

# HP Service Virtualization

For the Windows® operating system

Software Version: 2.11

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## User Guide

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# Welcome to HP Service Virtualization

Welcome to Service Virtualization, HP's tool for simulating services during testing.

HP Service Virtualization software allows developers and testers access to limited or unavailable services in a simulated, virtual environment. This helps application teams lower costs and reduce testing times by finding defects earlier in the application life cycle when they are easier, faster, and less expensive to fix. It helps improve quality by enabling quality assurance (QA) teams to test what otherwise couldn't be tested. It also helps isolate problems that are based on dependencies between services in composite applications. This helps significantly reduce delays and manage the costs and complexity of composite application development and testing.

## This chapter includes:

- "How This Guide Is Organized" below
- "Service Virtualization Documentation" on next page
- "What's New in Service Virtualization" on next page

## How This Guide Is Organized

This guide contains the following chapters:

| Chapter   | Description  |
|---|--|
| <b>Chapter 1</b> "Getting Started" on page 13                         | Describes how to install and configure Service Virtualization. |
| <b>Chapter 2</b> "Virtual Services" on page 15                        | Describes what Virtual Services are and how they are used.     |
| <b>Chapter 3</b> "Simulation Modeling" on page 34                     | Describes how to use simulation models.                        |
| <b>Chapter 4</b> "Composite Application Topology" on page 61          | Describes how to use the topology interface.                   |
| <b>Chapter 5</b> "Supported Technologies And Environments" on page 70 | Describes how to install and work with agents.                 |
| <b>Chapter 6</b> "Service Virtualization Server" on page 84           | Describes how to access the Server.                            |
| <b>Chapter 7</b> "Security" on page 86                                | Describes how to define security settings.                     |
| <b>Chapter 8</b> "HP Test Automation Tools Integration" on page 97    | Service Test, Load Runner and Performance Center integration.  |
| <b>Chapter 9</b> "Troubleshooting" on page 101                        | Suggestions for dealing with some issues that may arise.       |
| <b>Chapter 10</b> "Service Virtualization Demos" on page 108          | A series of functional demonstrations.                         |

## Service Virtualization Documentation

Service Virtualization includes the following online documentation:

**HP Service Virtualization Online Help.** Available from the Service Virtualization user interface by clicking in the window and pressing F1 or clicking the **Help** button.

**Printer Friendly Documentation.** Online books can be viewed and printed using Adobe Reader, which can be downloaded from the Adobe Web site. To access, click [www.adobe.com](http://www.adobe.com).

- **HP Service Virtualization User Guide.** can be accessed from **HP Service Virtualization 2.11 > Documentation > User Guide** from the Start menu.

## What's New in Service Virtualization

What's New contains the following parts:

- "What's New in Service Virtualization 2.1" below
- "What's New in Service Virtualization 2.0" on next page

## What's New in Service Virtualization 2.1

- **Performance improvements**

With **HP Service Virtualization Server 64-bit edition**, the simulation performance is now limited only by any limitations of your hardware. You can use an unlimited number of deployed services, and simulate large messages.

For details on hardware prerequisites, see the *HP Service Virtualization Installation Guide*.

- **Security additions**

The enterprise environment sets high requirements for security features of deployed software. HP Service Virtualization Server now adds **Server Authentication**, which restricts access to server management and also encrypts communication between the management client (HP Service Virtualization Designer) and the server.

For details on server authentication, see the *HP Service Virtualization Installation Guide*.

- **Functional improvements**

You can now add dynamic data to simulation. Setting the **Sequential Number Generator** function makes each response unique by setting generated numbers to specific columns. The **Relative Date/Time** function ensures that each date/time value is always up-to-date. Setting a delivery confirmation as "next week" will always return the "next week" date, unlike a fixed recorded date.

For details on dynamic data functions, see the : "[How to Manage Rules](#)" on page 44.

## What's New in Service Virtualization 2.0

- **Enhanced support for service virtualization protocols**

HP Service Virtualization 2.0 now supports a broad set of communication protocols. Developers, functional and performance test engineers can quickly create or provision virtual integration and test environments for Software as a Service (SaaS), Cloud and Mobile applications using **Representational State Transfer (REST) access protocol**.

In addition, HP Service Virtualization 2.0 now supports the virtualization of **IBM® WebSphere® MQ** systems to enable rapid delivery of new applications without the need to access high cost production business systems. Now, users are able to continuously test applications depending on mainframe systems without a need to wait for their availability.

HP Service Virtualization 2.0 also adds support for **Generic XML and Binary** protocol virtualization. It allows creation of virtual testing environments without a necessity of understanding specific message structures. Generic XML allows virtualization of XML oriented protocols with access to non-specific XML messages structure. Generic binary virtualization allows simulation of any other protocol with access to text/binary representation of messages.

Another Service Virtualization 2.0 enhancement is support for **protocols metadata**. Users can now very easily add, modify and manage protocol headers or other transport dependent information that must be used in creation of virtual service models.

- **Enhanced Virtual Services modeling**

Ease of use and intuitive navigation is a key to any productive tool. HP Service Virtualization 2.0 introduces usability enhancements to Service Virtualization Designer. **Enhanced Data Model Editor** allows easier navigation and manipulation of learned, imported or entered data into virtual service models. It also introduces enhanced Virtual Service wizards with easy navigation and filtering of out of the box and custom protocols. Data driven virtualization now support also REST and MQ protocols.

Another addition is the new **Service Description Learning and Editing**. Service Virtualization 2.0 allows creation of Virtual Services without Service Description file (e.g. XSD schema) by selecting non-service-description option in virtual service creation wizard. It also introduces possibility to add schemas to already learned Virtual Services in generic virtualization or edit structure of underlying Service Description.

Message oriented communication is very often asynchronous in its nature. Responses may be in some cases delivered as a sequence of multiple messages. HP Service Virtualization 2.0 now adds support for **Multi-response message simulation**. Virtual services may now learn and simulate response messages split to multiple parts (e.g. large documents), simulate real-time process generating a series of responses (e.g. information stream) or transactions formed as responses from multiple subsystems (e.g. complex provisioning system).

Data driven testing is important for using pre-prepared test datasets, esp. when shared among several tools. Service Virtualization 2.0 now adds support for **Data driving arrays and choices**. This completes set of message type constructs for which external data can be used.

Using **Services Administration** there is now possible to manage services of any connected HP Service Virtualization Server, without necessity to open a project.

- **Functional and technical improvements**

Service Virtualization becomes a critical piece for agile application development and testing. Demand for performance and scalability of service virtualization solutions grows as customers start leveraging its benefits out of project teams across business units and enterprises. HP Service Virtualization 2.0 introduces **15% improvements in performance** of Service Virtualization Server when comparing to previous version as well as enhanced support for centralized deployments.

# Chapter 1

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## Getting Started

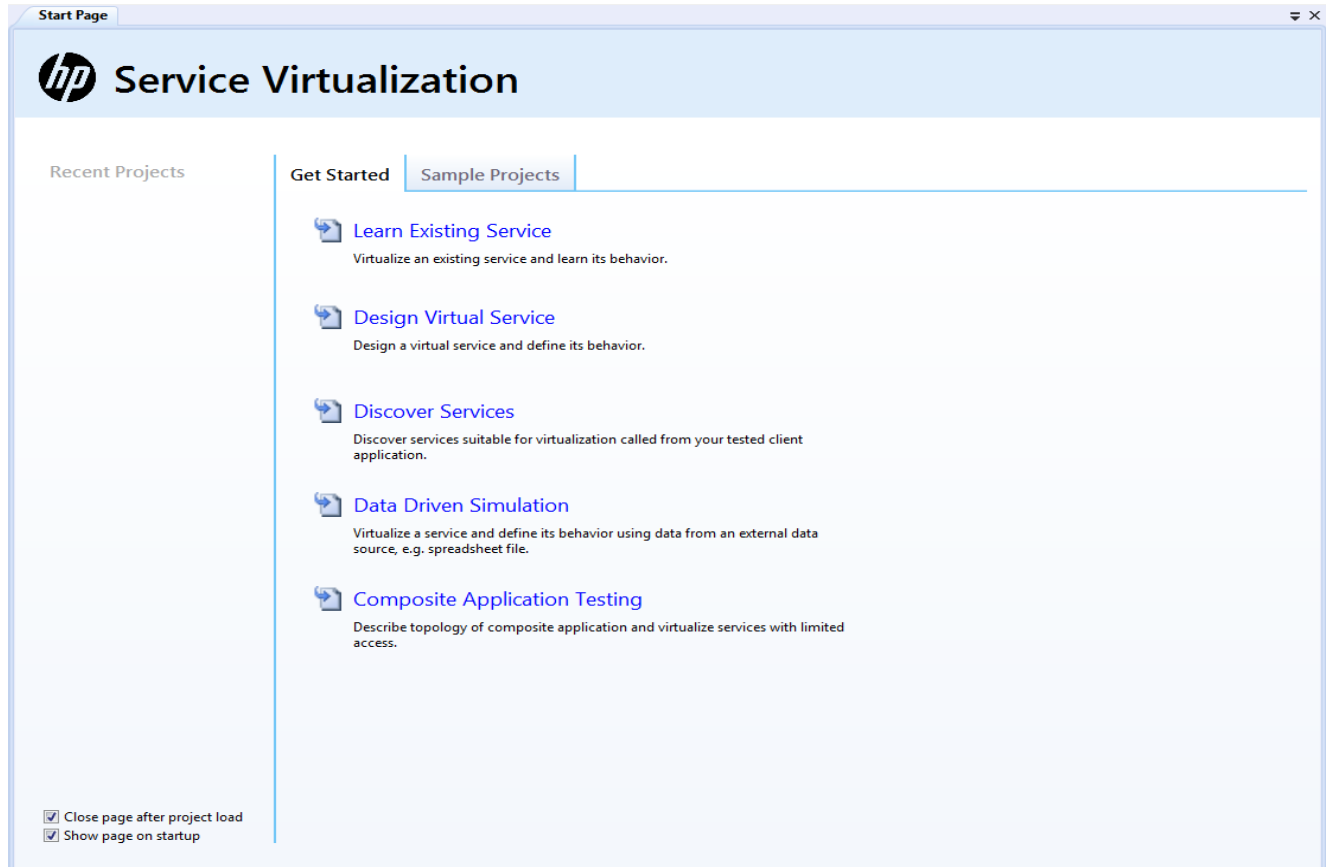
This chapter includes:

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## Start Page

To start HP Service Virtualization, from the Windows Start menu, select All Programs > HP Service Virtualization > Designer 2.11 > HP Service Virtualization Designer.

When you start the application, the Start Page opens.



The Start Page includes links to the most recent projects, links to common procedures, and a tab for the installed sample projects.

See "How to Create a Virtual Service" on page 16.

Select **Close page after project load** to close the Start Page as soon as you load a project.

Select **Show page on startup** to show the Start Page on startup.

## Updating Projects

Projects created in earlier versions of HP Service Virtualization are fully compatible with Service Virtualization 2.11.

When opening an earlier project, a pop up window will inform you that the project contains resources in an older format and ask you if you want to update them.

Click **Yes** to update your existing project.

# Chapter 2

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## Virtual Services

Service Virtualization places a Virtual Service between the service under test and the real service you want to simulate.

The Virtual Service uses the same service description as the real service. During Learning Sessions, the Virtual Service passes the communication between the service under test and the real service and records the service behavior and performance to the Simulation Model.

During Simulation Sessions, the Virtual Service does not pass the communication to the real service, and instead returns responses and performance defined by the Simulation Model.

**This chapter includes:**

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## Virtualization Explorer

The Virtualization Explorer is initially the left hand pane of the application.

Open projects are presented in a tree format displaying the logical structure of the virtualization project.

Click on an object in the list to display the details of the object in the lower pane.

Double-click an object in either pane to view a description of that object.

Right clicking on objects brings up the context menu allowing different options depending on the object.

## Virtual Service Design

The service virtualization process means creating virtual service endpoints. When you create an endpoint you can reconfigure your client application to use this endpoint instead of the real service endpoint. The purpose of the virtual service is to mediate between the client and the real service. Service Virtualization allows you to manipulate virtual services to get different results.

A virtual service has three basic modes- Learning, Simulating, and Standby:

- **Learning mode:** A virtual service can work as a proxy to record and learn the behavior of a real service – it forwards real communication between a client and a service.
- **Simulating mode:** A virtual service is typically switched to a Simulating mode. In this mode the virtual service answers a client according to learned behavior and the real service does not receive any communication.
- **Standby mode:** Real service responds to client requests.

## How to Create a Virtual Service

The most important step in simulating a service is the creation of a Virtual Service.

### To Create a Virtual Service:

1. If no project exists yet, click **Learn Existing Service** or **Design Virtual Service** in the Get Started tab of the Start Page. If a project does exist, open the project context menu in the Virtualization Explorer and select **Add>Virtual Service** to open the Import Real Service Description dialog box.

**Note:** If no project exists, it is created with the creation of a new virtual service.

- a. If you have a real service description available to import such as a SOAP service (`.wsdl`) or an XML schema (`.xsd`), enter the file name, or click **Browse** to go to the file location and click **Start**.
  - i. If more than one Real Service Endpoint is detected in a SOAP service, you will have to select which endpoints you require. If using an XML schema, select a transport



protocol and provide destinations.

- ii. Click **Next**.
  - iii. Your selections are presented in the Summary Of Virtualization. Click **Change** to alter your selections or **Virtualize** if your selections are correct.  
  
See "[How to Import Service Descriptions](#)" below.
- b. If you do not have a real service for import, select **I don't have a service description** and click **Start** to open the Choose Service Protocol dialog box.
- i. The available protocols are presented and may be filtered by protocol type and transport type. Click on the required protocol and fill in the details required for selected protocol. See "[How to Create REST Services](#)" on page 21 and "[How to Create XML or Binary Services](#)" on page 21.
  - ii. Click **Next**.
  - iii. Your selections are presented in the Summary Of Virtualization. Click **Change** to alter your selections or **Virtualize** if your selections are correct.

Service Virtualization creates a new virtual service, a data model, and a performance model as part of the virtualization project, and opens the "[Virtual Service Editor](#)" on page 25 view.

## How to Import Service Descriptions

In order to virtualize a service, Service Virtualization needs to know what it does and what endpoints it uses. The most common way to obtain this information is to import service description documents.

Service Virtualization supports the following service description document types:

- **WSDL**

Web-Service Definition Language documents are the most common way to describe SOAP services. They often contain references to other WSDLs and XSDs that must be available in the referenced locations in order to import them and correctly describe the services they define.

For details, see "[How to Import SOAP Service Descriptions](#)" below.

- **XSD**

XML Schema documents may also describe XML services. They often contain references to additional XSDs that must be available in the referenced locations in order to import them and correctly describe the services they define.

For details, see "[How to Import XML Service Descriptions](#)" on page 19.

## How to Import SOAP Service Descriptions

The most common way to describe a SOAP Service is with a WSDL document. Service Virtualization provides an import wizard that analyzes the content of the WSDL and enables you to associate it with a particular virtualized service.

**To Import SOAP Service Descriptions:**

1. Access the Import Real Service Description wizard in one of the following ways:
  - During the creation of a Virtual Service. For details, see ["How to Create a Virtual Service" on page 16](#).
  - In the Topology Editor view, virtualize a service that does not contain a service description. For details, see ["How to Create Virtual Services in Topologies" on page 66](#).
  - In the Topology Tasks view, virtualize services that do not contain a service description. For details, see ["How to Virtualize Services in the Tasks View" on page 64](#).
  - Open an existing project. From the **File** menu, select **New > Virtual Service**.
2. To select the WSDL specifying the SOAP Service, do one of the following:
  - Input the path to the WSDL or use the browse button to find the location.
  - Input the URL where the WSDL is exposed.
3. Click **Start** to process the selected WSDL.
  - If the WSDL describes multiple services or a single service specifying multiple ports, select one from the list of available ports and click **Next** to proceed to the Summary of Virtualization.
  - If the WSDL only describes one service with a single port, the Summary Of Virtualization is presented.
  - If the description is for SOAP over JMS, a dialog will open allowing the change of the destination name and the possibility of entering a reply to address.
4. **Optional:** Configure real and endpoint for virtual service if different from what is presented in the Summary of Virtualization:
  - a. For **SOAP over HTTP(s)**:
    - i. Click **Change** under the Virtual Service description to open the **Change Virtual Service** dialog.

The Virtual Service name, Agent type and Path can be altered. Click **Save** to save changes or **Discard** to go back to default values.
    - ii. Click **Change** under the Real Service description to open the **Change Real Service** dialog.

The Real Service Endpoint can be altered. Click **Save** to save changes or **Discard** to go back to default values.

**Note:** If service is secured, you must manage the credential store. For details, see ["Setting Authentication Credentials" on page 24](#).
    - iii. When all values are correct, click **Virtualize** to create the service.
  - b. For **SOAP over JMS**:

Click **Change** under the Virtual Service description to open the **Change Virtual Service** dialog.

- i. Keep the default or rename the Virtual Service.
- ii. Select different agent from the drop down list if required.
- iii. Specify **Destination Name** (JNDI name) for virtual **Destination** endpoint.
- iv. (Optional) If you are using a permanent **Reply To** destination, fill its JNDI name. Otherwise, leave the field blank and a temporary **Reply To** destination is used.
- v. Click **Save** to save changes or **Discard** to go back to default values.

Click **Change** under the Real Service description to open the **Change Real Service** dialog.

- i. Check if the **Destination Name**, **Reply To** (blank if temporary **Reply To** is used) and **Connection Factory** in the Change Real Service dialog have been pre-filled with correct JNDI names. If necessary, change these values according to your JMS configuration.
  - ii. Click **Save** to save changes or **Discard** to go back to default values.
- c. For **SOAP over TIBCO Enterprise Message Service™** (hereafter TIBCO EMS):

Click **Change** under the Virtual Service description to open the **Change Virtual Service** dialog.

- i. Keep the default or rename the Virtual Service.
- ii. Select appropriate agent from the drop down list.

Click **Change** under the Real Service description to open the **Change Real Service** dialog.

- i. Check if **Destination Name** has been pre-filled correctly and change the values according to your EMS configuration.
- ii. Select a **Destination Type** from the drop down list.
- iii. Click **Save** to save changes or **Discard** to go back to default values.

5. Review the settings for the virtual service and click **Virtualize** to virtualize the selected service, add the virtual service to the virtualization project, and put the virtual service in Standby Mode.

## How to Import XML Service Descriptions

### To Import XML Service Descriptions:

1. Access Import Real Service Description in one of the following ways:
  - During the creation of a virtual XML Service. For details, see ["How to Create a Virtual Service" on page 16](#).
  - In the Topology Editor view, virtualize a service that does not contain a service description. For details, see ["How to Create Virtual Services in Topologies" on page 66](#).
  - In the Topology Tasks view, virtualize services that do not contain a service description. For details, see ["How to Virtualize Services in the Tasks View" on page 64](#).
  - Open an existing project. From the **File** menu, select **New > Virtual Service**.

2. Enter a path, a URL, or use the browse button to an existing XML schema (.xsd).
3. Click **Start**.
4. Select the required protocol and click **Next**.

**Note:** Protocols can be filtered by either entering text in the search field or using the provided Protocol and Transport filters.

5. Select an input and output message type from the drop down lists and click **Next**.
6. Fill in the properties for the specific service:

***XML over generic JMS:***

Virtual Service

**Destination name:** JNDI name of destination where virtual service will expect requests.

**Reply to:** JNDI name of destination where virtual service will send responses. If the client provides a ReplyTo JMS property, this field can be left empty.

Real service

**Destination name:** JNDI name of destination where real service expects requests.

**Reply to:** JNDI name of destination where real service sends responses. If this field is left empty, the application will create a temporary destination for receiving response from the real service and will set the ReplyTo JMS property in request to point to it.

**Connection factory:** JNDI name of connection factory to use.

***XML over TIBCO EMS***

**Destination name:** Name of destination where requests are sent.

**Destination type:** Type of destination where requests are sent.

Since Service Virtualization records messages on TIBCO EMS non-intrusively, all parameters in the configuration are only related to the real service. At the moment when the virtual service mode is switched to emulation mode, the real service is automatically disconnected from TIBCO EMS and it is replaced by Service Virtualization.

There is no response destination name since the response destination is always read from request properties.

***XML over IBM® WebSphere® MQ***

Virtual Service

**Destination name:** Name of queue where the virtual service should expect requests.

**Reply to:** Name of queue where virtual service will send responses. If the client provides a ReplyToQueue message property, this field can be left empty.

Real service

**Destination name:** Name of queue where real service expects requests.

**Reply to:** Name of queue where real service sends responses. If this field is left empty, The application will create a temporary queue for receiving responses from the real service and set

the ReplyToQueue message property in the request to point to it. Note that WebSphere MQ must be configured so that the application has permission to create temporary queues.

7. Click **Next**.
8. Your selections are presented in the Summary Of Virtualization. Click **Change** to alter your selections or **Virtualize** if your selections are correct.

**Note:** If using and HTTP or HTTPS Gateway agent, the virtual service may have only one specified endpoint.

## How to Create REST Services

1. Access Import Real Service Description in one of the following ways:
  - During the creation of a Virtual Service. For details, see "[How to Create a Virtual Service](#)" on page 16.
  - In the Topology Editor view, virtualize a service that does not contain a service description. For details, see "[How to Create Virtual Services in Topologies](#)" on page 66.
  - In the Topology Tasks view, virtualize services that do not contain a service description. For details, see "[How to Virtualize Services in the Tasks View](#)" on page 64.
2. Select **I don't have a service description**.
3. Click **Start**.
4. Select the REST Service Protocol and click **Next**.
5. Enter the endpoint. If multiple endpoints are required, separated them with a space, comma, semicolon or a new line and ensure that they are all for the same service.
6. Click **Next**.
7. Your selections are presented in the Summary Of Virtualization. Click **Change** to alter your selections or **Virtualize** if your selections are correct.

## How to Create XML or Binary Services

If you have an existing XML or binary service, it can be added to the simulation and if not, it can be created from scratch. If the service is of an unknown type, creating a binary service is the best solution. Even if Service Virtualization cannot understand the message format, it can record it in binary format, although it is not able to fully recognize the structure.

1. Access Import Real Service Description in one of the following ways:
  - During the creation of a Virtual Service. For details, see "[How to Create a Virtual Service](#)" on page 16.
  - In the Topology Editor view, virtualize a service that does not contain a service description. For details, see "[How to Create Virtual Services in Topologies](#)" on page 66.
  - In the Topology Tasks view, virtualize services that do not contain a service description. For details, see "[How to Virtualize Services in the Tasks View](#)" on page 64.
2. Select **I don't have a service description**.

3. Click **Start**.
4. Select a binary messages type and click **Next**.
5. Fill in the properties for the specific service.

***XML/Binary over HTTP***

Endpoint: Supply Endpoints separated by space, comma, semicolon or a new line.

***XML/Binary over Generic JMS:***

Virtual Service

**Destination name:** JNDI name of destination where virtual service will expect requests.

**Reply to:** JNDI name of destination where virtual service will send responses. If the client provides a ReplyTo JMS property, this field can be left empty.

Real service

**Destination name:** JNDI name of destination where real service expects requests.

**Reply to:** JNDI name of destination where real service sends responses. If this field is left empty, the application will create a temporary destination for receiving response from the real service and will set the ReplyTo JMS property in request to point to it.

**Connection factory:** JNDI name of connection factory to use.

***XML/Binary over TIBCO EMS***

**Destination name:** Name of destination where requests are sent.

**Destination type:** Type of destination where requests are sent.

- a. Fill in the properties for the specific service:

***XML over generic JMS:***

Virtual Service

**Destination name:** JNDI name of destination where virtual service will expect requests.

**Reply to:** JNDI name of destination where virtual service will send responses. If the client provides a ReplyTo JMS property, this field can be left empty.

Real service

**Destination name:** JNDI name of destination where real service expects requests.

**Reply to:** JNDI name of destination where real service sends responses. If this field is left empty, the application will create a temporary destination for receiving response from the real service and will set the ReplyTo JMS property in request to point to it.

**Connection factory:** JNDI name of connection factory to use.

***XML over TIBCO EMS***

**Destination name:** Name of destination where requests are sent.

**Destination type:** Type of destination where requests are sent.

Since Service Virtualization records messages on TIBCO EMS non-intrusively, all parameters in the configuration are only related to the real service. At the moment when the virtual service mode is switched to emulation mode, the real service is automatically disconnected from TIBCO EMS and it is replaced by Service Virtualization.

There is no response destination name since the response destination is always read from request properties.

***XML over IBM® WebSphere® MQ***

Virtual Service

**Destination name:** Name of queue where the virtual service should expect requests.

**Reply to:** Name of queue where virtual service will send responses. If the client provides a ReplyToQueue message property, this field can be left empty.

Real service

**Destination name:** Name of queue where real service expects requests.

**Reply to:** Name of queue where real service sends responses. If this field is left empty, The application will create a temporary queue for receiving responses from the real service and set the ReplyToQueue message property in the request to point to it. Note that WebSphere MQ must be configured so that the application has permission to create temporary queues.

- b. Click **Next**.
- c. Your selections are presented in the Summary Of Virtualization. Click **Change** to alter your selections or **Virtualize** if your selections are correct.

***XML/Binary over WebSphere MQ***

Virtual Service

**Destination name:** Name of queue where the virtual service should expect requests.

**Reply to:** Name of queue where virtual service will send responses. If the client provides a ReplyToQueue message property, this field can be left empty.

Real service

**Destination name:** Name of queue where real service expects requests.

**Reply to:** Name of queue where real service sends responses. If this field is left empty, The application will create a temporary queue for receiving responses from the real service and set the ReplyToQueue message property in the request to point to it. Note that WebSphere MQ must be configured so that the application has permission to create temporary queues.

6. Click **Next**.
7. Your selections are presented in the Summary Of Virtualization. Click **Change** to alter your selections or **Virtualize** if your selections are correct.

**Note:** If using and HTTP or HTTPS Gateway agent, the virtual service may have only one specified endpoint.

## Service Administration

The Service Administration module enables you to view all services from configured servers, without opening individual projects. All virtual services are displayed with their statuses, associated models, and server locations.

To access Service Administration, click the **Service Administration** link on the Get Started tab of the Start Page. The view can be filtered by server location.

The following options are available for services:

- Switch modes:
  - Switch between **Standby** and **Simulate** modes.
  - Switch from **Learning** mode to **Standby** or **Simulate** mode. When you switch from Learning mode in Service Administration, the learning is stopped. The learned new data remains on the server until the service switched to Standby or Simulate mode from within a project.

For details on virtual service modes, see ["Virtual Service Design" on page 16](#).

- Change Data Model and Performance Model. When a model is changed, an asterisk is displayed next to the model name, indicating that the change was not yet applied. To apply the new model, the relevant service needs to be redeployed. This is done by changing its mode to Standby or Simulate

For more details on Data and Performance Models, see ["Simulation Modeling" on page 34](#).

- To undeploy a service, click **More Actions** and select **Undeploy**.
- To unlock a service, click **More Actions** and select **Unlock**. For details, see ["Service Locking" on page 32](#).

To manage servers, from the **Tools** menu, select **Options** and then select the **Servers** tab. Alternatively, use the quick link from the **More Actions** button at the bottom of the window and select **Manage Servers**. The following options are available for servers:

- To add a server, click **Add**, provide the address of the server, and click **Ok**.
- To remove a server, select a server click **Delete**. Click **Yes** to confirm.

## How to Change Servers

To move a project from one server to another server:

1. Right click the object in the Virtualization Explorer and select **Change Server** or from the Project menu, select **Change Server**.
2. Select an existing server or enter the URL for a server and click **Next**.
3. Select agent from the drop down lists and click **Finish**.

## Setting Authentication Credentials

Some services may require client authentication on either the transport or message level. When virtualizing these services, Service Virtualization needs to know the client credentials used to



connect to the real service. For details on how to set authentication credentials, see "How to Set Authentication Credentials " on page 88.

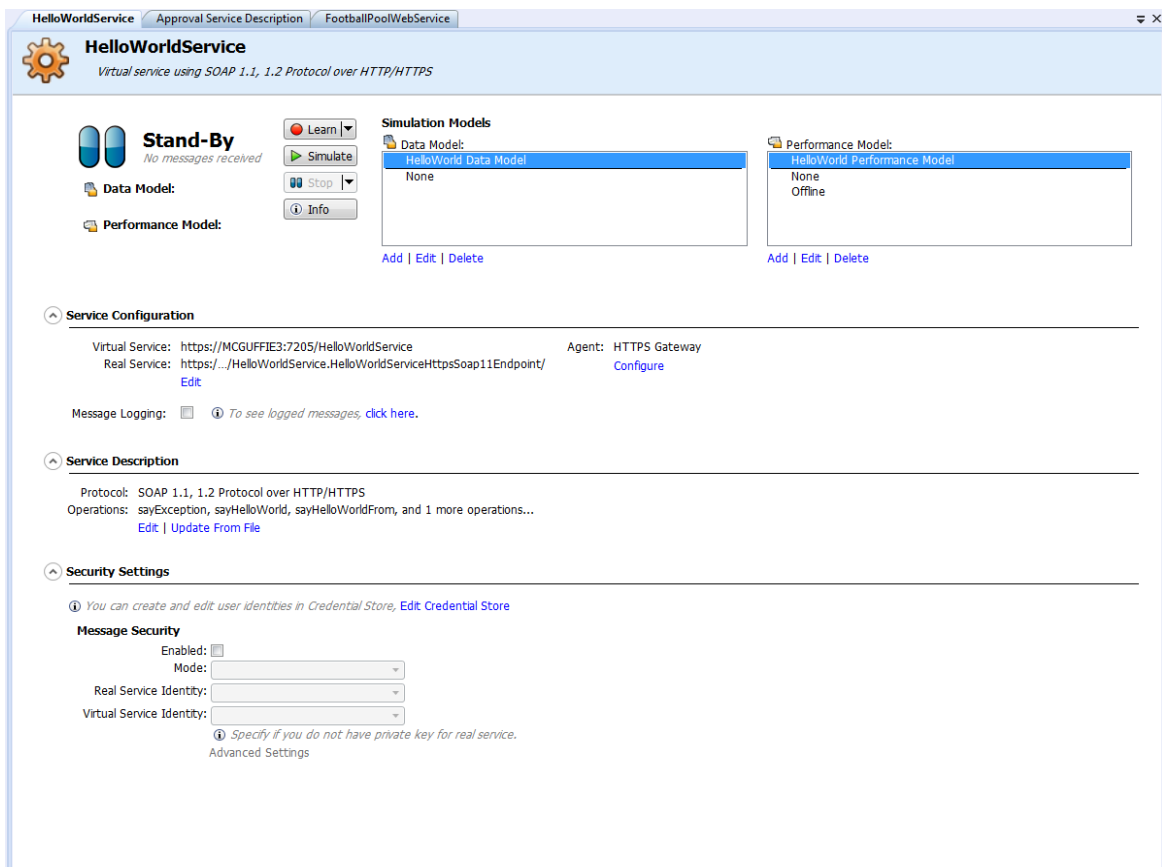
## Virtual Service Editor

The Virtual Service Editor enables you to control the mode of the virtual service and the models currently in use, configure the endpoints, and configure any security settings.

Access the Virtual Service Editor in one of the following ways:

- In the Virtualization Explorer, double-click the Virtual Service you want to view or edit.
- In the Runtime View, click the name of the Virtual Service you want to view or edit.
- In the Topology Editor, open the context menu for the Virtual Service you want to view or edit and select **Open**.

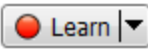
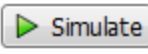

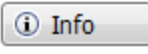
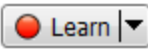
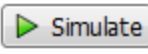

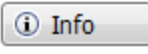
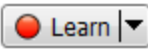
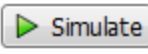

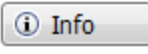
### Virtual Service Editor



The Virtual Service Editor displays the following content and controls:

### Virtual Service Editor Content

| Section                              | Description  |
|--------------------------------------|--|
| Virtual Service Name and Description | The name and description of the Virtual Service (click to Edit). |

| Section   | Description  |         |             |   |  |   |  |   |  |   |   |
|---|--|---------|-------------|---|--|---|--|---|--|---|---|
| Current Mode and Models   | The large icon displays whether the service is in Learning, Simulation, Standby Mode or if the service is Offline. Below the icon, the Data and Performance Models currently in use are displayed.   |         |             |   |  |   |  |   |  |   |   |
| Virtual Service Controls  | <table border="1"> <thead> <tr> <th data-bbox="557 373 748 436">Control</th> <th data-bbox="748 373 1377 436">Description</th> </tr> </thead> <tbody> <tr> <td data-bbox="557 436 748 741">  </td> <td data-bbox="748 436 1377 741">                     Put the service into Learning Mode. Any communication through the Virtual Service is added to the Simulation Model in this mode. Use the drop down arrow to select which models to update:                     <ul style="list-style-type: none"> <li>• Data &amp; Performance (default)</li> <li>• Data Model</li> <li>• Performance Model</li> </ul> </td> </tr> <tr> <td data-bbox="557 741 748 835">  </td> <td data-bbox="748 741 1377 835">                     Finish the current learning session and add any data learned in the session to the Simulation Model.                 </td> </tr> <tr> <td data-bbox="557 835 748 930">  </td> <td data-bbox="748 835 1377 930">                     Put the service into Standby Mode with the option of maintaining or disposing of learned data.                 </td> </tr> <tr> <td data-bbox="557 930 748 1024">  </td> <td data-bbox="748 930 1377 1024">                     Open the Runtime Report to display current information about the service.                 </td> </tr> </tbody> </table> | Control | Description |  | Put the service into Learning Mode. Any communication through the Virtual Service is added to the Simulation Model in this mode. Use the drop down arrow to select which models to update: <ul style="list-style-type: none"> <li>• Data &amp; Performance (default)</li> <li>• Data Model</li> <li>• Performance Model</li> </ul> |  | Finish the current learning session and add any data learned in the session to the Simulation Model. |  | Put the service into Standby Mode with the option of maintaining or disposing of learned data. |  | Open the Runtime Report to display current information about the service. |
| Control   | Description  |         |             |   |  |   |  |   |  |   |   |
|  | Put the service into Learning Mode. Any communication through the Virtual Service is added to the Simulation Model in this mode. Use the drop down arrow to select which models to update: <ul style="list-style-type: none"> <li>• Data &amp; Performance (default)</li> <li>• Data Model</li> <li>• Performance Model</li> </ul>   |         |             |   |  |   |  |   |  |   |   |
|  | Finish the current learning session and add any data learned in the session to the Simulation Model.   |         |             |   |  |   |  |   |  |   |   |
|  | Put the service into Standby Mode with the option of maintaining or disposing of learned data.   |         |             |   |  |   |  |   |  |   |   |
|  | Open the Runtime Report to display current information about the service.  |         |             |   |  |   |  |   |  |   |   |
| Simulation Models   | The Simulation Models section enables you to select which Data and Performance models are in use and manage the models associated with the Virtual Service.  |         |             |   |  |   |  |   |  |   |   |
| Enable Message Logging  | The checkbox toggles logging. The messages are stored on disk in the Designer log directory <code>%TEMP%\HPServiceVirtualizationLogs</code> . Messages processed by the embedded server are stored in the sub-directory <code>msg-embedded\[Virtual Service Name]</code> . Messages processed by the standalone server are stored in the sub-directory <code>msg-standalone\[Virtual Service Name]</code> on the standalone server itself. Each message is stored in a single file named <code>[Message Order Number]-[Message Id]</code> .  |         |             |   |  |   |  |   |  |   |   |
| Service Configuration   | Displays the endpoints for the Virtual Service with options to copy these details to the clipboard. Click <b>Edit</b> to change the endpoint details.  |         |             |   |  |   |  |   |  |   |   |
| Agent   | Displays the agent selected for the service. If using the embedded server, click <b>Configure</b> to change the agent settings. For details, see " <a href="#">Supported Technologies And Environments</a> " on page 70. If using a standalone server, click configure to see documentation regarding agents.  |         |             |   |  |   |  |   |  |   |   |
| Service Description   | Displays service descriptions and any metadata associated with the service. Click <b>Edit</b> to add new operations or update metadata. Click <b>Update From File</b> to update the service description.   |         |             |   |  |   |  |   |  |   |   |

| Section  | Description  |
|----------|--|
| Security | Depending on protocol, displays any credentials used to access the service with management options. Click <b>Edit Credential Store</b> to modify credentials. For details, see " <a href="#">Setting Authentication Credentials</a> " on page 24. For Message Security, select Enabled to apply settings. For details, see " <a href="#">How to Set Message Security</a> " on page 89. |

## Managing Virtual Services

The Virtual Services in the virtualization project can be managed in several ways:

- Switching between the simulation and standby modes, passing the control to the real service without reconfiguring clients.
- Activating learning mode where the real service responds and the selected data and/or performance models of virtual service get updated.
- Managing all services at once in the runtime view and changing the runtime where the virtual services run (i.e. from an embedded to a standalone server).

**This section includes:**

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|--------------------------------|----|
| Learning Service Behavior..... | 28 |
| Simulating Services.....       | 28 |
| Runtime View.....              | 29 |
| Problem List.....              | 31 |

## Learning Service Behavior

Real services may not be available on a permanent basis due to cost, access, or if different model is required.

After a Virtual Service is created, the behavior of the real service must be recorded in order to see the requests and responses of the real services.

Once this behavior is captured by Service Virtualization, it can be used to create data and performance models.

For details, see "How to Learn Services " below.

## How to Learn Services

---

### Prerequisites:

- Create a virtual service. For details, see "How to Create a Virtual Service" on page 16.
- *Optional:* Select the Data and Performance Models to record to. For details, see "How to Select Models" on next page.

1. After a virtual service is created, it is displayed in Standby mode by default. Clicking on **Learn** stops or starts the learning mode. Click the arrow next to the Learn button to select the data model, the performance model, or both.
2. Run the application communicating with the real service. All service calls are recorded.
3. When you have enough recorded messages, click the **Stop** button to stop the learning process. The simulation model updates with the recorded data.

## Simulating Services

The virtual service can use both the data and performance models for the simulation or use them individually.

### Data Simulation Options

It is possible to simulate learned responses by selecting one of the data models. It is also possible to turn the data simulation off and let the real service respond, and thereby simulating only the performance using one of the performance models.

See "Data Model" on page 35

### Performance Simulation Options

It is possible to simulate learned or customized performance by selecting one of the performance models.

See "How to Manage Models" on page 35

It is possible to turn the performance simulation off by selecting the **None** performance model. The response times are not affected by any model and the virtual service responds as fast as possible.

It is also possible to simulate the absence of the service by selecting the **Offline** performance model. The virtual service does not respond back to the client in this mode.

["How to Select Models"](#) below

["How to Start Simulations"](#) below

## How to Select Models

Before you start a learning or simulation session, you can select which Data and Performance Models you want to associate with each Virtual Service.

---

### Prerequisites:

- Create a virtual service. For details, see ["How to Create a Virtual Service"](#) on page 16.
  - *Optional but recommended:* Record the performance of the real service. For details, see ["Learning Service Behavior"](#) on previous page.
  - *Optional:* Edit the Data and Performance Models. For details, see ["Simulation Modeling"](#) on page 34.
- 

### To Select a Data or Performance Model:

1. In the Virtualization Explorer, click the virtual service name to open the Virtual Service Editor.
2. The Simulation Model section shows the available models for the Virtual Service. Select your models.

Models can be added, edited, or deleted from the Virtual Service using the associated buttons. For details, see ["How to Manage Models"](#) on page 35

## How to Start Simulations

### Prerequisites:

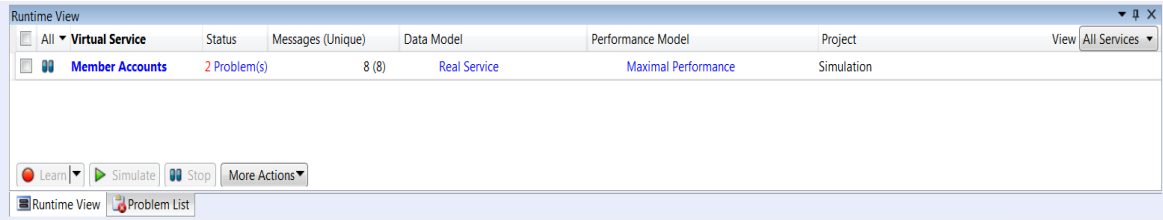
- A simulation model must already exist. For details, see ["How to Learn Services"](#) on previous page
- 

1. From the virtual service page, click the **Simulate** button to start simulation of a real service.
2. Run the application communicating with the original real service.

## Runtime View

The Runtime View provides an overview of all the Virtual Services in your Virtualization Project and the functionality to control them. During a learning or simulation session, the Runtime View provides an overview of the communication through the Virtual Services.

Access the Runtime View using the **View > Runtime View** menu option.



The Runtime View displays a table of all the Virtual Services in your project with the following options and information for each service:

### Runtime Display

| Column                       | Description  |
|------------------------------|--|
| Selection Boxes              | Select services and apply the controls under Virtual Service Controls in the "Virtual Service Editor" on page 25.                          |
| Virtual Service Mode         | Displays whether the services are in Learning or Simulation Mode with an option to filter the table.                                       |
| Virtual Services             | Click the service name to open its editor.   |
| Problems                     | Indicates any problems which occurred during the learning or simulation.   |
| Messages / Unique            | Indicates the number of messages and unique messages passed through the Virtual Service during the current learning or simulation session. |
| Data Model (Accuracy)        | Indicates the Data Model currently in use and its accuracy during simulation.  |
| Performance Model (Accuracy) | Indicates the Performance Model currently in use and its accuracy during simulation.   |
| Project                      | Displays the name of the Project to which the Virtual Service belongs.   |

The Runtime View contain the following controls:

| Control | Description  |
|---------|--|
|         | Put the service into Learning Mode. Any communication through the Virtual Service is added to the Simulation Model in this mode. Use the drop down arrow to select which models to update: <ul style="list-style-type: none"> <li>• Data &amp; Performance (default)</li> <li>• Data Model</li> <li>• Performance Model</li> </ul> |
|         | Finish the current learning session and add any data learned in the session to the Simulation Model.   |
|         | Put the service into Standby Mode with the option of maintaining or disposing of learned data.   |

| Control | Description  |
|---------|--|
| Info    | Located in the <b>More Actions</b> menu. Open the Runtime Report to display current information about the service.             |
| Unlock  | Located in the <b>More Actions</b> menu. Used to unlock a blocked service. See <a href="#">"Service Locking" on next page.</a> |

## Problem List

The Problem list displays problems that occurred during the application or server run. The source of problems can be either runtime errors in the application or a problem occurring during a service lifecycle ie: deployment/ standby/ learning/ simulating.



| Column        | Description   |
|---------------|---|
| Problems      | Filters different problem types. Error/ Warning/ Information  |
| Type          | Problem Category and number of occurrences.   |
| Fix It        | Some problems can be resolved with user interaction. These contain a Fix It link to the part of the UI that may be source of the problem. |
| Source Filter | Filters problems for a specific service call.   |
| Description   | A description of the problem.   |
| Time          | Time and date of problem occurrence.  |

## Updating Virtual Services

After a virtual service is created you may need to update the service description.

To update the service description:

1. Right click the service in the Virtualization Editor and select **Update Service Description**. If the service is not locked (see ["Service Locking" on next page](#)), the wizard starts.
2. Enter the path or URL, or use the Browse button to enter the new WSDL. Click **Next**.
3. The designer now examines the new description and displays the supported and unsupported transformations. If there is an unsupported transformation, the update stops and the WSDL must be altered. If all transformations are supported, click **Finish** to apply the update.

**Note:** In some cases, the designer may prompt the reloading of open editors.

## Service Discovery

Service Discovery can be used to find all services used by an application via a proxy gateway. It can only be used in the case of an embedded server.

To use Service Discovery:

1. Either create a new **Service Discovery Project** through the **New Virtualization Project Wizard** or right click in the Topology view of an existing project.

2. Select the server and proxies.

**Note:** The client application must be using the Service Virtualization proxy before attempting to find services.

3. Click **Run Service Discovery**.

4. When Services are discovered, click **Stop Discovery** to continue with the project. Discovered services are presented in a grouping called Discovered Services and can be used in the topology. For details, see "[How to Model Composite Applications](#)" on page 62.

## Service Templates

Service Templates can be created in order to:

- Reuse Virtual Services in multiple testing environments.
- Reuse configuration, custom functions, data and views.

**Note:** Service Templates can be created by Professional services with complex functionality.

**To save a service as a template:**

1. Right click the service in the Virtualization Explorer and select **Save As Template**.
2. Give the template a name and specify the location.
3. Click **Save**.

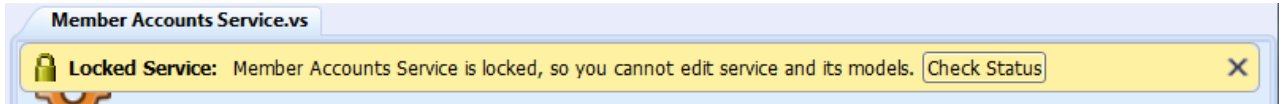
## Service Locking

A Designer or a test emanating from HP LoadRunner / HP Service Test may require indicating that they own a virtual service (start session) or that virtual service is free (stop session) in order to prevent conflicts. They may also need to know who is the present owner of a service as a service can be only owned by one client at a time. A service may be locked by the owner and other clients can see who the owner is as each client has a unique "client ID".

When a service is locked then its configuration and all its Data and Performance models are also locked. The owner of the service can modify the service and its model, but other clients are not allowed. If a user tries to modify the service or its model then the UI displays that the service is locked and which client is the owner of the service. If a Designer or a test is the owner then modification is allowed.

If a service is locked, the following message is displayed :





If a technical problem occurs or a test runs too long, you can force an unlock in Designer. The action **Unlock** can be found in the **More Actions** menu in the **Runtime View**.

**Note:** No changes are allowed to a service and its models during the learning process. This process must be completed regardless of the owner of the virtual service. **Unlock** is not available during this time.

# Chapter 3

---

## Simulation Modeling

The most important part of Service Virtualization are the Simulation Models. Simulation Models are one of the following model types:

- **Data Model**

The **Data Model** enables you to record actual requests and responses for the real service and then use this data for simulation using the Virtual Service. You can edit the data model from scratch or add to recorded data, add service calls, and model *stateful* behavior. This enables you to model the interaction between the service under test and the simulated service to meet many integration test cases. For details, see ["Data Model" on next page](#).

- **Performance Model**

The Performance Model enables you to record the performance for the real service and then use this as a model for the Virtual Service. You can customize the performance criteria of the model to meet many performance use cases. For details, see ["Performance Model" on page 54](#).

When you create a Virtual Service, Service Virtualization creates a Data Model and Performance Model associated with it. These models serve as the default models for Learning and Simulation Sessions. For details, see ["How to Create a Virtual Service" on page 16](#).

You can associate each Virtual Service with multiple customizable Data and Performance Models. For details, see ["How to Manage Models" on next page](#)

Prior to a Learning or Simulation Session, you can select which Data and Performance Models to use, including additional non-customizable options. For details, see ["How to Select Models" on page 29](#).

Each model is customizable, enabling you to perform simulations that meet specific test use cases. For details, see ["How to Edit Data Models" on page 43](#) and ["How to Edit Performance Models" on page 56](#).

**This chapter includes:**

|                                 |    |
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| Data Model.....                 | 35 |
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| Performance Model Editor.....   | 54 |
| Service Description Editor..... | 57 |

## How to Manage Models

By default, each Virtual Service is associated with one data model and one performance model, which are created with the Virtual Service. Additional models can be associated with a Virtual Service.

---

### Prerequisites:

- Create a virtual service. For details, see ["How to Create a Virtual Service" on page 16](#).

---

### To Manage Models:

1. From the Virtualization Explorer, open the Editor view for a Virtual Service.

The Virtual Service Editor displays a Simulation Model section showing the Data and Performance Models associated with the Virtual Service. Each type of model has **Add**, **Edit**, and **Delete** actions associated with it.

**Note:** **None** and **Offline** are not actual models. They are options available for simulation purposes. **None** for Data Model messages are passed to the real service and its responses are sent back while still simulating the performance according to the selected Performance Model. **None** for Performance Model makes the Virtual Service respond as fast as possible. **Offline** Performance Model simulates the unavailability of the service.

2. For either Data Models or Performance Models, do any of the following:

- **To Add a New Model:**

- i. Click the relevant **Add** link.
- ii. Input a name for the new model, and optionally for Performance Models, select to copy the performance metrics of the currently active model.
- iii. Click **OK** to add the new model to the relevant set of models.

- **To Edit a Model:**

- Select the model you want to edit, and click the relevant **Edit** link to open the Data Model Editor or Performance Model Editor view.

For details, see ["Data Model Editor" on page 37](#) and ["Performance Model Editor" on page 54](#).

- **To Delete a Model:**

- Select the model you want to delete, click the relevant **Delete** link, and confirm your decision.

3. Save the Virtual Service.

## Data Model

The Data Model enables you to customize the requests and responses, and service call activity of a service during simulation.

When you create a Virtual Service, Service Virtualization creates a Data Model associated with it. For details, see ["How to Create a Virtual Service"](#) on page 16.

Each Virtual Service can have multiple Data Models. For details, see ["How to Manage Models"](#) on previous page.

Prior to recording or simulation you can select which model to use, including selecting to use the real service. For details, see ["How to Select Models"](#) on page 29.

This model is then available to learn the data behavior of the real service and can be customized to set specific data rules for its individual operations.

#### Data Rules

The main part of the Data Model consists of a set of Data Rules for each operation in the service. The following types of rules are available:

- **Learned Data Rule**

The Learned Rule displays the requests and responses from Learning Sessions. In general, you do not customize this data but you may want to set conditions to ignore parts of the requests and responses and add service call activity.

- **Default Response**

The Default Response provides a single custom response to apply in cases where there is no other data, or where you want to ignore specific parts of recorded response data.

- **Custom Rules**

Custom Rules enable you to set custom responses and service call activity to specific requests enabling you to perform various testing use cases.

- **External Rules**

External Rules are used to bind request and response data from external data source that can be used by several applications or exported from external applications like HP Service Test, HP LoadRunner or HP QuickTest. The data source can be edited by an external application and then the data can be refreshed in the Data Model.

You can set the priority order of multiple rules to meet various simulation testing use cases. Generally, the following order applies:

1. Custom or External Rules to provide specific responses and service call activity for the purpose of testing specific service behavior.
2. Learned Data Rule to provide typical responses and service call activity of the real service.
3. Custom Rules to provide responses and service call activity for requests that cannot be recorded or have not been recorded yet.
4. Default Response to provide a single generic response or generic parts of response data where other rules do not apply.

#### Service Call Activity

In many cases, the simulated service can call another service to perform some particular operation or to receive some additional data. Virtual Services can simulate this behavior by adding Service Call Activity to an operation. You can define static request data for the Service Call Activity for any row in the rule or use the **Copy from** function to copy data from the Virtual Service request or from

the response of another Service Call Activity. If a called service also has a response, you can use the **Copy from** function to copy some response data from a service call activity to a Virtual Service response. For more details, see ["How to Add Service Call Activity" on page 50](#).

### **Tracks**

The other main feature of the Data Model are Tracks that determine the order of the simulated service behavior.

In many test cases, the order of requests is important because a service may return different responses for the same request depending on the current state of the service. Service Virtualization enables you to simulate this *stateful* behavior using Tracks. Tracks enable you to construct sequences of requests and responses in the Data Model for the service. During a simulation session, Service Virtualization moves along the Tracks according to test requests that match the requests in the track and returns the appropriate response. For example, if the simulated service can return an approve or deny response which is determined by a particular state of the service, you can determine which response to return by specifying the sequence of requests and responses in the track. For more details, see ["How to Edit Data Models" on page 43](#)

### **Import Messages**

New rows can be added to a rule by learning new data, by adding a new row and manually editing its cells or by importing messages.

Importing messages is useful in the case when it is not possible or it is difficult to learn communication between a tested application and a simulated service directly, but it is possible to listen to the communication and log transported messages via another tool. Importing Messages is available in the Data Model Editor from the context menu of the rules data table (only for Custom and Learned Rules). It is possible to import a request and/or response part of the message in the same format as it is sent via communication protocol from a clipboard or from a file. If a message is imported from a file, the file can contain just request or response part of one message. For more details, see ["How to Add Data Sources" on page 50](#).

### **Multi Response**

In addition to the simple simulation of a request-response pattern, when some operations are marked one-way, Service Virtualization is able to simulate a request-response pattern where 0 to n responses are given per request. The number of responses can differ according to the state of the service and can be changed in the Data Model Editor. Service Virtualization permits the learning and editing of a different number of responses, their types and the state of the services (which may affect both the data in the response as well as their number). Multi Response can be used in templates, functions and custom functions, generation of responses from multiple rules, data driving, and activities. The performance simulation is limited to the learning and simulation of the response time of the first response. These features are available on both standalone and embedded servers. The supported protocols are XML and binary services over WebSphere MQ and JMS.

## **Data Model Editor**

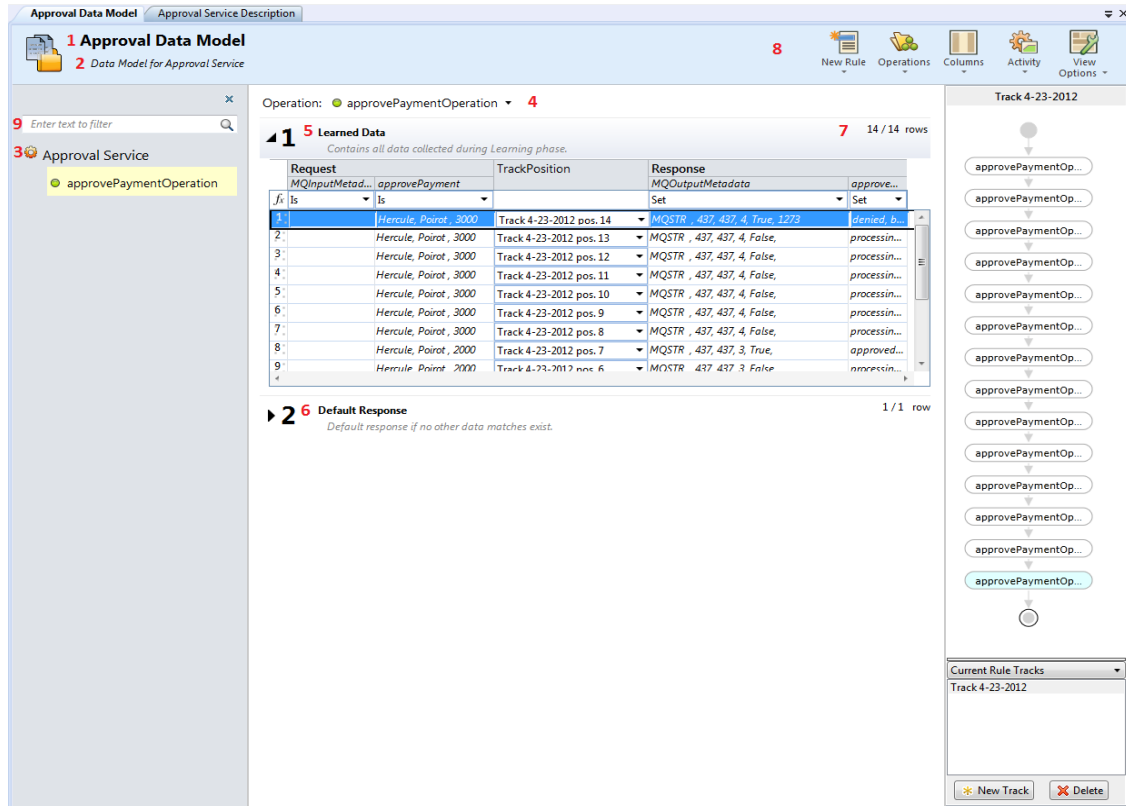
The Data Model Editor enables you to configure requests and responses, and service activity calls for individual operations of a Virtual Service during simulation.

Access the Data Model Editor in one of the following ways:

- In the Virtualization Explorer, double-click the Data Model you want to view or edit.
- In the Virtual Service Editor, in the Data Model section, select the model you want to view and click **Edit**.

The Data Model Editor opens for the selected model showing details at the operation level.

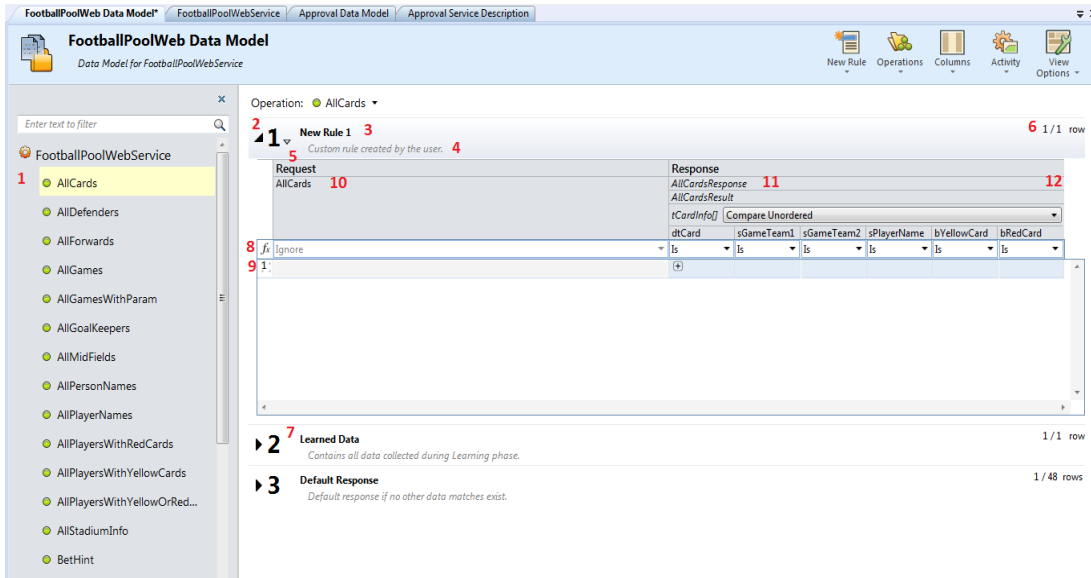
### Data Model Editor Overview



1. Name of data model which can be edited in place.
2. Description of data model which can be edited in place.
3. List of operations for the virtual service associated with the model.
4. List of global rules. A global rule exists across all operations for the virtual service.
5. The rule **Learned Data** contains learned data. It displays the requests and responses learned during the learning state of a virtual service. In general, you do not customize this data but you may want to set conditions to ignore parts of the requests and responses for performance testing and add service call activity.
6. The rule **Default Response** provides a single custom response to apply in cases where there is no other data for a given column or where you want to ignore specific parts of recorded response data.
7. Number of rows in the global rule across all operations.
8. Toolbar with action buttons.

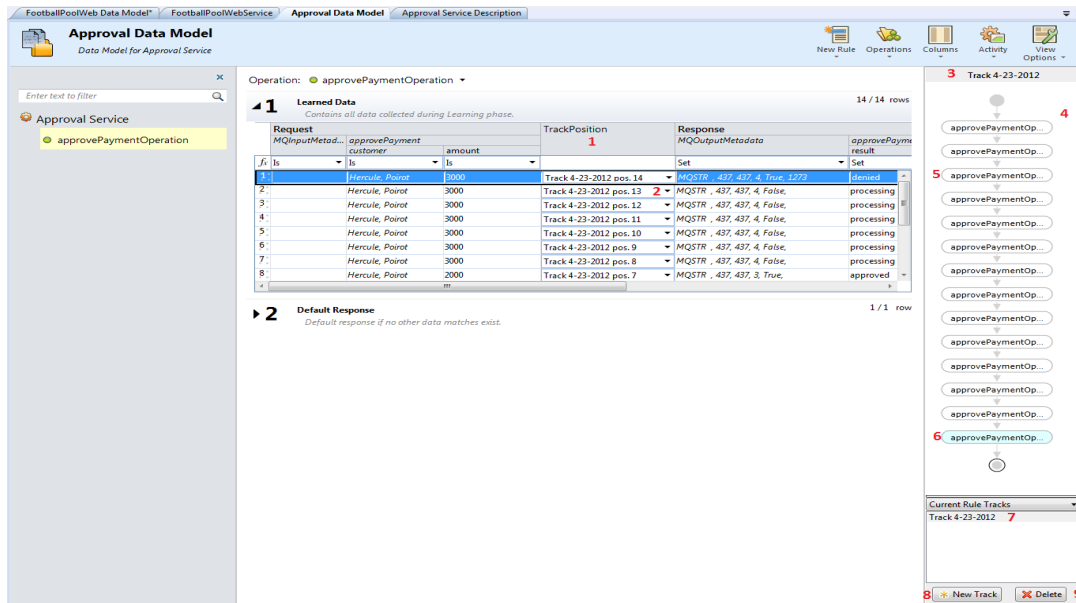
9. Element filter.

**Custom Rule**



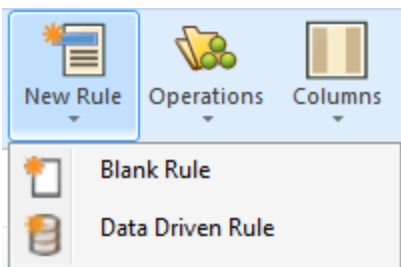
1. Selected operation.
2. Custom rule.
3. Name of the rule. Click to edit.
4. Description of the rule. Click to edit.
5. Action button to change the priority of a custom rule. The priority of the custom rule can be increased or decreased.
6. The term **1/1 rows** indicates that the global rule **New Rule 1** contains one row across all operations and one row for the selected operation in this rule.
7. Priority of the rule. Priority is from 1 to n. 1 is the highest priority.
8. Row with conditions for data columns. Use the drop down controls for each column to control the condition to be applied to the data.
9. Row with data.
10. Request column header.
11. Response column header.
12. Action to collapse whole message section. For example a request, a response or a service activity call.

**Stateful View**



1. **Track Position** column contains information about how rows are used in a stateful simulation. This information is represented by an association with a given track and a position in that track.
2. User can see how the given call (request/response pair) is used during a stateful simulation. User can use **Add to Track** to insert the given call into a sequence of calls in track on a position.
3. Name of track which can be edited in place.
4. Sequence of calls in displayed track.
5. One call of given operation in a sequence of calls for the track.
6. Selected call of a given operation. The associated row for the call is selected in the table and its rule is opened.
7. List of all tracks which model stateful behavior. This list can be filtered by the current opened rule.
8. Button to create a new track to model stateful behavior.
9. Button to delete selected/displayed track.

### Rule button menu



**Blank Rule** - Create a new global rule with an embedded data source. The global rule exists across all operations.

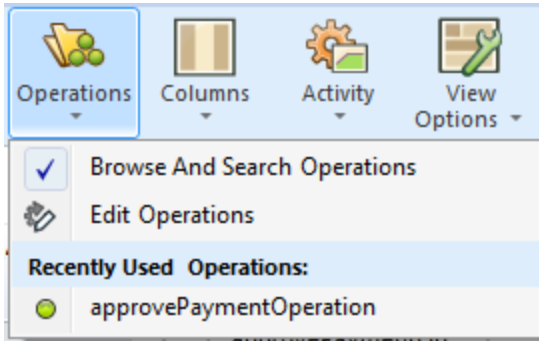
**Data Driven Rule** - Use an external file, i.e.: MS Excel, as a data source for a rule. A new read-



only rule is created for this data source. This action opens the **Use Existing Data Source** dialog allowing the user to reference an MS Excel file as a data source with the options of using the first row for column names.

See "How to Manage Rules" on page 44.

**Operations/Uri Spaces button menu**



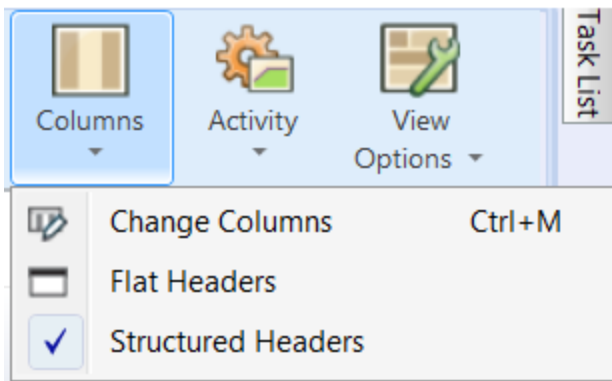
**Browse and Search Operations/Uri Spaces** - opens/closes left pane with operations/uri spaces list - this pane will require its own chapter as well as there is additional functionality.

**Edit Operations/Uri Spaces** - opens service description editor allowing to modification of operations/uri spaces, their data formats and metadata.

**Recently Used Operations** - a list of the most recently used operations for quicker access.

See "Service Description Editor" on page 57.

**Columns button menu**

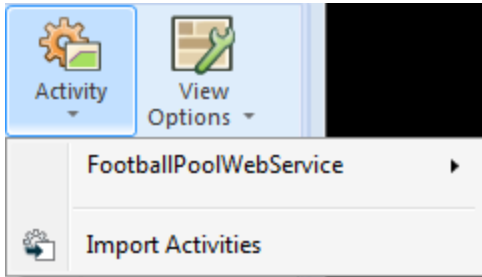


**Change Columns** - Opens Change Columns dialog. This dialog is used to configure table column visibility. See "Changing Columns" on page 43.

**Flat Headers** - Toggles between flat and structured column headers.

**Structured Headers** - Toggles between flat and structured column headers.

**Activity button menu**

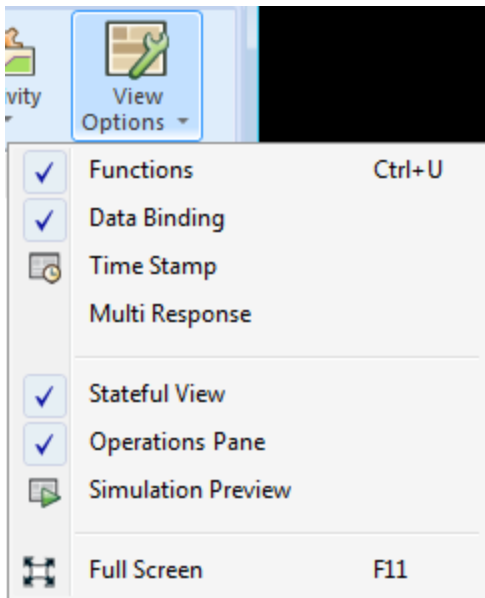


List of imported services whose operations can be used as a service call activity.

**Import Activities** - Import a service description of a service whose operations can be later used as service call activities.

See "How to Add Service Call Activity" on page 50.

#### **View Options button menu**



**Functions** - Displays the row with conditions for data columns.

**Data Binding** - Display row with binding to a data source in rules, i.e:MS Excel file. Binding is only visible for rules which are connected to an external data source.

**Time Stamp** - Displays the column in rules. This column contains the time of creation or last modification.

**Multi Response** - In the case that response data contains more than one response, these are presented. For details, see "[Data Model](#)" on page 35

**Stateful View** - Displays the **Track Position** column in rules and the **Track View**.

**Operations** - Toggles the display of individual operations in the left hand pane.

**Simulation Preview** - displays in real time how changes in the Data Model are affecting the simulation.

**Full Screen** - Switches the **Data Model** editor to the full screen view.

## Changing Columns

The Change Columns Dialog is accessed by clicking the **Columns** button in the Data Model Editor and selecting **Change Columns**, using the hot key **Ctrl+M** or by accessing the context menu on a rule. The main function is to toggle the visibility of structured columns in the data table of a rule by selecting checkboxes corresponding to the required view.

Columns are presented in a tree format and context menus are available allowing easy navigation within large structures.

Columns can be filtered using by entering text in the search field. Arrows on the right of the filter fields provides navigation between found results and clicking **x** clears the filters text.

A header selected in the Change Columns window will be highlighted in the open table.

**Note:** Changes in columns visibility are applied immediately. Changes can be reverted by clicking **Cancel** and confirmed by clicking **Ok**.

## How to Edit Data Models

Each virtual service is associated with at least one data model which can contain the recorded behavior of the service and also customized data for simulation. Each data model contains a set of Rules defining data behavior for each operation in the service and Tracks to determine the order of stateful behavior. For more details about the Data Model, see ["Data Model" on page 35](#).

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### Prerequisites:

- Create a virtual service. For details, see ["How to Create a Virtual Service" on page 16](#).
- Optional but recommended: Record the behavior of the real service. For details, see ["How to Learn Services " on page 28](#)

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### To Access the Data Model Editor:

- Do one of the following:
  - In the Virtualization Explorer, double-click the Data Model you want to edit.
  - In the Virtual Service Editor, select the Data Model you want to edit, and click **Edit**.

The Data Model Editor opens displaying the Rules and Tracks for the model. For UI details, see ["Data Model Editor" on page 37](#).

### To Change the Model Name or Description:

1. Click the name to make the name and description editable.
2. Input the new name and description.
3. Hit **Enter** to commit your changes.

You can edit various aspects of the Data Model. For details, see the following sections:

- ["How to Manage Rules" below](#)
- ["How to Add Data Sources" on page 50](#)

## How to Manage Rules

Rule Function fields are used to give column data meaning. Setting a function to the column directly modifies the behavior of the simulation. Functions are set on a per column per operation principle. They can be split into two parts:

- *Condition functions*: Is, Ignore, Compare ordered, Compare unordered, and Custom condition functions
- *Action functions*: Set, Copy from, Replace array, and several Dynamic data functions (see below)

The default function for all columns is Ignore: the value does not influence the simulation in any way. Functions can be applied to various levels of a data line. Learned data rules are set as *is* function on requests and *set* function on responses.

When the simulation is in progress, the simulator engine walks through the rule according to rule priorities attempting to find a single line (from each rule) that most precisely conforms to the condition functions used. When a single data line is selected, all the action functions are applied to that data line.

## Dynamic Data Functions

You can use dynamic data functions to generate dynamic data in certain elements of the responses. There are three types of dynamic data functions:

- **Sequential number generator**. Used to generate a series of increasing/decreasing numbers in a specified format. The number increases/decreases by a predefined value with each received request.
- **Set relative date/time**. Used to generate a date and/or time that is relative to the time of the request arrival. For example: time of request arrival plus 2 hours and 5 minutes.
- **Set date/time relative to**. Used to generate a date and/or time that is relative to a date/time that is stored in any element of the request. For example: time stored in a certain element minus 3 days and 5 hours.

This section includes:

- ["Sequential Number Generator Function"](#)
- ["Set Relative Date/Time Function"](#)
- ["Set Date/Time Relative To Function"](#)
- ["Offset Format Specification"](#)
- ["Date/Time Formatting Used in Set Date/Time Functions"](#)

### Sequential Number Generator Function

Each cell under this function must contain a value in the following format:

Offset;Increment;FormatString

where:

- Offset is an integer
- Increment is an integer (positive or negative)
- FormatString is a regular text string that contains zero or more special sequences. Each of these sequences starts and ends with the '#' character. The output of the generator is defined by going through the FormatString and constructing an output string using these rules:
  - Any characters that are not part of the special sequence are copied to the output string.
  - For each empty special sequence (i.e. there are two '#' characters next to each other), a single '#' character is inserted into the output string.
  - Each non-empty special sequence must contain one or more 'D' characters. These characters act like a digit wildcard for a number that will be generated by this generator function. The number will always occupy exactly the number of specified digits.

To generate a sequence of numbers that differs for each request/response, each cell with this generator function has an internal numerical counter. When the simulation starts, this counter is always set to 0. Each time a generator function is called, the value (Offset + Counter) is used for the purposes of number formatting of each special sequence found in the FormatingString (see below). After the output is determined, the value of the Counter is increased by the value of the Increment (or decreased, if the Increment is a negative number).

**Formatting the special sequence:**

Each special sequence consists of a number of 'D' characters. The value (Offset + Counter) needs to be stored as a number that has exactly as many digits as there are 'D' characters in the special sequence:

- If the number does not occupy all digits, zeros are added before it so that it does.
- If the number is greater than the maximal number that can be stored within the digits, it is truncated so that it fits within (e.g. if the number was 3456 and the special sequence was #DDD#, the output will be 456).
- If the number is negative, it is truncated the same way as above. Then an additional offset is applied. The value of this offset is based on the number of digits and is selected so that -1 becomes the biggest number that fits within these digits. For example, if the special sequence was #DDDDD#, -1 becomes 99999. If it was #DD#, -67813 becomes -13 which then becomes 87.

**Examples of Sequential Number Generator (SNG) usage:**

The sequential number generator (SNG) is used to generate a token or a transaction identifier in a sequential manner. As sequential generation enables you to generate the same output given the same input, it can also be useful for testing purposes by reproducing failing scenarios.

*Increasing sequence*

The typical use case is generating strings that make use of an increasing number sequence.

Example: Cell „0;1;Visitor####DDD# will produce sequence Visitor#000, Visitor#001, Visitor#002...

*Decreasing sequence*

In cases where remaining time or another resource that is being depleted may identify some object, the decreasing sequences are used to generate such identifiers.

Example: The real service may be generating identifiers based on time remaining until some event starts.

Cell „10000;-100; SnapshotTimeTMinus:#DDDDD#

This cell produces the sequence: SnapshotTimeTMinus:10000, SnapshotTimeTMinus:09900...

#### *Multiple independent sequences*

When generating several classes of identifiers for various products, you want to maintain an independent sequence of identifiers for each class. You can achieve that by creating a separate rule for each class and use just one row in every rule. Use the *Is* function in the request to distinguish classes from each other. Each rule has a separate counter for SNG, so that the sequences are independent.

Example: The 3 product lines have to have easily distinguishable ids. Class 1 has the „1“ set as the first digit, class 2 has 2 etc.

Rule 1, Row 1, Cell under SNG function: „100000;1; codeNR-#DDDDDD#“

Rule 2, Row 1, Cell under SNG function: „200000;1; codeNR-#DDDDDD#“

Rule 3, Row 1, Cell under SNG function: „300000;1; codeNR-#DDDDDD#“

Requesting IDs in the following sequence {1,2,2,1,3,2,3,1}, the output results are as follows:

codeNR100000-, codeNR-200000, codeNR-200001, codeNR-100001, codeNR-300000, codeNR-200002, codeNR-300001, codeNR-100002,

#### *Multiple dependent sequences*

Consider following the previous use case with just one rule containing all rows instead of separate rules. In such a case, the internal counter is shared. Therefore, the sequences are not independent and the output relies on the previous sequence of calls even though they were not triggering the current row.

Example:

Rule 1,Row 1: „10;10;X1-#DDD#

Rule 1,Row 2: „100;100;X2-#DDD#

If we invoke the virtual service hitting the Row1,Row2,Row1, we get „X1-010; X2-110; X1-120“.

If the two rows were in separate rules, the output would be: „X1-010; X2-100; X1-020“.

#### *Multiple number occurrences*

It is possible to split the number that is being computed by SNG into multiple parts in the output string. This is achieved by repeating the #DDD# sequence. Note that the 'Ds' sequences within a single row may differ in length.

Example: A cell with following format (for example, a credit card number format):

"1234567890123456;1;#DDDD#-#DDDD#-#DDDD#-#DDDD#"

produces the following output sequence:

1234-5678-9012-3456

1234-5678-9012-3457

1234-5678-9012-3458

1234-5678-9012-3459

...

### **Set Relative Date/Time Function**

The **Set relative date/time** function stores a Date and/or Time value in the element that is calculated by adjusting a date/time when the request was received by a predefined Offset. The Offset is obtained from the cell. If the Offset is not specified for a particular cell or is in an incorrect format, 0s (0 seconds) offset is used. For information about the format of the Offset, see "[Offset Format Specification](#)" below.

The resulting date/time that will be put in the message is formatted according to the xsd type of the element. It can also be custom formatted. In that case, the cell with the custom format must contain the Offset, followed by a '#' character, followed by the Custom format specification (For example, -1:25:00#hh:mm).

For more information about the formatting according to xsd types and custom formatting, see "[Date/Time Formatting Used in Set Date/Time Functions](#)" on next page.

### **Set Date/Time Relative To Function**

The **Set date/time relative to** function stores a Date and/or Time value that is calculated in the element by adjusting a specified date/time by a predefined Offset. Instead of adjusting the date/time of the message arrival, this function requires the user to select a source element containing the date/time to be adjusted. Other than that, it works like the "Set relative date/time" function. The Offset is obtained from the cell. If the Offset is not specified for a particular cell or is in incorrect format, 0s offset will be used. For information about format of Offset, see "[Offset Format Specification](#)" below.

The resulting date/time that will be put in the message is formatted according to the xsd type of the element. It can also be custom formatted. In that case, the cell with custom format has to contain Offset followed by '#' character followed by Custom format specification (E.g. -1:25:00#hh:mm:ss).

For more information about the formatting according to xsd types and custom formatting, see "[Date/Time Formatting Used in Set Date/Time Functions](#)" on next page.

### **Offset Format Specification**

The Offset format contains a specification of the form:

[-][d.]hh:mm:ss[.ff]

Items in square brackets ([ and ]) are optional, colons and periods (: and .) are literal characters, and other items are as follows:

- "-" optional minus sign indicating a negative time
- "d" optional days
- "hh" mandatory hours, ranging from 0 to 23
- "mm" mandatory minutes, ranging from 0 to 59

- "ss" mandatory seconds, ranging from 0 to 59
- "ff" optional fractional seconds, consisting of 1 to 7 decimal digits

Examples:

- -54.12:00:59.1234567
- 0:00:00.001
- 365.0:00:00

### **Date/Time Formatting Used in Set Date/Time Functions**

Autodetection of types is based on the type of the element. The application can detect these xsd date/time types:

- xsi:date - "yyyy-MM-dd" (e.g. 1984-11-28)
- xsi:time - "HH:mm:ss" (e.g. 23:59:59)
- xsi:dateTime - "yyyy-MM-ddThh:mm:ss" (For example, 2001-12-13T10:15:33)

No other formats, including JSON date/time formats, can be detected, as their internal type is xsi:string. If the application cannot detect the format from the element's type, xsi:dateTime's format is used by default. If you want to specify other output formats, use the custom format feature. For details, see the custom formats below.

As noted above, the custom format is specified by adding '#' character after the offset (possibly empty) followed by custom format specification, which consists of:

- "d" - The day of the month, from 1 through 31.
- "dd" - The day of the month, from 01 through 31.
- "f" .. "fffffff" - Fractions of a second, number of "f" characters specifies number of digits to print
- "h" - The hour, using a 12-hour clock from 1 to 12.
- "hh" - The hour, using a 12-hour clock from 01 to 12.
- "H" - The hour, using a 24-hour clock from 0 to 23.
- "HH" - The hour, using a 24-hour clock from 00 to 23.
- "m" - The minute, from 0 through 59.
- "mm" - The minute, from 00 through 59.
- "M" - The month, from 1 through 12.
- "MM" - The month, from 01 through 12.
- "s" - The second, from 0 through 59.
- "ss" - The second, from 00 through 59.
- "tt" - The AM/PM designator.
- "yyyy" - The year, four digit number.



- regular characters (all characters except the ones mentioned above) - generated "as is". To generate a character that has a special meaning (is part of one of the custom formats above, such as "s"), place a '\' before it.

## Custom Functions

To define more complex conditions, Custom Functions can be used. These are to be used by an advanced user aware of the complete system structure. Complex conditions can be set with structured query language.

There are two classes of variables: Input (`$input_*`) and Data (`$data_*`). Input variables are those present in a processing row during simulation. A more simplified explanation of Input variables is that they are requests and Data variables are present in the data model.

Available variables:

- `$input_string` - original string - is automatically quoted in the place of usage
- `$input_string_unquoted` - original string - is not automatically quoted
- `$input_int` - original string converted to int data type - contains NULL if input string is not of this data type
- `$input_float` - original string converted to float data type - contains NULL if input string is not of this data type
- `$input_date` - original string converted to date data type - contains NULL if input string is not of this data type
- `$data_string`
- `$data_int`
- `$data_float`
- `$data_date`

Examples of custom functions:

- Match request data (cast to integer) smaller than actual value (cast to integer) found in the column `$input_int < $data_int`
- Match request data (cast to integer) smaller than actual value (cast to float) found in the column `$input_int < $data_float`
- Match actual value found in the column (cast to string) equal to 'cat' string `$data_string = 'cat'`
- Match request data (cast to string) equal to 'cat' string `$input_string = 'cat'`
- Match request data (cast to string) equal to actual value (cast to string using an SQL 'LIKE' operation) `$input_string LIKE $data_string`
- Match request data (cast to string) equal to any string starting with the actual value found in the column `$input_string LIKE $data_string + '%'`
- Match request data (cast to string) containing a substring 'cat' `$input_string LIKE`

```
'%cat%'
```

- Match request data (cast to date) smaller than actual data `$input_date < $data_date`
- Match request data smaller than actual data OR request data equal to 'dogs' string `$input_date < $data_date OR $input_string = 'dogs'`

## Simulation Preview

Simulation Preview displays in real time how changes in the Data Model are affecting the simulation. The Simulation Preview is in the **View Options** menu in the Data Model Editor. The Simulation Preview displays a simulation of the message that has the request part equal to the currently selected message in the Data Model Editor. The message is passed to the simulation engine and the result is displayed in the response section.

## How to Add Service Call Activity

External services can be called by the Virtual Service. Only SOAP services are supported .

1. In the Data Model, select the operation for **Service Call Activity**.
2. Click **Import Activities** under the Activity menu.
3. Enter the path of the WSDL schema.
4. Click **Finish**.
5. Click on Activity menu again.
6. Select operation of the imported schema.
7. Service Call Activity is added into each rule for the selected operation.
8. You can turn Off/On calling of the service for any rule.
9. Use **Copy from** function on any Service Call Activity request column or Virtual Service response column.
  - a. **Choose Copy** from function
  - b. Move the cursor over the columns. The cursor type indicates if you can use a column as a source for the **Copy from** function or not (using **Copy from** on incompatible data types is not permitted).
  - c. Click on a source column.
  - d. The name of the source column is now displayed in brackets next to the **Copy from** function.
10. You can set data in the rule rows for another columns or set other functions available in Data Model Editor. For details, see "[Data Model Editor](#)" on page 37.

## How to Add Data Sources

Additional data from external data sources can be added to a data model for testing purposes. The supported format for this data is MS Excel (*.xls*, *.xlsx*).

1. In the Data Model, click **Data Driven Rule** under the **New Rule** menu.
2. Enter the path and filename for the data source.
3. Optional: Use the first row of the table for column names.
4. Give the data source a name.
5. Click **Finish**.

**How to Bind an External Data Source:**

1. Select **External Data** rule.
2. Expand a table header and its child headers until you have a "leaf" header (only leaf headers can be bound).

Click **bind data...** on the top of a column (if it is not visible, select **Data Binding** from the View Options menu).

- a. Optionally, an array can also be bound by selecting content that is not yet related to the target sheet. The **Edit Sheet Relations** dialog displays, and a Primary and Foreign Key must be assigned. For more details on binding arrays, see ["Array Binding" on next page](#).
- b. When binding data formats and/or response types, you can map values using the Data Format Binding dialog box. For details, see ["Data Format, Response Type, or Choice Binding" on page 53](#).

Click **OK** to confirm and close the dialog box.

3. Click on any column in the displayed external data source table.
4. Repeat previous two steps for other columns.
5. Click **OK**.

**How to Refresh an External Data Source:**

1. Select the **Refresh Data Source** command from the Data Source menu.

Alternately:

Right click on the rule number and select **Refresh Data Source**.

2. Click **OK**.

**Note:** Data source is refreshed when simulation is started/restarted.

**How to change the path of a data source:**

1. Select **Change Data Source Path** from the Data Source menu.

Alternately:

Right click on the rule number and select **Change Data Source Path**.

2. Enter the path and filename for the data source.
3. Optional: Use the first row of the table for column names.
4. Click **Finish**.

**Note:** To remove a binding from the table, Click **X** next to the **Bind data** button.

## Array Binding

This section discusses binding arrays. For details on adding data sources, see "How to Add Data Sources" on page 50.

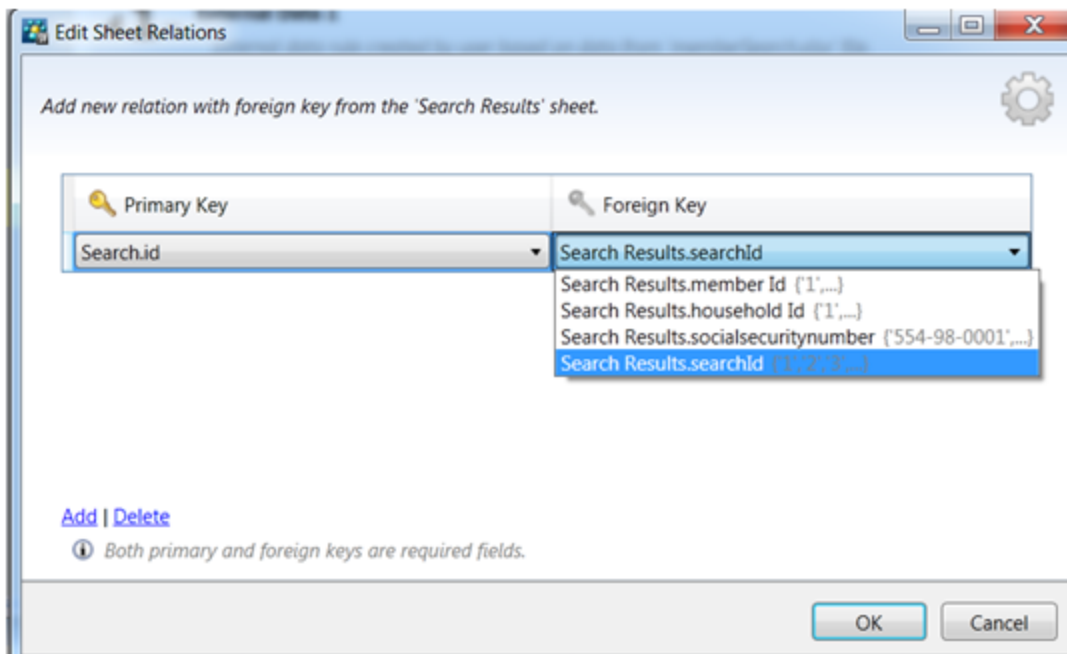
When the message structure contains an array that needs to be data-driven, an Excel file needs to be prepared for this. The file should contain database-like relationships, using primary and foreign keys, which allow the mapping of one row to many.

The following example shows the relationship between a search definition and the search result. A record in the **Search** worksheet is identified via its primary key 'id', and referenced from the Search Result worksheet via the foreign key 'searchId'.

|    | A  | B         | C                         | D                    |  | A         | B            | C          | D        |
|----|----|-----------|---------------------------|----------------------|--|-----------|--------------|------------|----------|
| 1  | id | firstName | lastName                  | socialSecurityNumber |  | member Id | household Id | socialsecu | searchId |
| 2  | 1  | Hercule   | Poirot                    | 554-98-0001          |  | 1         | 1            | 554-98-00  | 1        |
| 3  | 2  | Hercule   | Poirot                    |                      |  | 1         | 1            | 554-98-00  | 2        |
| 4  | 3  |           | Poirot                    |                      |  | 1         | 1            | 554-98-00  | 3        |
| 5  | 4  | Karel     | Got (fail: not in system) |                      |  | 11        | 11           | 554-98-00  | 3        |
| 6  | 5  | Sherlock  | Holmes                    | 332-10-0002          |  | 2         | 2            | 332-10-00  | 5        |
| 7  | 6  |           |                           | 332-10-0002          |  | 2         | 2            | 332-10-00  | 6        |
| 8  | 7  | Albert    | Einstein                  | 809-42-0002          |  | 3         | 3            | 809-42-00  | 7        |
| 9  | 8  |           |                           | 809-42-0002          |  | 3         | 3            | 809-42-00  | 8        |
| 10 | 9  |           | Einstein                  |                      |  | 3         | 3            | 809-42-00  | 9        |
| 11 |    |           |                           |                      |  |           |              |            |          |

This enables the return of two rows for a search with id 3, or zero rows for search of id 4.

When an item under the array is going to be bound, the **Edit Sheet Relations** dialog box displays:



This dialog box can be also launched manually from the context menu above rule or table headers.

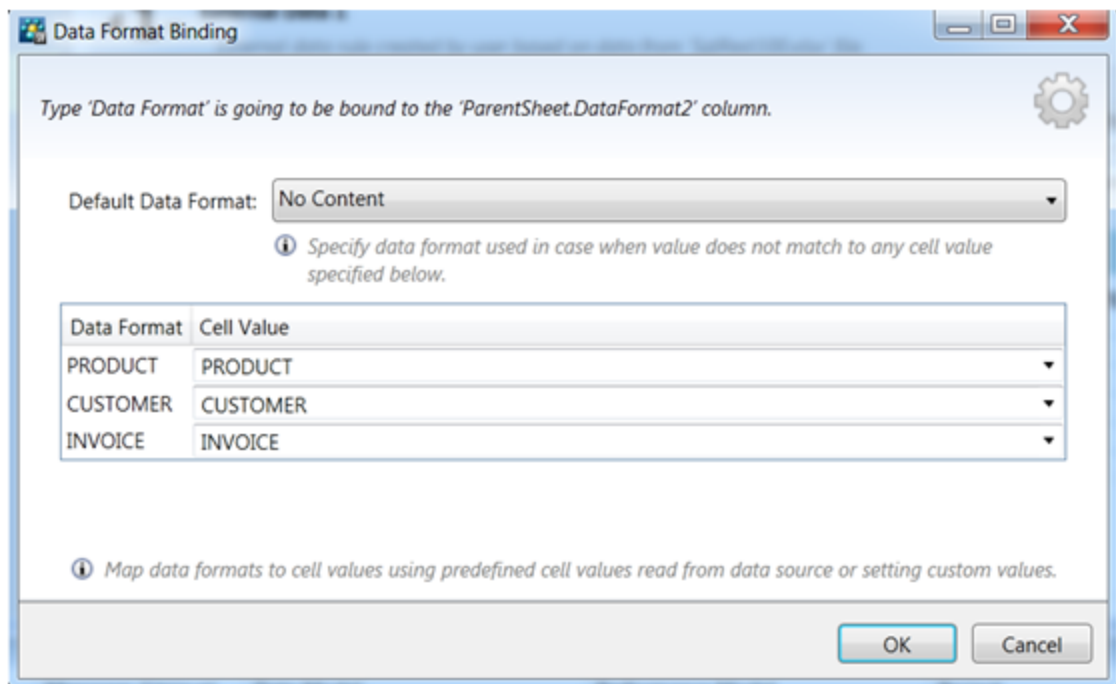
The dialog box enables you to set relationships between worksheets, which is required for array binding. There can be multiple relationships from/to one worksheet.

**Tip:** When there is a 1 to 1 relationship, there will be exactly one item in the array for each row. Items of the array can be located on the same worksheet as other data, and the relationship will be specified as the same worksheet column for the Primary and Foreign Key. This works only for a one level array. It cannot be used if the array is part of another array.

## Data Format, Response Type, or Choice Binding

This section discusses data format, response type, and choice binding. For details on adding data sources, see "How to Add Data Sources" on page 50.

When binding to an Excel worksheet column where the response can contain different Data Formats (REST), different Response Types (SOAP), or a message structure which can be considered to contain different types, the following dialog box opens, enabling you to configure the binding:



This dialog box enables you to configure mappings between real types/formats and cell values:

- The default value is used when no value from the mapping table matches.
- The table enables you to configure each possible type/format to a cell value.
- If there is no need to bind different types/format in one Excel worksheet, a special column is not required. In this case, a default binding is automatically created.

## Performance Model

The Performance Model enables you to customize the performance of a service during simulation.

When you create a Virtual Service, Service Virtualization creates a Performance Model associated with it. For details, see ["How to Create a Virtual Service" on page 16](#).

This model is then available to learn the performance of the real service and can be customized to set specific performance rules either for the whole service, or its individual operations.

You can edit the Performance Model in the following ways:

- **Boosters**

Select to boost an aspect of the service performance (for example, CPU or Network performance) and set a multiplier. Service Virtualization applies the boost to the relevant performance criteria.

- **Basic Performance Criteria**

Set levels for the following performance criteria for specific operations of the service:

- Response Time [ms] - the time for the service to process a request and return a relevant response.
- Threshold [hits/s] - the maximum number of requests and responses the service can process without any impact on performance.
- Throughput Limit [MB/s] - the maximum data capacity the service can process.

- **Advanced Performance Criteria**

In addition to the basic criteria, set levels for the following criteria for specific operations of the service:

- Tolerance [%] - the acceptable range of variation in performance for the operation.
- Maximum Hits per Second - the maximum number of requests and responses the operation is allowed to process.
- Maximum Response Time - the maximum time for a response at peak performance levels.

For more details, see ["How to Edit Performance Models" on page 56](#).

Each Virtual Service can have multiple performance models. For details, see ["How to Manage Models" on page 35](#).

Prior to recording or simulation you can select which model to use, including non-customizable models to ignore the performance or simulate the unavailability of a service. For details, see ["How to Select Models" on page 29](#).

## Performance Model Editor

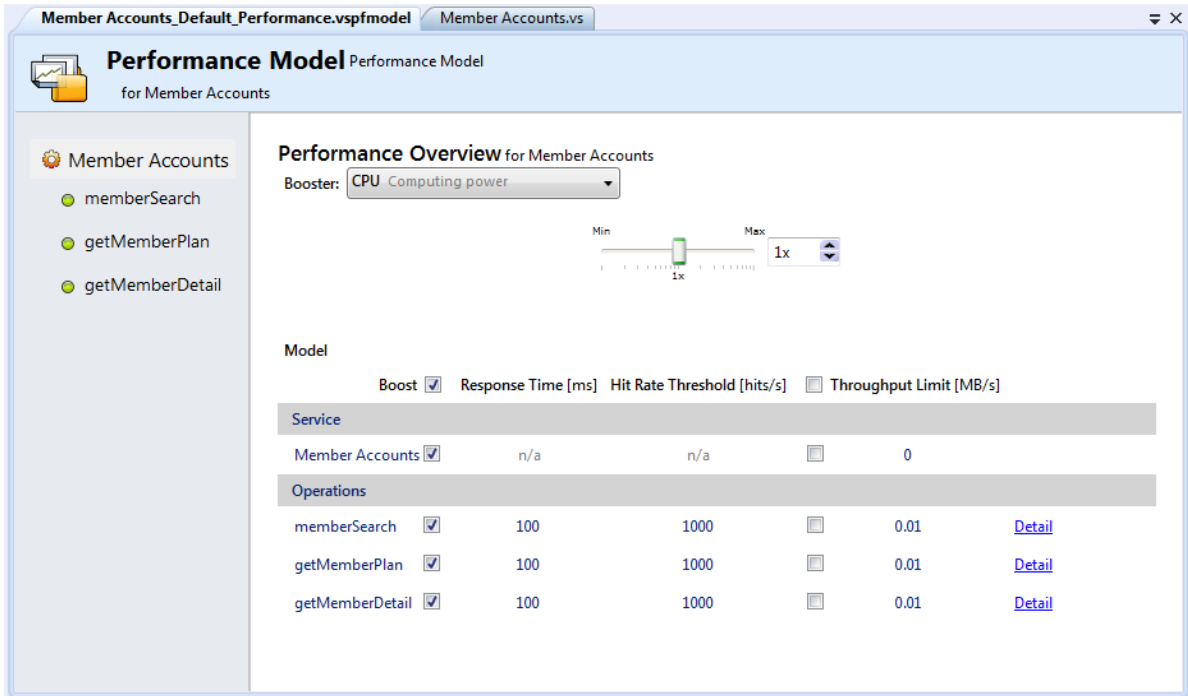
The Performance Model Editor enables you to configure performance metrics for a Virtual Service during simulation. The performance can be configured for the whole service or for its individual operations.

Access the Performance Model Editor in one of the following ways:

- In the Virtualization Explorer, double-click the Performance Model you want to view or edit.
- In the Virtual Service Editor, in the Performance Model section, select the model you want to view and click **Edit**.

The Performance Model Editor opens for the selected model showing details at the service level.

**Performance Model Editor - Service Level**



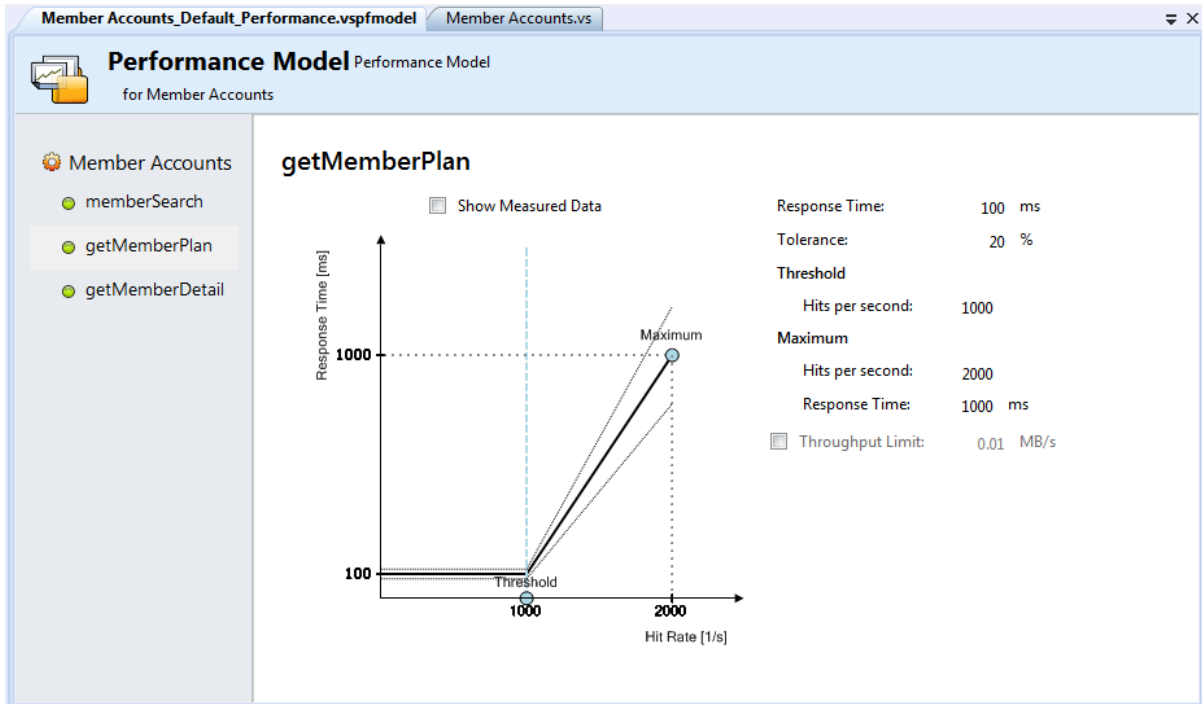
The service view of the Performance Model displays the following content and controls:

**Performance Model Editor - Service Level Content**

| Column                        | Description  |
|-------------------------------|--|
| Model Name                    | The name of the model (click to edit).   |
| Service / Operation Hierarchy | The hierarchy on the left shows the service name and a tree of its operations. Click an item in the hierarchy to view its details.   |
| Boosters                      | A set of boosters to provide high-level control of the operations selected in the operations table.  |
| Booster Controls              | The sliding controls and inputs enable you to set the boost level for the selected booster. The setting affects the various performance criteria displayed in the operations table.    |
| Operations Table              | Enables you to set more granular settings for individual performance criteria for individual operations. Click <b>Detail</b> to open an operation level view of the performance model. |

Selecting an operation from the hierarchy or clicking its Detail link in the operations table opens the detail for that operation.

**Performance Model Editor - Operation Level**



The operation view of the Performance Model displays the following content and controls:

**Performance Model Editor - Operation Level Content**

| Column                        | Description   |
|-------------------------------|---|
| Model Name                    | The name of the model (click to edit).  |
| Service / Operation Hierarchy | The hierarchy on the left shows the service name and a tree of its operations. Click an item in the hierarchy to view its details.  |
| Operation Name                | Performance criteria for the operation (click to edit).   |
| Performance Graph             | The graph displays the expected performance based on the criteria set for the operation. Select <b>Show Measured Data</b> to view any recorded performance data in the graph. |
| Performance Criteria          | Displays the advanced performance criteria for the operation with the option to edit them.  |

For more details about the Performance Model Editor controls and their impact, see "[How to Edit Performance Models](#)" below.

**How to Edit Performance Models**



**Prerequisites:**

- Create a virtual service. For details, see "How to Create a Virtual Service" on page 16.
- Optional but recommended: Record the performance of the real service.

**To Change the Performance of a Virtual Service:**

1. In the Virtualization Explorer, double click on **Performance Model** or once on **Edit** to open the Performance Model
2. Click the **Booster** drop down list to display available options:
  - **CPU:** Use the slider, enter a value or use the arrow buttons to assign a CPU power multiplication factor .
  - **Network:** Use the slider, enter a value or use the arrow buttons to assign a network throughput multiplication factor.
  - **Cluster:** Use the slider, enter a value or use the arrow buttons to assign a scalability multiplication factor.
  - **Expert:** Use the sliders, enter values or use the arrow buttons to assign multiplication factors to *Response Time*, *Hit Rate* and *Throughput Limit* values.
  - **None:** Turn off all boosters.

**Note:** Simulation must be restarted to apply changes.

3. Clicking the **Boost** and **Throughput Limit** radio buttons applies the performance changes to the service and all operations. These can also be selected individually by clicking the radio button next to the required service or operation.

**Advanced Performance Criteria**

1. Click **Detail** or the name of the name of the operation in the side column to open the Operation Detail page for that operation.
2. Modify values by clicking on the value and entering a new value or by dragging the **Maximum** and **Threshold** indicators in the graph.
3. Optional: Click the **Show Measured Data** radio button to present Measured Data can be presented in the graph.
4. Optional: Click the **Throughput Limit** radio button to change the value and modify the Throughput Limit .
5. Save the modifications with the **File>Save** menu or closing the model.

## Service Description Editor

The Service Description Editor is used for editing a virtual service. It can be accessed by double clicking a Service Description in the Virtualization Explorer, clicking Edit in the Service Description

section of the Virtual Service Editor, or selecting Edit URI Spaces from the URI Spaces menu of the Data Model Editor.

The Service Description Editor consists of two parts: Service Editing and the URI Space Editing.

### **Service Editing**

Metadata are generally not part of a message body and mainly contain URL parameters and HTTP headers.

Some types of metadata, such as HTTP Headers, are not required for tested applications; they may be important for the protocol, but the application does not require them and they are not learned for purposes of virtualization. By default they are disabled in the request but it is possible to enable them and edit the data in the Data Model Editor for use in a simulation.

Metadata such as URI Parameters are generally used by tested applications and are enabled by default.

["How to Edit Metadata" below](#)

["Working with XML Schema" on next page](#)

**Note:** Currently, REST is fully supported and WebSphere MQ is partially supported for editing.

### **URI Space Editing**

["How to Add a URI Space" on next page](#)

["How to Delete a URI Space" on next page](#)

["Working with Data Formats" on next page](#)

**Note:** Not all operations are available for all protocols.

## **How to Edit Metadata**

Click **Edit Request Metadata** or **Edit Response Metadata** in the Service Description Editor to open the Edit Request or Response Metadata window.

Select the item you would like to edit. Items can be filtered by entering text in the filter box.

- Click **Add** to Add New Metadata
  1. Enter a name for the metadata
  2. Select a type from the drop down box
  3. Click **OK**.
- Select metadata and click **Delete** to remove the metadata from an item.
- Click **Enable/Disable** on either an item or its metadata to either activate or deactivate the selection.
- Click **Edit** to change the settings of any metadata.

## Working with XML Schema

Default XML Schema are presented in the Service Description Editor and can be edited, added or removed from the service description.

- Click **Add** and select an existing schema (.xsd file) to have it added to available schema for the service description.
- Click **Edit** to open the schema and alter it in an xml editor.
- Click **Delete** to remove the schema from the service description.

## How to Add a URI Space

In order to diversify your data, you may want to create more URI spaces to place the data in.

Existing URI spaces are presented in a tree structure on the left side of the Service Description Editor. Clicking on the name of an existing URI space opens it in the URI Space Editor.

Click **Add URI Space** in the left bottom of the Service Description Editor.

Enter a URI path and click **Add**.

**Note:** Segments are separated with a '/' and the wildcard character '\*' is used for several characters or segments. An example being "Customer/\*/Europe/\*".

**Caution:** If a URI Space that is in conflict with an existing URI Space and the new URI Space is more specific, the conflicting URI Space is split to several new URI Spaces and data from all associated rules are moved to these new URI Spaces.

## How to Delete a URI Space

Select a URI Space in the left column of either the Service Description Editor or the URI Space Editor and click **Delete URI Space** in the left column to remove the URI Space.

## Working with Data Formats

Data formats can be added and removed from a URI Space as either Request or Response Data Formats.

In either format, click **Add** to open Add Message Type window and optionally:

1. Select **Copy from existing URI Space**.
2. Choose a URI Space from the drop down list.
3. Click **Finish** to add the format.

Or

1. Select **New Data Format**.
2. Choose a format from the drop down list.
3. Choose a type from the second drop down list.

Optionally, click **External File** to import schema other sources.

4. Click **Finish** to add the format.

# Chapter 4

---

## Composite Application Topology

The Topology Editor and Tools enables you to model composite applications by creating a visual map of services, group them into larger composites, mark their types, and display the service calls between them. This document refers to these maps as a Topology.

**This chapter includes:**

|   |    |
|---|----|
| How to Add Topologies.....                          | 62 |
| How to Model Composite Applications.....            | 62 |
| How To Test Composite Applications.....             | 63 |
| How to Create Virtual Services in Topologies.....   | 66 |
| How to Reconfigure Clients in Topologies.....       | 67 |
| How to Learn Service Behavior in Topologies.....    | 68 |
| How to Simulate Service Behavior in Topologies..... | 68 |
| Topology Editor Reference.....                      | 69 |

## How to Add Topologies

### To add a topology:

1. From the **File** menu, select **New > Topology**.  
Alternatively, in the Virtualization Explorer, right-click and select **Add > Topology**.  
The Summary of New Topology page opens, displaying a default name for the new topology.
2. To create the new topology using the default name, click **Create**.
3. Alternatively, to change the name of the new topology, click **Change**. Edit the topology name, or enter a new name. Click **Save** to return to the Summary page.  
Click **Create** to create the new topology.
4. Service Virtualization creates a new topology in your virtualization project, and opens the Topology Editor, enabling you to edit the new topology. The default topology contains a service calling a limited access service.

To learn more about topologies, see "Composite Application Topology" on previous page.





## How to Model Composite Applications

---

### Prerequisites:

- Add or import a topology to your project. For details, see "[How to Add Topologies](#)" above
- 

### To Edit Service Topologies:

1. Open the Topology Editor view.  
In the Virtualization Explorer, double-click a topology to open the Topology Editor and Tools.
2. Add items to the Topology.  
Drag and drop the required items from Tools to the Editor.  
Tools contains the following items:
  -  **Service**  
A service with no particular notation.
  -  **Limited Service**  
A service marked as having limited access.
  -  **Secured Service**  
A service marked as requiring some authentication.
  -  **Group**  
A generic box enabling you to organize services into larger composites for visual purposes.

**3. Rename Services and Groups.**



Open the context menu for a topology item and select Rename, select the item and press F2 or double click the text.

**4. Connect services together with Service Call Connectors.**



Move the cursor to the right edge of the calling service until you see the hand icon, and then click and drag the connector to the called service.

**5. Mark relevant services as limited or secured.**

Open the context menu for a service to use the following options:

-  **Set / Unset Limited Access**  
Mark or unmark a service as having limited access.
-  **Set / Unset Secured Access**  
Mark or unmark a service as requiring authentication.

**Other Context Actions:**

| Context Action                       | Icon   | Description  |
|--------------------------------------|--|--|
| Test                                 |   | Begin testing of the service.                        |
| Preview Test Impact                  |  | Switch On / Off the Test Impact highlighting.        |
| Learn and Simulate                   |  | Shortcut combo for Create Virtual Service and Learn. |
| Create Virtual Service               |  | Starts the Create Virtual Service wizard.            |
| Rename (or double-click the service) |  | Give a different name to the service.                |
| Delete                               |  | Remove the service from the topology.                |

## How To Test Composite Applications

In the topology view of a composite application, you can initiate a step-by-step process for testing a particular service which guides you through all the processes required to virtualize, learn, and simulate the limited access services that the tested service calls.

---

**Prerequisites:**

- Model your composite application by editing the topology, ensuring that you mark the limited and secured services. For details, see "[How to Model Composite Applications](#)" on previous page.

---

**To Test Services in a Composite Application:**

- In the Topology Editor, open the context menu for the services you want to test and select **Test**. 

The Tasks view opens showing a guided process for end-to-end setup and configuration for testing the composite application. For details, see the following topics:

1. ["How to Virtualize Services in the Tasks View" below](#)
2. ["How to Reconfigure Clients in the Tasks View" on next page](#)
3. ["How to Learn Services in the Tasks View" on next page](#)
4. ["How to Simulate Services in the Tasks View" on page 66](#)

## How to Virtualize Services in the Tasks View

If you have not yet created virtual services for limited access services or if there is some missing information, you are prompted to provide this information.

---

### Prerequisites:

1. Model your composite application by editing the topology, ensuring that you mark the limited and secured services. For details, see ["How to Model Composite Applications" on page 62](#).
2. Mark at least one service as being tested. For details, see ["How To Test Composite Applications" on previous page](#).

---

### To Virtualize Services in the Tasks View:

1. To virtualize services, do one of the following:
  - To provide all the missing information for all virtualized services, click **Virtualize Services**.
  - To provide the missing information for selected virtualized services, expand **Customize Virtualization of Services**, select the Services to virtualize, and click **Virtualize Selected Services**.

The Virtualize Services dialog box opens.

2. *Optional:* The Virtualize Services dialog box displays the services requiring additional information. Click **Next** to continue.

**Tip:** Select **Do not show this message again** if you want to skip this information panel in future testing.

3. **Specify Virtualization for Service:**

You may either select an existing virtual service from the drop down list or create a new virtual service. See ["How to Create a Virtual Service" on page 16](#).

When all the missing information for each service is complete, Virtualize Services is marked as complete and you proceed to Reconfigure Clients. For details, see ["How to Reconfigure Clients in the Tasks View" on next page](#).



Service Virtualization adds the virtual services, any new service descriptions, and a data and performance model for each service to the Virtualization Explorer. The Runtime View also updates to include the new virtual services.

## How to Reconfigure Clients in the Tasks View

In cases where Service Virtualization can only perform intrusive virtualization, you must reconfigure calling services to use the virtual services instead of the real ones.

---

### Prerequisites:

1. Model your composite application by editing the topology, ensuring that you mark the limited and secured services. For details, see ["How to Model Composite Applications" on page 62](#).
  2. Mark at least one service as being tested. For details, see ["How To Test Composite Applications" on page 63](#).
  3. Provide any missing information required to virtualize limited and secured services. For details, see ["How to Virtualize Services in the Tasks View" on previous page](#).
- 

### To Reconfigure Clients:

1. Click **View** to open the Instructions to Reconfigure Clients dialog box showing the particular details for the virtualized services in your composite application.
2. *Optional:* Click **Save As** to save a text document copy of these instructions.
3. Click **Mark as Completed** when you have reconfigured the tested service and are ready to proceed to Learn Services. For details, see ["How to Learn Services in the Tasks View" below](#).

## How to Learn Services in the Tasks View

When your virtual services are properly setup and the calling services reconfigured to use them, you can learn the behavior of the composite application.

**Note:** If you already have simulation models for your composite application, you can click **Skip to Simulate Services** to proceed without recording any additional service communication. For details, see ["How to Simulate Services in the Tasks View" on next page](#).

---

### Prerequisites:

1. Model your composite application by editing the topology, ensuring that you mark the limited and secured services. For details, see ["How to Model Composite Applications" on page 62](#).
  2. Mark at least one service as being tested. For details, see ["How To Test Composite Applications" on page 63](#).
  3. Provide any missing information required to virtualize limited and secured services. For details, see ["How to Virtualize Services in the Tasks View" on previous page](#).
  4. Reconfigure any components that call the virtualized services. For details, see ["How to Reconfigure Clients in the Tasks View" above](#).
- 

### To Learn Services:

1. Click **Learn Services** to put the virtual services into Learning Mode.
2. Run your test through the composite application using a client or test script. Service Virtualization records the requests and responses for each virtualized service and creates a simulation model for each.

As you run your test, the Runtime View updates the details for each virtual service.

When you have finished recording, you are ready to proceed to Simulate Services. For details, see ["How to Simulate Services in the Tasks View"](#) below.

## How to Simulate Services in the Tasks View

When you have a simulation model, you can simulate the behavior of the real services without using them. The tested service calls the virtual services and returns results based on the simulation model instead of actual responses from the real services.

---

### Prerequisites:

1. Model your composite application by editing the topology, ensuring that you mark the limited and secured services. For details, see ["How to Model Composite Applications"](#) on page 62.
2. Mark at least one service as being tested. For details, see ["How To Test Composite Applications"](#) on page 63.
3. Provide any missing information required to virtualize limited and secured services. For details, see ["How to Virtualize Services in the Tasks View"](#) on page 64.
4. Reconfigure any components that call the virtualized services. For details, see ["How to Reconfigure Clients in the Tasks View"](#) on previous page.
5. Learn the behavior of the virtualized services. For details, see ["How to Learn Services in the Tasks View"](#) on previous page.

---

### To Simulate Services:

1. Click **Simulate Services** to put the virtual services into simulate mode.
2. Run your test through the composite application using a client or test script. Service Virtualization processes the requests to each virtualized service and returns responses based on the simulation model for each.

As you run your test, the Runtime View updates the details for each virtual service.

## How to Create Virtual Services in Topologies

---

### Prerequisites:

- Your topology must contain at least one service. For details, see ["How to Model Composite Applications"](#) on page 62.

---

### To Create Virtual Services:

1. In the Topology Editor, open the context menu for the service you want to virtualize, and select **Create Virtual Service**.
2. The Virtualize Services wizard steps through the following dialogs for the service, depending on which information is required:

**Specify Virtualization for Service**

- a. You may either select an existing virtual service from the drop down list or create a new virtual service. See "[How to Create a Virtual Service](#)" on page 16.
- b. **Add Service Security Settings**

If a service is marked as secure and does not already have any associated authentication, Service Virtualization cannot access the service and prompts you to provide authentication. For details, see "[Setting Authentication Credentials](#)" on page 24.

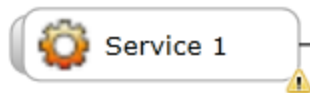
When the service contains all the required information the topology diagram updates to indicate that the service is virtualized.



When you virtualize services, the components that call them may require reconfiguration. For details, see "[How to Reconfigure Clients in Topologies](#)" below.

## How to Reconfigure Clients in Topologies

When you virtualize a service in the topology editor, the editor indicates that the calling components may require reconfiguration by adding an exclamation icon to the calling component.



---

**Prerequisites:**

- Your topology must contain at least two services. For details, see "[How to Model Composite Applications](#)" on page 62.
- A called service must have been virtualized. For details, see "[How to Create Virtual Services in Topologies](#)" on previous page.

---

**To Reconfigure Clients:**

1. In the Topology Editor, click the exclamation icon to open the Reconfigure Service pop-up.  
The pop-up displays the endpoint details for the real and virtual services the component calls, providing the information you require to reconfigure the calling component.
2. When you have reconfigured the calling component, click **Mark Completed** and close the pop-up.

The exclamation icon is removed from the calling component.

## How to Learn Service Behavior in Topologies

In the topology view of a composite application you can learn the behavior of individual services.

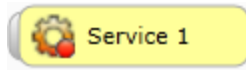
---

### Prerequisites:

- Edit the topology, marking limited and secured services, and importing service descriptions for the services you want to learn. For details, see ["How to Model Composite Applications"](#) on page 62.
- 

### To Learn Service Behavior:

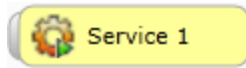
1. In the Topology Editor, open the context menu for each service you want to record and select **Learn**. The topology diagram changes, displaying the service in Learning Mode.



2. Run your test through the composite application using a client or test script. Service Virtualization records the requests and responses for the virtualized services and creates simulation models for each one.

As you run your test, the Runtime View displays details for each virtual service.

3. When you have finished recording, open the context menu for the services you are recording and select **Stop Learning**. The topology diagram changes, displaying the service in Simulate Mode. Optionally, select **Simulate** and the application stops the learning process and switches directly to simulating.



## How to Simulate Service Behavior in Topologies

In the topology view of a composite application you can simulate the behavior of individual services.

---

### Prerequisites:

1. Edit the topology, marking limited and secured services, and importing service descriptions for the services you want to simulate. For details, see ["How to Model Composite Applications"](#) on page 62.
  2. Learn the behavior of the services you want to simulate. For details, see ["How to Learn Service Behavior in Topologies"](#) above.
- 

### To Simulate Service Behavior:

1. In the Topology Editor, open the context menu for each service you want to record and select **Simulate**. The topology diagram changes, displaying the service in Simulate Mode.



2. Run your test through the composite application using a client or test script. Service Virtualization processes the requests to each virtualized service and returns responses based on the simulation model for each.

As you run your test, the Runtime View displays details for each virtual service.

## Topology Editor Reference

The annotation for each service varies depending on its settings and various stages of configuration.

| Service Diagram | Description  |
|-----------------|--|
|                 | An empty service which does not contain an associated service description.   |
|                 | A service marked as having limited access.   |
|                 | A service marked as secure, requiring credentials to access.   |
|                 | A virtualized service.   |
|                 | A virtualized service in Learning Mode. Service Virtualization records any requests and responses through this service and adds them to the associated Simulation Model. |
|                 | A virtualized service in Simulation Mode. Service Virtualization monitors any requests to this service and returns responses based on the associated Simulation Model.   |
|                 | A service marked as being tested.  |
|                 | A service suggested for virtualization.  |
|                 | A service requiring attention because it calls a virtualized service and may require reconfiguration to call the virtual service instead of the real one.                |

# Chapter 5

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## Supported Technologies And Environments

This chapter provides details of the transport and message protocols supported by Service Virtualization, as well as instructions on configuring the Service Virtualization agents that handle communication specific to these protocols.

**This chapter includes:**

|  |    |
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# Supported Transport and Message Protocols Matrix

The following combinations of transport and message protocols are supported in Service Virtualization.

| Message / Transport Protocol Matrix | Transports     | HTTP(S)            |                     |                     | IBM WebSphere MQ   | TIBCO EMS       | JMS               |
|-------------------------------------|----------------|--------------------|---------------------|---------------------|--------------------|-----------------|-------------------|
|                                     |                | HTTP(S) Gateway    |                     | HTTP(S) Proxy       |                    |                 |                   |
|                                     | HP SV Agents   | HTTP Gateway Agent | HTTPS Gateway Agent | HTTP(S) Proxy Agent | WebSphere MQ Agent | TIBCO EMS Agent | Generic JMS Agent |
| Messages                            |                |                    |                     |                     |                    |                 |                   |
| Service Type                        | Message Format |                    |                     |                     |                    |                 |                   |
| SOAP                                | SOAP           | ✓                  | ✓                   | ✓                   | -                  | ✓               | ✓                 |
| Binary                              | Binary         | ✓📄                 | ✓📄                  | ✓📄                  | ✓📄                 | ✓               | ✓📄                |
| XML                                 | XML            | ✓📄                 | ✓📄                  | ✓📄                  | ✓📄                 | ✓               | ✓📄                |
| REST                                | Binary         | -                  | -                   | ✓📄                  | -                  | -               | -                 |
|                                     | XML            | -                  | -                   | ✓📄                  | -                  | -               | -                 |
|                                     | JSON           | -                  | -                   | ✓📄                  | -                  | -               | -                 |

## Legend:

- Transport = The transport level protocol refers to the technology used for communication between the client and the service.
- Message = The message level protocol refers to the message types or data format used in communication between the client and the server.
- ✓ = indicates a supported combination of transport and message protocols.
- 📄 = indicates that metadata is supported for the protocol combination. When editing a data model, transport protocol metadata, such as HTTP headers, can be added or modified.
- "-" = indicates that the combination is not currently supported.

## How to Change Agent Configuration

A Service Virtualization agent is the software component that handles communication between a client and a real or virtual service. It maintains endpoints on which Service Virtualization communicates.

### Agent configuration in Designer UI

If using the embedded server, the agent configuration can be changed in the Designer UI from the menu: **Tools > Options > Agents**.

### Agent configuration in configuration files.

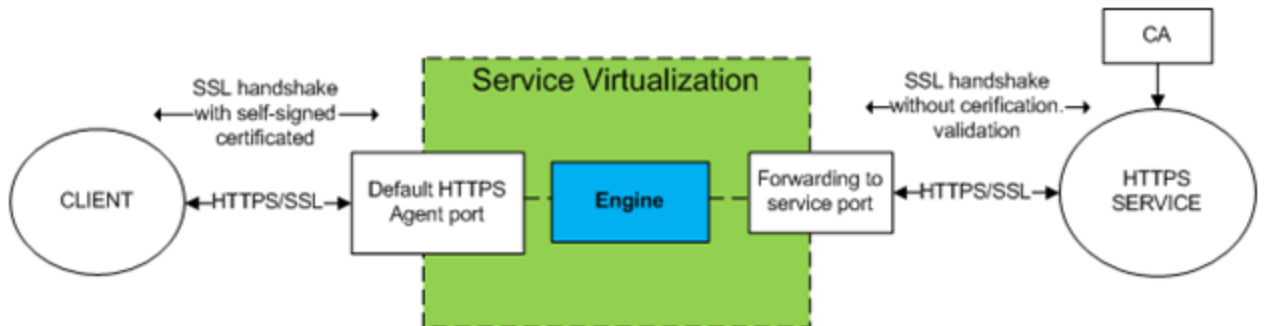
Agent configurations for both Embedded and Standalone servers are stored separately in the file system.

- Embedded server agent configuration at:
  - %APPDATA%\Hewlett-Packard\VirtualServiceDesigner\Agents\AgentConfigurations.xml
- Standalone server agent configuration at:
  - %[INSTA-LLLOCATION]%\StandaloneServer\bin\Agents\AgentConfigurations.xml

To change the agent configuration, you must change the agent configuration file manually. To apply the changes in the configuration files, restart the changed server.

## Configuring HTTP(S) Gateway Agent

The HTTP(S) Gateway Agent serves to virtualize HTTP communication. A virtual HTTP endpoint is created to mediate between a client and a real service HTTP endpoint. During the learning process, real communication is forwarded to a real service HTTP endpoint and the communication is recorded.



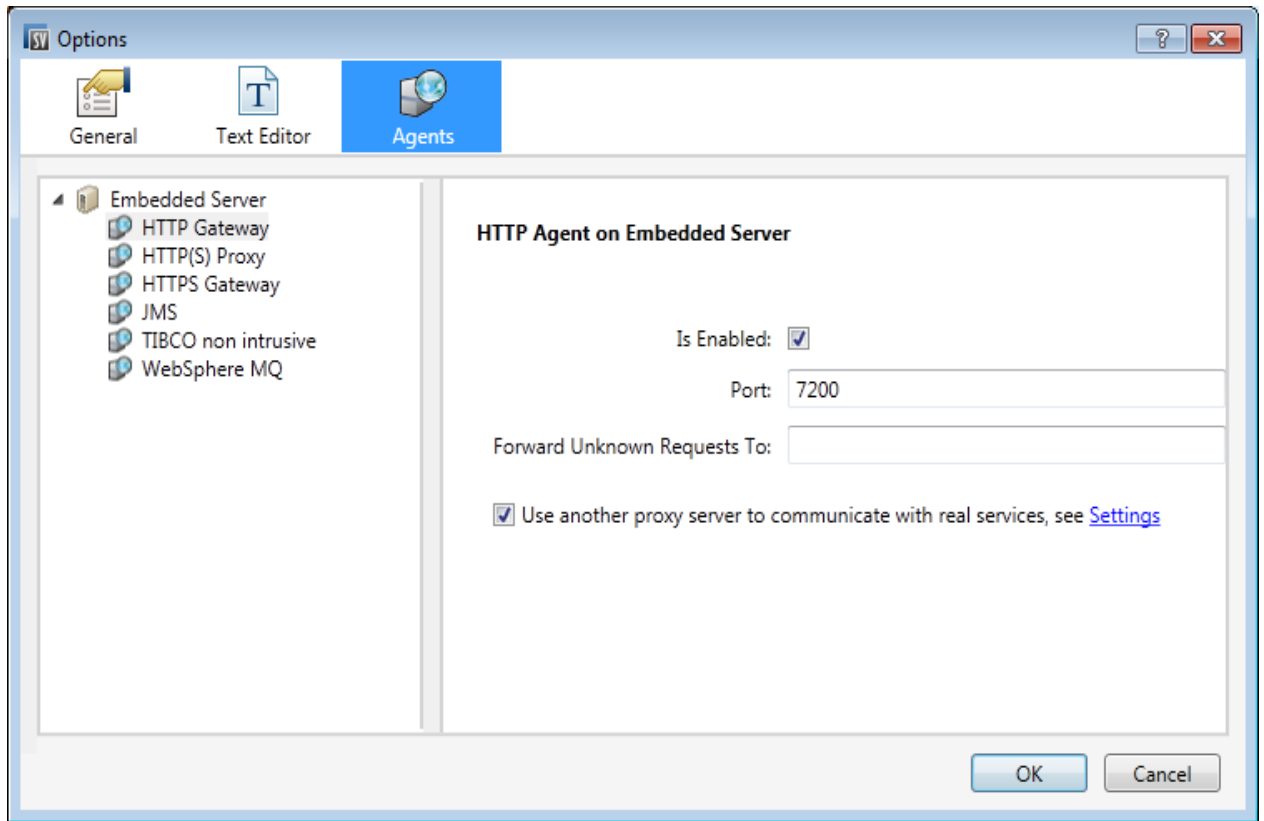
### To configure the HTTP(S) Gateway Agent:

From the **Tools** menu, select **Options**, click the **Agents** tab and choose **HTTP** Gateway from the tree menu.

There are two configuration options:

- Port: The port of the Service Virtualization Server used by the agent to deploy virtual services.
- Forward Unknown Request To: The URL prefix that forwards requests other than the requests to virtual services.





In the case you are not able to reconfigure clients on a service basis (ie: changing the endpoint of each service to a virtual service) and all of your HTTP(S) services reside on a single host, you can use the **Forward Unknown Request To** option of the HTTP(S) Gateway agent.

Example:

The client is calling several backend services:

```
http://esb.demo.hp.com:8080/BackendServices/MemberAccounts
```

```
http://esb.demo.hp.com:8080/BackendServices/ExchangeRate
```

```
http://esb.demo.hp.com:8080/BackendServices/Approval
```

You are only virtualizing the MemberAccounts service but are only able to reconfigure the application to use another host for all services rather than changing the endpoint of just the one MemberAccounts service in the application.

You reconfigure your application to use the SV Server HTTP Gateway at:

```
http://svserver.hp.com:7200 instead of http://esb.demo.hp.com:8080
```

The application will access backend services at these endpoints:

```
http://svserver.hp.com:7200/BackendServices/MemberAccounts
```

```
http://svserver.hp.com:7200/BackendServices/ExchangeRate
```

```
http://svserver.hp.com:7200/BackendServices/Approval
```

You create the MemberAccounts service so this functions but the other services would be inaccessible for the application until you virtualized all of them.

To avoid the virtualization of all backend services set the DEFAULT TARGET HOST to

```
http://esb.demo.hp.com:8080
```

Now all requests to non-virtualized services are forwarded to the

`http://esb.demo.hp.com:8080` host and reaching the real services you do not intend to virtualize now.

**Note:** The Forward Unknown Request To can contain base URL in several formats: the host, optional port and optional base path, i.e.: `http://esb.demo.hp.com`, `http://esb.demo.hp.com:8080`

### ***Additional HTTPS Gateway Agent configuration.***

The HTTPS Gateway agent requires the same steps as the HTTP Gateway agent.

HTTPS requires assigning a certificate to a port used for listening.

Generate a certificate with a private key (if you don't have one), import the certificate to either a current user's personal store (for an embedded server) or to a local machine's personal store (for a standalone server). Grant access to the private key to the current user (for an embedded server) or to the account running the standalone server.

To configure HTTP ports and to install a self-signed SSL certificate we provide the tool `configureHttpAgent.bat`.

See [How to Install Self-Signed Certificate](#) in the installation guide.

To install a custom certificate we provide the tool `addCustomCertificate.bat`.

See [How to Install Custom Certificate](#) in the installation guide.

To set agent configuration properties, see "[Configuring HTTP\(S\) Proxy Agent](#)" below.

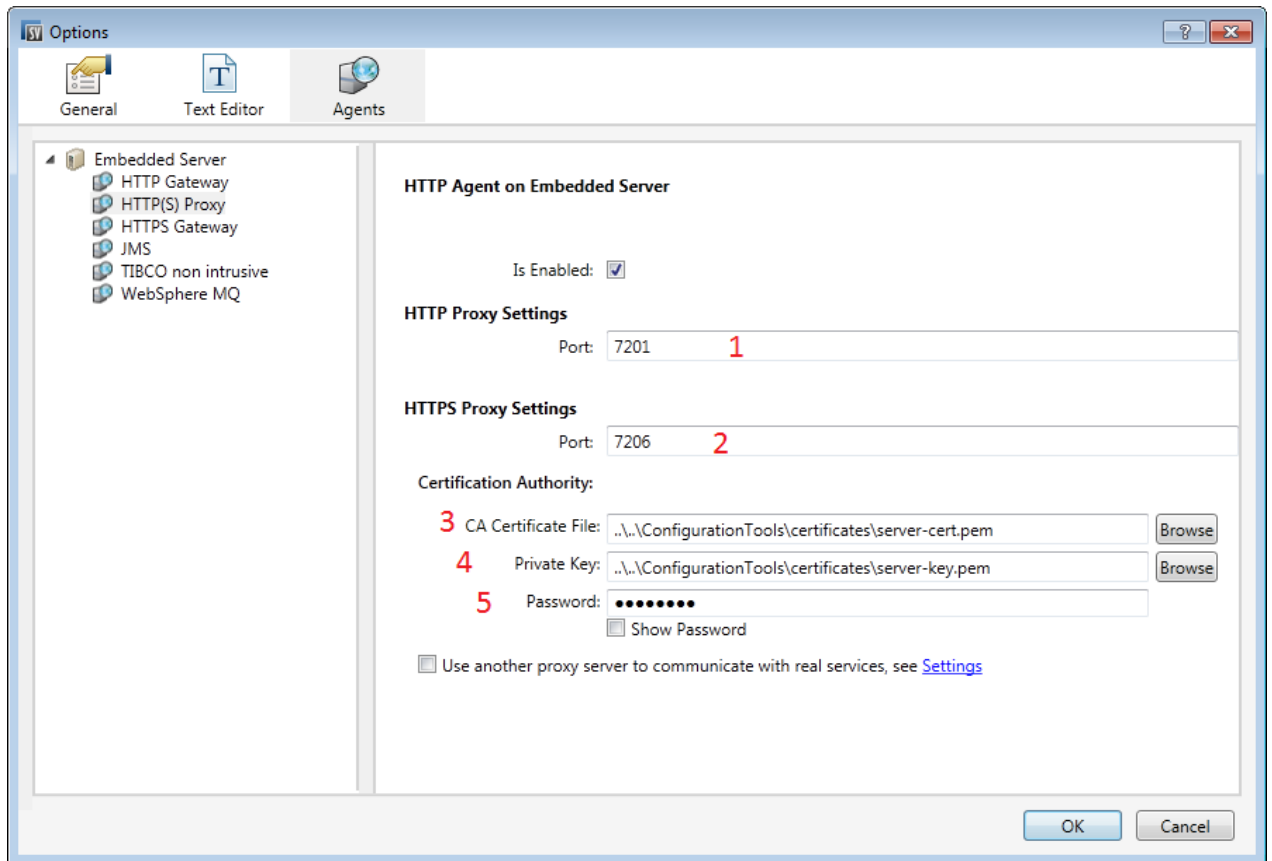
## **Configuring HTTP(S) Proxy Agent**

The HTTP(S) Proxy Agent serves to virtualize HTTP and HTTPS communication. No endpoint is created, and an HTTP(S) proxy is used to receive and forward client communication to a real service HTTP or HTTPS endpoint.

The HTTP(S) proxy agent dynamically generates certificates for requested hosts on the fly. The certificates are signed by the configured certificate authority (CA). The CA certificate and private key can be configured in the HTTP(S) Proxy agent configuration.

The client must trust certificates signed using a configured CA otherwise the communication may fail due to the agent rejecting it.

HTTP(S) Agent Configuration provides options as per the following image:



1. HTTP Proxy Settings Port – port for HTTP communication
2. HTTPS Proxy Settings Port - port for HTTPS communication

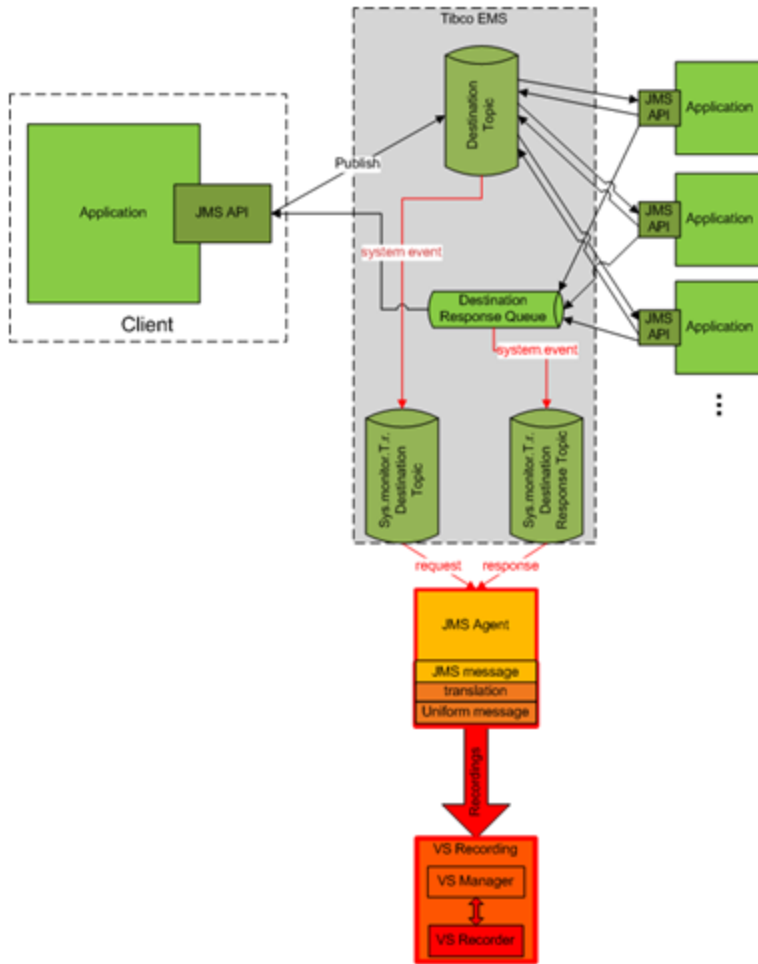
**Certification authority**

3. CA Certificate File - file used to generate host certificates
4. Private key – private key for above configured file
5. Password – password for private key

**Note:** In case of Java based clients running on JDK 6 or newer and in the case of self-signed certificates, it may be necessary to add the “-Dsun.security.ssl.allowUnsafeRenegotiation=true” startup parameter or the client may reject communication with the HTTPS Agent. See <http://java.sun.com/javase/javaseforbusiness/docs/TLSReadme.html> for more details.

## Configuring TIBCO EMS Non Intrusive Agent

The TIBCO EMS Non Intrusive Agent serves to virtualize JMS communication in TIBCO Enterprise Message Service™ (TIBCO EMS). No endpoint is created and a client application does not require reconfiguration. The agent listens to system topics where all communication can be monitored. When the service is switched to Simulating mode, it manipulates the service JMS account permissions in the JMS bus (EMS) to forbid a real service from receiving client communication. Administrator account credentials in TIBCO EMS are required.



The TIBCO EMS Non Intrusive agent is not installed by default and if required, must be installed manually. The TIBCO EMS Non Intrusive agent requires 2 DLL libraries that are not supplied with the product: `Tibco.EMS.dll` and `Tibco.EMS.Admin.dll`. These libraries are supplied with the installation of TIBCO Enterprise Message Service™ (EMS) and can be found in the `bin` directory in the EMS installation folder. The typical default location is `c:\tibco\ems\6.0\bin\`.

1. To install the TIBCO EMS agent, ensure that the TIBCO EMS libraries `Tibco.EMS.dll` and `Tibco.EMS.Admin.dll` are either registered in the Global Assembly Cache (GAC) or copied to the `Designer\bin` and `StandaloneServer\bin` directories in the application installation directory. Installation to GAC should be an optional part of the TIBCO EMS installation.

The application must be restarted after libraries have been copied to the directory.

When the agent is installed properly, configuration needs to be setup according to EMS specifics.

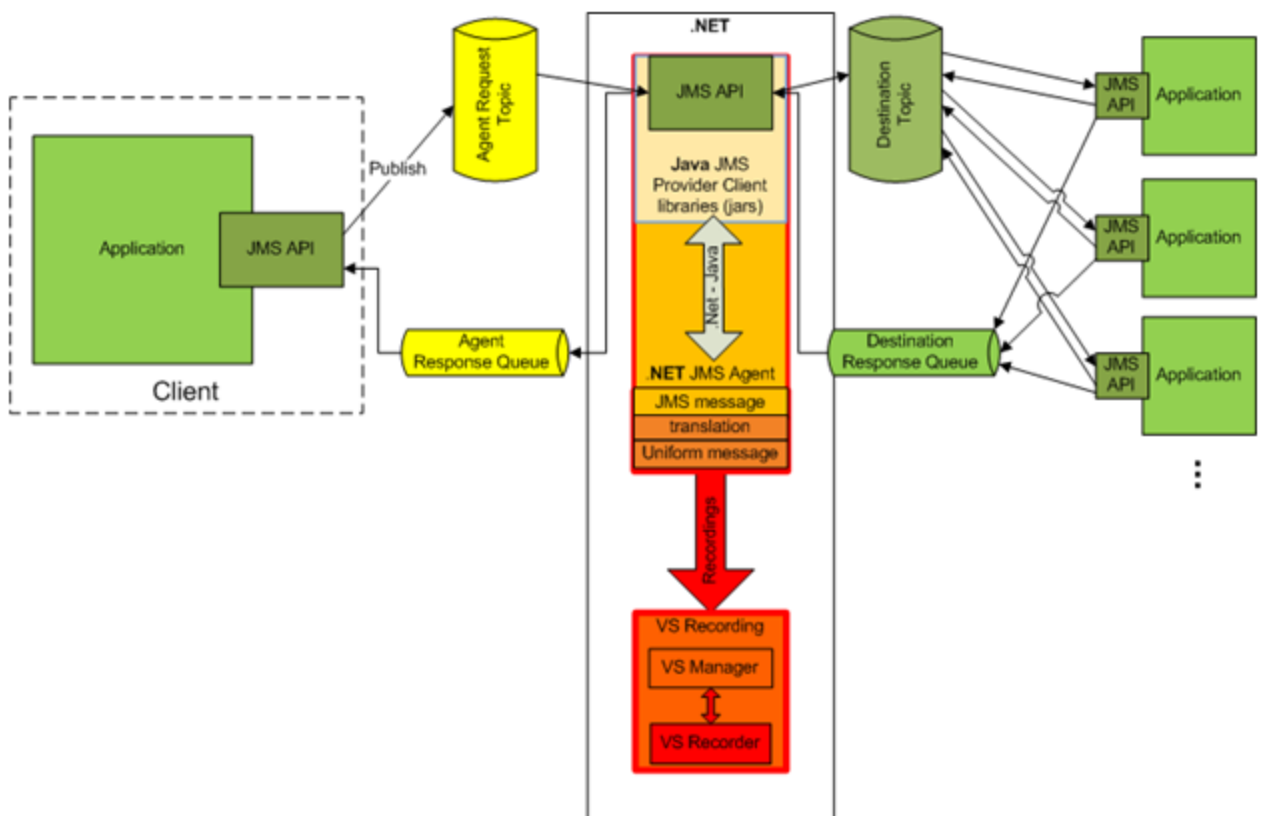
2. Setting agent configuration properties:
  - a. *Provider Url* – Host and Server Port where EMS is running.

- b. *Credentials* – Username and Password for EMS account with appropriate privileges to change permissions on destinations and the JMS server (admin account).

## Configuring Generic JMS Agent

The Generic JMS Agent serves to virtualize JMS communication in any JMS provider (IBM® WebSphere® MQ, Weblogic, JBoss, ...). It uses general JMS API and JNDI to lookup and work with JMS resources (context factories, connection factories, queues, topics). It loads Java JVM (Java Virtual Machine) with JMS provider libraries required for JMS communication in process.

**Note:** Generic JMS Agent only supports JMS BytesMessage and TextMessage according to the SOAP over JMS specifications.



A standard JMS API with JNDI lookups is being used in Generic JMS Agent. Environment with JMS resources must be configured first:

1. Create virtual destination(s) in JMS server (WebSphere MQ, Weblogic, JBoss, ...)
  - a. Create Virtual Request destination
  - b. Create Virtual Reply destination, only if you want to use permanent ReplyTo destination, otherwise temporary ReplyTo destination will be used
2. Configure JNDI mapping for virtual destination(s) to allow agents lookup destination(s) in JNDI.

- a. For Virtual Request destination
  - b. For Virtual Reply destination only if permanent ReplyTo destination is used
3. When the JMS environment and resources are configured, the agent configuration needs to be setup according to JMS provider specifics.

Setting Generic JMS Agent configuration properties:

JNDI URL – URL where JNDI provider and JNDI context with JMS resources is located

Context Factory – provider specific context factory

Class Path – class path with all necessary JMS provider specific libraries for JMS implementation

Username

Password

**Note:** To ensure maximum compatibility use the same JMS/J2EE jar libraries for the agent classpath that are in use by the client application. If not possible, please follow your application server documentation for selection of correct J2EE/JMS libraries.

**Example of Generic JMS Agent configuration:**

***Agent configuration for WebLogic 10.3:***

- JNDI URL: t3://czvm58.devlab.ad:7001/
- Context Factory: weblogic.jndi.WLInitialContextFactory
- Class Path:

```
C:\Temp\WL103\wlthint3client.jar
```

**Note:** The above sample used WebLogic Thin T3 Client. In case of issues, please use other Weblogic Client libraries (e.g. “WebLogic Full Client” using “wlfullclient.jar”). See chapter 2 of “Overview of Stand-alone Clients” in your “Oracle® Fusion Middleware Programming Stand-alone Clients for Oracle WebLogic Server 11g Release 1” documentation for more details.

***Agent configuration for MQ-7.0.1.3 on WAS-6.1.0:***

- JNDI URL: corbaloc::czvm24.devlab.ad:2809/NameServiceServerRoot
- Context Factory: com.ibm.websphere.naming.WsnInitialContextFactory
- Class Path:

```
C:\Temp\WAS6\com.ibm.mq.jar;
```

```
C:\Temp\WAS6\com.ibm.mq.jmqi.jar;
```

```
C:\Temp\WAS6\com.ibm.mqjms.jar;
```

```
C:\Temp\WAS6\com.ibm.ws.admin.client_6.1.0.jar;
```

```
C:\Temp\WAS6\com.ibm.ws.runtime_6.1.0.jar;
```

```
C:\Temp\WAS6\connector.jar;
```

```
C:\Temp\WAS6\dhbcore.jar;
```

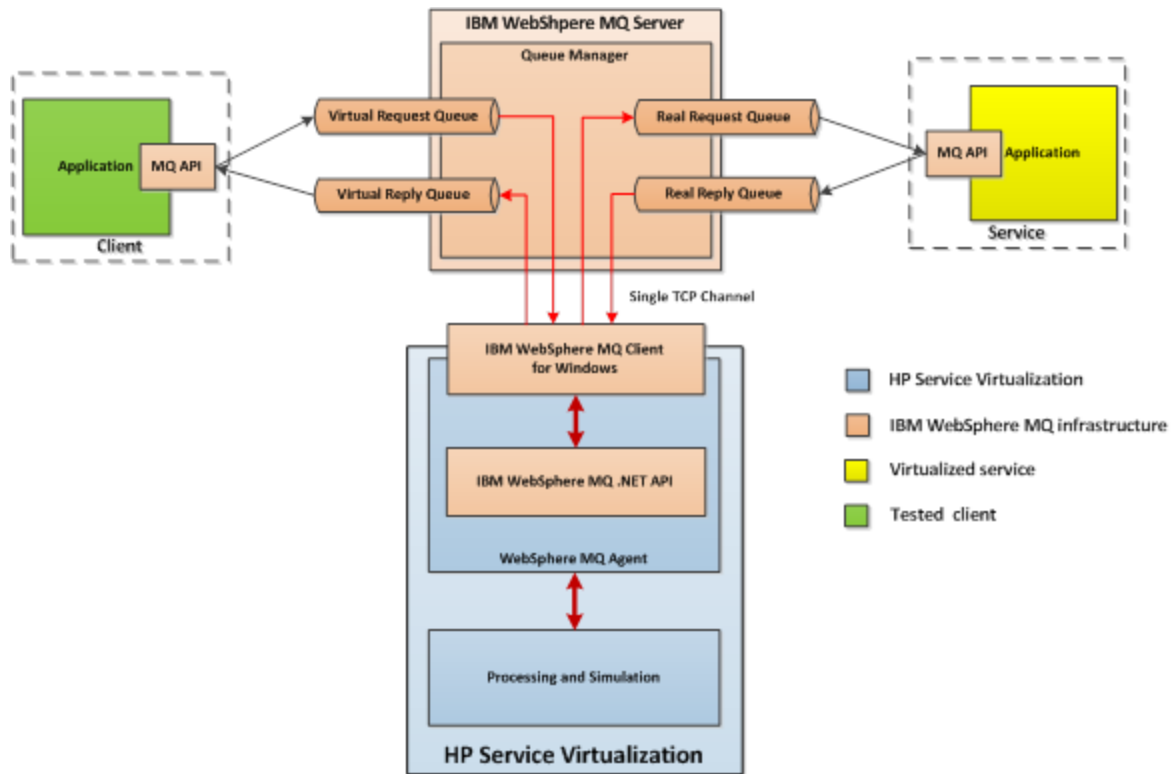
```
C:\Temp\WAS6\fscontext.jar;  
C:\Temp\WAS6\ibmorb.jar;  
C:\Temp\WAS6\jms.jar;  
C:\Temp\WAS6\jndi.jar;  
C:\Temp\WAS6\ldap.jar;  
C:\Temp\WAS6\providerutil.jar
```

**Agent configuration for JBoss 6.0:**

- JNDI URL: jnp://[machine-name]:1099/
- Context Factory: org.jnp.interfaces.NamingContextFactory
- Class Path:

```
C:\Temp\JBAS6\concurrent.jar;  
C:\Temp\JBAS6\hornetq-core-client.jar;  
C:\Temp\JBAS6\hornetq-jms-client.jar;  
C:\Temp\JBAS6\jboss-client.jar;  
C:\Temp\JBAS6\jboss-ejb3-core-client.jar;  
C:\Temp\JBAS6\jboss-ejb3-ext-api.jar;  
C:\Temp\JBAS6\jboss-jms-api_1.1_spec.jar;  
C:\Temp\JBAS6\jboss-logging.jar;  
C:\Temp\JBAS6\jnp-client.jar;  
C:\Temp\JBAS6\netty.jar
```

## Configuring WebSphere MQ Agent



### Prerequisites for using WebSphere MQ Agent:

The WebSphere MQ Agent is not installed by default. The agent is dependent on the IBM WebSphere MQ Client 7.0.1.6 or newer (`amqmdnet.dll` library with version 1.0.0.3 and its dependencies). The IBM WebSphere MQ Client full installation places the required library in the Global Assembly Cache (GAC) making the agent available (if the client is installed while the server or the designer is running, you must restart the application prior to enabling the agent).

Because the WebSphere MQ Agent uses the IBM WebSphere MQ Client internally, you can use all diagnostic tools and logs provided by the client if you need to investigate any issues with WebSphere MQ communication between HP Service Virtualization and the IBM WebSphere MQ Server.

### To configure WebSphere MQ agent:

From the Tools menu, select Options and the Agents tab.

The following options are available:

- **IsEnabled** – turn on or off the agent. The agent can be turned on only if prerequisites were fulfilled.
- **Queue Manager Name** – the name of the queue manager the agent will be connecting to.
- **Channel Name** – the name of the TCP channel the agent will use to connect to the queue manager.



- **Host** – the name of the server hosting the queue manager.
- **Port** – the TCP port where the channel listens for client connections.
- **CCSID** – the character set used by the host.
- **User name** – the user connecting to the queue manager.
- **Password** – the password for the user connecting to the queue manager.

**Additional global configuration**

There are additional configurations available through the application configuration files:

```
% [INSTA-  
LLLOCATION]%\StandaloneServer\bin\HP.SV.StandaloneServer.exe.config  
  
% [INSTALLLOCATION]%\Designer\bin\VirtualServiceDesigner.exe.config
```

The following configuration elements can be defined in the `appSettings` section in those configuration files:

```
<add key="MQAgent.DefaultCharacterSet" value="0"/>  
<add key="MQAgent.UseUtfMethods" value="false"/>  
<add key="MQAgent.StripXmlDeclaration" value="true"/>
```

These configuration elements setup global behavior for processing WebSphere MQ messages:

- **MQAgent.DefaultCharacterSet** – configures default character set for simulated XML responses. This configuration is used if the character set is not recorded as message metadata. If the value is set to 0 the character set is not set.
- **MQAgent.UseUtfMethods** – HP Service Virtualization supports binary and XML messages over WebSphere MQ. When using an XML service, the message can be either transferred as a string (with a specified character set) or as binary data (UTF). By default the agent reads and writes messages as a string. If binary messages with UTF content should be used instead, set the value to true.
- **MQAgent.StripXmlDeclaration** – when the value is configured to true, XML messages sent from the agent will not contain XML declarations.

**Agent limitations**

- The WebSphere MQ Agent instance can only use queues from a single Queue manager.
- The WebSphere MQ Agent instance can only use a single TCP channel to connect to the Queue manager.
- CCSID configuration in the WebSphere MQ Agent instance requires an application restart.
- CCSID configuration is global for whole the application (there cannot be two agents with different CCSIDs).
- The WebSphere MQ Agent is not able to automatically reconnect when a TCP connection to the WebSphere MQ Server is lost. Each service using the agent must be restarted (alternately, restart the whole application).

## Forwarding HTTP(S) Gateway/Proxy Agent Communication through HTTP Proxy

It is possible to forward the HTTP(S) communication between HTTP(S) Proxy or Gateway agents and real service through additional proxy (proxy chaining).

To enable proxy chaining, perform following steps:

1. From the Tools menu, select options and the Agents tab.
2. From either the HTTP Gateway, HTTP(S) Proxy or HTTPS Gateway settings, select the **Use another proxy server to communicate with real services** options and click the **Settings** link.

The following options are available:

- **Proxy host and Port** – Address or hostname of proxy machine and port number.

**Note:** With the HTTP Proxy agent, both HTTP and HTTPS communication is forwarded through same port.

- **Credentials** – Credentials for authentication. Authentication is automatically detected and supports BASIC, DIGEST, NTLM, and Negotiate authentication types.
  - **None** – No username / password used for proxy authentication.
  - **Current User** – Current username and password provided by windows integrated authentication is used. Note: Only NTLM and Negotiate authentication is supported.
  - **Custom Credentials** – Custom username and password.
- Do not use proxy server for addresses beginning with
  - Defines list of addresses (separated with semicolon or new lines) for which proxy won't be used.
- Bypass proxy server for local addresses.
  - If checked, proxy is not used when accessing local addresses (IPv4 and IPv6 loopback and current machine hostname).

## Configuration of Windows Firewall and HTTP Settings

The Windows Firewall and HTTP settings may require configuration if a user changes the HTTP(S) agent port, with the exception of HTTPS Proxy Agent.

The user may need to configure:

- HTTP settings (if UAC is enabled):
  - Allow the new agent port using the provided configuration tool or manually from the command line.

- Windows Firewall (if Windows Firewall is enabled)
  - Add Windows Firewall inbound rule for the new agent port using the provided configuration tool or manually from the command line.

HTTP and Windows Firewall settings for the default HTTP(S) agent ports are configured during the initial installation.

**Caution:** The port selected for the HTTP(S) agent must not be used by any other application and it must not be blocked by a firewall.

If UAC is enabled or the user is not in a local administrator role, the user must obtain permission to listen on the port. To assign such permission, use the command line interface with elevated privileges (such as administrator) and:

1. Use the provided tool `configureHttpAgent.bat`. See HTTP Port Configuration in the installation guide for command line options.
2. Or manually run the following command (the following example is for HTTP port 9000 granting permission to all users on the current machine):
  - a. Windows Server 2008 and Windows 7:

```
netsh http add urlacl url=http://+:9000/ user=EVERYONE  
listen=yes delegate=no
```

- b. Windows XP and Windows Server 2003 (See Prerequisites in the installation guide for httpcfg tool installation):

```
httpcfg set urlacl -u http://+:9000/ -a "D:(A;;GX;;;WD)"
```

It is only required to run this command once for each port. The registration remains in the system until it is removed.

If Windows Firewall is enabled the firewall inbound rules must be added to allow HTTP communication from remote host with HP Service Virtualization. To add these exceptions, use the command line interface with elevated privileges (such as administrator) and do one of the following:

- Use the provided tool `configureHttpAgent.bat` to add Windows Firewall exceptions. See HTTP Port Configuration in the installation guide for details.
- Or add them manually (the following example is adding firewall exceptions for HTTP port 9000 for all applications):

**To add HTTP Proxy port exception for port e.g. 9000, run the following commands:**

```
netsh firewall add portopening TCP 9000 "Port 9000 HTTP Proxy" ENABLE  
netsh firewall add portopening UDP 9000 "Port 9000 HTTP Proxy" ENABLE
```

# Chapter 6

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## Service Virtualization Server

HP Service Virtualization Server is a version of the runtime that is completely separate from the Service Virtualization Designer. It provides the same functionality as the Embedded Server running in the Designer, such as creating and learning services and simulating the use of learned rules or rules provided by the user, without the need to run the Designer.

**Note:** A valid product license is required to start the application. For details, see the License Installation section of the *HP Service Virtualization Installation Guide*.

The Service Virtualization Server can be configured as either secured or unsecured. To prevent unauthorized access, it may be configured as secured. For additional details and configuration information on the Service Virtualization Server, see the HP Service Virtualization Server section of the *HP Service Virtualization Installation Guide*.

**This chapter includes:**

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|--|----|

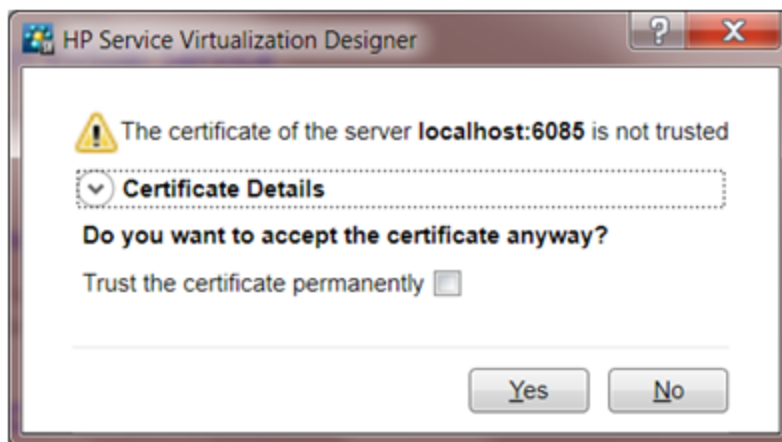
## Accessing a Secured Service Virtualization Server

You can determine whether the Service Virtualization Server is secured based on its URL. The URL of an unsecured server begins with **http**, whereas the URL of the secured server begins with **https**. For example, the URL of a secured server might be `https://mymachine.com:6085/management`. In addition, the port of the secured server is different from that of the unsecured server.

When the HP Service Virtualization Designer contacts a secured Service Virtualization Server for the first time, it requests user input in order to establish a secured communication channel.

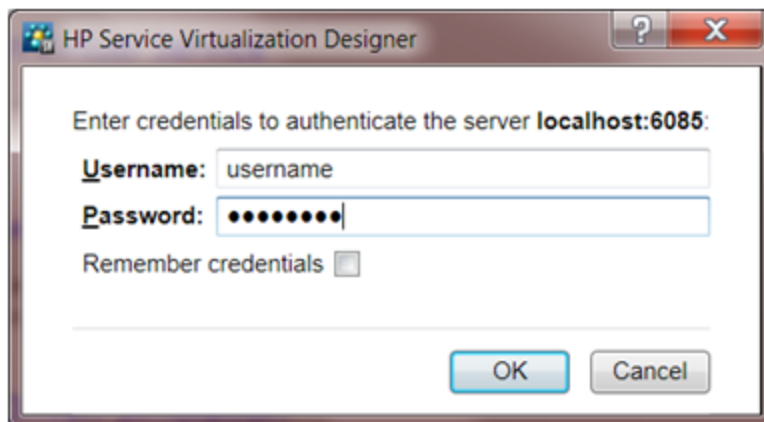
### To access a secured Service Virtualization Server:

1. When the HP Service Virtualization Designer contacts a secured Service Virtualization server for the first time, the following dialog box opens:



Select **Trust the certificate permanently** to prevent the Designer from prompting you again.

2. Click **Yes** to accept the certificate. The following dialog box opens:



Enter credentials to connect to the Service Virtualization Server. For details on credentials validation and user authentication, see the *HP Service Virtualization Installation Guide*.

# Chapter 7

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## Security

Service virtualization supports virtualization of secured services using either HTTP transport level security or subset of SOAP message level security.

**This chapter includes:**

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| How to Set Authentication Credentials..... | 88 |
| How to Set Message Security.....           | 89 |
| How to Set Transport Security.....         | 95 |

## Virtualized Service Security

Security consists of four components:

- Confidentiality – the data is encrypted. Only an ultimate recipient can read the data.
- Integrity – data is signed. A recipient can validate that the data has not been modified during transmissions.
- Authentication – the identity of a client is transferred with the message.
- Authorization – the service validates that an authenticated client can execute the required operation.

Service virtualization does not handle authorization. Authorization logic is left for the real service but service virtualization must deal with other parts:

- Confidentiality – Service Virtualization must be able to decrypt the message passed to the virtual service in order to learn the service. It must also be able to encrypt messages passed to the real service.
- Integrity – Service Virtualization must be able to validate signatures in messages received from clients and the real service. It must also be able to sign messages sent to clients and the real service.
- Authentication – Service Virtualization does not validate received client credentials. In some scenarios, incoming credentials are secured and are not directly readable. Therefore, the virtual service must have these credentials (certificates with private keys or user names with passwords) defined in the Credential Store, to be able to compute the secured value and pass it to the real service.

### Transport security

Transport level security is point-to-point. Security is ensured only on the transport level connection between two machines. Transport level integrity and confidentiality is ensured through SSL / TLS (HTTP(s) Proxy agent or the HTTPS Gateway agent) and transport level authentication is ensured with HTTP authentication mechanisms.

Transport authentication in service virtualization is used only in pass through and recording modes to access the real service. It is transparently managed by the HTTP Gateway or HTTP(S) proxy agents. Transport authentication only requires that correctly configured credentials are available in the Credential Store.

For details, see ["How to Set Transport Security" on page 95](#)

### Message security

Message level security is end-to-end. Security is ensured on the message level – security is part of message data which can be passed through many intermediaries (many connections) without revealing unsecured message content.

Message security in service virtualization is used for pass through, recording, and simulation modes.

For details, see ["How to Set Message Security" on page 89](#)

### Mixed security

Mixed security uses transport security to ensure confidentiality and integrity and message security to pass client credentials (authentication). This security configuration requires the use of the HTTPS agent and message security modes with names ending with OverTransport.

## How to Set Authentication Credentials

Some services may require client authentication on either the transport or message level. When virtualizing these services, Service Virtualization needs to know the client credentials used to connect to the real service. The only exception is a scenario wherein a real service with HTTP transport authentication (Basic, Digest, NTLM) is virtualized through the HTTP(S) proxy agent. In this scenario, authentication requests are forwarded. Service Virtualization does not need to have the credentials in the service's credential store.

---

### Prerequisites:

When creating credentials for transport security over HTTP(S) Gateway agent, the user of the virtual service must be a valid Windows account user, used for authentication to the real service. If it is a local account, it must also exist on the machine running Service Virtualization.

---

### To set authentication credentials:

1. In the Virtualization Explorer view, double-click a service to open it in the Virtual Service Editor.
2. Expand **Security Settings**.
3. To modify the authentication credentials for a secured service, click **Edit Credential Store**.
4. To **add** user credentials:
  - a. Click **Add Identity**.
  - b. In the Add Identity dialog box, enter an identity name to describe the credentials you are adding.
  - c. Enter a username and password. The type of user depends on the security mode you are using. Transport security (Basic, Digest, NTLM) requires a Windows user account. Message security can work with custom accounts as well.
  - d. To display the password, click **Show Password**.
  - e. To add a certificate, click the browse button and select a certificate to add. The following certificate types are supported: .pfs, .p12, .cer, .der, .crt. Click **OK**. If the certificate's private key requires a password, you are prompted to enter the password.
  - f. Click **OK** to add the credentials to the service Security Settings.
5. To **edit** user credentials:
  - a. Select a user and click **Edit**.
  - b. In the Edit Identity dialog box, you can modify the username and password.
  - c. To display the password, click **Show Password**.



- d. To add or change a certificate, click the browse button and select a certificate to add. The following certificate types are supported: .pfs, .p12, .cer, .der, .crt. Click **OK**. If the certificate's private key requires a password, you are prompted to enter the password.
    - e. Click **OK** to change the credentials in the service Security Settings.
6. To **remove** user credentials, select one or more users and click **Delete**. Click **Yes** to confirm.
7. To **import** user credentials:
  - a. Click **Import**.
  - b. In the Import Identities dialog box, select the virtual service containing the identity you want to import.
  - c. Select the identity to import.
  - d. Click **OK** to import the identity into the selected virtual service.
8. Click **OK** to close the **Edit Credential Store** dialog box.
9. Save the virtual service.

## How to Set Message Security

If the service is secured with message security, use the following security settings:

### Basic Message Security Basic Settings

- Mode – Predefined supported message security mode.
- Real Service Identity – The identity of the real service (certificate) is stored in the Credential Store. This setting is used if a service uses a certificate for message security. The public key of the certificate is used to encrypt messages sent to the real service.
- Virtual Service Identity – The identity of the virtual service (certificate) is stored in the Credential Store. The purpose of this configuration is the same as in Real Service Identity. If the Real Service Identity contains the certificate with a private key, this setting does not need to be configured. In this scenario, the Real Service Identity is also used as the identity of the virtual service. If the Real Service Identity contains only a certificate without a private key, this setting must be configured to provide the identity of the virtual service. The configured identity must contain a certificate with a private key, as the service requires the private key to decrypt the messages coming from the client. Clients must trust the certificate used as the identity of the virtual service.

### Advanced Message Security Settings

- Protection Level – Describes the level of security applied to each message. This configuration has service scope levels. All messages must have the same security requirements.
- Message Protection Order – Describes the order of protection operations used to secure messages.
- Message Security Version – Describes a set of WS-\* specifications used to establish security.
- Require Derived Keys – Defines if supporting tokens must use derived keys.
- Include Timestamp – Defines if messages must contain a security timestamp.

- Allow Serialized Token on Reply – Defines if replies can contain a service token used to sign the message. This setting is only used for asymmetric security bindings.

This section also includes:

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| Configuring MutualCertificate.....                  | 92 |
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## Configuring CertificateOverTransport

Certificate over transport mode uses an endorsing supporting binary token over HTTPS:

- **Transport security binding**
  - Algorithm suite: Basic256
  - Layout: Strict
- **Endorsing supporting token**
  - X509Token (WssX509V3Token10) always included to recipient
  - Inclusion type: MustSupportRefThumbprint / RequireThumbprintReference

### Prerequisites:

- Create a Virtual Service. For details, see ["How to Create a Virtual Service"](#) on page 16
- The Credential Store must contain an identity with each used client certificate.
- Certificates must contain a private key.

### To configure CertificateOverTransport:

1. Check **Enabled** in **Message Security**.
  2. Select **CertificateOverTransport** in **Mode**.
- Do not configure **Real Service Identity** or **Virtual Service Identity**.

### Advanced settings for CertificateOverTransport:

- *Protection Level* – this setting has no effect because encryption and signing are provided by the transport level (HTTPS)
- *Message Protection Order* – this setting has no effect because encryption and signing are provided by the transport level (HTTPS).
- *Message Security Version* – only WS-Security 1.1 is supported because this configuration mode requires thumbprint token inclusion mode which is not supported in WS-Security 1.0.
- *Require Derived Keys* – this setting should not be changed.
- *Include Timestamp* – this setting must be checked because the endorsing supporting token passed in the request must sign the timestamp header.
- *Allow Serialized Signing Token on Reply* – this setting has no effect.

## Configuring UserNameOverTransport

User name over transport mode uses a signed supporting user name token over HTTPS:

- **Transport security binding**
  - Algorithm suite: Basic256
  - Layout depends on WS-Security version configured in **Advanced** settings:

- WS-Security 1.0
  - Lax
- WS-Security 1.1
  - Strict
- **Endorsing supporting token**
  - UsernameToken (WssUsernameToken10) always included to recipient.
    - Only PasswordText token type is supported.

**Prerequisites:**

- Create a Virtual Service. For details, see ["How to Create a Virtual Service" on page 16](#)
- The Credential Store must contain an identity with each user and password used for authentication to the real service.

**To configure UsernameOverTransport:**

1. Check **Enabled** in **Message Security**.
  2. Select **UsernameOverTransport** in **Mode**.
- Do not configure **Real Service Identity** or **Virtual Service Identity**.

**Advanced settings for UsernameOverTransport:**

- *Protection Level* – this setting has no effect because encryption and signing are provided by the transport level (HTTPS).
- *Message Protection Order* – this setting has no effect because encryption and signing are provided by the transport level (HTTPS).
- *Message Security Version* – layout used for security header.
  - Message security versions using WS-Security 1.0 use Lax layout for security header.
  - Message security versions using WS-Security 1.1 use Strict layout for security header.
- *Require Derived Keys* – this setting has no effect.
- *Include Timestamp* – this setting controls if requests and responses must contain a security timestamp.
- *Allow Serialized Signing Token on Reply* – this setting has no effect.

## Configuring MutualCertificate

MutualCertificate is a mode with asymmetric security binding (WS-Security 1.0) which uses both client and server certificates to secure messages over unsecured transport (HTTP):

- Asymmetric security binding
  - Initiator token: X509Token (WssX509V3Token10) always included to recipient.
  - Recipient token: X509Token (WssX509V3Token10) never included.

- Algorithm suite: Basic256
- Layout: Strict
- Token inclusion type:
  - MustSupportRefKeyIdentifier
  - MustSupportRefIssueSerial

**Prerequisites:**

- Create a Virtual Service. For details, see ["How to Create a Virtual Service"](#) on page 16
- The Credential Store must contain an identity with a real service certificate.

If the certificate does not contain a private key, the Credential Store must also contain an identity for the virtual service, with a certificate containing a private key.

- The Credential Store must contain an identity with each used client certificate.
- Client certificates must contain a private key.

**To configure MutualCertificate:**

1. Check **Enabled** in **Message Security**.
2. Select **MutualCertificate** in **Mode**.
3. Select an identity configured in **Credential Store** for **Real Service Identity**.
4. If the identity for the real service does not contain a certificate with a private key, or if you want to use separate identity for the virtual service, select an identity configured in the Credential Store for Virtual Service Identity. This identity must contain a certificate with a private key.

**Advanced settings for MutualCertificate:**

- *Protection Level* – configures the level of security applied to each message.
- *Message Protection Order* – configures the order of protection operations used to secure messages.
- *Message Security Version* – use only WS-Security 1.0.
- *Require Derived Keys* – this setting should not be changed.
- *Include Timestamp* – this setting controls if requests and responses must contain a security timestamp.
- *Allow Serialized Signing Token on Reply* – this setting has no effect.

## Configuring MutualCertificateDuplex

MutualCertificateDuplex mode with asymmetric security binding (WS-Security 1.0 and 1.1) uses both client and server certificates to secure messages over unsecured transport (HTTP). The difference between MutualCertificate and MutualCertificateDuplex is that MutualCertificateDuplex security mode also sends the recipient's signing token back to the initiator.

- Asymmetric security binding
  - Initiator token: X509Token (WssX509V3Token10) always included to recipient.
  - Recipient token: X509Token (WssX509V3Token10) always included to initiator.
  - Algorithm suite: Basic256
  - Layout: Strict
  - Token inclusion type depends on WS-Security version configured in Advanced settings:
    - WS-Security 1.0
      - MustSupportRefKeyIdentifier
      - MustSupportRefIssueSerial
    - WS-Security 1.1
      - MustSupportRefThumbprint / RequireThumbprintReference

**Prerequisites:**

- Create a Virtual Service. For details, see ["How to Create a Virtual Service" on page 16](#)
- The Credential Store must contain an identity with a real service certificate.
  - If the certificate contain does not contain a private key, the Credential Store must also contain an identity for the virtual service with a certificate containing a private key.
- The Credential Store must contain an identity with each used client certificate.
- Client certificates must contain private key.

**To configure MutualCertificateDuplex:**

1. Check **Enabled in Message Security**.
2. Select **MutualCertificateDuplex** in **Mode**.
3. Select an identity configured in **Credential Store for Real Service Identity**.
4. If the identity for the real service does not contain a certificate with a private key, or if you want to use separate identity for the virtual service, select an identity configured in **Credential Store for Virtual Service Identity**. This identity must contain a certificate with a private key.

**Advanced settings for MutualCertificateDuplex:**

- *Protection Level* – configures the level of security applied to each message.
- *Message Protection Order* – configures the order of protection operations used to secure messages.
- *Message Security Version* – this setting defines how the binary token is referenced in the request message.
  - Message security versions using WS-Security 1.0 requires either issuer serial number or key identifier of the certificate.
  - Message security versions using WS-Security 1.1 requires thumbprint of the certificate.
- *Require Derived Keys* – this setting should not be changed.

- *Include Timestamp* – this setting controls if requests and responses must contain a security timestamp.
- *Allow Serialized Signing Token on Reply* – this setting must be checked because the recipient's signing token is always send back to an initiator.

## Configuring SupportingCertificateOverTransport

Supporting certificate over transport mode uses a supporting binary token over HTTPS:

- **Transport security binding**
  - Algorithm suite: Basic256
  - Layout: Strict
- **Endorsing supporting token**
  - X509Token (WssX509V3Token10) always included to recipient
  - Inclusion type: MustSupportRefThumbprint / RequireThumbprintReference

### Prerequisites:

- Create a Virtual Service. For details, see "[How to Create a Virtual Service](#)" on page 16
- The Credential Store must contain an identity with each used client certificate.
- Certificates must contain a private key.

### To configure SupportingCertificateOverTransport:

1. Check **Enabled** in **Message Security**.
  2. Select **SupportingCertificateOverTransport** in **Mode**.
- Do not configure **Real Service Identity** or **Virtual Service Identity**.

This mode does not support advanced configuration.

## How to Set Transport Security

Transport level security is completely handled by the HTTP based agent. The virtual and real services can use HTTP authentication to prevent unauthorized use. The service can use basic, digest, NTLM authentication or Mutual HTTPS.

### HTTPS and mutual authentication

Services secured with HTTPS are supported by either the HTTPS Gateway agent or the HTTP(S) Proxy agent. Both agent types also support Mutual HTTPS where the client authenticates itself with a client certificate. To use Mutual HTTPS, the credential store must contain a client certificate and its private key for every client accessing the virtual service. See [How to Set Authentication Credentials](#).

### HTTP authentication over HTTP(S) Proxy agent

When using a proxy agent and running the virtual service in pass through (stand-by) or recording mode, the authentication is fully transparent and the virtual service doesn't need any further

configuration. The entire security handshake is passed from the client to the real service through the proxy and client credentials are validated just by the real service.

HTTP authentication is not used when the service is in simulating mode.

### **HTTP authentication over HTTP / HTTPS Gateway agent**

When using the gateway agent and running the virtual service in pass through (stand-by) or recording mode, the client authenticates to the virtual service and the virtual service authenticates to the real service. The virtual service must be able to validate a client's credentials and pass them to the real service, meaning that the service must have all user names and passwords in the credential store.

There are several steps to set this authentication:

1. All users who are authenticating to your service must be present in the Windows system where the virtual service is running. They can be added as local users of the machine or added to the domain to which the computer belongs. The username and password must be the same as the one the client uses to authenticate to the real service.

**Note:** HTTP digest authentication only works with domain users, not local ones. The domain must have reversibly encrypted passwords. See IIS documentation for details.

2. To delegate requests to the real service (when learning or in stand-by mode), the username and password must be in the service's credential store.
  - a. From the Virtual Service Editor, open the Security Settings and click **Edit Credential Store**.
  - b. Click **Add Identity**.
  - c. Enter Identity details and supply a certificate if required.
  - d. Click **OK** to add the identity and **OK** again to close the Credential Store.

**Note:** When using HTTP Basic authentication, credentials missing in the credential store are automatically detected and can be simply added via the Fix It command in the Problem List.

HTTP authentication is not used when the service is in simulating mode.

### **Windows accounts for HTTP authentication**

Basic, digest and NTLM authentication in the HTTP / HTTPS Gateway agent is supported only with Windows accounts:

1. If the computer running Service Virtualization is in the same domain as the service host, make sure the domain users are able to log on to the machine the application is running on. The virtual service authenticates against the same users as the real one.
2. If machines cannot be placed in the same domain, create local windows or domain user accounts (domain users still need to be able to log on the machine the application is running on) with the same names that the client is using to authenticate to the service.

**Note:** If you would like to use the HTTP Digest authentication, use only domain user accounts as local user accounts will not authenticate.



# Chapter 8

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## HP Test Automation Tools Integration

Service Virtualization can be integrated with HP test automation tools. The virtual services are managed via the tests and the performance monitors exposed by the virtual services are used by the performance testing tools.

Virtual services must be deployed to the Service Virtualization Server for this integration. For details, see "HP Service Virtualization Server" in the installation guide.

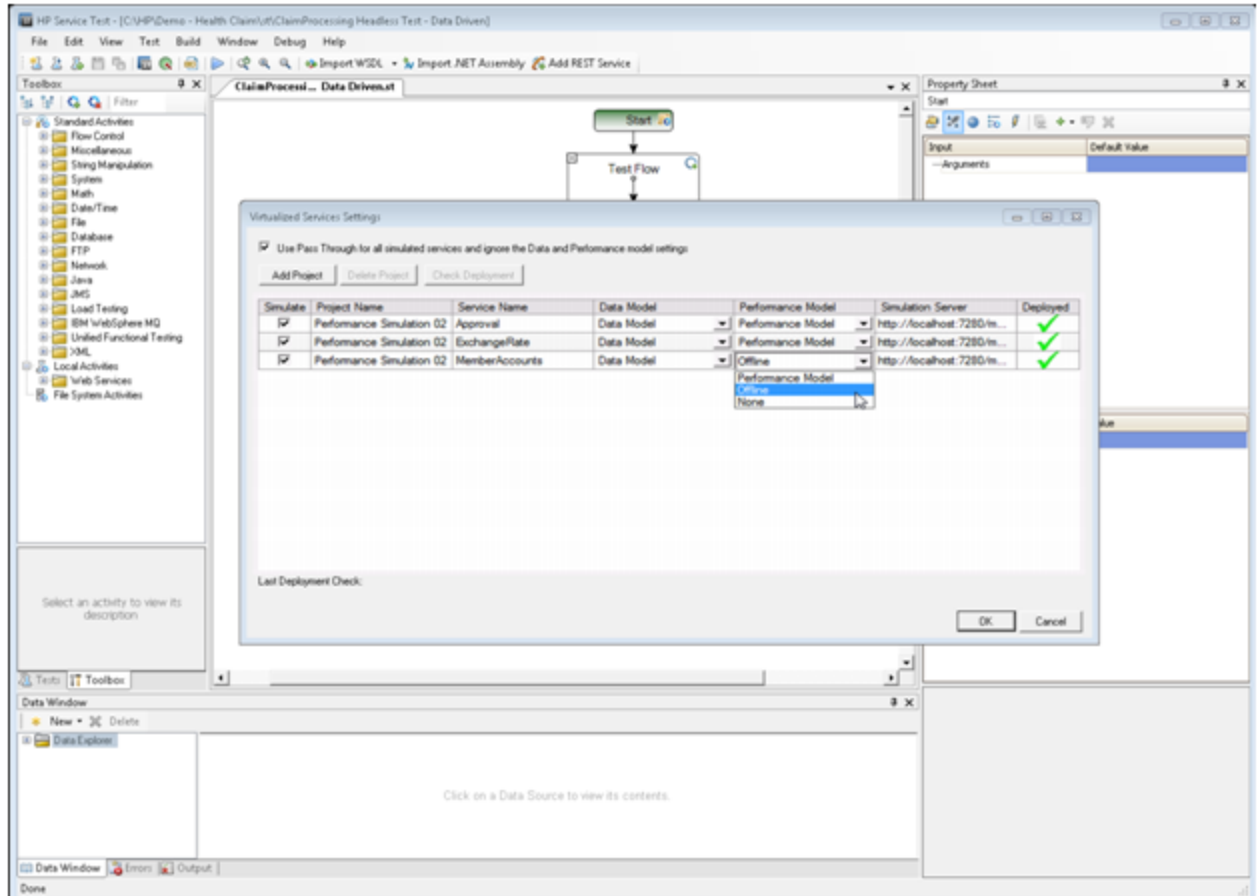
Service Virtualization integrates with Service Test 11.20, Load Runner 11.00 and Performance Center 11 with latest patches.

**This chapter includes:**

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## Service Test

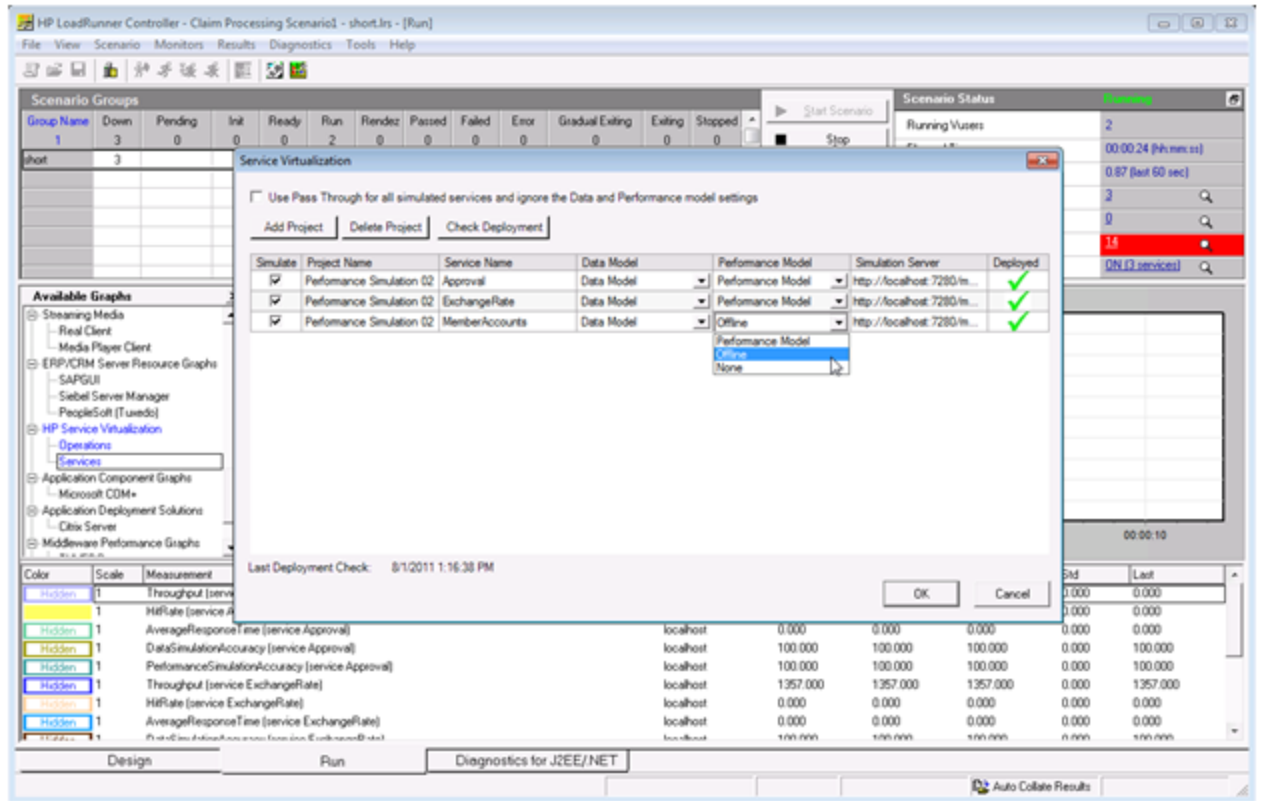
Service virtualization projects can be integrated with HP Service Test (see HP Service Test documentation). The virtual services are then managed by the test after the integration.



- The simulation start is triggered by the test start.
- Particular data and performance models can be selected for the test.
- *Simulating* or *Standby* modes using the real service are chosen during the test.

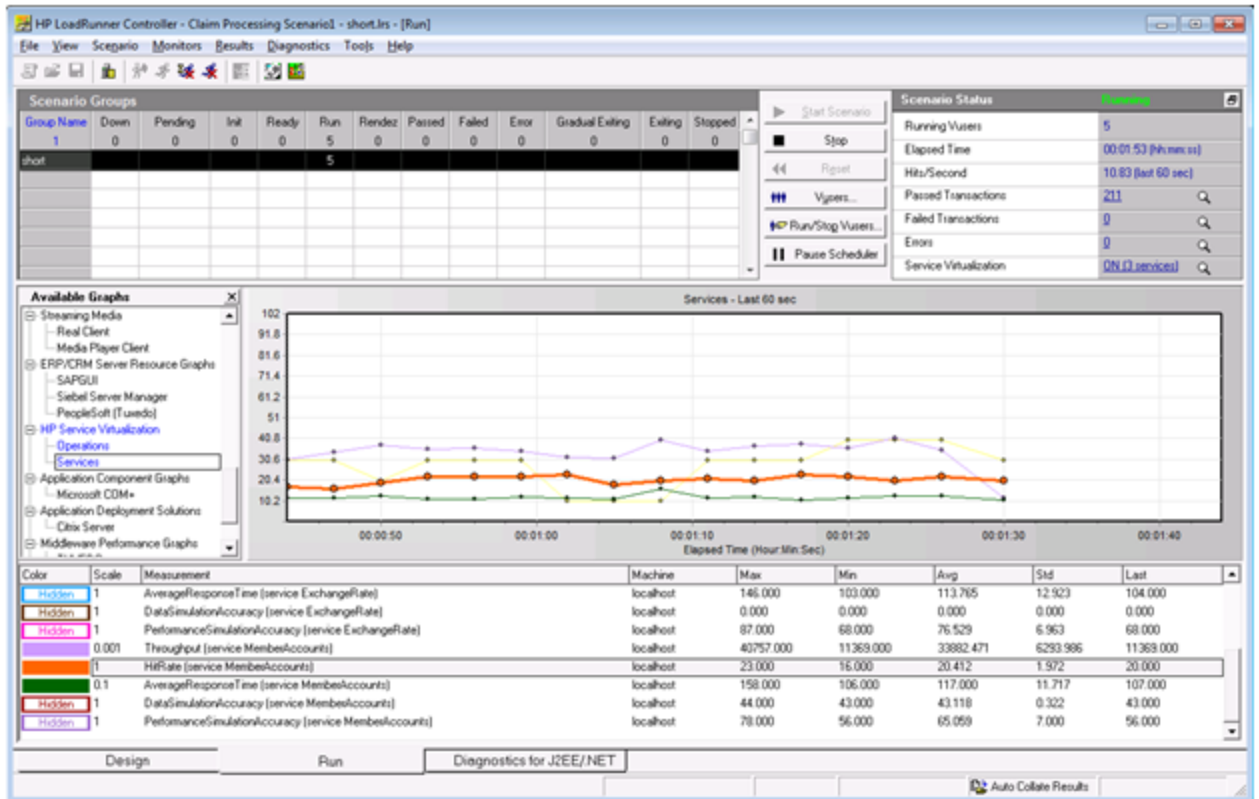
## Performance Center and Load Runner

Service virtualization projects can be integrated with the Performance Center or Load Runner Scenarios (see Performance Center or Load Runner Documentation). The virtual services are then managed by the test after the integration.



- The simulation start is triggered by the test start.
- Specific data and performance models can be selected for the test.
- *Simulating* or *Standby* modes using the real service are selected during the test.

Performance monitors exposed by virtual services are used immediately in the Performance Center or Load Runner Controller:



The performance monitors exposed by Service Virtualization are named **Services** and **Operations**.

- The **Services** performance counter provides measurement data per virtual service.
- The **Operations** performance counter provides data per virtual service and service operation.

# Chapter 9

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## Troubleshooting

**This chapter includes:**

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## Runtime View

**Runtime view doesn't respect selected data model when changing mode.**

**Problem:** User chooses a simulation model in the Service Editor and starts a new learning/simulation from the Runtime View. Instead of using the new simulation, the simulation model from the previous learning/simulation is used again.

**Solution:** Runtime View is used just to change service modes, not configurations. To change the simulation model, open the Service Editor, select a new simulation model and start a new learning/simulation from the Service Editor.

**Cannot start learning service 'My Service'.**

**Problem:** Real Data model or Performance model must be selected in service configuration.

**Solution:** This error may happen when all data and performance models are deleted from the service configuration and the user tries to start a new learning/simulation session from the Runtime View. To solve the problem, create a new Data/Performance Model and start a new learning/simulation session from the Service Editor.

## HTTPS Client Connection Aborted

**Problem:** The client connection to a virtualized service deployed on an HTTPS endpoint is aborted with the error message `SSL_ERROR_RX_RECORD_TOO_LONG` when Service Virtualization is running on a Windows XP or Windows 2003 machine. The client is normally able to connect to a real service without any issue.

**Solution:** See <http://support.microsoft.com/default.aspx?scid=kb;EN-US;933430> for a list of possible solutions. For Windows 2003, any workaround method as described in the Knowledge Base article can be used, however, only the first or second methods work with Windows XP.

## Configuring HTTP Proxy on Clients

**Problem:** A virtual service is created on a proxy agent and the user is unable to record messages.

**Solution:** Configure the HTTP Proxy on clients.

All examples below of specific client configurations are using the proxy server *HTTP Proxy Agent* listening on address `hostname` with port 6071.

### **HTTP Proxy in .Net Client**

The .Net client can be configured to use a default proxy server or a specific proxy server.

If using the default proxy server take *HTTP Proxy Agent* settings to configure the default proxy server. This is done in MS Windows or Internet Explorer in **Internet Properties > Connections > LAN settings > Proxy server**. The client then must be configured to use the default proxy. This is set in application configuration file either for application in element `<defaultProxy>`:

```
<configuration>
  <system.net>
    <defaultProxy enabled="true">
```

```
        <proxy usesystemdefault="true"/>
    </defaultProxy>
</system.net>
</configuration>
```

, or for a specific binding in a binding element:

```
<configuration>
    <system.serviceModel>
        <bindings>
            <basicHttpBinding>
                <binding name="myHttpBinding" bypassProxyOnLocal="false"
useDefaultWebProxy="true">
                    </binding>
            </basicHttpBinding>
        </bindings>
    </system.serviceModel>
</configuration>
```

The same configuration file can be used to set a specific proxy server. This is an example of client configuration for application:

```
<configuration>
    <system.net>
        <defaultProxy enabled="true">
            <proxy proxyaddress="http://hostname:6071"/>
        </defaultProxy>
    </system.net>
</configuration>
```

, or for specific binding:

```
<configuration>
    <system.serviceModel>
        <bindings>
            <basicHttpBinding>
                <binding name="myHttpBinding" bypassProxyOnLocal="false"
useDefaultWebProxy="false" proxyAddress=" http://hostname:6071">
                    </binding>
            </basicHttpBinding>
        </bindings>
    </system.serviceModel>
</configuration>
```

```
</bindings>
</system.serviceModel>
</configuration>
```

### **HTTP Proxy in Java Client**

The proxy settings for Java client are given to the JVM via command line arguments. This is example of how to run client from command line with proxy configuration:

```
java -Dhttp.proxyHost=hostname -Dhttp.proxyPort=6071 MyJavaClient
```

### **HTTP Proxy in WebLogic**

Add the Java proxy parameters to Java options in `JAVA_OPTIONS` environment variable in the proper section of script `%WL_HOME%\common\bin\commEnv.cmd` for MS Windows or in `${WL_HOME}/common/bin/commEnv.sh` for Unix/Linux. This is example of setting proxy configuration in file `commEnv.cmd` (MS Windows):

```
set JAVA_OPTIONS=%JAVA_OPTIONS% -Dhttp.proxyHost=hostname -
Dhttp.proxyPort=6071
```

, or in file `commEnv.sh` (Unix/Linux):

```
JAVA_OPTIONS="${JAVA_OPTIONS} -Dhttp.proxyHost=hostname -
Dhttp.proxyPort=6071
```

### **HTTP Proxy in WebSphere**

The HTTP proxy on the WebSphere application server can be configured via setting transport properties `http.proxyHost` and `http.proxyPort`. These HTTP transport properties can be set via:

1. Using `wsadmin`.
2. Using an assembly tool.
3. Using the JVM custom property panel in the administrative console.

To learn more about (1) and (2), see the *Configuring additional HTTP transport properties documentation* in WebSphere. To configure the HTTP proxy properties using (3) use the administrative console with the following steps:

1. Open the administrative console.
2. Click **Servers > Application Servers > server > Java and Process Management > Process definition > Java Virtual Machine > Custom Properties**.
3. (Optional) If the property is not listed, create a new property name.
4. Enter the name `http.proxyHost` and value `hostname`.
5. Enter the name `http.proxyPort` and value `6071`.
6. Restart the server.

### **HTTP Proxy in JBoss**

Add the Java proxy parameters to Java options in `JAVA_OPTS` environment variable in the startup script `%JBOSS_HOME%\bin\run.bat` or `run.conf.bat` for MS Windows or in `${JBOSS_`



HOME}/bin/run.sh or run.conf for Unix/Linux. This is an example of setting the proxy configuration in JAVA\_OPTS environment variable in file run.conf.bat (MS Windows):

```
set "JAVA_OPTS=-Dhttp.proxyHost=hostname -Dhttp.proxyPort=6071
```

, or in file run.conf (Unix/Linux):

```
JAVA_OPTS="-Dhttp.proxyHost=hostname -Dhttp.proxyPort=6071
```

## Setting HTTP Proxy in Designer

**Problem:**User is unable to access any remote WSDL or Service Virtualization Server.

**Solution:**Proxy setting needs to be configured in Designer.

### *How to Set HTTP Proxy in Designer*

In some cases Service Virtualization Designer communicates with external services using the HTTP protocol. The first case is the communication with Service Virtualization Server, where the service is the server management API. The second case is the import of the a real service WSDL. In some situations, the Designer's HTTP communication must be forwarded through an external HTTP Proxy. In that situation, the HTTP Proxy settings must be placed in the Designer's configuration file.

**Note:** The setting of HTTP Proxy for agents is not done in the Designer configuration file. See ["Forwarding HTTP\(S\) Gateway/Proxy Agent Communication through HTTP Proxy"](#) on page 82 for details.

### *Setting HTTP Proxy in the Designer configuration file*

In order to use an external HTTP Proxy for the Designer HTTP communication with a server and the import of a WSDL from real services, the Designer configuration file must be modified. This file is located at

```
%[INSTALLLOCATION]%\Designer\bin\VirtualServiceDesigner.exe.config.
```

In the configuration file the element `<defaultProxy>` holds the HTTP Proxy configuration. This element is located in the document in elements `<configuration><system.net>`. By default, HTTP Proxy is disabled by `<defaultProxy enabled="false"/>`.

The Designer can be configured to use the system HTTP Proxy or to use a specific HTTP Proxy. Detailed documentation can be found at <http://msdn.microsoft.com/library/kd3cf2ex.aspx>. The Designer must be restarted in order to apply the changes in the configuration file.

### **System HTTP Proxy**

If using the system HTTP Proxy, ensure that the HTTP Proxy is configured in the system. The settings are available in Windows Internet Explorer® menu **Internet Properties > Connections > LAN settings > Proxy server**. The Designer must be configured to use the same proxy in the configuration file in the element `<defaultProxy>` like this:

```
<configuration>
  <system.net>
    <defaultProxy enabled="true">
      <proxy usesystemdefault="true"/>
    </defaultProxy>
```

```
    </system.net>
</configuration>
```

### Specific HTTP Proxy

If using a specific HTTP Proxy other than the system one, follow this example of Designer configuration:

```
<configuration>
  <system.net>
    <defaultProxy enabled="true">
      <proxy proxyaddress="http://foo.com:8080"/>
    </defaultProxy>
  </system.net>
</configuration>
```

### Setting Credentials for Authenticated HTTP Proxy

If the Designer is configured to use HTTP Proxy with authentication, some additional modifications may be required in the Designer configuration file. This will allow the supplying of credentials for the HTTP Proxy. These modifications are required in the case of HTTP communication with the server management API. In the case of WSDL imports, these modifications are only optional as the Designer will prompt the user for credentials if needed.

In order to set credentials for authenticated HTTP Proxy in the Designer, this section must be enabled in the configuration file `VirtualServiceDesigner.exe.config`:

```
<configuration>
  <system.net>
    <defaultProxy enabled="true" useDefaultCredentials="false">
      <module type =
"HP.SOAQ.ServiceVirtualization.ServerManagementClient.Remote.AuthenticatedProxy,
HP.SV.ServerManagementClient" />
    </defaultProxy>
  </system.net>
</configuration>
```

The credentials for the authenticated HTTP Proxy are set in application keys section. Example of credential settings follows:

```
<configuration>
  <appSettings>
    <add key="proxyUserName" value="user1" />
    <add key="proxyPassword" value="pass1" />
    <add key="proxyAddress" value="http://foo.com:8080" />
  </appSettings>
</configuration>
```

```
</appSettings>  
</configuration>
```

Where `keys` are defined as:

|                            |  |
|----------------------------|--|
| <code>proxyUserName</code> | User name for authenticated proxy credentials  |
| <code>proxyPassword</code> | Password for authenticated proxy credentials   |
| <code>proxyAddress</code>  | Address of authenticated proxy (e.g. <code>http://foo.com:8080</code> ). If this value is empty then the Proxy Server address in the system proxy is used. |

Once the credentials and the proxy settings are configured as described above then the Designer will use them both for HTTP communication with the server management API and WSDL imports from real services.

## Slow Designer Responsiveness

**Problem:** After installing the new version of Service Virtualization, or making a change to your computer, such as installing an update or new software, the Designer responds very slowly, especially when working in the Data Model Editor.

**Solution:** Modify the Designer configuration file, **VirtualServiceDesigner.exe.config**, located in `%[INSTALLLOCATION]%\Designer\bin\`. To edit the file, you must have administrator privileges on the machine.

Open the file in a text editor and change the value of `SeV.Global.EnableAutomationFix` from `False` to `True`. If the Designer is open, close it and restart.

If this does not solve the problem, do the following:

1. Change the value of `SeV.Global.EnableAutomationFix` back to `False`.
2. Change the value of `SeV.Global.ClearAutomationEvents` from `False` to `True`.
3. If the Designer is open, close it and restart.

# Chapter 10

---

## Service Virtualization Demos

Service Virtualization application demos are installed as an option during the installation process. The following six demos are included:

### **Claim Processing Demo**

The simulation of a backend SOAP service with limited accessibility in a simple composite application. The service can optionally use HTTP authentication (see demo readme).

### **Claim Processing REST Demo**

This demo shows a composite application consisting of 2 REST services using JSON and XML data formats.

### **Claim Processing Faults Demo**

The simulation of a backend SOAP service with limited accessibility in a simple composite application. The simulated service returns either regular response or one of 3 different SOAP faults.

### **Claim Processing Security Demo**

This demo shows a composite application consisting of 2 SOAP services. It allows demonstrating how to record and simulate the behavior of one of the SOAP services. Both services authenticate each other using X509 certificates.

### **Claim Processing Standalone Server Demo**

This demo shows a composite application consisting of 2 SOAP services. It allows demonstrating how to record and simulate the behavior of one of the SOAP services on a standalone server.

### **Claim Approval JMS Demo**

This demo shows a composite application consisting of 3 SOAP services. It allows demonstrating how to record and simulate the behavior of two SOAP services. Demo is similar to the Claim processing service simulation demo. One XML over JMS service (TIBCO EMS approval service) has been added to the topology here and is being simulated, too.

### **Claim Approval WebSphere MQ Demo**

This demo shows a composite application consisting of 3 SOAP services. It allows demonstrating how to record and simulate the behavior of two SOAP services. The demo is similar to the Claim Processing service virtualization demo. One XML over WebSphere MQ service (WebSphere MQ approval service) has been added to the topology here, and is being simulated, too.

### **Request Tracking Service Activity Demo**

This demo shows a composite application consisting of 4 SOAP services. It allows demonstrating how to record and simulate the behavior of two SOAP services. In addition, activity can be demonstrated by calling the third SOAP service from a simulated service.

### **ShoppingCart - No Sessions Demo**

This demo shows virtualization of stateful shopping cart service, where only one client is using the stateful service.

**ShoppingCart - Sessions by Clients Demo**

This demo shows virtualization of stateful shopping cart service, where multiple concurrent clients are using the stateful service and private session is generated for each client.

**ShoppingCart - Sessions by Orders**

This demo shows virtualization of stateful shopping cart service, where multiple concurrent clients are using the stateful service and sessions are generated per each shopping order. The checkout operation finishing shopping order destroys the client session (the next operation creates a new one).