[MS-SWSB-Diff]:

SOAP Over WebSocket Protocol Binding

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Revision Summary

Date	Revision History	Revision Class	Comments
12/16/2011	1.0	New	Released new document.
3/30/2012	1.0	None	No changes to the meaning, language, or formatting of the technical content.
7/12/2012	2.0	Major	Significantly changed the technical content.
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3/16/2017	4.0	Major	Significantly changed the technical content.
6/1/2017	4.0	None	No changes to the meaning, language, or formatting of the technical content.

Table of Contents

1 Introduction

The SOAP over WebSocket Protocol Binding Specification defines a binding of SOAP to the WebSocket protocol (as defined in [RFC6455]), including a WSDL transport URI and supported message exchange patterns (MEPs). This specification also defines a WebSocket subprotocol.

Note This specification does not define any SOAP messages. Rather, it specifies how messages defined by a higher-layer protocol are formed and framed for transport over [RFC6455].

Sections 1.5, 1.8, 1.9, 2, and 3 of this specification are normative. All other sections and examples in this specification are informative.

1.1 Glossary

This document uses the following terms:

endpoint: A client that is on a network and is requesting access to a network access server (NAS).

SOAP: A lightweight protocol for exchanging structured information in a decentralized, distributed environment. SOAP uses XML technologies to define an extensible messaging framework, which provides a message construct that can be exchanged over a variety of underlying protocols. The framework has been designed to be independent of any particular programming model and other implementation-specific semantics. SOAP 1.2 supersedes SOAP 1.1. See [SOAP1.2-1/2003].

SOAP message: An XML document consisting of a mandatory SOAP envelope, an optional SOAP header, and a mandatory SOAP body. See [SOAP1.2-1/2007] section 5 for more information.

Uniform Resource Identifier (URI): A string that identifies a resource. The URI is an addressing mechanism defined in Internet Engineering Task Force (IETF) Uniform Resource Identifier (URI): Generic Syntax [RFC3986].

Web Services Description Language (WSDL): An XML format for describing network services as a set of endpoints that operate on messages that contain either document-oriented or procedure-oriented information. The operations and messages are described abstractly and are bound to a concrete network protocol and message format in order to define an endpoint. Related concrete endpoints are combined into abstract endpoints, which describe a network service. WSDL is extensible, which allows the description of endpoints and their messages regardless of the message formats or network protocols that are used.

MAY, SHOULD, MUST, SHOULD NOT, MUST NOT: These terms (in all caps) are used as defined in [RFC2119]. All statements of optional behavior use either MAY, SHOULD, or SHOULD NOT.

1.2 References

Links to a document in the Microsoft Open Specifications library point to the correct section in the most recently published version of the referenced document. However, because individual documents in the library are not updated at the same time, the section numbers in the documents may not match. You can confirm the correct section numbering by checking the Errata.

1.2.1 Normative References

We conduct frequent surveys of the normative references to assure their continued availability. If you have any issue with finding a normative reference, please contact dochelp@microsoft.com. We will assist you in finding the relevant information.

[MC-NBFSE] Microsoft Corporation, ".NET Binary Format: SOAP Extension".

[MC-NBFS] Microsoft Corporation, ".NET Binary Format: SOAP Data Structure".

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997, http://www.rfc-editor.org/rfc/rfc2119.txt

[RFC3902] Baker, M., and Nottingham, M., "The 'application/soap+xml' media type", RFC 3902, September 2004, http://www.rfc-editor.org/rfc/rfc3902.txt

[RFC6455] Fette, I., and Melnikov, A., "The WebSocket Protocol", RFC 6455, December 2011, http://www.ietf.org/rfc/rfc6455.txt

[SOAP1.2-1/2007] Gudgin, M., Hadley, M., Mendelsohn, N., et al., "SOAP Version 1.2 Part 1: Messaging Framework (Second Edition)", W3C Recommendation, April 2007, http://www.w3.org/TR/2007/REC-soap12-part1-20070427/

[SOAP1.2-2/2007] Gudgin, M., Hadley, M., Mendelsohn, N., et al., "SOAP Version 1.2 Part 2: Adjuncts (Second Edition)", W3C Recommendation, April 2007, http://www.w3.org/TR/2007/REC-soap12-part2-20070427

[SOAP1.2-3/2007] W3C, "SOAP 1.2 Part 3: One-Way MEP", W3C Working Group Note 2, July 2007, http://www.w3.org/TR/2007/NOTE-soap12-part3-20070702

[WSDLSOAP] Angelov, D., Ballinger, K., Butek, R., et al., "WSDL 1.1 Binding Extension for SOAP 1.2", W3C Member Submission, April 2006, http://www.w3.org/Submission/2006/SUBM-wsdl11soap12-20060405/

[WSDL] Christensen, E., Curbera, F., Meredith, G., and Weerawarana, S., "Web Services Description Language (WSDL) 1.1", W3C Note, March 2001, http://www.w3.org/TR/2001/NOTE-wsdl-20010315

[XMLNS-2ED] World Wide Web Consortium, "Namespaces in XML 1.0 (Second Edition)", August 2006, http://www.w3.org/TR/2006/REC-xml-names-20060816/

[XMLSCHEMA1] Thompson, H., Beech, D., Maloney, M., and Mendelsohn, N., Eds., "XML Schema Part 1: Structures", W3C Recommendation, May 2001, http://www.w3.org/TR/2001/REC-xmlschema-1-20010502/

[XMLSCHEMA2] Biron, P.V., Ed. and Malhotra, A., Ed., "XML Schema Part 2: Datatypes", W3C Recommendation, May 2001, http://www.w3.org/TR/2001/REC-xmlschema-2-20010502/

1.2.2 Informative References

None.

1.3 Overview

The SOAP over WebSocket Protocol Binding:

- Specifies a WSDL Transport URI (http://schemas.microsoft.com/soap/websocket) for identifying this protocol as the transport for sending SOAP 1.2 messages [SOAP1.2-2/2007].
- Defines a new WebSocket subprotocol (soap), as described in [RFC6455], which is used by the client to indicate to the service that it intends to use the SOAP-over-WebSockets protocol for message exchange.
- Defines two new HTTP headers ('soap-content-type' and 'microsoft-binary-transfer-mode') that are used by the client during the initial WebSocket handshake to indicate the SOAP content-type and the transfer-mode of the subsequent messages.

1.4 Relationship to Other Protocols

The SOAP over WebSocket Protocol Binding uses the WebSocket protocol, as described in [RFC6455], as the transport. The SOAP over WebSocket Protocol Binding uses WebSocket framing as defined in section 5 of [RFC6455] to send SOAP 1.2 messages [SOAP1.2-2/2007].

The following figure shows the protocol stack.

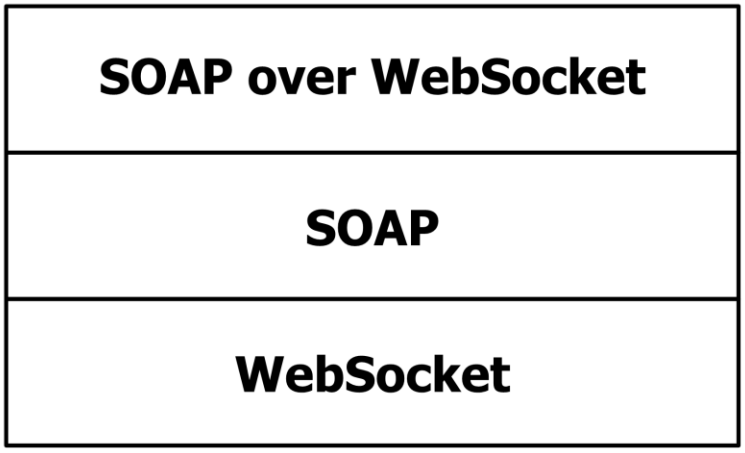

Figure 1: Protocol stack

1.5 Prerequisites/Preconditions

The SOAP over WebSocket Protocol Binding requires that a client can connect to the service over the WebSocket protocol, as described in [RFC6455].

1.6 Applicability Statement

The SOAP over WebSocket Protocol Binding is applicable in scenarios where a client and a service require a communication mechanism to send and receive SOAP messages over WebSocket ([RFC6455]).

1.7 Versioning and Capability Negotiation

This document covers versioning issues in the following areas:

- **Supported transports:** This protocol requires WebSocket ([RFC6455]) as the transport.
- **Protocol versions:** The use of SOAP version 1.2 [SOAP1.2-1/2007] is required.
- **Capability negotiation**: This protocol does not support negotiation of the version or the capabilities to use.

1.8 Vendor-Extensible Fields

This protocol has no vendor-extensible fields.

1.9 Standards Assignments

There are no standards assignments for this protocol.

2 Messages

2.1 Transport

The SOAP over WebSocket Protocol Binding requires the WebSocket transport protocol (as specified in [RFC6455]).

A service endpoint that uses the SOAP over WebSocket Protocol Binding with SOAP 1.2 [SOAP1.2-1/2007] MUST set the value of the transport attribute of the `wsoap12:binding` element [WSDLSOAP] to http://schemas.microsoft.com/soap/websocket.

2.2 Common Message Syntax

This section contains common definitions used by this protocol. The syntax of the definitions uses XML schema as defined in [XMLSCHEMA1] and [XMLSCHEMA2], and Web Services Description Language (WSDL) as defined in [WSDL].

2.2.1 Namespaces

This specification defines and references various XML namespaces using the mechanisms specified in [XMLNS-2ED]. Although this specification associates a specific XML namespace prefix for each XML namespace that is used, the choice of any particular XML namespace prefix is implementation-specific and not significant for interoperability.

Prefix	Namespace URI	Reference
soap12	http://schemas.xmlsoap.org/wsdl/soap12/	[WSDLSOAP]
wsdl	http://schemas.xmlsoap.org/wsdl/	[WSDL]

2.2.2 Messages

This specification does not define any common XML schema message definitions.

2.2.3 Elements

This specification does not define any common XML schema element definitions.

2.2.4 Complex Types

This specification does not define any common XML schema complex type definitions.

2.2.5 Simple Types

This specification does not define any common XML schema simple type definitions.

2.2.6 Attributes

This specification does not define any common XML schema attribute definitions.

2.2.7 Groups

This specification does not define any common XML schema group definitions.

2.2.8 Attribute Groups

This specification does not define any common XML schema attribute group definitions.

2.2.9 Common Data Structures

This specification does not define any common XML schema data structures.

2.3 Directory Service Schema Elements

None.

3 Protocol Details

3.1 Server Details

A service endpoint MUST support the following message exchange patterns:

- http://www.w3.org/2003/05/soap/mep/request-response/ (defined in [SOAP1.2-2/2007])
- http://www.w3.org/2006/08/soap/mep/one-way/ (defined in [SOAP1.2-3/2007])

3.1.1 Abstract Data Model

None.

3.1.2 Timers

None.

3.1.3 Initialization

None.

3.1.4 Message Processing Events and Sequencing Rules

None.

3.1.5 Timer Events

None.

3.1.6 Other Local Events

None.

3.2 Client Details

A client initiates the process by establishing a WebSocket connection, as specified in [RFC6455], to a service. A client MUST specify that it intends to communicate with the service using this SOAP-over-Websocket subprotocol by providing a "soap" value in the "Sec-WebSocket-Protocol" HTTP header during the initialization while performing a WebSocket handshake as specified in [RFC6455] section 1.3. A client MUST also specify a soap-content-type header to indicate the content-type of the subsequent SOAP messages once the WebSocket handshake is successfully completed. A client SHOULD also specify a 'microsoft-binary-transfer-mode' with the transfer-mode while using the binary encoding as specified in [MC-NBFS] or [MC-NBFSE]. Valid values for the transfer-mode are:

1. 'Streamed', which indicates that messages sent and received from the web service endpoint are transferred as a stream of bytes.
2. 'StreamedRequest', which indicates that only the messages sent to a web service endpoint are transferred as a stream of bytes.
3. 'StreamedResponse', which indicates that the messages received from the web service endpoint are interpreted as a stream of bytes.

Once a WebSocket connection has been successfully established between the client and the server, all subsequent message exchanges MUST conform to the SOAP 1.2 [SOAP1.2-1/2007] specification with the encoding as specified in [RFC3902] while sending the messages using the framing as defined in [RFC6455].

3.2.1 Abstract Data Model

None.

3.2.2 Timers

None.

3.2.3 Initialization

None.

3.2.4 Message Processing Events and Sequencing Rules

None.

3.2.5 Timer Events

None.

3.2.6 Other Local Events

None.

4 Protocol Examples

Section 6, Appendix A: Full WSDL, specifies the SOAP over WebSocket Binding Transport URI defined in this document.

The following HTTP headers section is an example of the WebSocket subprotocol defined by this specification:

```
GET http://myHost/myService HTTP/1.1
Connection: Upgrade,Keep-Alive
Upgrade: websocket
Sec-WebSocket-Key: ROOw9dYOJkStW2nx5r1k9w==
Sec-WebSocket-Version: 13
Sec-WebSocket-Protocol: soap
soap-content-type: application/soap+msbinsession1
microsoft-binary-transfer-mode: Buffered
Accept-Encoding: gzip, deflate

HTTP/1.1 101 Switching Protocols
Upgrade: websocket
Connection: Upgrade
Sec-WebSocket-Accept: s3pPLMBiTxaQ9kYGzzhZRbK+xOo=
Sec-WebSocket-Protocol: soap
```

5 Security

5.1 Security Considerations for Implementers

Security considerations are discussed in detail under the security considerations section (section 10) in [RFC6455].

There are no special security considerations for this protocol.

5.2 Index of Security Parameters

None.

6 Appendix A: Full WSDL

The following WSDL specifies the WSDL 1.1 binding extension transport URI with SOAP1.2:

WSDL 1.1 binding extension transport URI with SOAP 1.2 [SOAP1.2-2/2007]

```
<?xml version="1.0" encoding="utf-8"?>
<wsdl:definitions
    xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
    xmlns:soap12="http://schemas.xmlsoap.org/wsdl/soap12/">
  <!-- omitted elements -->
  <wsdl:binding name="MyBinding" type="MyPortType">
            <!-- omitted elements -->
            <soap12:binding transport="http://schemas.microsoft.com/soap/websocket"/>
            <wsdl:operation name="MyOperation">
                    <!-- ommitted elements -->
            </wsdl:operation>
  </wsdl:binding>
  <wsdl:service name="MyService">
              <wsdl:port name="MyPort" binding="MyBinding">
                      <soap12:address location=" ws://myHost/myService/" />
            </wsdl:port>
</wsdl:service>
</wsdl:definitions>
```

7 Appendix B: Product Behavior

The information in this specification is applicable to the following Microsoft products or supplemental software. References to product versions include released service packs.

This document specifies version-specific details in the Microsoft .NET Framework. For information about which versions of the .NET Framework are available in each released Windows product or as supplemental software, see [MS-NETOD] section 4.

- Microsoft .NET Framework 4.5
- Microsoft .NET Framework 4.6
- Microsoft .NET Framework 4.7
- Windows 8 operating system
- Windows Server 2012 operating system
- Windows 8.1 operating system
- Windows Server 2012 R2 operating system
- Windows 10 operating system
- Windows Server 2016 operating system

Exceptions, if any, are noted below. If a service pack or Quick Fix Engineering (QFE) number appears with the product version, behavior changed in that service pack or QFE. The new behavior also applies to subsequent service packs of the product unless otherwise specified. If a product edition appears with the product version, behavior is different in that product edition.

Unless otherwise specified, any statement of optional behavior in this specification that is prescribed using the terms "SHOULD" or "SHOULD NOT" implies product behavior in accordance with the SHOULD or SHOULD NOT prescription. Unless otherwise specified, the term "MAY" implies that the product does not follow the prescription.

8 Change Tracking

~~This section identifies~~ No table of changes ~~that were made to this~~ is available. The document is either new or has had no changes since ~~the~~its last release. ~~Changes are classified as Major, Minor, or None.~~

~~The revision class **Major** means that the technical content in the document was significantly revised. Major changes affect protocol interoperability or implementation. Examples of major changes are:~~

- ~~A document revision that incorporates changes to interoperability requirements.~~
- ~~A document revision that captures changes to protocol functionality.~~

~~The revision class **Minor** means that the meaning of the technical content was clarified. Minor changes do not affect protocol interoperability or implementation. Examples of minor changes are updates to clarify ambiguity at the sentence, paragraph, or table level.~~

~~The revision class **None** means that no new technical changes were introduced. Minor editorial and formatting changes may have been made, but the relevant technical content is identical to the last released version.~~

~~The changes made to this document are listed in the following table. For more information, please contact dochelp@microsoft.com.~~

~~**Section**~~	~~**Description**~~	~~**Revision class**~~
~~7 Appendix B: Product Behavior~~	~~7189 : Added .NET Framework 4.7 to the Product Behavior appendix.~~	~~Major~~

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