        Interworking between the Session Initiation Protocol (SIP) and the
     Extensible Messaging and Presence Protocol (XMPP): Instant Messaging

Abstract

   This document defines a bidirectional protocol mapping for the
   exchange of single instant messages between the Session Initiation
   Protocol (SIP) and the Extensible Messaging and Presence Protocol
   (XMPP).

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 5741.

   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/rfc7572.

Table of Contents

1. Introduction

   In order to help ensure interworking between instant messaging (IM)
   systems that conform to the instant messaging / presence requirements
   [RFC2779], it is important to clearly define protocol mappings
   between such systems. Within the IETF, work has proceeded on two
   instant messaging technologies:

   o Various extensions to the Session Initiation Protocol ([RFC3261])
      for instant messaging, in particular the MESSAGE method extension
      [RFC3428]; collectively the capabilities of SIP with these
      extensions are commonly called SIP for Instant Messaging and
      Presence Leveraging Extensions (SIMPLE).

   o The Extensible Messaging and Presence Protocol (XMPP), which
      consists of a formalization of the core XML streaming protocols
      developed originally by the Jabber open-source community; the
      relevant specifications are [RFC6120] for the XML streaming layer
      and [RFC6121] for basic presence and instant messaging extensions.

   One approach to helping ensure interworking between these protocols
   is to map each protocol to the abstract semantics described in
   [RFC3860]; that is the approach taken by [SIMPLE-CPIM] and [RFC3922].
   In contrast, the approach taken in this document is to directly map
   semantics from one protocol to another (i.e., from SIP / SIMPLE to
   XMPP and vice versa), since that is how existing systems solve the
   interworking problem.

   Both XMPP systems and IM-capable SIP systems enable entities to
   exchange "instant messages". The term "instant message" usually
   refers to a message sent between two entities for delivery in close

   to real time (rather than a message that is stored and forwarded to
   the intended recipient upon request). This document specifies
   mappings only for single messages (sometimes called "pager-mode"
   messaging), since they form the lowest common denominator for IM.
   Separate documents cover "session-mode" instant messaging in the form
   of one-to-one chat sessions [RFC7573] and multi-party chat sessions
   [GROUPCHAT]. In particular, session-mode instant messaging supports
   several features that are not part of pager-mode instant messaging,
   such as a higher level of assurance regarding end-to-end message
   delivery. As with all of these documents, the architectural
   assumptions underlying such direct mappings are provided in
   [RFC7247], including mapping of addresses and error conditions.

2. Intended Audience

   The documents in this series are intended for use by software
   developers who have an existing system based on one of these
   technologies (e.g., SIP) and who would like to enable communication
   from that existing system to systems based on the other technology
   (e.g., XMPP). We assume that readers are familiar with the core
   specifications for both SIP [RFC3261] and XMPP [RFC6120], with the
   base document for this series [RFC7247], and with the following
   IM-related specifications:

   o "Session Initiation Protocol (SIP) Extension for Instant
      Messaging" [RFC3428]

   o "Extensible Messaging and Presence Protocol (XMPP): Instant
      Messaging and Presence" [RFC6121]

   Note well that not all protocol-compliant messages are shown (such as
   SIP 100 TRYING messages), in order to focus the reader on the
   essential aspects of the protocol flows.

3. Terminology

   A number of terms used here are explained in [RFC3261], [RFC3428],
   [RFC6120], and [RFC6121].

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

4. XMPP to SIP

   As described in [RFC6121], a single instant message is an XML
   stanza of type "normal" sent over an XML stream (since
   "normal" is the default for the 'type' attribute of the
   stanza, the attribute is often omitted).

   When the XMPP user Juliet with a Jabber Identifier (JID) of
   <juliet@example.com> wants to send an instant message to Romeo, she
   interacts with her XMPP client, which generates an XMPP
   stanza. The syntax of the stanza, including required and
   optional elements and attributes, is defined in [RFC6121] (for single
   instant messages, Section 5.1 of [RFC6121] recommends that the value
   of the 'to' address be a "bare JID" of the form
   "localpart@domainpart"). The following is an example of such a
   stanza:

   Example 1: XMPP User Sends Message

   | <message from='juliet@example.com/yn0cl4bnw0yr3vym'
   | to='romeo@example.net'>
   | <body>Art thou not Romeo, and a Montague?</body>
   | </message>

   Upon receiving such a message stanza, the XMPP server needs to
   determine the identity of the domainpart in the 'to' address, which
   it does by following the procedures explained in Section 5 of
   [RFC7247]. If the domain is a SIP domain, the XMPP server will hand
   off the message stanza to an XMPP-to-SIP gateway or connection
   manager that natively communicates with IM-aware SIP servers.

   The XMPP-to-SIP gateway is then responsible for translating the XMPP
   message stanza into a SIP MESSAGE request from the XMPP user to the
   SIP user:

   Example 2: XMPP User Sends Message (SIP Transformation)

   | MESSAGE sip:romeo@example.net SIP/2.0
   | Via: SIP/2.0/TCP x2s.example.com;branch=z9hG4bK776sgdkse
   | Max-Forwards: 70
   | To: sip:romeo@example.net
   | From: <sip:juliet@example.com;gr=yn0cl4bnw0yr3vym>;tag=12345
   | Call-ID: D9AA95FD-2BD5-46E2-AF0F-6CFAA96BDDFA
   | CSeq: 1 MESSAGE
   | Content-Type: text/plain
   | Content-Length: 35
   |
   | Art thou not Romeo, and a Montague?

The destination SIP server is responsible for delivering the message
to the intended recipient, and the recipient is responsible for
generating a response (e.g., 200 OK).

Example 3: SIP User Agent Indicates Receipt of Message

```
|  SIP/2.0 200 OK
|  Via: SIP/2.0/TCP x2s.example.com;branch=z9hG4bK776sgdkse
|  From: sip:juliet@example.com;tag=12345
|  To: sip:romeo@example.net;tag=vwxyz
|  Call-ID: D9AA95FD-2BD5-46E2-AF0F-6CFAA96BDDFA
|  CSeq: 1 MESSAGE
|  Content-Length: 0
```

As described in [RFC3428], a downstream proxy could fork a MESSAGE
request, but it would return only one 200 OK to the gateway.

   Note: This document does not specify handling of the 200 OK by the
   XMPP-to-SIP gateway (e.g., to enable message acknowledgements).
   See [RFC7573] for a mapping of message acknowledgements in the
   context of one-to-one chat sessions.

The mapping of XMPP syntax to SIP syntax MUST be as shown in the
following table.

Table 1: Message Syntax Mapping from XMPP to SIP

```
+----------------------------+--------------------------+
|  XMPP Element or Attribute  |  SIP Header or Contents  |
+----------------------------+--------------------------+
|  <body/>                    |  body of MESSAGE         |
|  <subject/>                 |  Subject                 |
|  <thread/>                  |  Call-ID                 |
|  from                       |  From (1)                |
|  id                         |  transaction identifier  |
|  to                         |  To or Request-URI       |
|  type                       |  (no mapping) (2)        |
|  xml:lang                   |  Content-Language        |
+----------------------------+--------------------------+
```

1. As shown in the foregoing example and described in [RFC7247], the
    XMPP-to-SIP gateway MUST map the bare JID
    ("localpart@domainpart") of the XMPP sender to the SIP From
    header and include the resourcepart of the "full JID"
    ("localpart@domainpart/resourcepart") as the Globally Routable
    User Agent URI (GRUU) portion [RFC5627] of the SIP URI.

   2. Because there is no SIP header field that matches the meaning of
       the XMPP message 'type' values ("normal", "chat", "groupchat",
       "headline", "error"), no general mapping is possible here.

5. SIP to XMPP

   As described in [RFC3428], a single instant message is a SIP MESSAGE
   request sent from a SIP user agent to an intended recipient who is
   most generally referenced by an Instant Messaging (IM) URI [RFC3861]
   of the form <im:user@domain> but who might be referenced by a SIP or
   SIPS URI of the form <sip:user@domain> or <sips:user@domain>.

   When a SIP user Romeo with a SIP URI of <sip:romeo@example.net> wants
   to send an instant message to Juliet, he interacts with his SIP user
   agent, which generates a SIP MESSAGE request. The syntax of the
   MESSAGE request is defined in [RFC3428]. The following is an example
   of such a request:

   Example 4: SIP User Sends Message

   | MESSAGE sip:juliet@example.com SIP/2.0
   | Via: SIP/2.0/TCP s2x.example.net;branch=z9hG4bKeskdgs677
   | Max-Forwards: 70
   | To: sip:juliet@example.com
   | From: sip:romeo@example.net;tag=vwxyz
   | Call-ID: 9E97FB43-85F4-4A00-8751-1124FD4C7B2E
   | CSeq: 1 MESSAGE
   | Content-Type: text/plain
   | Content-Length: 44
   |
   | Neither, fair saint, if either thee dislike.

   Section 5 of [RFC3428] stipulates that a SIP user agent presented
   with an im: URI should resolve it to a sip: or sips: URI. Therefore,
   we assume that the Request-URI of a request received by an IM-capable
   SIP-to-XMPP gateway will contain a sip: or sips: URI. Upon receiving
   the MESSAGE, the SIP server needs to determine the identity of the
   domain portion of the Request-URI or To header, which it does by
   following the procedures explained in Section 5 of [RFC7247]. If the
   domain is an XMPP domain, the SIP server will hand off the MESSAGE to
   an associated SIP-to-XMPP gateway or connection manager that natively
   communicates with XMPP servers.

   The SIP-to-XMPP gateway is then responsible for translating the
   request into an XMPP message stanza from the SIP user to the XMPP
   user and returning a SIP 200 OK message to the sender:

   Example 5: SIP User Sends Message (XMPP Transformation)

   | <message from='romeo@example.net/dr4hcr0st3lup4c'
   | to='juliet@example.com'>
   | <body>Neither, fair saint, if either thee dislike.</body>
   | </message>

   Note that the stanza-handling rules specified in [RFC6121] allow the
   receiving XMPP server to deliver a message stanza whose 'to' address
   is a bare JID ("localpart@domainpart") to multiple connected devices.
   This is similar to the "forking" of messages in SIP.

   The mapping of SIP syntax to XMPP syntax MUST be as shown in the
   following table.

   Table 2: Message Syntax Mapping from SIP to XMPP

   +--------------------------+----------------------------+
   | SIP Header or Contents | XMPP Element or Attribute |
   +--------------------------+----------------------------+
Call-ID	<thread/>
Content-Language	xml:lang
CSeq	(no mapping)
From	from (1)
Subject	<subject/>
Request-URI or To	to
body of MESSAGE	<body/>
transaction identifier	id
   +--------------------------+----------------------------+

   1. As shown in the foregoing example and described in [RFC7247], if
       the IM-capable SIP-to-XMPP gateway has information about the GRUU
       [RFC5627] of the particular endpoint that sent the SIP message,
       then it MUST map the sender's address to a full JID
       ("localpart@domainpart/resourcepart") in the 'from' attribute of
       the XMPP stanza and include the GRUU as the resourcepart.

   When transforming SIP pager-mode messages, an IM-capable SIP-to-XMPP
   gateway MUST specify no XMPP 'type' attribute or, equivalently, a
   'type' attribute whose value is "normal" [RFC6121].

   See Section 7 of this document about the handling of SIP message
   bodies that contain content types other than plain text.

6. Message Size

   [RFC3428] specifies that (outside of a media session) the size of a
   MESSAGE request is not allowed to exceed 1300 bytes. Although, in
   practice, XMPP instant messages do not often exceed that size,
   neither [RFC6120] nor [RFC6121] sets an upper limit on the size of
   XMPP stanzas. However, XMPP server deployments usually do limit the
   size of stanzas in order to help prevent denial-of-service attacks,
   and [RFC6120] states that if a server sets a maximum stanza size,
   then the limit is not allowed to be less than 10,000 bytes. Because
   of this mismatch, an XMPP-to-SIP gateway SHOULD return astanza error if an XMPP user attempts to send an XMPP
   message stanza that would result in a SIP MESSAGE greater than 1300
   bytes. Although such a gateway might decide to "upgrade" from page
   mode to session mode using the Message Session Relay Protocol (MSRP)
   -- thus treating the instant message as part of a chat session as
   described in [RFC7573] -- such behavior is application-specific and
   this document provides no guidelines for how to complete such an
   upgrade.

7. Content Types

   SIP requests of type "MESSAGE" are allowed to contain essentially any
   content type. The recommended procedures for SIP-to-XMPP gateways to
   use in handling these content types are as follows.

   An IM-aware SIP-to-XMPP gateway MUST process SIP messages that
   contain message bodies of type "text/plain" and MUST encapsulate such
   message bodies as the XML character data of the XMPP <body/> element.

   An IM-aware SIP-to-XMPP gateway SHOULD process SIP messages that
   contain message bodies of type "text/html"; if so, a gateway MUST
   transform the "text/html" content into XHTML content that conforms to
   the XHTML-IM Integration Set specified in [XEP-0071].

   Although an IM-aware SIP-to-XMPP gateway MAY process SIP messages
   that contain message bodies of types other than "text/plain" and
   "text/html", the handling of such content types is a matter of
   implementation.

8. Internationalization Considerations

   Both XMPP and SIP support the UTF-8 encoding [RFC3629] of Unicode
   characters [UNICODE] within messages, along with tagging of the
   language for a particular message (in XMPP via the 'xml:lang'
   attribute and in SIP via the Content-Language header). Gateways MUST
   map these language tagging mechanisms if they are present in the
   original message. Several examples follow, using the "XML Notation"
   [RFC3987] for Unicode characters outside the ASCII range.

   Example 6: SIP User Sends Message

   | MESSAGE sip:juliet@example.com SIP/2.0
   | Via: SIP/2.0/TCP s2x.example.net;branch=z9hG4bKeskdgs677
   | Max-Forwards: 70
   | To: sip:juliet@example.com
   | From: sip:romeo@example.net;tag=vwxyz
   | Call-ID: 5A37A65D-304B-470A-B718-3F3E6770ACAF
   | CSeq: 1 MESSAGE
   | Content-Type: text/plain
   | Content-Length: 45
   | Content-Language: cs
   |
   | Nic z ob쎩ho, m쎡 d쒛vo spanil쎡,
   | nenavid쎭얡-li jedno nebo druh쎩.

   Example 7: SIP User Sends Message (XMPP Transformation)

   | <message from='romeo@example.net'
   | to='juliet@example.com'
   | xml:lang='cs'>
   | <body>
   | Nic z ob쎩ho, m쎡 d쒛vo spanil쎡,
   | nenavid쎭얡-li jedno nebo druh쎩.
   | </body>
   | </message>

9. Security Considerations

   Detailed security considerations are given in the following
   documents:

   o For instant messaging protocols in general, see [RFC2779]

   o For SIP-based instant messaging, see [RFC3428] and also [RFC3261]

   o For XMPP-based instant messaging, see [RFC6121] and also [RFC6120]

   o For SIP-XMPP interworking in general, see [RFC7247]

   This document specifies methods for exchanging "pager-mode" instant
   messages through a gateway that translates between SIP and XMPP, and
   [RFC7573] specifies such methods for "session-mode" instant messaging
   between MSRP and XMPP. Such a gateway MUST be compliant with the
   minimum security requirements of the textual chat protocols for which
   it translates (i.e., SIP or MSRP and XMPP).

   The addition of gateways to the security model of instant messaging
   specified in [RFC2779] introduces some new risks. In particular,
   end-to-end security properties (especially confidentiality and
   integrity) between instant messaging clients that interface through a
   gateway can be provided only if common formats are supported.
   Specification of those common formats is out of scope for this
   document. For instant messages, it is possible to use the methods
   described in [RFC3862] and [RFC3923], but those methods are not
   widely implemented. A more widely implemented, albeit
   nonstandardized, method for interoperable end-to-end encryption would
   be Off-the-Record Messaging [OTR].

10. References

10.1. Normative References

   [RFC2119]   Bradner, S., "Key words for use in RFCs to Indicate
                Requirement Levels", BCP 14, RFC 2119,
                DOI 10.17487/RFC2119, March 1997,
                <http://www.rfc-editor.org/info/rfc2119>.

   [RFC3261]   Rosenberg, J., Schulzrinne, H., Camarillo, G.,
                Johnston, A., Peterson, J., Sparks, R., Handley, M.,
                and E. Schooler, "SIP: Session Initiation Protocol",
                RFC 3261, DOI 10.17487/RFC3261, June 2002,
                <http://www.rfc-editor.org/info/rfc3261>.

   [RFC3428]   Campbell, B., Ed., Rosenberg, J., Schulzrinne, H.,
                Huitema, C., and D. Gurle, "Session Initiation Protocol
                (SIP) Extension for Instant Messaging", RFC 3428,
                DOI 10.17487/RFC3428, December 2002,
                <http://www.rfc-editor.org/info/rfc3428>.

   [RFC3861]   Peterson, J., "Address Resolution for Instant Messaging
                and Presence", RFC 3861, DOI 10.17487/RFC3861, August
                2004, <http://www.rfc-editor.org/info/rfc3861>.

   [RFC5627]   Rosenberg, J., "Obtaining and Using Globally Routable
                  User Agent URIs (GRUUs) in the Session Initiation
                  Protocol (SIP)", RFC 5627, DOI 10.17487/RFC5627,
                  October 2009, <http://www.rfc-editor.org/info/rfc5627>.

   [RFC6120]   Saint-Andre, P., "Extensible Messaging and Presence
                  Protocol (XMPP): Core", RFC 6120, DOI 10.17487/RFC6120,
                  March 2011, <http://www.rfc-editor.org/info/rfc6120>.

   [RFC6121]   Saint-Andre, P., "Extensible Messaging and Presence
                  Protocol (XMPP): Instant Messaging and Presence",
                  RFC 6121, DOI 10.17487/RFC6121, March 2011,
                  <http://www.rfc-editor.org/info/rfc6121>.

   [RFC7247]   Saint-Andre, P., Houri, A., and J. Hildebrand,
                  "Interworking between the Session Initiation Protocol
                  (SIP) and the Extensible Messaging and Presence
                  Protocol (XMPP): Architecture, Addresses, and Error
                  Handling", RFC 7247, DOI 10.17487/RFC7247, May 2014,
                  <http://www.rfc-editor.org/info/rfc7247>.

   [XEP-0071]   Saint-Andre, P., "XHTML-IM", XSF XEP 0071, November
                  2012.

10.2. Informative References

   [GROUPCHAT]   Saint-Andre, P., Corretge, S., and S. Loreto,
                  "Interworking between the Session Initiation Protocol
                  (SIP) and the Extensible Messaging and Presence
                  Protocol (XMPP): Groupchat", Work in Progress,
                  draft-ietf-stox-groupchat-11, March 2015.

   [OTR]   Goldberg, I., "Off-the-Record Messaging",
                  <https://otr.cypherpunks.ca/>.

   [RFC2779]   Day, M., Aggarwal, S., Mohr, G., and J. Vincent,
                  "Instant Messaging / Presence Protocol Requirements",
                  RFC 2779, DOI 10.17487/RFC2779, February 2000,
                  <http://www.rfc-editor.org/info/rfc2779>.

   [RFC3629]   Yergeau, F., "UTF-8, a transformation format of ISO
                  10646", STD 63, RFC 3629, DOI 10.17487/RFC3629,
                  November 2003,
                  <http://www.rfc-editor.org/info/rfc3629>.

   [RFC3860]   Peterson, J., "Common Profile for Instant Messaging
                  (CPIM)", RFC 3860, DOI 10.17487/RFC3860, August 2004,
                  <http://www.rfc-editor.org/info/rfc3860>.

   [RFC3862]   Klyne, G. and D. Atkins, "Common Presence and Instant
                  Messaging (CPIM): Message Format", RFC 3862,
                  DOI 10.17487/RFC3862, August 2004,
                  <http://www.rfc-editor.org/info/rfc3862>.

   [RFC3922]   Saint-Andre, P., "Mapping the Extensible Messaging and
                  Presence Protocol (XMPP) to Common Presence and Instant
                  Messaging (CPIM)", RFC 3922, DOI 10.17487/RFC3922,
                  October 2004, <http://www.rfc-editor.org/info/rfc3922>.

   [RFC3923]   Saint-Andre, P., "End-to-End Signing and Object
                  Encryption for the Extensible Messaging and Presence
                  Protocol (XMPP)", RFC 3923, DOI 10.17487/RFC3923,
                  October 2004, <http://www.rfc-editor.org/info/rfc3923>.

   [RFC3987]   Duerst, M. and M. Suignard, "Internationalized Resource
                  Identifiers (IRIs)", RFC 3987, DOI 10.17487/RFC3987,
                  January 2005, <http://www.rfc-editor.org/info/rfc3987>.

   [RFC7573]   Saint-Andre, P. and S. Loreto, "Interworking between
                  the Session Initiation Protocol (SIP) and the
                  Extensible Messaging and Presence Protocol (XMPP):
                  One-to-One Text Chat Sessions", RFC 7573,
                  DOI 10.17487/RFC7573, June 2015,
                  <http://www.rfc-editor.org/info/rfc7573>.

   [SIMPLE-CPIM] Campbell, B. and J. Rosenberg, "CPIM Mapping of SIMPLE
                  Presence and Instant Messaging", Work in Progress,
                  draft-ietf-simple-cpim-mapping-01, June 2002.

   [UNICODE]   The Unicode Consortium, "The Unicode Standard",
                  <http://www.unicode.org/versions/latest/>.

Authors' Addresses

   Peter Saint-Andre
   &yet
   EMail: peter@andyet.com
   URI: https://andyet.com/

   Avshalom Houri
   IBM
   Rorberg Building, Pekris 3
   Rehovot 76123
   Israel
   EMail: avshalom@il.ibm.com

   Joe Hildebrand
   Cisco Systems, Inc.
   1899 Wynkoop Street, Suite 600
   Denver, CO 80202
   United States
   EMail: jhildebr@cisco.com