



XMPP

XEP-0388: Extensible SASL Profile

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2017-03-16

Version 0.1.0

Status	Type	Short Name
Experimental	Standards Track	sasl2

This document describes a replacement for the SASL profile documented in RFC 6120 which allows for greater extensibility.

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Contents

1	Introduction	1
1.1	Terminology	1
2	Overview	1
2.1	Discovering Support	1
2.2	SASL Data Encoding	2
2.3	Initiation	2
2.4	Challenges and Responses	2
2.5	During Authentication	3
2.6	Completing Authentication	3
2.6.1	Success	3
2.6.2	Failure	4
2.6.3	Continue	4
3	SASL Profile Definition	5
3.1	Service Name	5
3.2	Mechanism negotiation	5
3.3	Message Definitions	6
3.3.1	Initiation	6
3.3.2	Server Challenges and Client Responses	6
3.3.3	Outcome	6
3.4	Non-Empty Authorization Strings	6
3.5	Aborting	6
3.6	Security Layer Effect	6
3.7	Security Layer Order	6
3.8	Multiple Authentication	7
4	Security Considerations	7
5	IANA Considerations	7
6	XMPP Registrar Considerations	7
7	Acknowledgements	7

1 Introduction

While SASL provides an excellent framework that has served us well over the past 18 years, a number of shortcomings in the profile - the syntax binding to XMPP - that is in use. This specification addresses a number of shortfalls:

- Number of round trips
- Extensibility
- Support for second factor
- Support for mandatory password changes

The new SASL profile documented herein is primarily a syntactic change to allow extensibility, combined with removal of the (largely) redundant stream restart, and additional results beyond total success or abject failure.

1.1 Terminology

Although initiating entities, in general, use SASL, and receiving entities offer it, the SASL specification and common parlance both use "Client " and "Server"; this specification uses Client and Server and assumes C2S links. This is not intended to preclude use of this SASL profile on S2S links. The term "SASL2" is used to mean the new SASL profile specified in this document; however the same RFC 4422 definition of SASL (and SASL profiles) applies. Examples often use hypothetical SASL mechanisms and sub-extensions; this specification does not intend to make a position on any particular SASL mechanism, and the Mandatory To Implement mechanisms are unaffected.

2 Overview

2.1 Discovering Support

Servers capable of SASL2 offer a stream feature of `<mechanisms/>`, qualified by the "urn:xmpp:sasl:0" namespace. This in turn contains one or more `<mechanism/>` elements in the same namespace, and potentially other elements (for example, the `<hostname/>` element defined within XEP-0233).

Note that SASL2 is impossible for clients to initiate without at least one mechanism being available, and therefore **MUST NOT** be offered.

The feature so advertised, and its child content, **SHOULD** be stable for the given stream to and from attributes and encryption state, and therefore **MAY** be cached by clients for later connections.

The Service Name used by XMPP is unchanged from RFC 6120.

2.2 SASL Data Encoding

In all cases, both Clients and Servers encode SASL exchanges using Base 64 encoding. This SHOULD NOT include any line wrapping or other whitespace. As the form `<element/>` is equivalent to `<element></element>`, these both indicate an empty string, which is used to indicate no data (ie, the absence of the data). In order to explicitly transmit a zero-length SASL challenge or response, the sending party sends a single equals sign character ("=").

2.3 Initiation

Clients, upon observing this stream feature, initiate the authentication by the use of the `<authenticate/>` top-level element, within the same namespace. The nature of this element is to inform the server about properties of the final stream state, as well as initiate authentication itself. To achieve the latter, it has a single mandatory attribute of "mechanism", with a string value of a mechanism name offered by the Server in the stream feature, and an optional child element of `<initial-response/>`, containing a base64-encoded SASL Initial Response.

On subsequent connections, if a Client has previously cache the stream feature, the Client MAY choose to send it before seeing the stream features - sending it "pipelined" with the Stream Open tag for example.

Listing 1: An authentication request

```
<authenticate xmlns='urn:xmpp:sasl:0' mechanism="BLURDLYBLOOP">
  <initial-response>
    SW1wcm92ZWQgZW5jYXNwdWxhdGlvbiBvZiBvcHRpb25hbCBTQVNMLU1SIGRhdGE=
  </initial-response>
</authenticate>
```

In order to provide support for other desired stream states beyond authentication, additional child elements are used. For example, a hypothetical XEP-0198 session resumption element might be included, and/or Resource Binding requests.

Listing 2: An authentication request with a (hypothetical) bind request

```
<authenticate xmlns='urn:xmpp:sasl:0' mechanism='BLURDYBLOOP'>
  <initial-response>
    U0FTTC1JUiBlbmNvZGVkIGFsb25nc2lkZSBiaW5kIHJlcXVlc3Q=
  </initial-response>
  <bind xmlns='urn:xmpp:bind:example' />
</authenticate>
```

2.4 Challenges and Responses

Server Challenges MAY then be sent. Each Challenge MUST be responded to by a Client in a Client Response. These are not extensible, and contain the corresponding base64 encoded

SASL data:

Listing 3: A challenge and response exchange

```

<!--{}- A server might send: -{}->
<challenge xmlns='urn:xmpp:sasl:0'>
  QmFzZSA2NCB1bmNvZGVkIFNBU0wgY2hhbGxlbmd1IGRhdGE=
</challenge>

<!--{}- A client might respond: -{}->
<response xmlns='urn:xmpp:sasl:0'>
  QmFzZSA2NCB1bmNvZGVkIFNBU0wgcVzcG9uc2UgZGF0YQ==
</response>

```

2.5 During Authentication

At any time while authentication is in progress, neither Client nor Server sends any element (including stanzas) or other data except the top-level elements defined herein. Clients MUST NOT send whitespace, and MUST send only <response/> elements as appropriate or an <abort/> element to immediately cause an error. Servers MUST disconnect Clients immediately if any other traffic is received. Servers are similarly REQUIRED to send no whitespace, and only the <response/> and completion elements from the section below.

2.6 Completing Authentication

Authentication may complete in one of three ways. It may complete successfully, in which case the client is authenticated. It may also fail, in which case the client is not authenticated and the stream and session state remain entirely unchanged.

Finally, it may have completed successfully, but further interaction is required - for example, a password change or second-factor authentication.

2.6.1 Success

If the Client is now authenticated, the Server sends a <success/> element, which contains an OPTIONAL <additional-data/> element containing SASL additional data. It also contains a <authorization-identity/> element containing the negotiated identity - this is a bare JID, unless resource binding has occurred, in which case it is a full JID.

Listing 4: Successful authentication

```

<success xmlns='urn:xmpp:sasl:0'>
  <success-data>
    T3B0aW9uYWwgQmFzZSA2NCB1bmNvZGVkIFNBU0wgc3VjY2VzcyBkYXRh

```

```

</success-data>
<authorization-identifier>juliet@montague.example/Balcony/
  a987dsh9a87sdh</authorization-identifier>
</success>

```

Other extension elements MAY also be contained by the <success/> element.

Listing 5: Successful re-authentication and resumption

```

<success xmlns='urn:xmpp:sasl:0'>
  <additional-data>
    T3B0aW9uYWwgQmFzZSA2NCB1bmNvZGVkIFNBU0wgc3VjY2VzcyBkYXRh
  </additional-data>
  <authorization-identifier>juliet@montague.example/Balcony/
    a987dsh9a87sdh</authorization-identifier>
  <sm:resumed xmlns='urn:xmpp:sm:3:example' h='345' previd='124' />
</success>

```

Any security layer negotiated SHALL take effect after the ">" octet of the closing tag (ie, immediately after "</success>").

2.6.2 Failure

A <failure/> element is used by the server to terminate the authentication attempt. It MAY contain application-specific error codes, and MAY contain a textual error. It MUST contain one of the SASL error codes from RFC 6120 Section 6.5.

Listing 6: Failure

```

<failure xmlns='urn:xmpp:sasl:0'>
  <aborted xmlns='urn:ietf:params:xml:ns:xmpp-sasl' />
  <optional-application-specific xmlns='urn:something:else' />
  <text>This is a terrible example.</text>
</failure>

```

2.6.3 Continue

A <continue/> element is used to indicate that while the SASL exchange was successful, it is insufficient to allow authentication at this time.

This can be used to indicate that the Client needs to perform a Second Factor Authentication ("2FA"), or is required to change password. These are conducted as additional SASL mechanisms. Such SASL mechanisms MUST NOT change the authorization identifier, or introduce any security layer. The authorization identifier transmitted during the subsequent <success/>, and any security layer which comes into effect after the eventual <success/>, therefore MUST be that of the first mechanism.

The element contains a <mechanisms/> element, as defined above as a stream feature, containing suitable mechanisms. It MAY contain an <additional-data/> element, as the <success/> element does.

Finally, it MAY contain a <text/> element, which can contain human-readable data explaining the nature of the step required.

Listing 7: Continue Required

```
<continue xmlns='urn:xmpp:sasl:0'>
  <additional-data>
    T3B0aW9uYWwgQmFzZSA2NCBlbmNvZGVkIFNBU0wgc3VjY2VzcyBkYXRh
  </additional-data>
  <mechanisms>
    <mechanism>HOTP-EXAMPLE</mechanism>
    <mechanism>TOTP-EXAMPLE</mechanism>
  </mechanisms>
  <text>This account requires 2FA</text>
</continue>
```

Clients respond with a <next-authenticate/> element, which has a single mandatory attribute of "mechanism", containing the selected mechanism name, and contains an OPTIONAL base64 encoded initial response.

Listing 8: Client Continues

```
<next-authenticate xmlns='urn:xmpp:sasl' mechanism='TOTP-EXAMPLE'>
  MkZBIG9yIHBhc3N3b3JkIGNoYW5nZSBvcjBzb21ldGhpbmc=
</next-authenticate>
```

3 SASL Profile Definition

This provides pointers and/or clarifications to the in the order and manner defined in RFC 4422, section 4.

3.1 Service Name

The service name SHALL be "xmpp", as defined by RFC 6120.

3.2 Mechanism negotiation

Servers list mechanisms during stream features (See) and within the <continue/> element (See).

TODO: Neither this specification nor RFC 6120 allow clients access to the mechanism list after

SASL negotiation...?

3.3 Message Definitions

3.3.1 Initiation

Clients initiate using the <authenticate/> top level element (See , and after any <continue/> with the <next-authenticate/> message (See).

3.3.2 Server Challenges and Client Responses

See .

3.3.3 Outcome

See .

3.4 Non-Empty Authorization Strings

If a Client specifies an authorization string which is non-empty, the identifier is normalized by treating it as a JID, and performing normalization as described in RFC 7622.

3.5 Aborting

Clients MAY abort unilaterally by sending <abort/> as specified in .
Servers MAY abort unilaterally by sending <failure/> with the <aborted/> error code as defined in .

3.6 Security Layer Effect

See .

3.7 Security Layer Order

Option (a) is used - any SASL Security Layer is applied first to data being sent, and TLS applied last.

3.8 Multiple Authentication

Although the <continue/> concept does use multiple SASL sequences, only the first SASL mechanism used is considered an authentication, and only the first can negotiate a security layer.

In particular, once <success/> has been sent by the server, any further <authenticate/> element MUST result in a stream error.

4 Security Considerations

Relative to the SASL profile documented in RFC 6120, this introduces more data unprotected by any security layer negotiated by SASL itself.

5 IANA Considerations

This XEP requires no interaction with the [Internet Assigned Numbers Authority \(IANA\)](#) ¹.

6 XMPP Registrar Considerations

None.

7 Acknowledgements

The author wishes to share any credit with many members of the community, including Lance Stout, Ralph Meijer, and Florian Schmaus.

¹The 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/>.