



TIBCO ActiveMatrix® Service Grid

REST Binding Development Guide

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Contents

Contents	2
TIBCO ActiveMatrix Binding Type for REST Overview	5
REST Binding Type Key Terms	5
REST Binding Type Usage	7
REST Binding Type Key Features	8
Easy-to-Use Configuration GUI	8
Message Exchange Patterns	9
Error Handling	9
Complex XSD Constructs Mapping Rules	10
REST Binding Development	12
Payload Generation	12
Generating XML Payloads	12
Generating Badgerfish JSON Payloads	13
Overriding Media Types (For Service Only)	13
Configuring REST Bindings	14
Generating a Swagger JSON File from TIBCO Business Studio - BPM Edition	16
Overview of the Swagger JSON File	17
Sample Swagger JSON File	18
Sending and Consuming HTTP Headers	21
Creating and Mapping Context Parameters	22
For REST Service Binding	23
For REST Reference Binding	26
Mapping HTTP Status Code and Status Message	28
Modifying a REST Resource Configuration File	28
Policies Supported	32

Sample Projects	33
Executing the Bookstore Sample	34
Importing the Bookstore Sample Project	34
Reviewing the WSDL that Defines the Service Interface	35
Reviewing the Composite Configuration	36
Running the Bookstore Sample	37
Executing the MultipleComplexTypes Sample	37
Importing the MultipleComplexTypes Sample Project	38
Reviewing the Mediation Flow	38
Running the MultipleComplexTypes Sample	39
Executing the Bookstore Client Sample (Reference)	40
Importing the Bookstore Client Sample Project	40
Reviewing the REST Resource Configuration File That Defines the REST Service Interface	41
Running the Bookstore Client Sample	41
Executing the Facebook Client Sample (Reference)	41
Importing the Facebook Client Sample Project	42
Running the Facebook Client Sample	42
Executing the Pass-Through Mode Sample (Reference)	43
Executing the rest.context Sample	44
Running the rest.context Example	45
Breakdown of the rest.context Scenario	46
REST-Java-REST: Success Scenario of REST-Java	47
REST-Java-REST: Fault Scenario of REST-Java	49
Executing the rest.extendedJSONConversion Sample	50
Running the rest.extendedJSONConversion Example	52
REST-Java-REST: Runtime Node Logs for Rest-Java	54
Limitations	58
General Limitations	58
Validation Limitations	59
Service Limitations	59

Schema Limitations	60
Troubleshooting	61
TIBCO Documentation and Support Services	63
Legal and Third-Party Notices	65

TIBCO ActiveMatrix Binding Type for REST Overview

TIBCO ActiveMatrix Binding Type for REST allows you to map SCA services to REST, so that thin-clients such as scripting, mobile, and Web clients can directly invoke these services.

TIBCO ActiveMatrix Binding Type for REST makes client development simpler and cheaper by not requiring a SOAP stack on the client side. Clients can use HTTP methods such as GET, POST, PUT, and POST with XML or JSON to invoke backend SCA services. During configuration, you can choose the XML, JSON, or BJSON media type in TIBCO Business Studio™ - BPM Edition.

When you configure a SOAP service, WSDL becomes the contract between service provider and consumer. In contrast, REST service providers do not use WSDL but use out-of-band mechanisms such as sample payloads to communicate with REST service consumers. This release of TIBCO ActiveMatrix Binding Type for REST does not include tools for generating these payloads but includes an example and documentation.

REST Binding Type Key Terms

HTTP Connector, Context Root, Media Type, Path Parameters, and Query Parameters are a few key terms used while discussing about the TIBCO ActiveMatrix Binding Type for REST.

For a discussion of general TIBCO ActiveMatrix® Service Grid terms, see the ActiveMatrix® Service Grid documentation. The following list presents the key terms for the TIBCO ActiveMatrix Binding Type for REST.

HTTP Connector

Name of the HTTP Connector resource instance that provides the HTTP transport for Binding Type for REST. Both HTTP and HTTPS are supported. The default is HTTP. You define and name the HTTP Connector at the design-time. At runtime, you need to create a resource of the type HTTP Connector and assign it the name you used at the design-time.

Context Root

Defines the base path for the URLs exposed by the REST binding.

Media Type

Format of the payload that ActiveMatrix Binding Type for REST accepts and produces. On the reference side, XML and standard JSON are supported. On the service side, XML, Standard JSON, and Badgerfish JSON are supported.

Path

You can specify Path as part of the configuration. Path can be any URI on which a given operation can be exposed.

Path Parameters

Path parameters can be configured on the service side and reference side.

On the service side, path parameters should map to the part name defined in the WSDL. Path parameters can be defined on the operation by using the Path field in the UI. For example, if you want to invoke a backend service operation `getBookByTitle(title)`, you can configure the path as `/book/{title}`. Path parameters are supported by parts that are simple types. On the reference side, path parameters can be configured by adding them in the 'Resource Path' field (for example, `'/{<pathParameter1>}'`). For the above `getBookByTitle(title)` operation, 'title' can be added as a path parameter using the syntax: `/book/{title}`. Here, `/book` is the Resource Path and `/title` is the Path parameter.

Query Parameters

Query parameters can be configured on the service side and reference side.

On the Service side, query parameters are not configured as part of the path for the operation. TIBCO ActiveMatrix Binding Type for REST expects that the query parameter name matches the part name of the WSDL operation. If you want to use a query parameter, the part name must be a simple type such as string, boolean, int, and so on.

On the reference side, you can configure query parameters by adding them in the "Request Parameters" section of the REST Resource Configuration file.



Note: You cannot add Content-Type or Accept as a Request Parameter.

REST Binding Type Usage

TIBCO ActiveMatrix Binding Type for REST allows you to integrate your SCA services with clients that use HTTP instead of SOAP to invoke services.

ActiveMatrix service development typically starts with WSDL, which defines the service interfaces. Developers expose SOAP or JMS services by adding SOAP or JMS bindings on a promoted component service.

TIBCO ActiveMatrix Binding Type for REST allows you to expose those services as REST services that can consume Badgerfish JSON, Standard JSON, or XML. You can add multiple bindings and multiple types of bindings on the same composite service. That means the same service can expose SOAP, JMS, and REST interfaces to service consumers at the same time.

Typical use cases include the following.

- Mobile clients have to consume an ActiveMatrix SCA service.
- Web clients or scripting clients (thin clients) participate in SCA.
- Mashups or websites have to expose services as APIs.

The REST bindings are especially helpful in the following situations.

- Mobile devices need to interact with back-end applications and services.
- Mobile application developers find it difficult to program the SOAP stack on the client side.
- Developers use modern scripting languages like JavaScript and Ruby, which provide first-class support for JSON and XML processing.

In these cases, TIBCO ActiveMatrix Binding Type for REST allows the clients to easily invoke ActiveMatrix SCA services.

If you want to expose existing services, you might have to use mediation. When an existing ActiveMatrix service is using WSDLs with multiple parts of complex type, the mediation service can normalize the WSDL to have a single part of complex type. See [Executing the MultipleComplexTypes Sample](#).

REST Binding Type Key Features

Using a configuration GUI and a robust error handler, TIBCO ActiveMatrix Binding Type for REST allows users to map SCA services as REST services and also allows users to consume a REST service using a REST reference.

Easy-to-Use Configuration GUI

TIBCO ActiveMatrix Binding Type for REST provides a custom binding palette to add, configure, and remove a REST binding using the TIBCO Business Studio.

This easy-to-use interface simplifies configuration. You can add, edit, or remove bindings. In addition, you can perform the following tasks specific to a service or a reference:

For a Service

- Specify a name, context root, HTTP connector, and media type for the binding.
- Configure the operation to use one of the supported HTTP methods.
 - Use HTTP GET or HTTP DELETE when the target WSDL operation has parts (single or multiple parts) of simple type.
 - Use HTTP POST or HTTP PUT to send XML, Standard JSON, and Badgerfish JSON payloads. Only one complexType is allowed when the input message is a multi-part message. Use a mediation component if your source has multiple complex types.
- Use a mediation component if you have to map a WSDL that uses multiple parts of a complex type. See [Complex XSD Constructs Mapping Rules](#).
- You can choose Standard JSON, Badgerfish JSON, or XML as the media type.
 - **Standard JSON:** TIBCO ActiveMatrix Binding Type for REST can consume and produce JSON as defined by the standard convention.
 - **Badgerfish JSON:** TIBCO ActiveMatrix Binding Type for REST can consume and produce JSON as defined by the Badgerfish convention. Badgerfish JSON is being used because it maps XML constructs such as namespaces to JSON.
 - **XML:** TIBCO ActiveMatrix Binding Type for REST can consume and produce XML.

The XML payload must be schema-compliant.

For a Reference

Specify a name, description, REST resource configuration file, HTTP Client, enable or disable Pass Through Mode.

For more information on modifying the REST resource configuration file, see [Modifying a REST Resource Configuration File](#).

Message Exchange Patterns

Clients of TIBCO ActiveMatrix Binding Type for REST can invoke backend services that are exposing IN-ONLY or IN-OUT message exchange patterns using HTTP operations (GET, PUT, POST, and DELETE).

For a Service

- IN-ONLY operations return HTTP code 200 OK for success or an HTTP error code in case of failure.
- IN-OUT operations return a response or a fault in the HTTP body for success or failure. An HTTP error code is returned for protocol errors.

For a Reference

Configuring the Out-Only operation in the REST Resource Configuration file results in the addition of the dummy query parameter naming 'AmxInOutBoolean' for that operation.

Error Handling

The TIBCO ActiveMatrix Binding Type for REST returns an error in the response body in case there is fault in a request or a component.

TIBCO ActiveMatrix Binding Type for REST handles errors as follows:

Service

- System errors such as invalid requests are returned as protocol errors, that is, HTTP error codes.
- When a wired service returns a SOAP fault, the REST binding returns a 200 OK code by default. A fault message is returned as a response body.
- The component that implements the WSDL service can override the HTTP response code by using a context parameter named HTTP_RESP_CODE. This parameter is of type int.

If a component throws an undeclared-fault or a runtime exception, TIBCO ActiveMatrix Binding Type for REST returns an Internal Server Error with HTTP Code 500 and an HTTP_RESP_CODE. If any context variables are set, they are ignored.

Reference

- All errors for a specific operation can be configured in the REST resource configuration file.
- Implementation Type consuming REST reference can receive HTTP Status Code and Status Message of the response received using Context Parameters.

Direction: Output

Data Type: Int (for statusCode) and String (for Status Message)

Header Name: statusCode (for HTTP Status Code) / statusMsg (for HTTP Status Message)

Context Parameter Name: statusCode (for HTTP Status Code) / statusMsg (for HTTP Status Message)

Complex XSD Constructs Mapping Rules

If backend services are using complex XSD constructs for WSDL operation signatures, such as multiple parts with complex types, you can use a mediation component between the Implementation Type for REST component and the backend component.

Follow these rules when mapping WSDL operation arguments (message parts) to HTTP operations.

- Multi-part Operation

- Simple types, or built-in simple XSD types such as string, float, boolean, integer, and so on, must be passed as query or path parameters.
- The name of the query parameter or path parameter must match the part name.
- Complex types, such as `xsd:complexType` must be passed as the HTTP body.

TIBCO ActiveMatrix Binding Type for REST supports backend WSDL operations with only one part of `complexType` in the operation signature for multipart WSDL.

[Executing the MultipleComplexTypes Sample](#) illustrates how to use mediation to expose a multi-part WSDL to REST clients.

- Single-part Operation

- Simple types, or built-in simple XSD types such as string, float, boolean, integer, and so on, must be passed as query or path parameters.
- Complex types, such as `xsd:complexType` must be passed as the HTTP body.

REST Binding Development

Create and configure a binding for REST with TIBCO Business Studio - BPM Edition and package the binding into a distributed application archive (DAA).

TIBCO Business Studio - BPM Edition is a standards-based, unified business process modeling and development environment for modeling, developing, and deploying business process applications. TIBCO ActiveMatrix Binding Type for REST is integrated with TIBCO Business Studio - BPM Edition so you can configure and test the REST bindings from there.

For more information about TIBCO Business Studio - BPM Edition, see the *Workbench User Guide* in the Workbench online help. To view the online help, select **Help > Help Contents**.

After you configure and test the REST binding, you can create and deploy a distributed application archive from your project. For more information, see the ActiveMatrix Service Grid documentation.

Payload Generation

TIBCO ActiveMatrix Binding Type for REST supports XML, Standard JSON, and Badgerfish JSON payloads. You can generate an XML file from a WSDL file, and then using a tool included with TIBCO ActiveMatrix Binding Type for REST, you can generate a Badgerfish JSON payload.

Generating XML Payloads

Generate an XML file based on where the part types definitions are defined.

- Part types are defined in the XSD, imported from WSDL.

Right-click the .xsd file and select **Generate > XML file**.

- Part types are defined in WSDL.

In Eclipse, make a copy of the WSDL and change the extension to .xsd. Or, right-click the .xsd file and select **Generate > XML file**.

The generated XML file is a valid XML payload for methods exposed over HTTP POST.

Generating Badgerfish JSON Payloads

You can generate the payload for JSON with `xmltojsontool`, included in the installation.

Procedure

1. Go to `TIBCO_HOME/amx/<version_number>/samples/rest/tools`.
2. Run `xmltojsontool`. You pass in the XML file that you generated from Eclipse, see [Generating XML Payloads](#).


Result

For more information, see the readme of the tool.

Overriding Media Types (For Service Only)

You can override the media types to be consumed or produced by using HTTP headers.

The Media Type configured in the UI serves as the default media type for both the HTTP Request body content type and for the HTTP Response body content type.

 **Note:** You need to specify this information only if your REST client has to override the media type on a per message basis. In most cases, the configuration specifies the media type that is used throughout the application.

Override the content type based on the message type.

Option	Description
Request	Set the Content-Type header in the HTTP RequestClients to override the request body content type. The values are: <ul style="list-style-type: none">• Content-Type: application/json• Content-Type: application/xml• Content-Type: application/bjson

Option	Description
Response	Set the Accept header in the HTTP RequestClients to override the response content type. The values are: <ul style="list-style-type: none">• Accept: application/json• Accept: application/xml• Accept: application/bjson

Configuring REST Bindings

Specify various details after adding the REST binding type to the composite service or reference using TIBCO Business Studio - BPM Edition.

Before you begin

Install all four profiles of ActiveMatrix Service Grid or ActiveMatrix Service Bus.

You can add a REST binding to the composite service or reference from the TIBCO Business Studio - BPM Edition Composite Editor.

Procedure

1. Import an existing project or create a new project in TIBCO Business Studio - BPM Edition. See the ActiveMatrix Service Grid documentation set.
2. Add a REST binding from the canvas view or the properties view.

Option	Description
Canvas view	Right-click the service or reference and select Add > REST Binding from the popup menu.
Properties view	<ul style="list-style-type: none">• Click the service or reference on the canvas.• In the Properties view, click the Bindings tab.• Click Add Binding.

3. Select the service or reference and display its properties.
4. For a promoted service, specify the following details in the right pane of the Properties view.

Option	Description
Name	Name of the REST binding.
HTTP Connector	<p>HTTP Connector and Context Root together define the URL that is used at runtime.</p> <p>You define and name the HTTP Connector at the design-time. At runtime, you need to create a resource of the type HTTP Connector and assign it the name you used at the design-time.</p>
Context Root	HTTP Connector and Context Root together define the URL that is used at runtime.
Media Type	Select Standard JSON, Badgerfish JSON, or XML from the pull-down menu to specify the media type for the request or the response message.
Exclude namespaces from response	<p>Excludes namespaces from the response message.</p> <p>This option is displayed only when Media Type is set to Badgerfish JSON.</p>

5. For a promoted reference, specify the following details in the right pane of the Properties View.

Option	Description
Name	Name of the REST binding.
Description	Short description of the REST binding.
Media Type	(read-only field). The media type can be set from the REST resource configuration file.

Option	Description
Rest resource configuration file	<p>Location of the REST resource configuration file.</p> <p>A resource configuration file is not set by default. To create a resource configuration file, click the -not set- link or click the picker icon, and then click Create New. When you click Finish in this wizard, a new resource configuration file (.rrc) is created with the default media type (JSON) and resource base URI.</p> <p>Note: The .rrc file must be placed in the Service Descriptor folder of the SOA project.</p>
HTTP Client	Select the HTTP client.
Enable pass through mode	Enables the pass through mode. In the pass through mode, a fixed WSDL is configured on the REST binding. In the pass through mode, ActiveMatrix Binding Type for REST behaves like the HTTP Binding Type.

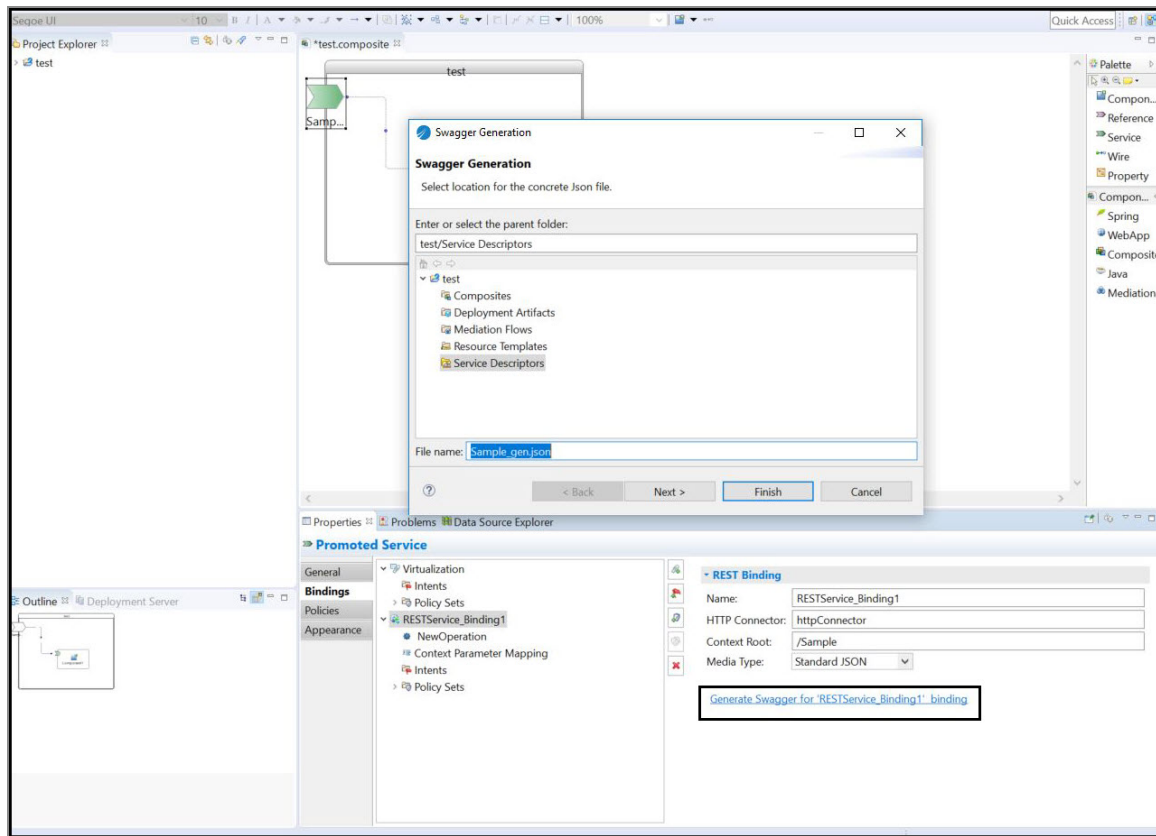
Generating a Swagger JSON File from TIBCO Business Studio - BPM Edition

Swagger is a set of open-source tools that can help you design, build, document, and consume REST APIs. Swagger scans the application code and exposes the documentation on the URL. You can consume this URL (a JSON document) to understand the capabilities of the REST service without accessing the actual source code and documentation. You can now generate a Swagger.json file from TIBCO Business Studio - BPM Edition as mentioned in the following steps.

Procedure

1. Click a promoted service.
2. In the Properties view, click the **Bindings** tab.
3. Select REST binding.
4. In the right pane of the Properties view, click the **Generate Swagger** link at the

bottom. The Swagger Generation dialog displays.



5. Enter or select the parent folder field. Accept the default folder or select a new one.
6. In the File name field, accept the default name (swagger_gen.json) or type a new one.
7. Click **Next**. The Concrete JSON Settings screen displays.
8. Accept the default values of host, port, and scheme. Optionally, you can enter new values. Click **Finish**.

A Swagger JSON file is generated in the parent folder and the file is opened in the editor.

Overview of the Swagger JSON File

The swagger.json file is a specification file that describes the REST APIs in accordance with the Swagger specification. The file describes details such as available endpoints, operations on each endpoint, input and output parameters for each operation, authentication methods, and other information.

The `swagger.json` file can be written in YAML or JSON.

For a sample file, see [Sample swagger.json File](#).

Basic Structure of a File

For more information on the basic structure of the `swagger.json` file, refer to <http://docs.swagger.io/spec.html#52-api-declaration>.

The Swagger representation can be specified in a single file or split into separate files, at your discretion. If it is split across files, you can use `$ref` fields in the specification to reference parts in different files. For more information on the `$ref` field, refer to <https://swagger.io/docs/specification/using-ref>.

Required Fields

For a complete list of all the objects and fields that can be defined in the `swagger.json` file, refer to <https://github.com/OAI/OpenAPI-Specification/>.

Sample Swagger JSON File

A sample Swagger `.json` file of the BookStore example is available in `<TIBCO_HOME>/amx/3.4/samples/rest/samples/bookstore/`.

An overview of the fields from the sample Swagger `.json` file is provided below. For a complete list of all the objects and fields that can be defined in the `swagger.json` file, refer to <https://github.com/OAI/OpenAPI-Specification/>.

Field Name	Description
swagger	Specifies the Swagger Specification version being used. For example: <pre>"swagger" : "2.0"</pre>
info	Provides metadata about the API. For example, the Application API version, title, and port type of service.

Field Name	Description
	<pre>"info" : { "version" : "1.0", "title": "com.tibco.restbt.sample.bookstore", "description" : "Port Type:BookStoreResource" }</pre>
basePath	<p>The base URL of the server. All API endpoints are relative to the base URL. The base URL is of the following format:</p> <pre>scheme://host[:port][/path][parameters]</pre> <p>Some examples are:</p> <pre>http://localhost:8080/bookstore/books http://localhost:8080/bookstore/books/{title} (with path parameters) http://localhost:8080/bookstore/books?storename=demo (with query parameters)</pre>
host	<p>The host of the Service. For example:</p> <pre>"host" : "localhost:9009"</pre>
schemes	<p>The type of the security scheme supported for authentication. For example:</p> <pre>"schemes" : ["http"]</pre>
paths	<p>The relative paths to the individual endpoints and their operations. The path is appended to the base URL to construct the full URL.</p>
tags	<p>A list of tags applicable for the operation. Tags can be used for logical grouping of operations. For example:</p>

Field Name	Description
	<pre>"tags" : ["BookStoreResource"]</pre>
description	<p>An explanation of the operation.</p> <pre>"description" : "getBookList"</pre>
operationId	<p>A unique string used to identify the operation. For example:</p> <pre>"operationId" : "getBookList"</pre>
produces	<p>A list of MIME types the operation can produce. For example:</p> <pre>"produces" : ["application/json", "application/bjson", "application/xml"]</pre>
consumes	<p>A list of MIME types the operation can consume. For example:</p> <pre>"consumes" : ["application/json", "application/bjson", "application/xml"]</pre>
parameters	<p>A list of parameters that are applicable for the operation. For example:</p> <pre>"parameters" : [{ "name" : "storename", "description" : "getBookListRequest", "schema" : { "description" : "getBookList", "type" : "string" }, "in" : "query" }]</pre>
responses	<p>A list of possible responses returned by executing the operation. For</p>

Field Name	Description
	<p>example, a successful response is:</p> <pre>"responses" : { "200" : { "description" : "Successful Response", "schema" : { "\$ref" : "#/definitions/getBookListResponse" } } }</pre>
\$ref	<p>Refer to other components in the specification, internally and externally. For example:</p> <pre>"\$ref" : "#/definitions/getBookListResponse"</pre>

Sending and Consuming HTTP Headers

You can send and consume HTTP headers from the REST operation invocations, using context parameters on REST reference and service bindings. The values populated by the REST binding map HTTP Transport headers to context parameters.

In the case of REST reference bindings, using context mapping, the values set by the Implementation type can be sent as HTTP Headers as part of the REST request. Also, the HTTP Headers received as part of the REST response, can be made available to the Implementation Type.

In the case of REST service bindings, using context mapping, the values of the HTTP Transport Headers can be made available to the Implementation Type (for example, Java IT). Also, the values set by the Implementation Type can be sent as HTTP Transport Headers as part of the REST response.

Note: The Content-Type or Accept headers are not supported in the context parameters and the REST Resource Configuration (RRC) file. That is, you cannot add a context parameter with the name as Content-Type or Accept. In the RRC file, you cannot add Content-Type or Accept as a Request Parameter.

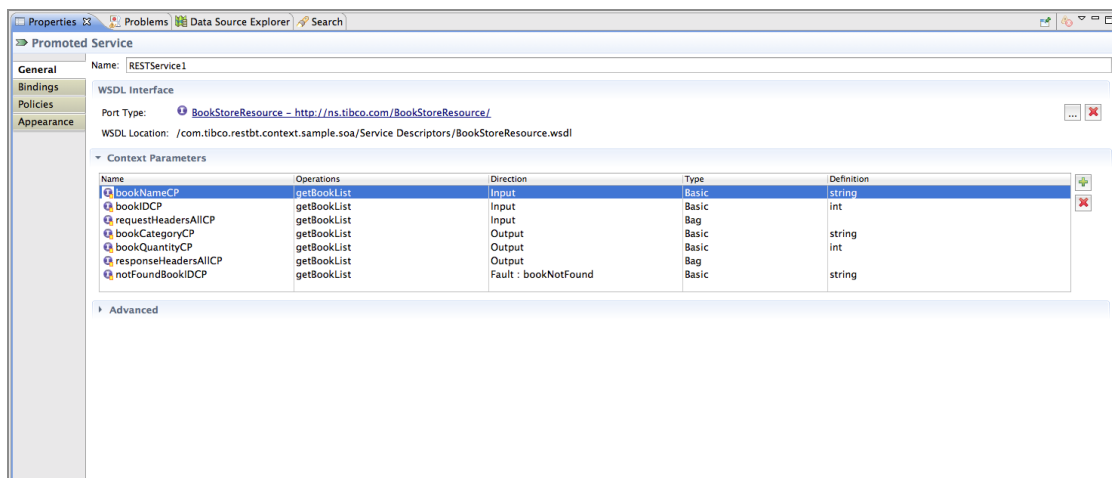
For details on configuring the Inbound, Outbound, and Fault messages for service and reference, refer to the following sections. A sample project is provided as part of the installation in `TIBCO_HOME/amx/<version>/samples/rest/samples/rest.context` to elaborate on the same. Refer to the `/rest.context/Readme.pdf` for details.

Creating and Mapping Context Parameters

You can add context parameters to REST bindings in the Context Parameters section of the **General** tab.

Procedure

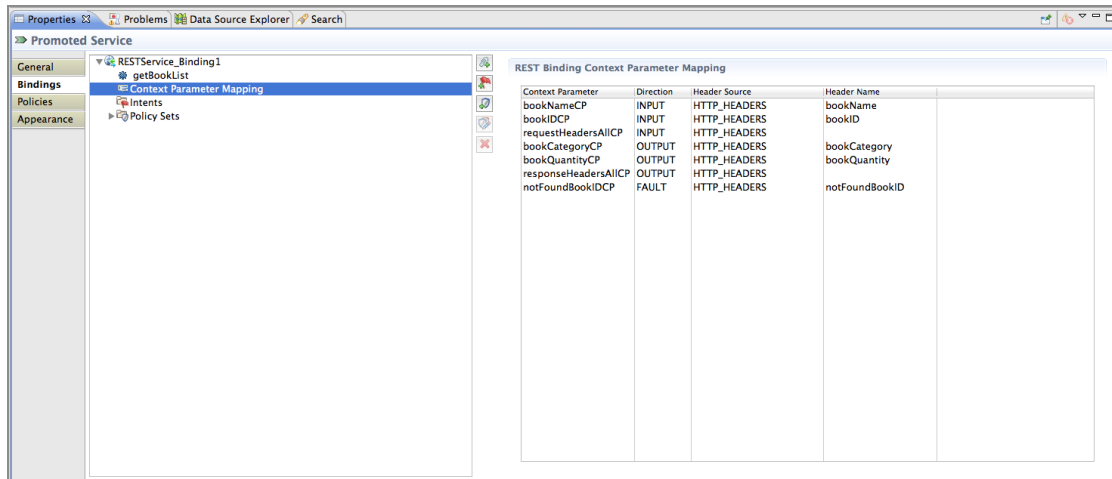
1. Navigate to the **General** tab > **Context Parameters** section of a Promoted Service or Reference.
2. Add a new **Context Parameter**. Select one or more Operations it applies to, the **Direction** (Input, Output or Fault), and the **Type** (Basic or Bag). For Basic Context Parameters, select a **Definition**, to describe the data type of the parameter.



For instance, `bookNameCP` is a Basic string context parameter that applies to the input flow of the `getBookList` operation. The name `bookNameCP` is used for context

parameter mapping in the next step, and is also referred to by IT Implementation.

3. Navigate to the **Bindings** tab in the **REST Binding Context Parameter Mapping** section and specify the HTTP header name in the **Header Name** column.



4. If the selected type is Basic, specify the HTTP header name in the **Header Name** column.

The specified Header Name appears as an HTTP Header on the wire and the context Parameter name is used by Java IT for the Get and Set methods. For instance, the Basic string context parameter bookNameCP is mapped to HTTP Header Name bookName. That is, when a REST service binding intercepts a request, it retrieves the value of the HTTP Header bookName and makes it available to IT Implementation as a value of context parameter bookNameCP.

5. Generate the Java IT Implementation and add the following declaration to the Implementation class:

```
//org.osoa.sca.annotations.Context
@Context
//com.tibco.amf.platform.runtime.extension.context.ComponentContext
public ComponentContext componentContext;
```

For REST Service Binding

To configure the inbound and outbound messages, see:

[Configuring for Request \(Inbound\) Flow](#)

[Configuring for Response \(Outbound or Fault\) Flow](#)

Configuring for Request (Inbound) Flow

You can configure inbound messages received on a service by configuring the following:

- Supported Type: Basic, Bag
- Supported Header Source: HTTP_HEADERS
- Direction: Inbound

Add the following code after receiving the service operation response:

To retrieve a 'Basic' context parameter:

```
//Retrieve requestContext from componentContext which contains the
inbound context parameters from Service-side
RequestContext originalRequestContext = (RequestContext)

componentContext.getRequestContext();
originalRequestContext.getParameter("bookNameCP", String.class));
```

The return value of the above `getParameter()` call corresponds to the HTTP Header value of the `bookName` header (corresponding to the context parameter `bookNameCP`) in the incoming REST Request.

To retrieve the context parameter 'Bag':

```
//Retrieve requestContext from componentContext which contains the
inbound context parameters from Service-side
RequestContext originalRequestContext = (RequestContext)
componentContext.getRequestContext();

HashMap<String, String> requestHeadersAllCP_service_map =
(HashMap<String, String>) originalRequestContext.getParameter
("requestHeadersAllCP", Map.class);
```

The `HashMap requestHeadersAllCP_service_map` contains all the HTTP Headers (user-defined and native HTTP Headers, corresponding to context parameter `requestHeadersAllCP`) in the incoming REST Request.

Configuring for Response (Outbound or Fault) Flow

You can configure outbound messages sent from a service by configuring the following:

- Supported Type: Basic, Bag
- Supported Header Source: HTTP_HEADERS
- Direction: Outbound / Fault

Add the following code.

To set a 'Basic' context parameter:

```
//Create a Mutable callbackContext (Response flow) from the original
RequestContext
MutableCallbackContext originalCallbackContext =
(MutableCallbackContext) originalRequestContext.createCallbackContext();

originalCallbackContext.setParameter("bookCategoryCP", String.class,
"Classic");
```

The value Classic is set for the HTTP Header bookCategory (corresponding to the context parameter bookCategoryCP) in the outgoing REST Response.

To set a context parameter 'Bag':

```
//Create a Mutable callbackContext (Response flow) from the original
RequestContext
MutableCallbackContext originalCallbackContext =
(MutableCallbackContext) originalRequestContext.createCallbackContext();

HashMap<String, String> responseHeadersAllCP_service_map = new
HashMap<String, String>();
responseHeadersAllCP_service_map.put("bookAuthor", "Harper Lee");
responseHeadersAllCP_service_map.put("bookPublishYear", "1960");
originalCallbackContext.setParameter("responseHeadersAllCP", Map.class,
responseHeadersAllCP_service_map);
```

The contents of the HashMap responseHeadersAllCP_service_map is set as HTTP Headers (user-defined, corresponding to context parameter responseHeadersAllCP) in the outgoing REST response. Setting native HTTP Headers is not permitted.

For REST Reference Binding

To configure the inbound and outbound messages, see the following sections.

[Configuring for Request \(Outbound\) Flow](#)

[Configuring for Response \(Inbound or Fault\) Flow](#)

Configuring for Request (Outbound) Flow

You can configure outbound messages sent from a reference by configuring the following:

- Supported Type: Basic, Bag
- Supported Header Source: HTTP_HEADERS
- Direction: Outbound

Add the following code.

To set a 'Basic' context parameter:

```
//Create a new Mutable requestContext from componentContext to set
context parameters for Reference-side
MutableRequestContext createMutableRequestContext =
componentContext.createMutableRequestContext();

createMutableRequestContext.setParameter("bookNameCP", String.class,
"How to Kill a Mockingbird");
```

The value How to Kill a Mockingbird is set for the HTTP Header bookName (corresponding to the context parameter bookNameCP) in the outgoing REST request.

To set a context parameter 'Bag':

```
//Create a new Mutable requestContext from componentContext to set
context parameters for Reference-side
MutableRequestContext createMutableRequestContext =
componentContext.createMutableRequestContext();

HashMap<String, String> requestHeadersAllCP_reference_map = new
HashMap<String, String>();
requestHeadersAllCP_reference_map.put("bookAuthor", "Harper Lee");
requestHeadersAllCP_reference_map.put("bookPublishYear", "1960");
```

```
createMutableRequestContext.setParameter("requestHeadersAllCP",
Map.class, requestHeadersAllCP_reference_map);
```

The contents of the HashMap `requestHeadersAllCP_reference_map` are set as HTTP Headers (user-defined, corresponding to the context parameter `requestHeadersAllCP`) in the outgoing REST request.

Configuring for Response (Inbound or Fault) Flow

You can configure inbound messages received on a reference ("out|fault" part of "in-out" MEP) by configuring the following:

- Supported Type: Basic, Bag
- Supported Header Source: HTTP_HEADERS
- Direction: Inbound/Fault

Add the following code after receiving the service operation response:

To retrieve a 'Basic' context parameter:

```
//Retrieve the callbackContext (Response/Fault flow) from the
mutableRequestContext
CallbackContext callbackContext =
createMutableRequestContext.getCallbackContext();

callbackContext.getParameter("bookCategoryCP", String.class));
```

The return value of the above `getParameter()` call corresponds to the HTTP Header value of the `bookCategory` header (corresponding to the context parameter `bookCategoryCP`) in the incoming REST response.

To retrieve a context parameter 'Bag':

```
//Retrieve the callbackContext (Response/Fault flow) from the
mutableRequestContext
CallbackContext callbackContext =
createMutableRequestContext.getCallbackContext();

HashMap<String, String> responseHeadersAllCP_reference_map =
```

```
(HashMap<String, String>)callbackContext.getParameter  
("responseHeadersAllCP", Map.class);
```

The HashMap `responseHeadersAllCP_reference_map` contains all HTTP Headers (user-defined and native HTTP Headers, corresponding to context parameter `responseHeadersAllCP`) in the incoming REST response.

Mapping HTTP Status Code and Status Message

You can find out the HTTP status code and status message of every REST response received by a REST reference binding. You can then map the HTTP status code and status message to a context parameter. This is helpful when you intend to make decisions based on the HTTP status code of the response received.

Configure the following:

- Supported Type: Basic
- Supported Header Source: HTTP_HEADERS
- Direction: Output
- Header Name: `statusCode` (for HTTP Status Code)/`statusMsg` (for HTTP Status Message)
- Context Parameter Name: `statusCode` (for HTTP Status Code)/`statusMsg` (for HTTP Status Message)


Modifying a REST Resource Configuration File

Procedure

1. Select a REST Binding on a reference.
2. In the Properties View, click the hyperlink of the REST resource configuration file.
This displays the REST Resource Configuration File Editor.
3. Specify the **Context Root**.

4. Select the **Media Type - Standard JSON** or **XML**. The default is **Standard JSON**.


i Note: This Media Type applies to all operations. You cannot set the Media Type at an operation level. This Media Type applies to both the request and response of each operation, that is, the default value of "Content-Type" and "Accept" header is derived from Media Type.




5. Click  to add a resource. In the **Details Section**, specify the following resource details.

- **Resource Name:** resource name must be unique.
- **Resource Path:** Resource Path is the path used to access a resource. It is appended to the value of Context Root.


i Note:
The URL is a combination of the following: <machine_name>:<port>/<ContextRoot>/<Resource>.

In TIBCO ActiveMatrix, a WSDL is usually created with operations in it. If a REST service hosts this WSDL, each operation name has a 'Path' (or Resource Path) associated with the operation. The 'Path' may be different from the Operation Name. This 'Path' must be mapped to the corresponding 'Resource' in the REST Resource Configuration file on a reference.

- **Path Parameters:** To create a path parameter, create a Path variable represented as *{path parameter}*. For example, Resource path to access a book with Id is `"/book/{id}"` where {id} is Path Parameter. **Path Parameters** are added automatically to the table based on the **Resource Path** value. In the table, you can edit the data type but you cannot add or remove parameters. **Path Parameters** cannot be null or empty.
6. Click  to add an operation to a resource. In the **Details Section**, specify operation details such as **Operation Name** and **HTTP Method**. **Operation Name** must be unique across all resources. You can select **GET**, **PUT**, **POST**, or **DELETE** as the **HTTP Method**. The default is **GET**. For each operation, specify the following request and response details, as appropriate.

Request or Response	Type of Request or Response	Procedure
<p>Request</p> <p>A request configuration includes query parameters, header, and body. Query parameter and header name cannot be null or empty. The header name cannot be "Accept" or "Content-Type".</p>	Standard JSON Request	<p>In the Rest Resources section, select Request under Operation.</p> <p>In the Details Section, click  to add the query parameters or header. In the Body (JSON) section, provide the JSON payload details.</p>
<p>NOTE: The Body (JSON) or Body (XML) sections are not displayed if the HTTP Method is set to GET or DELETE.</p>	XML Request	<p>In the Rest Resources section, select Request under Operation.</p> <p>In the Details Section, click  to add the query parameters or header. In the Body (XML) section, select the XSD element by clicking -not set- hyperlink or by clicking .</p> <p>NOTE: All the XSD files needed for the configuration of the RRC must be placed in the Service Descriptors folder. This includes all imported XSDs from within an XSD.</p> <p>XSD Element picker only shows XSD Element and not XSD Types.</p>

Request or Response	Type of Request or Response	Procedure
Response A response configuration includes a body.	Standard JSON Response	In the Rest Resources section, select Response under Operation . In the Details Section , specify the details in the Body (JSON) section or select the JSON file using the file picker.
	XML Response	In the Rest Resources section, select Response under Operation . In the Details Section , select the XSD in the Body (XML) section.

- Click  to add an error type to an operation.

One operation can have multiple error types. Every error type must be associated with either a single or a list of HTTP Status codes. If a list of status codes needs to be specified, separate them with a comma.

- To generate a WSDL file from the .rrc file, select the .rrc file in the Project Explorer window, and then select **Generate WSDL** from the shortcut menu.

A WSDL along with XSD (in case of Standard JSON) is generated.

- Configure the reference using the WSDL generated in step 8.

i Note: On the REST reference side, you must use only the WSDL generated from the REST Resource Configuration File Editor to configure the reference. Do not manually edit a WSDL generated from the REST Resource Configuration File Editor. Make sure that the WSDL and the .rrc file are always in sync with each other. If you make changes in the REST Resource Configuration File Editor, always regenerate the WSDL file.

Policies Supported

TIBCO ActiveMatrix® Binding Type for REST supports the following policies. For additional information on these policies, refer to the ActiveMatrix Service Grid or TIBCO ActiveMatrix® Service Bus documentation.

Service Side

Policy	Description
Basic Authentication	Basic Authentication is a security policy that ensures that a consumer request is validated based on the credentials in the header.
Basic or Username token authentication	Username Token Authentication is a security policy that ensures that a consumer request is validated based on the username token & credentials in the header.
Authorization by role	Authorization by Role is a security policy that ensures that a request is authorized based on the role used in the Security Assertion Markup Language (SAML) tokens.
Authentication by Kerberos	Authentication by Kerberos is a security policy to ensure that consumer requests provide their credentials as Special Negotiation (SPNEGO) tokens using Kerberos authentication.
Authentication by Siteminder	Authentication by SiteMinder is a security policy to ensure that the consumer credentials are validated as username tokens using the SiteMinder protocol.

Reference Side

Policy	Description
Basic Credential Mapping	Basic Credential Mapping is a policy to ensure that the credentials in the consumer request are validated once and propagated across domains. Credentials are mapped using a password identity provider.

Sample Projects

TIBCO ActiveMatrix Binding Type for REST installation includes sample programs, which demonstrates use of the HTTP operations and mediation component.

Service Side

TIBCO ActiveMatrix Binding Type for REST includes the following sample programs for the service side in the `TIBCO_HOME\amx\<version>\samples\rest` directory.

- **Bookstore sample:** Implemented in Java. Exposes a potential interaction of a bookstore administrator with the bookstore inventory. The sample includes two HTTP GET operations, `getBookList` and `getBookByTitle`, and one HTTP POST operation, `addBook`.
- **Multiplecomplextypes sample:** Demonstrates the use of a Mediation component to expose a WSDL operation with multiple parts of complex type. Your application might need to perform such mediation because the Binding Type for REST only supports WSDL operations with a single part of a complex type.

Reference Side

TIBCO ActiveMatrix Binding Type for REST includes the following sample programs for the reference side in the `TIBCO_HOME\amx\<version>\samples\rest` directory.

- **Bookstore client sample:** This sample is configured with REST Binding Type on reference with XML media-type. It consumes the 'bookstore' sample service included in the product.
- **Facebook client sample:** This sample is configured with REST Binding Type on reference with Standard JSON as the media-type. It invokes an external Facebook service.
- **Pass-Through Mode Sample:** This sample is configured with REST Binding Type on reference to demonstrate the Pass Through Mode.

Executing the Bookstore Sample

Deploy the Bookstore sample using TIBCO Business Studio - BPM Edition, review the composite configuration and then run the sample to understand about HTTP operations.

Before you begin

- Before running the samples, ensure that all the required software has been installed and is operating correctly.



Note: If you install only the Administration profile and not the SOA Development profile, the samples are not included in the installation.

- Download a REST client such as:
 - POSTMAN REST client: <https://www.getpostman.com/postman>
 - GitHub RESTClient: <https://github.com/wiztools/rest-client/>

The REST client offers an easy to use interface for setting HTTP headers and a simple text box for sending payload in the HTTP body. If you do not download a REST client, you can see results of GET operations in a Web browser, but you cannot perform HTTP POST operations.

The service operations are implemented in Java, and the service interface is defined in WSDL.

Load the project in TIBCO Business Studio - BPM Edition in order to run the sample.

The bookstore sample illustrates how a bookstore administrator might look up the inventory and add new books. Lookup is by title, or the administrator can get a list of books. Lookup can happen from a Web browser or a REST client. Adding new books can be done from a REST client.

Importing the Bookstore Sample Project

Load the project in TIBCO Business Studio - BPM Edition to run the sample.

Procedure

1. Start TIBCO Business Studio - BPM Edition.

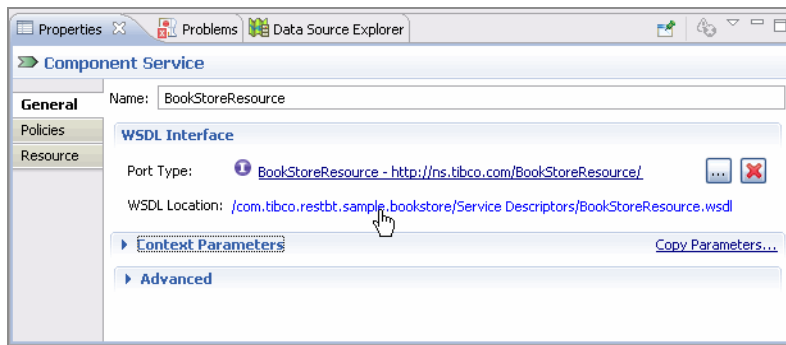
2. From the File menu, select **Import**.
3. In the Import dialog, select **General > Existing Projects into Workspace** and click **Next**.
4. Select the root directory of the sample project. Select the **Copy projects into workspace** checkbox.
5. Click **Finish**.

Reviewing the WSDL that Defines the Service Interface

Explore the WSDL properties to understand input and output operations for the component service.

Procedure

1. In the Project Explorer, select the bookstore project (`com.tibco.restbt.sample.bookstore`) and open Composites.
2. Traverse the hierarchy to get to the BookstoreResource component service, which displays in the **Properties** tab.



3. Click the WSDL link to display the WSDL in the modeling pane, and explore the inputs and outputs for the different operations.

BookStoreResource		
getBookList		
input	storename	getBookList
output	getBookListResponse	getBookListResponse
getBookByTitle		
input	title	getBookByTitle
output	booklist	getBookByTitleResponse
fault	fault	getBookByTitleFault
addBook		
input	book	addBook
output	parameters	addBookResponse

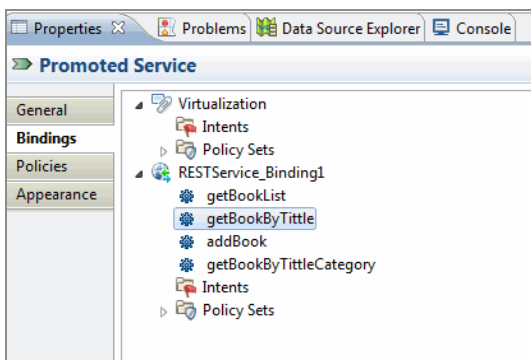
Reviewing the Composite Configuration

Explore the URL and operations associated with the REST bindings.

The composite includes the Java component and the composite service on which the REST bindings are defined.

Procedure

1. In the design window, select the **BookstoreResource** icon.
2. In the **Promoted Service** pane, examine **RESTService_Binding1** and the operations that are associated with it.



3. Select **RESTService_Binding1** to examine the HTTP Connector and context root associated with the binding. The two together form the URL that the service uses.
4. Examine the operation. Each operation maps to a WSDL implemented in Java. The **Path** field shows the URL where the operation is exposed.

Running the Bookstore Sample

Start the application and test the HTTP GET and POST operations. You can run the sample from TIBCO Business Studio - BPM Edition.

Procedure

1. Right-click the design panel background and select **Debug in RAD** to start the application.
2. Use an HTTP client such as a Web browser or a REST client tool to invoke one of the HTTP GET method.

For example, to test `getBookList`, specify the `http://host:port/bookstore/books` URL in a Web browser or a REST client.

- `host` and `port` are required by HTTP. You can find the port by choosing the bug icon in the title bar and selecting **Debug Configuration**. You see that information only after you have run the sample once.
- `/bookstore` is the context root for **RESTService_Binding1**.
- `/books` is the 'Path' of `getBookList`.

For samples of calling each method, see the `sample_payloads.txt` file.

3. To test the HTTP POST operation `addBook`, you need a REST client. You can specify the XML code for the book you want to add in the POST request.

Executing the MultipleComplexTypes Sample

Deploy and run the `MultipleComplexTypes` project to understand the use of mediation component for operations with complex types.

TIBCO ActiveMatrix Binding Type for REST supports operations with complex types, but does not allow more than one complex type per operation. At times, you might have a service that is implemented in Java, which has operations with multipart messages with complex types. If you want to make that information available to a REST client, you can use a mediation component. The `MultipleComplexTypes` sample illustrates this.

Importing the MultipleComplexTypes Sample Project

Load the project in TIBCO Business Studio - BPM Edition to run the sample.

Procedure

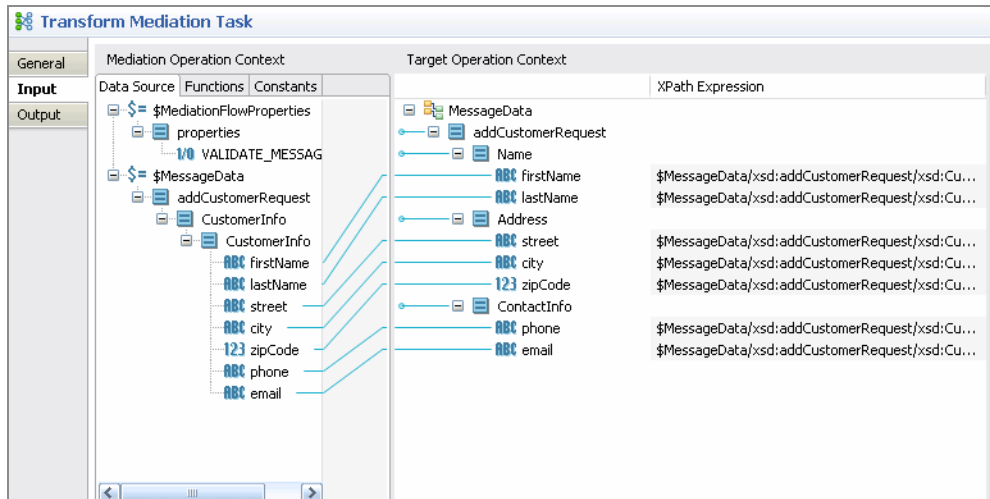
1. Start TIBCO Business Studio - BPM Edition.
2. From the File menu, select **Import**.
3. In the Import dialog, select **General > Existing Projects into Workspace** and click **Next**.
4. Select the root directory of the sample project. Select the **Copy projects into workspace** checkbox.
5. Click **Finish**.

Reviewing the Mediation Flow

Explore the mediation flow to see how multiple parts are mapped to a single field.

Procedure

1. In the Project Explorer, select the multiplecomplextypes composite.
2. Examine the SingleToMultiple mediation component in the design window.
3. Double-click the pre-defined mediation flow to open the Mediation Flow Editor.
4. Double-click the addCustomer operation to display the mapping properties in the Input tab of the Transform Mediation Task panel. You can see that the source has multiple parts (Name, Address, ContactInfo) while the mediation context maps the information to a single CustomerInput field.

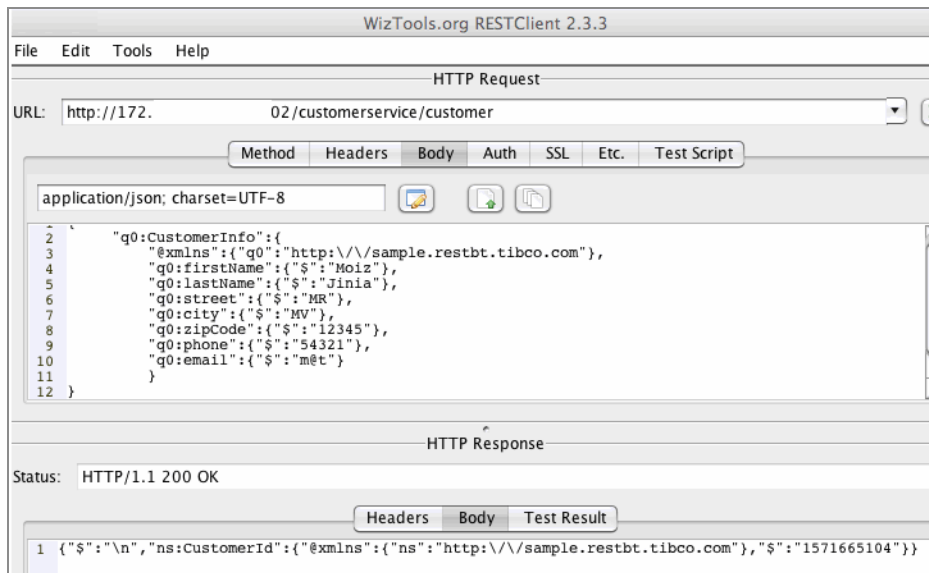


Running the MultipleComplexTypes Sample

Start the sample project by using TIBCO Business Studio - BPM Edition and run it using a REST client.

Procedure

1. In TIBCO Business Studio - BPM Edition, click the design panel background and select **Debug in RAD**.
2. Open a REST client and set the host and port to match your system and the port on which the service runs.
3. Set the application type to JSON.



4. Select the Body tab and enter one of the sample body strings from the sample_payloads.txt file.

Executing the Bookstore Client Sample (Reference)

Procedure

1. Deploy the Bookstore client sample by using TIBCO Business Studio - BPM Edition.
2. Review the composite configuration.
3. Run the sample to understand HTTP operations.

Importing the Bookstore Client Sample Project

Load the project in TIBCO Business Studio - BPM Edition to run the sample.

Procedure

1. Start TIBCO Business Studio - BPM Edition.
2. From the **File** menu, select **Import**.

3. In the Import dialog, select **General > Existing Projects into Workspace** and click **Next**.
4. Select the root directory of the sample project. Select the **Copy projects into workspace** checkbox.
5. Click **Finish**.

Reviewing the REST Resource Configuration File That Defines the REST Service Interface

Procedure

1. In the Project Explorer, select the bookstore client project and open **Composites**.
2. Traverse the hierarchy to get to the BookstoreResource component reference, which displays in the **Properties** tab.
3. Select **RESTReference_Binding1** and click the **REST Resource Configuration File** link.
4. Review the REST resource configuration file.

Running the Bookstore Client Sample

Start the application and test the HTTP GET and POST operations. You can run the sample from TIBCO Business Studio - BPM Edition.

Procedure

1. Right-click the design panel background.
2. Select Debug in RAD to start the application.

Executing the Facebook Client Sample (Reference)

Procedure

1. Deploy the Facebook client sample by using TIBCO Business Studio - BPM Edition.
2. Review the composite configuration.
3. Run the sample to understand HTTP operations.

Importing the Facebook Client Sample Project

Load the project in TIBCO Business Studio - BPM Edition.

Procedure

1. Start TIBCO Business Studio - BPM Edition.
2. From the **File** menu, select **Import**.
3. In the Import dialog, select **General > Existing Projects into Workspace** . Click **Next**.
4. Select the root directory of the sample project. Select the **Copy projects into workspace** checkbox.
5. Click **Finish**.

Running the Facebook Client Sample

Start the application and test the HTTP GET and POST operations. You can run the sample from TIBCO Business Studio - BPM Edition.

Procedure

1. Deploy the DAA located in Deployment Artifacts:
 - Facebook Graph APIs are SSL protected and hence the client must be SSL-enabled. The certificate file (.crt) and keystore (.jks) file are packaged along with this sample.
 - The above keystore is referred by Resource Template/FacebookKeystoreProviderResource.cred. Update it with the absolute path to the keystore.

i Note: If the keystore has expired, download it from the Facebook site.

2. Right-click the design panel background.
3. Select Debug in RAD to start the application.
4. Use the URL `http://<Host>:<Port>/fbGraphService?wsdl` to load the WSDL in the SOAP UI or in the WebService Explorer.

You can see an operation `getUserProfile` which accepts two arguments - `user` and `access_token`. The `access_token` argument is the OAuth token required by the Facebook REST API and `user` is the username or `id` or `me` (currently logged in user).

5. Get an Access Token:
 - a. Open Facebook Graph Explorer using the following URL:
`https://developers.facebook.com/tools/explorer/?method=GET&path=me`.
 - b. After authentication, click **Get Access Token** on the right side in Graph API Explorer.
 - c. After you get the Access Token, use it while invoking the `getUserProfile` operation.

Executing the Pass-Through Mode Sample (Reference)

Procedure

1. Import the Pass Through Model sample project in TIBCO Business Studio - BPM Edition.
 - a. Start TIBCO Business Studio - BPM Edition.
 - b. From the **File** menu, select **Import**.
 - c. In the Import dialog, select **General > Existing Projects into Workspace** and click **Next**.
 - d. Select the root directory of the sample project. Select the **Copy projects into workspace** checkbox.

- e. Click **Finish**.
2. Review the composite configuration.
3. Deploy the DAA in ActiveMatrix Service Grid Administrator.
4. Test the HTTP operations.

Executing the rest.context Sample

The rest.context sample includes:

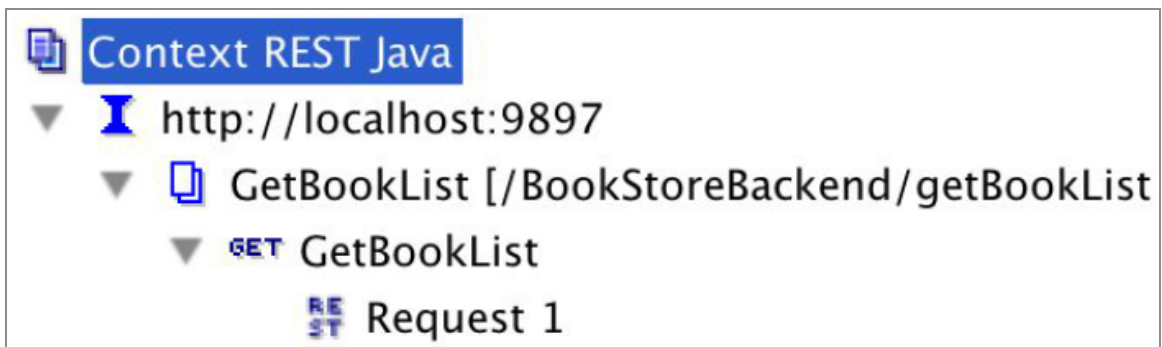
- REST SOA projects (/rest-soap-projects/):
 - /com.tibco.restbt.context.sample.soa/Composites/rest-java.composite (/com.tibco.restbt.context.sample.soa/Deployment Artifacts/rest-java.daa): REST-Java (Backend REST App)
 - /com.tibco.restbt.context.sample.restjava: Sample Java IT Provider Implementation for REST-Java App (1)
 - /com.tibco.restbt.context.sample.soa/Composites/restjavarest.composite (/com.tibco.restbt.context.sample.soa/Deployment Artifacts/rest-java-rest.daa): REST-Java-REST (Frontend REST App that connects with the Backend REST-Java App via REST Reference (1))
 - /com.tibco.restbt.context.sample.restjavarest: Sample JavaIT Provider/Consumer Implementation for REST-Java-REST App (3)
- SoapUI projects to invoke the REST Apps (/SoapUIprojects/):
 - context-REST-Java-REST-soapui-project: SOAPUI project to send a REST Request to the REST-Java-REST App (3) with the HTTP Headers
 - context-REST-Java-soapui-project.xml: SOAPUI project to send a REST Request to the REST-Java App (1) with the HTTP Headers
- SoapUI projects to invoke the REST Apps (/SoapUI-projects/):
 - context-REST-Java-REST-soapui-project: SOAPUI project to send a REST Request to the REST-Java-REST App (3) with the HTTP Headers
 - context-REST-Java-soapui -project.xml: SOAPUI project to send a REST

Request to the REST-Java App (1) with the HTTP Headers

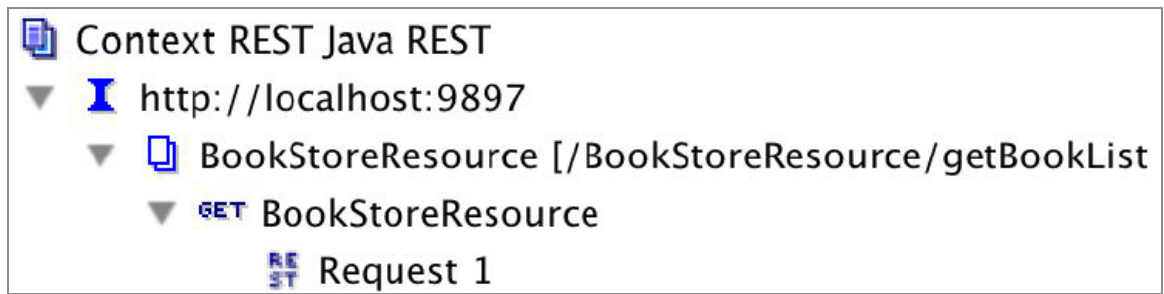
Running the rest.context Example

Procedure

1. Launch ActiveMatrix Service Grid Administrator.
2. Create an HTTP Connector Resource Template **httpConnector** with **host** as localhost and **port** as 9897.
3. Create and install the corresponding HTTP Connector Resource Instance **httpConnector** on Runtime Node.
4. For REST-Java App, deploy the following DAA:
`com.tibco.restbt.context.sample.soa/Deployment Artifacts/restjava.daa`
5. For REST-Java-REST App, deploy the following DAA:
`com.tibco.restbt.context.sample.soa/Deployment Artifacts/restjavarest.daa`
6. To send a REST Request to the REST-Java App, open the SOAP UI project `context-REST-Java-soapui-project.xml` using SOAP UI 5.0.0, and send the following REST Request:



7. To send a REST Request to the REST-Java-REST App, open the SOAP UI project `context-REST-Java-REST-soapui-project.xml` using SOAP UI 5.0.0, and send the following REST Request:

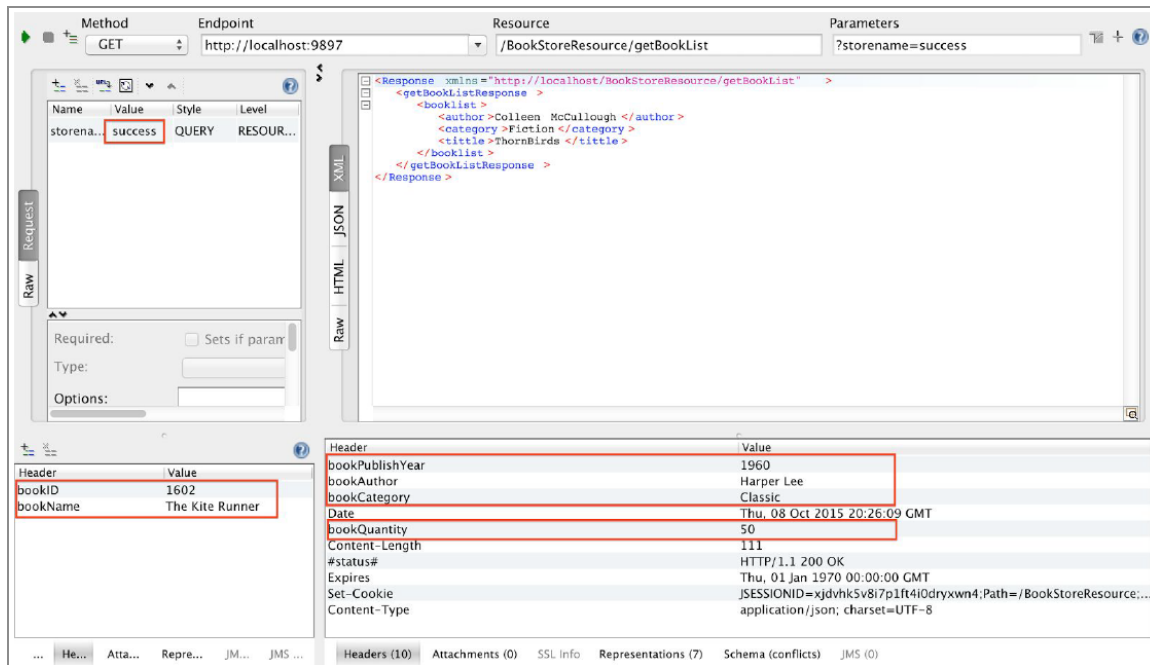


Breakdown of the rest.context Scenario

When a REST Request is sent to the REST-Java-REST App with the HTTP Headers (for example, bookName and bookID) using the SOAP UI project context-REST-Java-REST-soapui-project.xml:

1. They are mapped to context parameters that can be retrieved in the Java IT Implementation (“Java1 (service-inbound)” in the Runtime Node logs shown later).
2. The new basic header values and a collection of headers are sent to the REST-Java App via context parameters (“Java1 (reference-inbound)” in the Runtime Node logs shown later).
3. The headers are retrieved in the REST-Java App’s Java IT implementation (“Java2 (service-inbound)” in the Runtime Node logs shown later).
4. New outbound headers are set in the REST-Java App’s Java IT implementation (basic and bag) to be sent back to the REST-Java-REST App (Java2 (service-outbound) in the Runtime Node logs shown later).
5. The headers sent by REST-Java App are retrieved in REST-Java-REST App’s Java IT implementation (“Java1 reference-outbound)” in the Runtime Node logs shown later).
6. Some headers are set in REST-Java-REST App’s Java IT implementation to be sent back to the originating client (“Java1 (service-outbound)” or “Java1 (service-fault)” in the Runtime Node logs shown later, depending on the value of “storename” (“success” and “fault” respectively)).

REST-Java-REST: Success Scenario of REST-Java



Runtime Node Logs

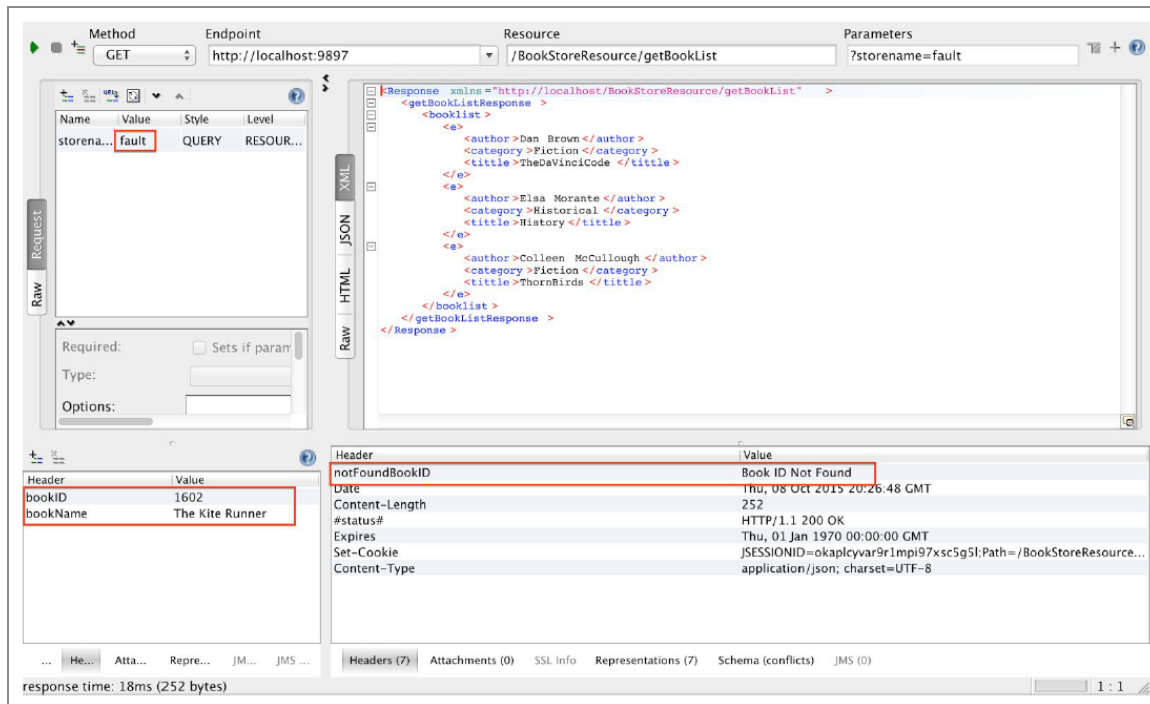
```
[INFO ] [rest-java-rest] stdout - ----- Java1(service-inbound) ----
-----
[INFO ] [rest-java-rest] stdout - storename = success
[INFO ] [rest-java-rest] stdout - ----- Java1(service-inbound) ----
-----
[INFO ] [rest-java-rest] stdout - Getting bookName = The Kite Runner
[INFO ] [rest-java-rest] stdout - Getting bookID = 1602
[INFO ] [rest-java-rest] stdout - Getting requestHeadersAllCP =
{Host=localhost:9897, User-Agent=Apache-Http-Client/4.1.1 (java
1.5),bookID=1602, Connection=Keep-Alive,bookName=The Kite Runner}
[INFO ] [rest-java-rest] stdout - ----- Java1(reference-inbound) --
-----
[INFO ] [rest-java-rest] stdout - Setting bookName = How to Kill a
Mockingbird
[INFO ] [rest-java-rest] stdout - Setting bookID = 1501
[INFO ] [rest-java-rest] stdout - Setting requestHeadersAllCP =
{bookPublishYear=1960, bookAuthor=Harper Lee}
[INFO ] [rest-java] stdout - ----- Java2 (service-inbound) -----
--
[INFO ] [rest-java] stdout - storename = success
```

```

[INFO ] [rest-java] stdout - ----- Java2 (service-inbound) -----
--
[INFO ] [rest-java] stdout - Getting bookName = How to Kill a
Mockingbird
[INFO ] [rest-java] stdout - Getting bookID = 1501
[INFO ] [rest-java] stdout - Getting requestHeadersAllCP =
{bookPublishYear=1960, bookAuthor=Harper
Lee, Cookie=JSESSIONID=1wt523hzhwphvlgyxxt8frpsu, Cookie2=$Version=1,
Host=localhost:9897, Accept-Charset=UTF-8, BookID=1501, Connection=Keep-
Alive, Accept=application/json, ContentType=application/json;
charset=UTF-8, bookName=How to Kill a Mockingbird}
[INFO ] [rest-java] stdout - ----- Java2 (service-outbound) -----
---
[INFO ] [rest-java] stdout - Setting bookCategory = Classic
[INFO ] [rest-java] stdout - Setting bookQuantity = 50
[INFO ] [rest-java] stdout - Setting responseHeadersAll: =
{bookPublishYear=1960, bookAuthor=Harper Lee}
[INFO ] [rest-java-rest] stdout - ----- Java1(reference-outbound) -
-----
[INFO ] [rest-java-rest] stdout - Getting bookCategory = Classic
[INFO ] [rest-java-rest] stdout - Getting bookQuantity = 50
[INFO ] [rest-java-rest] stdout - Getting responseHeadersAll: =
{bookPublishYear=1960, bookAuthor=Harper Lee, bookCategory=Classic,
bookQuantity=50, Date=Thu, 08 Oct 2015 21:04:22 GMT, Content-Length=111,
ContentType=application/json; charset=UTF-8} 08 Oct 2015 14:04:22,798
[httpConnector_10]
[INFO ] [rest-java-rest] stdout - ----- Java1(service-outbound) ---
-----
[INFO ] [rest-java-rest] stdout - Setting bookCategory = Classic
[INFO ] [rest-java-rest] stdout - Setting bookQuantity = 50
[INFO ] [rest-java-rest] stdout - Setting responseHeadersAll: =
{bookPublishYear=1960, bookAuthor=Harper Lee}

```


REST-Java-REST: Fault Scenario of REST-Java



Runtime Node Logs

```

[INFO ] [rest-java-rest] stdout - ----- Java1 (service-inbound) --
-----
[INFO ] [rest-java-rest] stdout - storename = fault
[INFO ] [rest-java-rest] stdout - ----- Java1 (service-inbound) --
-----
[INFO ] [rest-java-rest] stdout - Getting bookName = The Kite Runner
[INFO ] [rest-java-rest] stdout - Getting bookID = 1602
[INFO ] [rest-java-rest] stdout - Getting requestHeadersAllCP =
{Host=localhost:9897, User-Agent=Apache-Http-Client/4.1.1 (java
1.5),bookID=1602, Connection=Keep-Alive,bookName=The Kite Runner}
[INFO ] [rest-java-rest] stdout - ----- Java1 (reference-inbound)
-----
[INFO ] [rest-java-rest] stdout - Setting bookName = How to Kill a
Mockingbird
[INFO ] [rest-java-rest] stdout - Setting bookID = 1501
[INFO ] [rest-java-rest] stdout - Setting requestHeadersAllCP =
{bookPublishYear=1960, bookAuthor=Harper Lee}
[INFO ] [rest-java] stdout - ----- Java2 (service-inbound) -----
-----

```

```

[INFO ] [rest-java] stdout - storename = fault
[INFO ] [rest-java] stdout - ----- Java2 (service-inbound) -----
----
[INFO ] [rest-java] stdout - Getting bookName = How to Kill a
Mockingbird
[INFO ] [rest-java] stdout - Getting bookID = 1501
[INFO ] [rest-java] stdout - Getting requestHeadersAllCP =
{bookPublishYear=1960, bookAuthor=Harper Lee, Host=localhost:9897,
Accept-Charset=UTF-8, bookID=1501, Connection=Keep-Alive,
Accept=application/json, Content-Type=application/json; charset=UTF-8,
bookName=How to Kill a Mockingbird}
[INFO ] [rest-java] stdout - ----- Java2 (service-outbound) -----
-----
[INFO ] [rest-java] stdout - Setting bookCategory = Classic
[INFO ] [rest-java] stdout - Setting bookQuantity = 50
[INFO ] [rest-java] stdout - Setting responseHeadersAll: =
{bookPublishYear=1960, bookAuthor=Harper Lee}
[INFO ] [rest-java-rest] stdout - ----- Java1 (reference-outbound)
-----
[INFO ] [rest-java-rest] stdout - Getting bookCategory = Classic
[INFO ] [rest-java-rest] stdout - Getting bookQuantity = 50
[INFO ] [rest-java-rest] stdout - Getting responseHeadersAll: =
{bookPublishYear=1960, bookAuthor=Harper Lee, bookCategory=Classic,
bookQuantity=50, Date=Thu, 08 Oct 2015 21:03:43 GMT, Content-Length=
252, Expires=Thu, 01 Jan 1970 00:00:00 GMT, Set-
Cookie=JSESSIONID=1wt523hzhwphvlgxxt8frpsu;Path=/BookStoreBackend;HttpO
nly, Content-Type=application/json; charset=UTF-8}
[INFO ] [rest-java-rest] stdout - ----- Java1 (service-fault) ----
-----
[INFO ] [rest-java-rest] stdout - Setting notFoundBookID = Book ID Not
Found

```

Executing the rest.extendedJSONConversion Sample

The rest.extendedJSONConversion sample includes:

- REST SOA projects (/rest-soa-projects/):
 - restbt.sample.extended.json.conversion/Composites/restbt.sample.extended.json.conversion.composite (

`restbt.sample.extended.json.conversion/DeploymentArtifacts/restbt.sample.extended.json.conversion.daa`): REST-Java (Provider) and REST-Java-REST (Client) components to demonstrate the enhancements

- `com.sample.restbt.sample.extended.json.conversion`: Provider and Client Java Implementations
- SoapUI projects to invoke the REST Apps (`/SoapUI-projects/REST-ExtendedJSONConversion-soapui-project.xml`):
 - Service “InvokeRESTProvider”: SOAPUI project to send a REST request to the REST Provider (REST-Java)
 - Service “InvokeRESTClient”: SOAPUI project to send a REST request to the REST Client (REST-Java-REST) which in turns sends a REST request to the REST Provider (REST-Java)



Note: The SOAP UI projects work as-is if the REST Service Bindings (that use HTTP Connector “httpConnector”) are deployed on `localhost:9897`.

Provider side (Service/Outbound/Response): XML-to-JSON Conversion of String XSD Element

Consider an XSD element that is defined as a “string” in the Provider-side WSDL Schema (identified by the “type” attribute, which must be set to XSD string, for example ‘type=“xsd:string”’ where “xsd” points to the XML Namespace “http://www.w3.org/2001/XMLSchema”).

If the XML Response contains a non-numeric string as the value for that XSD element (for example “teststring” or “test1234”), the JSON Response object is serialized correctly as part of the standard XML-to-JSON Conversion that is as a JSON String (“teststring” or “test1234”).

However, if the XML response contains a purely numeric String as the value for that XSD element (for example “1234”), then the standard XML-to-JSON Conversion converts the element to a JSON Number (for example 1234 as opposed to “1234” that is not a JSON string), which would result in an inconsistent conversion.

This holds true for other JSON types as well, for example, Double, Boolean, and so on. With this release, the XSD Element's (in the sample scenario, the “Value” element in `Sample.wsd1`) “type” attribute is factored into the XML-to-JSON Conversion specifically for

JSON Strings that is if the XSD Element is of type "string", the resultant JSON Object is a JSON String as well and not a JSON Number.

This affects the service-side RESPONSE. The REQUEST is not affected.

Client side (Reference/Inbound/Request): XML-to-JSON Conversion of String XSD Element

Whether an element is of type "string" is inferred from the Reference-side REST Resource Configuration (RRC) file, specifically from the "Request" of the "POST" method.

In the sample scenario that would be the "Request" of the "addOperation". If you indicate via the RRC file that "Value" is a string (by use of "Value": "123"), then with this release, the POST Request generation honors the "string" type by sending a JSON string, even if the "Value" contains only a purely numeric value.

This affects the POST method's REQUEST. The POST method's RESPONSE is not affected.

This behavior is demonstrated in the "Test Scenario" section below.



Note: Only inline schemas are supported on the Service-side that is the XSD elements (of type string) that are of interest to this sample must be present in the Service-side WSDL.


Running the rest.extendedJSONConversion Example

Procedure

1. Launch ActiveMatrix Service Grid Administrator.
2. Set the TRA property
`com.tibco.amf.runtime.bindingtype.rest.extendedJsonConversion` to true for the appropriate Runtime Node (via Administrator UI or by adding the line
`java.property.com.tibco.amf.runtime.bindingtype.rest.extendedJsonConversion=true` in the .tra file of the Runtime Node) and restart the Runtime Node.
3. Enable the `com.tibco.amx.bt.rest` logger in the DEBUG level on the Runtime Node.
4. Create an HTTP Connector Resource Template `httpConnector` with **host** as `localhost` and **port** as `9897`.

5. Create and install the corresponding HTTP Connector Resource Instance “httpConnector” on Runtime Node.
6. For both REST-Java and REST-Java-REST applications, deploy the following DAA:

```
/rest-soa-projects/restbt.sample.extended.json.conversion/DeploymentArtifacts/restbt.sample.extended.json.conversion.daa
```
7. To send a REST Request to the REST-Java (Provider) App, open the SOAP UI project REST-ExtendedJSONConversion-soapui-project.xml using SOAP UI 5.0.0, and use the “InvokeRESTProvider” service. This sends a REST request to the REST-Java app and demonstrates the Provider-side (Service) behavior.

 **Note:** Set the HTTP Request Header to Accept = application/json.

GET method’s RESPONSE (returnOne)

Request URL: `http://localhost:9897/Sample/returnOne` (HTTP method: GET)

Sample Response (Standard JSON)

```
{
  "returnOneResponse": {
    "Flights": [
      {
        "Arrival": "arrival",
        "Departure": "123"
      }
    ]
  }
}
```

Note the [] indicating that Flights is an Array, based on the schema. Also, “123” is a string, which is schema-compliant.

8. To send a REST Request to the REST-Java-REST (Client) App, open the SOAP UI project REST- ExtendedJSONConversion-soapui-project.xml using SOAP UI 5.0.0, and use the “InvokeRESTClient” service. This sends a REST request to the REST-Java-REST app, which in turn sends a rest to the REST-Java app. This demonstrates the client-side (Reference) behavior.

POST method’s REQUEST (addOperation)

Request URL: `http://localhost:9897/SampleClient/addOperation` (HTTP method: POST)

Set HTTP Request Header:

```
Accept = application/json and Content-Type = application/json
```

SOAPUI Request to first REST Service Endpoint:

```
{"addOperation": {"Arrays": [{"Key": "ABC", "Value": "123"}]}}
```

POST Request generated by REST Reference Endpoint:

```
{"Arrays": [{"Key": "ABC", "Value": "123"}]}
```

Note the [] indicating that Arrays is an Array, based on the schema. Also, “123” is a string, based on the schema.

Response (Standard JSON):

```
{"addOperationResponse": {"Arrays": [{"Key": "ABC", "Value": "123"}]}}
```

Note the [] indicating that Arrays is an Array, based on the schema. Also, “123” is a string, based on the schema.

REST-Java-REST: Runtime Node Logs for Rest-Java

```
25 Jan 2016 17:23:22,168 [httpConnector_2] [DEBUG] []
com.tibco.amx.bt.rest.RESTDispatcherServlet - TIBCO-AMX-BT-REST-300100:
Request Message from External Consumer to REST Promoted Service.
PromotedServiceName=SampleClient/Sample, BindingName=RESTService_
Binding1, BindingType=REST,
URL=http://localhost:9897/SampleClient/addOperation,
ComponentURI=urn:amx:DevEnvironment/restbt.sample.extended.json.conversi
on/JavaClient_1.0.0.v2016-01-25- 1703_inbound_service_
SampleClient/Sample_RESTService_Binding1, OperationName=
{http://HdrTest/Sample/}addOperation, CorrelationID=1ed56457-33c4-47e0-
aff4-e91b03b4cb92, ContextID=1ed56457-33c4-47e0-aff4-e91b03b4cb92,
ParentContextID=null, RequestHeaders={RequestAttributes :
amx.connector.name = httpConnector; org.mortbay.jetty.newSessionId =
hxe pj3z2t0wde68d04zk9x4o; component.URI =
urn:amx:DevEnvironment/restbt.sample.extended.json.conversion#servicebin
ding(SampleClient/RESTService_Binding1)___1.0.0.v2016-01-25-1703; }
{RequestParameters : } { Protocol = HTTP/1.1 } { RequestURI =
/SampleClient/addOperation } { Method = POST } { HTTPHeader : Content-
Type = application/json; Content-Length = 58; Host = localhost:9897;
```

```
Connection = Keep-Alive; User-Agent = Apache-HttpClient/4.1.1 (java
1.5); }} QueryString : null }} PathInfo : /addOperation }
```

```
25 Jan 2016 17:23:22,254 [httpConnector_2] [DEBUG]
[restbt.sample.extended.json.conversion]
com.tibco.amx.bt.rest.RESTHttpClient -
Request Message from REST Promoted Reference to External Service.
PromotedReferenceName=extendedConversionRrcResource,
BindingName=RESTReference_Binding1, BindingType=REST,
URL=http://localhost:9897/Sample/addOperation,
ComponentURI=urn:amx:DevEnvironment/restbt.sample.extended.json.conversi
on/JavaClient_1.0.0.v2016-01-25-
1703_outbound_reference_extendedConversionRrcResource_RESTReference_
Binding1,
OperationName=
{http://ns.tibco.com/RSBT/extendedConversionRrcResource}add
Operation, CorrelationID=1ed56457-33c4-47e0-aff4-e91b03b4cb92,
ContextID=f4261c98-e8c5-46d0-99a7-d8c93747003f,
ParentContextID=1ed56457-33c4-47e0-aff4-e91b03b4cb92, Method=POST,
SchemeName=http, HostName=localhost, Port=9,897,
RequestURI=/Sample/addOperation, Headers=[Content-Type:
application/json; charset=UTF-8, Accept: application/json, Accept-
Charset: UTF-8],
body={"Arrays":[{"Key":"ABC","Value":"123"}]}
```

```
25 Jan 2016 17:23:22,290 [httpConnector_4] [DEBUG] []
com.tibco.amx.bt.rest.RESTDispatcherServlet - TIBCO-AMX-BT-REST-300100:
Request Message from External Consumer to REST Promoted Service.
PromotedServiceName=Sample/Sample, BindingName=RESTService_Binding1,
BindingType=REST, URL=http://localhost:9897/Sample/addOperation,
ComponentURI=urn:amx:DevEnvironment/restbt.sample.extended.json.conversi
on/JavaProvider_1.0.0.v2016-01-25-1703_inbound_service_Sample/Sample_
RESTService_Binding1, OperationName=
{http://HdrTest/Sample/}addOperation, CorrelationID=46080a36-a928-46db-
be47-2da6cb475b16, ContextID=46080a36-a928-46db-be47-2da6cb475b16,
ParentContextID=null, RequestHeaders={RequestAttributes :
amx.connector.name = httpConnector; org.mortbay.jetty.newSessionId =
1uttc7734evusb1od1db0fspx60; component.URI =
urn:amx:DevEnvironment/restbt.sample.extended.json.conversion#servicebin
ding(Sample/RESTService_Binding1)___1.0.0.v2016-01-25-1703; } {
RequestParameters : } { Protocol = HTTP/1.1 } { RequestURI =
/Sample/addOperation } { Method = POST } { HTTPHeader : Content-Type =
application/json; charset=UTF-8; Accept = application/json; Accept-
Charset = UTF-8; Content-Length = 40; Host = localhost:9897; Connection
= Keep-Alive; }} QueryString : null }} PathInfo : /addOperation }
```

```
25 Jan 2016 17:23:22,298 [httpConnector_4] [DEBUG]
[restbt.sample.extended.json.conversion]
com.tibco.amx.bt.rest. ESTGenericReplyCallback - TIBCO-AMX-BT-REST-
300103:
Response (Reply) Message from REST Promoted Service to External
Consumer. PromotedServiceName=Sample/Sample, BindingName=RESTService_
Binding1, BindingType=REST,
URL=http://localhost:9897/Sample/addOperation,
ComponentURI=urn:amx:DevEnvironment/restbt.sample.extended.json.conversi
on/JavaProvider_1.0.0.v2016-01-25- 1703_inbound_service_Sample/Sample_
RESTService_Binding1, OperationName=
{http://HdrTest/Sample/}addOperation, CorrelationID=46080a36-a928-46db-
be47-2da6cb475b16, ContextID=46080a36-a928-46db-be47-2da6cb475b16,
ParentContextID=null, Message={ Content-Type : application/json;
charset=UTF-8 }{ HTTP Status Code: 200 }{ HTTPBody :
{"addOperationResponse":{"Arrays":[{"Key":"ABC","Value":"123"}]}}
```

```
25 Jan 2016 17:23:22,312 [httpConnector_2] [DEBUG]
[restbt.sample.extended.json.conversion]
com.tibco.amx.bt.rest.RESTOutboundEndpoint - Response Message from
External Service to REST Promoted Reference.
PromotedReferenceName=extendedConversionRrcResource,
BindingName=RESTReference_Binding1, BindingType=REST, URL=N/A,

ComponentURI=urn:amx:DevEnvironment/restbt.sample.extended.json.conversi
on/JavaClient_1.0.0.v2016-01-25-
1703_outbound_reference_extendedConversionRrcResource_RESTReference_
Binding1,
OperationName=
{http://ns.tibco.com/RSBT/extendedConversionRrcResource}addOperation,
CorrelationID=1ed56457-33c4-47e0-aff4-e91b03b4cb92,
ContextID=f4261c98-e8c5-46d0-99a7-d8c93747003f,
ParentContextID=1ed56457-33c4-47e0-aff4-e91b03b4cb92, HTTP
Response=HTTP Response { Status Code=200, Status Line=OK, Headers=[Date:
Tue, 26 Jan 2016 01:23:22 GMT, Expires: Thu, 01 Jan 1970 00:00:00 GMT,
Set-
Cookie: JSESSIONID=1utc7734evusb1od1db0fspx60;Path=/Sample;HttpOnly,
Content-Type: application/json; charset=UTF-8, Content-Length: 65],
Body={"addOperationResponse":{"Arrays":[{"Key":"ABC","Value":"123"}]}}
```

```
25 Jan 2016 17:23:22,318 [httpConnector_2] [DEBUG]
[restbt.sample.extended.json.conversion]
com.tibco.amx.bt.rest.RESTGenericReplyCallback - TIBCO-AMX-BT-REST-
300103:
Response (Reply) Message from REST Promoted Service to External
Consumer. PromotedServiceName=SampleClient/Sample,
```



```
BindingName=RESTService_Binding1, BindingType=REST,  
URL=http://localhost:9897/SampleClient/addOperation,  
  
ComponentURI=urn:amx:DevEnvironment/restbt.sample.extended.json.conversi  
on/JavaClient_1.0.0.v2016-01-25-  
1703_inbound_service_SampleClient/Sample_RESTService_Binding1,  
OperationName={http://HdrTest/Sample/}addOperation,  
CorrelationID=1ed56457-33c4-47e0-aff4-e91b03b4cb92, ContextID=1ed56457-  
33c4-47e0-aff4-e91b03b4cb92, ParentContextID=null, Message={ Content-  
Type :  
application/json; charset=UTF-8 }{ HTTP Status Code: 200 }{ HTTPBody :  
{"addOperationResponse":{"Arrays":[{"Key":"ABC","Value":"123"}]}} }
```

Limitations

This section lists the limitations and usage guidelines.

General Limitations

Trailing Slash in Request URL

- A REST BT service does not differentiate between a URL ending with a trailing slash (/) and one without a trailing slash.
- A REST BT reference differentiates between a URL ending with a trailing slash and a URL not ending with a trailing slash. The reference treats them as different URLs and depends on how you have configured the resource path in the resource configuration file. For example:
 - If the resource path is books/ (with a trailing /), the resulting URL is `http://host:port/Context-Root/books/`.
 - If the resource path is books, the resulting URL is `http://host:port/Context-Root/books`.
 - If the resource path is books/ and a minimum of one query parameter (for example, ID), the resulting URL is `http://host:port/Context-Root/books?ID=value`.

Numbers and Special Characters

- Numbers and special characters (period, comma, hyphen, or hash) are not supported in a standard JSON payload key.

Validation Limitations

Design-time

For a standard JSON, if you configure the resource configuration file from payloads that do not have a well-defined root-level element, you must map the response and faults body to a unique status code.

Service Limitations

You cannot override the default status code (200) returned from a REST service.

Query and Path Parameters

- Mixing of path parameters and path parts in a resource URI is not supported. For example, an online bookstore has a service to update (add/delete) the number of books in the inventory based on ISBN. The resource URI of the update operations is:

`http://host:port/store/books/{ISBN}/addToStore/{number-of-books}` - where {ISBN} and {number-of-books} are path parameters.

`http://host:port/store/books/{ISBN}/subtractFromStore/{number-of-books}`

Such resource URIs are not supported. However, the current implementation of REST BT supports the resource URI where all the path parameters are suffixed. For example:

`http://host:port/store/books/addToStore/{ISBN}/{number-of-books}` - where {ISBN} and {number-of-books} are the path parameters.

- Usage guidelines for query and path parameters:
 - Path parameters and query parameters must be of Simple type.
 - Query parameters are optional, if not specified.
 - Configuring a custom default value for a query parameter is not supported.
 - The key of the query parameter is the WSDL part name.
 - Path parameters and query parameters must map to a WSDL part. The implementation does not receive query parameters that are not mapped to any

WSDL part name.

Request Response

- REST Request body - There can be at the most one WSDL part referring to a Complex-Type element, which if present is considered as an HTTP body.
- REST Request/Response - The WSDL part representing the REST body, must refer to Element and not the Type. Simple type in the body is not supported. However, you can construct a Simple type as Complex-TypeElement in a WSDL.

Schema Limitations

Standard JSON

- Standard JSON is not namespace-aware. All the elements, types, and attributes must be in a single namespace. No foreign namespace elements or attributes are supported.
- Global attributes are not supported in the schema, for a REST service with standard JSON as the media type.
- For Standard JSON, the `elementFormDefault` attribute must always be set to `qualified`.
- To pass an attribute using JSON, you must represent it as `"@key": "Value"`. That is, prefix the key with `"@"`. For example, the following payload works:

```
{
  "PersonDetailsInputNestedElements": {
    "PersonDetailsInputElementComplexType":
    { "@PersonDOB": "2001-10-26T21:32:52", "@PersonName": "Mr Person" }
  },
  "FriendDetailsInputElementComplexType":
  { "@PersonDOB": "2001-10-26T21:32:52", "@PersonName": "Mr Friend" }
}
```

This convention is not specified by Standard JSON. It is specific to the TIBCO implementation.

Troubleshooting

Issue	Workaround
<p>For a REST BT Reference, the RRC file shows error messages even when the validation shows no errors in the file. Error messages similar to the following are displayed in the Problems window:</p> <pre data-bbox="240 688 1049 819">'NewRrcResource1.rrc' has some error. Please validate manually. REST_Binding: 'NewRrcResource1.rrc' has some error. Please validate manually.</pre>	<p>Clean the project.</p>
<p>For a REST BT Reference, the RRC to WSDL generation does not generate an array type in XSD if the JSON payload has an array represented by []. As an example, for the following payload:</p> <pre data-bbox="240 1062 727 1428">{getMeresponseType: { "id": "100006769630394", "work": [{ "employer": { "id": "47358345258", "name":"TIBCO Software Inc." } }] }}</pre>	<p>Make sure that the array has at least two elements.</p>
<p>The generated XSD must look like:</p> <pre data-bbox="240 1570 940 1768"><xs:complexType name="getMeresponseType"> <xs:sequence> <xs:element type="xs:long" name="id" /> <xs:element type="workType" name="work" maxOccurs="unbounded" minOccurs="0" /> //array </xs:sequence></pre>	

Issue	Workaround
<pre></xs:complexType></pre>	
<p>If you send a request from a REST client running on the same machine where REST Service is deployed, you may see the REST client IP value as [0:0:0:0:0:0:1] on the TIBCO Service Performance Manager dashboard.</p>	<p>Make sure the IPv4 DNS resolution is used in the REST Client setting.</p>

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