



# XMPP

## XEP-0300: Use of Cryptographic Hash Functions in XMPP

Peter Saint-Andre  
<mailto:xf@stpeter.im>  
<xmpp:peter@jabber.org>  
<http://stpeter.im/>

Matthew Wild  
<mailto:mwild1@gmail.com>  
<xmpp:me@matthewwild.co.uk>

Kevin Smith  
<mailto:kevin@kismith.co.uk>  
<xmpp:kevin@doomsong.co.uk>

Tobias Markmann  
<mailto:tobias.markmann@isode.com>  
<xmpp:tm@ayena.de>

2019-11-13  
Version 1.0.0

Status	Type	Short Name
Draft	Standards Track	hashes

This document provides a common wire format for the transport of cryptographic hash function references and hash function values in XMPP protocol extensions.

# Legal

## Copyright

This XMPP Extension Protocol is copyright © 1999 – 2020 by the [XMPP Standards Foundation](#) (XSF).

## Permissions

Permission is hereby granted, free of charge, to any person obtaining a copy of this specification (the "Specification"), to make use of the Specification without restriction, including without limitation the rights to implement the Specification in a software program, deploy the Specification in a network service, and copy, modify, merge, publish, translate, distribute, sublicense, or sell copies of the Specification, and to permit persons to whom the Specification is furnished to do so, subject to the condition that the foregoing copyright notice and this permission notice shall be included in all copies or substantial portions of the Specification. Unless separate permission is granted, modified works that are redistributed shall not contain misleading information regarding the authors, title, number, or publisher of the Specification, and shall not claim endorsement of the modified works by the authors, any organization or project to which the authors belong, or the XMPP Standards Foundation.

## Warranty

## NOTE WELL: This Specification is provided on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, express or implied, including, without limitation, any warranties or conditions of TITLE, NON-INFRINGEMENT, MERCHANTABILITY, or FITNESS FOR A PARTICULAR PURPOSE. ##

## Liability

In no event and under no legal theory, whether in tort (including negligence), contract, or otherwise, unless required by applicable law (such as deliberate and grossly negligent acts) or agreed to in writing, shall the XMPP Standards Foundation or any author of this Specification be liable for damages, including any direct, indirect, special, incidental, or consequential damages of any character arising from, out of, or in connection with the Specification or the implementation, deployment, or other use of the Specification (including but not limited to damages for loss of goodwill, work stoppage, computer failure or malfunction, or any and all other commercial damages or losses), even if the XMPP Standards Foundation or such author has been advised of the possibility of such damages.

## Conformance

This XMPP Extension Protocol has been contributed in full conformance with the XSF's Intellectual Property Rights Policy (a copy of which can be found at <https://xmpp.org/about/xsf/ipr-policy>) or obtained by writing to XMPP Standards Foundation, P.O. Box 787, Parker, CO 80134 USA).

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Requirements</b>	<b>1</b>
<b>3</b>	<b>XML Format</b>	<b>1</b>
<b>4</b>	<b>Hash Functions and Recommendations</b>	<b>2</b>
<b>5</b>	<b>Determining Support</b>	<b>3</b>
<b>6</b>	<b>Recommendations for New XMPP Extensions</b>	<b>3</b>
<b>7</b>	<b>Security Considerations</b>	<b>4</b>
<b>8</b>	<b>IANA Considerations</b>	<b>4</b>
<b>9</b>	<b>XMPP Registrar Considerations</b>	<b>4</b>
9.1	Protocol Namespaces . . . . .	4
9.2	Protocol Versioning . . . . .	4
9.3	Service Discovery Features . . . . .	4
<b>10</b>	<b>XML Schema</b>	<b>6</b>
<b>11</b>	<b>Acknowledgements</b>	<b>7</b>

## 1 Introduction

Various XMPP extensions make use of cryptographic hash functions, but they do so in different ways (e.g., some define XML elements and some define XML attributes) and often mandate support for different algorithms. The lack of a consistent approach to the use of cryptographic hash functions in XMPP extensions can lead to interoperability problems and security vulnerabilities. Therefore, this document recommends a common approach and XML element that can be re-used in any XMPP protocol extension.

## 2 Requirements

This extension is designed to meet the following criteria:

**Agility** It is absolutely necessary to support more secure cryptographic hash functions as they become available, and to stop supporting less secure functions as they are deprecated. The wire format should make it easy to use multiple hash functions at the same time.

**Reusability** The extension needs to be reusable in any XMPP protocol.

## 3 XML Format

This document defines a new XML element that can be used in any XMPP protocol extension. An example follows.

```
<hash xmlns='urn:xmpp:hashes:2' algo='sha-256'>2XarmwT1NxDAMkvymloX3S5
+VbylNrJt/15QyPa+YoU=</hash>
```

An XMPP protocol can include more than one instance of the <hash/> element, as long as each one has a different value for the 'algo' attribute:

```
<hash xmlns='urn:xmpp:hashes:2' algo='sha-1'>2
AfMGH807UNPTvUVAM9aK13mpCY=</hash>
<hash xmlns='urn:xmpp:hashes:2' algo='sha-256'>2XarmwT1NxDAMkvymloX3S5
+VbylNrJt/15QyPa+YoU=</hash>
```

In certain scenarios it makes sense to communicate the hash algorithm that is used prior to the calculation of the hash value.

```
<hash-used xmlns='urn:xmpp:hashes:2' algo='sha-256' />
```

The value of the 'algo' attribute MUST be one of the values from the [IANA Hash Function Textual Names Registry](#) <sup>1</sup> maintained by the [Internet Assigned Numbers Authority \(IANA\)](#) <sup>2</sup>, or one of the values defined in the following table.

Hash Function Name	Reference
"sha3-256"	FIPS PUB 202: SHA-3 Standard: Permutation-Based Hash and Extendable-Output Functions FIPS PUB 202: SHA-3 Standard: Permutation-Based Hash and Extendable-Output Functions < <a href="http://dx.doi.org/10.6028/NIST.FIPS.202">http://dx.doi.org/10.6028/NIST.FIPS.202</a> >.
"sha3-512"	FIPS PUB 202: SHA-3 Standard: Permutation-Based Hash and Extendable-Output Functions FIPS PUB 202: SHA-3 Standard: Permutation-Based Hash and Extendable-Output Functions < <a href="http://dx.doi.org/10.6028/NIST.FIPS.202">http://dx.doi.org/10.6028/NIST.FIPS.202</a> >.
"blake2b-256"	RFC 7693 RFC 7693: The BLAKE2 Cryptographic Hash and Message Authentication Code (MAC) < <a href="http://tools.ietf.org/html/rfc7693">http://tools.ietf.org/html/rfc7693</a> >.
"blake2b-512"	RFC 7693 RFC 7693: The BLAKE2 Cryptographic Hash and Message Authentication Code (MAC) < <a href="http://tools.ietf.org/html/rfc7693">http://tools.ietf.org/html/rfc7693</a> >.

The digest produced by the used hash algorithm is included as the XML character data of the <hash/> element after being encoded using Base64 as specified in Section 4 of [RFC 4648](#) <sup>3</sup>. Thus the character data MUST conform to the base64Binary datatype <sup>4</sup> as defined in [XML Schema Part 2](#) <sup>5</sup>. The Base64 output MUST NOT include whitespace and MUST set padding bits to zero.

## 4 Hash Functions and Recommendations

Previously, this document made recommendations for specific hash functions. Those documentations have been removed in version 0.6.0 and are now found in [Cryptographic Hash Function Recommendations for XMPP \(XEP-0414\)](#) <sup>6</sup>.

<sup>1</sup>IANA registry of Hash Function Textual Names <<http://www.iana.org/assignments/hash-function-text-names>>.

<sup>2</sup>The Internet Assigned Numbers Authority (IANA) is the central coordinator for the assignment of unique parameter values for Internet protocols, such as port numbers and URI schemes. For further information, see <<http://www.iana.org/>>.

<sup>3</sup>RFC 4648: The Base16, Base32, and Base64 Data Encodings <<http://tools.ietf.org/html/rfc4648>>.

<sup>4</sup>See <<http://www.w3.org/TR/xmlschema-2/#base64Binary>>.

<sup>5</sup>XML Schema Part 2: Datatypes <<http://www.w3.org/TR/xmlschema11-2/>>.

<sup>6</sup>XEP-0414: Cryptographic Hash Function Recommendations for XMPP <<https://xmpp.org/extensions/xep-0414.html>>.

## 5 Determining Support

If an entity supports the protocol defined herein, it **MUST** report that by including a [Service Discovery \(XEP-0030\)](#)<sup>7</sup> feature of "urn:xmpp:hashes:2" in response to disco#info requests, along with one service discovery feature for each algorithm it supports:

Listing 1: Service discovery information request

```
<iq from='romeo@montague.lit/orchard'
  id='uw72g176'
  to='juliet@capulet.lit/balcony'
  type='get'>
  <query xmlns='http://jabber.org/protocol/disco#info' />
</iq>
```

Listing 2: Service discovery information response

```
<iq from='juliet@capulet.lit/balcony'
  id='uw72g176'
  to='romeo@montague.lit/orchard'
  type='result'>
  <query xmlns='http://jabber.org/protocol/disco#info'>
    <feature var='urn:xmpp:hashes:2' />
    <feature var='urn:xmpp:hash-function-text-names:sha-256' />
    <feature var='urn:xmpp:hash-function-text-names:sha3-256' />
  </query>
</iq>
```

In order for an application to determine whether an entity supports this protocol, where possible it **SHOULD** use the dynamic, presence-based profile of service discovery defined in [Entity Capabilities \(XEP-0115\)](#)<sup>8</sup>. However, if an application has not received entity capabilities information from an entity, it **SHOULD** use explicit service discovery instead.

## 6 Recommendations for New XMPP Extensions

The XSF is strongly encouraged to incorporate hash agility into new XMPP extensions that it develops by mandating re-use of the protocol defined in this specification (instead of hash elements or attributes specific to each extension).

Specifications should take the considerations in [Cryptographic Hash Function Recommendations for XMPP \(XEP-0414\)](#)<sup>9</sup> into account.

<sup>7</sup>XEP-0030: Service Discovery <<https://xmpp.org/extensions/xep-0030.html>>.

<sup>8</sup>XEP-0115: Entity Capabilities <<https://xmpp.org/extensions/xep-0115.html>>.

<sup>9</sup>XEP-0414: Cryptographic Hash Function Recommendations for XMPP <<https://xmpp.org/extensions/xep-0414.html>>.

## 7 Security Considerations

This entire document discusses security.

## 8 IANA Considerations

This document requires no interaction with the IANA. However, it reuses entries from the relevant IANA registry.

## 9 XMPP Registrar Considerations

### 9.1 Protocol Namespaces

This specification defines the following XML namespace:

- urn:xmpp:hashes:2

The [XMPP Registrar](#)<sup>10</sup> shall include the foregoing namespace in its registry at [<https://xmpp.org/registrar/namespaces.html>](https://xmpp.org/registrar/namespaces.html), as governed by [XMPP Registrar Function \(XEP-0053\)](#)<sup>11</sup>.

### 9.2 Protocol Versioning

If the protocol defined in this specification undergoes a revision that is not fully backwards-compatible with an older version, the XMPP Registrar shall increment the protocol version number found at the end of the XML namespaces defined herein, as described in Section 4 of XEP-0053.

### 9.3 Service Discovery Features

An entity SHOULD provide one service discovery feature for each algorithm it supports. Ideally these features would be of the form "urn:iana:hash-function-text-names:foo" (where "foo" is the name of an algorithm registered with the IANA); however there is no urn:iana namespace at present. Until there is, we use features of the form "urn:xmpp:hash-function-text-names:foo" instead. Therefore the registry submission is as follows.

---

<sup>10</sup>The XMPP Registrar maintains a list of reserved protocol namespaces as well as registries of parameters used in the context of XMPP extension protocols approved by the XMPP Standards Foundation. For further information, see <https://xmpp.org/registrar/>.

<sup>11</sup>XEP-0053: XMPP Registrar Function [<https://xmpp.org/extensions/xep-0053.html>](https://xmpp.org/extensions/xep-0053.html).

```
<var>
  <name>urn:xmpp:hash-function-text-names:md5</name>
  <desc>Support for the MD5 hashing algorithm</desc>
  <doc>XEP-0300</doc>
</var>

<var>
  <name>urn:xmpp:hash-function-text-names:sha-1</name>
  <desc>Support for the SHA-1 hashing algorithm</desc>
  <doc>XEP-0300</doc>
</var>

<var>
  <name>urn:xmpp:hash-function-text-names:sha-224</name>
  <desc>Support for the SHA-224 hashing algorithm</desc>
  <doc>XEP-0300</doc>
</var>

<var>
  <name>urn:xmpp:hash-function-text-names:sha-256</name>
  <desc>Support for the SHA-256 hashing algorithm</desc>
  <doc>XEP-0300</doc>
</var>

<var>
  <name>urn:xmpp:hash-function-text-names:sha-384</name>
  <desc>Support for the SHA-384 hashing algorithm</desc>
  <doc>XEP-0300</doc>
</var>

<var>
  <name>urn:xmpp:hash-function-text-names:sha-512</name>
  <desc>Support for the SHA-512 hashing algorithm</desc>
  <doc>XEP-0300</doc>
</var>

<var>
  <name>urn:xmpp:hash-function-text-names:sha3-224</name>
  <desc>Support for the SHA3-224 hashing algorithm</desc>
  <doc>XEP-0300</doc>
</var>

<var>
  <name>urn:xmpp:hash-function-text-names:sha3-256</name>
  <desc>Support for the SHA3-256 hashing algorithm</desc>
  <doc>XEP-0300</doc>
</var>

<var>
  <name>urn:xmpp:hash-function-text-names:sha3-384</name>
  <desc>Support for the SHA3-384 hashing algorithm</desc>
  <doc>XEP-0300</doc>
</var>
<var>
```



```

<name>urn:xmpp:hash-function-text-names:sha3-512</name>
<desc>Support for the SHA3-512 hashing algorithm</desc>
<doc>XEP-0300</doc>
</var>

<var>
  <name>urn:xmpp:hash-function-text-names:id-blake2b160</name>
  <desc>Support for the BLAKE2b-160 hashing algorithm</desc>
  <doc>XEP-0300</doc>
</var>

<var>
  <name>urn:xmpp:hash-function-text-names:id-blake2b256</name>
  <desc>Support for the BLAKE2b-256 hashing algorithm</desc>
  <doc>XEP-0300</doc>
</var>

<var>
  <name>urn:xmpp:hash-function-text-names:id-blake2b384</name>
  <desc>Support for the BLAKE2b-384 hashing algorithm</desc>
  <doc>XEP-0300</doc>
</var>

<var>
  <name>urn:xmpp:hash-function-text-names:id-blake2b512</name>
  <desc>Support for the BLAKE2b-512 hashing algorithm</desc>
  <doc>XEP-0300</doc>
</var>

```

## 10 XML Schema

```

<?xml version='1.0' encoding='UTF-8'?>

<xs:schema
  xmlns:xs='http://www.w3.org/2001/XMLSchema'
  targetNamespace='urn:xmpp:hashes:2'
  xmlns='urn:xmpp:hashes:2'
  elementFormDefault='qualified'>

  <xs:element name='hash'>
    <xs:complexType>
      <xs:simpleContent>
        <xs:extension base='xs:base64Binary'>
          <xs:attribute name='algo' type='xs:NCName' use='required' />
        </xs:extension>
      </xs:simpleContent>
    </xs:complexType>
  </xs:element>

  <xs:element name='hash-used'>

```

```
<xs:complexType>
  <xs:extension base='empty'>
    <xs:attribute name='algo' type='xs:NCName' use='required' />
  </xs:extension>
</xs:complexType>
</xs:element>

</xs:schema>
```

## 11 Acknowledgements

Thanks to Dave Cridland, Waqas Hussain, Glenn Maynard, Remko Tronçon, Paul Schaub, Christian Schudt, and Florian Schmaus for their input.