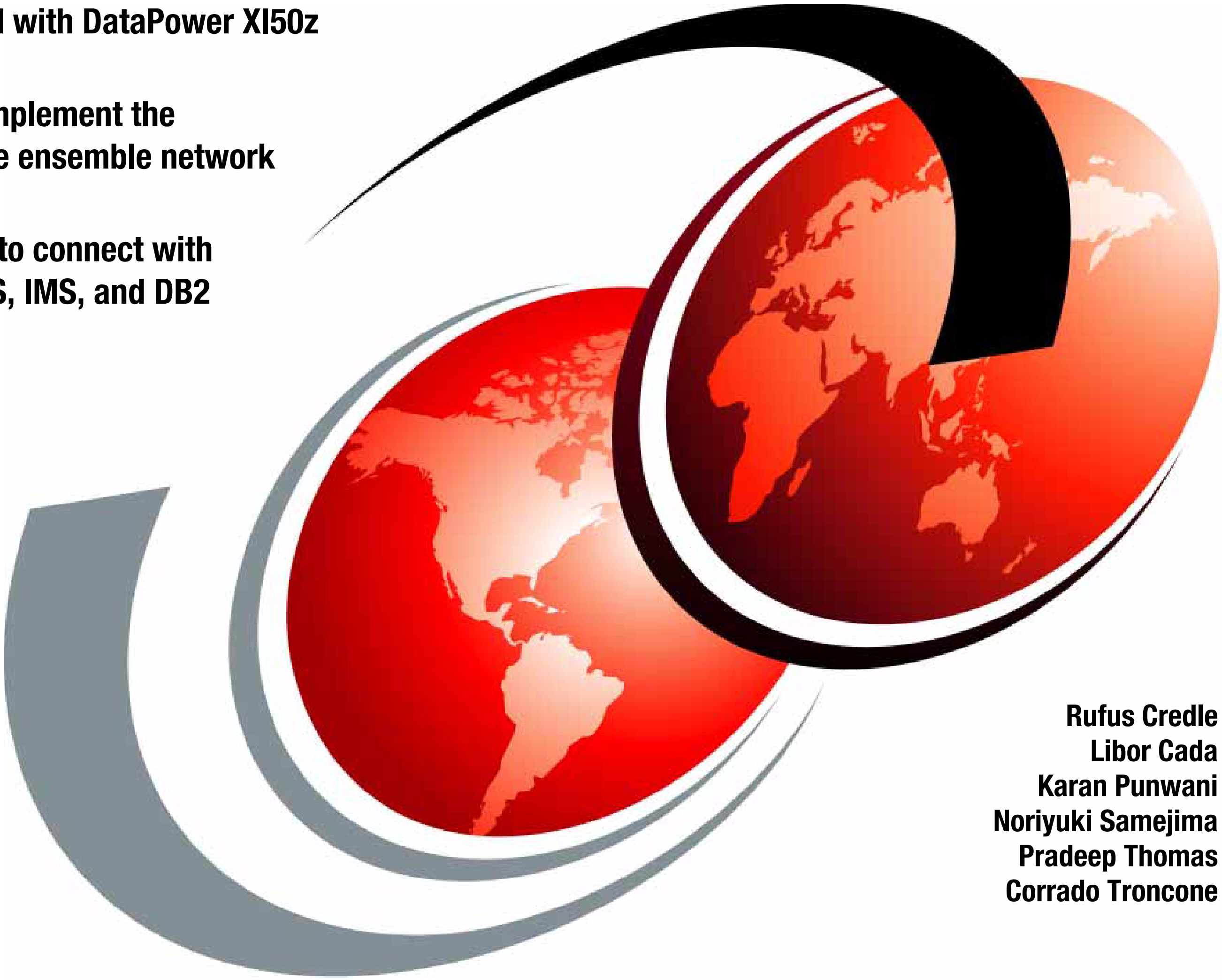
Set Up Security and Integration with the DataPower XI50z for zEnterprise

Bridge the gap between mainframe and distributed with DataPower XI50z

Learn to implement the zEnterprise ensemble network

Use XI50z to connect with WMQ, CICS, IMS, and DB2



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International Technical Support Organization

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First Edition (December 2011)

This edition applies to the DataPower® XI50z, zEnterprise BladeCenter® Extension (zBX) 002, and the System z z196.

Contents

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Preface

This IBM® Redbooks® publication discusses the new IBM WebSphere® DataPower® Integration Appliance XI50 for zEnterprise™ that bridges the gap between mainframe and distributed. The DataPower XI50z (a multifunctional appliance) within the zEnterprise BladeCenter® Extension (zBX) is managed with a single point of control, which can help to streamline operations and maintenance. The DataPower XI50z simplifies the translation of your existing formats to XML (hardware acceleration) for easier communication and connectivity.

This book will help you install, tailor, and configure the new attributes for implementing a zEnterprise ensemble network. The zEnterprise System introduces internal virtual networks (VLANs) and additional networking attributes that need to be addressed. Also, we describe the planning considerations for the internal virtual networks and external networks.

This book is for anyone who wants an understanding of the security on the zEnterprise that focuses on the usage of the XI50z Network Security Services.

As you can expect from an IBM Redbooks publication, we provide several integration use cases that you are able to use immediately within a production environment, for example, the XI50z connecting with and using WebSphere MQ (WMQ), connecting with CICS®, connecting with IMS™, and connecting with DB2®.

The team who wrote this book

This book was produced by a team of specialists from around the world working at the International Technical Support Organization, Raleigh Center.

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1

Getting started with the XI50z

This chapter discusses the planning attributes for implementing a zEnterprise ensemble network.

The zEnterprise System introduces internal virtual networks (VLANs) and additional networking attributes that need to be addressed. We also describe the planning considerations for the internal virtual networks and external networks. We provide the worksheets that helped us with the collection of information needed to implement the zEnterprise ensemble network.

This chapter includes the following sections:

- zEnterprise ensemble
- Ensemble networking
- Ensemble planning
- Initial setup

1.1 zEnterprise ensemble

A *zEnterprise ensemble* is a collection of zEnterprise central processor complex (CPC) systems and the optionally attached zEnterprise BladeCenter Extension (zBX) that is managed as a single logical entity. The Unified Resource Manager (zManager) provides advanced end-to-end management capabilities for the diverse systems in the ensemble.

Each zEnterprise CPC, and the optional zBX, is called a *node* of a zEnterprise ensemble. A zEnterprise ensemble can contain up to eight nodes, with up to eight zEnterprise CPC servers and up to eight zBXs. Figure 1-1 is an example of a node configuration.

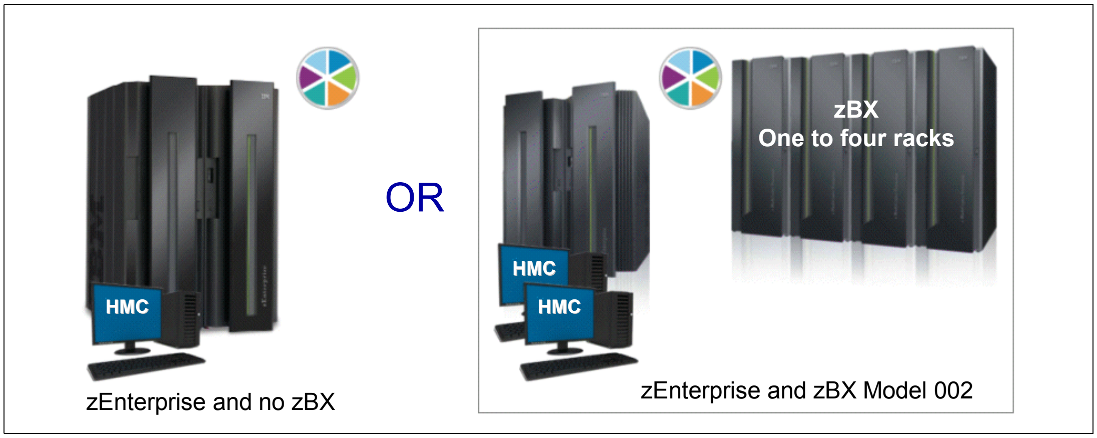


Figure 1-1 An ensemble node

The ensemble is provisioned and managed through the zManager, which resides in the Hardware Management Console (HMC). The zManager provides many system management functions, which can be grouped in the following manner:

- Defining and managing virtual environments
- Defining and managing workloads and workload policies
- Receiving and applying corrections and upgrades to the Licensed Internal Code (LIC)
- Performing temporary and definitive zEnterprise CPC capacity upgrades
- Monitoring and managing energy
- Managing a goal-oriented policy
- Managing data for the physical and logical resources of the ensemble

1.2 Ensemble networking

In this section, we introduce concepts about the types of LANs that connect to the zEnterprise system, security in the ensemble, and network connections to the zBX.

1.2.1 Types of LANs

There are three types of LANs that attach to the zEnterprise system, each with redundant connections:

- The intraensemble data network (IEDN)
- The intranode management network (INMN)
- The client-managed data network

Figure 1-2 depicts these three networks.

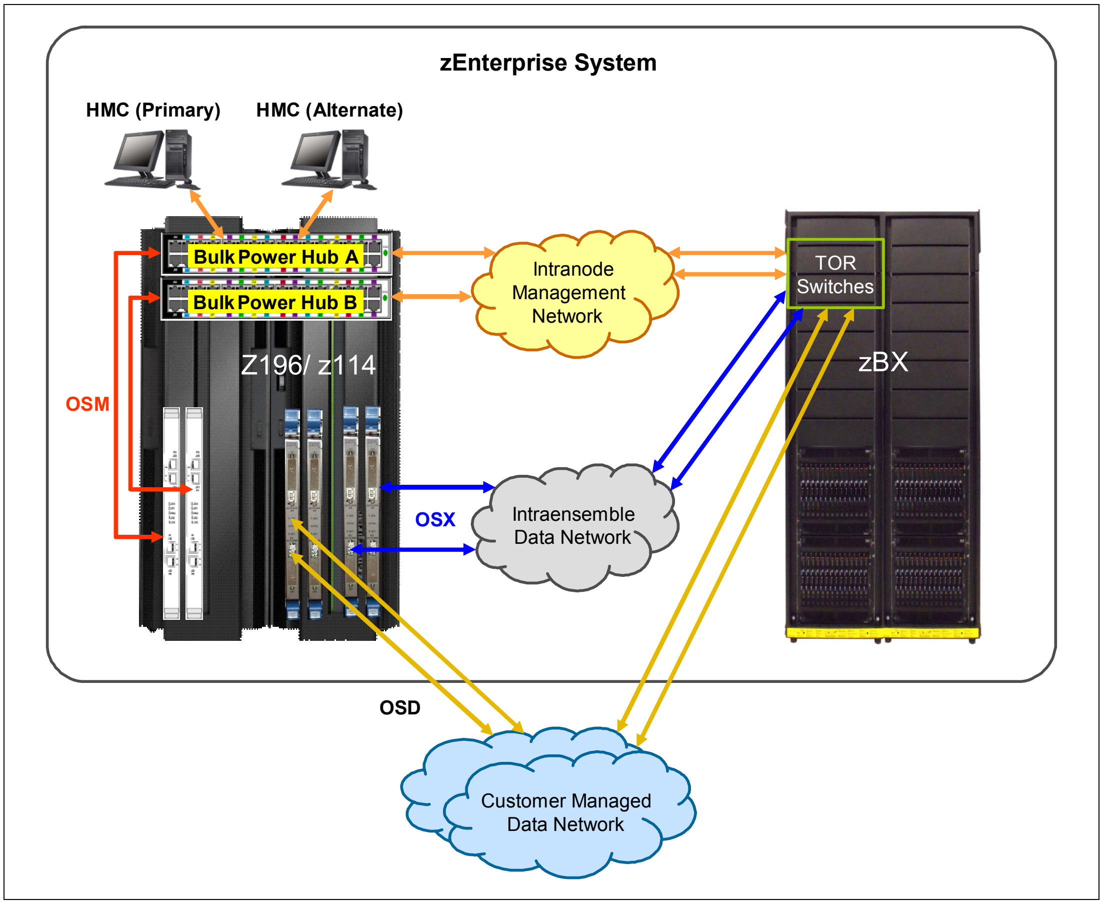


Figure 1-2 Network overview of INMN, IEDN, and client-managed data network

The ensemble system management functions to exploit the virtual server resources and the IEDN are provided by the HMC Support Element (HMC/SE) interface through the INMN.

Intraensemble data network

An intraensemble data network (IEDN) allows communication to flow along the ensemble network components and between the nodes that comprise an ensemble. An IEDN has these characteristics:

- Allows zEnterprise applications to communicate between operating system images to share data
- Allows zBX-to-zBX communication within an ensemble

Each IEDN is supported by a 10 GbE Open Systems Adapter (OSA) data link and a single dedicated physical Layer 2 network. An IEDN consists of zEnterprise equipment and is managed by the zManager (HMC) as part of the ensemble. The HMC manages the ensemble through its user interface and includes networking tasks that are collectively known as *network virtualization tasks*.

An IEDN requires two OSA-Express3 10 GbE adapters to ensure redundancy. The IEDN supports running IPv4 or IPv6 protocols, and IP addresses are client controlled.

Access to the IEDN is controlled by the zManager (HMC) by way of the SE, hypervisors, and physical switches. zManager controls the configuration for all switches and provides secure access to the IEDN. Communications through the IEDN has the benefit of being performed through a physical network within the machine; therefore, it is more secure than external network communications.

zEnterprise CPC connectivity to the IEDN is provided by OSA-Express for zBX (OSX) channel path identifier (CHPID) types. Currently, only z/OS and z/VM® TCP/IP can connect directly to OSX with a dedicated connection; other virtual servers must use the z/VM VSWITCH. Guests under z/VM on a VSWITCH can also participate in the ensemble through the z/VM hypervisor OSD to OSX simulation, which is called *OSDSIM*.

Intranode management network

An intranode management network (INMN) is required for platform management within a node, and it cannot span multiple nodes. The network allows the HMC to communicate to the hypervisors within the managed ensemble. An ensemble must have an INMN, and it is used by zManager components.

An INMN is a 1000BASET network that is provided and managed by IBM. However, unlike the IEDN, INMN configuration (VLAN, IP addressing) is automatically deployed by the HMC and its network virtualization function tasks.

zEnterprise connectivity to the INMN is provided by an OSA-Express3 (CHPID type OSM). An INMN requires two ports from two separate OSA-Express3 1000BaseT Ethernet adapters (ensuring redundancy). The INMN only supports running IPv6 protocols. IPv6 link local addresses are assigned by the system.

Client-provided data network

A client-provided data network is used for external communication by way of the IEDN. Depending on factors, such as network traffic patterns and load balancing requirements, you can connect the client-provided data network to the IEDN in two ways:

- Direct connection by way of the access ports in IEDN Top-of-rack (TOR) switches
- Connecting to a TCP/IP defined router in a z/OS partition (using an OSA feature)

The client data network is provided and managed by the client. It is not managed by an HMC and its network virtualization function tasks.

1.2.2 Network security in the ensemble

The isolation of networks from each other is a basic method of network security. In the ensemble, the two internal networks, the INMN and the IEDN, are physically isolated from each other.

The IEDN can be further logically subdivided at the Layer 2 level into multiple virtual networks, with each virtual network isolated from the others. This subdivision can be done by the use of unique VLAN IDs for each virtual network and the assignment of IEDN network endpoints to the virtual networks.

Because the IEDN is built on a Layer 2 network design, each server that accesses the IEDN must be an authorized virtual server and must belong to an authorized virtual LAN (VLAN) within the physical IEDN. VLAN enforcement is done within the hypervisor functions of the ensemble. Controls reside in the OSA (CHPID type OSX), in the z/VM VSWITCH, and in the VSWITCH hypervisor function of the blades in the zBX. The VLAN IDs and the virtual machine address codes (MACs) that are assigned to the connections from the virtual servers are tightly controlled through the zManager. Therefore, there is no chance of either MAC or VLAN spoofing for any of the servers on the IEDN. If you decide to attach to the TOR switches of the zBX to send data to virtual servers in the zBX, the permitted VLAN IDs and MACs must be authorized in the TOR switches. Although the TOR switches enforce the MACs and VLAN IDs, you must take the usual network security measures to ensure that the attaching devices in the client-managed network are not subject to MAC or VLAN spoofing. The zManager functions cannot control the assignment of VLAN IDs and MACs in those devices. In other words, whenever you decide to interconnect the external network to the secured IEDN, the security of that external network must involve all the usual layers of the IBM Security Framework: physical security, platform security, application and process security, data and information security, and so on.

An external client data network cannot connect directly to the INMN. The INMN is accessible only through the HMC, and the HMC is locally secured on a private LAN with authentication and authorization. If accessed remotely, the HMC is secure with firewall filtering through a Secure Sockets Layer (SSL) connection. Also, the zManager functions are further secured with discrete authorizations to its special functions.

The INMN uses separate hardware from the external network hardware. Although the IEDN 10Gb TOR switches are connected to an INMN management port in the 1Gb TOR switches, the INMN cannot forward or receive traffic from the IEDN data ports.

The INMN is entirely private and can be accessed only through the HMC, by its connection to the SE. Standard HMC security also still applies. There are additions to zManager “role-based” security, so that not just any user can reach the zManager panels even if that user can perform other HMC functions. Extremely strict authorizations for users and programs control who is allowed to take advantage of the INMN.

The centralized and internal network design of both the INMN and the IEDN limit the scope of vulnerability to security breaches. Both networks reduce the amount of network equipment, processes, and routing hops that are under the control of multiple individuals and subject to security threats. Both networks require the use of IBM-only equipment (switches and blades), which have been tested previously and, in certain cases, have been pre-installed.

In summary, many technologies are architected in a more robust, secure fashion in the client network than they have been implemented in the past. This improvement is because of either their implementation through the ensemble and zManager, or because of additional System Authorization Facility (SAF) controls that are specific to zEnterprise System and the ensemble, such as these controls:

- MAC filtering
- VLAN enforcement
- Access control
- Role-based security

The following standard security implementations are still available for use in the IEDN:

- Authentication

  Authorization and access control, including Multilevel Security (MLS). Also, firewall IP filtering. Only stateless firewalls or IP filtering implementations can be installed in a virtual server in the ensemble.

- Confidentiality
- Data integrity
- Non-repudiation

Ensemble security

Virtual machines running on separate operating system platforms are usually housed in separate physical boxes. The networks that connect them are essentially wires and cables that flow between the separate machines. These physical connections often span both virtual and physical networks with the potential of multiple hops and multiple points of failure. The security of distributed networks is often only as secure as the physical media.

Virtual servers in an ensemble communicate with each other over the IEDN, which is an internal secure and physically isolated data *highway*. Data path length within the IEDN can be logically reduced to one hop. External client networks enter through the zBX TOR Switch or through a traditional OSA OS deployment (OSD) adapter. VLAN and MAC enforcement guarantees that only packets that originate from particular VLANs or MAC addresses can enter the IEDN network. The OSA OSX, the z/VM VSWITCH, the zBX TOR Switch, and the zBX Ethernet Switch Module (ESM) can all act as security enforcement points, depending on where an external network packet originates. Also, the traditional mainframe, Linux, and AIX® security methods are still available.

The ensemble is more secure from within, because the IEDN can be segmented with separate VLANs. Nodes in the ensemble that need to communicate with other nodes or servers within the nodes are defined on the same VLAN network. The servers that do not need a direct connection to a particular VLAN network are not defined on that VLAN. Network addressability between virtual servers and ensemble nodes is limited by Layer 2 VLAN membership. Network traffic cannot route between separate Layer 2 VLANs unless a Layer 3 router is used as a gateway.

The zEnterprise consists of heterogeneous platforms where zManager acts as a single point of control for the virtual network, security, storage, energy, and performance policy management. A single interface controls the allocation and management of the System z resources across the diverse operating systems that coexist on a zEnterprise. This single interface provides additional security through the single point of control and the use of zManager user IDs and roles that have various management scopes and responsibilities.

Security in the INMN network

Virtual servers cannot communicate with each other over the INMN. The z/OS access to the INMN is further protected by the RACF® security class. External access to the INMN is impossible, because the end of the network is at the HMC/SE. The INMN is exploited and usable only by authorized management applications using communication between the virtual server and the SE.

Secure client external network

If preferred practices are followed, the IEDN and INMN networks are secure from connections by an external client network. Firewall requirements still exist for traffic entering and leaving the zEnterprise System or where separate workloads on separate virtual networks need to communicate with each other.

A *client external network* is a network that exists outside of the ensemble network, for example, a network that connects a client workstation to the mainframe to use for administrative purposes. There are also external client data networks where web servers or other external workload generators rely on dedicated network connections to the zEnterprise. However, these networks are managed by the client and not by zManager.

In addition to the requirement for the client data network to access the IEDN, there can also be a requirement for the external client management or administration network to connect to the IEDN. The client external network can connect to the IBM zEnterprise with the zBX TOR Switch or connect to the OSA OSD CHPID.

Access controls are provided for the enablement of each external port on the zBX TOR Switch. Using the zManager tasks, an administrator enables the physical TOR Switch ports by defining the specific VLANs that are to be granted access to the TOR switches (ports) and the MAC addresses for access to zBX system resources by servers that are not part of the ensemble.

Virtual local area networks (VLANs)

Ensemble networking has many of the same features and constructs as general networks. The virtual local area network (VLAN) is a central feature. All VLANs, by definition, are a grouping of hosts with the same subnet address and broadcast address. VLANs have the same operating characteristics as physical networks, but VLANs do not need to share the same physical switch or wires. Software performs the configuration of the VLAN, instead of requiring a change to wiring or switch locations.

Central to the VLAN is the unique VLAN ID tag that is affixed to every network packet. VLAN tags are attached to the data packets on entry to the VLAN. When an Ethernet frame (packet) traverses a switch or virtual switch, the tag is added. As the frame exits, the tag can be stripped off or it can be forwarded out of the VLAN if its tag does not match the VLAN ID of the current VLAN. An operating system that is VLAN-aware is capable of handling VLAN tags.

1.3 Ensemble planning

The high-level network diagram is the starting point for our ensemble networking scenario. In this chapter, we use the high-level diagram to create a detailed design of our networking environment and to help us determine the type of information that is needed to implement the network for our ensemble.

Our target network environment has two network security zones, which are isolated by VLANs, as shown in Figure 1-3 on page 8. The security zones are based on our workload data traffic flow and required server-to-server communication in the network. We use these VLANs in our networking environment:

- VLAN A: Client access to DataPower
- VLAN B: DataPower access to zEnterprise CPC (that is, the data serving layer)

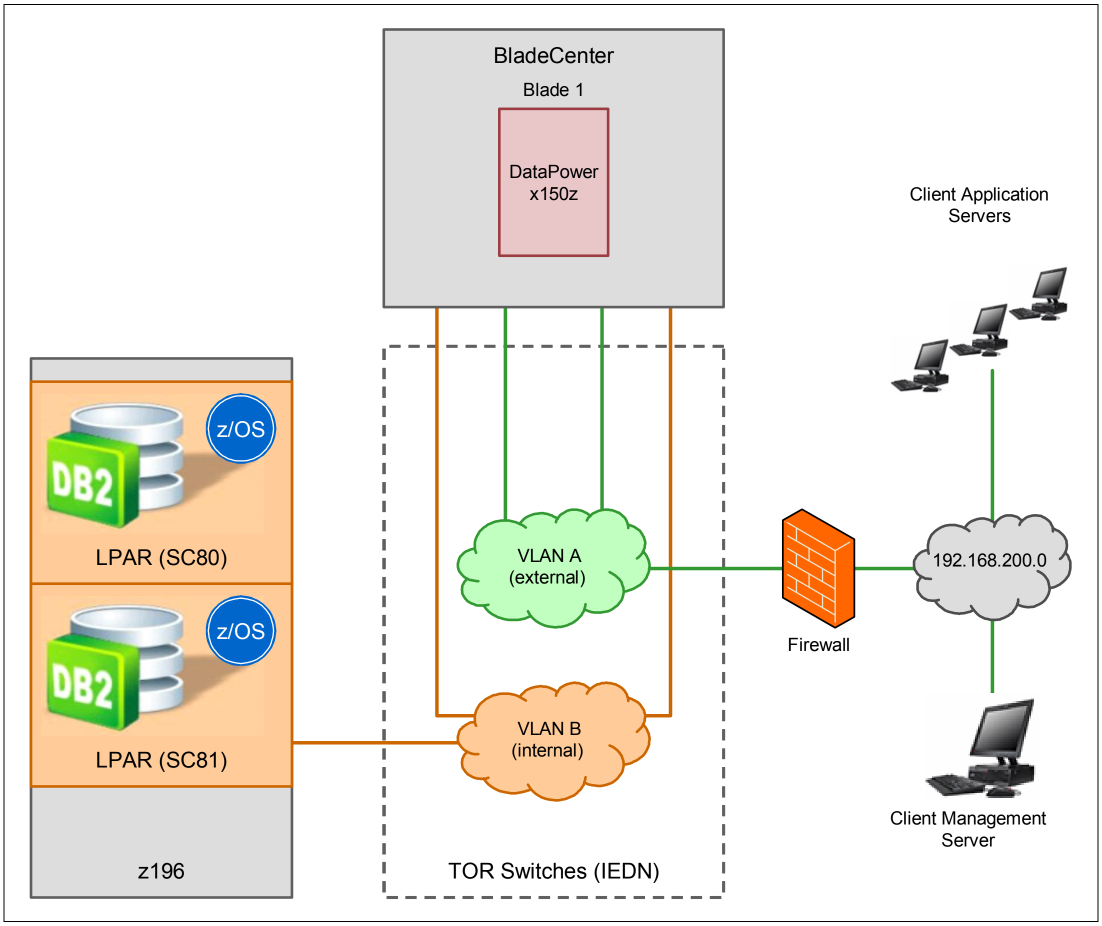


Figure 1-3 Network topology

1.3.1 Network planning

Based on the network diagram in Figure 1-3, we needed several sets of information to implement our network in the ensemble. The information pertains to the following areas:

- Virtual network definitions: Creating the VLANs (assigning VLAN IDs and IP subnetwork addressing schemes).
- TOR Switch configuration: Establishing internal and external connectivity. This area includes IEDN TOR Switch ports, ascribing VLAN IDs and port modes (trunk or access) and port types (internal or external to the ensemble).
- Virtual server network configuration: Adding the virtual servers to one or more of the VLANs.
- z/OS operating system configuration: Defining the IP configuration (IP addresses, subnet mask, and default gateway) to the operating systems.

1.4 Initial setup

Before you perform all of the tasks that are needed to set up your environment, you must first install a zBX, then connect it to the zEnterprise CPC, and then install the DataPower blades or other Power and System x blades. You might also have to perform other necessary tasks, as described in “Tasks already done” on page 9.

For the purposes of this IBM Redbooks publication, we assume that the tasks that are listed in “Tasks already done” on page 9 have already been completed.

In any case, for a comprehensive list and details about how to fully prepare and set up an ensemble, refer to Chapter 8 in *IBM zEnterprise Unified Resource Manager,* SG24-7921.

Tasks already done

We had already completed the following preliminary steps when we installed both the DataPower blade and the zBX containing the DataPower blade:

- Cabling to the ensemble OSA ports (OSM and OSX CHPIDs) on the CPC
- Cabling to the BladeCenter for the INMN and IEDN
- Cabling on the IEDN TORs to the external client network
- Defining the input/output configuration data set (IOCDS) for the ensemble

  OSM and OSX CHPIDs are set Online
- Installing the HMC and the zManager suite
- Implementing ensemble HMC user roles and tasks
- Creating an ensemble
- Adding members to the ensemble
- Entitling the zBX blades to the ensemble OSX definitions (performing the I/O configuration program (IOCP))

1.4.1 Setting up the virtual network

We create the virtual network or VLANs through the HMC interface to the ensemble. The purpose of the virtual network is to isolate each network within the ensemble, thereby providing network-level security. The VLANs that are planned for this integration scenario are meant to isolate the client networks from the zEnterprise CPC servers.

The planned VLANs will only allow client applications to communicate with the XI50z blades that are housed in the zBX. The XI50z will then communicate with the servers on the zEnterprise CPC through an isolated VLAN.

In this chapter, we provide a detailed description of how to implement the two VLANs that have been designed for this integration pattern. Figure 1-4 on page 10 shows the VLAN addressing scheme that is to be implemented.

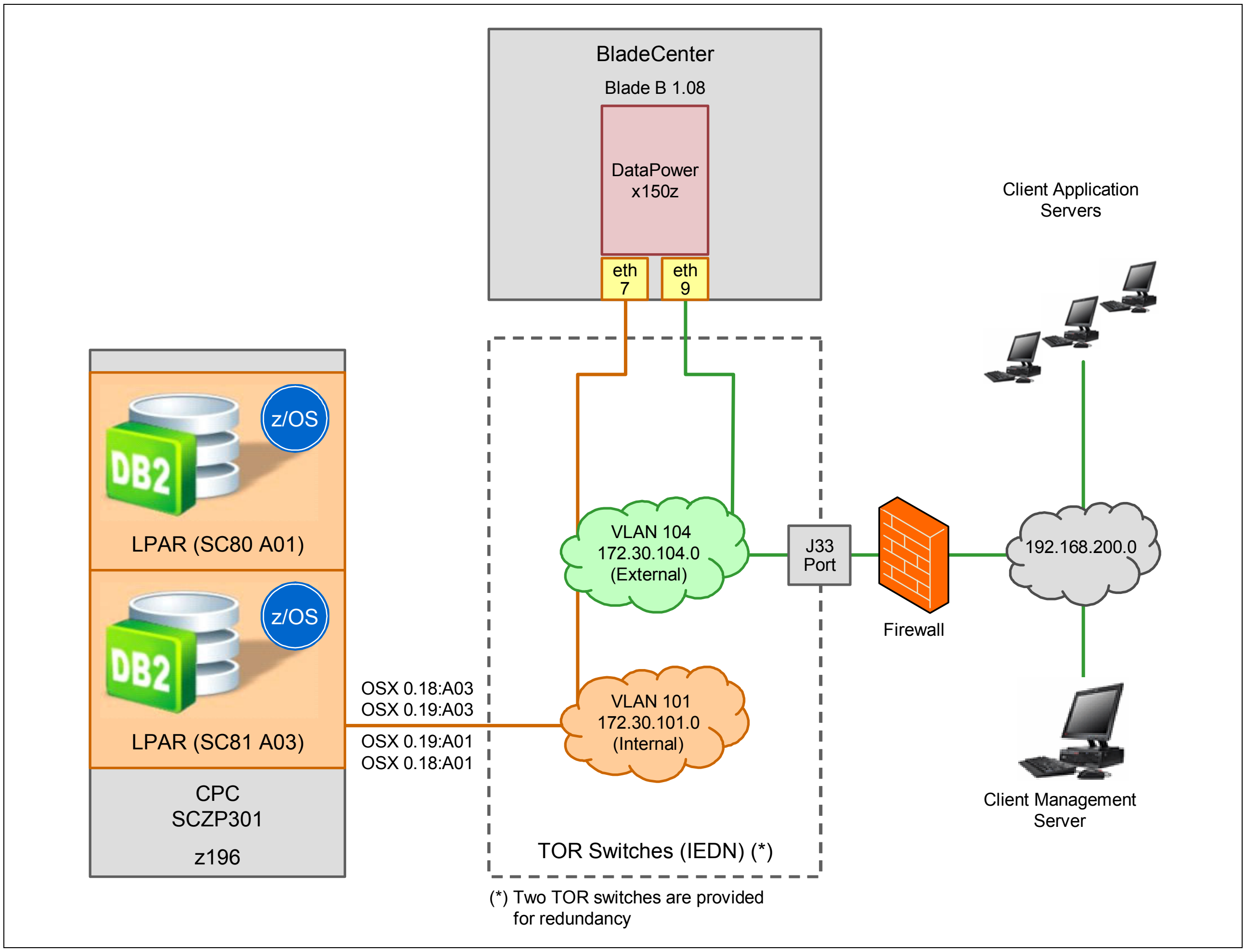


Figure 1-4 Network physical topology

As a "step-by-step" approach, we must follow this sequence to implement our virtual network:

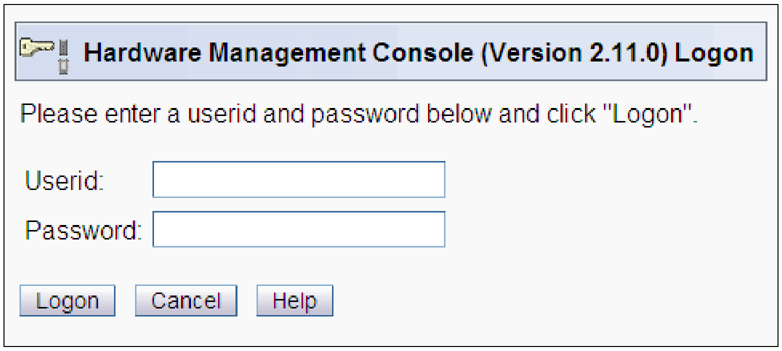
- Define virtual networks
- Define IEDN interfaces for DataPower
- Configure TOR Switch
- Add hosts to virtual networks

About the required definitions for the z/OS site, refer to 1.4.2, "z/OS definitions to set up the virtual network" on page 19.

Define virtual networks

To perform the required actions, you have to use the zManager or Unified Resource Manager (URM), the application that resides on the HMC and that manages the ensemble. Follow these steps:

1. Log on to the HMC (see Figure 1-5 on page 11).


Hardware Management Console (Version 2.11.0) Logon

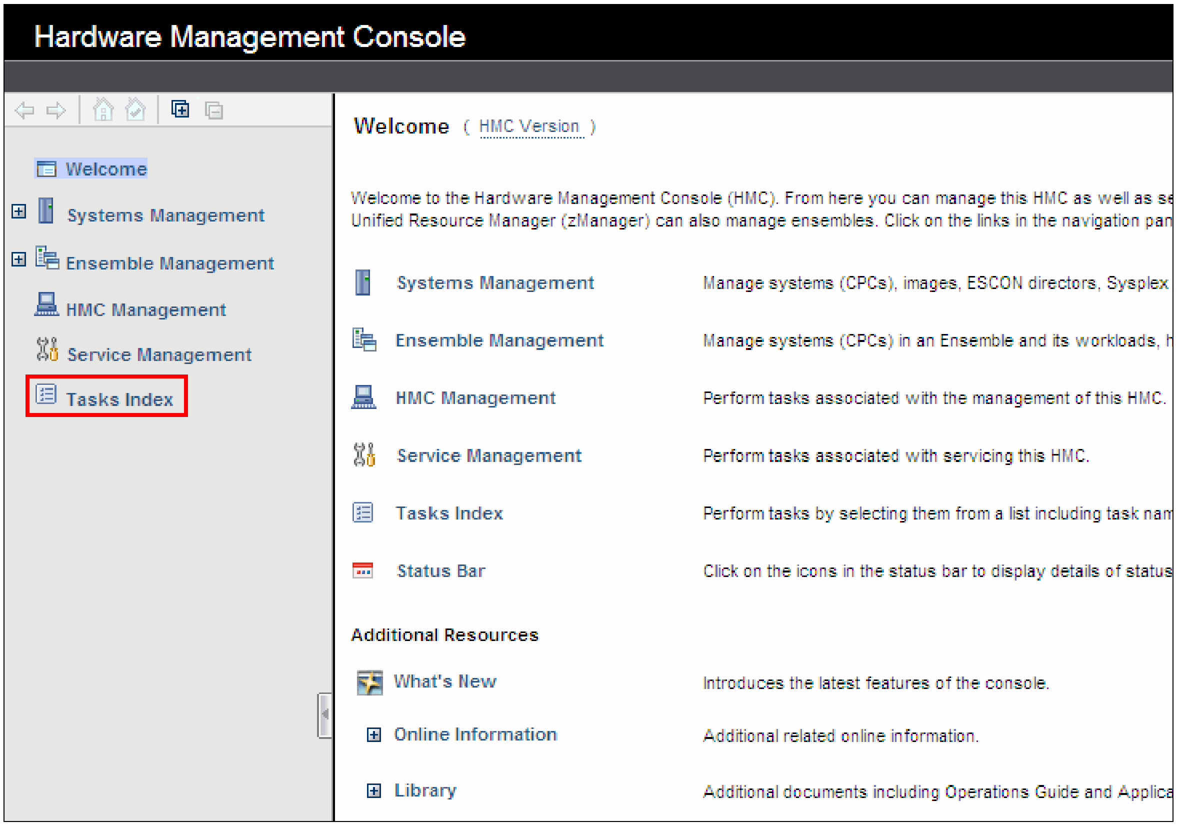
Please enter a userid and password below and click "Logon".

Userid:

Password:

Figure 1-5 Log on to HMC

After you log on, the initial window opens (Figure 1-6).


Hardware Management Console

Welcome (HMC Version)

Welcome to the Hardware Management Console (HMC). From here you can manage this HMC as well as se
Unified Resource Manager (zManager) can also manage ensembles. Click on the links in the navigation pan

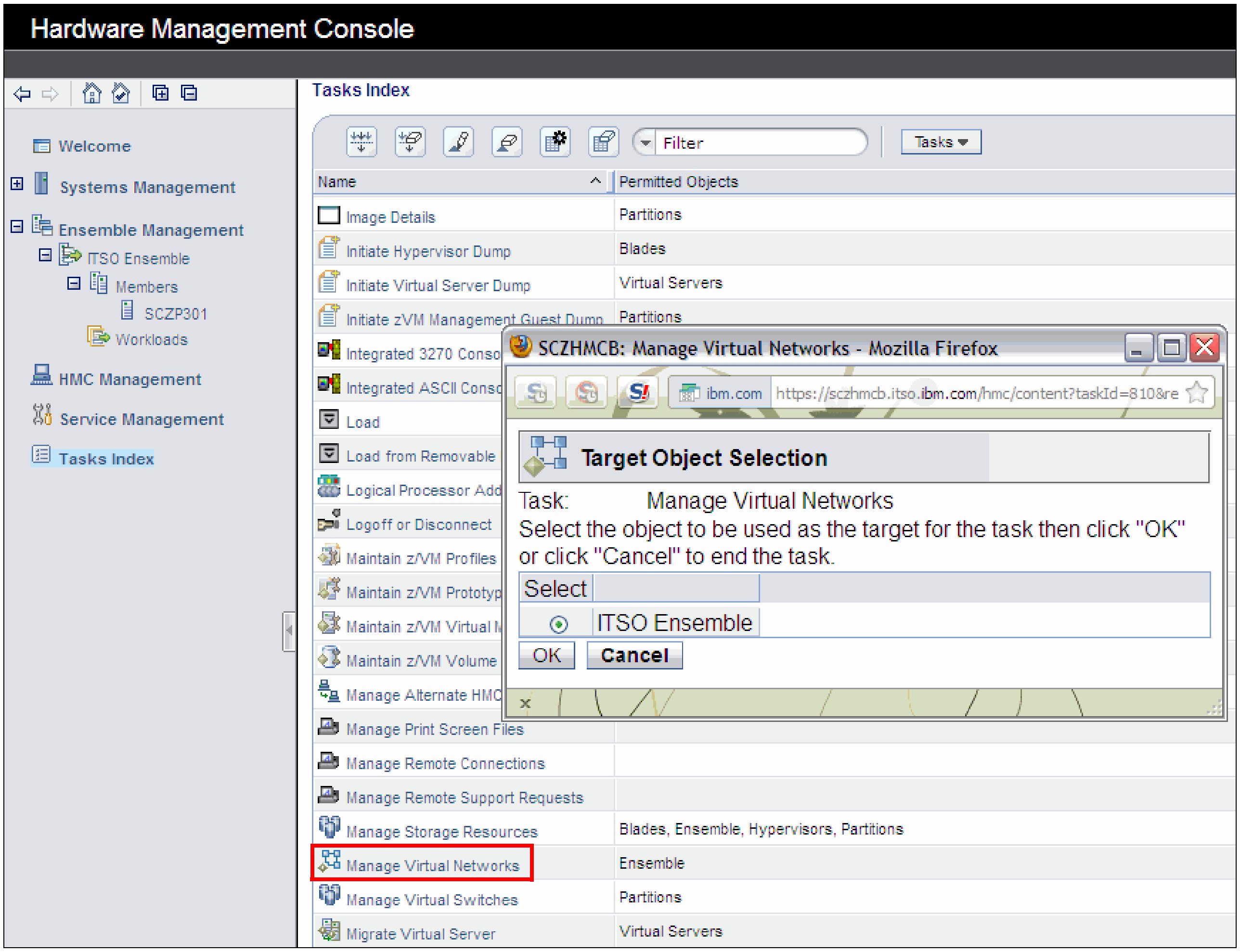
Systems Management	Manage systems (CPCs), images, ESCON directors, Sysplex
Ensemble Management	Manage systems (CPCs) in an Ensemble and its workloads, h
HMC Management	Perform tasks associated with the management of this HMC.
Service Management	Perform tasks associated with servicing this HMC.
Tasks Index	Perform tasks by selecting them from a list including task nam
Status Bar	Click on the icons in the status bar to display details of status

Additional Resources

What's New	Introduces the latest features of the console.
⊞ Online Information	Additional related online information.
⊞ Library	Additional documents including Operations Guide and Applica

Figure 1-6 Initial HMC window

2. On the left bar, click **Tasks Index** to expand it, look for Manage Virtual Networks, and click **Manage Virtual Networks**. Select the ensemble and then click **OK** (Figure 1-7 on page 12).



Name	Permitted Objects
Image Details	Partitions
Initiate Hypervisor Dump	Blades
Initiate Virtual Server Dump	Virtual Servers
Initiate zVM Management Guest Dump	Partitions
Integrated 3270 Conso	
Integrated ASCII Conso	
Load	
Load from Removable	
Logical Processor Add	
Logoff or Disconnect	
Maintain z/VM Profiles	
Maintain z/VM Prototyp	
Maintain z/VM Virtual M	
Maintain z/VM Volume	
Manage Alternate HMC	
Manage Print Screen Files	
Manage Remote Connections	
Manage Remote Support Requests	
Manage Storage Resources	Blades, Ensemble, Hypervisors, Partitions
Manage Virtual Networks	Ensemble
Manage Virtual Switches	Partitions
Migrate Virtual Server	Virtual Servers

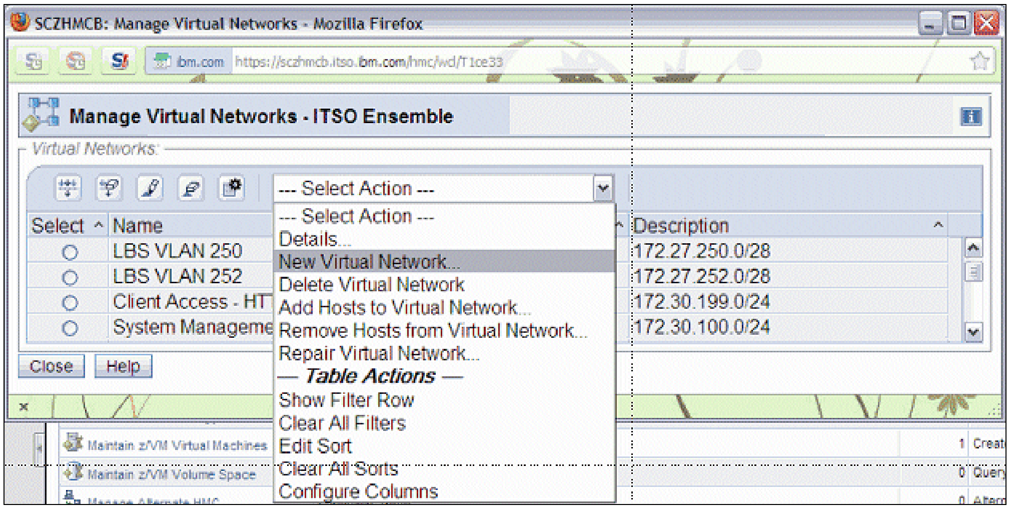
Task: Manage Virtual Networks

Select the object to be used as the target for the task then click "OK" or click "Cancel" to end the task.

Select	
●	ITSO Ensemble

Figure 1-7 Manage Virtual Networks

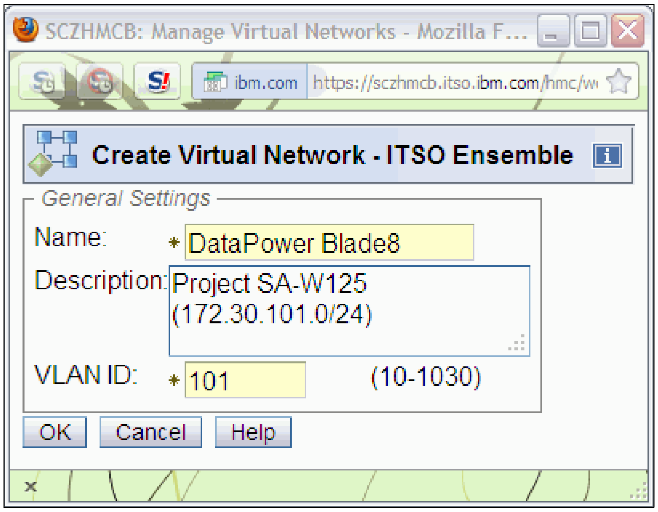
3. At this point, a window opens. From the Select Action drop-down menu, click **New Virtual Network** (Figure 1-8).


SCZHMCB: Manage Virtual Networks - Mozilla Firefox
ibm.com https://sczhmcb.itso.ibm.com/hmc/wcl/T1ce33
Manage Virtual Networks - ITSO Ensemble
Virtual Networks:
--- Select Action ---
--- Select Action ---
Details...
New Virtual Network...
Delete Virtual Network
Add Hosts to Virtual Network...
Remove Hosts from Virtual Network...
Repair Virtual Network...
— Table Actions —
Show Filter Row
Clear All Filters
Edit Sort
Clear All Sorts
Configure Columns
Close
Help
Maintain z/VM Virtual Machines
Maintain z/VM Volume Space
Manage Alternate HMC

Select	Name	Description
○	LBS VLAN 250	172.27.250.0/28
○	LBS VLAN 252	172.27.252.0/28
○	Client Access - HT	172.30.199.0/24
○	System Manageme	172.30.100.0/24

Figure 1-8 New Virtual Network

4. On the Create Virtual Network window, we type our definitions in the fields to create a new VLAN, as shown in Figure 1-9. In this case, for VLAN ID, we type `101` and click **OK**.


SCZHMCB: Manage Virtual Networks - Mozilla F...
ibm.com
https://sczhmcb.itso.ibm.com/hmc/w

Create Virtual Network - ITSO Ensemble

General Settings

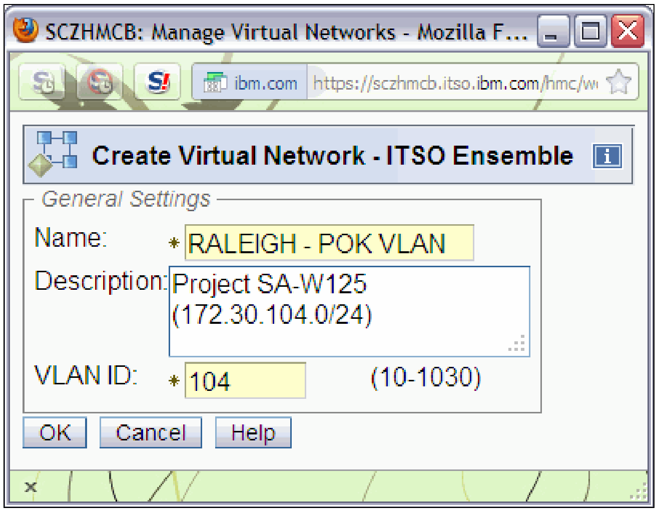
Name: * DataPower Blade8

Description: Project SA-W125 (172.30.101.0/24)

VLAN ID: * 101 (10-1030)

Figure 1-9 Create VLAN101

5. To define VLAN104, go through step 3 on page 12 and step 4, changing the definitions, as shown in Figure 1-10.


SCZHMCB: Manage Virtual Networks - Mozilla F...
ibm.com
https://sczhmcb.itso.ibm.com/hmc/w

Create Virtual Network - ITSO Ensemble

General Settings

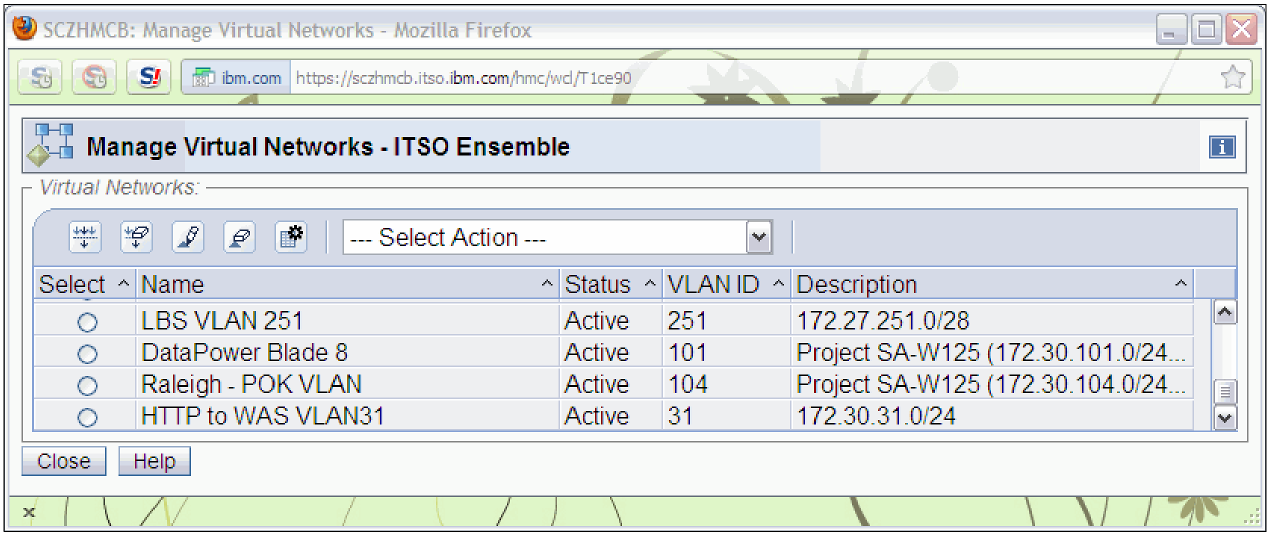
Name: * RALEIGH - POK VLAN

Description: Project SA-W125 (172.30.104.0/24)

VLAN ID: * 104 (10-1030)

Figure 1-10 Create VLAN104

At the end, both VLAN101 and VLAN104 show in the list of existing virtual networks (Figure 1-11 on page 14).


SCZHMCB: Manage Virtual Networks - Mozilla Firefox
ibm.com https://sczhmcb.itso.ibm.com/hmc/wcl/T1ce90
Manage Virtual Networks - ITSO Ensemble
Virtual Networks:
--- Select Action ---
Close
Help

Select	Name	Status	VLAN ID	Description
○	LBS VLAN 251	Active	251	172.27.251.0/28
○	DataPower Blade 8	Active	101	Project SA-W125 (172.30.101.0/24...
○	Raleigh - POK VLAN	Active	104	Project SA-W125 (172.30.104.0/24...
○	HTTP to WAS VLAN31	Active	31	172.30.31.0/24

Figure 1-11 Virtual networks defined

We have now defined VLAN101 for internal communications between DataPower and the logical partitions (LPARs), A01 and A03. Also, we have defined VLAN104 for external access to DataPower.

Define IEDN interfaces for DataPower

After the virtual networks (VLANs) are created, the next step is to add hosts to them.

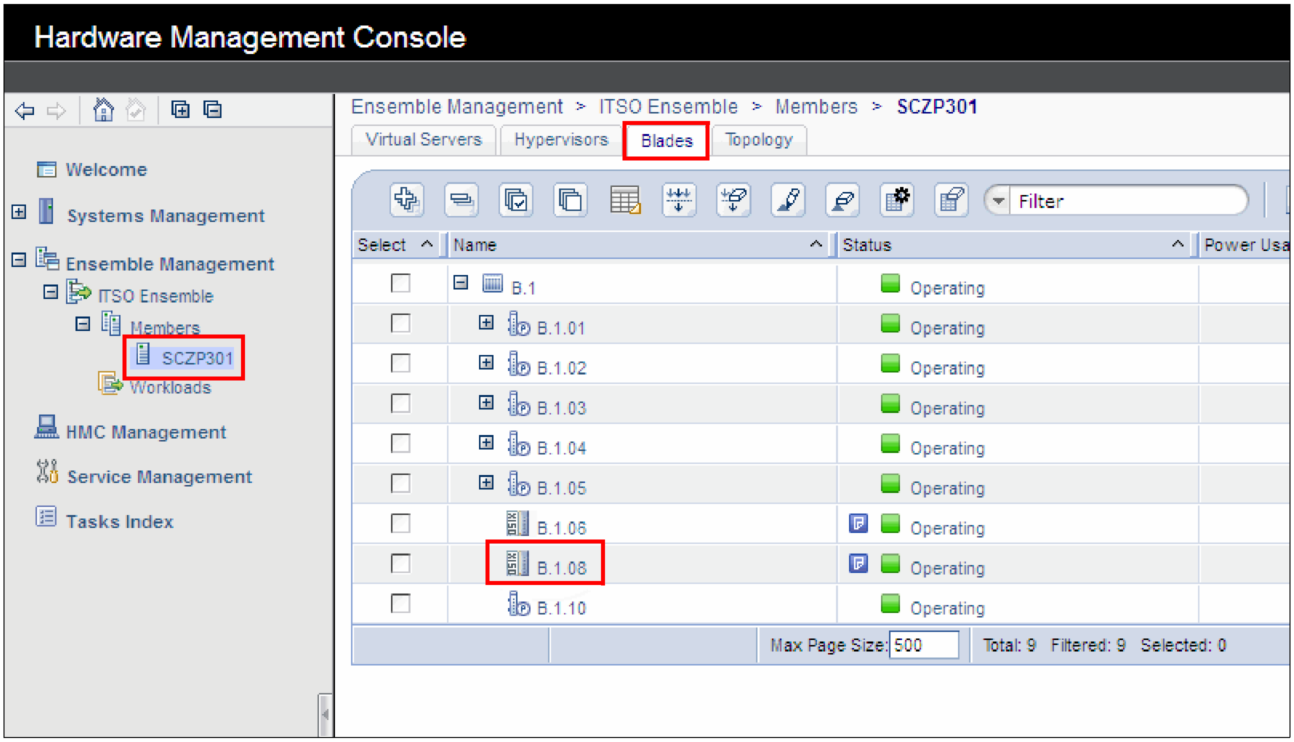
> **Adding the DataPower XI50z blades:** The DataPower XI50z blades are not shown in the “Select Hosts to add to the Virtual Network” option in the Select Action drop-down list. So, to add them, you use the IEDN Interfaces tab on the zBX Blade Details for that specific blade.

Follow these steps:

1. From the HMC initial window, expand **Ensemble Management** → **ITSO Ensemble** → **Members**, and click **SCZP301**.

2. Click the **Blades** tab at the top of the window and a list of blades appears.

3. Select the **B.1.08** DataPower blade by double-clicking it, as shown in Figure 1-12.

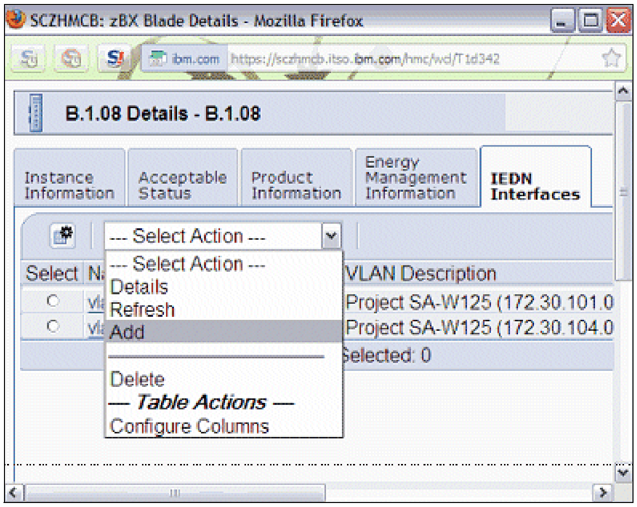


Select	Name	Status	Power Usa
□	B.1	🟩 Operating	
□	B.1.01	🟩 Operating	
□	B.1.02	🟩 Operating	
□	B.1.03	🟩 Operating	
□	B.1.04	🟩 Operating	
□	B.1.05	🟩 Operating	
□	B.1.06	🟩 Operating	
□	B.1.08	🟩 Operating	
□	B.1.10	🟩 Operating	

Max Page Size: 500 Total: 9 Filtered: 9 Selected: 0

Figure 1-12 Create the IEDN interfaces

4. Select the **IEDN Interfaces** tab. From the Select Action drop-down menu, choose **Add** (Figure 1-13).



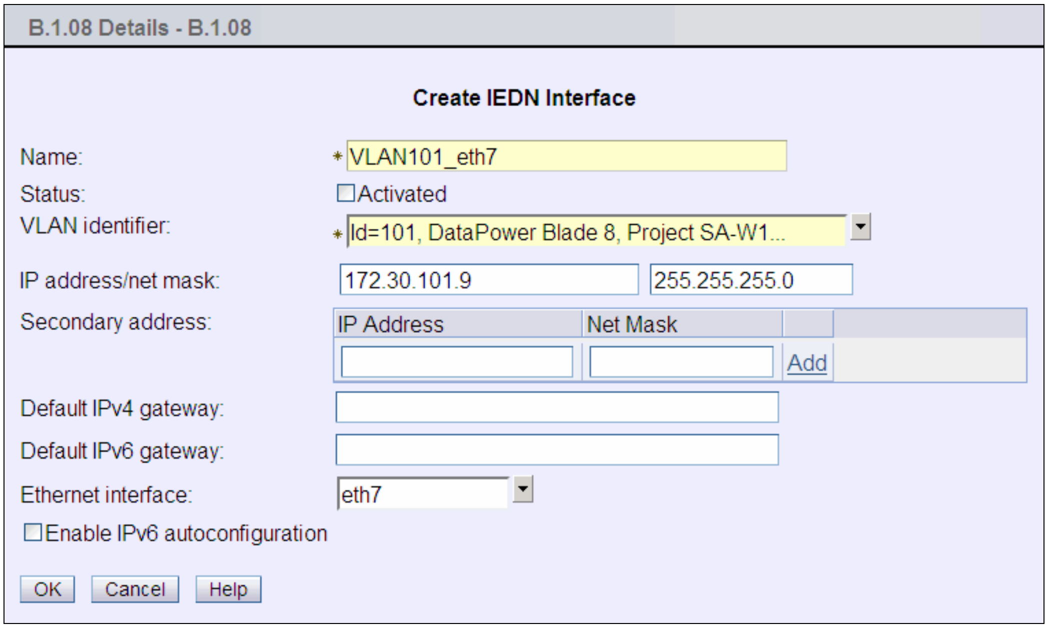
Select	N	VLAN Description
○	vl	Project SA-W125 (172.30.101.0
○	vl	Project SA-W125 (172.30.104.0

Selected: 0

Figure 1-13 Select Add from the IEDN Interfaces tab

5. On the Create IEDN Interface window, enter a name for the IEDN interface and the relative IP address/net mask. From the VLAN identifier drop-down list, select the VLAN ID to associate with each interface (see Figure 1-14 and Figure 1-15). Click **OK**.

> **Network interface ports:** The DataPower XI50z blades have four network interface ports: eth1, eth2, eth7, and eth9. The first two network interface ports, eth1 and eth2, are dedicated to redundant access to the SE through the INMN. The other two ports, eth7 and eth9, are available to set up virtual network interfaces.



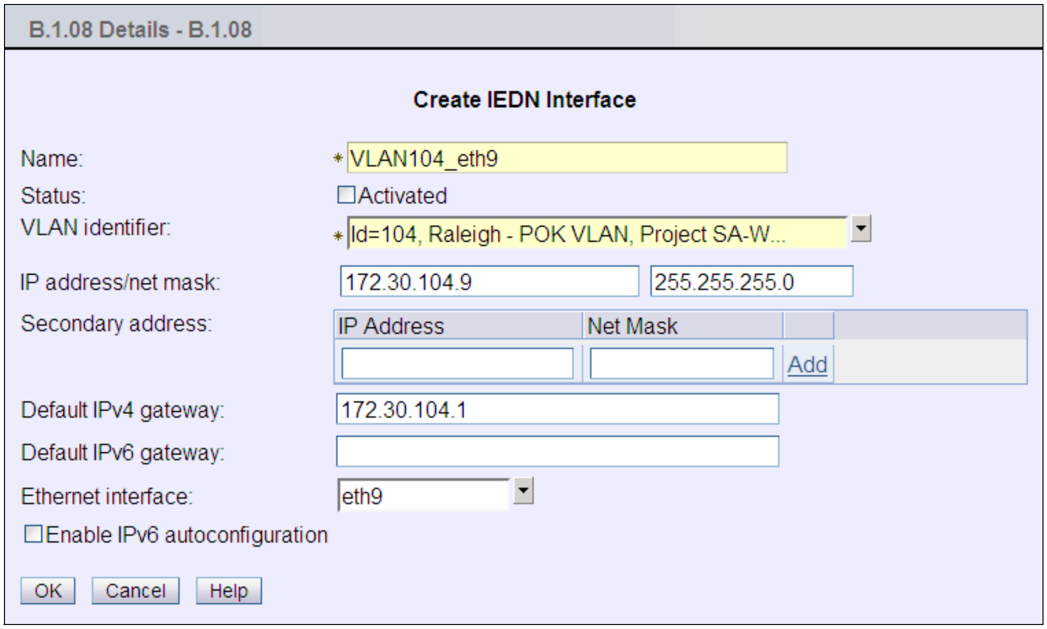
B.1.08 Details - B.1.08

Create IEDN Interface

Name:	* VLAN101_eth7
Status:	☐ Activated
VLAN identifier:	* Id=101, DataPower Blade 8, Project SA-W1...
IP address/net mask:	172.30.101.9 / 255.255.255.0
Secondary address:	IP Address / Net Mask / Add
Default IPv4 gateway:	
Default IPv6 gateway:	
Ethernet interface:	eth7

☐ Enable IPv6 autoconfiguration

Figure 1-14 Create interface 101



B.1.08 Details - B.1.08

Create IEDN Interface

Name:	* VLAN104_eth9
Status:	☐ Activated
VLAN identifier:	* Id=104, Raleigh - POK VLAN, Project SA-W...
IP address/net mask:	172.30.104.9 / 255.255.255.0
Secondary address:	IP Address / Net Mask / Add
Default IPv4 gateway:	172.30.104.1
Default IPv6 gateway:	
Ethernet interface:	eth9

☐ Enable IPv6 autoconfiguration

Figure 1-15 Create interface 104

Configure the TOR Switch

The IEDN TOR switches are the core of the data communications within the ensemble. All virtual servers, virtual switches, and external network data traffic must go through the IEDN TOR switches. The IEDN TOR switches enforce VLAN ID checking and MAC filtering. If inbound frames do not match one of the expected VLAN IDs or MAC addresses, those frames are dropped.

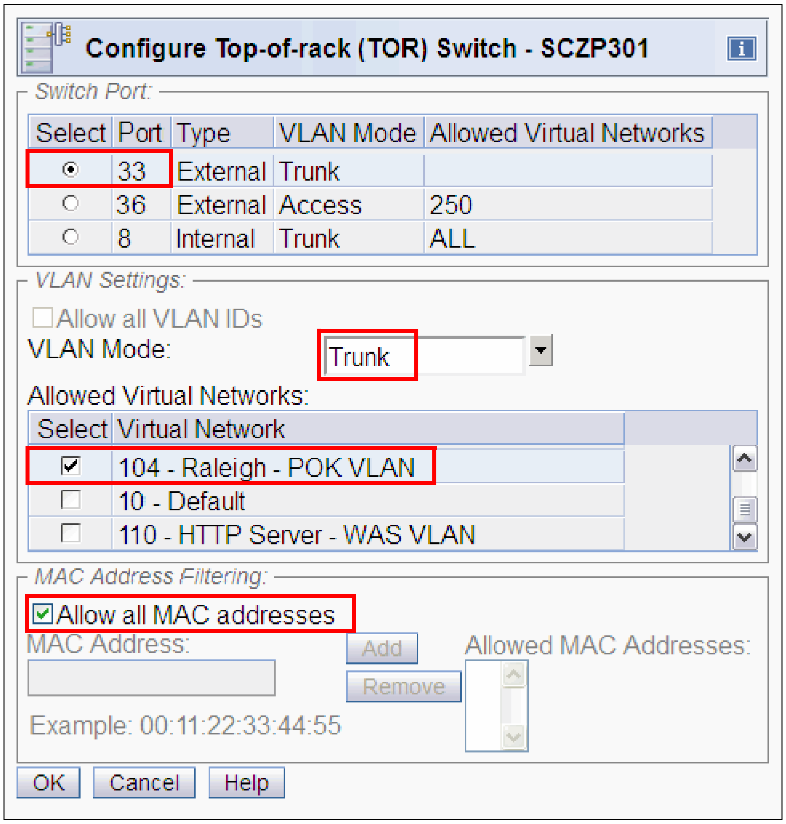
The IEDN TOR switches support two VLAN modes: *trunk* and *access*. When a port is configured with trunk mode, the IEDN TOR Switch expects all inbound frames to have VLAN tags. Therefore, the equipment at the other end of the connection must be VLAN-aware and support VLAN tagging. When a port is configured with access mode, the IEDN TOR Switch applies VLAN tags to each inbound frame. The equipment at the other end of the connection is not VLAN-aware and does not support VLAN tagging.

The internal ports (blade switch modules and TOR ports) are always configured as trunk mode. The internal ports allow all IEDN VLANs to flow but with the understanding that another device, the Hypervisor or VSwitch, is enforcing the access control. Follow these steps:

1. From the Tasks Index, select **Configure TOR Switch**.
2. Select **SCZP301** as the target inside the ensemble and click **OK**.
3. Select which switch to configure from the list and click **OK**.

> **Ports:** Three ports, Port 8, Port 36, and Port 33, appear in the list in Figure 1-16 on page 18. Ports appear on this list *only* if they are plugged into the fiber connection. Ports 33 and 36 are cabled to the external routers. Port 8 is an internal port that is cabled to BladeCenter Chassis number 1. There is an option to “Allow all VLAN IDs”; however, because we are configuring external ports and want secure access, we do not select this option.

4. On the Configure Top-of-rack (TOR) Switch - SCZP301 window, select port **33**, associate VLAN ID **104 - Raleigh - POK VLAN** from the list, select **Trunk** for the VLAN mode, check **Allow all MAC addresses**, and click **OK**. See Figure 1-16.



Configure Top-of-rack (TOR) Switch - SCZP301

Switch Port:

Select	Port	Type	VLAN Mode	Allowed Virtual Networks
●	33	External	Trunk	
○	36	External	Access	250
○	8	Internal	Trunk	ALL

VLAN Settings:

□ Allow all VLAN IDs

VLAN Mode: Trunk

Allowed Virtual Networks:

Select	Virtual Network
☑	104 - Raleigh - POK VLAN
□	10 - Default
□	110 - HTTP Server - WAS VLAN

MAC Address Filtering:

☑ Allow all MAC addresses

MAC Address:

Allowed MAC Addresses:

Example: 00:11:22:33:44:55

Figure 1-16 Configure TOR Switch

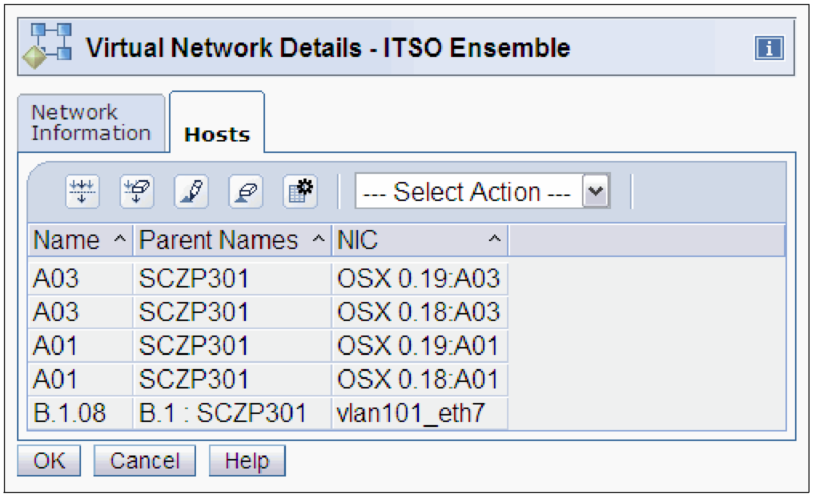
As you can see from Figure 1-16, the internal port 8 definition allows ALL the VLANs to go through this port. Our VLANs, 101 and 104, are automatically authorized to flow through this port.

Add hosts to virtual network

For VLAN101, which is used for internal communications between DataPower and z/OS LPARs, we need to add the names of the target LPARs, A01 and A03.

For VLAN104, for external network access to DataPower, we need to add the name of both TOR switches, in which are defined the ports, such as J33 in this case, used to connect to the external network. Follow these steps:

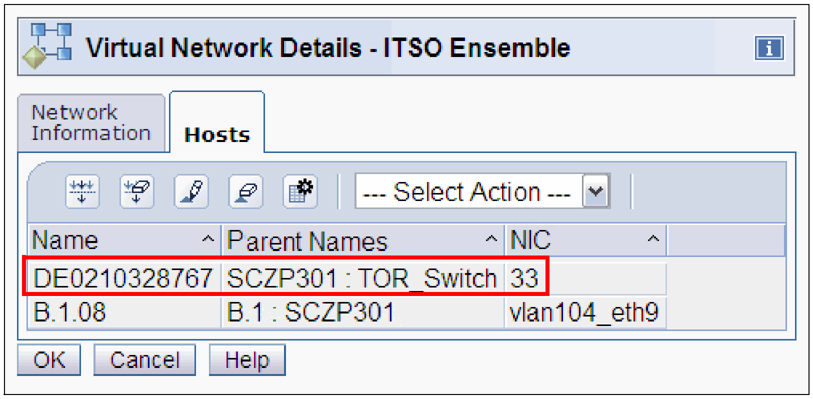
1. From the Tasks Index, select **Manage Virtual Networks**.
2. Select a VLAN ID and click **Add Hosts to Virtual Network** from the drop-down Select Action menu.
3. After the “Collecting Host in the Ensemble” task ends, select the necessary hosts and click **OK**.
4. When complete, you can check the VLANs and associated hosts by clicking **Details** from the drop-down Select Action menu, as shown in Figure 1-17 on page 19.



Name	Parent Names	NIC
A03	SCZP301	OSX 0.19:A03
A03	SCZP301	OSX 0.18:A03
A01	SCZP301	OSX 0.19:A01
A01	SCZP301	OSX 0.18:A01
B.1.08	B.1 : SCZP301	vlan101_eth7

Figure 1-17 Added hosts to VLAN101

> **Details view:** In the Details view for VLAN104, only the DataPower XI50z and TOR switches with the relative network interface card (NIC) ports are shown (see Figure 1-18). For this example, only one TOR Switch was used.



Name	Parent Names	NIC
DE0210328767	SCZP301 : TOR_Switch	33
B.1.08	B.1 : SCZP301	vlan104_eth9

Figure 1-18 Added hosts to VLAN104

1.4.2 z/OS definitions to set up the virtual network

You need to plan the following steps (certain steps are required) to enable z/OS to use the ensemble:

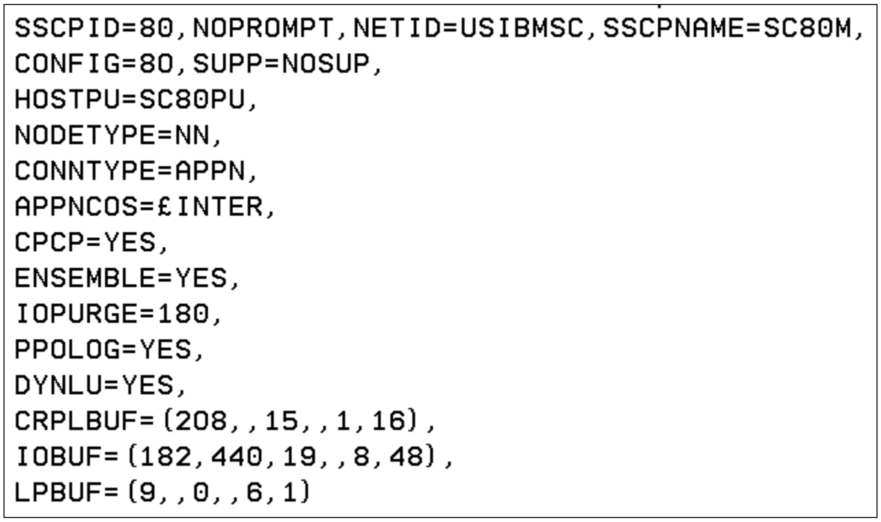
1. Configure VTAM® definitions to let z/OS participate in the ensemble
2. Define OSX interfaces for IEDN definitions
3. Enable z/OS for IPv6

Configure VTAM definitions to let z/OS participate in the ensemble

We assume that many preliminary steps were already performed, such as “Create Ensemble using zManager tasks”. For reference, the z/OS LPAR automatically becomes a member of the ensemble when the “Create Ensemble using zManager tasks” is performed and the CPC is added as a member of the ensemble. Unlike other virtual servers, z/OS, in its own LPAR, acquires a NIC with a MAC prefix coordinated by the zManager, for use in the ensemble.

LPAR targets: In this chapter, we show the definitions that we made for one of the z/OS LPAR targets of our network, SC80 only. However, all the definitions are to be replicated for both LPARs, SC80 and SC81, which are part of the sysplex.

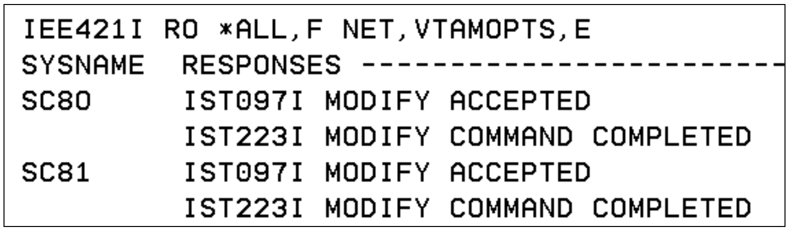
A change is required to VTAM to configure a z/OS LPAR to participate in the ensemble. You need to specify the new VTAM start option, `ENSEMBLE=YES`. In the VTAM member ATSCTR00, make the change from `ENSEMBLE=NO` to `ENSEMBLE=YES`, as shown in Figure 1-19.



```
SSCPID=80,NOPROMPT,NETID=USIBMSC,SSCPNAME=SC80M,
CONFIG=80,SUPP=NOSUP,
HOSTPU=SC80PU,
NODETYPE=NN,
CONNTYPE=APPN,
APPNCOS=£INTER,
CPCP=YES,
ENSEMBLE=YES,
IOPURGE=180,
PPOLOG=YES,
DYNLU=YES,
CRPLBUF=(208,,15,,1,16),
IOBUF=(182,440,19,,8,48),
LPBUF=(9,,0,,6,1)
```

Figure 1-19 VTAMLST definitions

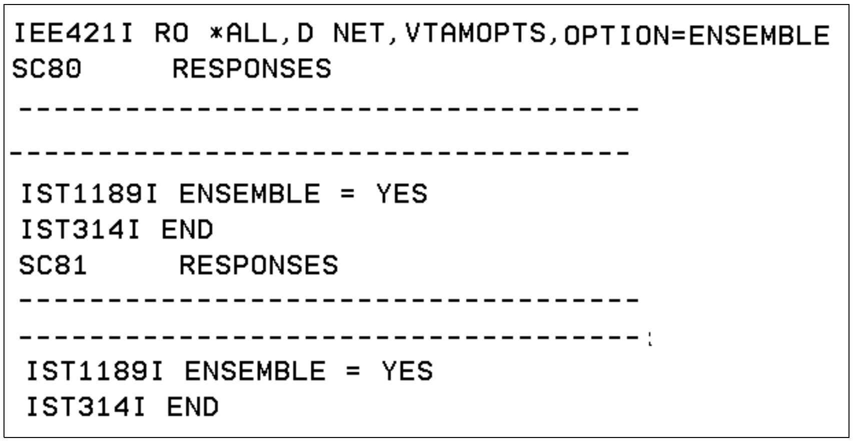
This parameter can be changed dynamically through a MODIFY VTAM command. See Figure 1-20.



```
IEE421I RO *ALL,F NET,VTAMOPTS,E
SYSNAME  RESPONSES ------------------
SC80     IST097I MODIFY ACCEPTED
         IST223I MODIFY COMMAND COMPLETED
SC81     IST097I MODIFY ACCEPTED
         IST223I MODIFY COMMAND COMPLETED
```

Figure 1-20 MODIFY VTAM command

After the MODIFY VTAM command is issued, you can verify the results using the DISPLAY VTAM command, as shown in Figure 1-21.



```
IEE421I RO *ALL,D NET,VTAMOPTS,OPTION=ENSEMBLE
SC80     RESPONSES
 ----------------------------------
----------------------------------
 IST1189I ENSEMBLE = YES
 IST314I END
 SC81     RESPONSES
 ----------------------------------
 ----------------------------------
  IST1189I ENSEMBLE = YES
  IST314I END
```

Figure 1-21 DISPLAY VTAM command

Now, it is necessary to recycle TCP/IP, because it needs to add its automatic definitions of Transport Resource List Entries (TRLEs) for the management network INMN.

We stop and initialize the TCP/IP stack using these commands:

- `P TCPIP`
- `S TCPIP`

After TCP/IP is re-initialized, the TRLEs, IUTMT00A and IUTMT00B, are created, as shown in Example 1-1.

Example 1-1 Displaying the TRLEs for the INMN connections in VTAM

```
D NET,E,ID=ISTTRL
IST097I DISPLAY ACCEPTED
IST075I NAME = ISTTRL, TYPE = TRL MAJOR NODE 248
.........................
IST1314I TRLE = IUTMT00B  STATUS = ACTIV      CONTROL = MPC     C
IST1314I TRLE = IUTMT00A  STATUS = ACTIV      CONTROL = MPC     D
.........................
IST314I END
```

Define OSX interfaces for IEDN definitions

Unlike the automatic definitions of the INMN component, you must explicitly define the IEDN interfaces.

z/OS accesses the IEDN through the 10 GbE OSA-Express3 features that are configured with the OSX CHPID type. You must configure those CHPIDs as Layer 3 IP interfaces to z/OS with an IP address and a subnet mask. These values must be consistent with the other virtual servers in the VLANs to which the z/OS TCP/IP stack will communicate.

In addition, because z/OS is VLAN-aware, the interface definition also requires the configuration of the VLAN ID, in our case, VLAN101. See Example 1-2 on page 22.

Example 1-2 IEDN interface statements are added to SYS1.TCPPARMS(PROF80)

```
; ------------- IEDN INTERFACES FOR ENSEMBLE ATTACHMENTS ---------
; ---VLAN 101 ---
INTERFACE OSX2300A
 DEFINE IPAQENET CHPIDTYPE OSX
 CHPID 18    VLANID 101
 MTU 8992     IPADDR 172.30.101.1/24
;;
INTERFACE OSX2320A
 DEFINE IPAQENET CHPIDTYPE OSX
 CHPID 19    VLANID 101
 MTU 8992     IPADDR 172.30.101.2/24
;;
```

Now, a new recycle for TCP/IP is necessary to accept the changes that have been made.

> **Important:** If “Add the z/OS Host Name to VLAN” does not show in “Add hosts to virtual network” on page 18, you get the following error messages for both interfaces when TCP/IP is reactivated:
>
> ```
> EZZ4336I ERROR DURING ACTIVATION OF INTERFACE OSX2300A - CODE
>  8010002B DIAGNOSTIC CODE 02
> IST1631I IUTXT019 SUBCHANNEL 2320 NOT ADDED TO VIRTUAL NET
> IST1650I IDX INITIALIZATION FAILED FOR IUTXT019 DEVICE 2320 CODE 1E
> ```

The VTAM TRLEs for IEDN, which are named IUTXT018 and IUTXT019, now show as ACTIVE in the output of a DISPLAY TRLE command. See Example 1-3.

Example 1-3 Displaying the TRLEs for the INMN and IEDN connections in VTAM

```
D NET,E,ID=ISTTRL
IST097I DISPLAY ACCEPTED
IST075I NAME = ISTTRL, TYPE = TRL MAJOR NODE 248
IST1314I TRLE = IUTXT019  STATUS = ACTIV       CONTROL = MPC     A
IST1314I TRLE = IUTXT018  STATUS = ACTIV       CONTROL = MPC     B
...........................
IST1314I TRLE = IUTMT00B  STATUS = ACTIV       CONTROL = MPC     C
IST1314I TRLE = IUTMT00A  STATUS = ACTIV       CONTROL = MPC     D
...........................
IST314I END
```

Enable TCP/IP for IPv6

You must enable IPv6 for the z/OS LPAR for OSM connectivity to participate in the INMN. Only the INMN network uses the IPv6 protocol; the other networks in your environment do not use the IPv6 protocol. To enable IPv6, there must be a change to BPXPRMxx member of SYS1.PARMLIB to add the `AF_INET6` statement, as shown in Example 1-4 on page 23. An IPL of z/OS or a dynamic activation of the BPXPRMxx member is required to complete the enablement. Example 1-4 on page 23 also shows the additional parameters that are added to the `AF_INET` part of the BPXPRMxx SYS1.PARMLIB member.

Example 1-4 Example BPXPRMxx entry for enabling IPv6

```
FILESYSTYPE TYPE(INET)ENTRYPOINT(EZBPFINI)
NETWORK DOMAINNAME(AF_INET6)
DOMMAINNUMBER(19)
MAXSOCKETS(3000)
TYPE(INET)
```

Next, display the TCP/IP stack's home list to verify that there is a LOOPBACK6 device. This device indicates that the stack is enabled for IPv6.

1.4.3 Initial DataPower setup

You must perform the initial setup for the DataPower blade before you start to use it.

Setting up the dp-admin user

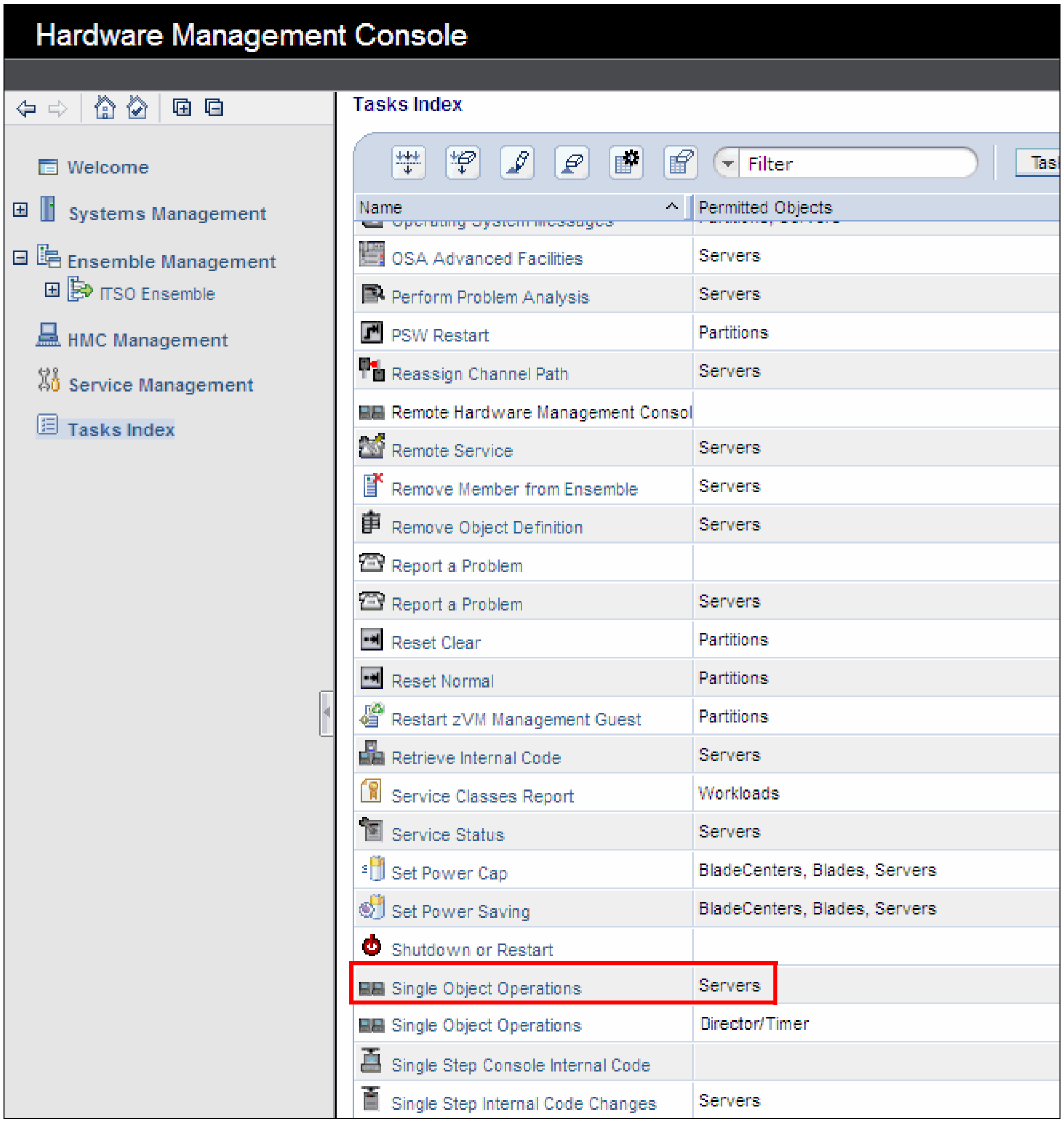
To set up the dp-admin user, you must access the DataPower from the HMC. When you access DataPower for the first time, the default user ID and password are both dp-admin. At the first logon, you are asked to change the password.

Perform the following steps:

1. Log on to the HMC.

   When the logon is complete, from the left bar, expand **Tasks Index** and a list appears, as shown in Figure 1-22 on page 24.

2. Click **Single Object Operations**, which connects you directly to the HMC SE.

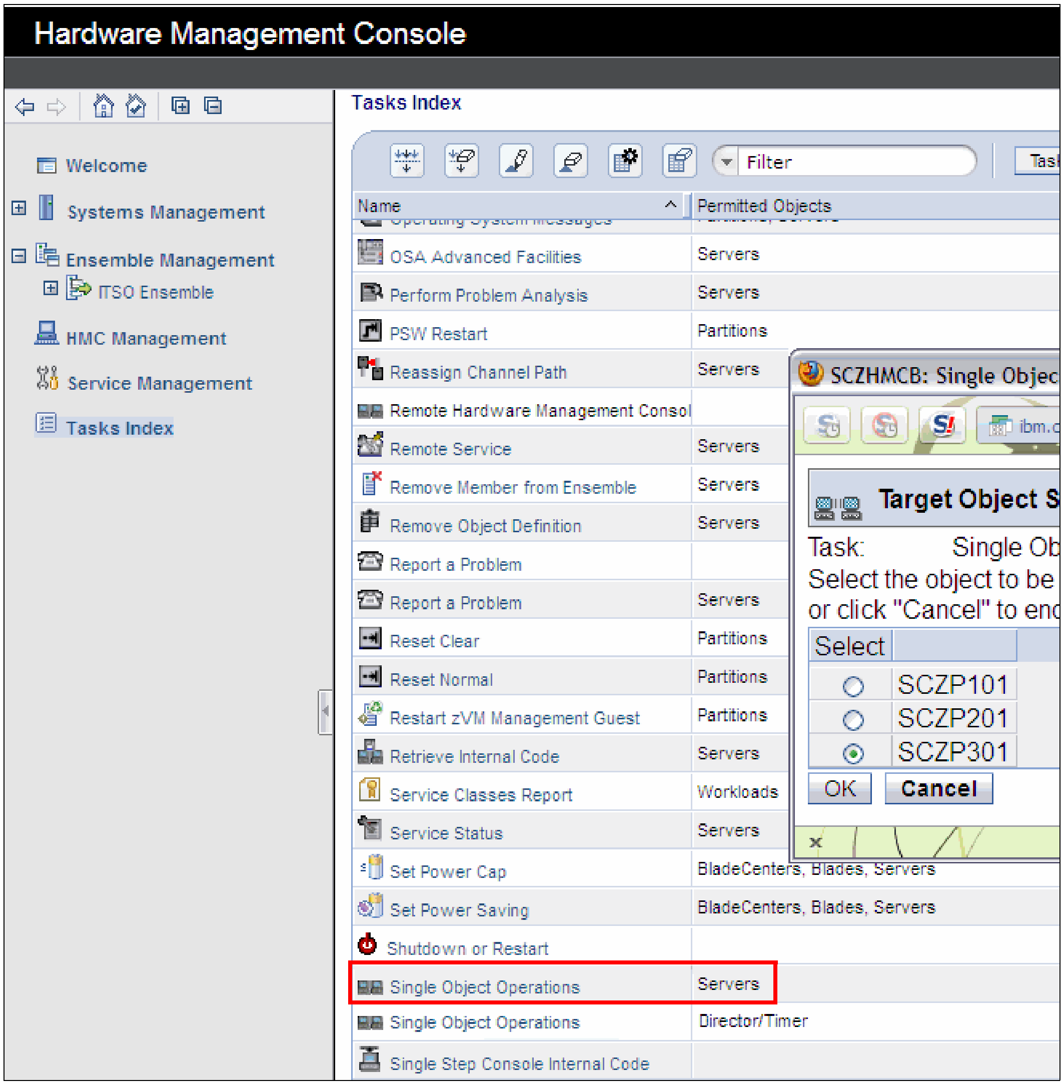


Tasks Index

Name	Permitted Objects
Operating System Messages	Partitions, Servers
OSA Advanced Facilities	Servers
Perform Problem Analysis	Servers
PSW Restart	Partitions
Reassign Channel Path	Servers
Remote Hardware Management Consol	
Remote Service	Servers
Remove Member from Ensemble	Servers
Remove Object Definition	Servers
Report a Problem	
Report a Problem	Servers
Reset Clear	Partitions
Reset Normal	Partitions
Restart zVM Management Guest	Partitions
Retrieve Internal Code	Servers
Service Classes Report	Workloads
Service Status	Servers
Set Power Cap	BladeCenters, Blades, Servers
Set Power Saving	BladeCenters, Blades, Servers
Shutdown or Restart	
Single Object Operations	Servers
Single Object Operations	Director/Timer
Single Step Console Internal Code	
Single Step Internal Code Changes	Servers

Figure 1-22 HMC panel

3. Clicking the Single Object Operations displays a list of servers in the pop-up window. Click the server, in this case, **SCZP301**, and click **OK**, as shown in Figure 1-23.



Hardware Management Console

- Welcome
- Systems Management
- Ensemble Management
  - ITSO Ensemble
- HMC Management
- Service Management
- Tasks Index

Tasks Index

Filter

Name	Permitted Objects
OSA Advanced Facilities	Servers
Perform Problem Analysis	Servers
PSW Restart	Partitions
Reassign Channel Path	Servers
Remote Hardware Management Consol	
Remote Service	Servers
Remove Member from Ensemble	Servers
Remove Object Definition	Servers
Report a Problem	
Report a Problem	Servers
Reset Clear	Partitions
Reset Normal	Partitions
Restart zVM Management Guest	Partitions
Retrieve Internal Code	Servers
Service Classes Report	Workloads
Service Status	Servers
Set Power Cap	BladeCenters, Blades, Servers
Set Power Saving	BladeCenters, Blades, Servers
Shutdown or Restart	
Single Object Operations	Servers
Single Object Operations	Director/Timer
Single Step Console Internal Code	

SCZHMCB: Single Objec

Target Object S

Task: Single Ob

Select the object to be

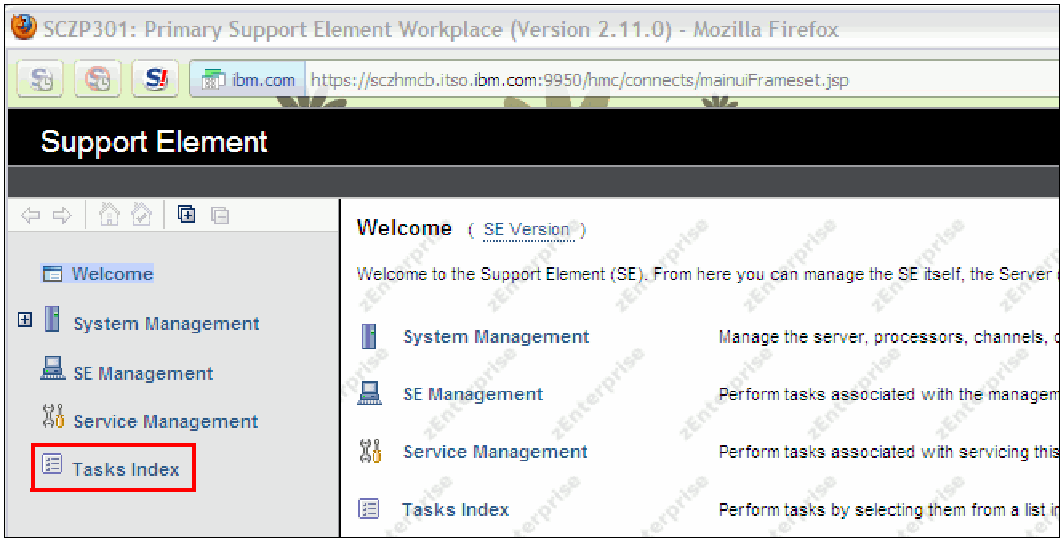
or click "Cancel" to end

Select	
○	SCZP101
○	SCZP201
●	SCZP301

OK Cancel

Figure 1-23 Single Object Operations

Now, the connection to the SE is established. Figure 1-24 shows the Support Element window.



SCZP301: Primary Support Element Workplace (Version 2.11.0) - Mozilla Firefox

https://sczhmcb.itso.ibm.com:9950/hmc/connects/mainuiFrameset.jsp

Welcome (SE Version)

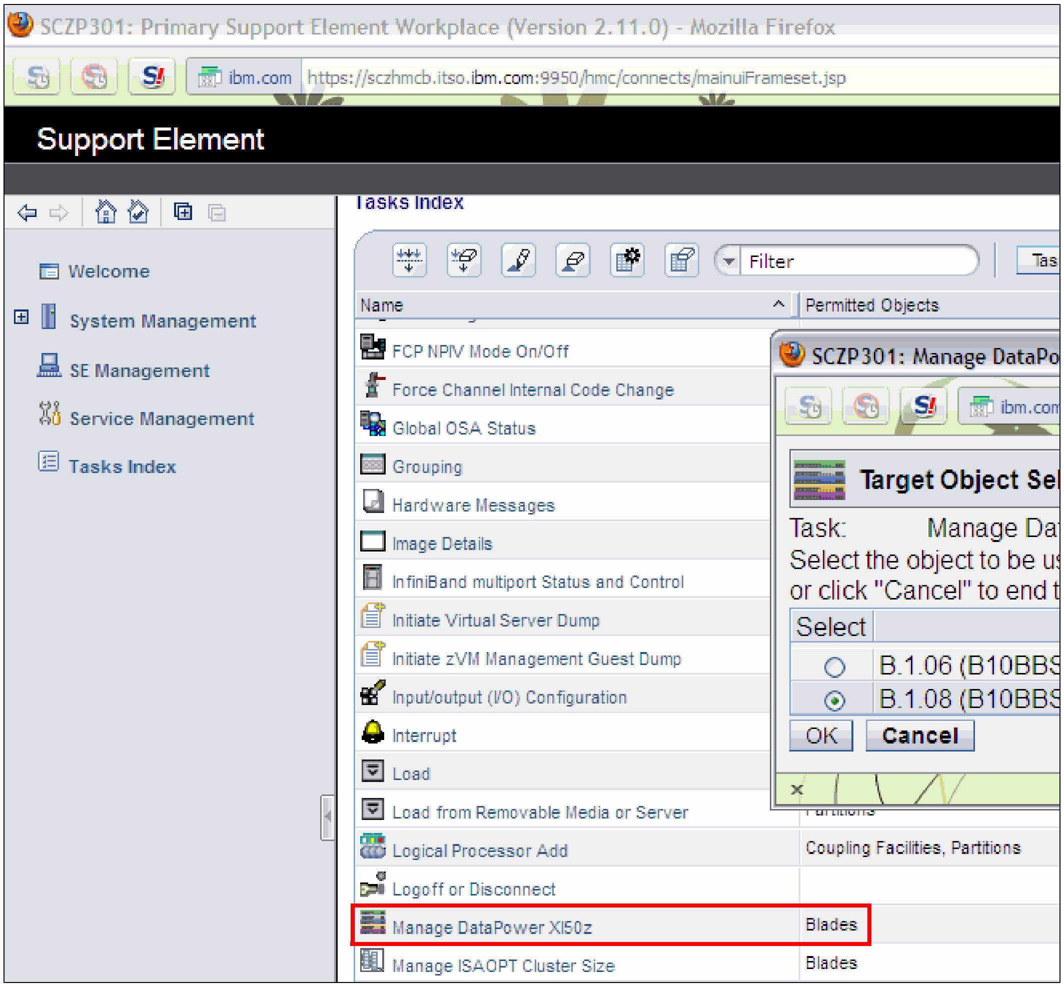
Welcome to the Support Element (SE). From here you can manage the SE itself, the Server

System Management	Manage the server, processors, channels,
SE Management	Perform tasks associated with the managem
Service Management	Perform tasks associated with servicing this
Tasks Index	Perform tasks by selecting them from a list i

Figure 1-24 Support Element

4. From the left panel, click **Tasks Index**.

5. Click **Manage DataPower xl50z** (See Figure 1-25).



Name	Permitted Objects
FCP NPIV Mode On/Off	
Force Channel Internal Code Change	
Global OSA Status	
Grouping	
Hardware Messages	
Image Details	
InfiniBand multiport Status and Control	
Initiate Virtual Server Dump	
Initiate zVM Management Guest Dump	
Input/output (I/O) Configuration	
Interrupt	
Load	
Load from Removable Media or Server	Partitions
Logical Processor Add	Coupling Facilities, Partitions
Logoff or Disconnect	
Manage DataPower XI50z	Blades
Manage ISAOPT Cluster Size	Blades

Task: Manage Da

Select the object to be us
or click "Cancel" to end t

Select	
○	B.1.06 (B10BBS
●	B.1.08 (B10BBS

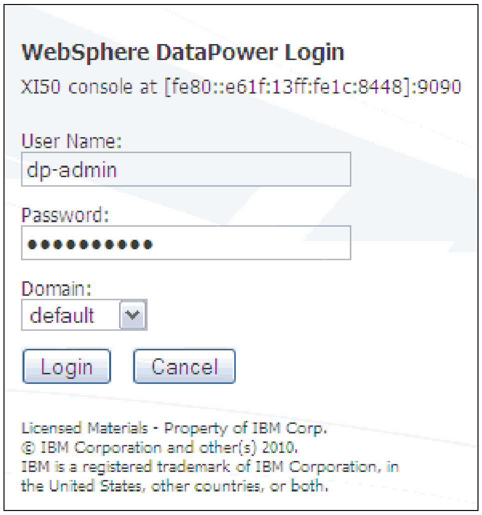
OK Cancel

Figure 1-25 Manage DataPower

6. Click the DataPower blade to which you want to connect, in this case, **B.1.08**.

7. After you connect to the DataPower blade, the WebSphere DataPower Login window opens, and you enter the dp-admin User Name and Password. Click **Login** to log in to DataPower. See Figure 1-26.

> **Login:** Remember, the default User Name and Password are both dp-admin. At the first login, you are asked to change the password.



WebSphere DataPower Login

XI50 console at [fe80::e61f:13ff:fe1c:8448]:9090

User Name: dp-admin

Password: ●●●●●●●●●●

Domain: default

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IBM is a registered trademark of IBM Corporation, in the United States, other countries, or both.

Figure 1-26 WebSphere DataPower Login

Now, you are connected to the DataPower and the Control Panel appears, as shown in Figure 1-27.

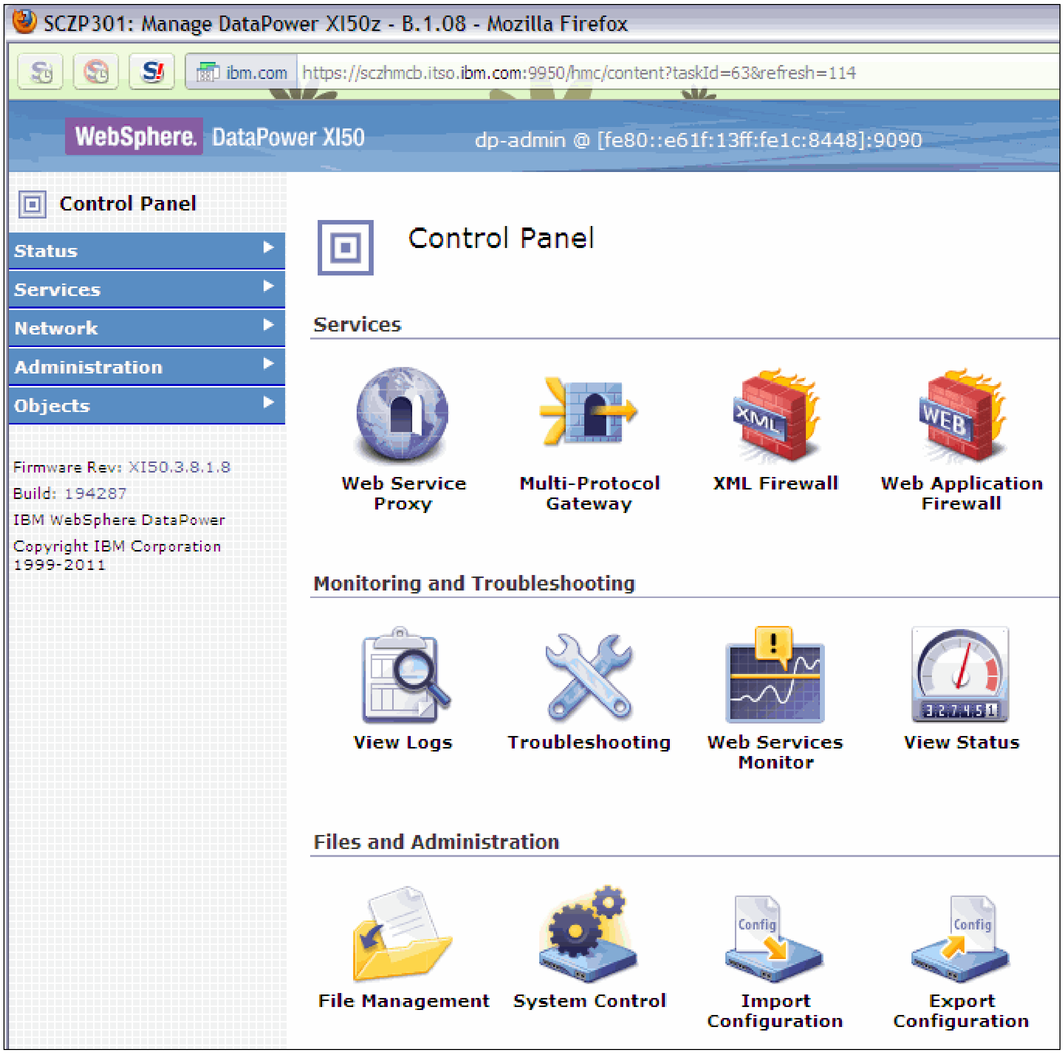


Figure 1-27 Control Panel

Set up DataPower IDs

After the dp-admin user is set, you can now define other user IDs as needed, as described in these steps:

1. Log on as dp-admin and click **Administration** (Figure 1-28).

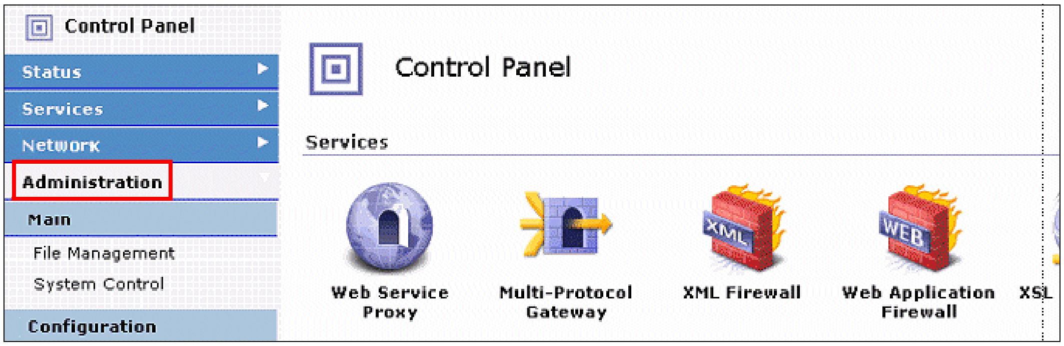
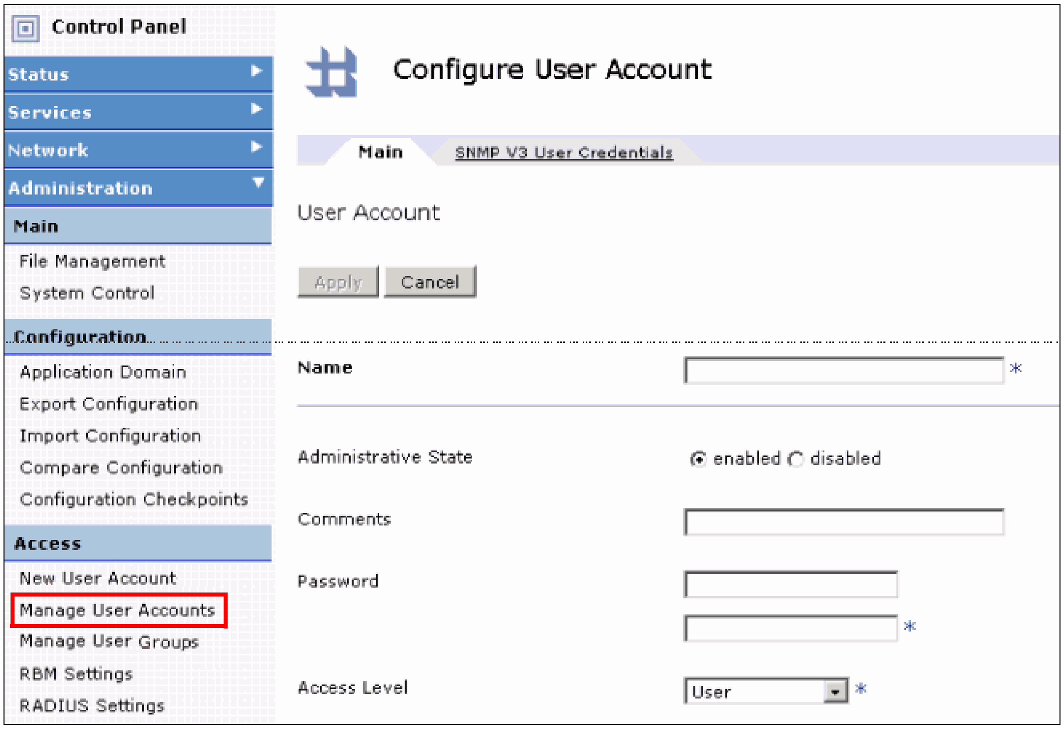


Figure 1-28 Administration

2. On the left panel, click **Manage User Accounts**. Type a Name (Figure 1-29).



Name: *

Administrative State: ● enabled ○ disabled

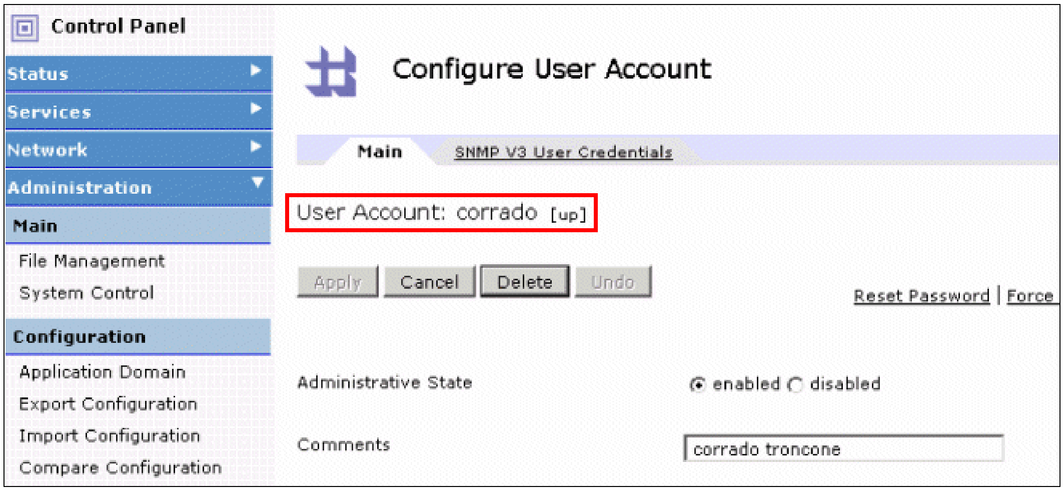
Comments:

Password: *

Access Level: User *

Figure 1-29 Configure User Account window

3. Create the user, type a comment, and click **Apply** (Figure 1-30).



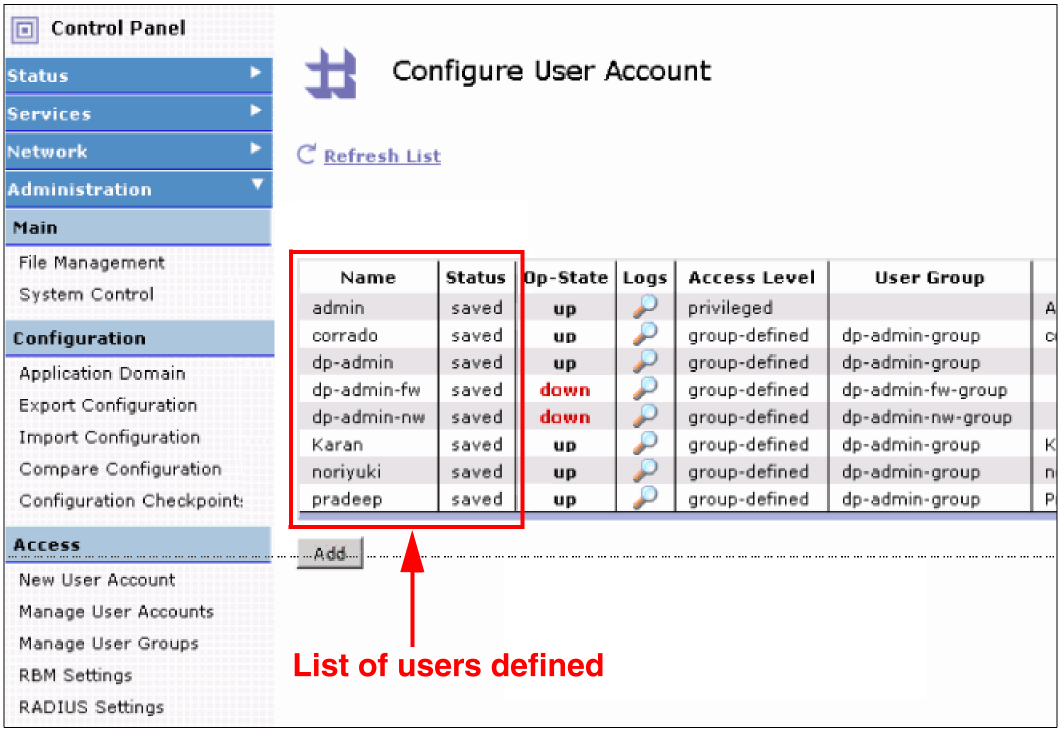
User Account: corrado [up]

Administrative State: ● enabled ○ disabled

Comments: corrado troncone

Figure 1-30 Configure User Account

After a user is created, it shows in the list (Figure 1-31).



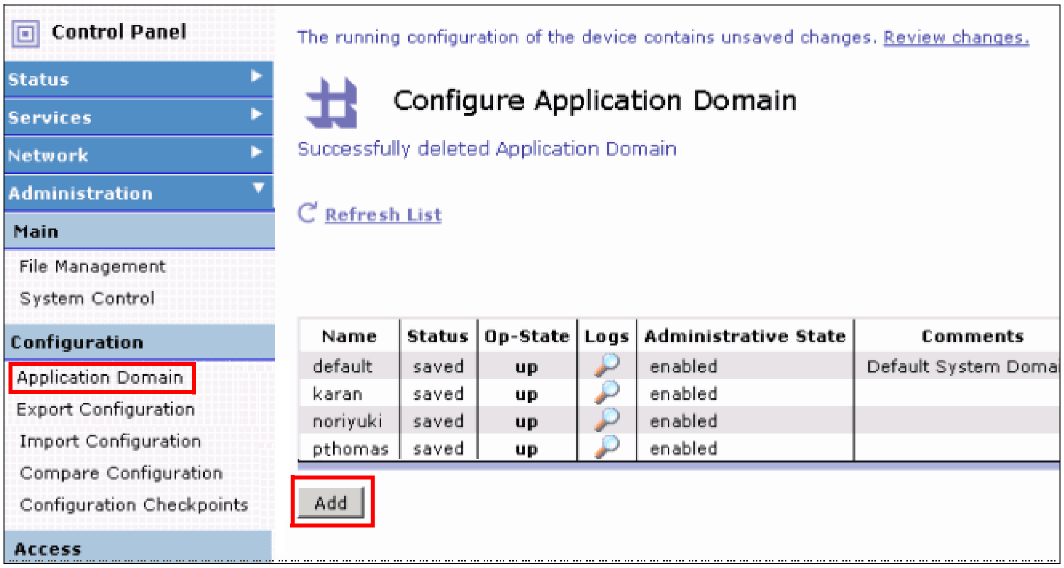
Name	Status	Op-State	Logs	Access Level	User Group	
admin	saved	up	🔍	privileged		A
corrado	saved	up	🔍	group-defined	dp-admin-group	c
dp-admin	saved	up	🔍	group-defined	dp-admin-group	
dp-admin-fw	saved	down	🔍	group-defined	dp-admin-fw-group	
dp-admin-nw	saved	down	🔍	group-defined	dp-admin-nw-group	
Karan	saved	up	🔍	group-defined	dp-admin-group	K
noriyuki	saved	up	🔍	group-defined	dp-admin-group	n
pradeep	saved	up	🔍	group-defined	dp-admin-group	P

Figure 1-31 List of users

Set the DataPower domain

The next task is to configure the application domain for each defined user. Follow these steps to configure the Application domain:

1. On the Configure Application Domain window, on the left panel, click **Application Domain** and click **Add** (Figure 1-32).



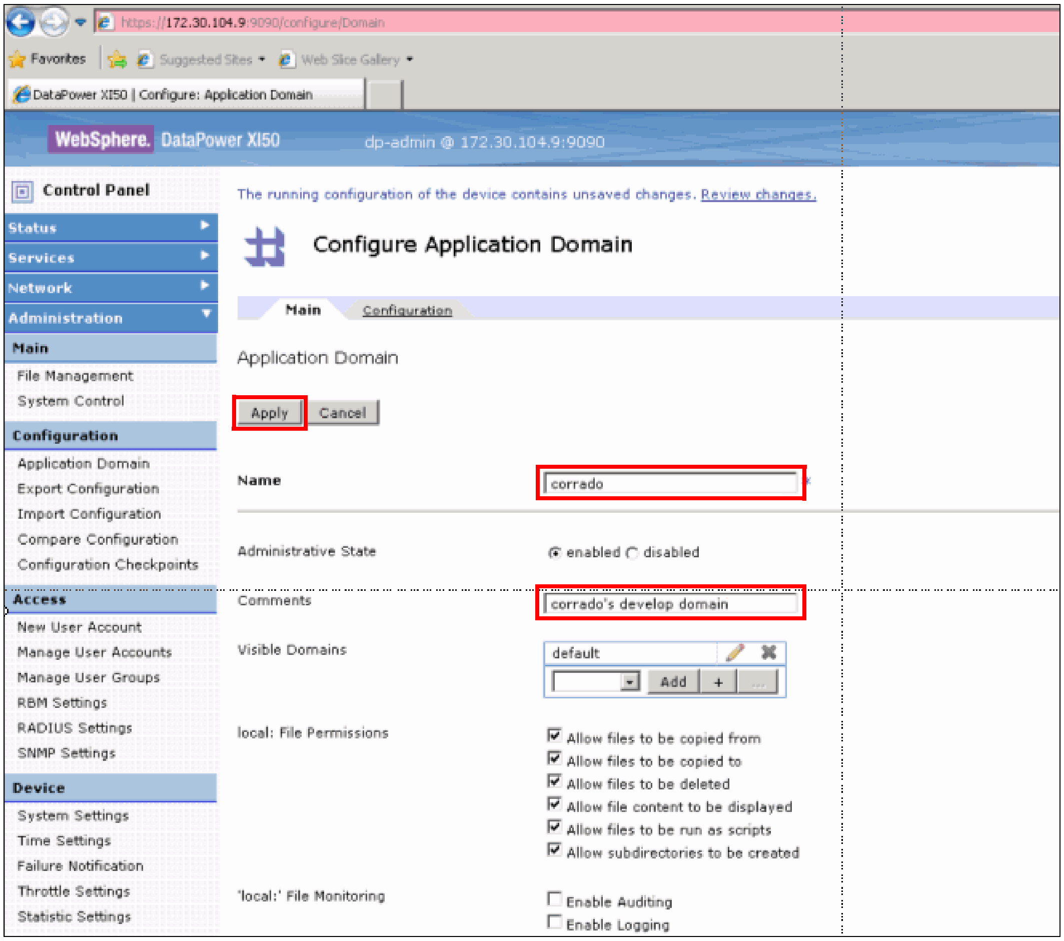
The running configuration of the device contains unsaved changes. Review changes.

Successfully deleted Application Domain

Name	Status	Op-State	Logs	Administrative State	Comments
default	saved	up	🔍	enabled	Default System Doma
karan	saved	up	🔍	enabled	
noriyuki	saved	up	🔍	enabled	
pthomas	saved	up	🔍	enabled	

Figure 1-32 Configure Application Domain

2. Type the Name and Comments, and click **Apply** (Figure 1-33).



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

Configure Application Domain

Application Domain

Name: corrado

Administrative State: ● enabled ○ disabled

Comments: corrado's develop domain

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

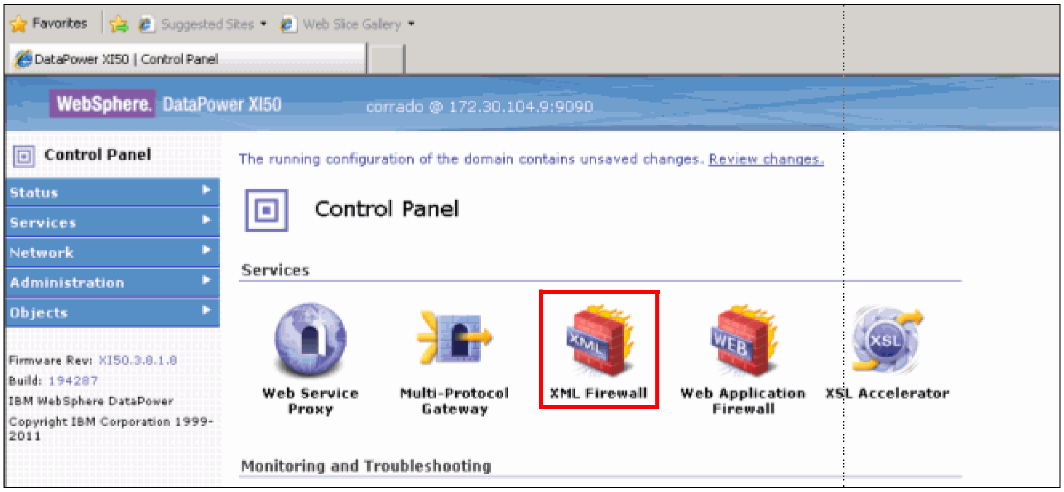
Figure 1-33 Application domain creation

At the end, do not forget to save the configuration. Click **Save Config**.

Verify DataPower

To verify that DataPower works properly, we defined a loopback firewall and activated it in DataPower. Using a simple program, you can test that DataPower works. Follow these steps:

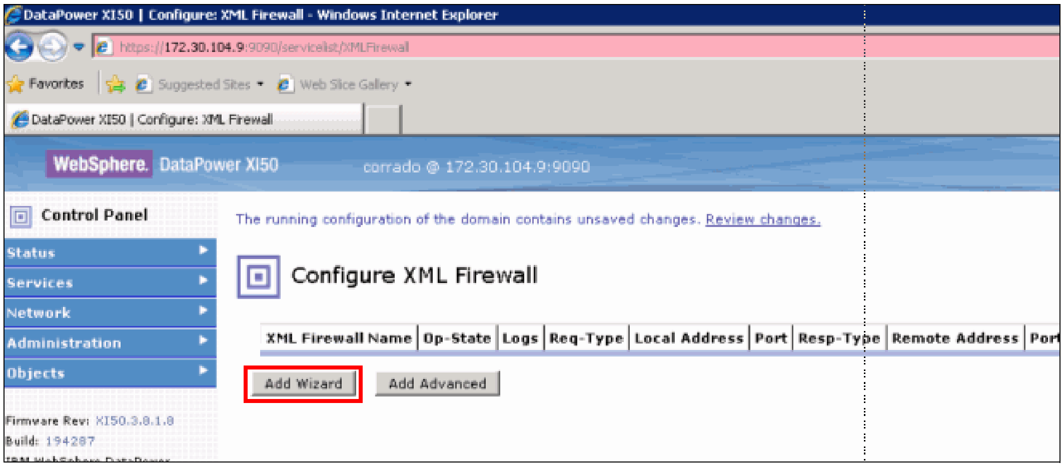
1. From the Control Panel, click the **XML Firewall** icon, as shown in Figure 1-34.



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

Figure 1-34 XML Firewall

2. Click **Add Wizard**, as shown in Figure 1-35.

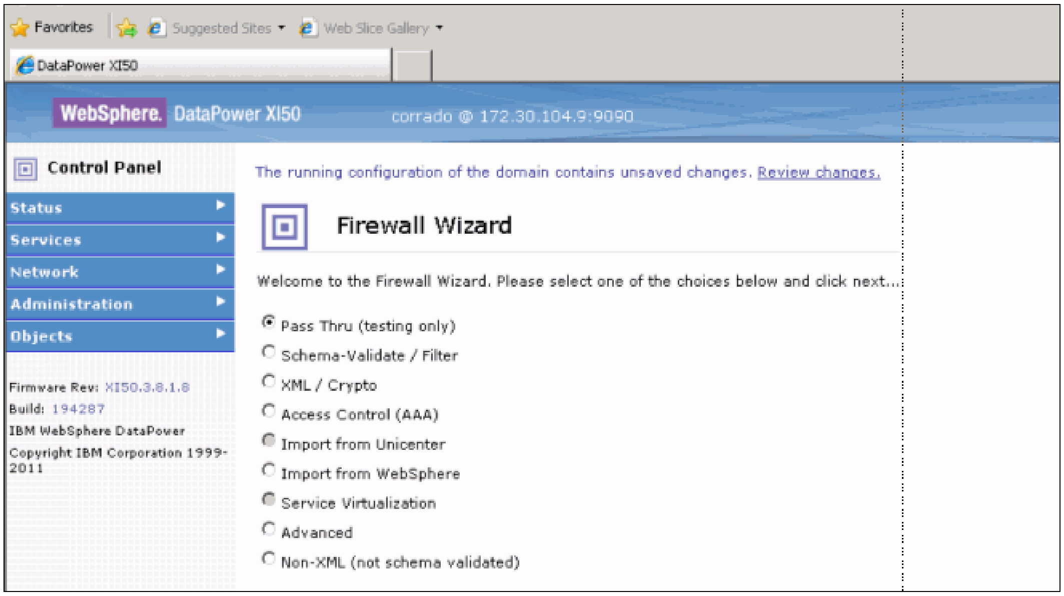

DataPower XI50 | Configure: XML Firewall - Windows Internet Explorer
https://172.30.104.9:9090/servicelist/XMLFirewall
Favorites
Suggested Sites
Web Slice Gallery
DataPower XI50 | Configure: XML Firewall
WebSphere. DataPower XI50
corrado @ 172.30.104.9:9090
Control Panel
Status
Services
Network
Administration
Objects
Firmware Rev: XI50.3.8.1.8
Build: 194287
Configure XML Firewall
Add Wizard
Add Advanced

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

XML Firewall Name	Op-State	Logs	Req-Type	Local Address	Port	Resp-Type	Remote Address	Port

Figure 1-35 Add Wizard

3. Click **Pass Thru (testing only)**, as shown in Figure 1-36, and click **Next**.



Firmware Rev: XI50.3.8.1.8
Build: 194287
IBM WebSphere DataPower
Copyright IBM Corporation 1999-2011

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

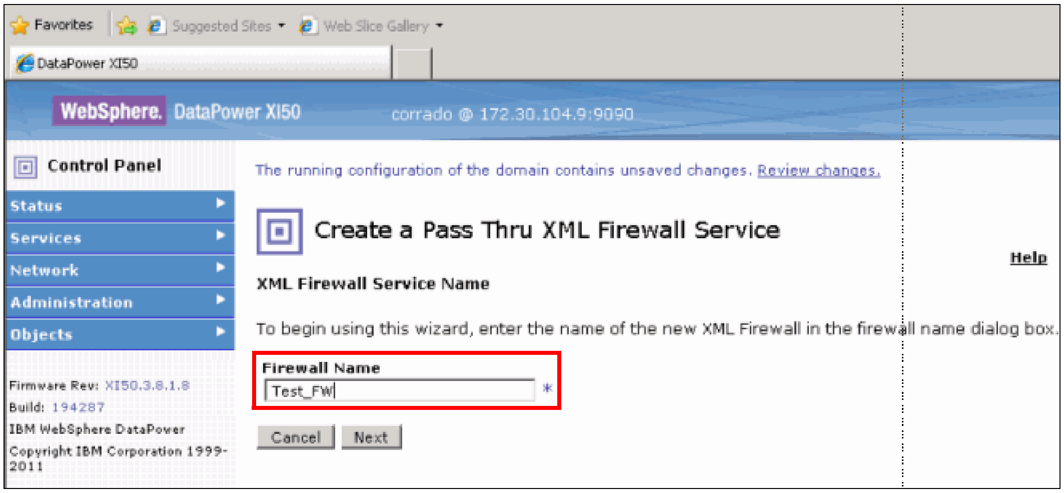
Firewall Wizard

Welcome to the Firewall Wizard. Please select one of the choices below and click next...

- ● Pass Thru (testing only)
- ○ Schema-Validate / Filter
- ○ XML / Crypto
- ○ Access Control (AAA)
- ○ Import from Unicenter
- ○ Import from WebSphere
- ○ Service Virtualization
- ○ Advanced
- ○ Non-XML (not schema validated)

Figure 1-36 Pass Thru (testing only)

4. Choose a name for the firewall service, in our example, we typed `TEST_FW`. Click **Next**, as shown in Figure 1-37.



Firmware Rev: XI50.3.8.1.8
Build: 194287
IBM WebSphere DataPower
Copyright IBM Corporation 1999-2011

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

Create a Pass Thru XML Firewall Service

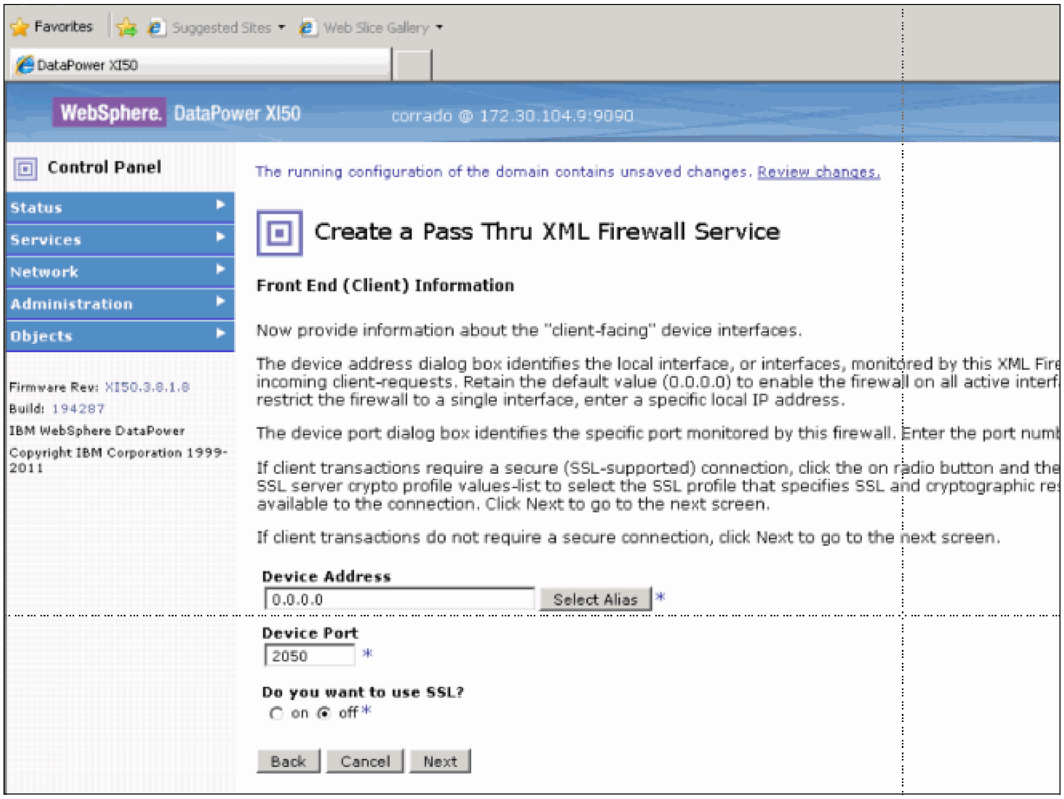
XML Firewall Service Name

To begin using this wizard, enter the name of the new XML Firewall in the firewall name dialog box.

Firewall Name: Test_FW *

Figure 1-37 Firewall Name

5. Type the Device Address and Device Port (Figure 1-38), and click **Next**.



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

Create a Pass Thru XML Firewall Service

Front End (Client) Information

Now provide information about the "client-facing" device interfaces.

The device address dialog box identifies the local interface, or interfaces, monitored by this XML Fire incoming client-requests. Retain the default value (0.0.0.0) to enable the firewall on all active interf restrict the firewall to a single interface, enter a specific local IP address.

The device port dialog box identifies the specific port monitored by this firewall. Enter the port numb

If client transactions require a secure (SSL-supported) connection, click the on radio button and the SSL server crypto profile values-list to select the SSL profile that specifies SSL and cryptographic re available to the connection. Click Next to go to the next screen.

If client transactions do not require a secure connection, click Next to go to the next screen.

Device Address
0.0.0.0 *

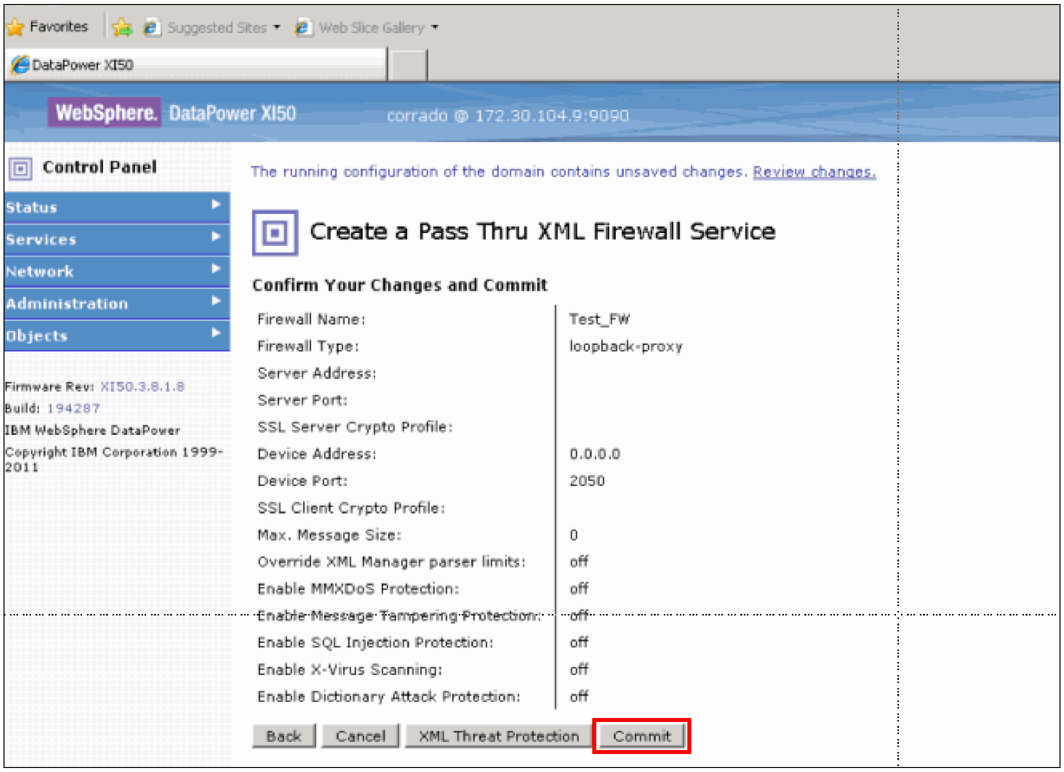
Device Port
2050 *

Do you want to use SSL?
○ on ● off *

Figure 1-38 Enter the Device Port number

6. Select **Service Type**, and then, select **Loopback-proxy**.

7. Then, a confirmation window lists what you have created. Click **Commit** to accept the changes that you have made. a list of what was created is shown and it is asked to confirm the choices, as shown in Figure 1-39.



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

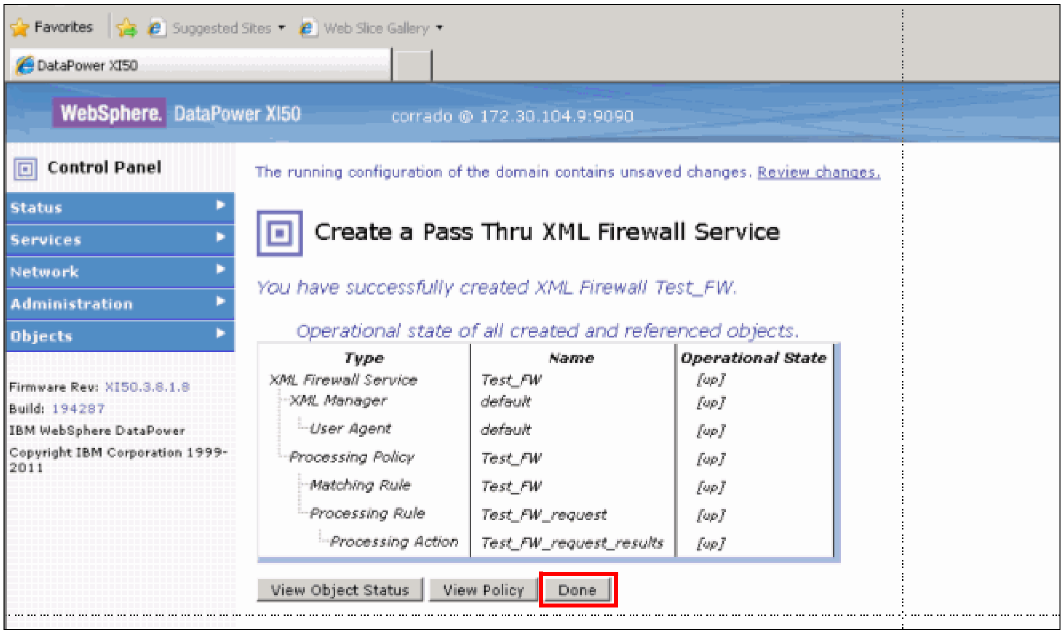
Create a Pass Thru XML Firewall Service

Confirm Your Changes and Commit

Firewall Name:	Test_FW
Firewall Type:	loopback-proxy
Server Address:	
Server Port:	
SSL Server Crypto Profile:	
Device Address:	0.0.0.0
Device Port:	2050
SSL Client Crypto Profile:	
Max. Message Size:	0
Override XML Manager parser limits:	off
Enable MMXDoS Protection:	off
Enable Message Tampering Protection:	off
Enable SQL Injection Protection:	off
Enable X-Virus Scanning:	off
Enable Dictionary Attack Protection:	off

Figure 1-39 Commit the changes

8. Finally, click **Done**, as shown in Figure 1-40.



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

Create a Pass Thru XML Firewall Service

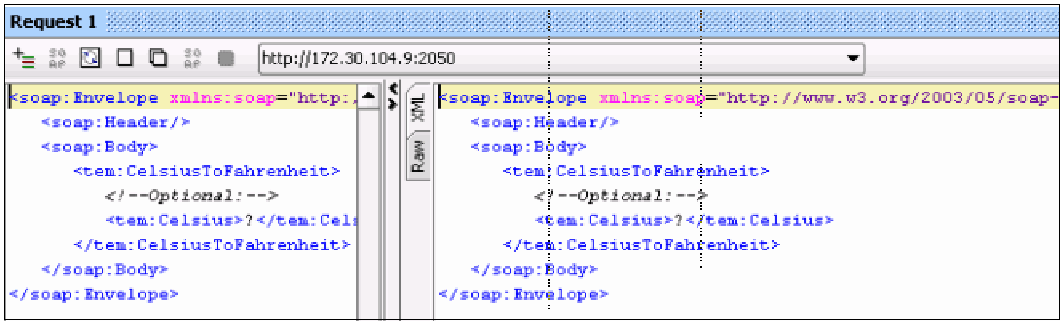
You have successfully created XML Firewall Test_FW.

Operational state of all created and referenced objects.

Type	Name	Operational State
XML Firewall Service	Test_FW	[up]
XML Manager	default	[up]
User Agent	default	[up]
Processing Policy	Test_FW	[up]
Matching Rule	Test_FW	[up]
Processing Rule	Test_FW_request	[up]
Processing Action	Test_FW_request_results	[up]

Figure 1-40 Successfully created

Now, using a simple program, as shown in Figure 1-41, you can test that DataPower works properly, because the original message is reflected back by the loopback firewall.



http://172.30.104.9:2050

```
<soap:Envelope xmlns:soap="http:/
   <soap:Header/>
   <soap:Body>
      <tem:CelsiusToFahrenheit>
         <!--Optional:-->
         <tem:Celsius>?</tem:Cels
      </tem:CelsiusToFahrenheit>
   </soap:Body>
</soap:Envelope>
```

```
<soap:Envelope xmlns:soap="http://www.w3.org/2003/05/soap-
   <soap:Header/>
   <soap:Body>
      <tem:CelsiusToFahrenheit>
         <!--Optional:-->
         <tem:Celsius>?</tem:Celsius>
      </tem:CelsiusToFahrenheit>
   </soap:Body>
</soap:Envelope>
```

Figure 1-41 Simple program

2

Security

This chapter describes the security on the zEnterprise, focusing on the usage of the XI50z Network Security Services (NSS).

This chapter includes the following topics:

- Security concepts for the XI50z
- The XI50z AAA framework
- zEnterprise security
- SAF authentication and authorization details
- Identity propagation using ICRX tokens for CICS WS
- Securing keys and certificates on zEnterprise

2.1 Security concepts for the XI50z

The IBM Service-Oriented Architecture (SOA) Security Reference Model defines the framework for providing security to IT solutions. We explain the security services and enablers that are most relevant to the XI50z. You can obtain more information about the IBM SOA Security Reference Model in Section 4.2 of the IBM Redbooks publication, *Understanding SOA Security Design and Implementation*, SG24-7310. In the security scenarios that we describe in this section, the XI50z can act in the role of an SOA gateway or an enterprise service bus (ESB). For more information about these architectural patterns, refer to Section 4.1 in the IBM Redpaper™ document, *Simplifying Integration with IBM WebSphere DataPower Integration Appliance XI50 for zEnterprise*, REDP-4783.

2.1.1 Authentication services

Authentication services enable an application to verify that a user-provided identity is known and registered in a policy-designated user registry. Authentication services also validate the user-provided proof of identity using a policy-designated challenge and authentication mechanism.

Often, the systems serving the request are not the systems to which the user provided the authentication data. There are two kinds of implementations that can be used to carry over an already authenticated identity from system to system:

- Implementations based on the use of authentication mechanisms supporting *delegation*, that is, the intermediate system has to provide valid and verifiable authentication data on behalf of the requesting user.
- Implementations based on *identity assertion*. With identity assertion, there is no authentication data carried over after the authentication has been performed by one system. Instead, the authenticating system propagates the user identity only and the other systems assume that this identity has been properly authenticated, on the basis of the trust they have been set up to have in the authenticating system. Refer to 2.1.7, “Identity propagation services” on page 45 for more information.

The XI50z provides the authentication, authorization, and auditing (AAA) framework to provide authentication services, as described in 2.2, “The XI50z AAA framework” on page 46. Authentication, in relation to the XI50z, also applies to the users logging in to the XI50z, for example, securing the processing policies and configurations residing on the DataPower device. Authentication is controlled by role-based management (RBM) settings on the XI50z; refer to 2.4, “The XI50z RBM settings: Enabling RACF users to use the management GUI” on page 61.

For scenarios regarding authentication in this IBM Redbooks publication, refer to Chapter 3, “Integration use cases” on page 105. The focus for this book is the interaction of the XI50z with the Security Services.

2.1.2 Authorization services

Access control is the service by which a user request for accessing a resource is submitted to checking for proper authorization, generally on the basis of the authenticated identity that is associated with the request. When enforced, access control is then considered *authorization*. Authorization is performed on transactions at run time using the AAA action in a processing policy that is associated with the DataPower service. Access to the device itself and its resources can also be controlled. Authorization or selective access to resources is usually defined using groups. These groups are attached to access profiles that define what resources can be accessed. The XI50z (unlike the XI52 or XI50 devices) comes with three predefined administrator groups (and associated access profiles that control access to objects and tasks on the XI50z):

dp-admin-group This group can create privileged users. It has read, write, audit, delete, and execute privileges on almost everything, except network-related tasks. Network-related tasks are performed by the dp-admin-nw group.

dp-admin-fw-group This group performs boot and quiesce type tasks on services and the blade.

dp-admin-nw-group This group can perform network-related tasks, such as modifying network parameters, such as Ethernet interface parameters (eth7 and eth9 only) and web management services, for example, WebGUI timeouts. However, this group cannot create or modify users or groups, such as the dp-admin-group.

Clients can create their own custom groups that grant specific privileges. For more information, go to the information center for the XI50z:

http://publib.boulder.ibm.com/infocenter/wsdatap/v3r8m1/topic/xi50/welcome.htm

The XI50z provides the AAA framework to provide authentication services for transactions, as described in 2.2, “The XI50z AAA framework” on page 46. You can obtain information about authorization and authentication using Network Software and Services (NSS) and Resource Access Control Facility (RACF) in 2.5, “SAF authentication and authorization details” on page 70.

2.1.3 Confidentiality services

Data from both service consumers and providers that are mediated through the ESB needs to be protected from disclosure. You can protect data from disclosure by using Confidentiality services and choosing message-level security using WS-Security and transport level-security with Secure Sockets Layer (SSL)/Transport Layer Security (TLS). Decisions about which method is appropriate depend upon the nature of the service being orchestrated and the business requirements.

For example, if the ESB expects signed and encrypted messages from a service provider, the service provider must be aware that the ESB expects signed and encrypted messages so that outbound messages are correctly prepared before sending. If the ESB then requires communication with one or more service providers to provide a response to the service consumer, it needs to be aware of message protection policies for interacting with those service providers.

The XI50z provides confidentiality service with the following mechanisms:

- SSL/TLS protection over most of the supported popular TCP transport protocols, such as HTTP, WebSphere MQ, Java Message Service (JMS), and TIBCO Enterprise Message Service (EMS). Optionally, the XI50z can support SSL mutual authentication (SSL client certificates).
- Encryption services in the XI50z also provides message-level confidentiality between service consumers and providers. Encryption can be based on symmetrical key (shared secret) or public key infrastructure (PKI)-based asymmetric encryption. In PKI-based asymmetric encryption, the message sender can encrypt with the public key of the receiver, who is the only one capable of decrypting the message with the receiver private key.

For scenarios in this book focusing on confidentiality, see “ICSF key storage encrypt/decrypt scenario” on page 98.

2.1.4 Integrity services

Protecting message content from being modified without detection, being sure of its origin, and protection against message replays are the primary concerns of Integrity services. Integrity services are usually achieved on an XI50z by digitally signing the message body, header elements, or any combination of these parts in a WS-Security message. Also, a signed message can come in from a business partner, and because only the holder of the private key (that is, the business partner) can sign the message, the XI50z can verify that the message was sent by that business partner by using the public key of the business partner. The public key is usually authorized (signed) by a well-known certificate authority (CA). The signature also includes a checksum that ensures that a message that is tampered with triggers a signature verification error.

Many security tokens that are defined in WS-Security have the ability to include a data element, such as a nonce, to prevent the reuse of a security token, and to protect against exploits that reuse a security token.

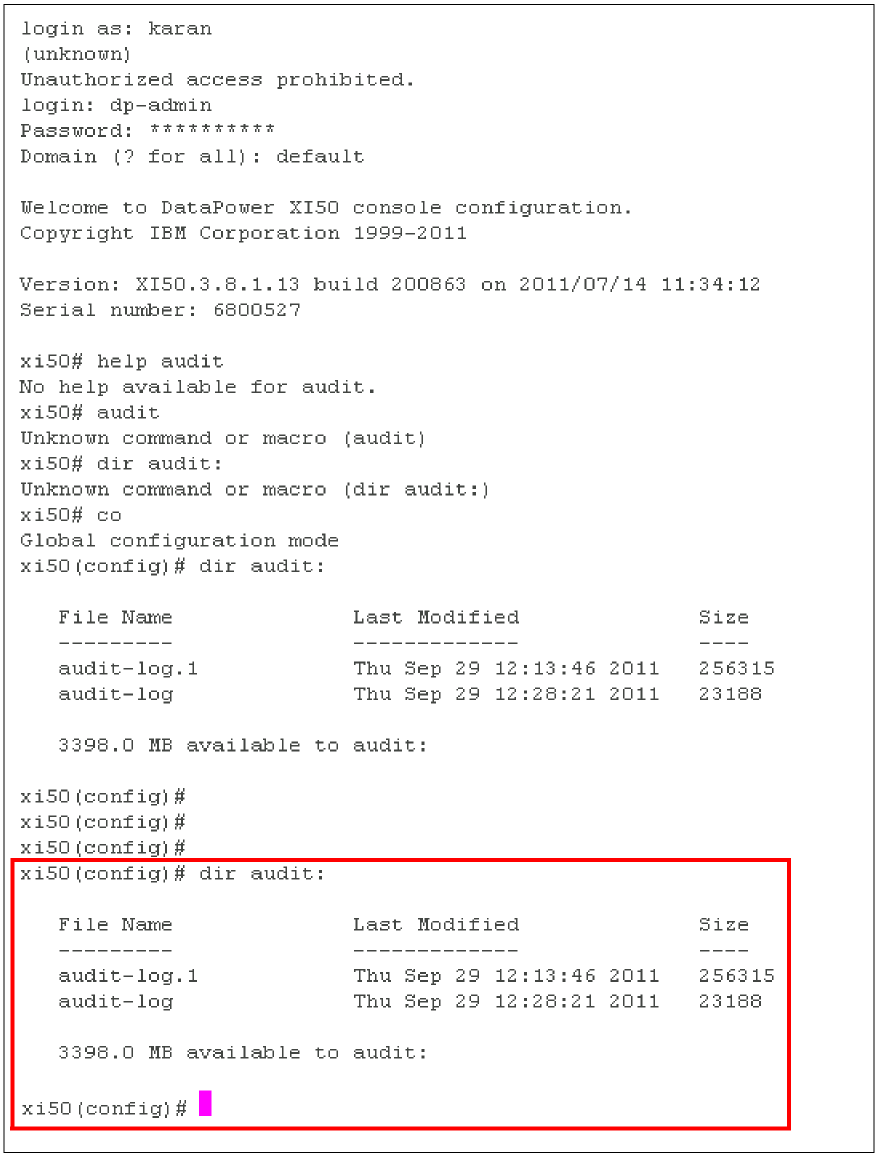
The XI50z as an ESB can use Integrity services to safeguard the data from both service consumers and providers that are mediated through the ESB.

For scenarios in this book focusing on Integrity services, see “Settings for digital signature/digital signature verification” on page 95.

2.1.5 Audit services

Auditing is the service that permanently maintains an audit trail of security-relevant events. A *security-relevant event* can be defined as an action taken that reflects adhesion to or violation of a security policy in place in a system. The audit trail is to provide historical data that can be used for the purpose of detecting precise actions (and their originators), or trends in actions, that diverge from or can potentially lead to divergence from the security policy.

The XI50z provides audit logs for the users that are logging in to the blade. You can view these audit logs from the GUI. You can also view the audit logs from the command-line interface (CLI), as shown in Figure 2-1.



```
login as: karan
(unknown)
Unauthorized access prohibited.
login: dp-admin
Password: **********
Domain (? for all): default

Welcome to DataPower XI50 console configuration.
Copyright IBM Corporation 1999-2011

Version: XI50.3.8.1.13 build 200863 on 2011/07/14 11:34:12
Serial number: 6800527

xi50# help audit
No help available for audit.
xi50# audit
Unknown command or macro (audit)
xi50# dir audit:
Unknown command or macro (dir audit:)
xi50# co
Global configuration mode
xi50(config)# dir audit:

   File Name               Last Modified              Size
   ---------               -------------              ----
   audit-log.1             Thu Sep 29 12:13:46 2011   256315
   audit-log               Thu Sep 29 12:28:21 2011   23188

   3398.0 MB available to audit:

xi50(config)#
xi50(config)#
xi50(config)#
xi50(config)# dir audit:

   File Name               Last Modified              Size
   ---------               -------------              ----
   audit-log.1             Thu Sep 29 12:13:46 2011   256315
   audit-log               Thu Sep 29 12:28:21 2011   23188

   3398.0 MB available to audit:

xi50(config)#
```

Figure 2-1 Audit logs viewed from the CLI interface

On the System z System Management Facility (SMF), you can off-load and print the audit trail by using the user exit routines, IRRADU00 and IRRADU86, within the SMF dump program IFASMFDP. Example 2-1 on page 44 shows a sample job. You can structure these audit logs as plain text or XML format, or you can off-load the audit logs into a relational database.

Example 2-1   SMF data unload into XML-style audit trail report

```
//SMFDUMP  EXEC PGM=IFASMFDP
//SYSPRINT DD  SYSOUT=*
//ADUPRINT DD  SYSOUT=*
//XMLFORM DD DISP=(NEW,CATLG,KEEP),
// DSN=CUI.RACF.XMLFORM,
// SPACE=(CYL,(1500,550),RLSE),UNIT=SYSDA,VOL=SER=BH8WA0,
// DCB=(LRECL=12288,RECFM=VB,BLKSIZE=0)
//SMFDATA  DD  DISP=SHR,DSN=SYS1.SMF.MAN1
//SMFOUT   DD  DUMMY
//SYSIN    DD  *
     INDD(SMFDATA,OPTIONS(DUMP))
     OUTDD(SMFOUT,TYPE(30(1,5),80:83))
     ABEND(NORETRY)
     USER2(IRRADU00)
     USER3(IRRADU86)
/*
```

For more information about z/OS Audit services, go to this website:

http://publibz.boulder.ibm.com/epubs/pdf/ichza8b0.pdf

The distributed identity is seen as part of the formatted records of the relevant SMF type. The type 30 (Common Address Space Work) subtype 1 (job start or start of other work unit) and 5 (job termination or termination of other work unit) and type 80 (Security Product Processing) contain the JOBINIT events that log the distributed identity. The ididReg element represents the UTF-8 hex and EBCDIC representation of the received Extended Identity Context Reference (ICRX). Example 2-2 shows a successful mapping of the username and registry name to a local RACF user ID.

Example 2-2   JOBINIT RACINITD work unit termination with distributed identity

```
<event>
  <eventType>JOBINIT</eventType>
  <eventQual>RACINITD</eventQual>
<details>
   <violation>N</violation>
<jobName>SC80CIC1</jobName>
<utkUserId>DISTCICS</utkUserId>
.....
.....
<ididUser>&#x43;&#x4E;&#x3D;&#x53;&#x41;&#x57;&#x31;&#x32;&#x35;&#x41;&#x2C;&#x20;
&#x4F;&#x3D;&#x4D;&#x59;&#x42;&#x49;&#x5A;&#x50;&#x41;&#x52;&#x54;&#x4E;&#x45;&#x5
2;&#x2C;&#x20;&#x53;&#x54;&#x3D;&#x4D;&#x44;&#x2C;&#x20;&#x43;&#x3D;&#x55;&#x53;
CN=SAW125A, O=MYBIZPARTNER, ST=MD, C=US</ididUser>
  <ididReg>&#x6C;&#x64;&#x61;&#x70;&#x73;&#x65;&#x72;&#x76; ldapserv</ididReg>
</details>
```

Refer to 2.6, “Identity propagation using ICRX tokens for CICS WS” on page 83 for details about ICRX and IDIDMAP RACF implementation.

2.1.6 Key management service

The key management service includes the generation, exchange, storage, safeguarding, and replacement of cryptographic keys.

The XI50z blade can provide key management services on the XI50z encrypted certificate folders. Self-signed keys and certificates can also be generated from the XI50z in privacy enhanced mail (PEM) format and can be converted to PFX or IBM Public Key Cryptography Standard#12 (PKCS#12) format using a tool, such as **openssl**.

A more centralized way for one or more XI50z blades to store certificates and keys is on the z/OS system. The z/OS system provides RACF and Integrated Cryptographic Service Facility (ICSF), which is a highly efficient cryptographic hardware and public key algorithm (PKA) key management service. The DataPower access to these z/OS key management services is through the use of NSS. The XI50z hosts can access key management services using the NSS client. See 2.3, “zEnterprise security” on page 47 for more information about NSS support for the XI50z.

2.1.7 Identity propagation services

In the request flow from the service consumer to the provider through the ESB, the user context needs to be maintained and the security of the identity information needs to be ensured. In an enterprise system, you can use separate physical identities, such as user names and certificates, to represent a single logical identity through various parts of the enterprise. The propagation of an identity ensures that the logical identity is kept throughout the system by mapping between the various physical forms as necessary.

For example, for a SOAP-based Web Service, a message might enter the system using the WS-Security Username Token, but a Binary Security Token containing an ICRX token might be required for the server processing of the message, for example, CICS Web Services security processing. The XI50z as an SOA gateway or an ESB performs identity propagation, which ensures that the mapped identity is placed in the correct place for the outbound transport.

DataPower provides identity propagation support for z/OS by passing the client-supplied credentials as an ICRX credential to z/OS. For more information, see 2.6, “Identity propagation using ICRX tokens for CICS WS” on page 83.

Distributed identities

A distributed identity is originated from a security registry, typically from a distributed system, and contains the distinguished name (DN) that is represented with the X.500 naming standard. The X.500 naming standard is the same standard that is used by Lightweight Directory Access Protocol (LDAP) directories.

Example 2-3 represents a DN.

Example 2-3 Distinguished name

```
C=US, ST=MD, O=MYBIZPARTNER, CN=SAW125A
where the attributes used stand for:
Common Name (CN),
Organizational Unit (OU),
Organization (O)
State (ST)
Country (C).
```

The DN is a component of the ICRX structure, which is the structure that CICS passes to RACF to perform the identity mapping operation that is required by z/OS RACF to identify the distributed identity. The ICRX structure is enabled and created by DataPower.

2.2 The XI50z AAA framework

The DataPower XI50z is a comprehensive policy enforcement point for controlling access to services. Its powerful authentication, authorization, and auditing (AAA) framework enables the XI50z to integrate flexibly with most types of access control solutions: from an onboard XML file for testing, to standards-based integration using LDAP, remote authentication dial-in user service (RADIUS), XML Key Management Specification (XKMS), Security Assertion Markup Language (SAML), WS-Security, and WS-* for both inbound and outbound messages and for access to the device itself.

Figure 2-2 illustrates the AAA framework.

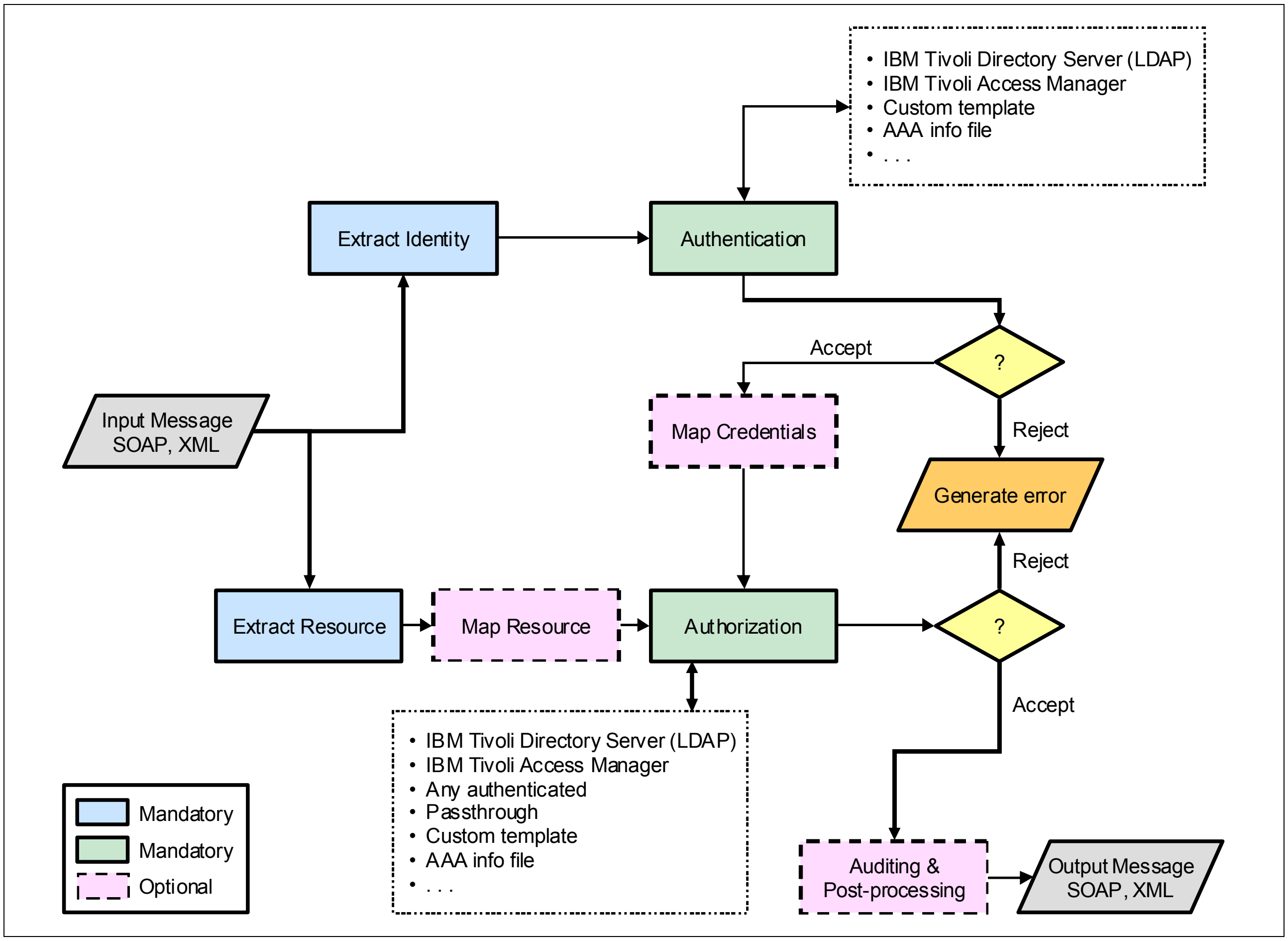


Figure 2-2 Processing the AAA policy

The following steps explain the blocks that are shown in Figure 2-2, in the order that they occur:

1. Extract identity (EI).

   Establish an asserted identity from the contents of the message or protocol envelope.

2. Extract resource (ER).

   Establish a requested resource (commonly a Uniform Resource Identifier (URI)).

3. Authenticate (AU).

   Authenticate the asserted identity. This identity is approved or disapproved by the authenticating agent.

4. Map credentials (MC).

   Transform or replace the extracted identity with another value, which might not be based in whole or in part on the extracted identity. This value might also be none, which leaves the extracted identity intact.

5. Map resource (MR).

   Transform or replace the extracted resource with another value, which might not be based in whole or in part on the extracted resource. This value might also be none, which leaves the extracted resource intact.

6. Authorize (AZ).

   Approve or disapprove of the use of the mapped resource by an agent that is identified by the mapped credentials.

7. Audit and post-process (PP).

   Perform additional transformations or processing on the results of the previous steps.

The AAA framework is provided by the AAA action in a DataPower processing policy.

2.3 zEnterprise security

The security of the systems is a primary concern for most organizations. The XI50z enforces security standards in an easy-to-use centralized fashion as is necessary for a modern enterprise. This section describes security on the zEnterprise, including NSS, virtual local area network (VLAN), and Top-of-rack (TOR) security.

2.3.1 Network Security Services for the DataPower XI50z

Many organizations, which have a zEnterprise platform as the core of their IT environment, want to use existing services. They need to integrate with the z/OS RACF security offerings, such as z/OS Network Security Services (NSS). NSS is designed as a centralized server providing Security Access Facility (SAF), private key, and Certificate services to middleware appliances, such as the DataPower XI50z, using an NSS mechanism called *XML appliance discipline.*

You must configure the DataPower XI50z as an NSS XML appliance client to use these services on the z/OS NSS server.

The DataPower XI50z can perform many security tasks, such as authentication and authorization, using LDAP or IBM Tivoli Access Manager. In this case, it means adding an external resource, perhaps on an external server, to be managed. Such proliferation, in terms of resources, contrasts with the goals to reduce the complexity and handling costs of an organization’s current IT strategy.

NSS benefits

In this case, NSS centralizes the authentication and authorization functions of the DataPower XI50z blades at the z/OS level. NSS also enables the storage of private keys and digital certificates in RACF or on ICSF hardware storage. NSS enables centralization and consolidation so that the control of all security mechanisms that relate to the DataPower XI50z becomes managed by a single, secure, and central point of control inside the z/OS.

The XML Appliance discipline of NSS includes the following services:

- SAF service
- Private key services
- X.509 certificate services

SAF service

The XI50z issues calls to the NSS server to authenticate and authorize users to access services on the back end.

Figure 2-3 on page 49 shows the flow sequence of events, when a SAF service is requested by DataPower for AAA purposes:

- The Web Service request reaches the DataPower XI50z.
- DataPower receives the request; it parses the request to determine the identity (user ID) and the resource being accessed (service top-level element). Then, DataPower sends a SAF request to the NSS server using a secured connection over SSL/TLS and AT_TLS.

> **Secured connection:** The secured connection requires SSL keyrings on the z/OS RACF side and a validation credential (SSL client) on DataPower.

- The NSS server forwards the request to z/OS RACF.
- z/OS RACF verifies the authentication and eventually authorizes the user to perform the requested actions by replying by way of the NSS server to DataPower.
- The requested action, for example, executing a Web Service, occurs. The requested action typically is accessing a target application on the back-end side.

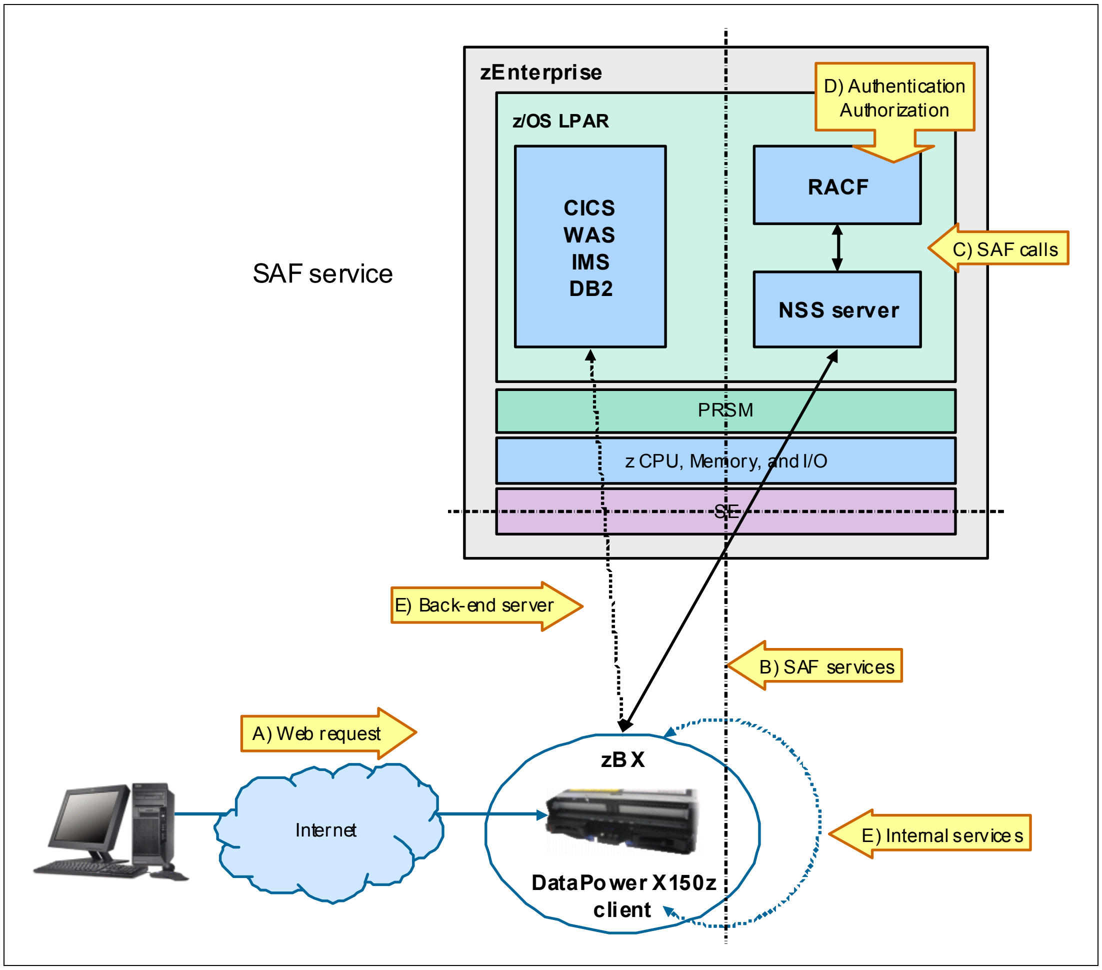


Figure 2-3 SAF service

Private key service

The most secure option of storing private keys is the z/OS ICSF. Only authorized clients are allowed to request Rivest-Shamir-Adleman algorithm (RSA) operations, such as decryption and digital signature generation. The benefits of this method are that ICSF-protected private keys are not retrieved by this service, so the RSA private keys never leave z/OS, and the entire RSA operation is performed within z/OS.

Private non-ICSF RSA keys: DataPower also has the capability to retrieve private non-ICSF RSA keys over the secure intraensemble data network (IEDN) connection. DataPower also can perform private key operations, such as creating an RSA signature or decrypting data, locally on the XI50z.

Certificate service

The Certificate service allows authorized clients to list and retrieve certificates from the keyring that is configured inside the NSS server. The X.509 certificates are the most widely adopted standard and are supported and retrieved one time from the NSS keyring. X.509 certificates can be distributed across the zEnterprise to extend the use of z/OS X.509 certificates to non-z/OS clients.

Figure 2-4 shows the flow sequence of events when a Private Key or Certificate service is requested by DataPower for security authorizations:

- The Web Service request reaches the DataPower XI50z.
- DataPower receives the request; it parses it to determine the request type. DataPower then sends a key/certificate request to the NSS server over a secured connection with SSL/TLS and AT_TLS.
- The NSS server calls the SAF over SSL.
- If the request is for a Private Key on the keyring, RACF verifies the client's authority to access the key.
- If the request is for an X.509 certificate, RACF verifies the client's authority to access X.509 certificates.
- After the RACF verification, the certificate/key is retrieved by the XI50z by way of the NSS server.
- The actions requested are executed.

For information about the security server changes that are necessary on z/OS to authorize users to use NSS services, go to this website:

http://publib.boulder.ibm.com/infocenter/zos/v1r12/index.jsp?topic=%2Fcom.ibm.zos.r12.halz002%2Fnssac.htm

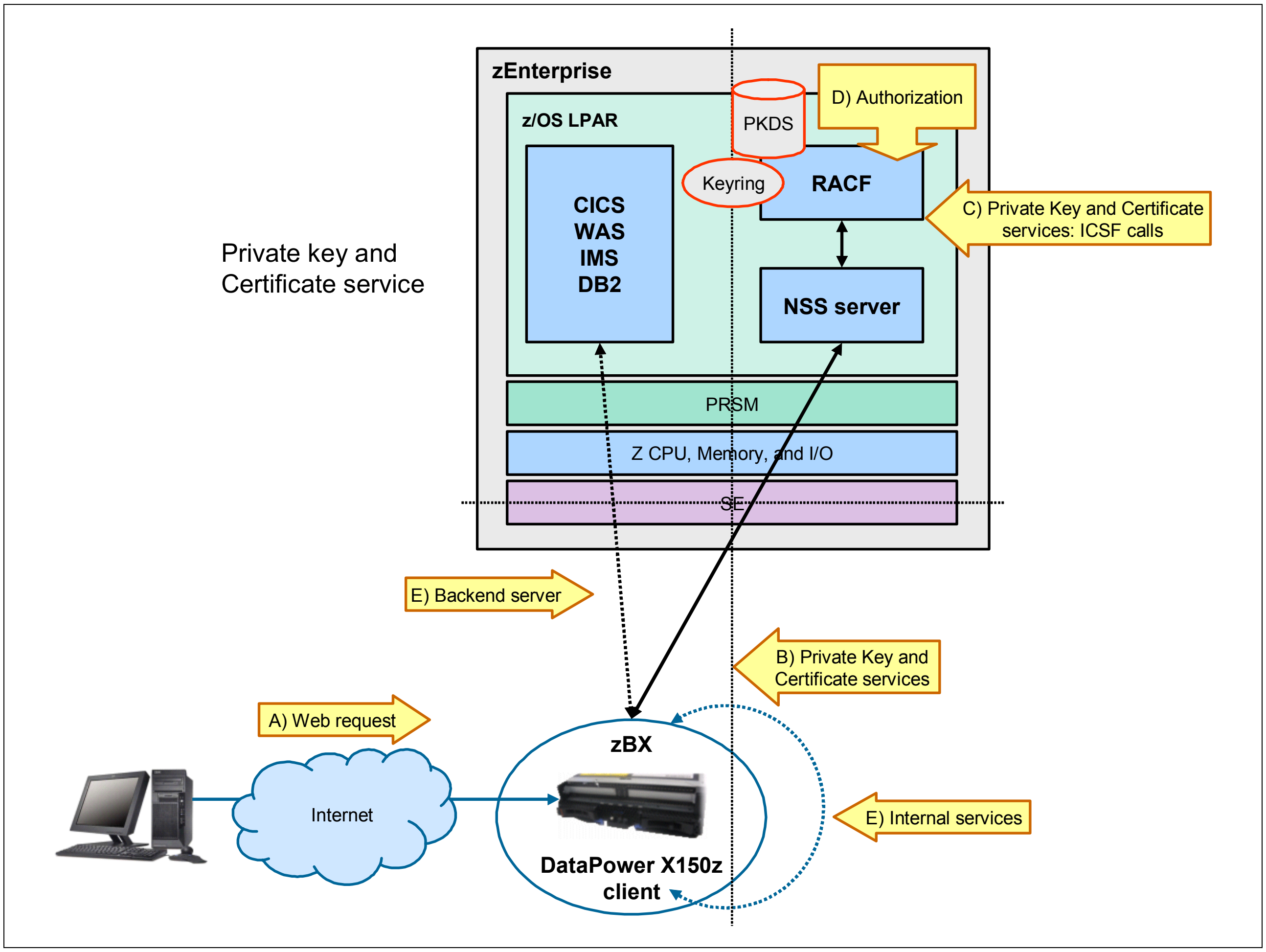


Figure 2-4 Private Key and Certificate service

2.3.2 Network Security Services server and Policy Agent setup on z/OS

Network Security Services (NSS) provides discipline-specific security services for security integration, enforcement, and management. In z/OS 1.10, NSS is enhanced to support the XML appliance discipline.

Network Security Services server configuration

We performed the following configuration on the z/OS image for DataPower integration. We used the XML appliance discipline with SAFAccessService, CertificateService, and PrivateKeyService enabled. We created a *started task procedure* with a STARTED assigned user ID of NSSD for convenience. Figure 2-5 shows the procedure.

```
//NSSD PROC
//NSSD EXEC PGM=NSSD,REGION=0K,TIME=NOLIMIT,
// PARM=('POSIX(ON) ALL31(ON)',
// 'ENVAR("_BPXK_SETIBMOPT_TRANSPORT=TCPIP"',
// '"_CEE_ENVFILE=DD:STDENV")/')
//*
//STDENV DD PATH='/etc/security/nssd.env',PATHOPTS=(ORDONLY)
//SYSPRINT DD SYSOUT=*
//SYSOUT DD SYSOUT=*
```

Figure 2-5 Network Security Services server procedure

We pointed the STDENV data definition to `/etc/security/nssd.env` for convenience. Example 2-4 shows our environment variables file.

Example 2-4 nssd.env - Network Security Services server environment variables file

```
NSSD_FILE=/etc/security/nssd.conf
NSSD_CODEPAGE=IBM-1047
```

If no NSSD_FILE is provided on the PARM statement or in the environment variables, the NSS server scans the `/etc/security` directory for the `nssd.conf` file as part of the default search order. A sample `nssd.conf` file is provided in `/usr/lpp/tcpip/samples`. We used the `nssd.conf` file, as shown in Example 2-5.

Example 2-5 nssd.conf - Network security services server configuration file

```
NssConfig
{
Port 4159
SyslogLevel 255
 KeyRing KEYRING
Discipline IPSec Enable
Discipline XMLAppliance Enable
}
IPSecDisciplineConfig
{
FIPS140 No
URLCacheInterval 10080
}
```

Example 2-6 shows the content of the RACF keyring named KEYRING that holds the NSSD-owned certificates. All client and Certificate Authority (CA) certificates must reside in the NSSD keyring.

Example 2-6 Network Security Services server RACF KEYRING

```
Digital ring information for user NSSD:

  Ring:
       >KEYRING<
  Certificate Label Name             Cert Owner     USAGE      DEFAULT
  --------------------------------   ------------   --------   -------
  SAW125 ITSO SharedSite1            SITE           PERSONAL     YES
  SAW125 ITSO CA1                    CERTAUTH       CERTAUTH     NO
  DataPowerCert1                     ID(NSSD)       PERSONAL     NO
  DPICSF                             ID(NSSD)       PERSONAL     NO

***
```

The NSS daemon needs UID 0 and the appropriate RACF definitions, as shown in Example 2-7. In Example 2-7, ITSOCLNT is the DataPower NSS client ID and existing RACF user ID. Refer to the updated TCP/IP sample EZARACF in TCPIP.SEZAINST that contains the sample RACF setup.

Example 2-7 RACF definitions for NSSD and disciplines

```
ADDUSER  NSSD     DFLTGRP(OMVSGRP) NOPASSWORD OMVS(UID(0)  HOME('/u/NSSD'))
RDEFINE  STARTED  NSSD.*            STDATA(USER(NSSD))
SETROPTS GENERIC(STARTED) RACLIST(STARTED) REFRESH

PERMIT IRR.DIGTCERT.ADD CLASS(FACILITY) ID(NSSD) ACC(CONTROL)
PERMIT IRR.DIGTCERT.ADDRING CLASS(FACILITY) ID(NSSD) ACC(UPDATE)
PERMIT IRR.DIGTCERT.CONNECT CLASS(FACILITY) ID(NSSD) ACC(CONTROL)
PERMIT IRR.DIGTCERT.GENCERT CLASS(FACILITY) ID(NSSD) ACC(CONTROL)
PERMIT IRR.DIGTCERT.GENREQ CLASS(FACILITY) ID(NSSD) ACC(CONTROL)
PERMIT IRR.DIGTCERT.LIST CLASS(FACILITY) ID(NSSD) ACC(CONTROL)
PERMIT IRR.DIGTCERT.LISTRING CLASS(FACILITY) ID(NSSD) ACC(UPDATE)
SETROPTS RACLIST(FACILITY) REFRESH

PERMIT BPX.DAEMON CLASS(FACILITY) ID(NSSD) ACCESS(READ)
SETROPTS RACLIST(FACILITY) REFRESH

RDEFINE SERVAUTH EZB.NSS.SC80.ITSOCLNT.XMLAPPLIANCE.SAFACCESS UACC(NONE)
PERMIT EZB.NSS.SC80.ITSOCLNT.XMLAPPLIANCE.SAFACCESS CLASS(SERVAUTH) ID(ITSOCLNT)
ACCESS(READ)
RDEFINE SERVAUTH EZB.NSS.SC80.ITSOCLNT.XMLAPPLIANCE.CERT UACC(NONE)
PERMIT EZB.NSS.SC80.ITSOCLNT.XMLAPPLIANCE.CERT CLASS(SERVAUTH) ID(ITSOCLNT)
ACCESS(READ)
RDEFINE SERVAUTH EZB.NSS.SC80.ITSOCLNT.XMLAPPLIANCE.PRIVKEY UACC(NONE)
PERMIT EZB.NSS.SC80.ITSOCLNT.XMLAPPLIANCE.PRIVKEY CLASS(SERVAUTH) ID(ITSOCLNT)
ACCESS(READ)
SETROPTS GENERIC(SERVAUTH) RACLIST(SERVAUTH) REFRESH

RDEFINE SERVAUTH EZB.NSSCERT.SC80.SAW125$ITSO$CA1.PRIVKEY UACC(NONE)
PERMIT EZB.NSSCERT.SC80.SAW125$ITSO$CA1.PRIVKEY CLASS(SERVAUTH) ID(ITSOCLNT)
ACCESS(READ)
```

```
SETROPTS GENERIC(SERVAUTH) RACLIST(SERVAUTH) REFRESH

RDEFINE SERVAUTH EZB.NSSCERT.SC80.DATAPOWERCERT1.HOST UACC(NONE)
PERMIT EZB.NSSCERT.SC80.DATAPOWERCERT1.HOST CLASS(SERVAUTH) ID(ITSOCLNT)
ACCESS(READ)
SETROPTS RACLIST(SERVAUTH) GENERIC(SERVAUTH) REFRESH

RDEFINE SERVAUTH EZB.NSSCERT.SC80.SAW125$ITSO$CA1.CERTAUTH UACC(NONE)
PERMIT EZB.NSSCERT.SC80.SAW125$ITSO$CA1.CERTAUTH CLASS(SERVAUTH) ID(ITSOCLNT)
ACCESS(READ)
SETROPTS GENERIC(SERVAUTH) RACLIST(SERVAUTH) REFRESH

RDEFINE CSNDDSG CLASS(CSFSERV) UACC(NONE)
PERMIT CSNDDSG CLASS(CSFSERV) ID(NSSD) ACCESS(READ)
RDEFINE CSNDPKD CLASS(CSFSERV) UACC(NONE)
PERMIT CSNDPKD CLASS(CSFSERV) ID(NSSD) ACCESS(READ)
SETROPTS CLASSACT(CSFSERV)
SETROPTS RACLIST(CSFSERV) REFRESH
```

> **Restriction:** The maximum allowable length of a SERVAUTH profile name is 64 characters. You must define the profile names with uppercase characters even where lowercase labels are used.

Or, you can use wild cards for the RACF definitions, but you lose part of the security granularity and control when you use wild cards. Alternatively, you can use PassTickets for password security. For more information about the PassTicket RACF feature, go to this website:

http://publib.boulder.ibm.com/infocenter/zos/v1r11/index.jsp?topic=/com.ibm.zos.r11.icha700/defpro.htm

For the verification of a loaded configuration or configuration refresh, use the provided set of modify commands. Example 2-8 shows the NSSD configuration. You can use the unformatted system service (USS) command interface to monitor the state of clients, as shown in Example 2-9 on page 54. The use of the **nssctl** command is restricted by the use of the EZB.NETMGMT.*sysname*.*sysname*.NSS.DISPLAY profile.

Example 2-8 MODIFY NSSD,DISPLAY MVS command

```
RESPONSE=SC80
 EZD1386I DISPLAY NSS CONFIGURATION 282
 DISPLAY Network Security Server Configuration Parameters:
     Port        = 4159
     SyslogLevel = 255     (0x00ff)
     KeyRing     = "KEYRING"
     ----------------------------------
     Discipline IPSec        = Disabled
     Discipline XMLAppliance = Enabled
     ----------------------------------
   IPSec Discipline Configuration Parameters:
     FIPS140     = No
     URLCacheInterval = 10080
     There are 0 CertificateURL and CertificateBundleURL entries
```

Example 2-9 nssctl -d USS command

```
CUI:/u/cui: >nssctl -d

CS V1R12 nssctl  SystemName: SC80      Sun Oct  9 10:51:38 2011
Function: Display           NSSClientName: n/a

ClientName:                      ITSOCLNT
ClientAPIVersion:                3
StackName:
SystemName:                      SC80
ClientIPAddress:                 172.30.101.9
ClientPort:                      59836
ServerIPAddress:                 172.30.101.1
ServerPort:                      4159
UserID:                          SAW125A
ConnectState:                    connected
TimeConnected:                   2011/10/09 10:02:33
TimeOfLastMessageFromClient:     2011/10/09 10:02:33
Discipline:                      XMLAppliance
  CertificateServiceSelected:    Yes
  CertificateServiceEnabled:     Yes
  PrivateKeyServiceSelected:     Yes
  PrivateKeyServiceEnabled:      Yes
  SAFAccessServiceSelected:      Yes
  SAFAccessServiceEnabled:       Yes
```

Important: Do not use AUTOLOG to start the NSS server. Although AUTOLOG will work, you will lose NSS cached information if the NSS procedure has already been initialized and the AUTOLOG process causes it to cancel and restart.

Our environment included the Crypto Express3 (CEX3) with two coprocessors and a fully functional ICSF feature defined, as shown in Example 2-10.

Example 2-10 ICSF started task - initialization messages

```
CSFO0166 DEFAULT CICS WAIT LIST WILL BE USED.
CSFM607I A CKDS KEY STORE POLICY IS NOT DEFINED.
CSFM607I A PKDS KEY STORE POLICY IS NOT DEFINED.
CSFM610I GRANULAR KEYLABEL ACCESS CONTROL IS DISABLED.
CSFM611I XCSFKEY EXPORT CONTROL FOR AES IS DISABLED.
CSFM611I XCSFKEY EXPORT CONTROL FOR DES IS DISABLED.
CSFM612I PKA KEY EXTENSIONS CONTROL IS DISABLED.
CSFM111I CRYPTOGRAPHIC FEATURE IS ACTIVE. CRYPTO EXPRESS3 COPROCESSOR G03, SERIAL
NUMBER 90003664.
CSFM111I CRYPTOGRAPHIC FEATURE IS ACTIVE. CRYPTO EXPRESS3 COPROCESSOR G04, SERIAL
NUMBER 90003605.
CSFM001I ICSF INITIALIZATION COMPLETE
CSFM400I CRYPTOGRAPHY - SERVICES ARE NOW AVAILABLE.
CSFM126I CRYPTOGRAPHY - FULL CPU-BASED SERVICES ARE AVAILABLE
```

For more information about the ICSF feature and how to enable it, go to this website:

http://publib.boulder.ibm.com/infocenter/zos/v1r12/index.jsp?topic=%2Fcom.ibm.zos.r12.ikya100%2Fdicsf.htm

Policy Agent configuration

AT-TLS is a TCP/IP stack service that provides SSL/TLS services at the TCP transport layer. AT-TLS is transparent to upper-layer protocols. The Policy Agent is used to install the AT-TLS policy into the TCP/IP stack. In most installations, PAGENT is already present and configured.

We have created a *started task procedure* with a STARTED assigned user ID of PAGENT for convenience. Figure 2-6 shows the procedure.

```
//PAGENT   PROC
//PAGENT   EXEC PGM=PAGENT,REGION=OK,TIME=NOLIMIT,
//       PARM='ENVAR("_CEE_ENVFILE=DD:STDENV")/'
//STDENV   DD PATH='/etc/security/pagent.env',PATHOPTS=(ORDONLY)
//SYSPRINT DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//*
//CEEDUMP  DD SYSOUT=*,DCB=(RECFM=FB,LRECL=132,BLKSIZE=132)
```

Figure 2-6   Policy Agent started task procedure

Example 2-11 demonstrates the use of the PAGENT_CONFIG_FILE to point to the initial configuration file of `pagent.conf`.

Example 2-11   pagent.env - Policy Agent environment variables file

```
PAGENT_CONFIG_FILE=/etc/security/pagent.conf
PAGENT_LOG_FILE=/var/log/pagent2.log
PAGENT_LOG_FILE_CONTROL=500,5
LIBPATH=/usr/lib
TZ=EST5EDT
```

The `pagent.conf` file contains policy statements for the Policy Agent, which installs them to the appropriate TCP/IP stack (TCP/IP by default). We use a minimal configuration for only the TTLS policy, as shown in Example 2-12.

Example 2-12   pagent.conf - Policy Agent configuration file

```
TTLSConfig /etc/security/pagent.TTLS.conf FLUSH PURGE
```

The file in Example 2-13 was created by the IBM Configuration Assistant for zCS and transferred to the appropriate path in USS.

Example 2-13   pagent.TTLS.conf - Policy Agent TTLS configuration file

```
TTLSRule                          Default_NSS_Server
{
  LocalAddr                       ALL
  RemoteAddr                      ALL
  LocalPortRangeRef               portR1
  RemotePortRangeRef              portR2
  Direction                       Inbound
  Priority                        255
  TTLSGroupActionRef              gAct1NSS_Server
  TTLSEnvironmentActionRef        eAct1NSS_Server
  TTLSConnectionActionRef         cAct1NSS_Server
}
TTLSGroupAction                   gAct1NSS_Server
```

```
{
  TTLSEnabled                     On
  Trace                           6
}
TTLSEnvironmentAction             eAct1NSS_Server
{
  HandshakeRole                   Server
  EnvironmentUserInstance         0
  TTLSKeyringParmsRef             keyR1
}
TTLSConnectionAction              cAct1NSS_Server
{
  HandshakeRole                   Server
  TTLSCipherParmsRef              cipher1Default_Ciphers
  TTLSConnectionAdvancedParmsRef  cAdv1NSS_Server
  CtraceClearText                 Off
  Trace                           31
}
TTLSConnectionAdvancedParms       cAdv1NSS_Server
{
  ApplicationControlled           On
  SecondaryMap                    Off
}
TTLSKeyringParms                  keyR1
{
  Keyring                         KEYRING
}
TTLSCipherParms                   cipher1Default_Ciphers
{
  V3CipherSuites                  TLS_RSA_WITH_AES_256_CBC_SHA
  V3CipherSuites                  TLS_DHE_RSA_WITH_AES_256_CBC_SHA
  V3CipherSuites                  TLS_DH_RSA_WITH_AES_256_CBC_SHA
  V3CipherSuites                  TLS_DHE_DSS_WITH_AES_256_CBC_SHA
  V3CipherSuites                  TLS_DH_DSS_WITH_AES_256_CBC_SHA
  V3CipherSuites                  TLS_RSA_WITH_3DES_EDE_CBC_SHA
  V3CipherSuites                  TLS_DHE_RSA_WITH_3DES_EDE_CBC_SHA
  V3CipherSuites                  TLS_DH_RSA_WITH_3DES_EDE_CBC_SHA
  V3CipherSuites                  TLS_DHE_DSS_WITH_3DES_EDE_CBC_SHA
  V3CipherSuites                  TLS_DH_DSS_WITH_3DES_EDE_CBC_SHA
  V3CipherSuites                  TLS_RSA_WITH_AES_128_CBC_SHA
  V3CipherSuites                  TLS_DHE_RSA_WITH_AES_128_CBC_SHA
  V3CipherSuites                  TLS_DH_RSA_WITH_AES_128_CBC_SHA
  V3CipherSuites                  TLS_DHE_DSS_WITH_AES_128_CBC_SHA
  V3CipherSuites                  TLS_DH_DSS_WITH_AES_128_CBC_SHA
}
PortRange                         portR1
{
  Port                            4159
}
PortRange                         portR2
{
  Port                            1024-65535
}
TTLSGroupAction              NSSTLSON
{
   TTLSEnabled               On
}
TTLSCipherParms              NSSCIPHERPARMS
{
   V3CipherSuites            TLS_RSA_WITH_3DES_EDE_CBC_SHA
}
TTLSEnvironmentAction        NSSTLSCLIENTENV
{
   HandShakeRole             Client
   TTLSCipherParmsRef        NSSCIPHERPARMS
   TTLSKeyRingParms
   {
      Keyring                KEYRING
   }
}
TTLSRule                     NSSTLSCLIENT1
{
   RemotePortRange           4159
   Direction                 Outbound
   TTLSGroupActionRef        NSSTLSON
   TTLSEnvironmentActionRef  NSSTLSCLIENTENV
}
```

Example 2-14 illustrates the necessary RACF commands to enable the Policy Agent. Define and authorize selected subsystems to the profile EZB.INITSTACK.*sysname*.*imagename* that controls which users can access the TCP/IP stack before PAGENT is active (and the TTLS policy is loaded).

Example 2-14 RACF definitions for PAGENT and TTLS

```
ADDUSER  PAGENT   DFLTGRP(OMVSGRP) OMVS(UID(0) HOME('/u/PAGENT')) NOPASSWORD

PERMIT BPX.DAEMON CLASS(FACILITY) ID(PAGENT) ACCESS(READ)

RDEFINE  STARTED  PAGENT.* STDATA(USER(PAGENT))
SETROPTS GENERIC(STARTED) RACLIST(STARTED) REFRESH

RDEFINE  SERVAUTH EZB.PAGENT.SC80.TCPIP.* UACC(NONE)
PERMIT   EZB.PAGENT.SC80.TCPIP.* CLASS(SERVAUTH) ID(SAW125A) ACCESS(READ)
SETROPTS GENERIC(SERVAUTH) RACLIST(SERVAUTH) REFRESH
```

Example 2-15 shows that the Policy Agent is configured with the CA certificate in its keyring.

Example 2-15 Policy Agent RACF KEYRING

```
Digital ring information for user PAGENT:

  Ring:
       >KEYRING<
  Certificate Label Name             Cert Owner     USAGE      DEFAULT
  --------------------------------   ------------   --------   -------
  SAW125 ITSO CA1                    CERTAUTH       CERTAUTH     NO

***
```

Example 2-16 shows the necessary modifications to the TCP/IP configuration profile. Optionally, you can add port reservations.

Example 2-16 TCP/IP profile TCPCONFIG TTLS statement

```
TCPCONFIG TCPSENDBFRSIZE 16K TCPRCVBUFRSIZE 16K SENDGARBAGE FALSE
  RESTRICTLOWPORTS TTLS
```

Tip: Do not use AUTOLOG to start the NSS server. You will lose NSS cached information if the NSS procedure has already been initialized and the AUTOLOG process causes it to cancel and restart.

You can verify the AT-TLS installation by using these supplied MVS™ and USS commands:

- You can use D TCPIP,TCPIP,N,CONN,CLIENT=NSSD, as shown in Example 2-17.
- You can use D TCPIP,TCPIP,N,TTLS,CONN=0084,DETAIL (where 0084 is a variable to represent the CONN ID for the NSSD connection) to see the current configuration that is installed in the stack, as shown in Example 2-18.
- You can use **pasearch -t**, which is a USS command, for a more detailed display.

Example 2-17 D TCPIP,TCPIP,N,CONN,CLIENT=NSSD MVS command

```
RESPONSE=SC80
 EZZ2500I NETSTAT CS V1R12 TCPIP 096
 USER ID  CONN     LOCAL SOCKET           FOREIGN SOCKET         STATE
 NSSD     00000084 172.30.101.1..4159     172.30.101.9..45998    ESTBLSH
 NSSD     0000005B 0.0.0.0..4159          0.0.0.0..0             LISTEN
 2 OF 2 RECORDS DISPLAYED
 END OF THE REPORT
```

Example 2-18 D TCPIP,TCPIP,N,TTLS,CONN=0084,DETAIL

```
D TCPIP,TCPIP,N,TTLS,CONN=0084,detail
EZD0101I NETSTAT CS V1R12 TCPIP 108
CONNID: 00000084
  JOBNAME:      NSSD
  LOCALSOCKET:  172.30.101.1..4159
  REMOTESOCKET: 172.30.101.9..45998
  SECLEVEL:     TLS VERSION 1
  CIPHER:       35 TLS_RSA_WITH_AES_256_CBC_SHA
  CERTUSERID:   N/A
  MAPTYPE:      PRIMARY
  FIPS140:      OFF
TTLSRULE: DEFAULT_NSS_SERVER
  PRIORITY:       255
  LOCALADDR:      ALL
  LOCALPORT:      4159
  REMOTEADDR:     ALL
  REMOTEPORTFROM: 1024             REMOTEPORTTO: 65535
  DIRECTION:      INBOUND
  TTLSGRPACTION:  GACT1NSS_SERVER
    GROUPID:                  00000001
    TTLSENABLED:              ON
    CTRACECLEARTEXT:          OFF
    TRACE:                    6
    SYSLOGFACILITY:           DAEMON
    SECONDARYMAP:               OFF
    FIPS140:                    OFF
  TTLSENVACTION:  EACT1NSS_SERVER
    ENVIRONMENTUSERINSTANCE:    0
    HANDSHAKEROLE:              SERVER
    KEYRING:                    KEYRING
    SSLV2:                      OFF
    SSLV3:                      ON
    TLSV1:                      ON
    TLSV1.1:                    ON
    RESETCIPHERTIMER:           0
    APPLICATIONCONTROLLED:      OFF
    HANDSHAKETIMEOUT:           10
    TRUNCATEDHMAC:              OFF
    CLIENTMAXSSLFRAGMENT:       OFF
    SERVERMAXSSLFRAGMENT:       OFF
    CLIENTHANDSHAKESNI:         OFF
    SERVERHANDSHAKESNI:         OFF
    CLIENTAUTHTYPE:             REQUIRED
    CERTVALIDATIONMODE:         ANY
  TTLSCONNACTION: CACT1NSS_SERVER
    HANDSHAKEROLE:              SERVER
    V3CIPHERSUITES:             35 TLS_RSA_WITH_AES_256_CBC_SHA
                                39 TLS_DHE_RSA_WITH_AES_256_CBC_SHA
                                37 TLS_DH_RSA_WITH_AES_256_CBC_SHA
                                38 TLS_DHE_DSS_WITH_AES_256_CBC_SHA
                                36 TLS_DH_DSS_WITH_AES_256_CBC_SHA
                                0A TLS_RSA_WITH_3DES_EDE_CBC_SHA
                                16 TLS_DHE_RSA_WITH_3DES_EDE_CBC_SHA
                                10 TLS_DH_RSA_WITH_3DES_EDE_CBC_SHA
                                13 TLS_DHE_DSS_WITH_3DES_EDE_CBC_SHA
                                0D TLS_DH_DSS_WITH_3DES_EDE_CBC_SHA
                                2F TLS_RSA_WITH_AES_128_CBC_SHA
                                33 TLS_DHE_RSA_WITH_AES_128_CBC_SHA
                                31 TLS_DH_RSA_WITH_AES_128_CBC_SHA
                                32 TLS_DHE_DSS_WITH_AES_128_CBC_SHA
                                30 TLS_DH_DSS_WITH_AES_128_CBC_SHA
    CTRACECLEARTEXT:            OFF
    TRACE:                      31
    APPLICATIONCONTROLLED:      ON
    SECONDARYMAP:               OFF
1 OF 1 RECORDS DISPLAYED
END OF THE REPORT
```

For more information about NSSD, PAGENT, and DataPower integration, refer to Chapter 10 of *IBM z/OS V1R12 Communications Server TCP/IP Implementation: Volume 4 Security and Policy-Based Networking*, SG24-7899.

2.3.3 Security provided by VLAN

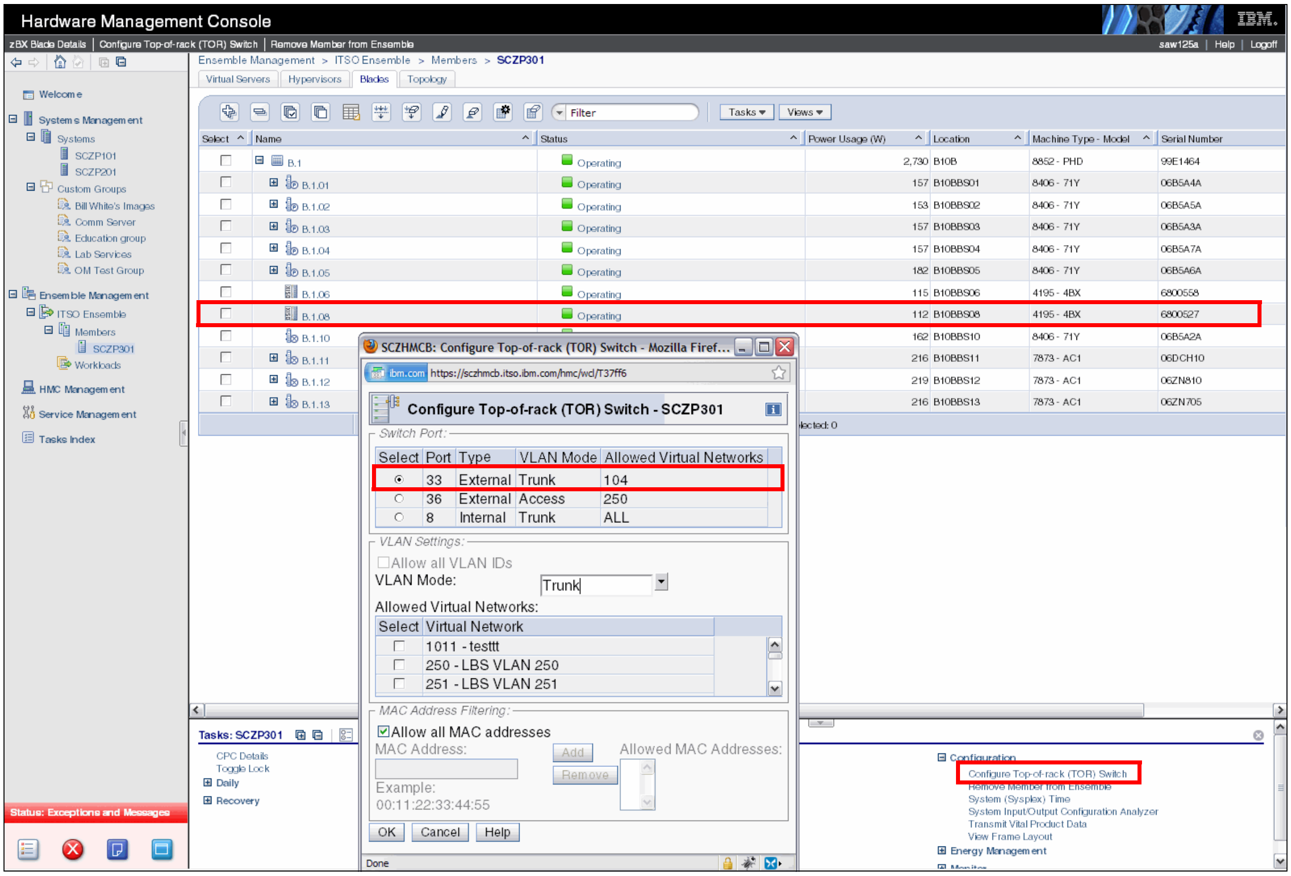
The zEnterprise provides the ability to define multiple distinct virtual networks for all network access points across a common shared physical network fabric called the IEDN. VLAN support provides the enforced isolation of network traffic with secure private networks and integration with RACF security. You can view these virtual networks as distinct security zones and exploit the VLAN technology for the strict isolation of these networks. The IEDN allows you to set up VLAN connections between the virtual servers running in the ensemble. From z/VM, the virtual servers attach to the IEDN through virtual switches. For more information, refer to 1.2.2, “Network security in the ensemble” on page 4.

2.3.4 Top-of-rack (TOR) Switch security

The Top-of-rack (TOR) Switch enables external connectivity for the zEnterprise to the outside. We have two DataPower Ethernet interfaces, eth7 and eth9, that are available for user configuration. Interfaces eth0 and eth1 remain under the control of the zEnterprise and cannot be configured by using the Hardware Management Console (HMC).

For the purposes of this Redbooks test environment, we chose interface eth7 to be the internal interface to use to connect to the z196s within the ensemble. For communication outside the ensemble (including the WebGUI management interface), we selected interface eth9. Chapter 1, “Getting started with the XI50z” on page 1 describes the VLAN structure in detail. In summary, we have defined two VLANs. VLAN 101 is active on eth7 for internal communication from the XI50z blade (B.1.08 in Figure 2-5 on page 51) to CICS, IMS, DB2, and other applications that are running on the z196. VLAN 104 is active on eth9 for external communication outside the zEnterprise. Usually, a router or server is connected to a port (in our case, port 33 in Figure 2-7 on page 61) on the TOR Switch. The port then shows in the list of switch ports. The network administrator can then attach the defined VLANs to the “Allowed Virtual Networks” list.

Figure 2-5 shows the Configure Top-of-rack (TOR) Switch task that enables you to restrict VLANs that communicate outside the zEnterprise by way of the TOR Switch.



Select	Name	Status	Power Usage (W)	Location	Machine Type - Model	Serial Number
☐	B.1	Operating	2,730	B10B	8852 - PHD	99E1464
☐	B.1.01	Operating	157	B10BBS01	8406 - 71Y	06B5A4A
☐	B.1.02	Operating	153	B10BBS02	8406 - 71Y	06B5A5A
☐	B.1.03	Operating	157	B10BBS03	8406 - 71Y	06B5A3A
☐	B.1.04	Operating	157	B10BBS04	8406 - 71Y	06B5A7A
☐	B.1.05	Operating	182	B10BBS05	8406 - 71Y	06B5A6A
☐	B.1.06	Operating	115	B10BBS06	4195 - 4BX	6800558
☐	B.1.08	Operating	112	B10BBS08	4195 - 4BX	6800527
☐	B.1.10		162	B10BBS10	8406 - 71Y	06B5A2A
☐	B.1.11		216	B10BBS11	7873 - AC1	06DCH10
☐	B.1.12		219	B10BBS12	7873 - AC1	06ZN810
☐	B.1.13		216	B10BBS13	7873 - AC1	06ZN705

SCZHMCB: Configure Top-of-rack (TOR) Switch - Mozilla Firef...

https://sczhmcb.itso.ibm.com/hmc/wcl/T37ff6

Configure Top-of-rack (TOR) Switch - SCZP301

Switch Port:

Select	Port	Type	VLAN Mode	Allowed Virtual Networks
●	33	External	Trunk	104
○	36	External	Access	250
○	8	Internal	Trunk	ALL

VLAN Settings:

☐ Allow all VLAN IDs

VLAN Mode: Trunk

Allowed Virtual Networks:

Select	Virtual Network
☐	1011 - testtt
☐	250 - LBS VLAN 250
☐	251 - LBS VLAN 251

MAC Address Filtering:

☑ Allow all MAC addresses

MAC Address:

Example: 00:11:22:33:44:55

Allowed MAC Addresses:

Figure 2-7 Configure Top-of-rack (TOR) Switch security

2.4 The XI50z RBM settings: Enabling RACF users to use the management GUI

The DataPower appliance manages access through role-based management (RBM). RBM provides a flexible and integrated means to control whether an authenticated user has the necessary privileges to access resources through access policies.

RBM consists of the following capabilities:

- Authenticating users

  RBM authenticates the user against a user repository. The repository can reside on the DataPower appliance, or it can be remote. DataPower appliances support three commonly used remote authentication servers:

  - LDAP server
  - RADIUS servers
  - System Authorization Facility (SAF)

  SAF is an interface that is defined by z/OS that processes security authorization requests directly or works with RACF, or other security products, to process them.

- Credential mapping

  The credentials represent the user's privileges to access resources and configuration functions. After a user is authenticated, the user's credentials are determined by inspecting the *access profile,* which describes a permission (read, write, add, delete, and execute) for one or more resources, and mapping each permission into a credential. When a user attempts to access a resource or execute a configuration task, the RBM subsystem checks the credentials to determine if the user has the required privileges.

RBM settings using z/OS SAF services

In this section, we provide a detailed description about RBM settings for SAF. Figure 2-8 shows our test environment.

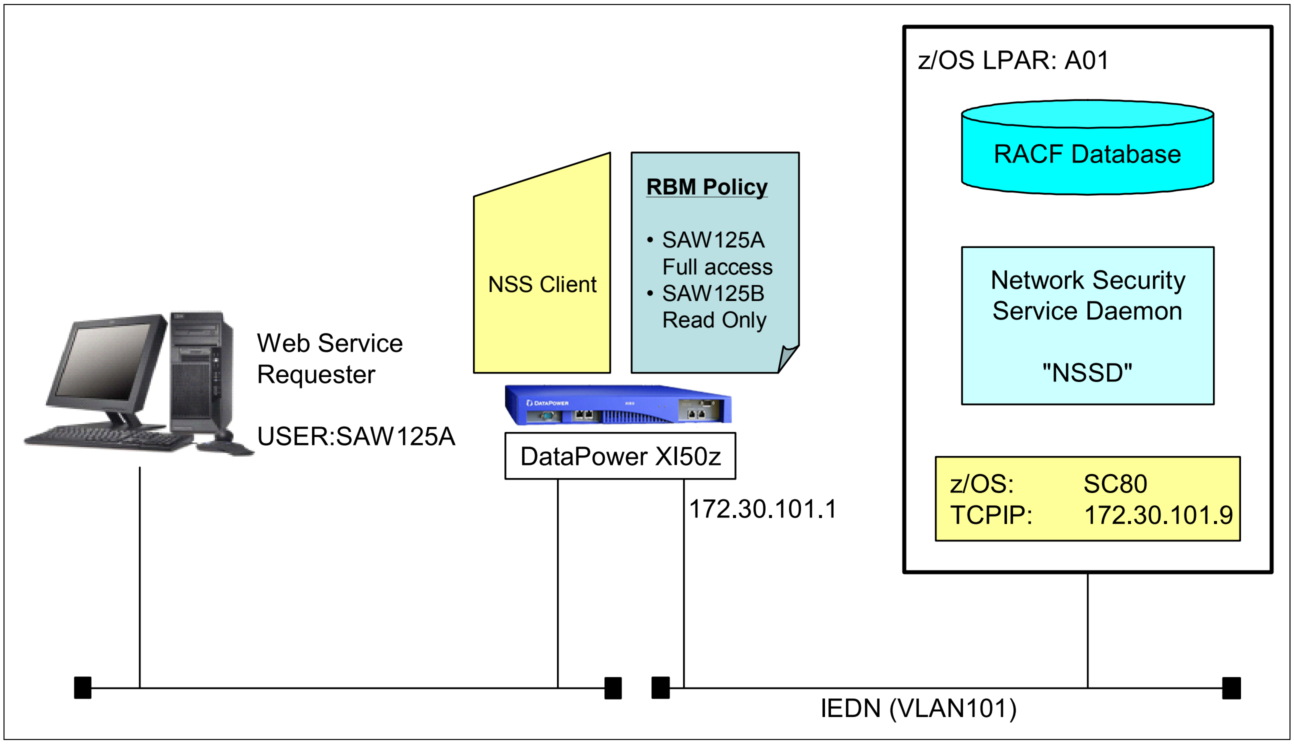


Figure 2-8 Test environment

The DataPower appliance provides three administrative interfaces (CLI, web-based GUI (WebGUI), and SOAP-based XML management interface (XML)). We use the DataPower WebGUI to perform the administrative tasks for the DataPower appliance. There are two ways to connect to the WebGUI:

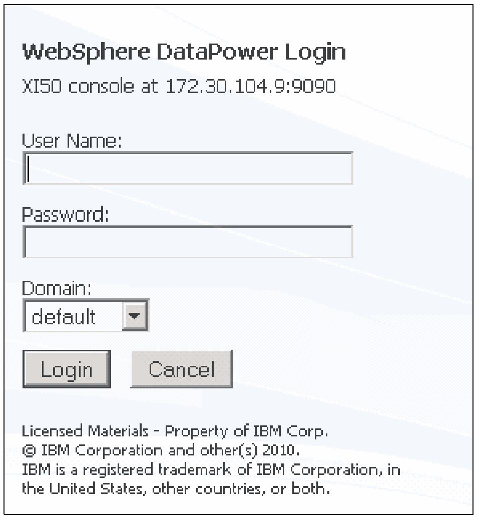
- Using a zManager

  Using a zManager, you connect to the SE and then select **Manage DataPower XI50z**. For more information, refer to 1.4.3, "Initial DataPower setup" on page 23.

- Using a browser

  Using a browser, you use the management port number that is assigned by the DataPower administrator. The default port number is 9090.

After you connect to the WebGUI, the login window that is shown in Figure 2-9 opens.



WebSphere DataPower Login

XI50 console at 172.30.104.9:9090

Domain: default

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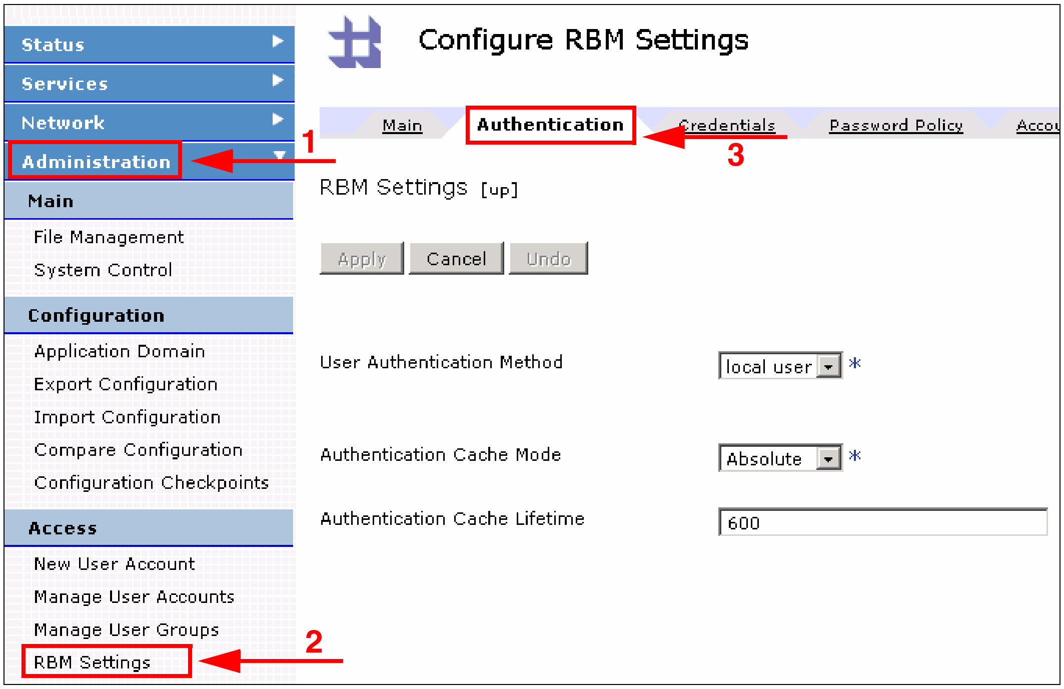
IBM is a registered trademark of IBM Corporation, in the United States, other countries, or both.

Figure 2-9 The XI50z WEB GUI console login window

The following steps define how to use SAF and the NSS client on the XI50z to authenticate the users that are defined in RACF. This method is a more centralized approach and it might prove to be useful, especially if there are multiple XI50z blades in the zBX. Follow these steps:

1. Log on to the DataPower with the user dp-admin. Then, select **Administration** → **RBM Settings**. Click the **Authentication** tab, as shown in Figure 2-10.



Configure RBM Settings

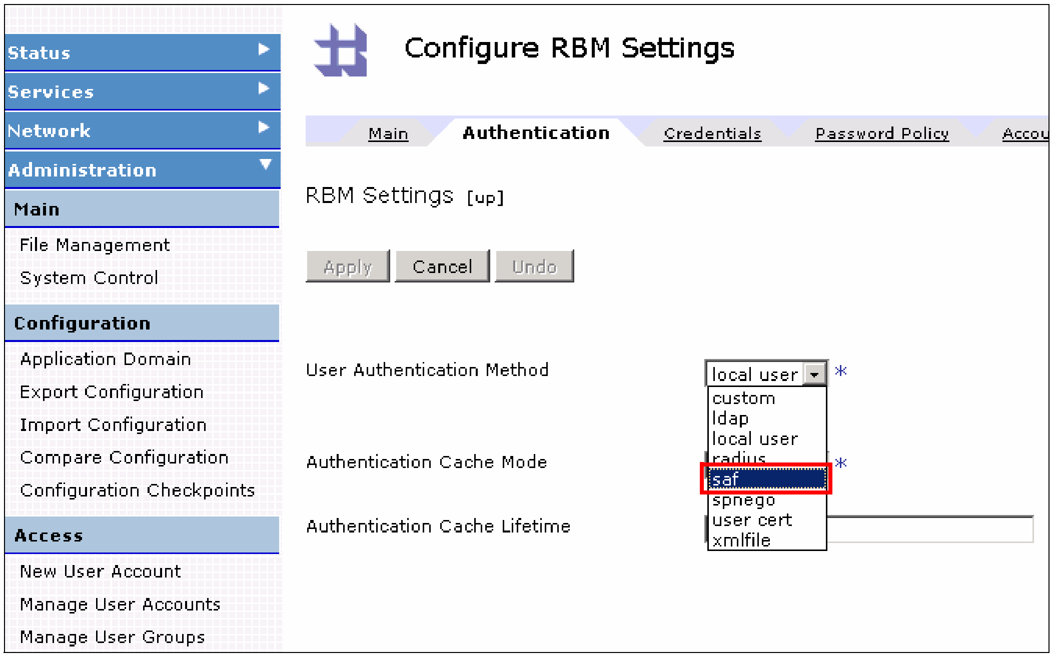
User Authentication Method: local user *

Authentication Cache Mode: Absolute *

Authentication Cache Lifetime: 600

Figure 2-10 Beginning to configure the RBM settings

2. For the User Authentication Method, select **saf**, as shown in Figure 2-11.



RBM Settings [up]

User Authentication Method: local user *

Authentication Cache Mode *

Authentication Cache Lifetime

Figure 2-11 Select User Authentication Method

3. On the Configure RBM Settings window, select the plus symbol (**+**) to the right of the ZOS/NSS Client Configuration field to define the NSS client, as shown in Figure 2-12. Provide the following information (a, b, and c correspond to the fields on the window):

   a. Local Login As Fallback

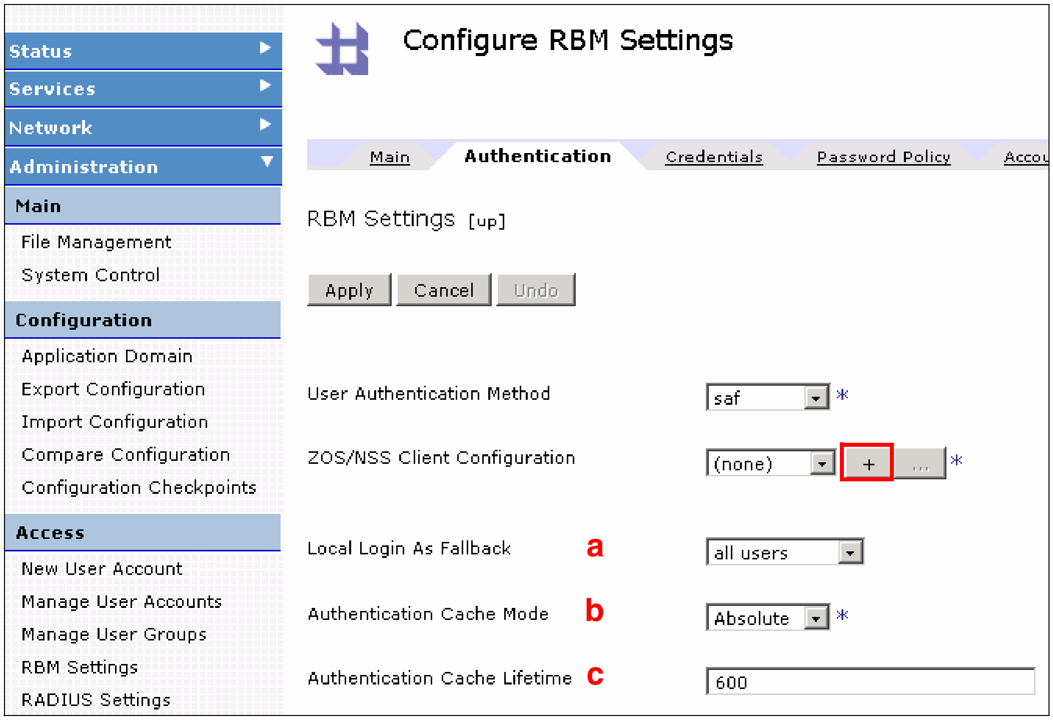
      Select whether to use local user accounts as fallback users. With fallback users, locally defined users can log on to the appliance if the authentication method fails or in the event of a network outage that affects the primary login authentication (for example, the remote authentication server is down).

   b. Authentication Cache Mode

      Select the desired caching mode.

   c. Authentication Cache Lifetime

      Specify an explicit TTL in seconds to retain the cached results.



User Authentication Method: saf *

ZOS/NSS Client Configuration: (none) *

Local Login As Fallback: all users

Authentication Cache Mode: Absolute *

Authentication Cache Lifetime: 600

Figure 2-12 Select ZOS/NSS Client Configuration

4. Enter the following items to define the NSS Client and click **Apply**, as shown in Figure 2-13 on page 66 (a, b, c, and so on correspond to the fields on the window):

   a. Remote Address

      Specify the IP address or host name of the NSS server.

   b. Remote Port

      Specify the port on which the NSS server listens. The default port is 4159.

   c. SSL Proxy

      Select an SSL Proxy Profile to provide a secured connection to the remote authentication server.

d. Client ID

Specify the name that is assigned to each NSS client that will request authentication of the NSS server.

e. System Name

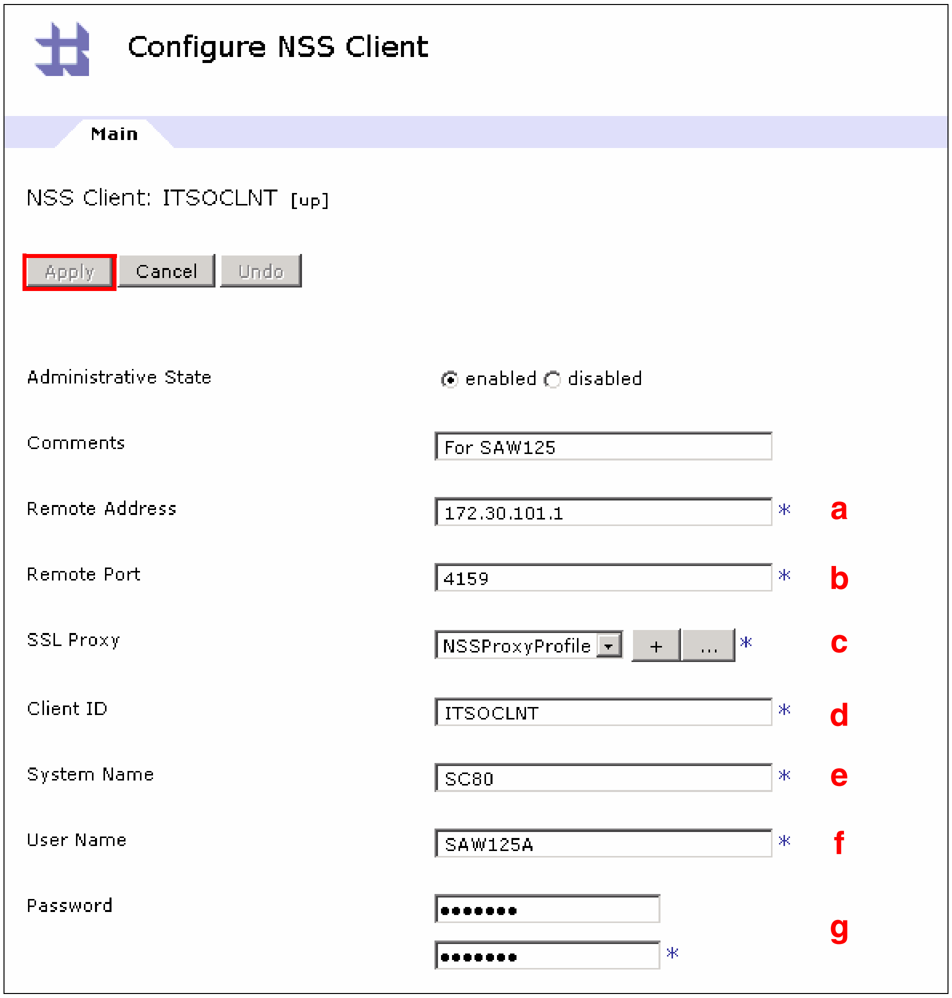
Specify the system name to identify the NSS client to the NSS server.

f. User Name

Specify the user name to use to authenticate with the SAF.

g. Password

Specify the password to use to authenticate with the SAF.



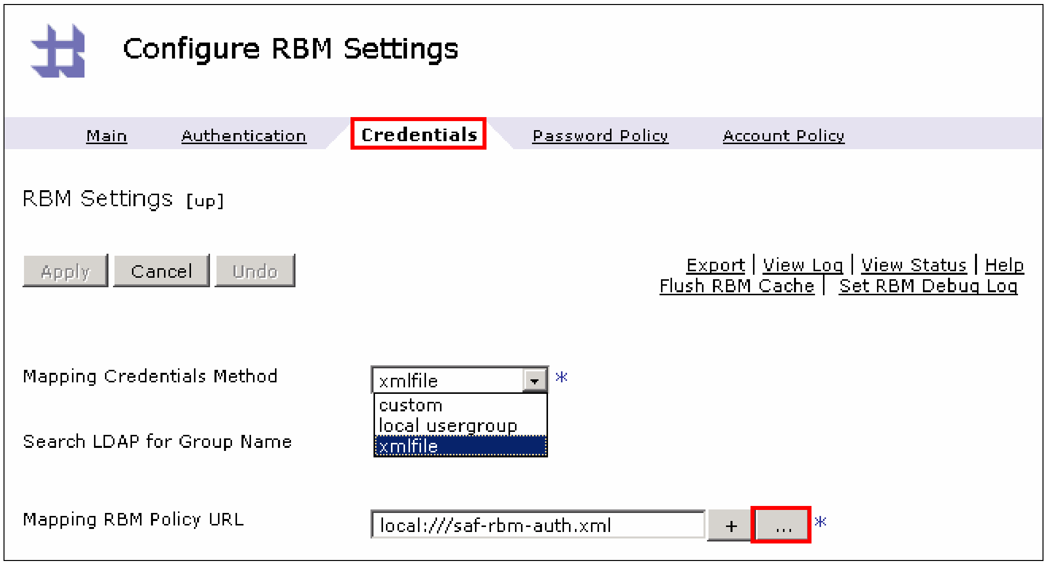
Configure NSS Client

NSS Client: ITSOCLNT [up]

Administrative State	● enabled ○ disabled
Comments	For SAW125
Remote Address	172.30.101.1 *
Remote Port	4159 *
SSL Proxy	NSSProxyProfile *
Client ID	ITSOCLNT *
System Name	SC80 *
User Name	SAW125A *
Password	••••••• ••••••• *

Figure 2-13 Define NSS Client

5. Select the **Credentials** tab. For the Mapping Credentials Method, in this case, choose **xmlfile**. When we select xmlfile, we type the URL of the RBM file in the Mapping RBM Policy URL input field. The default URL is `local:///saf-rbm-auth.xml`. Click the ellipsis (**...**) to customize this file, as shown in Figure 2-14.



Configure RBM Settings

RBM Settings [up]

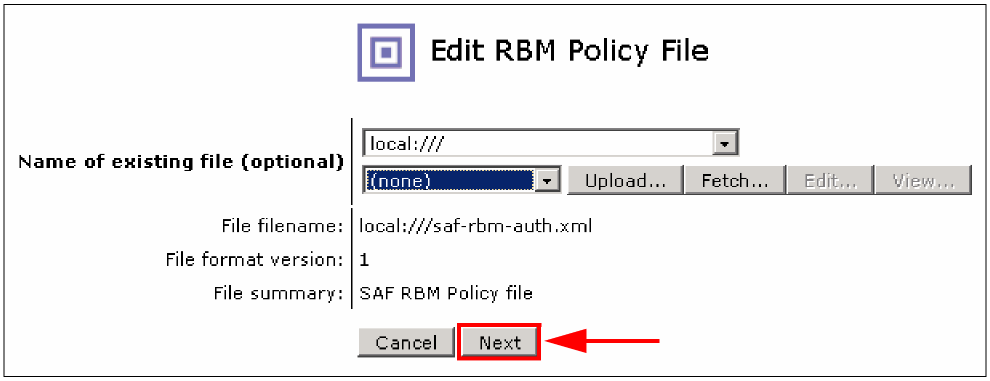
Mapping Credentials Method: xmlfile *

Search LDAP for Group Name

Mapping RBM Policy URL: local:///saf-rbm-auth.xml *

Figure 2-14 Select credentials

6. Verify the filename and then click **Next**, as shown in Figure 2-15.



Edit RBM Policy File

Name of existing file (optional): local:/// (none)

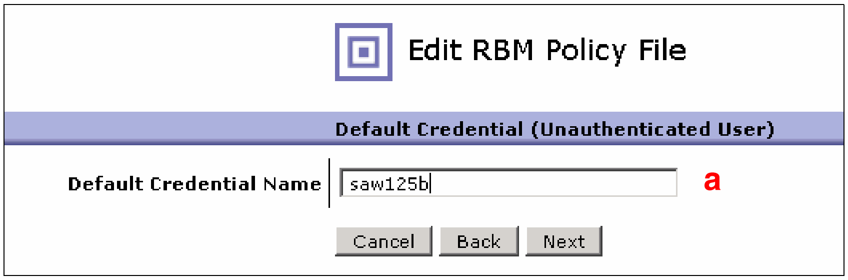
File filename: local:///saf-rbm-auth.xml

File format version: 1

File summary: SAF RBM Policy file

Figure 2-15 Edit RBM Policy FIle

7. Enter the Default Credential Name, as shown in Figure 2-16. This credential will be used for requests for which no User Authentication entry matched. Leave this field blank to deny access to all users who fail authentication.



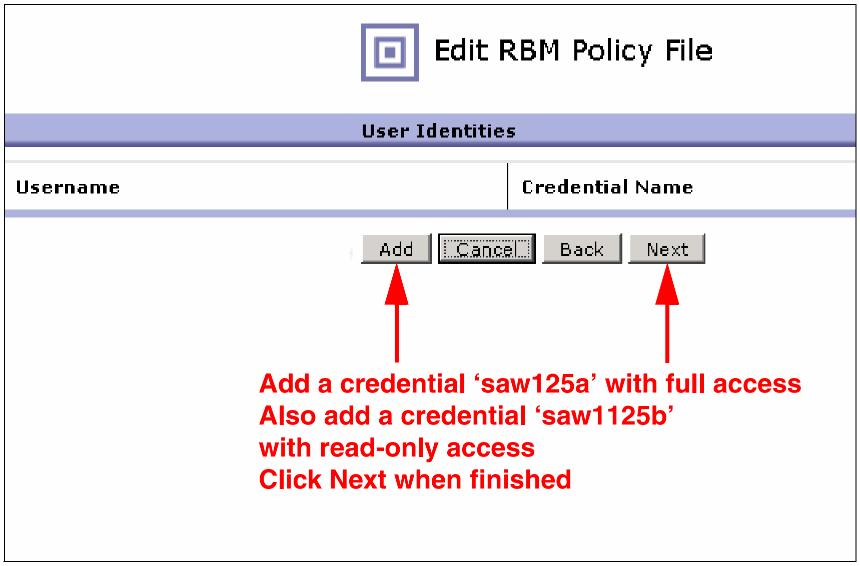
Edit RBM Policy File

Default Credential (Unauthenticated User)

Default Credential Name: saw125b

Figure 2-16 Enter Default Credential Name

8. Add a credential. In this case, we add a credential `saw125a` with full access, and add a credential `saw125b` with read-only access. Click **Add** and then click **Next**, as shown in Figure 2-17.



Add a credential 'saw125a' with full access
Also add a credential 'saw1125b'
with read-only access
Click Next when finished

Figure 2-17 Add a credential

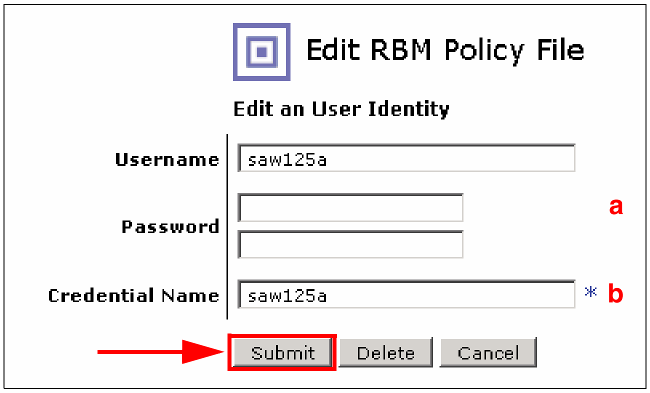
9. Enter the username and Credential Name and then click **Submit**, as shown in Figure 2-18:

   a. Username and Password

      Specify a user name and password.

   b. Credential Name

      Specify the name of the credential to assign to this user. The value in the Credential Name field is stored in the Authenticate section of the `RBMInfo.xml` file as the value of the OutputCredential for this user.



Edit an User Identity

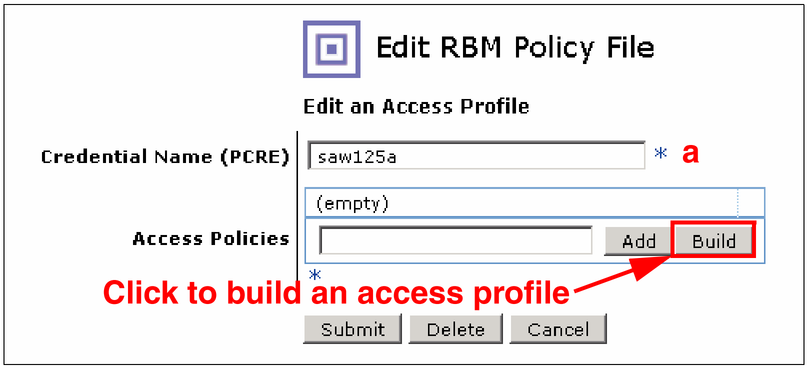
Username: saw125a

Password:

Credential Name: saw125a *

Figure 2-18 Add a credential saw125a

10. Click **Next** to display the Access Profile Mappings catalog. If this is a new file, no access policy maps are listed. Click **Build** to create a new Access Profile, as shown in Figure 2-19.



Edit RBM Policy File

Edit an Access Profile

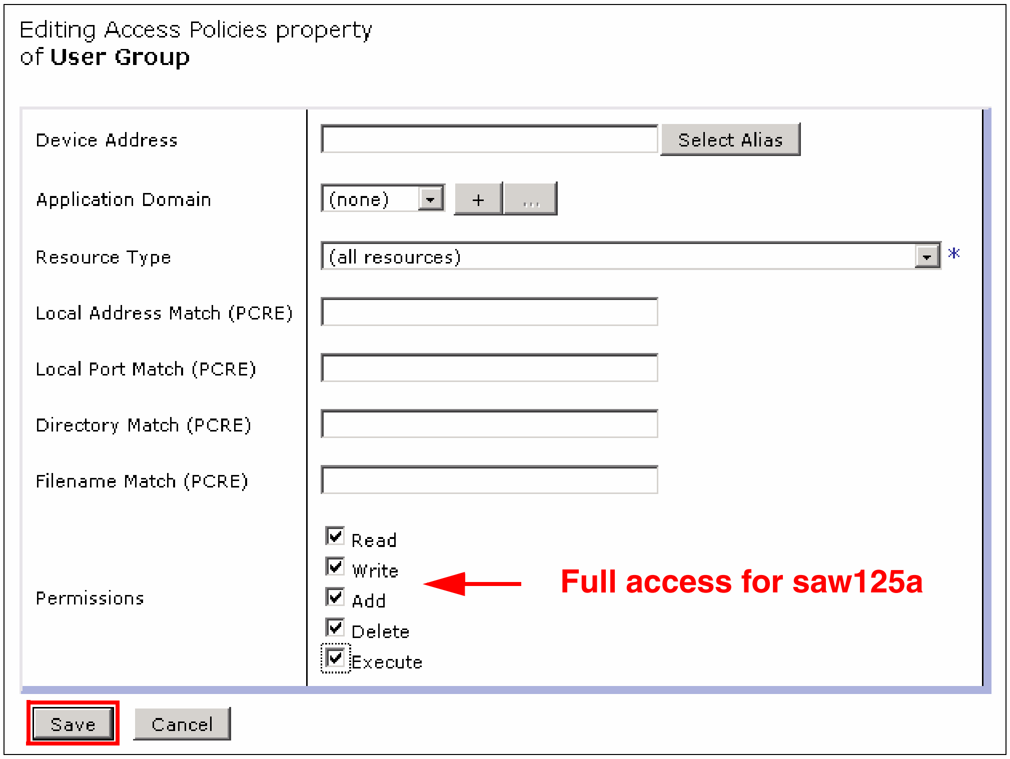
Credential Name (PCRE): saw125a *

Access Policies: (empty)

Click to build an access profile

Figure 2-19 Access Profile Mappings catalog

11. In this case, we allow saw125a full access, so select all the check boxes that are associated with Permissions. Then, click **Save**, as shown in Figure 2-20.



Editing Access Policies property
of **User Group**

Device Address:

Application Domain: (none)

Resource Type: (all resources) *

Local Address Match (PCRE):

Local Port Match (PCRE):

Directory Match (PCRE):

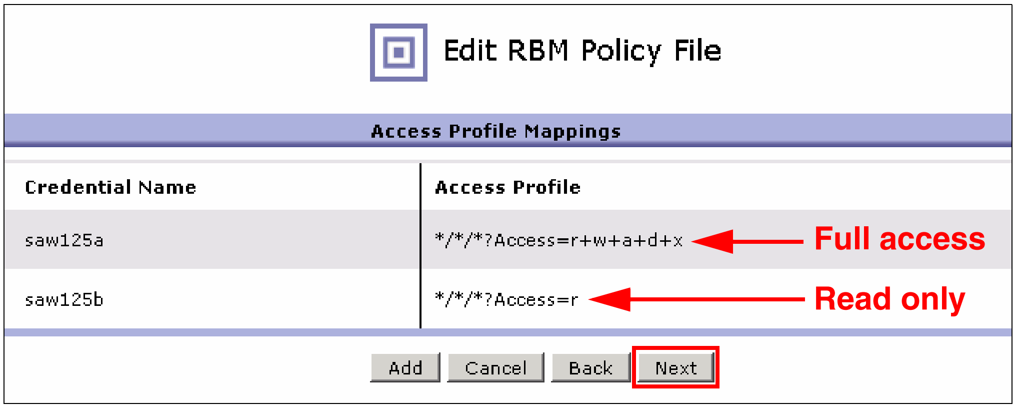
Filename Match (PCRE):

Permissions:
☑ Read
☑ Write
☑ Add
☑ Delete
☑ Execute

Full access for saw125a

Figure 2-20 Edit access profile

12. Repeat the same procedure to create the credential saw125b. Verify the Access Profile settings and then click **Next**, as shown in Figure 2-21.



Edit RBM Policy File

Access Profile Mappings

Credential Name	Access Profile
saw125a	*/*/*?Access=r+w+a+d+x
saw125b	*/*/*?Access=r

Figure 2-21 Verify the Access Profile

2.5 SAF authentication and authorization details

The XI50z acts as an intermediary, usually an SOA gateway or an ESB, that protects and mediates transactions for the ensemble. One of the commonly used patterns on the XI50z is to provide a facade to existing services on the zEnterprise. This facade can be consumed by clients with separate format, protocol, and security requirements than what the existing services can provide.

The XI50z provides a range of security, transformation, and routing schemes to service consumers over a variety of popular protocols while maintaining the back-end connectivity without requiring a change to the existing z/OS services. Also, the Web Services consumer is isolated from the back-end implementation and continues to send requests to the same DataPower port even if the back-end implementation changes.

Consider a scenario in which a RACF security system is well-established for CICS, IMS, DB2, and other z/OS applications, These applications need to be opened up to new Web Services-based clients. The XI50z can act as an intermediary and perform the authentication and authorization of the transaction before forwarding it to the z/OS application. You can tailor the security scheme that is used inbound into the XI50z to the convenience of the services consumer, and the XI50z provides a variety of choices.

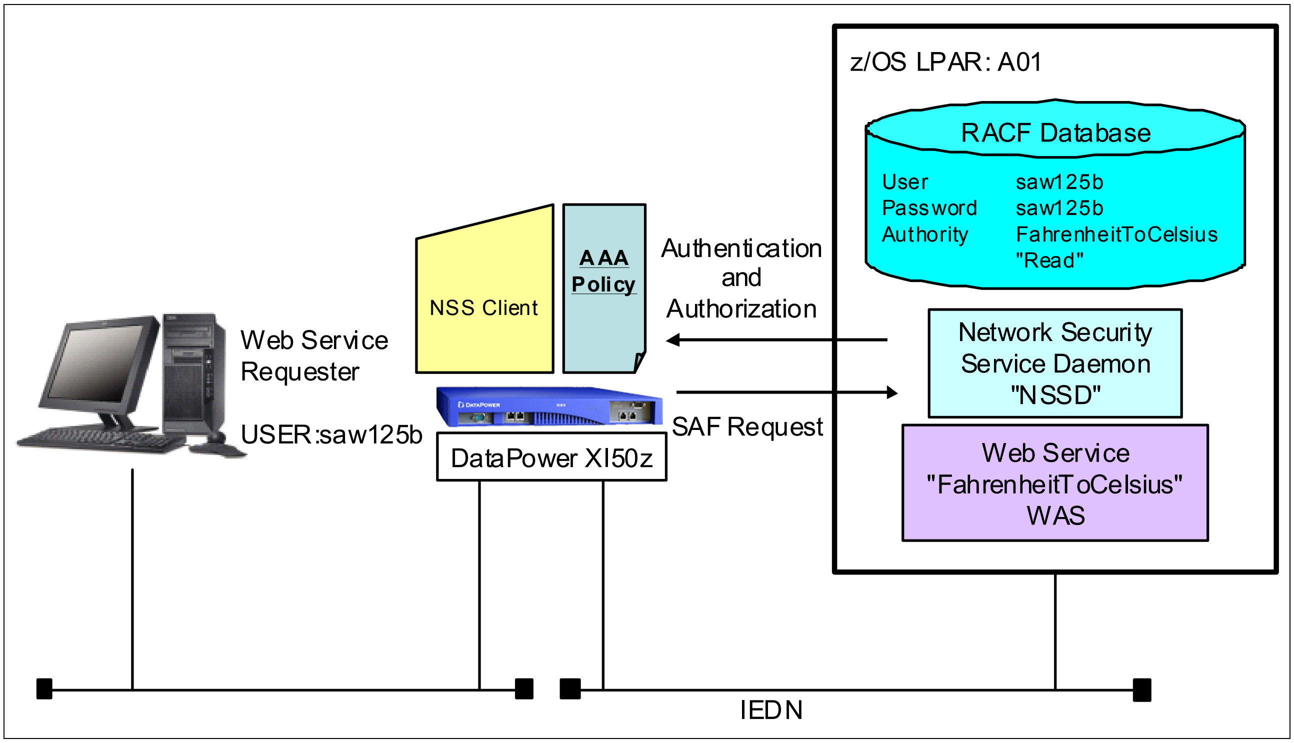
In our scenario, the consumer authenticates with the XI50z using WS-Security Username Token; the username and password are authenticated using SAF Authentication against a RACF repository. Figure 2-22 on page 71 shows our scenario. The WS-Security Username Token, where the username (saw125b) and password combination is sent in the SOAP header from the consumer, is extracted in the XI50z, along with the resource being accessed, which we have selected to be the top-level element of the Web Service (FahrenheitToCelsius).

We implemented two use cases in the same AAA action. We explain them in detail with window images. We also explain the required RACF configuration changes.

Authentication and authorization are the two use cases:

- Authentication using the username and password
- Authorization of the authenticated credential to be able to access the FahrenheitToCelsius service (resource=FahrenheitToCelsius is defined in RACF, giving read permission to the user)

After the transaction is authenticated and authorized by the XI50z, acting as a SOAP gateway, the message can be transformed to back-end specifications (usually a binary transformation to a COBOL copybook format) and routed to the appropriate back end. The transformation and routing are not included in this scenario, because they focus on security.



z/OS LPAR: A01
RACF Database
User saw125b
Password saw125b
Authority FahrenheitToCelsius "Read"
NSS Client
AAA Policy
Authentication and Authorization
Web Service Requester
USER:saw125b
Network Security Service Daemon "NSSD"
SAF Request
DataPower XI50z
Web Service "FahrenheitToCelsius" WAS
IEDN

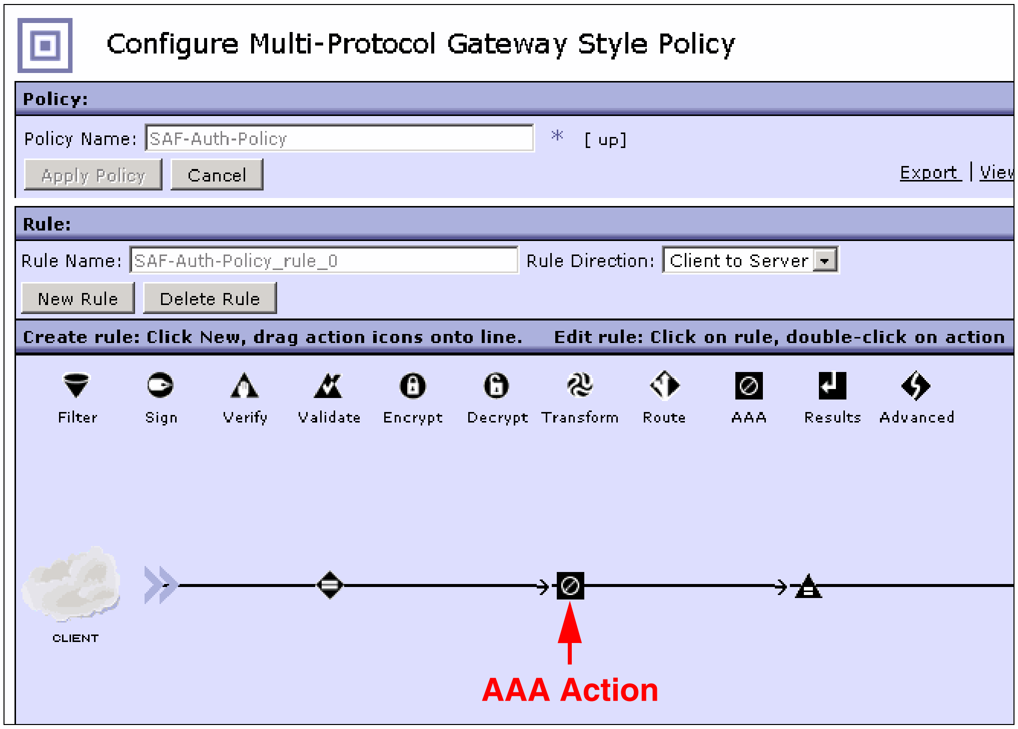
Figure 2-22 SAF authentication against a RACF repository

The following steps describe how to configure the authentication and authorization of a transaction coming into the zEnterprise XI50z, which is acting as an SOA gateway against a RACF repository using NSS SAF services:

1. Configure the AAA action:

   a. Add the AAA action.

      Select the **AAA Action** icon, and click the plus symbol (**+**) beside the AAA Policy list, as shown in Figure 2-23.



Configure Multi-Protocol Gateway Style Policy

Policy:

Policy Name: SAF-Auth-Policy * [up]

Rule:

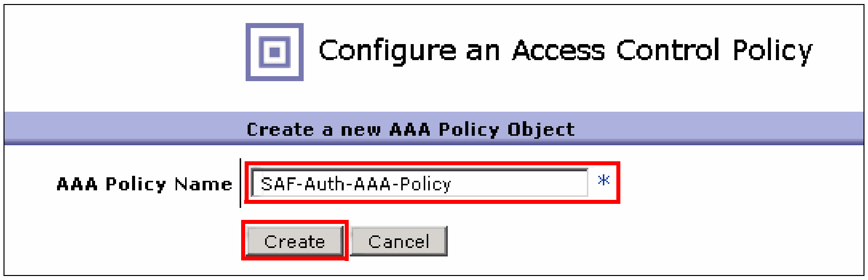
Rule Name: SAF-Auth-Policy_rule_0 Rule Direction: Client to Server

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

Figure 2-23 Configure the AAA Action

   b. Create a new AAA Policy Object.

      In the AAA Policy Name field, enter the name for the new AAA policy. For our example, type `SAF-Auth-AAA-Policy`. Click **Create**.



Configure an Access Control Policy

Create a new AAA Policy Object

AAA Policy Name: SAF-Auth-AAA-Policy *

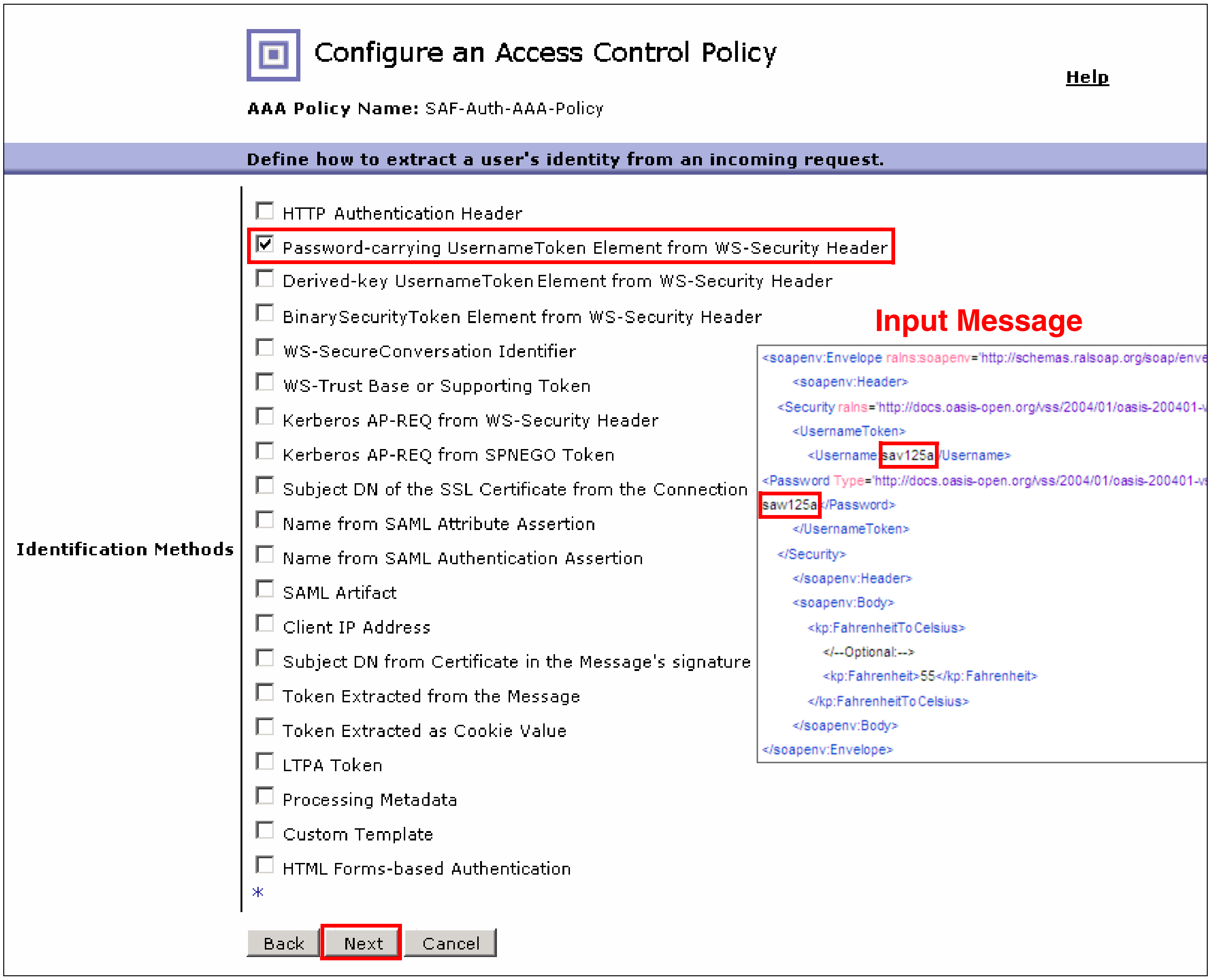
Figure 2-24 Create a new AAA Policy Object

c. Specify the Identity method.

Specify the method or methods that are used by the AAA Policy to extract the identity that is claimed by the service requester.

In this case, we use the UserName element from the WS-Security header. The claimed identity of the requester is extracted from the WS-Security UserName element (name and password) that is contained in a SOAP header.

Select **Password-carrying UsernameToken Element from WS-Security Header** and click **Next**, as shown in Figure 2-25.



Configure an Access Control Policy

AAA Policy Name: SAF-Auth-AAA-Policy

Define how to extract a user's identity from an incoming request.

Identification Methods

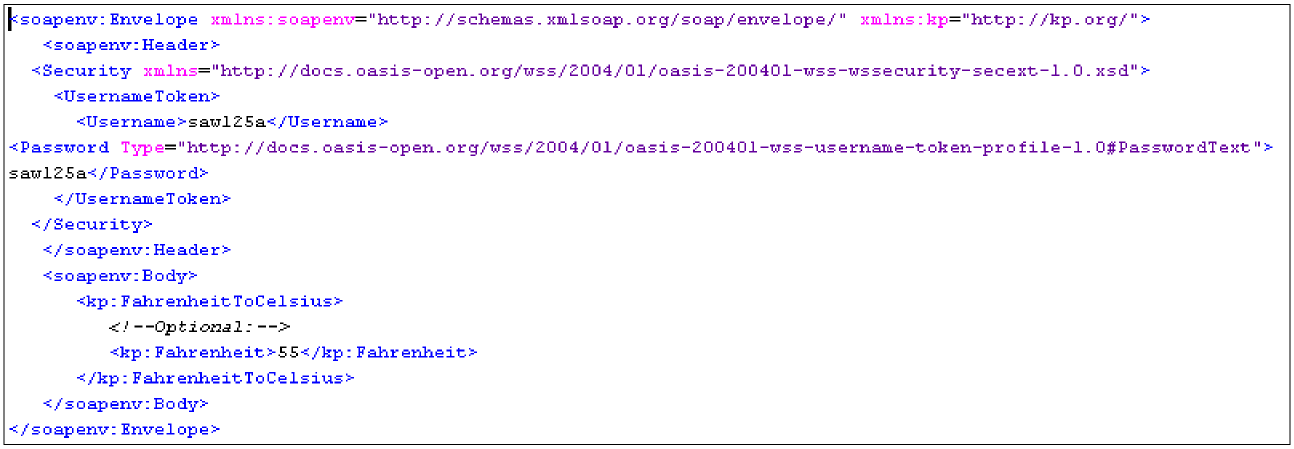
☐ HTTP Authentication Header
☑ Password-carrying UsernameToken Element from WS-Security Header
☐ Derived-key UsernameToken Element from WS-Security Header
☐ BinarySecurityToken Element from WS-Security Header
☐ WS-SecureConversation Identifier
☐ WS-Trust Base or Supporting Token
☐ Kerberos AP-REQ from WS-Security Header
☐ Kerberos AP-REQ from SPNEGO Token
☐ Subject DN of the SSL Certificate from the Connection
☐ Name from SAML Attribute Assertion
☐ Name from SAML Authentication Assertion
☐ SAML Artifact
☐ Client IP Address
☐ Subject DN from Certificate in the Message's signature
☐ Token Extracted from the Message
☐ Token Extracted as Cookie Value
☐ LTPA Token
☐ Processing Metadata
☐ Custom Template
☐ HTML Forms-based Authentication
*

Input Message

```
<soapenv:Envelope ralns:soapenv='http://schemas.ralsoap.org/soap/enve
     <soapenv:Header>
   <Security ralns='http://docs.oasis-open.org/vss/2004/01/oasis-200401-
     <UsernameToken>
        <Usernamesav125a/Username>
<Password Type='http://docs.oasis-open.org/vss/2004/01/oasis-200401-v
saw125a</Password>
     </UsernameToken>
   </Security>
     </soapenv:Header>
     <soapenv:Body>
        <kp:FahrenheitTo Celsius>
           </--Optional:-->
           <kp:Fahrenheit>55</kp:Fahrenheit>
        </kp:FahrenheitTo Celsius>
     </soapenv:Body>
</soapenv:Envelope>
```

Figure 2-25 Specify identity method

Figure 2-26 shows the input message.

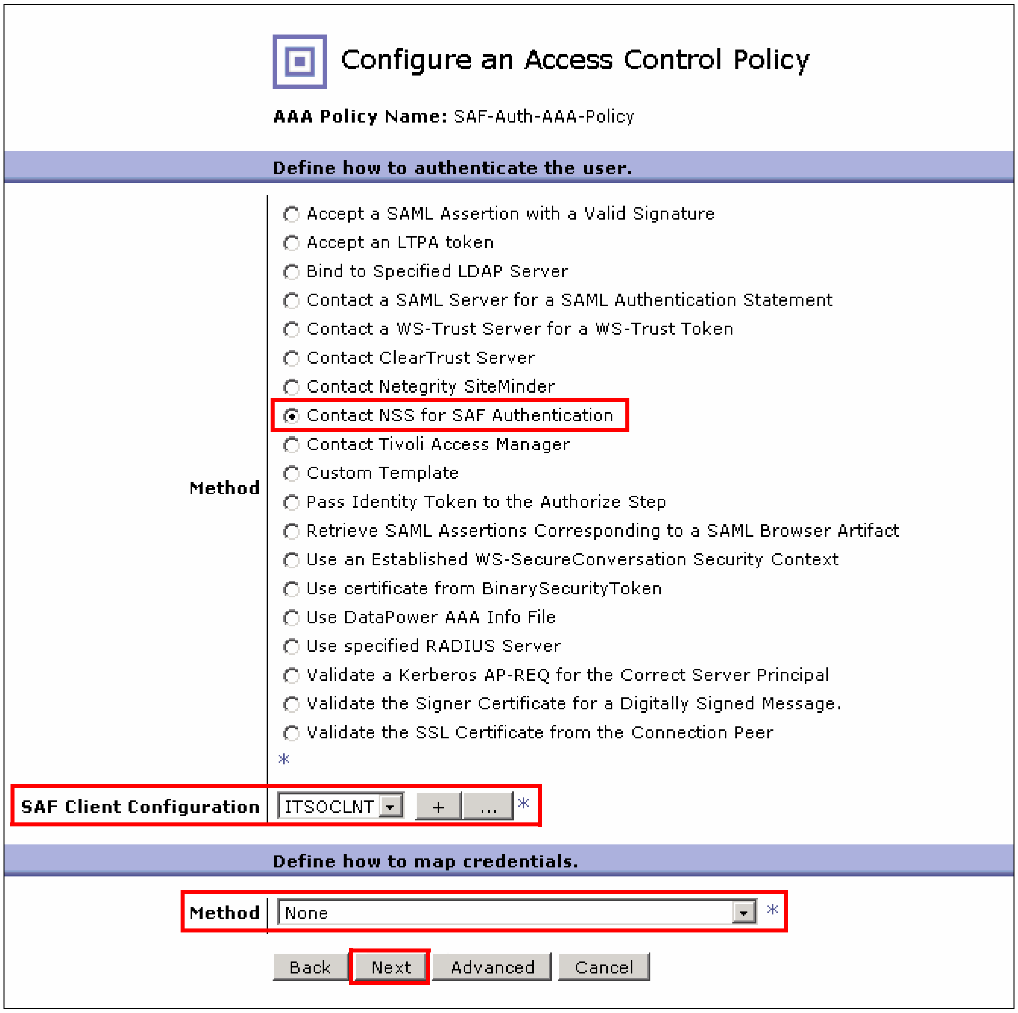


```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:kp="http://kp.org/">
   <soapenv:Header>
  <Security xmlns="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd">
    <UsernameToken>
      <Username>saw125a</Username>
<Password Type="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0#PasswordText">
saw125a</Password>
    </UsernameToken>
  </Security>
   </soapenv:Header>
   <soapenv:Body>
      <kp:FahrenheitToCelsius>
         <!--Optional:-->
         <kp:Fahrenheit>55</kp:Fahrenheit>
      </kp:FahrenheitToCelsius>
   </soapenv:Body>
</soapenv:Envelope>
```

Figure 2-26 Input message

d. Specify the authentication method.

The authentication process can use internal or external resources. In this case, select **Contact NSS for SAF Authentication**. Through this action, the requester is authenticated by the SAF. For the SAF Client Configuration field, click the plus symbol (**+**) and select **NSS Client object**. In the Define how to map credentials Method field, select **None**. Then, click **Next**, as shown in Figure 2-27.



Configure an Access Control Policy

AAA Policy Name: SAF-Auth-AAA-Policy

Define how to authenticate the user.

Method

○ Accept a SAML Assertion with a Valid Signature
○ Accept an LTPA token
○ Bind to Specified LDAP Server
○ Contact a SAML Server for a SAML Authentication Statement
○ Contact a WS-Trust Server for a WS-Trust Token
○ Contact ClearTrust Server
○ Contact Netegrity SiteMinder
● Contact NSS for SAF Authentication
○ Contact Tivoli Access Manager
○ Custom Template
○ Pass Identity Token to the Authorize Step
○ Retrieve SAML Assertions Corresponding to a SAML Browser Artifact
○ Use an Established WS-SecureConversation Security Context
○ Use certificate from BinarySecurityToken
○ Use DataPower AAA Info File
○ Use specified RADIUS Server
○ Validate a Kerberos AP-REQ for the Correct Server Principal
○ Validate the Signer Certificate for a Digitally Signed Message.
○ Validate the SSL Certificate from the Connection Peer
*

SAF Client Configuration ITSOCLNT *

Define how to map credentials.

Method None *

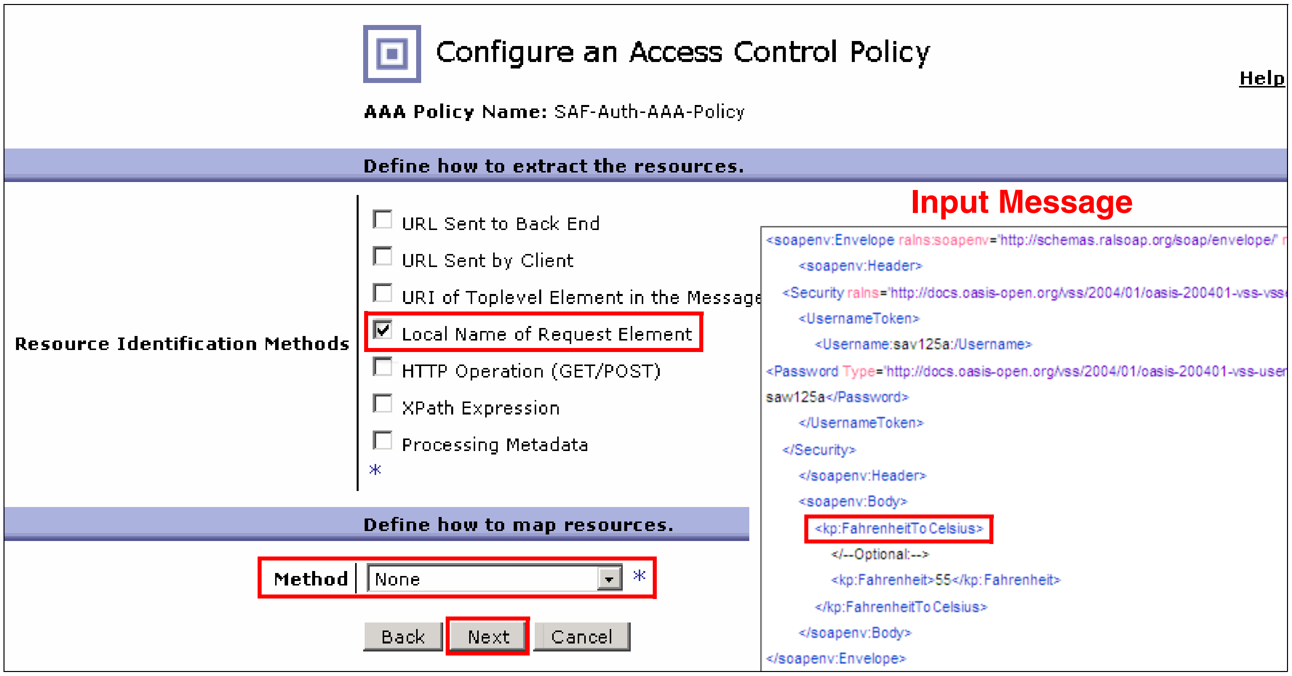
Figure 2-27 Specify the authentication method

e. Specify the Resource Extraction Method.

You designate the methods that are used to identify the resource that is requested by an authenticated client.

In this case, select **Local Name of Request Element** in the Resource Identification Methods field. Through this action, the identity of the requested resource is extracted from the simple name of the top-level application element (FahrenheitToCelsius).

Select **None** in the Define how to map resources method field. Then, click **Next**, as shown in Figure 2-28.



Configure an Access Control Policy

Help

AAA Policy Name: SAF-Auth-AAA-Policy

Define how to extract the resources.

Resource Identification Methods

- □ URL Sent to Back End
- □ URL Sent by Client
- □ URI of Toplevel Element in the Message
- ☑ Local Name of Request Element
- □ HTTP Operation (GET/POST)
- □ XPath Expression
- □ Processing Metadata

*

Define how to map resources.

Method None *

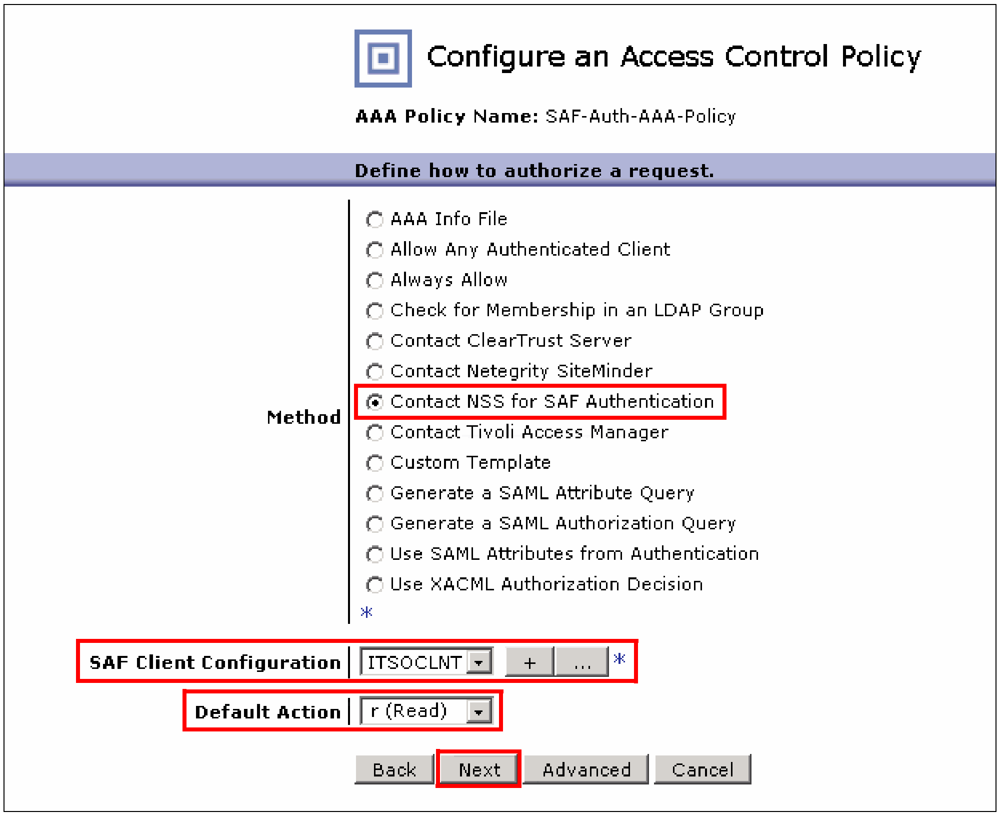
Input Message

```
<soapenv:Envelope ralns:soapenv='http://schemas.ralsoap.org/soap/envelope/' r
      <soapenv:Header>
   <Security ralns='http://docs.oasis-open.org/vss/2004/01/oasis-200401-vss-vss
      <UsernameToken>
         <Username:sav125a:/Username>
<Password Type='http://docs.oasis-open.org/vss/2004/01/oasis-200401-vss-user
saw125a</Password>
      </UsernameToken>
   </Security>
      </soapenv:Header>
      <soapenv:Body>
         <kp:FahrenheitToCelsius>
            </--Optional:-->
            <kp:Fahrenheit>55</kp:Fahrenheit>
         </kp:FahrenheitToCelsius>
      </soapenv:Body>
</soapenv:Envelope>
```

Figure 2-28 Specify Resource Extraction Method

f. Specify how to authorize a request.

You select the way to determine if the authenticated service requester is allowed access to the requested resource. In this case, select **Contact NSS for SAF Authentication** in the Method field. The WebGUI prompts for the SAF Client Configuration, select **NSS Client object**. For the Default Action, select **r (Read)**. Then, click **Next**, as shown in Figure 2-29.



Configure an Access Control Policy

AAA Policy Name: SAF-Auth-AAA-Policy

Define how to authorize a request.

Method

○ AAA Info File
○ Allow Any Authenticated Client
○ Always Allow
○ Check for Membership in an LDAP Group
○ Contact ClearTrust Server
○ Contact Netegrity SiteMinder
● Contact NSS for SAF Authentication
○ Contact Tivoli Access Manager
○ Custom Template
○ Generate a SAML Attribute Query
○ Generate a SAML Authorization Query
○ Use SAML Attributes from Authentication
○ Use XACML Authorization Decision
*

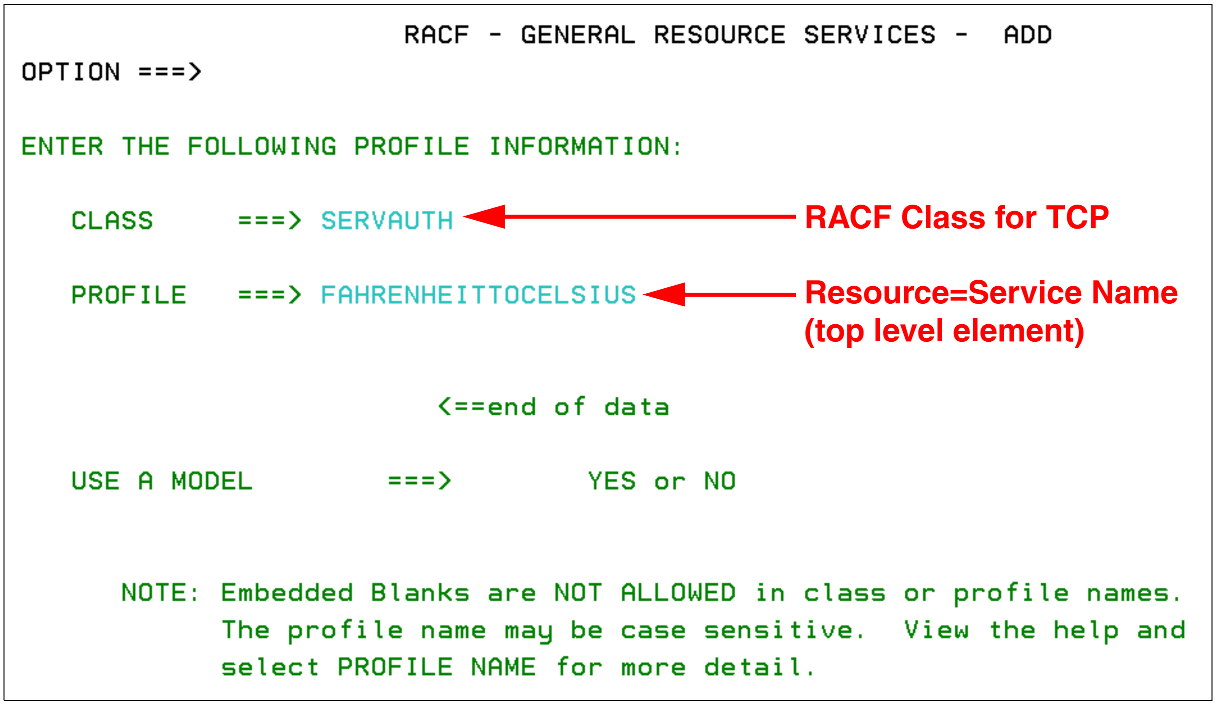
SAF Client Configuration ITSOCLNT + ... *

Default Action r (Read)

Figure 2-29 Specify how to authorize a request

2. RACF definition:

   a. Add the Resource Profile in the SERVAUTH CLASS. Enter `SERVAUTH` for the RACF Class for TCP in the CLASS field. Enter `FAHRENHEITTOCELSIUS` for the Resource (Service name) in the PROFILE field. See Figure 2-30.



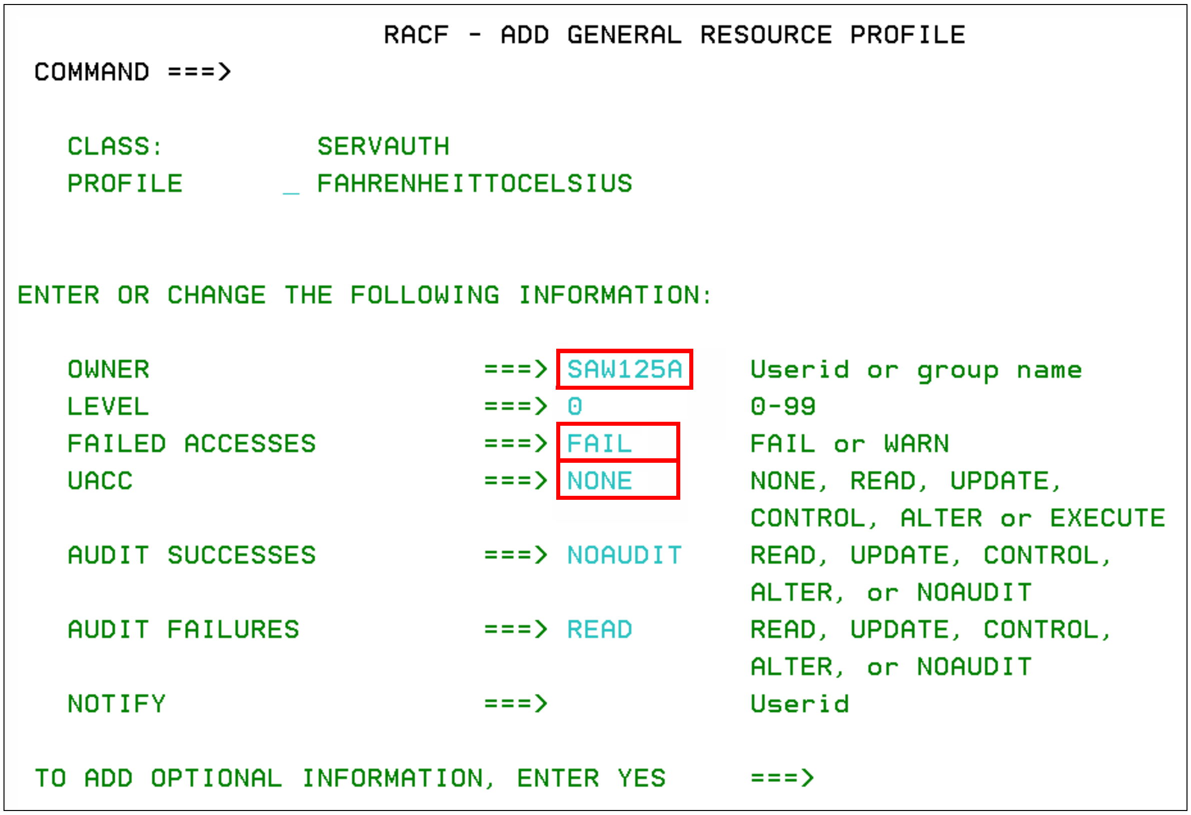
```
                         RACF - GENERAL RESOURCE SERVICES -  ADD
OPTION ===>

ENTER THE FOLLOWING PROFILE INFORMATION:

   CLASS     ===> SERVAUTH

   PROFILE   ===> FAHRENHEITTOCELSIUS


                           <==end of data

   USE A MODEL        ===>        YES or NO


      NOTE: Embedded Blanks are NOT ALLOWED in class or profile names.
            The profile name may be case sensitive.  View the help and
            select PROFILE NAME for more detail.
```

RACF Class for TCP

Resource=Service Name (top level element)

Figure 2-30   Add Resource Profile in SERVAUTH CLASS

b. Then, specify `SAW125A` for the Owner of this resource, type `FAIL` for the Failed Accesses behavior, and type `NONE` for the universal access authority (UACC), as shown in Figure 2-31.

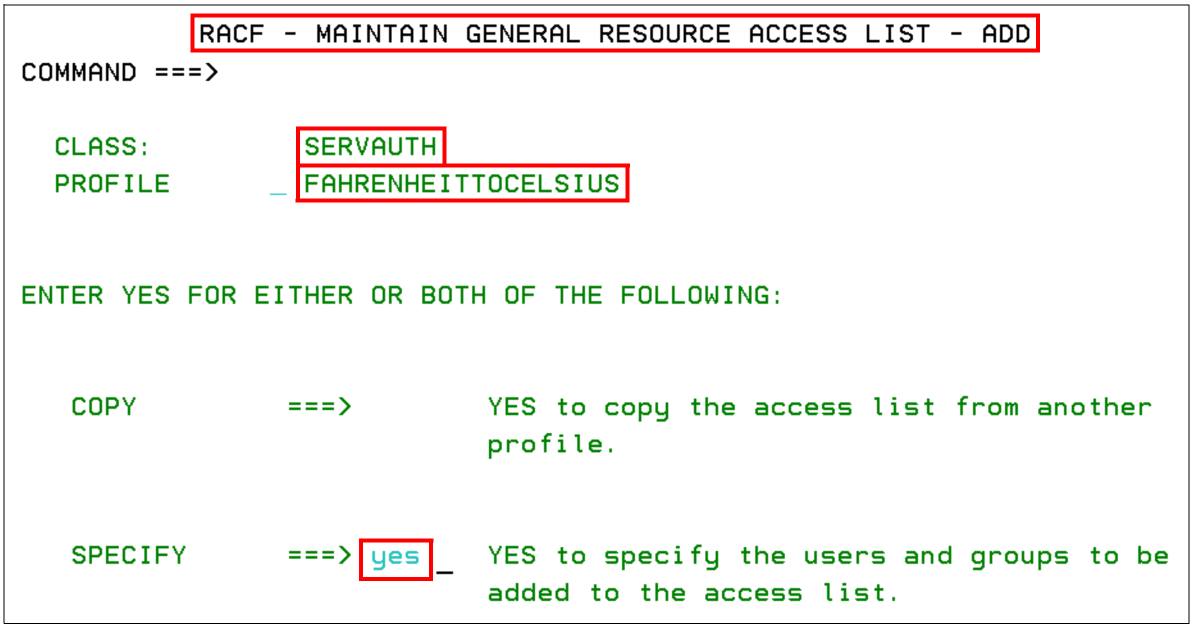


```
                      RACF - ADD GENERAL RESOURCE PROFILE
 COMMAND ===>

   CLASS:             SERVAUTH
   PROFILE          _ FAHRENHEITTOCELSIUS


ENTER OR CHANGE THE FOLLOWING INFORMATION:

   OWNER                       ===> SAW125A    Userid or group name
   LEVEL                       ===> 0          0-99
   FAILED ACCESSES             ===> FAIL       FAIL or WARN
   UACC                        ===> NONE       NONE, READ, UPDATE,
                                               CONTROL, ALTER or EXECUTE
   AUDIT SUCCESSES             ===> NOAUDIT    READ, UPDATE, CONTROL,
                                               ALTER, or NOAUDIT
   AUDIT FAILURES              ===> READ       READ, UPDATE, CONTROL,
                                               ALTER, or NOAUDIT
   NOTIFY                      ===>            Userid

 TO ADD OPTIONAL INFORMATION, ENTER YES        ===>
```

Figure 2-31 Specify the general information of the resource profile

c. Add the access list for the resource profile.

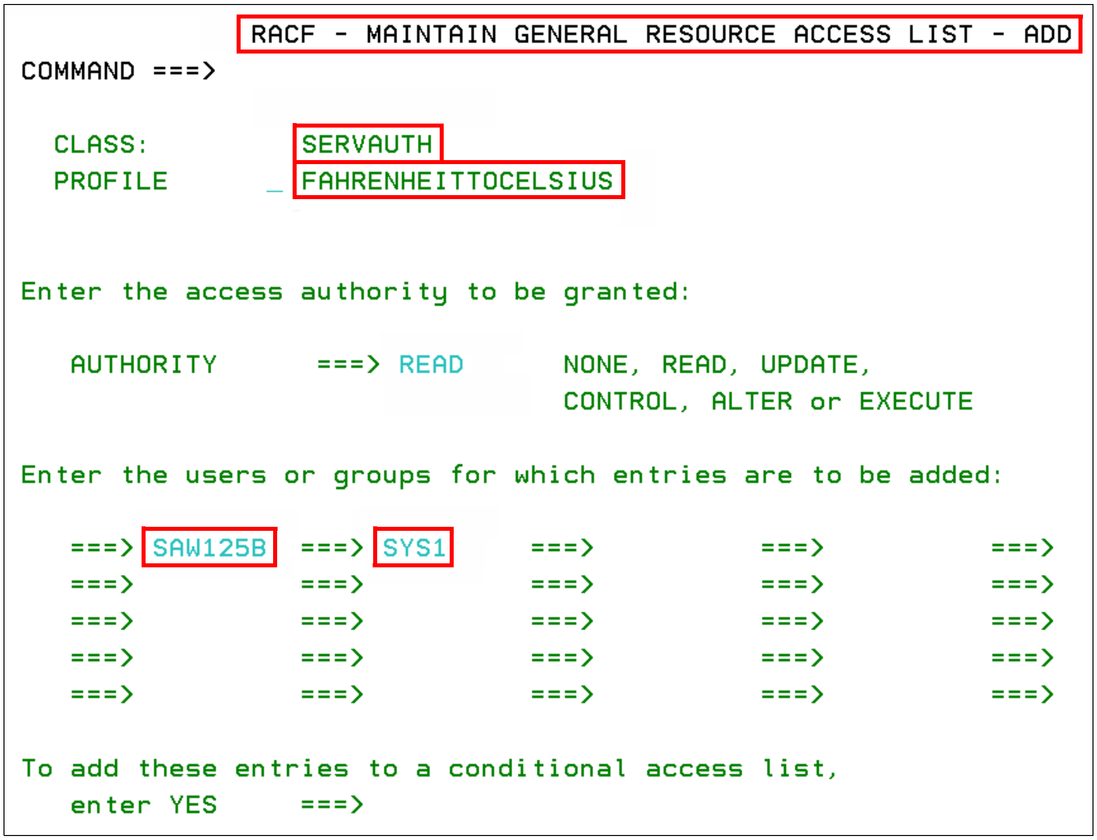
Add the access list for the just-defined resource profile. Type `SERVAUTH` for the CLASS and enter `FAHRENHEITTOCELSIUS` for the Profile name. Then, select COPY or SPECIFY. If you want to copy an existing access list from another profile, choose COPY. In our case, we entered `yes` in the SPECIFY field to manually create the access list, as shown in Figure 2-32.



```
                RACF - MAINTAIN GENERAL RESOURCE ACCESS LIST - ADD
COMMAND ===>

  CLASS:          SERVAUTH
  PROFILE       _ FAHRENHEITTOCELSIUS


ENTER YES FOR EITHER OR BOTH OF THE FOLLOWING:


   COPY          ===>        YES to copy the access list from another
                             profile.


   SPECIFY       ===> yes _  YES to specify the users and groups to be
                             added to the access list.
```

Figure 2-32 Add Access list

d. Then, for the access authority, type READ. For the users (or groups), type SAW125B and SYS1, as shown in Figure 2-33.

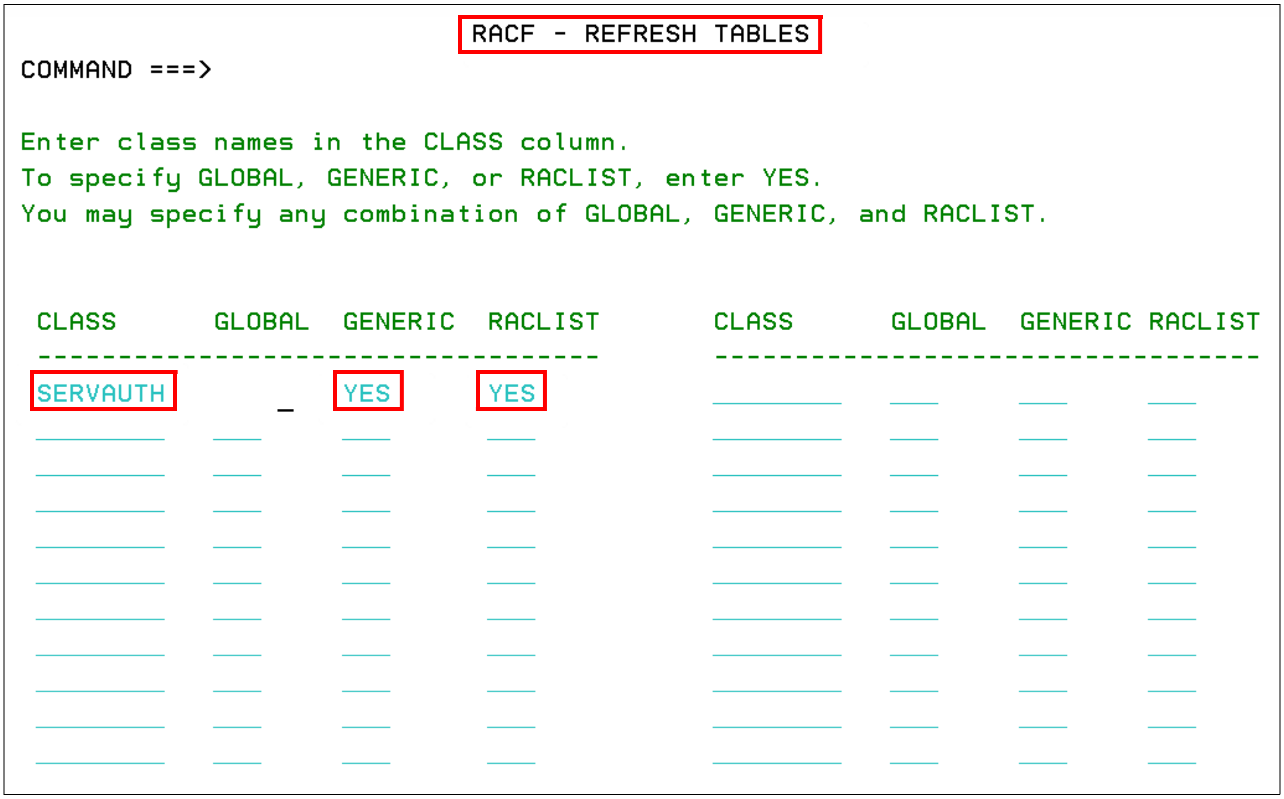


```
                   RACF - MAINTAIN GENERAL RESOURCE ACCESS LIST - ADD
COMMAND ===>

  CLASS:          SERVAUTH
  PROFILE       _ FAHRENHEITTOCELSIUS


Enter the access authority to be granted:

   AUTHORITY      ===> READ        NONE, READ, UPDATE,
                                   CONTROL, ALTER or EXECUTE

Enter the users or groups for which entries are to be added:

   ===> SAW125B  ===> SYS1     ===>          ===>          ===>
   ===>          ===>          ===>          ===>          ===>
   ===>          ===>          ===>          ===>          ===>
   ===>          ===>          ===>          ===>          ===>
   ===>          ===>          ===>          ===>          ===>

To add these entries to a conditional access list,
   enter YES      ===>
```

Figure 2-33 Specify the authority and users (groups)

e. Refresh the RACF table.

To activate the definition, refresh the RACF tables. Specify `SERVAUTH` in the CLASS field, `YES` in the GENERIC field, and `YES` in the RACLIST field, as shown in Figure 2-34. Or, you can issue the `TSO SETR RACLIST(SERVAUTH) GENERIC(SERVAUTH) REFRESH` command.



```
                                RACF - REFRESH TABLES
COMMAND ===>

Enter class names in the CLASS column.
To specify GLOBAL, GENERIC, or RACLIST, enter YES.
You may specify any combination of GLOBAL, GENERIC, and RACLIST.


 CLASS      GLOBAL  GENERIC  RACLIST      CLASS      GLOBAL  GENERIC RACLIST
 -----------------------------------      -----------------------------------
 SERVAUTH        _  YES      YES
```

Figure 2-34 Refresh the RACF table

3. Confirm the successful authorization in the NSSD log.

   You can explore the various logs and read the entries to confirm that the authentication and authorization succeed. Example 2-19 shows the output of the `/var/syslog/NSSD.log`.

Example 2-19 Successful authentication and authorization log

```
Sep 19 20:51:51 WTSC80/NSSD     NSSD     NSSD: DBG0031I NSS_VERBOSE UseridCheck(
SAW125B,******) passed (1)
Sep 19 20:51:51 WTSC80/NSSD     NSSD     NSSD: DBG0016I NSS_SAF_ACCESS_INFO
Clientname (ITSOCLNT                 ) requested authentication for SAF ID (saw125b
) - user authenticated: (yes) (1)
Sep 19 20:51:51 WTSC80/NSSD     NSSD     NSSD: DBG0032I NSS_VERBOSE ProfileCheck
(SAW125B ,FAHRENHEITTOCELSIUS) rc 0 (AUTH (LEVEL CHECK)) racfRC 0 racfRsn 0 (2)
Sep 19 20:51:51 WTSC80/NSSD     NSSD     NSSD: DBG0017I NSS_SAF_ACCESS_INFO Clie
ntname (ITSOCLNT                 ) requested access level (0x02) authorization for
SAF ID (saw125b ) to SAF CLASS (SERVAUTH) resource (FahrenheitToCelsius) - user
authorized: (yes) (2)
```

In Example 2-19, the bold numbers correspond to the following information:

- The user ID that is presented by the NSS client passed authentication **(1)**
- The user ID is authorized to access the SERVAUTH profile that we created earlier **(2)**

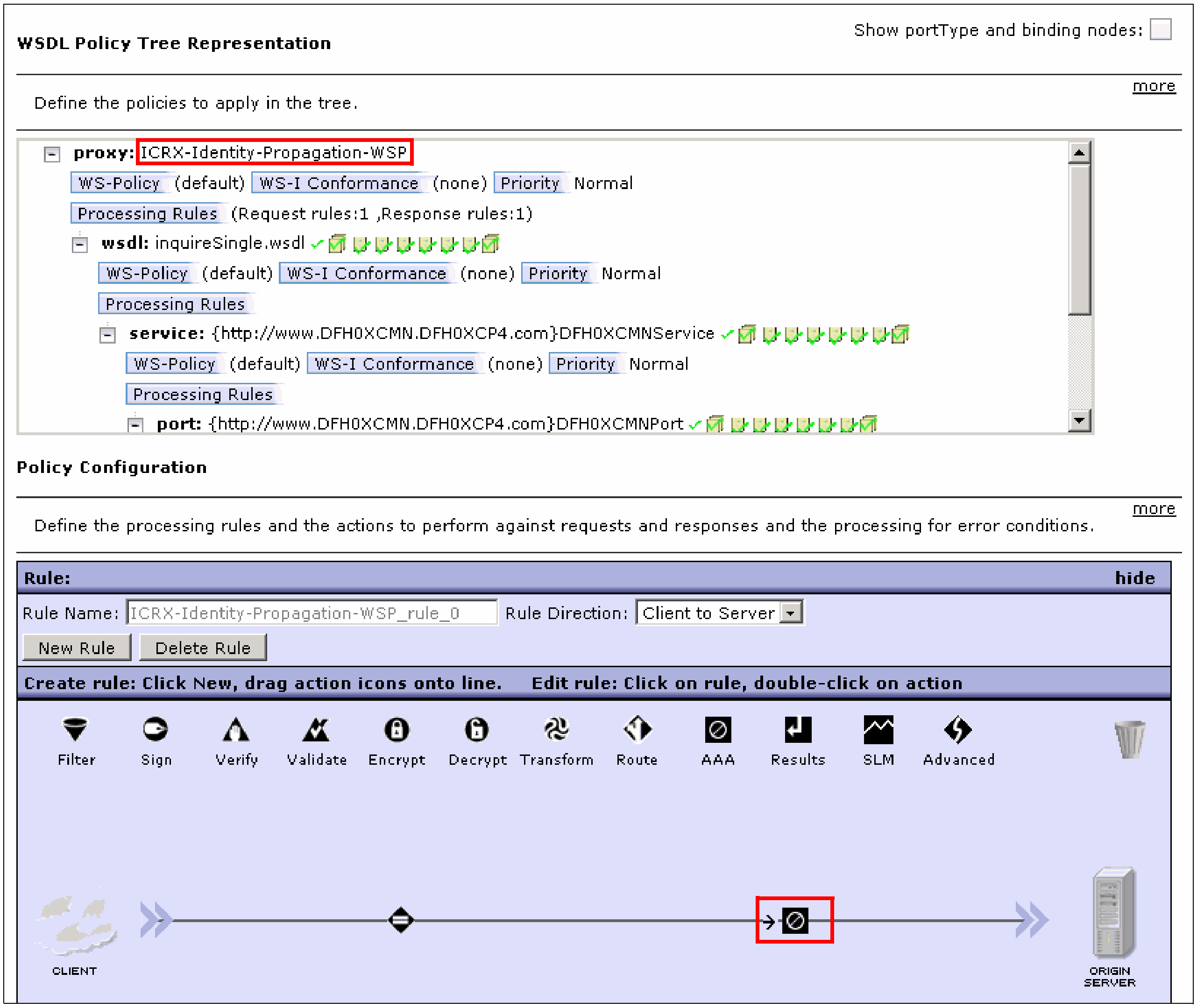
2.6 Identity propagation using ICRX tokens for CICS WS

Identity propagation is a new function that is provided by z/OS V1R11 and CICS Transaction Server V4.1. It provides an end-to-end security solution, together with WebSphere DataPower, for enabling identity assertion, control, and auditing. The WebSphere DataPower XI50z can act as an intermediary and provides an effective service virtualization pattern for CICS Web Services. Remote requestor applications can connect to the WebSphere DataPower appliance using SOAP encoding over a variety of protocols. WebSphere DataPower authenticates the credentials that are supplied by the remote client and creates credentials for a z/OS ICRX identity token on the outbound side. The SOAP message is then forwarded to CICS with an ICRX identity token in a WS-Security header. The transport between DataPower and the CICS WS back end can be encrypted, but with the XI50z, the IEDN provides the isolation (and thus the integrity and privacy) required so that SSL is not required.

> **Important:** Identity propagation support needs the following products:
>
> - z/OS, Version 1 Release 11 with z/OS support APAR OA26294
> - CICS TS for z/OS, Version 4.1 with the following APARs:
>
>   PK95579, PM01622, PK83741, PK98426

The ICRX token is created by using the AAA framework, as shown in Figure 2-35 on page 84. For our scenario, we have a business partner communicating with the zEnterprise consuming CICS Web Services. There are several users at the business partner that want to use these services, but the company wants to differentiate between those users in an audit trail. For security purposes, all the users have the same type of security, so only a single credential needs to represent them in the company RACF repository.

Each SOAP consumer (business partner user) digitally signs the message with its private key before sending the message over to the company's zEnterprise system. The XI50z blade in the zEnterprise, acting as the ESB, uses the Subject DN from the digital signature as the identity to propagate. The authentication scheme is "Validate the Signer Certificate for a Digitally Signed Message" and no authorization is performed. The ICRX token is generated with the authenticated credential (Subject DN) and the Realm (ldapserv). Starting with Figure 2-35 on page 84, we show you the windows for the scenario.



WSDL Policy Tree Representation

Show portType and binding nodes: □

Define the policies to apply in the tree.

proxy: ICRX-Identity-Propagation-WSP
WS-Policy (default) WS-I Conformance (none) Priority Normal
Processing Rules (Request rules:1 ,Response rules:1)
wsdl: inquireSingle.wsdl
WS-Policy (default) WS-I Conformance (none) Priority Normal
Processing Rules
service: {http://www.DFH0XCMN.DFH0XCP4.com}DFH0XCMNService
WS-Policy (default) WS-I Conformance (none) Priority Normal
Processing Rules
port: {http://www.DFH0XCMN.DFH0XCP4.com}DFH0XCMNPort

Policy Configuration

Define the processing rules and the actions to perform against requests and responses and the processing for error conditions.

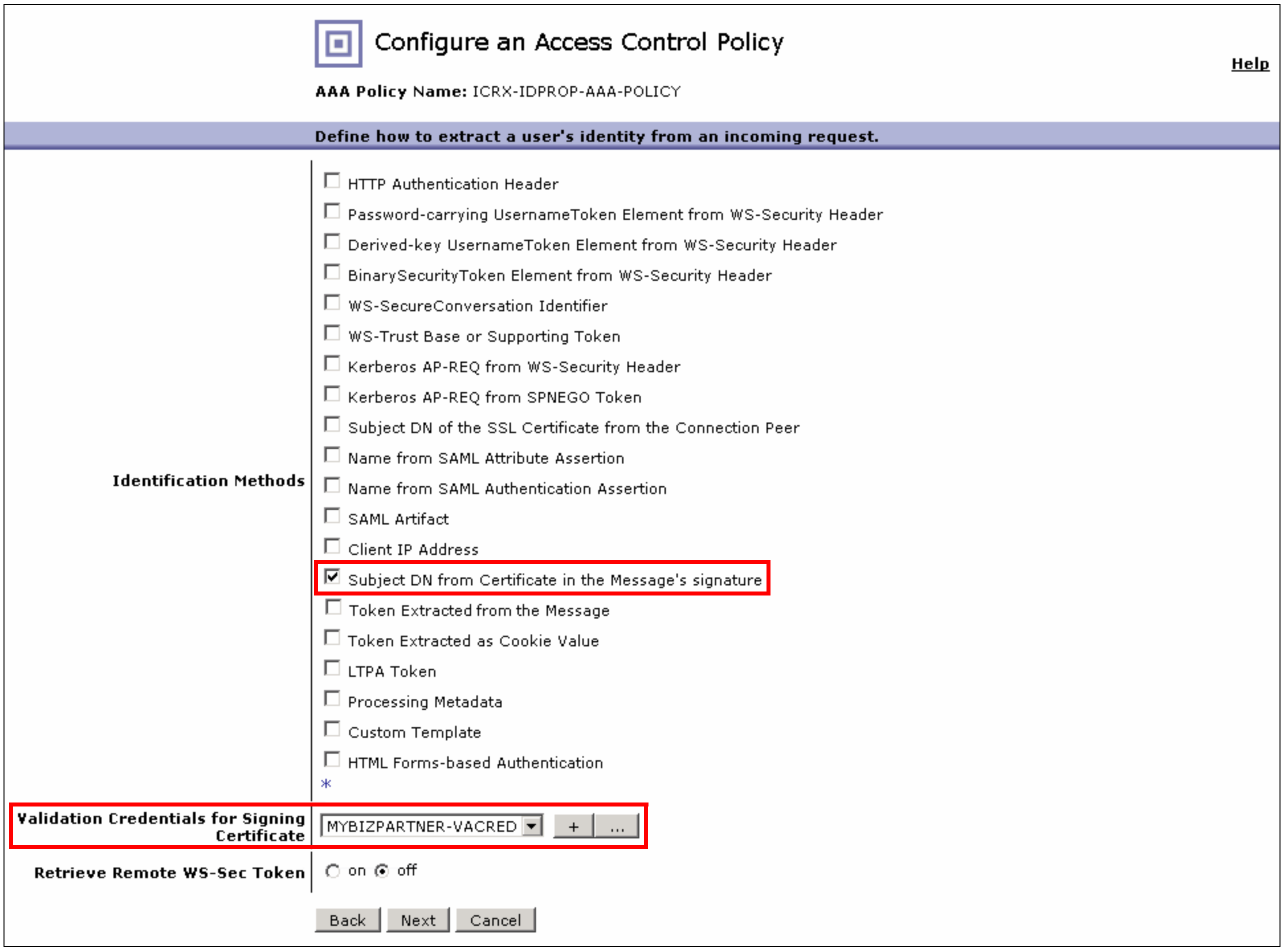
Rule:

Rule Name: ICRX-Identity-Propagation-WSP_rule_0 Rule Direction: Client to Server

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

Figure 2-35 Web Service Proxy (WSP) with AAA action

Figure 2-36 shows the identity extraction phase (see 2.2, “The XI50z AAA framework” on page 46 for more information about the phases of the AAA framework).



Configure an Access Control Policy

AAA Policy Name: ICRX-IDPROP-AAA-POLICY

Define how to extract a user's identity from an incoming request.

Identification Methods

- □ HTTP Authentication Header
- □ Password-carrying UsernameToken Element from WS-Security Header
- □ Derived-key UsernameToken Element from WS-Security Header
- □ BinarySecurityToken Element from WS-Security Header
- □ WS-SecureConversation Identifier
- □ WS-Trust Base or Supporting Token
- □ Kerberos AP-REQ from WS-Security Header
- □ Kerberos AP-REQ from SPNEGO Token
- □ Subject DN of the SSL Certificate from the Connection Peer
- □ Name from SAML Attribute Assertion
- □ Name from SAML Authentication Assertion
- □ SAML Artifact
- □ Client IP Address
- ☑ Subject DN from Certificate in the Message's signature
- □ Token Extracted from the Message
- □ Token Extracted as Cookie Value
- □ LTPA Token
- □ Processing Metadata
- □ Custom Template
- □ HTML Forms-based Authentication

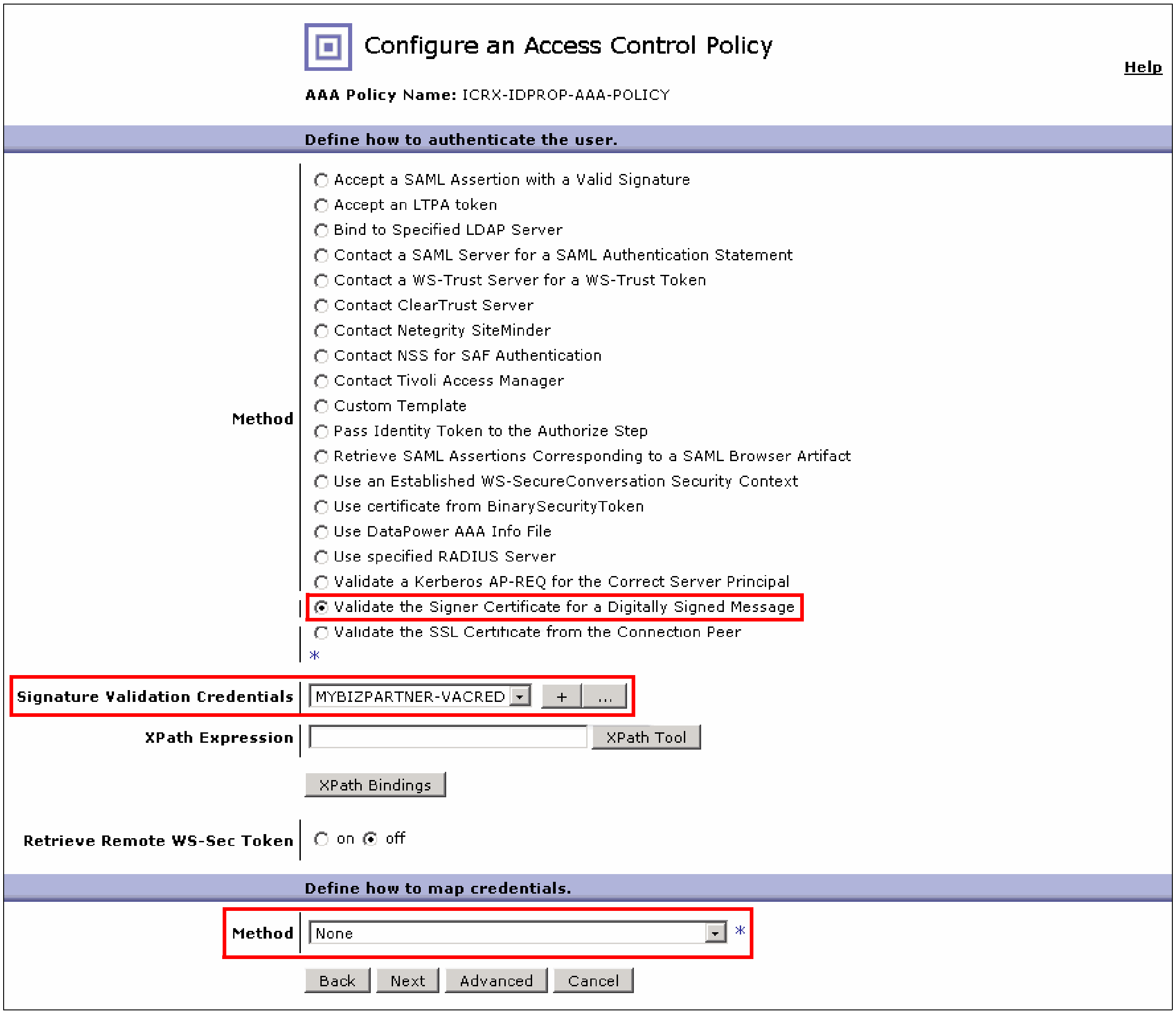
*

Validation Credentials for Signing Certificate MYBIZPARTNER-VACRED

Retrieve Remote WS-Sec Token ○ on ● off

Figure 2-36 Authentication: Extract identity phase showing the Subject DN being extracted

Figure 2-37 shows the authentication phase (AU) of the AAA framework. The authentication scheme is “Validate the Signer Certificate for a Digitally Signed Message”. The validation credential using the public key certificate of the business partner is used to verify the signature. No mapping of credentials is necessary.



Configure an Access Control Policy

Help

AAA Policy Name: ICRX-IDPROP-AAA-POLICY

Define how to authenticate the user.

Method

- ○ Accept a SAML Assertion with a Valid Signature
- ○ Accept an LTPA token
- ○ Bind to Specified LDAP Server
- ○ Contact a SAML Server for a SAML Authentication Statement
- ○ Contact a WS-Trust Server for a WS-Trust Token
- ○ Contact ClearTrust Server
- ○ Contact Netegrity SiteMinder
- ○ Contact NSS for SAF Authentication
- ○ Contact Tivoli Access Manager
- ○ Custom Template
- ○ Pass Identity Token to the Authorize Step
- ○ Retrieve SAML Assertions Corresponding to a SAML Browser Artifact
- ○ Use an Established WS-SecureConversation Security Context
- ○ Use certificate from BinarySecurityToken
- ○ Use DataPower AAA Info File
- ○ Use specified RADIUS Server
- ○ Validate a Kerberos AP-REQ for the Correct Server Principal
- ● Validate the Signer Certificate for a Digitally Signed Message
- ○ Validate the SSL Certificate from the Connection Peer

*

Signature Validation Credentials MYBIZPARTNER-VACRED + ...

XPath Expression XPath Tool

XPath Bindings

Retrieve Remote WS-Sec Token ○ on ● off

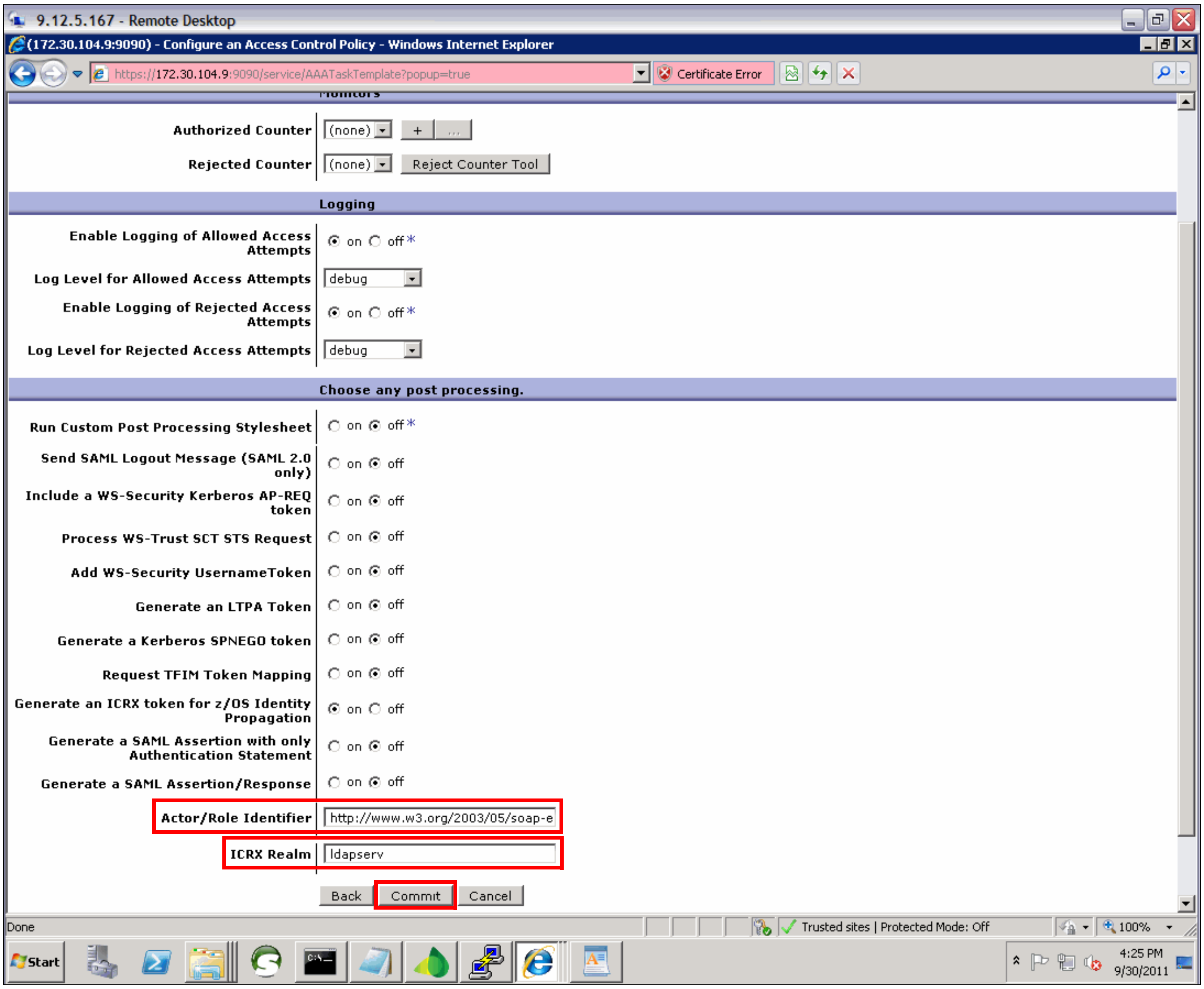
Define how to map credentials.

Method None *

Back Next Advanced Cancel

Figure 2-37 Authentication phase: Validate the Signer Certificate for a Digitally Signed Message

Figure 2-38 shows the post-processing phase of the AAA action.


9.12.5.167 - Remote Desktop
(172.30.104.9:9090) - Configure an Access Control Policy - Windows Internet Explorer
https://172.30.104.9:9090/service/AAATaskTemplate?popup=true
Certificate Error
Monitors

Authorized Counter (none) + ...

Rejected Counter (none) Reject Counter Tool

Logging

Enable Logging of Allowed Access Attempts ● on ○ off *

Log Level for Allowed Access Attempts debug

Enable Logging of Rejected Access Attempts ● on ○ off *

Log Level for Rejected Access Attempts debug

Choose any post processing.

Run Custom Post Processing Stylesheet ○ on ● off *

Send SAML Logout Message (SAML 2.0 only) ○ on ● off

Include a WS-Security Kerberos AP-REQ token ○ on ● off

Process WS-Trust SCT STS Request ○ on ● off

Add WS-Security UsernameToken ○ on ● off

Generate an LTPA Token ○ on ● off

Generate a Kerberos SPNEGO token ○ on ● off

Request TFIM Token Mapping ○ on ● off

Generate an ICRX token for z/OS Identity Propagation ● on ○ off

Generate a SAML Assertion with only Authentication Statement ○ on ● off

Generate a SAML Assertion/Response ○ on ● off

Actor/Role Identifier http://www.w3.org/2003/05/soap-e

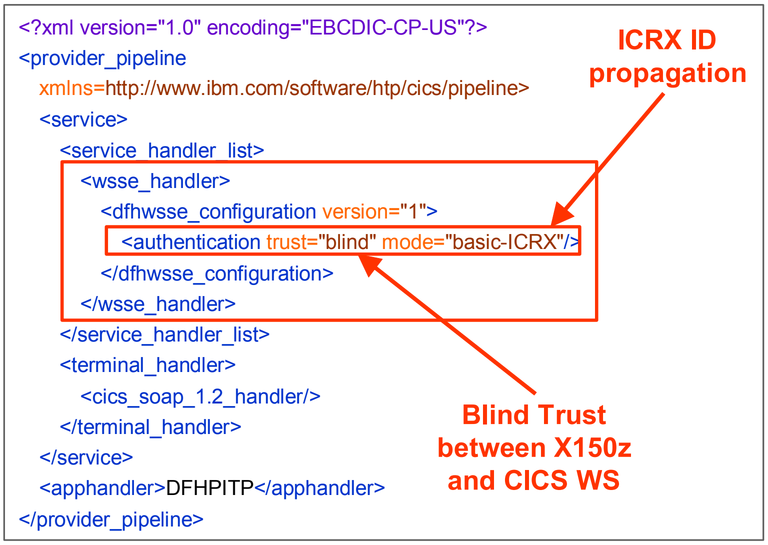
ICRX Realm ldapserv

Back Commit Cancel

Figure 2-38 Post-processing phase where the ICRX token is generated

The Actor/Role Identifier is `http://www.w3.org/2003/05/soap-envelope/role/next`, which means that *everyone, including the intermediary and ultimate receiver, receives the message and can process the Security header*. The LDAP realm is ldapserv and the identity of the user is C=US, ST=MD ,O=MYBIZPARTNER. Both the identity and the realm are used to map to a distributed identity using a map that is defined by the RACMAP command.

CICS receives the SOAP message from WebSphere DataPower. The PIPELINE configuration file in Figure 2-39 specifies blind trust. The only possible client is the WebSphere DataPower appliance, and WebSphere DataPower communicates with CICS over a secure IEDN connection. Therefore, you do not need to specify additional authentication in the PIPELINE configuration file. The WS-Security handler program locates the first ICRX in the WS-Security header and uses the ICRX to identify the user.



```
<?xml version="1.0" encoding="EBCDIC-CP-US"?>
<provider_pipeline
  xmlns=http://www.ibm.com/software/htp/cics/pipeline>
  <service>
    <service_handler_list>
      <wsse_handler>
        <dfhwsse_configuration version="1">
          <authentication trust="blind" mode="basic-ICRX"/>
        </dfhwsse_configuration>
      </wsse_handler>
    </service_handler_list>
    <terminal_handler>
      <cics_soap_1.2_handler/>
    </terminal_handler>
  </service>
  <apphandler>DFHPITP</apphandler>
</provider_pipeline>
```

ICRX ID propagation

Blind Trust between X150z and CICS WS

Figure 2-39 Blind trust between the XI50z and CICS Web Services

The following elements appear in the RACMAP command:

- *<distributedUserId>* is the distributed identity.
- *<distributedRealmName>* is the realm name of the distributed identity.
- *<someLabel>* is a name of the label of the RACMAP by which it is known to RACF.

Use the following command to activate the IDIDMAP class. This command only needs to be run one time at the beginning:

```
SETROPTS CLASSACT(IDIDMAP) RACLIST(IDIDMAP)
```

Use the following command after any changes are made to the RACMAP profiles for the changes to take effect:

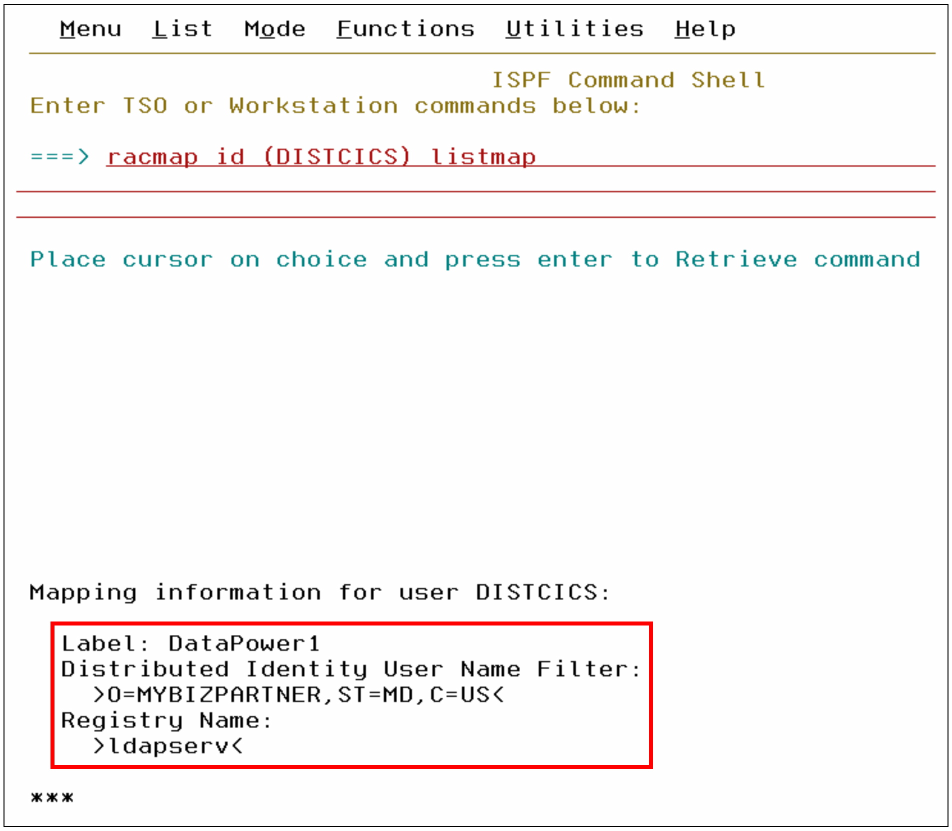
```
SETROPTS RACLIST(IDIDMAP) REFRESH
```

For our scenario, we used the following RACMAP command, as shown in Example 2-20.

Example 2-20 RACMAP command

```
RACMAP ID(DISTCICS) MAP USERDIDFILTER(NAME('C=US, ST=MD ,O=MYBIZPARTNER'))
REGISTRY(NAME('ldapserv')) WITHLABEL('DataPower1')
```

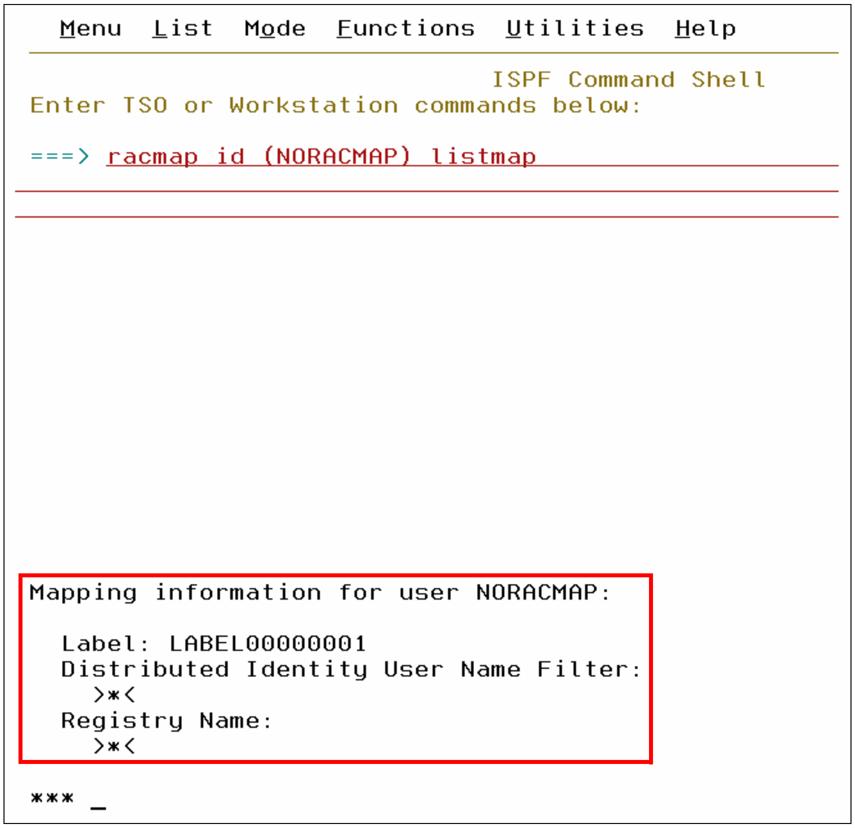
Figure 2-40 shows the distributed identity DISTCICS and its mapping to the MYBIZPARTNER (C=US,ST=MD,O=MYBIZPARTNER).



```
                              ISPF Command Shell
Enter TSO or Workstation commands below:

===> racmap id (DISTCICS) listmap

Place cursor on choice and press enter to Retrieve command

Mapping information for user DISTCICS:

  Label: DataPower1
  Distributed Identity User Name Filter:
    >O=MYBIZPARTNER,ST=MD,C=US<
  Registry Name:
    >ldapserv<

***
```

Figure 2-40 RACMAP for DISTCICS ID

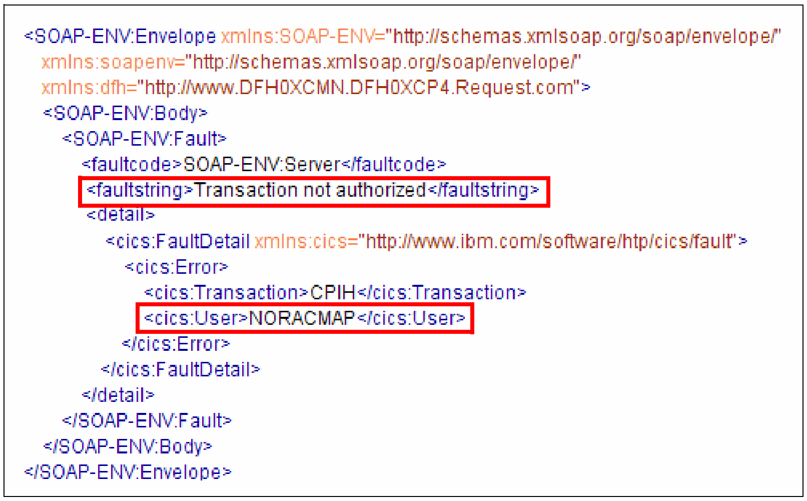
Figure 2-41 shows the dummy distributed identity NORACMAP, which is defined with generics and represents the default if no RACMAP for a specific identity can be found. The user ID that is associated is restricted and has no authority, which ensures that the default access is not to allow access when there is no match to the RACMAP definition.



```
   Menu  List  Mode  Functions  Utilities  Help
 
                              ISPF Command Shell
 Enter TSO or Workstation commands below:

 ===> racmap id (NORACMAP) listmap





 Mapping information for user NORACMAP:

   Label: LABEL00000001
   Distributed Identity User Name Filter:
     >*<
   Registry Name:
     >*<

 *** _
```

Figure 2-41 RACMAP for NORACMAP identity

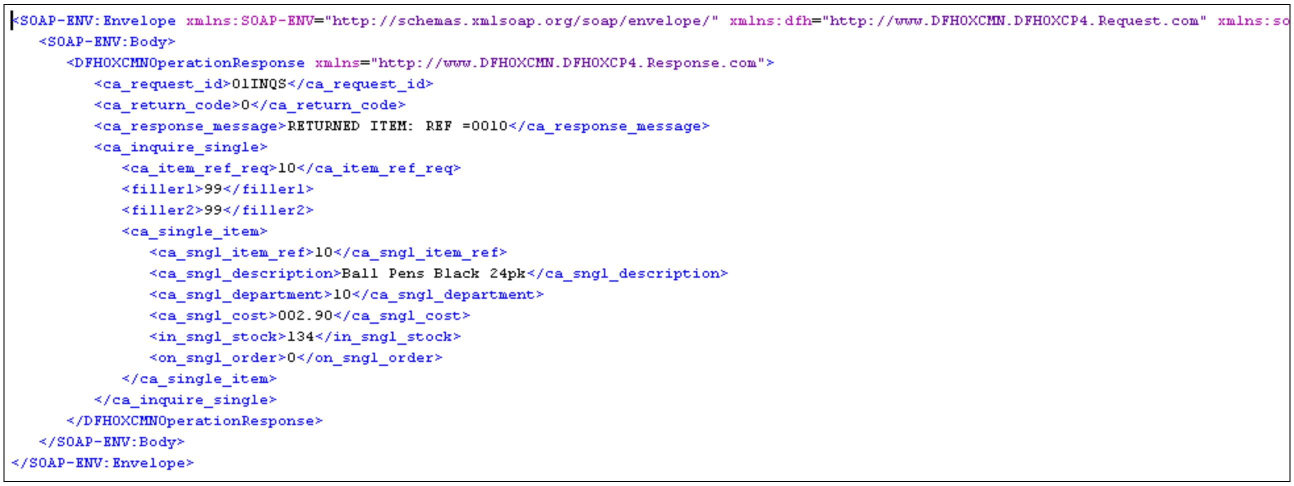
We performed the following test: an unauthorized user (not using the correct certificate) is mapped to RACNOMAP and rejected. Figure 2-42 shows the message that was received.



```
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
  xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
  xmlns:dfh="http://www.DFH0XCMN.DFH0XCP4.Request.com">
  <SOAP-ENV:Body>
    <SOAP-ENV:Fault>
      <faultcode>SOAP-ENV:Server</faultcode>
      <faultstring>Transaction not authorized</faultstring>
      <detail>
        <cics:FaultDetail xmlns:cics="http://www.ibm.com/software/htp/cics/fault">
          <cics:Error>
            <cics:Transaction>CPIH</cics:Transaction>
            <cics:User>NORACMAP</cics:User>
          </cics:Error>
        </cics:FaultDetail>
      </detail>
    </SOAP-ENV:Fault>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

Figure 2-42 Message result

Figure 2-43 on page 91 shows the successful transaction.



```
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/" xmlns:dfh="http://www.DFHOXCMN.DFHOXCP4.Request.com" xmlns:so
   <SOAP-ENV:Body>
      <DFHOXCMNOperationResponse xmlns="http://www.DFHOXCMN.DFHOXCP4.Response.com">
         <ca_request_id>01INQS</ca_request_id>
         <ca_return_code>0</ca_return_code>
         <ca_response_message>RETURNED ITEM: REF =0010</ca_response_message>
         <ca_inquire_single>
            <ca_item_ref_req>10</ca_item_ref_req>
            <filler1>99</filler1>
            <filler2>99</filler2>
            <ca_single_item>
               <ca_sngl_item_ref>10</ca_sngl_item_ref>
               <ca_sngl_description>Ball Pens Black 24pk</ca_sngl_description>
               <ca_sngl_department>10</ca_sngl_department>
               <ca_sngl_cost>002.90</ca_sngl_cost>
               <in_sngl_stock>134</in_sngl_stock>
               <on_sngl_order>0</on_sngl_order>
            </ca_single_item>
         </ca_inquire_single>
      </DFHOXCMNOperationResponse>
   </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

Figure 2-43 Successful response from CICS Web Service

2.7 Securing keys and certificates on zEnterprise

The DataPower XI50z blade can securely store keys and certificates in an encrypted folder. For central management keys and certificates, they can also be stored in RACF and retrieved during certificate and key object start-up.

These keys can be used like any other certificates and keys that are stored on the XI50z and used for cryptographic operations for use in SSL, digital signatures, verifications, encryption, and decryption. These keys are retrieved during boot time and cached. A valid NSS client connection must be up when the keys are being retrieved.

Keys, such as *saf-remote-keys,* are considered the highest level of security. You need to store these keys in the ICSF public key dataset (PKDS) or ICSFPKDS. You can only use these keys for creating digital signatures and encryption/decryption operations. These ICSF keys are not retrieved or cached, unlike the RACF keys and certificates.

Centralized key management with RACF key storage

You can use the *saf-key* and *saf-cert* in several security scenarios, such as digital signatures, signature verifications, encryption/decryption, and for SSL. Typical scenarios for the XI50z acting as an ESB or an SOA gateway to the z196 applications include certificates for SSL termination, the digital signature verification of a business partner message, the public key infrastructure (PKI) encryption of an outbound message to a partner using a business partner certificate stored in RACF, digitally signing a message for an external entity, and several others. For our scenario, we demonstrate the usage of a saf-cert in an SSL server (using Identity Credentials), and digital signature (using saf-key) and signature verification (using saf-cert) in the same gateway for convenience. But, the message typically comes signed from the consumer using the consumer's private key and is verified using the consumer's public key/certificate. The consumer's public key.certificate typically has been securely transferred and stored in RACF and defined as a saf-cert in the DataPower XI50z. We use a SOAP client sending a message over HTTPS to the XI50z. The XI50z performs a digital signature using saf-key and the digital signature verification using saf-key.

Figure 2-44 shows the concept.

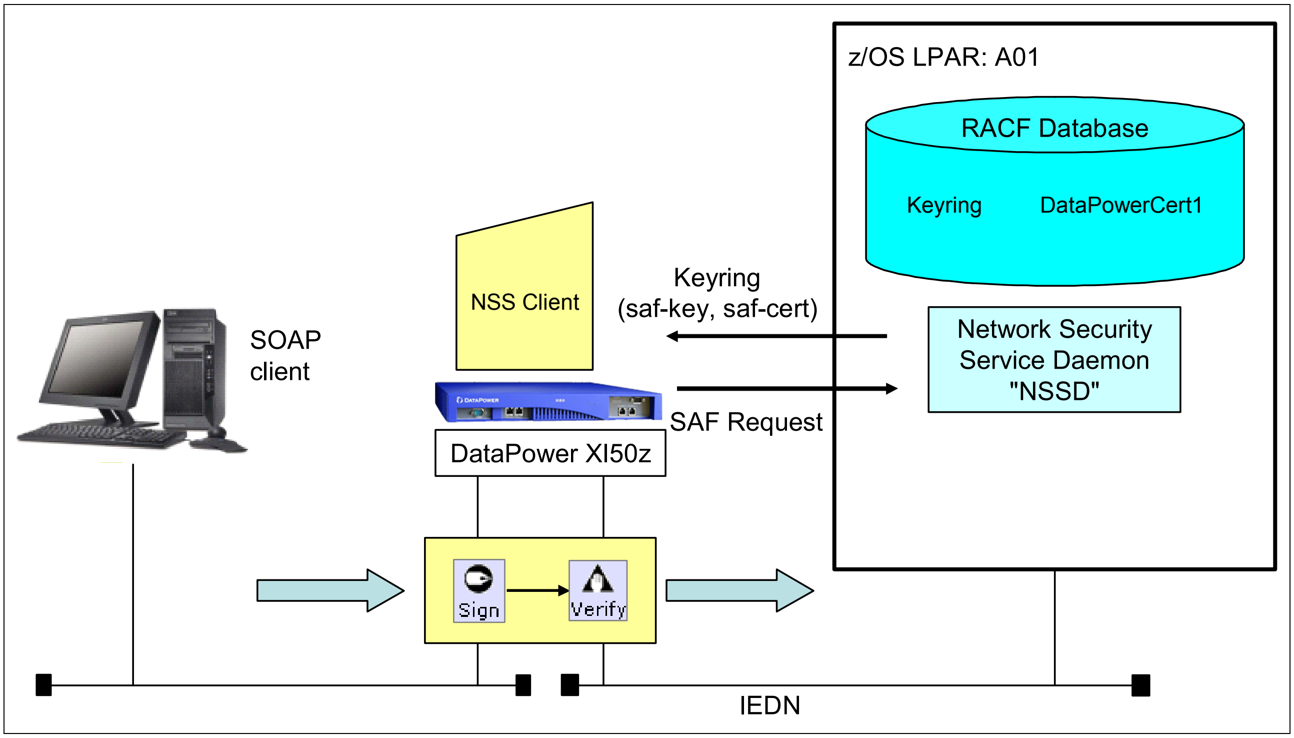


Figure 2-44 RACF key storage

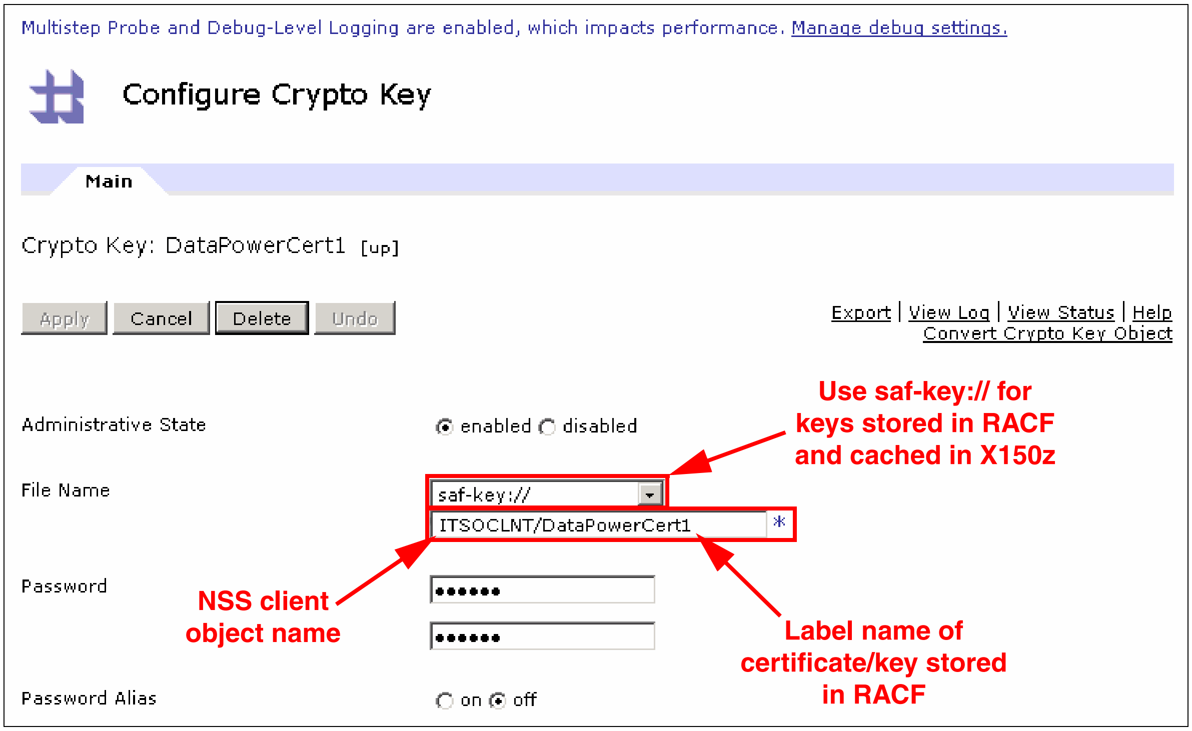
saf-key and saf-cert definition

In this section, we discuss saf-key and saf-cert in a DataPower definition. We also mention the keyring definition in RACF.

Figure 2-45 shows the saf-key definition in DataPower. Specify the location and the file name in the File Name field. In this case, we use saf-key, so we select **saf-key://** for the File Name. Then, we specify the file name using the following format:

`nssclient/ZOSKEYLABEL`

In this format, `nssclient` specifies an existing NSS client object, and `ZOSKEYLABEL` specifies the label name of an existing SAF key residing on the z/OS system.



Multistep Probe and Debug-Level Logging are enabled, which impacts performance. Manage debug settings.

Configure Crypto Key

Main

Crypto Key: DataPowerCert1 [up]

Apply | Cancel | Delete | Undo

Export | View Log | View Status | Help
Convert Crypto Key Object

Administrative State ● enabled ○ disabled

File Name saf-key://
ITSOCLNT/DataPowerCert1 *

Password ••••••
••••••

Password Alias ○ on ● off

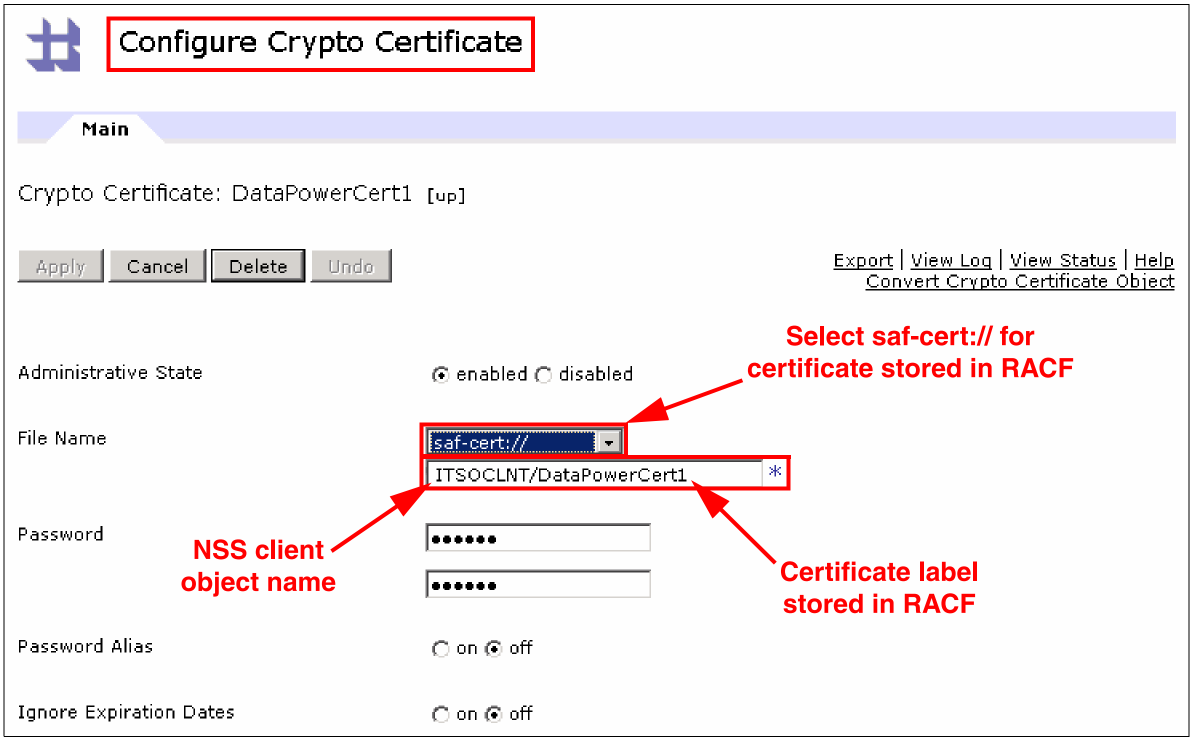
Use saf-key:// for keys stored in RACF and cached in X150z

NSS client object name

Label name of certificate/key stored in RACF

Figure 2-45 saf-key definition in DataPower

Figure 2-46 on page 94 shows the saf-cert definition in DataPower.


Main
Apply
Cancel
Delete
Undo
Export | View Log | View Status | Help
Convert Crypto Certificate Object

Configure Crypto Certificate

Crypto Certificate: DataPowerCert1 [up]

Administrative State ● enabled ○ disabled

File Name saf-cert:// ITSOCLNT/DataPowerCert1 *

Password •••••• ••••••

Password Alias ○ on ● off

Ignore Expiration Dates ○ on ● off

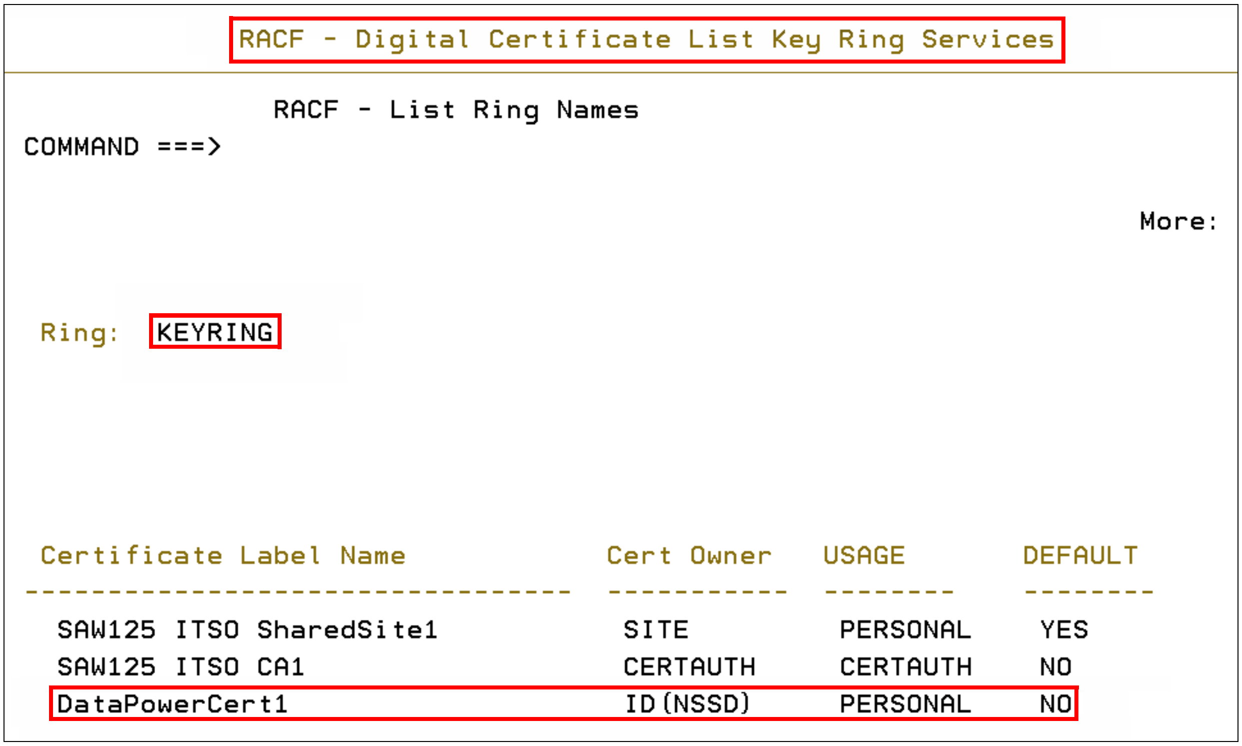
Select saf-cert:// for certificate stored in RACF

NSS client object name

Certificate label stored in RACF

Figure 2-46 saf-cert definition in DataPower

Figure 2-47 shows the keyring definition in RACF. In this case, we use “DataPowerCert1” for the Certificate Label Name.



```
          RACF - Digital Certificate List Key Ring Services

                 RACF - List Ring Names
COMMAND ===>

                                                                More:

 Ring:  KEYRING

 Certificate Label Name            Cert Owner   USAGE      DEFAULT
---------------------------------  -----------  --------   --------
  SAW125 ITSO SharedSite1           SITE         PERSONAL   YES
  SAW125 ITSO CA1                   CERTAUTH     CERTAUTH   NO
  DataPowerCert1                    ID(NSSD)     PERSONAL   NO
```

Figure 2-47 Keyring definition in RACF

Settings for digital signature/digital signature verification

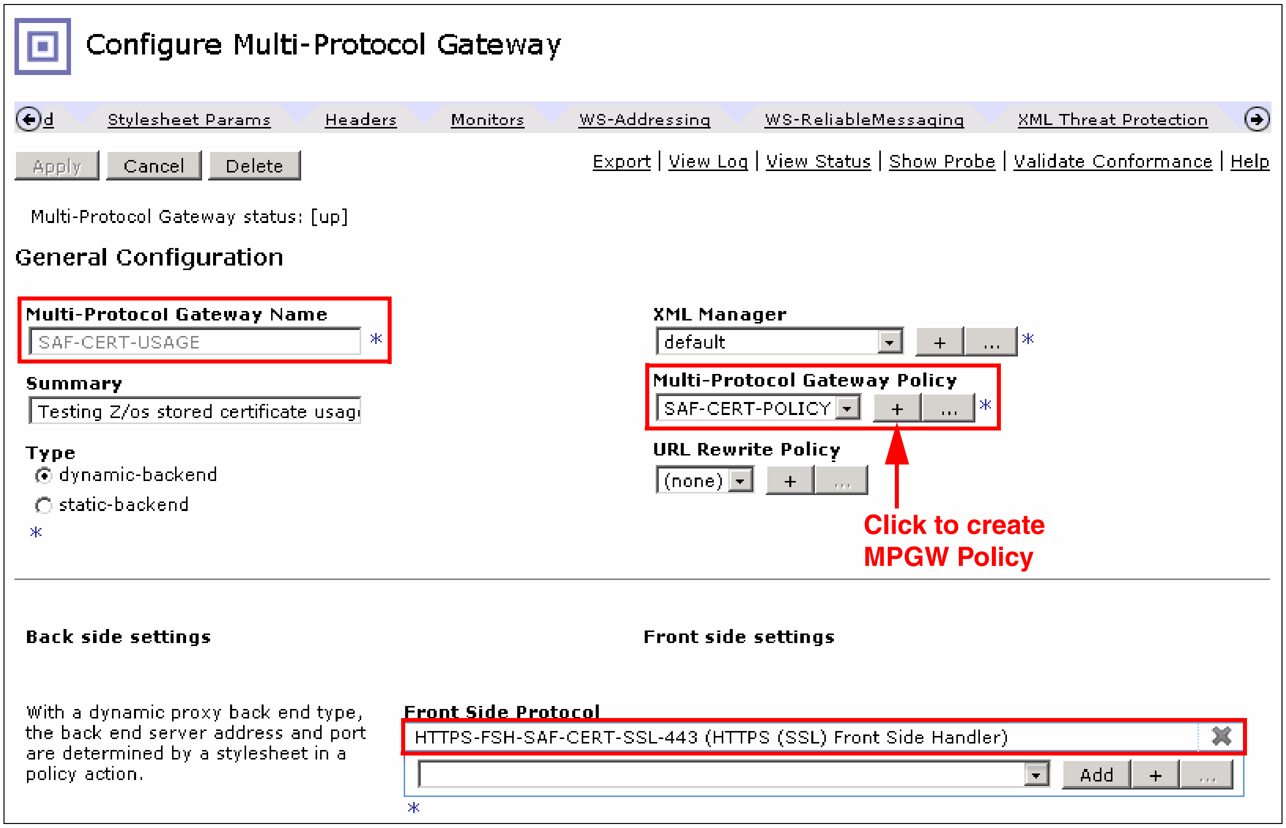
The following steps describe the usage of saf-key and saf-cert for digital signature verification.

Using saf-key and saf-cert

We perform the digital signature (using saf-key) and digital signature verification (using saf-cert) in the same gateway in our scenario for convenience. In this section, we explain the settings in the XI50z. Follow these steps:

1. Create the new Multi-Protocol Gateway.

   Figure 2-48 shows the configuration of the Multi-Protocol Gateway. To create a new Multi-Protocol Gateway, specify the new Multi-Protocol Gateway Name. Then, click the plus symbol (+) to the right of the Multi-Protocol Gateway Policy field. Also, select an existing Front Side Handler from the drop-down list box and click **Add** in the Front Side Protocol field.



Configure Multi-Protocol Gateway

Multi-Protocol Gateway status: [up]

General Configuration

Multi-Protocol Gateway Name: SAF-CERT-USAGE *

Summary: Testing Z/os stored certificate usag

Type: ● dynamic-backend ○ static-backend *

XML Manager: default *

Multi-Protocol Gateway Policy: SAF-CERT-POLICY *

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.

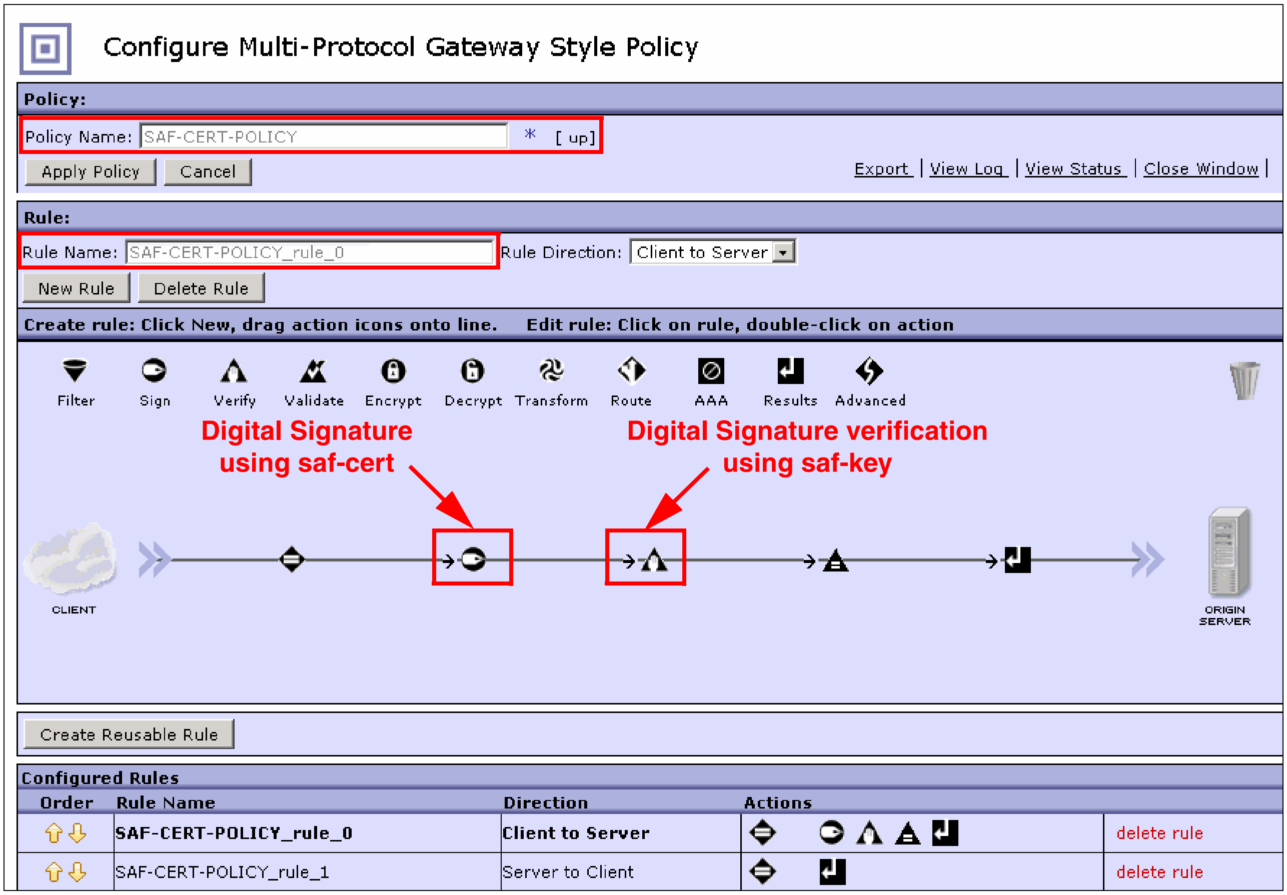
Front side settings

Front Side Protocol: HTTPS-FSH-SAF-CERT-SSL-443 (HTTPS (SSL) Front Side Handler) *

Figure 2-48 Configure Multi-Protocol Gateway

2. Add the Digital Signature and Digital Signature verification.

   Add the digital signature using saf-cert and the digital signature verification using saf-key. See Figure 2-49.



Policy Name: SAF-CERT-POLICY * [up]

Rule Name: SAF-CERT-POLICY_rule_0 Rule Direction: Client to Server

Digital Signature using saf-cert

Digital Signature verification using saf-key

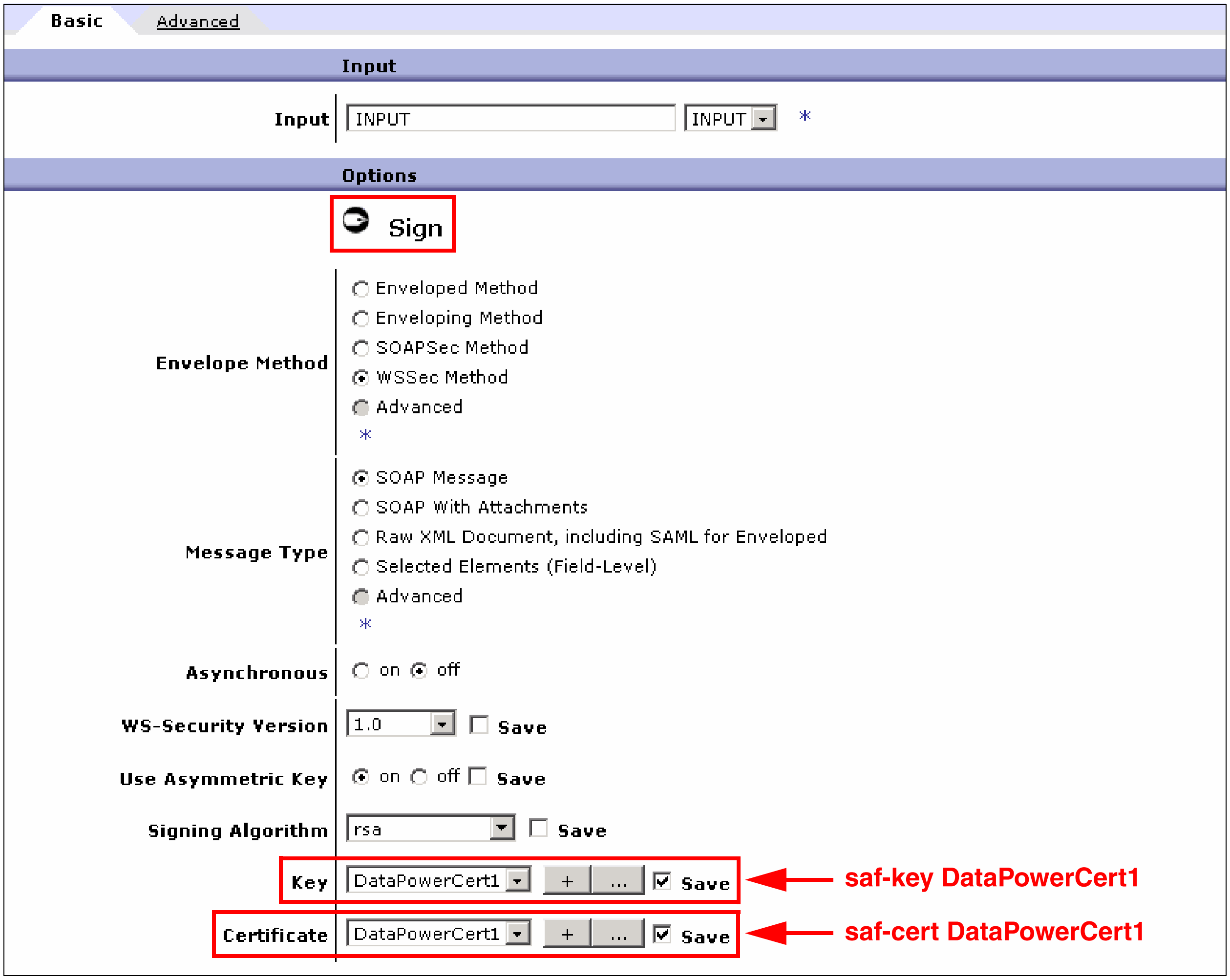
Configured Rules

Order	Rule Name	Direction	Actions	
⇧⇩	**SAF-CERT-POLICY_rule_0**	**Client to Server**		delete rule
⇧⇩	SAF-CERT-POLICY_rule_1	Server to Client		delete rule

Figure 2-49 Add digital signature and digital signature verification

3. Define the digital signature.

   Figure 2-50 shows the definition of the digital signature. We select the Certificate Label Name that is defined in RACF in the Key field and in the Certificate field. In this case, we click **DataPowerCert1** for the Certificate Label Name in both the Key drop-down list box and the Certificate drop-down list box.



Input

Input: INPUT | INPUT ▾ *

Options

Sign

Envelope Method: ○ Enveloped Method ○ Enveloping Method ○ SOAPSec Method ● WSSec Method ○ Advanced *

Message Type: ● SOAP Message ○ SOAP With Attachments ○ Raw XML Document, including SAML for Enveloped ○ Selected Elements (Field-Level) ○ Advanced *

Asynchronous: ○ on ● off

WS-Security Version: 1.0 ▾ □ Save

Use Asymmetric Key: ● on ○ off □ Save

Signing Algorithm: rsa ▾ □ Save

Key: DataPowerCert1 ▾ + ... ☑ Save

Certificate: DataPowerCert1 ▾ + ... ☑ Save

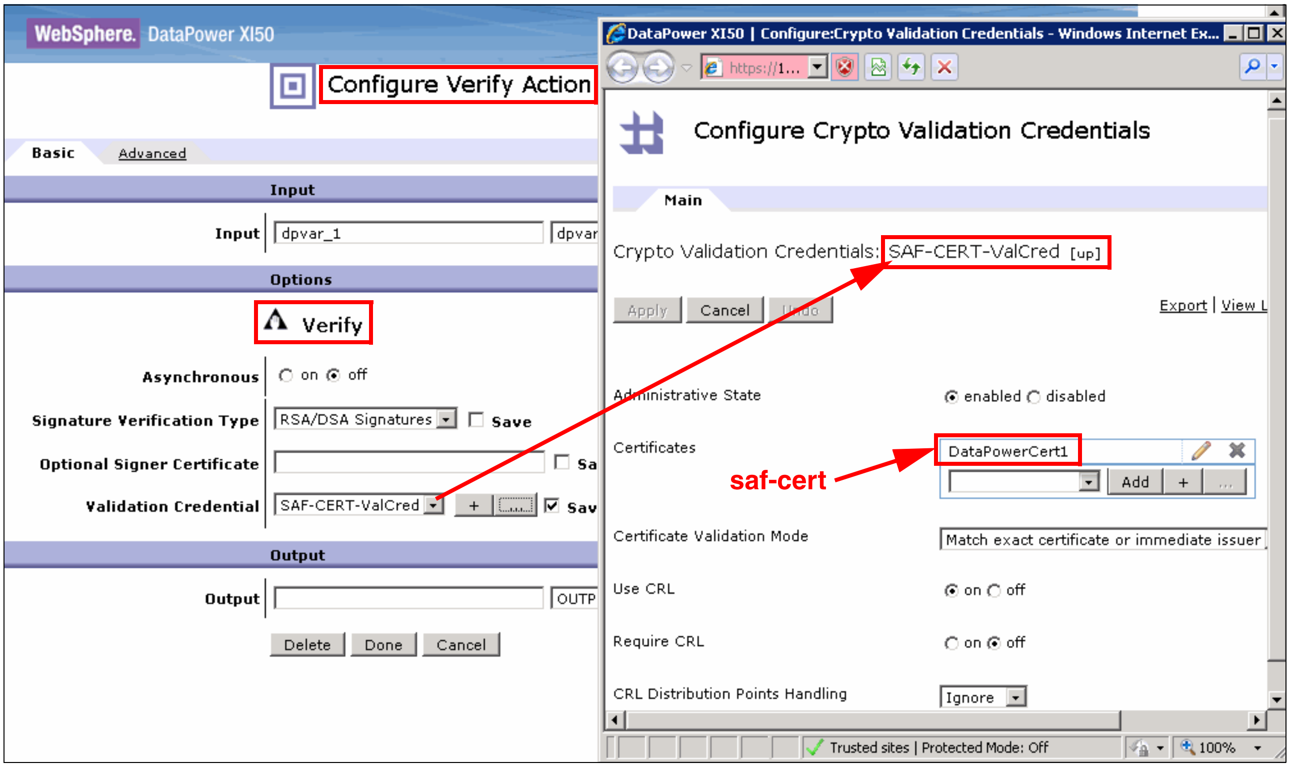
saf-key DataPowerCert1

saf-cert DataPowerCert1

Figure 2-50 Define digital signature

4. Define the digital signature verification.

   Figure 2-51 shows the definition of the digital signature verification. We use “SAF-CERT-ValCred” for the Validation Credential name. To create a validation credential, select **saf-cert** from the Certificates list. In this case, saf-cert is **DataPowerCert1** defined in RACF.



WebSphere. DataPower XI50
DataPower XI50 | Configure:Crypto Validation Credentials - Windows Internet Ex...
https://1...
Trusted sites | Protected Mode: Off
100%

Configure Verify Action

Basic | Advanced

Input

Input: dpvar_1 | dpvar

Options

Verify

Asynchronous: ○ on ● off

Signature Verification Type: RSA/DSA Signatures □ Save

Optional Signer Certificate: □ Sa

Validation Credential: SAF-CERT-ValCred + ... ☑ Sav

Output

Output: OUTP

Delete | Done | Cancel

Configure Crypto Validation Credentials

Main

Crypto Validation Credentials: SAF-CERT-ValCred [up]

Apply | Cancel | Undo | Export | View L

Administrative State: ● enabled ○ disabled

Certificates: DataPowerCert1 | Add | + | ...

saf-cert

Certificate Validation Mode: Match exact certificate or immediate issuer

Use CRL: ● on ○ off

Require CRL: ○ on ● off

CRL Distribution Points Handling: Ignore

Figure 2-51 Define digital signature verification

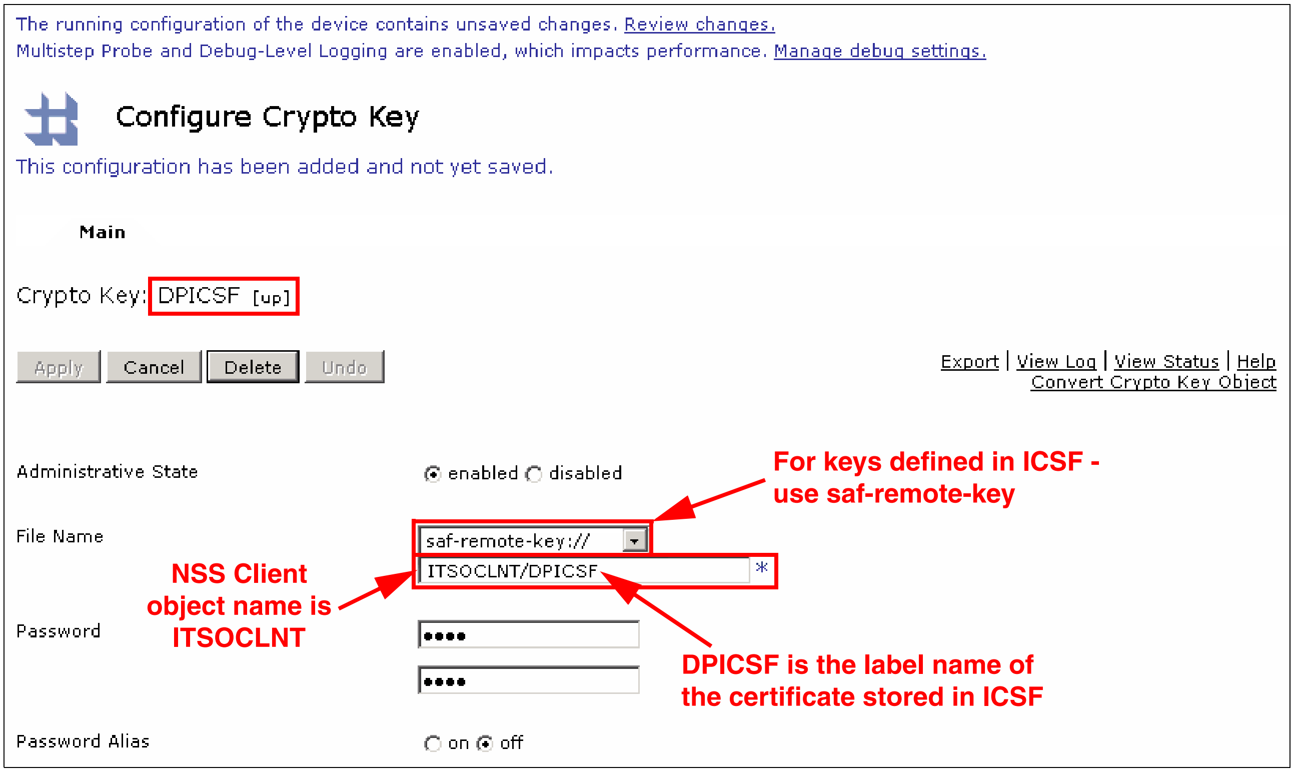
ICSF key storage encrypt/decrypt scenario

The most secure centralized key storage option for the XI50z blades is the saf-remote-key option for SAF key storage. The use is limited to encryption/decryption and sign/verify RSA operations. You cannot use saf-remote-key for SSL server usage.

A client does not want to cache keys on the XI50z appliance and prefers the key storage only on z/OS. In a realistic scenario, a business partner sends a message that is encrypted with the public key certificate of the intended recipient (the zEnterprise system). The zEnterprise SOA gateway (XI50z) uses the ICSF stored saf-remote-key (private key) to decrypt the message to ensure privacy between the business partner and itself even if the underlying transport does not provide the privacy. For our scenario, we show how PKI-based encryption (using DPICSF saf-cert) and decryption (using DPICSF saf-remote-key) are used in the same Multi-Protocol Gateway for demonstration purposes.

saf-remote-key definition

Figure 2-52 shows the saf-remote-key definition in DataPower. Specify the location and the file name in File Name field. In this case, we use saf-remote-key, so select **saf-remote-key://**. Then, specify the file name. Refer to “saf-key and saf-cert definition” on page 92 for information about the File Name field.



The running configuration of the device contains unsaved changes. Review changes.
Multistep Probe and Debug-Level Logging are enabled, which impacts performance. Manage debug settings.

Configure Crypto Key

This configuration has been added and not yet saved.

Main

Crypto Key: DPICSF [up]

Apply
Cancel
Delete
Undo
Export | View Log | View Status | Help
Convert Crypto Key Object

Administrative State ● enabled ○ disabled

File Name saf-remote-key://
ITSOCLNT/DPICSF *

Password ●●●●
●●●●

Password Alias ○ on ● off

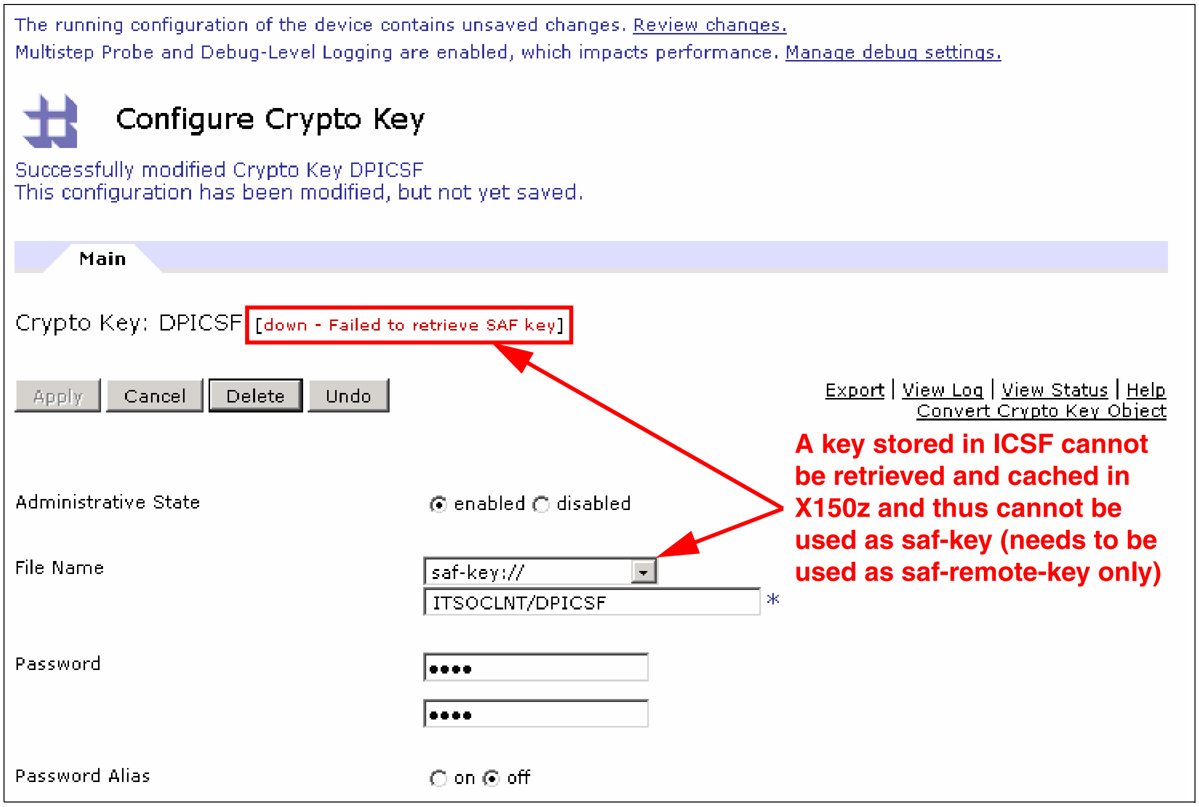
For keys defined in ICSF - use saf-remote-key

NSS Client object name is ITSOCLNT

DPICSF is the label name of the certificate stored in ICSF

Figure 2-52 Configure saf-remote-key

Key stored in ICSF: A key stored in ICSF cannot be retrieved and cached in the XI50z and thus cannot be used as a saf-key; it needs to be used as saf-remote-key only. See Figure 2-53 on page 100.



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

Multistep Probe and Debug-Level Logging are enabled, which impacts performance. Manage debug settings.

Configure Crypto Key

Successfully modified Crypto Key DPICSF

This configuration has been modified, but not yet saved.

Crypto Key: DPICSF [down - Failed to retrieve SAF key]

Main
Apply
Cancel
Delete
Undo
Export | View Log | View Status | Help
Convert Crypto Key Object

Administrative State	● enabled ○ disabled
File Name	saf-key:// ITSOCLNT/DPICSF *
Password	•••• ••••
Password Alias	○ on ● off

A key stored in ICSF cannot be retrieved and cached in X150z and thus cannot be used as saf-key (needs to be used as saf-remote-key only)

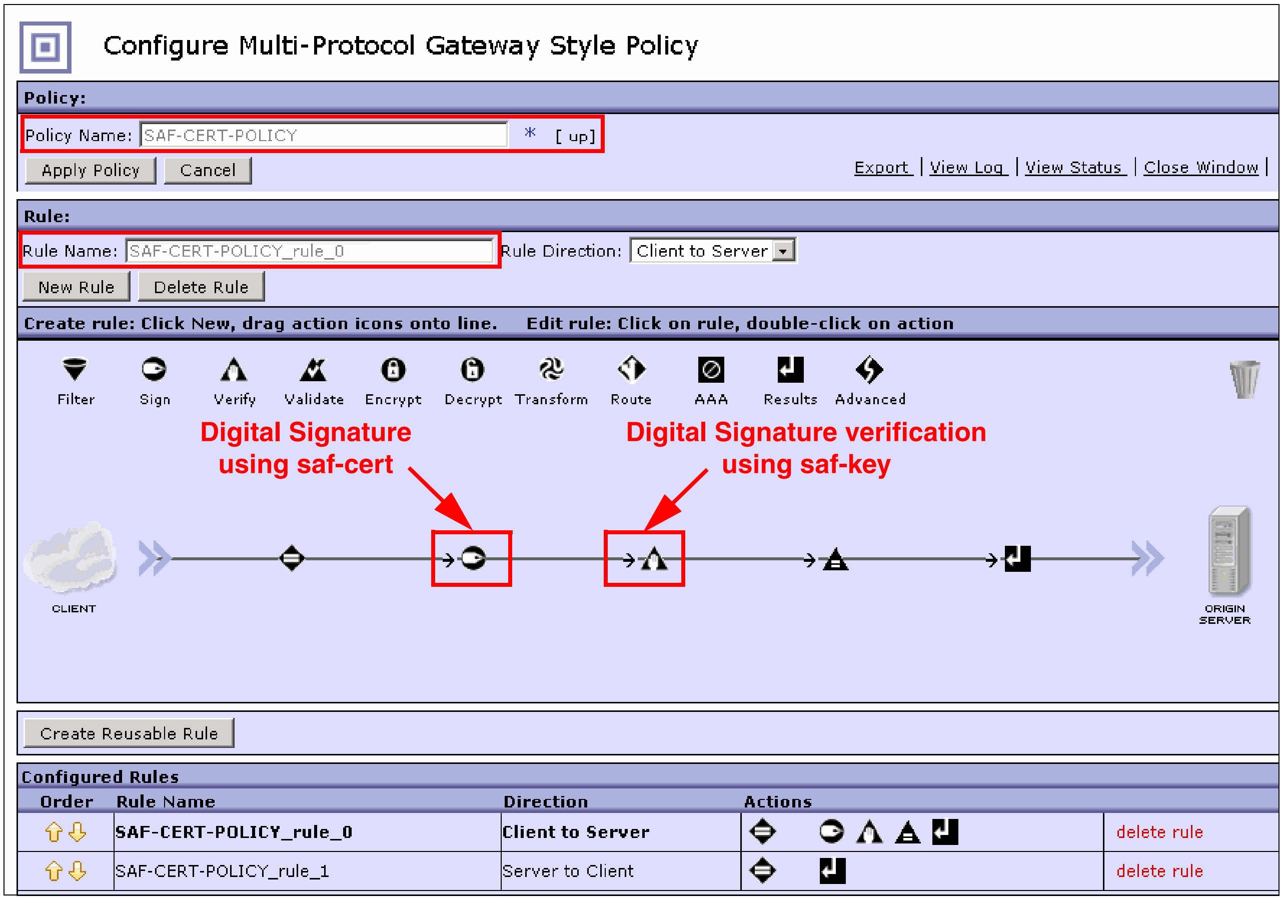
Figure 2-53 Notes about configuring the saf-remote-key

Settings for Encrypt and Decrypt using saf-remote-key

In this section, we explain the Encrypt and Decrypt settings in the XI50z:

1. Add Encrypt and Decrypt in the Multi-Protocol Gateway.

   Just as in the saf-key and saf-cert scenario, “Using saf-key and saf-cert” on page 95, create a new Multi-Protocol Gateway, and then add the Encrypt and Decrypt actions, as shown in Figure 2-54.



Configure Multi-Protocol Gateway Style Policy

Policy:

Policy Name: SAF-CERT-POLICY * [up]

Rule:

Rule Name: SAF-CERT-POLICY_rule_0 Rule Direction: Client to Server

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

Digital Signature using saf-cert

Digital Signature verification using saf-key

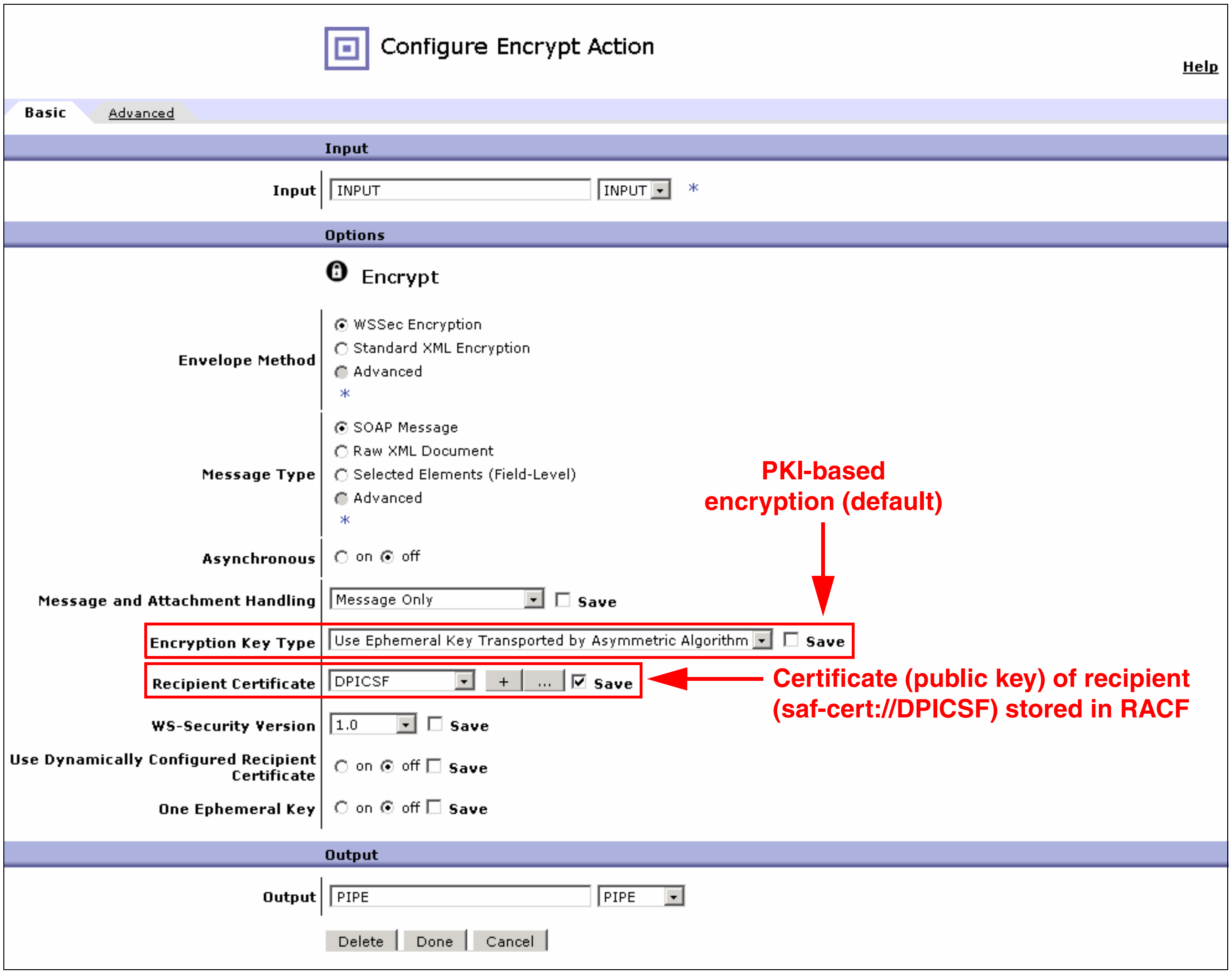
Configured Rules

Order	Rule Name	Direction	Actions	
⇧⇩	**SAF-CERT-POLICY_rule_0**	**Client to Server**	◆ ◒ ▲ ▲ ↵	delete rule
⇧⇩	SAF-CERT-POLICY_rule_1	Server to Client	◆ ↵	delete rule

Figure 2-54 Add Encrypt and Decrypt actions in Multi-Protocol Gateway

2. Configure the Encrypt action.

   Figure 2-55 shows the definition of the Encrypt Action. For the Encryption Key Type, select **Use Ephemeral Key Transported by Asymmetric Algorithm**, which is PKI-based encryption and the default. Then, for the Recipient Certificate, select **DPICSF**.



Configure Encrypt Action

Input

Input: INPUT | INPUT *

Options

Encrypt

Envelope Method: ● WSSec Encryption ○ Standard XML Encryption ○ Advanced *

Message Type: ● SOAP Message ○ Raw XML Document ○ Selected Elements (Field-Level) ○ Advanced *

Asynchronous: ○ on ● off

Message and Attachment Handling: Message Only □ Save

Encryption Key Type: Use Ephemeral Key Transported by Asymmetric Algorithm □ Save

Recipient Certificate: DPICSF + ... ☑ Save

WS-Security Version: 1.0 □ Save

Use Dynamically Configured Recipient Certificate: ○ on ● off □ Save

One Ephemeral Key: ○ on ● off □ Save

Output

Output: PIPE | PIPE

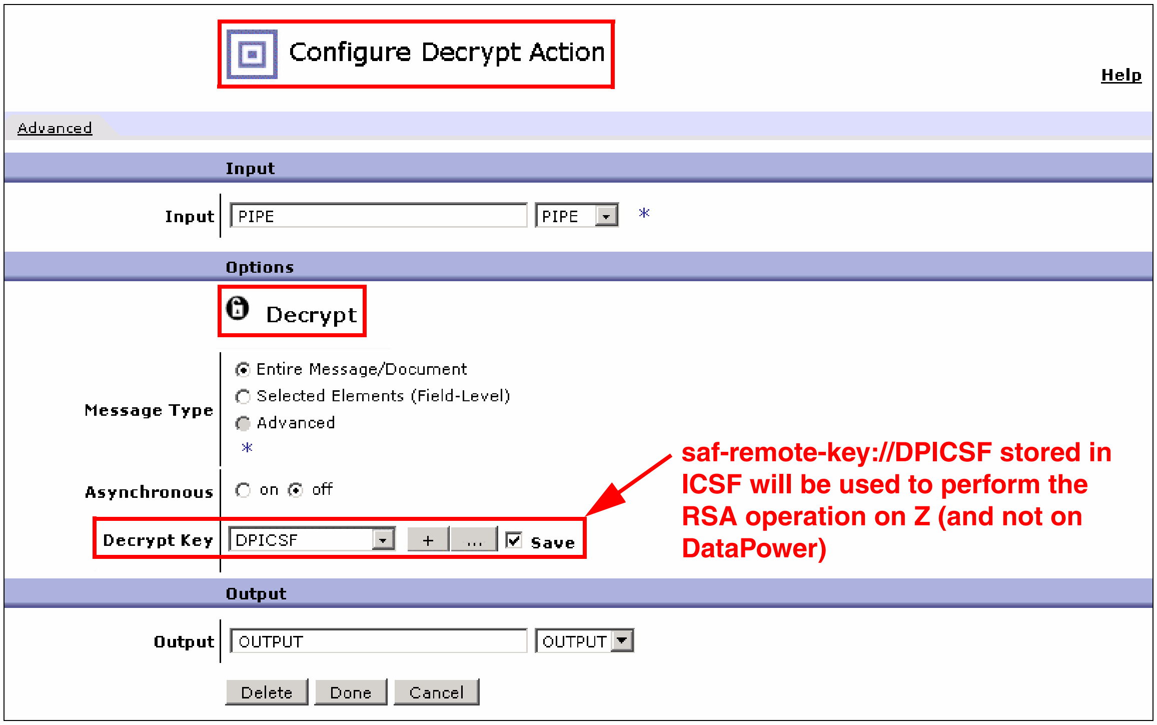
PKI-based encryption (default)

Certificate (public key) of recipient (saf-cert://DPICSF) stored in RACF

Figure 2-55 Configure Encrypt Action

3. Configure the Decrypt Action.

   Figure 2-56 shows the definition of the Decrypt Action. Just as in the Configure Encrypt Action window, set the Decrypt Key. In this case, the recipient certificate is DPICSF, so you select **DPICSF** for the Decrypt Key.



Configure Decrypt Action

Input

Input: PIPE | PIPE *

Options

Decrypt

Message Type: ● Entire Message/Document ○ Selected Elements (Field-Level) ○ Advanced *

Asynchronous: ○ on ● off

Decrypt Key: DPICSF ☑ Save

Output

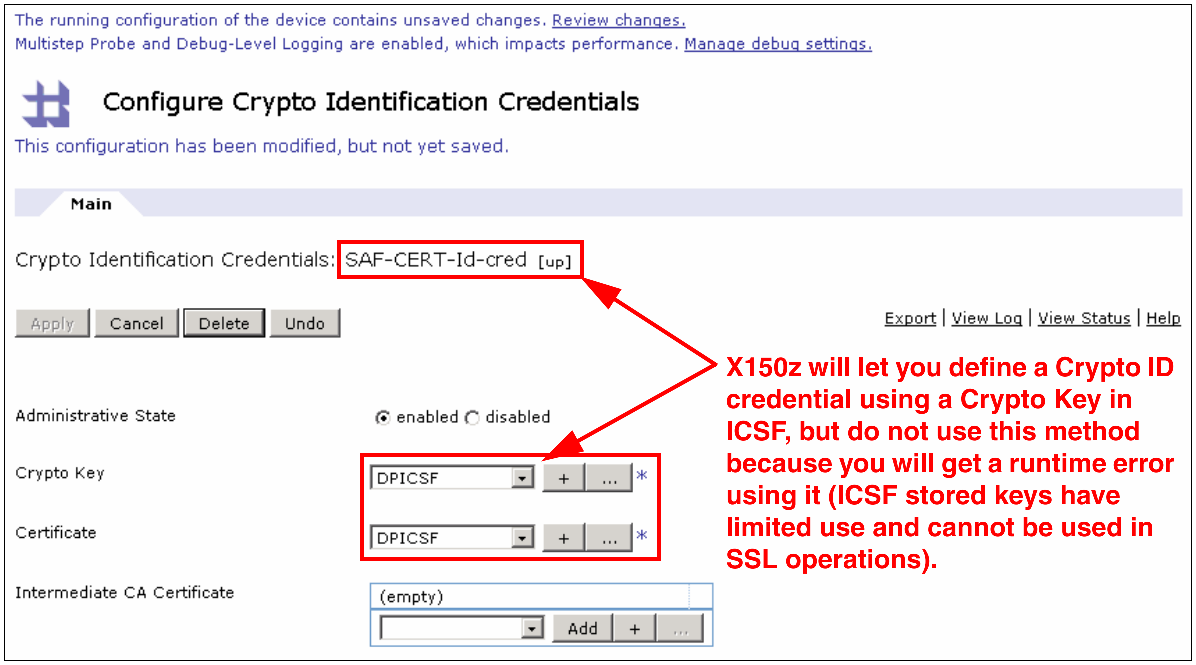
Output: OUTPUT | OUTPUT

saf-remote-key://DPICSF stored in ICSF will be used to perform the RSA operation on Z (and not on DataPower)

Figure 2-56 Configure Decrypt Action

> **Important:** The XI50z will let you define a Crypto ID credential using a Crypto Key in ICSF. However, you *must* not use this method, because you will get a runtime error using it. ICSF stored keys have limited use and cannot be used in SSL operations.

4. Figure 2-57 shows defining an Identification Credential based on a key that is stored in ICSF that will be used to decrypt the transaction.



The running configuration of the device contains unsaved changes. Review changes.
Multistep Probe and Debug-Level Logging are enabled, which impacts performance. Manage debug settings.

Configure Crypto Identification Credentials

This configuration has been modified, but not yet saved.

Crypto Identification Credentials: SAF-CERT-Id-cred [up]

Administrative State ● enabled ○ disabled

Crypto Key DPICSF

Certificate DPICSF

Intermediate CA Certificate (empty)

X150z will let you define a Crypto ID credential using a Crypto Key in ICSF, but do not use this method because you will get a runtime error using it (ICSF stored keys have limited use and cannot be used in SSL operations).

Figure 2-57 Crypto Identification Credentials

5. Confirm the encryption and decryption in the NSSD log on z/OS.

   You can see that the encryption and decryption ran successfully, as shown in Example 2-21 and Example 2-22. The output is taken from the NSSD log. The CSNDDSG service is called on z/OS to perform a signature operation, and the CSNDPKD service is called on z/OS to perform decryption.

   Example 2-21 Successful encryption log

```
Sep 21 16:10:19 WTSC80/NSSD     NSSD     NSSD: DBG0013I NSS_CERTINFO The ICSF
CSNDDSG callable service for client ITSOCLNT                    completed with
rc=0x00000000, rsn=0x00000000
```

   Example 2-22 Successful decryption log

```
Sep 21 18:08:56 WTSC80/NSSD     NSSD     NSSD: DBG0013I NSS_CERTINFO The ICSF
CSNDPKD callable service for client ITSOCLNT                    completed with
rc=0x00000000, rsn=0x00000000
```

For more information about the PKA callable services, go to these websites:

- http://publib.boulder.ibm.com/infocenter/zos/v1r12/topic/com.ibm.zos.r12.csfb400/sumpka.htm
- http://publib.boulder.ibm.com/infocenter/zos/v1r12/topic/com.ibm.zos.r12.csfb400/spkd.htm

3

Integration use cases

The DataPower XI50z provides a security layer and ESB capabilities, such as connectivity, routing, data transformation, and protocol bridging. The XI50z can rapidly enable an existing application to be available to new channels and clients using various standards-based protocols from several platforms. A service-oriented architecture (SOA) is normally the preferred architecture, because it facilitates the maximum reuse of existing assets. Service integration can be based on point-to-point connections, or it can provide the capability to mediate, transform, route, and transport service requests from the service requester to the correct service provider.

This chapter specifically outlines integration scenarios that uniquely position the XI50z to be the ideal solution to exploit and reuse the wealth of assets that are hosted in the zEnterprise. It isolates the zEnterprise systems from the external world, by providing a secure service facade to all external client applications that need to use the vast array of business functions hosted by the systems on the zEnterprise.

This chapter includes the following integration topics:

- XI50z connecting to and using WMQ
- Connecting with CICS
- Connecting with IMS
- Connecting with DB2 on z/OS

3.1 XI50z connecting to and using WMQ

WebSphere MQ is used in a majority of the z/OS existing systems. Many of the z/OS systems have exposed services to the enterprise by way of WebSphere MQ. In this chapter, we discuss a recommended WebSphere MQ architecture for the DataPower XI50z.

3.1.1 Connecting to the z/OS Queue Manager

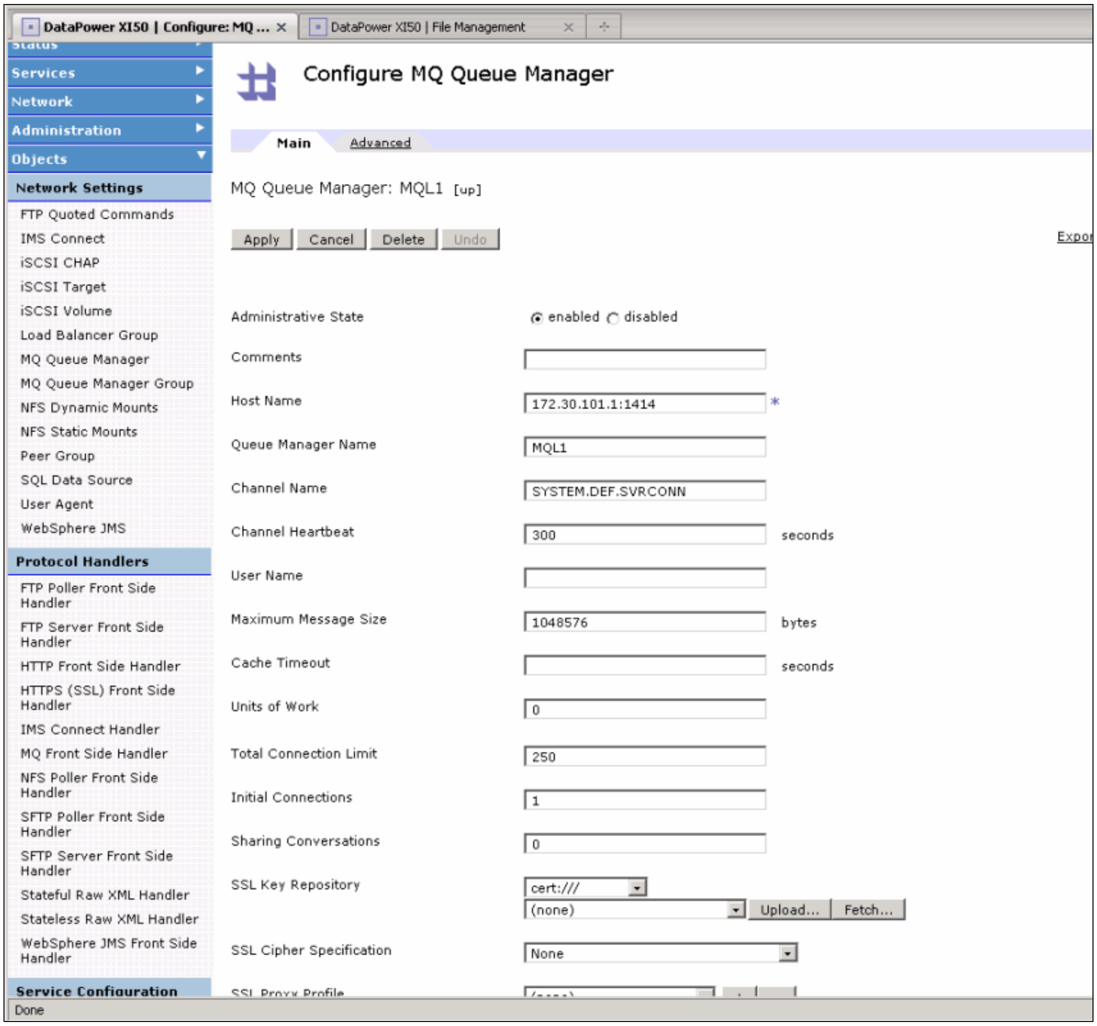
IBM WebSphere MQ for z/OS helps to ensure reliable, proven message delivery, where messages are delivered exactly one time and transactional (unit-of-work) support helps ensure the integrity of critical transactions. Engineered natively for z/OS, WebSphere MQ for z/OS takes full advantage of the unique features of the platform to enable its tremendous quality of service (QoS) and dynamic workload management. Features include integration with platform services, such as IBM Resource Access Control Facility (RACF), automatic restart manager (ARM), IBM Workload Manager (WLM), Parallel Sysplex with WebSphere MQ shared-queue support, DB2 data sharing, and Resource Recovery Services (RRS) global transaction coordination. WebSphere MQ for z/OS provides a specialized bridge for CICS and IMS transactions. For these reasons, a WebSphere MQ client is now on the DataPower XI50, which allows the device to be a powerful gateway for the z/OS platform.

The XI50z makes client MQ connections to the queue managers on the z/OS logical partitions (LPARs) using the private intraensemble data network (IEDN) that was established using the 101 virtual local area network (VLAN) interfaces that were defined in Chapter 1, “Getting started with the XI50z” on page 1. The queue manager named MQL1 that is hosted on the SC80 LPAR is isolated from the public network and can be accessed only by the XI50z. Therefore, only the XI50z is able to put messages to the queues on this queue manager.

This queue manager is also accessed by the CICS and IMS regions that are hosted on the same LPAR. The request messages that are sent from the XI50z to the queues are accessed by CICS Adapter Programs, CICS MQ bridge, IMS Adapter Programs, or the IMS MQ bridge programs, which then invoke the appropriate CICS or IMS transactions/programs for processing. We explain these integration scenarios in detail in subsequent sections of this chapter. Note that the XI50z will act as the sole gateway that is allowed access to this queue manager. In other words, no external application will be able to send messages directly to this queue manager, due to the privacy and protection that are provided by the private VLAN.

Therefore, when an external application wants to request any back-end service that is exposed by way of queues that are hosted by the queue manager on this LPAR, the external application will need to send the request message to the XI50z DataPower device. The XI50z will then route the message to the appropriate queue.

A queue manager object is defined on the XI50z to access this queue manager. The queue manager object is defined on the XI50z, as shown Figure 3-1. It is important to notice that the IP Address that is entered for the Host Name is the VLAN address of the z/OS LPAR.



Configure MQ Queue Manager

MQ Queue Manager: MQL1 [up]

Administrative State	● enabled ○ disabled	
Comments		
Host Name	172.30.101.1:1414	*
Queue Manager Name	MQL1	
Channel Name	SYSTEM.DEF.SVRCONN	
Channel Heartbeat	300	seconds
User Name		
Maximum Message Size	1048576	bytes
Cache Timeout		seconds
Units of Work	0	
Total Connection Limit	250	
Initial Connections	1	
Sharing Conversations	0	
SSL Key Repository	cert:/// (none)	
SSL Cipher Specification	None	
SSL Proxy Profile	(none)	

Figure 3-1 DataPower Queue Manager Object MQL1

3.1.2 Connecting to distributed queue managers to receive service requests

The XI50z will connect to external queue managers that are not hosted on z/OS. These queue managers can be hosted on the zBX BladeCenter on POWER7® Blades or an external server. DataPower makes connections to these queue managers using MQ Front Side Handlers that are configured on the various gateways on the XI50z.

As a general practice, the XI50z is given access to two or more queue managers that act as a gateway in receiving messages for the XI50z. These gateway queue managers are hosted on a distributed platform, either on the zBX BladeCenter that is part of the zEnsemble or externally on other servers. You set these queue managers up in a highly available configuration so that DataPower can always receive request messages by way of the MQ Transport. Figure 3-2 shows the DataPower with MQ cluster integration.

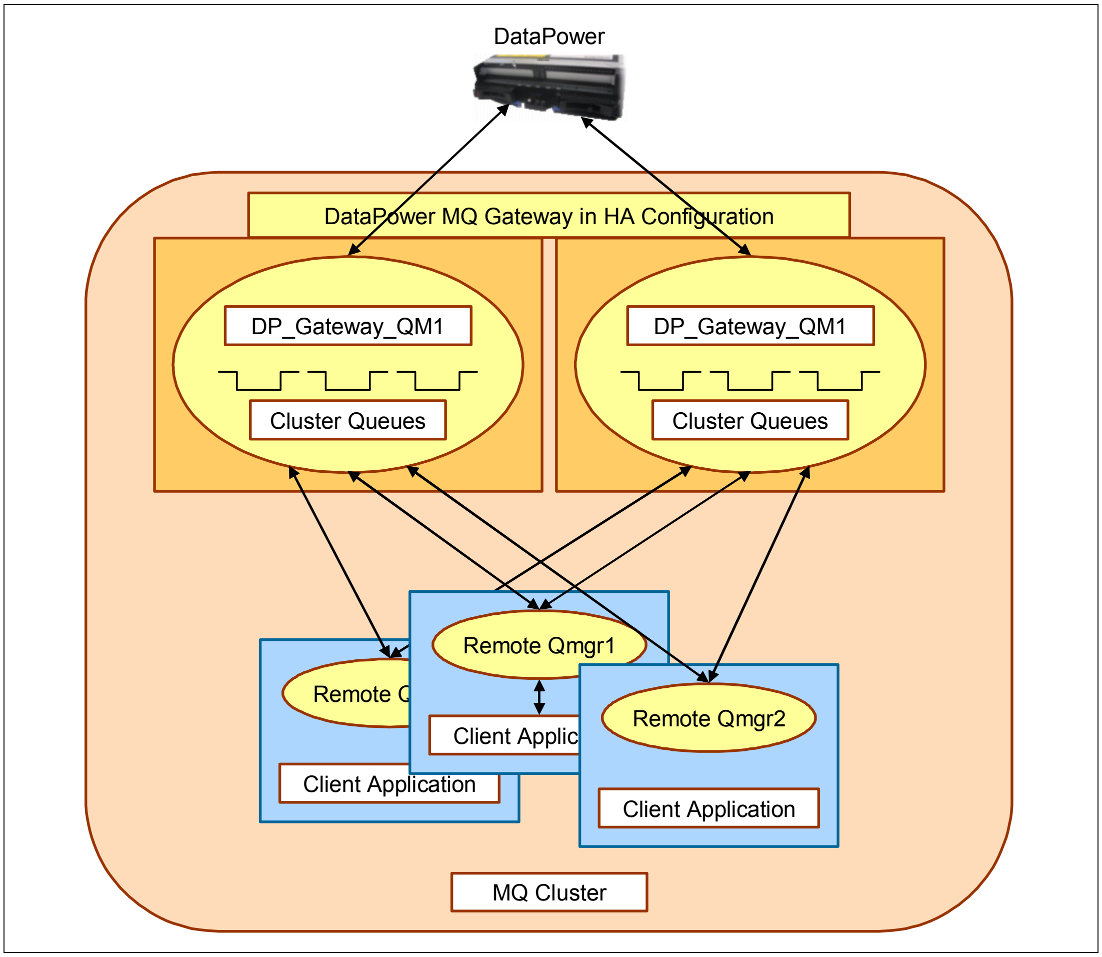
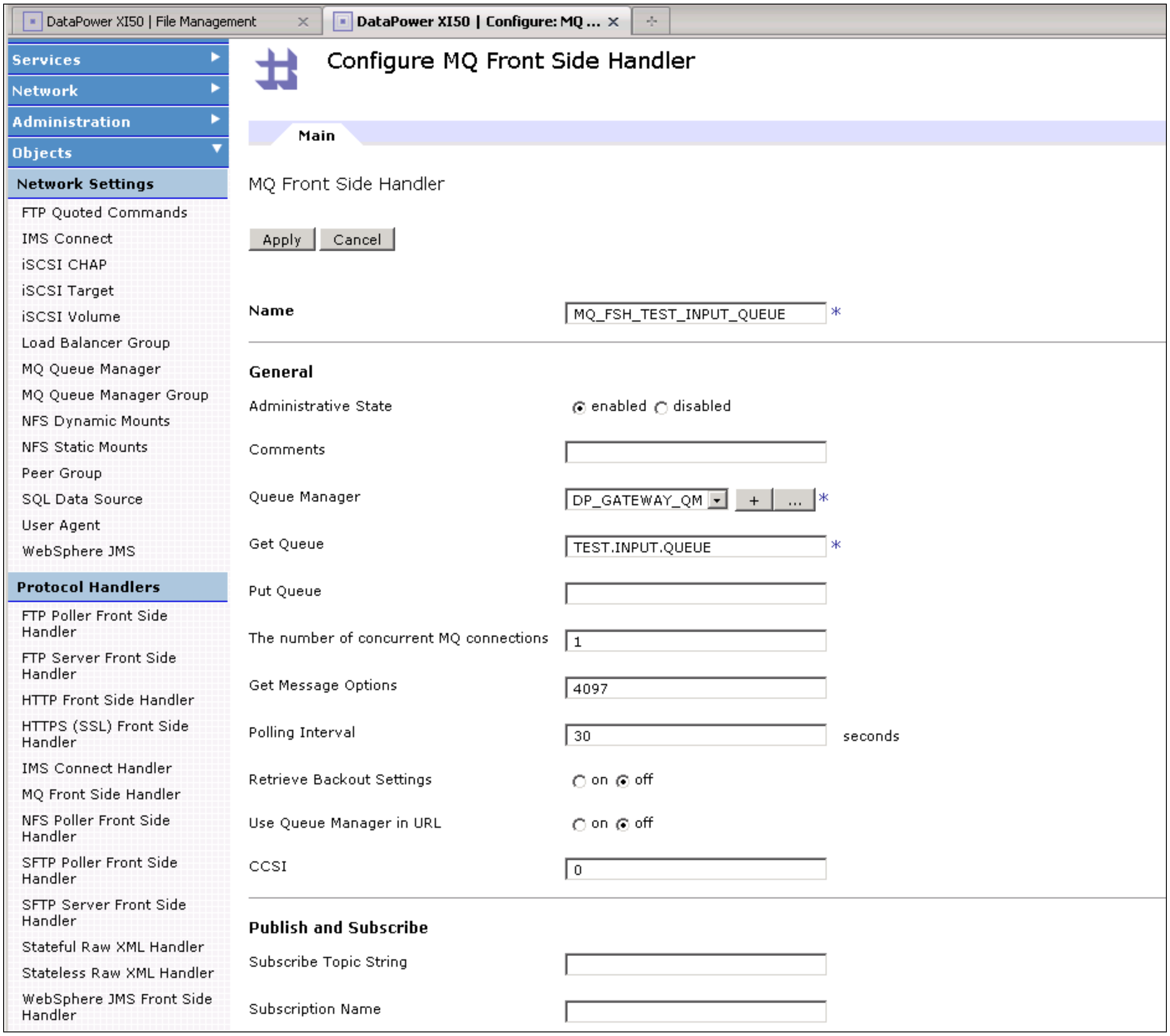


Figure 3-2 MQ Gateway Architecture for DataPower

The XI50z has Front Side Handlers to read the messages of the queues on the gateway queue managers, process them, and route them to the appropriate z/OS-based back-end systems by way of the IEDN private network. When the response messages are received, (1) it will put them in the appropriate remote queues on the gateway queue manager, (2) to be routed by MQ to a remote queue manager containing the designated response queue that is monitored by the service-requesting program. Figure 3-3 shows the Front Side Handlers configuration.



Configure MQ Front Side Handler

MQ Front Side Handler

Name: MQ_FSH_TEST_INPUT_QUEUE *

General

Administrative State: ● enabled ○ disabled

Comments:

Queue Manager: DP_GATEWAY_QM *

Get Queue: TEST.INPUT.QUEUE *

Put Queue:

The number of concurrent MQ connections: 1

Get Message Options: 4097

Polling Interval: 30 seconds

Retrieve Backout Settings: ○ on ● off

Use Queue Manager in URL: ○ on ● off

CCSI: 0

Publish and Subscribe

Subscribe Topic String:

Subscription Name:

Figure 3-3 MQ Front Side Handler configuration connecting to queue manager on a distributed server

3.2 Connecting with CICS

In this scenario, a client sends a request message through various supported protocols to the DataPower XI50z (see Figure 3-4). The DataPower XI50z transforms the message to a format that can be consumed by the target CICS application. The message is transported from the DataPower XI50z over the private and secure IEDN that connects the zBX to the z/OS LPARs running core business applications.

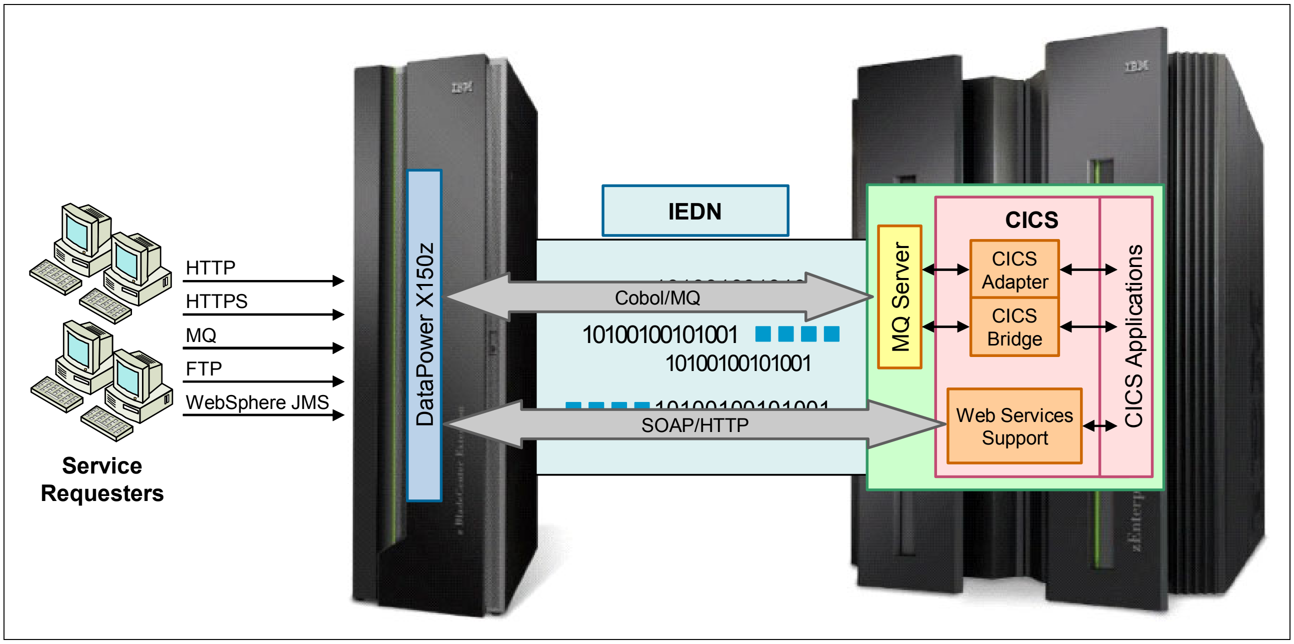


Figure 3-4 CICS Integration with the XI50z

3.2.1 Integrating with CICS by way of WebSphere MQ

In this integration pattern, the XI50z receives a request message from a client application through the external network. The XI50z performs gateway security functions as required on the request message. These security functions include authentication, authorization, verifying message integrity, and decryption.

The XI50z transforms the request message to the format that is required by the CICS application. The XI50z then makes a connection or uses an established connection to the WebSphere MQ Queue Manager running on z/OS over the secure IEDN. The WebSphere MQ Queue Manager connects to the CICS region using well-proven components, such as the CICS Adapter and CICS bridge for WebSphere MQ. When the response message is received, the XI50z does the necessary processing and transformation and then routes the response message back to the client application.

CICS Adapter

The IBM WebSphere MQ CICS Adapter (also referred to as the CICS Adapter in this section) allows you to connect your queue manager to CICS for z/OS, and enables CICS applications to use the Message Queue Interface (MQI). The CICS Adapter connects a CICS subsystem to a queue manager. A single CICS address space can connect to only one queue manager at a time. However, multiple CICS address spaces can connect to the same queue manager.

The CICS Adapter's control functions (the CKQC transaction) let you manage the connections between CICS and WebSphere MQ dynamically. You can invoke these functions using the CICS Adapter panels, from the CICS command line, or from a CICS application. The functions include starting, stopping, and modifying the current connection to WebSphere MQ.

The CICS Adapter implements the MQI for use by CICS application programs. The MQI calls, and how they are used, are described in the *WebSphere MQ Application Programming Guide,* SC34-6939-01. The adapter also supports an application programming interface (API)-crossing exit and a trace facility.

All application programs that run under CICS must be link-edited with the supplied API stub program called CSQCSTUB if they are to access WebSphere MQ, unless the program is using dynamic calls. This stub provides the application with access to all MQI calls. For transaction integrity, the adapter supports syncpointing under the control of the CICS syncpoint manager, so that units of work can be committed or backed out, as required. The adapter also supports security checking of WebSphere MQ resources when used with an appropriate security management product, such as Security Server (previously known as RACF). The adapter provides high availability with the automatic connection retry feature after a queue manager termination, and automatic resource resynchronization after a restart. It also features an alert monitor (the CKAM transaction) that responds to unscheduled events, such as a shutdown of the queue manager.

CICS and the adapter share the same address space. The queue manager executes in its own address space.

Part of the adapter is a CICS task-related user exit that communicates with the WebSphere MQ Queue Manager. CICS management modules call the exit directly. Application programs call the exit through the supplied API stub program (CSQCSTUB). The *CICS Customization Guide*, SC34-6429-08, describes the task-related user exits and stub programs.

CKTI is a WebSphere MQ-supplied CICS transaction that acts as a task initiator or trigger monitor to start a CICS transaction. Each CKTI transaction is normally in an MQGET WAIT state, ready to respond to any trigger messages that are placed on its initiation queue. CKTI starts a CICS transaction when a WebSphere MQ trigger message is read, for example, when a message is put onto a specific queue.

When a message is put onto an application message queue, a trigger is generated if the trigger conditions are met. The queue manager then writes a message, containing user-defined data that is known as a *trigger message*, to the initiation queue that has been specified for that message queue. In a CICS environment, you can set up an instance of CKTI to monitor an initiation queue and to retrieve the trigger messages from it as they arrive. CKTI starts another CICS transaction (specified using the DEFINE PROCESS command), which typically reads the message from the application message queue and then processes it. The process must be named on the application queue definition, not the initiation queue.

Each copy of CKTI services a single initiation queue. To start or stop a copy of CKTI, you must supply the name of the queue that this CKTI is to serve, or is serving. You cannot start more than one instance of CKTI against the same initiation queue from a single CICS subsystem.

At CICS system initialization or at connect time, you can define a default initiation queue. If you issue a STARTCKTI or a STOPCKTI command without specifying an initiation queue, these commands are automatically interpreted as the default initiation queue.

Figure 3-5 shows an overview of the CICS Adapter topology.

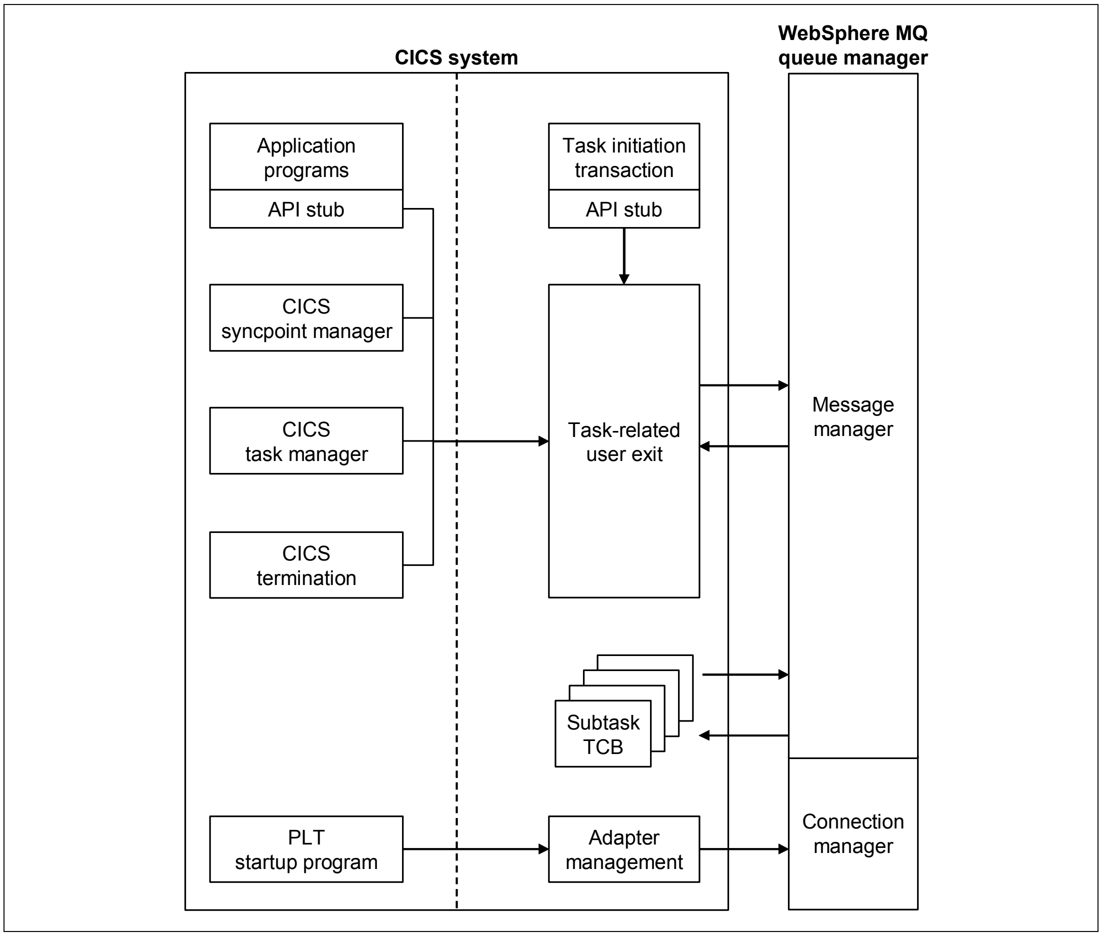


Figure 3-5 Relationships between CICS, the CICS Adapter, and a WebSphere MQ Queue Manager

The XI50z interacts with the CICS applications by writing and reading from the queues on the queue manager that is attached to the CICS region. Figure 3-6 is an illustration of how the XI50z interacts with CICS using CKTI as the trigger monitor to call the CICS application program. The CICS application program has the capability to GET a request message, process it, and PUT the response message back on the queue for the XI50z to consume.

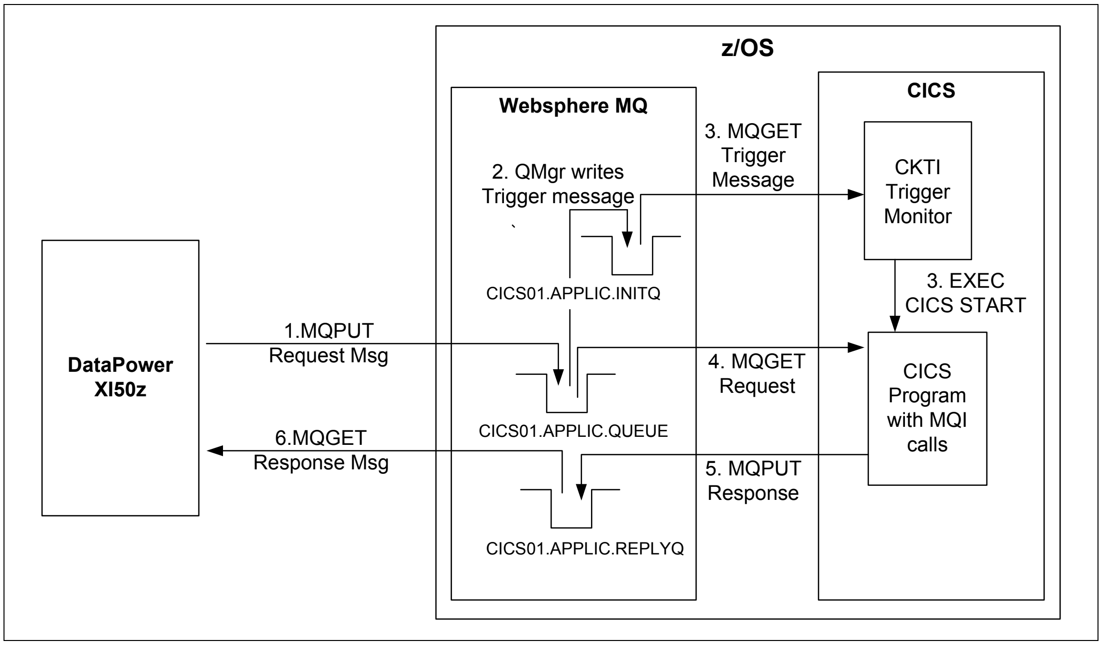


Figure 3-6 CICS Adapter with CKTI trigger monitor

The following procedure documents each numbered step that is shown in Figure 3-6 and explains what happens:

1. DataPower puts a message in the request queue CICS01.APPLIC.QUEUE. Every back-end service program has a dedicated queue.
2. The WebSphere MQ Queue Manager writes out a trigger message to the CICS01.APPLIC.INITQ. The content of the trigger message is derived from the process definition of the process that was named on the request queue CICS01.APPLIC.QUEUE.
3. CKTI is a long-running transaction that monitors the initiation queue CICS01.APPLIC.INITQ. When the message is received, it uses the application ID that is in the message to launch the required transaction.
4. The CICS application program uses the MQ API to GET the message of the queue and process the request appropriately.
5. After processing the message, the CICS application program puts the response message back to the response queue CICS01.APPLIC.REPLYQ.
6. DataPower is waiting on the CICS01.APPLIC.REPLYQ for the response message, and takes it off the queue as soon as it arrives.

The following steps show DataPower integrating with CICS by way of the CICS Adapter. Note that the sample MQI program that is added from the CICS installation is set up as a transaction that is used for this scenario. In an actual business scenario, you also have message transformation and processing per the business requirements.

The purpose of this specific scenario is to highlight the minimal steps that are required for DataPower to write an MQ message that can be consumed by the CICS program using the CICS Adapter that is provided by the MQI calls.

Figure 3-7 describes the scenario we are building.

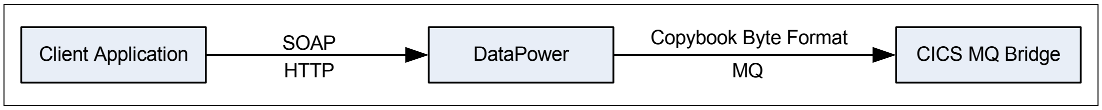
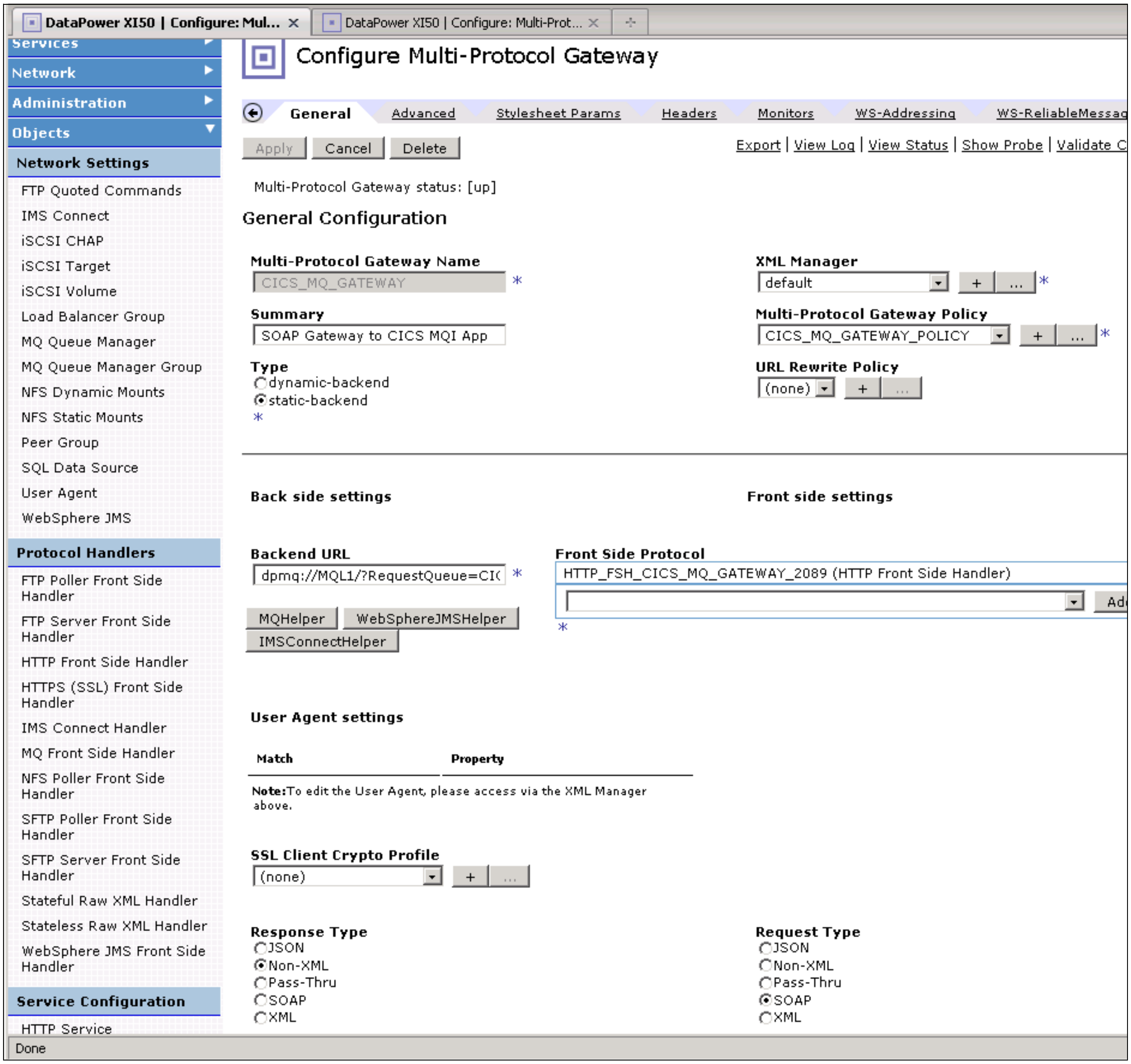


Figure 3-7 DataPower integration with CICS by way of MQ

Figure 3-8 shows the configuration window for the multi-protocol gateway.



Configure Multi-Protocol Gateway

Multi-Protocol Gateway status: [up]

General Configuration

Multi-Protocol Gateway Name: CICS_MQ_GATEWAY *

XML Manager: default *

Summary: SOAP Gateway to CICS MQI App

Multi-Protocol Gateway Policy: CICS_MQ_GATEWAY_POLICY *

Type
○ dynamic-backend
● static-backend
*

URL Rewrite Policy: (none)

Back side settings

Front side settings

Backend URL: dpmq://MQL1/?RequestQueue=CI(*

Front Side Protocol: HTTP_FSH_CICS_MQ_GATEWAY_2089 (HTTP Front Side Handler)
*

User Agent settings

Match	Property

Note: To edit the User Agent, please access via the XML Manager above.

SSL Client Crypto Profile: (none)

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

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

Figure 3-8 Multi-Protocol Gateway configuration panel for CICS MQ integration

We set the following information in Figure 3-8:

- The Backend connection type is set to **static-backend**.

- We set the Backend URL connection string to:

  ```
  dpmq://MQL1/?RequestQueue=CICS01.APPLIC.QUEUE;ReplyQueue=CICS01.APPLIC.REPLYQ;P
  arseHeaders=true
  ```

  We explain the following information in this Backend URL connection string:

  – `MQL1` is the name of the DP MQ object that points to the z/OS Queue Manager.

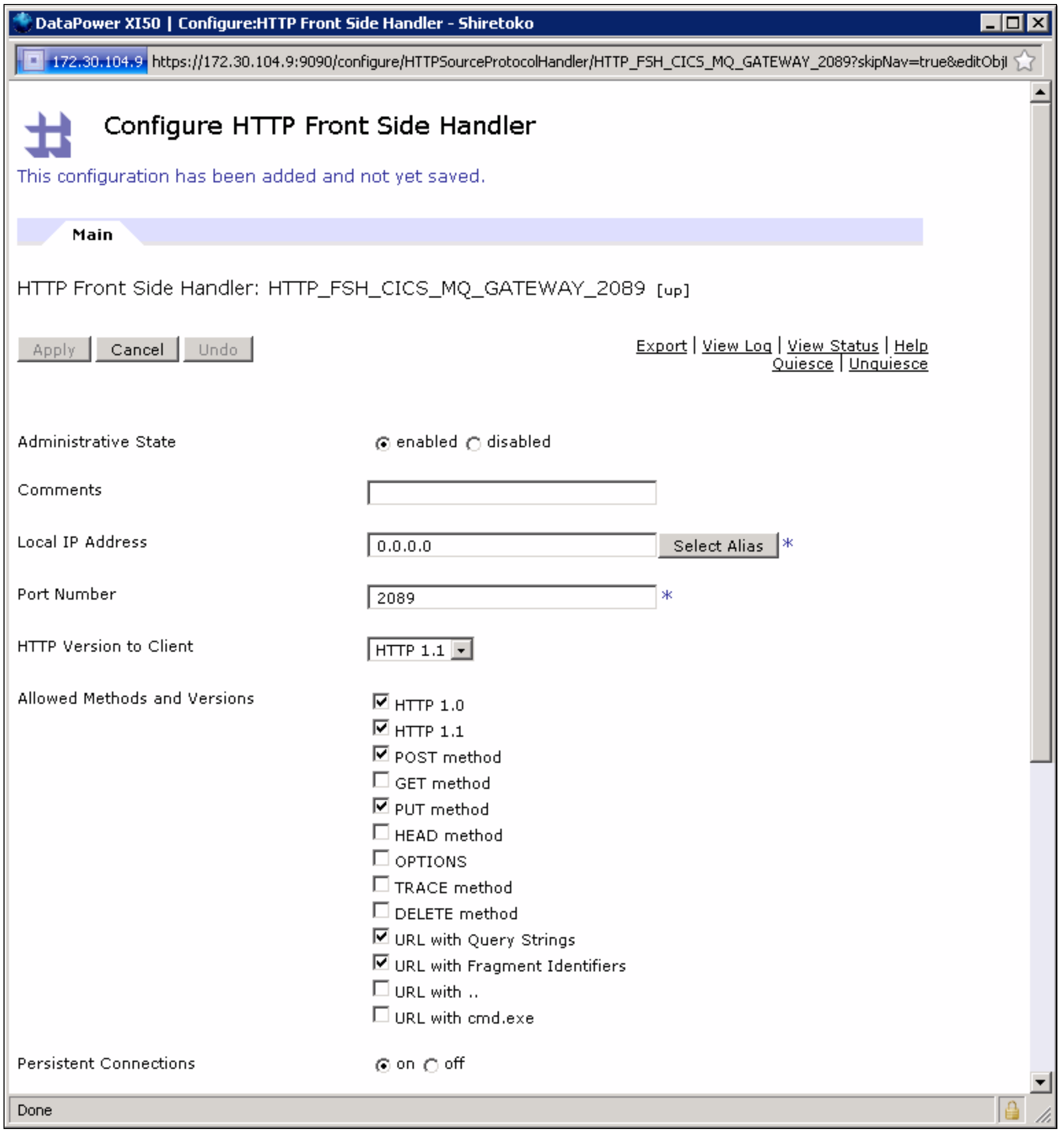
  – `RequestQueue` is the queue on which the request message is put by DataPower.

  – `ReplyQueue` is the queue which DataPower monitors for the response message from the CICS Adapter, after the CICS Adapter puts the request message on the request queue.

  – `ParseHeaders` instruct DataPower to parse any additional MQ headers that the back-end CICS program might send into standard header nodes, and then to pass only the message body to the Response rule.

- The Request Type is set to **SOAP**, because we will send it in a SOAP XML request message.
- The Response Type is set to **non-XML**, because the back-end CICS program will send back a byte stream that conforms to a COBOL copybook structure.
- The Front Side Handler that listens for the client application request messages is set to listen on port `2089`.

All other parameters in the Front Side Handler contain the default values, as shown in Figure 3-9 on page 116.



DataPower XI50 | Configure:HTTP Front Side Handler - Shiretoko

172.30.104.9 https://172.30.104.9:9090/configure/HTTPSourceProtocolHandler/HTTP_FSH_CICS_MQ_GATEWAY_2089?skipNav=true&editObjl

Configure HTTP Front Side Handler

This configuration has been added and not yet saved.

Main

HTTP Front Side Handler: HTTP_FSH_CICS_MQ_GATEWAY_2089 [up]

Apply | Cancel | Undo

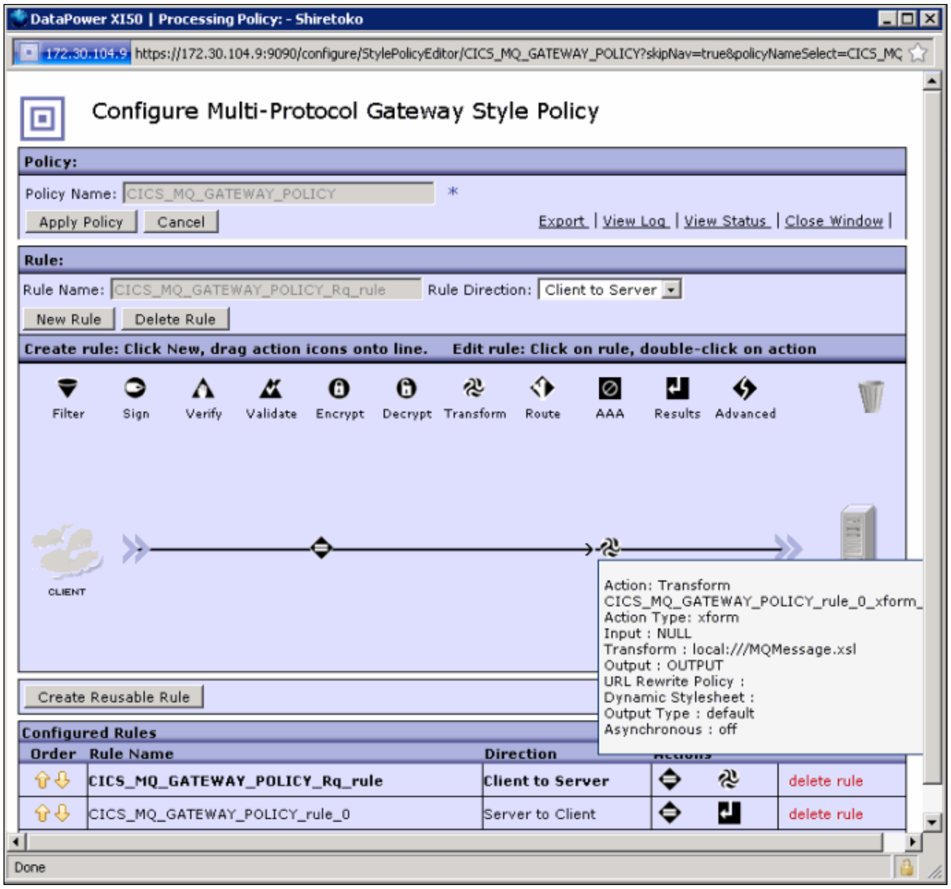
Export | View Log | View Status | Help
Quiesce | Unquiesce

Administrative State	● enabled ○ disabled
Comments	
Local IP Address	0.0.0.0 Select Alias *
Port Number	2089 *
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

Done

Figure 3-9 CICS MQ Gateway: Front Side Handler

We configured the policy rule for test purposes. The policy rule contains the minimum number of actions to drive the back-end CICS distributed program link (DPL) sample program, as shown in Figure 3-10.


DataPower XI50 | Processing Policy: - Shiretoko
172.30.104.9
https://172.30.104.9:9090/configure/StylePolicyEditor/CICS_MQ_GATEWAY_POLICY?skipNav=true&policyNameSelect=CICS_MQ
Apply Policy
Cancel
Export | View Log | View Status | Close Window |
New Rule
Delete Rule
Create rule: Click New, drag action icons onto line.   Edit rule: Click on rule, double-click on action
Filter
Sign
Verify
Validate
Encrypt
Decrypt
Transform
Route
AAA
Results
Advanced
CLIENT
Create Reusable Rule
Done

Configure Multi-Protocol Gateway Style Policy

Policy:

Policy Name: CICS_MQ_GATEWAY_POLICY *

Rule:

Rule Name: CICS_MQ_GATEWAY_POLICY_Rq_rule Rule Direction: Client to Server

Action: Transform
CICS_MQ_GATEWAY_POLICY_rule_0_xform_
Action Type: xform
Input : NULL
Transform : local:///MQMessage.xsl
Output : OUTPUT
URL Rewrite Policy :
Dynamic Stylesheet :
Output Type : default
Asynchronous : off

Configured Rules

Order	Rule Name	Direction	Actions		
⇧⇩	CICS_MQ_GATEWAY_POLICY_Rq_rule	Client to Server	◆	Transform	delete rule
⇧⇩	CICS_MQ_GATEWAY_POLICY_rule_0	Server to Client	◆	Results	delete rule

Figure 3-10 Multi-Protocol Gateway Policy for the CICS MQ Gateway

The Request rule that is displayed in Figure 3-10 contains one Transform action that calls the stylesheet `MQMessage.xsl`. In order to keep it simple, this action accepts no input and sends constant output that is generated by the stylesheet.

The Response rule is a simple pass-through rule that passes the byte-stream response through “as is”.

Figure 3-11 lists the source code for the stylesheet.

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

    <xsl:output method="text"/>

    <xsl:template match="/">
        <!-- populate the mandatory MQMD fields -->
        <xsl:variable name="MQMDNodeset">
          <MQMD>
            <Format>MQSTR</Format>
            <ReplyToQ>
              <xsl:value-of select="'CICS01.APPLIC.REPLYQ'"/>
            </ReplyToQ>
          </MQMD>
        </xsl:variable>
        <!-- serialize the nodeset for transport -->
        <xsl:variable name="mqmdStr">
            <dp:serialize select="$MQMDNodeset" omit-xml-decl="yes"/>
        </xsl:variable>
        <!-- set the MQMD request header value -->
        <dp:set-http-request-header name="'MQMD'" value="$mqmdStr"/>
        <!-- Hard coded byte stream that forms the message body, for the
purpose of this test -->
     <xsl:value-of select="'01INQS00c         001000000000000
000      0000000'"/>
    </xsl:template>
</xsl:stylesheet>
```

Figure 3-11 MQMessage.xsl stylesheet that is executed in the Transform action

You must set the following mandatory fields in the MQMD message header:

- `MQMD.Format`: This field contains the value MQSTR to indicate that the message is in a byte-stream string format and needs to be converted to the code page of the z/OS Queue Manager before it is passed to the CICS application.
- `MQMD.ReplyToQ`: This field contains the Reply queue name. The CICS application program needs to place a response into this header using the MQI MQPUTcall or place a response to use the MQI MQPUTcall.

In the sample scenario, a byte-stream message body was sent to the request queue using a hard-coded byte stream that was embedded in the last line of the stylesheet. In an actual client scenario, the body of the message is usually generated by a WebSphere Transformation Extender Map for DataPower in a subsequent binary transformation action.

CICS bridge

The WebSphere MQ-CICS bridge enables applications to run a CICS program or transaction that does not have to be MQI-enabled. Therefore, you can use your existing applications with WebSphere MQ without needing to rewrite them.

The CICS bridge is the component of WebSphere MQ for z/OS that allows direct access from DataPower to applications on your CICS system. The CICS applications that are called by the CICS bridge will not make any WebSphere MQ calls (the CICS bridge enables implicit MQI support). Therefore, you can re-engineer your existing applications that were controlled by 3270-connected terminals to be controlled by WebSphere MQ messages, without having to rewrite, recompile, or relink-edit them.

DataPower uses the CICS bridge header (the MQCIH structure) in the message data to ensure that the applications can execute as they did when driven by terminals. The CICS bridge header in the message data allows DataPower to run a program or transaction on CICS and get a response back. This method is possible because the XI50z can securely connect to the queue manager on z/OS to which the CICS region is connected over the private IEDN network and send/receive messages from the CICS Bridge.

A CICS program can be invoked using the EXEC CICS LINK command. It must conform to the DPL subset of the CICS API, that is, it must not use the CICS terminal or syncpoint facilities. A CICS transaction, however, is designed to run on a 3270 terminal. This transaction can use basic mapping support (BMS) or terminal control (TC) commands. It can be conversational or part of a pseudoconversation. It is permitted to issue syncpoints. For information about the transactions that can be run, see the *CICS Transaction Server for z/OS V4.1: External Interfaces Guide*, SC34-7019-02.

Running CICS DPL programs

The necessary data to run the program is provided in the WebSphere MQ message. The bridge builds a COMMAREA from this data and runs the program using EXEC CICS LINK. Figure 3-12 shows the sequence of actions taken to process a single message to run a CICS DPL program.

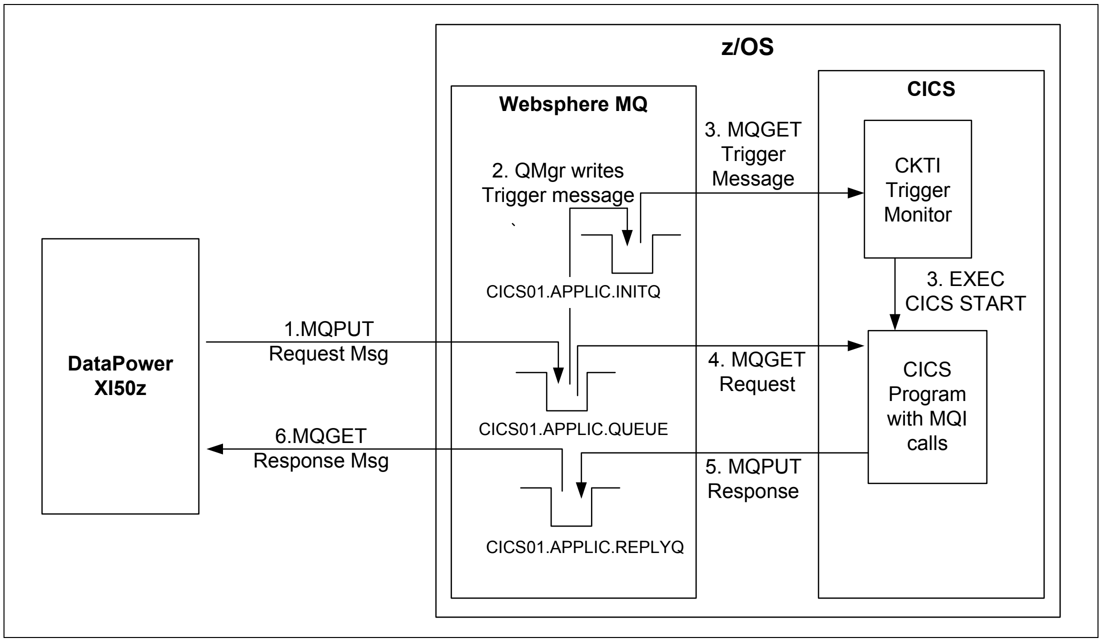


Figure 3-12   CICS MQ Bridge: Calling a DPL program

The following procedure documents each numbered step in Figure 3-12 and explains what happens:

1. A message, with a request to run a CICS program, is put on the request queue.

2. The CICS bridge monitor task, which is constantly browsing the queue, recognizes that a `start unit of work` message is waiting (CorrelId=MQCI_NEW_SESSION).
3. Relevant authentication checks are made, and a CICS DPL bridge task is started with the appropriate authority, with a particular user ID (depending on the options that are used to start the bridge monitor).
4. The CICS DPL bridge task removes the message from the request queue.
5. The CICS DPL bridge task builds a COMMAREA from the data in the message and issues an EXEC CICS LINK for the program that is requested in the message.
6. The program returns the response in the COMMAREA that is used by the request.
7. The CICS DPL bridge task reads the COMMAREA, creates a message, and puts it on the reply-to queue that is specified in the request message. All response messages (normal and error, requests, and replies) are put to the reply-to queue with default context.
8. The CICS DPL bridge task ends. If this message is the last flow in the transaction, the transaction ends. If it is not the last message, the transaction waits until the next message is received or the specified timeout interval expires.

Running CICS 3270 transactions

The WebSphere MQ message provides the necessary data to run the transaction. The CICS transaction runs as though it has an actual 3270 terminal, but instead it uses one or more MQ messages to communicate between the CICS transaction and the WebSphere MQ application.

Unlike traditional 3270 emulators, the bridge does not work by replacing the VTAM flows with WebSphere MQ messages. Instead, the message consists of a number of parts called *vectors*, each of which corresponds to an EXEC CICS request. Therefore, the application is talking directly to the CICS transaction, rather than through an emulator, using the actual data, which is known as application data structures (ADS), that is used by the transaction.

Figure 3-13 shows the sequence of actions taken to process a single message to run a CICS 3270 transaction.

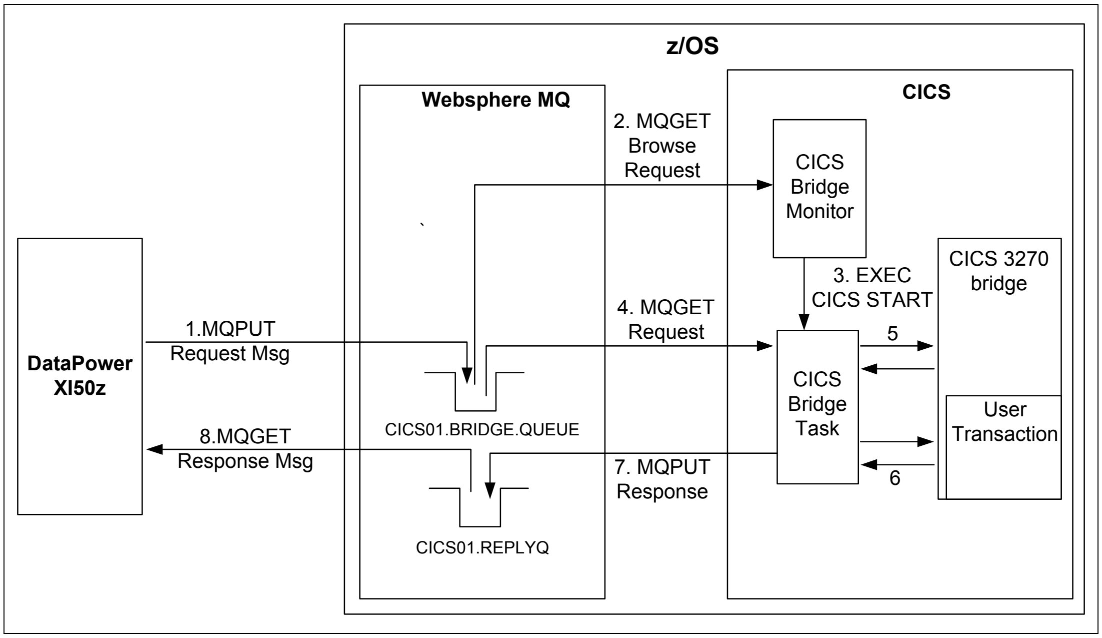


Figure 3-13 CICS MQ Bridge: Calling a 3270 transaction

The following procedure documents each step in Figure 3-13 on page 120 and explains what happens:

1. A message, with a request to run a CICS transaction, is put on the request queue.
2. The CICS bridge monitor task, which is constantly browsing the queue, recognizes that a *start unit of work* message is waiting (CorrelId=MQCI_NEW_SESSION).
3. Relevant authentication checks are made, and a CICS 3270 bridge task is started with the appropriate authority with a particular user ID (depending on the options that are used to start the bridge monitor).
4. The WebSphere MQ-CICS bridge removes the message from the queue and changes the task to run a user transaction.
5. Vectors in the message provide data to answer all terminal-related input EXEC CICS requests in the transaction.
6. Terminal-related output EXEC CICS requests result in output vectors being built.
7. The WebSphere MQ-CICS bridge builds all the output vectors into a single message and puts this message on the reply-to queue.
8. The CICS 3270 bridge task ends. If this message is the last flow in the transaction, the transaction ends. If it is not the last message, the transaction waits until the next message is received or the specified timeout interval expires.

The following basic steps show DataPower integrating with CICS. Note that the installation verification programs from CICS installation were used for this scenario. The scenario covers the CICS Bridge calling a DPL program. In an actual business scenario, there will be message transformation and processing per business requirements. The purpose of this specific scenario is to highlight the minimal steps that are required for the CICS MQ Bridge to accept and process the request message.

Figure 3-14 describes the scenario we are building.

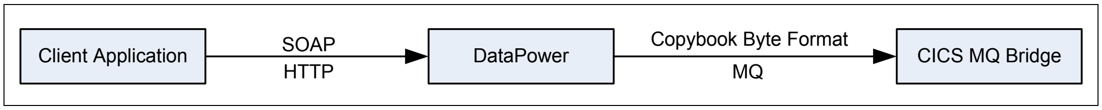
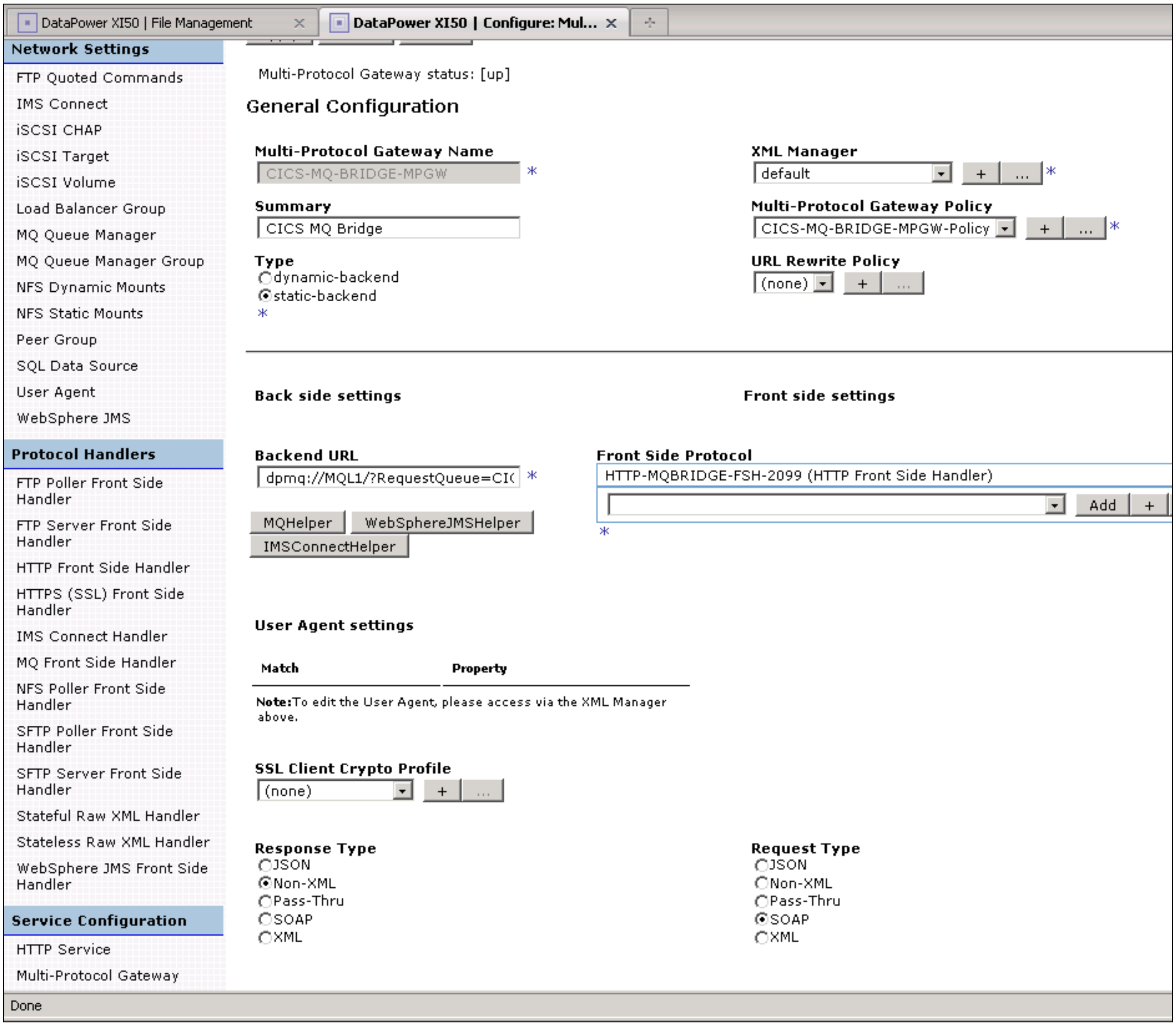


Figure 3-14 DataPower Integration with CICS MQ Bridge

Figure 3-15 shows the Multi-Protocol Gateway general configuration window for this scenario.



Multi-Protocol Gateway status: [up]

General Configuration

Multi-Protocol Gateway Name: CICS-MQ-BRIDGE-MPGW *

Summary: CICS MQ Bridge

Type: ○ dynamic-backend ● static-backend *

XML Manager: default *

Multi-Protocol Gateway Policy: CICS-MQ-BRIDGE-MPGW-Policy *

URL Rewrite Policy: (none)

Back side settings

Backend URL: dpmq://MQL1/?RequestQueue=CI(*

Front side settings

Front Side Protocol: HTTP-MQBRIDGE-FSH-2099 (HTTP Front Side Handler) *

User Agent settings

Match	Property

Note:To edit the User Agent, please access via the XML Manager above.

SSL Client Crypto Profile: (none)

Response Type: ○ JSON ● Non-XML ○ Pass-Thru ○ SOAP ○ XML

Request Type: ○ JSON ○ Non-XML ○ Pass-Thru ● SOAP ○ XML

Figure 3-15 Multi-Protocol Gateway configuration window for the CICS MQ Bridge

We set the following information in Figure 3-15:

- The Backend connection type is set to **static-backend**.
- We set the Backend URL connection string to:

  `dpmq://MQL1/?RequestQueue=CICS01.BRIDGE.QUEUE;ReplyQueue=CSQ4SAMP.B2.REPLY.1;ParseHeaders=true`

  We explain the following information in this Backend URL connection string:

  – `MQL1` is the name of the DP MQ object that points to the z/OS Queue Manager.

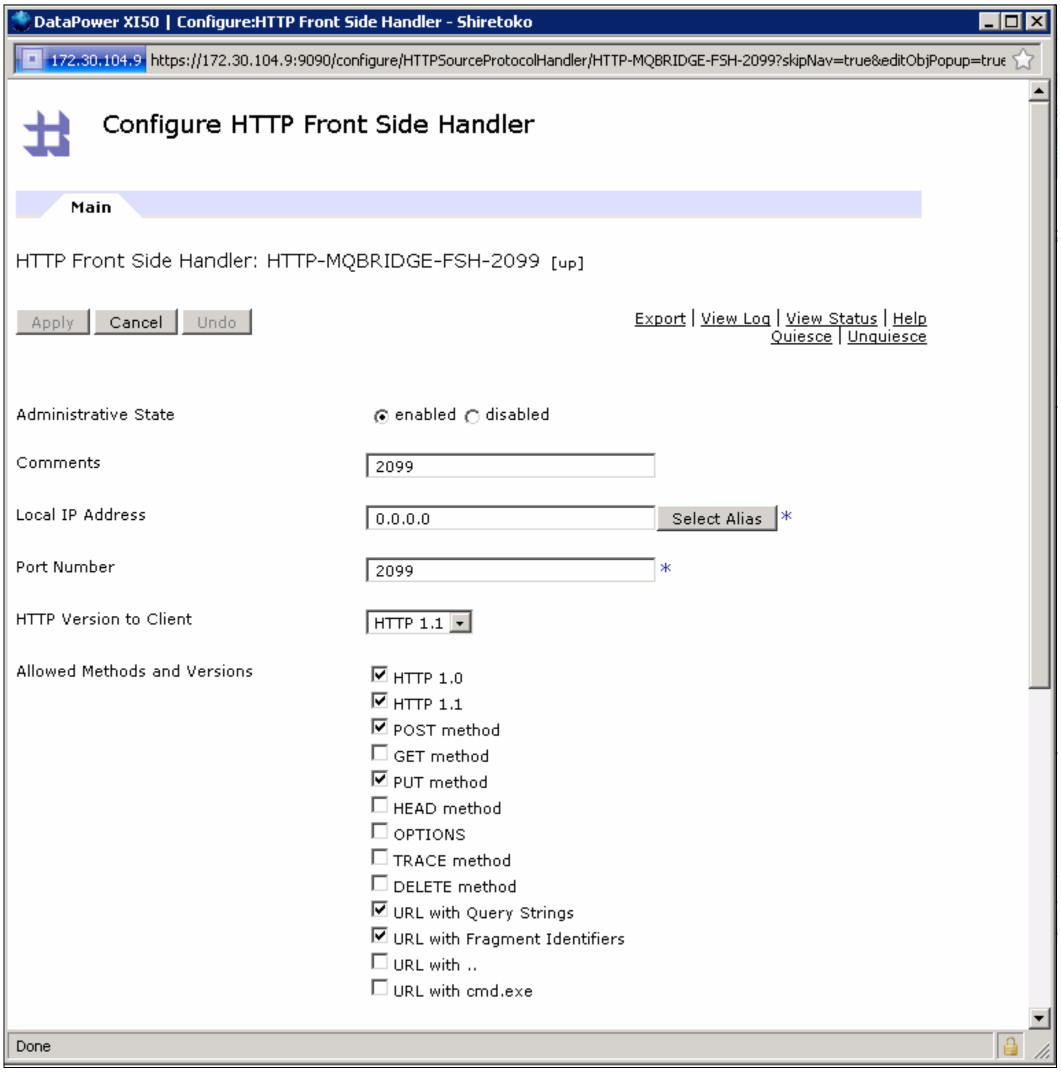
  – `RequestQueue` is the queue on which the request message is put by DataPower.

  – `ReplyQueue` is the queue that DataPower monitors for the response message from the CICS MQ Bridge, after it places the request message on the request queue.

  – `ParseHeaders` instruct DataPower to parse the MQCIH header into a header node before passing control to the Response rule.

- The Request Type is set to **SOAP**, because we will send it a SOAP XML request message.
- The Response Type is set to **Non-XML**, because the back-end CICS program will send back a byte stream, which conforms to a COBOL copybook structure.
- The Front Side Handler that listens for client application request messages is set to listen on port 2099.

All other parameters in the Front Side Handler contain the default values. Figure 3-16 shows the Front Side Handler configuration window.



DataPower XI50 | Configure:HTTP Front Side Handler - Shiretoko
172.30.104.9 https://172.30.104.9:9090/configure/HTTPSourceProtocolHandler/HTTP-MQBRIDGE-FSH-2099?skipNav=true&editObjPopup=true
Main
Apply
Cancel
Undo
Export | View Log | View Status | Help
Quiesce | Unquiesce
Select Alias
Done

Configure HTTP Front Side Handler

HTTP Front Side Handler: HTTP-MQBRIDGE-FSH-2099 [up]

Administrative State ● enabled ○ disabled

Comments 2099

Local IP Address 0.0.0.0 *

Port Number 2099 *

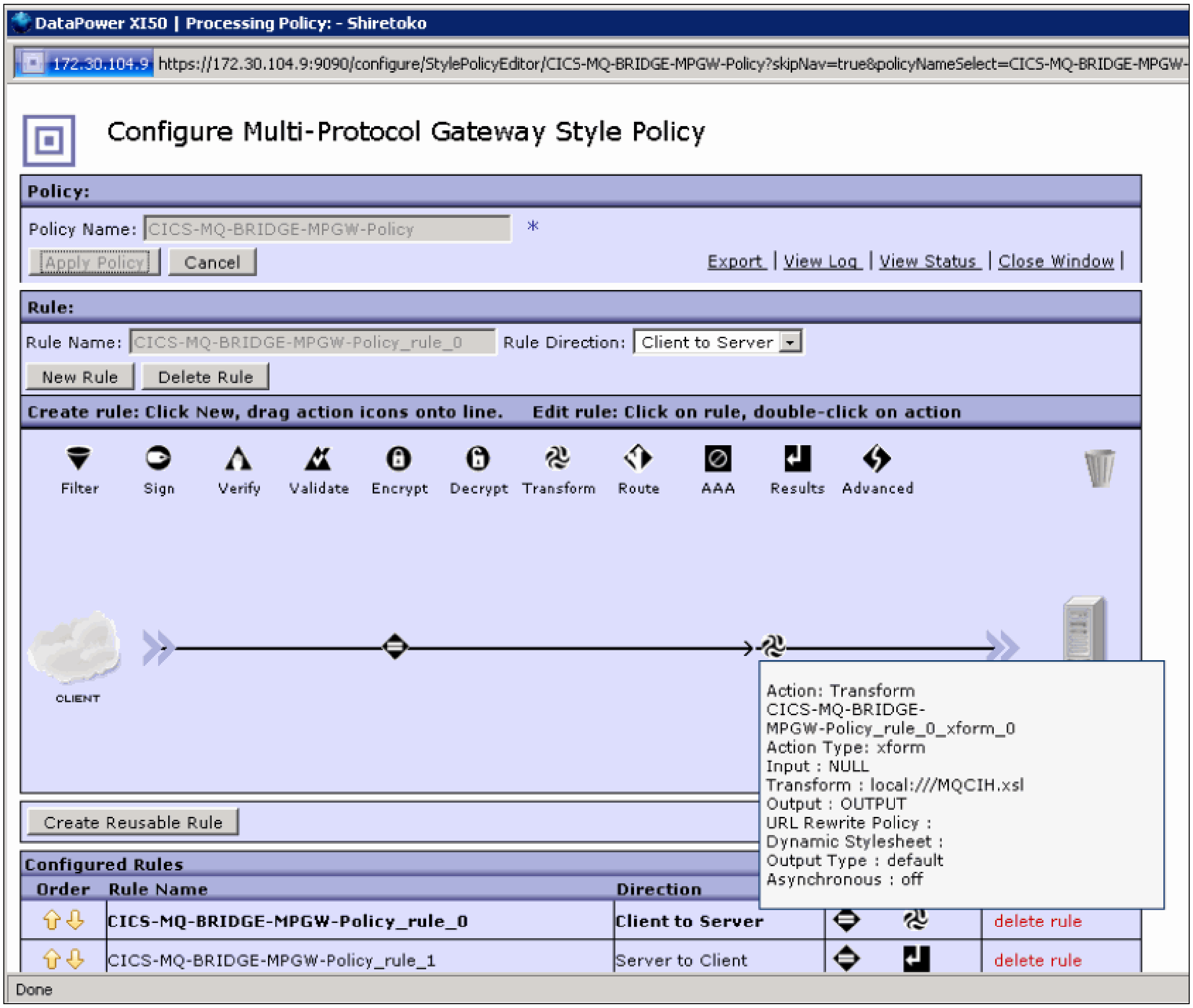
HTTP Version to Client HTTP 1.1

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

Figure 3-16 CICS MQ Bridge Gateway: Front Side Handler

We configured the policy rule for test purposes. The policy rule contains the minimum number of actions to drive the back-end CICS DPL sample program, as shown in Figure 3-17.



DataPower XI50 | Processing Policy: - Shiretoko

172.30.104.9 https://172.30.104.9:9090/configure/StylePolicyEditor/CICS-MQ-BRIDGE-MPGW-Policy?skipNav=true&policyNameSelect=CICS-MQ-BRIDGE-MPGW-

Configure Multi-Protocol Gateway Style Policy

Policy:

Policy Name: CICS-MQ-BRIDGE-MPGW-Policy *

Rule:

Rule Name: CICS-MQ-BRIDGE-MPGW-Policy_rule_0 Rule Direction: Client to Server

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

Action: Transform CICS-MQ-BRIDGE-MPGW-Policy_rule_0_xform_0
Action Type: xform
Input : NULL
Transform : local:///MQCIH.xsl
Output : OUTPUT
URL Rewrite Policy :
Dynamic Stylesheet :
Output Type : default
Asynchronous : off

Configured Rules

Order	Rule Name	Direction		
⇧⇩	**CICS-MQ-BRIDGE-MPGW-Policy_rule_0**	**Client to Server**		delete rule
⇧⇩	CICS-MQ-BRIDGE-MPGW-Policy_rule_1	Server to Client		delete rule

Done

Figure 3-17 Multi-Protocol Gateway Policy Rule for the CICS MQ Bridge

The Request rule that is displayed contains one Transform action that calls the stylesheet `MQCIH.xsl`. In order to keep it simple, this action accepts no input and sends constant output that is generated by the stylesheet.

The Response rule is a simple pass-through rule that passes the byte-stream response through “as is” after parsing the MQCIH header.

Figure 3-18 on page 125 lists the source code for the stylesheet.

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

    <xsl:output method="text"/>

    <xsl:template match="/">
        <!-- populate the mandatory MQMD fields -->
        <xsl:variable name="MQMDNodeset">
          <MQMD>
            <Format>MQCICS</Format>
            <CorrelId>
               <xsl:value-of
select="'414D51214E45575F53455353494F4E5F434F5252454C4944'"/>
            </CorrelId>
            <ReplyToQ>
              <xsl:value-of select="'CSQ4SAMP.B2.REPLY.1'"/>
            </ReplyToQ>
          </MQMD>
        </xsl:variable>
        <!-- serialize the nodeset for transport -->
        <xsl:variable name="mqmdStr">
            <dp:serialize select="$MQMDNodeset" omit-xml-decl="yes"/>
        </xsl:variable>
        <!-- set the MQMD request header value -->
        <dp:set-http-request-header name="'MQMD'" value="$mqmdStr"/>

        <!-- populate the mandatory MQCIH fields -->
        <xsl:variable name="MQCIHNodeset">
          <MQCIH>
            <!-- set MQCIH.Format to 'MQSTR' -->
           <Format>MQSTR</Format>
           <!-- set MQCIH.UOWControl to 'MQCUOWC_ONLY'  -->
           <UOWControl>273</UOWControl>
           <!-- MQCIH.LinkType to 'MQCLT_PROGRAM'  -->
           <LinkType>1</LinkType>
         </MQCIH>
        </xsl:variable>
        <!-- serialize the nodeset for transport -->
        <xsl:variable name="mqcihStr">
            <dp:serialize select="$MQCIHNodeset" omit-xml-decl="yes"/>
        </xsl:variable>
        <!-- set the MQCIH request header value -->
        <dp:set-http-request-header name="'MQCIH'" value="$mqcihStr"/>
        <!-- Hard coded byte stream that forms the message body,
        the first 8 chars of the message body constitute
        the name of the CICS program to be called -->
    <xsl:value-of select="'DFHOXCMN01INQS00c       001000000000000
000      0000000'"/>
    </xsl:template>
</xsl:stylesheet>
```

Figure 3-18 The MQCIH.xsl stylesheet executed in the Transform action

You must set the following mandatory fields in the MQMD message header:

- `MQMD.Format`: This field contains the value MQCICS to indicate that the MQCIH header follows.
- `MQMD.CorrelId`: This field contains the byte-stream equivalent MQCI_NEW_SESSION to notify the CICS bridge that this field is the start of a new session.
- `MQMD.ReplyToQ`: This field contains the Reply queue into which the CICS Bridge needs to place the response.

You must set the following mandatory fields in the MQCIH message header:

- `MQCIH.Format`: This field contains the value MQSTR to indicate that the body needs to be converted to the code page of the host queue manager.
- `MQCIH.UOWControl`: This field contains the constant equal to MQCUOWC_ONLY and tells the CICS bridge to start the unit of work, perform the function, and then commit the unit of work.
- `MQCIH.LinkType`: This field contains the constant value equivalent to MQCLT_PROGRAM, which tells the CICS bridge to call the DPL program that is named in the first eight characters of the message body. If the program name is shorter than eight bytes, it needs to be padded with blanks.

In the sample scenario that we created, the byte-stream body of the message that is sent to the request queue is a hard-coded byte stream that is embedded as the last line of the stylesheet. In an actual client scenario, the body of the message is usually generated by WebSphere Transformation Extender Map for DataPower in a subsequent binary transformation action. Also, note that the first eight characters of the message body need to be the name of the CICS program, which, in this case, is DFH0XCMN.

3.2.2 Integration with CICS by way of Web Services support

In this integration pattern, the DataPower XI50z receives a request message from a client application through the external network. The DataPower XI50z performs gateway security functions as required on the request message. It then processes the message, transforming the incoming message to the format that is required by the CICS Web Service and encapsulating the request in a SOAP envelope with the appropriate SOAP headers.

The DataPower XI50z transfers the SOAP message to the z/OS LPAR running the CICS subsystem over the secure IEDN.

The CICS TCP/IP listener performs the following tasks:

1. The listener receives the message and passes it to another transaction for pipeline processing.
2. In the case of an HTTP transport, the Tcpipservice that is listening on a specific port receives the message and the web attach transaction passes it to a message handler in an appropriate pipeline.
3. A message handler in the pipeline extracts the message from the body of the SOAP envelope.
4. The extracted message is passed to a data mapper, which transforms the message to the format that is required by the CICS program.
5. The transformed message is then sent to the CICS program using the COMMAREA or container. The CICS program completes the processing of the message.

6. The response is a message that is passed back to the pipeline, wrapped in a SOAP envelope, and sent back to the XI50z as the HTTP Response.

The XI50z performs any additional processing and transformation that might be required on the response message and, then, routes it back to the requesting client application.

3.3 Connecting with IMS

This section addresses the integration of the DataPower XI50z with IMS on z/OS. IMS-based application programs have been serving the critical business needs of organizations for years. The costs and risks that are associated with rebuilding these applications are significantly high, which makes enabling them for reuse as services in an SOA a winning proposition for all companies. The DataPower XI50z gives IMS the flexibility and agility to quickly adapt to an SOA-based framework. Therefore, this approach provides modern applications that use the latest technologies, such as WEB 2.0, access to all the valuable assets that are contained in IMS systems.

Figure 3-19 outlines the integration patterns that can be used by the DataPower XI50z to integrate and use the IMS IT assets of an organization with a minimal development and testing effort.

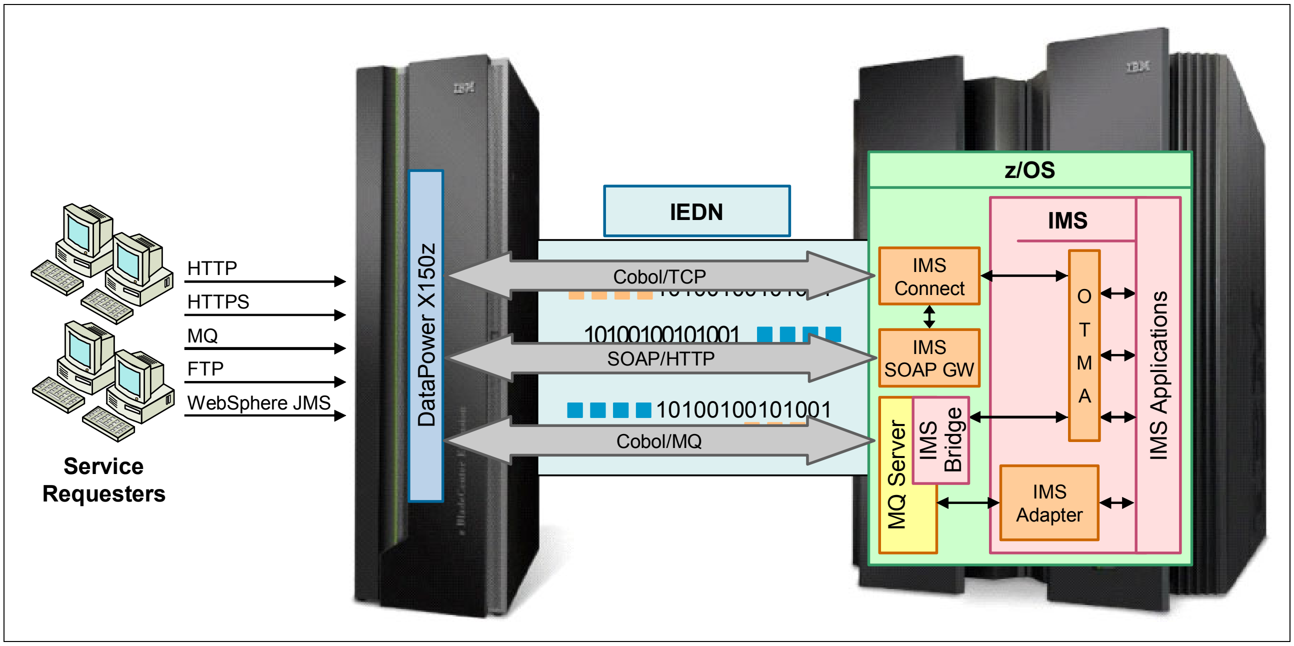


Figure 3-19 IMS integration scenarios

3.3.1 WebSphere MQ-IMS bridge

This section discusses how WebSphere MQ works with IMS. The IMS adapter allows you to connect your queue manager to IMS and enables IMS applications to use the MQI.

Additionally, the WebSphere MQ-IMS bridge enables applications to run an IMS application that does not use the MQI. Therefore, you can use your existing applications with WebSphere MQ without needing to rewrite them.

We discuss both options in detail in this section.

The IMS adapter

The IMS adapter is the interface between IMS application programs and a WebSphere MQ subsystem. It makes it possible for IMS application programs to use the MQI.

The IMS adapter receives and interprets requests for access to WebSphere MQ using the External Subsystem Attach Facility (ESAF) that is provided by IMS. The *IMS Customization Guide*, SC18-7817-04, describes this facility. Usually, IMS connects to WebSphere MQ automatically without operator intervention.

The WebSphere MQ adapters enable various application environments to send and receive messages through a message queuing network. The IMS adapter is the interface between IMS application programs and a WebSphere MQ subsystem. It makes it possible for IMS application programs to use the MQI.

The adapter supports a two-phase commit protocol for changes that are made to resources that are owned by WebSphere MQ with IMS acting as the syncpoint coordinator. The IMS adapter does not support conversations where IMS is not the syncpoint coordinator, for example, Advanced Program-to-Program Communication (APPC)-protected (SYNCLVL=SYNCPT) conversations.

The application programs and the IMS adapter run in the same address space. The queue manager is separate, in its own address space.

Every IMS program that issues one or more MQI calls needs to be link-edited to a suitable IMS language interface module, and the WebSphere MQ-supplied API stub program, CSQQSTUB (except when it uses the MQI calls dynamically). When the application issues an MQI call, the stub transfers control to the adapter through the IMS external subsystem interface, which manages the request processing by the message queue manager.

The adapter provides a trigger monitor transaction called CSQQTRMN. The IMS trigger monitor, CSQQTRMN, is a WebSphere MQ-supplied IMS application that starts an IMS transaction when a WebSphere MQ trigger event occurs. A trigger event occurs when a message is put onto a specific queue that is set up for triggering. The *WebSphere MQ Application Programming Guide,* SC34-6064-03, explains setting up triggering on the WebSphere MQ queue in detail.

Each copy of CSQQTRMN services a single initiation queue. When it has started, the trigger monitor runs until WebSphere MQ or IMS ends.

The APPLCTN macro for CSQQTRMN must specify SCHDTYP=PARALLEL, because the trigger monitor is a batch-oriented batch message processing program (BMP). IMS transactions that are started by the trigger monitor contain the following information:

- Blanks in the LTERM field of the input/output program communication block (IOPCB)
- The program specification block (PSB) name of the trigger monitor BMP in the Userid field of the IOPCB

If the target IMS transaction is protected by Security Server (previously known as RACF), you might need to define CSQQTRMN as a user ID to Security Server.

The XI50z interacts with the IMS applications by writing and reading from the queues on the queue manager that is attached to the IMS region. Figure 3-20 on page 129 is an illustration of how the XI50z interacts with IMS, using CSQQTRMN as the trigger monitor. The CSQQTRMN calls an IMS application program that has the capability to GET a request message, process it, and PUT the response message back on the queue for the XI50z to consume.

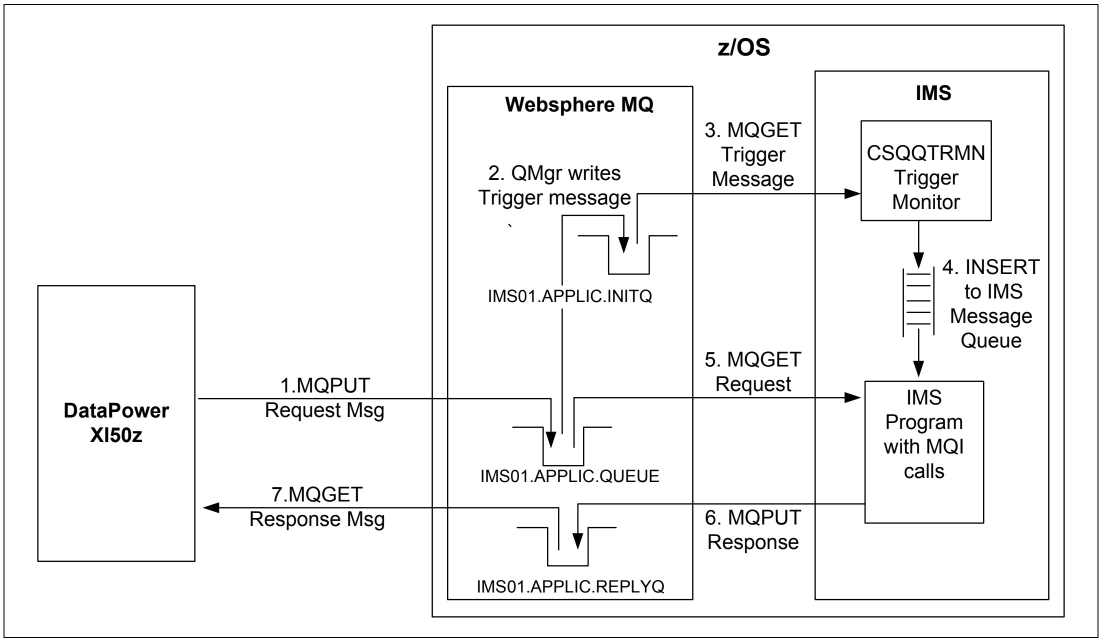


Figure 3-20 IMS adapter with CSQQTRMN trigger monitor

The following procedure documents each numbered step in Figure 3-20 and explains what happens:

1. The XI50z puts a message to an application message queue, which is set up as a triggered queue.
2. The queue manager then writes a trigger message, which contains user-defined data, to the initiation queue that has been specified for that request queue.
3. The specific instance of CSQQTRMN that monitors the initiation queue retrieves the trigger messages from the initiation queue.
4. CSQQTRMN schedules an IMS transaction by an INSERT (ISRT) to the IMS message queue.
5. IMS starts the requested application. The started IMS application reads the message from the application message queue and then processes it.
6. The IMS application writes a response to a response queue.
7. The XI50z reads the response message from the response queue.

The WebSphere MQ-IMS bridge

The WebSphere MQ-IMS bridge is the component of WebSphere MQ for z/OS that allows direct access from WebSphere MQ applications to applications on your IMS system (the bridge enables implicit MQI support). You can re-engineer your existing applications that were controlled by the 3270-connected terminals to be controlled by WebSphere MQ messages. You do not need to rewrite, recompile, or re-link them. The bridge is an IMS Open Transaction Manager Access (OTMA) client.

In bridge applications, there are no WebSphere MQ calls within the IMS application. The application gets its input using a GET UNIQUE (GU) to the IOPCB and sends its output using an ISRT to the IOPCB. WebSphere MQ applications use the IMS header (the MQIIH structure) in the message data to ensure that the applications can execute as they did when driven by non-programmable terminals. If you use an IMS application that processes multi-segment messages, note that all segments must be contained within one WebSphere MQ message.

One WebSphere MQ Queue Manager can connect to multiple IMS control regions, and one IMS control region can connect to multiple WebSphere MQ Queue Managers. The only restriction is that they must all belong to the same z/OS cross-system coupling facility (XCF) group and must all be in the same sysplex.

The IMS OTMA facility is a transaction-based *connection-less* client/server protocol that runs on IMS Version 5.1 or later. It functions as an interface for host-based communications servers accessing IMS Transaction Manager (TM) applications through the z/OS XCF.

The OTMA enables clients to connect to IMS to provide high performance for interactions between clients and IMS for a large network or large number of sessions. You implement OTMA in a z/OS sysplex environment. Therefore, the domain of OTMA is restricted to the domain of XCF. Figure 3-21 shows how the WebSphere MQ-IMS bridge connects with IMS.

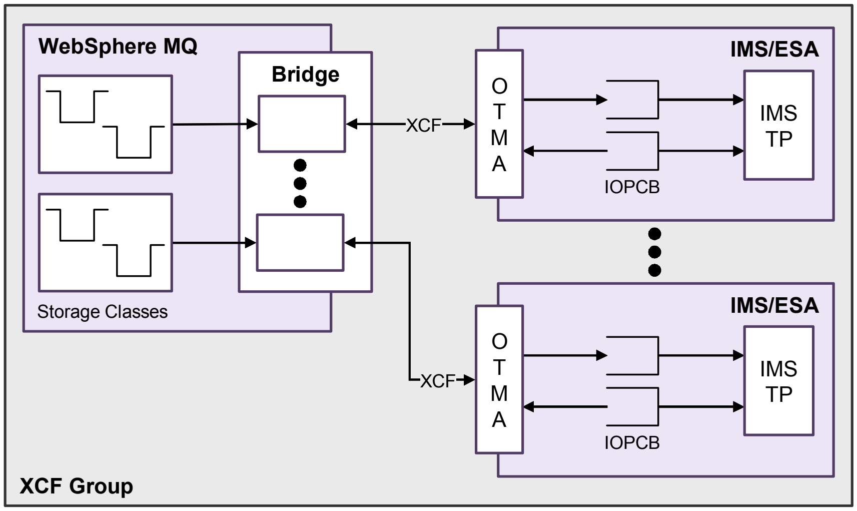


Figure 3-21 WebSphere MQ-IMS bridge

The WebSphere MQ-IMS bridge is code in the WebSphere MQ Queue Manager, and it does not require connecting WebSphere MQ to IMS through ESAF.

The WebSphere MQ-IMS bridge is an OTMA client that ships with WebSphere MQ Queue manager code. The IMS bridge communicates with IMS using specially defined queues for taking the messages off the queue and sending them to IMS using the IMS OTMA interface, as well as receiving the output messages through the OTMA interface. The storage class of the WebSphere MQ queue determines whether the queue is an OTMA queue. An OTMA queue is used to transmit messages to the WebSphere MQ-IMS bridge and the particular IMS partner to which the message data is sent.

As with all OTMAs and OTMA clients, WebSphere MQ (client) and the IMS control region (OTMA server) must be in the same XCF group. One WebSphere MQ Queue Manager can connect to multiple IMS control regions, and one IMS control region can connect to multiple WebSphere MQ Queue Managers. WebSphere MQ and IMS can be on separate z/OS LPARs in the same Parallel Sysplex.

To enable OTMA on WebSphere MQ, use the CSQ6SYSP macro to provide the OTMACON zPARM that specifies names for the following (XCFGroup, Member, Druexit, Age, or Tpipepfx). We used the values that are shown in Example 3-1 on page 131 for the MQ

OTMACON during the MQ IMS bridge use case. We verified the presence of message CSQ2010I for the successful connection to the partner.

Example 3-1 DIS SYSTEM: MQ command

```
CSQJ322I -MQL1 DISPLAY SYSTEM report ...
Parameter   Initial value          SET value
----------- --------------------- ----------------------
OPMODE      COMPAT  , 701
IDBACK      20
IDFORE      50
LOGLOAD     500000
CMDUSER     IBMUSR
QMCCSID     0
ROUTCDE     1
SMFACCT     YES
SMFSTAT     YES
STATIME     30
OTMACON
  GROUP     IMSLXCF
  MEMBER    MQL1
  DRUEXIT   DFSYDRU0
  AGE       2147483647
  TPIPEPFX  CSQ
```

For more information about MQ zPARM and the CSQ6SYSP macro, go to this website:

`http://publib.boulder.ibm.com/infocenter/wmqv7/v7r0/topic/com.ibm.mq.csqsav.doc/zs10580_.htm`

To enable OTMA on IMS, specify the following parameters in the DFSPBxx configuration member with the appropriate values:

- `OTMA=`
- `OTMANM=`
- `OTMASE=`
- `GRNAME=`

You can confirm the enablement of the IMS OTMA connection by examining the output of the DISPLAY OTMA command, as shown in Example 3-2, and the successful XCF connection.

Example 3-2 DISPLAY OTMA: IMS command

```
DFS4444I DISPLAY FROM ID=IMSL
+    GROUP/MEMBER      XCF-STATUS   USER-STATUS    SECURITY  TIB INPT
 SMEM
                         DRUEXIT  T/O
     IMSLXCF
     -IMSL             ACTIVE       SERVER         NONE        0 8000
     -IMSL               N/A        0
     -IMSLHWS          ACTIVE       ACCEPT TRAFFIC NONE        0 5000
     -IMSLHWS            HWSYDRU0 120
     -MQL1             ACTIVE       ACCEPT TRAFFIC NONE        0 5000
     -MQL1               DFSYDRU0 120
     *11290/195233*
```

For more information about IMS parameters, go to this website:

http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/topic/com.ibm.ims11.doc.ccg/ims_otma_admin_003.htm

To invoke an IMS transaction, the XI50z puts messages on a WebSphere MQ queue as usual. The WebSphere MQ queue has been specifically defined for the IMS OTMA interface. The messages contain IMS transaction data. The messages can have an IMS header (the MQIIH structure) or allow the WebSphere MQ-IMS bridge to make assumptions about the data in the message. The WebSphere MQ-IMS bridge then puts the message to an IMS queue for processing. The storage class of the WebSphere MQ queue determines whether the queue is an OTMA queue and the particular IMS partner to which the message data is sent.

Figure 3-22 shows the steps for DataPower integrating with IMS by way of the MQ-IMS Bridge queue. Note that we used the installation verification programs from the IMS installation for this scenario. The scenario has the XI50z putting a message to a queue that is configured to be an MQ-IMS Bridge queue, which will eventually invoke an IMS program. An actual client's business scenario also includes message transformation and processing per the business requirements. The purpose of this specific scenario is to highlight the minimal steps that are required on the XI50z to format a message for the MQ-IMS Bridge to accept and process the request message.

Figure 3-22 describes the scenario that we are building.

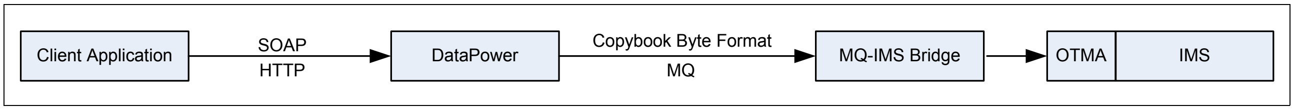
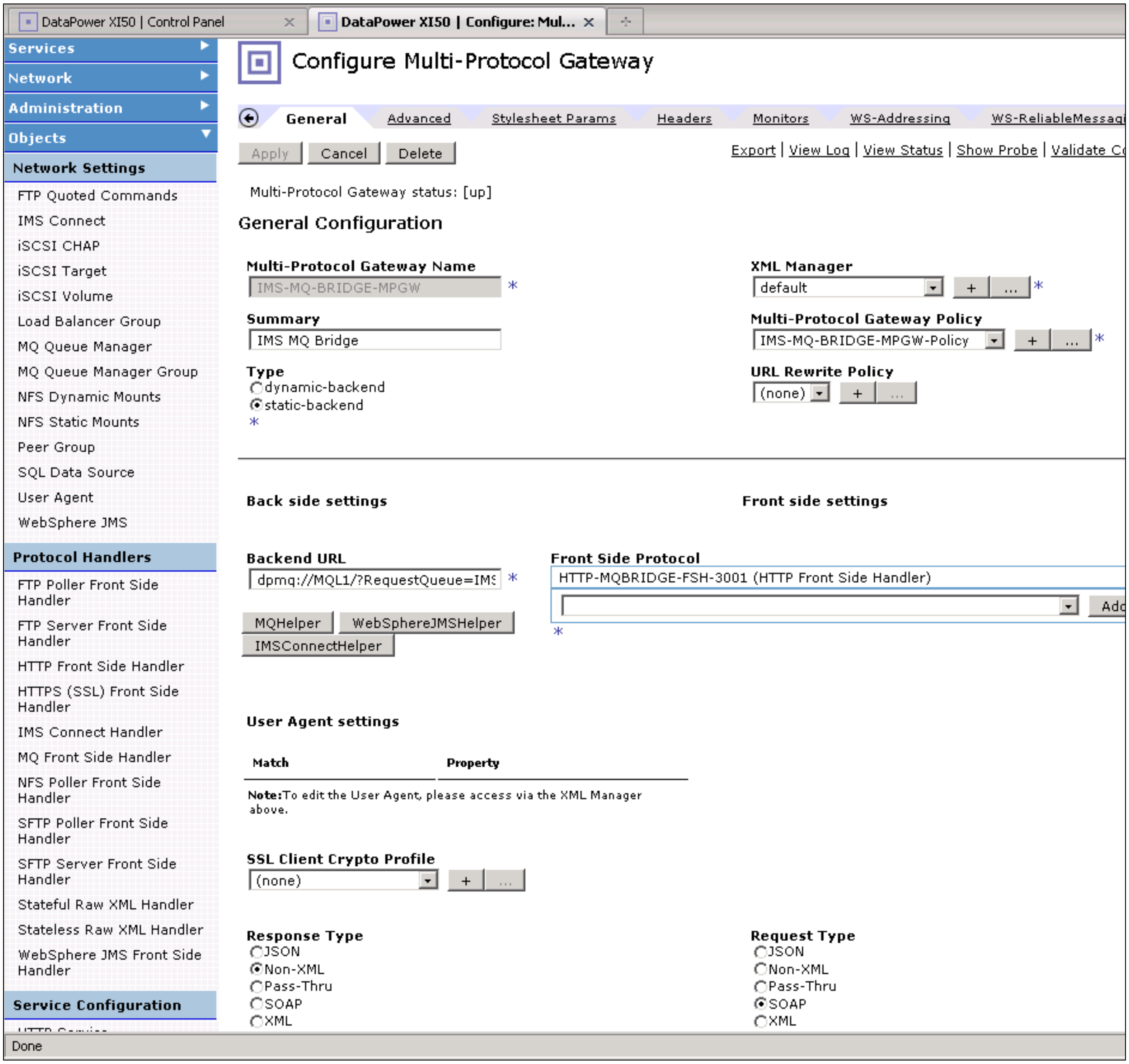


Figure 3-22 DataPower Integration with MQ-IMS bridge

We configured the multi-protocol gateway, which receives the messages to be transformed and put to the MQ-IMS bridge queue, as shown in Figure 3-18 on page 125.



Configure Multi-Protocol Gateway

Multi-Protocol Gateway status: [up]

General Configuration

Multi-Protocol Gateway Name: IMS-MQ-BRIDGE-MPGW *

Summary: IMS MQ Bridge

Type: ○ dynamic-backend ● static-backend *

XML Manager: default *

Multi-Protocol Gateway Policy: IMS-MQ-BRIDGE-MPGW-Policy *

URL Rewrite Policy: (none)

Back side settings

Backend URL: dpmq://MQL1/?RequestQueue=IMS *

Front side settings

Front Side Protocol: HTTP-MQBRIDGE-FSH-3001 (HTTP Front Side Handler) *

User Agent settings

Match	Property

Note: To edit the User Agent, please access via the XML Manager above.

SSL Client Crypto Profile: (none)

Response Type: ○ JSON ● Non-XML ○ Pass-Thru ○ SOAP ○ XML

Request Type: ○ JSON ○ Non-XML ○ Pass-Thru ● SOAP ○ XML

Figure 3-23 WebSphere MQ-IMS bridge Configure Multi-Protocol Gateway window

We set the following information in Figure 3-23:

- The Backend connection type is set to **static-backend**.
- We set the Backend URL connection string to:

  `dpmq://MQL1/?RequestQueue==IMS01.BRIDGE.QUEUE;ReplyQueue=CSQ4SAMP.B2.REPLY.1;ParseHeaders=true`

  We explain the following information in this Backend URL connection string:

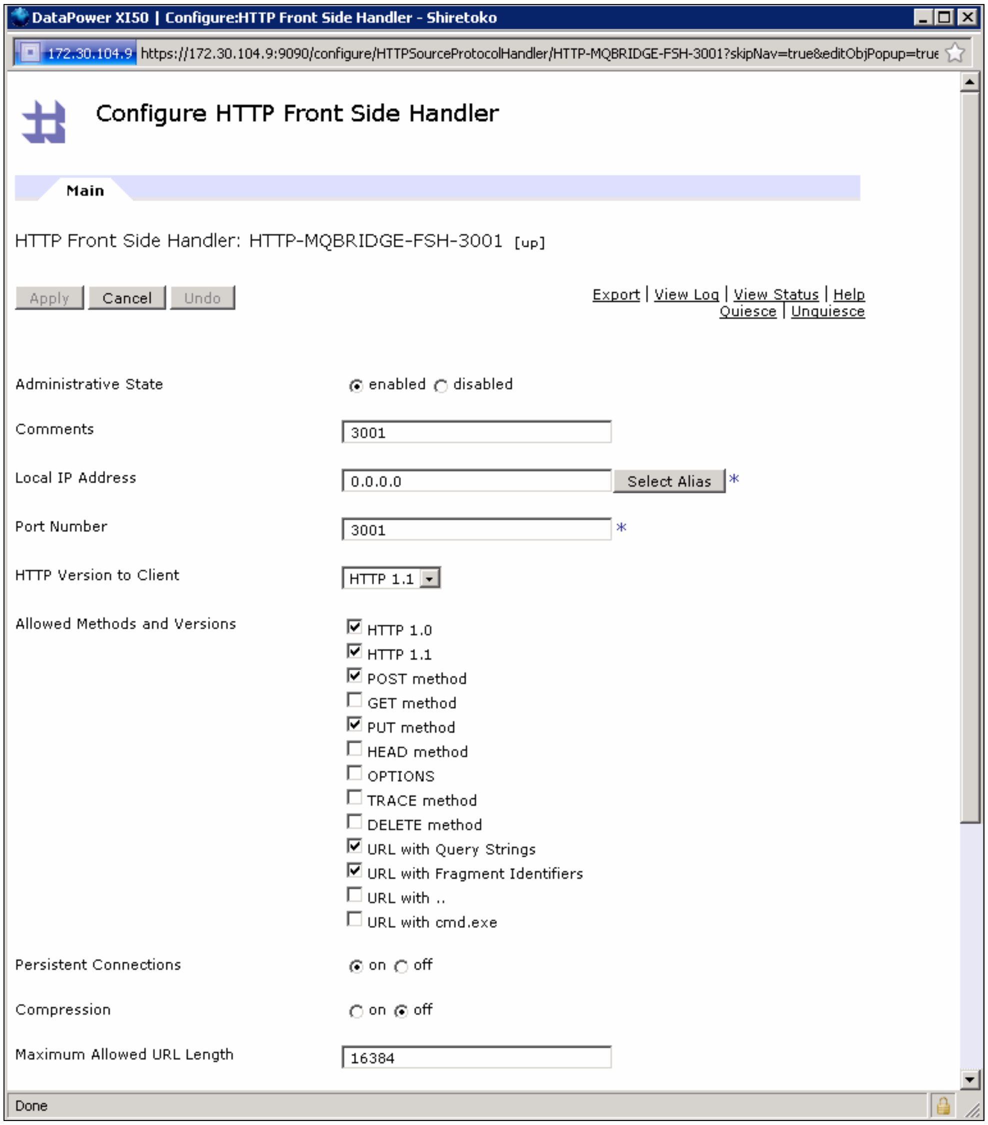
  – `MQL1` is the name of the DP MQ object that points to the z/OS Queue Manager.

  – `RequestQueue` is the MQ-IMS bridge queue on which the request message is put by DataPower.

– `ReplyQueue` is the MQ-IMS bridge queue which DataPower monitors for the response message from IMS.

– `ParseHeaders` instructs DataPower to parse the MQIIH header into a header node before passing control to the Response rule.

Figure 3-24 shows the Front Side Handler configuration window. We configured the HTTP Front Side Handler to listen on Port `3001` for incoming client requests.



DataPower XI50 | Configure:HTTP Front Side Handler - Shiretoko

172.30.104.9 https://172.30.104.9:9090/configure/HTTPSourceProtocolHandler/HTTP-MQBRIDGE-FSH-3001?skipNav=true&editObjPopup=true

Configure HTTP Front Side Handler

HTTP Front Side Handler: HTTP-MQBRIDGE-FSH-3001 [up]

Administrative State ● enabled ○ disabled

Comments 3001

Local IP Address 0.0.0.0 Select Alias *

Port Number 3001 *

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

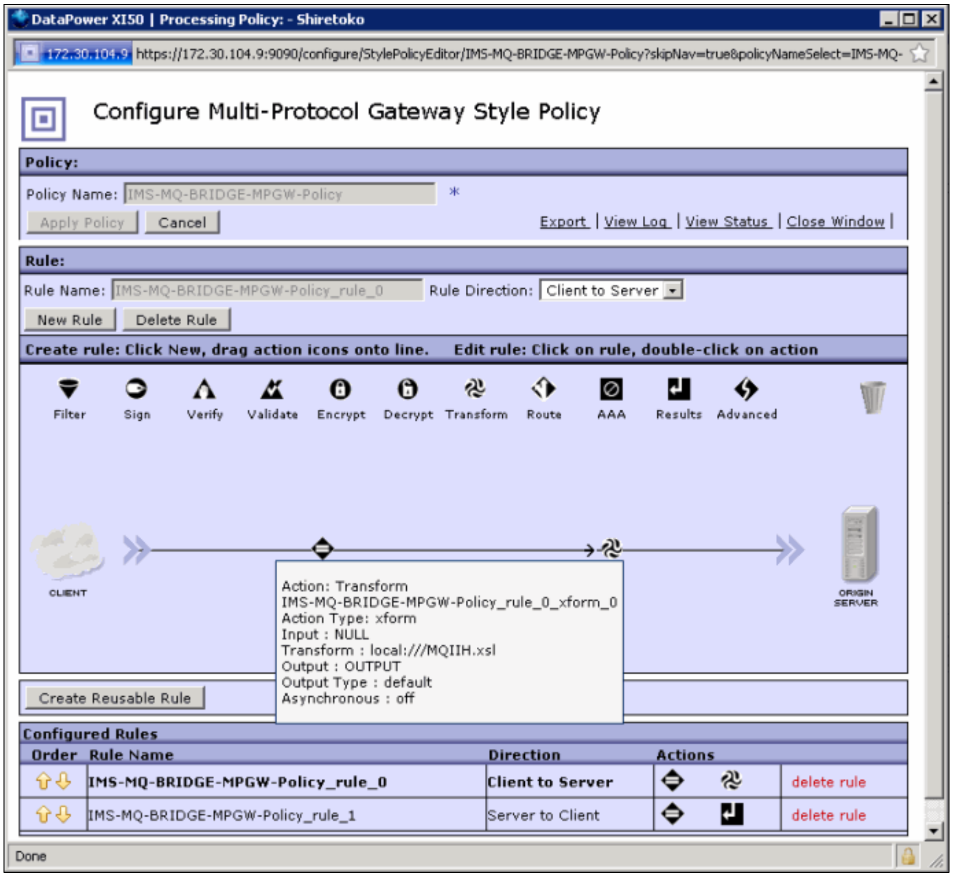
Persistent Connections ● on ○ off

Compression ○ on ● off

Maximum Allowed URL Length 16384

Figure 3-24 Front Side Handler for MQ-IMS Multi-Protocol Gateway

We configured the policy rule for test purposes. The policy rule contains the minimum number of required actions to send a byte-stream message with the MQIIH header to the MQ-IMS bridge queue to get a response from the back-end sample IMS program. Figure 3-25 shows the policy rule configuration.



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https://172.30.104.9:9090/configure/StylePolicyEditor/IMS-MQ-BRIDGE-MPGW-Policy?skipNav=true&policyNameSelect=IMS-MQ-

Configure Multi-Protocol Gateway Style Policy

Policy:

Policy Name: IMS-MQ-BRIDGE-MPGW-Policy *

Rule:

Rule Name: IMS-MQ-BRIDGE-MPGW-Policy_rule_0 Rule Direction: Client to Server

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

Action: Transform
IMS-MQ-BRIDGE-MPGW-Policy_rule_0_xform_0
Action Type: xform
Input : NULL
Transform : local:///MQIIH.xsl
Output : OUTPUT
Output Type : default
Asynchronous : off

Configured Rules

Order	Rule Name	Direction	Actions		
⇧⇩	**IMS-MQ-BRIDGE-MPGW-Policy_rule_0**	**Client to Server**	◆	✲	delete rule
⇧⇩	IMS-MQ-BRIDGE-MPGW-Policy_rule_1	Server to Client	◆	↲	delete rule

Done

Figure 3-25 The MQ-IMS bridge policy

The Request rule that is displayed contains one Transform action that calls the stylesheet `MQIIH.xsl`. To keep it simple, this action accepts no input and sends a hard-coded byte stream that is generated by the stylesheet.

The Response rule is a simple pass-through rule that passes the byte-stream response through after parsing the MQIIH header.

Figure 3-26 shows the source code for the stylesheet.

```
<?xml version="1.0" encoding="UTF-8"?>
<xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform" version="1.0"
    xmlns:dp="http://www.datapower.com/extensions"
    extension-element-prefixes="dp" exclude-result-prefixes="dp">
    <xsl:output method="xml"/>
    <xsl:template match="/">
        <!-- populate the mandatory MQMD fields -->
        <xsl:variable name="MQMDNodeset">
            <MQMD>
                <Format>MQIMS   </Format>
                <ReplyToQ>
                    <xsl:value-of select="'CSQ4SAMP.B2.REPLY.1'"/>
                </ReplyToQ>
            </MQMD>
        </xsl:variable>
        <!-- serialize the nodeset for transport -->
        <xsl:variable name="mqmdStr">
            <dp:serialize select="$MQMDNodeset" omit-xml-decl="yes"/>
        </xsl:variable>
        <!-- set the MQMD request header value -->
        <dp:set-http-request-header name="'MQMD'" value="$mqmdStr"/>
        <!-- Create MQIIH header to prefix the message data -->
        <xsl:variable name="MQIIHNodeset">
            <MQIIH>
                <Encoding>0</Encoding>
                <CodedCharSetId>1208</CodedCharSetId>
                <Format>MQSTR</Format>
                <Flags>0</Flags>
                <LTermOverride/>
                <MFSMapName/>
                <ReplyToFormat>MQSTR</ReplyToFormat>
                <Authenticator>IMSSOAP</Authenticator>
                <TranInstanceId>01234567890123456</TranInstanceId>
                <TranState>0</TranState>
                <CommitMode>1</CommitMode>
                <SecurityScope>0</SecurityScope>
                <Reserved/>
            </MQIIH>
        </xsl:variable>
        <!-- serialize the nodeset for transport -->
        <xsl:variable name="MQIIHstr">
            <dp:serialize select="$MQIIHNodeset" omit-xml-decl="yes"/>
        </xsl:variable>
        <!-- set the MQIIH request header value -->
        <dp:set-http-request-header name="'MQIIH'" value="$MQIIHStr"/>
        <!-- Hard coded byte stream that forms the message body, for the
purpose of this test -->
        <xsl:value-of select="‘96 OIVTNO     DISPLAY LAST1'"/>
    </xsl:template>
</xsl:stylesheet>
```

Figure 3-26 MQIIH stylesheet that is executed in the Transform action

You must set the following mandatory fields in the MQMD message header:

- MQMD.Format: This field contains the value MQIMS to indicate that the MQIIH header follows the MQMD header, as the next header.
- MQMD.ReplyToQ: This field contains the MQ-IMS bridge Reply queue where the response will be expected.

3.3.2 IMS Connect

IMS Connect is a TCP/IP server that enables TCP/IP clients to exchange messages with IMS Open Transaction Manager Access (OTMA). IMS Connect provides communication links between TCP/IP clients and IMS applications. It supports multiple TCP/IP clients accessing multiple data store resources.

The DataPower XI50z includes a client for IMS Connect, offering an alternative to WebSphere MQ for communicating with IMS COBOL applications. Multi-protocol gateways offer IMS Connect as a backside URL option. A new Front Side Handler for IMS Connect has also been added.

A common use case is to expose an IMS COBOL application as a web service with DataPower. You implement this use case with a Multi-Protocol Gateway with an HTTP Front Side Handler and an IMS Connect backside URL. You can develop SOAP <-> COBOL non-XML transformations with IBM WebSphere Transformation eXtender to perform the message mapping within the gateway's processing policy.

IMS Connect runs in a separate z/OS address space from IMS and provides a TCP/IP gateway for IMS. The DataPower XI50z accesses IMS through IMS Connect using an IMS Connect Client.

In our use case, we set up an IMS Connect and ODBM address spaces with minimum configuration. We do not set up security for simplicity. Example 3-3 shows our HWSCFGxx member.

Example 3-3 HWSCFGxx IMS Connect configuration member

```
HWS=(ID=IMSLHWS,XIBAREA=100,RACF=N)
 TCPIP=(EXIT=(HWSSMPL1),HOSTNAME=TCPIP,
 IPV6=N,PORTID=(9999,LOCAL))
 DATASTORE=(GROUP=IMSLXCF,ID=IMSLDS,MEMBER=IMSLHWS,
 TMEMBER=IMSL,DRU=HWSYDRU0)
 ODACCESS=(ODBMAUTOCONN=Y,IMSPLEX=(MEMBER=IMSLHWS,TMEMBER=PLEX1),
      DRDAPORT=(ID=9998,PORTTMOT=6000),ODBMTMOT=6000)
```

To verify the settings and connection to the data store, use the IMS Connect QUERY DATASTORE NAME(*) modify command or VIEWDS ALL to reply. Example 3-4 shows the output.

Example 3-4 QUERY DATASTORE NAME(*) modify command

```
HWSC0001I    DATASTORE=IMSLDS   STATUS=ACTIVE
HWSC0001I      GROUP=IMSLXCF  MEMBER=IMSLHWS
HWSC0001I      TARGET MEMBER=IMSL            STATE=AVAIL
HWSC0001I      DEFAULT REROUTE NAME=HWS$DEF
HWSC0001I      RACF APPL NAME=
HWSC0001I      OTMA ACEE AGING VALUE=2147483647
HWSC0001I      OTMA ACK TIMEOUT VALUE=120
```

```
HWSC0001I      OTMA MAX INPUT MESSAGE=5000
HWSC0001I      SUPER MEMBER NAME=      CMO ACK TOQ=
HWSC0001I    ODBM=IMSLOOD  STATUS=REGISTERED   ODBMRRS=Y
HWSC0001I      ALIAS=IMSL     STATUS=ACTIVE
```

Figure 3-27 shows the flow of the message between DataPower and IMS Connect.

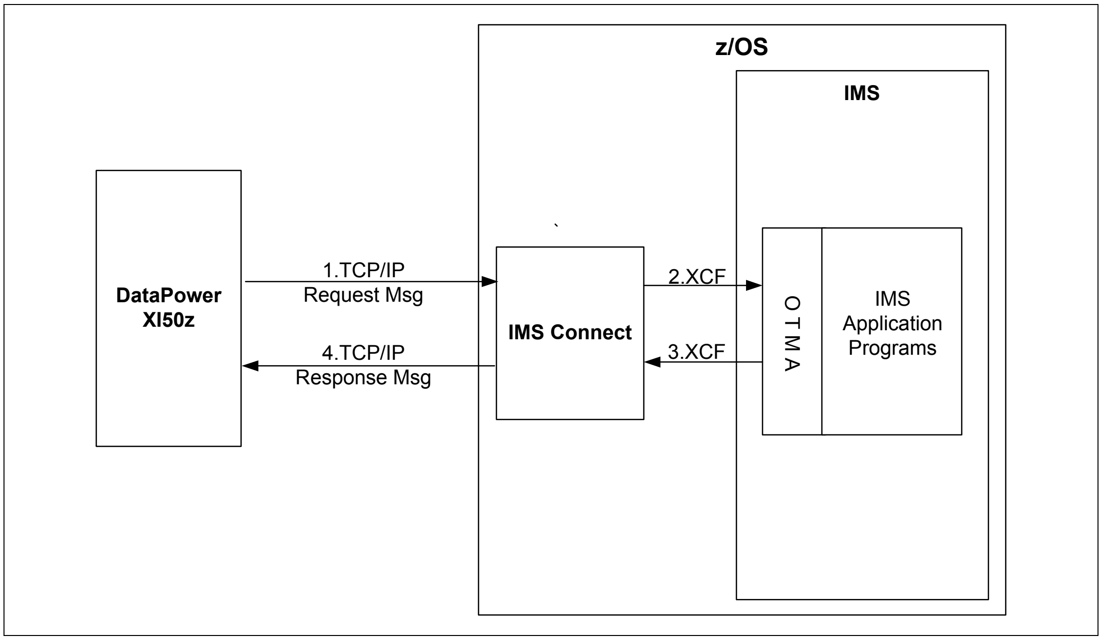


Figure 3-27 IMS Connect

The following procedure documents each numbered step in Figure 3-27 and explains what happens:

1. The IMS Client in DataPower establishes a TCP/IP socket with IMS Connect Server on z/OS using an IP address and port number and sends a request message to IMS Connect.
2. IMS Connect passes the incoming request to IMS by using the services of the z/OS cross-coupling facility (XCF).
3. The IMS Open Transaction Manager (OTMA) component of IMS receives the request. The IMS application processes the request. The IMS OTMA component returns the response to IMS Connect.
4. IMS Connect returns the response to the client.

The DataPower XI50z can expose services using several formats and protocols, thus supporting a wide range of clients. Services can be exposed and called using any combination of the typical protocols, such as HTTP, HTTPS, and WebSphere MQ, that are used for passing SOAP and XML messages in an SOA.

Next, we describe the required steps to configure DataPower to integrate with IMS by way of MQ Connect. Note that we used the installation verification programs from IMS installation for this scenario. In the scenario, the XI50z sends a message over TCP/IP to IMS Connect on z/OS. IMS Connect passes the message to the OTMA using the XCF, which then invokes an IMS program. An actual client's business scenario also includes message security actions, transformation actions, and other processing in the DataPower per business requirements, before sending the message onto IMS. The purpose of our specific scenario is to highlight the minimal steps that are required on the XI50z to send a message to IMS using IMS Connect.

Figure 3-28 shows the scenario that we are building.

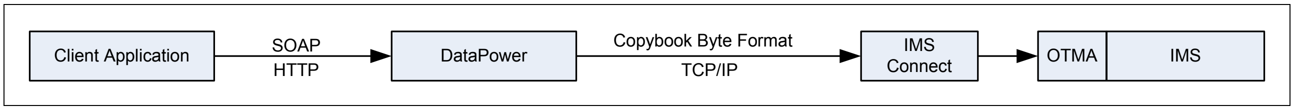
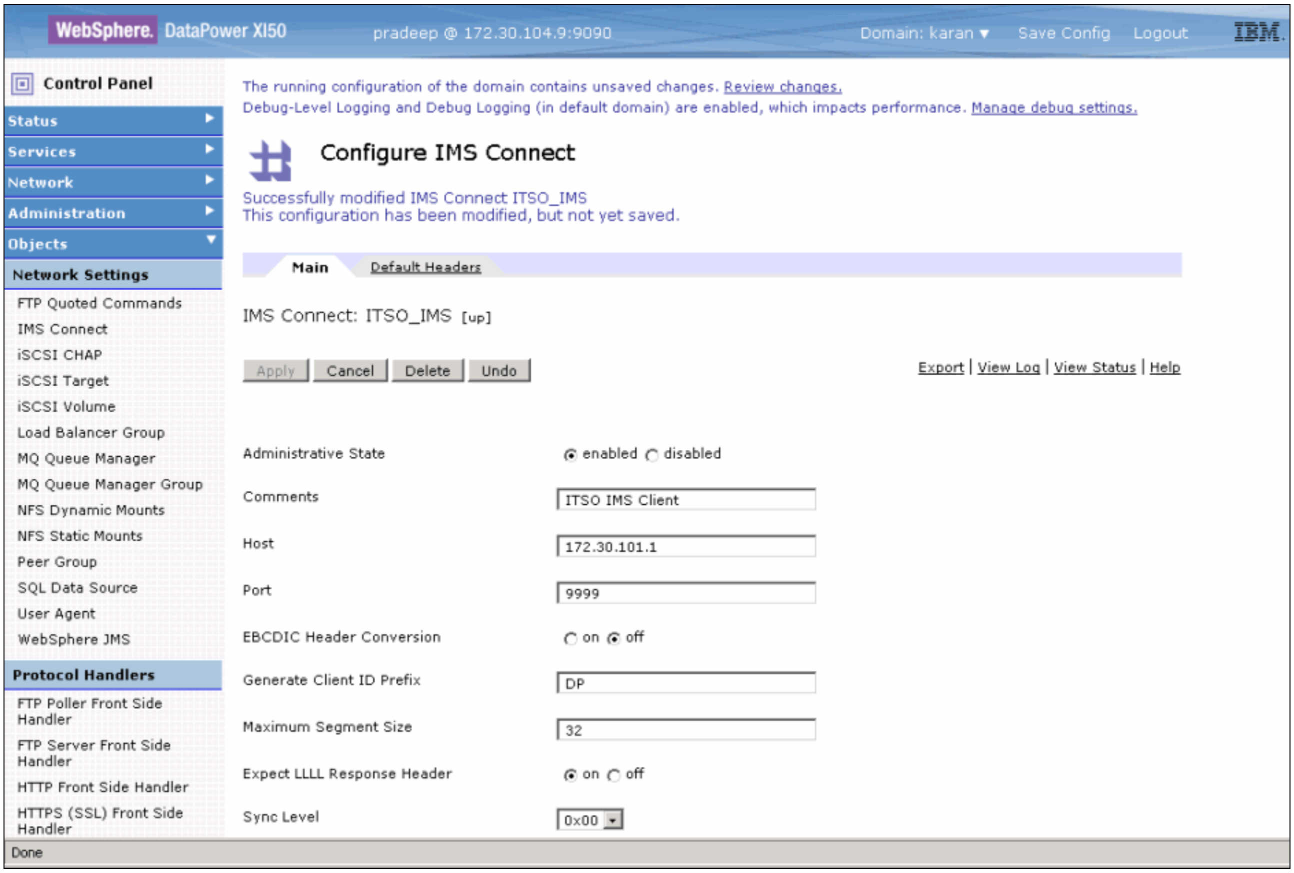


Figure 3-28 DataPower integration with IMS by way of IMS Connect

Figure 3-29 shows the required configuration details in the Configure IMS Connect client object window.



The running configuration of the domain contains unsaved changes. Review changes.
Debug-Level Logging and Debug Logging (in default domain) are enabled, which impacts performance. Manage debug settings.

Configure IMS Connect

Successfully modified IMS Connect ITSO_IMS
This configuration has been modified, but not yet saved.

IMS Connect: ITSO_IMS [up]

Administrative State	● enabled ○ disabled
Comments	ITSO IMS Client
Host	172.30.101.1
Port	9999
EBCDIC Header Conversion	○ on ● off
Generate Client ID Prefix	DP
Maximum Segment Size	32
Expect LLLL Response Header	● on ○ off
Sync Level	0x00

Figure 3-29 IMS Connect client configuration window on DataPower

We explain the following terms in reference to Figure 3-29:

- Host

  Enter the host name or IP address of the IMS Connect server.

- Port

  Enter the port number on which the IMS Connect server is running.

- EBCDIC Header Conversion

  You can turn this option on for converting the headers to EBCDIC. The IMS Connect exit typically can process EBCDIC data. Certain IMS Connect exits can handle both UTF-8 and EBCDIC. This conversion affects only the headers. Any data conversion needs to be done in the policy using transformation.

- Generate Client ID Prefix

  This two-letter prefix is for the generated client ID. DP is used, if you do not specify an ID.

- Maximum Segment Size

  Specify `0` (OFF) or an integer value in the range from 1 - 32, representing the segment size in kilobytes. The default is 0, which disables segmentation.

- Expect LLLL Response Header

  This value Indicates whether the response message includes an extra 4-byte LLLL header that specifies the total response message size back from IMS Connect. The default is off.

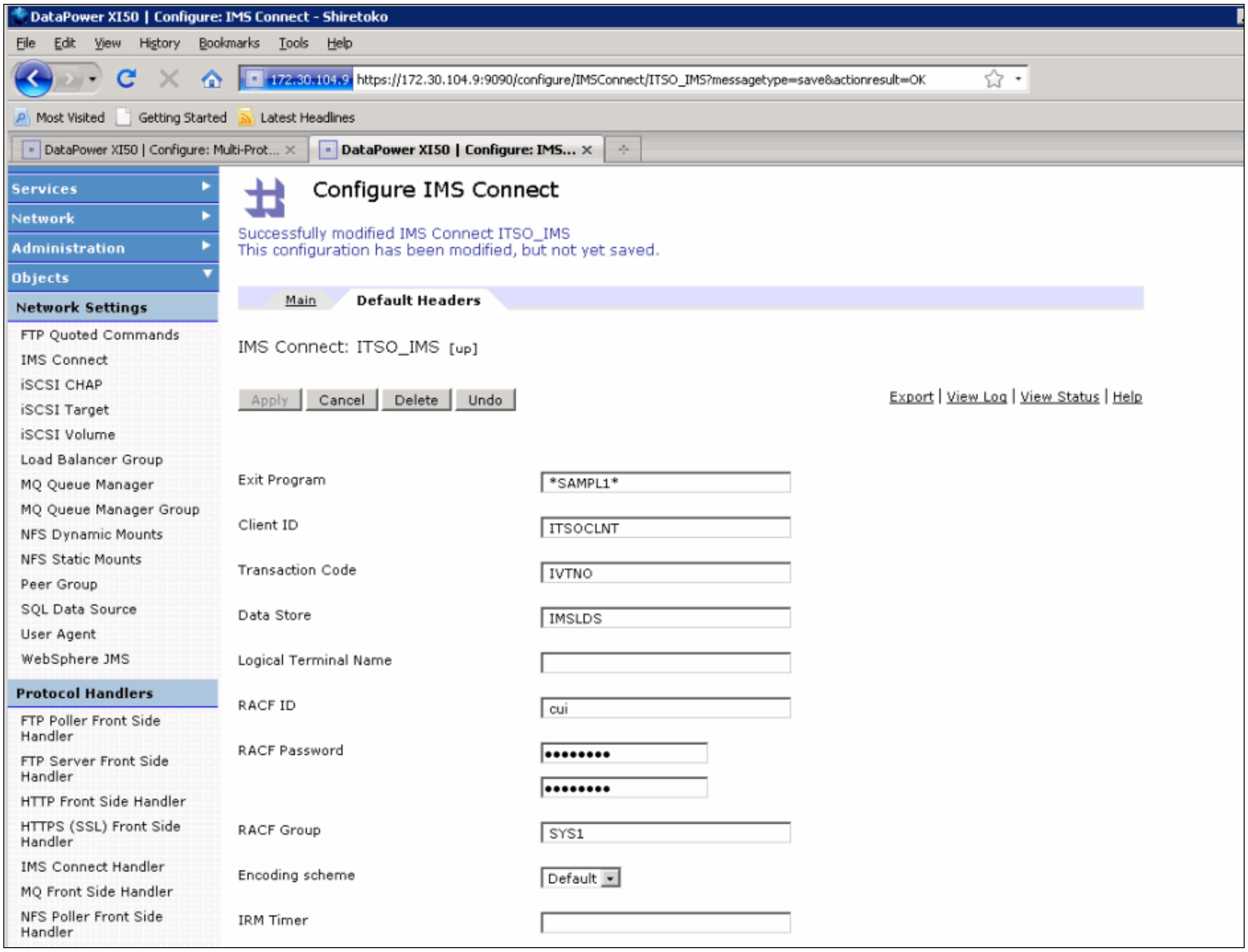
- Sync Level

  You can select either 0x00: IMS Sync Level 0x00 (NONE) or 0x01: IMS Sync Level 0x01 (CONFIRM).

  This field indicates whether the Sync Level is 0x00 (NONE) or 0x01 (CONFIRM). The default is 0x00 (NONE).

When communicating with the IMS Connect server on the back end and a transaction is specified with a Sync Level of 0x01 (CONFIRM), the client must send an ACK (successful) or a NAK (unsuccessful) after processing the response. The IMS Connect server then sends DEALLOCATE CONFIRM (successful) or DEALLOCATE ABORT (unsuccessful) back to the client. The DataPower appliance always sends an ACK upon receiving the response and then checks for the DEALLOCATE CONFIRM.

Figure 3-30 shows the configuration of the Default Headers that are used for this connection by the IMS Connect client object in DataPower.



Configure IMS Connect

Successfully modified IMS Connect ITSO_IMS
This configuration has been modified, but not yet saved.

IMS Connect: ITSO_IMS [up]

Exit Program	*SAMPL1*
Client ID	ITSOCLNT
Transaction Code	IVTNO
Data Store	IMSLDS
Logical Terminal Name	
RACF ID	cui
RACF Password	•••••••• ••••••••
RACF Group	SYS1
Encoding scheme	Default
IRM Timer	

Figure 3-30 IMS client configuration Default Headers tab on DataPower

We describe the following header values in reference to Figure 3-30:

- Exit Program

  Use this exit program for all the IMS connections.

- Client ID

  This value is string of one to eight uppercase alphanumeric (A through Z, 0 to 9) or special (@, #, $) characters, which are 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, the user exit generates it.

- Transaction Code

  Enter the IMS transaction code to invoke.

- Data Store

  This field specifies the datastore name (IMS destination ID).

- Logical Terminal Name

  This field is the LTERM override value to be used by OTMA.

- RACF ID

  This field is the plaintext string sent to the server for identifying the client.

- RACF Password

  This field is the host security password that is used to log on to the IMS Connect server. Enter the password twice to confirm its accuracy.

- RACF Group

  This field is the name of the group to which the Host security ID belongs.

- Encoding scheme

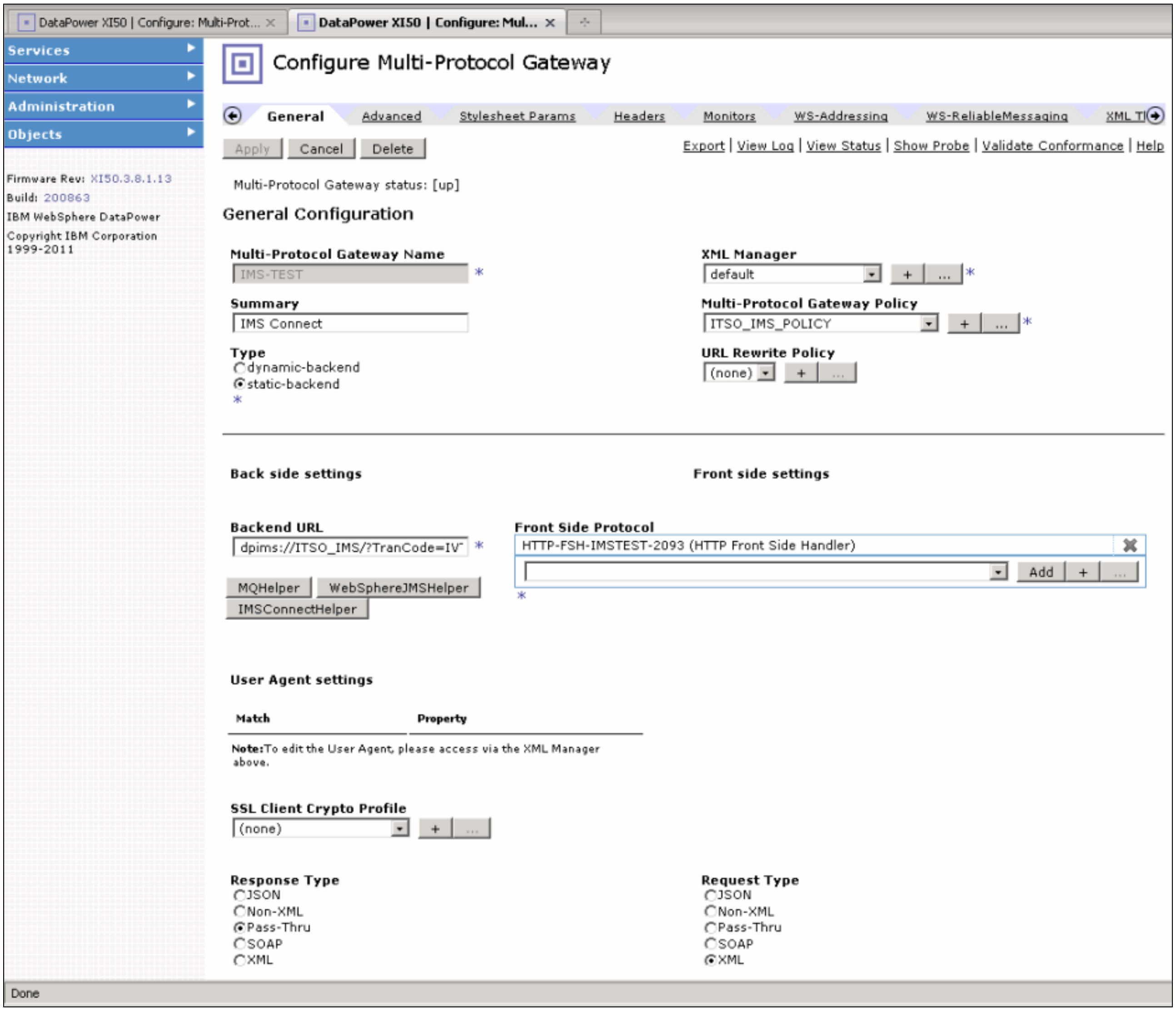
  Select the Unicode encoding schema. Leave as (none) to be set dynamically in the IMS header. (For example, in the IMS proxy scenario, the incoming IMS header value can be used directly.)

  - (none): It uses the encoding that is set by the IMS Connect handler object or by a Transform action in the processing policy.
  - Default: It uses the encoding that is set by the message.
  - UTF8: It uses UTF8 encoding.
  - UCS2: It uses UCS2 encoding.
  - UTF16: It uses UTF16 encoding.

- IRM Timer

  Set the IRM_TIMER value to an appropriate wait time for IMS to return data to IMS Connect. See the IMS Connect documentation for details. An example value of `21` sets an IRM Timer value of 0.21 seconds.

Figure 3-31 shows the Multi-Protocol Gateway for the IMS Connect integration.



Firmware Rev: XI50.3.8.1.13
Build: 200863
IBM WebSphere DataPower
Copyright IBM Corporation 1999-2011

Configure Multi-Protocol Gateway

Multi-Protocol Gateway status: [up]

General Configuration

Multi-Protocol Gateway Name: IMS-TEST *

Summary: IMS Connect

Type: ○ dynamic-backend ● static-backend *

XML Manager: default *

Multi-Protocol Gateway Policy: ITSO_IMS_POLICY *

URL Rewrite Policy: (none)

Back side settings

Front side settings

Backend URL: dpims://ITSO_IMS/?TranCode=IV *

Front Side Protocol: HTTP-FSH-IMSTEST-2093 (HTTP Front Side Handler) *

User Agent settings

Match	Property

Note:To edit the User Agent, please access via the XML Manager above.

SSL Client Crypto Profile: (none)

Response Type: ○ JSON ○ Non-XML ● Pass-Thru ○ SOAP ○ XML

Request Type: ○ JSON ○ Non-XML ○ Pass-Thru ○ SOAP ● XML

Figure 3-31 Configure Multi-Protocol Gateway window for IMS Connect integration

We set the following information in Figure 3-31:

- The Backend connection type is set to **static-backend**.
- We set the Backend URL connection string to:

  `dpims://ITSO_IMS/?TranCode=IVTNO;DataStoreID=IMSLDS`

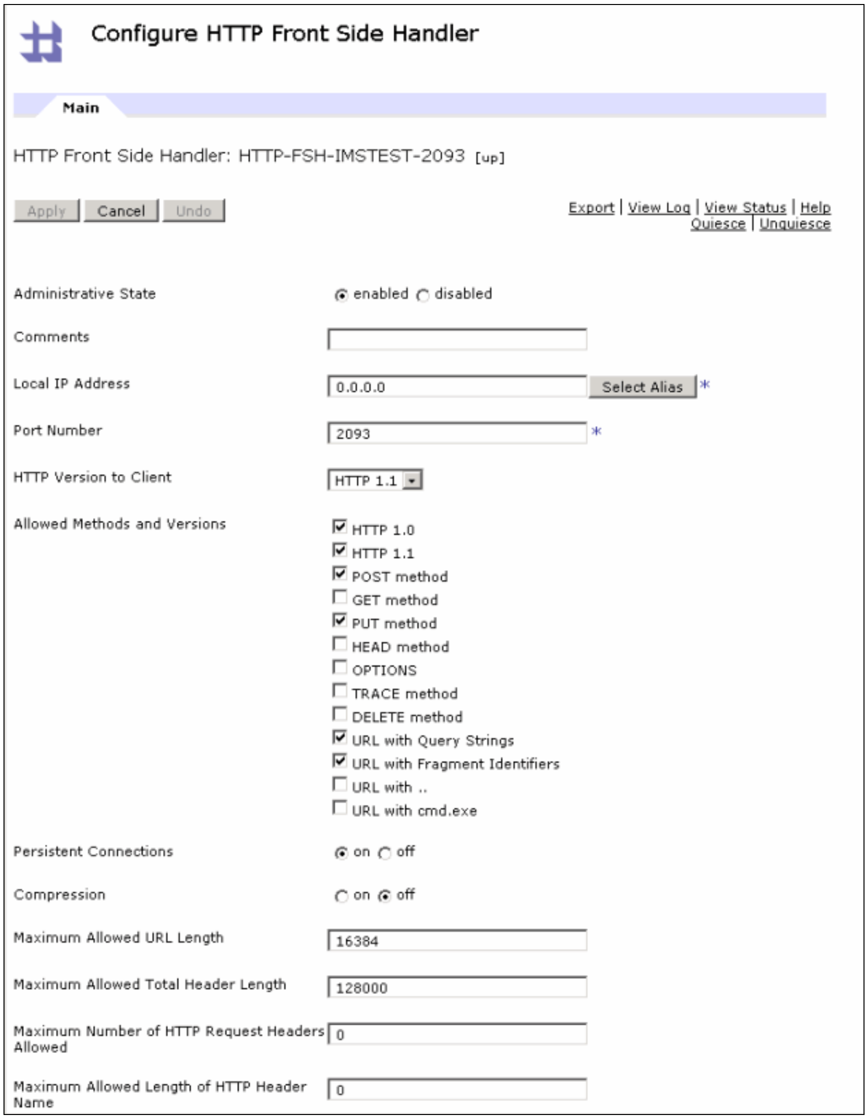
  We explain the following information in this Backend URL connection string:

  – `ITSO_IMS` is the IMS Connect Client that is defined on DataPower.

  – `TranCode=IVTNO` specifies the IMS transaction code. This parameter is required. The default is an eight-character blank string.

  – `DataStoreID=IMSLDS` specifies the datastore name (IMS destination ID). This parameter is required. The default is an eight-character blank string.

We configured the DataPower HTTP Front Side Handler to receive SOAP messages from client applications, as shown in Figure 3-32. We set the port number to `2093` and left all other configuration fields with the DataPower default values.



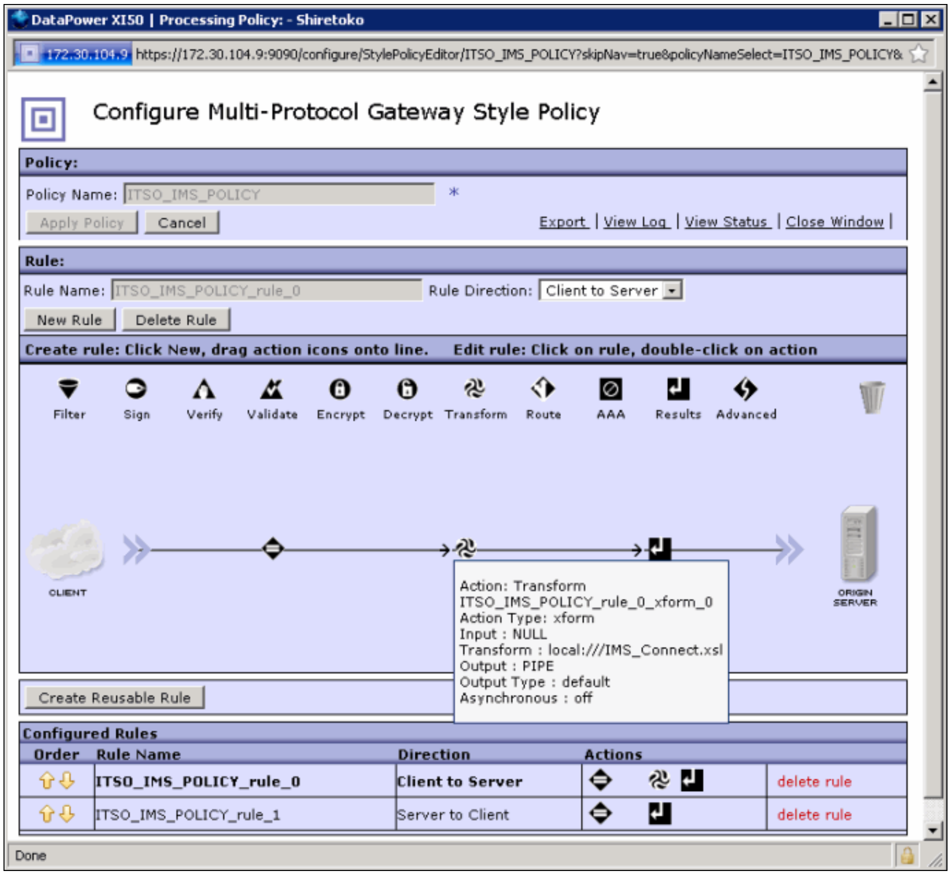
Configure HTTP Front Side Handler

HTTP Front Side Handler: HTTP-FSH-IMSTEST-2093 [up]

Administrative State	● enabled ○ disabled
Comments	
Local IP Address	0.0.0.0 *
Port Number	2093 *
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
Compression	○ on ● off
Maximum Allowed URL Length	16384
Maximum Allowed Total Header Length	128000
Maximum Number of HTTP Request Headers Allowed	0
Maximum Allowed Length of HTTP Header Name	0

Figure 3-32 Configure HTTP Front Side Handler window for IMS Connect multi-protocol gateway

We configured the policy for test purposes. It contains the minimum number of required actions to send a byte-stream message to invoke the IVTNO sample transaction to get a response from the back-end sample IMS program. We configured the Multi-Protocol Gateway to pass through the byte-steam response from the sample IMS program. We configured the policy rule, as shown in Figure 3-33.



DataPower XI50 | Processing Policy: - Shiretoko

https://172.30.104.9:9090/configure/StylePolicyEditor/ITSO_IMS_POLICY?skipNav=true&policyNameSelect=ITSO_IMS_POLICY&

Configure Multi-Protocol Gateway Style Policy

Policy:

Policy Name: ITSO_IMS_POLICY *

Rule:

Rule Name: ITSO_IMS_POLICY_rule_0 Rule Direction: Client to Server

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

Action: Transform
ITSO_IMS_POLICY_rule_0_xform_0
Action Type: xform
Input : NULL
Transform : local:///IMS_Connect.xsl
Output : PIPE
Output Type : default
Asynchronous : off

Configured Rules

Order	Rule Name	Direction	Actions	
⇧⇩	ITSO_IMS_POLICY_rule_0	Client to Server		delete rule
⇧⇩	ITSO_IMS_POLICY_rule_1	Server to Client		delete rule

Done

Figure 3-33 Policy for IMS Connect integration

We used a simple stylesheet to generate the single-segment byte stream that is sent to IMS Connect and, subsequently, the sample installation verification IMS transaction. Figure 3-34 shows the stylesheet. The first eight characters of the byte stream need to be the IMS transaction code padded with blanks, which is then followed by the input data.

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

    <xsl:value-of select="'IVTNO     DISPLAY LAST1'"/>

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

Figure 3-34 IMS Connect stylesheet

3.4 Connecting with DB2 on z/OS

In most organizations that use zEnterprise, DB2 databases on z/OS contain a wealth of information that needs to be accessible by the business units within the organization. The DataPower XI50z provides an extremely secure way to access the data that is stored in DB2. The DataPower XI50z uses Distributed Relational Database Architecture™ (DRDA®) to access DB2 on z/OS. IBM developed DRDA to enable access to relational data that is distributed among multiple platforms.

In this section, we discuss Data Web Services (DWS), which is a tool that can be used to generate code that can be used by DataPower to securely expose DB2 data to the enterprise by way of Web Services. Then, we show how to configure DataPower to access DB2 for z/OS.

3.4.1 Data Web Services

Data Web Services (DWS) is a solution to significantly ease the development, deployment, and management of Web Services-based access to DB2 database servers.

IBM Data Studio lets you use data manipulation statements, such as SELECT, INSERT, UPDATE, DELETE, AND XQUERY, and stored procedure calls to generate Web services without writing a single line of code.

DWS provides a full Web service interface, including support for SOAP and Representational State Transfer (REST)-style bindings. All of this interface is part of IBM Data Studio Developer, which means that you can develop Web Services and database applications in one environment. The generated Web Services (Web Services Description Language (WSDL), data mapping, and query XSL Transformation (XSLT)) are packaged in a form that can be deployed to the DataPower XI50z easily.

Figure 3-35 shows the integration pattern that can be used by the DataPower XI50z to expose DWS to the enterprise by using the secure, high-performance, private 10 Gbps IEDN to connect to the z/OS-based DB2 servers.

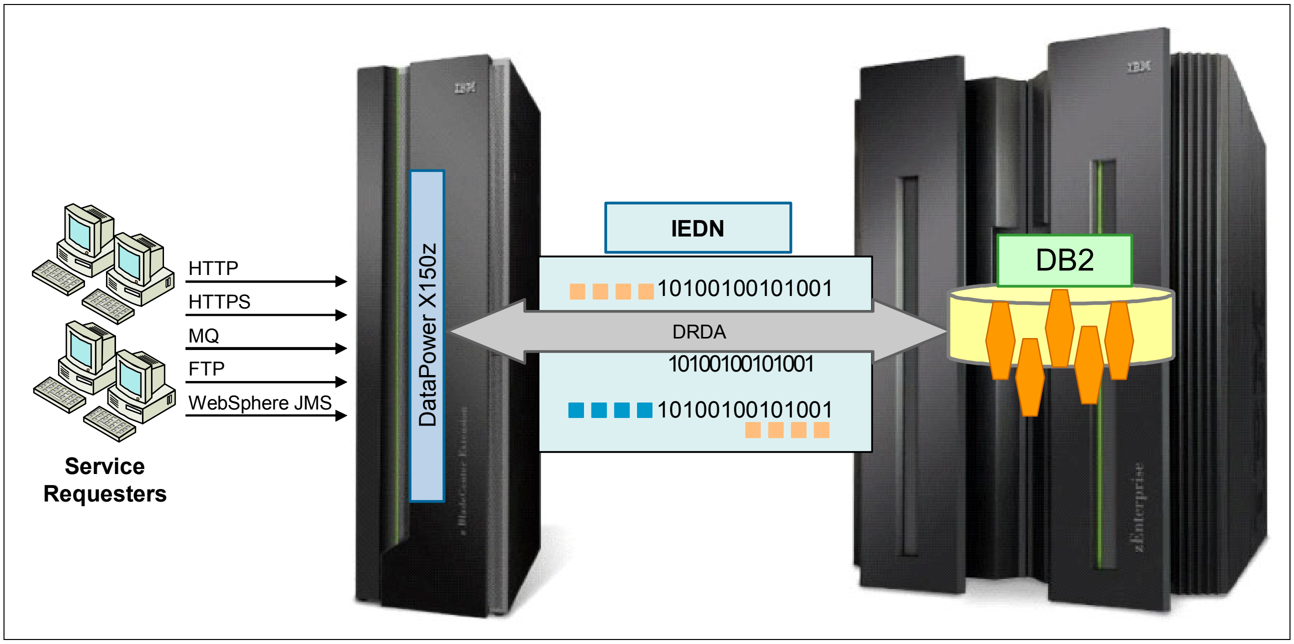


Figure 3-35 The DataPower XI50z integration with IMS on z/OS

DRDA is a database interoperability standard from The Open Group. The IBM WebSphere DataPower XI50z can access DB2 data directly using the DRDA protocol without needing DB2 Connect™.

Using the DataPower XI50z Integration Appliance as the hosting environment for Data Web Services exploits the superior support of the network protocols. Using the XI50z as the hosting environment for DWS gives a wide variety of clients the ability to talk to DB2 and access the data and information that are contained within DB2 without even being database-aware.

3.4.2 Connecting to DB2 on z/OS

In this section, we describe the required steps to configure DataPower to integrate with DB2 using the DRDA protocol. Note that this scenario uses the sample database that is installed with the DB2 installation. The scenario uses the XI50z running an SQL query against the DB2 database on z/OS over the IEDN using the VLAN host address that was set up in Chapter 1, “Getting started with the XI50z” on page 1. The purpose of this sample scenario is to highlight the minimal configuration steps that are required on the DataPower XI50z to run an SQL query against a DB2 table that is hosted on the zEnterprise ensemble.

Figure 3-36 shows the scenario that we are building.

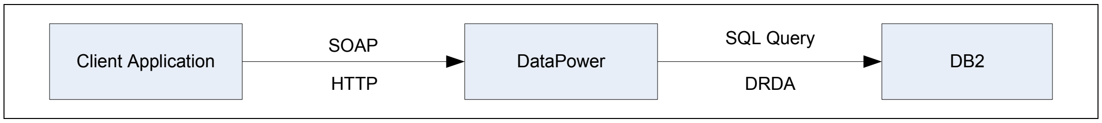
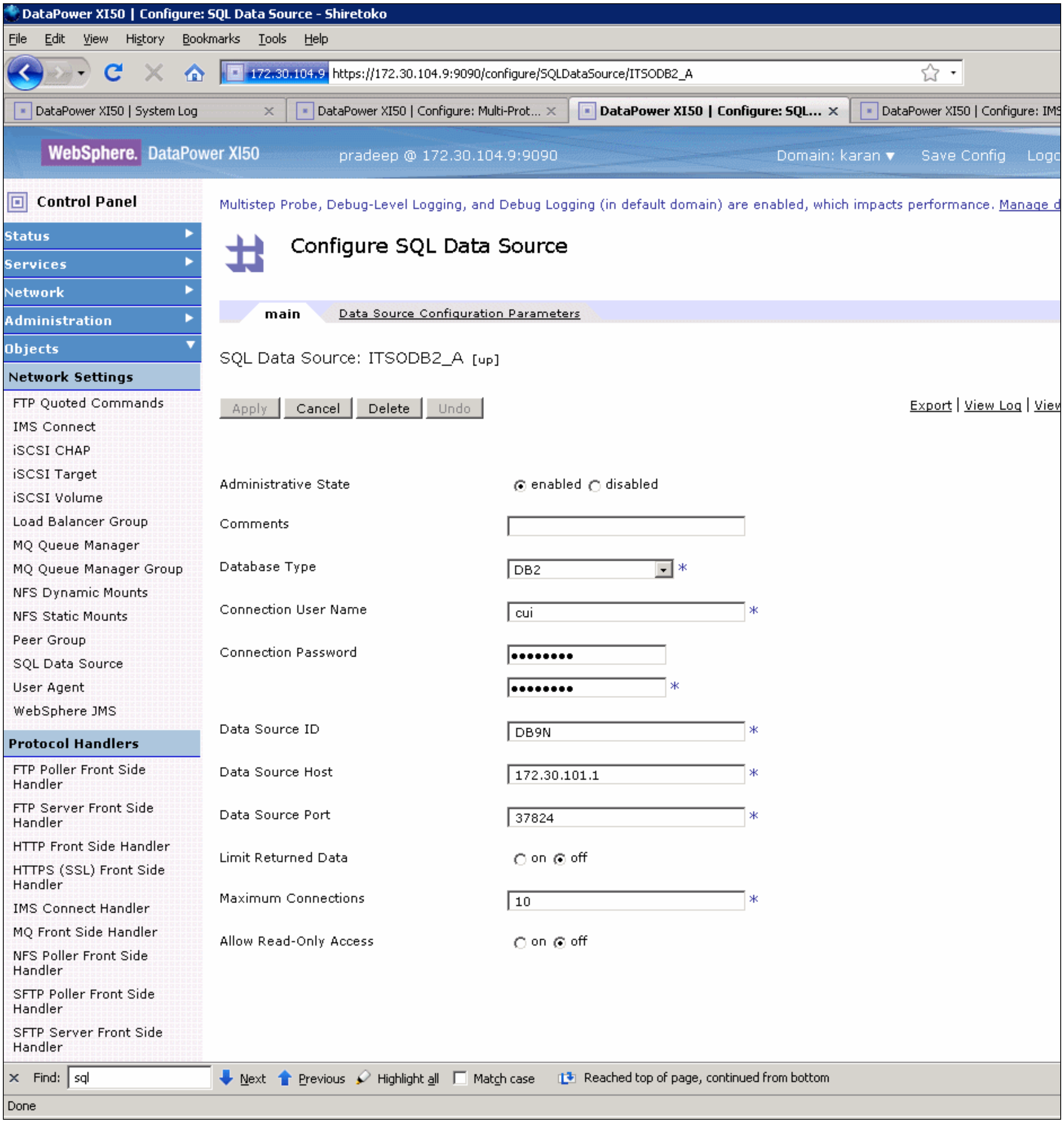


Figure 3-36 DataPower integration with DB2

Figure 3-37 shows the required configuration details for the SQL Data Source object to connect to DB2 on z/OS.


DataPower XI50 | Configure: SQL Data Source - Shiretoko
File Edit View History Bookmarks Tools Help
172.30.104.9 https://172.30.104.9:9090/configure/SQLDataSource/ITSODB2_A
DataPower XI50 | System Log
DataPower XI50 | Configure: Multi-Prot...
DataPower XI50 | Configure: SQL...
DataPower XI50 | Configure: IMS
WebSphere. DataPower XI50
pradeep @ 172.30.104.9:9090
Domain: karan
Save Config
Logo
Control Panel
Status
Services
Network
Administration
Objects
Network Settings
FTP Quoted Commands
IMS Connect
iSCSI CHAP
iSCSI Target
iSCSI Volume
Load Balancer Group
MQ Queue Manager
MQ Queue Manager Group
NFS Dynamic Mounts
NFS Static Mounts
Peer Group
SQL Data Source
User Agent
WebSphere JMS
Protocol Handlers
FTP Poller Front Side Handler
FTP Server Front Side Handler
HTTP Front Side Handler
HTTPS (SSL) Front Side Handler
IMS Connect Handler
MQ Front Side Handler
NFS Poller Front Side Handler
SFTP Poller Front Side Handler
SFTP Server Front Side Handler
main
Data Source Configuration Parameters
Apply
Cancel
Delete
Undo
Export | View Log | View
Find: sql
Next
Previous
Highlight all
Match case
Reached top of page, continued from bottom
Done

Multistep Probe, Debug-Level Logging, and Debug Logging (in default domain) are enabled, which impacts performance. Manage d

Configure SQL Data Source

SQL Data Source: ITSODB2_A [up]

Administrative State	● enabled ○ disabled
Comments	
Database Type	DB2 *
Connection User Name	cui *
Connection Password	•••••••• •••••••• *
Data Source ID	DB9N *
Data Source Host	172.30.101.1 *
Data Source Port	37824 *
Limit Returned Data	○ on ● off
Maximum Connections	10 *
Allow Read-Only Access	○ on ● off

Figure 3-37 DB2 SQL Data Source configuration window on DataPower

We describe the item’s configuration parameters in Figure 3-37:

- Connection User Name

  This field is the name of the user to establish the connection to the data source. The data server maintains this information, not the appliance.

- Connection Password

  This field is the password for the user to establish the connection to the data source. The data server maintains this information, not the appliance.

- Data Source ID

  This field is the identifier of the data source.

- Data Source Host

  This field is the host name or IP address of the server where the data source resides. In this case, we use the VLAN IP address to which the XI50z has access.

- Data Source Port

  This field is the TCP port on which the data source (DB2 on z/OS) listens for requests.

- Limited Returned Data

  This field shows whether to limit the amount of data that a SQL SELECT statement can return:

  - To limit, set to on and set the maximum limit to allow.
  - To not limit, set to off, which is the default.

- Maximum Connections

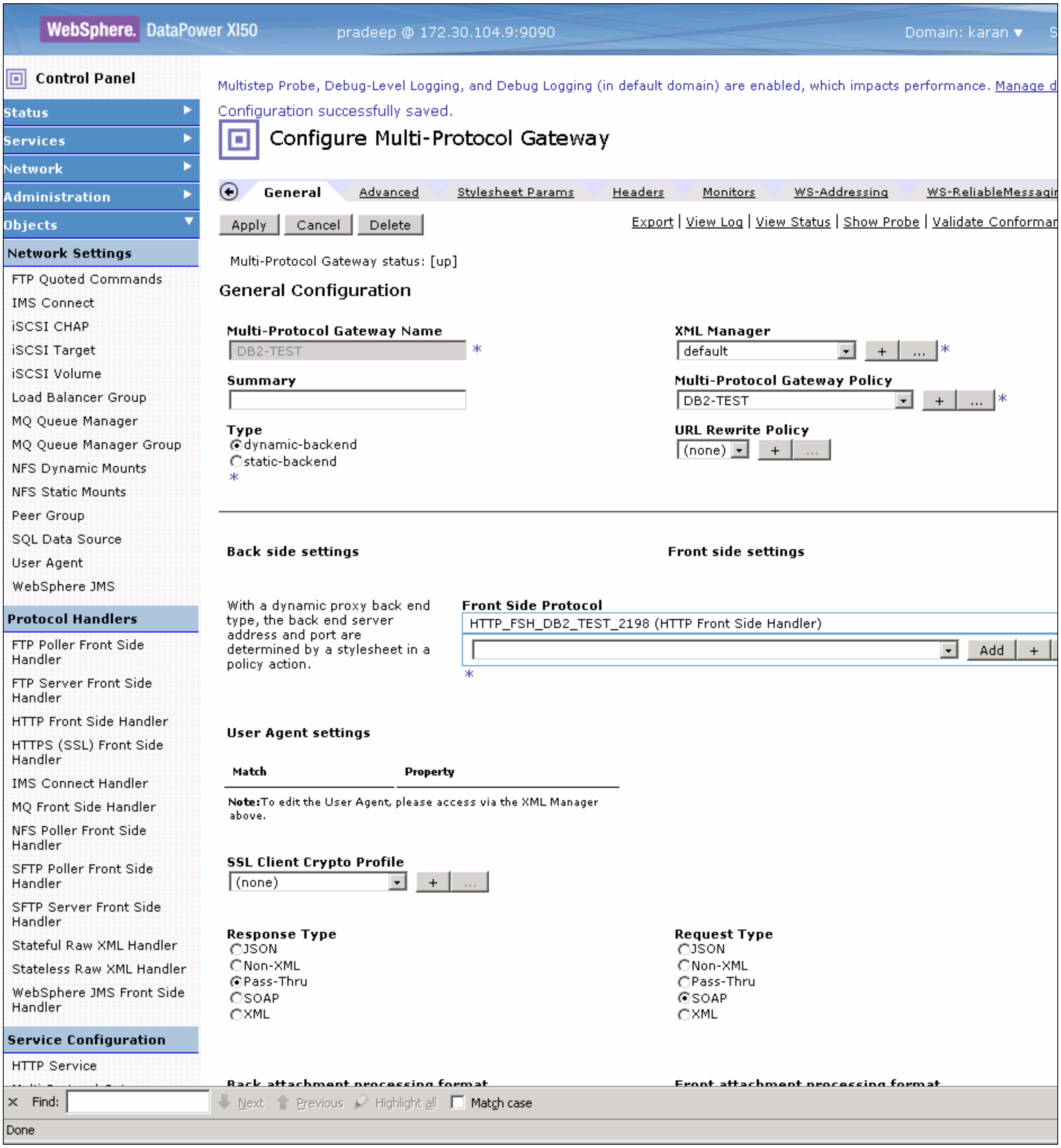
  This field is the maximum number of concurrent connections that can be opened to this data source. The default is 10.

- Allow Read-Only Access

  This field shows whether the data source accepts only SQL SELECT statements or all statements:

  - To restrict SQL SELECT statements, set this field to on. If you select on, you allow only SELECT statements, reject UPDATE, MODIFY, and DELETE statements, and prevent the execution of stored procedures or functions.
  - To accept all statements, set this field to off, which is the default.

Figure 3-38 shows the Configure Multi-Protocol Gateway window for the DB2 Connect integration.



Multistep Probe, Debug-Level Logging, and Debug Logging (in default domain) are enabled, which impacts performance. Manage d

Configuration successfully saved.

Configure Multi-Protocol Gateway

Multi-Protocol Gateway status: [up]

General Configuration

Multi-Protocol Gateway Name: DB2-TEST *

Summary:

Type: ● dynamic-backend ○ static-backend *

XML Manager: default *

Multi-Protocol Gateway Policy: DB2-TEST *

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: HTTP_FSH_DB2_TEST_2198 (HTTP Front Side Handler) *

User Agent settings

Match	Property

Note: To edit the User Agent, please access via the XML Manager above.

SSL Client Crypto Profile: (none)

Response Type: ○ JSON ○ Non-XML ● Pass-Thru ○ SOAP ○ XML

Request Type: ○ JSON ○ Non-XML ○ Pass-Thru ● SOAP ○ XML

Back attachment processing format

Front attachment processing format

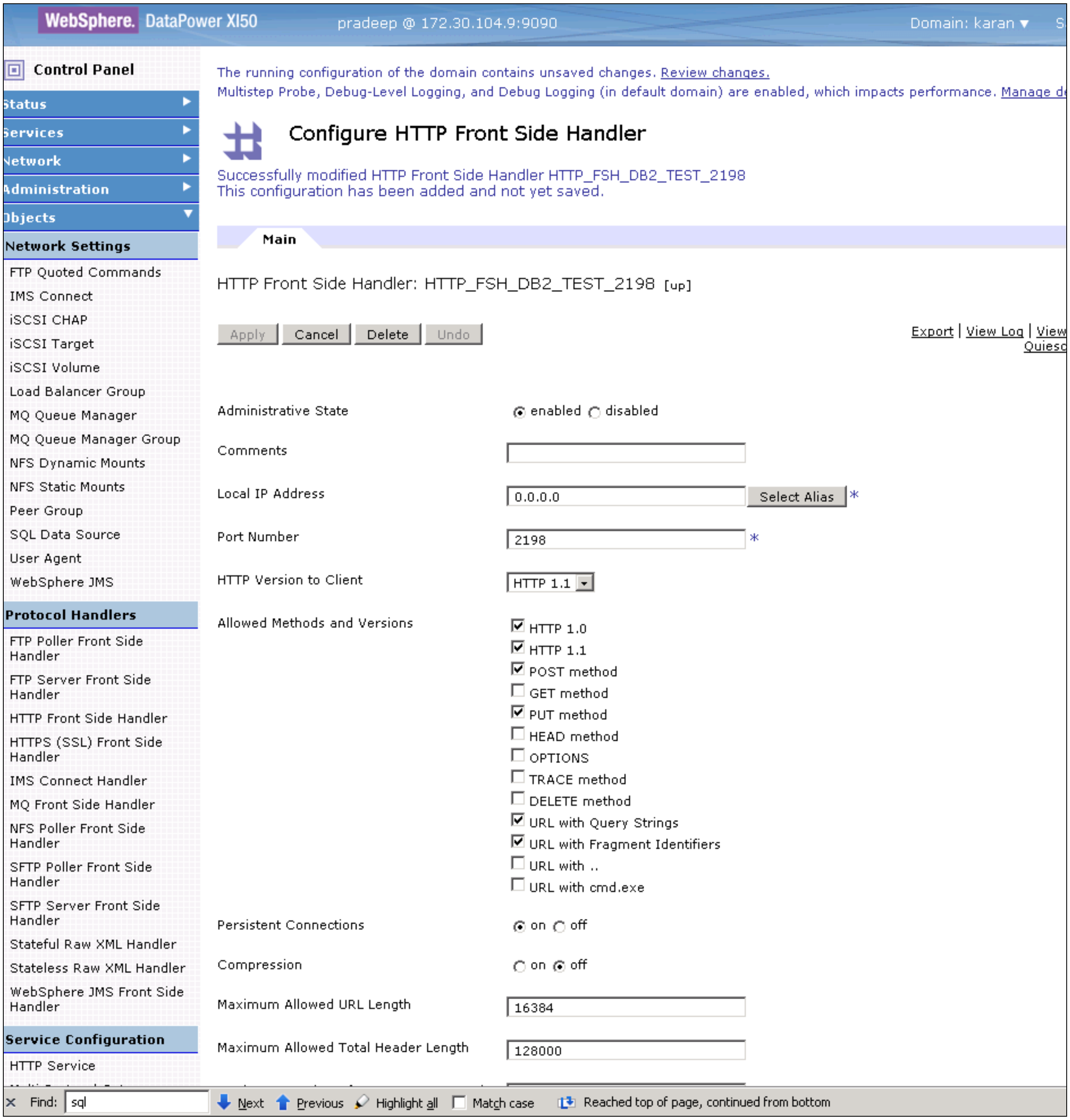
Figure 3-38 Configure Multi-Protocol Gateway window for DB2 integration

We set the following information in Figure 3-38:

- The Backend connection type is set to **dynamic-backend**. The SQL query action within the Policy rule that is called by the Multi-Protocol Gateway Policy will reference the SQL Data Source Object that was configured in Figure 3-37 on page 148.

- The Request Type is configured as **SOAP**, so the Gateway will only accept SOAP messages and validate the request message for conformance with the SOAP standards.
- The Response Type is set as **Pass-Thru**, which means that DataPower passes the response back to the client without processing or modifying it.

We configured the DataPower HTTP Front Side Handler for the DB2 integration to receive SOAP messages from client applications, as shown in Figure 3-39. We set the port number to `2198`, and left all other configuration fields with the DataPower default values.



The running configuration of the domain contains unsaved changes. Review changes.
Multistep Probe, Debug-Level Logging, and Debug Logging (in default domain) are enabled, which impacts performance. Manage d

Configure HTTP Front Side Handler

Successfully modified HTTP Front Side Handler HTTP_FSH_DB2_TEST_2198
This configuration has been added and not yet saved.

HTTP Front Side Handler: HTTP_FSH_DB2_TEST_2198 [up]

Administrative State	● enabled ○ disabled
Comments	
Local IP Address	0.0.0.0 *
Port Number	2198 *
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
Compression	○ on ● off
Maximum Allowed URL Length	16384
Maximum Allowed Total Header Length	128000

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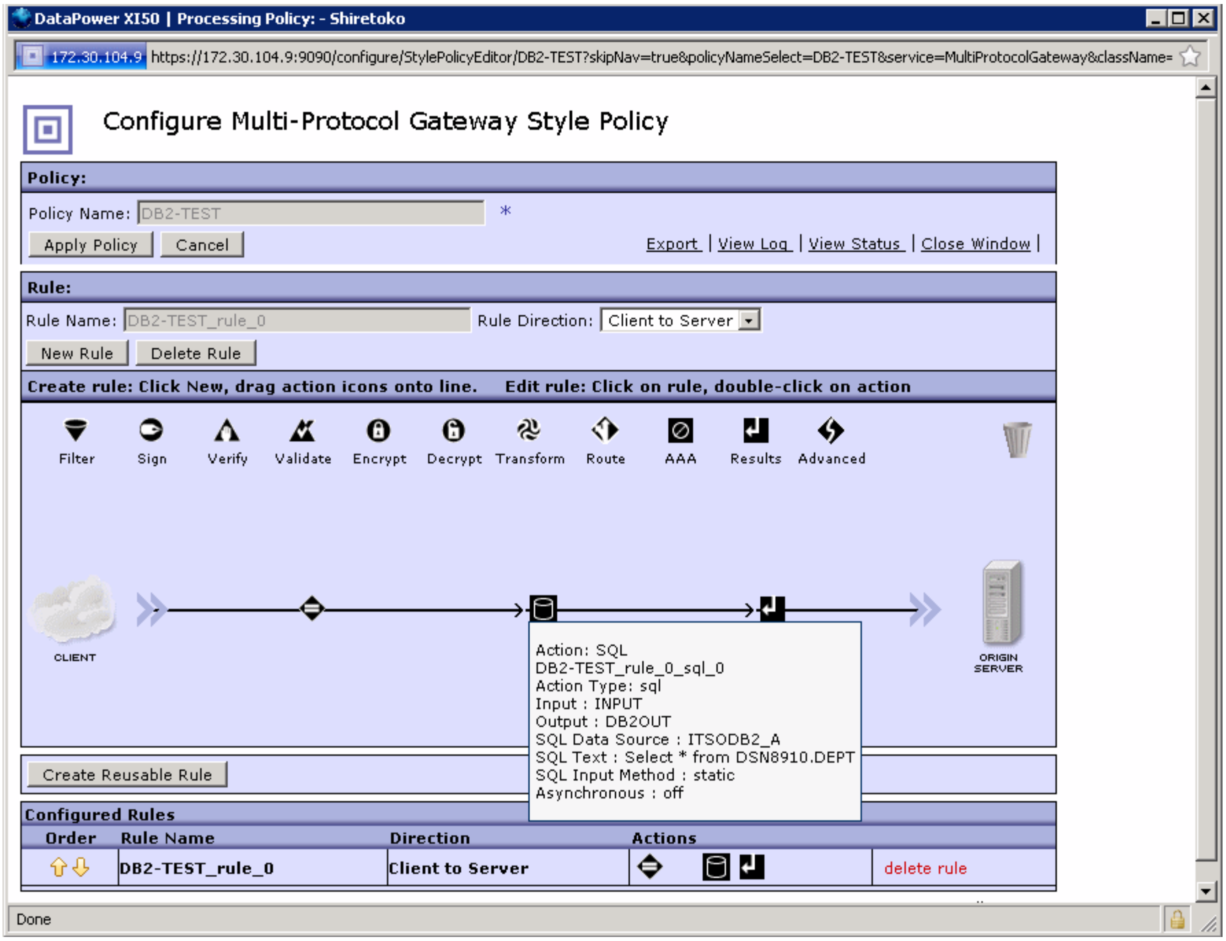
Figure 3-39 Front Side Handler for DB2 integration multi-protocol gateway

We configured the policy for test purposes. The policy contains only a query action that connects to the sample DB2 data source to query the sample table that was provided as part of the DB2 installation. We configured the Multi-Protocol Gateway to pass through the response; therefore, the XML-formatted SQL response is passed through to the client "*as is*". Figure 3-40 shows the policy rule that we configured.



DataPower XI50 | Processing Policy: - Shiretoko
172.30.104.9 https://172.30.104.9:9090/configure/StylePolicyEditor/DB2-TEST?skipNav=true&policyNameSelect=DB2-TEST&service=MultiProtocolGateway&className=
Configure Multi-Protocol Gateway Style Policy
Policy:
Apply Policy
Cancel
Export | View Log | View Status | Close Window |
Rule:
New Rule
Delete Rule
Create rule: Click New, drag action icons onto line. Edit rule: Click on rule, double-click on action
Filter
Sign
Verify
Validate
Encrypt
Decrypt
Transform
Route
AAA
Results
Advanced
CLIENT
ORIGIN SERVER
Create Reusable Rule
Done

Policy Name: DB2-TEST *

Rule Name: DB2-TEST_rule_0 Rule Direction: Client to Server

Action: SQL
DB2-TEST_rule_0_sql_0
Action Type: sql
Input : INPUT
Output : DB2OUT
SQL Data Source : ITSODB2_A
SQL Text : Select * from DSN8910.DEPT
SQL Input Method : static
Asynchronous : off

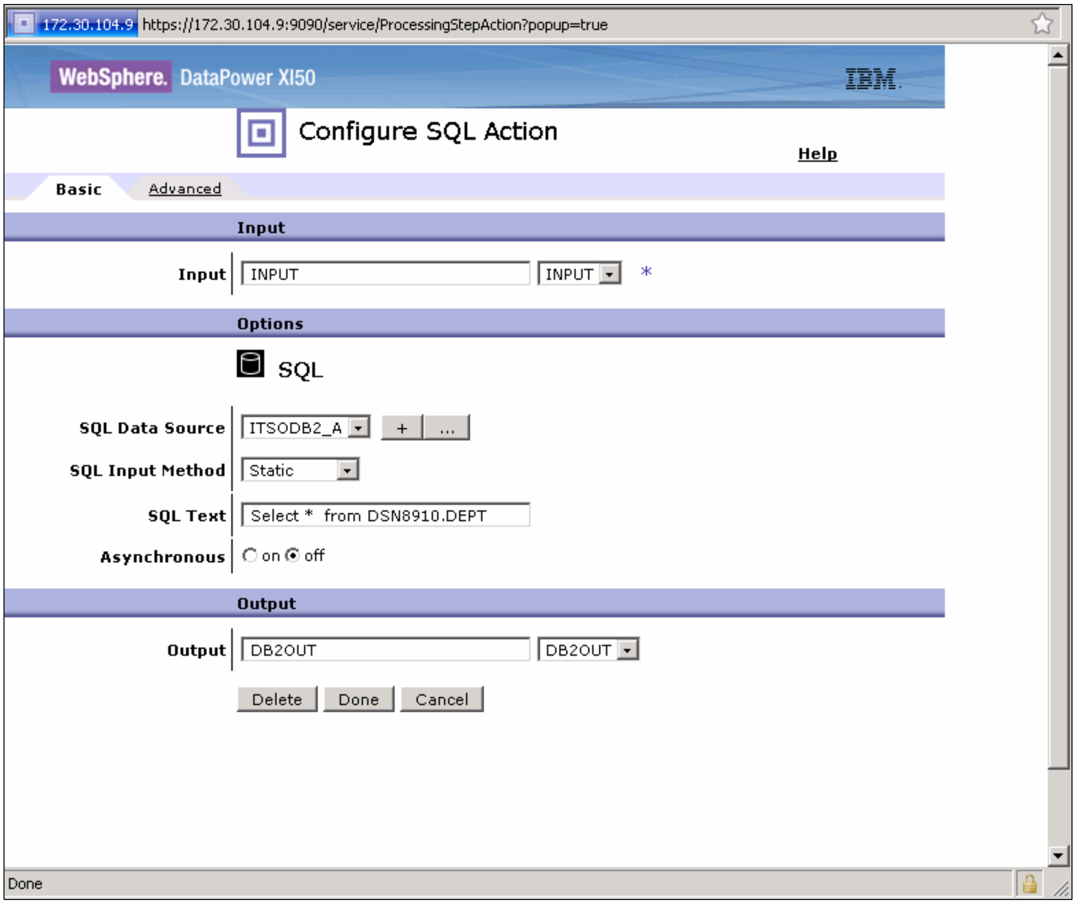
Configured Rules

Order	Rule Name	Direction	Actions	
⇧⇩	DB2-TEST_rule_0	Client to Server		delete rule

Figure 3-40 Policy rule to execute the DB2 query

This policy rule does not use any XSLT stylesheets, because the SQL text in the SQL action contains the SQL query to be executed.

Figure 3-41 shows the configuration of the SQL action.



172.30.104.9
https://172.30.104.9:9090/service/ProcessingStepAction?popup=true
WebSphere. DataPower XI50
IBM.
Help
Basic
Advanced
Delete
Done
Cancel
Done

Configure SQL Action

Input

Input | INPUT | INPUT *

Options

SQL

SQL Data Source | ITSODB2_A | + | ...

SQL Input Method | Static

SQL Text | Select * from DSN8910.DEPT

Asynchronous | ○ on ● off

Output

Output | DB2OUT | DB2OUT

Figure 3-41 Configuration of the SQL action to execute the DB2 Query

We describe the configuration parameters for the SQL action in Figure 3-41:

- SQL Data Source: Select the SQL Data Source object to use when executing this action. In this case, it is ITSODB2_A, which was configured as shown in Figure 3-37 on page 148.
- SQL Input Method: Select the source of the SQL statement for the SQL action. You can select one of these sources:
  - Static: Hard-coded SQL Statement (as in this use case)
  - Stylesheet: The name and location of the stylesheet that contains the SQL statement
  - Variable: A DataPower context variable that contains the SQL statement
- SQL Text: In this case, we entered the hard-coded SQL Statement `Select * from DSN8910.DEPT`.

The response is received in an XML format, as shown in Figure 3-42, and passed through to the client application by the Multi-Protocol Gateway without modification.

```
<sql result="success">
   <row>
      <column>
         <name>DEPTNO</name>
         <value>A00</value>
      </column>
      <column>
         <name>DEPTNAME</name>
         <value>SPIFFY COMPUTER SERVICE DIV.</value>
      </column>
      <column>
         <name>MGRNO</name>
         <value>000010</value>
      </column>
      <column>
         <name>ADMRDEPT</name>
         <value>A00</value>
      </column>
      <column>
         <name>LOCATION</name>
         <value></value>
      </column>
   </row>
   <row>
      <column>
         <name>DEPTNO</name>
         <value>B01</value>
      </column>
      <column>
         <name>DEPTNAME</name>
         <value>PLANNING</value>
      </column>
      <column>
         <name>MGRNO</name>
         <value>000020</value>
      </column>
      <column>
         <name>ADMRDEPT</name>
         <value>A00</value>
      </column>
      <column>
         <name>LOCATION</name>
         <value></value>
      </column>
   </row>
</sql>
```

Figure 3-42 DB2 query response

Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this book.

IBM Redbooks

The following IBM Redbooks publications provide additional information about the topic in this document. Note that several publications referenced in this list might be available in softcopy only.

- *Simplifying Integration with IBM WebSphere DataPower Integration Appliance XI50 for zEnterprise*, REDP-4783-00
- *DataPower SOA Appliance Service Planning, Implementation, and Best Practices*, SG24-7943-00
- *DataPower SOA Appliance Administration, Deployment, and Best Practices*, SG24-7901-00
- *IBM zEnterprise 196 Technical Guide*, SG24-7833-01
- *IBM zEnterprise 114 Technical Guide,* SG24-7954-00
- *WebSphere MQ Application Programming Guide,* SC34-6939-01

You can search for, view, download or order these documents and other Redbooks, Redpapers, Web Docs, draft and additional materials, at the following website:

ibm.com/redbooks

Online resources

These websites are also relevant as further information sources:

- XI50z information center:

  http://publib.boulder.ibm.com/infocenter/wsdatap/v3r8m1/topic/xi50/welcome.htm
- *Security Server RACF Auditor's Guide*

  http://publibz.boulder.ibm.com/epubs/pdf/ichza8b0.pdf
- Steps for authorizing resources for Network Security Services (NSS)

  http://publib.boulder.ibm.com/infocenter/zos/v1r12/index.jsp?topic=%2Fcom.ibm.zos.r12.halz002%2Fnssac.htm
- Installing and configuring Integrated Cryptographic Service Facility (ICSF) (optional)

  http://publib.boulder.ibm.com/infocenter/zos/v1r12/index.jsp?topic=%2Fcom.ibm.zos.r12.ikya100%2Fdicsf.htm
- SOAP versions

  http://www.w3.org/2003/05/soap-envelope/role/next
- Defining Profiles in the PTKTDATA Class

http://publib.boulder.ibm.com/infocenter/zos/v1r11/index.jsp?topic=/com.ibm.zos.r11.icha700/defpro.htm

- Summary of the Public Key Algorithm (PKA) Callable Services

  http://publib.boulder.ibm.com/infocenter/zos/v1r12/topic/com.ibm.zos.r12.csfb400/sumpka.htm

- PKA Decrypt (CSNDPKD and CSNFPKD)

  http://publib.boulder.ibm.com/infocenter/zos/v1r12/topic/com.ibm.zos.r12.csfb400/spkd.htm

- Using CSQ6SYSP

  http://publib.boulder.ibm.com/infocenter/wmqv7/v7r0/topic/com.ibm.mq.csqsav.doc/zs10580_.htm

- Configuring Open Transaction Manager Access (OTMA) during Information Management System (IMS) system definition

  http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/topic/com.ibm.ims11.doc.ccg/ims_otma_admin_003.htm

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IBM Global Services

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IBM Redbooks

Set Up Security and Integration with the DataPower XI50z for zEnterprise

(0.2”spine)
0.17”<->0.473”
90<->249 pages

Set Up Security and Integration with the DataPower XI50z for zEnterprise

Bridge the gap between mainframe and distributed with DataPower XI50z

Learn to implement the zEnterprise ensemble network

Use XI50z to connect with WMQ, CICS, IMS, and DB2

This IBM Redbooks publication discusses the new IBM WebSphere DataPower Integration Appliance XI50 for zEnterprise that bridges the gap between mainframe and distributed. The DataPower XI50z (a multifunctional appliance) within the zEnterprise BladeCenter Extension (zBX) is managed with a single point of control, which can help to streamline operations and maintenance. The DataPower XI50z simplifies the translation of your existing formats to XML (hardware acceleration) for easier communication and connectivity.

This book will help you install, tailor, and configure the new attributes for implementing a zEnterprise ensemble network. The zEnterprise System introduces internal virtual networks (VLANs) and additional networking attributes that need to be addressed. Also, we describe the planning considerations for the internal virtual networks and external networks.

This book is for anyone who wants an understanding of the security on the zEnterprise that focuses on the usage of XI50z Network Security Services.

As you can expect from an IBM Redbooks publication, we provide several integration use cases that you are able to use immediately within a production environment, for example, the XI50z connecting with and using WebSphere MQ (WMQ), connecting with CICS, connecting with IMS, and connecting with DB2.

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