Web Services Addressing - Core

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Abstract<a>

Web Services Addressing provides transport-neutral mechanisms to address Web services and messages. Web Services Addressing Core (this document) defines a set of abstract properties and an XML Infoset [*XML Information Set [p.15]*] representation thereof to identify Web service endpoints and to secure end-to-end identification of endpoints in messages. This specification enables messaging systems to support message transmission through networks that include processing nodes such as endpoint managers, firewalls, and gateways in a transport-neutral manner.

Status of this Document

This section describes the status of this document at the time of its publication. Other documents may supersede this document. A list of current W3C publications and the latest revision of this technical report can be found in the W3C technical reports index at http://www.w3.org/TR/.

This is the First Public Working Draft of the Web Services Addressing - Core specification for review by W3C members and other interested parties. It has been produced by the Web Services Addressing Working Group (WG), which is part of the W3C Web Services Activity.

In this Working Draft, the Web Services Addressing Working Group has, in keeping with its charter, separated the WS-Addressing Member Submission into three separate specifications: Core, SOAP Binding, and WSDL Binding. The Working Group expects to publish an updated draft in the near future incorporting more resolutions from its issues list.

Discussion of this document takes place on the public public public-ws-addressing@w3.org mailing list (public archive). Comments on this specification should be sent to this mailing list.

This document was produced under the 5 February 2004 W3C Patent Policy. The Working Group maintains a public list of patent disclosures relevant to this document; that page also includes instructions for disclosing [and excluding] a patent. An individual who has actual knowledge of a patent which the individual believes contains Essential Claim(s) with respect to this specification should disclose the information in accordance with section 6 of the W3C Patent Policy.

Per section 4 of the W3C Patent Policy, Working Group participants have 150 days from the title page date of this document to exclude essential claims from the W3C RF licensing requirements with respect to this document series. Exclusions are with respect to the exclusion reference document, defined by the W3C Patent Policy to be the latest version of a document in this series that is published no later than 90 days after the title page date of this document.

Publication as a Working Draft does not imply endorsement by the W3C Membership. This is a draft document and may be updated, replaced or obsoleted by other documents at any time. It is inappropriate to cite this document as other than work in progress.

Editorial note	
The Web Services Addressing Working Group has decided to use XML Schema, where appropriate, to describe constructs defined in this specification. Note that this restricts use of Web Services Addressing to XML 1.0.	

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>1. Introduction

Web Services Addressing (WS-Addressing) defines two constructs that convey information that is typically provided by transport protocols and messaging systems: endpoint references and message addressing properties. These constructs normalize this underlying information into a uniform format that can be processed independently of transport or application.

A Web service endpoint is a (referenceable) entity, processor, or resource to which Web service messages can be targeted. Endpoint references convey the information needed to identify/reference a Web service endpoint, and may be used in several different ways:

- To convey the information needed to access a Web service endpoint
- To provide addresses for individual messages sent to and from Web services

To deal with this last usage case this specification defines a family of message addressing properties that allows uniform addressing of messages independent of underlying transport. These message addressing properties convey end-to-end message characteristics including addressing for source and destination endpoints as well as message identity.

Both of these constructs are designed to be extensible and re-usable so that other specifications can build on and leverage endpoint references and message information headers.

The following example illustrates the use of these mechanisms in a SOAP 1.2 message being sent from http://business456.example/client1 to http://fabrikam123.example/Purchasing:

Example 1-1. Use of message addressing properties in a SOAP 1.2 message.

```
(001) <S:Envelope xmlns:S="http://www.w3.org/2003/05/soap-envelope"
                  xmlns:wsa="http://www.w3.org/2004/12/addressing">
(002)   <S:Header>
(003)    <wsa:MessageID>
(004)      http://example.com/6B29FC40-CA47-1067-B31D-00DD010662DA
(005)    </wsa:MessageID>
(006)    <wsa:ReplyTo>
(007)      <wsa:Address>http://business456.example/client1</wsa:Address>
(008)    </wsa:ReplyTo>
(009)    <wsa:To>http://fabrikam123.example/Purchasing</wsa:To>
(010)    <wsa:Action>http://fabrikam123.example/SubmitPO</wsa:Action>
(011)   </S:Header>
(012)   <S:Body>
(013)     ...
(014)   </S:Body>
(015) </S:Envelope>
```

Lines (002) to (011) represent the header of the SOAP message where the mechanisms defined in the specification are used. The body is represented by lines (012) to (014).

Lines (003) to (010) contain the message information header blocks. Specifically, lines (003) to (005) specify the identifier for this message and lines (006) to (008) specify the endpoint to which replies to this message should be sent as an Endpoint Reference. Line (009) specifies the address URI of the ultimate receiver of this message. Line (010) specifies an Action URI identifying expected semantics.

1.1 Notational Conventions

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 [*IETF RFC 2119 [p.14]*].

When describing abstract data models, this specification uses the notational convention used by the XML Infoset [*XML Information Set [p.15]*]. Specifically, abstract property names always appear in square brackets (e.g., [some property]).

When describing concrete XML schemas [*XML Schema Structures [p.15]* , *XML Schema Datatypes [p.15]*], this specification uses the notational convention of WS-Security [*WS-Security [p.15]*]. Specifically, each member of an element's [children] or [attributes] property is described using an XPath-like notation (e.g., /x:MyHeader/x:SomeProperty/@value1). The use of {any} indicates the presence of an element wildcard (<xs:any/>). The use of @{any} indicates the presence of an attribute wildcard (<xs:anyAttribute/>).

1.2 Namespaces

This specification uses a number of namespace prefixes throughout; they are listed in Table 1-1 [p.5] . Note that the choice of any namespace prefix is arbitrary and not semantically significant (see [*XML Namespaces [p.14]*]).

Table 1-1. Prefixes and Namespaces used in this specification

Prefix	Namespace
S	http://www.w3.org/2003/05/soap-envelope
S11	http://schemas.xmlsoap.org/soap/envelope
wsa	http://www.w3.org/2004/12/addressing
xs	http://www.w3.org/2001/XMLSchema

WS-Addressing may be used with SOAP [*SOAP 1.2 Part 1: Messaging Framework [p.15]*] as described in Web Services Addressing - SOAP Binding[*WS-Addressing-SOAP [p.14]*]. WS-Addressing may be used with WSDL [*WSDL 2.0 [p.14]*] described services as described in Web Services Addressing - WSDL Binding[*WS-Addressing-WSDL [p.14]*]. Examples in this specification use an XML 1.0 [*XML 1.0 [p.14]*] representation but this is not a requirement.

All information items defined by WS-Addressing are identified by the XML namespace URI [*XML Namespaces [p.14]*] "http://www.w3.org/2004/12/addressing". A normative XML Schema [*XML Schema Structures [p.15]* , *XML Schema Datatypes [p.15]*] document can be obtained by dereferencing the XML namespace URI.

2. Endpoint References

This section defines the information model and syntax of an endpoint reference.

This specification introduces the endpoint reference, a construct designed to support the following usage scenarios:

- Dynamic generation and customization of service endpoint descriptions.
- Identification and description of specific service instances that are created as the result of stateful interactions.
- Flexible and dynamic exchange of endpoint information in tightly coupled environments where communicating parties share a set of common assumptions about specific policies or protocols that are used during the interaction.

2.1 Information Model for Endpoint References

An endpoint reference consists of the following abstract properties:

[address] : URI (mandatory)

An address URI that identifies the endpoint. This may be a network address or a logical address.

[reference properties] : xs:any (0..unbounded).

A reference may contain a number of individual properties that are required to identify the entity or resource being conveyed. Reference identification properties are element information items that are named by QName and are required to properly dispatch messages at the endpoint. Reference properties are provided by the issuer of the endpoint reference and are otherwise assumed to be opaque to consuming applications. The interpretation of these properties (as the use of the endpoint reference in general) is dependent upon the protocol binding and data encoding used to interact with the endpoint. Web Services Addressing - SOAP Binding[*WS-Addressing-SOAP [p.14]*] defines the default binding for the SOAP protocol. Consuming applications SHOULD assume that endpoints represented by endpoint references with different [reference properties] may accept different sets of messages or follow a different set of policies, and consequently may have different associated metadata (WSDL, XML Schema, and policies). The relationship between reference properties and endpoint policies is further explained in **2.3 Endpoint Reference Comparison** [p.9]

[reference parameters] : xs:any (0..unbounded).

A reference may contain a number of individual parameters which are associated with the endpoint to facilitate a particular interaction. Reference parameters are element information items that are named by QName and are required to properly interact with the endpoint. Reference parameters are also provided by the issuer of the endpoint reference and are otherwise assumed to be opaque to consuming applications. The use of reference parameters is dependent upon the protocol binding and data encoding used to interact with the endpoint. Web Services Addressing - SOAP Binding[*WS-Addressing-SOAP [p.14]*] describes the default binding for the SOAP protocol. Unlike [reference properties], the [reference parameters] of two endpoint references may differ without an implication that different XML Schema, WSDL or policies apply to the endpoints.

[selected port type] : QName (0..1)

The QName of the primary portType of the endpoint being conveyed, see Web Services Addressing - WSDL Binding*WS-Addressing-WSDL [p.14]* for more details.

[service-port] : (QName, NCName (0..1)) (0..1)

The QName identifying the WSDL service element that contains the definition of the endpoint being conveyed, see Web Services Addressing - WSDL Binding*WS-Addressing-WSDL [p.14]* for more details.

[policies] : xsd:any (0..unbounded)

A reference may contain a number of policies that describe the behavior, requirements and capabilities of the endpoint. Policies may be included in an endpoint to facilitate easier processing by the consuming application, or because the policy was dynamically generated. However, embedded policies are not authoritative and may be stale or incoherent with the policies associated with the endpoint at the time when the interaction occurs.

2.2 Endpoint Reference XML Infoset Representation

This section defines an XML Infoset-based representation for an endpoint reference as both an XML type (wsa:EndpointReferenceType) and as an XML element (<wsa:EndpointReference>).

The wsa:EndpointReferenceType type is used wherever a Web service endpoint is referenced. The following describes the contents of this type:

Example 2-1. Structure of the wsa:EndpointReference element.

```
<wsa:EndpointReference>
    <wsa:Address>xs:anyURI</wsa:Address>
    <wsa:ReferenceProperties>... </wsa:ReferenceProperties> ?
    <wsa:ReferenceParameters>... </wsa:ReferenceParameters> ?
    <wsa:PortType>xs:QName</wsa:PortType> ?
    <wsa:ServiceName PortName="xs:NCName"?>xs:QName</wsa:ServiceName> ?
    <wsa:Policies> ... </wsa:Policies>?
    <xs:any/<*
</wsa:EndpointReference>
```

The following describes the attributes and elements listed in the schema overview above:

/wsa:EndpointReference

This represents some element of type wsa:EndpointReferenceType. This example uses the predefined <wsa:EndpointReference> element, but any element of type wsa:EndpointReferenceType may be used.

/wsa:EndpointReference/wsa:Address

This REQUIRED element (of type xs:anyURI) specifies the [address] property of the endpoint reference. This address may be a logical address or identifier for the service endpoint.

/wsa:EndpointReference/wsa:ReferenceProperties/

This OPTIONAL element contains the elements that convey the [reference properties] of the reference.

/wsa:EndpointReference/wsa:ReferenceProperties/{any}

Each child element of ReferenceProperties represents an individual [reference property].

/wsa:EndpointReference/wsa:ReferenceParameters/

This OPTIONAL element contains the elements that convey the [reference parameters] of the reference.

/wsa:EndpointReference/wsa:ReferenceParameters/{any}

Each child element of ReferenceParameters represents an individual [reference parameter].

/wsa:EndpointReference/wsa:PortType

This OPTIONAL element (of type xs:Qname) specifies the value of the [selected port type] property of the endpoint reference, see Web Services Addressing - WSDL Binding*WS-Addressing-WSDL [p.14]* for more details..

/wsa:EndpointReference/wsa:ServiceName

This OPTIONAL element (of type xs:QName) specifies the <wsdl:service> definition that contains a WSDL description of the endpoint being referenced, see Web Services Addressing - WSDL Binding*WS-Addressing-WSDL [p.14]* for more details..

/wsa:EndpointReference/wsa:ServiceName/@PortName

This OPTIONAL attribute (of type xs:NCName) specifies the name of the <wsdl:port> definition that corresponds to the endpoint being referenced, see Web Services Addressing - WSDL Binding*WS-Addressing-WSDL [p.14]* for more details.

/wsa:EndpointReference/wsa:Policies

This OPTIONAL element contains policies that are relevant to the interaction with the endpoint.

/wsa:EndpointReference/wsa:Policies/{any}

Each child element of Policies represents an individual [policy].

/wsa:EndpointReference/{any}

This is an extensibility mechanism to allow additional elements to be specified.

/wsa:EndpointReference/@{any}

This is an extensibility mechanism to allow additional attributes to be specified.

The following shows an example endpoint reference. This element references the port of type "fabrikam:InventoryPortType" at the URI "http://www.fabrikam123.example/acct".

Example 2-2. Example endpoint reference.

```
<wsa:EndpointReference xmlns:wsa="..." xmlns:fabrikam="...">
   <wsa:Address>http://www.fabrikam123.example/acct</wsa:Address>
   <wsa:PortType>fabrikam:InventoryPortType</wsa:PortType>
</wsa:EndpointReference>
```

2.3 Endpoint Reference Comparison

During the course of Web services interactions applications may receive multiple endpoint references describing the endpoints it needs to interact with. Different copies of an endpoint reference may also be received over time.

The following rules clarify the relation between the behaviors of the endpoints represented by two endpoint references with the same [address] and the same [reference properties].

- The two endpoints accept the same sets of messages, and follow and require the same set of policies. That is, the XML Schema, WSDL, and policy metadata applicable to the two references are the same.
- In particular, the policies applicable to the two endpoints are the same regardless of the values of any embedded [policies]. Embedded policies are not authoritative and may be stale or incoherent with the policies associated with the endpoint.

The [address] properties of two endpoint references are compared according to Section 6 of [*RFC 2396bis [p.14]*]. The [reference properties] of two endpoint references are equal if:

- they contain the same number of individual properties;
- for each reference property in one endpoint reference there exists an equivalent reference property in the other. One [reference property] is equivalent to another [reference property] if their byte streams per Exclusive XML Canonicalization are equal.

Therefore, a consuming application should assume that different XML Schemas, WSDL definitions and policies apply to endpoint references whose address or reference properties differ.

3. Message Addressing Properties

This section defines the information model and syntax of message addressing properties.

Message addressing properties enable the identification and location of the endpoints involved in an interaction. The basic interaction pattern from which all others are composed is "one way". In this pattern a source sends a message to a destination without any further definition of the interaction. "Request Reply" is a common interaction pattern that consists of an initial message sent by a source endpoint (the request) and a subsequent message sent from the destination of the request back to the source (the reply). A reply can be either an application message, a fault, or any other message.

Message addressing properties collectively augment a message with the following abstract properties to support one way, request reply, and any other interaction pattern:

[destination] : URI (mandatory)

The address of the intended receiver of this message.

[source endpoint] : endpoint reference (0..1)

Reference of the endpoint where the message originated from.

[reply endpoint] : endpoint reference (0..1)

An endpoint reference that identifies the intended receiver for replies to this message. If a reply is expected, a message MUST contain a [reply endpoint]. The sender MUST use the contents of the [reply endpoint] to formulate the reply message as defined in **3.2 Formulating a Reply Message** [p.13] . If the [reply endpoint] is absent, the contents of the [source endpoint] may be used to formulate a message to the source. This property MAY be absent if the message has no meaningful reply. If this property is present, the [message id] property is REQUIRED.

[fault endpoint] : endpoint reference (0..1)

An endpoint reference that identifies the intended receiver for faults related to this message. When formulating a fault message as defined in **3.2 Formulating a Reply Message** [p.13] , the sender MUST use the contents of the [fault endpoint] of the message being replied to to formulate the fault message. If the [fault endpoint] is absent, the sender MAY use the contents of the [reply endpoint] to formulate the fault message. If both the [fault endpoint] and [reply endpoint] are absent, the sender MAY use the contents of the [source endpoint] to formulate the fault message. This property may be absent if the sender cannot receive fault messages (e.g., is a one-way application message). If this property is present, the [message id] property is REQUIRED.

[action] : URI (mandatory)

An identifier that uniquely (and opaquely) identifies the semantics implied by this message.

It is RECOMMENDED that value of the [action] property is a URI identifying an input, output, or fault message within a WSDL port type. An action may be explicitly or implicitly associated with the corresponding WSDL definition. Web Services Addressing - WSDL Binding*WS-Addressing-WSDL [p.14]* describes the mechanisms of association. Finally, if in addition to the [action] property, a SOAP Action URI is encoded in a request, the URI of the SOAP Action MUST be the same as the one specified by the [action] property.

[message id] : URI (0..1)

A URI that uniquely identifies this message in time and space. No two messages with a distinct application intent may share a [message id] property. A message MAY be retransmitted for any purpose including communications failure and MAY use the same [message id] property. The value of this property is an opaque URI whose interpretation beyond equivalence is not defined in this specification. If a reply is expected, this property MUST be present.

[relationship] : (QName, URI) (0..unbounded)

A pair of values that indicate how this message relates to another message. The type of the relationship is identified by a QName. The related message is identified by a URI that corresponds to the related message's [message id] property. The message identifier URI may refer to a specific message, or be the following well-known URI that means "unspecified message": `http://www.w3.org/2004/12/addressing`

This specification has one predefined relationship type as shown in Table 3-1 [p.11] .

Table 3-1. Description of the QName used in [relationship]

QName	Description
wsa:Reply	Indicates that this is a reply to the message identified by the URI.

A reply message MUST contain a [relationship] property consisting of wsa:Reply and the message id property of the request message.

The dispatching of incoming messages is based on two message properties. The mandatory "destination" and "action" fields identify the target processing location and the verb or intent of the message.

Due to the range of network technologies currently in wide-spread use (e.g., NAT, DHCP, firewalls), many deployments cannot assign a meaningful global URI to a given endpoint. To allow these "anonymous" endpoints to initiate message exchange patterns and receive replies, WS-Addressing defines the following well-known URI for use by endpoints that cannot have a stable, resolvable URI: `http://www.w3.org/2004/12/addressing`

Requests whose [reply endpoint], [source endpoint] and/or [fault endpoint] use this address MUST provide some out-of-band mechanism for delivering replies or faults (e.g. returning the reply on the same transport connection). This mechanism may be a simple request/reply transport protocol (e.g., HTTP GET or POST). This URI MAY be used as the [destination] for reply messages and SHOULD NOT be used as the [destination] in other circumstances.

3.1 XML Infoset Representation of Message Addressing Properties

Message addressing properties provide end-to-end characteristics of a message that can be easily secured as a unit. These properties are immutable and not intended to be modified along a message path.

The following describes the XML Infoset representation of message addressing properties:

Example 3-1. XML Infoset representation of message addressing properties.

```
<wsa:MessageID> xs:anyURI </wsa:MessageID>
<wsa:RelatesTo RelationshipType="..."?>xs:anyURI</wsa:RelatesTo>
<wsa:To>xs:anyURI</wsa:To>
<wsa:Action>xs:anyURI</wsa:Action>
<wsa:From>endpoint-reference</wsa:From>
<wsa:ReplyTo>endpoint-reference</wsa:ReplyTo>
<wsa:FaultTo>endpoint-reference</wsa:FaultTo>
```

The following describes the attributes and elements listed in the schema overview above:

/wsa:MessageID

This OPTIONAL element (of type xs:anyURI) conveys the [message id] property. This element MUST be present if wsa:ReplyTo or wsa:FaultTo is present.

/wsa:RelatesTo

This OPTIONAL (repeating) element information item contributes one abstract [relationship] property value, in the form of a (URI, QName) pair. The [children] property of this element (which is of type xs:anyURI) conveys the [message id] of the related message. This element MUST be present if the message is a reply.

/wsa:RelatesTo/@RelationshipType

This OPTIONAL attribute (of type xs:QName) conveys the relationship type as a QName. When absent, the implied value of this attribute is wsa:Reply.

/wsa:ReplyTo

This OPTIONAL element (of type wsa:EndpointReferenceType) provides the value for the [reply endpoint] property. This element MUST be present if a reply is expected. If this element is present, wsa:MessageID MUST be present.

/wsa:From

This OPTIONAL element (of type wsa:EndpointReferenceType) provides the value for the [source endpoint] property.

/wsa:FaultTo

This OPTIONAL element (of type wsa:EndpointReferenceType) provides the value for the [fault endpoint] property. If this element is present, wsa:MessageID MUST be present.

/wsa:To

This REQUIRED element (of type xs:anyURI) provides the value for the [destination] property.

/wsa:Action

This REQUIRED element of type xs:anyURI conveys the [action] property. The [children] of this element convey the value of this property.

3.2 Formulating a Reply Message

The reply to a WS-Addressing compliant request message MUST be compliant to WS-Addressing and be constructed according to the rules defined in this section.

The following example illustrates a request message using message information header blocks in a SOAP 1.2 message:

Example 3-2. Example request message.

```
<S:Envelope xmlns:S="http://www.w3.org/2003/05/soap-envelope"
  xmlns:wsa="http://www.w3.org/2004/12/addressing">
  <S:Header>
  <wsa:MessageID>http://example.com/someuniquestring
    </wsa:MessageID>
    <wsa:ReplyTo>
    <wsa:Address>http://business456.example/client1</wsa:Address>
    </wsa:ReplyTo>
    <wsa:To S:mustUnderstand="1">mailto:joe@fabrikam123.example</wsa:To>
    <wsa:Action>http://fabrikam123.example/mail/Delete</wsa:Action>
  </S:Header>
  <S:Body>
    <f123:Delete>
       <maxCount>42</maxCount>
    </f123:Delete>
  </S:Body>
</S:Envelope>
```

This message would have the following property values:

[destination] The URI mailto:joe@fabrikam123.example

[reply endpoint] The endpoint with [address] http://business456.example/client1

[action] http://fabrikam123.example/mail/Delete

[message id] http://example.com/someuniquestring

The following example illustrates a reply message using message information header blocks in a SOAP 1.2 message:

Example 3-3. Example response message.

```
<S:Envelope
  xmlns:S="http://www.w3.org/2003/05/soap-envelope"
  xmlns:wsa="http://www.w3.org/2004/12/addressing">
  <S:Header>
    <wsa:MessageID>
      http://example.com/someotheruniquestring
    </wsa:MessageID>
```

```
    <wsa:RelatesTo>
      http://example.com/someuniquestring
    </wsa:RelatesTo>
    <wsa:To S:mustUnderstand="1">
      http://business456.example/client1
    </wsa:To>
    <wsa:Action>http://fabrikam123.example/mail/DeleteAck</wsa:Action>
  </S:Header>
  <S:Body>
    <f123:DeleteAck/>
  </S:Body>
</S:Envelope>
```

This message would have the following property values:

[destination] http://business456.example/client1

[action] http://fabrikam123.example/mail/DeleteAck

[message id] http://example.com/someotheruniquestring

[relationship] (wsa:Reply, http://example.com/someuniquestring)

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A. Acknowledgements (Non-Normative)

TBD

B. Change log (Non-Normative)

Date	Editor	Description
2004-11-23 @ 21:38	mhadley	Updated titles of examples. Fixed table formatting and references. Replaced uuid URIs with http URIs in examples. Added document status.
2004-11-22 @ 15:40	mhadley	Removed reference to WS-Policy
2004-11-15 @ 19:43	mhadley	Fixed some inter and intra spec references.
2004-11-12 @ 21:19	mgudgin	Removed TBD sections
2004-11-11 @ 18:31	mgudgin	Added some TBD sections
2004-11-07 @ 02:03	mhadley	Second more detailed run through to separate core, SOAP and WSDL document contents. Removed dependency on WS-Policy. Removed references to WS-Trust and WS-SecurityPolicy
2004-11-02 @ 22:25	mhadley	Removed static change log and added dynamically generated change log from cvs.
2004-10-28 @ 17:05	mhadley	Initial cut of separating specification into core, soap and wsdl