DataPower for IMS

Implementation Guide

3rd Edition, June, 2014

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Introduction

This document is a reference guide for implementing a DataPower solution to integrate existing services with any IMS environment.

The IBM Information Management System (IMS) is comprised of IMS Database Manager (IMS DB), a hierarchical database management system, and IMS Transaction Manager (IMS TM), a message-based transaction processor.

Overview of DataPower for IMS

WebSphere DataPower is a security and integration gateway appliance, built for simplified deployment & hardened security, bridging multiple protocols & performing conversions at wire speed.
The IBM WebSphere DataPower Integration Appliance provides three types of support for IMS:

- **Access to databases in IMS DB. Access to IMS DB** allows an external application to issue SQL calls against IMS databases using the IMS Universal JDBC driver that is delivered with DataPower.
- **Access to IMS transactions that are running in IMS TM.** Access to IMS TM through DataPower allows an external application to initiate a transaction request to an application program that is running in an IMS TM dependent region and fetch data back
- **Support for synchronous callout requests** from application programs running in IMS TM systems to data or service providers running on the DataPower backend. This is also referred to as an IMS *consumer scenario*.

DataPower provides plug-in usability with little to no changes to an existing network or application software. No proprietary schemas, coding, or APIs are required to install or manage the device, and it supports popular XML Integrated Development Environments to help reduce the number of hours spent in developing and debugging XML applications.

For full product information about IBM WebSphere DataPower SOA Appliances, refer to: http://www.ibm.com/software/integration/datapower/index.html

To address the need for tooling-generated data transformation and data mapping, IBM offers WebSphere Transformation Extender (WTX). WTX has the ability of transforming any two data formats, and generates artifacts that can be deployed on any DataPower appliance; this offers a flexible solution for security-rich XML enablement, enterprise service buses (ESBs), and mainframe connectivity. For more information about WebSphere Transformation Extender see the WebSphere Transformation Extender home page at http://www.ibm.com/software/products/us/en/wdatastagetx/.

Intended Audience

This document is intended for anyone responsible for the installation, configuration and maintenance of DataPower, IMS, and the connections between the two.
Ideally, individuals that are responsible for installing and configuring DataPower support for IMS should have the following knowledge:

- Familiarity with IMS Connect configuration
- Familiarity with configuring IMS features, including IMS.PROCLIB members and their customization
- Basic knowledge of network protocols (HTTP(s), (S)FTP, etc)
- Familiarity with XSD, XSLT, WSDL,
- WebSphere Transformation Extender (WTX)

Prerequisite assumptions for DataPower and IMS component configuration

These instructions are limited to configuring communication between a DataPower appliance and an IMS system. For any information not included here, including general configuration information not specifically related to communication between DataPower and IMS, see the DataPower and IMS documentation:

- IBM WebSphere DataPower SOA appliance documentation in the IBM Knowledge Center at http://www.ibm.com/support/knowledgecenter/SS9H2Y/welcome

- IMS documentation in the IBM Knowledge Center at http://www.ibm.com/support/knowledgecenter/SSEPH2/welcome

These instructions assume that in the IMS system, IMS Connect, ODBM, and OTMA are already running. If they are not, see the IMS documentation for information about starting them.

These instructions use the optional, separately licensed product WebSphere Transformation Extender, and assume that you have the separately licensed DataPower SQL Data Source component.

These instructions assume that security protocols are already in place and that you have the proper credentials and authorities for working with both DataPower and IMS.

These instructions provide specific guidance for configuring IMS support for DataPower only.

Requirements

The prerequisites can differ depending on the support that you need to implement.

Requirements for access to transactions in IMS TM

Software requirements

- IMS Version 11 or later
- DataPower firmware release 3.6.1 or later. Check the IBM Support Portal for the latest supported firmware versions and recommended upgrade levels for WebSphere DataPower SOA appliances at http://www-01.ibm.com/support/docview.wss?uid=swg21237631.

Hardware requirements

- Check the IBM WebSphere DataPower appliance documentation for the models that support IMS TM Provider feature

Recommended tooling

- IBM WebSphere Transformation Extender (tooling for Data Transformation)

Requirements for IMS Synchronous Callout support

Software requirements

- For Version 13 of IMS and IMS Connect, the following IMS Connect APARs:
  - For the IBM WebSphere DataPower message exit routine (HWSDPWR1), IMS Connect APAR PM81857 (PTF UK97704)
  - For improved cleanup after lost connections, IMS Connect APARs PM90777 (PTF UK95578) and PM98701 (PTF UI12241)
- For Version 12 of IMS and IMS Connect, the following APARs:
  - For map name support for synchronous callout requests, IMS APAR PM73135 (PTF UK82636)
  - For the IBM WebSphere DataPower message exit routine (HWSDPWR1), IMS Connect APAR PM76086 (PTF UK91544)
- IBM WebSphere DataPower Firmware V6.0 or higher. DataPower Firmware V7.0 or higher is required to use the *ims-callout-user-id* header in a WTX map artifact or a stylesheet,

- If data transformation is required, a data map or stylesheet. Use the recommended IBM WebSphere Transformation Extender Design Studio to create data transformation maps, or you can code style sheets yourself.

Hardware requirements

- IBM WebSphere DataPower appliance XI52, XI50B, XB62

If callout requests must be transformed from the data format used in IMS to a data format used by the service provider on the DataPower backend,

Requirements for access to IMS DB

Software requirements

- IMS Version 12 or higher, with the following IMS components enabled:
    - IMS Catalog
    - The Open Database(ODBM) component of the IMS Common Service Layer (CSL)
    - The Structured Call Interface (SCI) component of CSL
- IBM WebSphere DataPower Firmware V6.0 or higher

Hardware requirements

- IBM WebSphere DataPower appliance XG45, XI52, XI50B, XB62

Overview of IMS and DataPower Components

The following chapter describes the details of components used in a DataPower for IMS solution. They are divided into two categories:

- Components in the IMS environment
- Components in the DataPower environment

Components in the IMS environment

The components in the IMS environment that might be used depending on the DataPower for IMS solution that you implementation include. In particular

- IMS Connect
    - DataPower User Exit for synchronous callout support
    - ODACCESS statement for IMS DB access support
    - DATASTORE statement for synchronous callout and IMS TM access support
- OTMA
    - OTMA destination descriptors for synchronous callout support
- ODBM for IMS DB access support
- IMS Catalog for IMS DB access support

IMS Connect

IMS Connect is a TCP/IP server that connects IMS with client applications. IMS Connect ships with IMS as a key component for distributed access to IMS databases and integrates IMS into a Service-Oriented Architecture.

IMS Connect is the gateway to IMS for all of the DataPower for IMS solutions.

Note: This implementation guide does not contain complete information for configuring IMS Connect. Only the aspects of IMS Connect configuration that are specific to a DataPower and IMS scenario are included.

For IMS Version 13 information about configuring IMS Connect, see http://www.ibm.com/support/knowledgecenter/SSEPH2_13.1.0/com.ibm.ims13.doc.sdg/ims_hstinst.htm.

The IMS Connect DataPower user exit routine (HWSDPWR1) for synchronous callout support

The IMS Connect DataPower user exit routine (HWSDPWR1) is required for IMS Connect to support the retrieval of IMS synchronous callout requests through DataPower.

The HWSDPWR1 exit routine was added to IMS Version 12 by PTF UK91544 and is available as object code only, so it is not customizable.

Connecting IMS Connect to ODBM for access to IMS DB - ODACCESS statement considerations

This ODBM configuration is required for DataPower support for access to IMS databases.

IMS Connect has to be configured to register with ODBM to enable client access to IMS DB using the IMS Open Database architecture; you must code the IMS Connect ODACCESS statement in HWSCFGxx member of the IMS PROCLIB data set.

For IMS Version 13 information about the ODACCESS statement, see http://www.ibm.com/support/knowledgecenter/SSEPH2_13.1.0/com.ibm.ims13.doc.sdg/ims_hwscfgxx_proclib_odaccess.htm.

OTMA

The IMS™ Open Transaction Manager Access (OTMA) is a transaction-based, connectionless client/server protocol. OTMA is required for access to IMS TM and for synchronous callout support.

For IMS synchronous callout support, IMS Version 12 PTF UK82636 is required. PTF UK82636 contains APAR PM73135, which adds support for the 1- to 8-character map name that the IMS application program includes with the ICAL that initiates the synchronous callout request. The map name is then passed through OTMA and IMS Connect to the DataPower appliance.

To enable callout communication between IMS and the DataPower appliance you need to specify one or more OTMA destination descriptors.

An OTMA destination descriptor defines an output destination, or *TPIPE*, for IMS output messages, such as synchronous callout messages. The DataPower IMS Callout front side handler retrieves synchronous callout messages from IMS by listening on the TPIPE specified on the OTMA destination descriptor.

For IMS Version 13 information about OTMA destination descriptors, see http://www.ibm.com/support/knowledgecenter/SSEPH2_13.1.0/com.ibm.ims13.doc.ccg/ims_otma_admin_006.htm.

For IMS Version 13 information about coding OTMA destination descriptors, see OTMA destination descriptor syntax and parameters in the IMS documentation at http://www.ibm.com/support/knowledgecenter/SSEPH2_13.1.0/com.ibm.ims13.doc.sdg/ims_dfsydtx_proclib_dest_dscrp.htm.

ODBM

ODBM is an IMS component that is used for routing IMS DB requests to IMS subsystems and databases.

Configuring the ODBM member CSLDCxxx

This component customization is required for access to IMS DB.

The Open Database Manager (ODBM) must be configured to recognize the IMS data stores that are referenced as alias names by incoming IMS database requests from application programs. The CSLDCxxx member of the IMS.PROCLIB data set establishes these associations and contains a global section with settings that apply to all IMS data stores and a local section with settings that apply to specific data stores.

In some instances in which you are using DataPower parallel connections (concurrent HTTP requests) you might need to change the values in the CSLDCxxx member.

As general rule for the assignment of the parameter values you can use the formula:

(MAXTHD * FPBUF) + FPBOF <= CNBA

For example:

```
<SECTION=GLOBAL_DATASTORE_CONFIGURATION>
MAXTHRDS=50
FBUF=20
FPBOF=5
CNBA=1100
```

Use the QUERY ODBM TYPE(DATASTORE) IMS type-2 command to check the current parameter values.

Make sure that the ALIAS parameter in CSLDCxxx correctly indicates the alias name used by the DataPower DB connection. For instance if the connection is looking for IMS1 as the system name, specify:

```
ALIAS(NAME=RRSN,NAME=IMS1)
```

Expect an error messages from DataPower whenever this condition is not satisfied, such as:

```
sql-source (SQA-IMS): Could not establish database connection:
com.ibm.ims.dli.PSBCreationException: An error occurred accessing the
PSB: com.ibm.ims.dli.DLIException: Unable to retrieve metadata
information for Database (PSB), COGPSBR, from the IMS Catalog. The PSB
COGPSBR.IMS1 was not allocated. Diagnostic info: HWSK2875W NO ODBM IS
AVAILABLE FOR MESSAGE ROUTING; C=ODBE472D, IMSA=IMS1, P=5555 , IMSA1= ,
ODBM= , R=IMSANFND, M=MRCV.
```

Tip: IMS provides an Installation Verification Program (IVP) that includes a sample job that defines an ODBM configuration member and adds it to IMS.PROCLIB data set.

For more information, see CSLDCxxx member of the IMS PROCLIB data set in the IMS documentation at http://www.ibm.com/support/knowledgecenter/SSEPH2_13.1.0/com.ibm.ims13.doc.sdg/ims_csldcxxx_proclib.htm.

IMS Catalog

This component is required for access to IMS DB. The IMS Catalog, which is new in IMS Version 12, contains metadata about the program and database resources in IMS and simplifies distributed access to IMS databases.

In conjunction with a deployed Universal driver, a DataPower appliance uses metadata fetched from the IMS catalog to determine the IMS data format.

IMS Catalog information is also used to verify that the IMS PSB specified in the DataPower “SQL Data Source” definitions is valid.

Components in the DataPower environment

Depending on which type of DataPower support you are implementing, the DataPower components that you need to configure are different and can include:

- A Multi-protocol gateway, which is required for all types of IMS support
- An IMS Callout Front Side Handler to support synchronous callout requests from IMS applications to data or services on the DataPower backside
- DataPower IMS DB support for access to IMS databases
- The separately licensed DataPower SQL Data Source for access to IMS databases
- If data transformation is required, a data transformation map or a stylesheet. Use WebSphere® Transformation Extender Design Studio to create data transformation maps. You must code stylesheets yourself.
- An *IMS Connect object* for access to IMS transactions and application programs in an IMS TM provider scenario

Multi-protocol gateway

A Multi-Protocol Gateway connects client requests that are transported over one or more protocols to a remote destination that uses the same or a different protocol. The Multi-Protocol Gateway supports the FTP, HTTP, HTTPS, IMS™, MQ, NFS, SFTP, TIBCO EMS, and WebSphere® JMS protocols.

A Multi-Protocol Gateway offers many of the same services and capabilities as a Web Service Proxy. Unlike a Web Service Proxy, a Multi-Protocol Gateway cannot use a WSDL to determine the configuration.

A Multi-Protocol Gateway is required for each type of IMS support.

You can configure multiple Multi-Protocol Gateways.

A Multi-Protocol Gateway includes the following capabilities:

- Implement Reliable Messaging policies
- Implement WS-Addressing protocol enforcement
- Accept and send SOAP, raw XML, or unprocessed (binary) documents
- Transform XML to binary format documents and binary format documents to ML
- Filter, validate, transform, encrypt, or decrypt XML documents
- Route XML documents
- Sign documents or verify signatures
- Process large documents in the streaming mode

- Implement document-level security or service-level security
- Communicate with clients, servers, and peers with SSL encryption
- Monitor and control data traffic based on request sources and requested resources
- Allow, reject, strip, or process attachments (MIME, DIME, MTOM)

IMS Callout Front Side Handler for synchronous callout support

The IMS Callout handler of the DataPower Multi-Protocol Gateway retrieves IMS callout request messages from an IMS application and sends the callout response data back to the IMS application.

WebSphere Transformation Extender data transformation maps

Using WebSphere® Transformation Extender Design Studio is recommended to create the data transformation maps that are required to transform IMS synchronous callout requests into the data format that is used by the data or service provider on the DataPower backend. After the transformation, the DataPower appliance can perform other processing actions (validate, transform, route) on the XML message. The DataPower appliance can also use maps to transform message data from XML to binary.

Design Studio can be used in combination with any IBM WebSphere DataPower appliance that has the DataGlue license to perform the following tasks:

- Create data objects to define the structure of your data, including source and target data structures
- Develop maps to define the logic for data transformation
- Test and deploy maps to appliance

For more information, see the WebSphere Transformation Extender documentation at http://www.ibm.com/support/knowledgecenter/SSVSD8/welcome.

SQL Data Source for access to IMS DB

An SQL Data Source provides the configuration to establish a direct connection to an IMS database. When configured, it is possible to dynamically perform database operations, such as basic CRUD[1] operations, on the IMS database.

The DataPower SQL-ODBC component requires a dedicated license. You can view your available licenses by doing a ‘show license’ from the command line interface (CLI).
In the Web GUI, click Status and under the System header, click Device Features to see what you are licensed to use, and Library Information to see what licensed features are currently installed.

[1] CRUD refers to the four basic functions of persistent storage: create, read, update and delete. It is used here to describe the user interface conventions that facilitate viewing, searching, and changing information in relational DB application (insert, select, update, delete).

IMS Connect object for access to IMS TM

The DataPower IMS™ Connect object handles IMS protocol communications from a DataPower® service to IMS applications. The configuration of the IMS Connect object defines the behavior of the connection to IMS TM.

Working with DataPower appliances

This section contains general information about working with DataPower appliances.

DataPower user interfaces

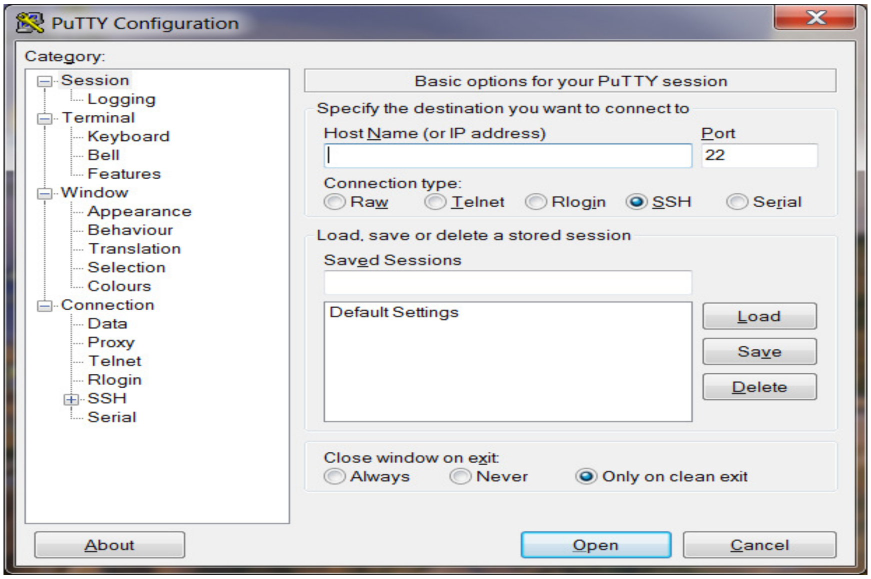
You can use either one of two interfaces for configuring and managing your DataPower appliance:

- Command line interface
- Web GUI

Command Line Interface

To interact with the command line interface (CLI) after the DataPower appliance is connected to your network, you can use an SSH-enabled terminal, such as PuTTy, a free, open-source terminal emulator, serial console and network file transfer application.

The following figure shows an example of a PuTTY



PuTTY Configuration

Basic options for your PuTTY session

Specify the destination you want to connect to

Host Name (or IP address):

Port: 22

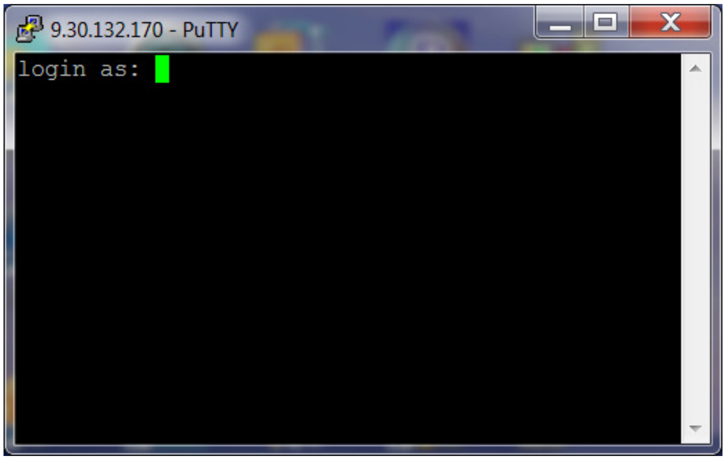
Connection type: ○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial

Load, save or delete a stored session

Saved Sessions: Default Settings

Close window on exit: ○ Always ○ Never ● Only on clean exit

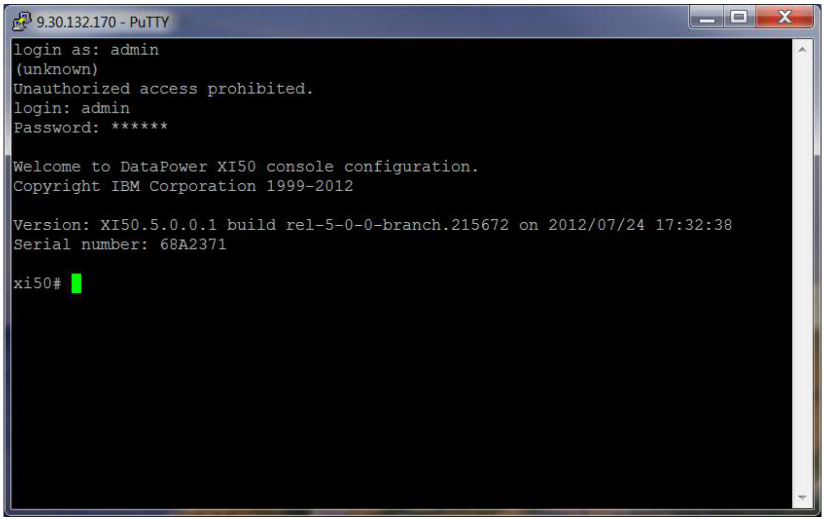
Login with your DataPower credentials:



```
login as: 
```

When the terminal is connected to the DataPower appliance, you can issue commands to the DataPower appliance. For the full list of DataPower commands, see the IBM WebSphere DataPower documentation at http://www.ibm.com/support/knowledgecenter/SS9H2Y/welcome.

The figure below shows the CLI after logging in. Information such as the model, version, and firmware of the DataPower appliance are displayed.

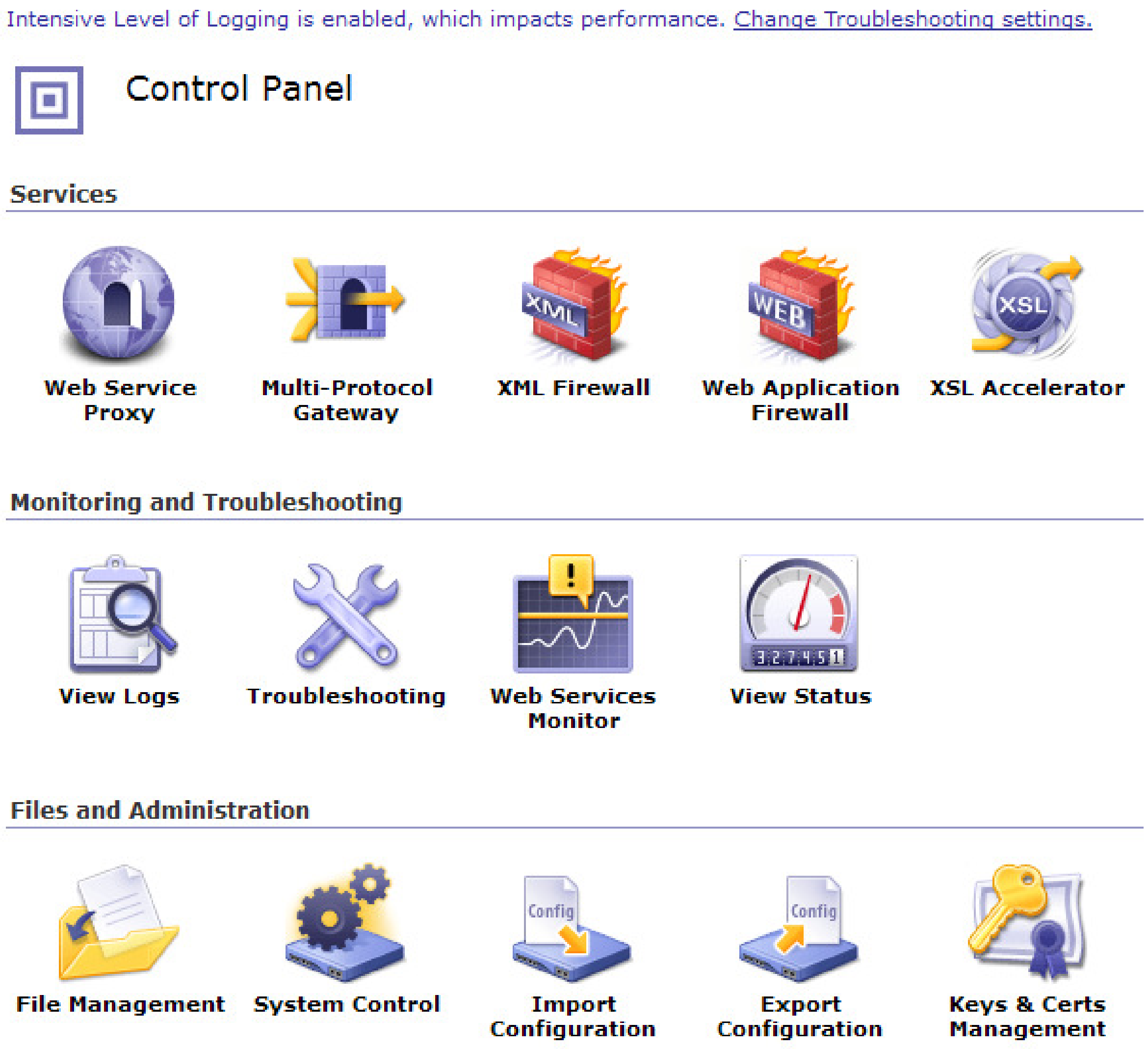


```
login as: admin
(unknown)
Unauthorized access prohibited.
login: admin
Password: ******

Welcome to DataPower XI50 console configuration.
Copyright IBM Corporation 1999-2012

Version: XI50.5.0.0.1 build rel-5-0-0-branch.215672 on 2012/07/24 17:32:38
Serial number: 68A2371

xi50# 
```

Web Based GUI

As an alternative to the CLI, you can use the Web Graphical User Interface (Web GUI) to configure and maintain your DataPower appliance.

DataPower control panel in the Web GUI



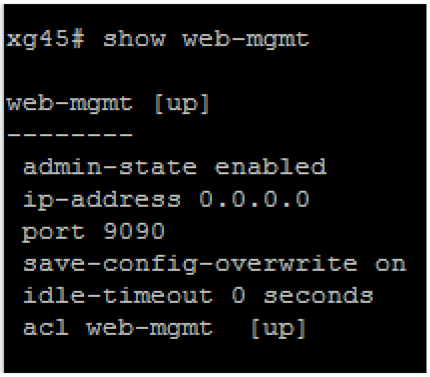
Intensive Level of Logging is enabled, which impacts performance. Change Troubleshooting settings.

The first time your DataPower appliance is booted up and connected to the network, the SSH service listener must be enabled in order to activate the Web GUI.

Using the command line interface, enter ‘co; ssh’ to enable the Web GUI. The following message should be displayed to inform you that the Web GUI has been enabled:

```
Xi52# co;ssh
Global configuration mode
SSH service listener enabled
```

Entering ‘show web-mgmt’ in the CLI, displays information about your Web GUI properties.

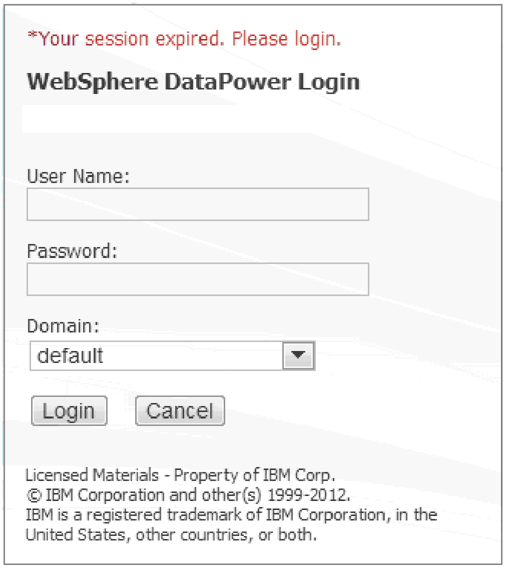


```
xg45# show web-mgmt

web-mgmt [up]
--------
 admin-state enabled
 ip-address 0.0.0.0
 port 9090
 save-config-overwrite on
 idle-timeout 0 seconds
 acl web-mgmt  [up]
```

Open a web browser and enter the following URL in the address field to display the Web GUI:

https://<DataPower IP>:<DataPower port>

The Login dialog opens:



*Your session expired. Please login.

WebSphere DataPower Login

User Name:

Password:

Domain: default

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Upon submitting your login information, the main control panel is displayed.

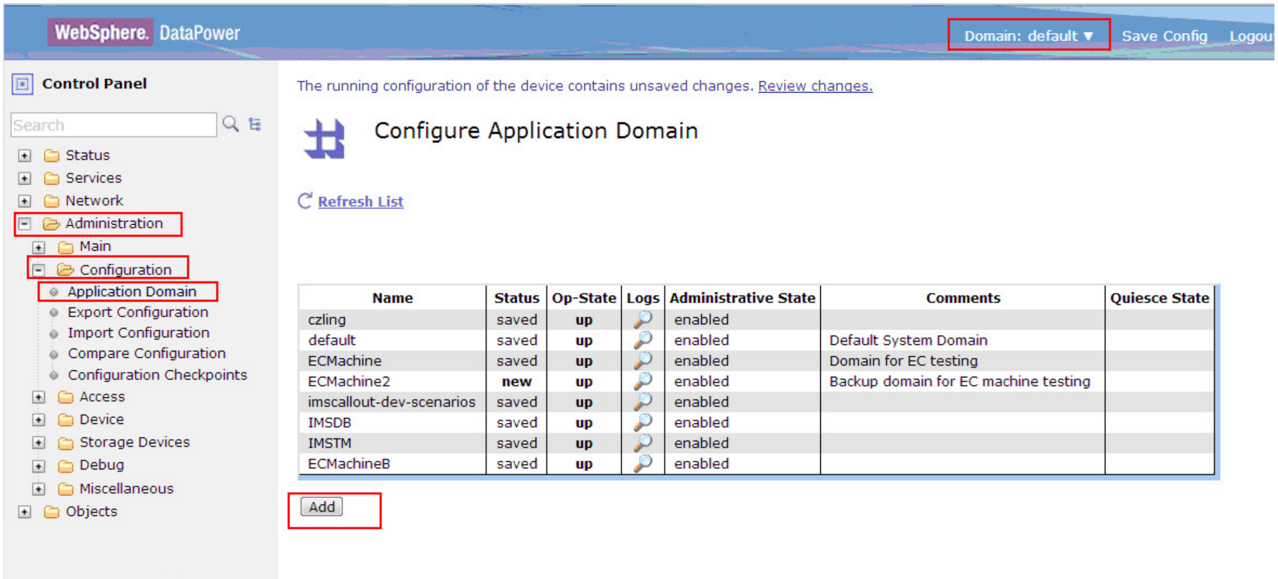
Tip: Multiple appliances can be managed together as part of a set through the use of IBM Tivoli Composite Appliance Management System Edition for WebSphere DataPower (ITCAMSE for WDP).

Creating a DataPower Domain

In some circumstances you might need to create your own domain within the DataPower appliance to isolate your activity from the activities of other users. A domain can be created and administered in DataPower as a separate entity.

To create your own domain:

1. Make sure that "*Domain: Default*" is selected in the upper right of the web page.
2. In the navigation menu on the left side of the page, select *Administration* > Configuration > *Application Domain.* The Configure Application Domain panel displays.
3. Click the "add" button at the bottom of the panel. The Main tab of the Configure Application Domain displays.

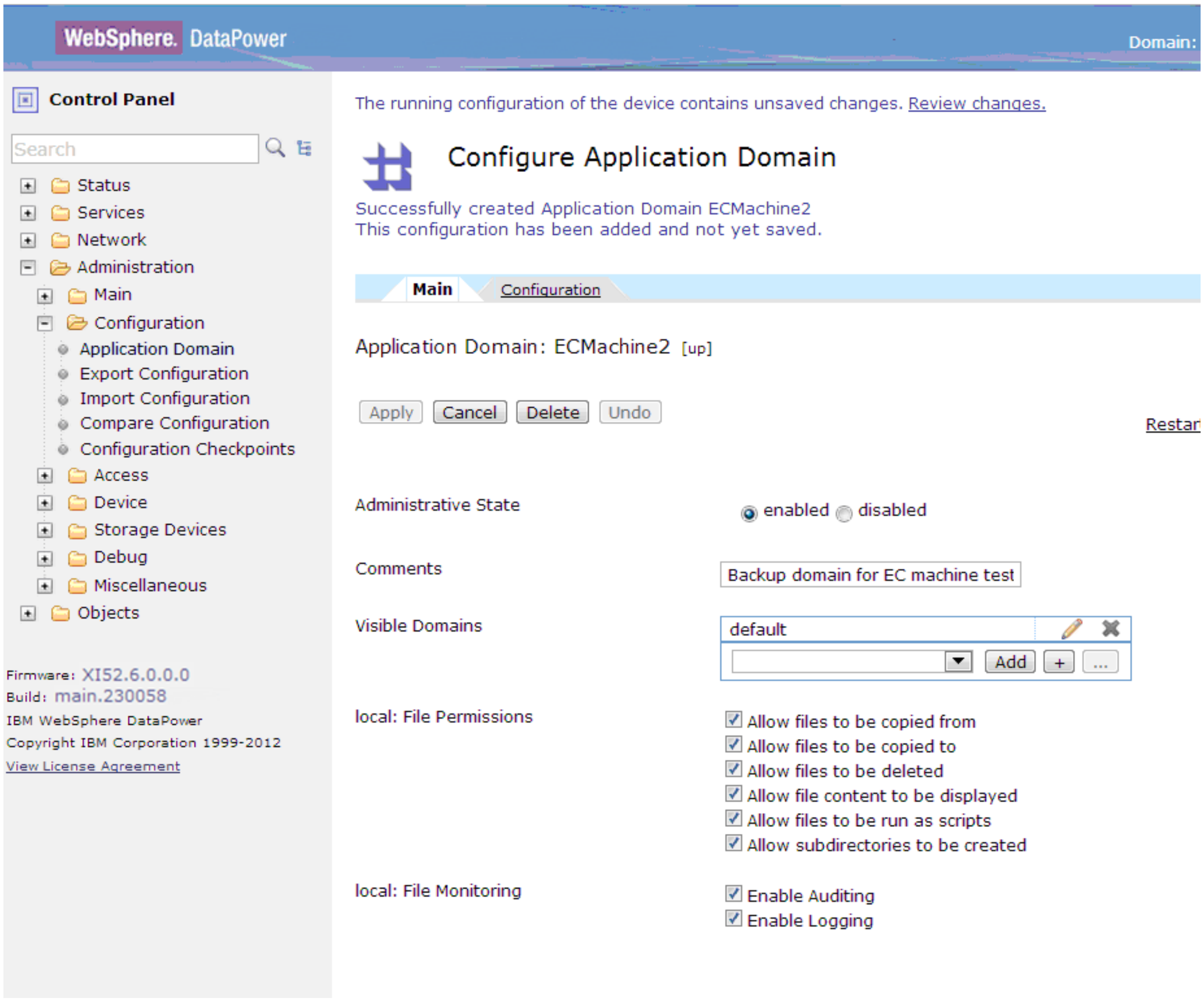


The running configuration of the device contains unsaved changes. Review changes.

Configure Application Domain

Refresh List

Name	Status	Op-State	Logs	Administrative State	Comments	Quiesce State
czling	saved	up	🔎	enabled		
default	saved	up	🔎	enabled	Default System Domain	
ECMachine	saved	up	🔎	enabled	Domain for EC testing	
ECMachine2	new	up	🔎	enabled	Backup domain for EC machine testing	
imscallout-dev-scenarios	saved	up	🔎	enabled		
IMSDB	saved	up	🔎	enabled		
IMSTM	saved	up	🔎	enabled		
ECMachineB	saved	up	🔎	enabled		



The running configuration of the device contains unsaved changes. Review changes.

Configure Application Domain

Successfully created Application Domain ECMachine2
This configuration has been added and not yet saved.

Application Domain: ECMachine2 [up]

Administrative State: ● enabled ○ disabled

Comments: Backup domain for EC machine test

Visible Domains: default

local: File Permissions:
- ☑ Allow files to be copied from
- ☑ Allow files to be copied to
- ☑ Allow files to be deleted
- ☑ Allow file content to be displayed
- ☑ Allow files to be run as scripts
- ☑ Allow subdirectories to be created

local: File Monitoring:
- ☑ Enable Auditing
- ☑ Enable Logging

Upgrading DataPower Firmware

If you have an older DataPower appliance, such as the XI50, your appliance might be able to support IMS synchronous callout requests or access to IMS transactions or databases if you update the firmware.

Note: Updating firmware requires a restart of the DataPower appliance.

To check for available firmware upgrades, see the Supported firmware versions and recommended upgrade levels for IBM WebSphere DataPower SOA Appliances web page at http://www-01.ibm.com/support/docview.wss?uid=swg21237631.

To update the firmware:

1) Control Panel -> System Control

2) Under "Boot Image" click "Fetch..."

3) In the popup window enter the firmware URL

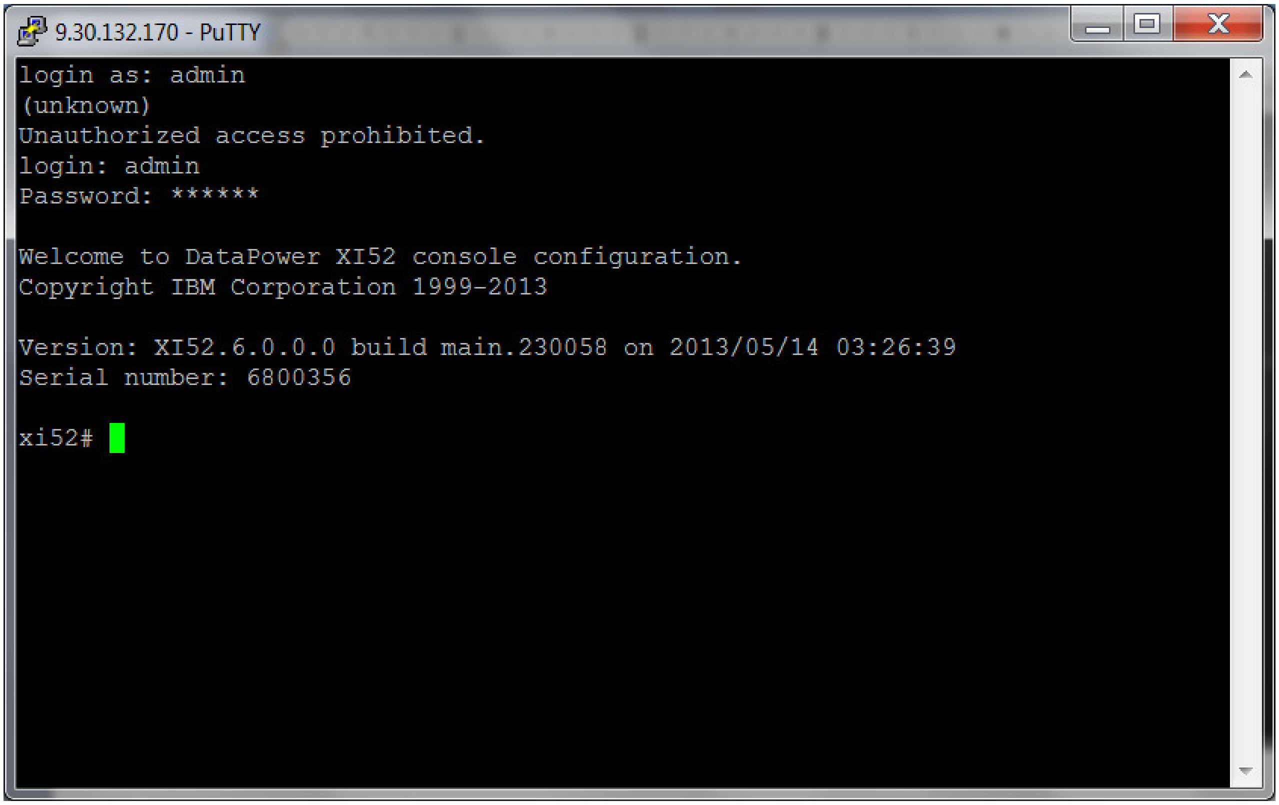
4) Click anywhere on the screen to let the other fields be auto-filled

5) Check "Overwrite Existing File" if necessary. Click "Fetch"

6) Click "Boot Image" in the System Control panel

7) 6) Wait for DataPower to reboot

The whole process takes 5-10 minutes.

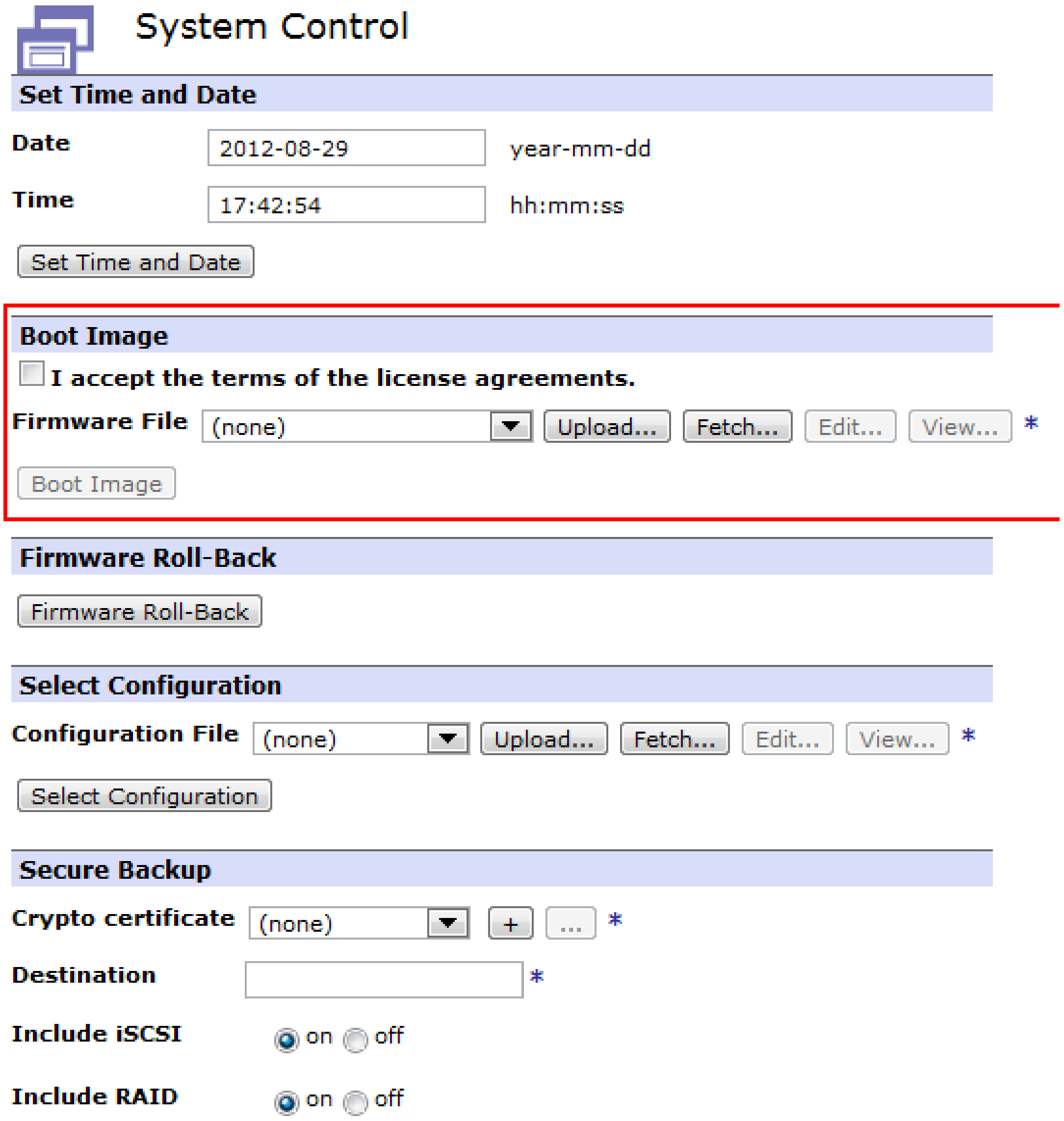


```
login as: admin
(unknown)
Unauthorized access prohibited.
login: admin
Password: ******

Welcome to DataPower XI52 console configuration.
Copyright IBM Corporation 1999-2013

Version: XI52.6.0.0.0 build main.230058 on 2013/05/14 03:26:39
Serial number: 6800356

xi52#
```



System Control

Set Time and Date

Date 2012-08-29 year-mm-dd

Time 17:42:54 hh:mm:ss

Boot Image

□ **I accept the terms of the license agreements.**

Firmware File (none)

Firmware Roll-Back

Select Configuration

Configuration File (none)

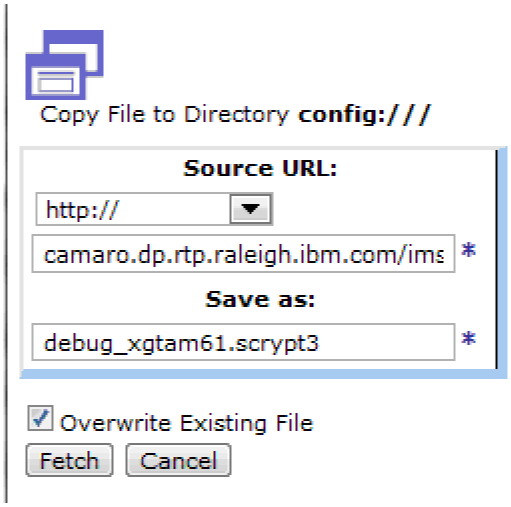
Secure Backup

Crypto certificate (none)

Destination

Include iSCSI ● on ○ off

Include RAID ● on ○ off



Copy File to Directory **config:///**

Source URL:

http://

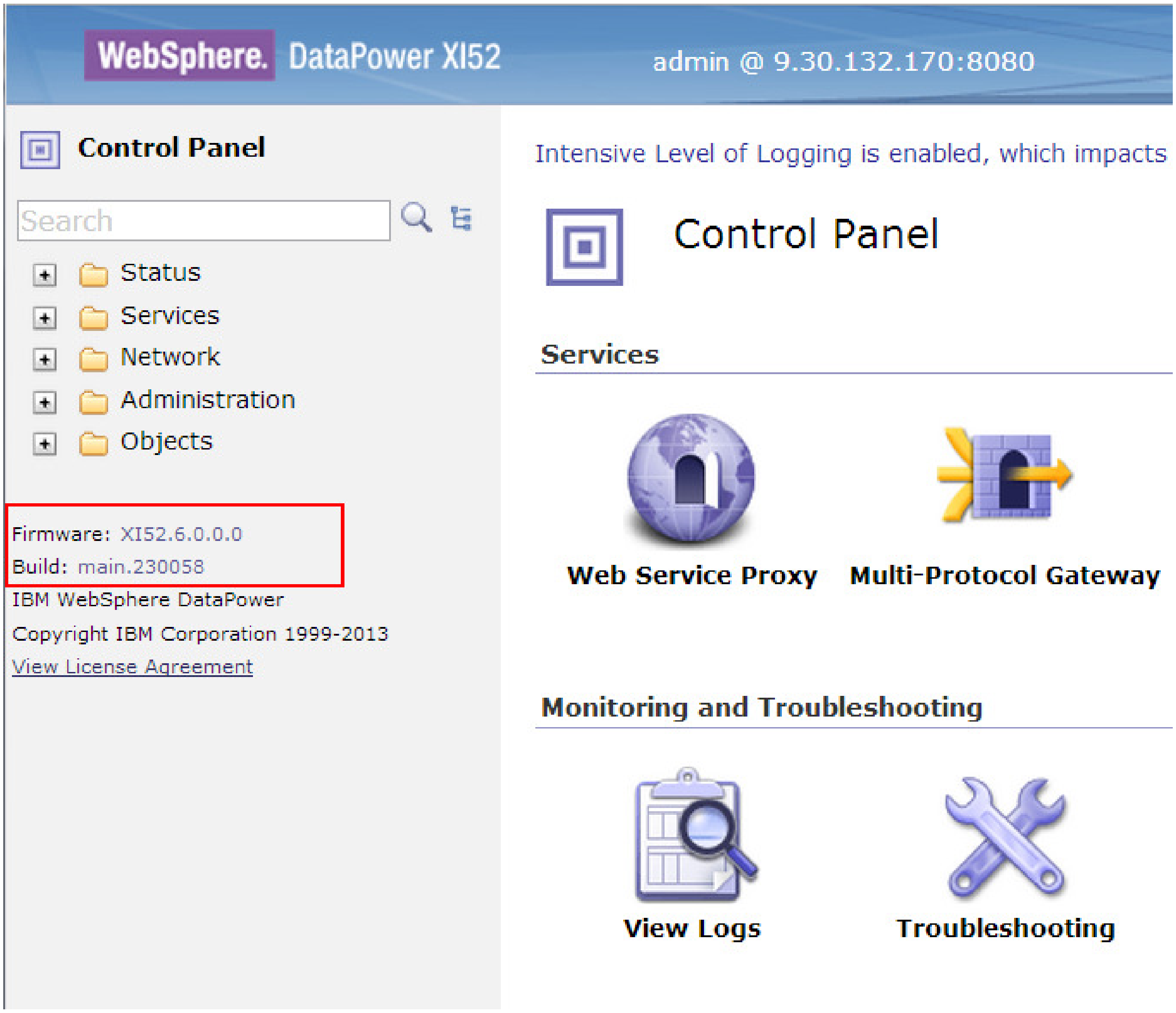
camaro.dp.rtp.raleigh.ibm.com/ims *

Save as:

debug_xgtam61.scrypt3 *

☑ Overwrite Existing File

The new firmware level installed will be displayed at the bottom of the left navigation panel as in the figure below



Firmware: XI52.6.0.0.0

Build: main.230058

IBM WebSphere DataPower

Copyright IBM Corporation 1999-2013

View License Agreement

Intensive Level of Logging is enabled, which impacts

Configuring the Synchronous Callout Solution

To configure DataPower and IMS to support access to the IMS TM server, you need to configure components in both the IMS and DataPower environments:

In the IMS environment, you need to configure:

- OTMA
- IMS Connect
- The ICAL call of the IMS DL/I API

In the DataPower environment, you need to configure:

- The Multi-Protocol Gateway
- The IMS Callout Front Side Handler
- The connection between DataPower and the backend service provider
- Define the Multi-Protocol Gateway processing policies and rules that determine the actions that DataPower takes the callout requests and responses that it handles.

Configuring IMS components for IMS synchronous callout requests

To support access to IMS TM from DataPower, the configuration steps in IMS are generally the same as they are for configuring access to IMS TM from any other IMS Connect client: you need to enable OTMA if it is not already enabled, and configure IMS Connect.

Configuring OTMA for Synchronous Callout support

To support synchronous callout, OTMA must be enabled in IMS and an OTMA destination descriptor must be defined that routes the callout requests through IMS Connect and the DataPower appliance.

Enabling OTMA

To enable IMS™ to use OTMA, specify the z/OS® cross-system coupling facility (XCF) group name and IMS OTMA member name during system definition.

OTMA is installed with IMS TM. The IMS INSTALL/IVP Dialog is not used to install OTMA.

To start OTMA, you can use the OTMA=Y startup parameter in the IMS procedure during IMS system definition or, after an IMS restart, issue the type-1 command /START OTMA.

Defining an OTMA destination descriptor for synchronous callout support

An OTMA destination descriptor defines an output destination, or *TPIPE*, for IMS output messages, such as synchronous callout messages. The DataPower IMS Callout front side handler retrieves synchronous callout messages from IMS by listening on the TPIPE specified on the OTMA destination descriptor.

You can also use the OTMA destination descriptor to specify a timeout value for synchronous callout requests. If a timeout value is specified in both the OTMA destination descriptor and in the DL/I ICAL call itself, the lesser of the two values is used.

OTMA destination descriptors can be created, modified, or deleted while IMS is running by using IMS type-2 commands, or they can be coded during IMS system definition and stored in the DFSYDT*x* member of the IMS.PROCLIB data set. However, IMS must be restarted to recognize any new or changed OTMA destination descriptors that are coded in the DFSYDTx member.

Here is an example of an OTMA destination descriptor:

```
D OTMDSC01 TYPE=IMSCON TMEMBER=HWS1 TPIPE=TPIPE1

D OTMDSC02 TYPE=IMSCON TMEMBER=HWS1 TPIPE=TPIPE2

D OTMDSC03 TYPE=IMSCON TMEMBER=HWS1 TPIPE=TPIPE3
```

Note: The tpipes must be dedicated to DataPower and the synchronous callout requests sent to a particular service. The tpipes cannot be shared with any other application or solution, such as IMS SOAP Gateway. If a TPIPE is shared, either DataPower or the other solution might be unable to retrieve the synchronous callout requests properly.

For IMS Version 13 information about OTMA destination descriptors, see http://www.ibm.com/support/knowledgecenter/SSEPH2_13.1.0/com.ibm.ims13.doc.ccg/ims_otma_admin_006.htm.

For IMS Version 13 information about the CREATE OTMADESC command and its keywords, see CREATE OTMADESC command at http://www.ibm.com/support/knowledgecenter/SSEPH2_13.1.0/com.ibm.ims13.doc.cr/imscmds/ims_createotmadesc.htm.

For IMS Version 13 information about coding OTMA destination descriptors, see OTMA destination descriptor syntax and parameters in the IMS documentation at http://www.ibm.com/support/knowledgecenter/SSEPH2_13.1.0/com.ibm.ims13.doc.sdg/ims_dfsydtx_proclib_dest_dscrp.htm.

Configuring IMS Connect for Synchronous Callout support

IMS Connect must be configured for IMS TM access with:

- A DATASTORE configuration statement
- The IBM WebSphere DataPower message exit routine (HWSDPWR1)

An IMS Connect DATASTORE statement defines a connection between IMS Connect and IMS TM. It is required for synchronous callout support and is in addition to the HWS and TCPIP statements that are required for all types of IMS Connect support. All of the IMS Connect configuration statements are defined in the HWSCFGxxx member of the IMS.PROCLIB data set.

The value of the ID keyword in the DATASTORE statement is the value that is specified in DataPower in the Data store field when you configure the IMS Callout front-side handler.

The port number on which IMS Connect listens for DataPower is defined in the TCPIP configuration statement on the PORT or PORTID keyword.

In the TCPIP statement, you must also specify the HWSDPWR1 exit routine on the EXIT= parameter. The HWSDPWR1 exit routine was added to IMS Version 12 by PTF UK91544 and is available as object code only, so it is not customizable.

To make the HWSDPWR1 exit routine available to IMS Connect you have to link the exit routine by using a job similar to that shown in the following example:

```
//HWSDPWR1 JOB LINK,MSGLEVEL=1,REGION=640K,CLASS=G
//*----------------------------*
//* Link the exit              *
//*----------------------------*
//LINKMOD  EXEC PGM=IEWL,
//            PARM='SIZE=(180K,28K),RENT,REFR,NCAL,LET,XREF,LIST,TEST'
//SYSPRINT DD SYSOUT=A
//SYSLMOD  DD UNIT=SYSVIO,DISP=(,PASS),SPACE=(TRK,(1,1,1)),
//            DSN=&&CSDM17
//SYSUT1   DD UNIT=SYSVIO,DISP=(,DELETE),SPACE=(CYL,(10,1),RLSE)
//SYSLIN   DD  DSN=IMSDTPWR.OBJECT.LIB             <== User defined info
//LINK1  EXEC PGM=IEWL,
//        PARM=('SIZE=(880K,64K)',RENT,REFR,
//            NCAL,LET,XREF,LIST,TEST)
//SYSPRINT DD SYSOUT=A
//TEXT     DD UNIT=SYSVIO,DISP=(OLD,PASS),DSN=&&CSDM17
//SYSLMOD  DD DSN=ICONEXIT.OBJECT.LIB,              <== Exit Object lib
//            DISP=SHR,UNIT=SYSDA,VOL=SER=SDV000
//RESLIB  DD DSN=IMSBLD.I12STSMM.CRESLIB,DISP=SHR  <== IMS RESLIB
//SYSUT1   DD UNIT=SYSVIO,DISP=(,DELETE),SPACE=(CYL,(10,1),RLSE)
//SYSLIN   DD *
 INCLUDE   TEXT(HWSDPWR1)
 ENTRY HWSDPWR1
 MODE RMODE(31),AMODE(31)
 NAME HWSDPWR1(R)
//
```

Coding the ICAL call for synchronous callout requests

The ICAL call of the IMS DL/I API is how an application program running in an IMS TM dependent region makes a synchronous callout request to a data or service provider on the DataPower backend.

You need to code the application programs to build and issue the ICAL call. The fields of the ICAL call are defined by an application interface block (AIB). In the AIB fields, the application program specifies the attributes and content of the callout request, including:

- The name of the OTMA destination descriptor.
- Optionally, a time out value in 100ths of a second.
- The length of the request data.
- The length of the response data.
- The 1- to 8-byte map name, left justified in the AIBUTKN field of the AIB. This ID is included in the state data section of the OTMA prefix in the callout message. This ID can be used as a unique service identifier for data transformation mapping and service routing. In DataPower, this ID appears with the callout request as the ims-callout-service-id request header.

When a timeout value for a synchronous callout request is specified in both the OTMA destination descriptor and in the DL/I ICAL call itself, IMS uses the lower of the two values.

Synchronous callout messages sent from IMS by using the ICAL call do not use the IMS message queues. Consequently, synchronous callout messages are not constrained to the 32K message segment restriction that is imposed by the IMS message queue.

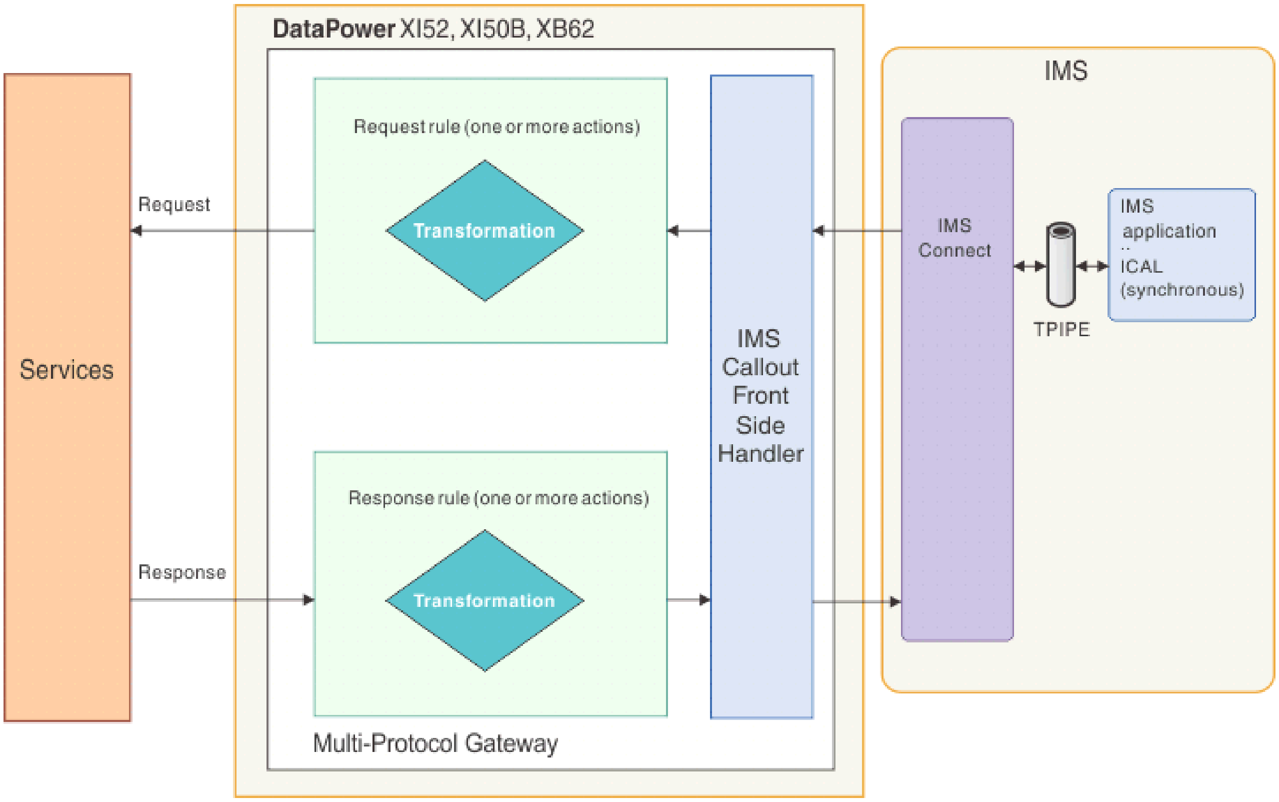
For a description of the parameter fields of an ICAL call and the valid values, see ICAL call in the IMS documentation at http://www.ibm.com/support/knowledgecenter/SSEPH2_13.1.0/com.ibm.ims13.doc.apr/ims_icalcalltm.htm.

Configuring DataPower for IMS synchronous callout requests

To configure DataPower to support synchronous callout requests from IMS to a data or service provided on the DataPower backside, you need to perform the following steps:

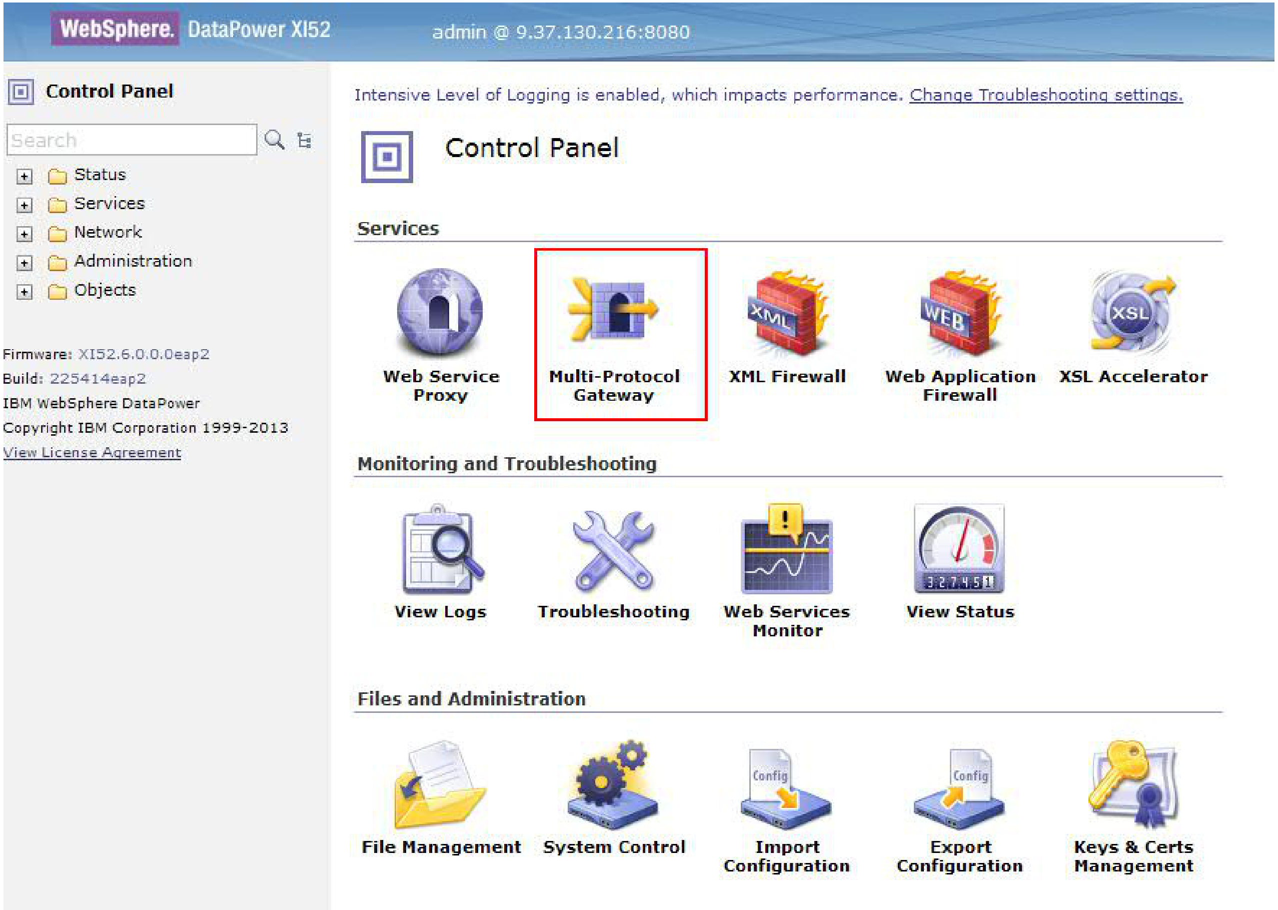
1. Configure the Multi-Protocol Gateway.
2. Configure IMS Callout Front Side Handler.
3. Configure the connection between DataPower and the backend external service provider.
4. Define the Multi-Protocol Gateway processing policies and rules that determine the actions that DataPower takes the callout requests and responses that it handles.
5. Apply the changes, and save the configuration

The following figure illustrates a DataPower configuration that supports IMS synchronous callout requests.


DataPower XI52, XI50B, XB62
Services
Request
Response
Request rule (one or more actions)
Transformation
Response rule (one or more actions)
Transformation
IMS Callout Front Side Handler
Multi-Protocol Gateway
IMS
IMS Connect
TPIPE
IMS application
ICAL (synchronous)

1. Configuring the Multi-Protocol Gateway for synchronous callout support

To configure the Multi-Protocol Gateway, start from the DataPower Control Panel and select Multi-protocol Gateway as in fig x below, and click on “add”.



Intensive Level of Logging is enabled, which impacts performance. Change Troubleshooting settings.

Firmware: XI52.6.0.0.0eap2
Build: 225414eap2
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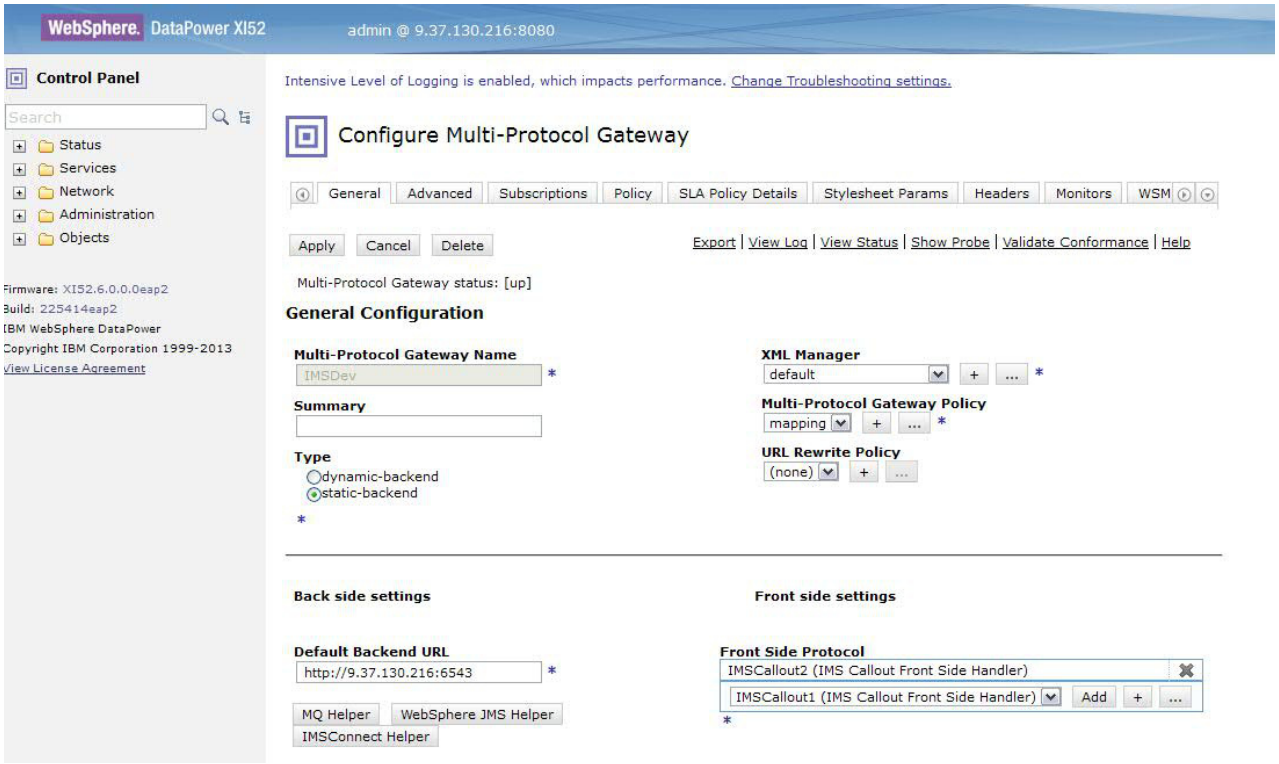
In the “Configure Multi-Protocol Gateway” panel, specify a Multi-Protocol Gateway name.



Firmware: XI52.6.0.0.0eap2
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Intensive Level of Logging is enabled, which impacts performance. Change Troubleshooting settings.

Configure Multi-Protocol Gateway

Multi-Protocol Gateway status: [up]

General Configuration

Multi-Protocol Gateway Name: IMSDev *

Summary:

Type
○ dynamic-backend
● static-backend
*

XML Manager: default *

Multi-Protocol Gateway Policy: mapping *

URL Rewrite Policy: (none)

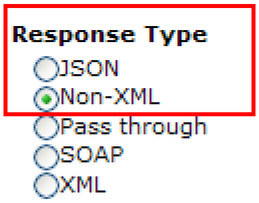
Back side settings

Default Backend URL: http://9.37.130.216:6543 *

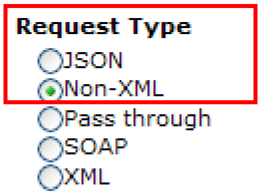
Front side settings

Front Side Protocol
IMSCallout2 (IMS Callout Front Side Handler)
IMSCallout1 (IMS Callout Front Side Handler)
*

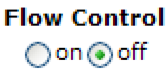
Toward the bottom of the panel, you must set the request type and response type. Request type defines the traffic between IMS and DataPower on the front end. Response type defines the traffic between the service provider and DataPower on the back end. Specify Non-XML for both request type and response type.



Response Type
○ JSON
● Non-XML
○ Pass through
○ SOAP
○ XML

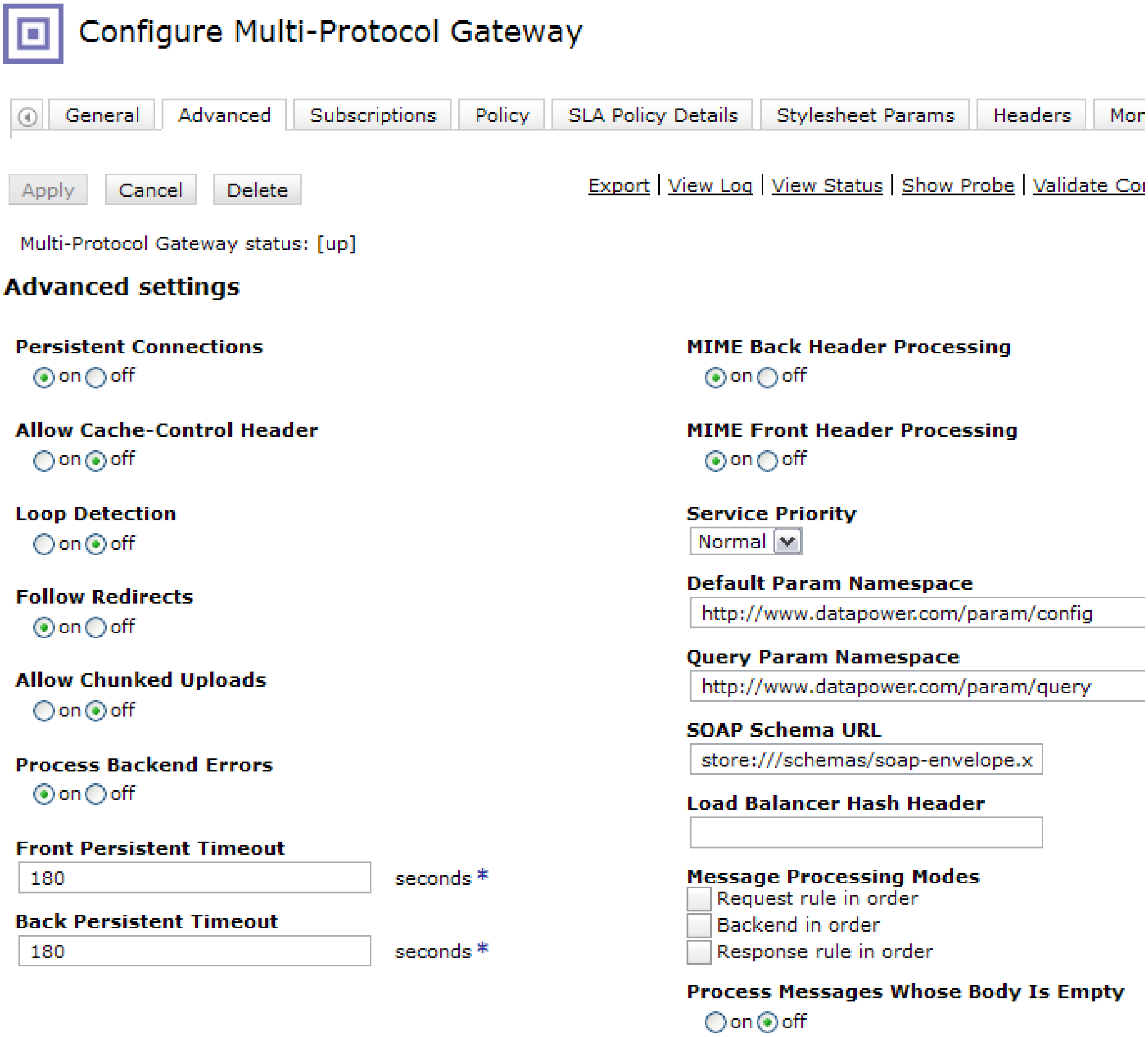


Request Type
○ JSON
● Non-XML
○ Pass through
○ SOAP
○ XML



Flow Control
○ on ● off

More Advanced settings, such as timeout values for front- and back-side connections, are available under the **Advanced** tab, as shown in the following figure.



Configure Multi-Protocol Gateway

Multi-Protocol Gateway status: [up]

Advanced settings

Persistent Connections
● on ○ off

Allow Cache-Control Header
○ on ● off

Loop Detection
○ on ● off

Follow Redirects
● on ○ off

Allow Chunked Uploads
○ on ● off

Process Backend Errors
● on ○ off

Front Persistent Timeout
180 seconds *

Back Persistent Timeout
180 seconds *

MIME Back Header Processing
● on ○ off

MIME Front Header Processing
● on ○ off

Service Priority
Normal

Default Param Namespace
http://www.datapower.com/param/config

Query Param Namespace
http://www.datapower.com/param/query

SOAP Schema URL
store:///schemas/soap-envelope.x

Load Balancer Hash Header

Message Processing Modes
□ Request rule in order
□ Backend in order
□ Response rule in order

Process Messages Whose Body Is Empty
○ on ● off

2. Configure IMS Callout Front Side Handler

To enable a Multi-Protocol Gateway to retrieve IMS ICAL callout requests from IMS, you must add an IMS Callout Front Side Handler. The IMS Callout Front Side Handler also manages the return of the response data to the IMS application.

By default, IMS Callout Front Side Handlers are enabled when they are created. During configuration of a Multi-Protocol Gateway, disable the IMS Callout Front Side Handler until the

Multi-Protocol Gateway and the backend service is ready to service requests. Otherwise, any callout requests sent to the IMS Callout Front Side Handler will get an error.

Also, if an IMS Callout Front Side Handler is enabled while the Multi-Protocol Gateway is being configured, each time you apply changes by clicking the Apply button, the Multi-Protocol Gateway effectively restarts the IMS Callout Front Side Handler and performs teardown and resume tpipe operations. When the Multi-Protocol Gateway is ready, you can enable the IMS Callout Front Side Handler to start the retrieval of IMS ICAL requests.

You can configure one or more IMS Callout Front Side Handlers in a single Multi-Protocol Gateway. For each front-side handler for IMS Callout support, you can configure one or more TPIPEs on the same IMS Connect host and port, and same IMS data store.

To configure the IMS Callout Front Side Handler, specify the following IMS system parameters. Required fields have an asterisk next to them.

Host
Specify the host name or IP address of the target IMS Connect server.

Port
Specify the port on which the IMS TCP/IP server, IMS Connect, is listening for DataPower.

Data store
Specify the name of the IMS data store. The value specified here must match the value specified on the ID keyword of an IMS Connect DATASTORE configuration statement.

OTMA tpipe names
Specifies the IMS OTMA tpipe names. DataPower passes the TPIPE name to IMS Connect as an alternate client ID. The TPIPE names defined in this panel have to match a tpipe name specified in an IMS OTMA destination descriptor in the DFSYDTx member of the IMS.PROCLIB data set.

Note: Do not specify a TPIPE that is used for anything other than synchronous callout requests for a particular service provider. TPIPEs cannot be shared by any other application or solution. If a TPIPE is shared, either DataPower or the other solution might be unable to retrieve the synchronous callout requests properly.

SAF user name
Specify the security authorization facility (SAF) user name. The value can be up to eight characters in length and cannot be blank. The value can use all alphanumeric characters and the following special characters: @ # $.

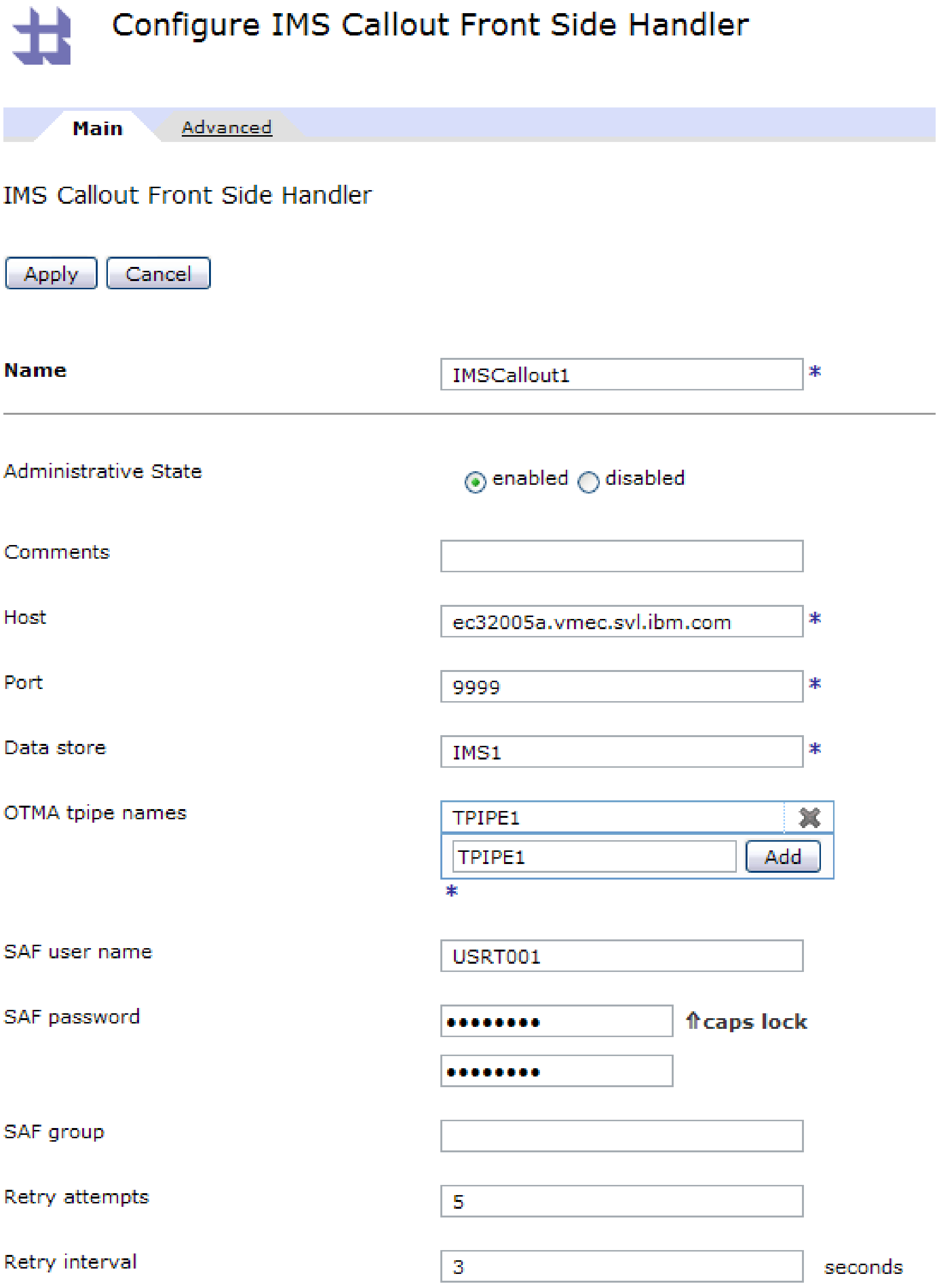
SAF password
Specify the security authorization facility (SAF) password. The value can use all alphanumeric characters and the following special characters: @ # $.

SAF group
Specify the name of the security authorization facility (SAF) group. The value can be up to eight

characters in length and cannot be blank. The value can use all alphanumeric characters and the following special characters: @ # $.

Retry attempts
Specify the number of times to attempt to resume a transaction pipe (tpipe) after processing encounters an error. Enter a value in the range 1 - 256. The default value is 5.

Retry interval
Specify the number of seconds to wait before processing attempts to resume the transaction pipe (tpipe). The minimum value is 1. The default value is 3.



Configure IMS Callout Front Side Handler

IMS Callout Front Side Handler

Name	IMSCallout1 *
Administrative State	● enabled ○ disabled
Comments	
Host	ec32005a.vmec.svl.ibm.com *
Port	9999 *
Data store	IMS1 *
OTMA tpipe names	TPIPE1 ✖ TPIPE1 Add *
SAF user name	USRT001
SAF password	•••••••• ⇑caps lock ••••••••
SAF group	
Retry attempts	5
Retry interval	3 seconds

Connection timeout

Specify the number of seconds that the appliance waits to establish a connection to IMS Connect. A value of 0 disables the timeout. The default value is 10.

More advanced settings, such as tracing and connection timeout values, are available in the "Advanced" tab.

After you are done configuring the IMS Callout Front Side Handler, click 'Apply' on the Front Side Handler panel and the Front Side Handler is enabled.

The status indicator shows the status of the Front Side Handler:

[up]: The IMS Callout Front Side Handler is enabled and is able to communicate with IMS Connect and IMS to actively process resume tpipe. If the IMS Callout Front Side Handler encountered an error, it attempts to retry at specified intervals, up to a specified maximum number of retry attempts before going into [down-pending] status.

[down - pending]: The IMS Callout Front Side Handler is enabled but is in recovery mode. The Front Side Handler attempts to ping IMS Connect every 60 seconds to re-establish a connection. It will go into [up] mode when it can get a successful response from /DIS OTMA command to verify both IMS and IMS Connect are responding.

[down - disabled]: The IMS Callout Front Side Handler is disabled.

3. Configuring the backend destination

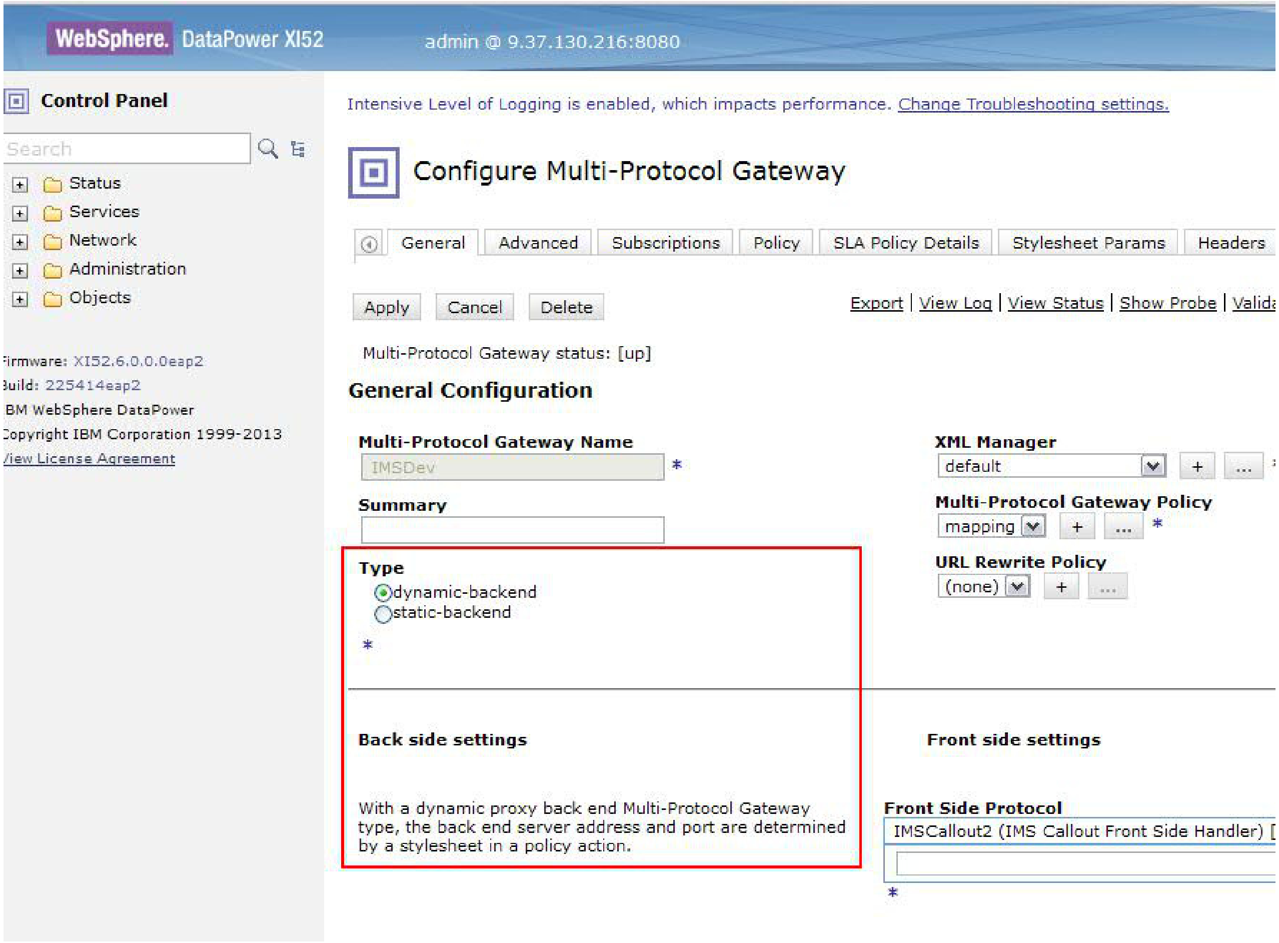
Under the “*General Configuration*” tab, you specify the address of the service provider that will process the callout request on the DataPower backend.

Addresses of the backend service providers can be specified statically or dynamically. If the IMS Callout requests will be processed by a single backend service provider, use a static backend. If the IMS callout requests will be distributed to multiple addresses for backend service providers, use a dynamic backend.

3a. Dynamically defined backend addresses

To specify dynamically defined backend addressing:

1. Select the dynamic-backend radio button under Type.
2. Define the addresses and routing logic in a stylesheet (XSLT) inside a Filter Action within the Multi-Protocol Gateway policy.



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Intensive Level of Logging is enabled, which impacts performance. Change Troubleshooting settings.

Configure Multi-Protocol Gateway

Multi-Protocol Gateway status: [up]

General Configuration

Multi-Protocol Gateway Name: IMSDev *

Summary:

Type
● dynamic-backend
○ static-backend
*

XML Manager: default

Multi-Protocol Gateway Policy: mapping *

URL Rewrite Policy: (none)

Back side settings

With a dynamic proxy back end Multi-Protocol Gateway type, the back end server address and port are determined by a stylesheet in a policy action.

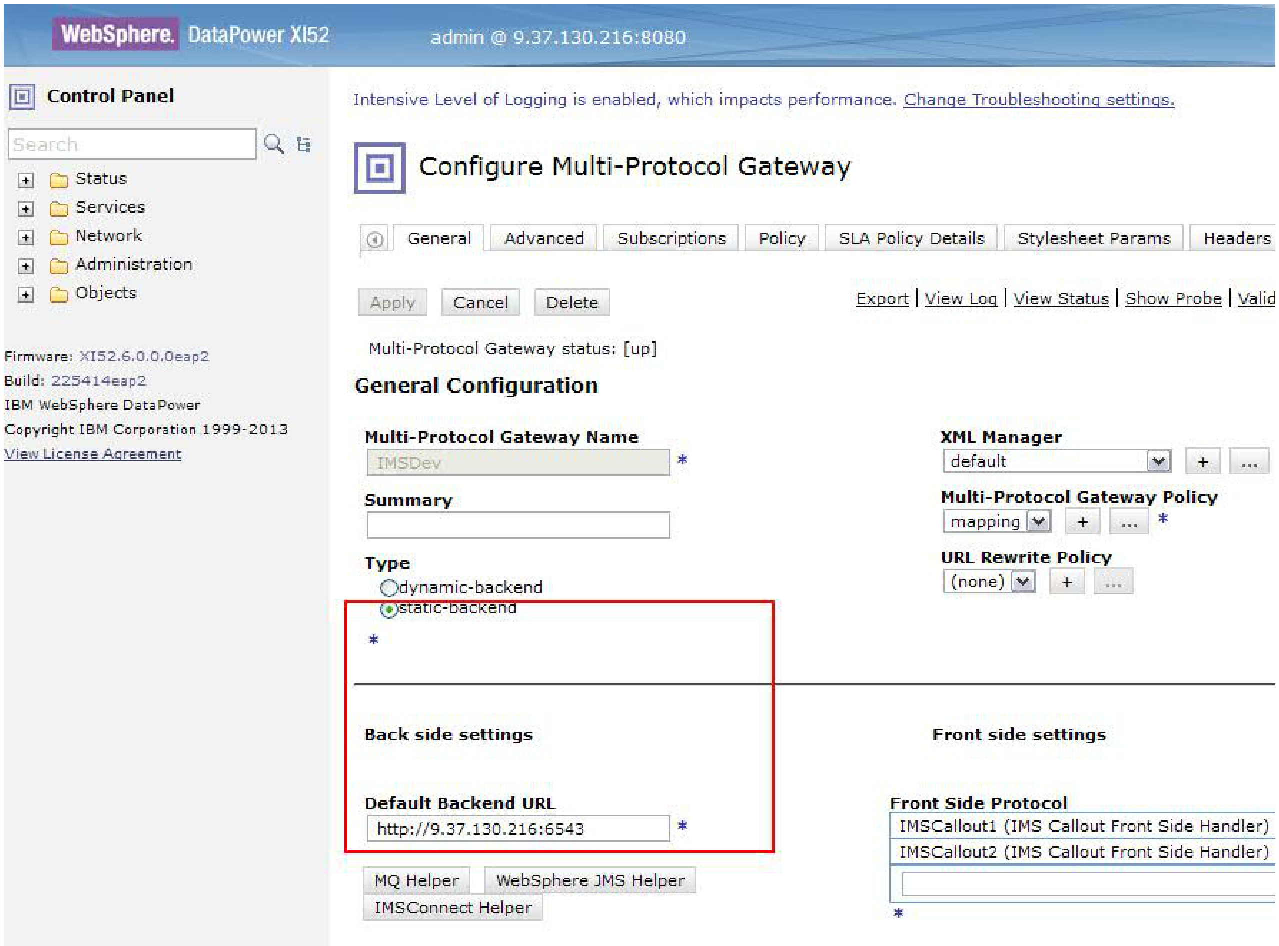
Front side settings

Front Side Protocol: IMSCallout2 (IMS Callout Front Side Handler) *

3b. Static backend

To specify a static backend service provider:

1. Select the static-backend radio button under Type.
2. Type the URL of the service provider into the Default Backend URL field. Routing logic is not required and you do not need to specify a stylesheet.



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Intensive Level of Logging is enabled, which impacts performance. Change Troubleshooting settings.

Configure Multi-Protocol Gateway

Multi-Protocol Gateway status: [up]

General Configuration

Multi-Protocol Gateway Name: IMSDev *

Summary:

Type
○ dynamic-backend
● static-backend
*

XML Manager: default

Multi-Protocol Gateway Policy: mapping *

URL Rewrite Policy: (none)

Back side settings

Default Backend URL: http://9.37.130.216:6543 *

Front side settings

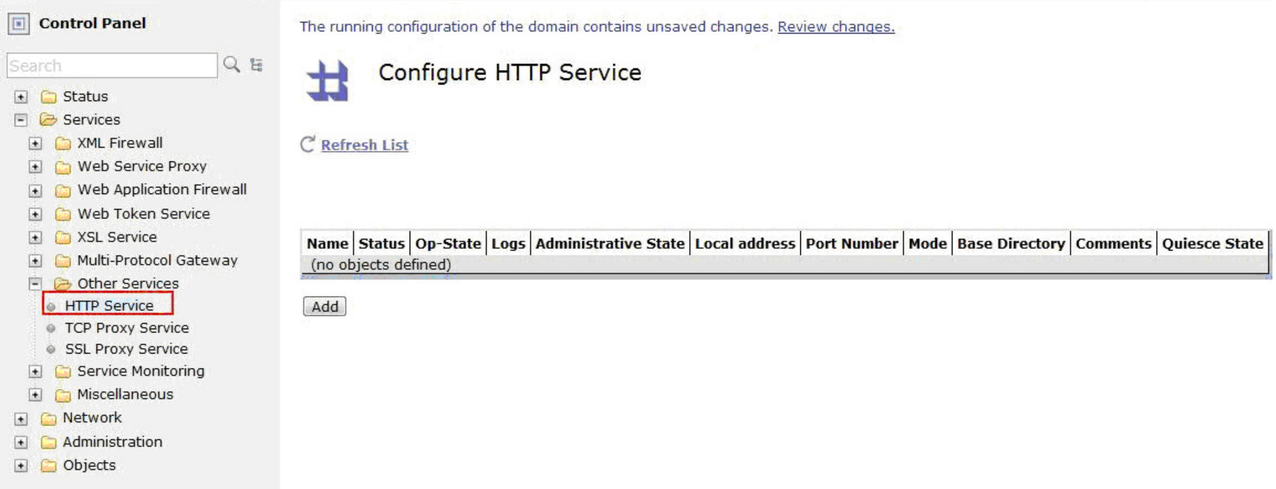
Front Side Protocol
IMSCallout1 (IMS Callout Front Side Handler)
IMSCallout2 (IMS Callout Front Side Handler)
*

3b. Adding an echo HTTP Service on the backend for testing purposes

While configuring the communication between IMS and DataPower, you can create an echo HTTP service to unit test the Multi-Protocol Gateway. The echo HTTP service emulates a backend connection with a server. With an echo service as the backend handler, the request message is returned to IMS unchanged as the response message.

To add an echo HTTP service:

1. In the left hand navigation pane on the Control Panel, expand Services, expand Other Services, and select HTTP Service.



The running configuration of the domain contains unsaved changes. Review changes.

Configure HTTP Service

Name	Status	Op-State	Logs	Administrative State	Local address	Port Number	Mode	Base Directory	Comments	Quiesce State
(no objects defined)										

2. In the Configure HTTP Service page, click on Add. The Main panel for configuring an HTTP service is displayed.

3. Specify a name in the **Name** field.

4. Specify an available port in the Port Number field.

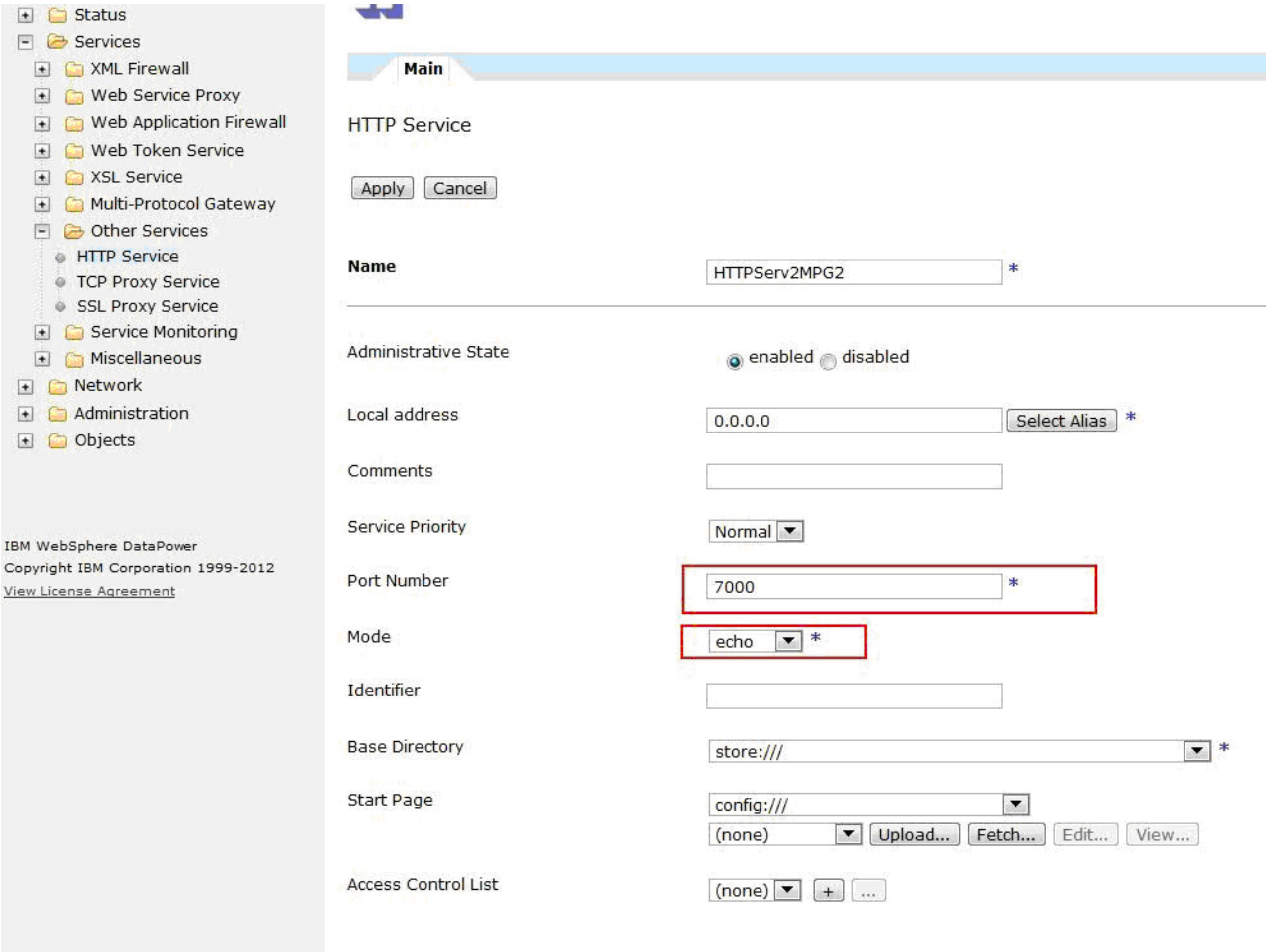
5. From the Mode drop down list, select **echo**.

6. Click ‘Apply’. The HTTP echo service is ready for service.

7. On the General tab of the Configure Multi-Protocol Gateway page, enter the hostname and port of the HTTP echo service in the Default Backend URL. For example:

   http:// 192.0.2.0:7000

8. Click **Apply**.



HTTP Service

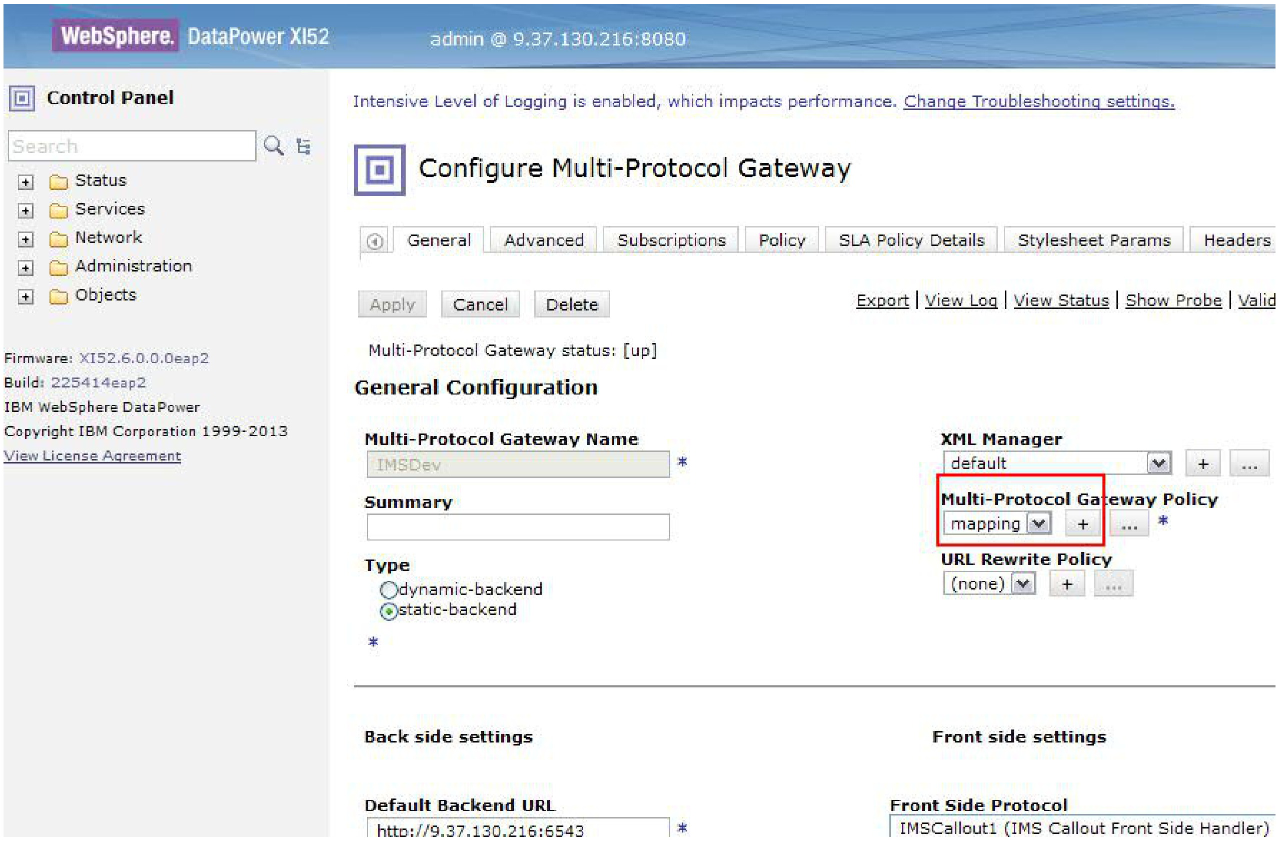
Name	HTTPServ2MPG2 *
Administrative State	● enabled ○ disabled
Local address	0.0.0.0 *
Comments	
Service Priority	Normal
Port Number	7000 *
Mode	echo *
Identifier	
Base Directory	store:/// *
Start Page	config:/// (none)
Access Control List	(none)

4. Defining a Processing Policy for the Multi-Protocol Gateway

A processing policy defines many, if not all, of the actions that are taken against the messages that pass through the Multi-Protocol Gateway service.

- A *processing policy* consists of one or more rules.
- A *rule* consists of a matching rule and a processing rule.
- A *matching rule* defines the criteria to determine whether incoming traffic is processed by its processing rule.
- A *processing rule* identifies the actions to perform against the incoming traffic.

To access the configuration panel for defining processing policies, from the Configure Multi-Protocol Gateway panel, click on the "+" button under Multi-Protocol Gateway Policy.



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Intensive Level of Logging is enabled, which impacts performance. Change Troubleshooting settings.

Configure Multi-Protocol Gateway

Multi-Protocol Gateway status: [up]

General Configuration

Multi-Protocol Gateway Name: IMSDev *

Summary:

Type
○ dynamic-backend
● static-backend
*

XML Manager: default

Multi-Protocol Gateway Policy: mapping *

URL Rewrite Policy: (none)

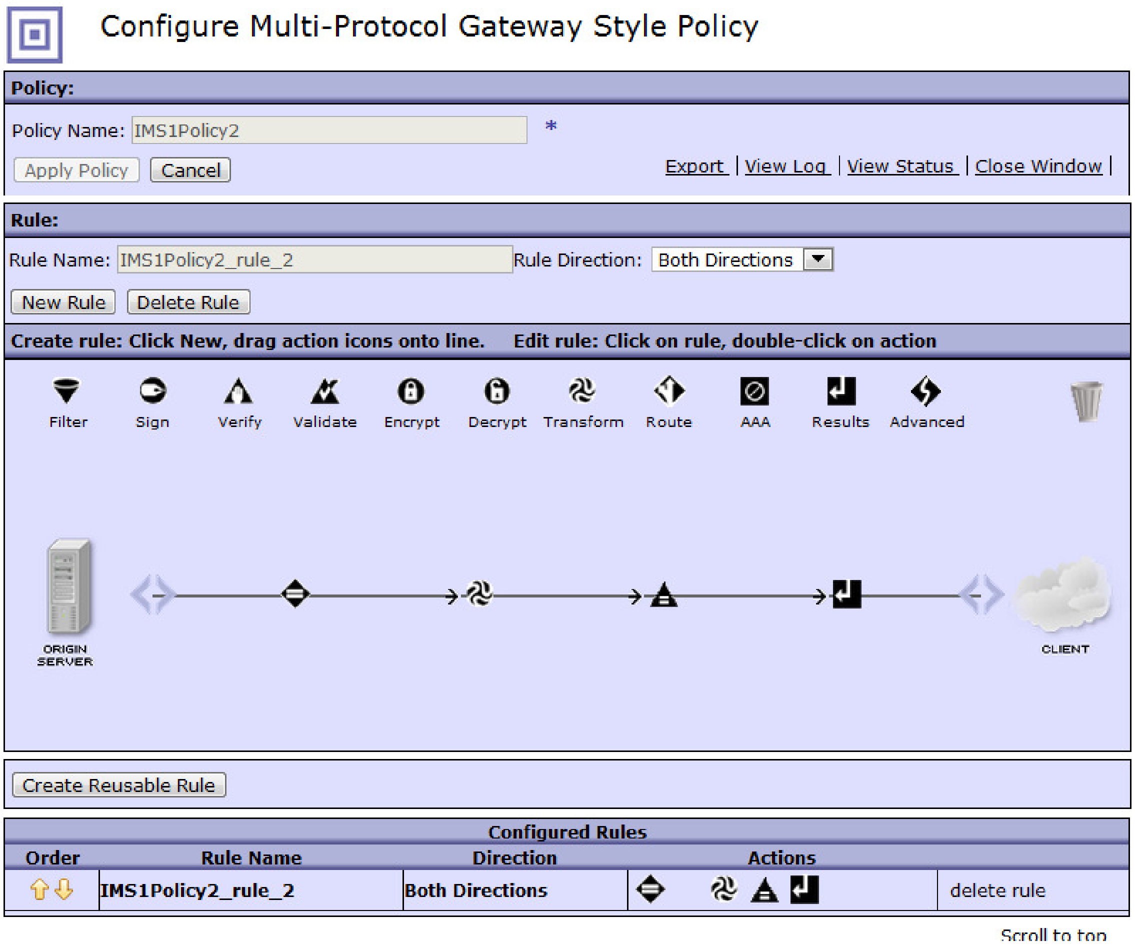
Back side settings

Default Backend URL: http://9.37.130.216:6543 *

Front side settings

Front Side Protocol: IMSCallout1 (IMS Callout Front Side Handler)

In the Configure Multi-Protocol Gateway Style Policy panel, a rule is depicted as a line with symbols on it, as shown in the following figure. Each rule consists of a Matching Rule, which determines whether or not to process the incoming data, a Results Action, and one or more processing actions in between; each rule can be configured to flow from client to server, vice-versa, or in both directions.



Configure Multi-Protocol Gateway Style Policy

Policy:

Policy Name: IMS1Policy2 *

Rule:

Rule Name: IMS1Policy2_rule_2 Rule Direction: Both Directions

Create rule: Click New, drag action icons onto line. Edit rule: Click on rule, double-click on action

Configured Rules

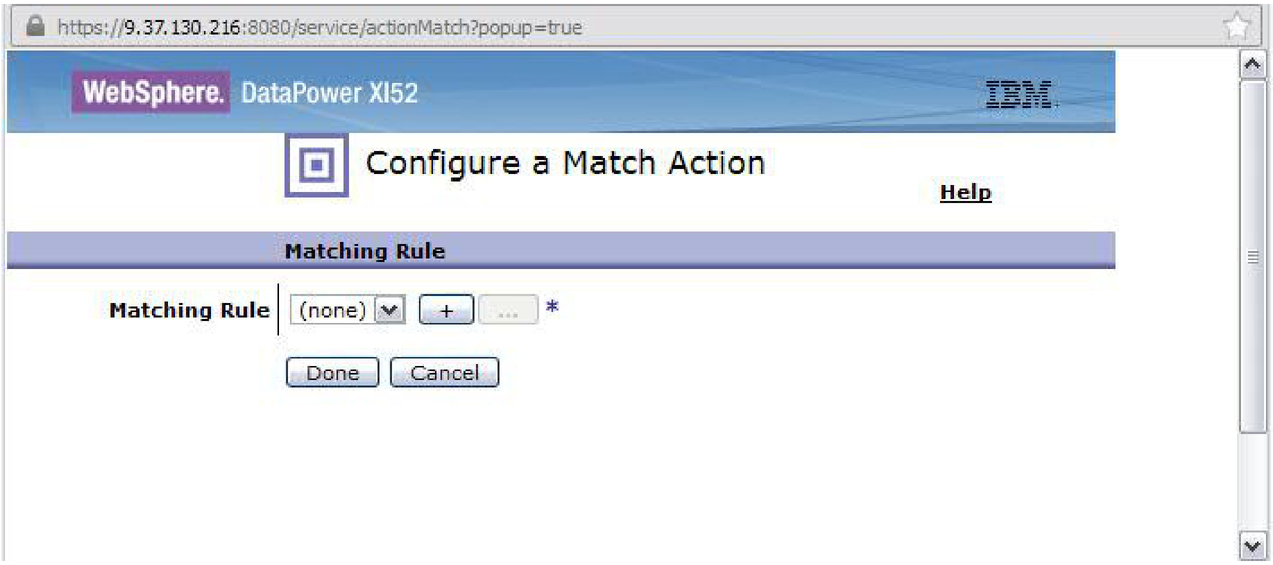
Order	Rule Name	Direction	Actions	
⇧⇩	IMS1Policy2_rule_2	Both Directions	◈ ✲ ▲ ↵	delete rule

4a. Configuring a Matching Rule

A matching rule determines whether and how to process incoming data.

A matching rule is represented by a Match Action icon, ◈. A Match Action icon is automatically placed on the rule line when you create your policy rule:

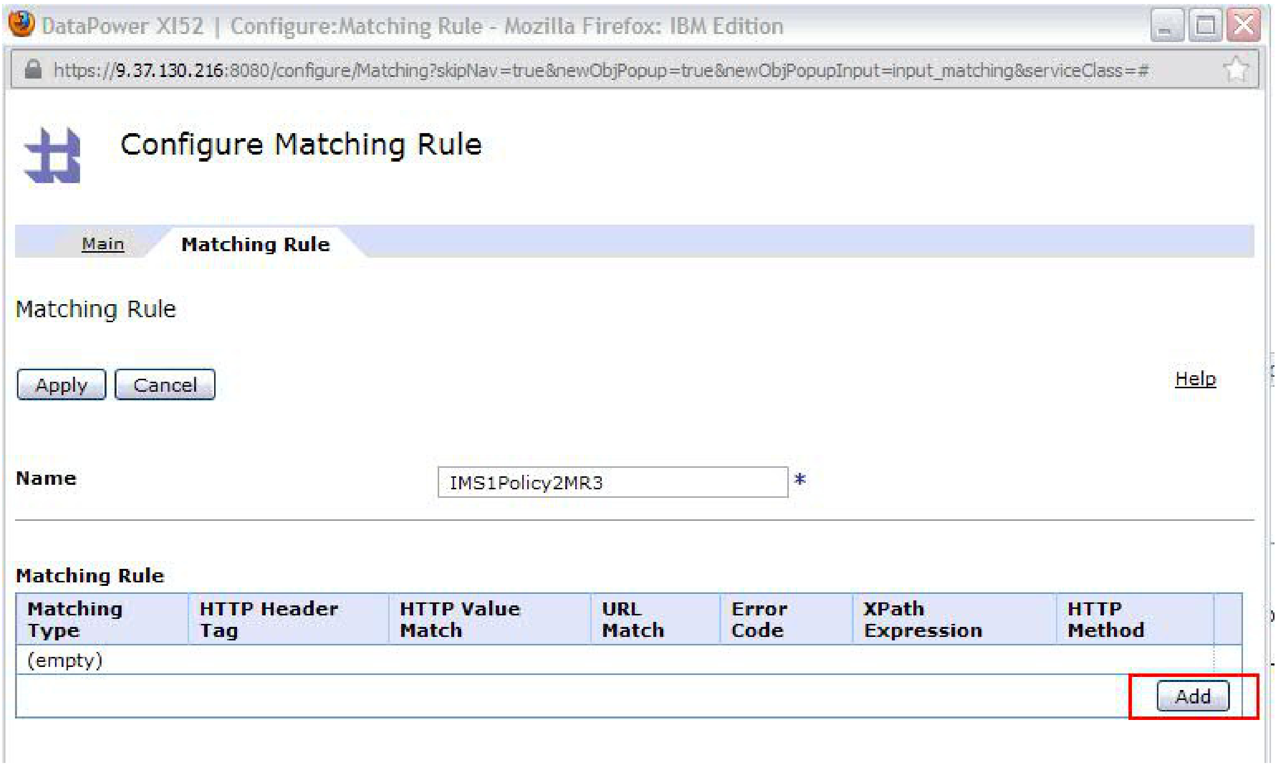
Double click on the Match Action icon to define the match rule. Click on the “+” button to add a new Matching Rule; click on “…” to edit an existing one.


https://9.37.130.216:8080/service/actionMatch?popup=true

Configure a Match Action

Matching Rule: (none)

Click the “Matching Rule” tab to add a new URL match pattern:


DataPower XI52 | Configure:Matching Rule - Mozilla Firefox: IBM Edition

https://9.37.130.216:8080/configure/Matching?skipNav=true&newObjPopup=true&newObjPopupInput=input_matching&serviceClass=#

Configure Matching Rule

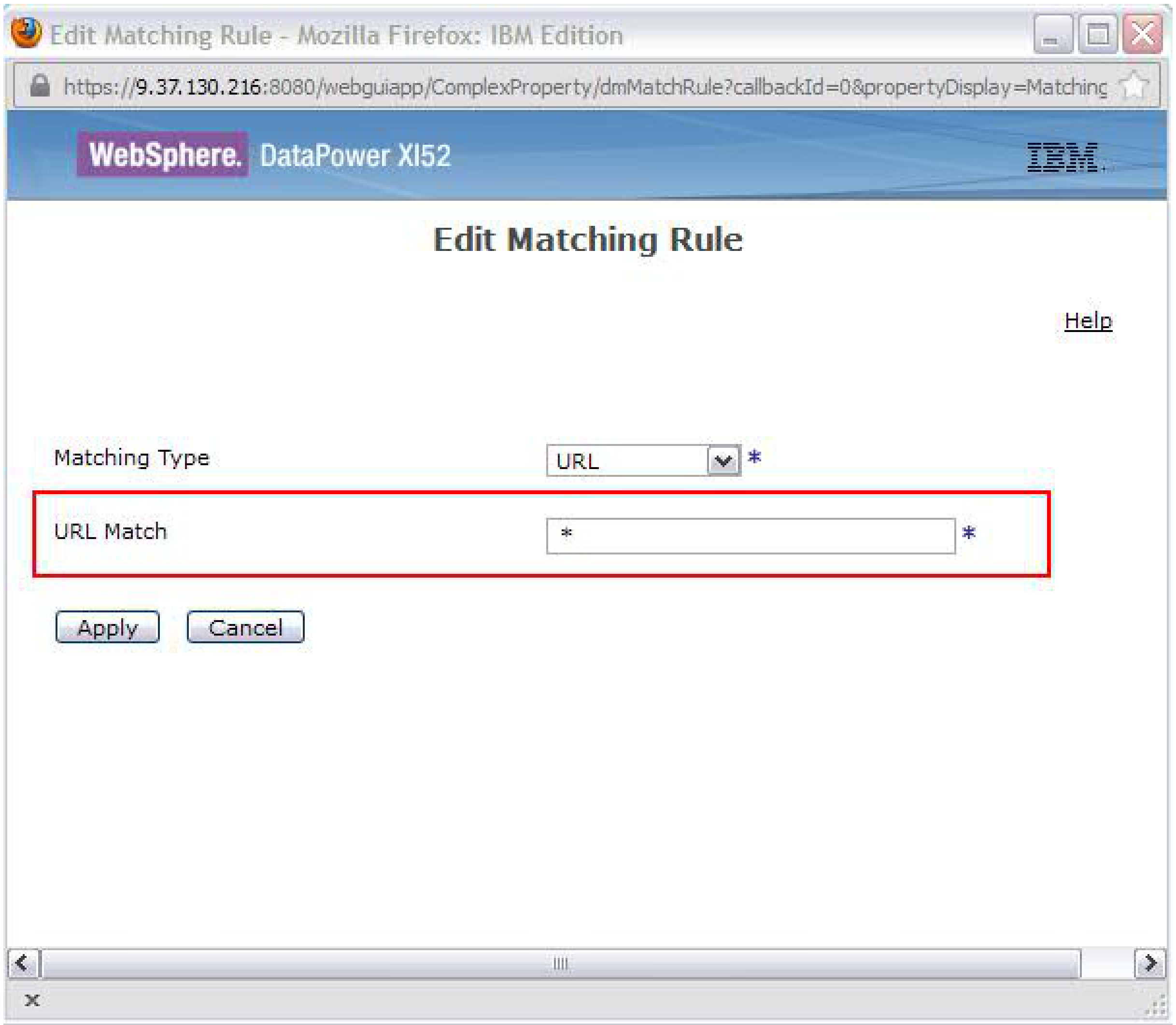
Matching Rule

Name: IMS1Policy2MR3

Matching Rule

Matching Type	HTTP Header Tag	HTTP Value Match	URL Match	Error Code	XPath Expression	HTTP Method
(empty)						

Specify a URL match template to match the URL stream of the incoming request (‘*’ indicates wildcard)



Edit Matching Rule - Mozilla Firefox: IBM Edition
https://9.37.130.216:8080/webguiapp/ComplexProperty/dmMatchRule?callbackId=0&propertyDisplay=Matching
WebSphere. DataPower XI52
IBM
Help
Apply
Cancel

Edit Matching Rule

Matching Type: URL *

URL Match: * *

Click on ‘Apply’ to save the Match Rule setting.

Click on ‘Apply’ to save the Match Action setting.

4b. Configure a Transform Action (a map or XSL Stylesheet-driven action)

A Transform Action transforms a message from one format, such as the format defined by the COBOL copybook of an IMS application program, to another format, such as an XML schema that is used by a web service provider on the DataPower backend.

The Transform Action requires either a WTX map artifact or a stylesheet that maps the data between the two formats. For more information on WTX maps, see Data maps with WebSphere Transformation Extender.

A stylesheet can also be used in a Transform Action to select between multiple WTX maps or to route the message to a backend destination by using request header values. For example, you can optionally access the values in the *ims-callout-correlation-token* and *ims-callout-service-id* headers of each IMS Callout request.

The *ims-callout-correlation-token* header contains a hexadecimal representation of the unique ICAL correlation token of the IMS callout request. This token contains the user ID for the request.

The *ims-callout-service-id* header contains the 8-byte map name that is specified in the AIBUTKN field in the AIB of the IMS ICAL call.

The *ims-callout-user-id* header contains the 8-byte user ID that is associated with the IMS application that issues a callout request. The user ID is extracted from the correlation token.

To dynamically direct a request to a backend URL, you can specify a target URL with the *var://service/routing-url* variable and make the routing decision by using the value of the *ims-callout-service-id* header. For example, in the following Sample XSL style sheet, if the value of header is SERVICE1, the request is sent to the backend server on port 6221, but if the header value is SERVICE2, the request is sent to the backend server on port 6222.

To dynamically select a particular WTX map, you can specify a target WTX map with the *var://context/map/name* variable and make the selection decision based on the *ims-callout-service-id* value. For example, in the following Sample XSL stylesheet, if the header value is SERVICE1, the WTX map *request-250-cp037.dpa* is used, but if the header value is SERVICE2, the WTX map *request-8000-cp037.dpa* is used.

A stylesheet can also use these values for diagnostic purposes. For example, in following Sample XSL stylesheet, if an error occurs in the transform action, the IMS correlation token and service ID is written out to the system log with error level.

Sample XSL:

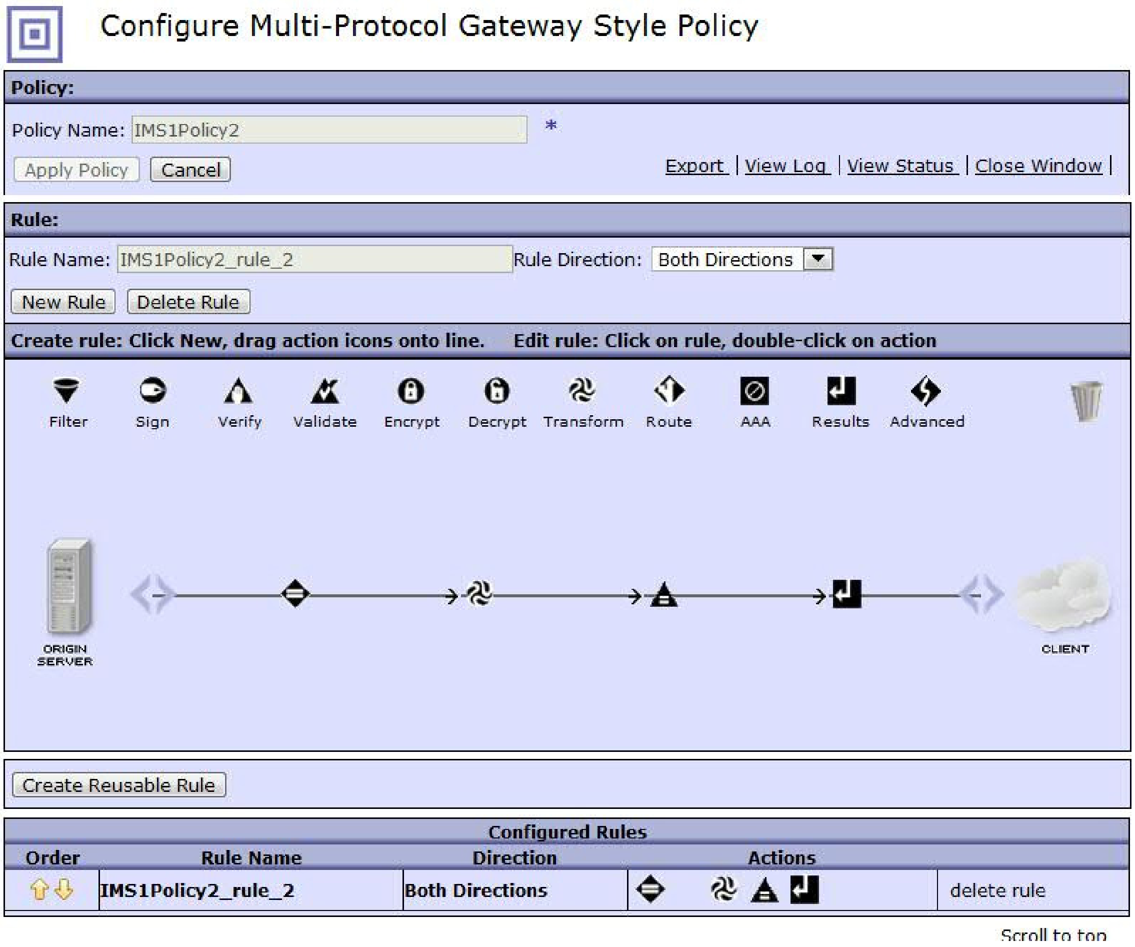
```
<?xml version="1.0" encoding="UTF-8"?>
<xsl:stylesheet version="1.0"
xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
xmlns:dp="http://www.datapower.com/extensions"
extension-element-prefixes="dp">

<xsl:template match='/'>

<xsl:variable name="be"
select="dp:request-header('ims-callout-service-id')"/>
```

```
<xsl:choose>

<xsl:when test="$be = 'SERVICE1'">
<dp:set-variable name="'var://context/map/name'"
value="'local://request-250-cp037.dpa'" />
<dp:set-variable name="'var://service/routing-url'"
value="'http:// 192.0.2.0:6221'" />
</xsl:when>

<xsl:when test="$be = 'SERVICE2'">
<dp:set-variable name="'var://context/map/name'"
value="'local://request-8000-cp037.dpa'" />
<dp:set-variable name="'var://service/routing-url'"
value="'http:// 192.0.2.0:6222'" />
</xsl:when>

<xsl:otherwise>
<dp:reject>unknown backend specified</dp:reject>
</xsl:otherwise>

</xsl:choose>

<xsl:message dp:priority="error">
Correlation token : <xsl:value-of
select="dp:request-header('ims-callout-correlation-token')"/>
</xsl:message>

<xsl:message dp:priority="error">
Service ID : <xsl:value-of
select="dp:request-header('ims-callout-service-id')"/>
</xsl:message>
```

```
<xsl:message dp:priority="error">
User ID : <xsl:value-of 
select="dp:request-header('ims-callout-user-id')"/>
</xsl:message>

</xsl:template>
</xsl:stylesheet>
```

4c. Adding a Transform Action

To add a Transform Action to your processing rule in the Configure Multi-Protocol Gateway Style Policy panel, drag the “Transform action” icon, Transform, onto the rule line right after the matching action.



Configure Multi-Protocol Gateway Style Policy

Policy:

Policy Name: IMS1Policy2 *

Rule:

Rule Name: IMS1Policy2_rule_2 Rule Direction: Both Directions

Create rule: Click New, drag action icons onto line. Edit rule: Click on rule, double-click on action

Configured Rules				
Order	Rule Name	Direction	Actions	
⇧⇩	IMS1Policy2_rule_2	Both Directions		delete rule

The Transform Action must specify the map or stylesheet to use in order to direct the message for data transformation and routing.

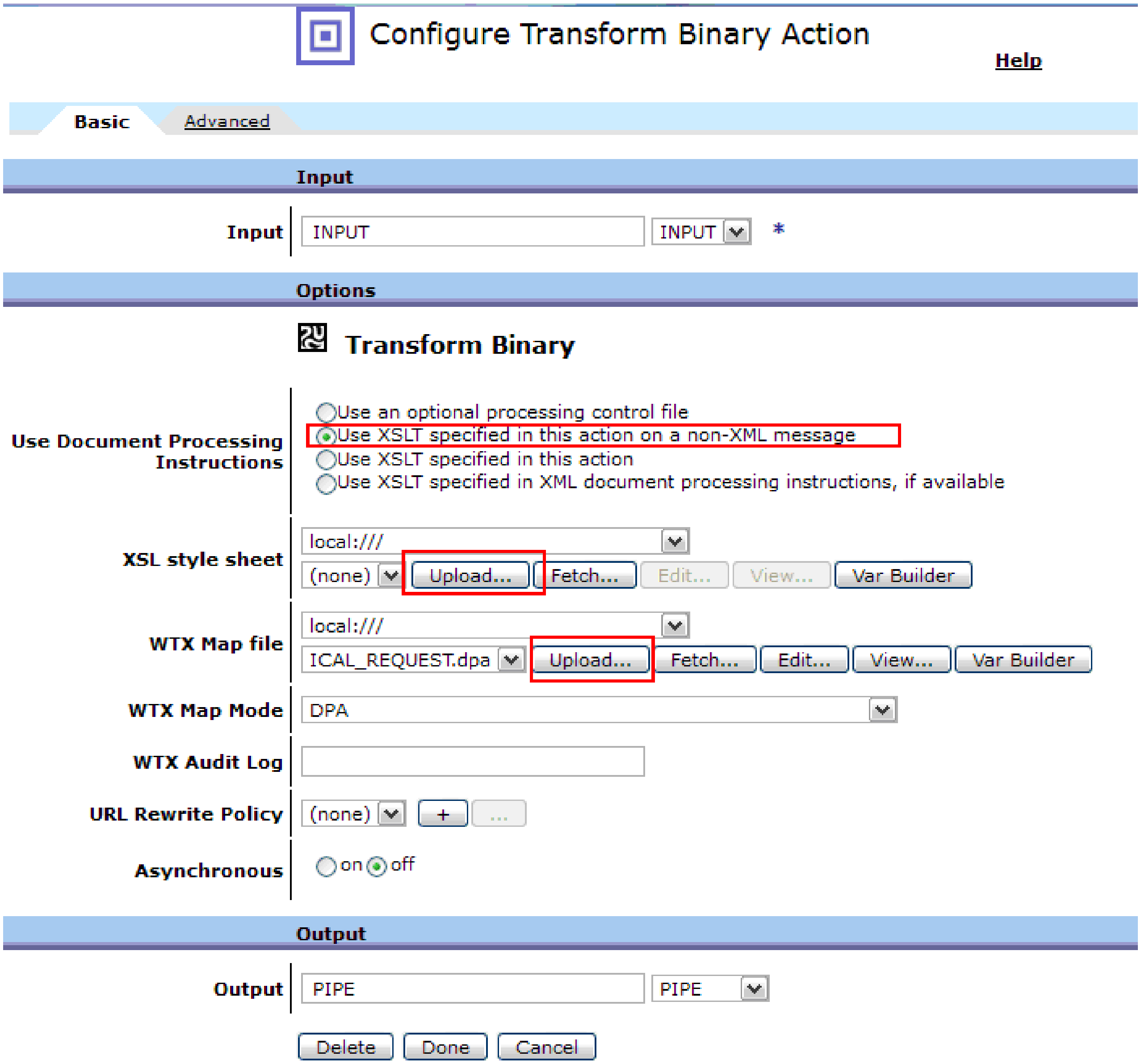
For more information about developing an XSL stylesheet, see *Using WebSphere DataPower SOA Appliances to enable the Information as a Service pattern* on developerWorks at http://www.ibm.com/developerworks/websphere/library/techarticles/0812_callaway/0812_callaway.html.

An XSL stylesheet must be stored locally on your workstation to upload it for use by the Transform Action.

To add a Transform Rule to a Transform Action, double click on the **Transform Action** icon on the line that represents your processing rule.

To specify a stylesheet or WTX map, select **Use XSLT specified in this action on a non-XML message**. For an XSL style sheet, click **Upload** to upload an XSL style sheet file. For a WTX map, click **Upload** to upload the dpa file.

Click on **Done** to save the Transform Action setting.



Configure Transform Binary Action

Input

Input: INPUT | INPUT *

Options

Transform Binary

Use Document Processing Instructions:
○ Use an optional processing control file
● Use XSLT specified in this action on a non-XML message
○ Use XSLT specified in this action
○ Use XSLT specified in XML document processing instructions, if available

XSL style sheet: local:/// | (none)

WTX Map file: local:/// | ICAL_REQUEST.dpa

WTX Map Mode: DPA

WTX Audit Log:

URL Rewrite Policy: (none)

Asynchronous: ○ on ● off

Output

Output: PIPE | PIPE

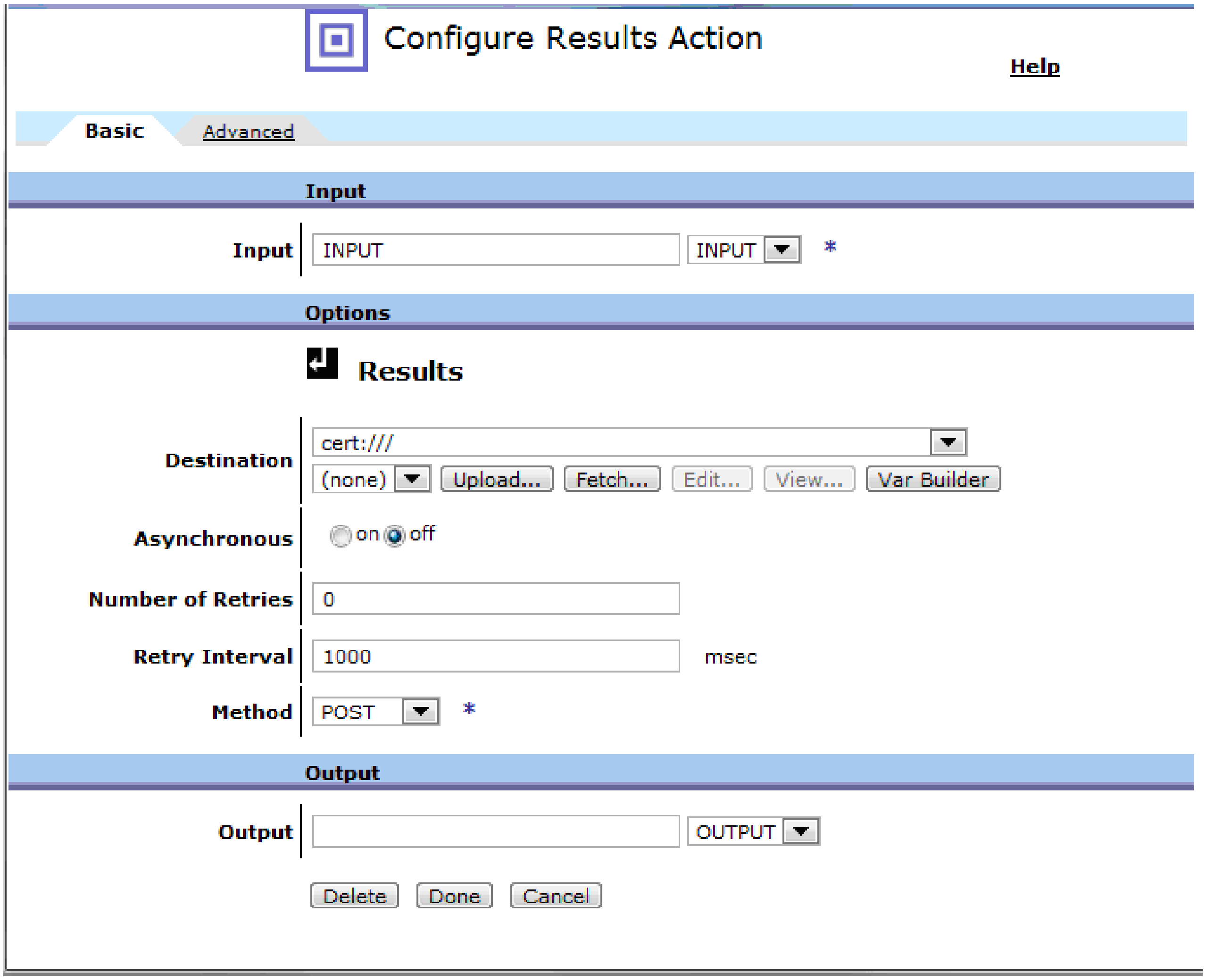
4d. Configure Results Action

Use a Results Action to configure a Multi-Protocol Gateway policy to return the transformed message.

To configure a Results Action, drag the **Results action** icon, Results, onto the end of the line that represents your processing rule.

Double click on the Results Action icon on the line to configure the Results Rule.

Click on ‘Done’ to save the Results Action setting.



Configure Results Action

Input

Input: INPUT | INPUT ▼ *

Options

Results

Destination: cert:/// ▼

(none) ▼ Upload... Fetch... Edit... View... Var Builder

Asynchronous: ○ on ● off

Number of Retries: 0

Retry Interval: 1000 msec

Method: POST ▼ *

Output

Output: | OUTPUT ▼

5. Apply the changes, and save the configuration

Click ‘Apply’ on the Configure Multi-Protocol Gateway panel, then click on **Save Config**. The configuration of the DataPower Multi-Protocol Gateway to support synchronous callout requests from IMS is complete. To confirm that DataPower is processing the synchronous callout request messages and their responses as expected, click on View Log link in the Configure Multi-Protocol

Gateway panel to see the log messages for the Multi-Protocol Gateway and IMS Callout Front Side Handler.

If the log records indicate that the messages are not being processed correctly, refer to the Troubleshooting section. If the log is not capture enough information to diagnose a problem, the Troubleshooting section also contains information about changing the level of logging to capture more information.

Moving an IMS Callout Front Side Handler to another Multi-Protocol Gateway

An IMS Callout Front Side Handler cannot be shared by multiple Multi-Protocol Gateways, but you can move an existing front side handler to a different Multi-Protocol Gateway.

To move an IMS Callout Front Side Handler from one Multi-Protocol Gateway to another:

1. Delete the IMS Callout Front Side Handler from the current Multi-Protocol Gateway
2. Save the current Multi-Protocol Gateway
3. Add the IMS Callout Front Side Handler to the destination Multi-Protocol Gateway
4. Save the destination Multi-Protocol Gateway.

Failover support for IMS Callout Front Side Handlers

For failover support, you can configure redundant IMS Callout Front Side Handlers with the same properties to listen on the same host TPIPE. The first IMS Callout Front Side Handler on a TPIPE has an active connection with IMS Connect, while the other IMS Callout Front Side Handlers on the same TPIPE are queued. If the active IMS Callout Front Side Handler fails, the next one in the queue takes over.

Testing the synchronous callout support

In order to verify that DataPower support for IMS Synchronous Callout requests is set up correctly, you can generate a callout request by using the IMS DL/I test program, DFSDDLT0.

Before you run the DFSDDLT0 test program, be sure the following steps have been completed:

- The OTMA descriptor for the outbound routing of the synchronous callout request is defined.
- Either the service provider that the IMS application is calling out to is set up to listen for callout messages, or the echo HTTP service is set up in DataPower. If neither of these are set up before the ICAL is issued, the ICAL is likely to time out, in which case IMS returns an error to the IMS application.

- The DataPower Exit needs to be installed in the IMS.SDFSRESL data set.

The following example JCL executes the DFSDDLT0 program in an IMS dependent batch message processing (BMP) region. The DFSDDLT0 program issues a synchronous callout request by using the ICAL call of the IMS DL/I API.

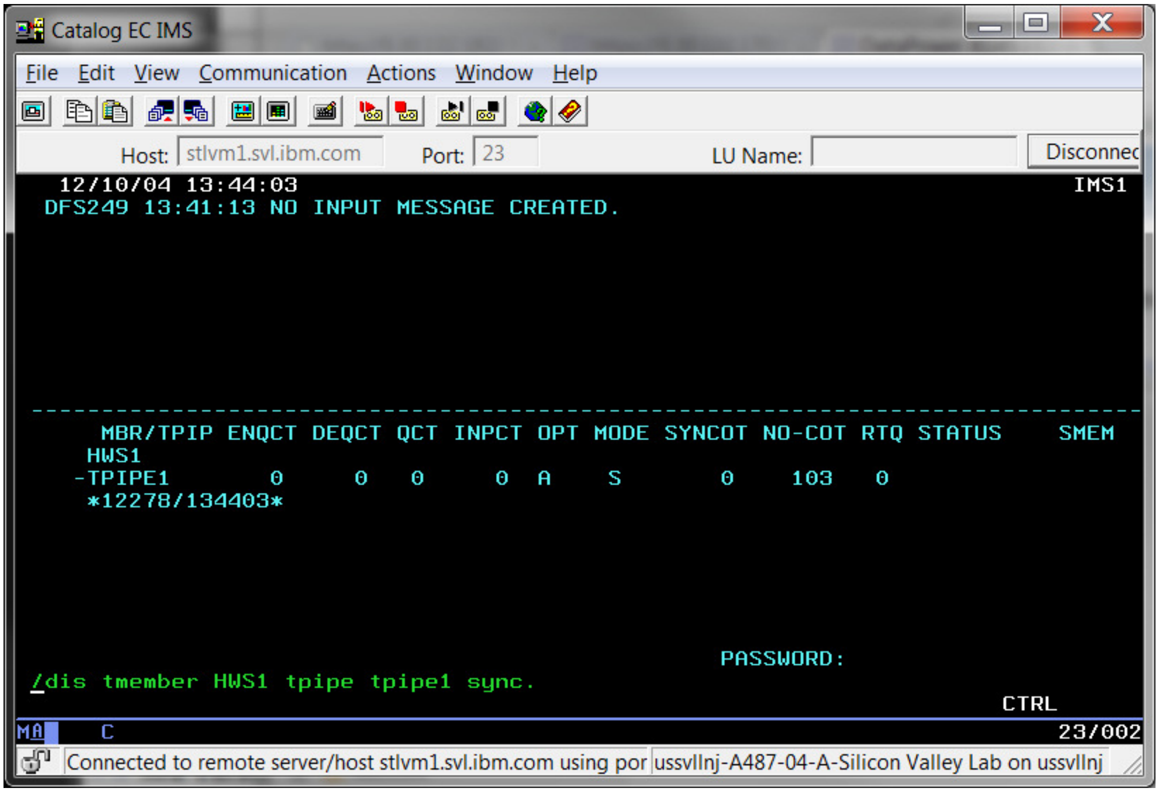
In the example, the DFSDDLT0 program issues 99 consecutive ICAL calls with the message “HELLO FROM ICAL2 BMP2”. The destination of the synchronous callout request is defined in IMS by the OTMA destination descriptor, OTMACL99.

```
//BMP2 JOB  ‘USER01’,CLASS=J,MSGCLASS=A,MSGLEVEL=(1,1),
//             TIME=1440
//DOIT    EXEC BMPACTAC,IMSID=IMS1,
//             MBR=DFSDDLT0,PSB=BMP255,
//             NBA=10,OBA=5
//BMP.SYSIN DD *
WTO PROGRAM DDLT0 STARTED
S1111 1 1 1   1IOPCB         AIB
L     99 ICAL  SENDRECV OTMACL99 006000 00100 01000
L        DATA      HELLO FROM ICALL BMP2
E      OK
WTO PROGRAM DDLT0 ENDED
/*
```

The information sent in the ICAL call is specified in the fields of an application interface block (AIB). The relevant AIB fields that are used by the DFSDDLT0 sample program in the preceding example are:

- AIBRSNM1, which contains the name of the example OTMA destination descriptor, OTMACL99
- AIBRSNFLD, which contains a time out value 6000 100th of a second
- AIBOALEN, which defines the length of the length of the request Data as 100 bytes
- AIBOAUSE, which defines the length of the response data as 1000 bytes

To verify that a callout request was sent from IMS to IMS Connect through the OTMA tpipe, issue the IMS command /DISPLAY TMEMBER ***ims_connect_id*** tpipe ***tpipe*** *sync*.


Catalog EC IMS
File Edit View Communication Actions Window Help
Host: stlvm1.svl.ibm.com
Port: 23
LU Name:
Disconnec

```
 12/10/04 13:44:03                                                  IMS1
DFS249 13:41:13 NO INPUT MESSAGE CREATED.

-----------------------------------------------------------------------
    MBR/TPIP ENQCT DEQCT QCT INPCT OPT MODE SYNCOT NO-COT RTQ STATUS     SMEM
   HWS1
  -TPIPE1        0     0   0     0  A    S       0    103   0
   *12278/134403*

                                                   PASSWORD:
/dis tmember HWS1 tpipe tpipe1 sync.
                                                                  CTRL
MA     C                                                         23/002
```

Connected to remote server/host stlvm1.svl.ibm.com using por ussvllnj-A487-04-A-Silicon Valley Lab on ussvllnj

The following output fields are displayed:

- **DEQCT**
  Total number of messages that are dequeued from the OTMA tpipe for the specified instance of IMS Connect. In a shared-queues environment, this field shows only the messages dequeued for the local subsystem.
- **ENQCT**
  Total number of messages that are enqueued on the OTMA tpipe for the specified instance of IMS Connect. In a shared-queues environment, this field shows only the messages enqueued for the local subsystem.
- **GROUP/MEMBER**
  Each member in each z/OS® cross-system coupling facility (XCF) group.

  When you issue /DISPLAY TMEMBER ALL, the server is always the first member displayed.
- **INPT**
  The maximum concurrent input message count for this member that can be waiting at the same time to be processed. If the YTIBs reach the INPT value, an OTMA FLOOD condition exists and the subsequent input messages from the member will be rejected.

- **MODE**
  The resume tpipe mode, which for synchronous callout is always S
- **NO-COT**
  The current number of ICAL messages received for this tpipe. If the number is greater than or equal to 65535, it will be reset to 1.
- **OPT**
  The resume tpipe option, which for synchronous callout requests to DataPower is always A.
- **QCT**
  Total number of messages that are still in the queue for OTMA tpipe for this instance of IMS Connect. In a shared-queues environment, this field shows only the messages enqueued for the local subsystem.
- **RTQ**
  The number of queued resume tpipe requests to be processed.

Troubleshooting Synchronous Callout support

DataPower offers a variety of features for troubleshooting problems with networking, logging, and error handling.

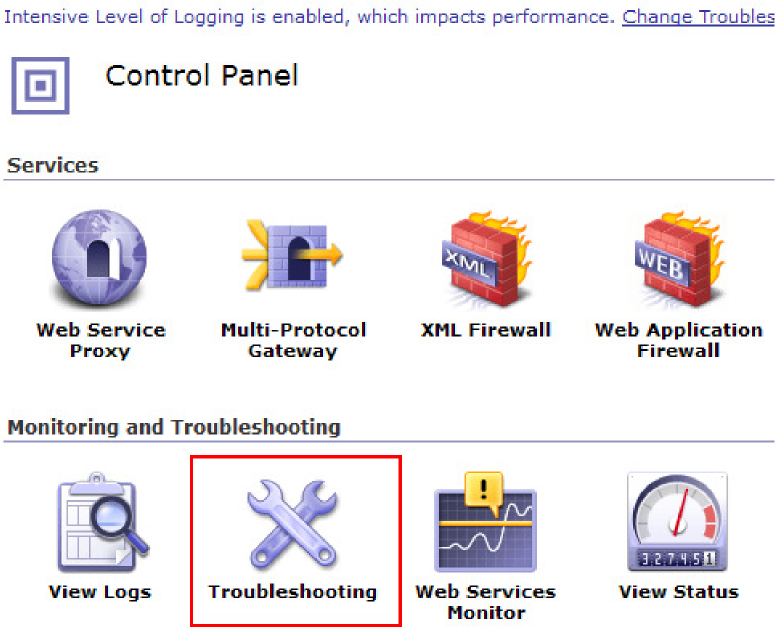
This section contains the following topics:

- Troubleshooting Network Connectivity
- Setting up Logging for the IMS Callout Font Side Handler
- Error Handling Considerations
- Collecting IMS Callout Trace
- Troubleshooting DataPower Web GUI timeout
- Troubleshooting Callout IMS Connect connections

Troubleshooting Network Connectivity

When diagnosing an ICAL timeout problem, it is important to first rule out a network issue. Check your firewall settings and ensure you can ping from client to DataPower to server, and vice versa.

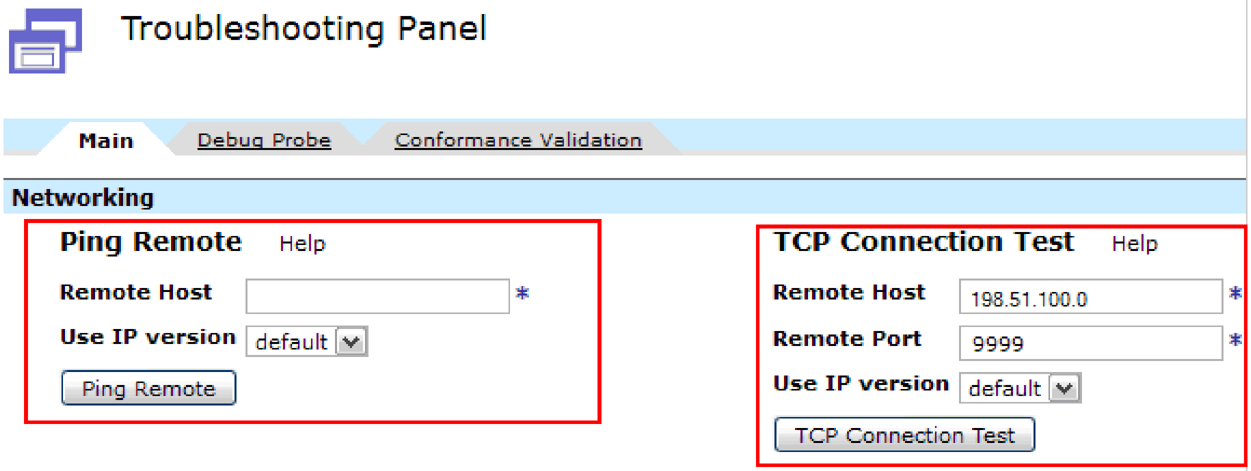
You access the troubleshooting options for DataPower network connectivity from the Control Panel by clicking on Troubleshooting icon.



Intensive Level of Logging is enabled, which impacts performance. Change Troubles

In the Networking section, you can validate network connectivity by:

- Pinging the client or server by entering the remote Host IP address and clicking **Ping Remote**.
- Testing the TCP connection by entering the remote Host IP address and remote port and clicking **TCP Connection Test**.



Ping Remote

Remote Host: *

Use IP version: default

TCP Connection Test

Remote Host: 198.51.100.0 *

Remote Port: 9999 *

Use IP version: default

Setting up Logging for the IMS Callout Font Side Handler

Logging can be an excellent diagnostic tool when you need to isolate a problem or monitor a behavior over a long period of time.
Recommendation: Enable or increase the level of logging in a DataPower and IMS configuration only when you need to debug a problem or when you are instructed to do so by the IBM Technical Support. While generally safe in production environments, logging can negatively affect the performance of the DataPower appliance, especially at higher levels.

You can activate logging for the IMS Callout Font Side Handler through the Troubleshooting panel of DataPower web GUI by the following actions:

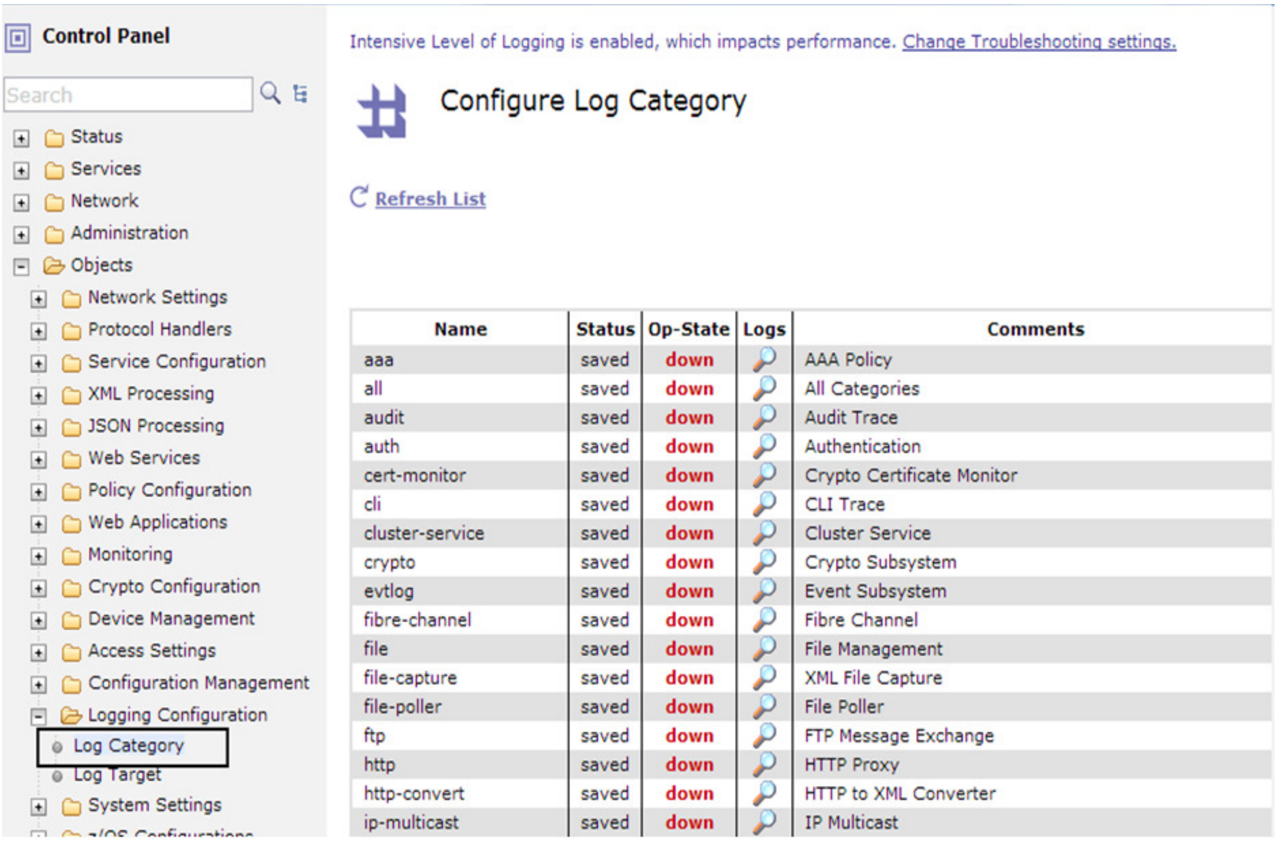
- Configure a log category
- Configure a log target
- Event Subscription

For more information, see *Troubleshooting and support* in the IBM WebSphere DataPower documentation at http://www.ibm.com/support/knowledgecenter/SS9H2Y/welcome.

Configuring a log category

To configure and add a log category:

1. In the left navigation bar of the DataPower web GUI, click on Objects -> Logging Configuration -> **Log Category**



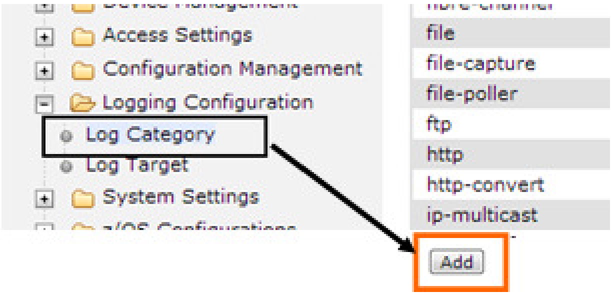
Intensive Level of Logging is enabled, which impacts performance. Change Troubleshooting settings.

Configure Log Category

Name	Status	Op-State	Logs	Comments
aaa	saved	down	🔎	AAA Policy
all	saved	down	🔎	All Categories
audit	saved	down	🔎	Audit Trace
auth	saved	down	🔎	Authentication
cert-monitor	saved	down	🔎	Crypto Certificate Monitor
cli	saved	down	🔎	CLI Trace
cluster-service	saved	down	🔎	Cluster Service
crypto	saved	down	🔎	Crypto Subsystem
evtlog	saved	down	🔎	Event Subsystem
fibre-channel	saved	down	🔎	Fibre Channel
file	saved	down	🔎	File Management
file-capture	saved	down	🔎	XML File Capture
file-poller	saved	down	🔎	File Poller
ftp	saved	down	🔎	FTP Message Exchange
http	saved	down	🔎	HTTP Proxy
http-convert	saved	down	🔎	HTTP to XML Converter
ip-multicast	saved	down	🔎	IP Multicast

2. Click the **Add** button at the bottom of the screen.

3. Enter “ims” as the name for the log category.

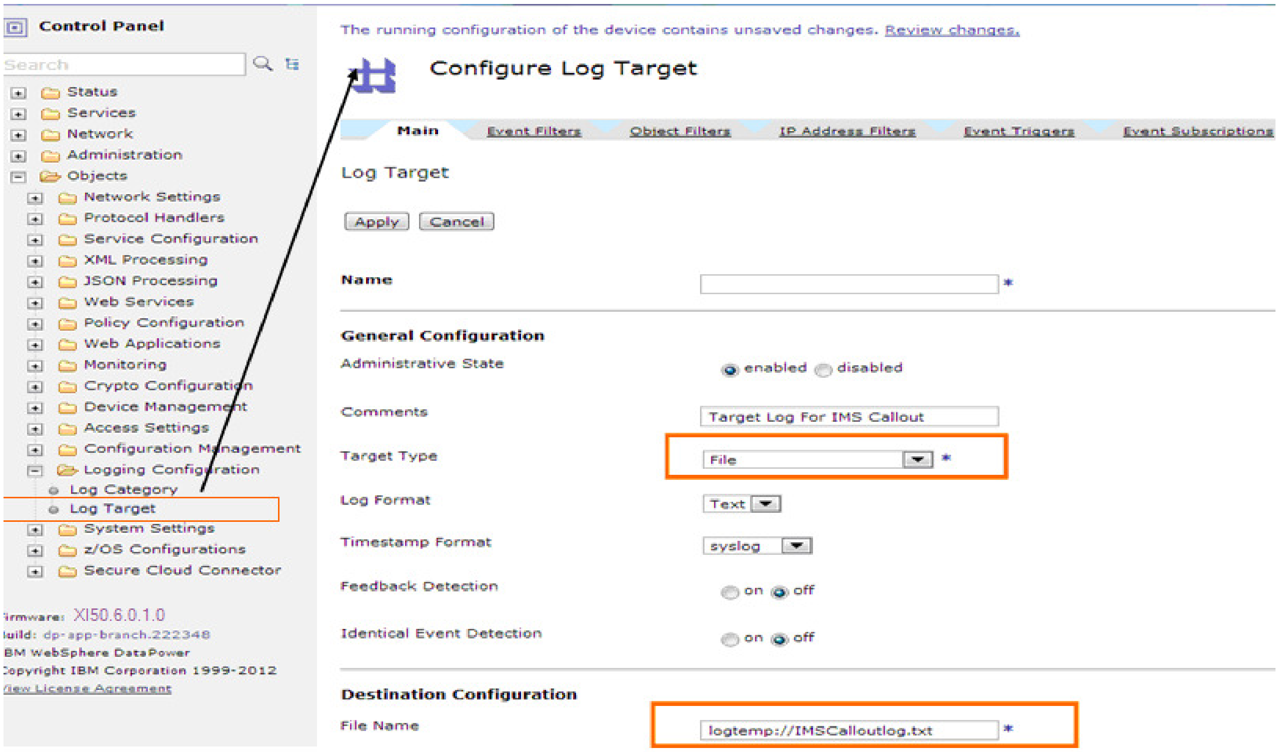


Next, configure the log target.

Configuring a log target

To configure and add a log target:

1. In the left navigation bar of the DataPower web GUI, click on: Objects -> Logging Configuration -> **Log Target**.



The running configuration of the device contains unsaved changes. Review changes.

Configure Log Target

Log Target

Name: *

General Configuration

Administrative State: ● enabled ○ disabled

Comments: Target Log For IMS Callout

Target Type: File *

Log Format: Text

Timestamp Format: syslog

Feedback Detection: ○ on ● off

Identical Event Detection: ○ on ● off

Destination Configuration

File Name: logtemp://IMSCalloutlog.txt *

2. In the **General Configuration** section:
   - Select **File** in the Target Type field
   - Select **Text** in the Log Format field
3. In the **Destination Configuration** section, specify the location and the file name into which DataPower will write the log messages that are generated by the IMS Callout Font Side Handler.
4. After all of the values are set up as shown in the preceding figure, click **Apply**.

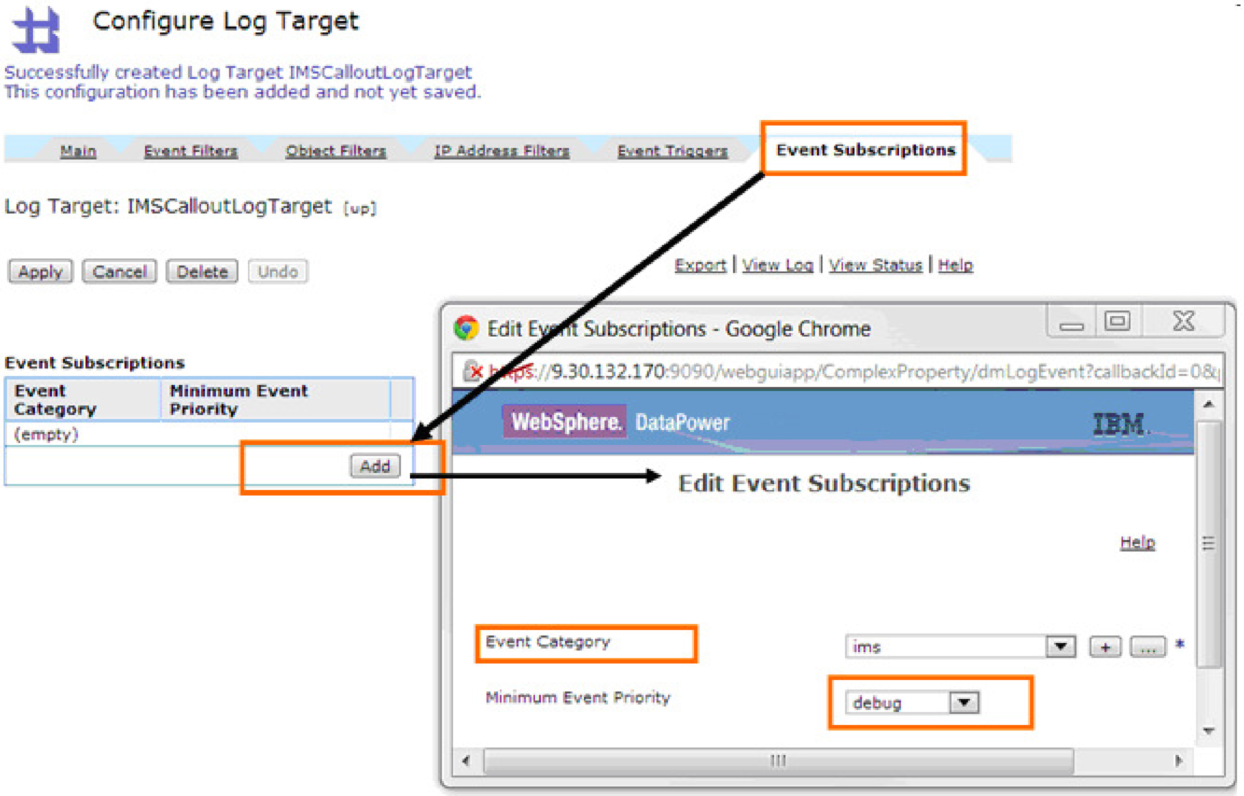
Next, add an event subscription.

Event Subscription

After defining the log category and configuring the log target, you must add an event subscription.

1. Under the **Event Subscription** tab of the **Configure Log Target** panel, click on the **Add** button. The **Edit Event Subscription** panel is displayed.
2. Select the event category name that you specified from a drop down menu.
3. Set the level of logging required.
4. After all the preceding steps are complete, click Apply
5. Save the configuration.

You can now activate logging for the IMS Callout Font Side Handler.



Configure Log Target

Successfully created Log Target IMSCalloutLogTarget
This configuration has been added and not yet saved.

Log Target: IMSCalloutLogTarget [up]

Event Subscriptions

Event Category	Minimum Event Priority
(empty)	

Edit Event Subscriptions - Google Chrome

https://9.30.132.170:9090/webguiapp/ComplexProperty/dmLogEvent?callbackId=0&

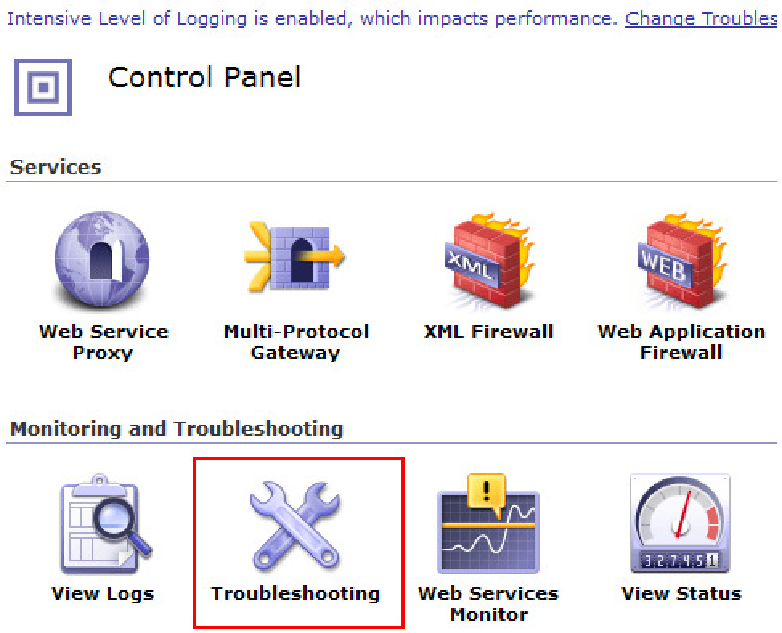
Edit Event Subscriptions

Event Category: ims *

Minimum Event Priority: debug

Activating Logging for the IMS Callout Font Side Handler

From Control Panel, click on the **Troubleshooting** icon.



Intensive Level of Logging is enabled, which impacts performance. Change Troubles

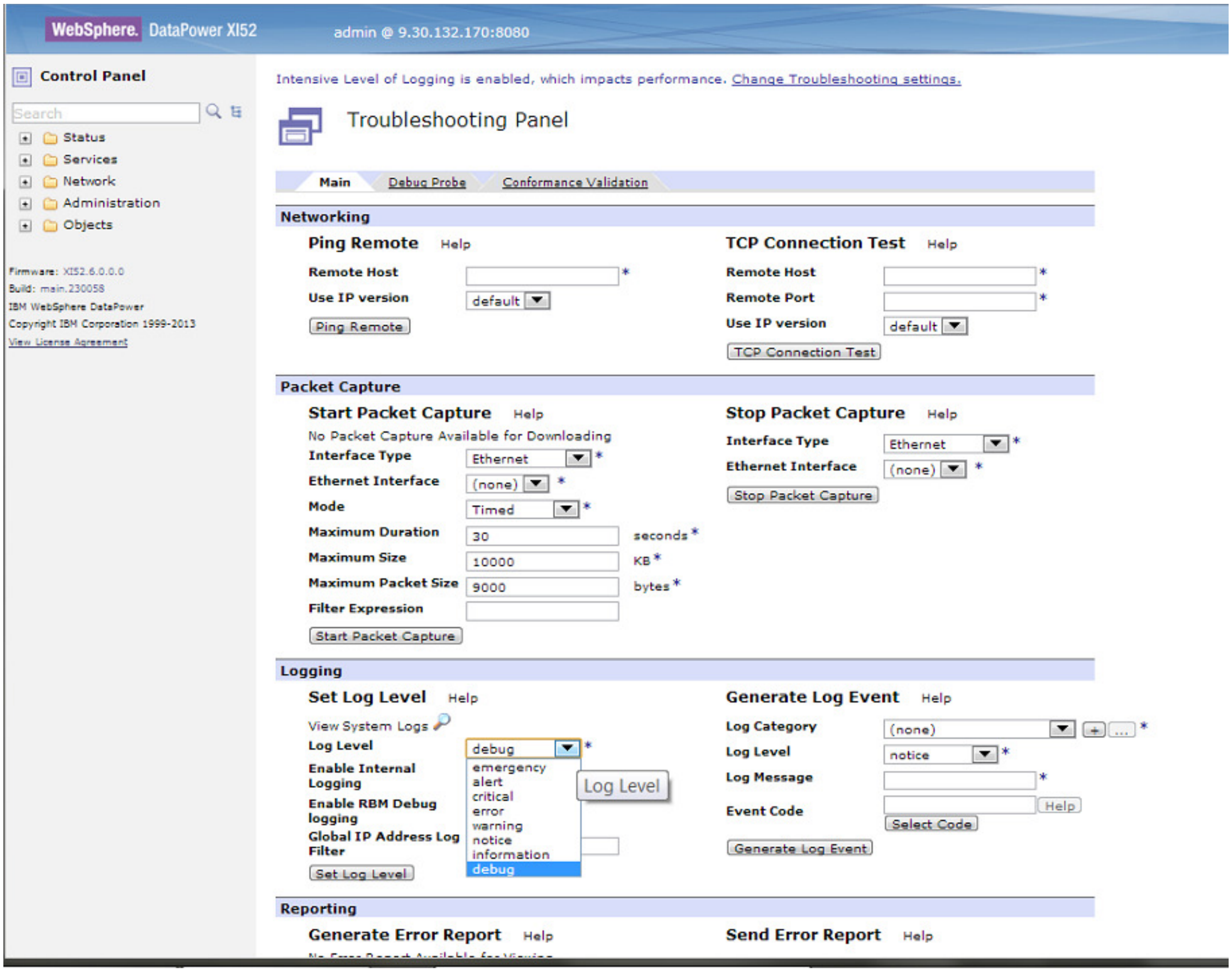
Control Panel

Services

Monitoring and Troubleshooting

In the **Logging** section:

- Select the required log category in the Log Category field
- Select the required level of logging in the Log Level field.



WebSphere. DataPower XI52 admin @ 9.30.132.170:8080

Control Panel

Search

- Status
- Services
- Network
- Administration
- Objects

Firmware: XI52.6.0.0.0
Build: main.230058
IBM WebSphere DataPower
Copyright IBM Corporation 1999-2013
View License Agreement

Intensive Level of Logging is enabled, which impacts performance. Change Troubleshooting settings.

Troubleshooting Panel

Main | Debug Probe | Conformance Validation

Networking

Ping Remote Help
Remote Host: *
Use IP version: default
Ping Remote

TCP Connection Test Help
Remote Host: *
Remote Port: *
Use IP version: default
TCP Connection Test

Packet Capture

Start Packet Capture Help
No Packet Capture Available for Downloading
Interface Type: Ethernet *
Ethernet Interface: (none) *
Mode: Timed *
Maximum Duration: 30 seconds *
Maximum Size: 10000 KB *
Maximum Packet Size: 9000 bytes *
Filter Expression:
Start Packet Capture

Stop Packet Capture Help
Interface Type: Ethernet *
Ethernet Interface: (none) *
Stop Packet Capture

Logging

Set Log Level Help
View System Logs
Log Level: debug *
Enable Internal Logging
Enable RBM Debug logging
Global IP Address Log Filter
Set Log Level

Generate Log Event Help
Log Category: (none) *
Log Level: notice *
Log Message: *
Event Code: Help
Select Code
Generate Log Event

Reporting

Generate Error Report Help

Send Error Report Help

Tracing IMS Callout support

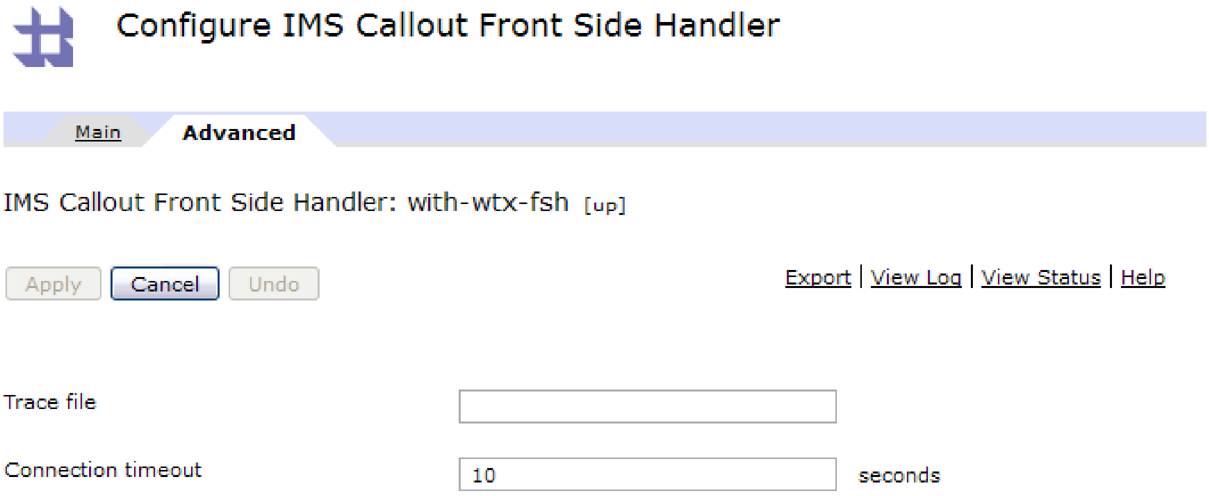
In order to diagnose complex problems, you can enable tracing in the IMS Synchronous Callout Front side handler in addition to the multi-level logging.

Recommendation: Do not activate tracing unless requested to do so by IBM Support. Tracing can negatively affect performance because of the volume of data that it collects.

To activate tracing:

1. In the IMS Callout front side handler configuration panel, click on the **Advanced** tab.
2. In the Trace file field, specify the output directory and file name for the trace. For example, *temporary://myTrace.txt*. You can use the following DataPower directories as the location when you enable tracing:
    - logtemp
    - logstore
    - temporary
3. Click on Apply to save the configuration.

To disable IMS Callout tracing, clear the Trace file field on the Advanced tab and click Apply.

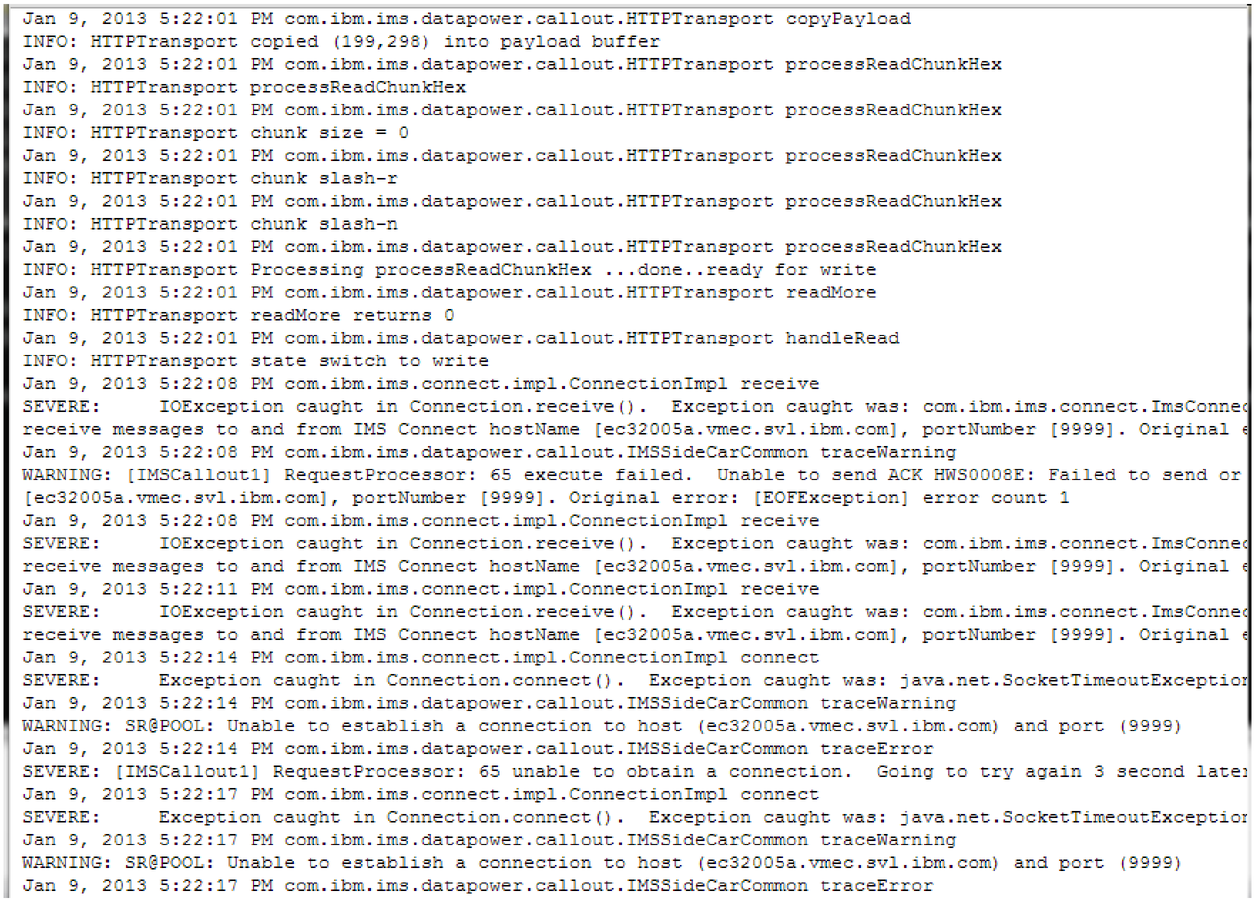

Configure IMS Callout Front Side Handler

IMS Callout Front Side Handler: with-wtx-fsh [up]

Trace file

Connection timeout 10 seconds

The following figure shows an example of a trace file.



```
Jan 9, 2013 5:22:01 PM com.ibm.ims.datapower.callout.HTTPTransport copyPayload
INFO: HTTPTransport copied (199,298) into payload buffer
Jan 9, 2013 5:22:01 PM com.ibm.ims.datapower.callout.HTTPTransport processReadChunkHex
INFO: HTTPTransport processReadChunkHex
Jan 9, 2013 5:22:01 PM com.ibm.ims.datapower.callout.HTTPTransport processReadChunkHex
INFO: HTTPTransport chunk size = 0
Jan 9, 2013 5:22:01 PM com.ibm.ims.datapower.callout.HTTPTransport processReadChunkHex
INFO: HTTPTransport chunk slash-r
Jan 9, 2013 5:22:01 PM com.ibm.ims.datapower.callout.HTTPTransport processReadChunkHex
INFO: HTTPTransport chunk slash-n
Jan 9, 2013 5:22:01 PM com.ibm.ims.datapower.callout.HTTPTransport processReadChunkHex
INFO: HTTPTransport Processing processReadChunkHex ...done..ready for write
Jan 9, 2013 5:22:01 PM com.ibm.ims.datapower.callout.HTTPTransport readMore
INFO: HTTPTransport readMore returns 0
Jan 9, 2013 5:22:01 PM com.ibm.ims.datapower.callout.HTTPTransport handleRead
INFO: HTTPTransport state switch to write
Jan 9, 2013 5:22:08 PM com.ibm.ims.connect.impl.ConnectionImpl receive
SEVERE:     IOException caught in Connection.receive().  Exception caught was: com.ibm.ims.connect.ImsConne
receive messages to and from IMS Connect hostName [ec32005a.vmec.svl.ibm.com], portNumber [9999]. Original
Jan 9, 2013 5:22:08 PM com.ibm.ims.datapower.callout.IMSSideCarCommon traceWarning
WARNING: [IMSCallout1] RequestProcessor: 65 execute failed.  Unable to send ACK HWS0008E: Failed to send or
[ec32005a.vmec.svl.ibm.com], portNumber [9999]. Original error: [EOFException] error count 1
Jan 9, 2013 5:22:08 PM com.ibm.ims.connect.impl.ConnectionImpl receive
SEVERE:     IOException caught in Connection.receive().  Exception caught was: com.ibm.ims.connect.ImsConne
receive messages to and from IMS Connect hostName [ec32005a.vmec.svl.ibm.com], portNumber [9999]. Original
Jan 9, 2013 5:22:11 PM com.ibm.ims.connect.impl.ConnectionImpl receive
SEVERE:     IOException caught in Connection.receive().  Exception caught was: com.ibm.ims.connect.ImsConne
receive messages to and from IMS Connect hostName [ec32005a.vmec.svl.ibm.com], portNumber [9999]. Original
Jan 9, 2013 5:22:14 PM com.ibm.ims.connect.impl.ConnectionImpl connect
SEVERE:     Exception caught in Connection.connect().  Exception caught was: java.net.SocketTimeoutExceptio
Jan 9, 2013 5:22:14 PM com.ibm.ims.datapower.callout.IMSSideCarCommon traceWarning
WARNING: SR@POOL: Unable to establish a connection to host (ec32005a.vmec.svl.ibm.com) and port (9999)
Jan 9, 2013 5:22:14 PM com.ibm.ims.datapower.callout.IMSSideCarCommon traceError
SEVERE: [IMSCallout1] RequestProcessor: 65 unable to obtain a connection.  Going to try again 3 second late
Jan 9, 2013 5:22:17 PM com.ibm.ims.connect.impl.ConnectionImpl connect
SEVERE:     Exception caught in Connection.connect().  Exception caught was: java.net.SocketTimeoutExceptio
Jan 9, 2013 5:22:17 PM com.ibm.ims.datapower.callout.IMSSideCarCommon traceWarning
WARNING: SR@POOL: Unable to establish a connection to host (ec32005a.vmec.svl.ibm.com) and port (9999)
Jan 9, 2013 5:22:17 PM com.ibm.ims.datapower.callout.IMSSideCarCommon traceError
```

Troubleshooting DataPower Web GUI timeout

By default, Web GUI sessions with DataPower time out after 60 minutes. If your session times out, or if you want to change the default timeout value, refer to the technote *WebGUI session time out on IBM WebSphere DataPower appliance* at http://www-01.ibm.com/support/docview.wss?uid=swg21256195.

DataPower Configuration Hits and Tips

- You can configure multiple Multi-Protocol Gateways.
- Always click Save after clicking Apply to ensure that configuration changes are saved. Any change that is not saved might be lost.
- You can configure one or more IMS Callout Front Side Handlers in a single Multi-Protocol Gateway. For each ~~front-side protocol handler~~front-side handler for IMS Callout support, you can configure one or more TPIPEs on the same IMS Connect host and port, and same IMS data store.
- An IMS Callout Front Side Handler cannot be shared by multiple Multi-Protocol Gateways, but you can move an existing front side handler to a different Multi-Protocol Gateway. To move an IMS Callout Front Side Handler from one Multi-Protocol Gateway to another:
  a. Delete the IMS Callout Front Side Handler from the current Multi-Protocol Gateway
  b. Save the current Multi-Protocol Gateway
  c. Add the IMS Callout Front Side Handler to the destination Multi-Protocol Gateway
  d. Save the destination Multi-Protocol Gateway.
- By default, IMS Callout Front Side Handlers are enabled when they are created. During configuration of a Multi-Protocol Gateway, disable the IMS Callout Front Side Handler until the Multi-Protocol Gateway and the backend service is ready to service requests. Otherwise, any callout requests sent to the IMS Callout Front Side Handler will get an error.
  Also, if an IMS Callout Front Side Handler is enabled while the Multi-Protocol Gateway is being configured, each time you apply changes by clicking the Apply button, the Multi-Protocol Gateway effectively restarts the IMS Callout Front Side Handler and performs teardown and resume tpipe operations. When the Multi-Protocol Gateway is ready, you can enable the IMS Callout Front Side Handler to start the retrieval of IMS ICAL requests.
- For failover support, you can configure redundant IMS Callout Front Side Handlers with the same properties to listen on the same host TPIPE. The first IMS Callout Front Side Handler on a TPIPE has an active connection with IMS Connect, while the other IMS Callout Front Side Handlers on the same TPIPE are queued. If the active IMS Callout Front Side Handler fails, the next one in the queue takes over.

- To display information about how IMS is processing synchronous callout requests, you can use the IMS command /DISPLAY TMEMBER TPIPE SYNC. The information displayed includes the number of active synchronous callout messages, the number of synchronous callout messages waiting for response, the resume tpipe option, the resume tpipe mode, and the tpipe status. For more information about the command, see /DISPLAY TMEMBER command in the IMS documentation at http://www.ibm.com/support/knowledgecenter/SSEPH2_13.1.0/com.ibm.ims13.doc.cr/imscmds/ims_displaytmember.htm.

Troubleshooting IMS Callout Front Side Handler

If an error occurs during the processing of an IMS synchronous callout request by DataPower, follow the steps to diagnose the problem:

1. Enable debug-level logging and examine the log messages for useful information.
   - IMS Callout Front Side Handler log: Verify in the log message that IMS Callout Front Side Handler is able to pass the initial test to validate that both IMS Connect and IMS are up. The test creates a connection to IMS Connect and sends a /DIS OTMA command to IMS. In the log, you can correlate a synchronous callout request to its reply message by the hexadecimal correlator token that uniquely identifies the transaction.
   - Multi-Protocol Gateway log message: Verify that the Multi-Protocol Gateway is able to flow the message from the IMS Callout Front Side Handler to the backend service and back.
2. If you do not need to preserve any, you can restart the IMS Callout Front Side Handler by disabling and re-enabling it. You must click the **Apply** button after each action. Check the log messages after restart.
   Attention: any in-flight requests or responses are lost when the IMS Callout Front Side Handler is restarted.
3. If restarting the IMS Callout Front Side Handler does not clear up the problem, you can restart the domain from the default domain. Again, any in-flight requests or responses will be lost. If the domain is restarted, the IMS Callout Front Side Handler might not be able to clean up the resume tpipe connection properly, resulting in an orphaned connection that must be cleaned up in IMS manually.
4. As a last resort, you can restart DataPower. Again, any in-flight requests or responses will be lost and the tpipe connection might not clean up properly. To restart DataPower, issue the DataPower **shutdown reload** command.

Error Response Considerations

Processing errors can occur in any of the different components in a DataPower for IMS configuration, such as:

- The IMS Callout Front Side Handler
- The DataPower Multi-Protocol Gateway processing policy, including in the data transformation stage
- The backend service

The IMS Callout Front Side Handler communicates with DataPower by using the HTTP protocol.

If an error occurs within the IMS Callout Front Side Handler, the following error response is sent back to the IMS application:

- Return code: X’0100’
- Reason code: X’0100’
- Extended reason code: 2001
- Error message: “REQUEST PROCESSING FAILED, CHECK EXTENDED REASON CODE.“

If an error that occurs after the IMS Callout Front Side Handler sends the request to DataPower, the following error response is sent to the IMS application:

- Return code: X’0100’
- Reason code: X’0100’
- Extended reason code: 2000-3000 (set as 2000+HTTP error code from DataPower)
- Error message: “REQUEST PROCESSING FAILED, CHECK EXTENDED REASON CODE.“

Troubleshooting ICAL

If an IMS application program receives an error response to an ICAL call, take the following steps to diagnose the problem:

1. Look up the return codes and reason codes in Table 1 of the ICAL call documentation at http://www.ibm.com/support/knowledgecenter/SSEPH2_13.1.0/com.ibm.ims13.doc.apr/ims_icalcalltm.htm.
2. Verify that the ICAL request was sent from IMS Connect. The IMS Connect administrator can verify in the IMS Connect trace that the data exchange happened. The IMS Connect administrator can also issue the IMS Connect command VIEWHWS to see:
   - The CLIENTID. The client ID of a DataPower IMS Callout Front Side Handler is generated by IMS Connect and has a prefix ‘DP’, for example: DPxxxxxx.
   - The STATUS. The state of the IMS Callout Front Side Handler as recognized by IMS Connect. See the section ‘Troubleshooting IMS Connect connections’

- The SECOND value. The number of seconds that this connection has remained in the state shown on the same row under the STATUS output field heading. This number resets after an ICAL message is delivered.

It is important that a TPIPE is dedicated to only one client, for example, DataPower, SOAP Gateway, TM Resource Adapter on WebSphere Application Server, and so on. Each client expects the message in different format. An ICAL message is rejected with return code (X'100') and reason code (X'108') for invalid format if it is received from a tpipe by a client that does not expect an ICAL call.

3. Verify that DataPower IMS Callout Front Side Handler received the request. This requires turning on the debug log. Check for IMS Callout Front Side Handler log message at the time when the ICAL request is sent.
4. Verify that the Multi-Protocol Gateway policy is able to process the data and deliver to the backend service. This requires turning on the debug log in DataPower. Check for Multi-Protocol Gateway messages in the log.
5. Verify that DataPower IMS Callout Front Side Handler delivered the response. If the connection to IMS Connect is not longer usable, the IMS Callout Front Side Handler attempts to redeliver again on a new connection. If the redelivery attempt fails because of connection issues, the correlation token is logged and the response is discarded. After delivering a response, the IMS Callout Front Side Handler waits for an acknowledgement (ACK) from IMS Connect. If a NACK is received, the correlation token is logged and the response is discarded.

Troubleshooting IMS Connect connections

When an IMS Callout Front Side Handler is enabled, for each TPIPE that is specified, DataPower creates a dedicated connection with IMS Connect to listen for ICAL requests. The connection has a CONN status in IMS Connect while waiting for output from IMS. After IMS Connect sends an ICAL request, the status of the connection changes to RECV WFCM (Wait-for-Confirm) while IMS Connect waits for an ACK from the client. After getting the ACK, the status of the connection changes back to goes back to CONN. The IMS Connect administrator can issue the VIEWHWS command to see the connection status.

For IMS Version 13 information about the VIEWHWS command and its output, see http://www.ibm.com/support/knowledgecenter/SSEPH2_13.1.0/com.ibm.ims13.doc.cr/compcmds/ims_viewhws.htm.

Note: if you are using IMS Connect Versoion 12 and DataPower is shut down while the IMS Connect Front Side Handler remains enabled, any existing IMS Connect connections that are in a CONN state break and must be cleaned up in IMS Connect manually.

IMS Connect Version 13 cleans up broken connections automatically after APARs PM90777 (PTF UK95578) and PM98701 (PTF UI12241) are applied.

If broken connections are not cleaned up in IMS Connect Version 12 before DataPower is restarted, the IMS Callout Front Side Handler, which reconnects automatically during restart, will appear to have twice the number of connections in IMS Connect Version 12. For example, if the IMS Connect Front Side Handler has 50 active connections with IMS Connect Version 12 when DataPower shuts down and they are not cleaned up before DataPower is restarted, you will probably see 100 connections for the Front Side Handler in IMS Connect after restart completes. Any ICAL requests will still fail, because they would be sent to the original broken connections. After the broken connections are cleaned up, ICAL processing can resume on the new active connections.

If IMS Connect Version 12 receives another ICAL request on the broken connection, the request is rejected and the broken connection is then terminated. The ICAL request is not sent to DataPower.

To manually clean up a broken connection in IMS Connect administrator can issue a command to manually destroy a connection. A z/OS MODIFY command is shown in the following example:

```
F HWS1,DELETE PORT NAME(9999) CLIENT (DP83OEFT)
```

To avoid broken connections in IMS Connect, before you shut down DataPower, disable the IMS Callout Front Side Handler and save the configuration.

Error Handling Considerations

You can configure the number of times that an IMS Callout Front Side Handler attempts to reconnect to IMS after a connection fails before the IMS Callout Front Side Handler goes into a ‘down – pending’ status.

The two parameters are:

1. RetryErrorLimit: The number of times to attempt to resume a connection with a TPIPE after a connection fails. The default is 5.
2. RetryInterval: The length of time to wait between attempts to resume a connection with a TPIPE. The default is 3 seconds.

If an error is due to network problem and the IMS Callout Front Side Handler goes in a “down - pending” state, the Front Side Handler attempts to self-recover.

An internal polling is performed every minute to verify when the network connectivity and/or IMS availability is reestablished. If the polling is successful, DataPower autonomously changes the status of the Front Side Handler to ‘up’ and operations are resumed.

In the unlikely event that the IMS Front Side Handler becomes non-operative, DataPower tries to restart processing automatically.

Configuring access to IMS databases

Configuring an IMS Database Connection involves configuring components in both the IMS and DataPower environments.

Configuring IMS Components for access to IMS DB

Access to IMS databases from DataPower requires configuring the following IMS components:

- IMS Connect
- The Open Database Manager (ODBM) of the IMS Common Service Layer (CSL)

OTMA is not used for access to IMS DB.

Configuring IMS Connect for access to IMS DB

An IMS Connect ODACCESS statement is required to configure IMS Connect to support access to IMS databases from DataPower.

Among other communication attributes, the ODACCESS statement defines the port on which IMS Connect listens for database access requests from DataPower. The same port number that is specified on the DRDAPORT keyword of the ODACCESS statement must also be specified in the Port field when the SQL Data Source is configured in DataPower.

The ODACCESS statement is in addition to the HWS and TCPIP statements that are required for all types of IMS Connect support. All of the IMS Connect configuration statements are defined in the HWSCFGxxx member of the IMS.PROCLIB data set.

Configuring ODBM for access to IMS DB

You configure ODBM by specifying an CSLDCxxx member in the IMS.PROCLIB data set.

Among other attributes, the CSLDCxxx member defines an alias name for the IMS DB server where the database resides. Optionally, this same alias name can be specified in the dataStoreName field on the Advanced tab when the SQL Data Source is configured.

Configuring DataPower Components for access to IMS DB

Access to the IMS DB database server through DataPower requires configuring the following components in the DataPower environment:

1. The DataPower Multi-Protocol Gateway
2. A Front Side Protocol handler
3. An SQL Data Source
4. A Multi-Protocol Gateway Processing Policy
5. SQL calls

6. A Matching Rule
7. SQL call enablement in DataPower for IMS
8. A Set Variable Action
9. A Results Action

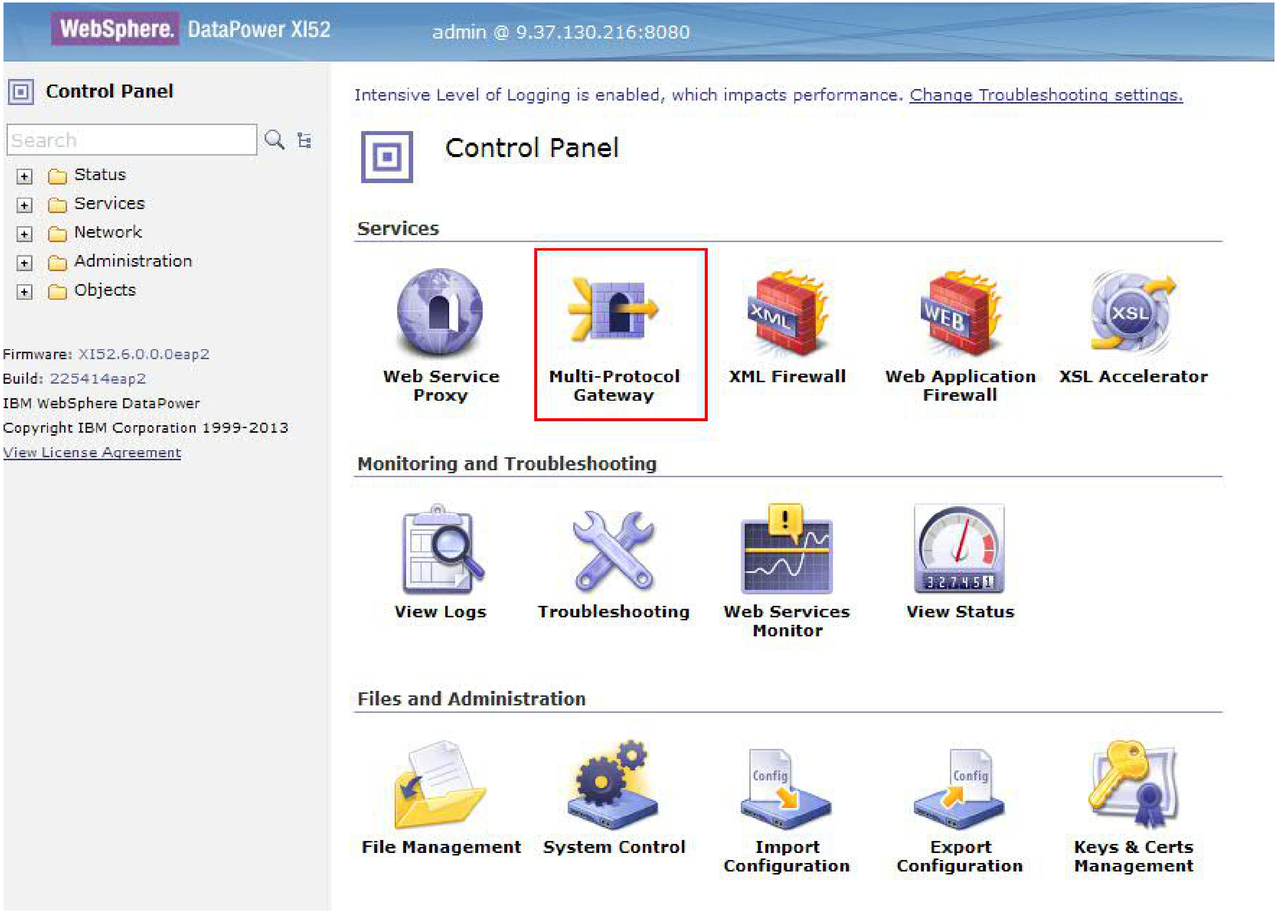
A backend is not needed to query an IMS Database; DataPower classifies such cases as “enrichment scenarios”, involving a call to an external source that is not the intended backend. For our setup we will create a loop feedback using a dynamic backend and XSLT logic.

The configuration steps included in the guide are for a bare minimum configuration, with only the core request and response processing elements. A complete implementation would have one or more of the following additional elements:

- Service level monitoring for flow control
- AAA (authentication/authorization)
- Logging elements
- Monitoring elements

1. Configuring the Multi-Protocol Gateway for access to IMS DB

To configure the Multi-Protocol Gateway, start from the DataPower Control Panel and select Multi-protocol Gateway as shown in the figure below and click on “add”.

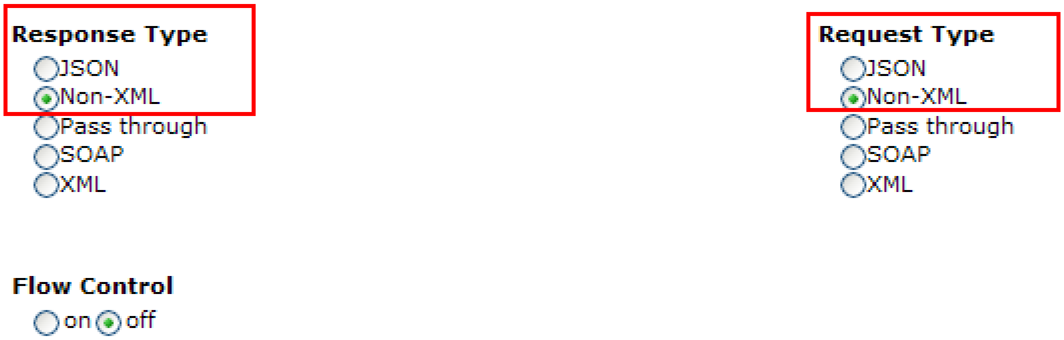


Firmware: XI52.6.0.0.0eap2
Build: 225414eap2
IBM WebSphere DataPower
Copyright IBM Corporation 1999-2013
View License Agreement

Intensive Level of Logging is enabled, which impacts performance. Change Troubleshooting settings.

In the “Configure Multi-Protocol Gateway” panel, specify a Multi-Protocol Gateway name.

Toward the bottom of the panel, you must set the request type and response type. Request type defines the IMS traffic on the front end. Response type defines the web service traffic on the backend. Specify Non-XML for both request type and response type.



Response Type

○ JSON
● Non-XML
○ Pass through
○ SOAP
○ XML

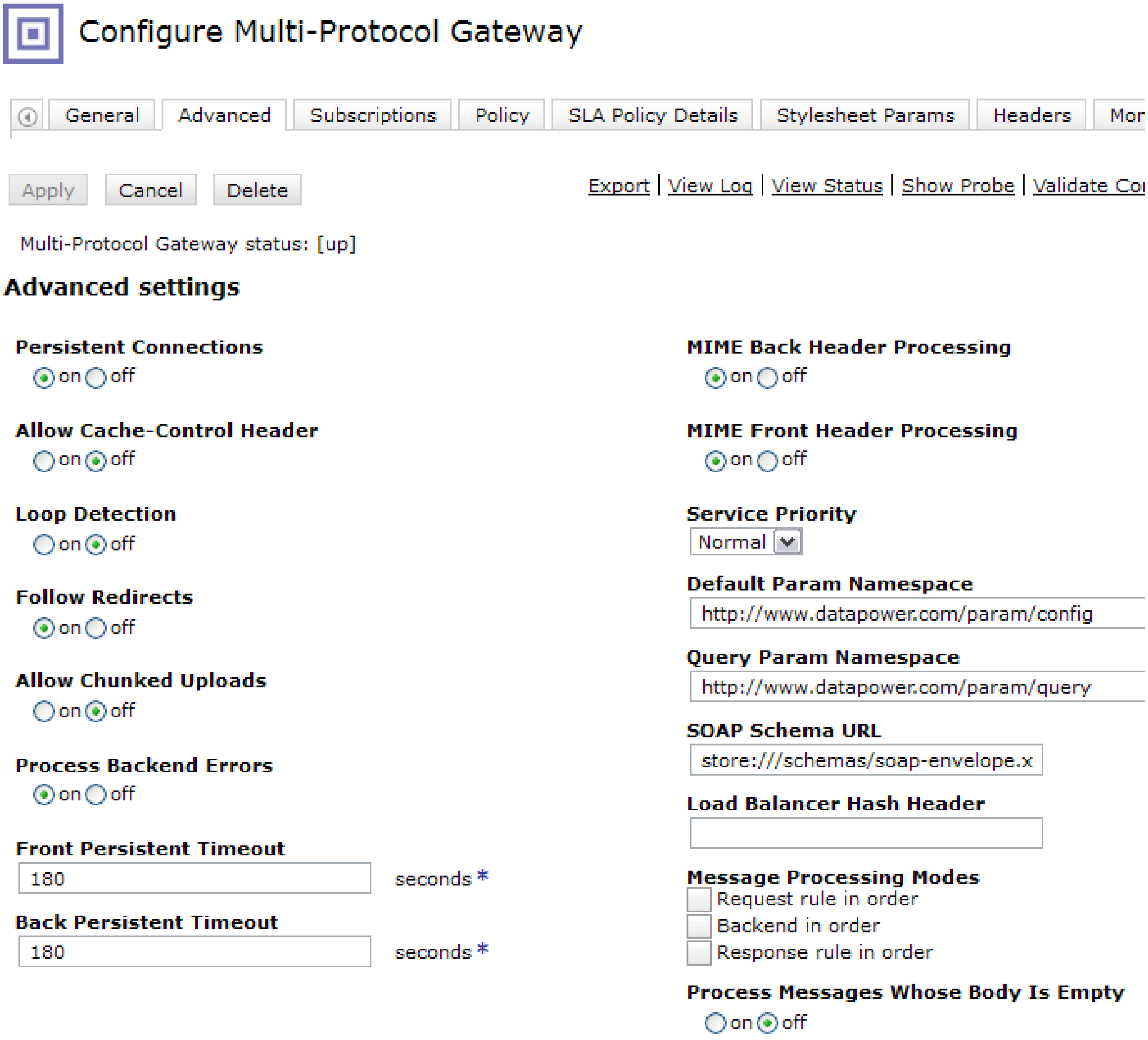
Request Type

○ JSON
● Non-XML
○ Pass through
○ SOAP
○ XML

Flow Control

○ on ● off

More Advanced settings are available in the **Advanced** tab.



Multi-Protocol Gateway status: [up]

Advanced settings

Persistent Connections
● on ○ off

Allow Cache-Control Header
○ on ● off

Loop Detection
○ on ● off

Follow Redirects
● on ○ off

Allow Chunked Uploads
○ on ● off

Process Backend Errors
● on ○ off

Front Persistent Timeout
180 seconds *

Back Persistent Timeout
180 seconds *

MIME Back Header Processing
● on ○ off

MIME Front Header Processing
● on ○ off

Service Priority
Normal

Default Param Namespace
http://www.datapower.com/param/config

Query Param Namespace
http://www.datapower.com/param/query

SOAP Schema URL
store:///schemas/soap-envelope.x

Load Balancer Hash Header

Message Processing Modes
□ Request rule in order
□ Backend in order
□ Response rule in order

Process Messages Whose Body Is Empty
○ on ● off

2. Define a Front Side Protocol handler for the IMS DB connection

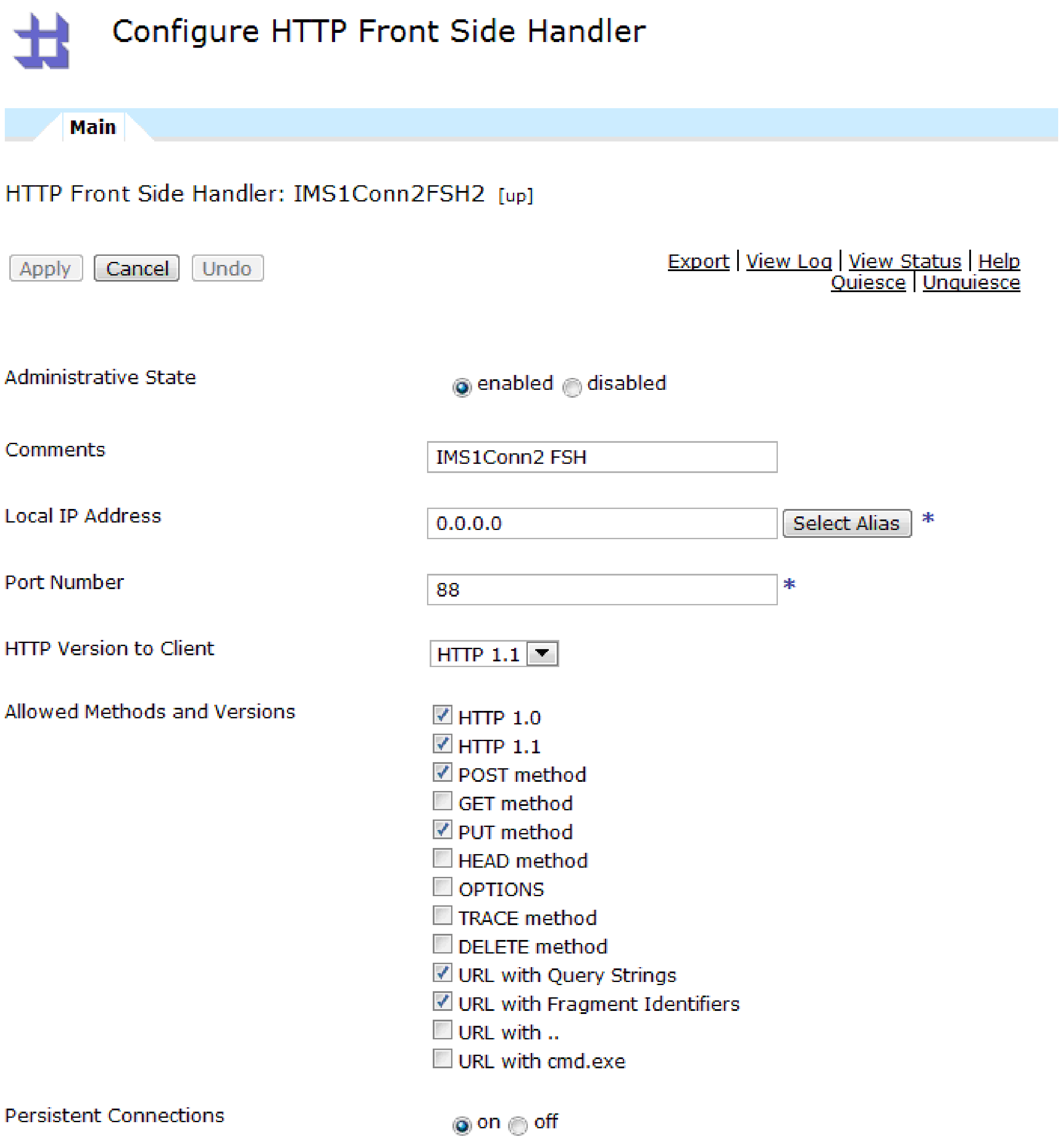
To add an HTTP Front Side Handler:

1. In the "Configure Multi-Protocol Gateway" panel on the "General" tab under the "Front side settings" heading, click the "+" button next to the "Front Side Protocol" field.
2. Select “HTTP Front Side Handler.”

3. In the "HTTP Front Side Handler panel, specify the local IP address. A value of 0.0.0.0 defaults the value to the host IP address of the DataPower appliance.

4. Specify a port to listen on.

5. Click Apply on the front side handler panel, then click Apply on the MPGW panel, and finally click 'save config'.



Configure HTTP Front Side Handler

HTTP Front Side Handler: IMS1Conn2FSH2 [up]

Administrative State: ● enabled ○ disabled

Comments: IMS1Conn2 FSH

Local IP Address: 0.0.0.0 Select Alias *

Port Number: 88 *

HTTP Version to Client: HTTP 1.1

Allowed Methods and Versions:
☑ HTTP 1.0
☑ HTTP 1.1
☑ POST method
□ GET method
☑ PUT method
□ HEAD method
□ OPTIONS
□ TRACE method
□ DELETE method
☑ URL with Query Strings
☑ URL with Fragment Identifiers
□ URL with ..
□ URL with cmd.exe

Persistent Connections: ● on ○ off

3. Configuring an SQL Data Source

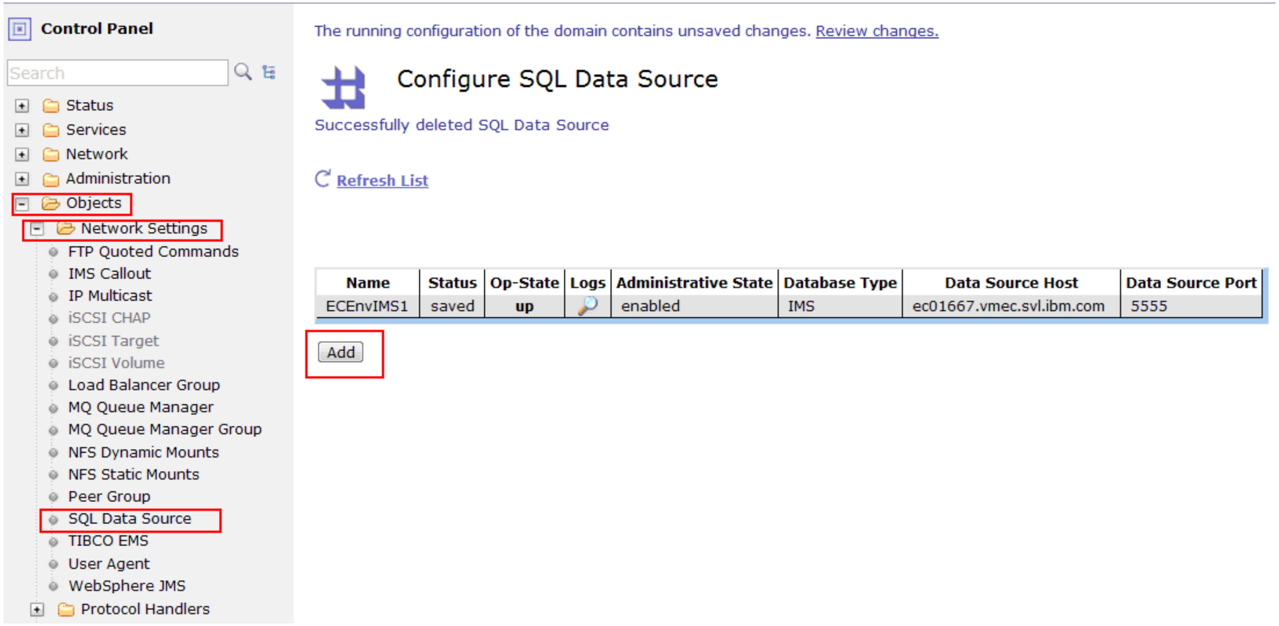
An IMS database is defined to DataPower as an SQL data source. For each IMS database that you will access, you need to configure a separate SQL data source. .

In IMS, a program specification block (PSB) associates an application program with a given database. When you configure the SQL Data Source in DataPower, to identify the target database of an application program, you specify the PSB name instead of the database name. The PSB name is specified in the Data Source ID field. An IMS JDBC driver, which comes preinstalled in the DataPower appliance, checks the PSB names in the IMS catalog to validate the Data Source ID.

The SQL data source is used by an SQL action in a processing policy. The SQL action retrieves the data for further processing by the processing policy. Conversely, the processing policy can store the processed data in the configured database instance.

The SQL Data Source utilizes the IMS Universal JDBC driver to establish a TCP/IP connection to the IMS system. This allows users to issue dynamic SQL calls to the underlying database, and returns the result set in tabular format.

To define an SQL Data Source, use the navigation panel on the left of the main DataPower Control panel:

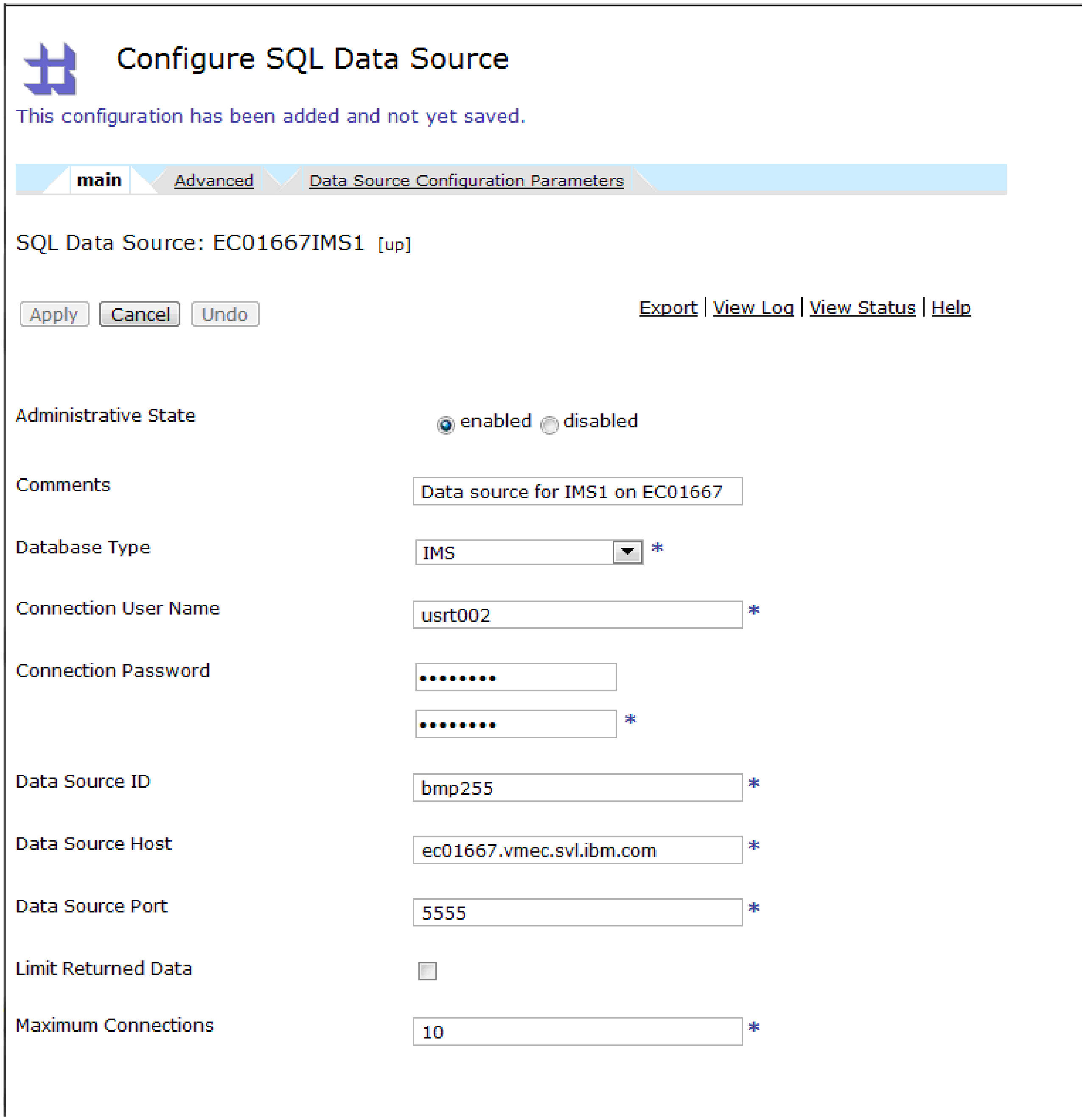


The running configuration of the domain contains unsaved changes. Review changes.

Configure SQL Data Source

Successfully deleted SQL Data Source

Name	Status	Op-State	Logs	Administrative State	Database Type	Data Source Host	Data Source Port
ECEnvIMS1	saved	up	🔎	enabled	IMS	ec01667.vmec.svl.ibm.com	5555


main
Advanced
Data Source Configuration Parameters
Apply
Cancel
Undo
Export | View Log | View Status | Help

Configure SQL Data Source

This configuration has been added and not yet saved.

SQL Data Source: EC01667IMS1 [up]

Administrative State	● enabled ○ disabled
Comments	Data source for IMS1 on EC01667
Database Type	IMS *
Connection User Name	usrt002 *
Connection Password	•••••••• •••••••• *
Data Source ID	bmp255 *
Data Source Host	ec01667.vmec.svl.ibm.com *
Data Source Port	5555 *
Limit Returned Data	□
Maximum Connections	10 *

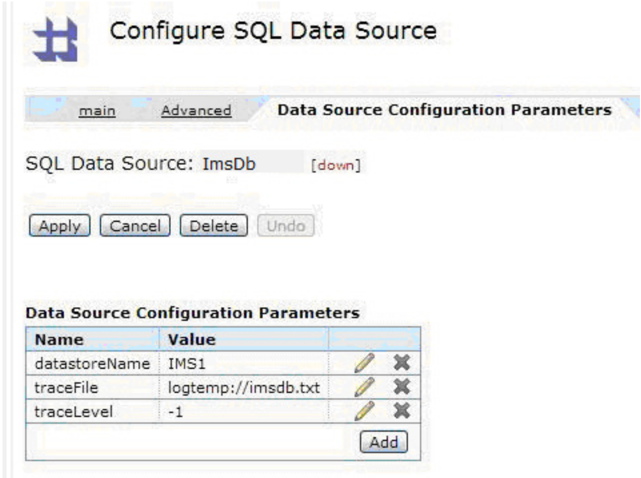
The configuration panel allows you to specify IMS-specific parameters:

- **Database Type:** IMS
- **Connection User Name:** TSO username
- **Connection Password:** TSO password

- **Data Source ID:** The name of the program specification block (PSB) that identifies the database to connect to
- **Data Source Host:** The IP address of the host on which the IMS system resides
- **Data Source Port:** The port on which IMS Connect receives database access requests. This port is defined to IMS Connect on the DRDAPORT keyword of the ODACCESS configuration statement.

Accept the defaults for the other parameters on this panel.

You can specify additional parameters under the “Data Source Configuration Parameters” tab.


Configure SQL Data Source
main
Advanced
Data Source Configuration Parameters
Apply
Cancel
Delete
Undo
Add

SQL Data Source: ImsDb [down]

Data Source Configuration Parameters

Name	Value
datastoreName	IMS1
traceFile	logtemp://imsdb.txt
traceLevel	-1

Some commonly used name-value pairs are:

- **datastoreName:** The name of your IMS system. This parameter is optional. When the datastoreName is omitted, IMS Connect searches for the appropriate IMS system among the active IMS systems that it is currently connected to. Specifying the datastoreName can result in a minor performance improvement. When specified, the datastoreName value must match an IMS alias name that is defined on the NAME keyword of the ALIAS statement in the CSLDCxxx member of the IMS.PROCLIB data set.
- **traceFile:** The full path and file name to which DataPower will write log messages. This is used mainly for debugging.
- **traceLevel:** The level of logging for traceFile. The value -1 indicates that all messages are logged. This is also used for debugging in conjunction with traceFile.

When you’re done configuring the SQL data source, click Apply.

On the Multi-Protocol Gateway panel, click Apply again.

Finally, click “save config”.

4. Defining a Processing Policy for IMS DB access

A processing policy is defined as a part of the configuration of a Multi-Protocol Gateway. A processing policy defines the actions DataPower takes against data passed through to the endpoint service. It consists of one or more *rules.*

A *rule* is depicted as a line in the policy definition panel, and consists of *actions*. Each rule must consist of:

- A Match Action, which processes an incoming request based on its target URL
- A Transform Action
- Optionally, a loop feedback for testing purposes
- A Results Action

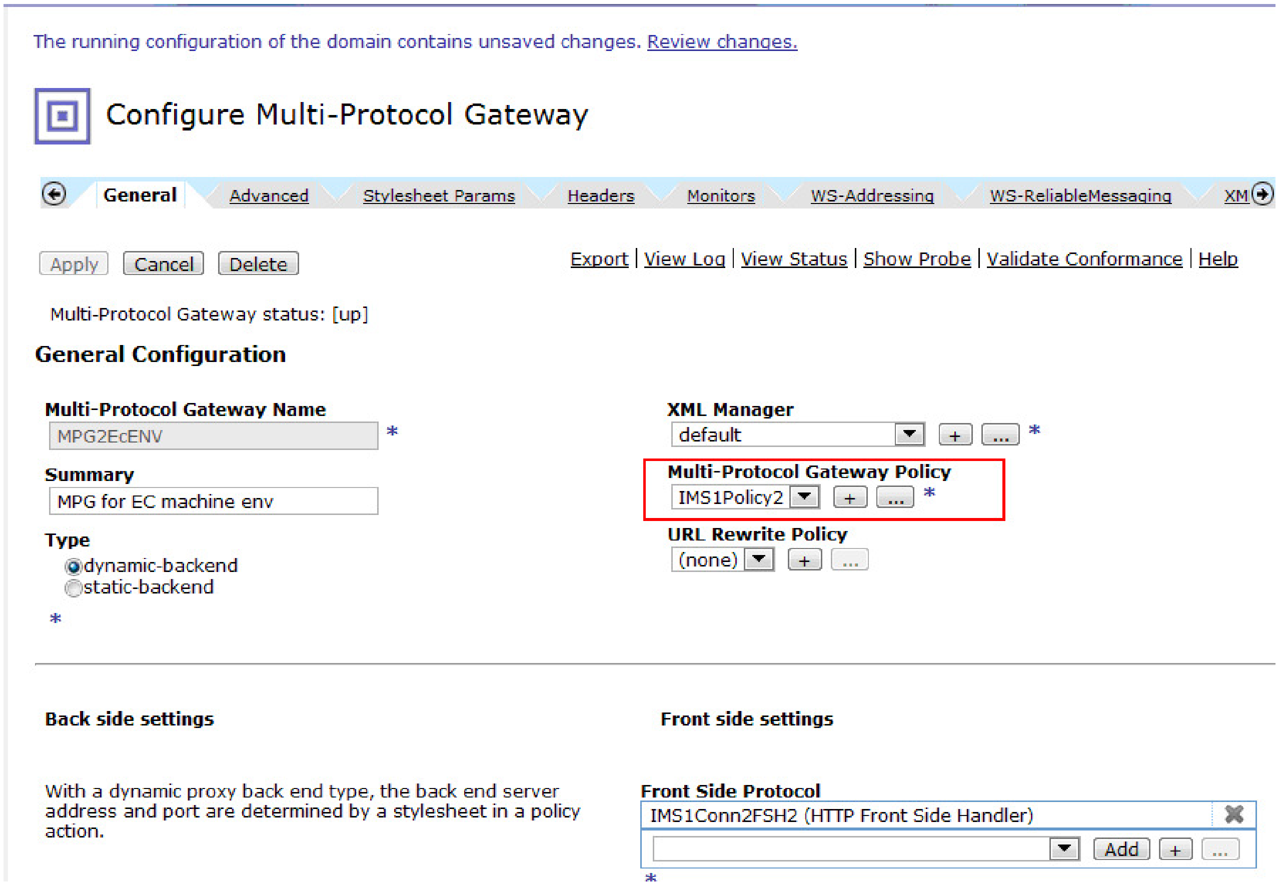
Each rule can be configured to flow from client to server, vice-versa, or in both directions.

4a. Defining a policy

To define a new policy:

1. Under the General tab on the Configure Multi-Protocol Gateway panel, click on the "+" button
2. Specify the name for the policy
3. Click Apply

After defining the new policy, define a rule for the processing policy.



The running configuration of the domain contains unsaved changes. Review changes.

Configure Multi-Protocol Gateway

Multi-Protocol Gateway status: [up]

General Configuration

Multi-Protocol Gateway Name: MPG2EcENV *

Summary: MPG for EC machine env

Type

● dynamic-backend
○ static-backend
*

XML Manager: default *

Multi-Protocol Gateway Policy: IMS1Policy2 *

URL Rewrite Policy: (none)

Back side settings

With a dynamic proxy back end type, the back end server address and port are determined by a stylesheet in a policy action.

Front side settings

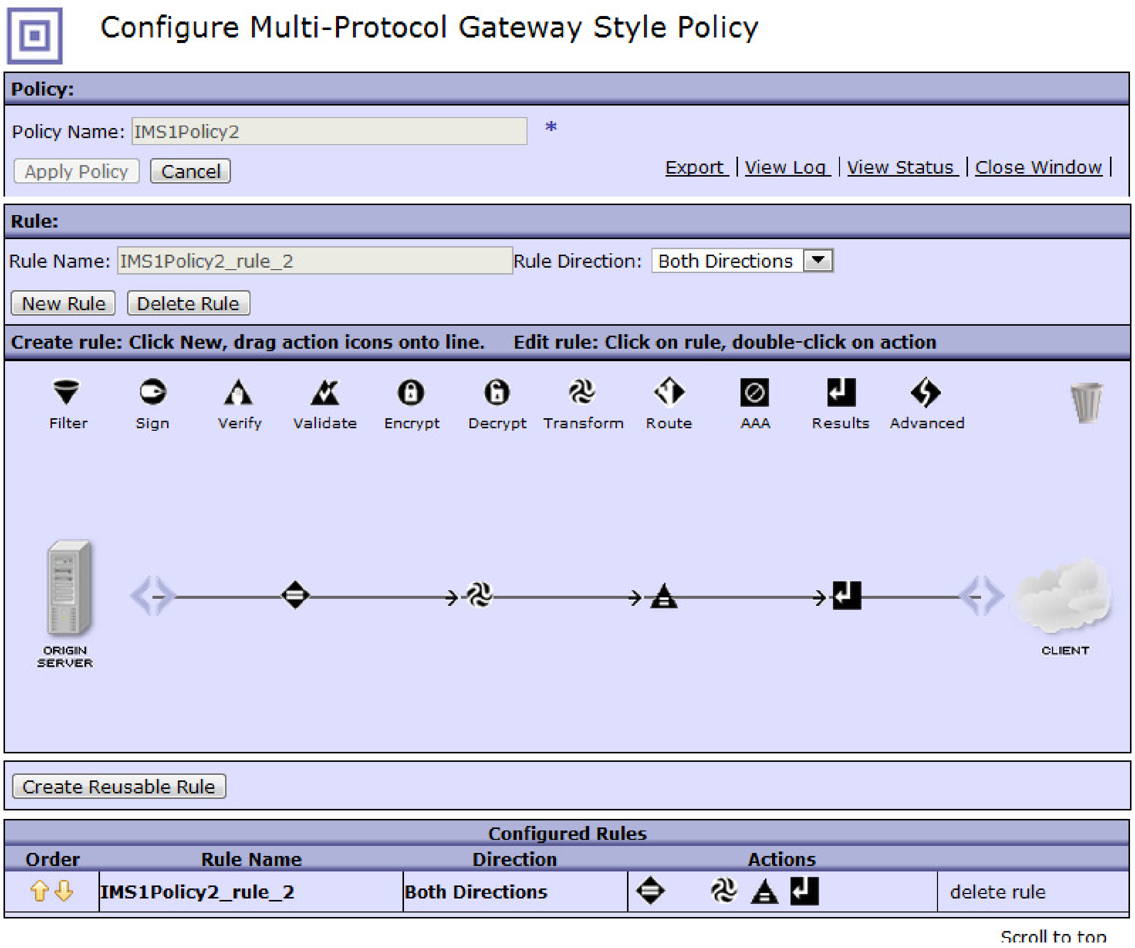
Front Side Protocol: IMS1Conn2FSH2 (HTTP Front Side Handler)
*

4b. Defining a New Rule

In the policy definition panel, a *rule* is depicted as a line between a server and a client. Matching, processing, and results actions are added to the rule by dragging icons onto the line.

To define a new rule:

1. Enter a name in the Rule Name field
2. Specify the rule direction
3. Click the New Rule button
4. Add actions to the rule by dragging action icons onto the rule line



Configure Multi-Protocol Gateway Style Policy

Policy:

Policy Name: IMS1Policy2 *

Rule:

Rule Name: IMS1Policy2_rule_2 Rule Direction: Both Directions

Create rule: Click New, drag action icons onto line. Edit rule: Click on rule, double-click on action

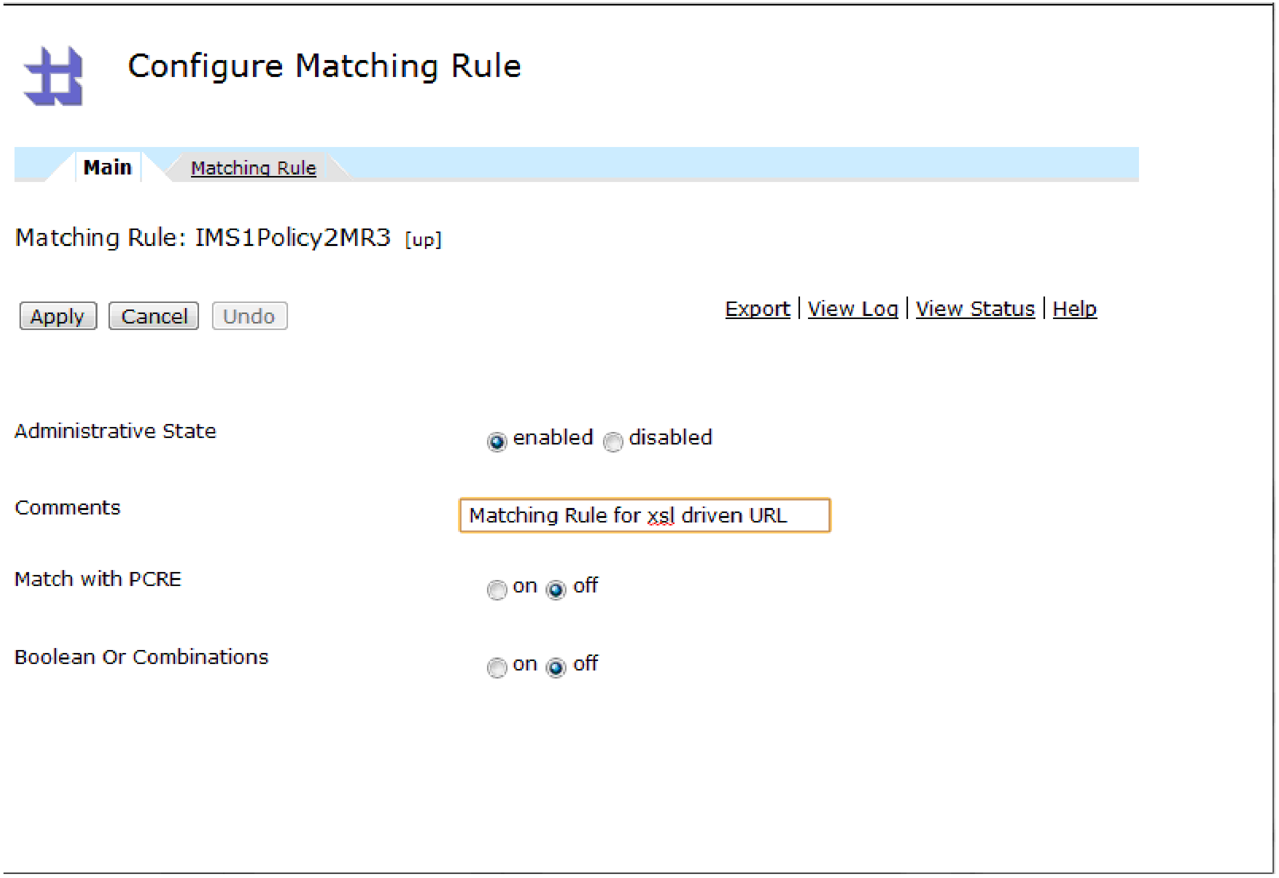
Configured Rules				
Order	**Rule Name**	**Direction**	**Actions**	
⇧⇩	**IMS1Policy2_rule_2**	**Both Directions**		delete rule

4c. Defining a Match Action

A Match Action contains one or more Matching Rules. A matching rule defines the criteria to determine whether incoming traffic is processed by its processing rule. For example, you might specify a matching action that applies the rule to any incoming message that specifies all or part of the URL address of the IMS DB server.

To define a matching rule:

1. Drag a matching icon, , onto the Rule line
2. Double click on the Matching rule icon (equals sign) and then on the edit ("…").The Configure Matching Rule panel displays:



Matching Rule: IMS1Policy2MR3 [up]

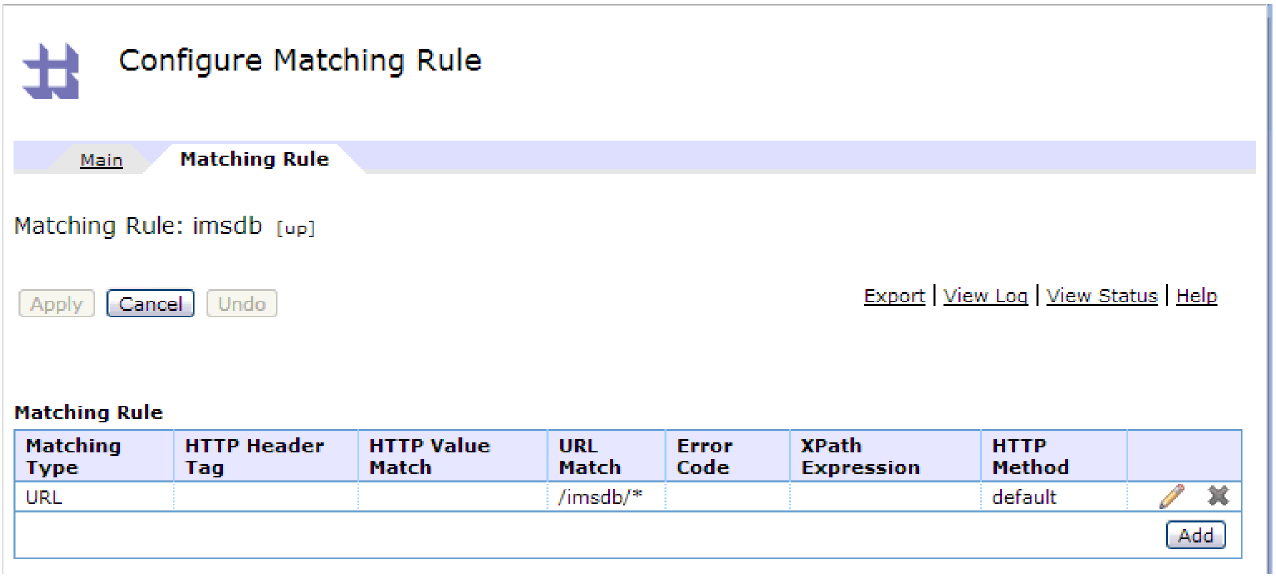
Administrative State ● enabled ○ disabled

Comments: Matching Rule for xsl driven URL

Match with PCRE ○ on ● off

Boolean Or Combinations ○ on ● off

3. Use the "Matching Rule" tab to configure this matching rule. An asterisk indicates a wildcard. The rule shown in the following figure will process all requests with target URL http://<hostname>:<port>/imsdb/<anything>.



Configure Matching Rule

Matching Rule: imsdb [up]

Matching Rule

Matching Type	HTTP Header Tag	HTTP Value Match	URL Match	Error Code	XPath Expression	HTTP Method
URL			/imsdb/*			default

4d. Configure a Transform Action (XSL Stylesheet-driven action)

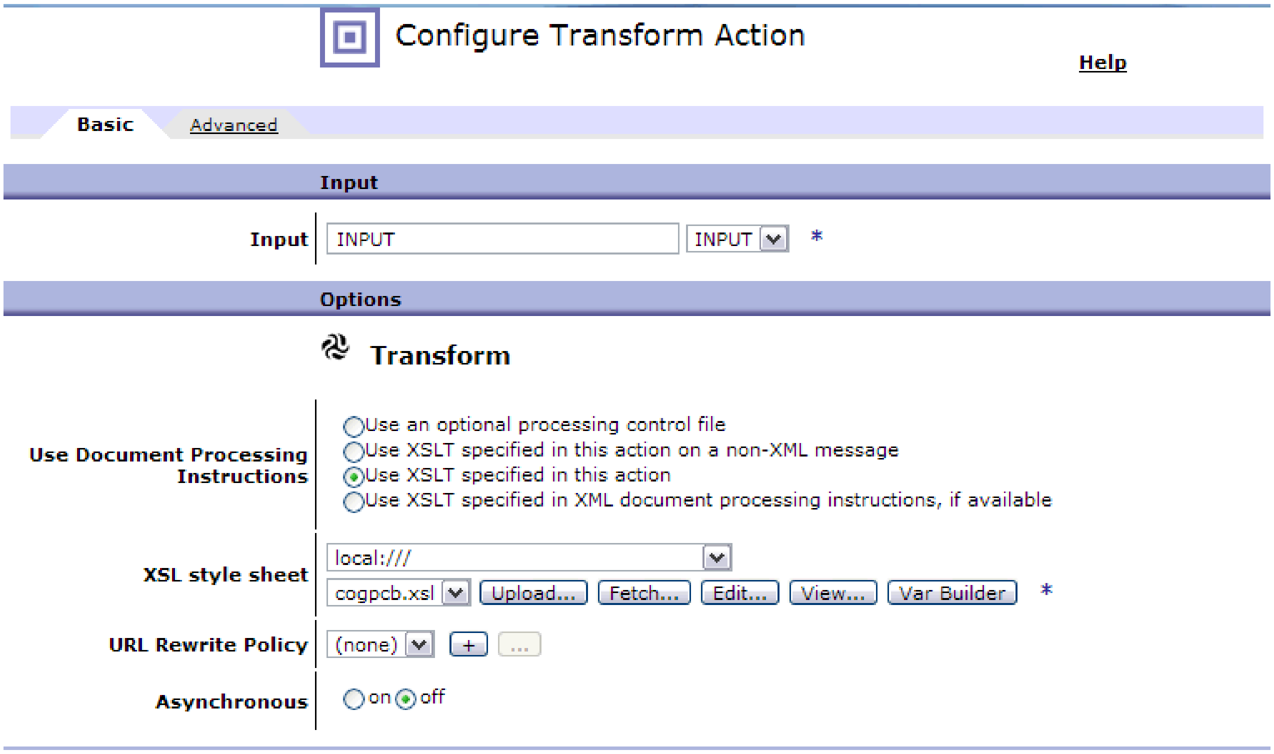
Before you add a Transform Action for accessing IMS databases, you should have an XSL stylesheet available and ready for upload into the Transform Action. For more information about coding an XSL stylesheet, see Enabling SQL calls in DataPower for IMS.

The stylesheet is used to:

- Direct the web services input message, also referred as payload, to the proper IMS system
- Specify the IMS program specification block (PSB) to use
- The query to perform
- The SQL Data Source (IMS) to use

To configure a Transform Action:

1. Drag the Transform Action icon, Transform , onto the rule line, right after the matching action.
2. Double-click the Transform Action icon on the rule line to open the configure the Transform Action.
3. Upload the stylesheet (.xsl file) by clicking the Upload… button.



Configure Transform Action

Input

Input: INPUT | INPUT ▾ *

Options

Transform

Use Document Processing Instructions:
- ○ Use an optional processing control file
- ○ Use XSLT specified in this action on a non-XML message
- ● Use XSLT specified in this action
- ○ Use XSLT specified in XML document processing instructions, if available

XSL style sheet: local:/// ▾ | cogpcb.xsl ▾ *

URL Rewrite Policy: (none) ▾

Asynchronous: ○ on ● off

Once the xsl stylesheet is correctly written and assuming the file is available locally on your workstation, you can upload it for the Transform Action to use.

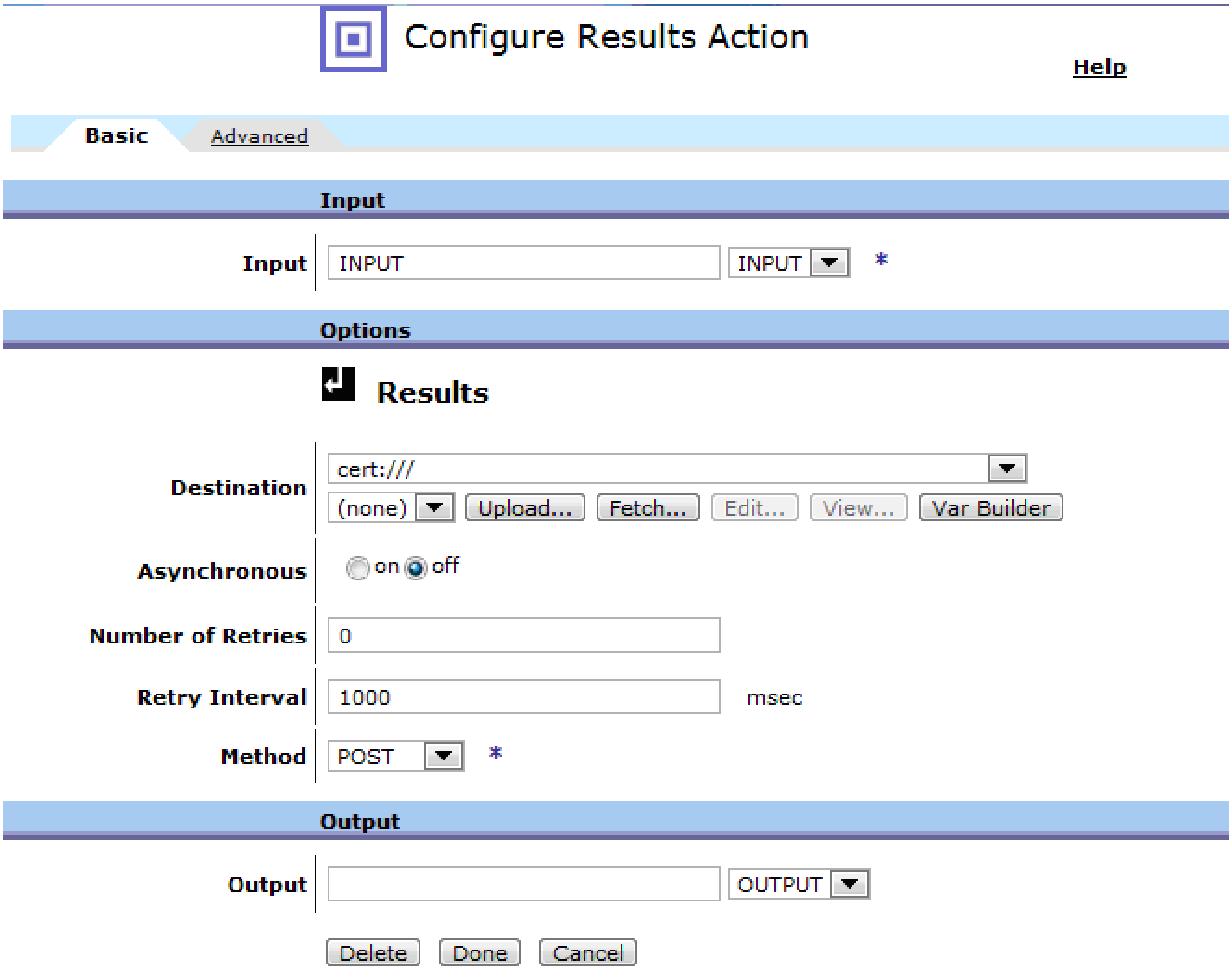
4e. Optionally, set up a Loop Feedback for testing purposes

Create an Advanced Action and select ‘Set Variable’. The variable name should be var://service/mpgw/skip-backside; set the variable assignment to 1. This prevents backside processing, because a DataPower enrichment scenario doesn’t require one.

A full list of DataPower variables for your appliance can be found in the file system in store://xml-mgmt.xsd.

4f. Configure Results Action

Results



Configure Results Action

Input

Input: INPUT | INPUT *

Options

Results

Destination: cert:/// | (none)

Asynchronous: ○ on ● off

Number of Retries: 0

Retry Interval: 1000 msec

Method: POST *

Output

Output: | OUTPUT

Enabling SQL calls in DataPower for IMS

In DataPower, SQL calls can be issued through:

- An *Extension Element*
- An *SQL Action*
- An *Extension Function*

Use the Extension Element to enable SQL calls in DataPower. You can also use an SQL Action or an Extension Function, but the SQL Action is best used for testing only, and the Extension Function is not covered in this guide.

For more information and code samples about issuing SQL calls in DataPower, see the article *Using WebSphere DataPower SOA Appliances to enable the Information as a Service pattern* in developerWorks at http://www.ibm.com/developerworks/websphere/library/techarticles/0812_callaway/0812_callaway.html.

Configuring an Extension Element

The Extension Element is an extended functionality that supports features such as parameterized SQL statements. Such statements have the following characteristics:

- Parameter markers are represented by question marks (‘?’) and act as placeholders for values
- All arguments are passed as XPath expressions

In the following example, an XSL style sheet executes an SQL SELECT call against the source ECEnvIMS1, which is defined to DataPower as an SQL Data Source. The SQL call is hardcoded into the <dp:sql-execute> element.

The SQL call is specified in the **statement** field. The statement specifies a query to the IMS Catalog through the IMS-defined program communication block (PCB) DFSCAT00.

The PSB name that is specified in the query must also be specified in the Data Source ID field when the SQL Data Source is configured. The PSB name must match an actual PSB defined in the IMS DB system.

The *match* attribute in <xsl:template> is the name that is used to invoke the query.

```
<xsl:stylesheet xmlns:dws="http://ibm.com/datatools/dsws/dataPower"
xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
xmlns:str="http://exslt.org/strings" xmlns:regexp="http://exslt.org/regular-
expressions" xmlns:dp="http://www.datapower.com/extensions"
xmlns:date="http://exslt.org/dates-and-times"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.0" extension-
element-prefixes="dp" exclude-result-prefixes="dp date str regexp dws">

<xsl:output method="xml" version="1.0" encoding="UTF-8" indent="yes"/>

      <xsl:template match="imsdb/">

            <xsl:variable name="dbd"/>

                  <dp:sql-execute source="'ECEnvIMS1'" statement="'select *
                  from DFSCAT00.PSB where PSB.IOASIZE = 600'"/>

      </xsl:template>

</xsl:stylesheet> .
```

The results should look like this:

```
      <sql result="success">

      <row>

      <column>

      <name>ROOT_ROOTKEY</name>
```

```
<value>1           </value></column>
<column>
<name>RNUM</name>
<value>4</value></column>
<column>
<name>CINT</name>
<value>10</value></column></row>
<row>
<column>
…
```

An invalid request results in an error message in the result XML.

Configuring an XSLT dp:sql-execute extension function

The dp:sql-execute Extension Function can execute an SQL statement against an IMS, DB2, Oracle, or Sybase database.

The syntax of this function is: dp:sql-execute(object, statement)

The timeout value for the dp:sql-execute extension function is the timeout value of the HTTP user agent for the appropriate XML manager. All arguments are passed as XPath expressions.

The following example shows the dp:sql-execute extension function:

```
<xsl:template match="/">
        <xsl:variable name="query">
                SELECT * FROM ORDERS WHERE customer_id =
                <xsl:value-of select="$customer_id"/>
                AND total > <xsl:value-of select="$min_total"/>
        </xsl:variable>
        <xsl:variable name="result" select="dp:sql-execute('db2datasource',$query)" />
        <xsl:copy-of select="$result" />
</xsl:template>
```

Testing DataPower support for access to IMS databases

After you have configured DataPower and IMS for access to IMS databases, you need to test your configuration. There are a variety of methods and resources you can use, such as:

- The DataPower cURL command
- An SQL Action

- Set Variable Action

Testing DataPower for IMS DB connection using cURL

You can use a cURL command to test the connectivity between DataPower and IMS. The following is an example of the cURL command:

curl -X POST -H "Content-Type: text/xml" -d@test.xml http://9.30.132.170:88/ECMachine/xsl/

CURL requests should follow this syntax:

```
curl –X POST –k –u <username>:<password> -d @data.xml
http://<hostname>:<port>/<matchURL>/
```

Where:

- <username> is your DataPower login username
- <password> is your DataPower login password
- <hostname> is the host address of your DataPower appliance
- <port> is the port specified in your HTTP Front Side Handler
- <matchURL> is the URL name specified in your Match Action (see 4. Defining a Processing Policy for IMS DB access)

data.xml would look something like this:

```
<?xml version="1.0" encoding="UTF-8"?>

<tsint/>
```

Where <tsint/> invokes the template whose *match* attribute is 'tsint'. A different value inside this element would invoke a different template element in your XSLT.

Configuring an SQL action

Another way to direct payload from a web service to a given IMS through DataPower is using the SQL Action.

An SQL Action retrieves data from a data source for further processing by the processing policy. There are three ways to specify a query:

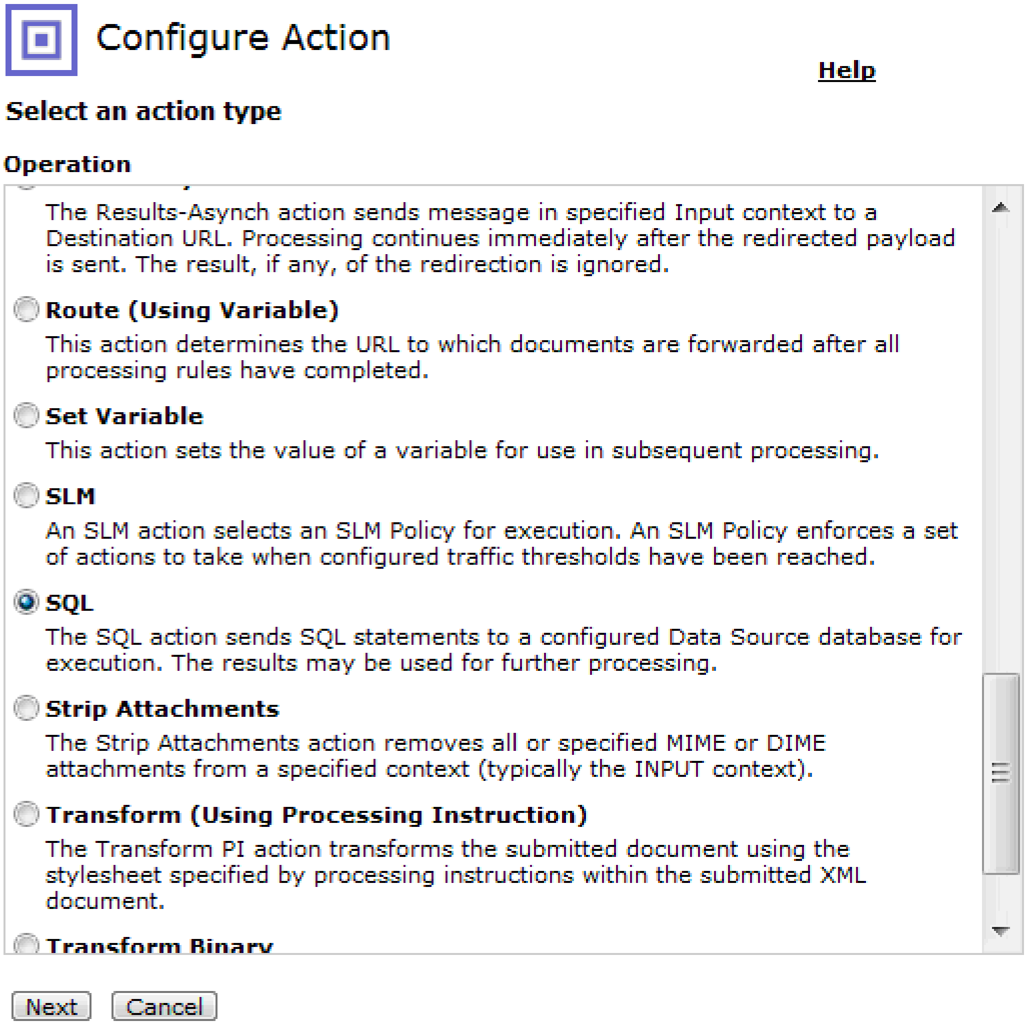
- A static SQL or XQuery statement
- A query string within a preprocessed DataPower variable
- A query generated from XSLT

An SQL Action is not a particularly flexible way to use SQL in DataPower, and the best practice to use the extension element that is described in Configuring an XSLT dp:sql-execute extension element.

The SQL Action can be useful for testing, because it is easy to configure and use. It is basically a pointer to a pre-defined SQL Data Source (IMS) with a specific query to perform.

After defining a processing policy, as described in 4. Defining a Processing Policy for IMS DB access, you can configure an SQL Action in the Create Rule panel by using the following steps:

1. Drag the Advanced Action icon, Advanced, onto the rule line.
2. Double click the Advanced Action icon to open the Configure Action panel.
3. Select SQL from the list of operations.
4. Click Next. The Configure SQL Action panel displays.



Configure Action

Help

Select an action type

Operation

The Results-Asynch action sends message in specified Input context to a Destination URL. Processing continues immediately after the redirected payload is sent. The result, if any, of the redirection is ignored.

○ **Route (Using Variable)**
This action determines the URL to which documents are forwarded after all processing rules have completed.

○ **Set Variable**
This action sets the value of a variable for use in subsequent processing.

○ **SLM**
An SLM action selects an SLM Policy for execution. An SLM Policy enforces a set of actions to take when configured traffic thresholds have been reached.

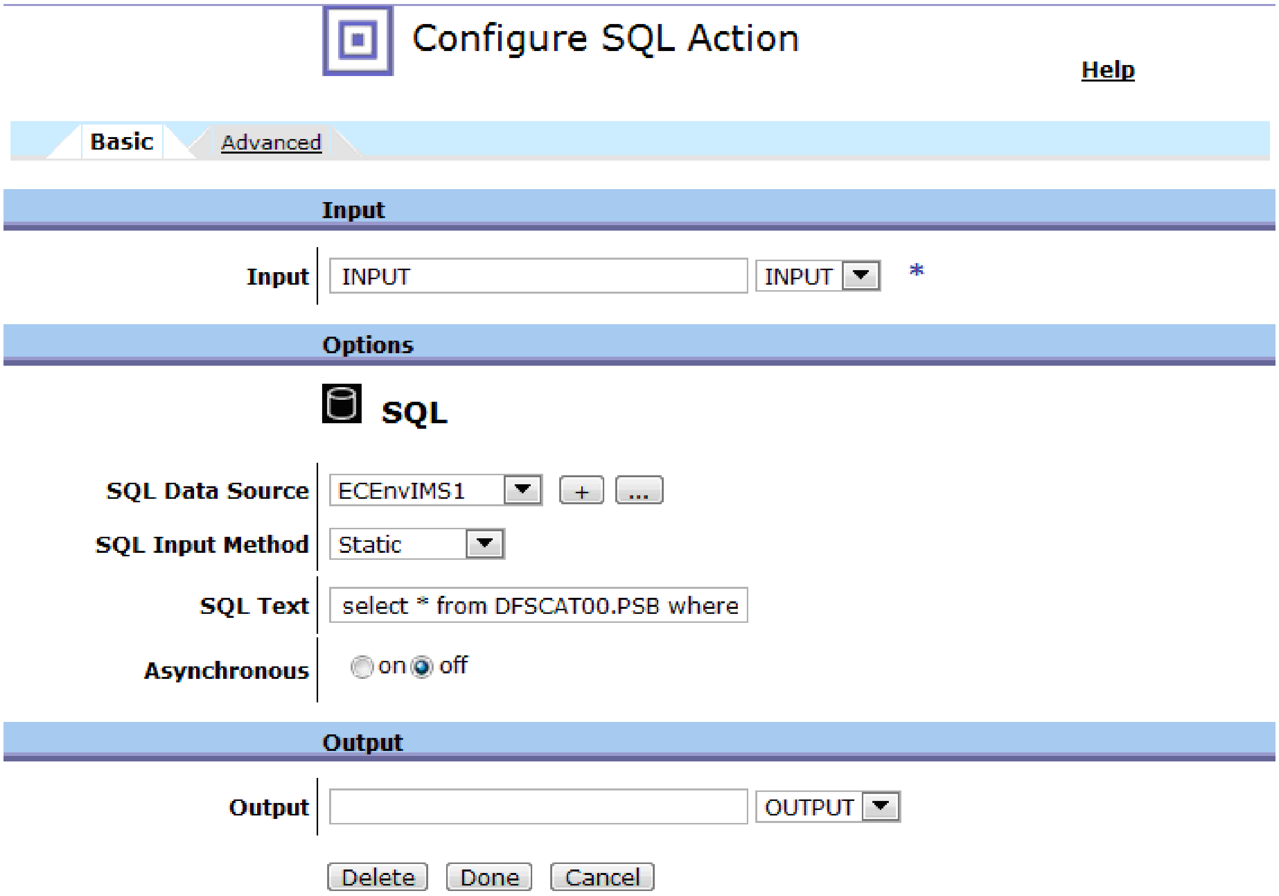
● **SQL**
The SQL action sends SQL statements to a configured Data Source database for execution. The results may be used for further processing.

○ **Strip Attachments**
The Strip Attachments action removes all or specified MIME or DIME attachments from a specified context (typically the INPUT context).

○ **Transform (Using Processing Instruction)**
The Transform PI action transforms the submitted document using the stylesheet specified by processing instructions within the submitted XML document.

○ **Transform Binary**

5. In the Configure SQL Action panel, specify:
    - INPUT in the Input field
    - The IMS PSB name in the SQL Data Source field
    - Static in the SQL Input Method field
    - The SQL call in the SQL Text field



Configure SQL Action

Input

Input: INPUT | INPUT *

Options

SQL

SQL Data Source: ECEnvIMS1

SQL Input Method: Static

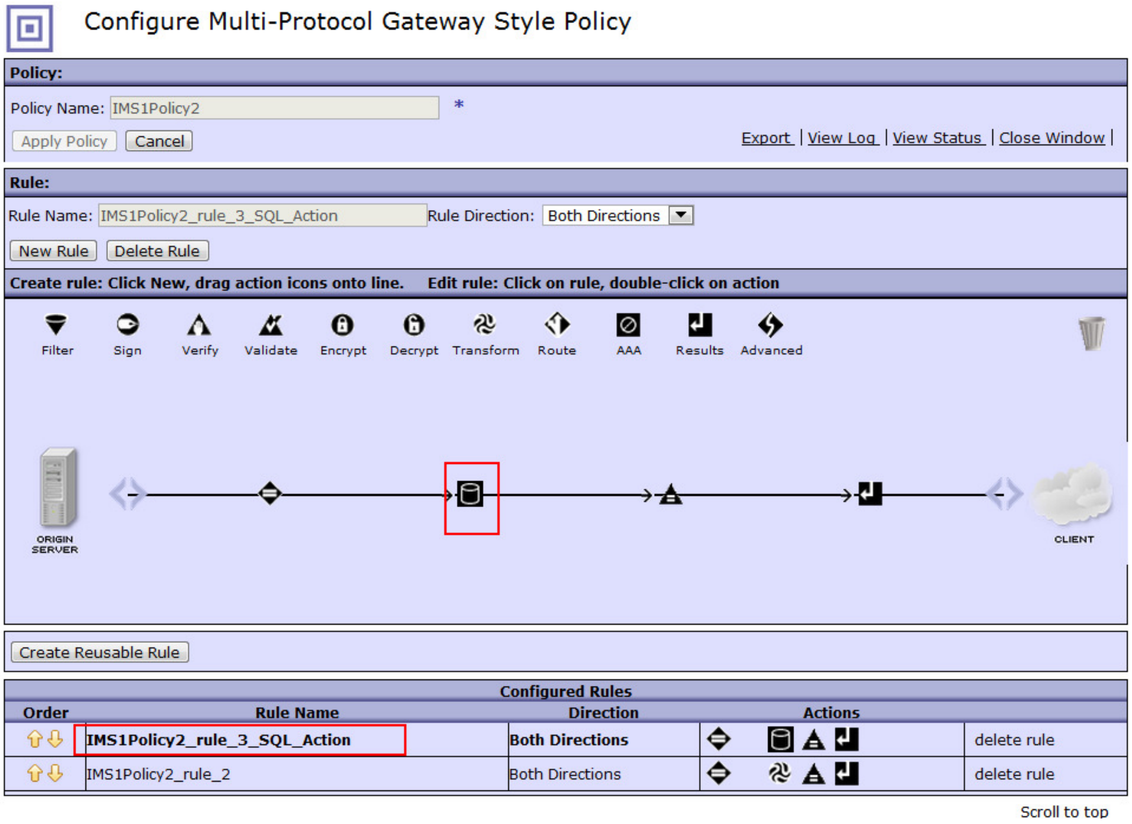
SQL Text: select * from DFSCAT00.PSB where

Asynchronous: ○ on ● off

Output

Output: | OUTPUT

After the SQL Action is added to the rule, the rule should look similar to the rule shown in the following figure:



Configure Multi-Protocol Gateway Style Policy

Policy:

Policy Name: IMS1Policy2 *

Rule:

Rule Name: IMS1Policy2_rule_3_SQL_Action Rule Direction: Both Directions

Create rule: Click New, drag action icons onto line. Edit rule: Click on rule, double-click on action

Configured Rules

Order	Rule Name	Direction	Actions	
⇧⇩	IMS1Policy2_rule_3_SQL_Action	Both Directions		delete rule
⇧⇩	IMS1Policy2_rule_2	Both Directions		delete rule

To drive the SQL Action, you can use cURL command that has the keyword specified in the Match Action for the IMS1Policy2_rule_3_SQL_Action. For example:

```
curl -X POST -H "Content-Type: text/xml" -d@test.xml http://192.0.2.0:88/ECMachine/sqlact/
```

Configuring Set Variable Action

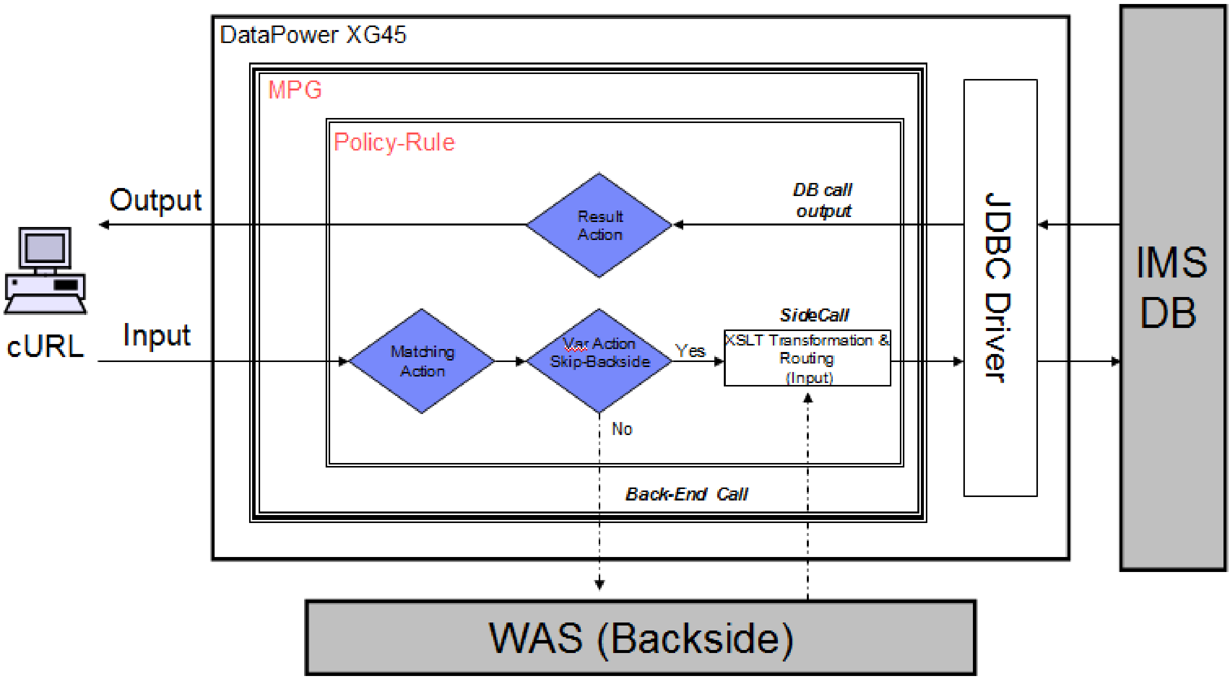
For connection testing purposes, defining a *Set Variable Action* with the *skip-backside* variable can be useful.

If your configuration includes a back-end server, such as Web Application Server, using the skip-backside variable might useful. The skip-backside variable essentially converts a processing rule to provide a loopback action: instead of sending transformed request data to a backend server, the data is echoed back to the client immediately.

This can be a convenient way to set up tests that are not dependent on a backend server.

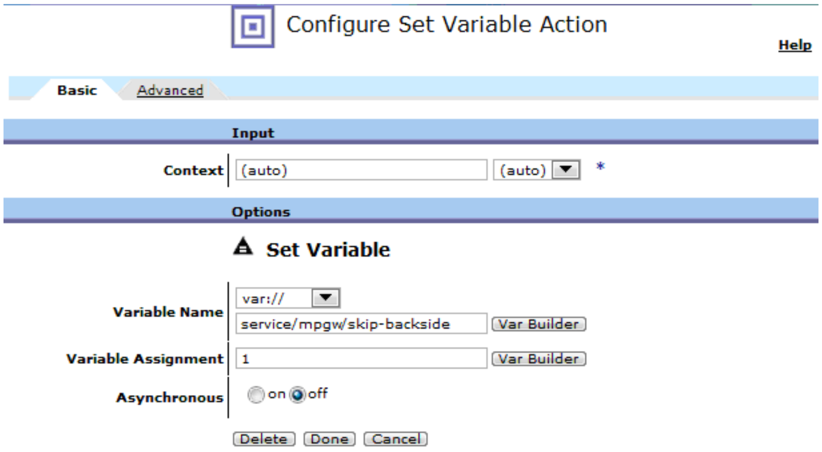
The following figure shows how a skip-backside Variable Action can be used within DataPower.

Basic Input / Output flow for IMS DB



The SQL request (IMS DB call) is a *SideCall*, which is usually used to *enrich* the data in requests and responses. The SideCall method is often used, and is sometimes referred as an "enrichment" scenario.

Regardless, the Variable Action Skip-Backside is not required, and is not likely to be useful outside of a test environment.



Configure Set Variable Action

Help

Basic | Advanced

Input

Context	(auto) (auto) *

Options

Set Variable

Variable Name	var:// service/mpgw/skip-backside [Var Builder]
Variable Assignment	1 [Var Builder]
Asynchronous	○ on ● off

[Delete] [Done] [Cancel]

Configuring access to IMS transactions

To configure DataPower and IMS to support access to the IMS TM server, you need to configure components in both the IMS and DataPower environments:

In the IMS environment, you need to configure:

- OTMA
- IMS Connect

In the DataPower environment, you need to configure:

- Multi-Protocol Gateway
- IMS Connect access for provider

Configuring IMS components for access to IMS TM from DataPower

To support access to IMS TM from DataPower, the configuration steps in IMS are generally the same as they are for configuring access to IMS TM from any other IMS Connect client:

- OTMA must be enabled in the IMS system
- IMS Connect must be configured for IMS TM access with a DATASTORE configuration statement

Enabling OTMA

If OTMA is not already enabled in the IMS system, you can enable it by specifying the z/OS® cross-system coupling facility (XCF) group name and IMS OTMA member name during IMS system definition.

OTMA is installed with IMS TM. The IMS INSTALL/IVP Dialog is not used to install OTMA.

To start OTMA, you can use the OTMA=Y startup parameter in the IMS procedure during IMS system definition or, after an IMS restart, issue the type-1 command /START OTMA.

Configuring IMS Connect for access to IMS TM from DataPower

In addition to HWS and TCPIP configuration statements, you must define a DATASTORE configuration statement when configuring IMS Connect to support access to IMS TM from DataPower. A DATASTORE statement defines a connection between IMS Connect and the IMS TM system on which the transactions will run.

IMS Connect configuration statements are defined in the IMS Connect HWSCFG*xx* member of the IMS.PROCLIB data set to support access to IMS TM through DataPower.

When you configure the IMS Connect object in DataPower, you must specify the ID of the DATASTORE statement that identifies the target IMS TM system. You specified this ID in the **Data Store ID** field.

When you configure the IMS Connect object in DataPower, the port number you specify must match the port number specified for DataPower in the TCPIP configuration statement.

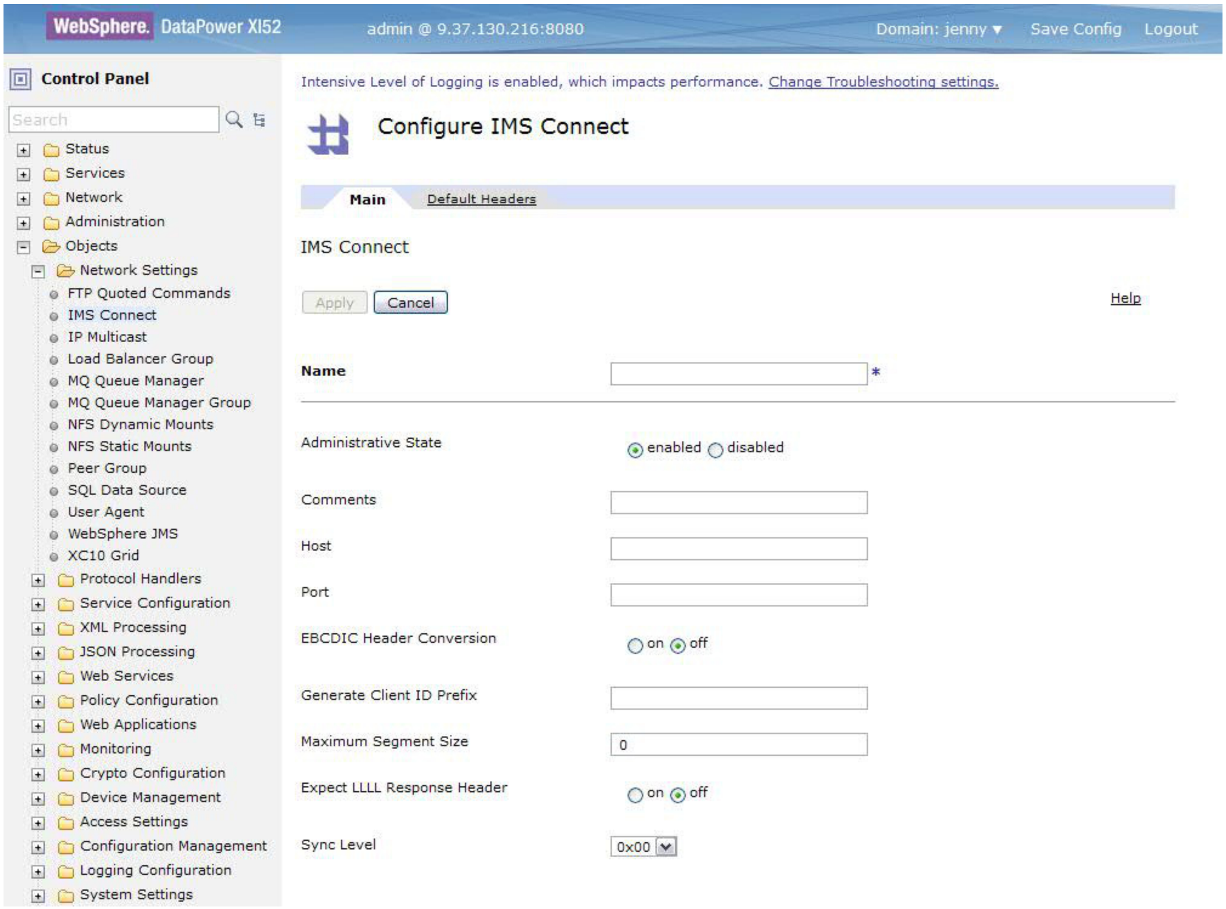
By default, IMS Connect uses the HWSSMPL1 user message exit routine to support access to IMS TM through DataPower. You can override this value when you configure the IMS Connect object in DataPower.

Configuring DataPower IMS Connect object for access to IMS TM

The main menu (see the following figure) is where you configure the Host, Port, Conversion, and a Client _ID prefix information for the DataPower IMS Connect object, as well as other properties, including those in the following list. For the most up to date information, see IMS Connect in the WebSphere DataPower Integration Appliance documentation in the IBM Knowledge Center..

- **Host**: Specify the host name or IP address of the IMS TCP/IP server, IMS Connect
- **Port**: Specify the port on which the IMS TCP/IP server is running.
- **EBCDIC header conversion**: This option can be turned on for converting the headers to EBCDIC. The IMS Connect user message exit can process EBCDIC data. Some IMS Connect exits can handle both UTF-8 and EBCDIC. This conversion affects only the headers. Use transformation to do any data conversion in the policy.
- **Generate client ID prefix**: A two-letter prefix for the generated client ID. "DP" is used if not specified.
- **Maximum segment size**: Set to 1 to have DataPower automatically calculate the length of the data and insert the length into a 4-byte LLZZ data in the byte stream when sending data to IMS. If this field is not set or is set to zero, DataPower does not add the 4-byte LLZZ length field that is expected by IMS and IMS rejects the byte stream sent from DataPower.
- **Expect LLLL response header**: When “on” is specified DataPower expects the response messages that are returned from IMS to include the length of the response message in an LLLL response header. If the LLLL response header is not included with a response message, the response message will time out in DataPower without being delivered.
- **Sync Level**: Specifies the IMS synchronization level to use. Valid values are:
  - **0x00**, which specifies an IMS Sync Level of NONE.
  - **0x01**, which specifies an IMS Sync Level of CONFIRM. When a transaction specifies 0x01, the client must send an ACK or a NAK after it processes the response. The IMS Connect server then sends DEALLOCATE CONFIRM (successful) or DEALLOCATE ABORT (unsuccessful) to the client. The DataPower appliance always

sends an ACK on receiving the response and then checks for the DEALLOCATE CONFIRM.



Intensive Level of Logging is enabled, which impacts performance. Change Troubleshooting settings.

Configure IMS Connect

IMS Connect

Name	*
Administrative State	● enabled ○ disabled
Comments	
Host	
Port	
EBCDIC Header Conversion	○ on ● off
Generate Client ID Prefix	
Maximum Segment Size	0
Expect LLLL Response Header	○ on ● off
Sync Level	0x00

Additional parameters that need to be customized are:

- **Exit Program**
  The IMS Connect user message exit routine to use for all the IMS connections.
- **Client ID**
  A string of 1 to 8 uppercase alphanumeric (A through Z, 0 to 9) or special (@, #, $) characters, left justified, and padded with blanks. It specifies the name of the client ID that is used by IMS Connect. If this string is not supplied from the client, then the IMS Connect user message exit routine generates it.
- **Transaction code**
  The code of the transaction to invoke in IMS.

- **Data store**
  It specifies the Datastore name (IMS destination ID).
- **Logical terminal name**
  The LTERM override value to be used by OTMA.
- **RACF ID**
  The plain text string sent to the server for identifying the client.
- **RACF Password**
  The host security password used to login to the IMS TCP/IP server, IMS Connect.
- **RACF Group**
  The group the Host security ID belongs to.
- **Encoding scheme**
  Select the Unicode encoding schema. Leave as (none) to be set dynamically in the IMS header.
- **IRM Timer**
  Specifies the amount of time that IMS Connect waits for IMS to return response data. An example value of 21 would set an IRM Timer value of 0.21 sec. For IMS Version 13 information about specifying timeout values, see IMS Connect timeout specifications in the IMS documentation at http://www.ibm.com/support/knowledgecenter/SSEPH2_13.1.0/com.ibm.ims13.doc.ccg/ims_ct_timeout_specs.htm.

After applying the changes, the confirmation panel appears.

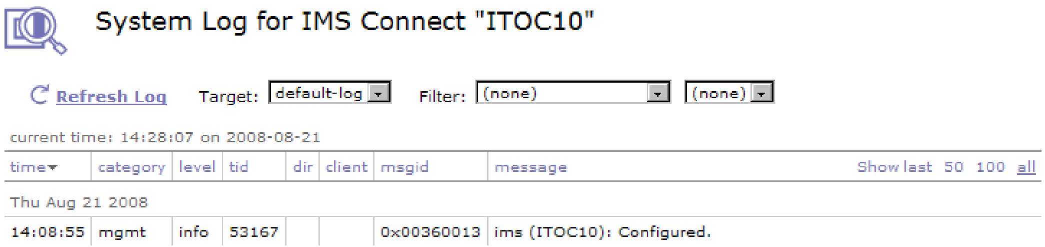
On the View Status Panel, the Object Status of the recently added IMS Connect Object is displayed.

Status:

- Invalid: Invalid Configuration
- Saved: Persisted Configuration
- New: New Configuration
- Modified: Modified Configuration
- Deleted: Deleted Configuration
- External: External Configuration

System log for the DataPower IMS Connect object

The system log for the IMS Connect object is where DataPower displays the activities associated with a connector. In this example, `Event Code 0x00360013 - Configured', indicates a valid configuration. The object is configured but not active at this time



System Log for IMS Connect "ITOC10"

Target: default-log

Filter: (none) (none)

current time: 14:28:07 on 2008-08-21

time	category	level	tid	dir	client	msgid	message
Thu Aug 21 2008							
14:08:55	mgmt	info	53167			0x00360013	ims (ITOC10): Configured.

Monitoring and Analyzing Performance of a DataPower for IMS Solution

Monitoring the health and capacity of the DataPower and IMS components in a DataPower for IMS solution is important to ensure that all of the components are functioning correctly and efficiently.

Monitoring not only notifies administrators of exceptions, it also provides trending analysis for managing the various components. Performance measurements can help assess their capacity utilization over time, thus enabling the organization to maximize its return-on-investment and properly manage increases in network volumes, exploit the solution potential capacity and help reaching the desired Service Level Agreements.

The following sections in this topic describe the basic methodology and the key pieces of data needed when performing Monitoring and Performance analysis of the DataPower for IMS solution. This basic methodology applies to all types of DataPower support for IMS; however, the DataPower support for IMS synchronous callout requests is used to provide the examples in this topic.

For the DataPower section the information reported is based on the Firmware Revision 6.0.0.0. Status indicators can change between DataPower firmware revisions, so check the latest firmware documentation for any additions or modifications to monitoring components.

IMS Monitoring and Performance Analysis

Comparing current performance against a performance baseline is often the best method for evaluating performance, so it is important to establish a performance baseline for the IMS dependent regions, IMS Connect, and applications that use synchronous callout and ICAL calls. Any configuration changes to improve performance of either IMS or DataPower can then have a meaningful context to assess the benefit demonstrated by the new measurements.

It should be noted that even with the same operating system, storage, and processor configurations, variations in workload and network conditions can cause significant differences in performance; therefore workload and network conditions must also be taken into account when comparing current performance against a baseline.

While the performance and monitoring activity is a relatively complex activity, this chapter focuses on only the steps necessary to collect data and evaluate DataPower support for IMS and IMS synchronous callout processing. This information is more of a general guide than a comprehensive reference.

Although z/OS and IMS provide helpful no-cost monitoring tools, such as the IMS Monitor, your installation might need additional tools to collect all of the data required for a complete IMS performance evaluation. This guide does not document all available tools; however, the following list includes some of the tools that IBM provides for performance analysis.

- IBM® IMS™ Performance Analyzer for z/OS® (IMS PA): a performance analysis and tuning aid for IMS Database (IMS DB) and Transaction Manager (IMS TM) systems. An example of how to use IMS PA for synchronous callout performance measurements is included in this guide.
- IBM® IMS™ Connect Extensions for z/OS is an excellent tool for monitoring and recording IMS Connect activity. Detailed journaling and reporting provides information to help you analyze performance, throughput, resource availability, and security related to IMS Connect traffic. This tool can be useful for understanding possible throughput bottlenecks and for measuring transaction transit times, which is the amount of time it takes IMS Connect to get a response to messages sent to either DataPower or OTMA in IMS.
- IBM® IMS™ Problem Investigator for z/OS (IMS PI) can be used in a performance and monitoring context to obtain a single, logical, end-to-end picture of a transaction's life cycle. Even without an expert understanding of log data structures and the relationships between log records, the IMS PI interactive ISPF panels enable a drill-down analysis of any performance issue that is highlighted in IMS PA reports.

For a more comprehensive overview of IMS performance monitoring and tuning information refer to the IBM Redbook: IMS Performance and Tuning Guide (IBM Form Number SG24-7324-00 or ISBN 0738494615)

Collecting processing and performance data in IMS

You can collect data about the IMS processing of messages sent to and received from a DataPower appliance by issuing commands in IMS. These commands return key information for determining the level of performance in IMS.

In particular, the following three commands are useful for collecting data about performance.

- /TRACE SET (ON/OFF) MONITOR ALL
- /CHECKPOINT STATISTICS
- /SWITCH OLDS

Use caution when issuing these commands in a production environment, because the processing of some of these commands can significantly impact the performance of your system and the amount of logging performed by IMS on the OLDS data set.

/TRACE SET (ON/OFF) MONITOR ALL

Use this command to activate the IMS™ Monitor. This feature collects data while the online IMS subsystem is running and gathers information for all dispatch events. This information is then placed in the form of IMS Monitor records (specifically log records with the ID of x’78’ and x’79’) in a sequential data set. Use the IMSMON DD statement in the IMS control region JCL to specify the IMS Monitor data set.

Make sure that your monitor data sets have been cleared from any previous run.

Monitor log records can be later made available as input to your performance analysis tool, such as IMS PA. IMS PA can generate reports, including a resource usage report for synchronous callout activity analysis and for the average response time for ICAL calls.

The IMS master terminal operator (MTO) can start and stop the IMS Monitor to obtain snapshots of the system at any time. However, be mindful that the IMS Monitor adds to system overhead and generates a considerable amount of data.

/CHECKPOINT STATISTICS

Use this command to collect performance related statistics and to write dedicated log records to the system log data set (for example, the OLDS).

Statistics records provide a useful guide to the performance of IMS resources, including the IMS message queue, various buffer pools, transaction control blocks (TCBs), Internal Resource Lock Manager (IRLM), and many others. Entering this command during a workload analysis is a key part of the performance evaluation process and an essential piece of information when the IMS PA is used.

The beginning of this particular type of checkpoint is delimited in the OLDS by a record with the ID of x’4001’ (Checkpoint Begin) and x’45FF’ (End of Statistics). The records containing the actual statistics and performance information use a record ID x’45xx’.

Note: when high volumes of workload are processed by IMS, this command can take a considerable amount of time to complete.

/SWITCH OLDS

Whichever performance analysis tools you use to process IMS log data and IMS Monitor data, it is advisable to have the beginning and end of the statistics/performance records isolated in a specific IMS OLDS dataset. You can use two /SWITCH OLDS commands to control in which system log data set the data is recorded. Use the message DFS3257I to identify the log DD used in the IMS start up procedure that indentifies the OLDS datasets names.

```
DFS3257I ONLINE LOG NOW SWITCHED - FROM DFSOLP01 TO DFSOLP02
DFS058I 17:12:53 SWITCH COMMAND COMPLETED
```

In a typical performance analysis data collection scenario, you can issue the following sequence of commands to gather the necessary information:

1. /TRACE SET ON MONITOR ALL
2. /SWITCH OLDS
3. /CHE STATISTICS
4. Assuming that your workload is being executed wait for some time period, 5 minutes, for example
5. /CHE STATISTICS

6. /SWITCH OLDS
7. /TRACE SET OFF MONITOR ALL

You can use the information collected in the OLDS as input to the IMS PA.

Statistics analysis using **IMS Performance Analyzer for z/OS**

IBM IMS Performance Analyzer (IMS PA) provides comprehensive reports on transaction performance and system resource usage for IMS DB and IMS TM systems. You can use these reports for monitoring, tuning, managing service levels, analyzing trends, and capacity planning.

You can use IMS PA to process the IMS Monitor datasets and produce reports that can help determine the level of performance of synchronous callout and other types of DataPower support.

IMS PA provides several different reports organized in categories. In this guide, we focus on the Resource Usage reports.

The Resource Usage reports provide a detailed analysis of the usage of IMS™ resources, including:

- Synchronous callout
- Buffer Pools; including Message Queue, OSAM, VSAM, and Message Formatting
- Latches
- Communication
- Multiple Systems Coupling (MSC)
- External Subsystems

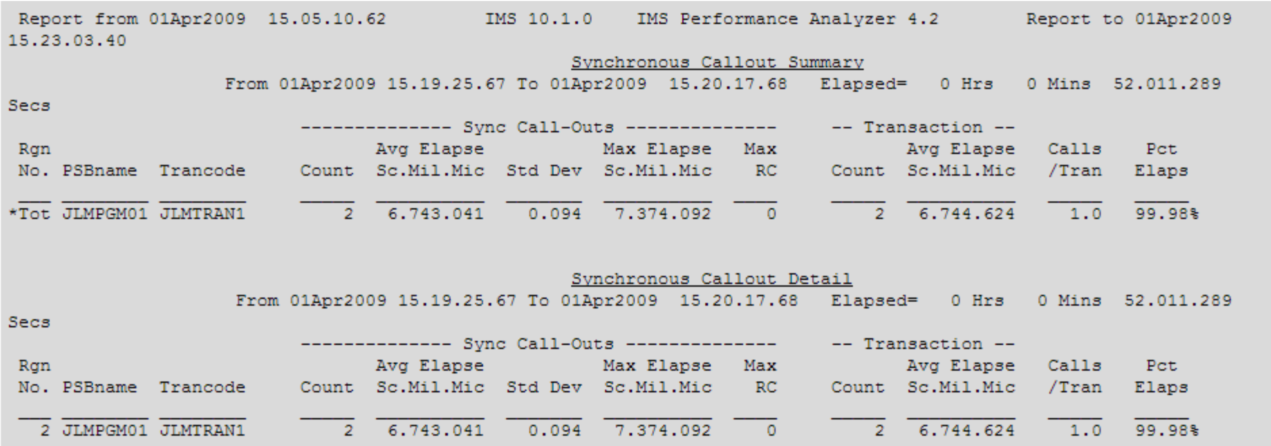
The Synchronous Callout report in particular provides a detailed analysis of synchronous callout activity and ICAL calls in regions and by application programs. Since this report is derived by the processing of the IMS monitor Records 78 and 79, the IMS Monitor must be active throughout the time span during which you intend to evaluate performance.

To obtain the report, select the Synchronous Callout report in the Monitor Report Set and specify a DDname for the output data set for this report. The format of the operand is:

```
          IMSPAMON     SYNCCOUT(
                      [DDNAME(ddname)])        default SYNCCOUT
```

Individual subsystem activity is broken down by Region and Program, with statistics of synchronous callout activity per transaction. Among other information you can find the average response time. This is key information needed to determine how long it is taking for the ICAL request to complete and a response to be received by a given IMS transaction and program.

The following figure shows an example of the report.



```
 Report from 01Apr2009  15.05.10.62         IMS 10.1.0    IMS Performance Analyzer 4.2        Report to 01Apr2009
15.23.03.40
                                                    Synchronous Callout Summary
                    From 01Apr2009 15.19.25.67 To 01Apr2009  15.20.17.68   Elapsed=   0 Hrs   0 Mins  52.011.289
Secs
                           -------------- Sync Call-Outs --------------     -- Transaction --
 Rgn                              Avg Elapse           Max Elapse   Max            Avg Elapse   Calls    Pct
 No. PSBname  Trancode     Count  Sc.Mil.Mic  Std Dev  Sc.Mil.Mic    RC     Count  Sc.Mil.Mic   /Tran   Elaps
 ___ ________ ________     _____  __________  _______  __________  ____     _____  __________   _____   _____
*Tot JLMPGM01 JLMTRAN1         2   6.743.041    0.094   7.374.092     0         2   6.744.624     1.0   99.98%

                                                    Synchronous Callout Detail
                     From 01Apr2009 15.19.25.67 To 01Apr2009  15.20.17.68   Elapsed=   0 Hrs   0 Mins  52.011.289
Secs
                           -------------- Sync Call-Outs --------------     -- Transaction --
 Rgn                              Avg Elapse           Max Elapse   Max            Avg Elapse   Calls    Pct
 No. PSBname  Trancode     Count  Sc.Mil.Mic  Std Dev  Sc.Mil.Mic    RC     Count  Sc.Mil.Mic   /Tran   Elaps
 ___ ________ ________     _____  __________  _______  __________  ____     _____  __________   _____   _____
   2 JLMPGM01 JLMTRAN1         2   6.743.041    0.094   7.374.092     0         2   6.744.624     1.0   99.98%
```

The report contains the following fields and information:

Rgn No.

The Region number.

PSBname

The PSB (program) name.

Trancode

The transaction code.

Sync Call-Outs

Count
The number of synchronous callout requests.

Avg Elapse Sc.Mil.Mic
The average elapsed time of a synchronous callout request, in microseconds.

Std Dev
The standard deviation of the elapsed time of the synchronous callout requests.

Max Elapse Sc.Mil.Mic
The maximum elapsed time of a synchronous callout request, in microseconds.

Max RC
The maximum return code from a synchronous callout request.

Transaction

Count

The number of transactions that issued the synchronous callout requests.

Avg Elapse Sc.Mil.Mic

The average elapsed time of the transactions, in microseconds.

Calls/Tran

The average number of synchronous callout requests made by a transaction.

Pct Elaps
The percentage of time that transactions spent processing synchronous callout requests.

For more information about how to analyze a Synchronous Callout report, see *Synchronous Callout report* in the IMS PA documentation at http://www.ibm.com/support/knowledgecenter/SSAVHQ/welcome?lang=en.

Key Data and fields to create a performance baseline report

The key data points can vary by user based on how and where an ICAL call is used. For example, if an application issued one ICAL call from an IMS transaction, some key data might include:

- From IMS Performance Analyzer Summary Report
  - Transaction count (Tran Count) for the transaction of interest – this can be used with the interval duration to determine the transaction rate of the given transaction
  - Average Input Queue Time – If this time is high than that means your transaction is waiting to be scheduled into a dependent region. If there is a need to reduce transaction elapsed time then more IMS Dependent Regions can be made available to process the transaction.
  - Average Processing Time – This time can be used along side other data, such as Synchronous Average Elapsed time from the IMS PA Synchronous Callout Summary report. With this information you can make an assessment of how much time is accounted for by ICAL processing as opposed to non-ICAL processing.
  - Average Output Queue Time – The time that IMS is waiting for a client to receive the output of the transaction after the output is ready.
  - Average Total IMS time – This should be roughly the sum of the time in the input and output queue time and the processing time.
- From IMS Performance Analyzer Synchronous Callout Summary Report
  - Average Elapsed (Avg Elapse) Time – The average elapsed time for the ICAL calls within the transaction.
  - Maximum Elapsed (Max Elapse) Time – The maximum elapsed time for an ICAL call for a given transaction.
- Application knowledge
  - It is helpful to have information about the running application, such as the number of ICAL calls, the sizes of request and response messages, and other non-ICAL types of processing, to get a feel for where time is being spent in the application.

- Configuration Information
    - The number of TPIPEs utilized for ICAL calls in your application
    - The number of IMS dependent regions that can make concurrent ICAL requests at a given time

  This information is helpful to ensure you have enough TPIPEs to handle the parallel load

Monitoring message processing in DataPower

DataPower provides information about general system health, as well as the consumption of resources and services. Physical parameters range from the temperature of CPUs, utilization of memory and file system, interface utilization, and voltage reading, among other physical values. In addition, there are more formulaic indicators, such as System Usage, which is a calculation of system capacity.

In a DataPower for IMS solution there are only few areas you should focus on to determine the general system health, and if the system capacity is acceptable for the workload received.

- System Usage
- CPU
- Memory Usage
- Message Flow Statistics

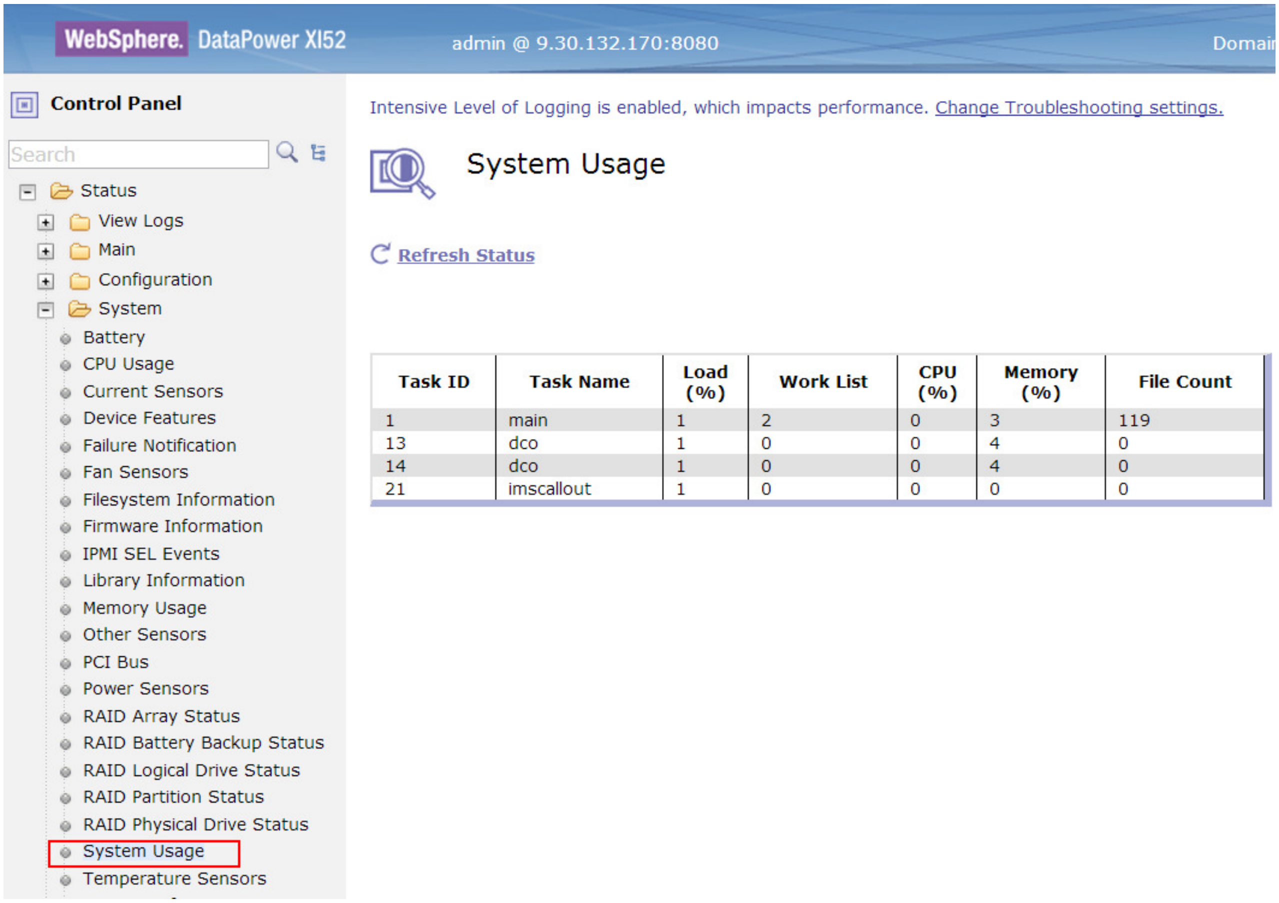
You can view this information in a variety of ways. While you can use **show** commands in either the Web GUI or the Command Line Interface (CLI) to browse a list of status values, this guide covers the Web GUI only.

While device-level data is automatically enabled, transaction data such as transaction rates or transaction times is usually available only when Statistics are enabled on the device. There are exceptions to this generalization. For example, CPU status requires statistic enablement, while System Load does not. Each domain must have its individual Statistics setting enabled to provide domain-specific status.

System Usage

System Usage is a measurement of the device's ability to accept additional work. It is a formulaic calculation based on various components of system load. System Usage is typically considered the best single indicator of overall system capacity. While it may sometimes spike to 100%, typical values are less than 75%.

The following figure shows system usage status.



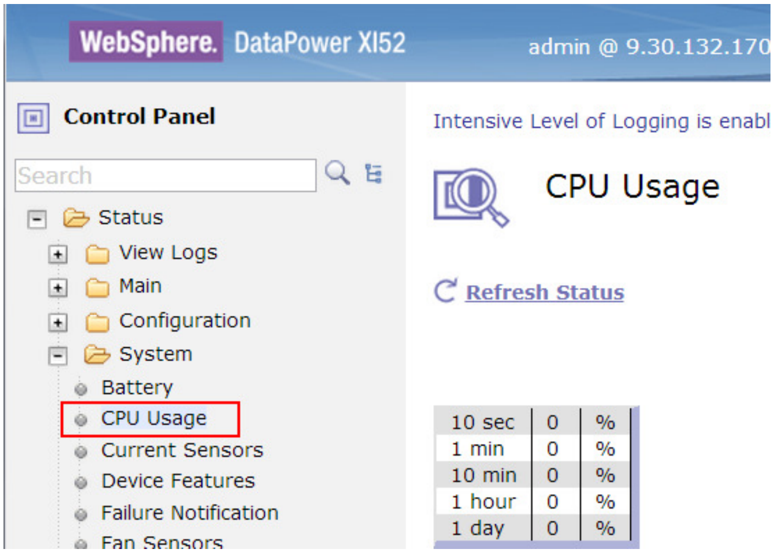
Intensive Level of Logging is enabled, which impacts performance. Change Troubleshooting settings.

System Usage

Task ID	Task Name	Load (%)	Work List	CPU (%)	Memory (%)	File Count
1	main	1	2	0	3	119
13	dco	1	0	0	4	0
14	dco	1	0	0	4	0
21	imscallout	1	0	0	0	0

CPU Usage

CPU Usage statistics are provided over five time intervals. Many customers are accustomed to monitoring CPU utilization, but this metric in DataPower is not as reliable as System Usage in determining device capacity. DataPower is self-optimizing, and spikes in CPU that are unassociated with traffic levels can occur as the device performs background activities. CPU usage can sometimes spike up to 100%, but this level is not necessarily a concern, unless it is sustained over numerous consecutive polls.



Intensive Level of Logging is enabl

CPU Usage

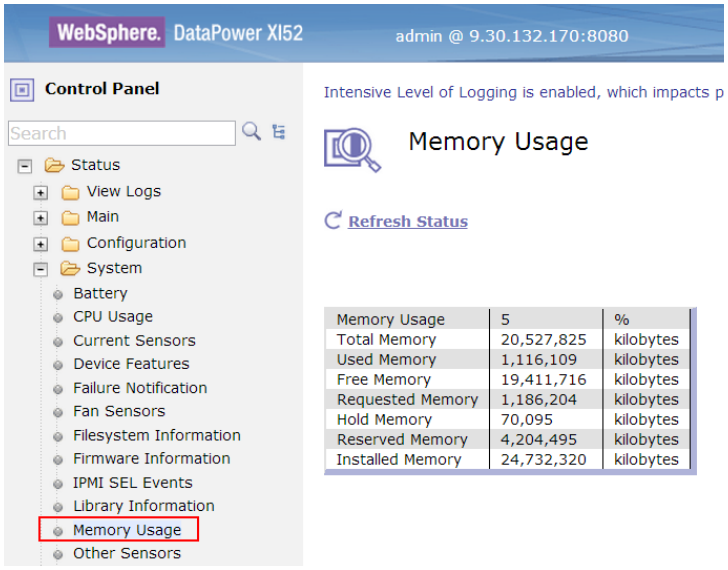
10 sec	0	%
1 min	0	%
10 min	0	%
1 hour	0	%
1 day	0	%

Memory Usage

Memory Usage statistics are provided for various classifications of the flash memory of the appliance. Statistics include the percentage of total memory in use, as well as the amount of memory in bytes that is used and free.

Again establishing a baseline before and after you introduce a given workload helps create a context and assign a meaning for the information you collect.

The percentage of used memory depends on the application, the size of the request and response messages, and the volume and latency of requests. Typical utilization runs less than 80%, and statistics beyond this threshold are of concern. You can use the device’s Throttle Settings to temporarily slow down request processing or to perform a warm restart, which recaptures memory in this situation.



Intensive Level of Logging is enabled, which impacts p

Memory Usage

Memory Usage	5	%
Total Memory	20,527,825	kilobytes
Used Memory	1,116,109	kilobytes
Free Memory	19,411,716	kilobytes
Requested Memory	1,186,204	kilobytes
Hold Memory	70,095	kilobytes
Reserved Memory	4,204,495	kilobytes
Installed Memory	24,732,320	kilobytes

Data maps with WebSphere Transformation Extender

WebSphere Transformation Extender (WTX) is recommended for DataPower to support data transformation for synchronous callout requests from IMS. Using WTX, you generate and deploy the data transformation maps that DataPower uses to transform a callout request from the data format used in IMS to the data format used by the data or service provider on the DataPower backside.

You build and deploy the maps by using the WTX Map Designer. The WTX maps are then deployed in DataPower.

Before you create a map in WTX, you need to create type trees that define both the data format used in IMS and the data format used by the backside service. You use the WTX Type Designer to create the type trees.

For detailed information about creating data transformation maps and type trees, refer to the WTX documentation in the WebSphere Transformation Extender information center at http://www.ibm.com/support/knowledgecenter/SSVSD8/welcome.

The high-level steps that are required to generate the maps that enable DataPower to transform data between IMS transaction and Web Services include:

1. Importing into WTX the COBOL copybook or PL/I Imports of the IMS application program
2. Generating the XML schema or importing the XML schema from the Web Service
3. Creating the type trees for the COBOL or PL/I and the XML schema
4. Creating the compiled map
5. Testing the map locally in WTX
6. Deploy and use the map in DataPower

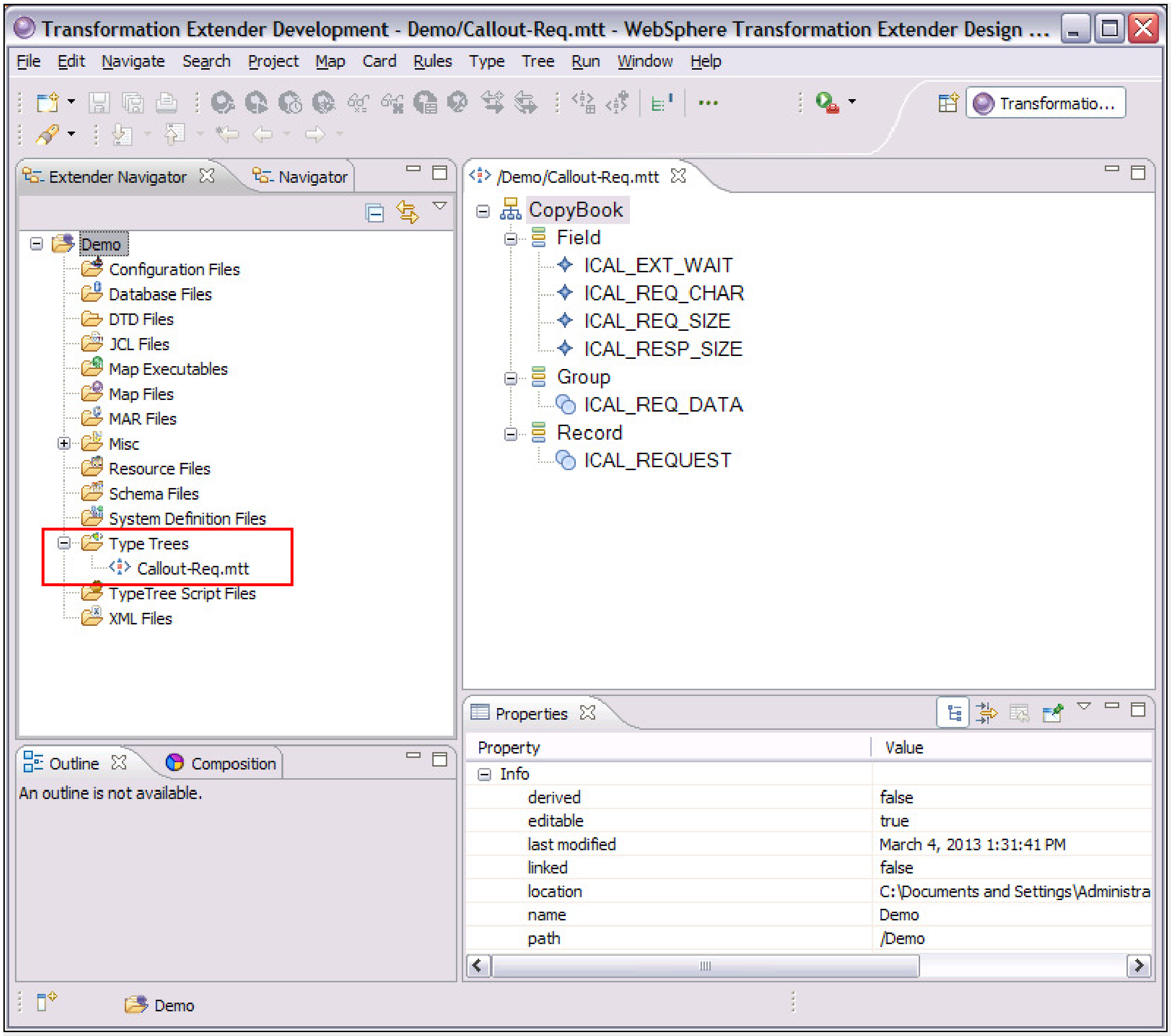
Creating a type tree in WTX

A Type Tree is a metadata description of input or output data. A Type Tree also contains metadata about your data format and provides this information to your map source.

Copy your input source into the project directory in Design Studio.

To create a Type Tree, open WebSphere Transformation Extender Design Studio. Right click on your project and select **Import**. Follow the import directions and point to your input file; click **Finish** to create your Type Tree.

You should see a type tree file (.mtt) in your **Type Trees** folder:



Property	Value
Info	
derived	false
editable	true
last modified	March 4, 2013 1:31:41 PM
linked	false
location	C:\Documents and Settings\Administra
name	Demo
path	/Demo

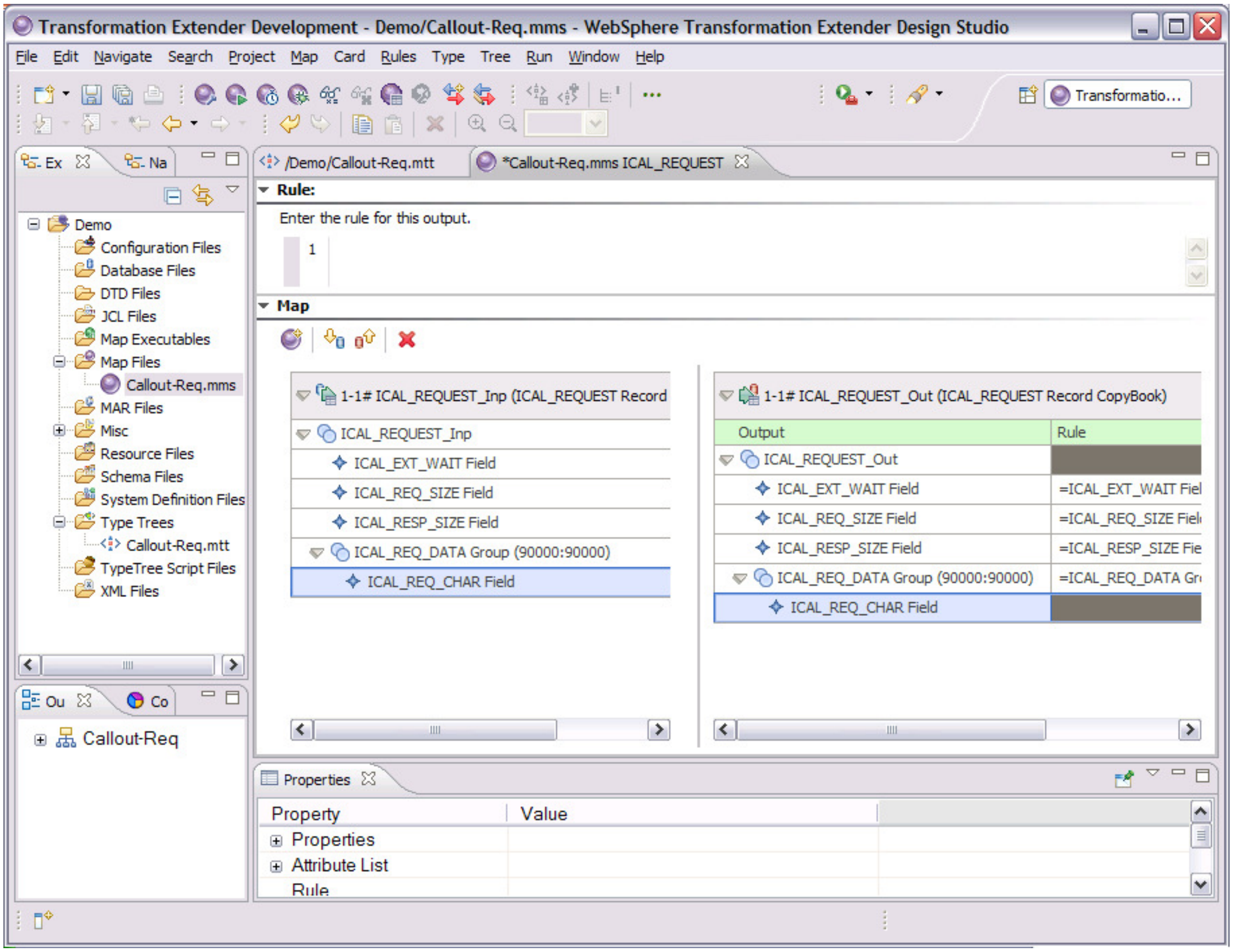
For a COBOL copybook, your type tree displays individual fields as well as the top-level element (ICAL_REQUEST).

For an XML schema, you can either import a schema into the Schema Files folder or you can create the schema from the COBOL copybook. However, creating a schema from an imported COBOL or PL/I type tree requires Microsoft .NET Framework.

Right click on the Group element and select ‘Export as Schema’. You may be prompted for an input and output file; you can skip this step for now and click ‘OK’. Design Studio will now generate a schema (.xsd) file based on your type tree.

Creating a map source file

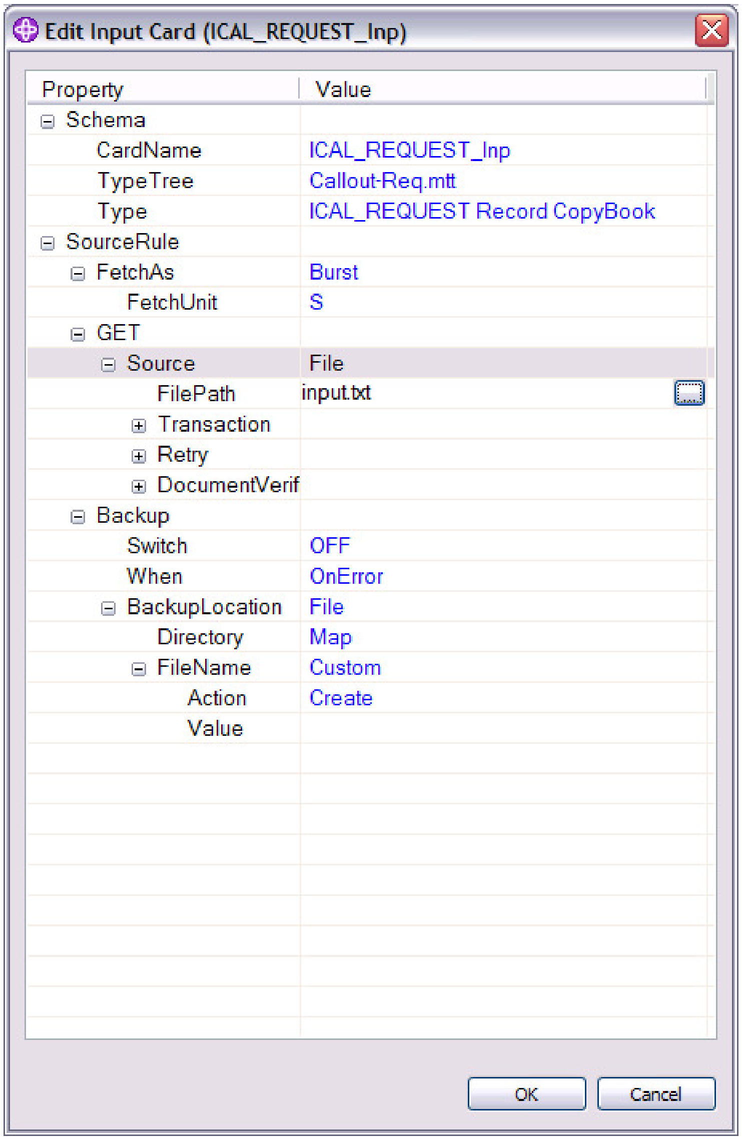
Create a new Map Source file (.mms). The display includes space for an input card and output card.



Output	Rule
ICAL_REQUEST_Out	
ICAL_EXT_WAIT Field	=ICAL_EXT_WAIT Fiel
ICAL_REQ_SIZE Field	=ICAL_REQ_SIZE Fiel
ICAL_RESP_SIZE Field	=ICAL_RESP_SIZE Fie
ICAL_REQ_DATA Group (90000:90000)	=ICAL_REQ_DATA Gr
ICAL_REQ_CHAR Field	

If you don’t see your input or output card displayed here, click either New input card or New output card.

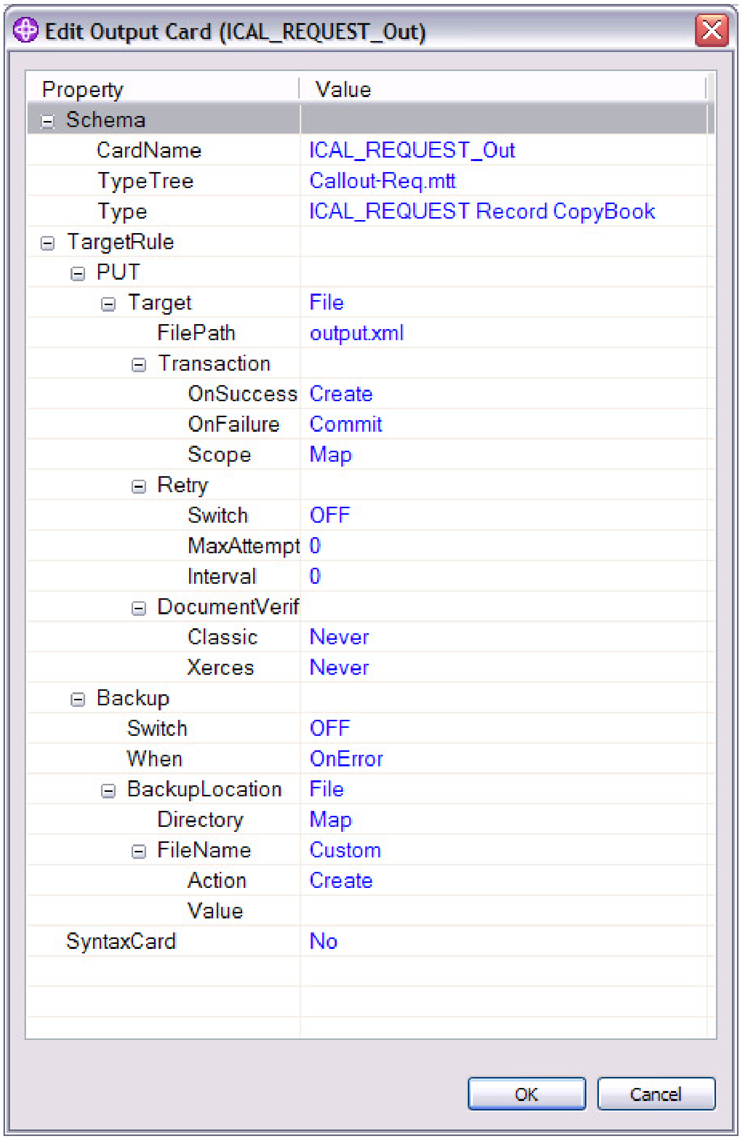
To edit an input card, right click on the input card to display the editing panel, which is shown in the following figure.



Property	Value
⊟ Schema	
CardName	ICAL_REQUEST_Inp
TypeTree	Callout-Req.mtt
Type	ICAL_REQUEST Record CopyBook
⊟ SourceRule	
⊟ FetchAs	Burst
FetchUnit	S
⊟ GET	
⊟ Source	File
FilePath	input.txt
⊞ Transaction	
⊞ Retry	
⊞ DocumentVerif	
⊟ Backup	
Switch	OFF
When	OnError
⊟ BackupLocation	File
Directory	Map
⊟ FileName	Custom
Action	Create
Value	

Unit Testing the map

To unit test your map with input data, change 'Source' to File and specify the location of your input file. In this example, the input data is in bytes in a flat file (input.txt). You will need to do the same to the output card, only specifying an output file (output.xml in this case). The map will transform the data format specified in the input card into the data format specified in the output card.

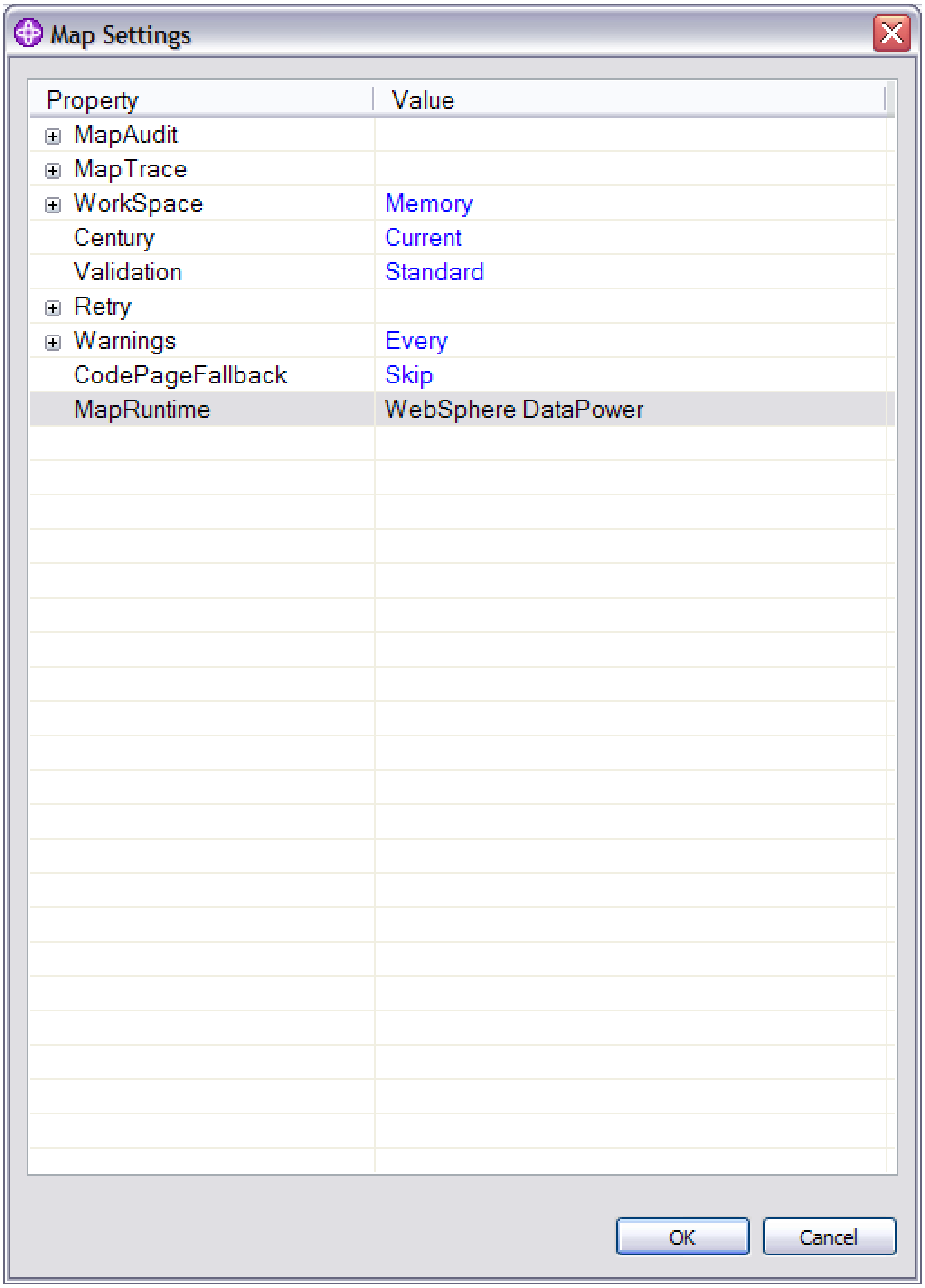


Property	Value
⊟ Schema	
CardName	ICAL_REQUEST_Out
TypeTree	Callout-Req.mtt
Type	ICAL_REQUEST Record CopyBook
⊟ TargetRule	
⊟ PUT	
⊟ Target	File
FilePath	output.xml
⊟ Transaction	
OnSuccess	Create
OnFailure	Commit
Scope	Map
⊟ Retry	
Switch	OFF
MaxAttempt	0
Interval	0
⊟ DocumentVerif	
Classic	Never
Xerces	Never
⊟ Backup	
Switch	OFF
When	OnError
⊟ BackupLocation	File
Directory	Map
⊟ FileName	Custom
Action	Create
Value	
SyntaxCard	No

To unit test a map source, you must provide an input file and specify an output file in the input and output cards, respectively.

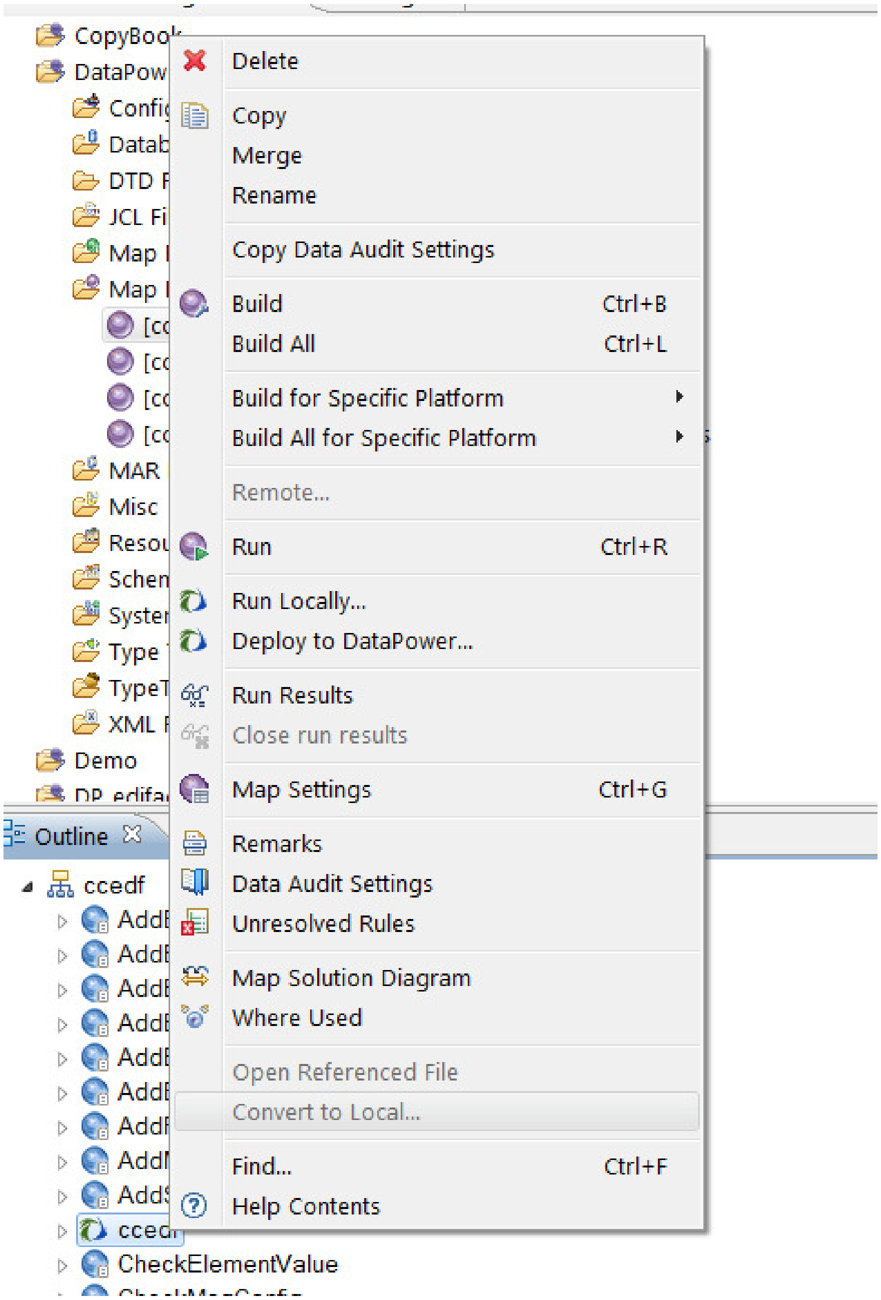
Test the map locally, before deployment:

To unit test your map source, right click your map source in the ‘Outline’ panel and choose ‘Map Settings’; ensure that MapRuntime is set to WebSphere DataPower.



Property	Value
⊞ MapAudit	
⊞ MapTrace	
⊞ WorkSpace	Memory
Century	Current
Validation	Standard
⊞ Retry	
⊞ Warnings	Every
CodePageFallback	Skip
MapRuntime	WebSphere DataPower

Then right click on the map source again and click ‘Build’. If the build is successful, a DataPower artifact (.dpa) is generated. Now you can test the file locally by selection ‘Run Locally’.



Test the map on DataPower from WTX Design Studio:

To test your map source:

1. Right click your map source in the 'Outline' panel and choose 'Map Settings
2. Specify WebSphere DataPower as the value for MapRuntime, if it is not specified already.

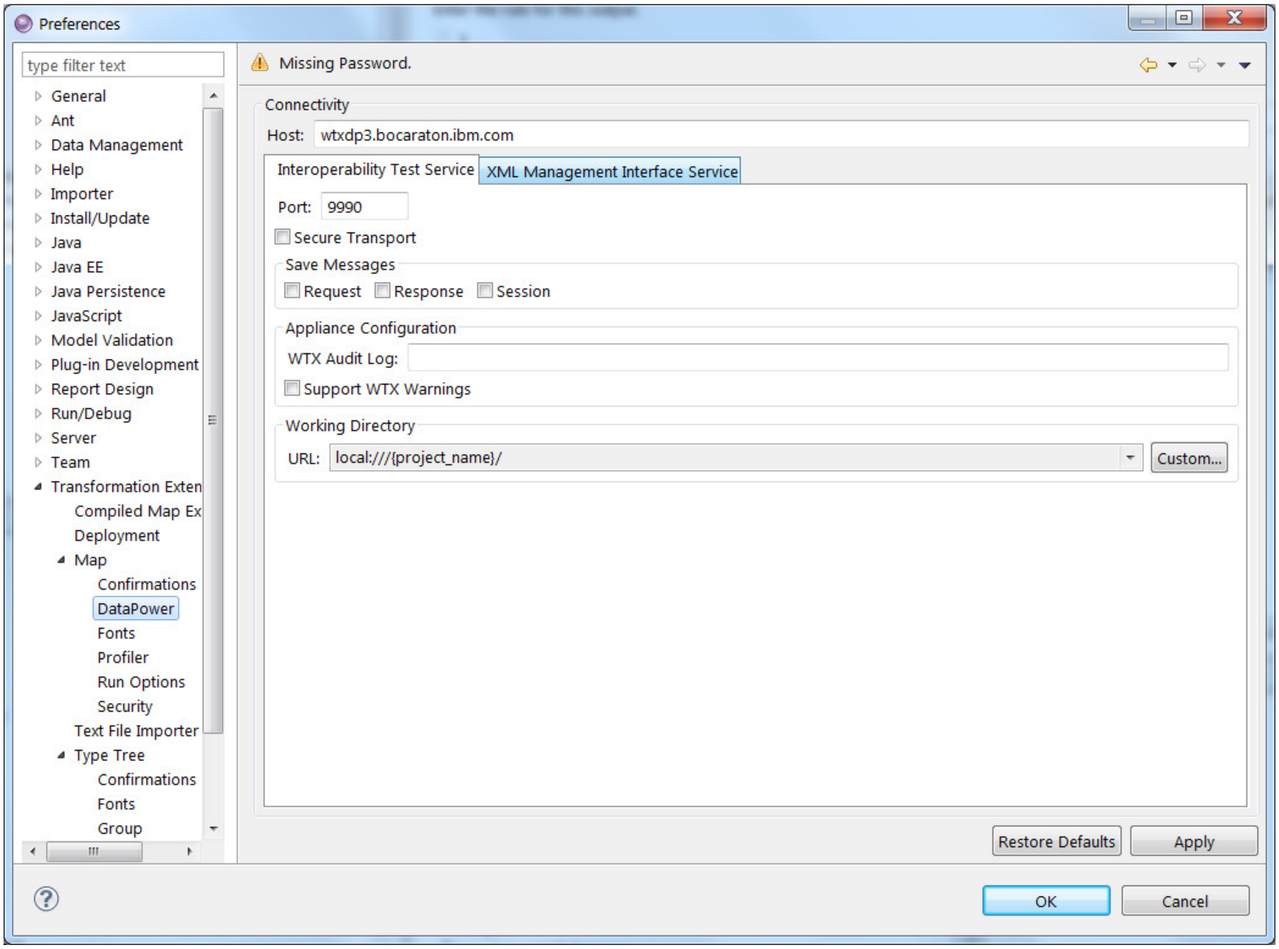
3. Right click on the map source and click **Build**. If the build is successful, a DataPower map is generated that has a .dpa file extension.
4. To test the file on DataPower, select **Run**.

Connect WTX to DataPower

Before you can deploy a map to DataPower, WTX must be connected to DataPower.

To connect WTX to DataPower:

1. Go to Window->Preferences
2. Expand Transformation Extender > Map and select DataPower.
3. Enter your DataPower address information.



Preferences

Missing Password.

Connectivity

Host: wtxdp3.bocaraton.ibm.com

Interoperability Test Service | XML Management Interface Service

Port: 9990

□ Secure Transport

Save Messages

□ Request □ Response □ Session

Appliance Configuration

WTX Audit Log:

□ Support WTX Warnings

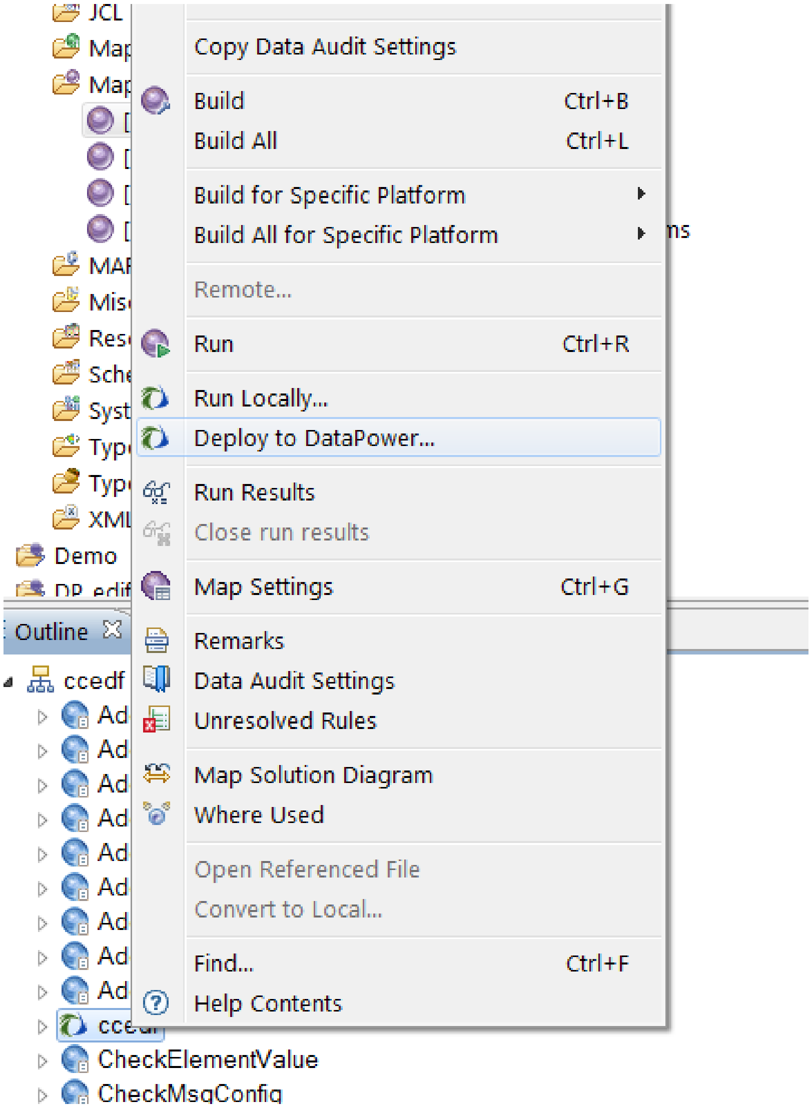
Working Directory

URL: local:///{project_name}/

Deploy maps directly to DataPower:

To deploy a map to DataPower:

Right click on the map source in the **Outline** panel and choose **Deploy to DataPower**.



Test the map on DataPower (end to end test):

To test the map on DataPower, the map must be uploaded into the Transform Action in the inbound/outbound processing policy in DataPower Multi-Protocol Gateway. For information about uploading a map into a Transform Action see 4b. Configure a Transform Action (a map or XSL Stylesheet-driven action).