Web Services Reliable Messaging Policy Assertion (WS-RM Policy) Version 1.1

OASIS Standard

14 June 2007

Specification URIs:

This Version:
http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.pdf
http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.html
http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.doc

Previous Version:
http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.pdf
http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.html
http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-spec-os-01.doc

Latest Version:
http://docs.oasis-open.org/ws-rx/wsrmp/v1.1/wsrmp.html
http://docs.oasis-open.org/ws-rx/wsrmp/v1.1/wsrmp.doc

Technical Committee:
OASIS Web Services Reliable Exchange (WS-RX) TC

Chairs:
Paul Fremantle <paul@wso2.com>
Sanjay Patil <sanjay.patil@sap.com>

Editors:
Doug Davis, IBM <dug@us.ibm.com>
Anish Karmarkar, Oracle <Anish.Karmarkar@oracle.com>
Gilbert Pilz, BEA <gpilz@bea.com>
Ümit Yalçinalp, SAP <umit.yalcinalp@sap.com>

Related Work:
This specification replaces or supercedes:
- WS-ReliableMessaging Policy v1.0

Declared XML Namespaces:
http://docs.oasis-open.org/ws-rx/wsrmp/200702

Abstract:
This specification describes a domain-specific policy assertion for WS-ReliableMessaging [WS-RM] that that can be specified within a policy alternative as defined in WS-Policy Framework [WS-Policy].

By using the XML [XML], SOAP [SOAP 1.1], [SOAP 1.2] and WSDL [WSDL 1.1] extensibility models, the WS* specifications are designed to be composed with each other to provide a rich Web services environment. This by itself does not provide a negotiation solution for Web services. This is a building block that is used in conjunction with other Web service and application-specific protocols to accommodate a wide variety of policy exchange models.
This document was last revised or approved by the WS-RX Technical Committee on the above date. The level of approval is also listed above. Check the "Latest Version" or "Latest Approved Version" location noted above for possible later revisions of this document.

Technical Committee members should send comments on this specification to the Technical Committee's email list. Others should send comments to the Technical Committee by using the "Send A Comment" button on the Technical Committee's web page at http://www.oasis-open.org/committees/ws-rx/.

For information on whether any patents have been disclosed that may be essential to implementing this specification, and any offers of patent licensing terms, please refer to the Intellectual Property Rights section of the Technical Committee web page (http://www.oasis-open.org/committees/ws-rx/ipr.php).

The non-normative errata page for this specification is located at http://www.oasis-open.org/committees/ws-rx/.
Notices

Copyright © OASIS® 1993–2007. All Rights Reserved. OASIS trademark, IPR and other policies apply.

All capitalized terms in the following text have the meanings assigned to them in the OASIS Intellectual Property Rights Policy (the "OASIS IPR Policy"). The full Policy may be found at the OASIS website.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published, and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this section are included on all such copies and derivative works. However, this document itself may not be modified in any way, including by removing the copyright notice or references to OASIS, except as needed for the purpose of developing any document or deliverable produced by an OASIS Technical Committee (in which case the rules applicable to copyrights, as set forth in the OASIS IPR Policy, must be followed) or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by OASIS or its successors or assigns.

This document and the information contained herein is provided on an "AS IS" basis and OASIS DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF INFORMATION HEREIN WILL NOT INFRINGE ANY OWNERSHIP RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

OASIS requests that any OASIS Party or any other party that believes it has patent claims that would necessarily be infringed by implementations of this OASIS Committee Specification or OASIS Standard, to notify OASIS TC Administrator and provide an indication of its willingness to grant patent licenses to such patent claims in a manner consistent with the IPR Mode of the OASIS Technical Committee that produced this specification.

OASIS invites any party to contact the OASIS TC Administrator if it is aware of a claim of ownership of any patent claims that would necessarily be infringed by implementations of this specification by a patent holder that is not willing to provide a license to such patent claims in a manner consistent with the IPR Mode of the OASIS Technical Committee that produced this specification. OASIS may include such claims on its website, but disclaims any obligation to do so.

OASIS takes no position regarding the validity or scope of any intellectual property or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; neither does it represent that it has made any effort to identify any such rights. Information on OASIS' procedures with respect to rights in any document or deliverable produced by an OASIS Technical Committee can be found on the OASIS website. Copies of claims of rights made available for publication and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementers or users of this OASIS Committee Specification or OASIS Standard, can be obtained from the OASIS TC Administrator. OASIS makes no representation that any information or list of intellectual property rights will at any time be complete, or that any claims in such list are, in fact, Essential Claims.

The name "OASIS", WS-ReliableMessaging Policy, WS-ReliableMessaging, WSRMP, WSRM, WS-RX are trademarks of OASIS, the owner and developer of this specification, and should be used only to refer to the organization and its official outputs. OASIS welcomes reference to, and implementation and use of, specifications, while reserving the right to enforce its marks against misleading uses. Please see http://www.oasis-open.org/who/trademark.php for above guidance.
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Terminology</td>
<td>5</td>
</tr>
<tr>
<td>1.2</td>
<td>Normative</td>
<td>5</td>
</tr>
<tr>
<td>1.3</td>
<td>Non Normative</td>
<td>6</td>
</tr>
<tr>
<td>1.4</td>
<td>Namespace</td>
<td>7</td>
</tr>
<tr>
<td>1.5</td>
<td>Conformance</td>
<td>7</td>
</tr>
<tr>
<td>2.1</td>
<td>Assertion Model</td>
<td>8</td>
</tr>
<tr>
<td>2.2</td>
<td>Normative Outline</td>
<td>8</td>
</tr>
<tr>
<td>2.3</td>
<td>Assertion Attachment</td>
<td>9</td>
</tr>
<tr>
<td>2.4</td>
<td>Assertion Example</td>
<td>11</td>
</tr>
<tr>
<td>2.5</td>
<td>Sequence Security Policy</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>Security Considerations</td>
<td>13</td>
</tr>
<tr>
<td>Appendix A</td>
<td>Schema</td>
<td>14</td>
</tr>
<tr>
<td>Appendix B</td>
<td>Acknowledgments</td>
<td>16</td>
</tr>
</tbody>
</table>

Copyright © OASIS® 1993–2007. All Rights Reserved. OASIS trademark, IPR and other policies apply.
1 Introduction

This specification defines a domain-specific policy assertion for reliable messaging for use with WS-Policy and WS-ReliableMessaging.

1.1 Terminology

The keywords "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [KEYWORDS].

This specification uses the following syntax to define normative outlines for messages:

- The syntax appears as an XML instance, but values in italics indicate data types instead of values.
- Characters are appended to elements and attributes to indicate cardinality:
  - "?" (0 or 1)
  - "*" (0 or more)
  - "+" (1 or more)
- The character "|" is used to indicate a choice between alternatives.
- The characters "[" and "]" are used to indicate that contained items are to be treated as a group with respect to cardinality or choice.
- An ellipsis (i.e. "...") indicates a point of extensibility that allows other child, or attribute, content. Additional children and/or attributes MAY be added at the indicated extension points but MUST NOT contradict the semantics of the parent and/or owner, respectively. If an extension is not recognized it SHOULD be ignored.
- XML namespace prefixes (see section 1.4) are used to indicate the namespace of the element being defined.

Elements and Attributes defined by this specification are referred to in the text of this document using XPath 1.0 [XPATH 1.0] expressions. Extensibility points are referred to using an extended version of this syntax:

- An element extensibility point is referred to using {any} in place of the element name. This indicates that any element name can be used, from any namespace other than the wsrm: namespace.
- An attribute extensibility point is referred to using @{any} in place of the attribute name. This indicates that any attribute name can be used, from any namespace other than the wsrm: namespace.

1.2 Normative

http://www.ietf.org/rfc/rfc2119.txt

http://www.w3.org/TR/2000/NOTE-SOAP-20000508/
1.3 Non Normative

http://www.w3.org/TR/2007/REC-WS-Policy-20070904228

http://www.w3.org/Submission/2006/SUBM-WS-PolicyAttachment-20060425/


http://www.openhealth.org/RDDL/20040118/rddl-20040118.html

http://www.w3.org/Submission/2006/SUBM-WS-PolicyAttachment-20060425/


http://www.w3.org/TR/2007/RECCR-ws-policy-attach-20070904228


http://www.w3.org/TR/REC-xml/

http://www.w3.org/TR/xmlschema-2/

http://www.w3.org/TR/xmlschema-1/

http://www.openhealth.org/RDDL/20040118/rddl-20040118.html


http://www.w3.org/TR/2007/REC-WS-Policy-20070904228

http://www.w3.org/Submission/2006/SUBM-WS-PolicyAttachment-20060425/


http://www.w3.org/TR/2007/RECCR-ws-policy-attach-20070904228


http://ietf.org/rfc/rfc3986


http://www.w3.org/Submission/2006/SUBM-WS-Policy-20060425/


http://www.w3.org/TR/2007/REC-WS-Policy-20070904228

http://www.w3.org/Submission/2006/SUBM-WS-PolicyAttachment-20060425/


http://www.w3.org/TR/2007/RECCR-ws-policy-attach-20070904228

1.4 Namespace

The XML namespace [XML-ns] URI that MUST be used by implementations of this specification is:

http://docs.oasis-open.org/ws-rx/wsrmp/200702

Dereferencing the above URI will produce the Resource Directory Description Language [RDDL 2.0] document that describes this namespace.

Table 1 lists the XML namespaces that are used in this specification. The choice of any namespace prefix is arbitrary and not semantically significant. The assertions defined within this specification have been designed to work independently of a specific version of WS-Policy. At the time of the publication of this specification the versions of WS-Policy known to correctly compose with this specification are WS-Policy 1.2 and 1.5. Within this specification the use of the namespace prefix wsp refers generically to the WS-Policy namespace, not a specific version.

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Namespace</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>wsdl</td>
<td><a href="http://schemas.xmlsoap.org/wsdl/">http://schemas.xmlsoap.org/wsdl/</a></td>
<td>[WSDL 1.1]</td>
</tr>
<tr>
<td>wsrmp</td>
<td><a href="http://docs.oasis-open.org/ws-rx/wsrmp/200702">http://docs.oasis-open.org/ws-rx/wsrmp/200702</a></td>
<td>This specification.</td>
</tr>
</tbody>
</table>

The normative schema for WS-ReliableMessaging can be found linked from the namespace document that is located at the namespace URI specified above.

All sections explicitly noted as examples are informational and are not to be considered normative.

1.5 Conformance

An implementation is not compliant with this specification if it fails to satisfy one or more of the MUST or REQUIRED level requirements defined herein. A SOAP Node MUST NOT use the XML namespace identifier for this specification (listed in section 1.4) within SOAP Envelopes unless it is compliant with this specification.

Normative text within this specification takes precedence over normative outlines, which in turn take precedence over the XML Schema [XML-Schema Part1, XML-Schema Part2] descriptions.
2 RM Policy Assertions

WS-Policy Framework and WS-Policy Attachment [WS-PolicyAttachment] collectively define a framework, model and grammar for expressing the requirements, and general characteristics of entities in an XML Web services-based system. To enable an RM Destination and an RM Source to describe their requirements for a given Sequence, this specification defines a single RM policy assertion that leverages the WS-Policy framework.

2.1 Assertion Model

The RM policy assertion indicates that the RM Source and RM Destination MUST use WS-ReliableMessaging to ensure reliable delivery of messages. Specifically, the WS-ReliableMessaging protocol determines invariants maintained by the reliable messaging endpoints and the directives used to track and manage the delivery of a Sequence of messages.

2.2 Normative Outline

The normative outline for the RM assertion is:

```xml
<wrpmp:RMAssertion [wsp:Optional="true"]? ... >
  <wsp:Policy>
    [ <wrmp:SequenceSTR/> | <wrmp:SequenceTransportSecurity/> ] ?
    <wrmp:DeliveryAssurance>
      <wsp:Policy>
        [ <wrmp:ExactlyOnce/> | <wrmp:AtLeastOnce/> | <wrmp:AtMostOnce/> ]
        <wrmp:InOrder/> ?
      </wsp:Policy>
    </wrmp:DeliveryAssurance>
  </wsp:Policy>
  ... 
</wrmp:RMAssertion>
```

The following describes the content model of the RMAssertion element.

/wrpmp:RMAssertion

A policy assertion that specifies that WS-ReliableMessaging protocol MUST be used when sending messages.

/wrpmp:RMAssertion/@wsp:Optional="true"

Per WS-Policy, this is compact notation for two policy alternatives, one with and one without the assertion. The intuition is that the behavior indicated by the assertion is optional, or in this case, that WS-ReliableMessaging MAY be used.

/wrpmp:RMAssertion/wsp:Policy

This required element allows for the inclusion of nested policy assertions.

/wrpmp:RMAssertion/wsp:Policy/wrpmp:SequenceSTR

When present, this assertion defines the requirement that an RM Sequence MUST be bound to an explicit token that is referenced from a wsse:SecurityTokenReference in the CreateSequence message. See section 2.5.1.
274 /wsrmp:RMAssertion/wsp:Policy/wsrmp:SequenceTransportSecurity
275 When present, this assertion defines the requirement that an RM Sequence MUST be bound to
276 the session(s) of the underlying transport-level protocol used to carry the CreateSequence and
277 CreateSequenceResponse message. When present, this assertion MUST be used in
278 conjunction with the sp:TransportBinding assertion, see section 2.5.2.
279
280 /wsrmp:RMAssertion/wsp:Policy/wsrmp:DeliveryAssurance
281 This expression, which may be omitted, describes the message delivery quality of service between
282 the RM and application layer. When used by an RM Destination it expresses the delivery
283 assurance in effect between the RM Destination and its corresponding application destination, and
284 it also indicates requirements on any RM Source that transmits messages to this RM destination.
285 Conversely when used by an RM Source it expresses the delivery assurance in effect between the
286 RM Source and its corresponding application source, as well as indicating requirements on any
287 RM Destination that receives messages from this RM Source. In either case the delivery
288 assurance does not affect the messages transmitted on the wire. Absence of this expression from
289 a wsrmp:RMAssertion policy assertion simply means that the endpoint has chosen not to
290 advertise its delivery assurance characteristics.
291 Note that when there are multiple policy alternatives of the RM Assertion, the Delivery Assurance
292 on each MUST NOT conflict.
293
295 This required element identifies additional requirements for the use of the
296 wsrmp:DeliveryAssurance.
297
299 This expresses the ExactlyOnce Delivery Assurance defined in [WS-RM].
300
302 This expresses the AtLeastOnce Delivery Assurance defined in [WS-RM].
303
305 This expresses the AtMostOnce Delivery Assurance defined in [WS-RM].
306
308 This expresses the InOrder Delivery Assurance defined in [WS-RM].
309
310 /wsrmp:RMAssertion/{any}
311 This is an extensibility mechanism to allow different (extensible) types of information, based on a
312 schema, to be passed.
313
314 /wsrmp:RMAssertion/@{any}
315 This is an extensibility mechanism to allow different (extensible) types of information, based on a
316 schema, to be passed.
317
318 2.3 Assertion Attachment
319 The RM policy assertion is allowed to have the following Policy Subjects [WS-PolicyAttachment]:
320 • Endpoint Policy Subject
321 • Message Policy Subject
WS-PolicyAttachment defines a set of WSDL/1.1 policy attachment points for each of the above Policy Subjects. Since an RM policy assertion specifies a concrete behavior, it MUST NOT be attached to the abstract WSDL policy attachment points.

The following is the list of WSDL/1.1 elements whose scope contains the Policy Subjects allowed for an RM policy assertion but which MUST NOT have RM policy assertions attached:

- `wsdl:message`
- `wsdl:portType/wsdl:operation/wsdl:input`
- `wsdl:portType/wsdl:operation/wsdl:output`
- `wsdl:portType/wsdl:operation/wsdl:fault`
- `wsdl:portType`

The following is the list of WSDL/1.1 elements whose scope contains the Policy Subjects allowed for an RM policy assertion and which MAY have RM policy assertions attached:

- `wsdl:port`
- `wsdl:binding`
- `wsdl:binding/wsdl:operation/wsdl:input`
- `wsdl:binding/wsdl:operation/wsdl:output`
- `wsdl:binding/wsdl:operation/wsdl:fault`

If an RM policy assertion is attached to any of:

- `wsdl:binding/wsdl:operation/wsdl:input`
- `wsdl:binding/wsdl:operation/wsdl:output`
- `wsdl:binding/wsdl:operation/wsdl:fault`

then an RM policy assertion, specifying `wsp:Optional="true"` MUST be attached to the corresponding `wsdl:binding` or `wsdl:port`, indicating that the endpoint supports WS-RM. Any messages, regardless of whether they have an attached Message Policy Subject RM policy assertion, MAY be sent to that endpoint using WS-RM. Additionally, the receiving endpoint MUST NOT reject any message belonging to a Sequence, simply because there was no Message Policy Subject RM policy assertion attached to that message. There might be certain RM implementations that are incapable of applying RM Quality of Service (QoS) semantics on a per-message basis. In order to ensure the broadest interoperability, when an endpoint decorates its WSDL with RM policy assertions using Message Policy Subject, it MUST also be prepared to accept that all messages sent to that endpoint might be sent within the context of an RM Sequence, regardless of whether the corresponding `wsdl:input`, `wsdl:output` or `wsdl:fault` had an attached RM policy assertion.

Rather than turn away messages that were unnecessarily sent with RM semantics, the receiving endpoint described by the WSDL MUST accept these messages.

By attaching an RM policy assertion that specifies `wsp:Optional="true"` to the corresponding endpoint that has attached RM policy assertions at the Message Policy Subject level, the endpoint is describing the above constraint in policy.

In the case where an optional RM Assertion applies to an output message, there is no requirement on the client to support an RM Destination implementation.
2.4 Assertion Example

Table 2 lists an example use of the RM policy assertion.

Table 2: Example policy with RM policy assertion

```
(01)<wsdl:definitions
(02)    targetNamespace="example.com"
(03)    xmlns:tns="example.com"
(04)    xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/
(05)    xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
(06)    xmlns:wsrmp="http://docs.oasis-open.org/ws-rx/wsrmp/200702"
(07)    xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd">
(08)
(09) <wsp:UsingPolicy wsdl:required="true" />
(10)
(11) <wsp:Policy wsu:Id="MyPolicy">
(12)   <wsrmp:RMAssertion>
(13)     <wsp:Policy/>
(14)   </wsrmp:RMAssertion>
(15)   <!-- omitted assertions -->
(16)   </wsp:Policy>
(17)
(18)   <!-- omitted elements -->
(19)   (<
(20) <wsdl:binding name="MyBinding" type="tns:MyPortType">
(21)   <wsp:PolicyReference URI="#MyPolicy" />
(22)   <!-- omitted elements -->
(23)   </wsdl:binding>
(24)
(25)</wsdl:definitions>
```

Line (09) in Table 2 indicates that WS-Policy is in use as a required extension.

Lines (11-16) are a policy expression that includes a RM policy assertion (lines 12-14) to indicate that WS-ReliableMessaging must be used.

Lines (20-23) are a WSDL binding. Line (21) indicates that the policy in lines (11-16) applies to this binding, specifically indicating that WS-ReliableMessaging must be used over all the messages in the binding.

2.5 Sequence Security Policy

WS-SecurityPolicy [SecurityPolicy] provides a framework and grammar for expressing the security requirements and characteristics of entities in a XML web services based system. The following assertions MAY be used in conjunction with WS-SecurityPolicy to express additional security requirements particular to RM Sequences.

2.5.1 RM Assertion with Sequence STR Assertion

This version of the RM assertion includes the requirement that an RM Sequence MUST be bound to an explicit token that is referenced from a wsse:SecurityTokenReference in the CreateSequence message.

This assertion MUST apply to [Endpoint Policy Subject]. The normative outline for this form of the Sequence STR Assertion is:

```
<wsp:RMAssertion [wsp:Optional="true"]? ...
<wsp:Policy>
```
The following describes the content model of the SequenceSTR element.

A policy assertion that specifies security requirements which MUST be used with an RM Sequence that are particular to WS-RM and beyond what can be expressed in WS-SecurityPolicy.

**2.5.2 RM Assertion with Sequence Transport Security Assertion**

This version of the RM assertion includes the requirement that an RM Sequence MUST be bound to the session(s) of the underlying transport-level security protocol (e.g. SSL/TLS) used to carry the CreateSequence and CreateSequenceResponse messages.

This assertion MUST apply to [Endpoint Policy Subject]. This assertion MUST be used in conjunction with the sp:TransportBinding assertion that requires the use of some transport-level security mechanism (e.g. sp:HttpsToken).

The normative outline for this form of the RM Assertion with the Sequence Transport Security Assertion is:

```
<wsp:Policy>
  <wsp:ExactlyOne>
    <wsp:All>
      <wrm:RMAssertion [wsp:Optional="true"]> ...>
       <wrm:SequenceTransportSecurity/>
      </wrm:RMAssertion>
    </wsp:Policy>
  </wsp:All>
</wsp:Policy>
```

The following describes the content model of the SequenceTransportSecurity element.

A policy assertion that specifies that any Sequences targeted to the indicated endpoint MUST be bound to the underlying session(s) of the transport-level security used to carry messages related to the Sequence.

This form of the RM Assertion says that an endpoint MAY have RM as an option but always requires HTTPS to be used. All the SequenceTransportSecurity assertion indicates is that RM's rules for protecting the Sequence over TLS are followed.
3 Security Considerations

It is strongly RECOMMENDED that policies and assertions be signed to prevent tampering.

It is RECOMMENDED that policies SHOULD NOT be accepted unless they are signed and have an associated security token to specify the signer has proper claims for the given policy. That is, a relying party shouldn't rely on a policy unless the policy is signed and presented with sufficient claims to pass the relying parties acceptance criteria.

It should be noted that the mechanisms described in this document could be secured as part of a SOAP message using WS-Security [WS-Security] or embedded within other objects using object-specific security mechanisms.
Appendix A. Schema

A normative copy of the XML Schema [XML-Schema Part1, XML-Schema Part2] description for this specification may be retrieved from the following address:

http://docs.oasis-open.org/ws-rx/wsrmp/200702/wsrmp-1.1-schema-200702.xsd

The following copy is provided for reference.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<!-- Copyright(C) OASIS(R) 1993-2007. All Rights Reserved. OASIS trademark, IPR and other policies apply. -->
<x:schema xmlns:tns="http://docs.oasis-open.org/ws-rx/wsrmp/200702"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
targetNamespace="http://docs.oasis-open.org/ws-rx/wsrmp/200702"
attributeFormDefault="qualified"
attributeFormDefault="unqualified">
  <x:element name="RMAssertion">
    <xs:complexType>
      <xs:sequence>
        <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
      </xs:sequence>
    </xs:complexType>
  </x:element>
  <x:element name="SequenceSTR">
    <xs:complexType>
      <xs:sequence/>
      <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:complexType>
  </x:element>
  <x:element name="SequenceTransportSecurity">
    <xs:complexType>
      <xs:sequence/>
      <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:complexType>
  </x:element>
  <x:element name="DeliveryAssurance">
    <xs:complexType>
      <xs:sequence>
        <xs:any namespace="##any" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
      </xs:sequence>
    </xs:complexType>
  </x:element>
  <x:element name="ExactlyOnce">
    <xs:complexType>
      <xs:sequence/>
    </xs:complexType>
  </x:element>
  <x:element name="AtLeastOnce">
    <xs:complexType>
      <xs:sequence/>
    </xs:complexType>
  </x:element>
  <x:element name="AtMostOnce">
    <xs:complexType>
      <xs:sequence/>
    </xs:complexType>
  </x:element>
</x:schema>
```
<xs:element name="InOrder">
  <xs:complexType>
    <xs:sequence/>
  </xs:complexType>
</xs:element>
</xs:schema>
Appendix B. Acknowledgments

This document is based on initial contribution to OASIS WS-RX Technical Committee by the following authors:

Stefan Batres, Editor, Microsoft 253  David Langworthy, Microsoft
Ruslan Bilorusets, BEA 254  Amelia Lewis, TIBCO Software
Don Box, Microsoft 255  Rodney Limprecht, Microsoft
Luis Felipe Cabrera, Microsoft 256  Steve Lucco, Microsoft
Derek Collison, TIBCO Software 257  Don Mullen, TIBCO Software
Donald Ferguson, IBM 258  Anthony Nadalin, IBM
Christopher Ferris, IBM 259  Mark Nottingham, BEA
Tom Freund, IBM 260  David Orchard, BEA
Mary Ann Hondo, IBM 261  Shivaje Samdarshi, TIBCO Software
John Ibbotson, IBM 262  John Shewchuk, Microsoft
Lei Jin, BEA 263  Tony Storey, IBM
Chris Kaler, Microsoft 264

The following individuals have provided invaluable input into the initial contribution:

Keith Ballinger, Microsoft 265  Frank Leymann, IBM
Allen Brown, Microsoft 266  Martin Nally, IBM
Michael Conner, IBM 267  Peter Nibblet, IBM
Francisco Curbera, IBM 268  Jeffrey Schlimmer, Microsoft
Steve Graham, IBM 269  Chris Sharp, IBM
Pat Helland, Microsoft 270  James Snell, IBM
Rick Hill, Microsoft 271  Keith Stobie, Microsoft
Scott Hinkelman, IBM 272  Satish Thatte, Microsoft
Tim Holloway, IBM 273  Stephen Todd, IBM
Elfm Hudson, Microsoft 274  Sanjiva Weerawarana, IBM
Johannes Klein, Microsoft 275  Roger Wolter, Microsoft

The following individuals were members of the committee during the development of this specification:

Abbie Barbir, Nortel 276  Alastair Green, Choreology
Charlton Barreto, Adobe 277  Mike Grogan, Sun
Stefan Batres, Microsoft 278  Ondrej Hrebidck, Microsoft
Hamid Ben Malek, Fujitsu 279  Kazuncir Iwasa, Fujitsu
Andreas Bjarlstrom, Ericsson 280  Chamikara Jayalath, WSO2
Toufic Boubex, Layer 7 281  Lei Jin, BEA
Doug Bunting, Sun 282  Ian Jones, BTplc
Lloyd Burch, Novell 283  Anish Karmarkar, Oracle
Steve Carter, Novell 284  Paul Knight, Nortel
Martin Chapman, Oracle 285  Dan Leshchiner, Tibco
Dave Chappell, Sonic 286  Mark Little, JBoss
Paul Cotton, Microsoft 287  Lily Liu, webMethods
Glen Daniels, Sonic 288  Matt Lovett, IBM
Doug Davis, IBM 289  Ashok Malhotra, Oracle
Blake Dournaee, Intel 290  Jonathan Marsh, Microsoft
Jacques Durand, Fujitsu 291  Daniel Millwood, IBM
Colleen Evans, Microsoft 292  Jeff Mischkinsky, Oracle
Christopher Ferris, IBM 293  Nilo Mira, Ericsson
Paul Fremantle, WSO2 294  Peter Nibblet, IBM
Robert Freund, Hitachi 295  Duane Nickull, Adobe
Peter Furniss, Eurebor 296  Eisaku Nishiyama, Hitachi
Marc Goodner, Microsoft 297  Dave Orchard, BEA
Chouthri Palanisamy, NEC
Sanjay Patil, SAP
Gilbert Pilz, BEA
Martin Raeppele, SAP
Eric Rajkovic, Oracle
Stefan Rossmanith, SAP
Tom Rutt, Fujitsu
Rich Salz, IBM
Shivajee Samdarshi, Tibco
Vladimir Videlov, SAP
Claus von Riegen, SAP
Pete Wenzel, Sun
Steve Winkler, SAP
Ummit Yalcinalp, SAP
Nobuyuki Yamamoto, Hitachi