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The WebSocket Protocol as a Transport for the Message Session Relay Protocol (MSRP)

Abstract

The WebSocket protocol enables two-way real-time communication between clients and servers in situations where direct access to TCP and UDP is not available (for example, from within JavaScript in a web browser). This document specifies a new WebSocket subprotocol as a reliable transport mechanism between Message Session Relay Protocol (MSRP) clients and relays to enable usage of MSRP in new scenarios. This document normatively updates RFCs 4975 and 4976.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 7841.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at http://www.rfc-editor.org/info/rfc7977.

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1. Introduction

The WebSocket [RFC6455] protocol enables message exchange between clients and servers on top of a persistent TCP connection (optionally secured with Transport Layer Security (TLS) [RFC5246]). The initial protocol handshake makes use of HTTP [RFC7230] semantics, allowing the WebSocket protocol to reuse existing HTTP infrastructure.

Modern web browsers include a WebSocket client stack complying with the WebSocket API [WS-API] as specified by the W3C. It is expected that other client applications (those running in personal computers and devices such as smartphones) will also make a WebSocket client stack available. The specification in this document enables usage of Message Session Relay Protocol [RFC4975] in these scenarios.

This specification defines a new WebSocket subprotocol (as defined in Section 1.9 in [RFC6455]) for transporting MSRP messages between a WebSocket client and MSRP relay [RFC4976] containing a WebSocket server, a new transport for MSRP, and procedures for MSRP clients and relays implementing the WebSocket transport.

MSRP over WebSocket is well suited for MSRP interactions between clients and servers. Common use cases for MSRP over WebSocket include:

- Human-to-machine messaging
- Client-to-server data exchange (for example, application control signaling)
- Human-to-human messaging where local policy requires authentication and/or logging

MSRP Connection Establishment for Media Anchoring (MSRP-CEMA) [RFC6714] is outside of the scope of this document, as this document is intended to describe connecting to a WebSocket server that is an MSRP relay.

2. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

2.1. Definitions

MSRP WebSocket Client: An MSRP entity capable of opening outbound connections to MSRP relays that are WebSocket servers and communicating using the WebSocket MSRP subprotocol as defined by this document.

MSRP WebSocket Server: An MSRP entity (specifically an MSRP relay [RFC4976]) capable of listening for inbound connections from WebSocket clients and communicating using the WebSocket MSRP subprotocol as defined by this document.

3. WebSocket Protocol Overview

The WebSocket protocol [RFC6455] is a transport layer on top of TCP (optionally secured with TLS [RFC5246]) in which both the client and server exchange message units in both directions. The protocol defines a connection handshake, WebSocket subprotocol and extensions negotiation, a frame format for sending application and control data, a masking mechanism, and status codes for indicating disconnection causes.

The WebSocket connection handshake is based on HTTP [RFC7230] and utilizes the HTTP GET method with an "Upgrade" request. This is sent by the client and then answered by the server (if the negotiation succeeded) with an HTTP 101 status code. Once the handshake is completed, the connection upgrades from HTTP to the WebSocket protocol. This handshake procedure is designed to reuse the existing HTTP infrastructure. During the connection handshake, client and server agree on the application protocol to use on top of the WebSocket transport. Such application protocol (also known as a "WebSocket subprotocol") defines the format and semantics of the messages exchanged by the endpoints. This could be a custom protocol or a standardized one (such as the WebSocket MSRP subprotocol defined in this document). Once the HTTP 101 response is processed, both client and server reuse the underlying TCP connection for sending WebSocket messages and control frames to each other. Unlike plain HTTP, this connection is persistent and can be used for multiple message exchanges.

WebSocket defines message units to be used by applications for the exchange of data, so it provides a message boundary-preserving transport layer. These message units can contain either UTF-8 text or binary data and can be split into multiple WebSocket text/binary transport frames as needed by the WebSocket stack.

The WebSocket API [WS-API] for web browsers only defines callbacks to be invoked upon receipt of an entire message unit regardless of whether it was received in a single WebSocket frame or split across multiple frames.

4. The WebSocket MSRP Subprotocol

The term WebSocket subprotocol refers to an application-level protocol layered on top of a WebSocket connection. This document specifies the WebSocket MSRP subprotocol for carrying MSRP requests and responses through a WebSocket connection.

4.1. Handshake

The MSRP WebSocket Client and MSRP WebSocket Server negotiate usage of the WebSocket MSRP subprotocol during the WebSocket handshake procedure as defined in Section 1.3 of [RFC6455]. The Client MUST include the value "msrp" in the Sec-WebSocket-Protocol header in its handshake request. The 101 reply from the Server MUST contain "msrp" in its corresponding Sec-WebSocket-Protocol header.

Below is an example of a WebSocket handshake in which the Client requests the WebSocket MSRP subprotocol support from the Server:

```
GET / HTTP/1.1
Host: a.example.com
Upgrade: websocket
Connection: Upgrade
Sec-WebSocket-Key: dGhlIHNhbXBsZSBub25jZQ==
Origin: http://www.example.com
Sec-WebSocket-Protocol: msrp
Sec-WebSocket-Version: 13
```

The handshake response from the Server accepting the WebSocket MSRP subprotocol would look as follows:

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

Once the negotiation has been completed, the WebSocket connection is established and can be used for the transport of MSRP requests and responses. The WebSocket messages transmitted over this connection MUST conform to the negotiated WebSocket subprotocol.

4.2. MSRP Encoding

WebSocket messages can be transported in either UTF-8 text frames or binary frames. MSRP [RFC4975] allows both text and binary bodies in MSRP requests. Therefore, MSRP WebSocket Clients and Servers MUST accept both text and binary frames.

The WebSocket API [WS-API] does not allow developers to choose whether to send UTF-8 text or binary frames but will not send non-UTF-8 characters in a text frame. The content of text frames MUST be interpreted as binary by WebSocket Clients and Servers.

5. MSRP WebSocket Transport

5.1. General

WebSocket clients cannot receive WebSocket connections initiated by other WebSocket clients or WebSocket servers. This means that it is challenging for an MSRP client to communicate directly with other MSRP clients. Therefore, all MSRP-over-WebSocket messages MUST be routed via an MSRP WebSocket Server. MSRP traffic transported over WebSockets MUST be protected by using a Secure WebSocket (WSS) connection (using TLS [RFC5246] over TCP).

MSRP WebSocket Servers can be used to route MSRP messages between MSRP WebSocket Clients and between MSRP WebSocket Clients and "normal" MSRP clients and relays.

Each MSRP chunk MUST be carried within a single WebSocket message, and a WebSocket message MUST NOT contain more than one MSRP chunk.

This simplifies parsing of MSRP messages for both clients and servers. When large messages are sent by a non-WebSocket peer, MSRP chunking (as defined in Section 5.1 of [RFC4975]) MUST be used by the WebSocket MSRP Servers to split the message into several smaller MSRP chunks.

5.2. Updates to RFC 4975

5.2.1. MSRP URI Transport Parameter

This document defines the value "ws" as the transport parameter value for an MSRP URI [RFC3986] to be contacted using the MSRP WebSocket subprotocol as transport.

The updated ABNF [RFC5234] for this parameter is the following (the original BNF for this parameter can be found in [RFC4975]):

```
transport  =  "tcp" / "ws" / 1*ALPHANUM
```

5.2.2. SDP Transport Protocol

This document does not define a new Session Description Protocol (SDP) transport protocol for MSRP over WebSockets. As all MSRP-over-WebSocket messages MUST be routed via an MSRP WebSocket Server, the MSRP WebSocket Client MUST specify "TCP/TLS/MSRP" protocols in the SDP m-line -- that being the protocol used by non-WebSocket clients and between MSRP relays (see Section 8.1 of [RFC4975]).

The "ws" transport parameter will appear in the endpoint URI in the SDP "path" attribute (see Section 8.2 of [RFC4975]). MSRP was designed with the possibility of new transport bindings in mind (see Section 6 of [RFC4975]), so MSRP implementations are expected to allow unrecognized transports, provided that they do not have to establish a direct connection to the resource described by the URI.

5.3. Updates to RFC 4976

5.3.1. AUTH Request Authentication

The MSRP relay specification [RFC4976] states that AUTH requests MUST be authenticated. This document modifies this requirement to state that all connections between MSRP clients and relays MUST be authenticated. In the case of the MSRP WebSocket Clients, there are three possible authentication mechanisms:

1. HTTP Digest authentication in AUTH (as per [RFC4976]).

2. Cookie-based or HTTP Digest authentication in the WebSocket Handshake (see Section 7).

3. Mutual TLS between the WebSocket-based MSRP client and the WebSocket server.

The AUTH request is a required event when authentication occurs at the WebSocket connection level since the "Use-Path:" header required to create the SDP offer is included in the 200 OK response to the AUTH request.

6. Connection Keepalive

It is RECOMMENDED that MSRP WebSocket Clients and Servers keep their WebSocket connections open by sending periodic WebSocket "Ping" frames as described in Section 5.5.2 of [RFC6455].

The WebSocket API [WS-API] does not provide a mechanism for applications running in a web browser to control whether or not periodic WebSocket "Ping" frames are sent to the server. The implementation of such a keepalive feature is the decision of each web browser manufacturer and may also depend on the configuration of the web browser.

A future WebSocket protocol extension providing a similar keepalive mechanism could also be used.

When MSRP WebSocket Clients or Servers cannot use WebSocket "Ping" frames to keep connections open, an MSRP implementation MAY use bodiless SEND requests as described in Section 7.1 of [RFC4975]. MSRP WebSocket Clients or Servers MUST be prepared to receive bodiless SEND requests.

7. Authentication

Prior to sending MSRP requests, an MSRP WebSocket Client connects to an MSRP WebSocket Server and performs the connection handshake. As described in Section 3, the handshake procedure involves a HTTP GET method request from the Client and a response from the Server including an HTTP 101 status code.

In order to authorize the WebSocket connection, the MSRP WebSocket Server MAY inspect any HTTP headers present (for example, Cookie [RFC6265], Host [RFC7230], or Origin [RFC6454]) in the HTTP GET request. For many web applications, the value of such a Cookie is provided by the web server once the user has authenticated themselves to the web server, which could be done by many existing mechanisms. As an alternative method, the MSRP WebSocket Server could request HTTP authentication by replying to the Client’s GET method request with a HTTP 401 status code. The WebSocket protocol [RFC6455] covers this usage in Section 4.1 and is paraphrased as follows:

> If the status code received from the server is not 101, the WebSocket client stack handles the response per HTTP [RFC7230] procedures; in particular, the client might perform authentication if it receives a 401 status code.

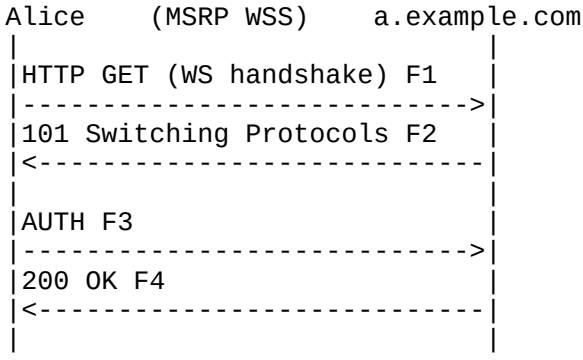
If the HTTP GET request contains an Origin header, the MSRP WebSocket Server SHOULD indicate Cross-Origin Resource Sharing [CORS] by adding an Access-Control-Allow-Origin header to the 101 response.

Regardless of whether the MSRP WebSocket Server requires authentication during the WebSocket handshake, authentication MAY be requested at the MSRP protocol level by an MSRP Server challenging AUTH requests using a 401 response. Therefore, an MSRP WebSocket Client SHOULD support HTTP Digest [RFC7235] authentication as stated in [RFC4976].

8. Examples

8.1. Authentication

8.1.1. WebSocket Authentication



Alice loads a web page using her web browser and retrieves JavaScript code implementing the WebSocket MSRP subprotocol defined in this document. The JavaScript code (an MSRP WebSocket Client) establishes a secure WebSocket connection with an MSRP relay (an MSRP WebSocket Server) at a.example.com. Upon WebSocket connection, Alice constructs and sends an MSRP AUTH request. Since the JavaScript stack in a browser has no way to determine the local address from which the WebSocket connection was made, this implementation uses a random ".invalid" domain name for the hostpart of the From-Path URI (see Appendix A).

In this example, it is assumed that authentication is performed at the WebSocket layer (not shown), so no challenge is issued for the MSRP AUTH message:

F1 HTTP GET (WS handshake) Alice -> a.example.com (TLS)

```
GET / HTTP/1.1
Host: a.example.com
Upgrade: websocket
Connection: Upgrade
Sec-WebSocket-Key: dGhlIHNhbXBsZSBub25jZQ==
Origin: https://www.example.com
Sec-WebSocket-Protocol: msrp
Sec-WebSocket-Version: 13
```

F2 101 Switching Protocols a.example.com -> Alice (TLS)

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

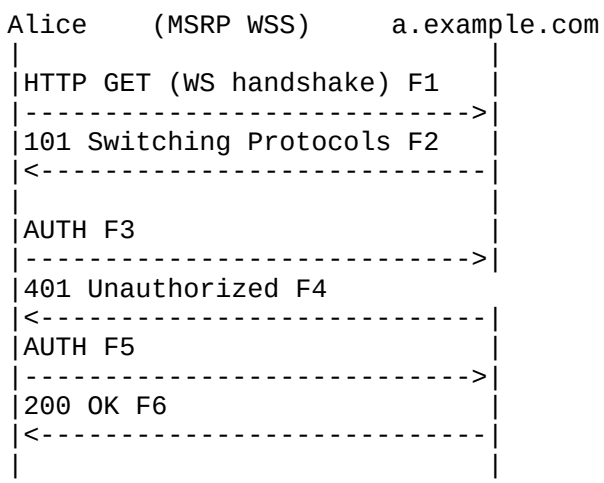
F3 AUTH Alice -> a.example.com (transport WSS)

```
MSRP 49fi AUTH
To-Path: msrps://alice@a.example.com:443;ws
From-Path: msrps://df7jal23ls0d.invalid:2855/98cjs;ws
-------49fi$
```

F4 200 OK a.example.com -> Alice (transport WSS)

```
MSRP 49fi 200 OK
To-Path: msrps://df7jal23ls0d.invalid:2855/98cjs;ws
From-Path: msrps://alice@a.example.com:443;ws
Use-Path: msrps://a.example.com:2855/jui787s2f;tcp
Expires: 900
-------49fi$
```

8.1.2. MSRP Authentication



This example uses the same scenario as Section 8.1.1 but with authentication performed at the MSRP layer.

Note that MSRP does not permit line folding. A "\" in the examples shows a line continuation due to limitations in line length of this document. Neither the backslash nor the extra CRLF is included in the actual MSRP message.

F1 HTTP GET (WS handshake) Alice -> a.example.com (TLS)

```
GET / HTTP/1.1
Host: a.example.com
Upgrade: websocket
Connection: Upgrade
Sec-WebSocket-Key: dGhlIHNhbXBsZSBub25jZQ==
Origin: https://www.example.com
Sec-WebSocket-Protocol: msrp
Sec-WebSocket-Version: 13
```

F2 101 Switching Protocols a.example.com -> Alice (TLS)

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

```
F3 AUTH  Alice -> a.example.com (transport WSS)

MSRP 4rsxt9nz AUTH
To-Path: msrps://alice@a.example.com:443;ws
From-Path: msrps://df7jal23ls0d.invalid:2855/98cjs;ws
-------4rsxt9nz$


F4 401 Unauthorized  a.example.com -> Alice (transport WSS)

MSRP 4rsxt9nz 401 Unauthorized
To-Path: msrps://df7jal23ls0d.invalid:2855/98cjs;ws
From-Path: msrps://alice@a.example.com:443;ws
WWW-Authenticate: Digest realm="example.com", \
 nonce="UvtfpVL7XnnJ63EE244fXDthfLihlMHOY4+dd4A=", qop="auth"
-------4rsxt9nz$


F5 AUTH  Alice -> a.example.com (transport WSS)

MSRP qy1hsow5 AUTH
To-Path: msrps://alice@a.example.com:443;ws
From-Path: msrps://df7jal23ls0d.invalid:2855/98cjs;ws
Authorization: Digest username="alice", realm="example.com", \
 nonce="UvtfpVL7XnnJ63EE244fXDthfLihlMHOY4+dd4A=", \
 uri="msrps://alice@a.example.com:443;ws", \
 response="5011d0d58fe975e0d0cdc007ae26f4b7", \
 qop=auth, cnonce="zic5ml401prb", nc=00000001
-------qy1hsow5$


F6 200 OK  a.example.com -> Alice (transport WSS)

MSRP qy1hsow5 200 OK
To-Path: msrps://df7jal23ls0d.invalid:2855/98cjs;ws
From-Path: msrps://alice@a.example.com:443;ws
Use-Path: msrps://a.example.com:2855/jui787s2f;tcp
Expires: 900
-------qy1hsow5$
```

8.2. Example Session: MSRP WebSocket Client to MSRP Client

The following subsections show various message exchanges occurring during the course of an MSRP session between a WebSocket client and a non-WebSocket client.

8.2.1. SDP Exchange

The following example shows SDP that could be included in a SIP message to set up an MSRP session between Alice and Bob where Alice uses a WebSocket MSRP relay and Bob uses a traditional MSRP client without a relay.

A "\" in the examples shows a line continuation due to limitations in line length of this document. Neither the backslash nor the extra CRLF is included in the actual SDP.

Alice makes an offer with a path including the relay (having already successfully authenticated with the relay):

```
c=IN IP4 a.example.com
m=message 1234 TCP/TLS/MSRP *
a=accept-types:message/cpim text/plain text/html
a=path:msrps://a.example.com:2855/jui787s2f;tcp \
       msrps://df7jal23ls0d.invalid:2855/98cjs;ws
```

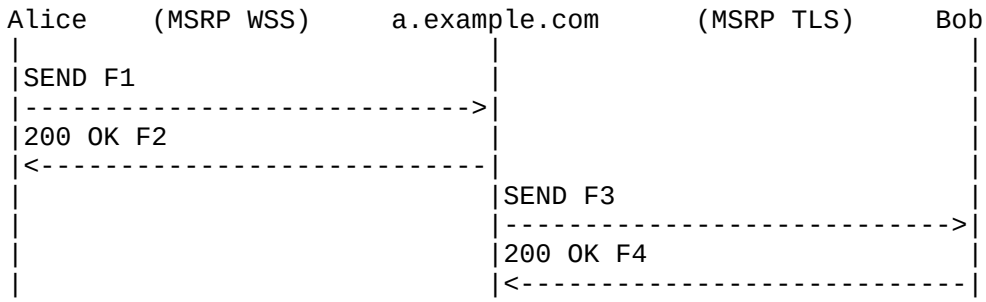
In this offer, Alice wishes to receive MSRP messages via the relay at a.example.com. She wants to use TLS as the transport for the MSRP session (beyond the relay). She can accept message/cpim, text/plain, and text/html message bodies in SEND requests.

Bob’s answer to this offer could look like:

```
c=IN IP4 bob.example.com
m=message 1234 TCP/TLS/MSRP *
a=accept-types:message/cpim text/plain
a=path:msrps://bob.example.com:49154/foo;tcp
```

Here, Bob wishes to receive the MSRP messages at bob.example.com. He can accept only message/cpim and text/plain message bodies in SEND requests and has rejected the text/html content offered by Alice. He does not need a relay to set up the MSRP session.

8.2.2. SEND (MSRP WebSocket Client to MSRP Client)



Later in the session, Alice sends an instant message to Bob. The MSRP WebSocket Server at a.example.com acts as an MSRP relay, routing the message to Bob over TLS.

Message details (A "\" in the examples shows a line continuation due to limitations in line length of this document. Neither the backslash nor the extra CRLF is included in the actual request or response):

F1 SEND Alice -> a.example.com (transport WSS)

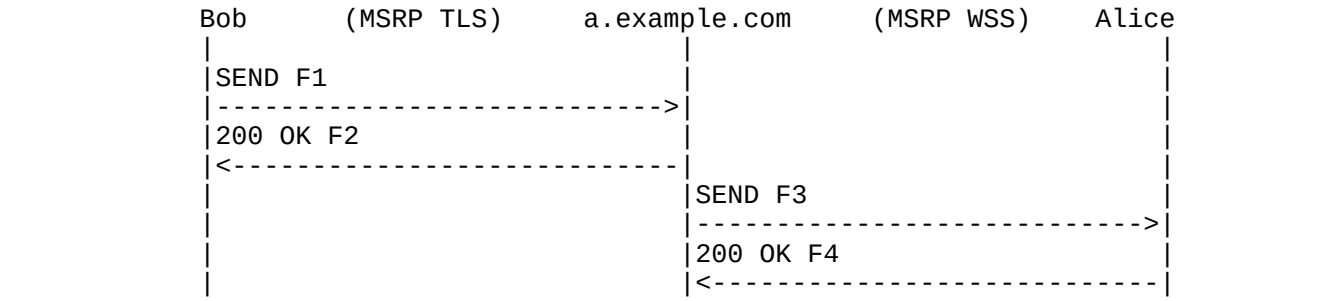
```
MSRP 6aef SEND
To-Path: msrps://a.example.com:2855/jui787s2f;tcp \
         msrps://bob.example.com:49154/foo;tcp
From-Path: msrps://df7jal23ls0d.invalid:2855/98cjs;ws
Success-Report: no
Byte-Range: 1-*/*
Message-ID: 87652
Content-Type: text/plain

Hi Bob, I’m about to send you file.mpeg
-------6aef$
```

F2 200 OK a.example.com -> Alice (transport WSS)

```
MSRP 6aef 200 OK
To-Path: msrps://df7jal23ls0d.invalid:2855/98cjs;ws
From-Path: msrps://a.example.com:2855/jui787s2f;tcp
-------6aef$
```

```
F3 SEND  a.example.com -> Bob (transport TLS)

MSRP juh76 SEND
To-Path: msrps://bob.example.com:49154/foo;tcp
From-Path:  msrps://a.example.com:2855/jui787s2f;tcp \
            msrps://df7jal23ls0d.invalid:2855/98cjs;ws
Success-Report: no
Byte-Range: 1-*/*
Message-ID: 87652
Content-Type: text/plain

Hi Bob, I'm about to send you file.mpeg
-------juh76$


F4 200 OK  Bob -> a.example.com (transport TLS)

MSRP juh76 200 OK
To-Path: msrps://a.example.com:2855/jui787s2f;tcp
From-Path: msrps://bob.example.com:49154/foo;tcp
-------juh76$
```

8.2.3. SEND (MSRP Client to MSRP WebSocket Client)



Later in the session, Bob sends an instant message to Alice. The MSRP WebSocket Server at a.example.com acts as an MSRP relay, routing the message to Alice over secure WebSocket.

Message details (A "\" in the examples shows a line continuation due to limitations in line length of this document. Neither the backslash nor the extra CRLF is included in the actual request or response):

```
F1 SEND  Bob -> a.example.com (transport TLS)

MSRP xght6 SEND
To-Path: msrps://a.example.com:2855/jui787s2f;tcp \
         msrps://df7jal23ls0d.invalid:2855/98cjs;ws
From-Path: msrps://bob.example.com:49154/foo;tcp
Success-Report: no
Byte-Range: 1-*/*
Message-ID: 87652
Content-Type: text/plain

Thanks for the file.
-------xght6$


F2 200 OK  a.example.com -> Bob (transport TLS)

MSRP xght6 200 OK
To-Path: msrps://bob.example.com:49154/foo;tcp
From-Path: msrps://a.example.com:2855/jui787s2f;tcp
-------xght6$


F3 SEND  a.example.com -> Alice (transport WSS)

MSRP yh67 SEND
To-Path:  msrps://df7jal23ls0d.invalid:2855/98cjs;ws
From-Path:  msrps://a.example.com:2855/jui787s2f;tcp \
            msrps://bob.example.com:49154/foo;tcp
Success-Report: no
Byte-Range: 1-*/*
Message-ID: 87652
Content-Type: text/plain

Thanks for the file.
-------yh67$
```

```
F4 200 OK  Alice -> a.example.com (transport WSS)

MSRP yh67 200 OK
To-Path:  msrps://a.example.com:2855/jui787s2f;tcp
From-Path:  msrps://df7jal23ls0d.invalid:2855/98cjs;ws
-------yh67$
```

8.3. Example Session: Two MSRP WebSocket Clients

The following subsections show various message exchanges occurring during the course of an MSRP session between two WebSocket clients.

8.3.1. SDP Exchange

The following example shows SDP that could be included in a SIP message to set up an MSRP session between Alice and Carol where both of them are using the same WebSocket MSRP relay.

Alice makes an offer with a path including the relay (having already successfully authenticated with the relay):

```
c=IN IP4 a.example.com
m=message 1234 TCP/TLS/MSRP *
a=accept-types:message/cpim text/plain text/html
a=path:msrps://a.example.com:2855/jui787s2f;tcp \
       msrps://df7jal23ls0d.invalid:2855/98cjs;ws
```

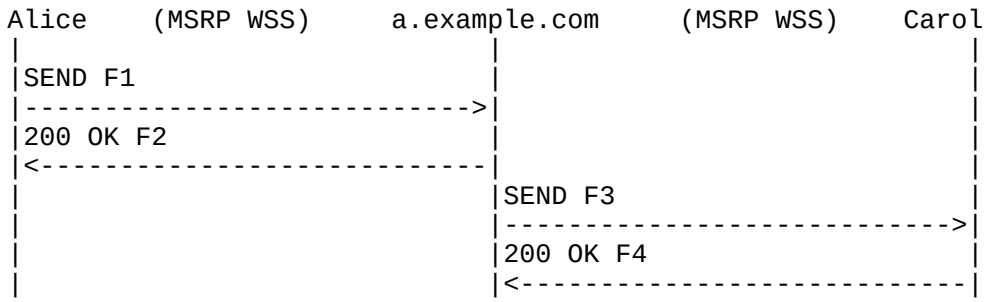
In this offer, Alice wishes to receive MSRP messages via the relay at a.example.com. She wants to use TLS as the transport for the MSRP session (beyond the relay). She can accept message/cpim, text/plain, and text/html message bodies in SEND requests.

Carol’s answer to this offer could look like:

```
c=IN IP4 a.example.com
m=message 1234 TCP/TLS/MSRP *
a=accept-types:message/cpim text/plain
a=path:msrps://a.example.com:2855/iwnslt;tcp \
       msrps://jk9awp14vj8x.invalid:2855/76qwe;ws
```

Here, Carol also wishes to receive the MSRP messages via a.example.com. She can accept only message/cpim and text/plain message bodies in SEND requests and has rejected the text/html content offered by Alice.

8.3.2. SEND



Later in the session, Alice sends an instant message to Carol. The MSRP WebSocket Server at a.example.com acts as an MSRP relay, routing the message to Carol over secure WebSocket.

In this example, both Alice and Carol are using MSRP WebSocket Clients and the same MSRP WebSocket Server. This means that a.example.com will appear twice in the To-Path in F1. a.example.com can either handle this internally or loop the MSRP SEND request back to itself as if it were two separate MSRP relays.

Message details (A "\" in the examples shows a line continuation due to limitations in line length of this document. Neither the backslash nor the extra CRLF is included in the actual request or response):

F1 SEND Alice -> a.example.com (transport WSS)

```
MSRP kjh6 SEND
To-Path: msrps://a.example.com:2855/jui787s2f;tcp \
         msrps://a.example.com:2855/iwnslt;tcp \
         msrps://jk9awp14vj8x.invalid:2855/76qwe;ws
From-Path: msrps://df7jal23ls0d.invalid:2855/98cjs;ws
Success-Report: no
Byte-Range: 1-*/*
Message-ID: 87652
Content-Type: text/plain

Carol, I sent that file to Bob.
-------kjh6$
```

```
F2 200 OK  a.example.com -> Alice (transport WSS)

MSRP kjh6 200 OK
To-Path: msrps://df7jal23ls0d.invalid:2855/98cjs;ws
From-Path: msrps://a.example.com:2855/jui787s2f;tcp
-------kjh6$


F3 SEND  a.example.com -> Carol (transport WSS)

MSRP re58 SEND
To-Path: msrps://jk9awp14vj8x.invalid:2855/76qwe;ws
From-Path: msrps://a.example.com:2855/iwnslt;tcp \
           msrps://a.example.com:2855/jui787s2f;tcp \
           msrps://df7jal23ls0d.invalid/98cjs;ws
Success-Report: no
Byte-Range: 1-*/*
Message-ID: 87652
Content-Type: text/plain

Carol, I sent that file to Bob.
-------re58$


F4 200 OK  Carol -> a.example.com (transport WSS)

MSRP re58 200 OK
To-Path: msrps://a.example.com:2855/iwnslt;tcp
From-Path: msrps://jk9awp14vj8x.invalid:2855/76qwe;ws
-------re58$
```

8.4. Example Session: MSRP WebSocket Client to MSRP Client Using a Relay

The following subsections show various message exchanges occurring during the course of an MSRP session between a WebSocket client and a non-WebSocket client, where the latter is also using an MSRP relay.

8.4.1. SDP Exchange

The following example shows SDP that could be included in a SIP message to set up an MSRP session between Alice and Bob where Alice uses a WebSocket MSRP relay and Bob uses a traditional MSRP client with a separate relay.

Alice makes an offer with a path including the relay (having already successfully authenticated with the relay):

```
c=IN IP4 a.example.com
m=message 1234 TCP/TLS/MSRP *
a=accept-types:message/cpim text/plain text/html
a=path:msrps://a.example.com:2855/jui787s2f;tcp \
       msrps://df7jal23ls0d.invalid:2855/98cjs;ws
```

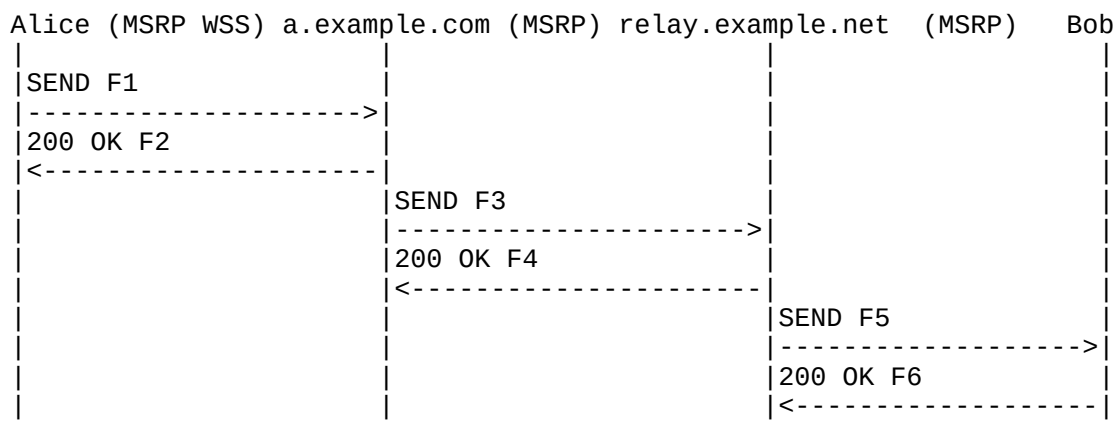
In this offer, Alice wishes to receive MSRP messages via the relay at a.example.com. She wants to use TLS as the transport for the MSRP session (beyond the relay). She can accept message/cpim, text/plain, and text/html message bodies in SEND requests.

Bob’s answer to this offer could look like:

```
c=IN IP4 bob.example.com
m=message 1234 TCP/TLS/MSRP *
a=accept-types:message/cpim text/plain
a=path:msrps://relay.example.net:2855/kwvin5f;tcp \
       msrps://bob.example.com:49154/foo;tcp
```

Here, Bob wishes to receive the MSRP messages via the relay at relay.example.net. He can accept only message/cpim and text/plain message bodies in SEND requests and has rejected the text/html content offered by Alice.

8.4.2. SEND



Later in the session, Alice sends an instant message to Bob. The MSRP WebSocket Server at a.example.com acts as an MSRP relay, routing the message to Bob via his relay, relay.example.net.

Message details (A "\" in the examples shows a line continuation due to limitations in line length of this document. Neither the backslash nor the extra CRLF is included in the actual request or response):

F1 SEND Alice -> a.example.com (transport WSS)

```
MSRP Ycwt SEND
To-Path: msrps://a.example.com:2855/jui787s2f;tcp \
         msrps://relay.example.net:2855/kwvin5f;tcp \
         msrps://bob.example.com:49154/foo;tcp
From-Path: msrps://df7jal23ls0d.invalid:2855/98cjs;ws
Success-Report: no
Byte-Range: 1-*/*
Message-ID: 87652
Content-Type: text/plain

Bob, that was the wrong file - don’t watch it!
-------Ycwt$
```

F2 200 OK a.example.com -> Alice (transport WSS)

```
MSRP Ycwt 200 OK
To-Path: msrps://df7jal23ls0d.invalid:2855/98cjs;ws
From-Path: msrps://a.example.com:2855/jui787s2f;tcp
-------Ycwt$
```

F3 SEND a.example.com -> relay.example.net (transport TLS)

```
MSRP 13GA SEND
To-Path: msrps://relay.example.net:2855/kwvin5f;tcp \
         msrps://bob.example.com:49154/foo;tcp
From-Path: msrps://a.example.com:2855/jui787s2f;tcp \
           msrps://df7jal23ls0d.invalid/98cjs;ws
Success-Report: no
Byte-Range: 1-*/*
Message-ID: 87652
Content-Type: text/plain

Bob, that was the wrong file - don’t watch it!
-------13GA$
```

```
F4 200 OK  relay.example.net -> a.example.com (transport TLS)

MSRP 13GA 200 OK
To-Path: msrps://a.example.com:2855/iwnslt;tcp
From-Path: msrps://relay.example.net:2855/kwvin5f;tcp
-------13GA$


F5 SEND  relay.example.net -> bob.example.com (transport TLS)

MSRP kXeg SEND
To-Path: msrps://bob.example.com:49154/foo;tcp
From-Path: msrps://relay.example.net:2855/kwvin5f;tcp \
           msrps://a.example.com:2855/jui787s2f;tcp \
           msrps://df7jal23ls0d.invalid/98cjs;ws
Success-Report: no
Byte-Range: 1-*/*
Message-ID: 87652
Content-Type: text/plain

Bob, that was the wrong file - don't watch it!
-------kXeg$


F6 200 OK  bob.example.com -> relay.example.net (transport TLS)

MSRP kXeg 200 OK
To-Path: msrps://relay.example.net:2855/kwvin5f;tcp
From-Path: msrps://bob.example.com:49154/foo;tcp
-------kXeg$
```

9. Security Considerations

MSRP traffic transported over WebSockets MUST be protected by using a secure WebSocket connection (using TLS [RFC5246] over TCP).

When establishing a connection using MSRP over secure WebSockets, the client MUST authenticate the server using the server's certificate according to the WebSocket validation procedure in [RFC6455].

Any security considerations specific to the WebSocket protocol are detailed in the relevant specification [RFC6455] and are considered outside the scope of this document. The certificate name matching (described by [RFC6455]) and cryptosuite selection will be handled by the browser, and the browser's procedures will supersede those specified in [RFC4975].

Since the TLS session is always terminated at the MSRP WebSocket Server and the WebSocket server can see the plain text, the MSRP client (browser) SHOULD NOT indicate end-to-end security to user.

TLS, as used in this document, should follow the best current practices defined in [RFC7525].

10. IANA Considerations

Per this specification, IANA has registered the WebSocket MSRP subprotocol in the "WebSocket Subprotocol Name Registry" with the following data:

Subprotocol Identifier: msrp

Subprotocol Common Name: WebSocket Transport for MSRP (Message Session Relay Protocol)

Subprotocol Definition: RFC 7977

Reference: RFC 7977

11. References

11.1. Normative References

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Appendix A. Implementation Guidelines: MSRP WebSocket Client Considerations

The JavaScript stack in web browsers does not have the ability to discover the local transport address used for originating WebSocket connections. Therefore, the MSRP WebSocket Client constructs a domain name consisting of a random token followed by the ".invalid" top-level domain name, as stated in [RFC2606], and uses it within its From-Path headers.

The From-Path URI provided by MSRP clients that use an MSRP relay is not used for routing MSRP messages, thus, it is safe to set a random domain in the hostpart of the From-Path URI.

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