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Web Services Make Connection (WS-MakeConnection) Version 1.0

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

Abstract:
This specification (WS-MakeConnection) describes a protocol that allows messages to be transferred between nodes implementing this protocol by using a transport-specific back-channel. The protocol is described in this specification in a transport-independent manner allowing it to be implemented using different network technologies. To support interoperable Web services, a SOAP binding is defined within this specification.

The protocol defined in this specification depends upon other Web services specifications for the identification of service endpoint addresses and policies. How these are identified and retrieved are detailed within those specifications and are out of scope for this document.

By using the XML [XML], SOAP [SOAP 1.1], [SOAP 1.2] and WSDL [WSDL 1.1] extensibility model, SOAP-based and WSDL-based specifications are designed to be composed with each other to define a rich Web services environment. As such, WS-MakeConnection by itself does not define all the

44 features required for a complete messaging solution. WS-MakeConnection is a building block that is
45 used in conjunction with other specifications and application-specific protocols to accommodate a
46 wide variety of requirements and scenarios related to the operation of distributed Web services.

47 **Status:**
48 This document was last revised or approved by the WS-RX Technical Committee on the above date.
49 The level of approval is also listed above. Check the "Latest Version" or "Latest Approved Version"
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1 Introduction

The primary goal of this specification is to create a mechanism for the transfer of messages between two endpoints when the sending endpoint is unable to initiate a new connection to the receiving endpoint. It defines a mechanism to uniquely identify non-addressable endpoints, and a mechanism by which messages destined for those endpoints can be delivered. It also defines a SOAP binding that is required for interoperability. Additional bindings can be defined.

This mechanism is extensible allowing additional functionality, such as security, to be tightly integrated. This specification integrates with and complements the WS-ReliableMessaging[WS-RM], WS-Security [WS-Security], WS-Policy [WS-Policy], and other Web services specifications. Combined, these allow for a broad range of reliable, secure messaging options.

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 specified in this document. Additional children elements and/or attributes MAY be added at the indicated extension points but they 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 `wsmc:` 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 `wsmc:` namespace.

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229		
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250 1.4 Namespace

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

252   `http://docs.oasis-open.org/ws-rx/wsmc/200702`

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

255 Table 1 lists the XML namespaces that are used in this specification. The choice of any namespace prefix
256 is arbitrary and not semantically significant. The assertions defined within this specification have been
257 designed to work independently of a specific version of WS-Policy and WS-Policy Attachment. Within this
258 specification the use of the namespace prefix "wsp" refers generically to the WS-Policy namespace, not a
259 specific version.

260 Table 1

Prefix	Namespace
S	(Either SOAP 1.1 or 1.2)
S11	http://schemas.xmlsoap.org/soap/envelope/

S12	http://www.w3.org/2003/05/soap-envelope
wsmc	http://docs.oasis-open.org/ws-rx/wsmc/200702
wsrm	http://docs.oasis-open.org/ws-rx/wsrm/200702
wsa	http://www.w3.org/2005/08/addressing
wsam	http://www.w3.org/2007/~~02~~05/addressing/metadata
xs	http://www.w3.org/2001/XMLSchema

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

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

1.5 Conformance

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

269 Normative text within this specification takes precedence over normative outlines, which in turn take
270 precedence over the XML Schema [XML Schema Part 1, Part 2] descriptions.
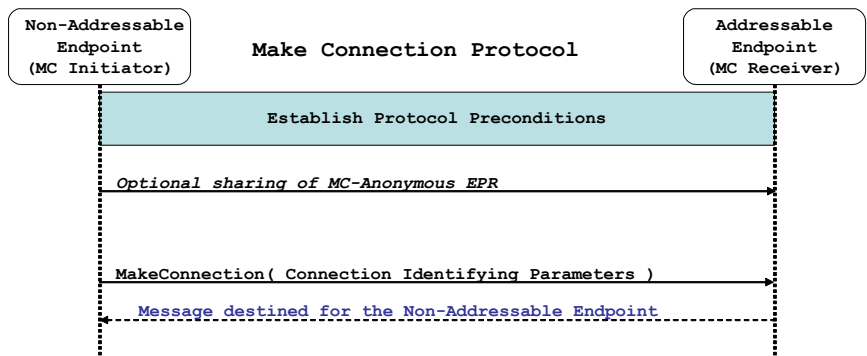
2 MakeConnection Model

The WS-Addressing [WS-Addressing] specification defines the anonymous URI to identify non-addressable endpoints and to indicate a protocol-specific back-channel is to be used for any messages destined for that endpoint. For example, when used in the WS-Addressing ReplyTo EPR, the use of this anonymous URI is meant to indicate that any response message is to be transmitted on the transport-specific back-channel. In the HTTP case this would mean that any response message is sent back on the HTTP response flow.

In cases where the connection is still available the WS-Addressing URI is sufficient. However, in cases where the original connection is no longer available, additional mechanisms are needed. Take the situation where the original connection that carried a request message is broken and therefore is no longer available to carry a response back to the original sender. Traditionally, non-anonymous (addressable) EPRs would be used in these cases to allow for the sender of the response message to initiate new connections as needed. However, if the sender of the request message is unable (or unwilling) to accept new connections then the only option available is for it to establish a new connection for the purposes of allowing the response message to be sent. This specification defines a mechanism by which a new connection can be established.

The MakeConnection model consists of two key aspects:

- An optional anonymous-like URI template is defined that has similar semantics to WS-Addressing's anonymous, but also allows for each non-addressable endpoint to be uniquely identified

- A new message is defined that establishes a connection that can then be used to transmit messages to these non-addressable endpoints

Figure 1 below illustrates the overall flow involved in the use of MakeConnection:

Figure 1 – Make Connection Model

The `MakeConnection` message is used to establish a new connection between the two endpoints. Within the message is identifying information that is used to uniquely identify a message that is eligible for transmission.

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2.1 Glossary

The following definitions are used throughout this specification:

Back-channel: When the underlying transport provides a mechanism to return a transport-protocol specific response, capable of carrying a SOAP message, without initiating a new connection, this specification refers to this mechanism as a back-channel.

Endpoint: As defined in the WS-Addressing specification; a Web service Endpoint is a (referenceable) entity, processor, or resource to which Web service messages can be addressed. Endpoint references (EPRs) convey the information needed to address a Web service Endpoint.

MC Initiator The endpoint that transmits the `MakeConnection` message – the destination endpoint for the messages being sent on the transport-specific back-channel.

MC Receiver: The endpoint that receives the `MakeConnection` message – the source endpoint for the messages being sent on the transport-specific back-channel.

Receive: The act of reading a message from a network connection.

Transmit: The act of writing a message to a network connection.

2.2 Protocol Preconditions

The correct operation of the protocol requires that a number of preconditions MUST be established prior to the processing of the initial sequenced message:

- The MC Receiver MUST be capable of accepting new incoming connections.
- The MC Initiator MUST be capable of creating new outgoing connections to the MC Receiver, and those connections MUST have a back-channel.
- If a secure exchange of messages is REQUIRED, then the MC Initiator and MC Receiver MUST have a security context.

2.3 Example Message Exchange

Figure 2 illustrates a message exchange in which the response message is delivered using MakeConnection.

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```
┌─────────────────┐                                          ┌─────────────────┐
│ Non-Addressable │                                          │   Addressable   │
│    Endpoint     │        Make Connection Protocol          │    Endpoint     │
│ (MC Initiator)  │                                          │  (MC Receiver)  │
└─────────────────┘                                          └─────────────────┘
         ┆                                                            ┆
         ┆  ╔══════════════════════════════════════════════════════╗ ┆
         ┆  ║          Establish Protocol Preconditions            ║ ┆
         ┆  ╚══════════════════════════════════════════════════════╝ ┆
         ┆                                                            ┆
         ┆  GetQuote Request Message (wsa:ReplyTo=MCAnonURI?uuid=...123) ┆
         ┆ ──────────────────────────────────────────────────────────▶ ┆
         ┆      Empty Response (HTTP 202)                             ┆
         ┆ ◀─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─  ┆
         ┆                                                            ┆
         ┆  MakeConnection(wsmc:Address=MCAnonURI?uuid=...123)        ┆
         ┆ ──────────────────────────────────────────────────────────▶ ┆
         ┆      Empty Response (HTTP 202)                             ┆
         ┆ ◀─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─  ┆
         ┆                                                            ┆
         ┆  MakeConnection(wsmc:Address=MCAnonURI?uuid=...123)        ┆
         ┆ ──────────────────────────────────────────────────────────▶ ┆
         ┆      GetQuoteResponse                                      ┆
         ┆ ◀─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─  ┆
```
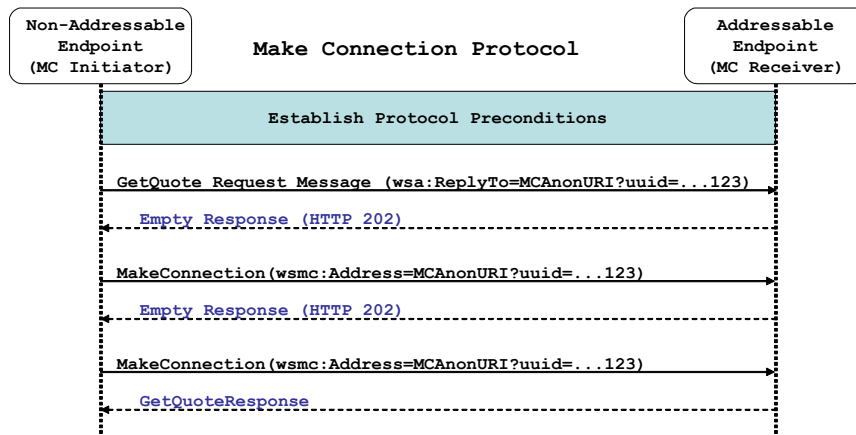
323 Figure 2: Example WS-MakeConnection Message Exchange

324 1. The protocol preconditions are established. These include policy exchange, endpoint resolution,
325   and establishing trust.

326 2. The client (MC Initiator) sends a GetQuote request message to the service (MC Receiver). The
327   WS-Addressing `wsa:ReplyTo` EPR uses the MakeConnection Anonymous URI Template –
328   indicating that if the GetQuoteResponse message is not sent back on this connection's back-
329   channel, then the client will use MakeConnection to retrieve it.

330 3. The service receives the request message and decides to close the connection by sending back
331   an empty response (in the HTTP case an HTTP 202 Accept is sent).

332 4. The client sends a `MakeConnection` message to the service. Within the `MakeConnection`
333   element is the `wsmc:Address` element containing the same MakeConnection Anonymous URI
334   used in step 2.

335 5. The service has not completed executing the GetQuote operation and decides to close the
336   connection by sending back an empty response (in the HTTP case an HTTP 202 Accept)
337   indicating that no messages destined for this MC Initiator are available at this time.

338 6. The client sends a second `MakeConnection` message to the service. Within the
339   `MakeConnection` element is the `wsmc:Address` element containing the same MakeConnection
340   Anonymous URI used in step 2.

341 7. The service uses this new connection to transmit the GetQuoteResponse message.

342 The service can assume that because the MakeConnection Anonymous URI Template was used in the
343 `wsa:ReplyTo` EPR the client will act as an MC Initiator for the purposes of retrieving messages destined
344 to that EPR (i.e. responses to the GetQuote). This allows the service the option of immediately releasing
345 resources used by the original connection – knowing that the client will, at some later point in time,
346 establish a new connection on which the GetQuoteResponse can be transmitted. Likewise, when the first
347 `MakeConnection` is received by the service, it again has the option of leaving the connection open until
348 the GetQuoteResponse is ready to be transmitted, or it can close the connection immediately knowing
349 that the MC Initiator will retransmit the `MakeConnection` message at some later point in time. Since the
350 nature and dynamic characteristics of the underlying transport and potential intermediaries are unknown in
351 the general case, the timing of re-transmissions cannot be specified. Additionally, over-aggressive re-
352 transmissions have been demonstrated to cause transport or intermediary flooding which are
353 counterproductive. Consequently, implementers are encouraged to utilize adaptive mechanisms that

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354 dynamically adjust re-transmission time and the back-off intervals that are appropriate to the nature of the
355 transports and intermediaries envisioned. For the case of TCP/IP transports, a mechanism similar to that
356 described as RTTM in RFC 1323 [RTTM] SHOULD be considered.

357 Now that the basic model has been outlined, the details of this protocol are now provided in section 3.

3 MakeConnection

The following sub-sections define the various MakeConnection features, and prescribe their usage by a conformant implementations.

3.1 MakeConnection Anonymous URI

When an Endpoint is not directly addressable (e.g. behind a firewall or not able to allow incoming connections), an anonymous URI in the EPR address property can indicate such an Endpoint. The WS-Addressing anonymous URI is one such anonymous URI. This specification defines a URI template (the WS-MC anonymous URI) which may be used to uniquely identify anonymous Endpoints.

```
http://docs.oasis-open.org/ws-rx/wsmc/200702/anonymous?id={unique-String}
```

The appearance of an instance of this URI template in the `wsa:Address` value of an EPR indicates a protocol-specific back-channel will be established through a mechanism such as `MakeConnection`, defined below. When using this URI template, "{unique-String}" MUST be replaced by a globally unique string (e.g a UUID value as defined by RFC4122 [UUID]). This specification does not require the use of one particular string generation scheme. This string uniquely distinguishes the Endpoint. A sending Endpoint SHOULD Transmit messages at Endpoints identified with the URI template using a protocol-specific back-channel, including but not limited to those established with a `MakeConnection` message. Note, this URI template is semantically similar to the WS-Addressing anonymous URI if a protocol-specific back-channel is available.

3.2 MakeConnection Message

The `MakeConnection` element is sent in the body of a one-way message that establishes a contextualized back-channel for the transmission of messages according to matching criteria (defined below). In the non-faulting case, if no matching message is available then no SOAP envelope will be returned on the back-channel. A common usage will be a client sending `MakeConnection` to a server for the purpose of receiving asynchronous response messages.

The following exemplar defines the `MakeConnection` syntax:

```
<wsmc:MakeConnection ...>
    <wsmc:Address ...> xs:anyURI </wsmc:Address> ?
    <wsrm:Identifier ...> xs:anyURI </wsrm:Identifier> ?
    ...
</wsmc:MakeConnection>
```

The following describes the content model of the `MakeConnection` element.

/wsmc:MakeConnection

This element allows the sender to create a transport-specific back-channel that can be used to return a message that matches the selection criteria. Endpoints MUST NOT send this element as a header block. At least one selection criteria sub-element MUST be specified – if not a `MissingSelection` fault MUST be generated.

/wsmc:MakeConnection/wsmc:Address

This element specifies the URI (`wsa:Address`) of the initiating Endpoint. Endpoints MUST NOT return messages on the transport-specific back-channel unless they have been addressed to this URI. This Address property and a message's WS-Addressing destination property are considered identical when they are exactly the same character-for-character. Note that URIs which are not

| 399 | identical in this sense may in fact be functionally equivalent. Examples include URI references |
| 400 | which differ only in case, or which are in external entities which have different effective base URIs. |

401 `/wsmc:MakeConnection/wsmc:Address/@{any}`

| 402 | This is an extensibility mechanism to allow additional attributes, based on schemas, to be added to |
| 403 | the element. |

404 `/wsmc:MakeConnection/wsrm:Identifier`

405	This element specifies the WS-RM Sequence Identifier that establishes the context for the
406	transport-specific back-channel. The Sequence Identifier should be compared with the Sequence
407	Identifiers associated with the messages held by the sending Endpoint, and if there is a matching
408	message it will be returned.

409 `/wsmc:MakeConnection/wsrm:Identifier/@{any}`

| 410 | This is an extensibility mechanism to allow additional attributes, based on schemas, to be added to |
| 411 | the element. |

412 `/wsmc:MakeConnection/{any}`

413	This is an extensibility mechanism to allow different (extensible) types of information, based on a
414	schema, to be passed. This allows fine-tuning of the messages to be returned, additional selection
415	criteria included here are logically ANDed with the `Address` and/or `wsrm:Identifier`. If an
416	extension is not supported by the Endpoint then it should generate an `UnsupportedSelection`
417	fault.

418 `/wsmc:MakeConnection/@{any}`

| 419 | This is an extensibility mechanism to allow additional attributes, based on schemas, to be added to |
| 420 | the element. |

421	If more than one selection criteria element is present, then the MC Receiver processing the
422	`MakeConnection` message MUST insure that any SOAP Envelope flowing on the back-channel satisfies
423	all of those selection criteria.

424	The management of messages that are awaiting the establishment of a back-channel to their receiving
425	Endpoint is an implementation detail that is outside the scope of this specification. Note, however, that
426	these messages form a class of asynchronous messages that is not dissimilar from "ordinary"
427	asynchronous messages that are waiting for the establishment of a connection to their destination
428	Endpoints.

429	This specification places no constraint on the types of messages that can be returned on the transport-
430	specific back-channel. As in an asynchronous environment, it is up to the recipient of the
431	`MakeConnection` message to decide which messages are appropriate for transmission to any particular
432	Endpoint. However, the Endpoint processing the `MakeConnection` message MUST insure that the
433	messages match the selection criteria as specified by the child elements of the `MakeConnection`
434	element.

| 435 | Since the message exchange pattern use by `MakeConnection` is untraditional, the following points need |
| 436 | to be reiterated for clarification: |

437	•	The `MakeConnection` message is logically part of a one-way operation; there is no reply
438		message to the `MakeConnection` itself, and any response flowing on the transport back-channel
439		is a pending message.

440	•	Since there is no reply message to `MakeConnection`, the WS-Addressing specific rules in
441		section 3.4 "Formulating a Reply Message" are not used. Therefore, the value of any
442		`wsa:ReplyTo` element in the `MakeConnection` message has no effective impact since the WS-

443   Addressing `[reply endpoint]` property that is set by the presence of `wsa:ReplyTo` is not
444   used.

445   •   In the absence of any pending message, there will be no message transmitted on the transport
446   back-channel. E.g. in the HTTP case just an `HTTP 202 Accepted` will be returned without any
447   SOAP envelope in the HTTP response message.

448   •   When there is a message pending, it is sent on the transport back-channel, using the connection
449   that has been initiated by the `MakeConnection` request.

450 3.3 MessagePending

451 When `MakeConnection` is used, and a message is returned on the transport-specific back-channel, the
452 `MessagePending` header SHOULD be included on the returned message as an indicator whether there
453 are additional messages waiting to be retrieved using the same selection criteria that was specified in the
454 `MakeConnection` element.

455 The following exemplar defines the `MessagePending` syntax:

```
456 <wsmc:MessagePending pending="xs:boolean" ...>
457      ...
458 </wsmc:MessagePending>
```

459 The following describes the content model of the `MessagePending` header block.

460 /wsmc:MessagePending

461   This element indicates whether additional messages are waiting to be retrieved.

462 /wsmc:MessagePending/@pending

463   This attribute, when set to "true", indicates that there is at least one message waiting to be
464   retrieved. When this attribute is set to "false" it indicates there are currently no messages waiting
465   to be retrieved.

466 /wsmc:MessagePending/{any}

467   This is an extensibility mechanism to allow different (extensible) types of information, based on a
468   schema, to be passed.

469 /wsmc:MessagePending/@{any}

470   This is an extensibility mechanism to allow additional attributes, based on schemas, to be added to
471   the element.

472 The absence of the `MessagePending` header has no implication as to whether there are additional
473 messages waiting to be retrieved.

474 3.4 MakeConnection Policy Assertion

475 The MakeConnection policy assertion indicates that the MakeConnection protocol (operation and the use
476 of the MakeConnection URI template in EndpointReferences) is required for messages sent from this
477 endpoint. This assertion has Endpoint Policy Subject [WS-PolicyAttachment].

478 The normative outline for the MakeConnection assertion is:

```
479 <wsmc:MCSupported ...> ... </wsmc:MCSupported>
```

480 The following describes the content model of the `MCSupported` element.

481 /wsmc:MCSupported

482   A policy assertion that specifies that the MakeConnection protocol is required for messages sent
483   from this endpoint.

/wsmc:MCSupported/{any}

485   This is an extensibility mechanism to allow different (extensible) types of information, based on a
486   schema, to be passed.

/wsmc:MCSupported/@{any}

488   This is an extensibility mechanism to allow additional attributes, based on schemas, to be added to
489   the element.

490 4 Faults

491 Entities that generate WS-MakeConnection faults MUST include as the [action] property the default fault
492 action IRI defined below. The value from the W3C Recommendation is below for informational purposes:

493   http://docs.oasis-open.org/ws-rx/wsmc/200702/fault

494 The faults defined in this section are generated if the condition stated in the preamble is met. Fault
495 handling rules are defined in section 6 of WS-Addressing SOAP Binding.

496 The definitions of faults use the following properties:

497 [Code] The fault code.

498 [Subcode] The fault subcode.

499 [Reason] The English language reason element.

500 [Detail] The detail element(s). If absent, no detail element is defined for the fault. If more than one detail
501 element is defined for a fault, implementations MUST include the elements in the order that they are
502 specified.

503 Entities that generate WS-MakeConnection faults MUST set the [Code] property to either "Sender" or
504 "Receiver". These properties are serialized into text XML as follows:

SOAP Version	Sender	Receiver
SOAP 1.1	S11:Client	S11:Server
SOAP 1.2	S:Sender	S:Receiver

505 The properties above bind to a SOAP 1.2 fault as follows:

```
506  <S:Envelope>
507   <S:Header>
508     <wsa:Action>
509         http://docs.oasis-open.org/ws-rx/wsmc/200702/fault
510     </wsa:Action>
511     <!-- Headers elided for brevity.  -->
512   </S:Header>
513   <S:Body>
514    <S:Fault>
515     <S:Code>
516       <S:Value> [Code] </S:Value>
517       <S:Subcode>
518        <S:Value> [Subcode] </S:Value>
519       </S:Subcode>
520     </S:Code>
521     <S:Reason>
522       <S:Text xml:lang="en"> [Reason] </S:Text>
523     </S:Reason>
524     <S:Detail>
525       [Detail]
526       ...
527     </S:Detail>
528    </S:Fault>
529   </S:Body>
530  </S:Envelope>
```

531 The properties bind to a SOAP 1.1 fault as follows when the fault is generated as a result of processing a
532 MakeConnection message:

```
533   <S11:Envelope>
534    <S11:Body>
535     <S11:Fault
536      <faultcode> [Subcode] </faultcode>
537      <faultstring> [Reason] </faultstring>
538     </S11:Fault>
539    </S11:Body>
540   </S11:Envelope>
```

4.1 Unsupported Selection

542 The QName of the unsupported element(s) are included in the detail.

543 Properties:

544 [Code] Receiver

545 [Subcode] wsmc:UnsupportedSelection

546 [Reason] The extension element used in the message selection is not supported by the MakeConnection
547 receiver

548 [Detail]

549
```
<wsmc:UnsupportedSelection> xs:QName </wsmc:UnsupportedSelection>+
```

Generated by	Condition	Action Upon Generation	Action Upon Receipt
MakeConnection receiver	In response to a `MakeConnection` message containing a selection criteria in the extensibility section of the message that is not supported	Unspecified.	Unspecified.

4.2 Missing Selection

551 The `MakeConnection` element did not contain any selection criteria.

552 Properties:

553 [Code] Receiver

554 [Subcode] wsmc:MissingSelection

555 [Reason] The `MakeConnection` element did not contain any selection criteria.

556 [Detail]

Generated by	Condition	Action Upon Generation	Action Upon Receipt

Generated by	Condition	Action Upon Generation	Action Upon Receipt
MakeConnection receiver	In response to a `MakeConnection` message that does not contain any selection criteria	Unspecified.	Unspecified.

5 Security Considerations

557

558 It is strongly RECOMMENDED that the communication between Web services be secured using the
559 mechanisms described in WS-Security. In order to properly secure messages, the body and all relevant
560 headers need to be included in the signature. Specifically, any standard messaging headers, such as
561 those from WS-Addressing, need to be signed with the body in order to "bind" the two together.

562 Different security mechanisms may be desired depending on the frequency of messages. For example, for
563 infrequent messages, public key technologies may be adequate for integrity and confidentiality. However,
564 for high-frequency events, it may be more performant to establish a security context for the events using
565 the mechanisms described in WS-Trust [Trust] and WS-SecureConversation [SecureConversation]. It
566 should be noted that if a shared secret is used it is RECOMMENDED that derived keys be used to
567 strengthen the secret as described in WS-SecureConversation.

568 Requests for messages which are not available to anonymous parties are strongly RECOMMENDED to
569 require usage of WS-Security so that the requestor can be authenticated and authorized to access the
570 indicated messages. Similarly, integrity and confidentiality SHOULD be used whenever messages have
571 restricted access.

572 Recipients of messages are RECOMMENDED to validate the signature to authenticate and verify the
573 integrity of the data. Specifically, recipients SHOULD verify that the sender has the right to "speak" for the
574 message.

575 The following list summarizes common classes of attacks that apply to this protocol and identifies the
576 mechanism to prevent/mitigate the attacks:

577 • Message alteration - Alteration is prevented by including signatures of the message information
578 using WS-Security.

579 • Message disclosure - Confidentiality is preserved by encrypting sensitive data using WS-Security.

580 • Key integrity - Key integrity is maintained by using the strongest algorithms possible (by comparing
581 secured policies - see WS-Policy and WS-SecurityPolicy [SecurityPolicy]).

582 • Authentication - Authentication is established using the mechanisms described in WS-Security and
583 WS-Trust. Each message is authenticated using the mechanisms described in WS-Security.

584 • Accountability - Accountability is a function of the type of and strength of the key and algorithms
585 being used. In many cases, a strong symmetric key provides sufficient accountability. However, in
586 some environments, strong PKI signatures are required.

587 • Availability - All reliable messaging services are subject to a variety of availability attacks. Replay
588 detection is a common attack and it is RECOMMENDED that this be addressed by the
589 mechanisms described in WS-Security. Other attacks, such as network-level denial of service
590 attacks are harder to avoid and are outside the scope of this specification. That said, care should
591 be taken to ensure that minimal state is saved prior to any authenticating sequences.

592 • Replay - Messages may be replayed for a variety of reasons. To detect and eliminate this attack,
593 mechanisms should be used to identify replayed messages such as the timestamp/nonce outlined
594 in WS-Security. Alternatively, and optionally, other technologies, such as sequencing, can also be
595 used to prevent replay of application messages.

596 Service endpoints SHOULD scope its searching of messages to those that were processed under the
597 same security context as the requesting `MakeConnection` message.

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Appendix A. Schema

599 The normative schema that is defined for WS-MakeConnection using [XML-Schema Part1] and [XML-
600 Schema Part2] is located at:

601   http://docs.oasis-open.org/ws-rx/wsmc/200702/wsmc-1.0-schema-200702.xsd

602 The following copy is provided for reference.

```
603  <?xml version="1.0" encoding="UTF-8"?>
604  <!-- Copyright(C) OASIS(R) 1993-2007. All Rights Reserved.
605       OASIS trademark, IPR and other policies apply.  -->
606  <xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
607  xmlns:wsa="http://www.w3.org/2005/08/addressing" xmlns:wsmc="http://docs.oasis-
608  open.org/ws-rx/wsmc/200702"  targetNamespace="http://docs.oasis-open.org/ws-
609  rx/wsmc/200702" elementFormDefault="qualified"
610  attributeFormDefault="unqualified">
611    <xs:import namespace="http://www.w3.org/2005/08/addressing"
612  schemaLocation="http://www.w3.org/2006/03/addressing/ws-addr.xsd"/>
613   <!-- Protocol Elements -->
614    <xs:complexType name="MessagePendingType">
615      <xs:sequence>
616        <xs:any namespace="##other" processContents="lax" minOccurs="0"
617  maxOccurs="unbounded"/>
618      </xs:sequence>
619      <xs:attribute name="pending" type="xs:boolean"/>
620      <xs:anyAttribute namespace="##other" processContents="lax"/>
621    </xs:complexType>
622    <xs:element name="MessagePending" type="wsmc:MessagePendingType"/>
623    <xs:element name="Address">
624      <xs:complexType>
625        <xs:simpleContent>
626          <xs:extension base="xs:anyURI">
627            <xs:anyAttribute namespace="##other" processContents="lax"/>
628          </xs:extension>
629        </xs:simpleContent>
630      </xs:complexType>
631    </xs:element>
632    <xs:complexType name="MakeConnectionType">
633      <xs:sequence>
634        <xs:element ref="wsmc:Address" minOccurs="0" maxOccurs="1"/>
635        <xs:any namespace="##other" processContents="lax" minOccurs="0"
636  maxOccurs="unbounded"/>
637      </xs:sequence>
638      <xs:anyAttribute namespace="##other" processContents="lax"/>
639    </xs:complexType>
640    <xs:element name="MakeConnection" type="wsmc:MakeConnectionType"/>
641    <xs:element name="UnsupportedSelection">
642      <xs:simpleType>
643        <xs:restriction base="xs:QName"/>
644      </xs:simpleType>
645    </xs:element>
646  </xs:schema>
```

Appendix B. WSDL

This WSDL describes the WS-MC protocol from the point of view of the endpoint that receives the `MakeConnection` message.

Also note that this WSDL is intended to describe the internal structure of the WS-MC protocol, and will not generally appear in a description of a WS-MC-capable Web service. See section 3.4 Policy for a higher-level mechanism to indicate that WS-MC is supported.

The normative WSDL 1.1 definition for WS-MakeConnection is located at:

http://docs.oasis-open.org/ws-rx/wsmc/200702/wsmc-1.0-wsdl-200702.wsdl

The following non-normative copy is provided for reference.

```
<?xml version="1.0" encoding="utf-8"?>
<!-- Copyright(C) OASIS(R) 1993-2007. All Rights Reserved.
     OASIS trademark, IPR and other policies apply.  -->
<wsdl:definitions xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:wsa="http://www.w3.org/2005/08/addressing"
xmlns:wsam="http://www.w3.org/2007/0205/addressing/metadata"
xmlns:wsmc="http://docs.oasis-open.org/ws-rx/wsmc/200702"
xmlns:tns="http://docs.oasis-open.org/ws-rx/wsmc/200702/wsdl"
targetNamespace="http://docs.oasis-open.org/ws-rx/wsmc/200702/wsdl">

  <wsdl:types>
    <xs:schema>
      <xs:import namespace="http://docs.oasis-open.org/ws-rx/wsmc/200702"
schemaLocation="http://docs.oasis-open.org/ws-rx/wsmc/200702/wsmc-1.0-schema-
200702.xsd"/>
    </xs:schema>
  </wsdl:types>

  <wsdl:message name="MakeConnection">
    <wsdl:part name="makeConnection" element="wsmc:MakeConnection"/>
  </wsdl:message>

  <wsdl:portType name="MCAbstractPortType">
    <wsdl:operation name="MakeConnection">
      <wsdl:input message="tns:MakeConnection" wsam:Action="http://docs.oasis-
open.org/ws-rx/wsmc/200702/MakeConnection"/>
      <!-- As described in the WS-MakeConnection specification, the
           MakeConnection operation establishes a connection. If a matching
           message is available then the back-channel of the connection will
           be used to carry the message. In SOAP terms the returned message
           is not a response, so there is no WSDL output message. -->
    </wsdl:operation>
  </wsdl:portType>

</wsdl:definitions>
```

692 Appendix C. Message Examples

693 Appendix C.1 Example use of MakeConnection

694 To illustrate how a `MakeConnection` message exchange can be used to deliver messages to an
695 Endpoint that is not addressable, consider the case of a pub/sub scenario in which the Endpoint to which
696 notifications are to be delivered (the "event consumer") is not addressable by the notification sending
697 Endpoint (the "event producer"). In this scenario the event consumer must initiate the connections in order
698 for the notifications to be delivered. One possible set of message exchanges (using HTTP) that
699 demonstrate how this can be achieved using `MakeConnection` is shown below.

700 **Step 1** – During a "subscribe" operation, the event consumer's EPR specifies the MC anonymous URI and
701 the WS-RM Policy Assertion [WS-RM Policy] to indicate whether or not RM is required:

```
702  <S:Envelope xmlns:S="http://www.w3.org/2003/05/soap-envelope"
703  xmlns:wsmc="http://docs.oasis-open.org/ws-rx/wsmc/200702"
704  xmlns:wsrmp="http://docs.oasis-open.org/ws-rx/wsrmp/200702"
705  xmlns:wsa="http://www.w3.org/2005/08/addressing">
706    <S:Header>
707      <wsa:To> http://example.org/subscriptionService </wsa:To>
708      <wsa:MessageID> http://client456.org/id-a6d8-a7c2eb546813</wsa:MessageID>
709      <wsa:ReplyTo>
710        <wsa:To> http://client456.org/response </wsa:To>
711      </wsa:ReplyTo>
712    </S:Header>
713    <S:Body>
714      <sub:Subscribe xmlns:sub="http://example.org/subscriptionService">
715        <!-- subscription service specific data -->
716        <targetEPR>
717          <wsa:Address>http://docs.oasis-open.org/ws-
718  rx/wsrm/200702/anonymous?id=550e8400-e29b-11d4-a716-446655440000</wsa:Address>
719          <wsa:Metadata>
720            <wsp:Policy wsu:Id="MyPolicy">
721              <wsrmp:RMAssertion/>
722            </wsp:Policy>
723          </wsa:Metadata>
724        </targetEPR>
725      </sub:Subscribe>
726    </S:Body>
727  </S:Envelope>
```

728 In this example the `subscribe` and `targetEPR` elements are simply examples of what a subscription
729 request message might contain. Note: the `wsa:Address` element contains the MC anonymous URI
730 indicating that the notification producer needs to queue the messages until they are requested using the
731 `MakeConnection` message exchange. The EPR also contains the WS-RM Policy Assertion indicating the
732 RM must be used when notifications related to this subscription are sent.

733

734 **Step 2** – Once the subscription is established, the event consumer checks for a pending message:

```
735  <S:Envelope xmlns:S="http://www.w3.org/2003/05/soap-envelope"
736  xmlns:wsmc="http://docs.oasis-open.org/ws-rx/wsmc/200702"
737  xmlns:wsa="http://www.w3.org/2005/08/addressing">
738    <S:Header>
739      <wsa:Action>http://docs.oasis-open.org/ws-
740  rx/wsmc/200702/MakeConnection</wsa:Action>
741      <wsa:To> http://example.org/subscriptionService </wsa:To>
```

```
742        </S:Header>
743        <S:Body>
744          <wsmc:MakeConnection>
745            <wsmc:Address>http://docs.oasis-open.org/ws-
746    rx/wsmc/200702/anonymous?id=550e8400-e29b-11d4-a716-446655440000</wsmc:Address>
747          </wsmc:MakeConnection>
748        </S:Body>
749    </S:Envelope>
```

750 **Step 3** – If there are messages waiting to be delivered then a message will be returned back to the event
751 consumer. However, because WS-RM is being used to deliver the messages, the first message returned
752 is a CreateSequence:

```
753    <S:Envelope xmlns:S="http://www.w3.org/2003/05/soap-envelope"
754    xmlns:wsmc="http://docs.oasis-open.org/ws-rx/wsmc/200702"
755    xmlns:wsrm="http://docs.oasis-open.org/ws-rx/wsrm/200702"
756    xmlns:wsa="http://www.w3.org/2005/08/addressing">
757      <S:Header>
758        <wsa:Action>http://docs.oasis-open-org/ws-
759    rx/wsrm/200702/CreateSequence</wsa:Action>
760        <wsa:To>http://docs.oasis-open.org/ws-rx/wsrm/200702/anonymous?id=550e8400-
761    e29b-11d4-a716-446655440000</wsa:To>
762        <wsa:ReplyTo> http://example.org/subscriptionService </wsa:ReplyTo>
763        <wsa:MessageID> http://example.org/id-123-456 </wsa:MessagID>
764        <wsmc:MessagePending pending="true"/>
765      </S:Header>
766      <S:Body>
767        <wsrm:CreateSequence>
768          <wsrm:AcksTo>
769            <wsa:Address> http://example.org/subscriptionService </wsa:Address>
770          </wsrm:AcksTo>
771        </wsrm:CreateSequence>
772      </S:Body>
773    </S:Envelope>
```

774 Notice from the perspective of how the RM Source on the event producer interacts with the RM Destination
775 of those messages, nothing new is introduced by the use of the MakeConnection, the use of RM
776 protocol is the same as the case where the event consumer is addressable. Note the message contains a
777 wsmc:MessagePending header indicating that additional message are waiting to be delivered.

778

779 **Step 4** – The event consumer will respond with a CreateSequenceResponse message per normal WS-
780 Addressing rules:

```
781    <S:Envelope xmlns:S="http://www.w3.org/2003/05/soap-envelope"
782    xmlns:wsrm="http://docs.oasis-open.org/ws-rx/wsrm/200702"
783    xmlns:wsa="http://www.w3.org/2005/08/addressing">
784      <S:Header>
785        <wsa:Action>http://docs.oasis-open-org/ws-
786    rx/wsrm/200702/CreateSequenceResponse</wsa:Action>
787        <wsa:To> http://example.org/subscriptionService </wsa:To>
788        <wsa:RelatesTo> http://example.org/id-123-456 </wsa:RelatesTo>
789      </S:Header>
790      <S:Body>
791        <wsrm:CreateSequenceResponse>
792          <wsrm:Identifier> http://example.org/rmid-456 </wsrm:Identifier>
793        </wsrm:CreateSequenceResponse>
794      </S:Body>
795    </S:Envelope>
```

796 Note, this message is carried on an HTTP request directed to the `wsa:ReplyTo EPR`, and the HTTP
797 response will be an HTTP 202.

798

799 **Step 5** – The event consumer checks for another message pending:

```
800  <S:Envelope xmlns:S="http://www.w3.org/2003/05/soap-envelope"
801  xmlns:wsmc="http://docs.oasis-open.org/ws-rx/wsmc/200702"
802  xmlns:wsa="http://www.w3.org/2005/08/addressing">
803    <S:Header>
804      <wsa:Action>http://docs.oasis-open.org/ws-
805  rx/wsmc/200702/MakeConnection</wsa:Action>
806      <wsa:To> http://example.org/subscriptionService </wsa:To>
807    </S:Header>
808    <S:Body>
809      <wsmc:MakeConnection>
810        <wsmc:Address>http://docs.oasis-open.org/ws-
811  rx/wsmc/200702/anonymous?id=550e8400-e29b-11d4-a716-446655440000</wsmc:Address>
812      </wsmc:MakeConnection>
813    </S:Body>
814  </S:Envelope>
```

815 Notice this is the same message as the one sent in step 2.

816

817 **Step 6** – Since there is a message pending for this destination then it is returned on the HTTP response:

```
818  <S:Envelope xmlns:S="http://www.w3.org/2003/05/soap-envelope"
819  xmlns:wsmc="http://docs.oasis-open.org/ws-rx/wsmc/200702"
820  xmlns:wsrm="http://docs.oasis-open.org/ws-rx/wsrm/200702"
821  xmlns:wsa="http://www.w3.org/2005/08/addressing">
822    <S:Header>
823      <wsa:Action> http://example.org/eventType1/</wsa:Action>
824      <wsa:To>http://docs.oasis-open.org/ws-rx/wsrm/200702/anonymous?id=550e8400-
825  e29b-11d4-a716-446655440000</wsa:To>
826      <wsrm:Sequence>
827        <wsrm:Identifier> http://example.org/rmid-456 </wsrm:Identifier>
828      </wsrm:Sequence>
829      <wsmc:MessagePending pending="true"/>
830    </S:Header>
831    <S:Body>
832      <!-- event specific data -->
833    </S:Body>
834  </S:Envelope>
```

835 As noted in step 3, the use of the RM protocol does not change when using `MakeConnection`. The
836 format of the messages, the order of the messages sent and the timing of when to send it remains the
837 same.

838

839 **Step 7** – At some later interval, or immediately due to the `MessagePending` header's "`pending`"
840 attribute being set to "true", the event consumer will poll again:

```
841  <S:Envelope xmlns:S="http://www.w3.org/2003/05/soap-envelope"
842  xmlns:wsmc="http://docs.oasis-open.org/ws-rx/wsmc/200702"
843  xmlns:wsa="http://www.w3.org/2005/08/addressing">
844    <S:Header>
845      <wsa:Action> http://docs.oasis-open.org/ws-rx/wsmc/200702/MakeConnection
846  </wsa:Action>
847      <wsa:To> http://example.org/subscriptionService </wsa:To>
848    </S:Header>
```

```
849    <S:Body>
850      <wsmc:MakeConnection>
851        <wsmc:Address>http://docs.oasis-open.org/ws-
852 rx/wsmc/200702/anonymous?id=550e8400-e29b-11d4-a716-446655440000</wsmc:Address>
853      </wsmc:MakeConnection>
854    </S:Body>
855  </S:Envelope>
```

856 Notice this is the same message as the one sent in steps 2 and 5. As in steps 3 and 6, the response to the
857 `MakeConnection` can be any message destined to the specified Endpoint. This allows the event
858 producer to send not only application messages (events) but RM protocol messages (e.g.
859 `CloseSequence`, `TerminateSequence` or even additional `CreateSequence` messages) as needed.

860

861 **Step 8** – If at any point in time there are no messages pending, in response to a `MakeConnection` the
862 event producer returns an HTTP 202 back to the event consumer. The process then repeats (back to step
863 7) until the subscription ends.

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900 Toufic Boubez, Layer 7
901 Doug Bunting, Sun
902 Lloyd Burch, Novell
903 Steve Carter, Novell
904 Martin Chapman, Oracle
905 Dave Chappell, Sonic
906 Paul Cotton, Microsoft
907 Glen Daniels, Sonic
908 Doug Davis, IBM
909 Blake Dournaee, Intel
910 Jacques Durand, Fujitsu
911 Colleen Evans, Microsoft
912 Christopher Ferris, IBM
913 Paul Fremantle, WSO2
914 Robert Freund, Hitachi
915 Peter Furniss, Erebor
916 Marc Goodner, Microsoft
917 Alastair Green, Choreology
918 Mike Grogan, Sun
919 Ondrej Hrebicek, Microsoft
920 Kazunori Iwasa, Fujitsu
921 Chamikara Jayalath, WSO2
922 Lei Jin, BEA
923 Ian Jones, BTplc
924 Anish Karmarkar, Oracle

925 Paul Knight, Nortel
926 Dan Leshchiner, Tibco
927 Mark Little, JBoss
928 Lily Liu, webMethods
929 Matt Lovett, IBM
930 Ashok Malhotra, Oracle
931 Jonathan Marsh, Microsoft
932 Daniel Millwood, IBM
933 Jeff Mischkinsky, Oracle
934 Nilo Mitra, Ericsson
935 Peter Niblett, IBM
936 Duane Nickull, Adobe
937 Eisaku Nishiyama, Hitachi
938 Dave Orchard, BEA
939 Chouthri Palanisamy, NEC
940 Sanjay Patil, SAP
941 Gilbert Pilz, BEA
942 Martin Raepple, SAP
943 Eric Rajkovic, Oracle
944 Stefan Rossmanith, SAP
945 Tom Rutt, Fujitsu
946 Rich Salz, IBM
947 Shivajee Samdarshi, Tibco
948 Vladimir Videlov, SAP
949 Claus von Riegen, SAP
950 Pete Wenzel, Sun
951 Steve Winkler, SAP
952 Ümit Yalçinalp, SAP
953 Nobuyuki Yamamoto, Hitachi

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