

WS-Policy

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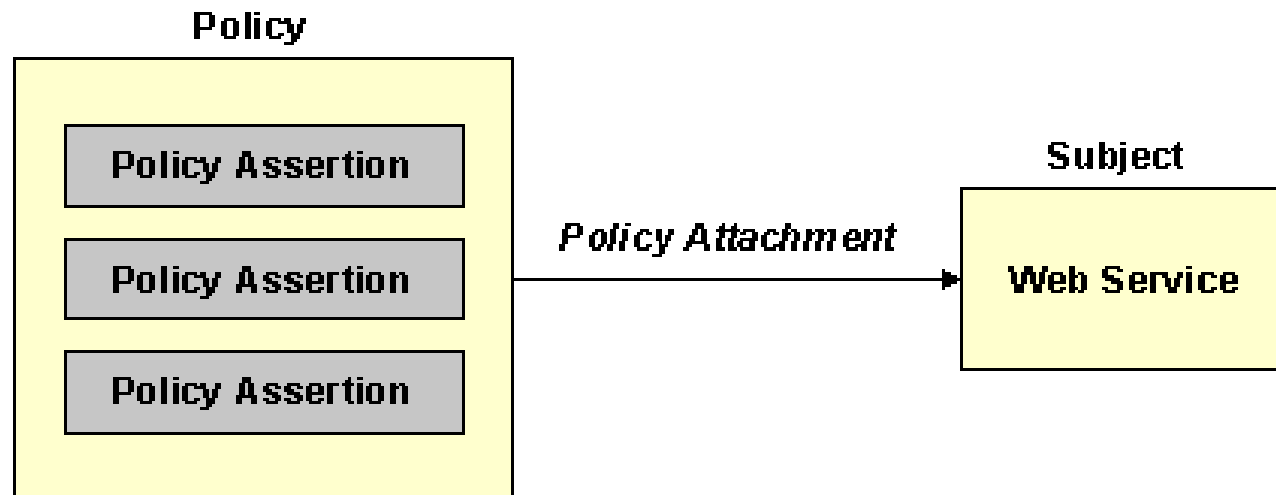
- To use a web service a client needs more information than is provided in WSDL file. Examples:
 - Does service support WS-Security? If so:
 - What encryption algorithm does it expect (or prefer)?
 - Must messages be signed?
 - What character encoding is used?
 - What version of SOAP is supported?
- A **policy** is a set of conditions expected by a service.
- Without this standard, developers need docs

WS-Policy

- WS-Policy specifies:
 1. An XML-based structure declarative mechanism for expressing a policy (called a policy expression) containing policy information
 2. Grammar elements to indicate how the contained policy assertions apply
- Policy expressions can be
 - integrated with WSDL or attached as a tModel in UDDI
 - enforced by web services infrastructure

Terminology

- **Policy:** refers to the set of information being expressed as *policy assertions*
- **Policy Assertion:** represents an individual preference, requirement, capability, etc.
- **Policy Expression:** set of one or more *policy assertions*
- **Policy Subject:** an entity to which a *policy expression* can be bound
- **Policy Attachment:** the mechanism for associating policy expressions with one or more subjects



Policy Expressions

- A Policy Expression is the XML representation of a policy
 - XML facilitates interoperability between a heterogeneous platforms

Policy Namespaces

- [WS-Policy schema](#) defines all constructs that can be used in a *policy expression*

Prefix	Description	Namespace
wsp	WS-Policy, WS-PolicyAssertions, and WS-PolicyAttachment	http://schemas.xmlsoap.org/ws/2002/12/policy
wsse	WS-SecurityPolicy	http://schemas.xmlsoap.org/ws/2002/12/secext
wsu	WS utility schema	http://schemas.xmlsoap.org/ws/2002/07/utility
msp	WSE 2.0 policy schema	http://schemas.microsoft.com/wse/2003/06/Policy

Policy Namespaces

- `wsp:Policy`
 - Representation of a *policy expression*
 - Container for *policy assertions*

```
<wsp:Policy xmlns:wsp="..."  
xmlns:wsu="..." wsu:Id="..."  
    Name="..." TargetNamespace="...">  
    <!-- policy assertions go here -->  
</wsp:Policy>
```

- The `wsu:Id` attribute assigns the *policy expression* an ID value as a URI

Policy Expression Naming

- A full ID is formed by:
 <base URI>#<wsu:Id value>

- Policy Expression:

```
<wsp:Policy xmlns:wsp="..."  
    xmlns:wsu="..." wsu:Id="MyPolicies" >  
    ...</wsp:Policy>
```

- Policy Reference:

```
...  
<wsp:PolicyReference xmlns:wsp="..."  
    URI="http://virginia.edu/isis/policy.xml#MyPolicies"/>  
...
```


Policy Assertions

- A policy assertion:
 - represents an individual preference, requirement, capability, or other characteristic
 - is the basic building block of a policy expression
 - an XML element with a well-known name and meaning

```
<wsp:Policy xmlns:wsp="..." xmlns:wsu="..." wsu:Id="..."  
    Name="..." TargetNamespace="..." >  
    <Assertion wsp:Usage="..." wsp:Preference="..." />  
    <Assertion wsp:Usage="..." wsp:Preference="..." />  
... </wsp:Policy>
```

Types of Assertions

- Two types:
 1. Requirements and capabilities that are explicitly manifested on the wire
 2. No wire manifestation, just provide information

The Usage Qualifier

- wsp:Usage distinguishes between
 - different types of assertions
 - how assertions are processed

Value	Meaning
wsp:Required	The assertion must be applied, otherwise an error results
wsp:Rejected	The assertion is not supported and, if present, will cause failure
wsp:Optional	The assertion may be made of the subject, but is not required
wsp:Observed	The assertion will be applied to all subjects and requestors are told
wsp:Ignored	The assertion will be ignored if present and requestors are told

Assertion Example

- What does this Assertion state?

```
<wsp:Policy xmlns:wsp="..." xmlns:wsse="...">
  <wsse:SecurityToken wsp:Usage="wsp:Required">
    <wsse:TokenType>wsse:Kerberosv5ST</wsse:TokenType>
  </wsse:SecurityToken>
  <wsse:Integrity wsp:Usage="wsp:Required">
    <wsse:Algorithm Type="wsse:AlgSignature"
      URI="http://www.w3.org/2000/09/xmlenc#aes" />
  </wsse:Integrity>
</wsp:Policy>
```

Two policy assertions:

1. Security Token is required
2. Use of AES is required

Assertion Preference

- `wsp:Preference` attribute:
 - Used to specify the service's preference as an integer value
 - Larger integer => higher preference
 - Omitted preference attribute is interpreted as a 0

Assertion Preference Example

- What does this Assertion state?

```
<wsp:Policy xmlns:wsp="..." xmlns:wsse="...">
  <wsse:SecurityToken wsp:Usage="wsp:Optional">

<wsse:TokenType>wsse:UsernameToken</wsse:TokenType>
  </wsse:SecurityToken>
  <wsse:SecurityToken wsp:Usage="wsp:Optional"
    wsp:Preference="1">
    <wsse:TokenType>wsse:x509v3</wsse:TokenType>
  </wsse:SecurityToken>
</wsp:Policy>
```

- The subject prefers X.509 certificates over UsernameTokens

Standard Policy Assertions

- WS-PolicyAssertions defines four general policy assertions for any subject

Policy Assertion	Description
wsp:TextEncoding	Specifies a character encoding
wsp:Language	Specifies a natural language (xml:Lang)
wsp:SpecVersion	Specifies a version of a particular specification
wsp:MessagePredicate	Specifies a predicate that can be tested against the message (XPath expressions by default)

General Assertion Example

- What does this Assertion state?

```
<wsp:Policy xmlns:wsse="...">
  <wsp:TextEncoding wsp:Usage="wsp:Required"
Encoding="utf-8" />
  <wsp:Language wsp:Usage="wsp:Required" Language="en" />
  <wsp:SpecVersion wsp:Usage="wsp:Required"
    URI="http://www.w3.org/TR/2000/NOTE-SOAP-20000508/" />
  ...
</wsp:Policy>
```

- The subject requires
 1. The UTF-8 character encoding
 2. Any form of the English language
 3. SOAP version 1.1

General Assertion Example

- What does this Assertion state?

```
<wsp:Policy xmlns:wsp="..." xmlns:wsse="...">
  <wsp:MessagePredicate wsp:Usage="wsp:Required">
    count(wsp:GetHeader(.) / wsse:Security) = 1
  </wsp:MessagePredicate>
  <wsp:MessagePredicate wsp:Usage="wsp:Required">
    count(wsp:GetBody(.) / *) = 1
  </wsp:MessagePredicate>
  ...
</wsp:Policy>
```

- Must be:
 1. Exactly one wsse:Security header element
 2. Exactly one child within the soap:Body element

WS-SecurityPolicy

- Defines a set of security-related assertions

Policy Assertion	Description
wsse:SecurityToken	Specifies a type of security token (defined by WS-Security)
wsse:Integrity	Specifies a signature format (defined by WS-Security)
wsse:Confidentiality	Specifies an encryption format (defined by WS-Security)
wsse:Visibility	Specifies portions of a message that MUST be able to be processed by an intermediary or endpoint
wsse:SecurityHeader	Specifies how to use the <Security> header defined in WS-Security
wsse:MessageAge	Specifies the acceptable time period before messages are declared "stale" and discarded

Combining Multiple Assertions

- *Policy operators* are used to combine assertions
 - Can nest operators

Policy Operator	Description
wsp:All	Requires that all of its child elements be satisfied
wsp:ExactlyOne	Requires that exactly one child to be satisfied
wsp:OneOrMore	Requires that at least one child be satisfied
wsp:Policy	Same as wsp:All

Assertion Combination Example

- What does this Assertion state?

```
<wsp:Policy xmlns:wsp="..." xmlns:wsse="...">
  <wsp:ExactlyOne wsp:Usage="Required">
    <wsse:SecurityToken>
      <wsse:TokenType>wsse:UsernameToken</wsse:TokenType>
    </wsse:SecurityToken>
    <wsse:SecurityToken wsp:Preference="10">
      <wsse:TokenType>wsse:x509v3</wsse:TokenType>
    </wsse:SecurityToken>
    <wsse:SecurityToken wsp:Preference="1">
      <wsse:TokenType>wsse:Kerberosv5ST</wsse:TokenType>
    </wsse:SecurityToken>
  </wsp:ExactlyOne>
</wsp:Policy>
```

- Exactly one child must be satisfied

Policy Reference

- Mechanism to share policy assertions across policy expressions
- Uses the naming conventions discussed above

```
<wsp:Policy xmlns:wsp="...">
  ...
  <wsp:PolicyReference URI="..."
    Ref="..."
    Digest="..."
    DigestAlgorithm="..." />
  ...
</wsp:Policy>
```

Policy Reference Example

```
<wsp:Policy wsu:Id="tokens" xmlns:wsp="..." xmlns:wsse="...">
  <wsp:ExactlyOne wsp:Usage="Required">
    <wsse:SecurityToken>
      <wsse:TokenType>wsse:UsernameToken</wsse:TokenType>
    </wsse:SecurityToken>
    <wsse:SecurityToken wsp:Preference="10">
      <wsse:TokenType>wsse:x509v3</wsse:TokenType>
    </wsse:SecurityToken>
    <wsse:SecurityToken wsp:Preference="1">
      <wsse:TokenType>wsse:Kerberosv5ST</wsse:TokenType>
    </wsse:SecurityToken>
  </wsp:ExactlyOne>
</wsp:Policy>
```

Policy Reference Example

```
<wsp:Policy wsu:Id="tokensWithSignature"
  xmlns:wsp="..." xmlns:wsse="...">
  <wsp:PolicyReference URI="#tokens" />
  <wsse:Integrity wsp:Usage="wsp:Required">
    ...
  </wsse:Integrity>
</wsp:Policy>
```

```
<wsp:Policy wsu:Id="tokensWithEncryption"
  xmlns:wsp="..." xmlns:wsse="...">
  <wsp:PolicyReference URI="#tokens" />
  <wsse:Confidentiality wsp:Usage="Required">
    ...
  </wsse:Confidentiality>
</wsp:Policy>
```

Policy Attachments

- WS-PolicyAttachment defines mechanisms to associate expressions with subjects
- Specifically defines mechanisms for:
 - XML elements
 - WSDL definitions
 - UDDI entries

Policy Attachments

- The attribute `wsp:PolicyAttachment` binds an endpoint to a policy expression
 - Requires no change to the web service

```
<wsp:PolicyAttachment>
  <wsp:AppliesTo>
    <wsa:EndpointReference xmlns:s="...">
      <wsa:Address>http://virginia.edu/someendpoint</wsa:Address>
      <wsa:PortType>s:SomePortType</wsa:PortType>
      <wsa:ServiceName>s:SomeService</wsa:ServiceName>
    </wsa:EndpointReference>
  </wsp:AppliesTo>
  <wsp:PolicyReference URI="http://virginia.edu/policy.xml" />
  <wsse:Security>
    <ds:Signature> ... </ds:Signature>
  </wsse:Security>
</wsp:PolicyAttachment>
```

Conclusion

- The policy specifications define a standard framework
- Developers can:
 - express requirements, capabilities, and preferences in an interoperable way
 - select web services more meaningfully
- Policies provide support for standard assertions

References

- http://msdn.microsoft.com/webservices/default.aspx?pull=/library/en-us/dnglobspec/html/ws-policy.asp#ws-policy_toc42483108
 - Official document describing WS-Policy
- <http://msdn.microsoft.com/library/default.asp?url=/library/en-us/dnwebsrv/html/understwspol.asp>
 - “Understanding WS-Policy” – A great reference that I used a lot for this presentation. Provides a great, easy explanation of WS-Policy.

References

- <http://schemas.xmlsoap.org/ws/2002/12/Policy/>
 - This is the policy schema definition
- <http://msdn.microsoft.com/webservices/default.aspx?pull=/library/en-us/dnglobspec/html/ws-policyassertions.asp>
 - Provides a very detailed description of WS-PolicyAssertions
- <http://msdn.microsoft.com/webservices/default.aspx?pull=/library/en-us/dnglobspec/html/ws-policyattachment.asp>
 - Provides a very detailed description of WS-PolicyAttachment
- <http://msdn.microsoft.com/webservices/default.aspx?pull=/library/en-us/dnglobspec/html/ws-securitypolicy.asp>
 - Provides a detailed description of WS-SecurityPolicy