First, we need to edit the properties of this resource. Click on the Resource icon, and look at the property editor box.



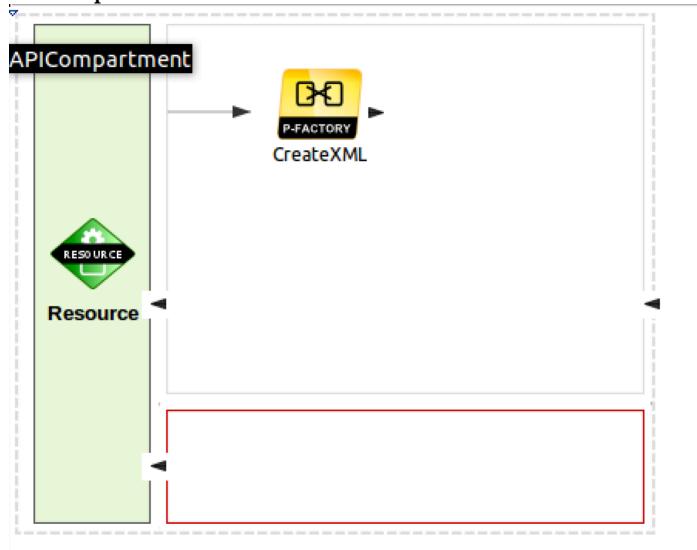
37. Change (or check) the following:

Url Style: **URI\_TEMPLATE** (then hit enter and the next box will appear)  
 Uri Template: **/{input}**  
 Methods / Get: **True** (should already be this).

This has said that this is modeling a GET resource with a URI template of:  
`http://hostname:port/echo/{input}`

38. There are lots of ways to create an XML payload to send to the SOAP service. For example, we could use XSLT, XQuery, or JavaScript. But the simplest way is a mediator called a PayloadFactory that simply populates the body with XML or JSON, and uses a template model to fill in parameters (e.g. \$1 is replaced by the first parameter).

Now expand the Mediators box, and choose the PayloadFactory mediator and drag it over to the upper half of the flow box. It will prompt you for a description. Use “CreateXML”:



39. Now edit the properties of the PayloadFactory.

The first thing is to make the right XML. We do this by pasting in a sample XML and replacing parts of it with the input parameter from the URL. To get the sample XML I used SOAPUI against the Echo service. If you want to do that, please go ahead, otherwise you can enter it from here. Choose Format (hit the little button, and then replace <inline/> with:

```
<p:echoString  
xmlns:p="http://echo.services.core.carbon.wso2.org">  
<in>$1</in>  
</p:echoString>
```

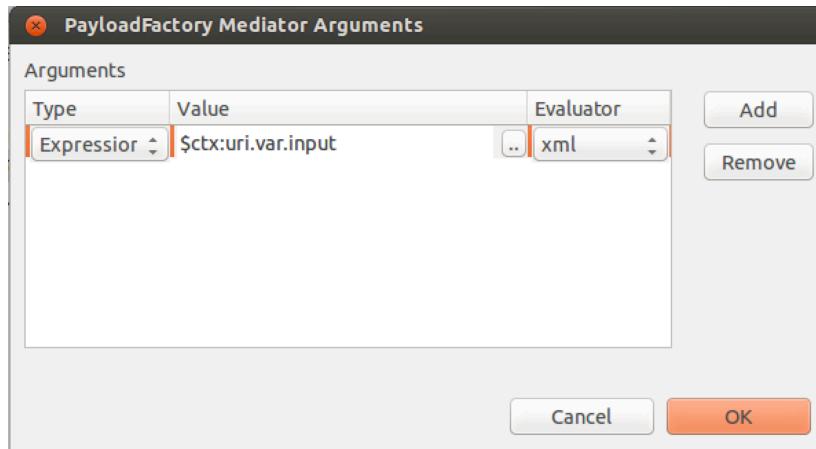
40. Now we need to grab the {input} data that came in the URI. We do this by

clicking on the button by Args: 

Then click **Add**. Change the type to **Expression**, and then click the button to edit the expression value.

Replace **/default/expression** with **\$ctx:uri.var.input**

It should look like:



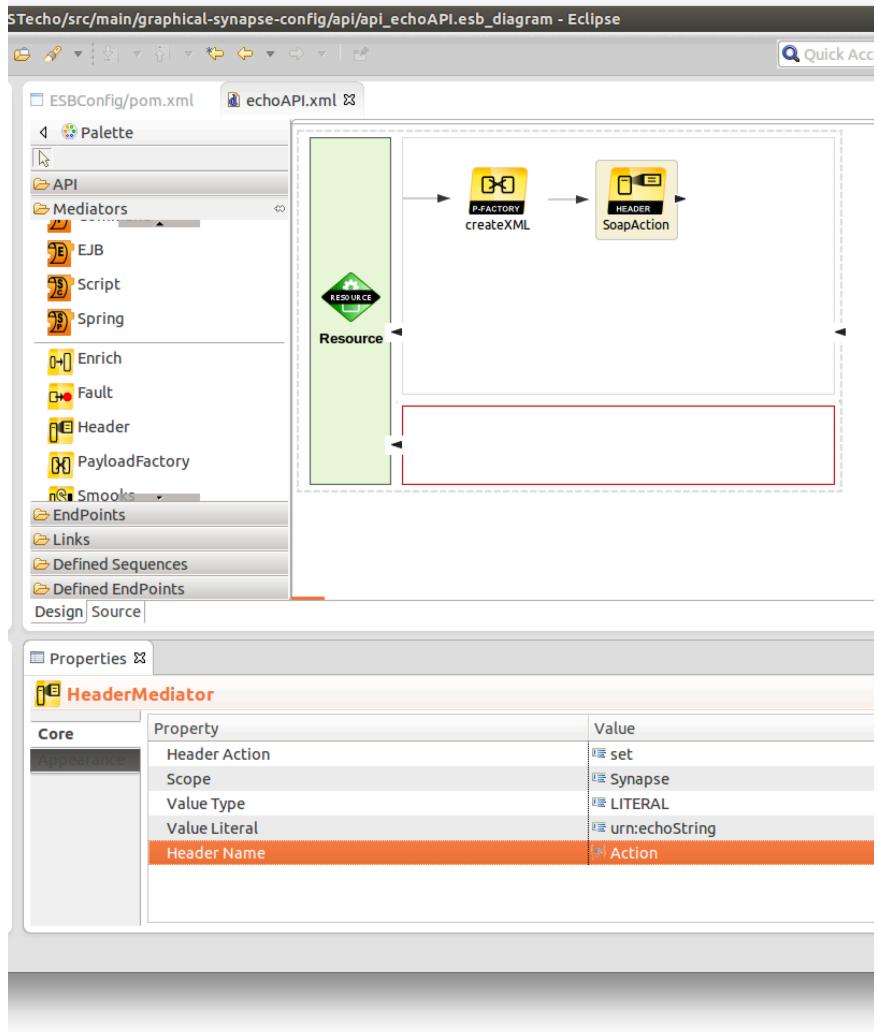
41. Click **OK**

42. Because we are sending the message to a SOAP service, we need a SOAP Action header. We can add that with a **Header** mediator. Grab one of those and drop it to the right of the PayloadFactory. Give it a useful description (like **Add Soap Action**). Now set the properties as:

Value Literal: **urn:echoString**

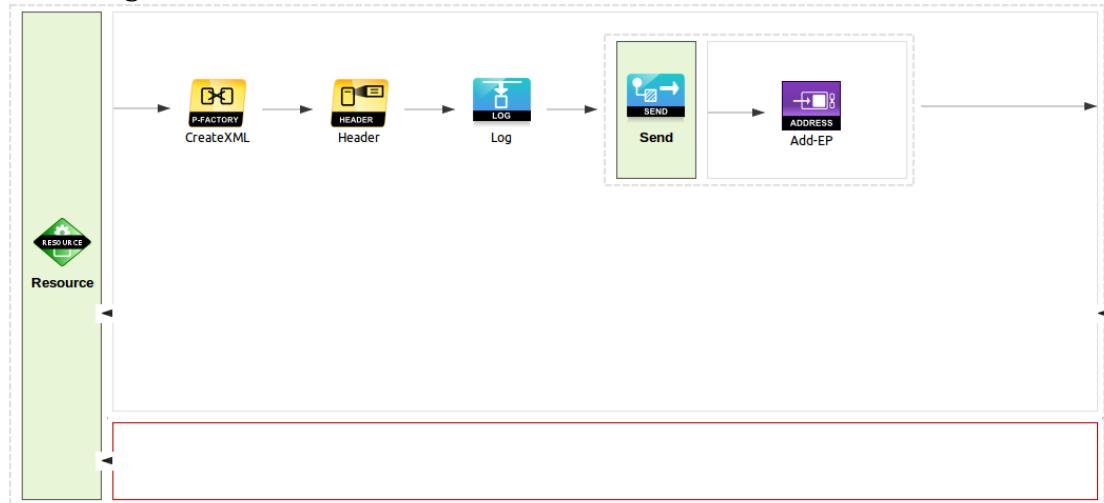
Header Name: **Action**

Your screen should look similar to this:



43. Now drop a Log mediator to the right, and set its log level to **FULL**.
44. We are now ready to send our SOAP message to the SOAP service. Drop a Send Mediator to the right. It will have an empty box inside the mediator.
45. Open the Endpoints section on the left and drop an **Address Endpoint** into the empty box. Edit the description from Add-EP to echoSOAP.
46. In the properties section, under **Basic**, change the URI from  
`http://www.example.org/service` to  
`http://localhost:9763/services/echo`
47. Scroll down the properties until you get to the Misc->Format, and set that to be **soap11**.

Your diagram should look like:

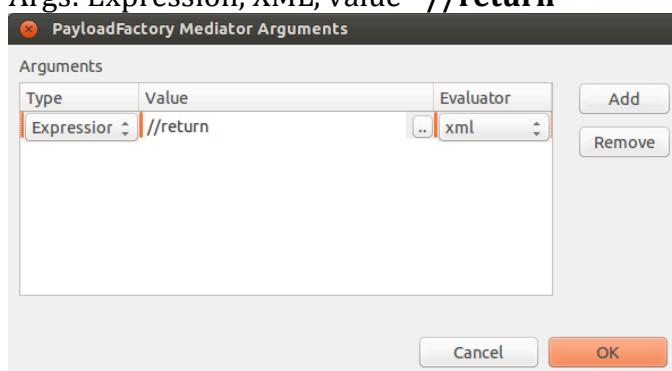


48. Underneath the previous line on the return path, now drop another Log mediator, and again set the log level to **FULL**.
49. To the left of that drop another PayloadFactory, and change its description to **toJSON**.
50. Set its properties as follows:

Media Type: JSON

Format: { **return**: "\$1" }

Args: Expression, XML, value - //return



This will grab the value of the first element called <return> and use that as the value of a JSON string.

51. Unfortunately due to a bug/feature/oversight (which is being fixed), despite using json in the PayloadFactory, the ESB still thinks the media type of the message is XML which came back from the SOAP service. We need to fix that.

Drop a property mediator to the left of the PayloadFactory. Set the description to be **jsonMediaType**.

Now edit the properties:

Property Name: **messageType**

Property Action: **set**

Value Literal: **application/json**

Property Scope: **axis2**

52. Now drag another Send Mediator left of the property mediator. You can leave the address empty because we are implicitly sending this back to the client on the open HTTP channel.

53. You have now created an ESB API that will:

- Listen at /echo/{input}
- Extract the {name} value
- Construct an XML message
  - Using the name parameter
- Send this as SOAP11 to our server endpoint
- Send the response back to the client

54. Before deploying this in the ESB, take a look at the XML configuration behind this configuration. Click on the Source tab (bottom left corner of the API design pane). Your XML should look like this:

```
<?xml version="1.0" encoding="UTF-8"?>
<api xmlns="http://ws.apache.org/ns/synapse" name="echoAPI" context="/echo">
    <resource methods="GET" uri-template="/{input}">
        <inSequence>
            <payloadFactory media-type="xml" description="CreateXML">
                <format>
                    <p:echoString xmlns:p="http://echo.services.core.carbon.wso2.org">
                        <in>$1</in>
                    </p:echoString>
                </format>
                <args>
                    <arg evaluator="xml" expression="$ctx:uri.var.input"/>
                </args>
            </payloadFactory>
            <header name="Action" scope="default" value="urn:echoString"/>
            <log level="full" description="Log"/>
            <send>
                <endpoint>
                    <address uri="http://localhost:9763/services/echo" format="soap11"/>
                </endpoint>
            </send>
        </inSequence>
        <outSequence>
            <log level="full" description="log again"/>
            <payloadFactory media-type="json" description="toJSON">
                <format>{ return: "$1"}</format>
                <args>
                    <arg evaluator="xml" expression="//return"/>
                </args>
            </payloadFactory>
            <property name="messageType" value="application/json" scope="axis2"
type="STRING" description="jsonMediaType"/>
            <send/>
        </outSequence>
        <faultSequence/>
    </resource>
</api>
```

This XML is available at <https://gist.github.com/pzfreo/7660591>

Firstly, we are defining an API which is a collection of resource definitions (in the REST style). Each resource is actually implemented by a sequence of flow logic. In this case, we are looking for a GET and mapping it to a simple flow with two mediators. First we create an XML payload, then we send that to an endpoint.

55. In order to test this we need to tell the Eclipse environment about our ESB server.

56. You can check the server is running (in a minute) by browsing <https://localhost:9444/>. You will need to Proceed past the security warning because by default the server is using a self-signed certificate. The default credentials are **admin/admin**.
57. To add this server to Eclipse, do File->New->Other->Server. Then scroll down to WSO2, and select **WSO2 Carbon remote server**.
58. Click **Next**.
59. Set the servers URL to be <https://localhost:9444/>. Test the connection and the credentials. Click **Finish**.
60. You need to make sure the RESTecho ESB config is part of the Composite Application Project. Open up the ESBConfig project and it will open the pom.xml. Make sure the RESTecho Artifact is checked:

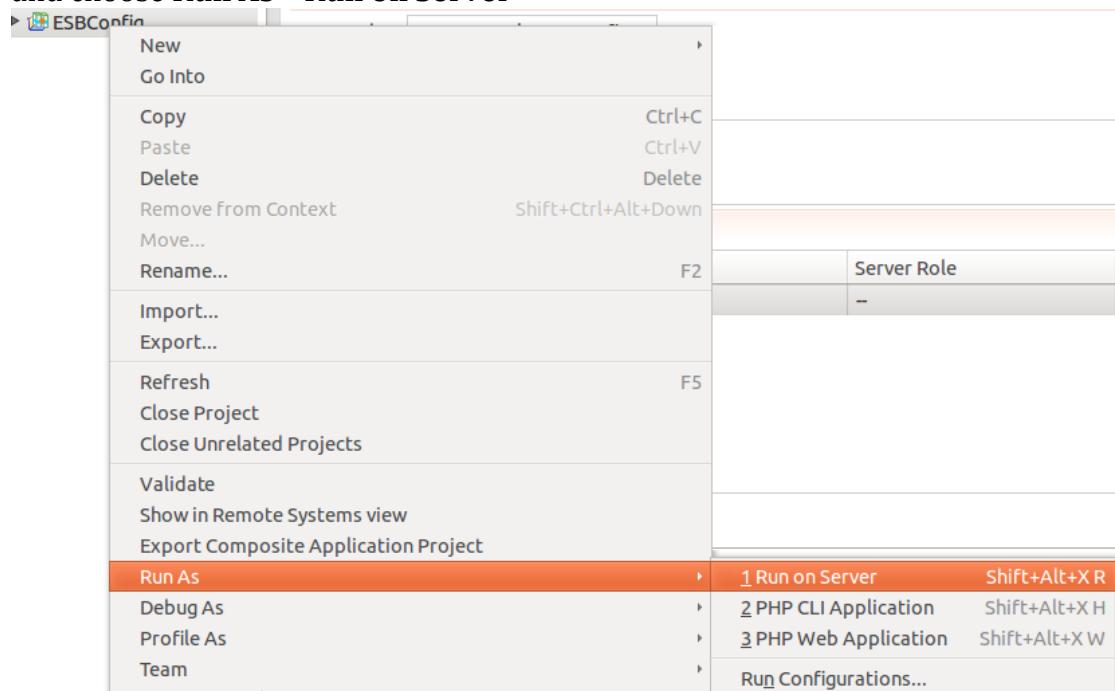
The screenshot shows the pom.xml file for the ESBConfig project. The 'Dependencies' section is expanded, displaying a table with three columns: Artifact, Server Role, and Version. A single row is present, showing 'RESTecho' as the artifact, '-' as the server role, and '1.0.0' as the version. The 'RESTecho' entry has a checked checkbox icon next to it, indicating it is selected. Below the table are two buttons: 'Select All' and 'Deselect All'. At the bottom of the screen, there are tabs for 'Design' and 'Source'.

Artifact	Server Role	Version
► <input checked="" type="checkbox"/> RESTecho	-	1.0.0

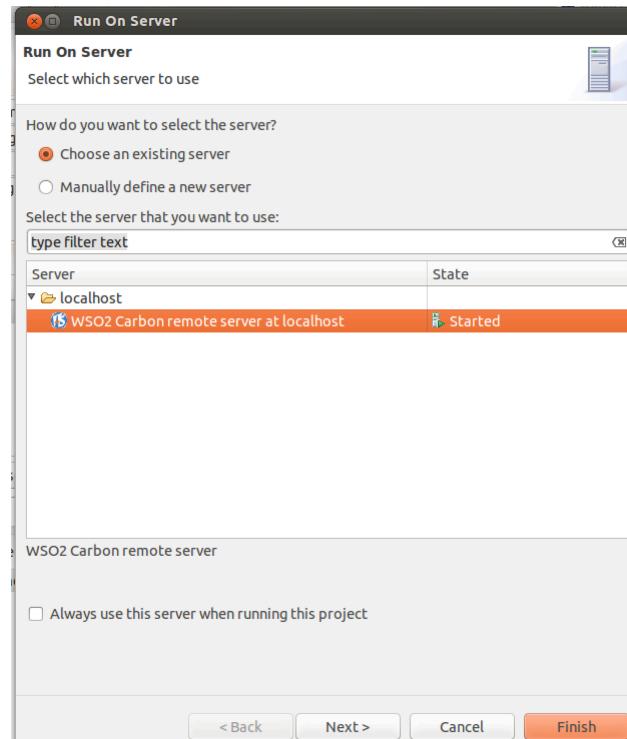
Select All   Deselect All

Design Source

61. Now you should be able to run the ESBConfig project on the server. You may need to restart Eclipse. To do this right-click on the ESBConfig project and choose **Run As->Run on Server**

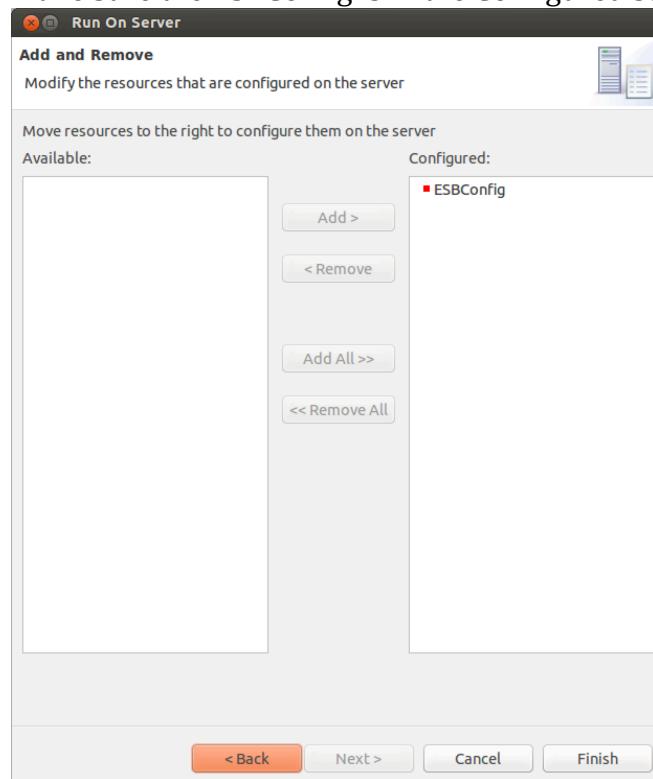


62. Make sure the Carbon Server is selected:



Click Next

63. Make sure the ESBConfig is in the Configured section:



64. Click **Finish**.

65. If you look at your ESB terminal window where the server is running you should see something like:

```
[2013-11-26 16:09:48,830] INFO - ApplicationManager
Deploying Carbon Application :
ESBConfig_1.0.0.car...
[2013-11-26 16:09:48,834] INFO - API Initializing
API: echoAPI
[2013-11-26 16:09:48,834] INFO - APIDeployer API
named 'echoAPI' has been deployed from file :
/home/ox-soa/servers/wso2esb-
4.8.0/repository/carbonapps/work/1385482188830ESBCon
fig_1.0.0.car/echoAPI_1.0.0/echoAPI-1.0.0.xml
[2013-11-26 16:09:48,834] INFO - ApplicationManager
Successfully Deployed Carbon Application :
ESBConfig_1.0.0 {super-tenant}
```

66. You can browse to the admin console and see if an API is visible in the API section.

Home > Manage > Service Bus > APIs

### Deployed APIs

 Add API

Search API  

Available defined APIs in the Synapse Configuration :- 1

Select all in this page | Select none

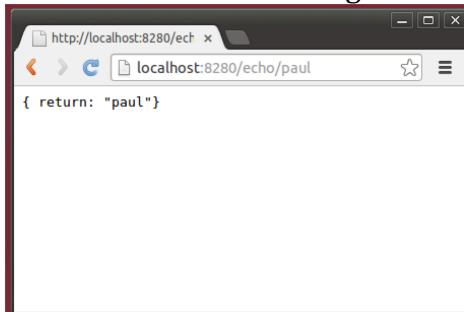
 Delete

Select	API Name	API Invocation URL	Action
<input type="checkbox"/>	echoAPI	http://172.16.40.135:8280/echo	

Select all in this page | Select none

 Delete

67. Now try the API by browsing <http://localhost:8281/echo/paul>  
You should see something like:



68. Check the ESB terminal window and you should see the log messages from the log mediators:

```
[2013-11-26 16:44:51,324] INFO - LogMediator To: /echo/paul,
WSAction: urn:echoString, SOAPAction: urn:echoString,
MessageID: urn:uuid:3176a1f4-4329-4bf6-93d4-9fbe67dc902,
Direction: request, Envelope: <?xml version="1.0"
encoding="utf-8"?><soapenv:Envelope
xmlns:soapenv="http://www.w3.org/2003/05/soap-
envelope"><soapenv:Body><p:echoString
xmlns:p="http://echo.services.core.carbon.wso2.org"><in
xmlns="http://ws.apache.org/ns/synapse">paul</in></p:echoString
></soapenv:Body></soapenv:Envelope>
[2013-11-26 16:44:51,330] INFO - TimeoutHandler This engine
will expire all callbacks after : 120 seconds, irrespective of
the timeout action, after the specified or optional timeout
[2013-11-26 16:44:51,358] INFO - LogMediator To:
http://www.w3.org/2005/08/addressing/anonymous, WSAction: ,
SOAPAction: , MessageID: urn:uuid:694d3459-4369-4c80-9e8c-
b365368e8009, Direction: response, Envelope: <?xml
version="1.0" encoding="utf-8"?><soapenv:Envelope
xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"><soap
env:Body><ns:echoStringResponse
xmlns:ns="http://echo.services.core.carbon.wso2.org"><return>pa
ul</return></ns:echoStringResponse></soapenv:Body></soapenv:Env
elope>
```

69. Extensions:

The ESB would allow you to do this completely “inline” without calling an external service, since the logic is pretty simple. Create a new API that does this. Hint: use the Respond mediator.

70. There are lots of ESB samples you can look at here:

<http://docs.wso2.org/display/ESB480/Samples>