HHI-2111
IBM Integration Bus and REST APIs

InterConnect
2017

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Agenda

- Introduction

- Developing a REST API in IIB
  - ➢ Demo

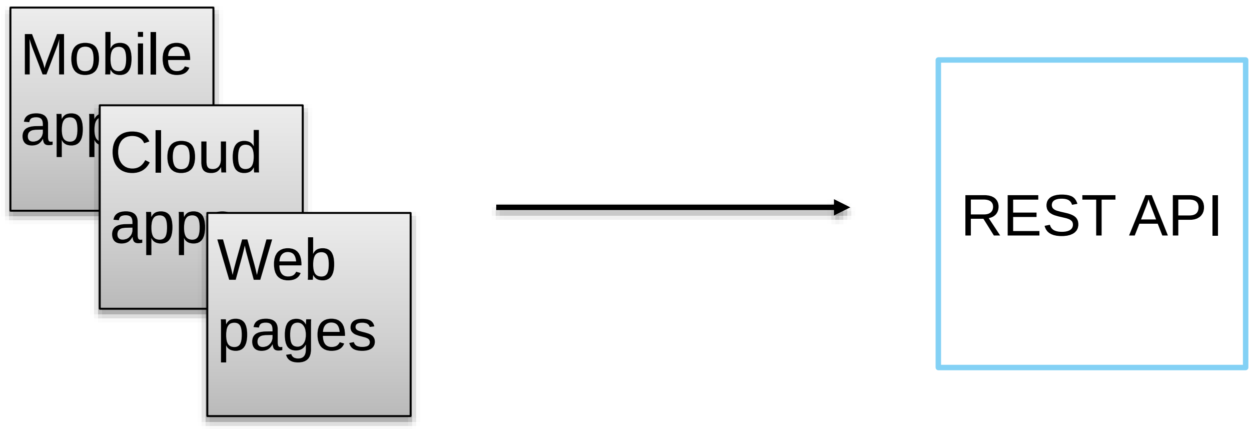
- Pushing a REST API to API Connect
  - ➢ Demo

- REST Request, REST Async Request, REST Async Response nodes
  - ➢ Demo

- Summary

REST APIs

- A REST API is a lightweight web service API based on HTTP, and is a much simpler alternative to SOAP based web services.
- A REST API describes a set of resources, and a set of operations that can be called on those resources.
- Those operations can be called from any HTTP client - there are HTTP clients available for most programming languages nowadays.
- Operations in a REST API can easily be called from JavaScript code running in a web browser, or application code running on a mobile device.



REST APIs - resources

- A REST API has a base path – the root from which all of the resources and operations are available. An example base path might be:
    - **http://mycompany.com:7843/customerdb/v1**
- Each resource in a REST API has a path, relative to the base path, which identifies that resource. Example resources might be:
    - **/customers** - all of the customers in the database
    - **/customers/12345** - customer #12345
    - **/customers/12345/orders** - all orders for customer #12345
    - **/customers/12345/orders/67890** - order #67890 for customer #12345

REST APIs - operations

- Each resource in a REST API has a set of operations.
- An operation in a REST API has a name, and an HTTP method, such as GET, POST, PUT, or DELETE.
- The combination of the path of the HTTP request and the HTTP method identifies which resource and operation is being called.
- Example operations on the resource /customers/12345 might be:
  - **GET** **getCustomer** - retrieve the customer details from the database.
  - **PUT** **updateCustomer** - update the customer details in the database.
  - **DELETE** **deleteCustomer** - delete the customer from the database.
- In order to call the updateCustomer operation, the HTTP client must make a HTTP PUT request to:
  - **http://mycompany.com:7843/customerdb/v1/customers/12345**

REST APIs - parameters

- Each operation defined in a REST API can also specify a set of parameters. Parameters can be used to pass information in to the operation.
- These parameters are in addition to the body passed in the HTTP request.
- Integration Bus supports three different types of parameters:
  1. **Path parameters** – one or more parts of the path for a resource can be defined as a variable. For example, the customer ID in the previous examples is a path parameter:
     - /customers/{customerId}/orders/{orderId}
     - /customers/**12345**/orders/**56789**
  2. **Query parameters** – one or more parameters can be specified in the URL following the path:
     - /customers?**maxResults=5**&**name=2**
  3. **Header parameters** – one or more parameters can be specified in the headers of the HTTP request:
     - **Api-Client-Id: ff6e2c5d-42d5-4026-8f7f-d1e56da7f777**

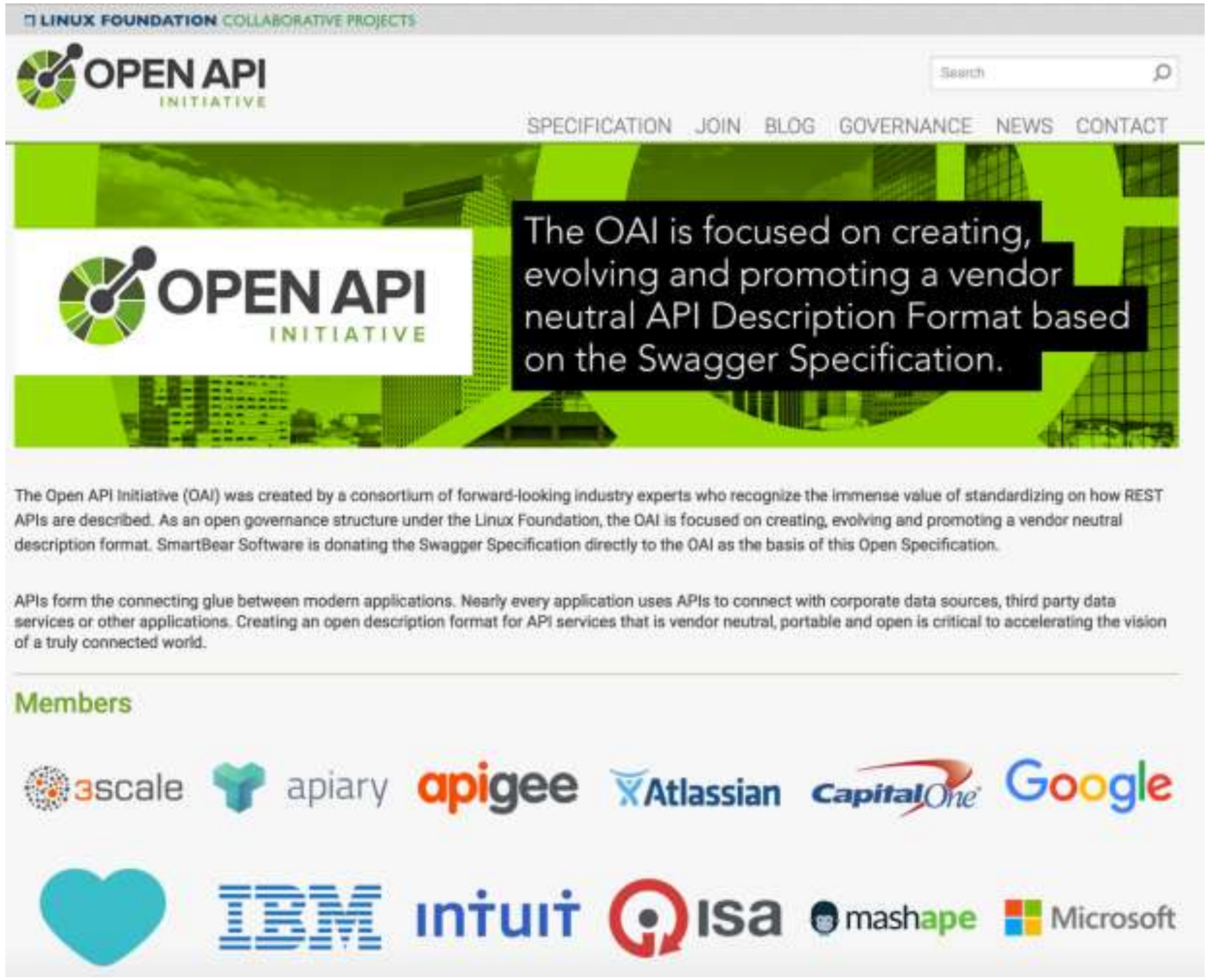
REST APIs - Swagger

- Swagger is an open standard for defining a REST API:
  - **http://swagger.io/**
- Along with the specification, there is a set of open source tooling that can be used to interact with Swagger documents and the REST APIs that they describe.
- A Swagger document includes definitions of the resources, operations, and parameters in a REST API. It can also include JSON Schema that describes the structure of the request and response bodies to an operation.
- A Swagger document can be thought of as the REST API equivalent of a WSDL document for a SOAP web service.
- Integration Bus supports Swagger 2.0. The specification for Swagger 2.0 can be found at:
  - **https://github.com/swagger-api/swagger-spec/blob/master/versions/2.0.md**
- REST APIs in Integration Bus are described by a Swagger 2.0 document.
- You can build a REST API by importing a Swagger document.
- Alternatively, you can now build a REST API from scratch using the toolkit!

REST APIs – Open API Initiative

“SAN FRANCISCO, November 5, 2015 – The Linux Foundation, the nonprofit organization dedicated to accelerating the growth of Linux and collaborative development, today is announcing the Open API Initiative. Founding members of the Open API Initiative include 3Scale, Apigee, Capital One, Google, IBM, Intuit, Microsoft, PayPal, Restlet and SmartBear.

The Initiative will extend the Swagger specification and format to create an open technical community within which members can easily contribute to building a vendor neutral, portable and open specification for providing metadata



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OPEN API INITIATIVE
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OPEN API INITIATIVE

The OAI is focused on creating, evolving and promoting a vendor neutral API Description Format based on the Swagger Specification.

The Open API Initiative (OAI) was created by a consortium of forward-looking industry experts who recognize the immense value of standardizing on how REST APIs are described. As an open governance structure under the Linux Foundation, the OAI is focused on creating, evolving and promoting a vendor neutral description format. SmartBear Software is donating the Swagger Specification directly to the OAI as the basis of this Open Specification.

APIs form the connecting glue between modern applications. Nearly every application uses APIs to connect with corporate data sources, third party data services or other applications. Creating an open description format for API services that is vendor neutral, portable and open is critical to accelerating the vision of a truly connected world.

Members

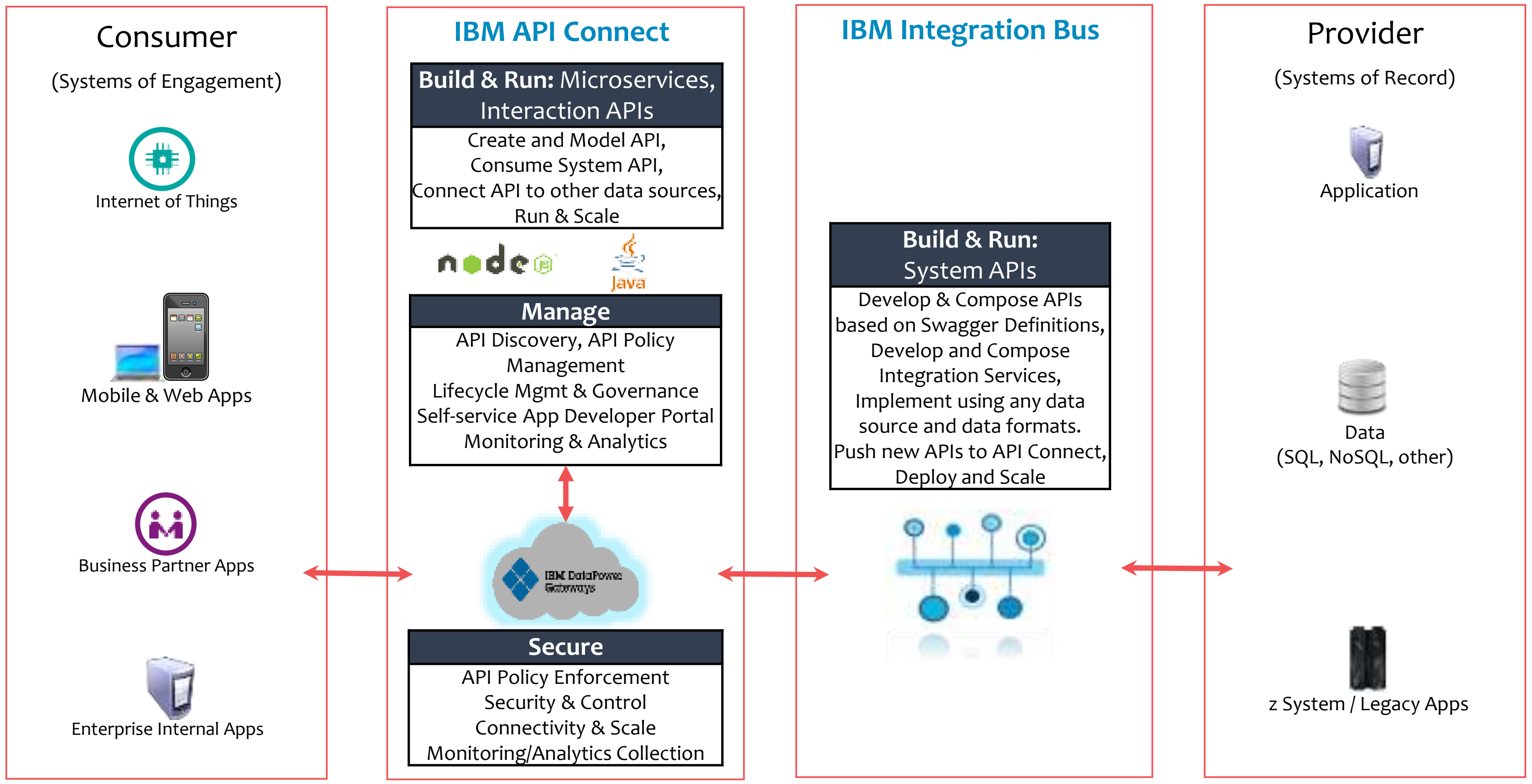
https://openapis.org/

REST APIs – current trends

- Everyone is building REST APIs!
- The API Economy is encouraging businesses to expose their applications and data via REST APIs, so that developers can consume those APIs in order to build new applications.

- One current trend is towards building applications as a collection of micro services. Micro services can expose their functionality as a REST API.
- For example, a weather micro service might provide a REST API with a single operation for accessing weather information for a supplied location.

REST APIs – what's IBM doing?



Build & Run: Microservices, Interaction APIs

Create and Model API,
Consume System API,
Connect API to other data sources,
Run & Scale

Manage

API Discovery, API Policy Management
Lifecycle Mgmt & Governance
Self-service App Developer Portal
Monitoring & Analytics

Secure

API Policy Enforcement
Security & Control
Connectivity & Scale
Monitoring/Analytics Collection

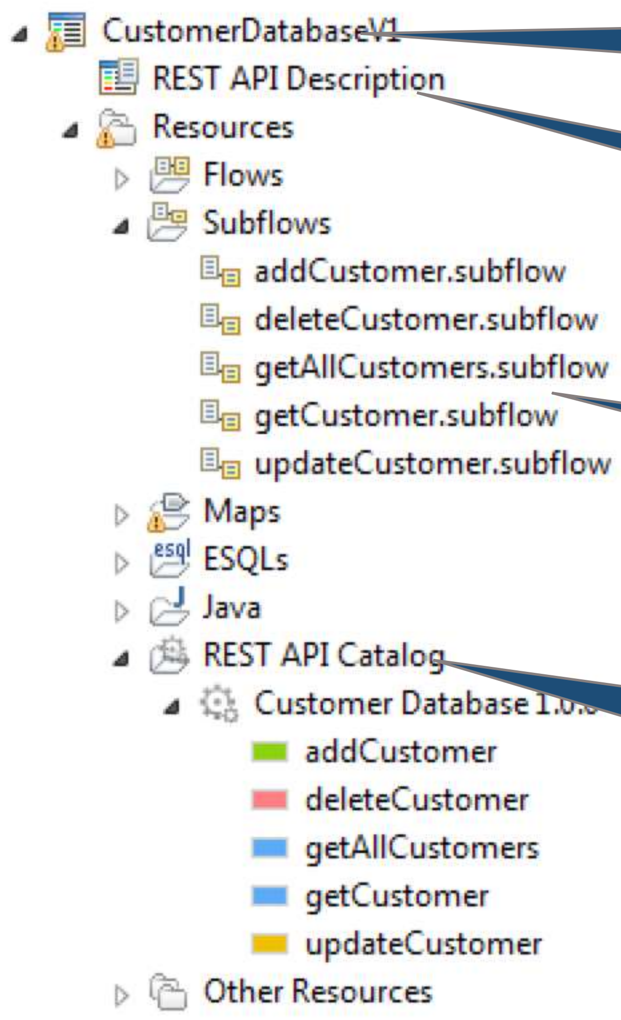
Build & Run:
System APIs

Develop & Compose APIs based on Swagger Definitions,
Develop and Compose Integration Services,
Implement using any data source and data formats.
Push new APIs to API Connect,
Deploy and Scale

REST APIs – IIB functionality

Version	Functionality
10.0.0.0	First-class support for building REST APIs and handling inbound requests.
10.0.0.2	Push to API Connect v4 from Toolkit.
10.0.0.4	Build a REST API from scratch using the Graphical Editor in the Toolkit. Graphical mapping support for JSON Schema defined in .json format
10.0.0.5	Push to API Connect v5 from WebUI and command line.
10.0.0.6	First-class support for handling outbound requests using a REST Request node. Graphical mapping support for JSON Schema defined in .yaml format
10.0.0.8	Support for passing User Context between REST Async Request/Response nodes. Support for allOf, one of, anyOf in graphical mapper for JSON schema

REST APIs – REST APIs in Integration Bus


CustomerDatabaseV1
REST API Description
Resources
Flows
Subflows
addCustomer.subflow
deleteCustomer.subflow
getAllCustomers.subflow
getCustomer.subflow
updateCustomer.subflow
Maps
ESQLs
Java
REST API Catalog
Customer Database 1.0.0
addCustomer
deleteCustomer
getAllCustomers
getCustomer
updateCustomer
Other Resources

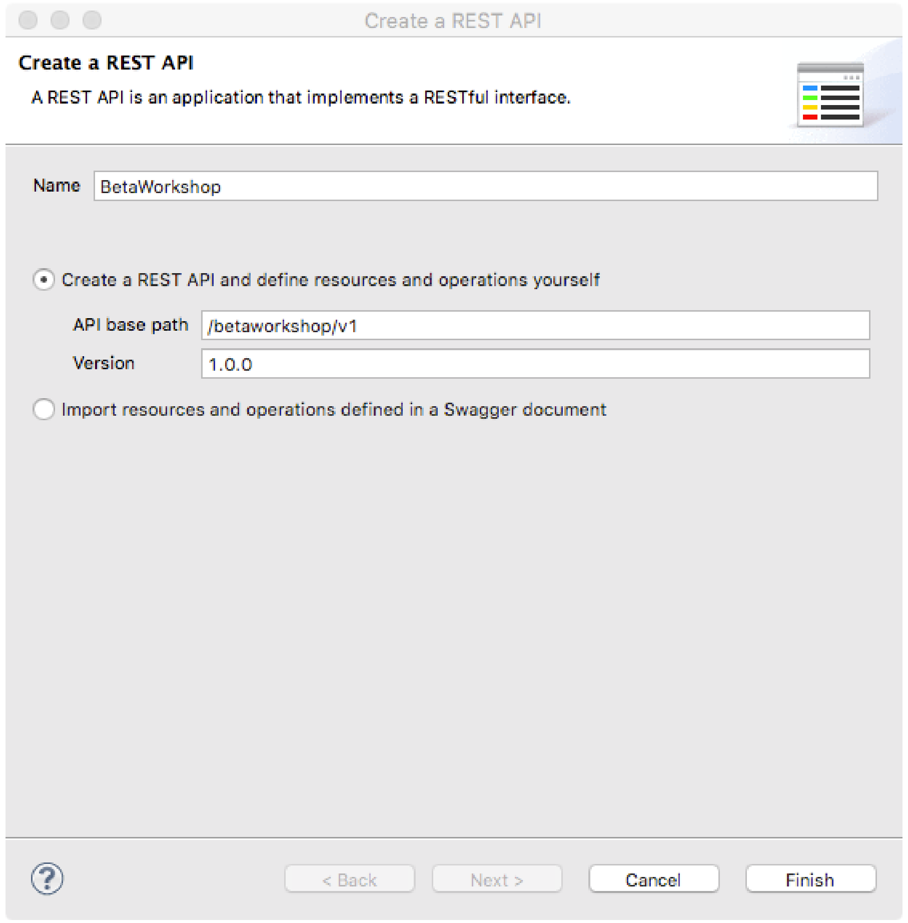
For Integration Bus V10, we have introduced a new type of project, or container, called a REST API.

Clicking on the REST API Description opens the Editor.

Operations defined in the REST API are implemented as subflows.

The “REST API Catalog” is a new category that appears in the REST API project and shows all REST APIs and operations that are available to be invoked.

REST APIs - new project wizard



Create a REST API

A REST API is an application that implements a RESTful interface.

Name: BetaWorkshop

[✓ Create a REST API and define resources and operations yourself]

API base path: /betaworkshop/v1

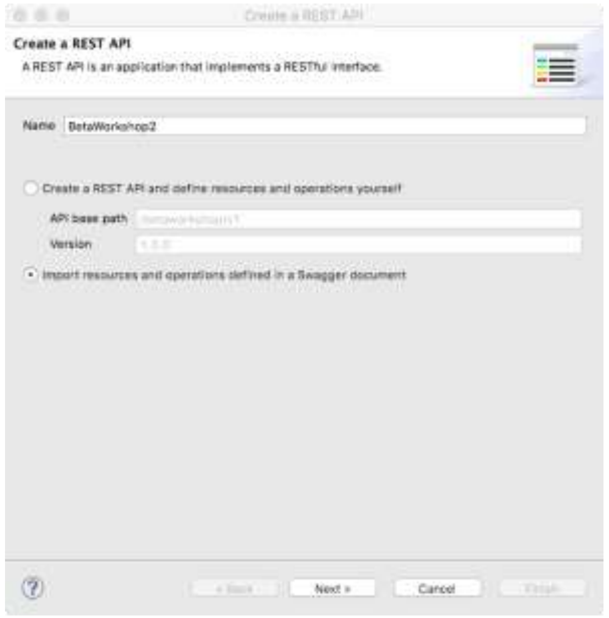
Version: 1.0.0

Import resources and operations defined in a Swagger document

- The first option lets you graphically build a REST API using the toolkit editor without needing to create a Swagger document.
- You can define resources, operations, parameters, and JSON Schema for your REST API without ever writing a line of Swagger!
- The toolkit editor automatically generates a Swagger document for you under the covers.

REST APIs – new project wizard

- However, if you already have a Swagger document, then the second option lets you build a REST API by importing that Swagger document.


Create a REST API

Create a REST API

A REST API is an application that implements a RESTful interface.

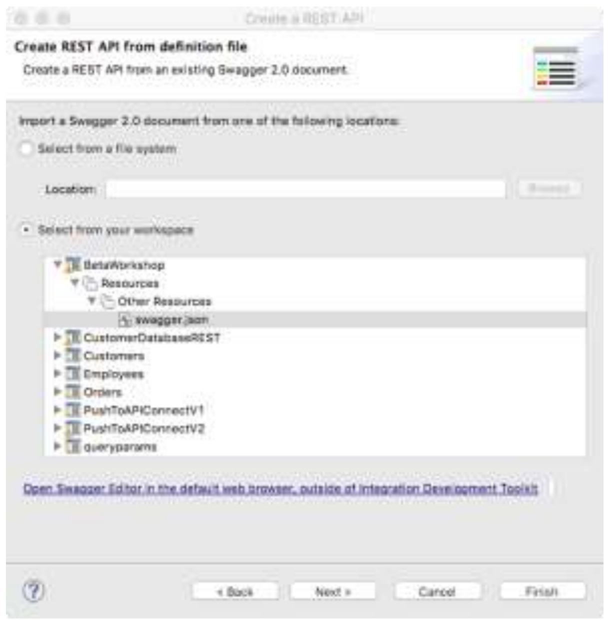
Name: BetaWorkshop2

( ) Create a REST API and define resources and operations yourself

API base path:

Version:

(•) Import resources and operations defined in a Swagger document


Create a REST API

Create REST API from definition file

Create a REST API from an existing Swagger 2.0 document.

Import a Swagger 2.0 document from one of the following locations:

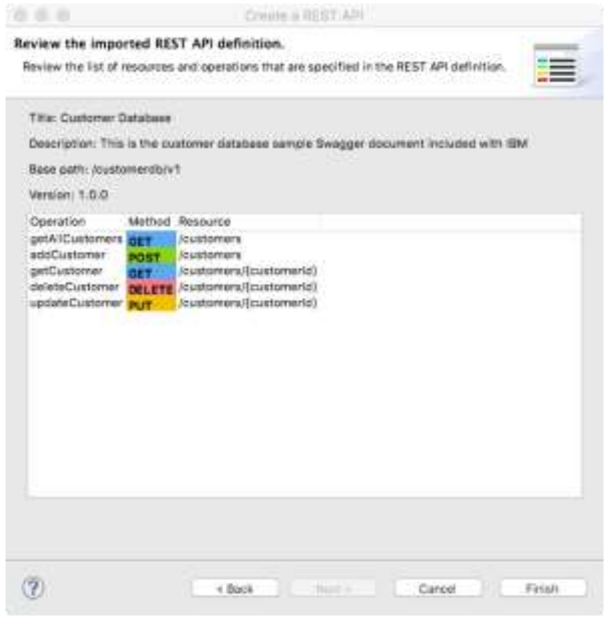
( ) Select from a file system

Location:

(•) Select from your workspace

```
▼ BetaWorkshop
  ▼ Resources
    ▼ Other Resources
        swagger.json
▶ CustomerDatabaseREST
▶ Customers
▶ Employees
▶ Orders
▶ PushToAPIConnectV1
▶ PushToAPIConnectV2
▶ queryparams
```

Open Swagger Editor in the default web browser, outside of Integration Development Toolkit


Create a REST API

Review the imported REST API definition.

Review the list of resources and operations that are specified in the REST API definition.

Title: Customer Database

Description: This is the customer database sample Swagger document included with IBM

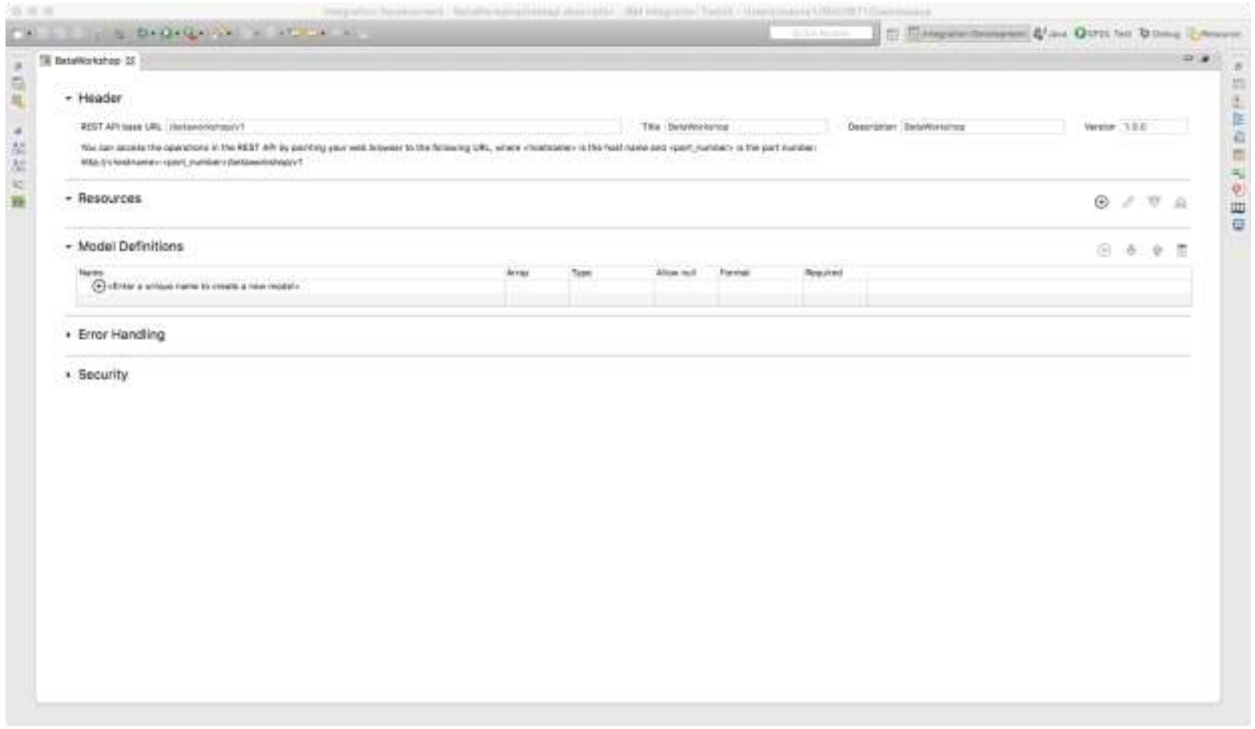
Base path: /customerdb/v1

Version: 1.0.0

Operation	Method	Resource
getAllCustomers	GET	/customers
addCustomer	POST	/customers
getCustomer	GET	/customers/{customerId}
deleteCustomer	DELETE	/customers/{customerId}
updateCustomer	PUT	/customers/{customerId}

REST APIs – REST API Editor

- The REST API Editor is the starting point for a newly created REST API.
- From this point, you can see all of the resources, operations, parameters and JSON Schemas defined in the REST API.



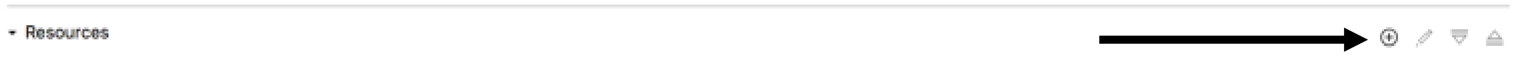
REST API base URL: /dataworkshop/v1 Title: DataWorkshop Description: DataWorkshop Version: 1.0.0

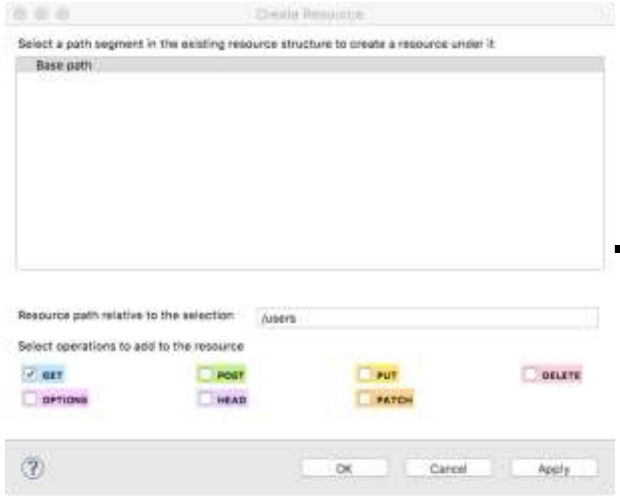
You can access the operations in the REST API by pointing your web browser to the following URL, where <hostname> is the host name and <port_number> is the port number:
http://<hostname>:<port_number>/dataworkshop/v1

Name	Array	Type	Allow null	Format	Required
<Enter a unique name to create a new model>					

REST APIs – defining resources

- We can add new resources into the REST API by clicking the (+) symbol on the resources section:





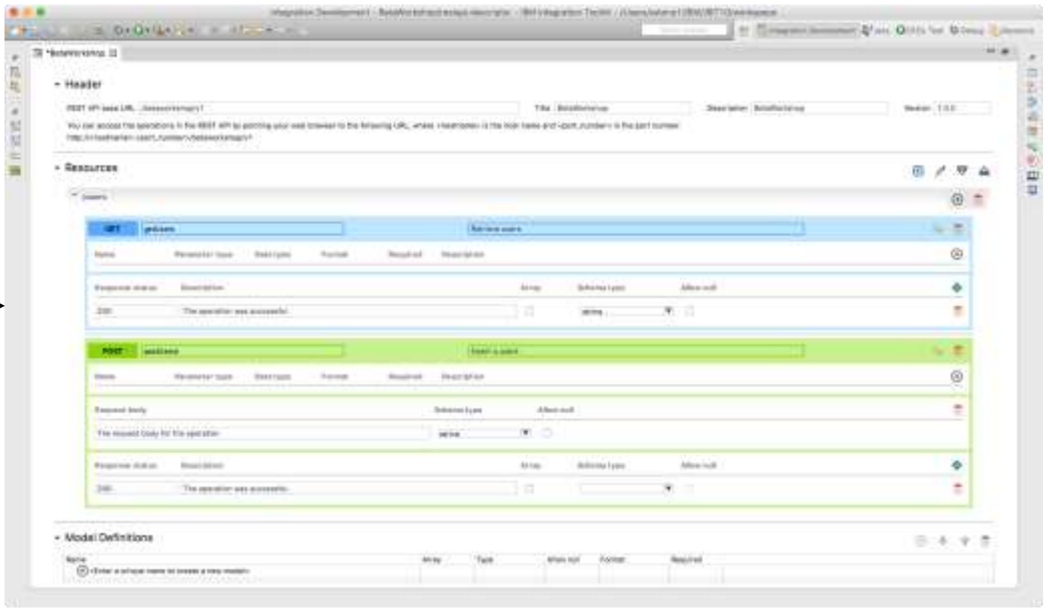
Select a path segment in the existing resource structure to create a resource under it

Base path

Resource path relative to the selection: /users

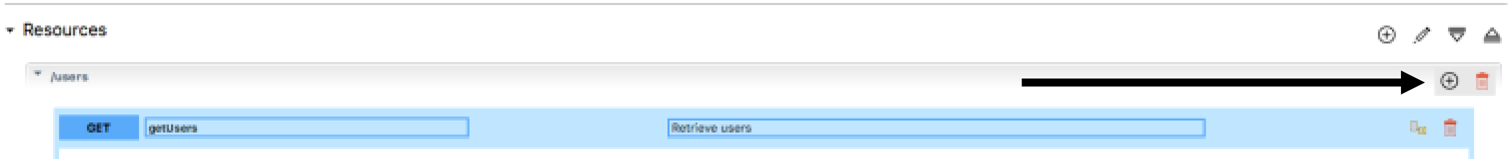
Select operations to add to the resource

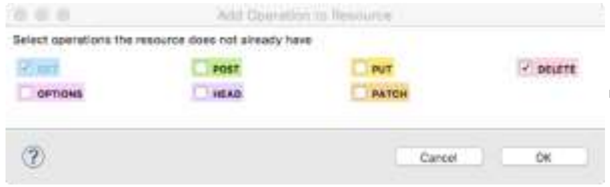
[✓ GET] POST PUT DELETE OPTIONS HEAD PATCH



REST APIs – defining operations

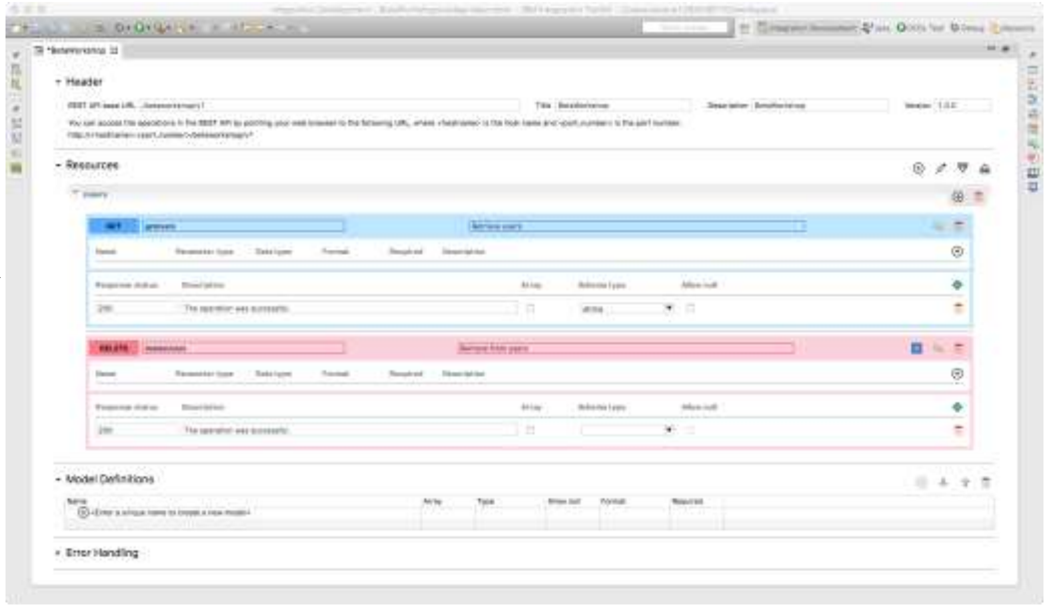
- The new resource dialog adds in default operations for you, but you can add new ones:




Add Operation to Resource

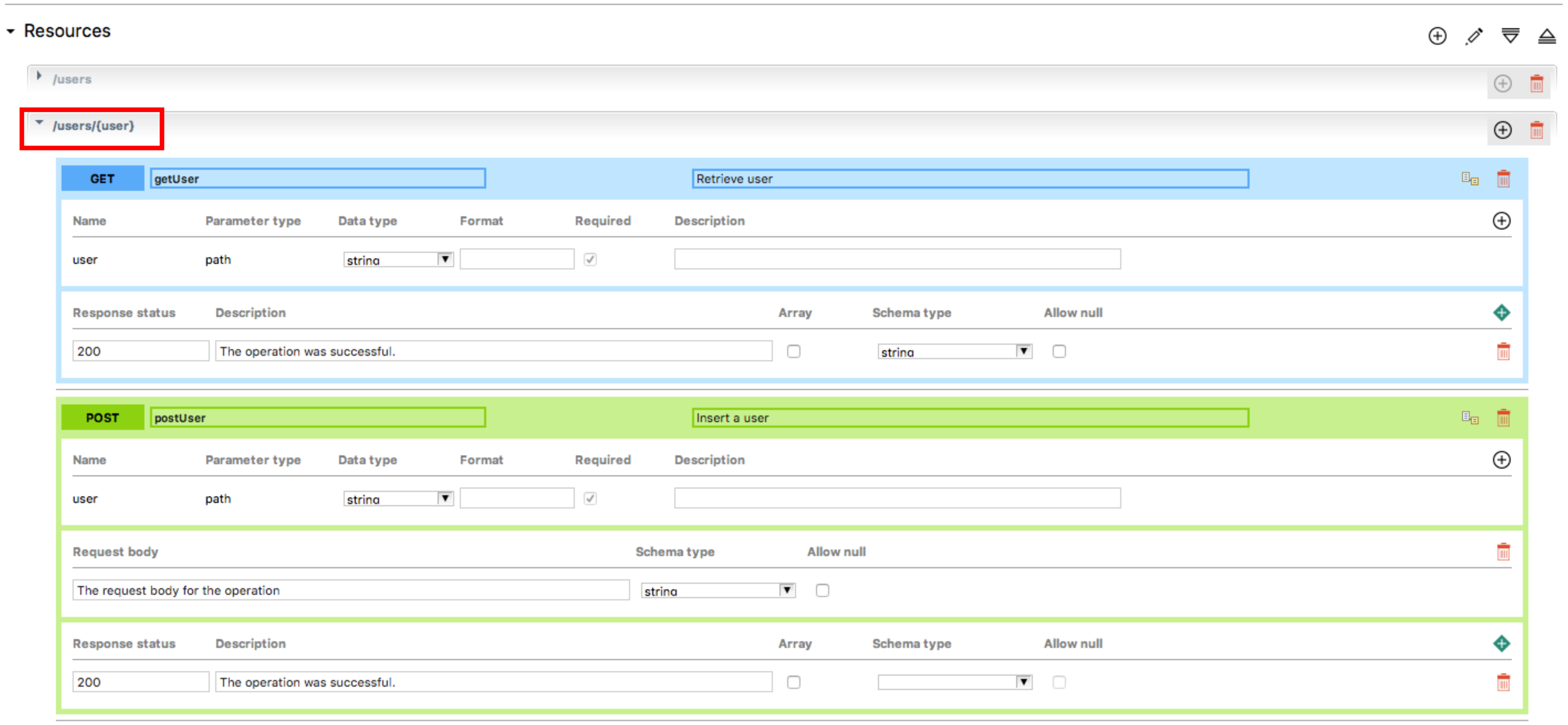
Select operations the resource does not already have

✓ GET	POST	PUT	✓ DELETE
OPTIONS	HEAD	PATCH	



REST APIs – defining parameters

- Path parameters are automatically added to operations when defined as part of the path, by specifying {param} in the path when you add a new resource:



GET getUser Retrieve user

Name	Parameter type	Data type	Format	Required	Description
user	path	string		✓	

Response status	Description	Array	Schema type	Allow null
200	The operation was successful.	☐	string	☐

POST postUser Insert a user

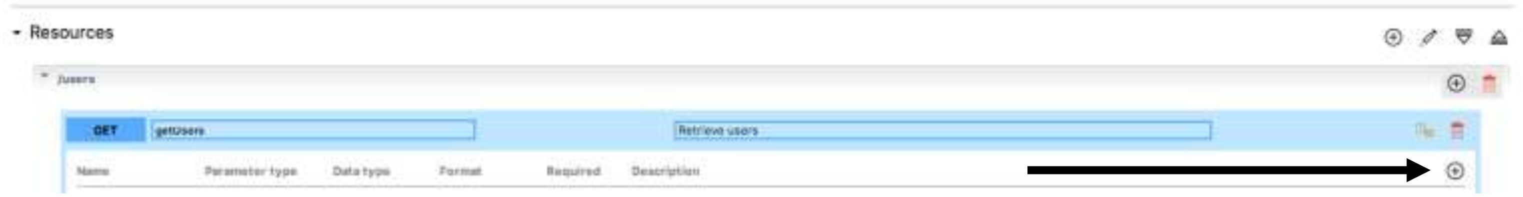
Name	Parameter type	Data type	Format	Required	Description
user	path	string		✓	

Request body	Schema type	Allow null
The request body for the operation	string	☐

Response status	Description	Array	Schema type	Allow null
200	The operation was successful.	☐		☐

REST APIs – defining parameters

- Otherwise, if your operations accept query or header parameters, then add them in using the (+) button on the operation:

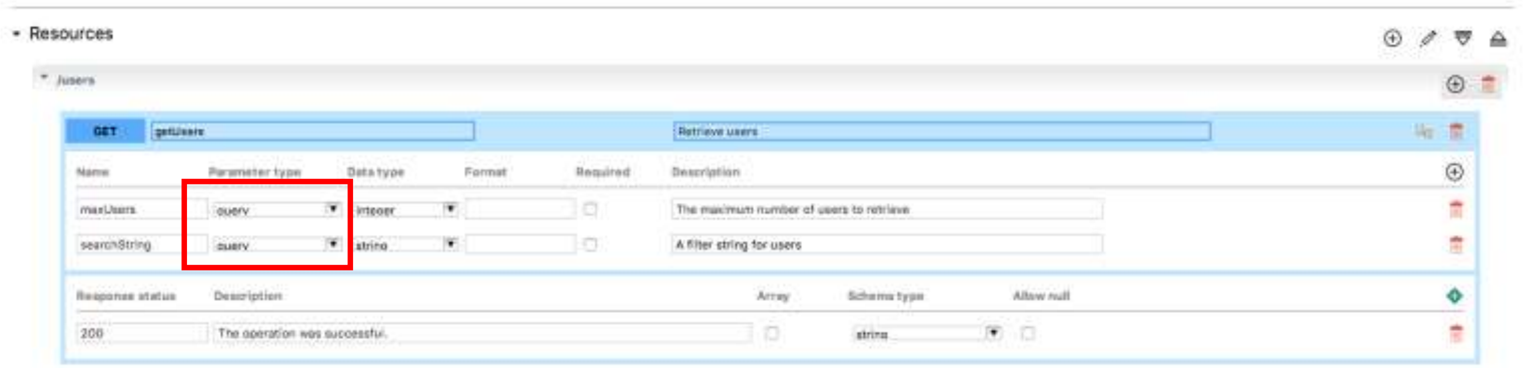


Resources

/users

GET getUsers Retrieve users

Name	Parameter type	Data type	Format	Required	Description



Resources

/users

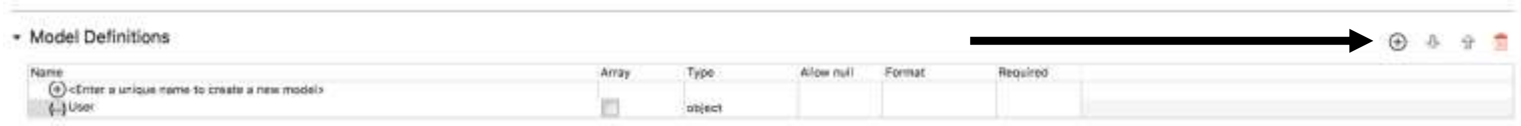
GET getUsers Retrieve users

Name	Parameter type	Data type	Format	Required	Description
maxUsers	query	integer		☐	The maximum number of users to retrieve
searchString	query	string		☐	A filter string for users

Response status	Description	Array	Schema type	Allow null
200	The operation was successful.	☐	string	☐

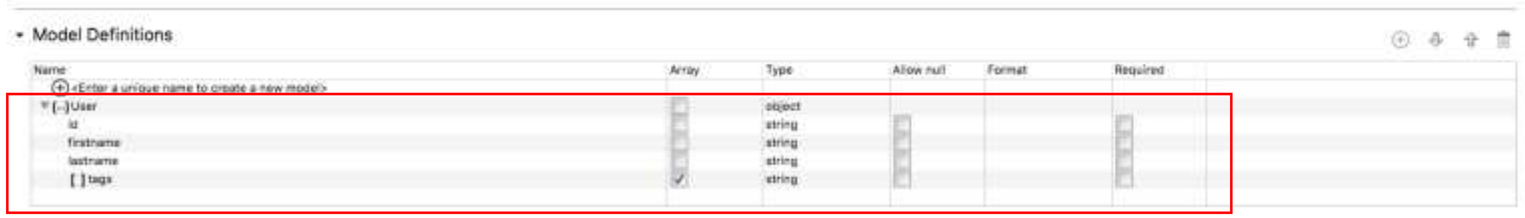
REST APIs – defining models

- Models describe the JSON request or response bodies. You can build JSON Schema that describes that JSON by adding new models to the REST API:



Model Definitions

Name	Array	Type	Allow null	Format	Required
<Enter a unique name to create a new model>					
{...}User	☐	object			

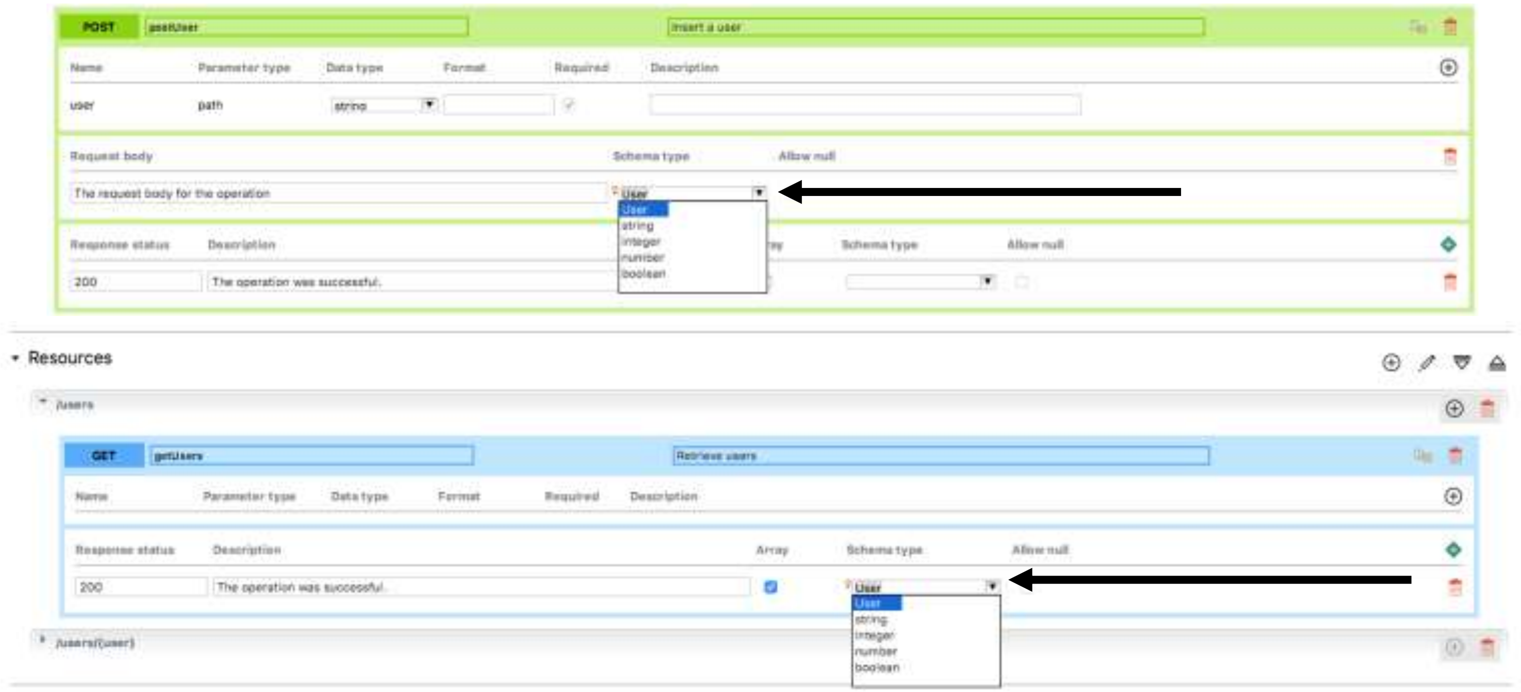


Model Definitions

Name	Array	Type	Allow null	Format	Required
<Enter a unique name to create a new model>					
{...}User	☐	object			
id	☐	string	☐		☐
firstname	☐	string	☐		☐
lastname	☐	string	☐		☐
[ ] tags	✓	string	☐		☐

REST APIs – referencing models

- Once defined, you can reference models in the request or response bodies for an operation:



POST postUser — Insert a user

Name	Parameter type	Data type	Format	Required	Description
user	path	string		✓	

Request body	Schema type	Allow null
The request body for the operation	User	

User
string
integer
number
boolean

Response status	Description	Array	Schema type	Allow null
200	The operation was successful.			

Resources

/users

GET getUsers — Retrieve users

Name	Parameter type	Data type	Format	Required	Description

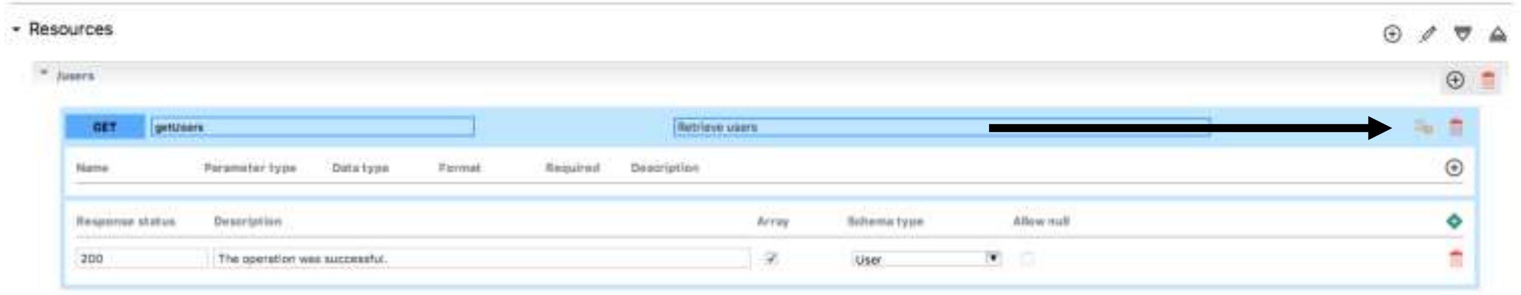
Response status	Description	Array	Schema type	Allow null
200	The operation was successful.	✓	User	

User
string
integer
number
boolean

/users/{user}

REST APIs – implementing operations

- Clicking on an unimplemented operation automatically generates an empty subflow for that operation, and creates the underlying links between the REST API and that subflow.



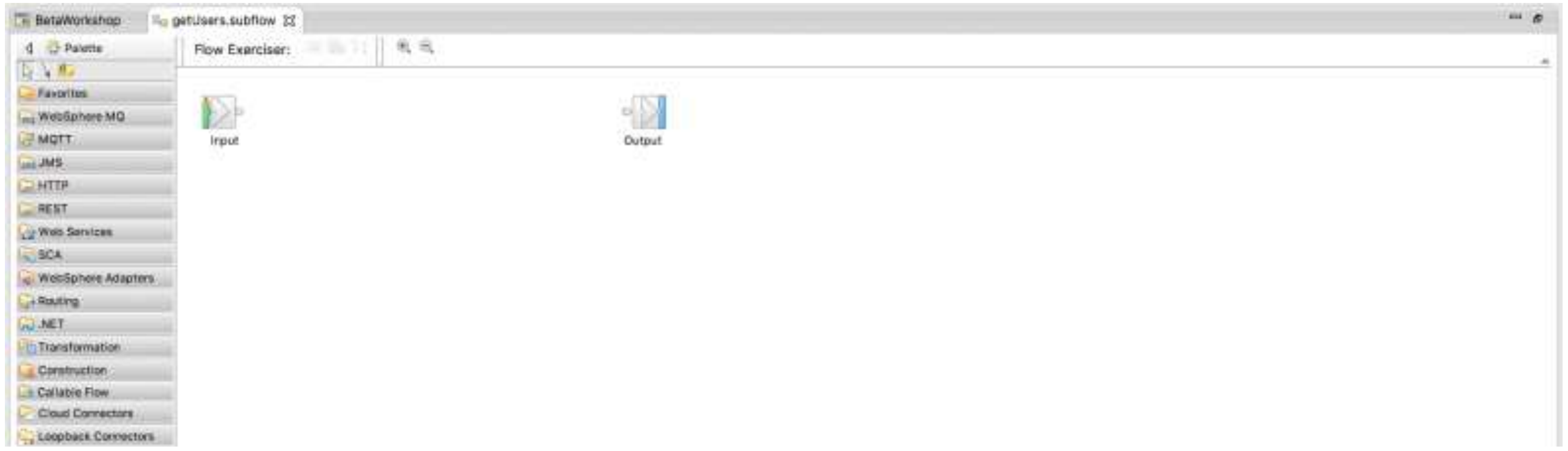
Resources

/users

GET getUsers Retrieve users

Name	Parameter type	Data type	Format	Required	Description

Response status	Description	Array	Schema type	Allow null
200	The operation was successful.	✓	User	



BetaWorkshop | getUsers.subflow

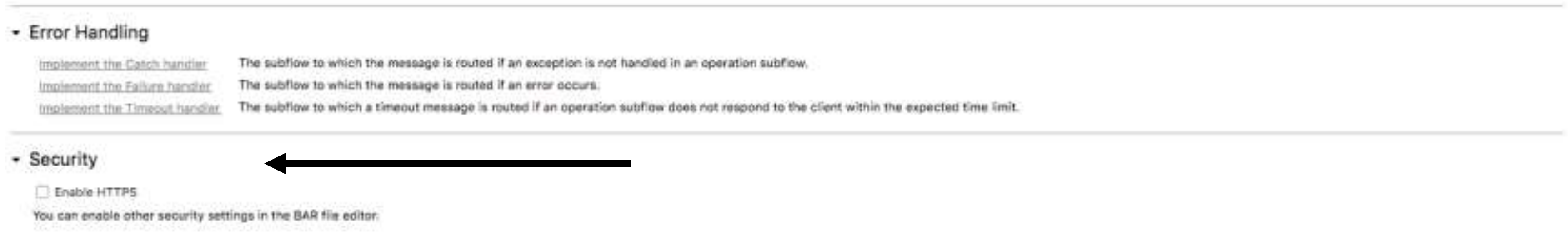
Palette

Flow Exerciser:

- Favorites
- WebSphere MQ
- MQTT
- JMS
- HTTP
- REST
- Web Services
- SCA
- WebSphere Adapters
- Routing
- .NET
- Transformation
- Construction
- Callable Flow
- Cloud Connectors
- Loopback Connectors

REST APIs – implementing error handlers and HTTPS

- You can also use the REST API Editor to implement error handling for a REST API. Error handlers are additional subflows that can be used to handle errors and exceptions that are not handled by the subflow for an operation.
- Finally, you can also enable or disable HTTPS:



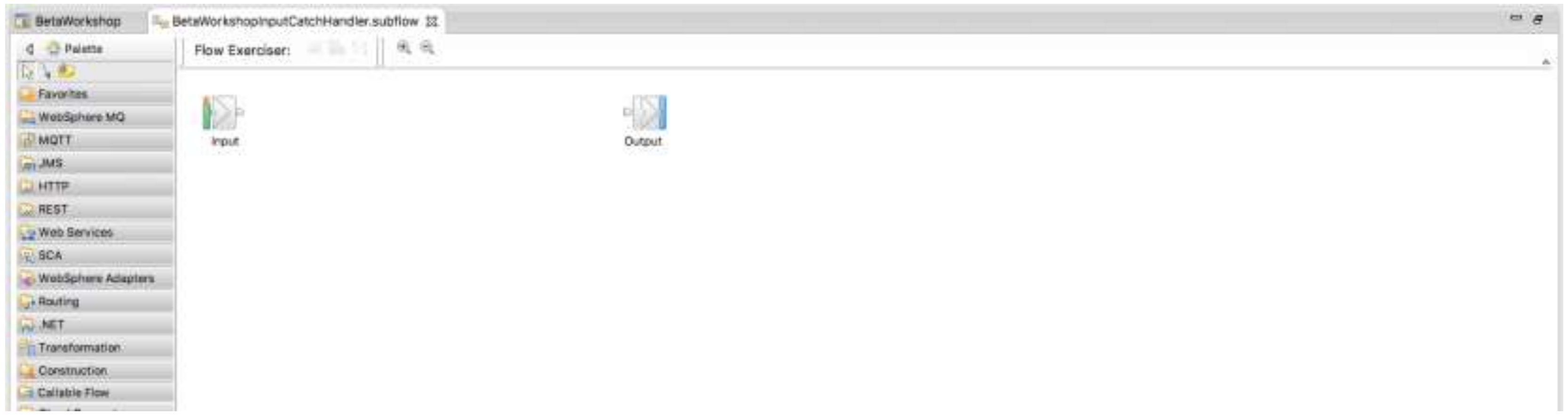
Error Handling

Implement the Catch handler	The subflow to which the message is routed if an exception is not handled in an operation subflow.
Implement the Failure handler	The subflow to which the message is routed if an error occurs.
Implement the Timeout handler	The subflow to which a timeout message is routed if an operation subflow does not respond to the client within the expected time limit.

Security

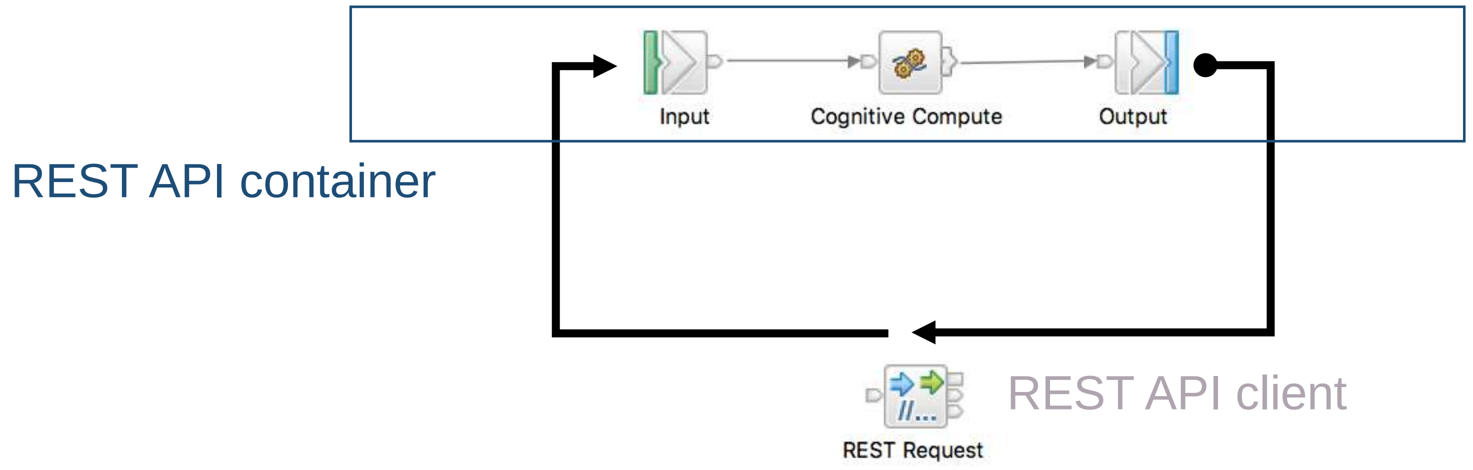
☐ Enable HTTPS

You can enable other security settings in the BAR file editor.



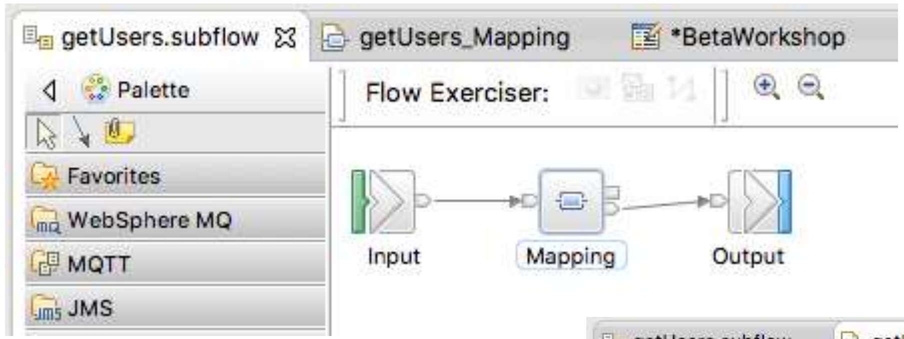
REST APIs – implementing an operation

- When the operation is called by an HTTP client, a message will be routed automatically by the REST API container to the Input node for the corresponding subflow for that operation.
- That message will have a JSON request body, if a body has been provided in the request. JSON is the default message domain for REST APIs, but you can also use other message domains - such as XMLNSC or DFDL.
- When the subflow completes and passes a message to the Output node of the subflow, the response is sent back to the HTTP client.



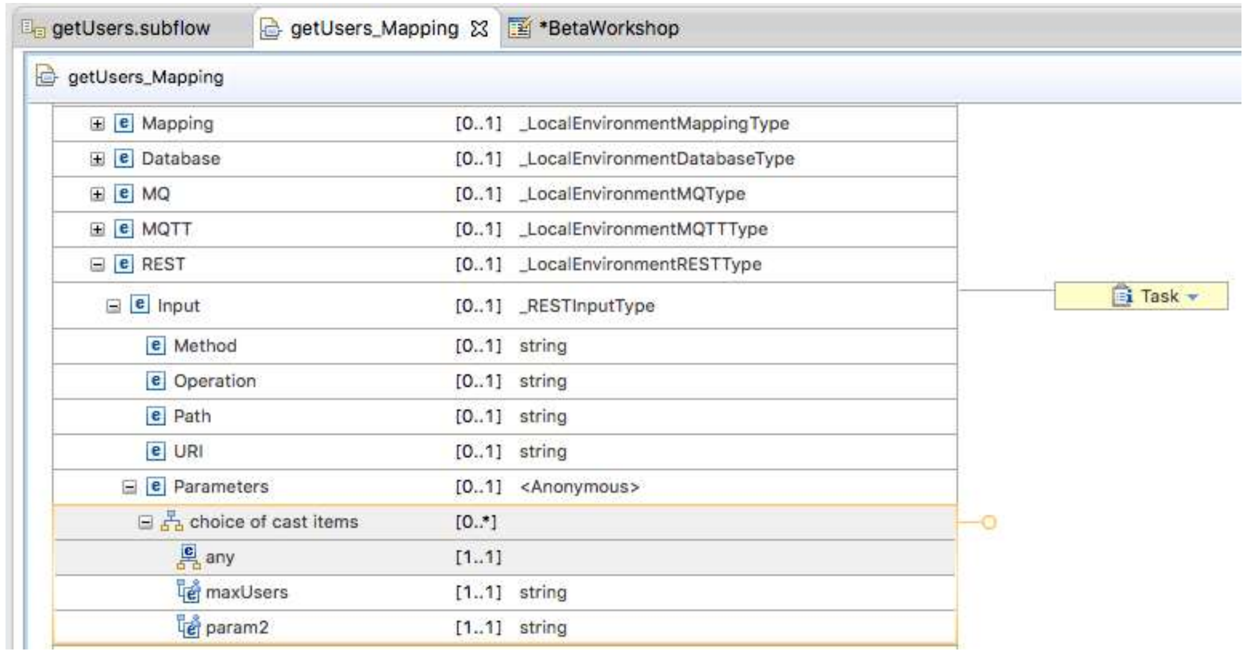
REST APIs – accessing parameter values

The message that arrives on the Input node of the subflow will contain the request body and the values of any parameters passed to that operation.



All of the parameters (path, query, and header parameters) defined by that operation are automatically extracted from the HTTP request and placed into the LocalEnvironment tree – if they have been specified!

If you use a graphical mapping node in the subflow, then the all of the parameter values are automatically defined in the LocalEnvironment structure for you.



getUsers_Mapping

Mapping	[0..1]	_LocalEnvironmentMappingType
Database	[0..1]	_LocalEnvironmentDatabaseType
MQ	[0..1]	_LocalEnvironmentMQType
MQTT	[0..1]	_LocalEnvironmentMQTTType
REST	[0..1]	_LocalEnvironmentRESTType
Input	[0..1]	_RESTInputType
Method	[0..1]	string
Operation	[0..1]	string
Path	[0..1]	string
URI	[0..1]	string
Parameters	[0..1]	<Anonymous>
choice of cast items	[0..*]	
any	[1..1]	
maxUsers	[1..1]	string
param2	[1..1]	string

REST APIs – accessing parameter values

You can also access the extracted parameter values placed into the LocalEnvironment tree from the message flow nodes by using any of the programming languages included in Integration Bus (ESQL, Java, or .NET).

ESQL:

```
DECLARE max INTEGER -1;
IF FIELDTYPE(InputLocalEnvironment.REST.Input.Parameters.max) IS NOT NULL THEN
  SET max = InputLocalEnvironment.REST.Input.Parameters.max;
END IF;
```

Java:

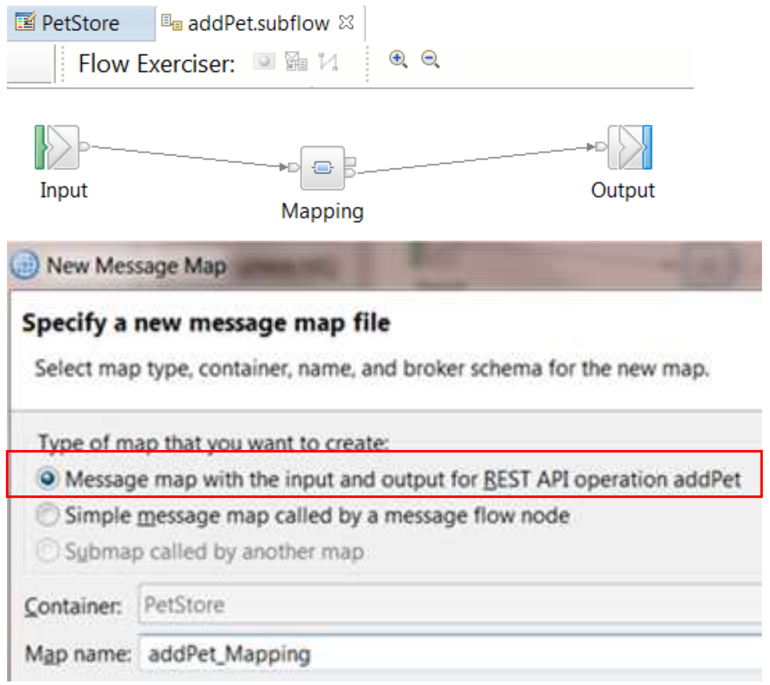
```
MbElement maxElement = inLocalEnvironment.getRootElement().getFirstElementByPath("/REST/Input/Parameters/max");
int max = -1;
if (maxElement != null) {
  max = Integer.valueOf(maxElement.getValueAsString());
}
```

.NET:

```
NBElement maxElement = inLocalEnvironment.RootElement["REST"]["Input"]["Parameters"]["max"];
int max = -1;
if (max != null) {
  max = (int) maxElement;
}
```

REST APIs – mapping JSON request/response bodies

- Graphical mapping enhancements introduce support for JSON Schema. The mapper ”knows” that it is in a REST API, and can automatically pick the models for you:



New Message Map

Specify a new message map file

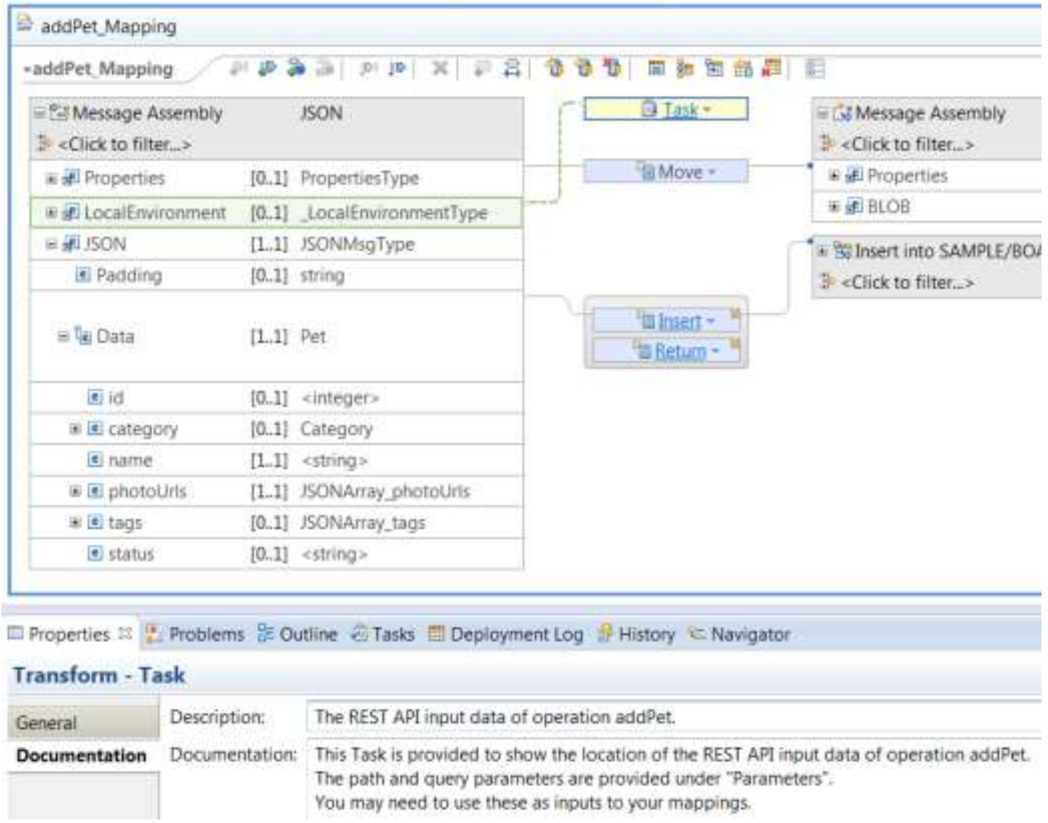
Select map type, container, name, and broker schema for the new map.

Type of map that you want to create:

- [✓ Message map with the input and output for REST API operation addPet]
- Simple message map called by a message flow node
- Submap called by another map

Container: PetStore

Map name: addPet_Mapping



Message Assembly		JSON
<Click to filter...>		
Properties	[0..1]	PropertiesType
LocalEnvironment	[0..1]	_LocalEnvironmentType
JSON	[1..1]	JSONMsgType
Padding	[0..1]	string
Data	[1..1]	Pet
id	[0..1]	<integer>
category	[0..1]	Category
name	[1..1]	<string>
photoUrls	[1..1]	JSONArray_photoUrls
tags	[0..1]	JSONArray_tags
status	[0..1]	<string>

Transform - Task

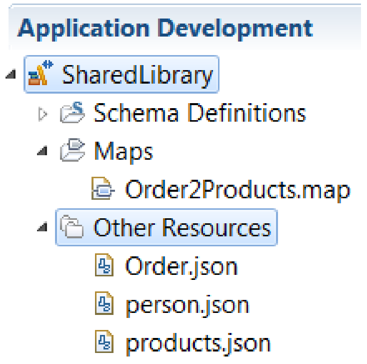
General | Documentation

Description: The REST API input data of operation addPet.

Documentation: This Task is provided to show the location of the REST API input data of operation addPet. The path and query parameters are provided under "Parameters". You may need to use these as inputs to your mappings.

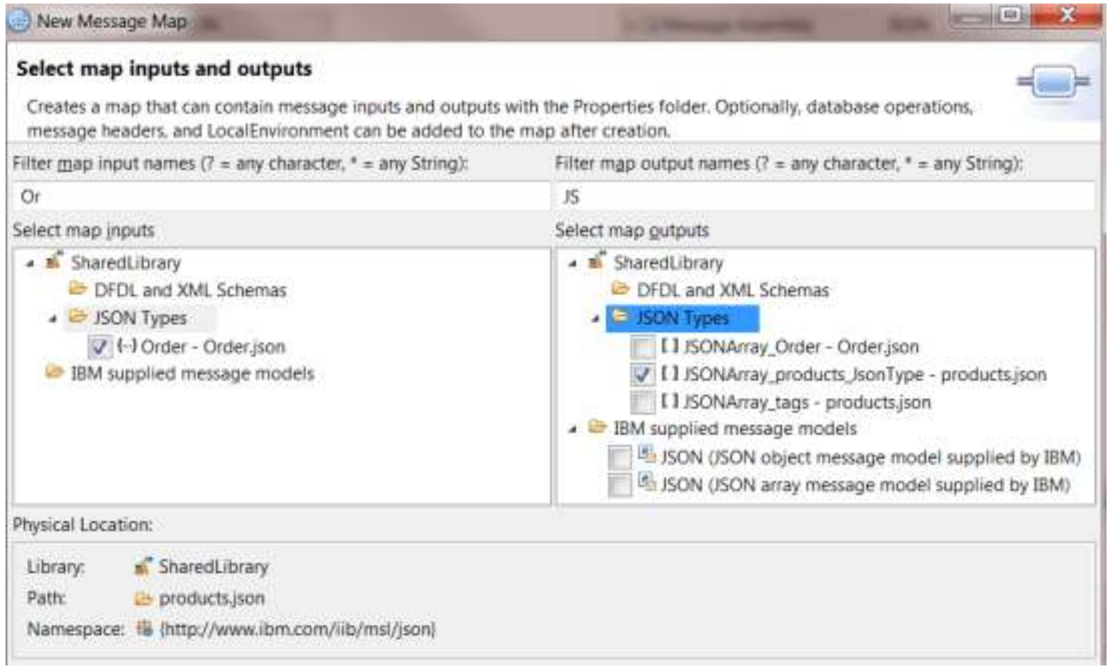
REST APIs – general mapping enhancements

- The JSON Schema support in the mapper can also be used outside of a REST API.
- At present, the JSON Schema and the map **must** be col-located in the same container



Application Development

- SharedLibrary
  - Schema Definitions
  - Maps
    - Order2Products.map
  - Other Resources
    - Order.json
    - person.json
    - products.json



New Message Map

Select map inputs and outputs

Creates a map that can contain message inputs and outputs with the Properties folder. Optionally, database operations, message headers, and LocalEnvironment can be added to the map after creation.

Filter map input names (? = any character, * = any String): Or

Filter map output names (? = any character, * = any String): JS

Select map inputs

- SharedLibrary
  - DFDL and XML Schemas
  - JSON Types
    - [✓] {-} Order - Order.json
  - IBM supplied message models

Select map outputs

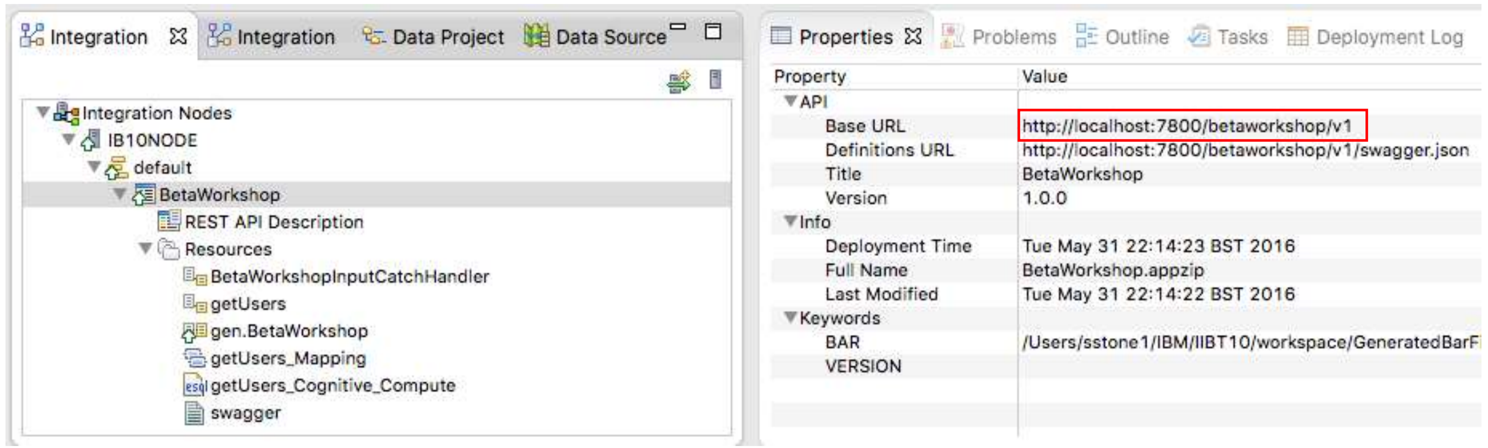
- SharedLibrary
  - DFDL and XML Schemas
  - JSON Types
    - [ ] [ ] JSONArray_Order - Order.json
    - [✓] [ ] JSONArray_products_JsonType - products.json
    - [ ] [ ] JSONArray_tags - products.json
  - IBM supplied message models
    - [ ] JSON (JSON object message model supplied by IBM)
    - [ ] JSON (JSON array message model supplied by IBM)

Physical Location:

Library: SharedLibrary
Path: products.json
Namespace: {http://www.ibm.com/iib/msl/json}

REST APIs – packaging and deployment

- REST APIs can be packaged into a BAR file and deployed to an integration server using any of the standard mechanisms – either the Integration Toolkit, the command line, or the Integration Java API.
- Once deployed, a REST API appears in the Integration Toolkit and web administration interface as a REST API, under a new REST APIs category.



```
▼ Integration Nodes
  ▼ IB10NODE
    ▼ default
      ▼ BetaWorkshop
          REST API Description
        ▼ Resources
            BetaWorkshopInputCatchHandler
            getUsers
            gen.BetaWorkshop
            getUsers_Mapping
            getUsers_Cognitive_Compute
            swagger
```

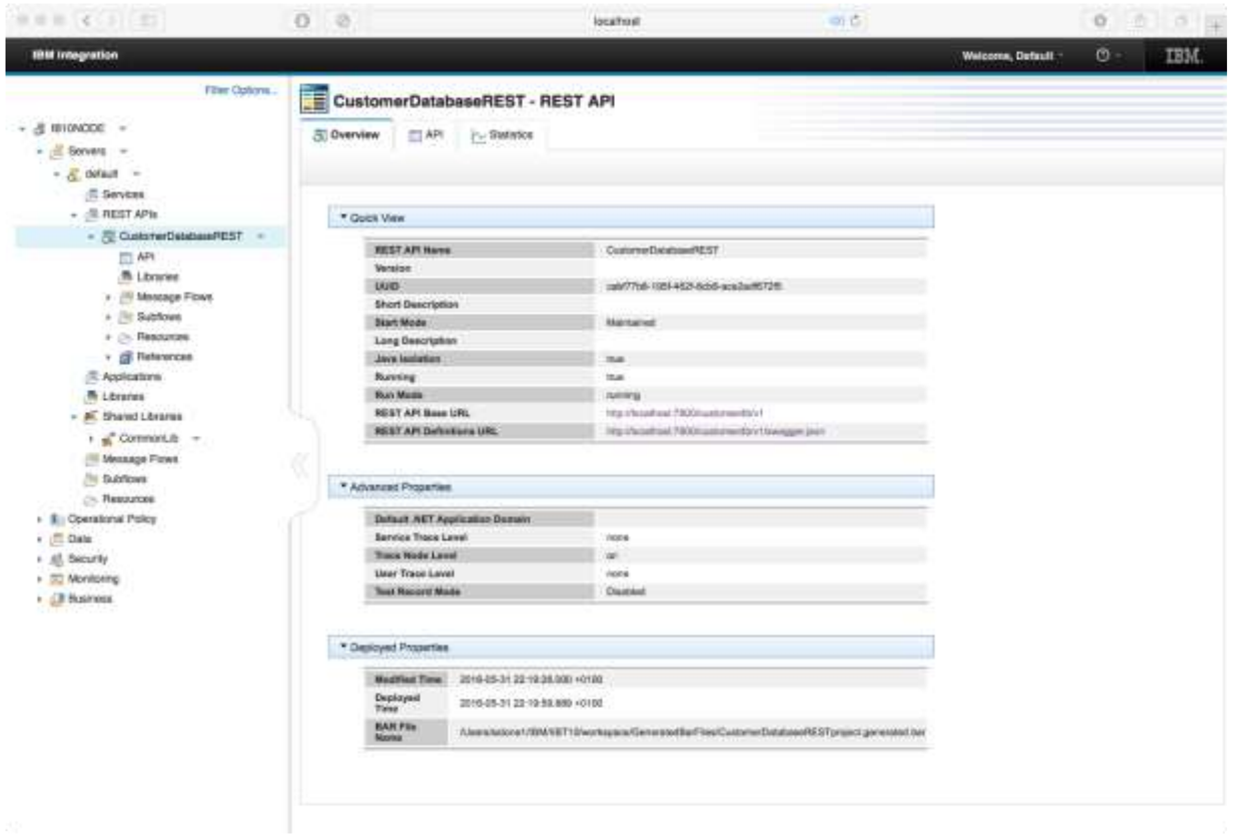
Property	Value
▼API	
Base URL	http://localhost:7800/betaworkshop/v1
Definitions URL	http://localhost:7800/betaworkshop/v1/swagger.json
Title	BetaWorkshop
Version	1.0.0
▼Info	
Deployment Time	Tue May 31 22:14:23 BST 2016
Full Name	BetaWorkshop.appzip
Last Modified	Tue May 31 22:14:22 BST 2016
▼Keywords	
BAR	/Users/sstone1/IBM/IIBT10/workspace/GeneratedBarF
VERSION	

- The base path of the REST API can be used to isolate a REST API from other REST APIs, in a similar way to a context root for a J2EE application.

- The base path can also be used to isolate multiple versions of the same REST API on a single integration server – for example, you could have /customerdb/v1 and /customerdb/v2.

REST APIs - administration

- All administrative and operational controls that are available for applications in Integration Bus are also available for REST APIs.
- The command line programs that work with applications will also work with REST APIs.
- There is support in the Integration API and administrative REST API for programatically interacting with deployed REST APIs.



CustomerDatabaseREST - REST API

▾ Quick View

REST API Name	CustomerDatabaseREST
Version	
UUID	[illegible]
Short Description	
Start Mode	Maintained
Long Description	
Java Isolation	true
Running	true
Run Mode	running
REST API Base URL	http://localhost:7800/customerdb/v1
REST API Definitions URL	http://localhost:7800/customerdb/v1/swagger.json

▾ Advanced Properties

Default .NET Application Domain	
Service Trace Level	none
Trace Node Level	on
User Trace Level	none
Test Record Mode	Disabled

▾ Deployed Properties

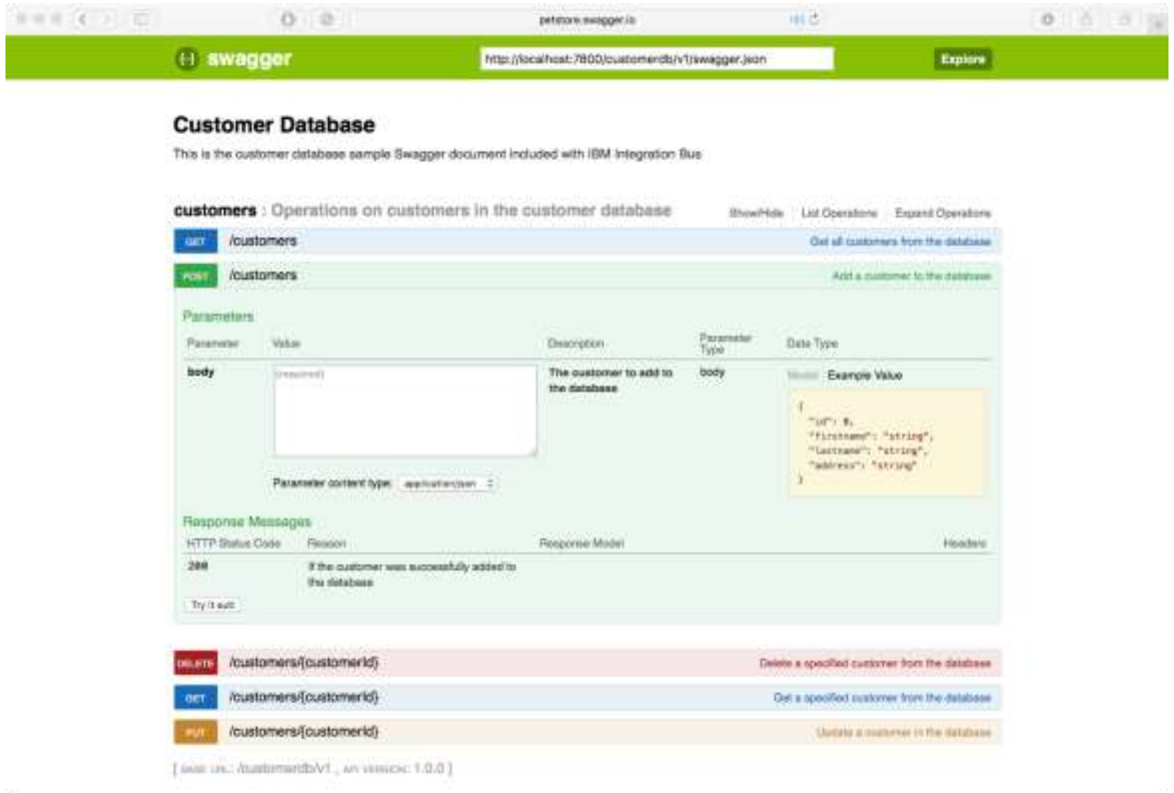
Modified Time	2016-05-31 22:19:28.000 +0100
Deployed Time	2016-05-31 22:19:59.880 +0100
BAR File Name	[illegible]/workspace/GeneratedBarFiles/CustomerDatabaseRESTproject.generated.bar

- The web user interface has also been extended to provide information about the resources, operations, and parameters that are available in a deployed REST API.

REST APIs – deployed Swagger

- When a REST API is deployed, the Swagger document for that REST API is automatically made available over HTTP from the same server and port that the REST API is hosted in. The URL for the deployed Swagger document is available from the Integration Nodes view in the Integration Toolkit, as well as the web user interface.
  - http://localhost:7800/customerdb/v1/swagger.json
  - http://localhost:7800/customerdb/v1/swagger.yaml
- The deployed Swagger document is automatically updated to reflect the server, port, and HTTP/HTTPS details for the deployed REST API. You do not have to update it with the correct details before deployment.
- This means that you can easily use the deployed Swagger document in combination with open source Swagger tooling, to explore and interact with a deployed REST API.

REST APIs – Swagger UI



petstore.swagger.io

swagger http://localhost:7800/customerdb/v1/swagger.json Explore

Customer Database

This is the customer database sample Swagger document included with IBM Integration Bus

customers : Operations on customers in the customer database — Show/Hide | List Operations | Expand Operations

GET /customers — Get all customers from the database

POST /customers — Add a customer to the database

Parameters

Parameter	Value	Description	Parameter Type	Data Type
body	(required)	The customer to add to the database	body	Model Example Value

```
{
  "id": 0,
  "firstname": "string",
  "lastname": "string",
  "address": "string"
}
```

Parameter content type: application/json

Response Messages

HTTP Status Code	Reason	Response Model	Headers
200	If the customer was successfully added to the database		

Try it out!

DELETE /customers/{customerId} — Delete a specified customer from the database

GET /customers/{customerId} — Get a specified customer from the database

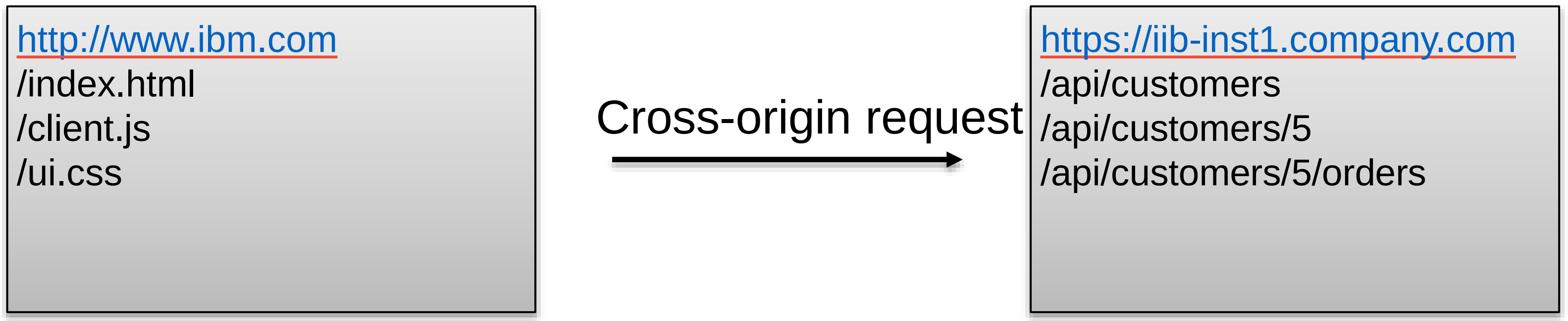
PUT /customers/{customerId} — Update a customer in the database

[BASE URL: /customerdb/v1 , API VERSION: 1.0.0]

- You can pass the URL of the deployed Swagger document to Swagger UI, which allows you to explore and test a deployed REST API. Swagger UI is available from:
    - http://petstore.swagger.io/ (live demo, but can also be used)
    - https://github.com/swagger-api/swagger-ui (source for download)
- In order for Swagger UI to work, you must enable Cross-Origin Resource Sharing (more on that shortly!).

REST APIs – Cross-Origin Resource Sharing (CORS)

- A web page has an origin. The origin of a web page is the scheme, host, and port of the web server that is hosting the web page.
    - For example, the origin of https://localhost:8080/test/index.html is https://localhost:8080.
- When a web page makes a request for another web page or resource on the same origin, a same-origin request is made.
- However, when a web page makes a request for another web page or resource on a different origin, a **cross-origin request** is made. This requires special support from the HTTP server that the cross-origin request is being made to. Without this support, the request is rejected by the web browser.



REST APIs – Cross-Origin Resource Sharing (CORS)

- If you are making an HTTP request from a web page to a REST API or other HTTP service deployed to Integration Bus, it is likely that a cross-origin request will need to be made.

- Integration Bus V10 now includes built in support for CORS. At V10 GA, this support was limited to the HTTP listener for the integration server, but as of V10 FP1 is available for the HTTP listener for the integration node as well.

- The support is disabled by default, but can be easily enabled with a single command:
  - `mqsichangeproperties IB10NODE -e default -o HTTPConnector -n corsEnabled -v true`
  - `mqsichangeproperties IB10NODE -b httplistener -o HTTPConnector -n corsEnabled -v true`

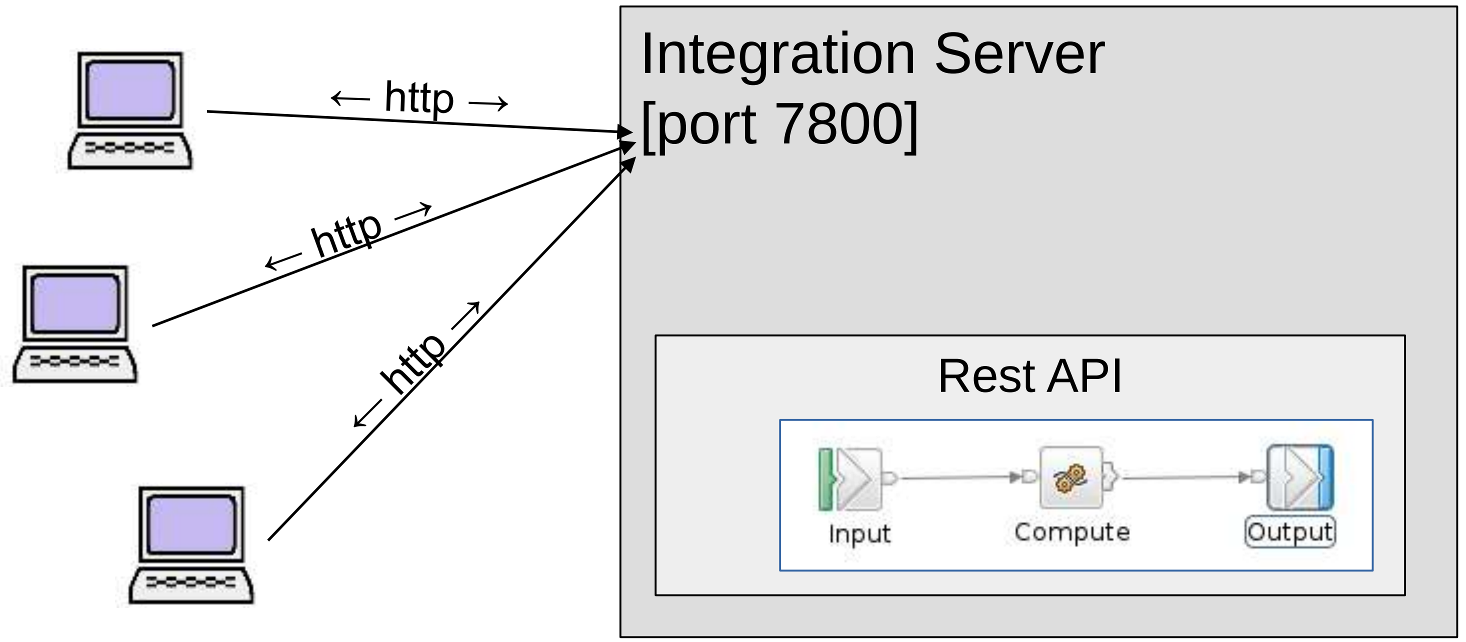
- When CORS settings are modified, the changes are effective immediately – there is no need to restart the integration server or node.

Demo: Develop a REST API in IIB

Pushing a REST API to API Connect

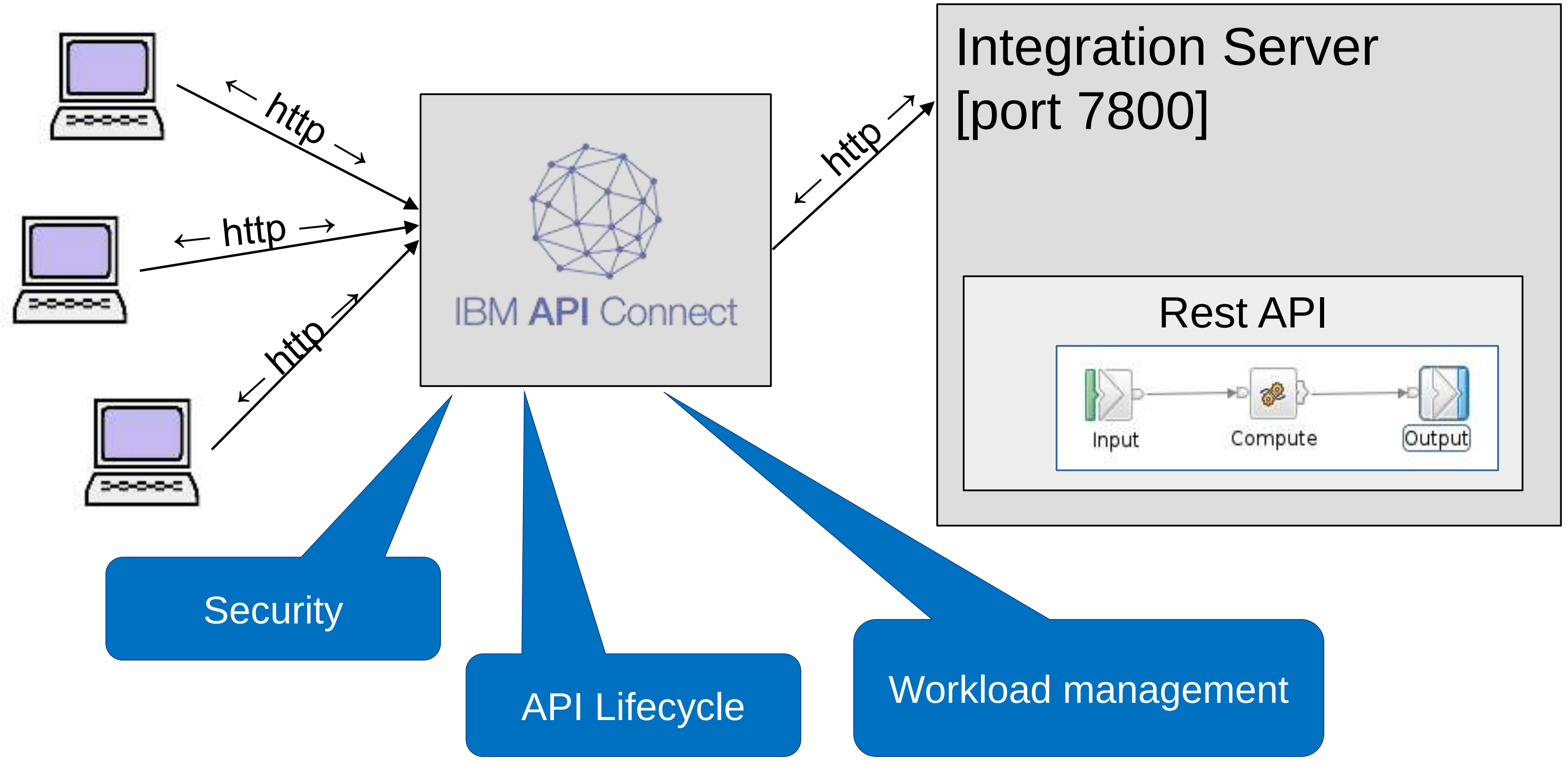
REST APIs developed in IIB

- We have just seen how REST APIs allow integrations to be exposed as a RESTful web services that can be called by HTTP clients.



IBM API Connect and IIB

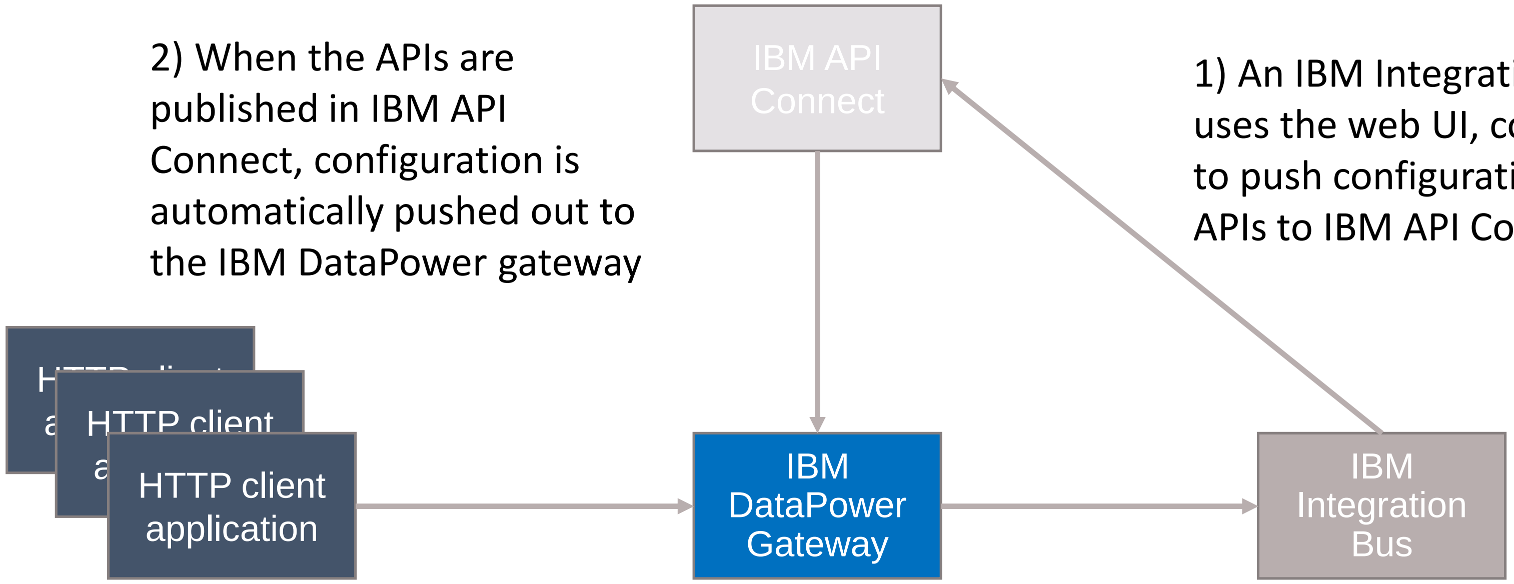
- IBM API Connect is an API management solution
- IBM API Connect provides a layer of security and manageability to your REST APIs.



Interaction between IIB and IBM API Connect

2) When the APIs are published in IBM API Connect, configuration is automatically pushed out to the IBM DataPower gateway

1) An IBM Integration Bus administrator uses the web UI, command line, or toolkit to push configuration for deployed REST APIs to IBM API Connect.

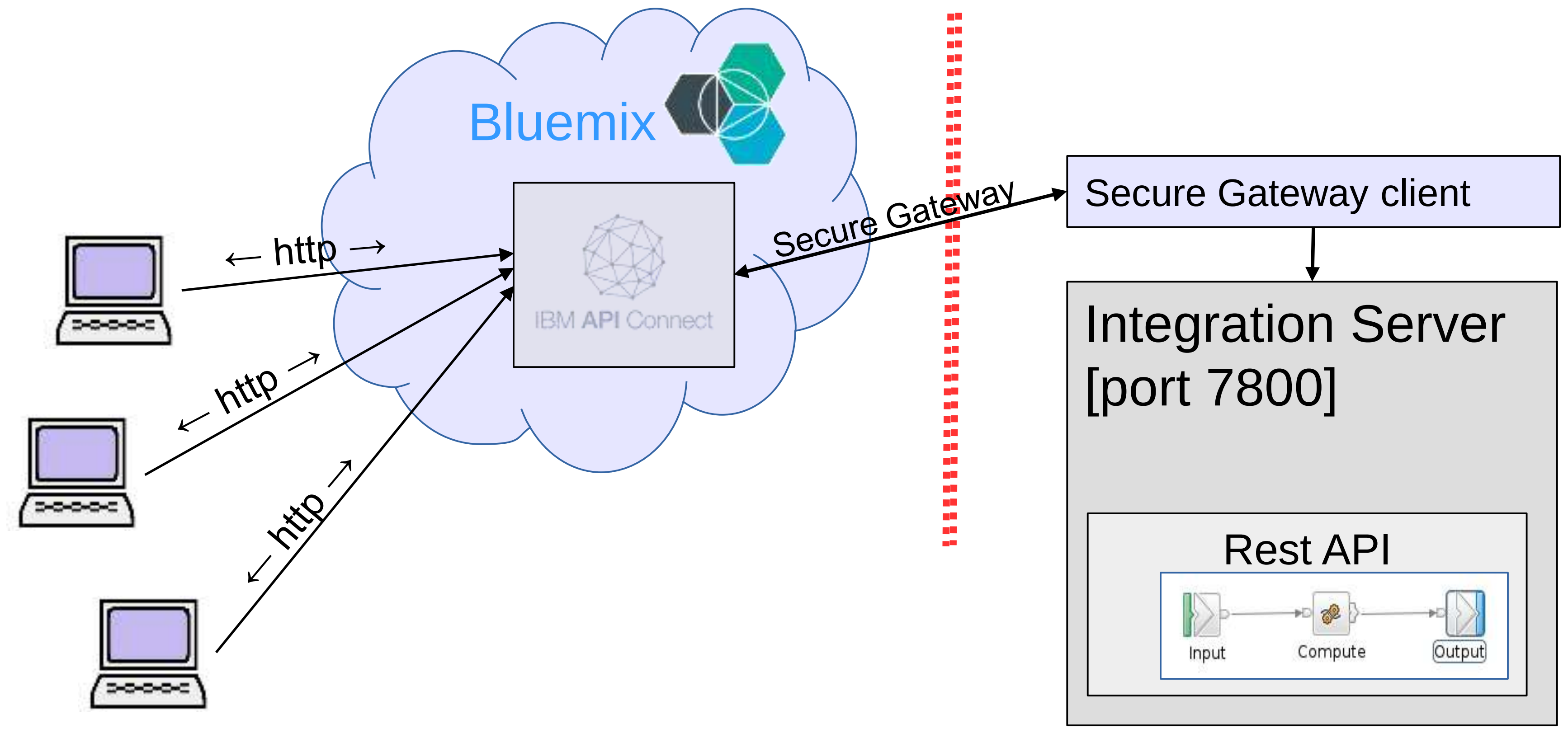


3) HTTP client applications wishing to make an HTTP request to the REST API deployed on IBM Integration Bus make an HTTP request to the IBM DataPower Gateway.

4) The IBM DataPower Gateway enforces access control, rate limiting, and other policies before it proxies the HTTP request to IBM Integration Bus.

IBM API Connect in Bluemix

- API Connect can fully reside in the Cloud, and utilise the Bluemix Secure Gateway component to bridge to on-premise IIB installation.

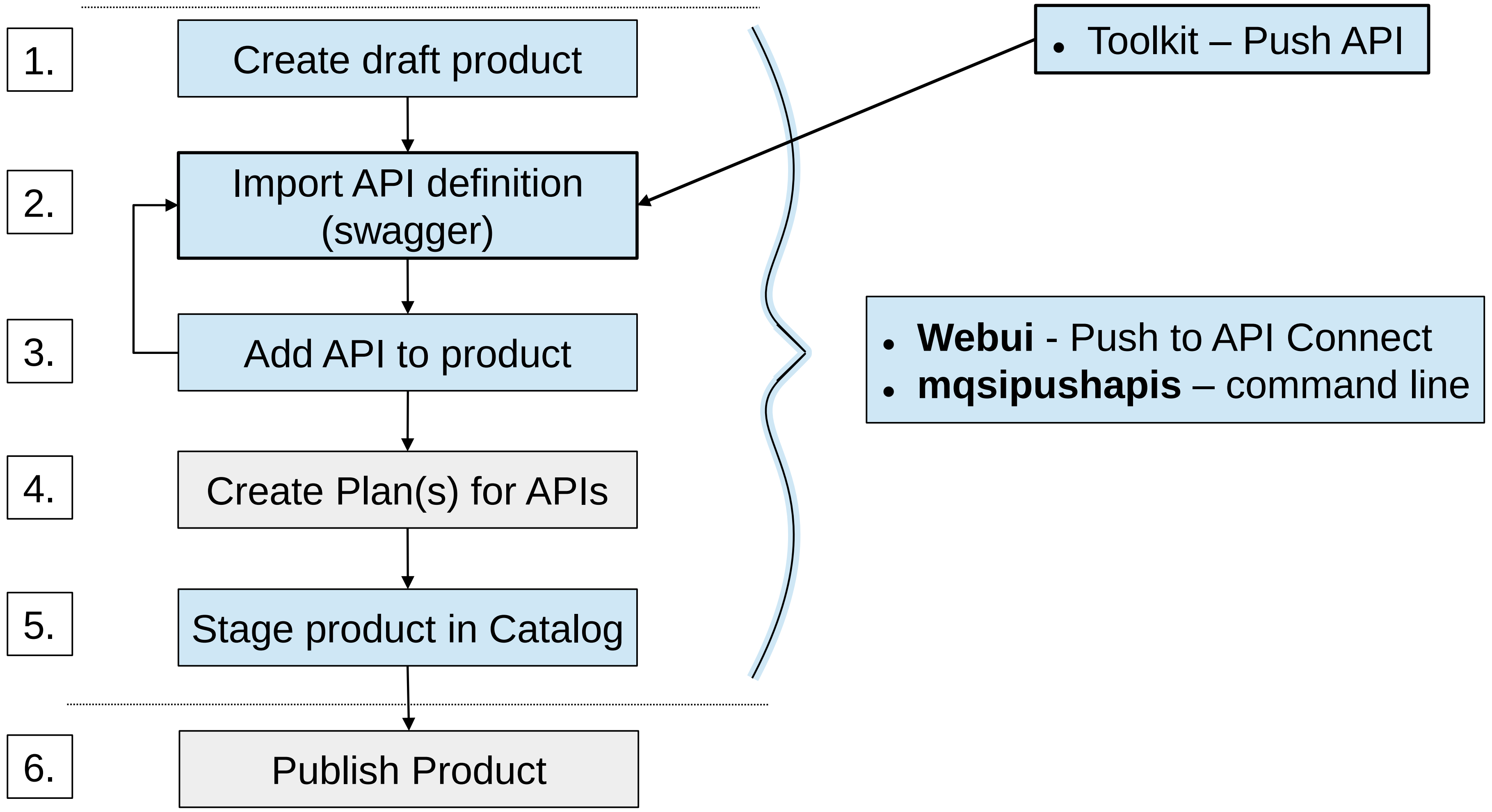


IBM API Connect Concepts

- APIs
  - An API is a collection of http operations. An API is identified by an API name and version.
- Plan
  - A plan defines the operational limits (rate, authorisation) of an API or APIs.
- Product
  - A product is a collection of APIs and Plans. A Product is identified by a Product name and version.
- Catalog
  - Products must be staged to a catalog before they can be invoked. A catalog behaves as a logical partition of the Gateway and the Developer Portal.

    (A 'Sandbox' catalog is useful when developing APIs, allowing APIs to updated and deleted without the deprecating / retiring the Product first.)

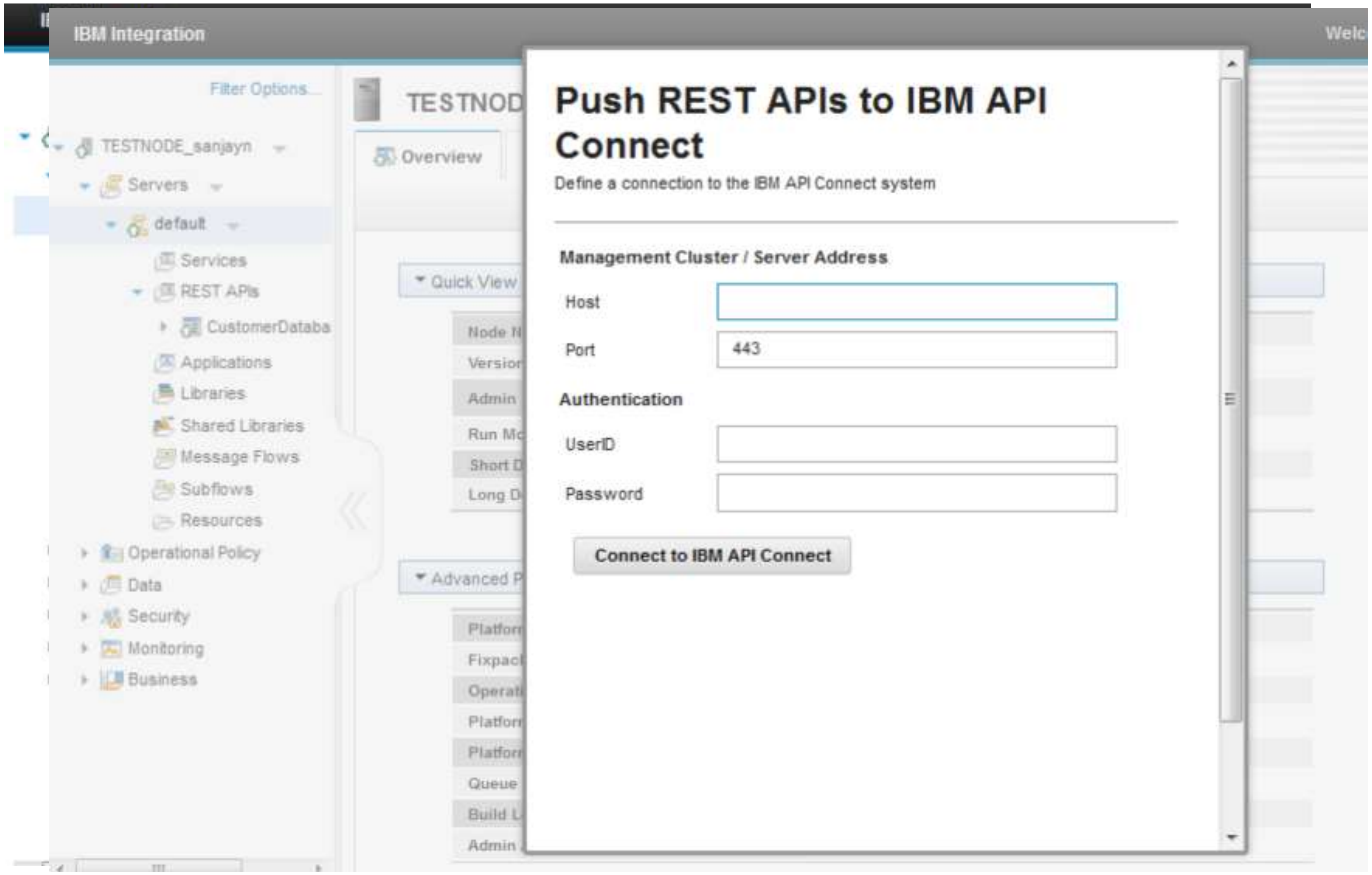
Exposing an API in IBM API Connect



Pushing API's from IIB to IBM API Connect

- Using Toolkit
  - Can only push single APIs. Does not create a product or stage the product in the catalog.
  - Works with IBM API Management v4 and IBM API Connect v5
- Using WebUI
  - Push multiple APIs to IBM API Connect
  - Available from Context menu on Integration Server
  - Creates Product and optionally stages in a Catalog
  - Works only with IBM API Connect v5
- Using 'mqsipushapis' command
  - Same operation as offered using WebUI
  - Works only with IBM API Connect v5

Pushing API's from IIB to IBM API Connect: Web UI



Push REST APIs to IBM API Connect

Define a connection to the IBM API Connect system

Management Cluster / Server Address

Host	
Port	443

Authentication

UserID	
Password	

Connect to IBM API Connect

Pushing API's from IIB to IBM API Connect: Command Line

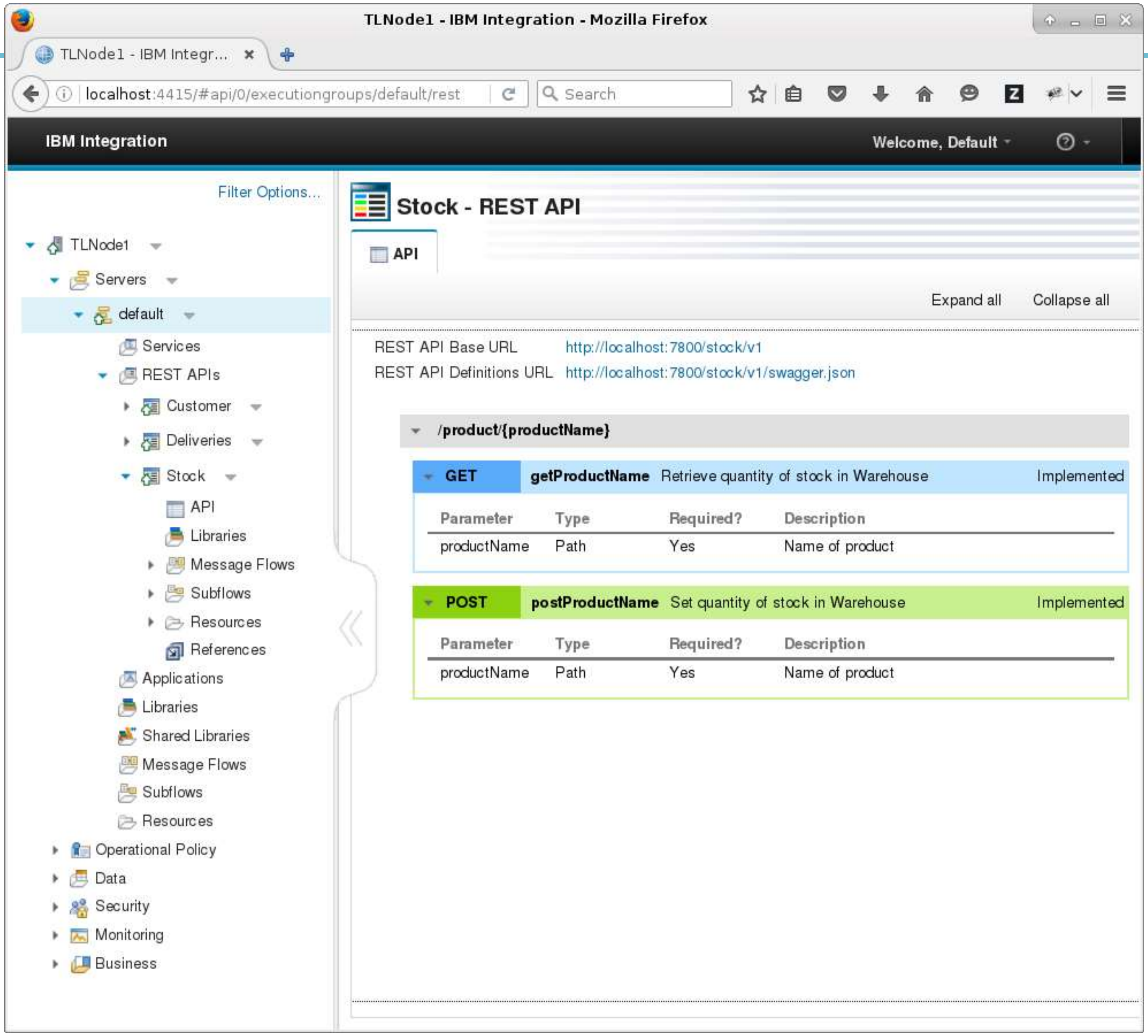
```
mqsipushapis integrationNodeSpec -e integrationServerName -t apiConnectHost -g apiConnectPort
        -u apiConnectUser -a apiConnectPassword -o apiConnectOrganization
        [-c apiConnectCatalogTitle] -r apiConnectProductTitle [-d apiConnectProductName]
        [-s apiConnectProductVersion] -k restApis [-x httpInboundProxyHost]
        [-y httpsInboundProxyHost] [-v traceFileName] [-w timeoutSecs]
```

Command Options:
'-t apiConnectHost' The host name of the IBM API Connect system.
'-g apiConnectPort' The port of the IBM API Connect system.
'-u apiConnectUser' The user name that is being used to connect to IBM API Connect.
'-a apiConnectPassword' The password that is being used to connect to IBM API Connect.
'-o apiConnectOrganization' The name of the API Connect Organization where the APIs will be pushed.
'-c apiConnectCatalogTitle' The title of the API Connect Catalog where the product will be staged.
'-r apiConnectProductTitle' The title of the IBM API Connect Product to create or update
'-d apiConnectProductName' The name of the IBM API Connect Product to create or update.
'-s apiConnectProductVersion' The version of the IBM API Connect Product to create or update.
'-k restApis' A list of API names, separated by colons (:), that will be pushed to IBM API Connect.
'-x httpInboundProxyHost' The host name and port of a proxy that receives the inbound HTTP request.
'-y httpsInboundProxyHost' The host name and port of a proxy that receives the inbound HTTPS request.
'-v traceFileName' Send verbose internal trace to the specified file. This is optional.
'-w timeoutSecs' Maximum number of seconds to wait for the integration node to respond.

Demo:
Push to
IBM API Connect

Integration Server contains a number of APIs

Demo – IIB WebUI



REST API Base URL http://localhost:7800/stock/v1
REST API Definitions URL http://localhost:7800/stock/v1/swagger.json

/product/{productName}

GET getProductName Retrieve quantity of stock in Warehouse Implemented

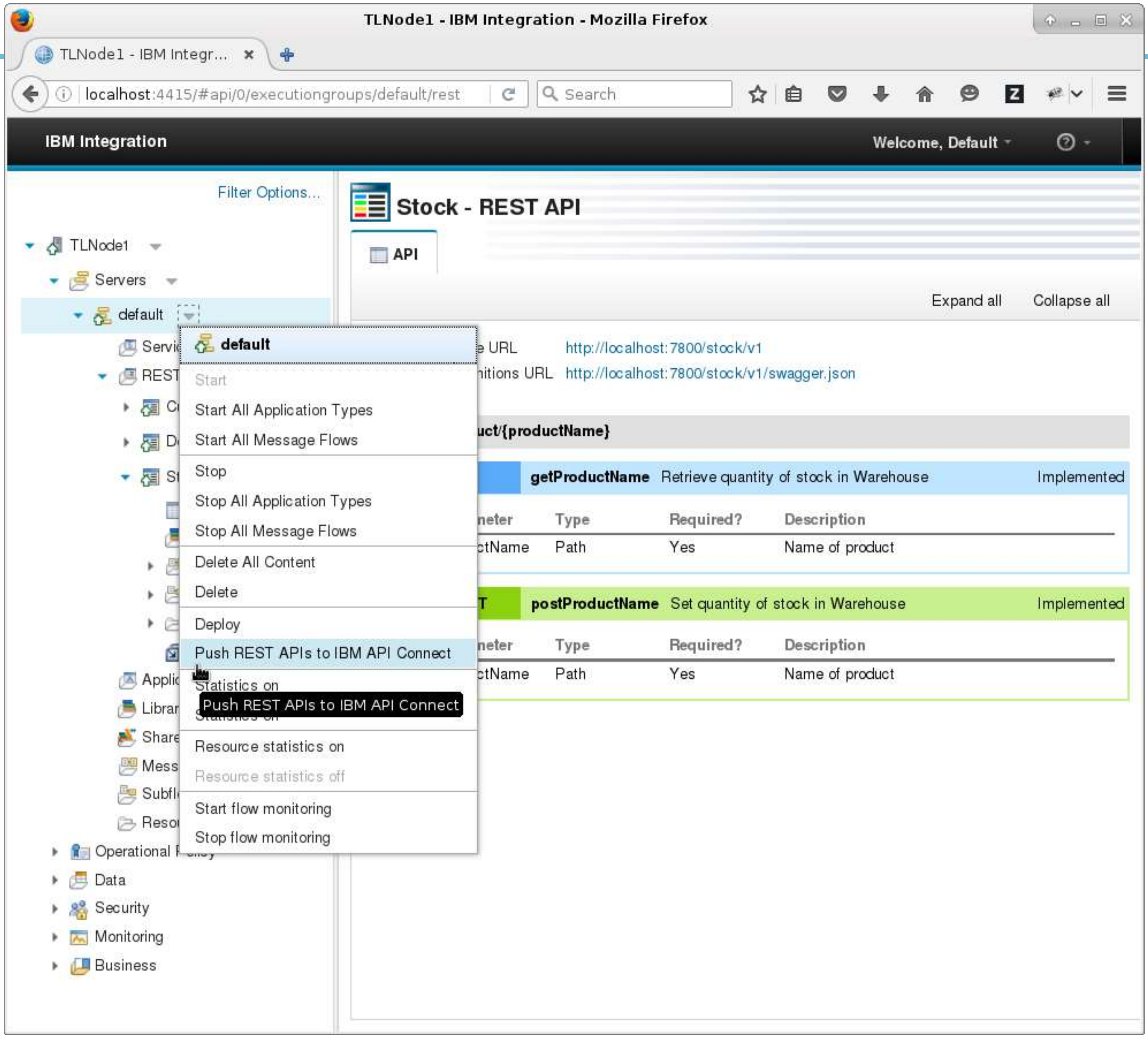
Parameter	Type	Required?	Description
productName	Path	Yes	Name of product

POST postProductName Set quantity of stock in Warehouse Implemented

Parameter	Type	Required?	Description
productName	Path	Yes	Name of product

Select "Push REST APIs to IBM API Connect"

Demo – IIB WebUI



e URL http://localhost:7800/stock/v1

nitions URL http://localhost:7800/stock/v1/swagger.json

uct/{productName}

getProductName Retrieve quantity of stock in Warehouse Implemented

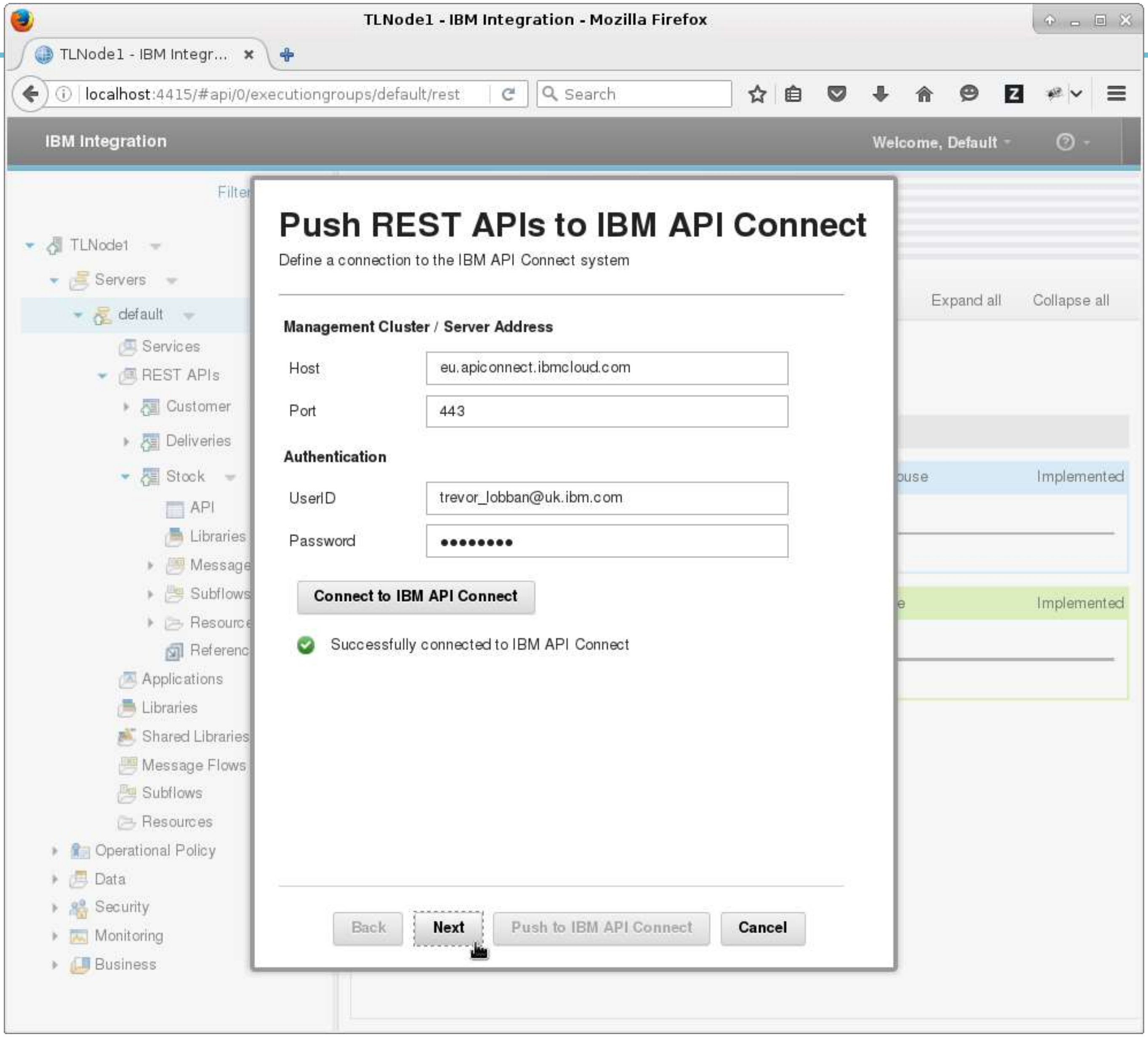
neter	Type	Required?	Description
ctName	Path	Yes	Name of product

postProductName Set quantity of stock in Warehouse Implemented

neter	Type	Required?	Description
ctName	Path	Yes	Name of product

Enter IBM API Connect credentials

Demo – IIB WebUI



Push REST APIs to IBM API Connect

Define a connection to the IBM API Connect system

Management Cluster / Server Address

Host	eu.apiconnect.ibmcloud.com
Port	443

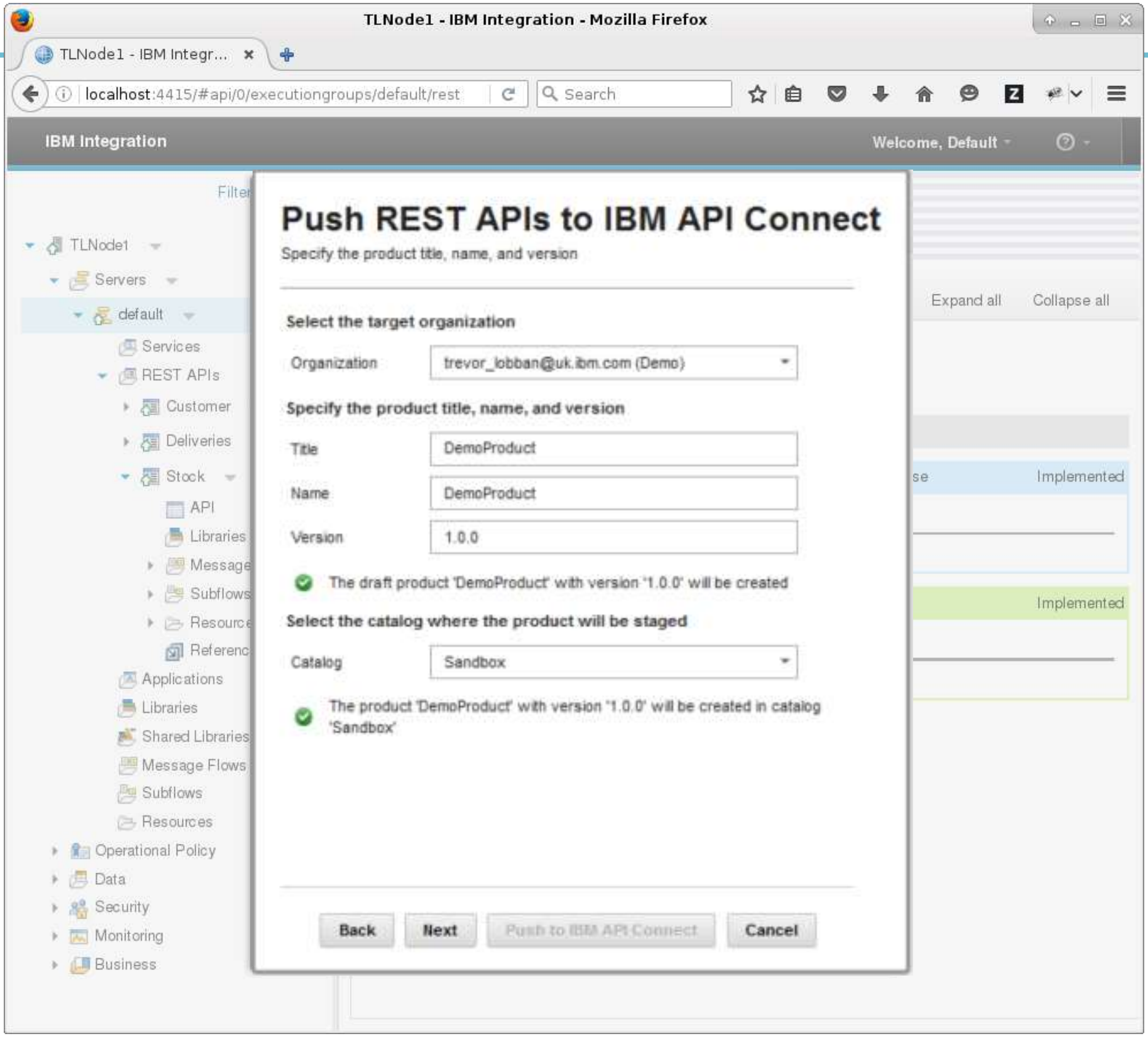
Authentication

UserID	trevor_lobban@uk.ibm.com
Password	●●●●●●●●●

Successfully connected to IBM API Connect

Enter IBM API Connect credentials

Demo – IIB WebUI



Push REST APIs to IBM API Connect

Specify the product title, name, and version

Select the target organization

Organization	trevor_lobban@uk.ibm.com (Demo)

Specify the product title, name, and version

Title	DemoProduct
Name	DemoProduct
Version	1.0.0

✓ The draft product 'DemoProduct' with version '1.0.0' will be created

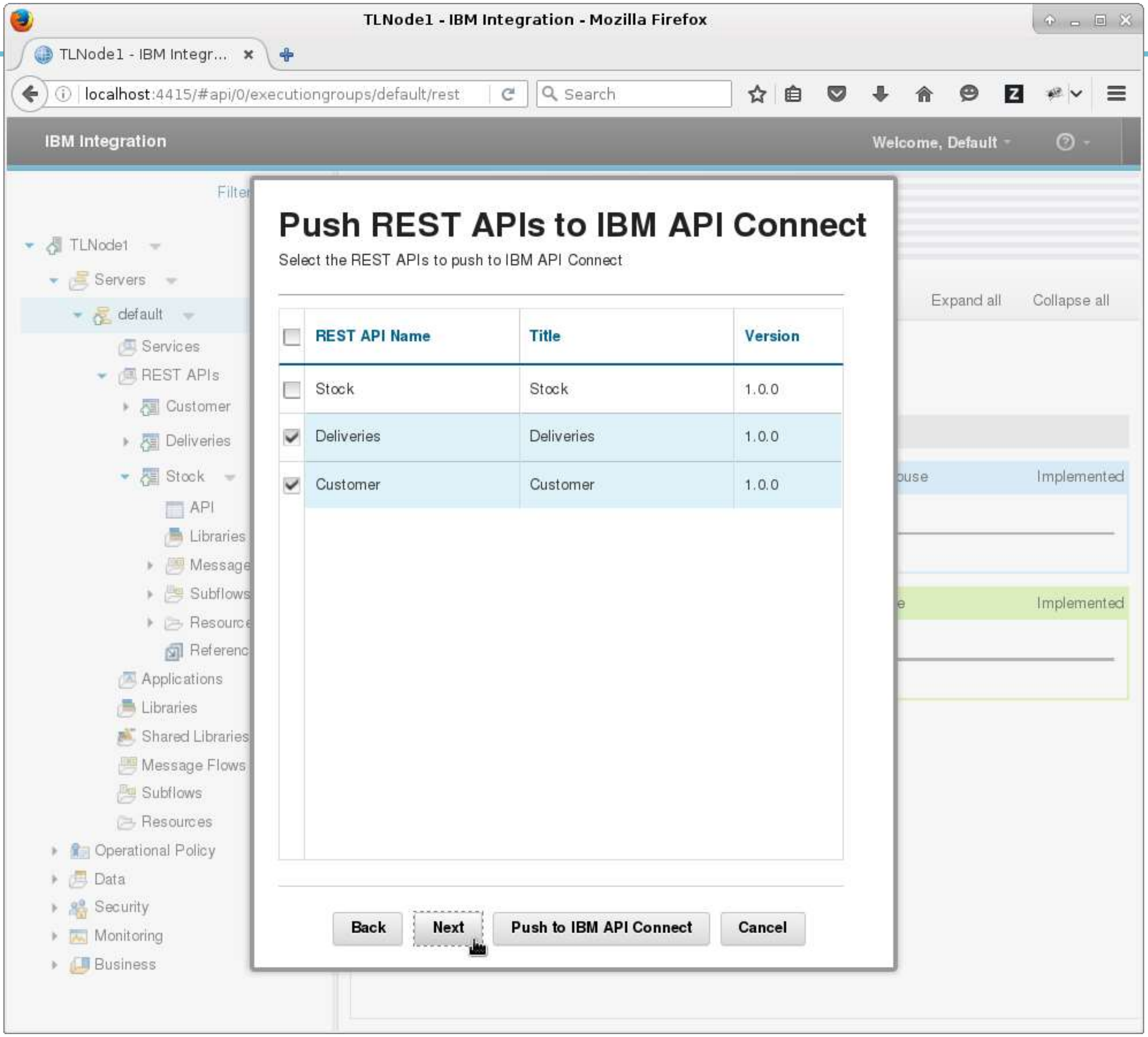
Select the catalog where the product will be staged

Catalog	Sandbox

✓ The product 'DemoProduct' with version '1.0.0' will be created in catalog 'Sandbox'

Select APIs to push

Demo – IIB WebUI



TLNode1 - IBM Integration - Mozilla Firefox

localhost:4415/#api/0/executiongroups/default/rest

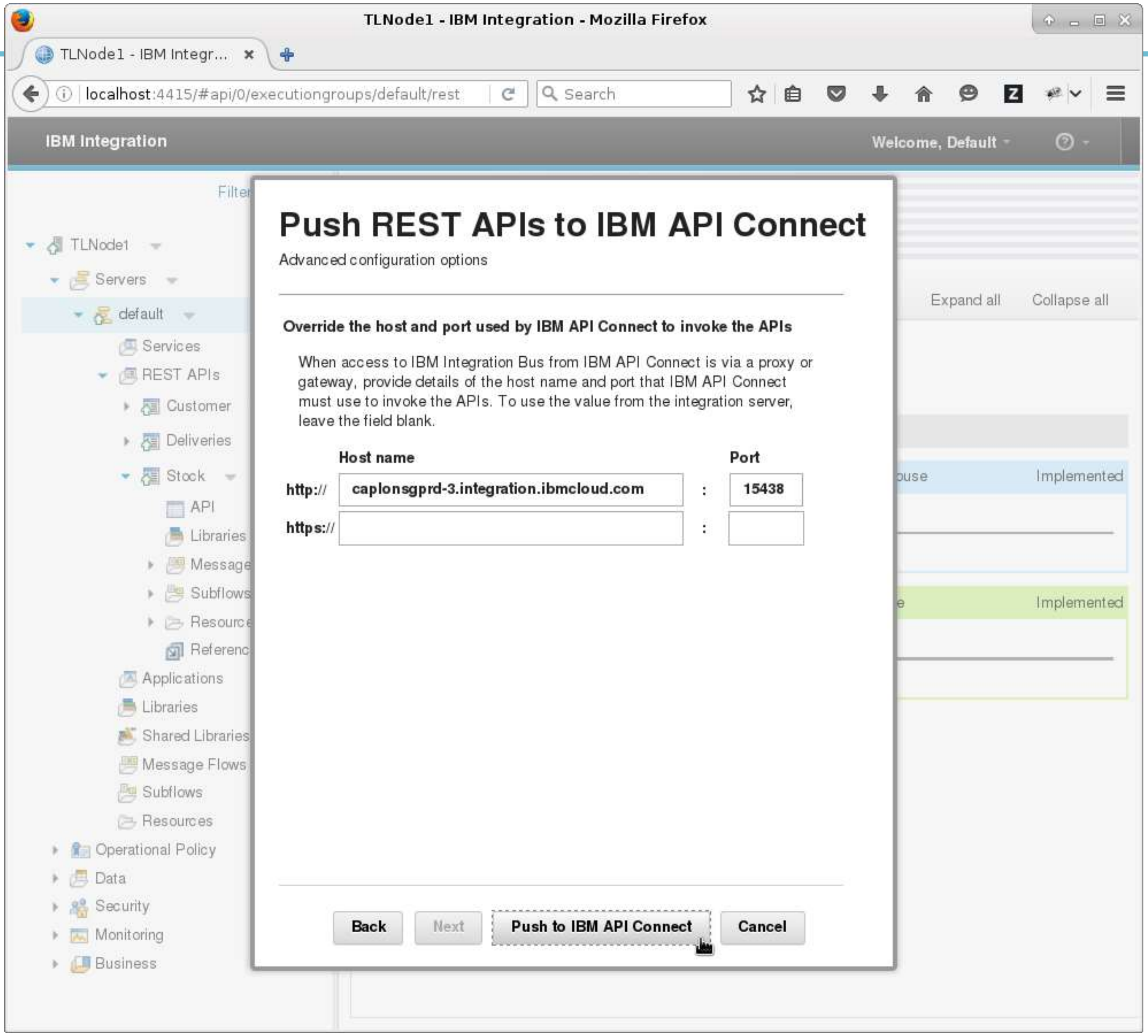
Push REST APIs to IBM API Connect

Select the REST APIs to push to IBM API Connect

	REST API Name	Title	Version
☐	Stock	Stock	1.0.0
✓	Deliveries	Deliveries	1.0.0
✓	Customer	Customer	1.0.0

Optionally provide Gateway details

Demo – IIB WebUI



Push REST APIs to IBM API Connect

Advanced configuration options

Override the host and port used by IBM API Connect to invoke the APIs

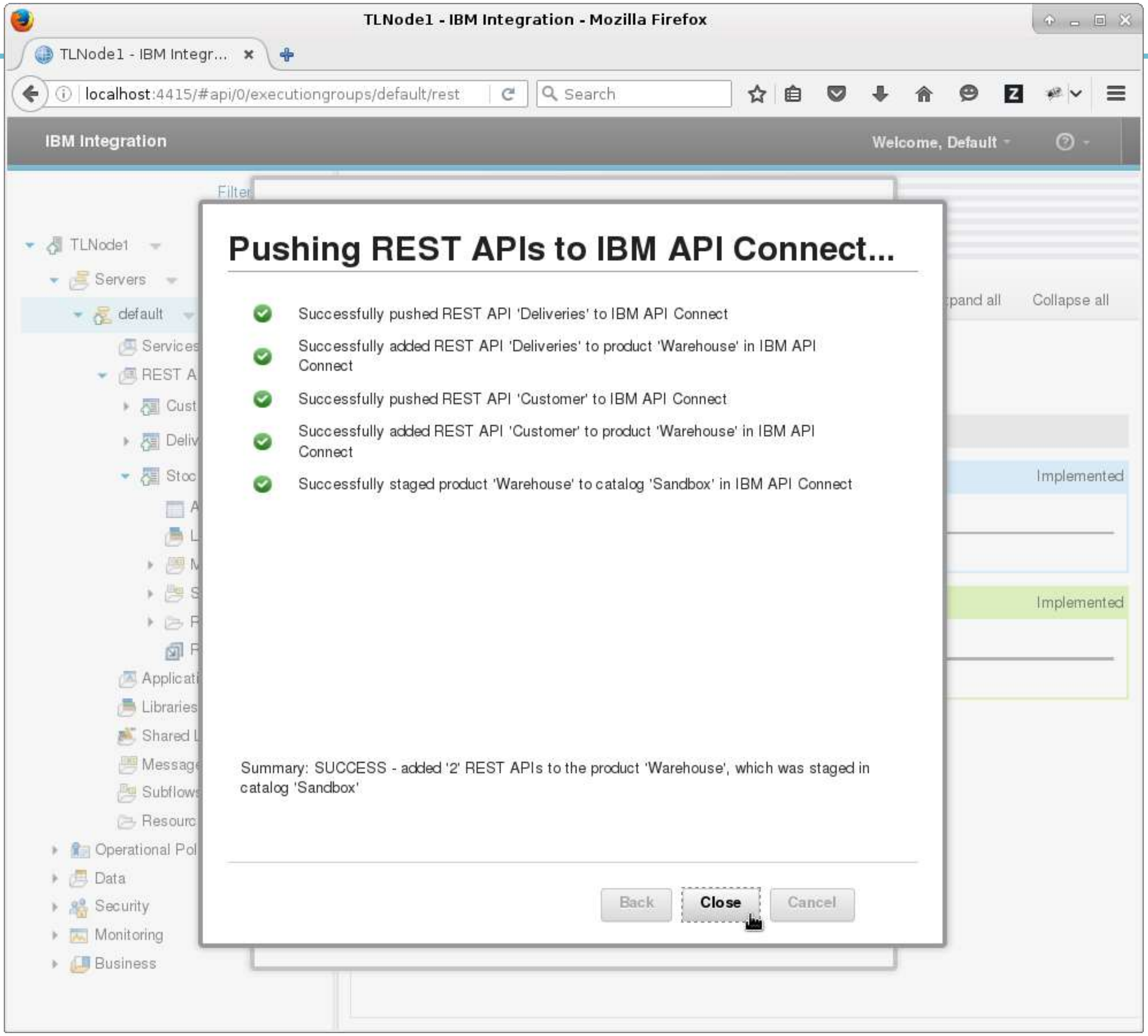
When access to IBM Integration Bus from IBM API Connect is via a proxy or gateway, provide details of the host name and port that IBM API Connect must use to invoke the APIs. To use the value from the integration server, leave the field blank.

	Host name		Port
http://	caplonsgprd-3.integration.ibmcloud.com	:	15438
https://		:	

Back | Next | Push to IBM API Connect | Cancel

Push definitions to IBM API Connect

Demo – IIB WebUI



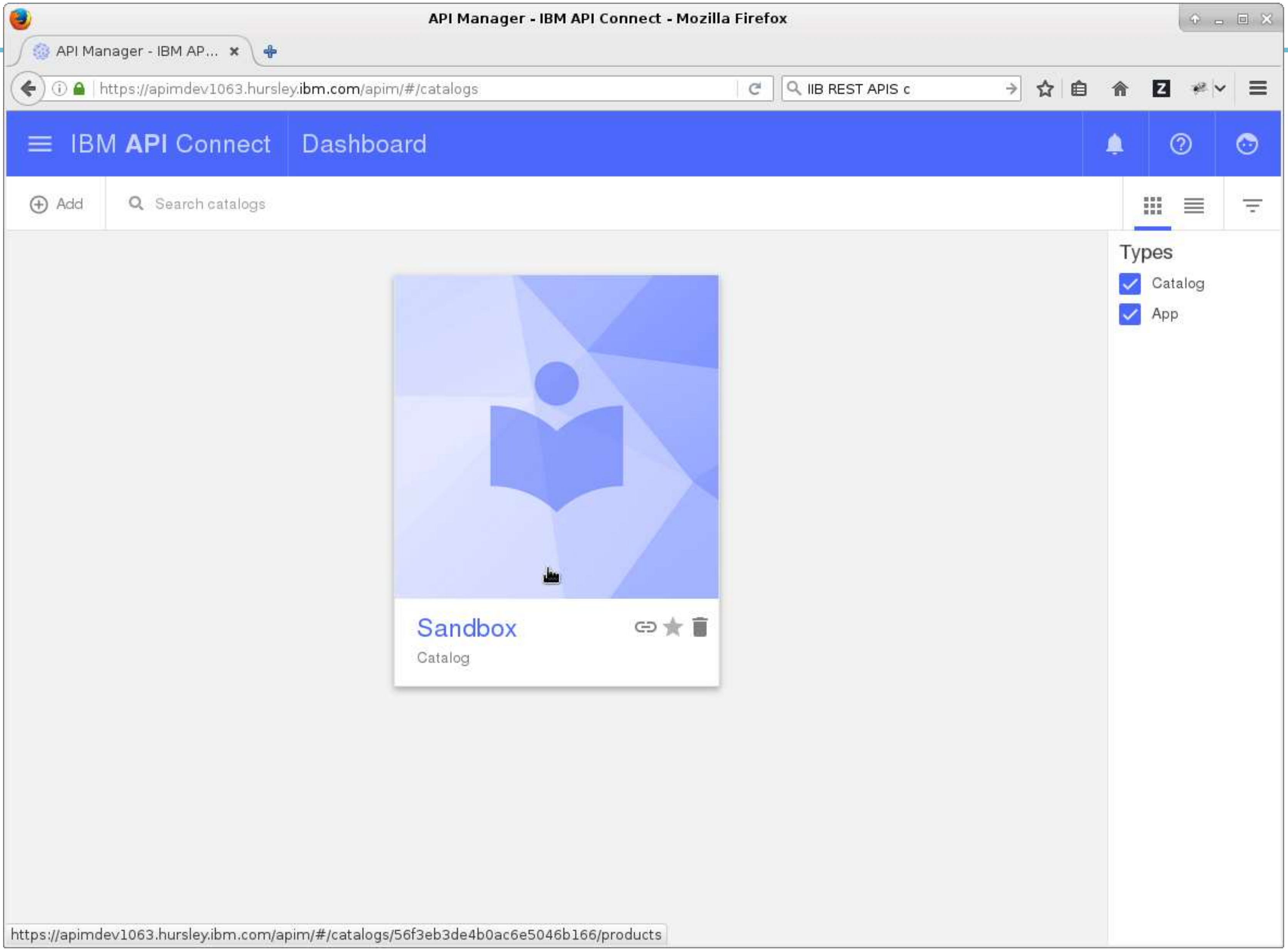
Pushing REST APIs to IBM API Connect...

- Successfully pushed REST API 'Deliveries' to IBM API Connect
- Successfully added REST API 'Deliveries' to product 'Warehouse' in IBM API Connect
- Successfully pushed REST API 'Customer' to IBM API Connect
- Successfully added REST API 'Customer' to product 'Warehouse' in IBM API Connect
- Successfully staged product 'Warehouse' to catalog 'Sandbox' in IBM API Connect

Summary: SUCCESS - added '2' REST APIs to the product 'Warehouse', which was staged in catalog 'Sandbox'

Push definitions to IBM API Connect

Demo – API Manager

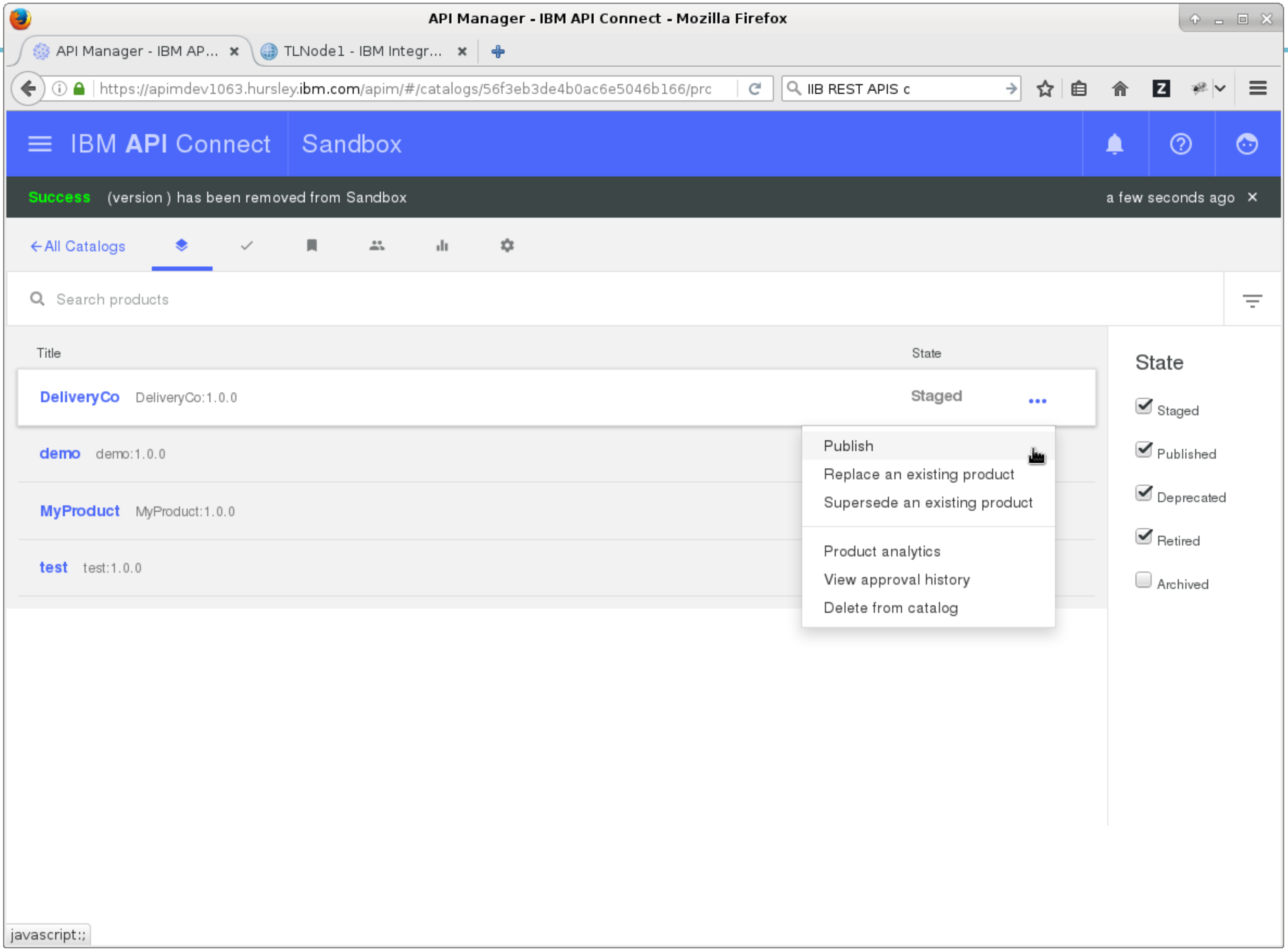

API Manager - IBM API Connect - Mozilla Firefox

https://apimdev1063.hursley.ibm.com/apim/#/catalogs

https://apimdev1063.hursley.ibm.com/apim/#/catalogs/56f3eb3de4b0ac6e5046b166/products

Push definitions to IBM API Connect

Demo – Publish API



API Manager - IBM API Connect - Mozilla Firefox

https://apimdev1063.hursley.ibm.com/apim/#/catalogs/56f3eb3de4b0ac6e5046b166/prc

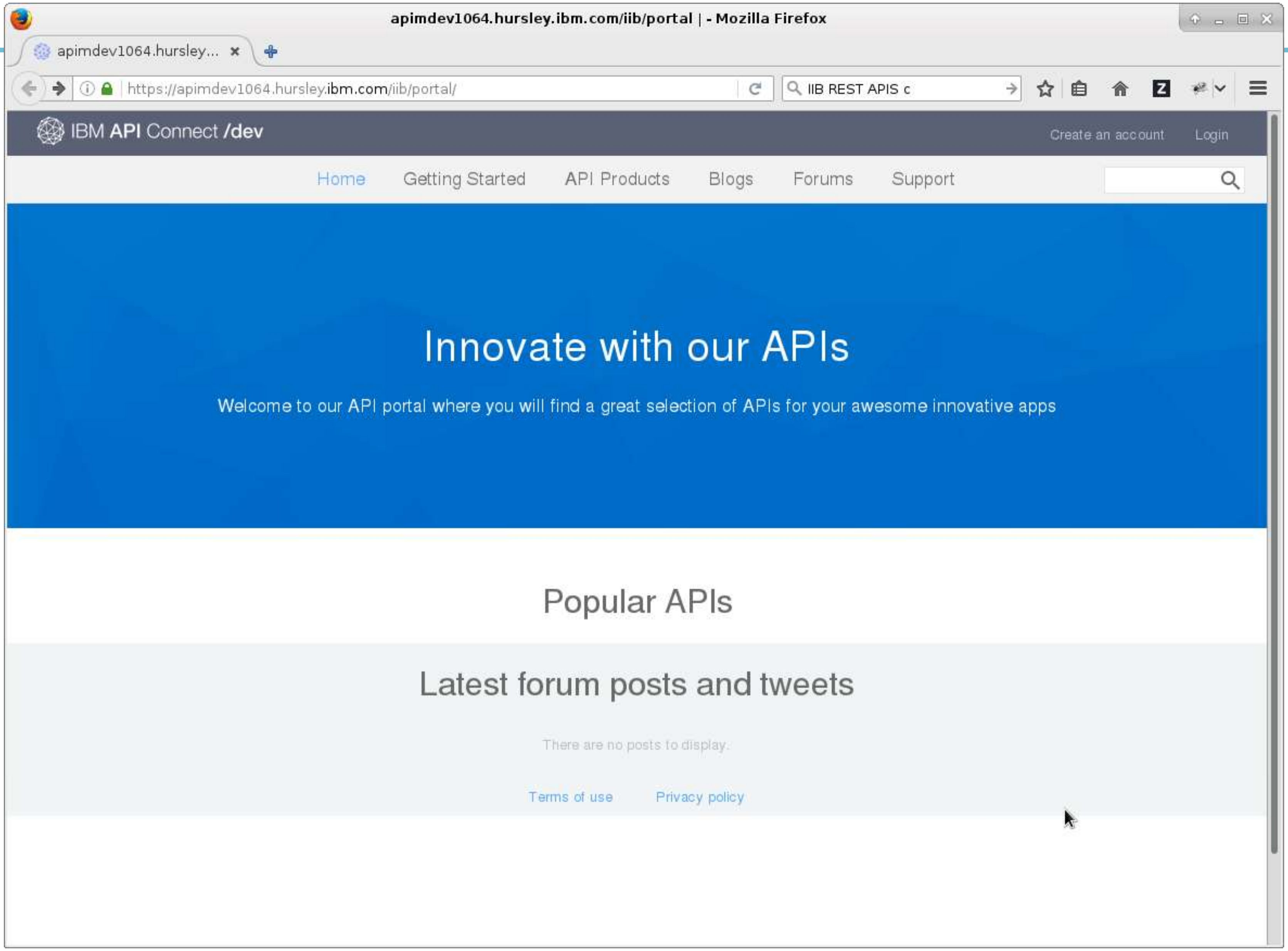
IBM API Connect Sandbox

Success (version) has been removed from Sandbox a few seconds ago

Title		State
DeliveryCo	DeliveryCo:1.0.0	Staged
demo	demo:1.0.0	
MyProduct	MyProduct:1.0.0	
test	test:1.0.0	

Push definitions to IBM API Connect

Demo – Developer Portal



Innovate with our APIs

Welcome to our API portal where you will find a great selection of APIs for your awesome innovative apps

Popular APIs

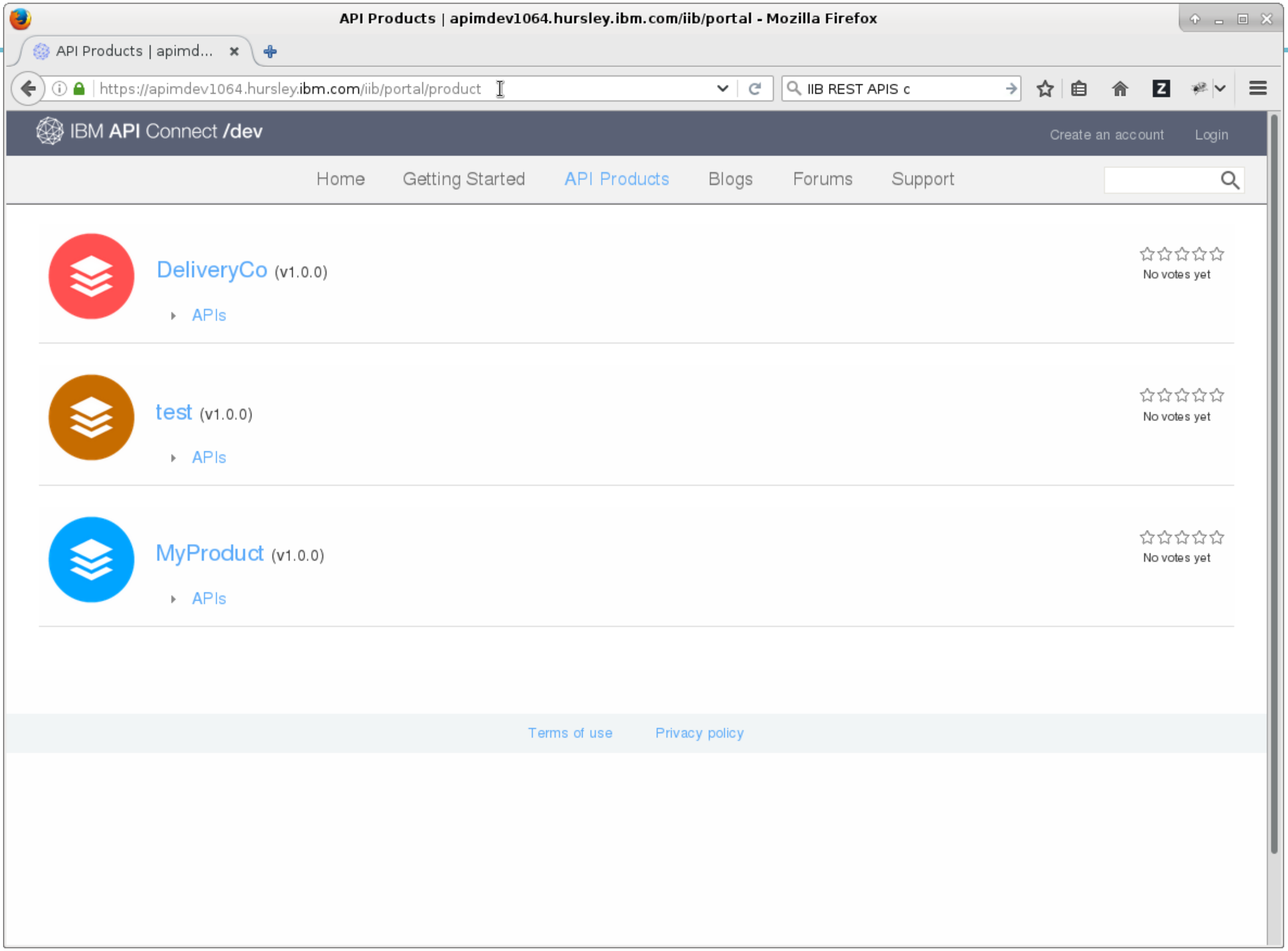
Latest forum posts and tweets

There are no posts to display.

Terms of use   Privacy policy

Push definitions to IBM API Connect

Demo – Developer Portal



API Products | apimdev1064.hursley.ibm.com/iib/portal - Mozilla Firefox

https://apimdev1064.hursley.ibm.com/iib/portal/product

IBM API Connect /dev

Create an account Login

Home Getting Started API Products Blogs Forums Support

DeliveryCo (v1.0.0)
APIs
No votes yet

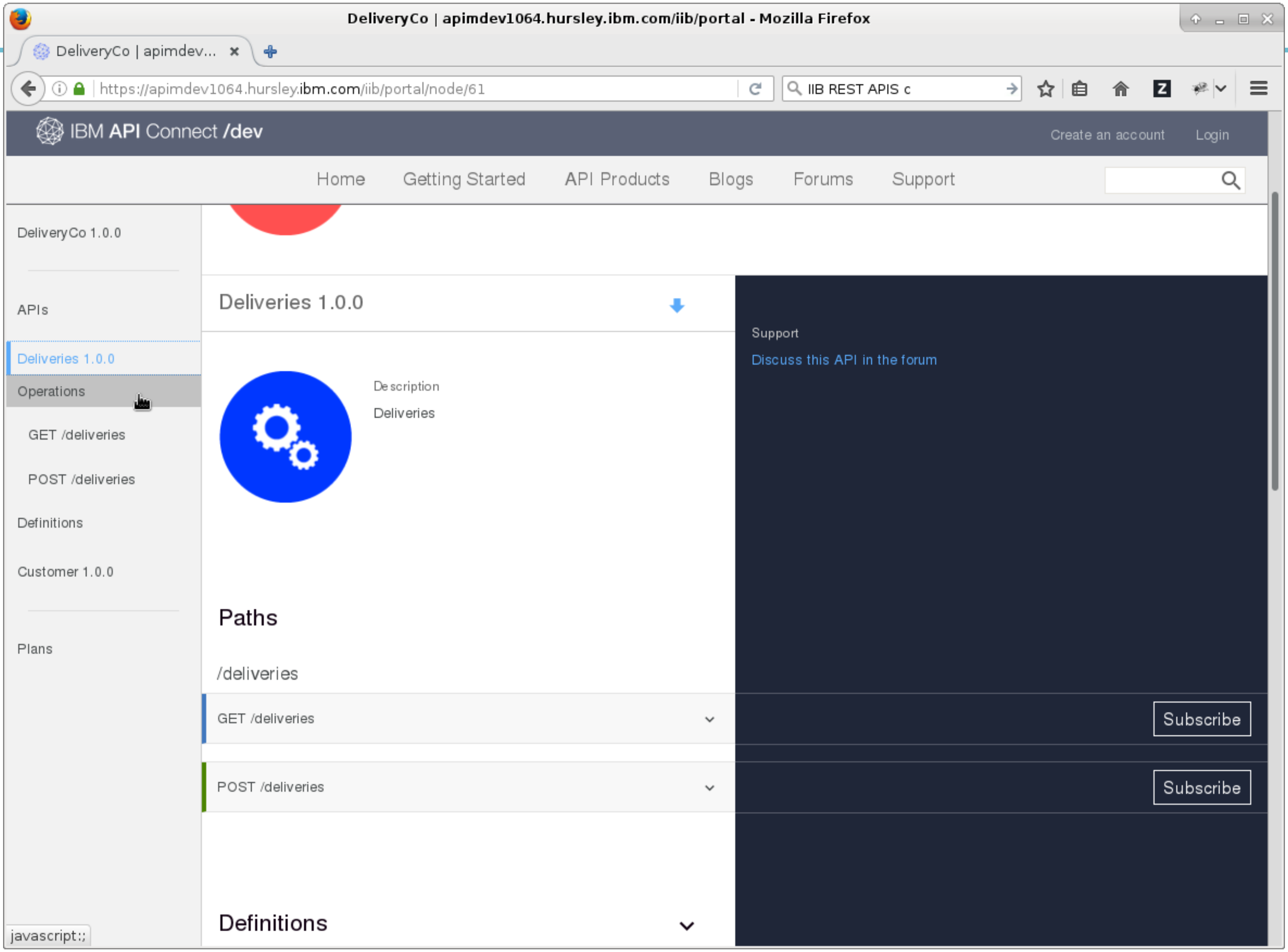
test (v1.0.0)
APIs
No votes yet

MyProduct (v1.0.0)
APIs
No votes yet

Terms of use Privacy policy

Push definitions to IBM API Connect

Demo – Developer Portal


DeliveryCo | apimdev1064.hursley.ibm.com/iib/portal - Mozilla Firefox

https://apimdev1064.hursley.ibm.com/iib/portal/node/61

IBM API Connect /dev

Create an account Login

Home Getting Started API Products Blogs Forums Support

DeliveryCo 1.0.0

APIs

Deliveries 1.0.0

Operations

GET /deliveries

POST /deliveries

Definitions

Customer 1.0.0

Plans

Deliveries 1.0.0

Description

Deliveries

Support

Discuss this API in the forum

Paths

/deliveries

GET /deliveries

POST /deliveries

Subscribe

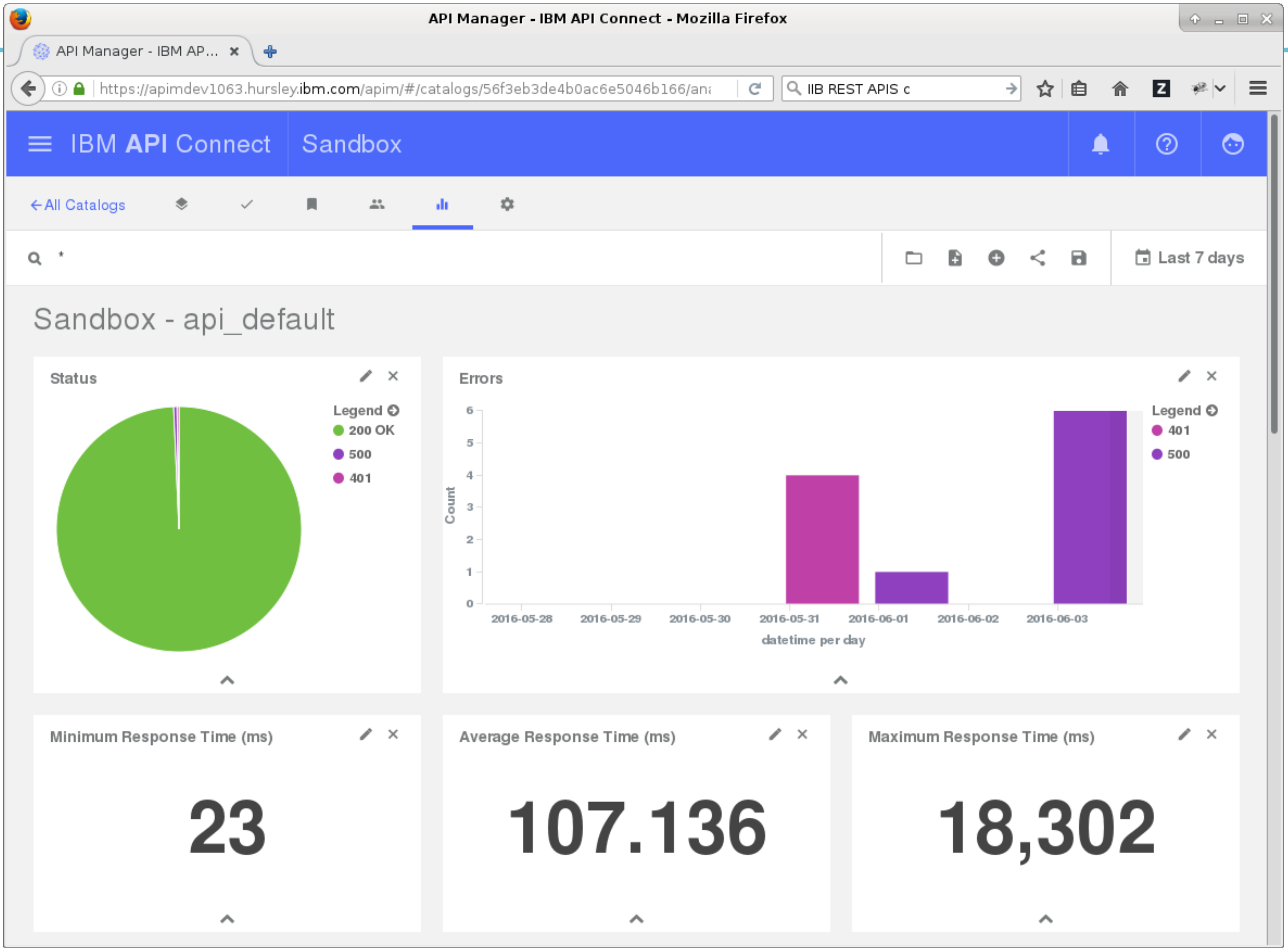
Subscribe

Definitions

javascript:;

Push definitions to IBM API Connect

Demo - Analytics


API Manager - IBM API Connect - Mozilla Firefox

https://apimdev1063.hursley.ibm.com/apim/#/catalogs/56f3eb3de4b0ac6e5046b166/an

IBM API Connect | Sandbox

←All Catalogs

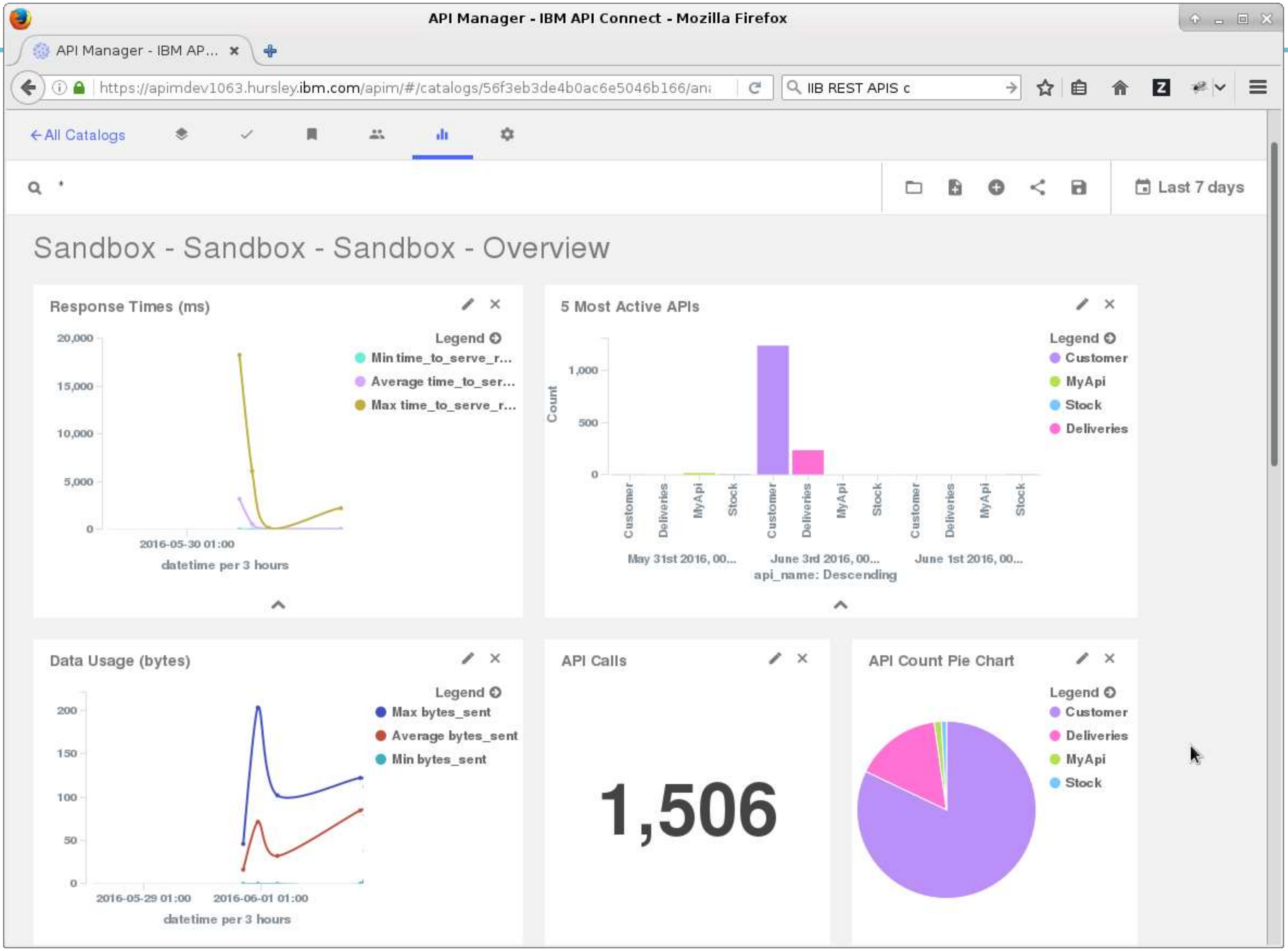
Last 7 days

Sandbox - api_default

Minimum Response Time (ms)	Average Response Time (ms)	Maximum Response Time (ms)
23	107.136	18,302

Push definitions to IBM API Connect

Demo - Analytics

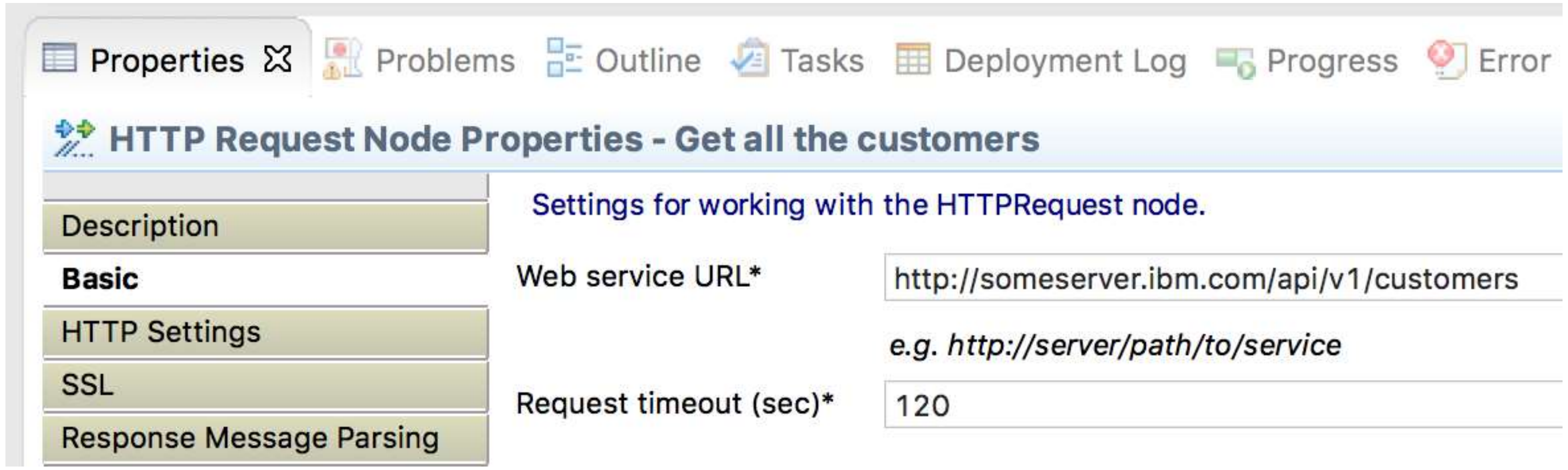

API Manager - IBM API Connect - Mozilla Firefox
API Manager - IBM AP...
https://apimdev1063.hursley.ibm.com/apim/#/catalogs/56f3eb3de4b0ac6e5046b166/ana
IIB REST APIS c
All Catalogs
Last 7 days

Sandbox - Sandbox - Sandbox - Overview

REST Request Node

Calling REST APIs using HTTP Request nodes

- You can call a REST API today in IIB using HTTP Request node.
  - It’s only standard HTTP under the covers!
- This is pretty simple for static URLs:



HTTP Request Node Properties - Get all the customers

Settings for working with the HTTPRequest node.

Web service URL* http://someserver.ibm.com/api/v1/customers

e.g. http://server/path/to/service

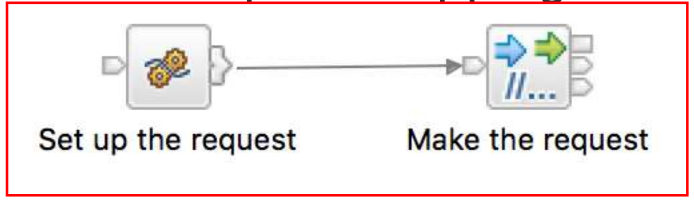
Request timeout (sec)* 120

Calling REST APIs using HTTP Request nodes

- But for dynamic URLs (for example, those with path parameters), it's a bit more involved and usually requires custom code:

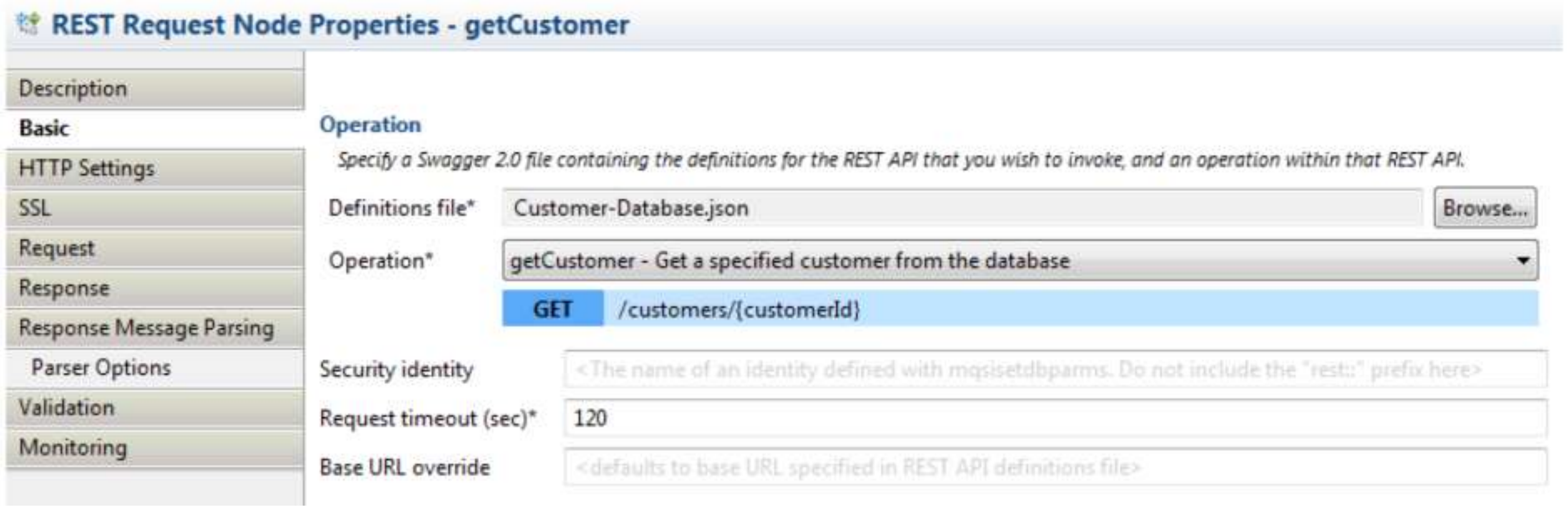
```
SET OutputLocalEnvironment.Destination.HTTP.RequestLine.Method = 'DELETE';
SET OutputLocalEnvironment.Destination.HTTP.RequestURL =
    'http://someserver.ibm.com/api/v1/customers/' ||
    customerId ||
    '/orders/' ||
    orderId ||
    '/items/' ||
    itemId;
SET OutputLocalEnvironment.Destination.HTTP.QueryString.forceDelete = TRUE;
SET OutputLocalEnvironment.Destination.HTTP.QueryString.areYouSure = 'really sure';
SET OutputLocalEnvironment.Destination.HTTP.QueryString.lastChance = 'do it';
```

- Most of the time, you're going to **need** a Compute/Mapping node before the HTTP Request node:



Introducing the REST Request node

- We have provided a new REST Request node to make it much simpler for an IIB flow developer to make a call to a REST API.


REST Request Node Properties - getCustomer

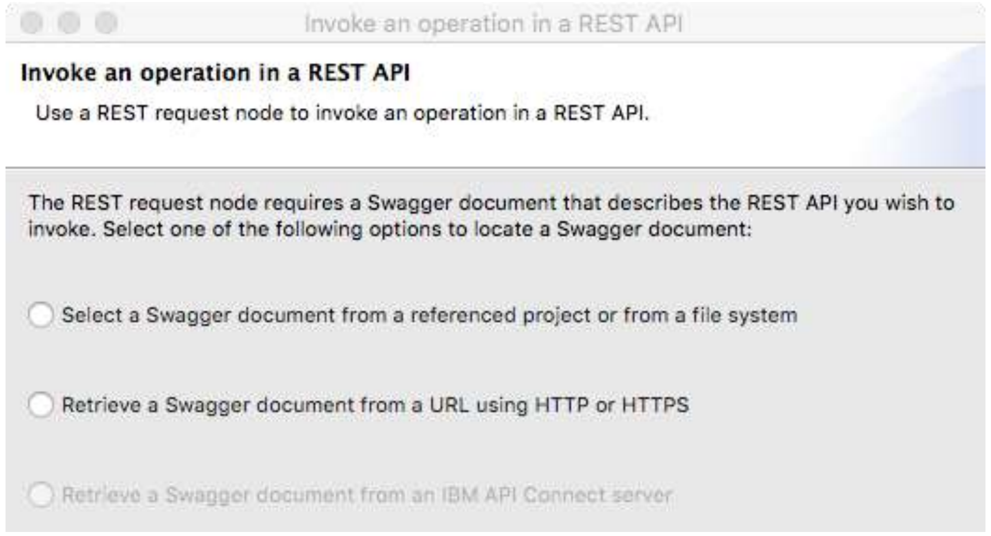
Operation

Specify a Swagger 2.0 file containing the definitions for the REST API that you wish to invoke, and an operation within that REST API.

Definitions file*	Customer-Database.json
Operation*	getCustomer - Get a specified customer from the database
	GET /customers/{customerId}
Security identity	<The name of an identity defined with mqsisetdbparms. Do not include the "rest::" prefix here>
Request timeout (sec)*	120
Base URL override	<defaults to base URL specified in REST API definitions file>

REST Request node and Swagger

- The REST Request node requires a Swagger document.
- Swagger documents can come from many different sources:



Invoke an operation in a REST API

Use a REST request node to invoke an operation in a REST API.

The REST request node requires a Swagger document that describes the REST API you wish to invoke. Select one of the following options to locate a Swagger document:

◯ Select a Swagger document from a referenced project or from a file system

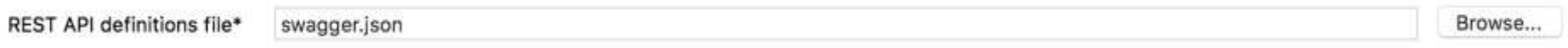
◯ Retrieve a Swagger document from a URL using HTTP or HTTPS

◯ Retrieve a Swagger document from an IBM API Connect server

- Swagger documents also come in two formats (JSON and YAML) - we now support YAML format since 10.0.0.6

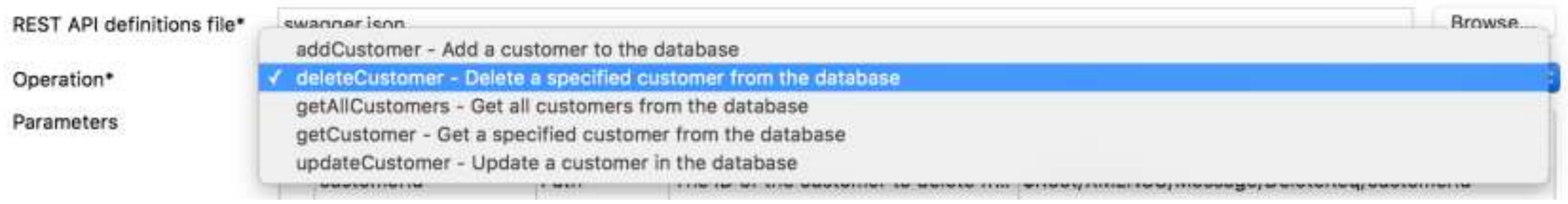
REST Request node configuration

- As before, you supply the REST Request node with a Swagger file:



REST API definitions file* swagger.json Browse...

- The REST Request node uses the information stored in the Swagger file to determine what HTTP call to make:
  - What URL to use (host name, port, SSL/TLS?)
  - What path to use
  - How to encode parameters (path, query, header?)
- You simply pick which operation you want to call and it does the rest!



REST API definitions file* swagger.json Browse...

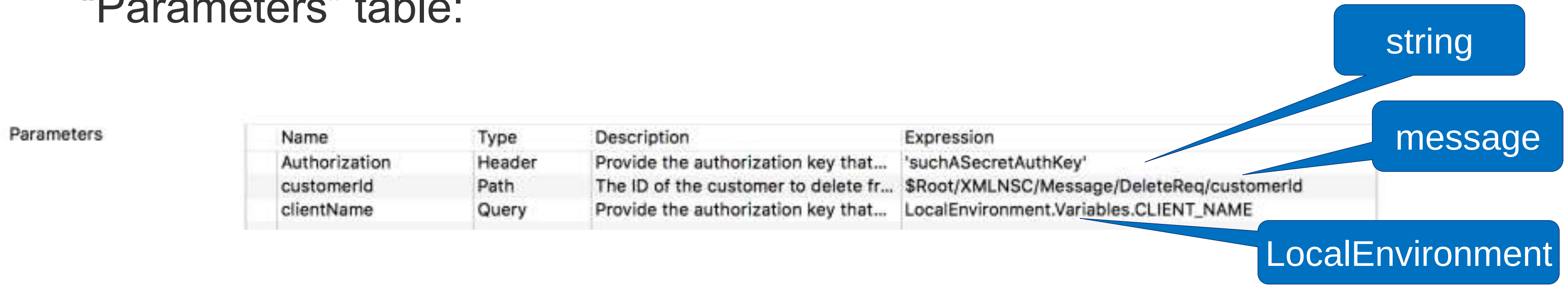
Operation*

Parameters

addCustomer - Add a customer to the database
✓ deleteCustomer - Delete a specified customer from the database
getAllCustomers - Get all customers from the database
getCustomer - Get a specified customer from the database
updateCustomer - Update a customer in the database

REST Request node configuration

- Well… almost! If the operation requires one or more parameters, then you will need to pass these into the REST Request node.
- These can be supplied as XPath or ESQL expressions on the "Parameters" table:



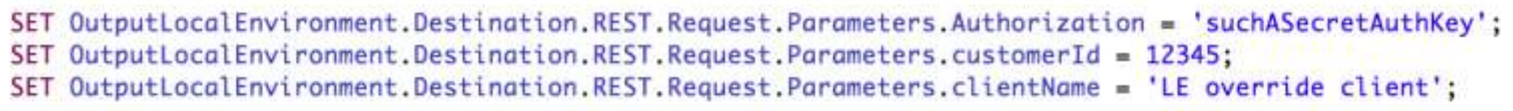
Parameters

Name	Type	Description	Expression
Authorization	Header	Provide the authorization key that...	'suchASecretAuthKey'
customerId	Path	The ID of the customer to delete fr...	$Root/XMLNSC/Message/DeleteReq/customerId
clientName	Query	Provide the authorization key that...	LocalEnvironment.Variables.CLIENT_NAME

- You can specify hard-coded literals (strings, numbers, or booleans).
- You can also extract information from the input message (message, local environment, environment, exception list).

REST Request node configuration

- You do not have to fill in the expressions on the “Parameters” table.
    - Even if the parameter is marked as required in the Swagger document!
- As an alternative, you can specify the parameter values in the Local Environment – there is a new folder for REST Request node overrides:

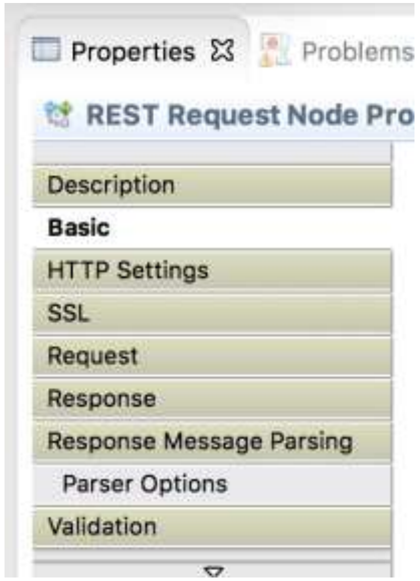


```
SET OutputLocalEnvironment.Destination.REST.Request.Parameters.Authorization = 'suchASecretAuthKey';
SET OutputLocalEnvironment.Destination.REST.Request.Parameters.customerId = 12345;
SET OutputLocalEnvironment.Destination.REST.Request.Parameters.clientName = 'LE override client';
```

- It is an error to not provide a value for a parameter that is marked as required in the Swagger document:
    - BIPxxxxE: No value could be found for the required parameter 'clientName'.

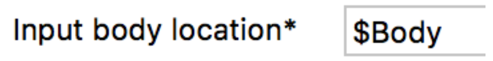
REST Request node configuration

- The other node options are familiar:
  - HTTP settings
  - SSL/TLS settings
  - Request/response message tree locations
  - Parser choice and parser options
  - Validation
  - Monitoring

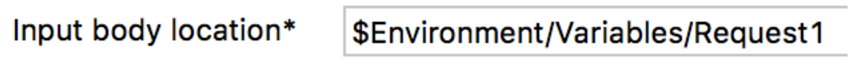


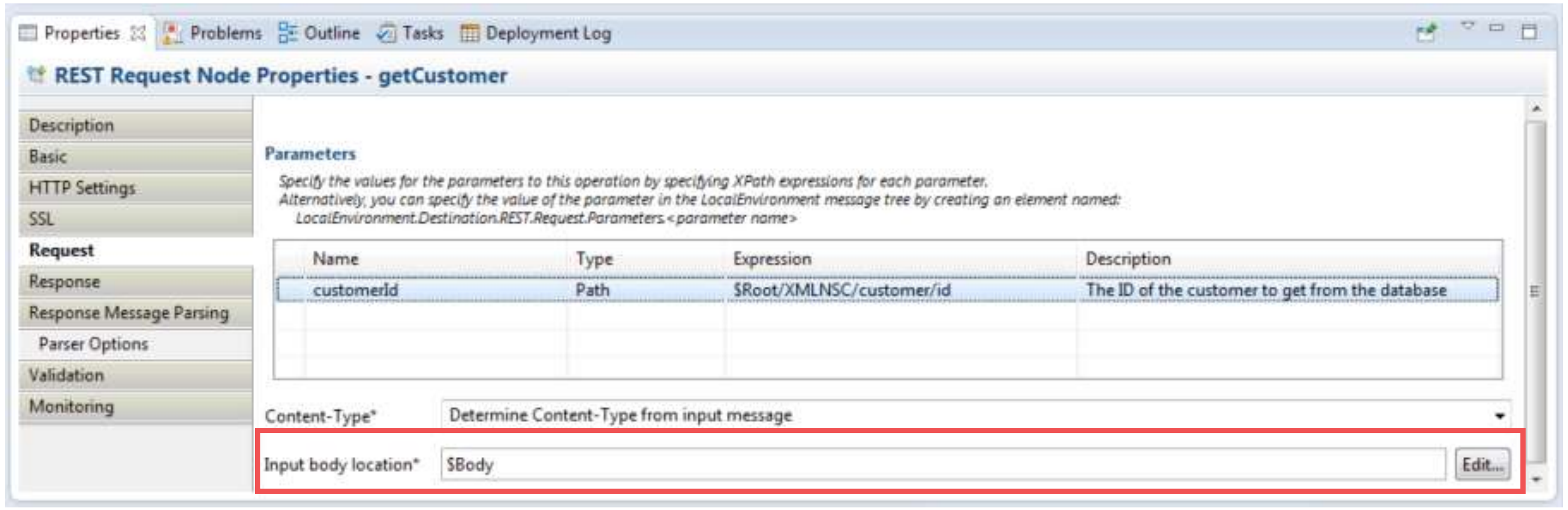
REST Request node request body

- The request body will be sent from the input message as per any other request node.
- Can modify the request body location – for example, to send a JSON request that has been placed into the Environment tree.


Input body location* $Body

Or, for example, you can specify a location in the Environment tree.


Input body location* $Environment/Variables/Request1



REST Request Node Properties - getCustomer

Parameters

Specify the values for the parameters to this operation by specifying XPath expressions for each parameter.
Alternatively, you can specify the value of the parameter in the LocalEnvironment message tree by creating an element named:
LocalEnvironment.Destination.REST.Request.Parameters.<parameter name>

Name	Type	Expression	Description
customerId	Path	$Root/XMLNSC/customer/id	The ID of the customer to get from the database

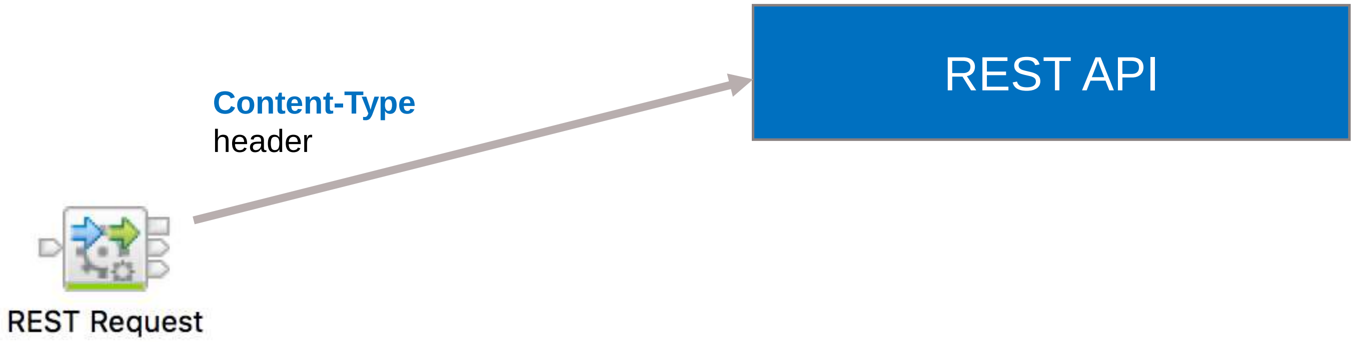
Content-Type* Determine Content-Type from input message

Input body location* $Body

REST Request node request headers

- A **Content-Type** header is sent in the request to describe the type of the data in the request body:

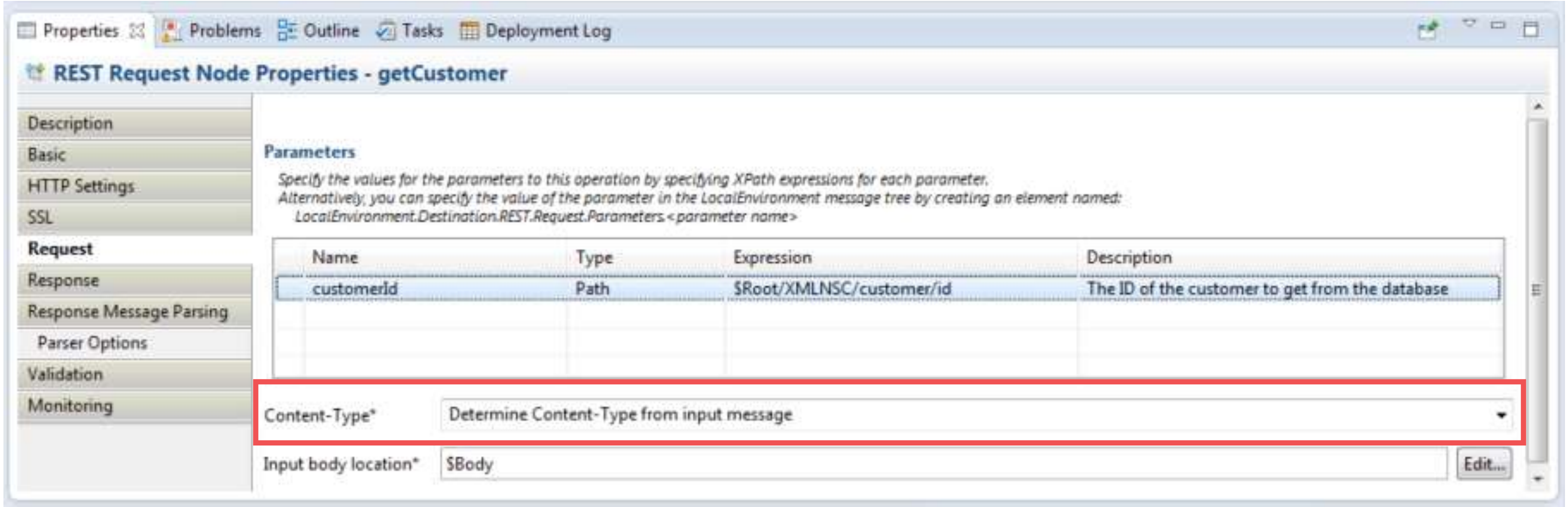
- Defaults to a sensible one for the parser in use (application/json for JSON, application/xml for XML/XMLNS/XMLNSC).
- The Swagger document can specify supported Content-Type values.
- You can select one of these, or type in your own value.



Content-Type* Determine Content-Type from input message

or

Content-Type* application/vnd.github.v3.text+json



REST Request Node Properties - getCustomer

Parameters

Specify the values for the parameters to this operation by specifying XPath expressions for each parameter.
Alternatively, you can specify the value of the parameter in the LocalEnvironment message tree by creating an element named:
LocalEnvironment.Destination.REST.Request.Parameters.<parameter name>

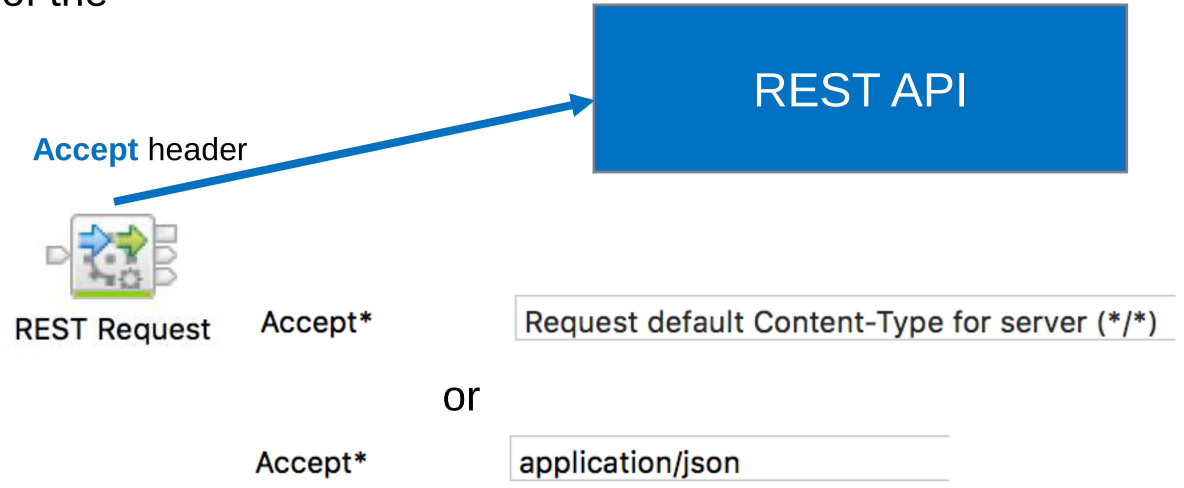
Name	Type	Expression	Description
customerId	Path	$Root/XMLNSC/customer/id	The ID of the customer to get from the database

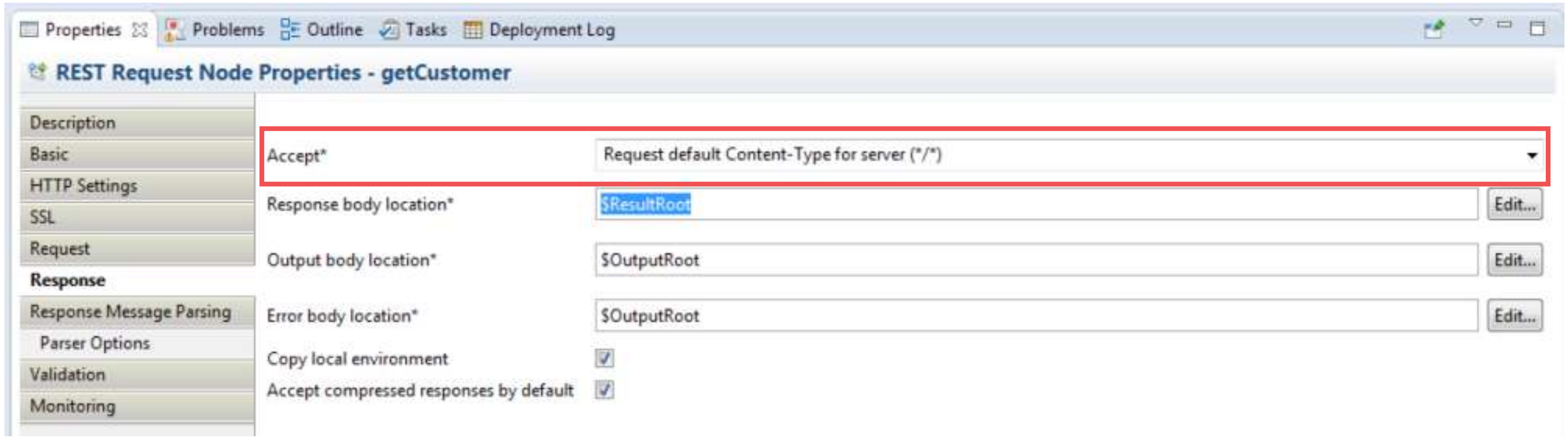
Content-Type* Determine Content-Type from input message

Input body location* $Body

REST Request node request headers

- An **Accept** header is sent in the request to describe the type of the data that we want in the response body from the server.
- Defaults to */* which is “let the server decide the default”.
- The Swagger document can specify supported Accept values.
  - The same operation might return either XML or JSON.
  - You specify which one you want by setting the Accept header.





Properties | Problems | Outline | Tasks | Deployment Log

REST Request Node Properties - getCustomer

Description
Basic
HTTP Settings
SSL
Request
Response
Response Message Parsing
Parser Options
Validation
Monitoring

Accept*	Request default Content-Type for server (*/*)
Response body location*	$ResultRoot
Output body location*	$OutputRoot
Error body location*	$OutputRoot
Copy local environment	✓
Accept compressed responses by default	✓

REST Request node response body

- By default the whole of the response body is placed into the output message at the specified location.
- However you can also select a specific part of the response body to place into the location specified in the output message.
- You can use this if your REST API returns a large amount of data, but you only want a specific section of that data.

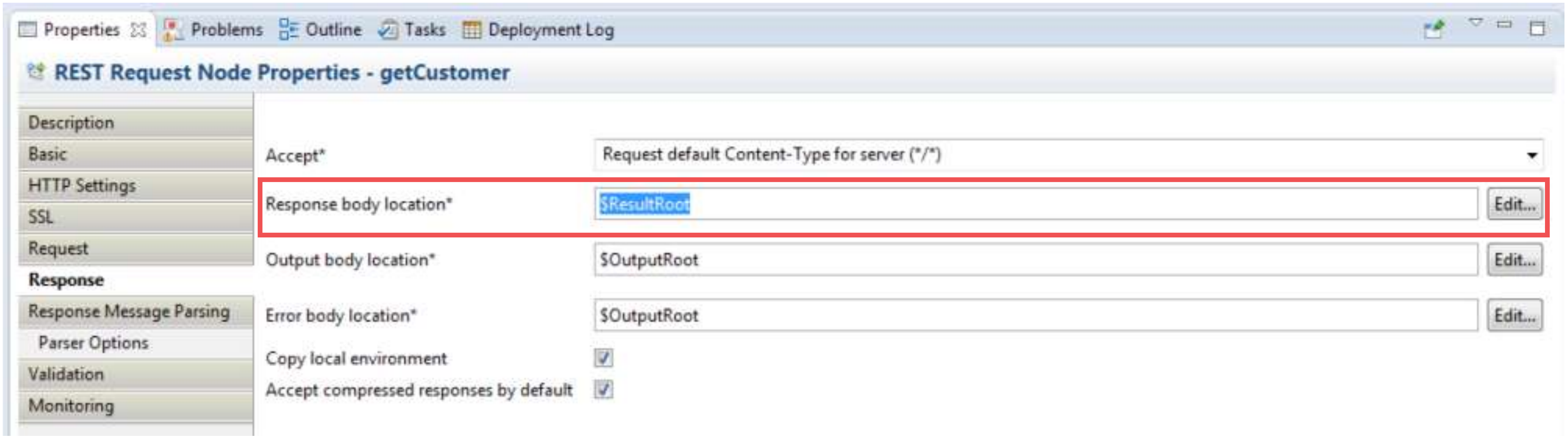
The entire response from the REST API is used.

Response body location* $ResultRoot

or

Response body location* $ResultRoot/JSON/Data/Customers/Item[2]/id

Only part of the response from the REST API is used.



REST Request Node Properties - getCustomer

Accept*	Request default Content-Type for server (*/*)
Response body location*	$ResultRoot
Output body location*	$OutputRoot
Error body location*	$OutputRoot
Copy local environment	✓
Accept compressed responses by default	✓

REST Request node output body

- By default, the node will replace the input message with an output message containing the response body.
- Can modify the output body location – for example, to place a JSON response in the Local Environment tree. You can use this to combine the input message with the output message.

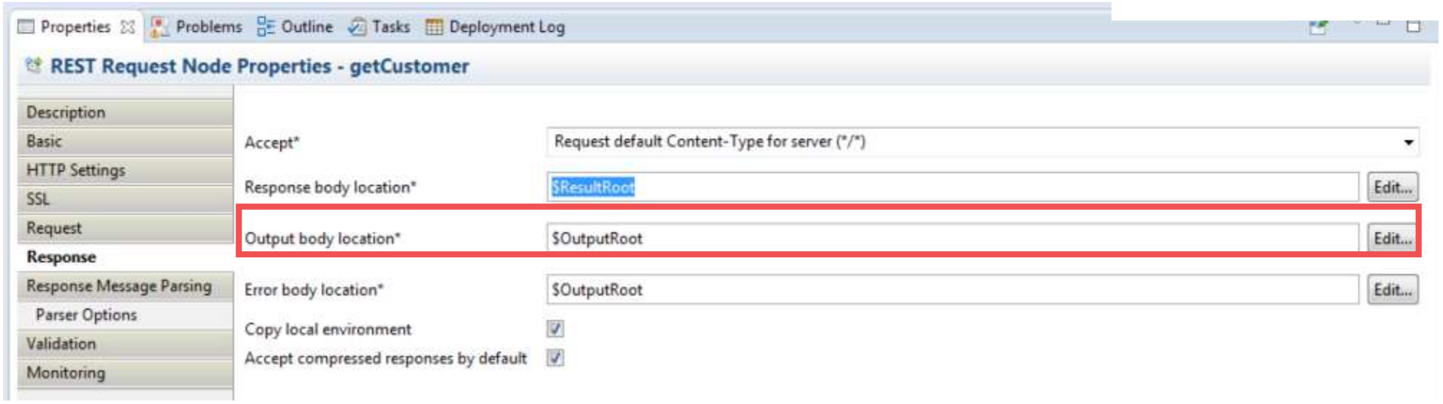
Response from the REST API is placed in the output message that is propagated from the REST Request node.

Output body location* $OutputRoot

or

Output body location* $OutputLocalEnvironment/Variables/Response1

Response from the REST API is placed in the Local Environment so that it can be accessed later on and combined with other data.

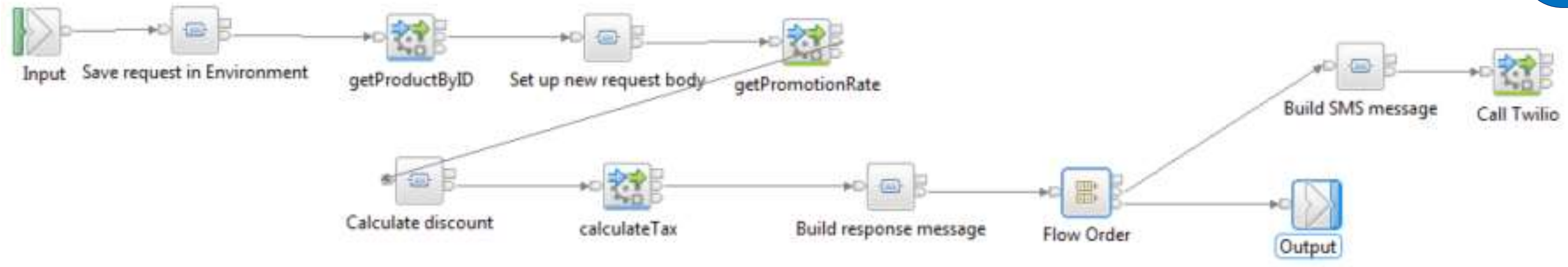


Properties | Problems | Outline | Tasks | Deployment Log

REST Request Node Properties - getCustomer

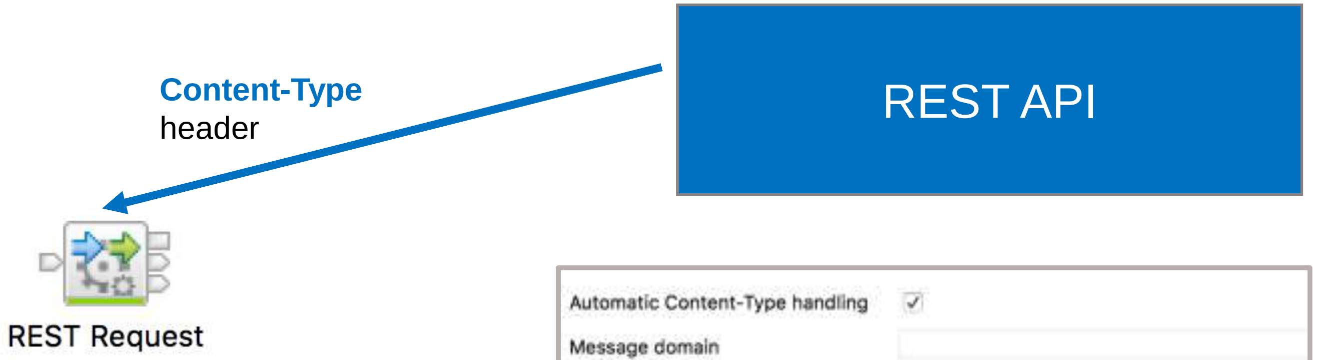
Description | Basic | HTTP Settings | SSL | Request | **Response** | Response Message Parsing | Parser Options | Validation | Monitoring

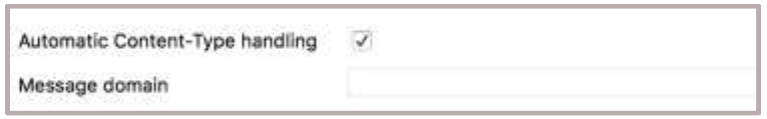
Accept*	Request default Content-Type for server (*/*)	
Response body location*	$ResultRoot	Edit...
Output body location*	$OutputRoot	Edit...
Error body location*	$OutputRoot	Edit...
Copy local environment	✓	
Accept compressed responses by default	✓	



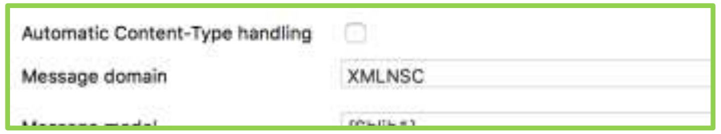
REST Request node response headers

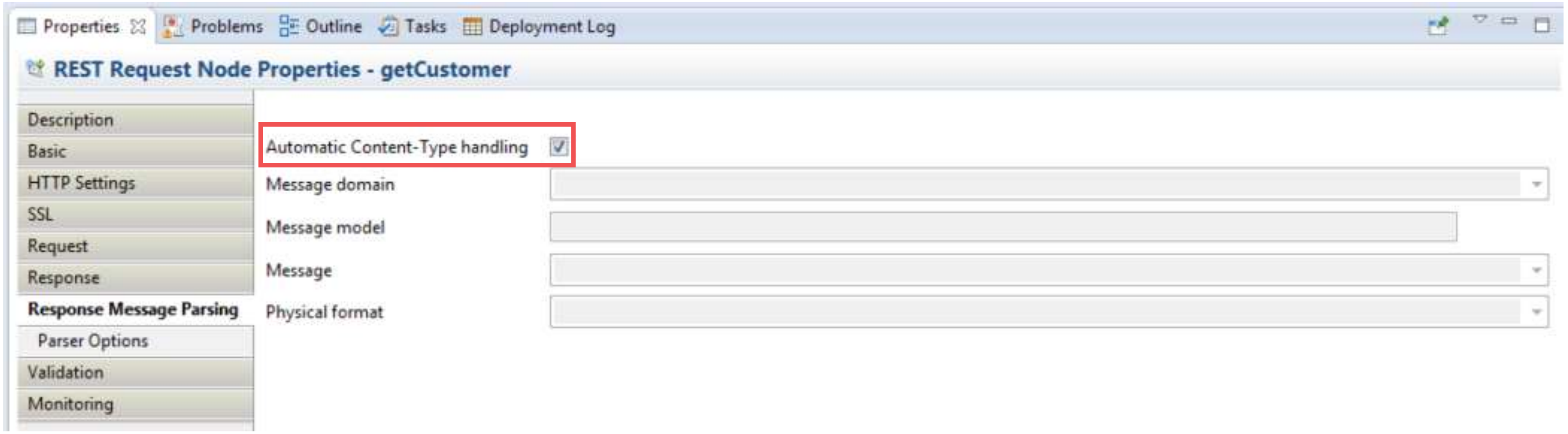
- The response from the REST API should contain a Content-Type header that describes the type of the data in the response body.
- By default, the node will choose the message domain (parser) based on the value of the Content-Type header in the response:
  - For application/json, it will pick JSON
  - For application/xml or text/xml, it will pick XMLNSC
  - Anything not recognized by IIB, it will pick BLOB
- You can disable this functionality and manually specify the parser.




Automatic Content-Type handling ✓
Message domain

or


Automatic Content-Type handling ☐
Message domain XMLNSC
Message model



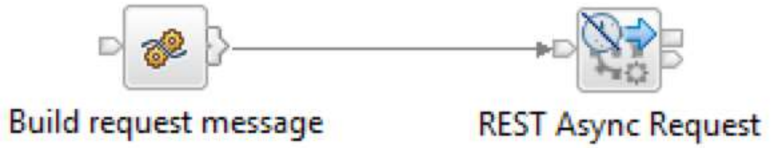
REST Request Node Properties - getCustomer

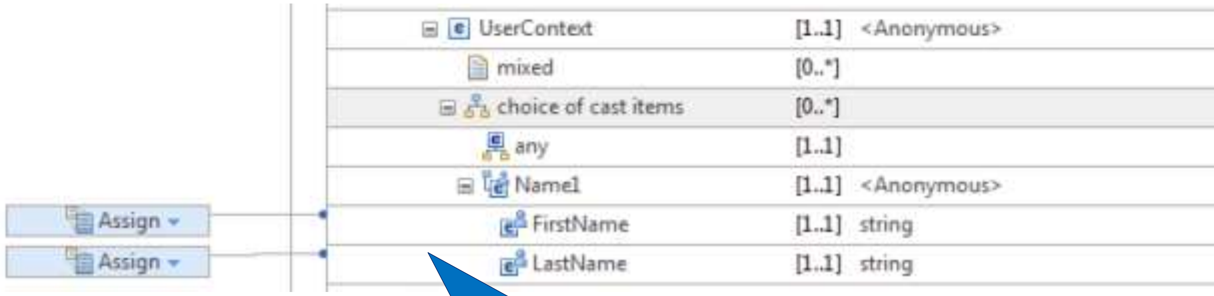
Automatic Content-Type handling ✓
Message domain
Message model
Message
Physical format

REST Request node **and friends!**

- New REST Async Request/Response nodes allows splitting of request and response processing into separate threads of execution:

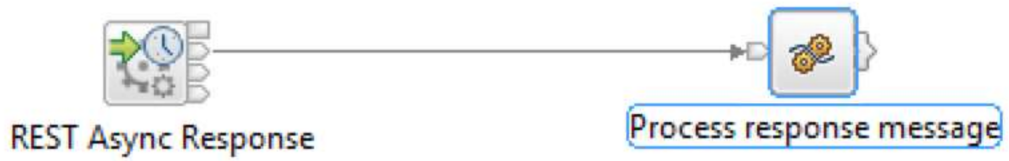
Thread 1





UserContext	[1..1]	<Anonymous>
mixed	[0..*]	
choice of cast items	[0..*]	
any	[1..1]	
Name1	[1..1]	<Anonymous>
Assign FirstName	[1..1]	string
Assign LastName	[1..1]	string

Thread 2

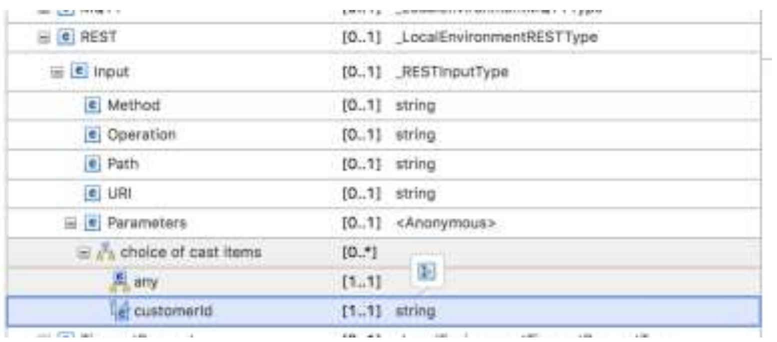


Share User Context between REST Async Request/Response nodes

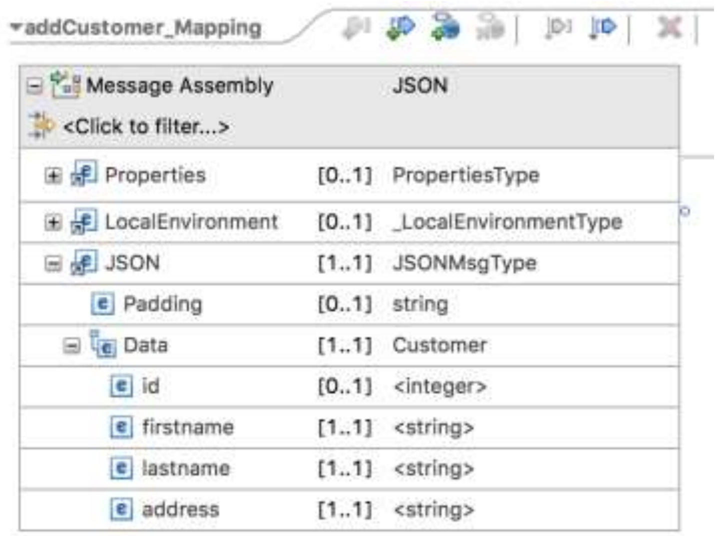
- Request and response processing is handled as separate transactions.

REST Request node and the graphical mapper

- The graphical mapper already supports using parameter information and JSON Schema from Swagger documents as part of our REST API support.
- Functionality enhanced so that the mapper can provide assistance for mapping request/response data for the REST Request node:



REST	[0..1]	_LocalEnvironmentRESTType
Input	[0..1]	_RESTInputType
Method	[0..1]	string
Operation	[0..1]	string
Path	[0..1]	string
URI	[0..1]	string
Parameters	[0..1]	<Anonymous>
choice of cast items	[0..*]	
any	[1..1]	
customerId	[1..1]	string



addCustomer_Mapping

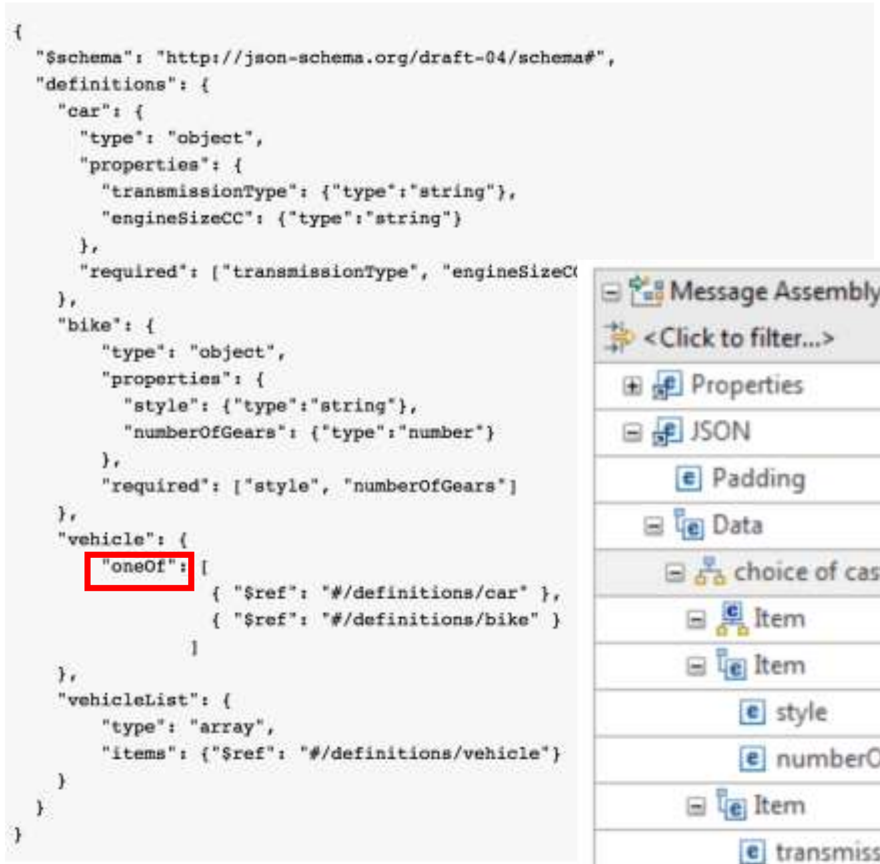
Message Assembly		JSON
<Click to filter...>		
Properties	[0..1]	PropertiesType
LocalEnvironment	[0..1]	_LocalEnvironmentType
JSON	[1..1]	JSONMsgType
Padding	[0..1]	string
Data	[1..1]	Customer
id	[0..1]	<integer>
firstname	[1..1]	<string>
lastname	[1..1]	<string>
address	[1..1]	<string>

- JSON types from both JSON schema and REST Swagger documents are available for performing mapping casts, enabling you to work with REST request nodes that place data in the environment tree.

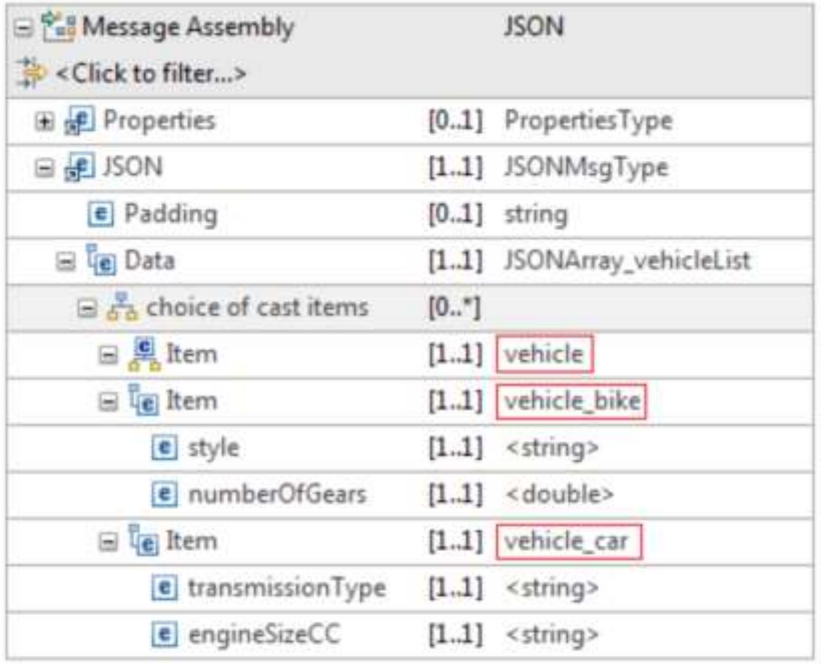
New allOf, oneOf, anyOf support in graphical mapper

- IIBv10.0.0.8 adds support for three further JSON constructs: allOf, anyOf and oneOf. These combination keywords facilitate the reuse of defined structures in your JSON schema.

- The allOf keyword lets you extend a structure with additional fields.
- The oneOf keyword lets you specify a structure which is valid if it matches *exactly* one of the defined options.
- For example, consider the example JSON schema definition below which has an array of vehicles, each of which is either a car or a bike.
- The anyOf keyword is similar to oneOf, but specifies that one *or more* of the contained structures must validate against the instance value.



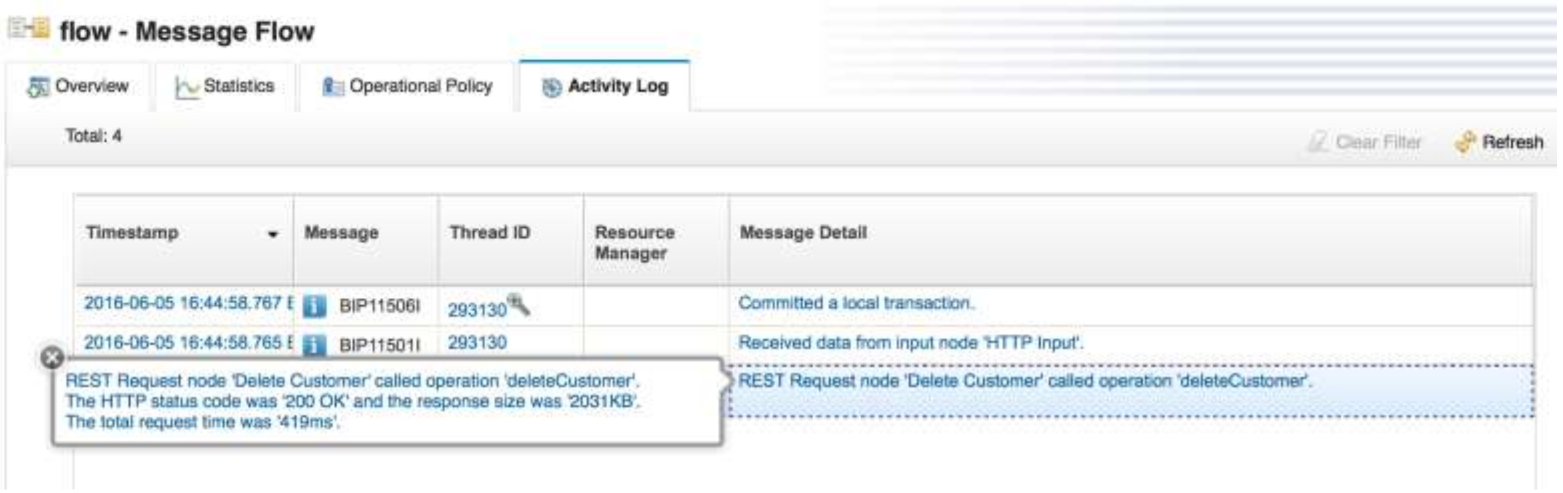
```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "definitions": {
    "car": {
      "type": "object",
      "properties": {
        "transmissionType": {"type":"string"},
        "engineSizeCC": {"type":"string"}
      },
      "required": ["transmissionType", "engineSizeC
    },
    "bike": {
        "type": "object",
        "properties": {
          "style": {"type":"string"},
          "numberOfGears": {"type":"number"}
        },
        "required": ["style", "numberOfGears"]
    },
    "vehicle": {
        "oneOf": [
                { "$ref": "#/definitions/car" },
                { "$ref": "#/definitions/bike" }
              ]
    },
    "vehicleList": {
        "type": "array",
        "items": {"$ref": "#/definitions/vehicle"}
    }
  }
}
```



```
Message Assembly                         JSON
<Click to filter...>
  Properties                    [0..1]  PropertiesType
  JSON                          [1..1]  JSONMsgType
    Padding                     [0..1]  string
    Data                        [1..1]  JSONArray_vehicleList
      choice of cast items      [0..*]
        Item                    [1..1]  vehicle
        Item                    [1..1]  vehicle_bike
          style                 [1..1]  <string>
          numberOfGears         [1..1]  <double>
        Item                    [1..1]  vehicle_car
          transmissionType      [1..1]  <string>
          engineSizeCC          [1..1]  <string>
```

Activity logging for the REST Request node

- REST Request node will have activity logging.
- All requests will be logged to the activity log for the message flow, along with the HTTP status code, response size, and total request time.
- Visible through command line, web UI, and Integration API.


flow - Message Flow

Overview | Statistics | Operational Policy | Activity Log

Total: 4

Clear Filter | Refresh

Timestamp	Message	Thread ID	Resource Manager	Message Detail
2016-06-05 16:44:58.767 E	BIP11506I	293130		Committed a local transaction.
2016-06-05 16:44:58.765 E	BIP11501I	293130		Received data from input node 'HTTP Input'.
				REST Request node 'Delete Customer' called operation 'deleteCustomer'.

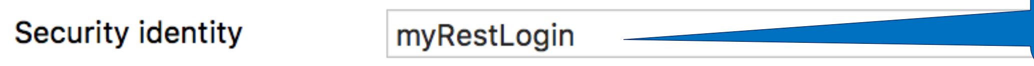
REST Request node 'Delete Customer' called operation 'deleteCustomer'. The HTTP status code was '200 OK' and the response size was '2031KB'. The total request time was '419ms'.

Outbound security for the REST Request node

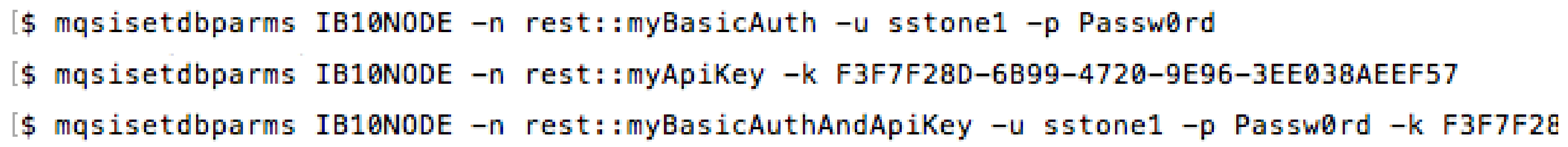
- A lot of REST APIs are going to be secured:
    - HTTP Basic Authentication (username + password)
    - API authorization key passed as header or query parameter
    - OAuth2
    - SSL/TLS client or mutual authentication
- HTTP Basic Authentication is not currently a simple experience for the IIB flow developer when using an HTTP Request node:
    - Place user ID/password in Properties tree
    - And, use default propagation policy set (which is not on by default!)
    - Or, create your own Authorization header

Outbound security for the REST Request node

- We are going to make it easier to use the following security mechanisms:
  - HTTP Basic Authentication (username + password)
  - API authorization key passed as header or query parameter
- We **do not** support OAuth2 at the moment.
- There will be a new security identity property on the node.
- You can use mqsisetdbparms to set the username + password and/or API authorization key and the node will take care of the authentication.

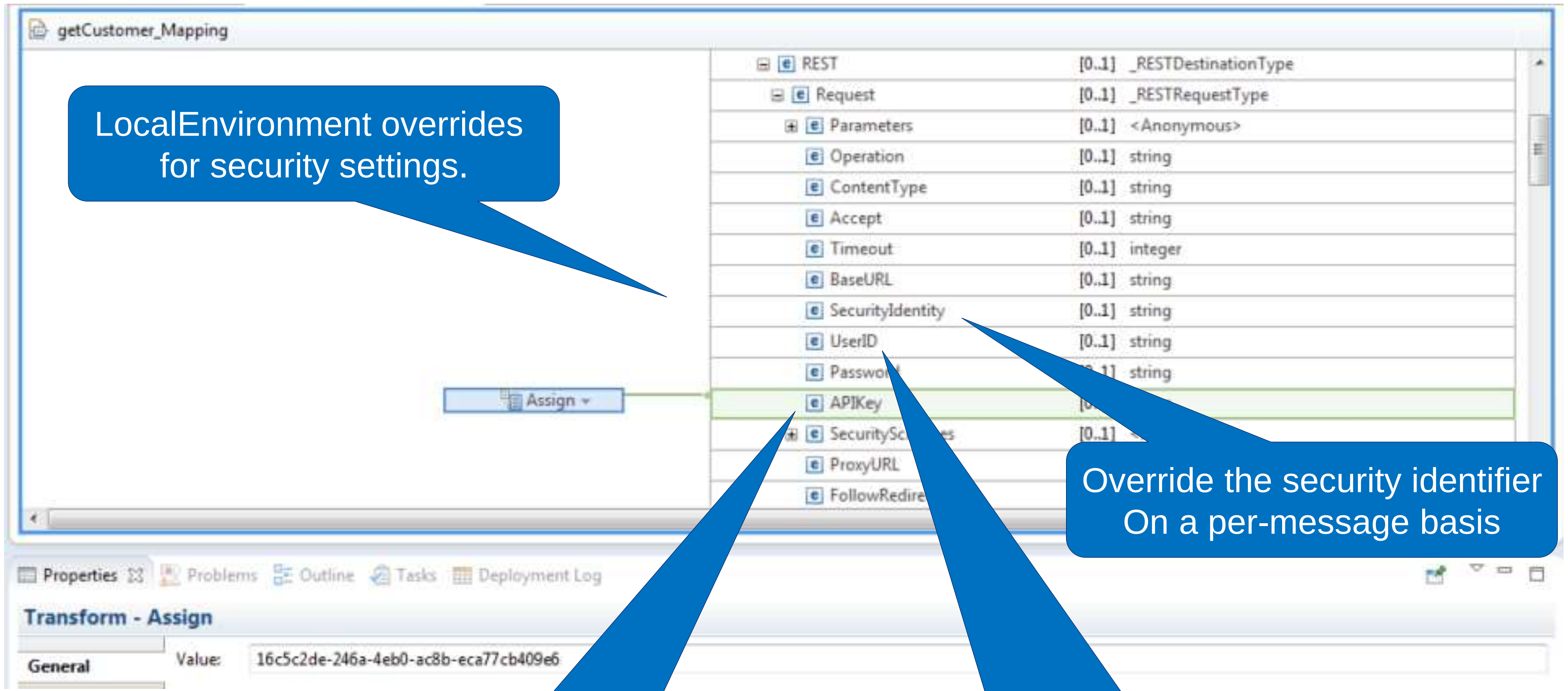

Security identity myRestLogin

Security Identifier defined on the REST Request node


```
[$ mqsisetdbparms IB10NODE -n rest::myBasicAuth -u sstone1 -p Passw0rd
[$ mqsisetdbparms IB10NODE -n rest::myApiKey -k F3F7F28D-6B99-4720-9E96-3EE038AEEF57
[$ mqsisetdbparms IB10NODE -n rest::myBasicAuthAndApiKey -u sstone1 -p Passw0rd -k F3F7F28
```

Security Identifier used by mqsisetdbparms

Outbound security for the REST Request node



getCustomer_Mapping

REST	[0..1]	_RESTDestinationType
Request	[0..1]	_RESTRequestType
Parameters	[0..1]	<Anonymous>
Operation	[0..1]	string
ContentType	[0..1]	string
Accept	[0..1]	string
Timeout	[0..1]	integer
BaseURL	[0..1]	string
SecurityIdentity	[0..1]	string
UserID	[0..1]	string
Passwo		string
APIKey		
SecuritySc	[0..1]	
ProxyURL		
FollowRedire		

Transform - Assign

General

Value: 16c5c2de-246a-4eb0-ac8b-eca77cb409e6

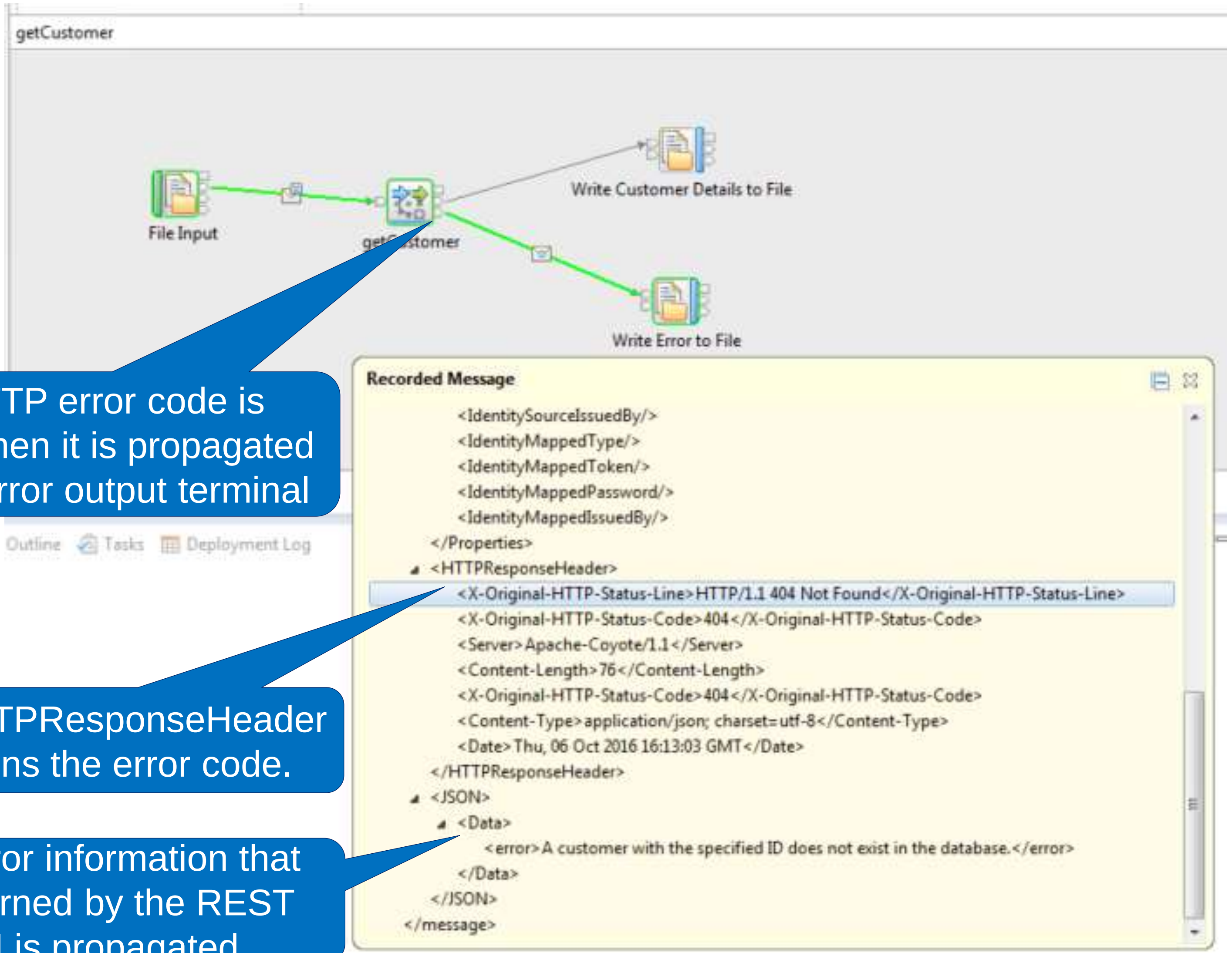
LocalEnvironment overrides for security settings.

Override the security identifier On a per-message basis

Override the username/password for HTTP Basic Authentication

Override the API authorization key

Error handling



```
        <IdentitySourceIssuedBy/>
        <IdentityMappedType/>
        <IdentityMappedToken/>
        <IdentityMappedPassword/>
        <IdentityMappedIssuedBy/>
      </Properties>
    ◢ <HTTPResponseHeader>
        <X-Original-HTTP-Status-Line>HTTP/1.1 404 Not Found</X-Original-HTTP-Status-Line>
        <X-Original-HTTP-Status-Code>404</X-Original-HTTP-Status-Code>
        <Server>Apache-Coyote/1.1</Server>
        <Content-Length>76</Content-Length>
        <X-Original-HTTP-Status-Code>404</X-Original-HTTP-Status-Code>
        <Content-Type>application/json; charset=utf-8</Content-Type>
        <Date>Thu, 06 Oct 2016 16:13:03 GMT</Date>
      </HTTPResponseHeader>
    ◢ <JSON>
      ◢ <Data>
          <error>A customer with the specified ID does not exist in the database.</error>
        </Data>
      </JSON>
    </message>
```

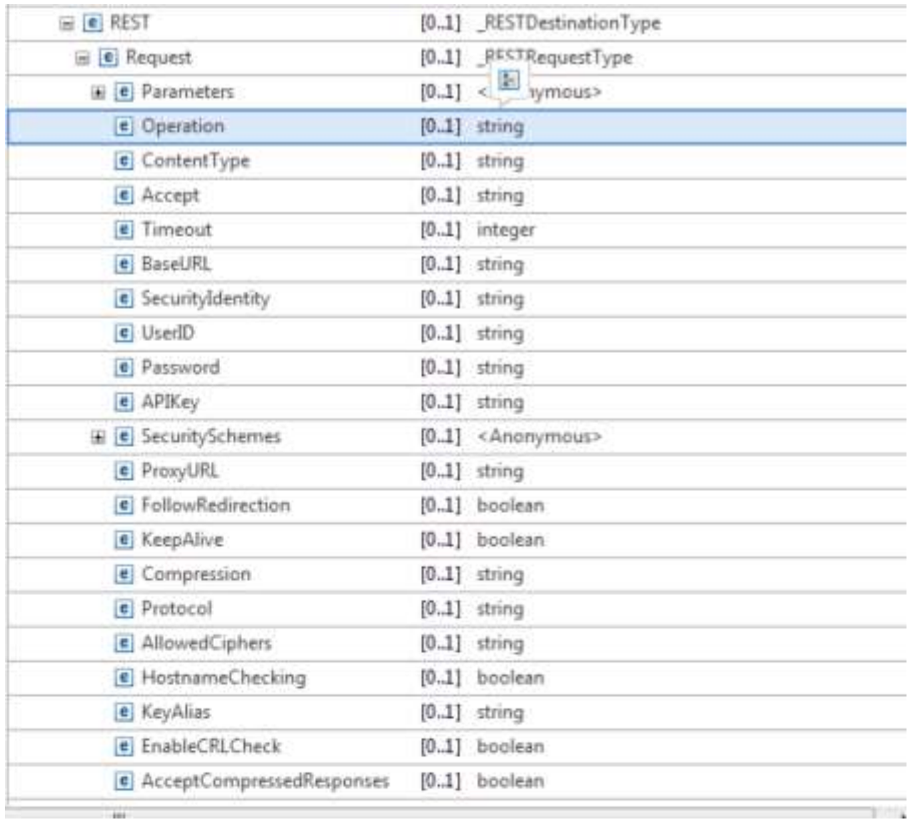
If an HTTP error code is returned, then it is propagated from the Error output terminal

The HTTPResponseHeader contains the error code.

Any error information that is returned by the REST API is propagated.

Local Environment

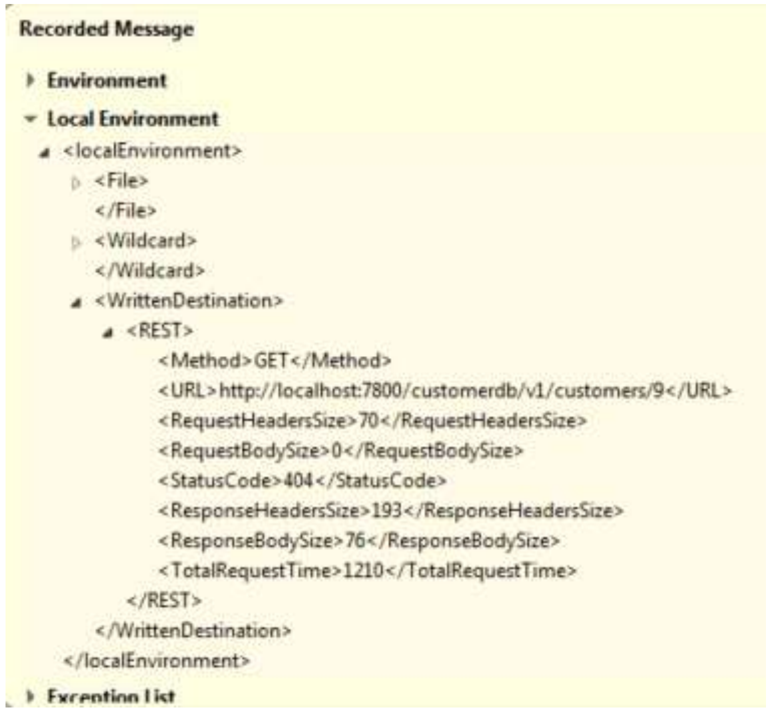
- The REST request nodes support an extensive set of Local Environment overrides that can be used to dynamically change the configuration of the REST request node at runtime.
- These Local Environment overrides include:
  - The operation name.
  - The values for parameters to the operation.
  - The values of the “Content-Type” and “Accept” node properties.
  - The value of the “Security identity” node property.
  - Usernames, passwords, and API keys can also be specified.
  - The value of the “Base URL” node property.



REST	[0..1]	_RESTDestinationType
Request	[0..1]	_RESTRequestType
Parameters	[0..1]	<Anonymous>
Operation	[0..1]	string
ContentType	[0..1]	string
Accept	[0..1]	string
Timeout	[0..1]	integer
BaseURL	[0..1]	string
SecurityIdentity	[0..1]	string
UserID	[0..1]	string
Password	[0..1]	string
APIKey	[0..1]	string
SecuritySchemes	[0..1]	<Anonymous>
ProxyURL	[0..1]	string
FollowRedirection	[0..1]	boolean
KeepAlive	[0..1]	boolean
Compression	[0..1]	string
Protocol	[0..1]	string
AllowedCiphers	[0..1]	string
HostnameChecking	[0..1]	boolean
KeyAlias	[0..1]	string
EnableCRLCheck	[0..1]	boolean
AcceptCompressedResponses	[0..1]	boolean

Local Environment - WrittenDestination

- The REST request nodes write a set of properties to the Local Environment output by the node.
- These output properties include:
  - The operation name, HTTP method, and URL used to call the REST API.
  - The size of the HTTP request headers and body sent to the REST API.
  - The size of the HTTP response headers and body received from the REST API.
  - The HTTP status code from the REST API.
  - The total time spent waiting for the response from the REST API.



Recorded Message

- Environment
- Local Environment

```
<localEnvironment>
  <File>
  </File>
  <Wildcard>
  </Wildcard>
  <WrittenDestination>
    <REST>
      <Method>GET</Method>
      <URL>http://localhost:7800/customerdb/v1/customers/9</URL>
      <RequestHeadersSize>70</RequestHeadersSize>
      <RequestBodySize>0</RequestBodySize>
      <StatusCode>404</StatusCode>
      <ResponseHeadersSize>193</ResponseHeadersSize>
      <ResponseBodySize>76</ResponseBodySize>
      <TotalRequestTime>1210</TotalRequestTime>
    </REST>
  </WrittenDestination>
</localEnvironment>
```

- Exception List

Demo:
Rest Request
Node

Links

Articles:

IIB V10.0.0.5 Push to API Connect
https://developer.ibm.com/integration/blog/2016/05/31/expose-your-integrations-to-your-organization-as-rest-apis-using-ibm-integration-bus-and-ibm-api-connect/

IIB V10.0.0.5 Push to API Connect using Secure Gateway
https://developer.ibm.com/integration/blog/2016/06/06/pushing-rest-apis-to-ibm-api-connect-provisioned-on-bluemix-and-accessing-them-through-a-secure-gateway-service/

10.0.0.6 REST Request :
https://developer.ibm.com/integration/blog/2016/09/27/consuming-rest-apis-by-using-the-new-rest-request-nodes-in-ibm-integration-bus/

Links

Videos:

10.0.04: REST, Graphical Mapper & Salesforce
https://youtu.be/XIK6QvNSHdY

10.0.0.5: Pushing REST APIs from IIB to API Connect
https://youtu.be/KTP94zIHKyI

10.0.0.5: Pushing REST APIs from IIB to API Connect on Bluemix and using Secure Gateway
https://youtu.be/JSgXum-iJnk

10.0.0.6 REST Request node: https://www.youtube.com/watch?v=r1EWkSWjnR8

10.0.0.6 Using REST Request node with security:
https://www.youtube.com/watch?v=C_6gPlrCHZQ

Summary

- IIB provides first class support for developing REST APIs to receive inbound requests and send back responses.
- The REST APIs can be created from scratch or a swagger (json or yaml) can be imported.
- The REST API catalog is shown in the project explorer where you can see at a glance the operations and their type (GET/POST etc)

- REST APIs can be pushed to API Connect and staged in a product using toolkit/webui/command line.

- IIB provides first class support for sending outbound requests and receiving responses to REST APIs using the REST Request, REST Async Request and REST Async Response nodes.
- Easy to configure parameters for operations on the REST Request node.
- Easier way to configure security on REST Request node.

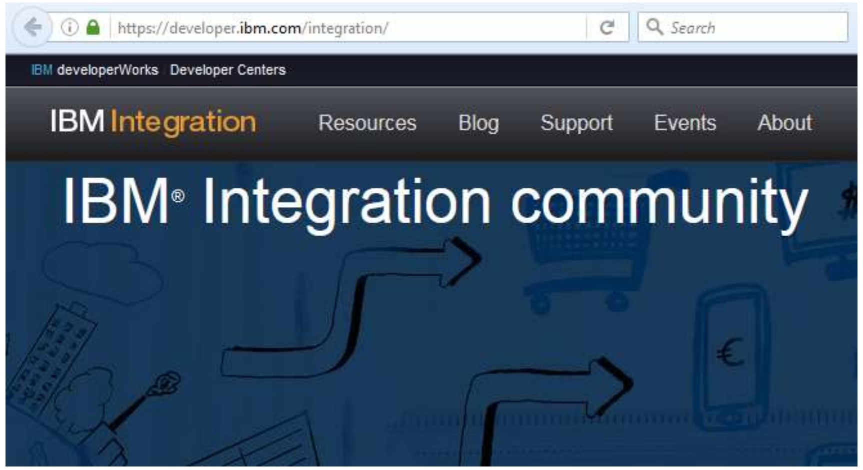
IIB Sessions at Interconnect 2017

Session	Who	Time
2110A What's New in IBM Integration Bus	BT	Monday 16:15 – 17:00
2141A IBM Integration Bus Futures and Strategy **(Inner Circle only)**	BT	Tuesday 11:30 – 12:15
2158A Technical Introduction to IBM Integration Bus	GG	Tuesday 13:30 – 14:15
2118A Developing Integrations for IBM Integration Bus on Cloud	GG	Tuesday 14:30 – 15:15
2144A IBM Integration Bus Customer Roundtable	BT	Tuesday 15:45 – 16:30
2121A Docker and IBM Integration Bus	GG	Wednesday 09:00 – 09:45
2151A Effective Administration of IBM Integration Bus	SN	Wednesday 10:15 – 11:00
2144B IBM Integration Bus Customer Roundtable	BT	Wednesday 16:15 – 17:00
2124A Operational and Business Monitoring with IBM Integration Bus	SN	Thursday 09:30 – 10:15
2111A IBM Integration Bus and REST APIs	SN	Thursday 10:30 – 11:15
2166 IBM Integration Bus Version 10 Hands-On Scheduled Lab	GG+SN	Monday 13:00 – 14:45
9402 IBM Integration Bus Version 10 Hands-On Open Lab	None	Any Open Lab Session

In case powerpoint isn’t your thing …

- https://developer.ibm.com/integration
- Lots of Blog entries, regular updates and links to product demo videos! All our recent enablement material is on youtube

IIB and Kibana dashboards	https://youtu.be/sCPrT2dHKSs
Running IIB in Bluemix Container Service	https://youtu.be/ybGOiPZO3sY
IIB and Kibana dashboards	https://youtu.be/sCPrT2dHKSs
IIB and Hybrid Connect	https://youtu.be/gWbxIooq3_g
IIB and LDAP	https://youtu.be/HrqY9MyfzNs
IIB LoopBack Request node	https://youtu.be/rUK_OQ5-Anw
Using IIB to integrate with MongoDB and Cloudant	https://youtu.be/Is1pphngUlM
Using IIB for REST, Graphical Mapping & Salesforce:	https://youtu.be/XIK6QvNSHdY
IIB, Kafka and Twilio SMS:	https://youtu.be/7mCQ_cfGGtU
Using Kafka with IIB	https://youtu.be/kYv0crxL86Y
Consuming REST APIs using the IIB REST Request node	https://youtu.be/C_6gPlrCHZQ
Easy demo of an IIB App Connect node	https://youtu.be/StwPbOiFKzk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