

Internet Engineering Task Force (IETF)  
Request for Comments: 6595  
Category: Standards Track  
ISSN: 2070-1721

K. Wierenga  
Cisco Systems, Inc.  
E. Lear  
Cisco Systems GmbH  
S. Josefsson  
SJD AB  
April 2012

## A Simple Authentication and Security Layer (SASL) and GSS-API Mechanism for the Security Assertion Markup Language (SAML)

### Abstract

The Security Assertion Markup Language (SAML) has found its usage on the Internet for Web Single Sign-On. The Simple Authentication and Security Layer (SASL) and the Generic Security Service Application Program Interface (GSS-API) are application frameworks to generalize authentication. This memo specifies a SASL mechanism and a GSS-API mechanism for SAML 2.0 that allows the integration of existing SAML Identity Providers with applications using SASL and GSS-API.

### 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/rfc6595>.

## Copyright Notice

Copyright (c) 2012 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

## Table of Contents

1. Introduction .....	3
1.1. Terminology .....	4
1.2. Applicability .....	4
2. Authentication Flow .....	5
3. SAML SASL Mechanism Specification .....	7
3.1. Initial Response .....	8
3.2. Authentication Request .....	8
3.3. Outcome and Parameters .....	9
4. SAML GSS-API Mechanism Specification .....	10
4.1. GSS-API Principal Name Types for SAML .....	11
5. Examples .....	11
5.1. XMPP .....	11
5.2. IMAP .....	15
6. Security Considerations .....	17
6.1. Man-in-the-Middle and Tunneling Attacks .....	17
6.2. Binding SAML Subject Identifiers to Authorization Identities .....	17
6.3. User Privacy .....	18
6.4. Collusion between RPs .....	18
6.5. Security Considerations Specific to GSS-API .....	18
7. IANA Considerations .....	18
7.1. IANA Mech-Profile .....	18
7.2. IANA OID .....	19
8. References .....	19
8.1. Normative References .....	19
8.2. Informative References .....	21
Appendix A. Acknowledgments .....	22

## 1. Introduction

Security Assertion Markup Language (SAML) 2.0 [[OASIS-SAMLv2-CORE](#)] is a set of specifications that provide various means for a user to be identified to a Relying Party (RP) through the exchange of (typically signed) assertions issued by an Identity Provider (IdP). It includes a number of protocols, protocol bindings [[OASIS-SAMLv2-BIND](#)], and interoperability profiles [[OASIS-SAMLv2-PROF](#)] designed for different use cases.

The Simple Authentication and Security Layer (SASL) [[RFC4422](#)] is a generalized mechanism for identifying and authenticating a user and for optionally negotiating a security layer for subsequent protocol interactions. SASL is used by application protocols like IMAP [[RFC3501](#)], the Post Office Protocol (POP) [[RFC1939](#)], and the Extensible Message and Presence Protocol (XMPP) [[RFC6120](#)]. The effect is to make modular authentication, so that newer authentication mechanisms can be added as needed. This memo specifies just such a mechanism.

The Generic Security Service Application Program Interface (GSS-API) [[RFC2743](#)] provides a framework for applications to support multiple authentication mechanisms through a unified programming interface. This document defines a pure SASL mechanism for SAML, but it conforms to the new bridge between SASL and the GSS-API called GS2 [[RFC5801](#)]. This means that this document defines both a SASL mechanism and a GSS-API mechanism. The GSS-API interface is OPTIONAL for SASL implementers, and the GSS-API considerations can be avoided in environments that use SASL directly without GSS-API.

As currently envisioned, this mechanism enables interworking between SASL and SAML in order to assert the identity of the user and other attributes to RPs. As such, while servers (as RPs) will advertise SASL mechanisms (including SAML), clients will select the SAML SASL mechanism as their SASL mechanism of choice.

The SAML mechanism described in this memo aims to reuse the Web Browser Single Sign-On (SSO) profile defined in [Section 4.1](#) of the SAML 2.0 profiles specification [[OASIS-SAMLv2-PROF](#)] to the maximum extent and therefore does not establish a separate authentication, integrity, and confidentiality mechanism. The mechanism assumes that a security layer, such as Transport Layer Security (TLS) [[RFC5246](#)], will continue to be used. This specification is appropriate for use when a browser instance is available. In the absence of a browser instance, SAML profiles that don't require a browser, such as the Enhanced Client or Proxy profile (as defined in [Section 4.2](#) of [[OASIS-SAMLv2-PROF](#)], may be used, but that is outside the scope of this specification.

Figure 1 describes the interworking between SAML and SASL: this document requires enhancements to the RP (the SASL server) and to the client, as the two SASL communication end points, but no changes to the SAML IdP are necessary. To accomplish this goal, some indirect messaging is tunneled within SASL, and some use of external methods is made.

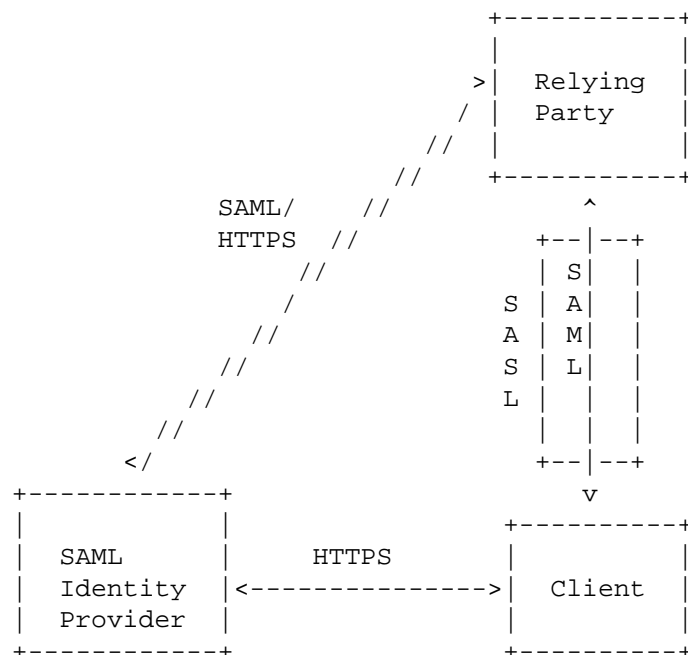


Figure 1: Interworking Architecture

### 1.1. 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 [RFC 2119](#) [RFC2119].

The reader is assumed to be familiar with the terms used in the SAML 2.0 core specification [OASIS-SAMLv2-CORE].

### 1.2. Applicability

Because this mechanism transports information that should not be controlled by an attacker, the SAML mechanism MUST only be used over channels protected by TLS, or over similar integrity-protected and authenticated channels. In addition, when TLS is used, the client MUST successfully validate the server's certificate ([RFC5280], [RFC6125]).

Note: An Intranet does not constitute such an integrity-protected and authenticated channel!

## 2. Authentication Flow

While SAML itself is merely a markup language, its common use case these days is with HTTP [RFC2616] or HTTPS [RFC2818] and HTML [W3C-REC-HTML401]. What follows is a typical flow:

1. The browser requests a resource of an RP (via an HTTP request).
2. The RP redirects the browser via an HTTP redirect (as described in Section 10.3 of [RFC2616]) to the IdP or an IdP discovery service. When it does so, it includes the following parameters: (1) an authentication request that contains the name of the resource being requested, (2) a browser cookie, and (3) a return URL as specified in Section 3.1 of [OASIS-SAMLv2-PROF].
3. The user authenticates to the IdP and perhaps authorizes the release of user attributes to the RP.
4. In its authentication response, the IdP redirects (via an HTTP redirect) the browser back to the RP with an authentication assertion (stating that the IdP vouches that the subject has successfully authenticated), optionally along with some additional attributes.
5. The RP now has sufficient identity information to approve access to the resource or not, and acts accordingly. The authentication is concluded.

When considering this flow in the context of SASL, we note that while the RP and the client both must change their code to implement this SASL mechanism, the IdP can remain untouched. The RP already has some sort of session (probably a TCP connection) established with the client. However, it may be necessary to redirect a SASL client to another application or handler. The steps are as follows:

1. The SASL server (RP) advertises support for the SASL SAML20 mechanism to the client.
2. The client initiates a SASL authentication with SAML20 and sends a domain name that allows the SASL server to determine the appropriate IdP.

3. The SASL server transmits an authentication request encoded using a Uniform Resource Identifier (URI) as described in [RFC 3986](#) [RFC3986] and an HTTP redirect to the IdP corresponding to the domain.
4. The SASL client now sends a response consisting of "=". Authentication continues via the normal SAML flow, and the SASL server will receive the answer to the challenge out of band from the SASL conversation.
5. At this point, the SASL client MUST construct a URL containing the content received in the previous message from the SASL server. This URL is transmitted to the IdP either by the SASL client application or an appropriate handler, such as a browser.
6. Next, the user authenticates to the IdP. The manner in which the end user is authenticated to the IdP, and any policies surrounding such authentication, are out of scope for SAML and hence for this document. This step happens out of band from SASL.
7. The IdP will convey information about the success or failure of the authentication back to the SASL server (RP) in the form of an authentication statement or failure, using an indirect response via the client browser or the handler (and with an external browser, client control should be passed back to the SASL client). This step happens out of band from SASL.
8. The SASL server sends an appropriate SASL response to the client.

Please note: What is described here is the case in which the client has not previously authenticated. It is possible that the client already holds a valid SAML authentication token so that the user does not need to be involved in the process anymore, but that would still be external to SASL. This is classic Web Single Sign-On, in which the Web Browser client presents the authentication token (cookie) to the RP without renewed user authentication at the IdP.

With all of this in mind, the flow appears as follows in Figure 2:

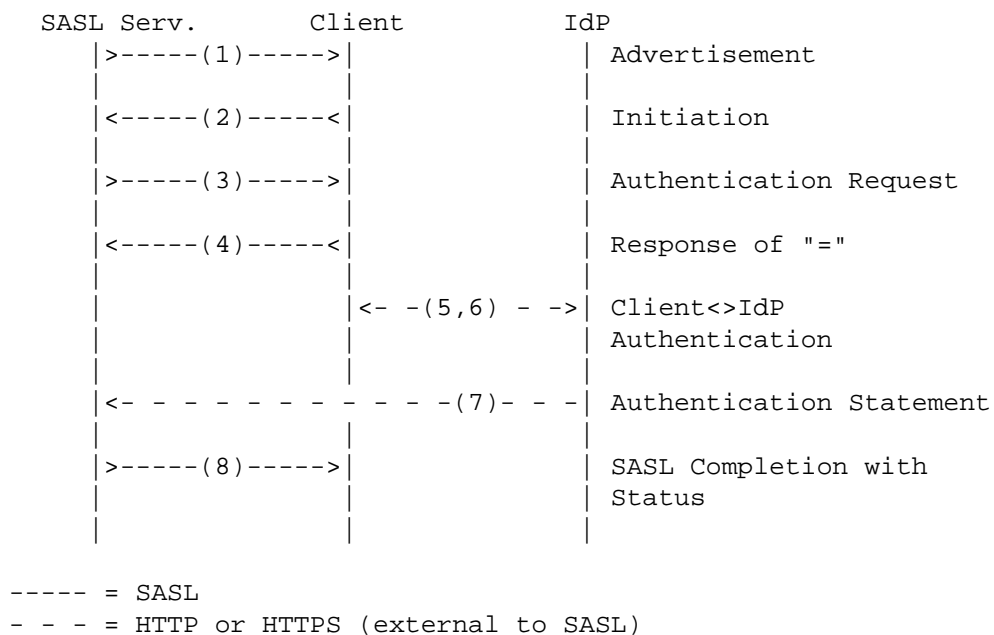


Figure 2: Authentication Flow

### 3. SAML SASL Mechanism Specification

This section specifies the details of the SAML SASL mechanism. See [Section 5 of \[RFC4422\]](#) for additional details.

The name of this mechanism is "SAML20". The mechanism is capable of transferring an authorization identity (via the "gs2-header"). The mechanism does not offer a security layer.

The mechanism is client-first. The first mechanism message from the client to the server is the "initial-response". As described in [\[RFC4422\]](#), if the application protocol does not support sending a client response together with the authentication request, the server will send an empty server challenge to let the client begin. The second mechanism message is from the server to the client, containing the SAML "authentication-request". The third mechanism message is from the client to the server and is the fixed message consisting of "=". The fourth mechanism message is from the server to the client, indicating the SASL mechanism outcome.

### 3.1. Initial Response

A client initiates a SAML20 authentication with SASL by sending the GS2 header followed by the Identity Provider identifier (message 2 in Figure 2) and is defined using ABNF [RFC5234] as follows:

```
initial-response = gs2-header IdP-Identifier
IdP-Identifier = domain ; domain name with corresponding IdP
```

The gs2-header is used as follows:

- The "gs2-nonstd-flag" MUST NOT be present.
- The "gs2-cb-flag" MUST be set to "n" because channel-binding [RFC5056] data cannot be integrity protected by the SAML negotiation. (Note: In theory, channel-binding data could be inserted in the SAML flow by the client and verified by the server, but that is currently not supported in SAML.)
- The "gs2-authzid" carries the optional authorization identity as specified in [RFC5801] (not to be confused with the IdP-Identifier).

A domain name is either a "traditional domain name" as described in [RFC1035] or an "internationalized domain name" as described in [RFC5890]. Clients and servers MUST treat the IdP-Identifier as a domain name slot [RFC5890]. They also SHOULD support internationalized domain names (IDNs) in the IdP-Identifier field; if they do so, all of the domain name's labels MUST be A-labels or NR-LDH labels [RFC5890]. If necessary, internationalized labels MUST be converted from U-labels to A-labels by using the Punycode encoding [RFC3492] for A-labels prior to sending them to the SASL server, as described in the protocol specification for Internationalized Domain Names in Applications [RFC5891].

### 3.2. Authentication Request

The SASL server transmits to the SASL client a URI that redirects the SAML client to the IdP (corresponding to the domain that the user provided), with a SAML authentication request as one of the parameters (message 3 in Figure 2) using the following ABNF:

```
authentication-request = URI
```

The URI is specified in [RFC3986] and is encoded according to Section 3.4 ("HTTP Redirect Binding") of the SAML 2.0 bindings specification [OASIS-SAMLv2-BIND]. The SAML authentication request is encoded according to Section 3.4 ("Authentication Request



Protocol") of [OASIS-SAMLv2-CORE]. Should the client support Internationalized Resource Identifiers (IRIs) [RFC3987], it MUST first map the IRI to a URI before transmitting it to the server, as defined in Section 3.1 of [RFC3987].

Note: The SASL server may have a static mapping of domain to corresponding IdP or, alternatively, a DNS-lookup mechanism could be envisioned, but that is out of scope for this document.

Note: While the SASL client MAY sanity-check the URI it received, ultimately it is the SAML IdP that will be validated by the SAML client; this topic is out of scope for this document.

The client then sends the authentication request via an HTTP GET (sent over a server-authenticated TLS channel) to the IdP, as if redirected to do so from an HTTP server and in accordance with the Web Browser SSO profile, as described in Section 4.1 of [OASIS-SAMLv2-PROF] (messages 5 and 6 in Figure 2).

The client handles both user authentication to the IdP and confirmation or rejection of the authentication of the RP (out of scope for this document).

After all authentication has been completed by the IdP, the IdP will send a redirect message to the client in the form of a URI corresponding to the RP as specified in the authentication request ("AssertionConsumerServiceURL") and with the SAML response as one of the parameters (message 7 in Figure 2).

Please note: This means that the SASL server needs to implement a SAML RP. Also, the SASL server needs to correlate the session it has with the SASL client with the appropriate SAML authentication result. It can do so by comparing the ID of the SAML authentication request it has issued with the one it receives in the SAML authentication statement.

### 3.3. Outcome and Parameters

The SASL server (in its capacity as a SAML RP) now validates the SAML authentication response it received from the SAML client via HTTP or HTTPS.

The outcome of that validation by the SASL server constitutes a SASL mechanism outcome and therefore (as stated in [RFC4422]) SHALL be used to set state in the server accordingly, and it SHALL be used by the server to report that state to the SASL client, as described in [RFC4422], Section 3.6 (message 8 in Figure 2).

#### 4. SAML GSS-API Mechanism Specification

This section and its sub-sections are not required for SASL implementors, but this section MUST be observed to implement the GSS-API mechanism discussed below.

This section specifies a GSS-API mechanism that, when used via the GS2 bridge to SASL, behaves like the SASL mechanism defined in this document. Thus, it can loosely be said that the SAML SASL mechanism is also a GSS-API mechanism. The SAML user takes the role of the GSS-API Initiator, and the SAML RP takes the role of the GSS-API Acceptor. The SAML IdP does not have a role in GSS-API and is considered an internal matter for the SAML mechanism. The messages are the same, but

- a) the GS2 header on the client's first message and channel-binding data are excluded when SAML is used as a GSS-API mechanism, and
- b) the initial context token header ([Section 3.1 of \[RFC2743\]](#)) is prefixed to the client's first authentication message (context token).

The GSS-API mechanism OID for SAML is 1.3.6.1.5.5.17 (see [Section 7.2](#) for more information). The DER encoding of the OID is 0x2b 0x06 0x01 0x05 0x05 0x11.

SAML20 security contexts MUST have the `mutual_state` flag (`GSS_C_MUTUAL_FLAG`) set to TRUE. SAML does not support credential delegation; therefore, SAML security contexts MUST have the `deleg_state` flag (`GSS_C_DELEG_FLAG`) set to FALSE.

The mutual authentication property of this mechanism relies on successfully comparing the TLS server's identity with the negotiated target name. Since the TLS channel is managed by the application outside of the GSS-API mechanism, the mechanism itself is unable to confirm the name, while the application is able to perform this comparison for the mechanism. For this reason, applications MUST match the TLS server's identity with the target name, as discussed in [\[RFC6125\]](#). More precisely, to pass identity validation, the client uses the securely negotiated `targ_name` as the reference identifier and matches it to the DNS-ID of the server's certificate, and it MUST reject the connection if there is a mismatch. For compatibility with deployed certificate hierarchies, the client MAY also perform a comparison with the Common Name ID (CN-ID) when there is no DNS-ID present. Wildcard matching is permitted. The `targ_name` reference identifier is a "traditional domain names"; thus, the comparison is made using case-insensitive ASCII comparison.

The SAML mechanism does not support per-message tokens or the `GSS_Pseudo_random()` function [RFC4401].

#### 4.1. GSS-API Principal Name Types for SAML

SAML supports standard generic name syntaxes for acceptors such as `GSS_C_NT_HOSTBASED_SERVICE` (see [RFC2743], Section 4.1). SAML supports only a single name type for initiators: `GSS_C_NT_USER_NAME`. `GSS_C_NT_USER_NAME` is the default name type for SAML. The query, display, and exported name syntaxes for SAML principal names are all the same. There are no SAML-specific name syntaxes -- applications should use generic GSS-API name types, such as `GSS_C_NT_USER_NAME` and `GSS_C_NT_HOSTBASED_SERVICE` (see [RFC2743] Section 4). The exported name token, of course, conforms to [RFC2743], Section 3.2.

### 5. Examples

#### 5.1. XMPP

Suppose the user has an identity at the SAML IdP `saml.example.org` and a Jabber Identifier (JID) `"somenode@example.com"` and wishes to authenticate his XMPP [RFC6120] connection to `xmpp.example.com`. The authentication on the wire would then look something like the following:

Step 1: Client initiates stream to server:

```
<stream:stream xmlns='jabber:client'
xmlns:stream='http://etherx.jabber.org/streams'
to='example.com' version='1.0'>
```

Step 2: Server responds with a stream tag sent to client:

```
<stream:stream
xmlns='jabber:client' xmlns:stream='http://etherx.jabber.org/streams'
id='some_id' from='example.com' version='1.0'>
```

Step 3: Server informs client of available authentication mechanisms:

```
<stream:features>
  <mechanisms xmlns='urn:ietf:params:xml:ns:xmpp-sasl'>
    <mechanism>DIGEST-MD5</mechanism>
    <mechanism>PLAIN</mechanism>
    <mechanism>SAML20</mechanism>
  </mechanisms>
</stream:features>
```

Step 4: Client selects an authentication mechanism and provides the initial client response -- containing the gs2-header and domain -- that has been encoded in base64 according to [Section 4 of \[RFC4648\]](#):

```
<auth xmlns='urn:ietf:params:xml:ns:xmpp-sasl' mechanism='SAML20'>
biwsZXhhbXBsZS5vcmc=</auth>
```

The decoded string is

```
n,,example.org
```

Step 5: Server sends a base64-encoded challenge to client in the form of an HTTP redirect to the SAML IdP corresponding to example.org (<https://saml.example.org>) with the SAML authentication request as specified in the redirection URL:

```
aHR0cHM6Ly9zYWlsLmV4YW1wbGUub3JnL1NBTUwvQnJvd3Nlcj9TQU1MUmVx
dWVzdDlQSE5oYld4d09rRjFkR2h1VW1WeGRXVnpkQ0I0Yld4dWN6cHpZVzFz
Y0QwaWRYSnVPbTloYzJsek9tNWWhiVlZ6T25Sak9sTkJUVXc2TWk0d09uQnli
MlJ2WTI5c0lnMETJQ0FnSUVsRVBTSmZZbVZqTkRJMFPtRTFNVEF6TkRjNE9U
QTVZVE13WmlZeFpUTXhNVFk0TXpJm1pqYzVORGmWt1RnMElpQldaWEp6YVc5
dVBTSXlMakFpRFFvZ0lDQWdTWE56ZFdWSmJuTjBZVzUwUUFNJeU1EQTNMVEV5
TFRFd1ZERXhPak0lT2pNMFDpSWdSbTl5WTJWQmRYUm9iajBpWmlGc2MyVWlE
UW9nSUNBZ1NYTlFZWE56YVhabFBTSmlZV3h6WlNJTkNpQWdJQ0JRY205MGIy
TnZiRUpwYmlScGJtYzljblZ5YmpwdllYTnBjenB1WVcxGN6cDBZenBUUVUx
TU9qSXVNRHBpYVc1a2FXNW5jenBJVkJZSUUxWQlBVmVFPpRFFvZ0lDQWdRWE56
WlhKMGMFXOXVRMjllYzNwdFpYS1RaWEoyYVdObFZWSk1QUTBLSUNBZ0lDQWdJ
Q0FpYUHSMDNITTZMeTk0YlhCd0xtVjRZVzF3YkdVdVkyOXRMU5CVFV3dlFY
TnpaWEowYVc5dVEyOXVjMlZ0WlhKVFPYSjJhV05sSWo0TkNpQThjMkZ0YkRw
SmMzTjFfaWElnZUCxc2JuTTZjMkZ0YkQwaWRYSnVPbTloYzJsek9tNWWhiVlZ6
T25Sak9sTkJUVXc2TWk0d09tRnpjMlZ5ZEdsdmJpSStEUW9nSUNBZ0lHaDBk
SEJ6T2k4dmVHMxdjQzVsZUdGdGNHeGxMbU52YlEws0lEd3ZjMkZ0YkRwSmMz
TjFfaWEkrRFFvZ1BITmhiV3h3T2s1aGJXVkpSRk1J2YkdsamVTQjRiV3h1Y3pw
ellXMXNjRDBpZFHkdU9tOWhjMmx6T201aGJXVnpPblJqT2xOQ1RVdZzNATR3
T25CeWlzUnZMjllZSWcwS0lDQWdJQ0JHYjNkdFlYUTlJblZ5YmpwdllYTnBj
enB1WVcxGN6cDBZenBUUVUxTU9qSXVNRHB1WVcxGN6cGFUXRabTl5YldGME9u
Qmxjbk5wYzNSbGJuUWlEUW9nSUNBZ0lGTlFUbUZ0WlZGMVlXehBabWxsY2ow
aWVHMxdjQzVsZUdGdGNHeGxMbU52YlNjZ1FXeHNiM2REY21WaGRHVt1JblJ5
ZFdVaUlDOctEUW9nUEhOaGJXehdPbEpsY1hWbGMzUmxaRUyxZEdodVEyOXVj
R1Y0ZEEwS0lDQWdJQ0I0Yld4dWN6cHpZVzFzY0QwaWRYSnVPbTloYzJsek9t
NWWhiVlZ6T25Sak9sTkJUVXc2TWk0d09uQnliMlJ2WTI5c0lpQU5DaUFnSUNB
Z0lDQWdRMjllY0dGeWFYTnZiajBpWlhoaFkzUWlQZzBLSUNBOGMyRnRiRHBC
ZFhSb2JrTnZiblJszUhsRGJHRnpjMUpsWmcwS0lDQWdJQ0FnZUCxc2JuTTZj
MkZ0YkQwaWRYSnVPbTloYzJsek9tNWWhiVlZ6T25Sak9sTkJUVXc2TWk0d09t
RnpjMlZ5ZEdsdmJpSStEUW9nb0NBZ0lDQjFjbTQ2YjJGemFYTTZibUZ0WlhN
NmRHTTZWMEZOVERveUxqQTZVZ002WTJ4aGMzTmxjenBRWVhOemQyOXlaRk1J5
YjNSbFkzUmxaRlJ5WVclenNHOXlkQTBLSUNBOEwzTmhiV3c2UVhWMGFHNURi
```

```
<saml:AuthnRequest xmlns:saml="urn:oasis:names:tc:SAML:2.0:protocol"
  ID="_bec424fa5103428909a30ff1e31168327f79474984" Version="2.0"
  IssueInstant="2007-12-10T11:39:34Z" ForceAuthn="false"
  IsPassive="false"
  ProtocolBinding="urn:oasis:names:tc:SAML:2.0:bindings:HTTP-POST"
  AssertionConsumerServiceURL=
    "https://xmpp.example.com/SAML/AssertionConsumerService">
<saml:Issuer xmlns:saml="urn:oasis:names:tc:SAML:2.0:assertion">
  https://xmpp.example.com
</saml:Issuer>
<saml:NameIDPolicy xmlns:saml="urn:oasis:names:tc:SAML:2.0:protocol"
  Format="urn:oasis:names:tc:SAML:2.0:nameid-format:persistent"
  SPNameQualifier="xmpp.example.com" AllowCreate="true" />
<saml:RequestedAuthnContext
```

```
    xmlns:samlp="urn:oasis:names:tc:SAML:2.0:protocol"
    Comparison="exact">
<saml:AuthnContextClassRef
  xmlns:saml="urn:oasis:names:tc:SAML:2.0:assertion">
    urn:oasis:names:tc:SAML:2.0:ac:classes:PasswordProtectedTransport
  </saml:AuthnContextClassRef>
</samlp:RequestedAuthnContext>
</samlp:AuthnRequest>
```

Note: The server can use the request ID  
("\_bec424fa5103428909a30ff1e31168327f79474984") to correlate the SASL  
session with the SAML authentication.

Step 5 (alternative): Server returns error to client if no SAML  
authentication request can be constructed:

```
<failure xmlns='urn:ietf:params:xml:ns:xmpp-sasl'>
  <temporary-auth-failure/>
</failure>
</stream:stream>
```

Step 6: Client sends the "=" response (base64-encoded) to the  
challenge:

```
<response xmlns='urn:ietf:params:xml:ns:xmpp-sasl'>
  PQ==
</response>
```

The following steps between brackets are out of scope for this  
document but are included to better illustrate the entire flow:

[The client now sends the URL to a browser instance for processing.  
The browser engages in a normal SAML authentication flow (external to  
SASL), like redirection to the IdP (<https://saml.example.org>); the  
user logs into <https://saml.example.org> and agrees to authenticate to  
[xmpp.example.com](https://xmpp.example.com). A redirect is passed back to the client browser.  
The client browser in turn sends the AuthN response, which contains  
the subject-identifier as an attribute, to the server. If the AuthN  
response doesn't contain the JID, the server maps the subject-  
identifier received from the IdP to a JID.]

Step 7: Server informs client of successful authentication:

```
<success xmlns='urn:ietf:params:xml:ns:xmpp-sasl' />
```

Step 7 (alternative): Server informs client of failed authentication:

```
<failure xmlns='urn:ietf:params:xml:ns:xmpp-sasl'>
  <not-authorized/>
</failure>
</stream:stream>
```

Please note: Line breaks were added to the base64 data for clarity.

## 5.2. IMAP

The following sequence describes an IMAP exchange. Lines beginning with 'S:' indicate data sent by the server, and lines starting with 'C:' indicate data sent by the client. Long lines are wrapped for readability.

```
S: * OK IMAP4rev1
C: . CAPABILITY
S: * CAPABILITY IMAP4rev1 STARTTLS
S: . OK CAPABILITY Completed
C: . STARTTLS
S: . OK Begin TLS negotiation now
C: . CAPABILITY
S: * CAPABILITY IMAP4rev1 AUTH=SAML20
S: . OK CAPABILITY Completed
C: . AUTHENTICATE SAML20
S: +
C: biwsZXhhbXBsZS5vcmc=
S: + aHR0cHM6Ly9zYWlsLmV4YW1wbGUub3JnL1NBtUwvQnJvd3Nlcj9TQU1M
UmVxdWVzdDlQSE5oYld4d09rRg0KMWRHaHVVbVZ4ZFdwemRDQjRiV3h1Y3pwe
l1lXMxNjRDBpZFhKdU9tOWhjMmx6T201aGJXVnpPblJqT2xOQg0KVfV3Nk1pNH
dPbkJ5YjNSdlkyOXNjZzBLSUNBZ01FbEVQU0pmWW1Wak5ESTBabUUxTVRBek5
ESTRPVEE1WQ0KVE13Wm1ZeFpUTXhNVFk0TXpJM1pqYzVORGmWt1RnMElpQlda
WEp6YVc5dVBTSXlMakFpRFFvZ01DQWdTWA0KTnpkV1ZKYm5OMFlXNTBQU015T
URBM0xURXlMVEV3VkrFEE9qTTVPak0wV21JZ1JtOXlZM1ZCZFhSb2JqMA0KaV
ptRnNjMlVpRFFvZ01DQWdTWE5RWVhOemFYWmxQU0ptWVd4elpTSU5DaUFnSUN
CUWntOTBiMk52YkVKcA0KYm1ScGJtYz1JblZ5YmpwdllYTnBjenB1WVcxGN6
cDBZenBUUVUxTU9qSXVNRHBpYVc1a2FXNW5jenBJVg0KR1JRTFZCUFUxUW1EU
W9nSUNBZ1FYTnpaWEowYVc5dVEyOXVjM1Z0WlhKVfPYsJjHv05sVlZKTVBRME
tJQw0KQWdJQ0FnSUNBaWFIUjBjSE02THk5dFlXbHNmbVY0WVcxZ2JHVXVZMj1
0TDFQlRVd3ZRWE56WlhKMGFxOQ0KdVEyOXVjM1Z0WlhKVfPYsJjHv05sSWo0
TkNpQThjMkZ0YkRwSmMzTjFaWElnZUcxc2JuTTZjMkZ0YkQwaQ0KZFhKdU9tO
WhjMmx6T201aGJXVnpPblJqT2xOQlRVdzZNaTR3T21GemMyVnlkR2x2YmlJK0
RRb2dJQ0FnSQ0KR2gwZEhCek9pOHZlRzF3Y0M1bGVHRnRjR3hstG1OdmJRMET
JRhd2YzJGdGJECEpjm04xWlhJK0RRb2dQSA0KTmhiV3h3T2s1aGJXVkpSRk2
YkdsamVTQjRiV3h1Y3pwe1lXMxNjRDBpZFhKdU9tOWhjMmx6T201aGJXVg0Ke
k9uUmpPbE5CVfV3Nk1pNHdPbkJ5YjNSdlkyOXNjZzBLSUNBZ01DQkdiM0p0WV
```



```

hROuluVnlianB2WVhOcA0KY3pwdVlXMWxjenAwWXpwVFFVMU1Pakl1TURwdVl
XMWxhVlF0Wm05eWJXRjBPbkJsY250cGMzUmxiblFpRA0KUW9nSUNBZ0lGTlFU
bUZ0WlZGMVlXehBabWxsY2owaWVHMxdjQzVsZUdGdGNHeGxMbU52YlNjZlFXe
HNiMw0KZERjbVZoZEdVOuluUnlkVlVpSUM4K0RRb2dQSE5oYld4d09sSmxjWF
ZsYzNSbFpFRjFkr2h1UTI5dWRHVg0KNGRBMetJQ0FnSUNCNGJXehVjenB6WVc
xc2NEMGlkWep1T205aGMybHpPbTVoYldWek9uUmpPbe5CVFV3Ng0KTWk0d09u
QnliMlJ2WTI5c0lpQU5DaUFnSUNBZ0lDQWdRMjl0Y0dGeWFYtNZiajBpWlhoa
FkzUWlQZzBLSQ0KQ0E4YzJGdGJECEJkWFJvYmtOdmJuUmxlSFJEYkdGemMxSm
xaZzBLSUNBZ0lDQWdlRzFzYm5NNmMyRnRiRA0KMGlkWep1T205aGMybHpPbTV
oYldWek9uUmpPbe5CVFV3NklpNHdPbUZ6YzJWEWRHbHZiaUkrRFFvZ0lDQ0K
Z0lDQjFjbTQ2YjJGemFYTTZibUZ0WlhNNmRHTTZVMEZOVERveUxqQTZZV002W
TJ4aGMzTmxjenBRWVhOeg0KZDI5eVpGQnliMlJsWTNSbFpGUnlZVzV6Y0c5eW
RBMetJQ0E4TDNOaGJXdzZRWfYwYUclRGIyNTBaWGgwUQ0KMnhoYzNOUlpXWSt
EUW9nUEM5ellXMXNjRHBTWlhGMVpYtjBaVlJCZFhSb2JrTnZiblJsZUHRK0lB
MetQQw0K0XpZVzFzY0RwQmRYUm9ibEpsYlhWbGMzUSs=
C: PQ==
S: . OK Success (TLS protection)

```

The decoded challenge is as follows:

```

https://saml.example.org/SAML/Browser?SAMLRequest=PHNhbWxwOkF
ldGhuUmVxdWVzdCB4bWxuczpzYWlscD0idXJuOm9hc2lzOm5hbWVzOnRjOlNB
TUw6Mi4wOnByb3RvY29sIg0KICAgIElEPSJfYmVjNDI0ZmElMTAzNDI0OTA5Y
TMwZmYxZTMxMTY4MzI3Zjc5NDc0OTg0IiBWZXJzaW9uPSIyLjAiDQogICAgSX
NzdWVJbnN0YWS0PSIyMDA3LTEyLWVDEwOjM5OjM0WiIgRm9yY2VBdXRobj0
iZmFsc2UiDQogICAgSXNqYXNzaXZlPSJmYWxzZSINCiAgICBQcm90b2NvbEJp
bmRpbmc9InVybjpYXNpczpuYW1lc2p0YzptQU1MOjIuMDpiaW5kaW5nczpuIV
FRQLVBPU1QiDQogICAgQXNzZXJ0aW9uQ29uc3VtZXJtZXJ2aWNlVWJMPQ0KIC
AgICAgICAgHR0cHM6Ly9tYWlsLmV4YW1wbGUuY29tLlNBTUwvQXNzZXJ0aW9
uQ29uc3VtZXJtZXJ2aWNlIj4NCiA8c2FtbDpJc3NlZXIgeGlsbnM6c2FtbD0i
dXJuOm9hc2lzOm5hbWVzOnRjOlNBUTUw6Mi4wOmFzc2VydGlvbiI+DQogICAgI
Gh0dHBzOi8veG1wcC5leGFtcGxlLmNvbQ0KIDwvc2FtbDpJc3NlZXI+DQogPH
NhbWxwOk5hbWVJRFBvbG1jesB4bWxuczpzYWlscD0idXJuOm9hc2lzOm5hbWV
zOnRjOlNBUTUw6Mi4wOnByb3RvY29sIg0KICAgICBGB3JtYXQ9InVybjpYXNp
czpuYW1lc2p0YzptQU1MOjIuMDpuYW1laWQtZm9ybWFOOnBlcnNpc3RlbnQiD
QogICAgIFNQTMftZVF1YWxpZmllcj0ieG1wcC5leGFtcGxlLmNvbSIgQWxs3
dDcmVhdGU9InRydWUiIC8+DQogPHNhbWxwOlJlcXVlc3RlZEFldGhuQ29udGV
4dA0KICAgICB4bWxuczpzYWlscD0idXJuOm9hc2lzOm5hbWVzOnRjOlNBUTUw6
Mi4wOnByb3RvY29sIiANCiAgICAgICAgQ29tcGFyaXNvbjo0iZXhhY3QiPg0KI
CA8c2FtbDpBdXRobjNvbNleHRDbGFzc1JlZg0KICAgICAgGlsbnM6c2FtbD
0idXJuOm9hc2lzOm5hbWVzOnRjOlNBUTUw6Mi4wOmFzc2VydGlvbiI+DQogICA
gICB1cm46b2FzaXM6bmFtZXM6dGM6U0FNTDoyLjA6YWM6Y2xhc3Nlc2pQYXNz
d29yZFBYb3RlY3RlZFRyYW5zcG9ydA0KICA8L3NhbWw6QXV0aG5Db250ZXh0Q
2xhc3NSZWY+DQogPC9zYWlscDpsZXFlZXN0ZWRBdXRobjNvbNleHQ+IA0KPC
9zYWlscDpBdXRobjlJlcXVlc3Q+

```



Where the decoded SAMLRequest looks like the following:

```
<samlp:AuthnRequest xmlns:samlp="urn:oasis:names:tc:SAML:2.0:protocol"
  ID="_bec424fa5103428909a30ff1e31168327f79474984" Version="2.0"
  IssueInstant="2007-12-10T11:39:34Z" ForceAuthn="false"
  IsPassive="false"
  ProtocolBinding="urn:oasis:names:tc:SAML:2.0:bindings:HTTP-POST"
  AssertionConsumerServiceURL=
    "https://mail.example.com/SAML/AssertionConsumerService">
  <saml:Issuer xmlns:saml="urn:oasis:names:tc:SAML:2.0:assertion">
    https://xmpp.example.com
  </saml:Issuer>
  <samlp:NameIDPolicy xmlns:samlp="urn:oasis:names:tc:SAML:2.0:protocol"
    Format="urn:oasis:names:tc:SAML:2.0:nameid-format:persistent"
    SPNameQualifier="xmpp.example.com" AllowCreate="true" />
  <samlp:RequestedAuthnContext
    xmlns:samlp="urn:oasis:names:tc:SAML:2.0:protocol"
    Comparison="exact">
    <saml:AuthnContextClassRef
      xmlns:saml="urn:oasis:names:tc:SAML:2.0:assertion">
      urn:oasis:names:tc:SAML:2.0:ac:classes:PasswordProtectedTransport
    </saml:AuthnContextClassRef>
  </samlp:RequestedAuthnContext>
</samlp:AuthnRequest>
```

## 6. Security Considerations

This section addresses only security considerations associated with the use of SAML with SASL applications. For considerations relating to SAML in general, and for general SASL security considerations, the reader is referred to the SAML specifications and to other literature.

### 6.1. Man-in-the-Middle and Tunneling Attacks

This mechanism is vulnerable to man-in-the-middle and tunneling attacks unless a client always verifies the server's identity before proceeding with authentication (see [RFC6125]). Typically, TLS is used to provide a secure channel with server authentication.

### 6.2. Binding SAML Subject Identifiers to Authorization Identities

As specified in [RFC4422], the server is responsible for binding credentials to a specific authorization identity. It is therefore necessary that only specific trusted IdPs be allowed. This is a typical part of SAML trust establishment between RPs and the IdP.

### 6.3. User Privacy

The IdP is aware of each RP that a user logs into. There is nothing in the protocol to hide this information from the IdP. It is not a requirement to track the visits, but there is nothing that prohibits the collection of information. SASL server implementers should be aware that SAML IdPs will be able to track -- to some extent -- user access to their services.

### 6.4. Collusion between RPs

It is possible for RPs to link data that they have collected on the users. By using the same identifier to log into every RP, collusion between RPs is possible. In SAML, targeted identity was introduced. Targeted identity allows the IdP to transform the identifier the user typed in to an RP-specific opaque identifier. This way, the RP would never see the actual user identifier but instead would see a randomly generated identifier.

### 6.5. Security Considerations Specific to GSS-API

Security issues inherent in GSS-API [RFC2743] and GS2 [RFC5801] apply to the SAML GSS-API mechanism defined in this document. Further, and as discussed in [Section 4](#), proper TLS server identity verification is critical to the security of the mechanism.

## 7. IANA Considerations

### 7.1. IANA Mech-Profile

The IANA has registered the following SASL profile:

SASL mechanism profile: SAML20

Security Considerations: See this document

Published Specification: See this document

For further information: Contact the authors of this document.

Owner/Change controller: the IETF

Intended usage: COMMON

Note: None

## 7.2. IANA OID

The IANA has also assigned a new entry for this GSS mechanism in the SMI Security for Mechanism Codes sub-registry, whose prefix is `iso.org.dod.internet.security.mechanisms (1.3.6.1.5.5)`, and referenced this specification in the registry.

## 8. References

### 8.1. Normative References

#### [OASIS-SAMLv2-BIND]

Cantor, S., Ed., Hirsch, F., Ed., Kemp, J., Ed., Philpott, R., Ed., and E. Maler, Ed., "Bindings for the OASIS Security Assertion Markup Language (SAML) V2.0", OASIS Standard `saml-bindings-2.0-os`, March 2005, <<http://docs.oasis-open.org/security/saml/v2.0/saml-bindings-2.0-os.pdf>>.

#### [OASIS-SAMLv2-CORE]

Cantor, S., Ed., Kemp, J., Ed., Philpott, R., Ed., and E. Maler, Ed., "Assertions and Protocols for the OASIS Security Assertion Markup Language (SAML) V2.0", OASIS Standard `saml-core-2.0-os`, March 2005, <<http://docs.oasis-open.org/security/saml/v2.0/saml-core-2.0-os.pdf>>.

#### [OASIS-SAMLv2-PROF]

Hughes, J., Ed., Cantor, S., Ed., Hodges, J., Ed., Hirsch, F., Ed., Mishra, P., Ed., Philpott, R., Ed., and E. Maler, Ed., "Profiles for the OASIS Security Assertion Markup Language (SAML) V2.0", OASIS Standard `OASIS.saml-profiles-2.0-os`, March 2005, <<http://docs.oasis-open.org/security/saml/v2.0/saml-profiles-2.0-os.pdf>>.

[RFC1035] Mockapetris, P., "Domain names - implementation and specification", STD 13, [RFC 1035](#), November 1987.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.

[RFC2616] Fielding, R., Gettys, J., Mogul, J., Frystyk, H., Masinter, L., Leach, P., and T. Berners-Lee, "Hypertext Transfer Protocol -- HTTP/1.1", [RFC 2616](#), June 1999.

[RFC2743] Linn, J., "Generic Security Service Application Program Interface Version 2, Update 1", [RFC 2743](#), January 2000.

- [RFC2818] Rescorla, E., "HTTP Over TLS", [RFC 2818](#), May 2000.
- [RFC3492] Costello, A., "Punycode: A Bootstring encoding of Unicode for Internationalized Domain Names in Applications (IDNA)", [RFC 3492](#), March 2003.
- [RFC3986] Berners-Lee, T., Fielding, R., and L. Masinter, "Uniform Resource Identifier (URI): Generic Syntax", STD 66, [RFC 3986](#), January 2005.
- [RFC3987] Duerst, M. and M. Suignard, "Internationalized Resource Identifiers (IRIs)", [RFC 3987](#), January 2005.
- [RFC4422] Melnikov, A., Ed., and K. Zeilenga, Ed., "Simple Authentication and Security Layer (SASL)", [RFC 4422](#), June 2006.
- [RFC5056] Williams, N., "On the Use of Channel Bindings to Secure Channels", [RFC 5056](#), November 2007.
- [RFC5234] Crocker, D., Ed., and P. Overell, "Augmented BNF for Syntax Specifications: ABNF", STD 68, [RFC 5234](#), January 2008.
- [RFC5246] Dierks, T. and E. Rescorla, "The Transport Layer Security (TLS) Protocol Version 1.2", [RFC 5246](#), August 2008.
- [RFC5280] Cooper, D., Santesson, S., Farrell, S., Boeyen, S., Housley, R., and W. Polk, "Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile", [RFC 5280](#), May 2008.
- [RFC5801] Josefsson, S. and N. Williams, "Using Generic Security Service Application Program Interface (GSS-API) Mechanisms in Simple Authentication and Security Layer (SASL): The GS2 Mechanism Family", [RFC 5801](#), July 2010.
- [RFC5890] Klensin, J., "Internationalized Domain Names for Applications (IDNA): Definitions and Document Framework", [RFC 5890](#), August 2010.
- [RFC5891] Klensin, J., "Internationalized Domain Names in Applications (IDNA): Protocol", [RFC 5891](#), August 2010.

- [RFC6125] Saint-Andre, P. and J. Hodges, "Representation and Verification of Domain-Based Application Service Identity within Internet Public Key Infrastructure Using X.509 (PKIX) Certificates in the Context of Transport Layer Security (TLS)", [RFC 6125](#), March 2011.
- [W3C-REC-HTML401]  
Le Hors, A., Ed., Raggett, D., Ed., and I. Jacobs, Ed.,  
"HTML 4.01 Specification", World Wide Web Consortium  
Recommendation REC-html401-19991224, December 1999,  
<<http://www.w3.org/TR/1999/REC-html401-19991224>>.

## 8.2. Informative References

- [RFC1939] Myers, J. and M. Rose, "Post Office Protocol - Version 3", STD 53, [RFC 1939](#), May 1996.
- [RFC3501] Crispin, M., "INTERNET MESSAGE ACCESS PROTOCOL - VERSION 4rev1", [RFC 3501](#), March 2003.
- [RFC4401] Williams, N., "A Pseudo-Random Function (PRF) API Extension for the Generic Security Service Application Program Interface (GSS-API)", [RFC 4401](#), February 2006.
- [RFC4648] Josefsson, S., "The Base16, Base32, and Base64 Data Encodings", [RFC 4648](#), October 2006.
- [RFC6120] Saint-Andre, P., "Extensible Messaging and Presence Protocol (XMPP): Core", [RFC 6120](#), March 2011.

## Appendix A. Acknowledgments

The authors would like to thank Scott Cantor, Joe Hildebrand, Josh Howlett, Leif Johansson, Thomas Lenggenhager, Diego Lopez, Hank Mauldin, RL "Bob" Morgan, Stefan Plug, and Hannes Tschofenig for their review and contributions.

### Authors' Addresses

Klaas Wierenga  
Cisco Systems, Inc.  
Haarlerbergweg 13-19  
1101 CH Amsterdam  
The Netherlands

Phone: +31 20 357 1752  
EMail: [klaas@cisco.com](mailto:klaas@cisco.com)

Eliot Lear  
Cisco Systems GmbH  
Richtistrasse 7  
CH-8304 Wallisellen  
Switzerland

Phone: +41 44 878 9200  
EMail: [lear@cisco.com](mailto:lear@cisco.com)

Simon Josefsson  
SJD AB  
Johan Olof Wallins vag 13  
Solna 171 64  
Sweden

EMail: [simon@josefsson.org](mailto:simon@josefsson.org)  
URI: <http://josefsson.org/>