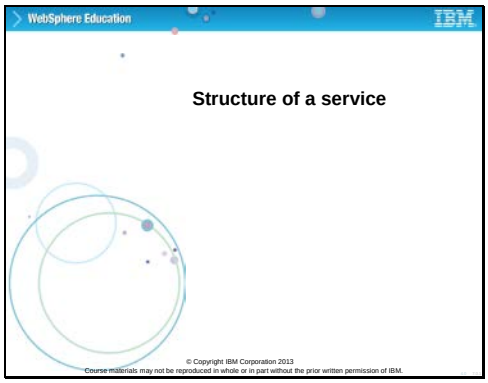
Slide 1


WebSphere Education
IBM
Structure of a service
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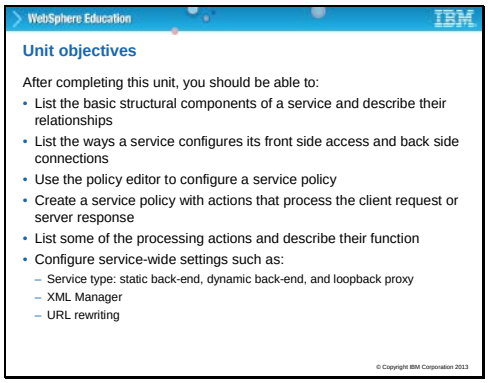
Slide 2

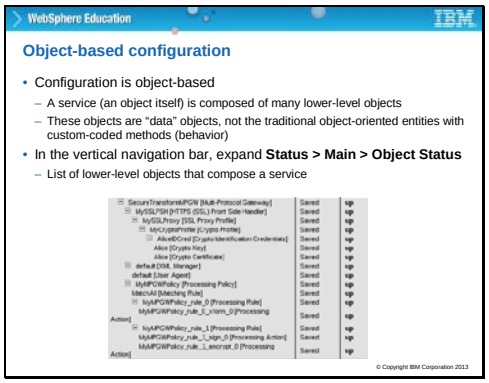


Unit objects

This unit focuses on;

1. List the basic structural components of a service and describe their relationships
2. List the ways a service configures its front side access and back side connections
3. Use the policy editor to configure a service policy
4. Create a service policy with actions that process the client request or server response
5. List some of the processing actions and describe their function
6. Configure service-wide settings such as:
   - Service type: static back-end, dynamic back-end, and loopback proxy
   - XML manager
   - URL rewriting

Slide 3



Object-oriented configuration

DataPower uses objects to create services. It is therefore object-oriented (OO). However, DataPower OO is a different meaning than object orientation in a programming language like Java. Here, it means that the configuration is done on objects such as a policy, a user agent, a queue manager, and then those objects are used together to create the service. It would probably be closer to call it object-based, but object that is oriented is the term that is adopted.

You can create your own objects – or at least, your own configuration of a pre-defined object – by going to the left navigation bar and choosing one of the subcategories from the Objects item. In this way, you can build your lower level objects; then create a higher level object by referencing your lower level objects, and such. You can also use one of the wizards from the control panel view. Each time a specific object is required the wizard asks you either to choose it or to create it. There are a few objects that cannot be created through the wizards, and so you come to the navigation bar to do it.

Slide 4

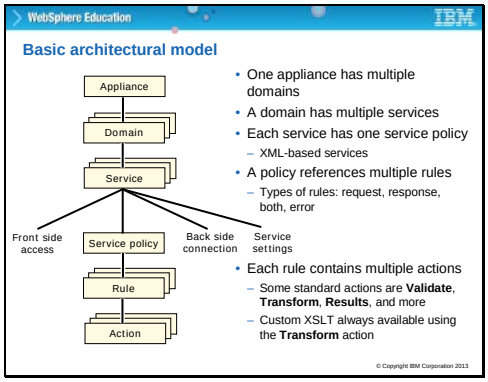
Approach to configuring objects.

There are two basic approaches to defining objects. The first approach is to configure the objects individually. The objects are located and configured by expanding the Objects section one, the navigation bar.

The second approach, and one most often used, is to configure objects from higher level objects. For example, a frond side handler and service policy are created and configured during the configuration of a service, such as a multiprotocol gateway. Another example is to configure processing rules and actions during the configuration of a processing policy.

Some of the objects also provide wizards to assist with the creation, such as the XPath tool, and XML firewall service.

Slide 5

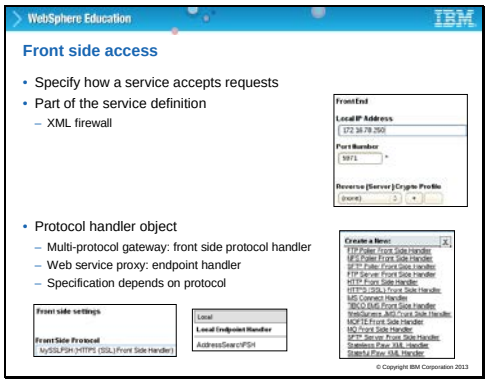


Basic architectural model

Policy is mentioned a few times. Here is what it is and where it fits into the DataPower architecture.

Starting from the appliance level, you can create as many services as you need, in as many domains as you need. Message processing in a service is done through a policy, and there is just one policy to each service. Within a policy, there are one or more rules. A rule is a set of actions to run on the message. For example, there might be a transform action. There is going to be at least one request rule, and there might be several, either matching different request types or all to be run for a request. There might be rules for the response, and there might be rules that are applied in both directions, both request and response. There might also be error rules, which are looked at in the unit on error handling.

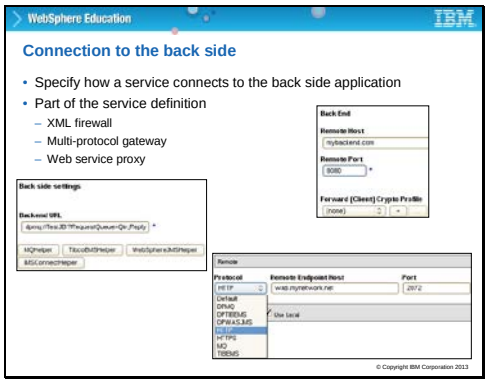
Slide 6



Front side access.

The front side access specifies how a service accepts requests. The front side access is usually a specific port number, WebSphere MQ queue, or FTP poller. The front side is part of the services definition and is referred to by two different names, depending on the service. Most services refer to the front side access point as a front side protocol handler. However, the web service proxy refers to the front side access point as an endpoint handler.

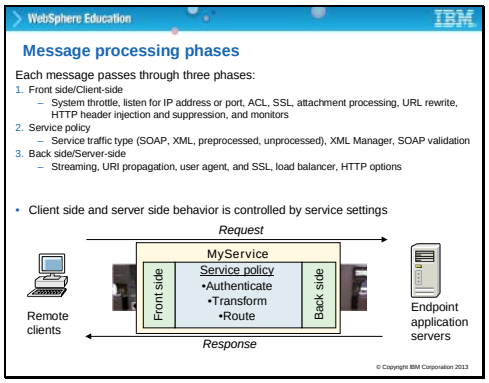
Slide 7



Connection to the back side.

The back side connection can be dynamically determined, rather than hardcoded. In this case, the connection is made from a style sheet within the service policy. Connections to the backside can also be static; in which case the literal back side destination is entered in the service, such as the IP address, port number, and URI of a web service.

Slide 8

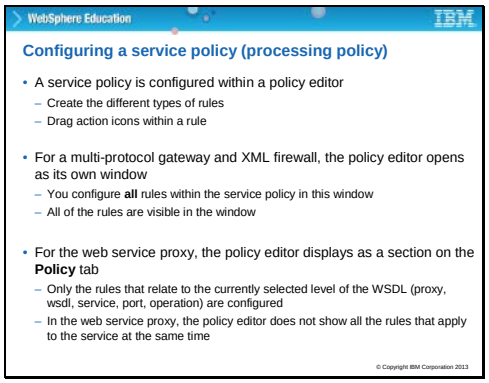


Message processing phases

There are three phases of message processing in DataPower. When a message arrives at the box, the message is first processed by any client-side settings you created. The settings are all settings that affect a message before it is examined for content, or validity, or destination. For example, is there a service level agreement, or SLA, in place between the client and the provider that states how many requests can be made in period of time? If so, then DataPower must first check whether the message that just arrived is within the number of permissible messages. If not, it must either discard the message or store it for processing in the next time period. By the way, there is a more detailed coverage of these options further on. If the message can be passed on, then it reaches the second phase of processing where the message type is determined. The message might be validated (if it is a SOAP message), and the service policy is applied. Finally, there is potentially some server-side processing such as URI propagation or load balancing. This is the order of events for the request direction. The responses are handed back to the DataPower box and a policy might be applied.

'Policy' is mentioned twice in this slide. What is a policy?

Slide 9



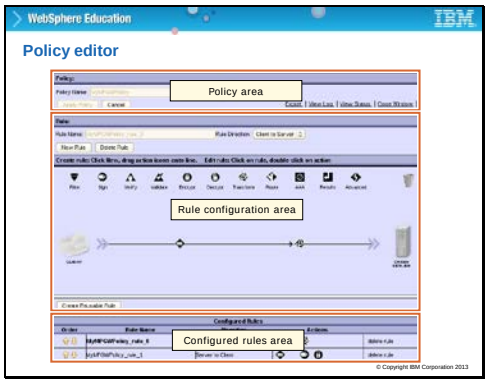
Processing policy

Here is the visual editor for a policy. Only one rule is edited at a time, so what you can see here is the rule line for one of maybe several rules in this policy.

All rules start with a match action. This determines whether the rule should run for a particular message. If the message is matched, actions are applied to it in left to right order. The available actions are listed along the top, starting with a filter action. You select the action that you want, drag its icon to the rule line, and then double-click it to open it and edit it. You can have multiple actions on the rule, and you can drag the same action multiple times. For example, you might have three different transformations that are applied, so you would drag three transform icons to the line and edit each in turn to call up the specific transformation you require.

Actions are always processed in a left to right order, whether the direction is client to server or server to client. So if the example on this slide was a ‘both directions’ rule, the order would be match-AAA-Results for the request and for the response.

Slide 10



Processing policy

Here is the visual editor for a policy. Only one rule is edited at a time, so what you can see here is the rule line for one of maybe several rules in this policy.

All rules start with a match action. The match determines whether the rule should be executed for a particular message. If the message is matched, actions are applied to it in left to right order. The available actions are listed along the top, starting with a filter action. You select the action that you want, drag its icon to the rule line, and then double-click it to open it and edit it. You can have multiple actions on the rule, and you can drag the same action multiple times. For example, you might have three different transformations that are applied, so you would drag three transform icons to the line and edit each in turn to call up the specific transformation you require.

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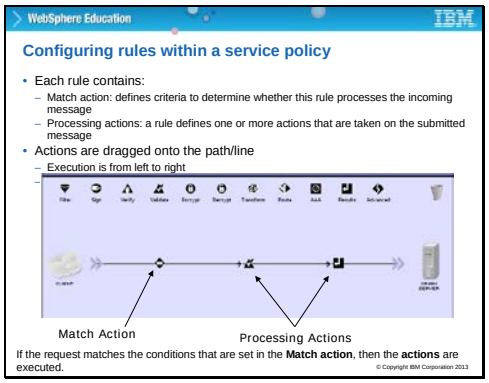
Slide 11



Processing rules

This slide shows a processing rule with three actions configured. On this rule are a Match action, a Validate action, and a Results action.

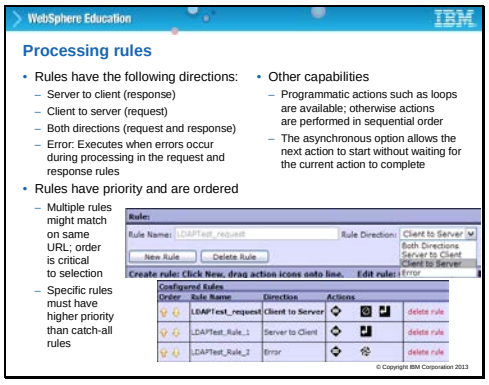
A rule can be configured to apply to:

- Server to client (server response)
- Both directions (client request and server response)
- Client to server (client request)
- Error (errors during message processing)

The rule is always processed from left to right on the rule configuration path, regardless of the rule direction.
The DataPower documentation might refer to a Match action as a matching rule. A Match action contains one or more matching rules.

Match actions are not displayed in the policy editor for web service proxies. The service builds them according to the location of the rule within the WSDL tree.

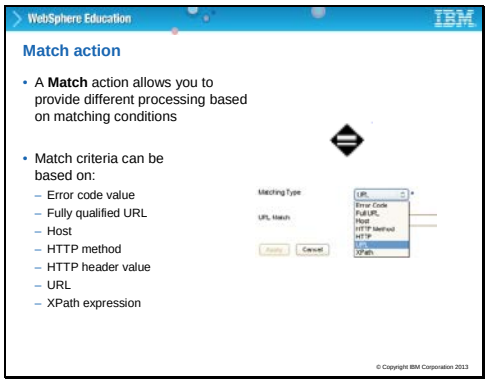
Slide 12



Processing rules

This slide shows the top and bottom of the editor you saw on the previous slide. At the top is an area where you can specify that you want a new rule (or that you want to delete a rule). You specify the name and direction of the rule. You can change the direction at any point just by reselecting. The lower image on the slide shows the bottom of the rule editor. Here, there is a list of all the rules of this policy. The icons of the actions are shown in addition to the direction of the rule. To the left there is a column that is called ‘order’. The process allows you to move the rules up or down the list. Why is rule movement important? Because the rules are run in top-down sequence, and so you might have certain rules ran before others. This only concerns rules that have the same direction. If you place a server-to-client rule before a client-to-server rule, when a request arrives it is the client-to-server rule that runs, and when the response comes back, the server-to-client rule runs.

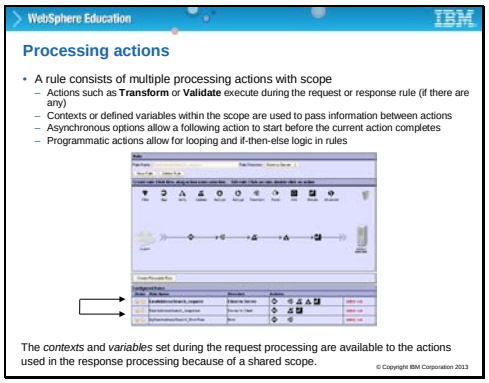
Slide 13



Match action

The first action for all rules is a match action. When you create a rule, this action is the only one that is already placed on the rule line for you. There are six options for matching a rule. If the rule is an error rule, you can match it to a specific code. For other rules, you can match on the host name (such as myserver.com), the URL (such as EastAddress/Search), the fully qualified URL (which is a combination of host and URL). You can also match the HTTP header or XPath expression, which dip into the message to find the necessary information.

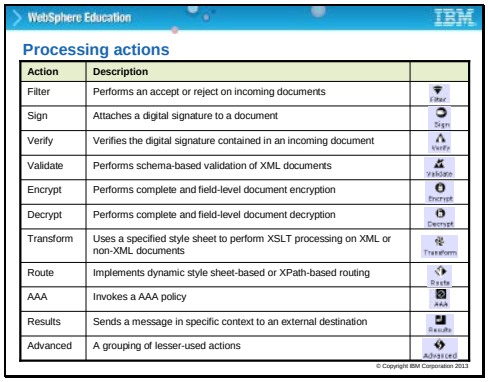
Slide 14



Processing actions

This slide sums up what you learned. A rule has any number of actions, with the match action always being the first. You can have transforms or validation in both directions. There is an asynchronous option that allows an action to begin before the previous one was finished, and a few programmatic actions such as conditional logic. The second bullet on the slide says that contexts are used to pass information from action to action. The next slide looks in detail at what a context is.

Slide 15



Processing actions (slide 1 of 2)

This slide contains a partial list of the processing actions available on the DataPower appliance. They include:

The **Encrypt** and **Decrypt** actions are used for XML encryption. The **Sign** and **Verify** actions are used in XML signatures. These actions are covered in the web services security unit.

The **AAA** action is covered in the AAA lecture.

The advanced actions are:

Anti-Virus: This action scans a message for viruses by using an external ICAP server

Call Processing Rule: calls a named rule; processing resumes on the next step

Conditional: selects an action for processing based on an XPath expression

Convert Query Params to XML: converts non-XML CGI-encoded input (an HTTP POST of HTML form or URI parameters) into an equivalent XML message

Crypto Binary: Calls a cryptographic operation (sign, verify, encrypt, decrypt) on binary data

Event-sink: This forces a wait for asynchronous actions before continuing

Extract Using XPath: applies an XPath expression to a context and stores the result in another context or a variable

Fetch: retrieves an identified external resource and places the result in the specified context

For-each: defines looping based on a count or expression

Header Rewrite: rewrites HTTP headers or URLs

Log: sends the content of the specified input context as a log message to the destination URL identified here

Method Rewrite: rewrites the HTTP method for the output message

WebSphere MQ Header: manipulates WebSphere MQ headers

On Error: sets a named rule as the error handler; it is called if subsequent processing encounters errors

Results Asynchronous: asynchronously sends a message in a specified context to a URL or to the special output context

Route (by using Variable): This routes the document according to the contents of a variable

Set Variable: sets the value of a variable for use in subsequent processing

SLM: calls an SLM (service level monitor) policy

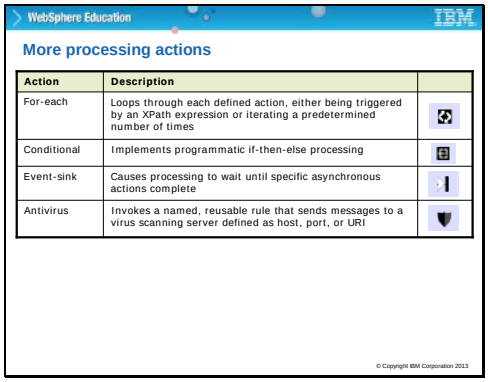
SQL: sends SQL statements to a database

Strip Attachments: removes either all or specific MIME or DIME attachments

Transform (by using processing instruction): This transforms by using XSLT that is specified by processing instructions within the XML document; the parameters might be passed

Transform Binary: Calls a specified transform on a non-XML message, such as binary or flat text

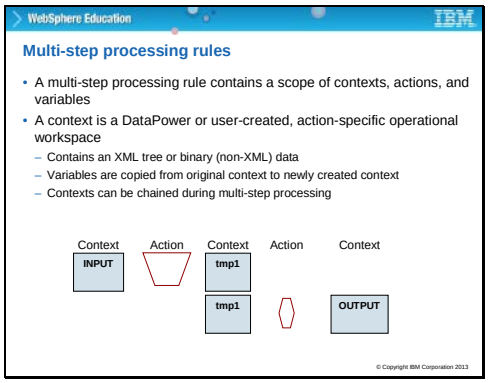
Slide 16



Processing actions (slide 2 of 2)

Many actions have an asynchronous option. **Event-sink** is used in processing rules to wait for certain asynchronous actions to complete before processing continues.

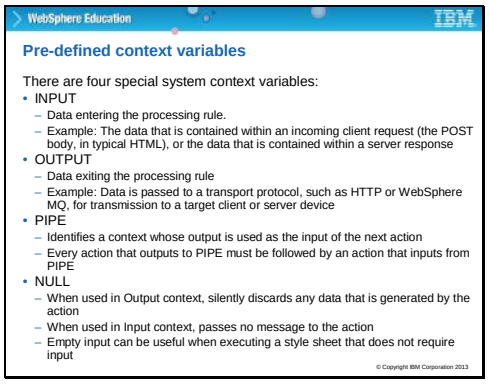
Slide 17



Multistep processing rules

When a message gets to the rule, it is first passed to the match action. If the match succeeds, the input message becomes available to the rule and can be passed to the actions of that rule. It is held in a variable called INPUT (all uppercase). The action might modify the input message and so the information that comes out of the action is placed into a context variable. This variable might now be used as input to a further action. This repeats through the rule until you reach the end, at which point you want to place the message in the OUTPUT context (again, all uppercase). This is the purpose of the Results action.

Slide 18



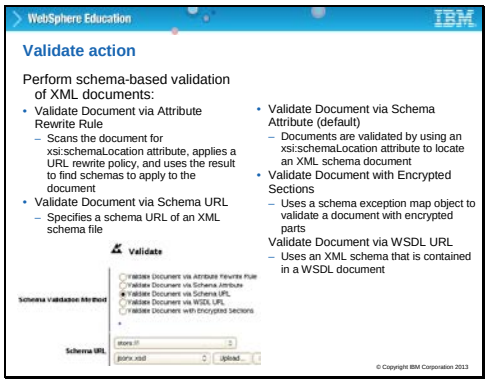
Pre-defined context variables

These context variables are configured when creating actions. Each action allows you to specify an input and output context to use for

It is not always necessary to specify a context within an action. The WebGUI provides default input and output contexts that can be used.

PIPE can improve processing efficiency and reduce latency by eliminating the need for temporary storage of processed documents. This feature is used for streaming documents through the appliance.

Slide 19



Validate action

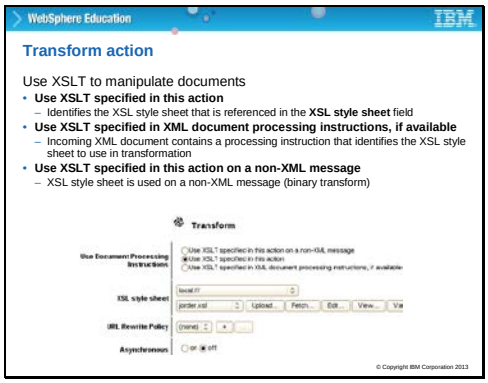
The **Validate** action is used to validate the schema of XML documents. The schema URL can reference either a local or remote file.

A schema exception map object uses an XPath expression to specify the encrypted and unencrypted parts of an XML document. It allows for encrypted XML documents to be validated by using XML schemas that do not support XML encryption.

The **Fetch** button can be used to download a style sheet from a URL and store it on the appliance.

The **Validate Document via Attribute Rewrite Rule** option searches for an **xsi:schemaLocation** attribute and rewrites this attribute value by using a URL rewrite policy. The validation is then completed against the rewritten schema reference.

Slide 20



Transform action

The **Transform action** is also used for supporting custom XSLT actions.

The style sheet can be either referenced from the appliance or uploaded from a remote site.

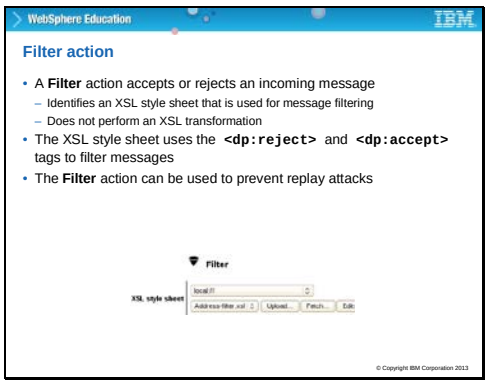
The **URL Rewrite Policy** rewrites external references that are contained within the input document.

Types of transformations include an XML-to-XML message transformation that might help integrate or enable communication between two different applications. And an XML-to-any transformation promotes the integration of legacy applications.

Technically, the **Transform action** transforms the input from the input context and stores the result in the output context. For custom XSLT, some style sheets might not complete transforms, but make remote calls instead. In these situations, you can use the **NULL** context variable in the output context if no the style sheet does not transform any data.

DataPower considers all non-XML message types as binary. This also includes text, so an XML to COBOL copybook transformation is considered an XML to binary transformation in DataPower.

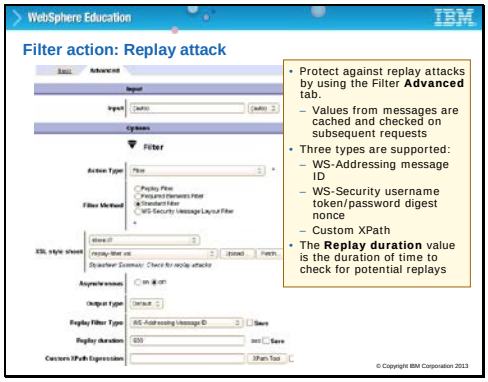
Slide 21



Filter action

A standard filter employs the selected XSLT style sheet to either accept or reject the submitted document.

Slide 22



Filter action – reply attack

A replay attack protects against hackers that send a valid message multiple times. This attack occurs when the intruder intercepts a valid message and sends that message on behalf of someone else. To protect against replay attacks, messages pass unique values in each message. The unique values that the replay filter supports are WS-Addressing messages that contain a message ID, a WS-Security username token with a nonce value, or a custom XPath. A nonce is a bit string that is generated to produce a unique string. It is used in authentication and security situations to create a unique ID.

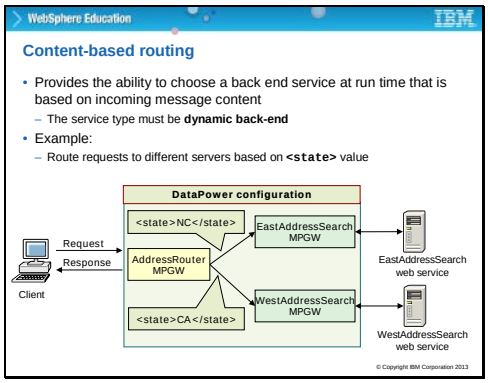
The replay attack filter uses a standard style sheet, replay-filter.xsl, to check whether messages are running replay attacks.

The WS-Addressing message ID is a unique message identifier.

The WS-Security username token can contain a password digest, which is a hashed value of the password. Optionally, it can contain a nonce value, which is a unique base 64- encoded value.

Custom XPath uses content from the XML message to detect replay attacks.

Slide 23



Content based routing

The content-based routing example that is shown in this slide routes the message to separate web services based on the value of the <state> field in the message. The **AddressRouter** multi-protocol gateway (MPGW) uses an XPath expression to extract the state value. If the value is "**NC**" (North Carolina), an eastern state in the United States, the message is forwarded to the **EastAddressSearch** multi-protocol gateway, which sends the message to the EastAddressSearch web service. If the value is "**CA**" (California), a western state in the United States, the message is forwarded to the **WestAddressSearch** multi-protocol gateway, which forwards the message to the WestAddressSearch web service.

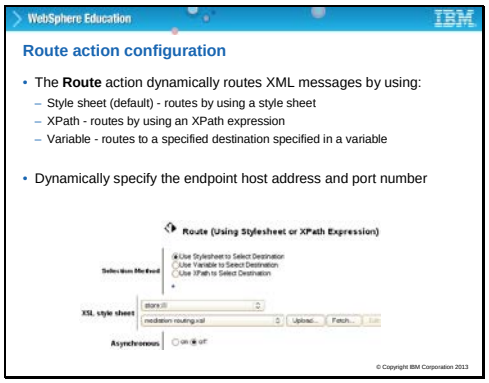
Why does a message get routed?

There are two major reasons:

Reason 1: Quality of service. Sometimes it is necessary to prioritize requests and send them to different servers for processing.

Reason 2: support for specific function or affinity. Version 1.0 requests that go to Server 1, and version 2.0 requests that go to Server 2. Sometimes an application maintains a state, such as a session state; therefore requests get rerouted back to a specific server.

Slide 24



Route action configuration

The **Route** action dynamically routes XML messages by using:

Style sheet (default) - routes by using a style sheet

XPath - routes by using an XPath expression

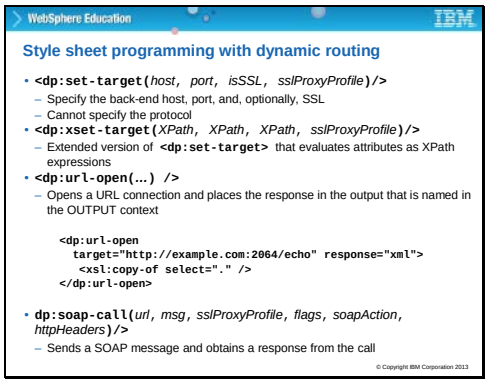
Variable - routes to a specified destination specified in a variable

The XPath Routing Map allows you to specify static destinations that are based on the evaluation of an XPath expression.

The XSL style sheet that is used in a **Route** action can use the DataPower extension function <dp:set-target> to set the endpoint.

However, the **Route** action does not allow you to specify the entire URL string. To change the URI part of the URL, use the variable var://service/URI.

Slide 25



Style sheet programming with dynamic routing.

This example uses dp:soap-call in an XSL style sheet.

Set up a variable call to contain the XML message.

Use dp:call-soap() to send the message and save the response in a variable, result.

```
<xsl:variable name="result"
select="dp:call-soap(http://fn.com/test',$call)"/>'
```

Use the dp:soap-fault extension function to generate a custom SOAP fault message.

The dp:http-request-header(headerFieldName) is a common extension function that is used to extract an HTTP header from a message.

Example:

```
<xsl:variable name="SOAPAction"
select="dp:http-request-header( SOAPAction')"/>'
```

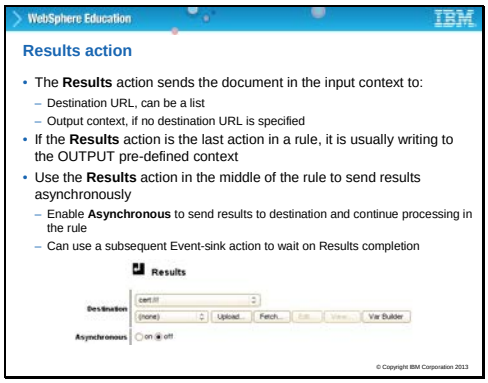
The **SOAPAction** parameter needs quotation marks (') because the function expects an XPath expression.

The equivalent usage of the <dp:set-target>(...) can also be accomplished by using DataPower service variables. For example, to set the back-end URI in a style sheet, use the following code:

```
<dp:set-variable name=" var://service/routing-url'"'
value=" http://1.2.3.1:2068'"/>'
<dp:set-variable name=" var://service/URI'"'
value=" /SomeBank/services/checking'"/>'
```

The **sslProxyProfile** parameter is the name of a DataPower **sslProxyProfile** object.

Slide 26



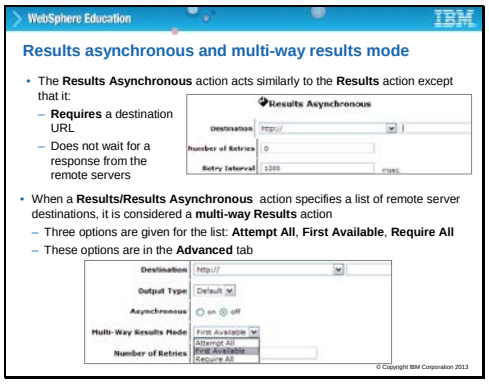
Results action

The **Results** action is typically the last action in a rule, since it is used to return a response at the end of the service policy. Make sure that the input context contains the variable with the document to return to the client.

An alternative is to have the last action itself write to the OUPUT context.

The default **Results** action copies the input context to the output context.

Slide 27



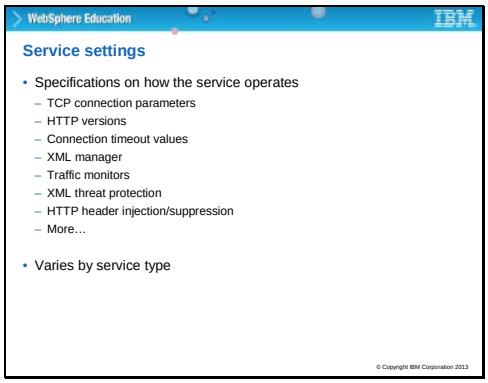
Results asynchronous and multi-way results mode

A regular **Results** action can be set to asynchronous mode, which can be used with an **Event Sink** action to wait for the remote server response.

A **Results Asynchronous** action cannot have an output context.

If a **Results** or a **Results Asynchronous** action must specify multiple locations as destinations, you must use a variable to represent the destination.

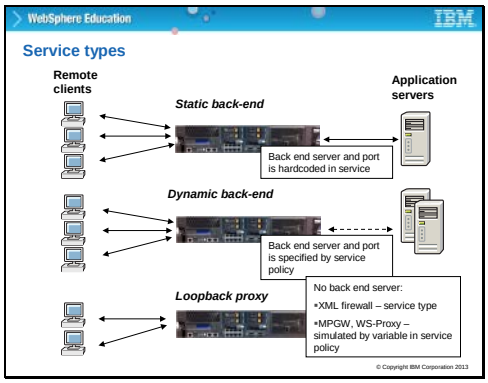
Slide 28



Service settings

Traffic monitors and XML threat protection are covered in other units.

Slide 29



Service types

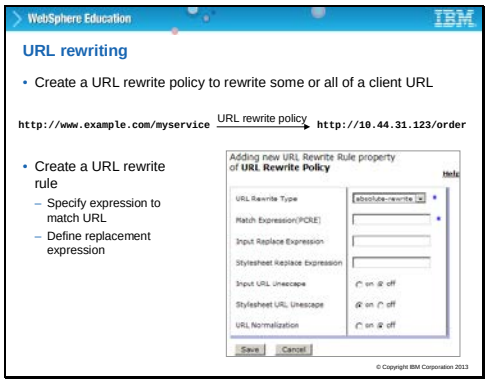
The static back-end forwards traffic to a statically defined endpoint.

The dynamic back-end forwards traffic that is based on the execution of a policy that specifies the back-end host address and port.

A loopback proxy does not forward the message to a back-end service when processing is complete. This service type is often useful for validation and transformation services.

A multi-protocol gateway (MPGW) and a web service proxy (WS-Proxy) can use a Set Variable action to set `var://service/mpgw/skip-backside` to "1". This setting makes these services act like a loopback proxy. Although you can use this variable in a web service proxy, it is unlikely.

Slide 30



URL rewriting

The URL rewrite policy executes at the service level and before the service policy.

Rewriting the URL at the service level affects the matching rule of the service policy.

If you rewrite the URL, make sure that it still matches one of the matching rules.

A URL rewrite policy can also be executed within a service policy by adding a **Header Rewrite** action to the policy header and referencing a URL rewrite policy.

PCRE refers to Perl-compatible regular expression. The match expression must be entered in this syntax.

The five options available under **URL Rewrite Type** are:

Absolute-Rewrite: rewrites the entire body of the URL

Content-Type: rewrites the contents of the content-type header field

Header Rewrite: rewrites the contents of a specific HTTP header field

Post-Body: rewrites the data that is transmitted in the HTTP post body

The Style sheet **Replace Expression** is used to specify a style sheet that transforms or filters a document that is identified by a rewritten URL.

The **Input URL Unescape** is used to specify whether URL-encoded characters (that is, %2F) are rewritten to literal character equivalents.

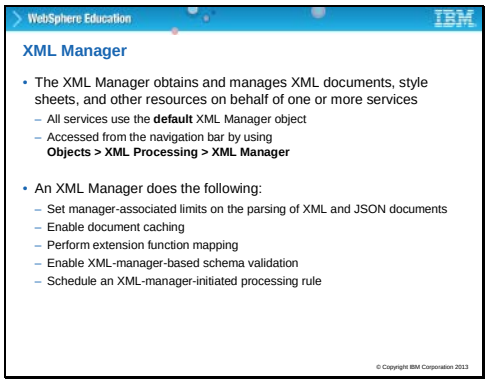
The Style sheet **URL Unescape** is used to specify whether the style sheet identified in style sheet **Replace Expression** is subject to literal character replacement of URL-encoded characters.

The **URL Normalization** field is used to enable normalization of URL strings (for example, **''**).

Optionally, if the **URL Rewrite Type** is **header-rewrite**, then a **Header Name** field is available to specify a target HTTP header field.

A URL rewrite policy can also be specified at the action level for Transform, Validate, and Header Rewrite actions.

Slide 31

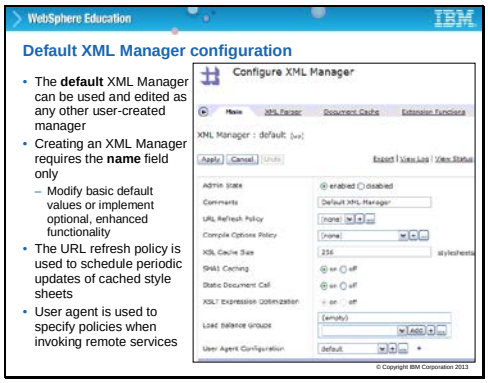


XML manager

The XML manager uses every service. By default it is the default manager that is used, but you can also write your own. Its task is to manage resources that the service needs, or to manage how the service deals with resources. Some examples of the tasks it performs are listed on the slide. The parsing limits is an initial security trap – when an XML file arrives. If the parser exceeds any limit that is set by the manager, such as the number of attributes for a node, or the nesting depth of elements, the document is rejected.

Move on to the next two slides, which show more detail for the XML manager.

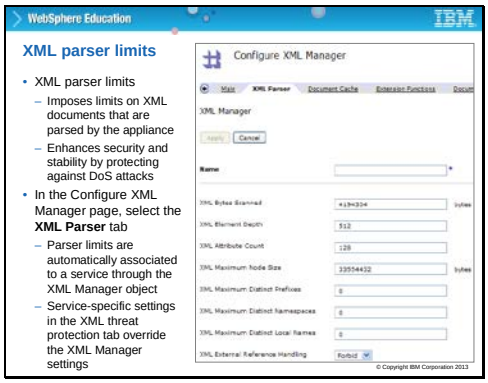
Slide 32



Default XML Manager configuration

The XML manager is configured on seven different tabs. You can see four of them on this slide. The image shows the fields available on the main tab. The URL Refresh Policy gives control over how frequently style sheets that are cached on the DataPower box should be updated. There are different options for caching, and there are two other tabs with more caching options, one of which you can see on the slide, the Document Cache tab. Some of the options on this tab are covered in further units (such as the load balance groups and the user agent).

Slide 33

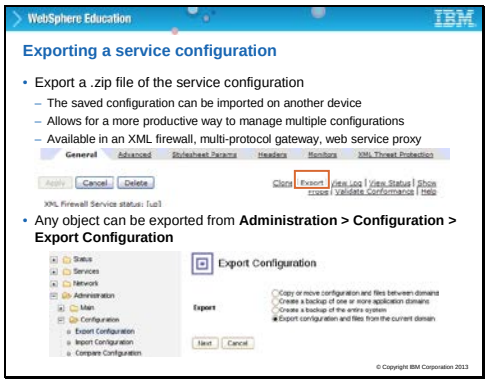


XML parser limits

Look at one more of the tabs, the XML Parser tab. What you can do here is set limits on the size of the document that are applied globally over all services. In the image on the slide, you can see the default sizes. Element depth refers to the nesting of elements within other elements. 512 is probably excessive nesting! To make the effective, you would want to set the value to a much lower number. Likewise, with the attribute count, which is 128 by default.

You can override these generic limits by enabling the Single Message Denial of Service Protection on a web service proxy, a multi-protocol gateway, or an XML firewall.

Slide 34



Exporting a service configuration.

Click the **Export** button to download a .zip file of the XML firewall configuration.

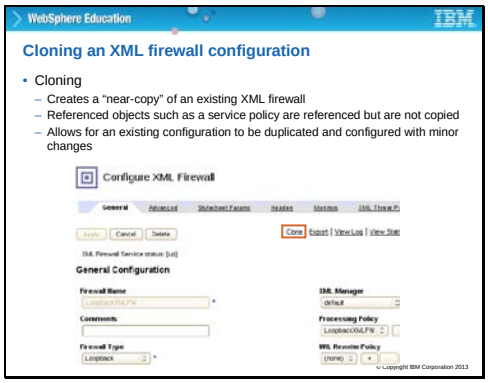
The .zip file contains only the configuration data and files of the selected XML firewall service.

Use **Administration > Configuration > Export Configuration** to have more control over the objects and files that are exported.

Notice that there is an Import Configuration as well.

The most used approach to exporting configuration is through the .zip file, although an XML file that represents a configuration is also supported through **Administration > Configuration > Export Configuration**.

Slide 35



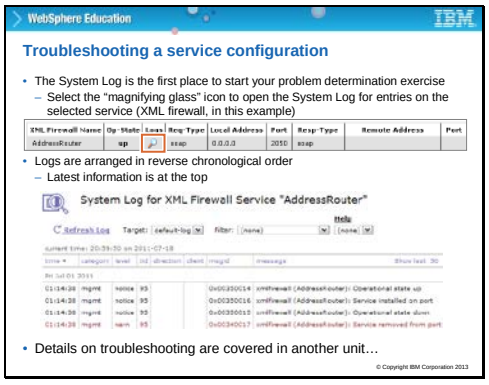
Cloning an XML firewall configuration

Use the **Clone** button to initiate the cloning process.

Since the XML firewall is a top-level object (no other objects depend upon it), you can delete a firewall at any time. Deleting the XML firewall does not delete any of the objects that the firewall uses (such as the service policy).

When cloning a configuration, make sure to change the port number of the cloned XML firewall.

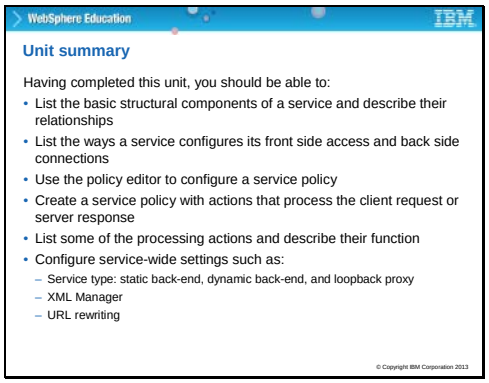
Slide 36



Troubleshooting a service configuration.

The system log opened by the XML firewall is a filtered version of the main system log, and it shows only the events that your XML firewall generates.

Slide 37


WebSphere Education
IBM
Unit summary
Having completed this unit, you should be able to:
• List the basic structural components of a service and describe their relationships
• List the ways a service configures its front side access and back side connections
• Use the policy editor to configure a service policy
• Create a service policy with actions that process the client request or server response
• List some of the processing actions and describe their function
• Configure service-wide settings such as:
– Service type: static back-end, dynamic back-end, and loopback proxy
– XML Manager
– URL rewriting
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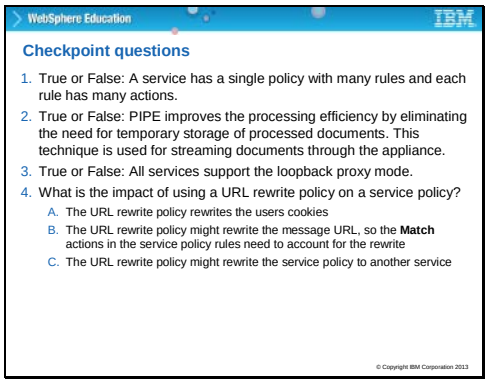
Slide 38


WebSphere Education
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Checkpoint questions
1. True or False: A service has a single policy with many rules and each rule has many actions.
2. True or False: PIPE improves the processing efficiency by eliminating the need for temporary storage of processed documents. This technique is used for streaming documents through the appliance.
3. True or False: All services support the loopback proxy mode.
4. What is the impact of using a URL rewrite policy on a service policy?
A. The URL rewrite policy rewrites the users cookies
B. The URL rewrite policy might rewrite the message URL, so the Match actions in the service policy rules need to account for the rewrite
C. The URL rewrite policy might rewrite the service policy to another service
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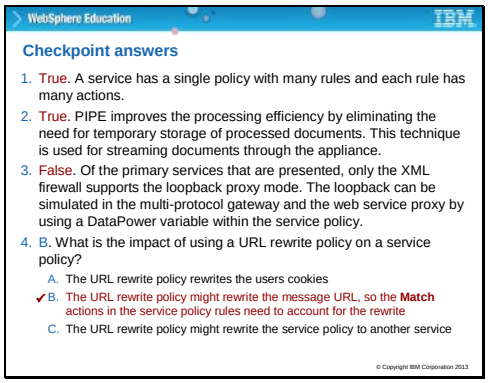
Slide 39


WebSphere Education
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Checkpoint answers
1. True. A service has a single policy with many rules and each rule has many actions.
2. True. PIPE improves the processing efficiency by eliminating the need for temporary storage of processed documents. This technique is used for streaming documents through the appliance.
3. False. Of the primary services that are presented, only the XML firewall supports the loopback proxy mode. The loopback can be simulated in the multi-protocol gateway and the web service proxy by using a DataPower variable within the service policy.
4. B. What is the impact of using a URL rewrite policy on a service policy?
A. The URL rewrite policy rewrites the users cookies
✔B. The URL rewrite policy might rewrite the message URL, so the Match actions in the service policy rules need to account for the rewrite
C. The URL rewrite policy might rewrite the service policy to another service
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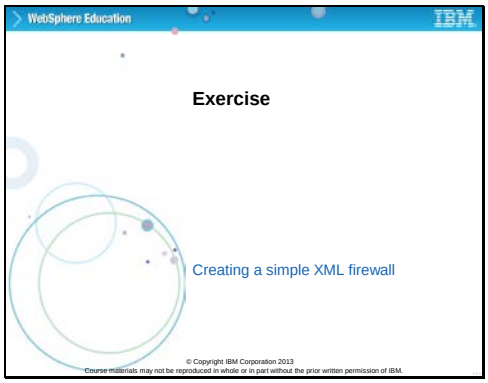
Slide 40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Exercise
Creating a simple XML firewall
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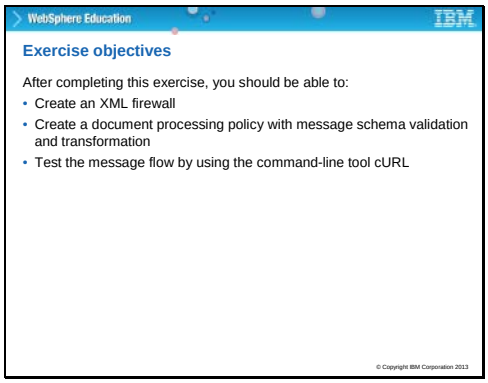
Slide 41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Exercise objectives
After completing this exercise, you should be able to:
• Create an XML firewall
• Create a document processing policy with message schema validation and transformation
• Test the message flow by using the command-line tool cURL
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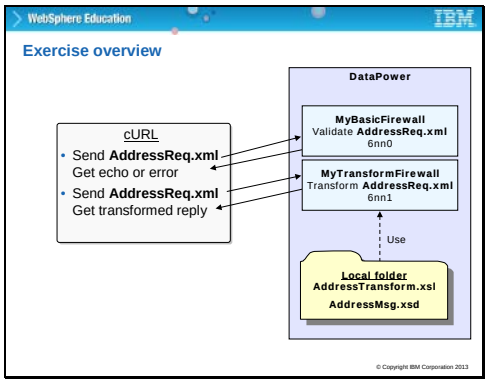
Slide 42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Exercise overview
DataPower
cURL
• Send AddressReq.xml
Get echo or error
• Send AddressReq.xml
Get transformed reply
MyBasicFirewall
Validate AddressReq.xml
6nn0
MyTransformFirewall
Transform AddressReq.xml
6nn1
Use
Local folder
AddressTransform.xsl
AddressMsg.xsd
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