Shibboleth Architecure

Protocols and Profiles

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Abstract:
This specification defines the general architecture, protocols, and message formats that make up the Shibboleth web single sign-on and attribute-exchange mechanism, which is built on the OASIS SAML 1.1 specification (http://www.oasis-open.org/committees/security). Readers should be familiar with that specification before reading this document.

This is a **working draft** and the text may change before completion. Please submit comments to the shibboleth-dev mailing list (see http://shibboleth.internet2.edu/ for subscription details).

Table of Contents

1 Introduction....3
1.1 Notation....3
2 Architectural Overview....4
2.1 Identity Provider....5
2.1.1 Authentication Authority....5
2.1.2 Attribute Authority....5
2.1.3 Single Sign-On Service....5
2.1.4 Inter-Site Transfer Service....6
2.2 Service Provider....6
2.2.1 Assertion Consumer Service....6
2.2.2 Attribute Requester....6
2.3 WAYF....7
3 Protocols and Profiles....8
3.1 Authentication Request and Response....8
3.1.1 Authentication Request....8
3.1.1.1 Message Format and Transmission....8
3.1.1.2 Processing Rules....8
3.1.1.3 Example....9
3.1.2 Browser/POST Authentication Response....9
3.1.2.1 Example....9
3.1.3 Browser/Artifact Authentication Response....11
3.1.3.1 Example....11
3.2 Attribute Request and Response....11
3.2.1 Attribute Request....11
3.2.1.1 Example....12
3.2.2 Attribute Response....12
3.2.2.1 Example....12
3.3 NameIdentifier Profile....13
3.4 Authentication Assertion Profile....13
3.5 Attribute Assertion Profile....13
3.6 Identity Provider Discovery Profile....14
3.7 Metadata Profile....14
3.7.1 Element <md:EntitiesDescriptor>....14
3.7.2 Element <md:EntityDescriptor>....14
3.7.3 Element <md:IDPSSODescriptor>....15
3.7.4 Element <md:AttributeAuthorityDescriptor>....15
3.7.5 Element <md:SPSSODescriptor>....15
3.7.6 Element <md:AttributeConsumerDescriptor>....15
4 Security and Privacy Considerations....16
4.1 Additional Browser Profile Considerations....16
4.1.1 Information Leakage and Impersonation....16
4.1.2 Time Synchronization....16
5 References....17
5.1 Normative References....17
5.2 Non-Normative References....17

1 Introduction

This specification defines a set of related profiles of SAML 1.1 and additional messages and protocols that make up the Shibboleth architecture. It is functionally a superset of the SAML 1.1 web browser single sign-on and attribute exchange mechanisms that incorporates additional profiles for user privacy, destination-site-first access, and identity provider discovery.

All Shibboleth implementations must support the required aspects of this specification to interoperate effectively.

Unless specifically noted, nothing in this document should be taken to conflict with the SAML 1.1 specification, or any bindings and profiles referenced within it. Readers are advised to familiarize themselves with that specification first.

1.1 Notation

This specification uses normative text to describe the use of SAML 1.1 and additional SAML profiles.

The keywords "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this specification are to be interpreted as described in [RFC 2119]:

> …they MUST only be used where it is actually required for interoperation or to limit behavior which has potential for causing harm (e.g., limiting retransmissions)…

These keywords are thus capitalized when used to unambiguously specify requirements over protocol and application features and behavior that affect the interoperability and security of implementations. When these words are not capitalized, they are meant in their natural-language sense.

```
Listings of XML schemas appear like this.
```

```
Example code listings appear like this.
```

Conventional XML namespace prefixes are used throughout the listings in this specification to stand for their respective namespaces as follows, whether or not a namespace declaration is present in the example:

- The prefix `saml:` stands for the SAML 1.1 assertion namespace, `urn:oasis:names:tc:SAML:1.0:assertion`.
- The prefix `samlp:` stands for the SAML 1.1 request-response protocol namespace, `urn:oasis:names:tc:SAML:1.0:protocol`.
- The prefix `md:` stands for the SAML 2.0 metadata namespace, `urn:oasis:names:tc:SAML:2.0:metadata`.
- The prefix `ds:` stands for the W3C XML Signature namespace, `http://www.w3.org/2000/09/xmldsig#`.
- The prefix `xsd:` stands for the W3C XML Schema namespace, `http://www.w3.org/2001/XMLSchema`, in example listings. In schema listings, this is the default namespace and no prefix is shown.

This specification uses the following typographical conventions in text: `<SAMLElement>`, `<ns:ForeignElement>`, `Attribute`, **Datatype**, `OtherCode`.

2 Architectural Overview

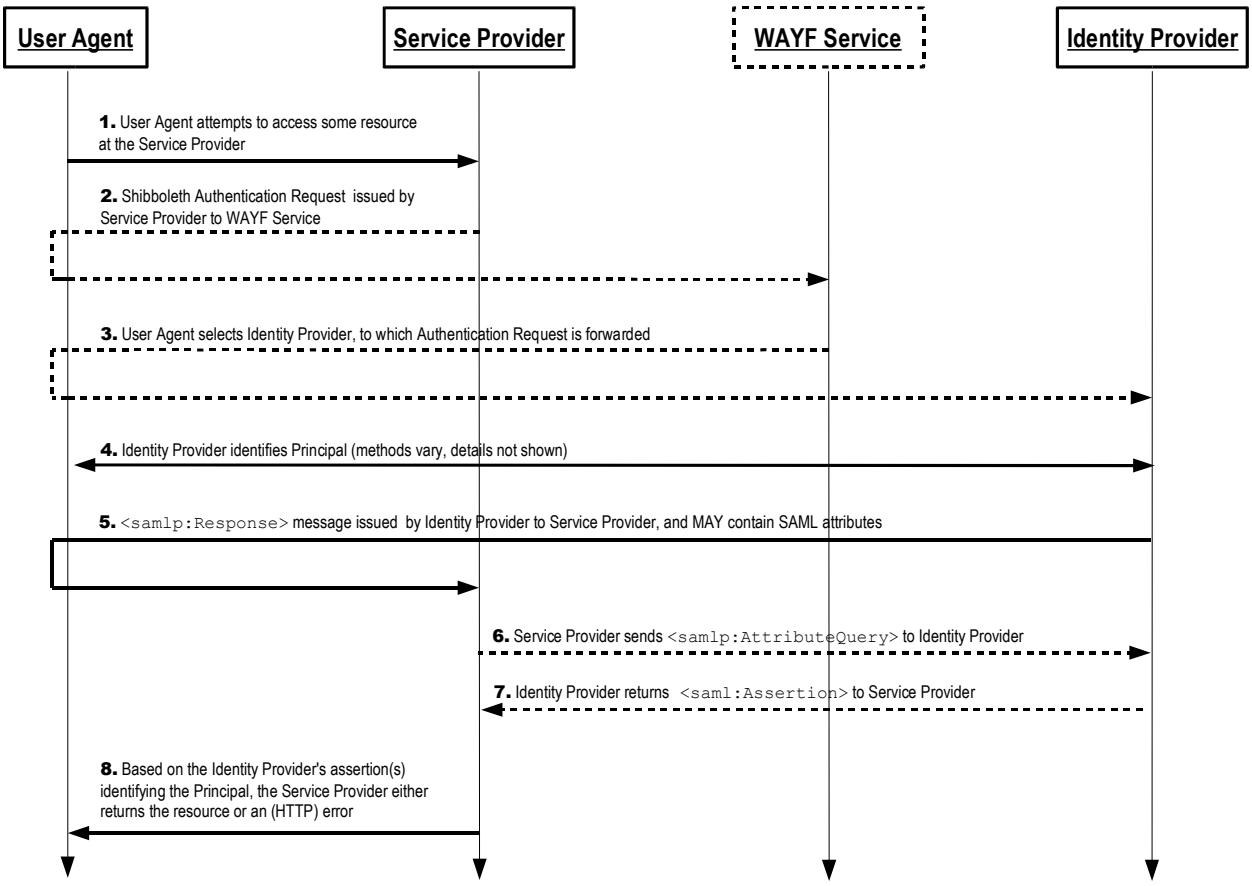
Broadly speaking, the Shibboleth architecture defines a set of interactions between an *identity provider* and a *service provider* to facilitate web browser single sign-on and attribute exchange.

Previous versions of this specification and the SAML 1.1 specification variously refer to these roles of identity provider and service provider as "source site" or "origin" and "destination site" or "target". This specification adopts terminology used within the Liberty ID-FF specification [LibertyProt], also based on SAML, and the draft SAML 2.0 specification [SAML2Gloss].

An additional component called a *WAYF service* acts independently as a means of identity provider discovery.

The following sequence diagram illustrates the set of required and optional interactions when using the Browser/POST profile. The Browser/Artifact profile replaces step 5 below with an artifact issued to the service provider followed by a SAML request/response exchange between the service provider and identity provider.

Dashed lines and boxes represent optional behavior.



2.1 Identity Provider

An identity provider is an entity that authenticates principals and produces assertions of authentication and attribute information in accordance with [SAMLCore] and the SAML Browser/POST and/or Browser/Artifact profiles in [SAMLBind]. It consists of functional components drawn from the SAML domain model, an *authentication authority* and an *attribute authority*, along with an *inter-site transfer service*, defined by the Browser profiles, and a *single sign-on service*, defined by this specification. Note that physically, the single sign-on service and inter-site transfer service MAY be the same location.

Each identity provider MUST be assigned a unique identifier, or *provider ID*. The identifier MUST be a URI [RFC 2396] of no more than 1024 characters. Use of an "https" URL for this purpose may be advantageous for metadata publication (see section @@).

2.1.1 Authentication Authority

The authentication authority is a SAML-defined service that issues authentication assertions about principals to relying parties (service providers, in the case of Shibboleth). Shibboleth does not specify how authentication of principals should be performed; the authority works with the principal's authentication service so that assertions about the authentication event are issued.

The only specifically defined use of an authentication assertion in Shibboleth is in accordance with the Browser/POST and Browser/Artifact profiles. As a result, the authentication authority is NOT REQUIRED to process SAML `<samlp:Request>` messages containing `<samlp:AuthenticationQuery>` or `<saml:AssertionIDReference>` elements, but MAYchoose to do so. Also note that the Browser/POST and Browser/Artifact profiles do not specifically require the authentication authority to remember the assertions that it issues over an extended period of time, though this is also permitted.

2.1.2 Attribute Authority

The attribute authority is a SAML-defined service that supports a SAML protocol binding and the processing of SAML `<samlp:Request>` messages containing the `<samlp:AttributeQuery>` element. It issues attribute assertions to service providers, typically using SSL/TLS [RFC 2246] or SAML message signatures to mutually authenticate the exchange.

Shibboleth additionally requires that control of attribute release to service providers be available to both administrators and principals. Therefore, a Shibboleth attribute authority MUST have the ability to authenticate requests and MUST implement some form of access control governing the release of specific attributes and values belonging to specific principals to specific requesting service providers. Subject to that constraint, any access control mechanism MAY be supported.

A Shibboleth attribute authority MAY implement support for `<saml:SubjectConfirmation>` when processing queries, but is NOT REQUIRED to do so. That is, it MAY return errors when presented with queries containing unsupported confirmation methods or when asked to produce assertions containing them.

2.1.3 Single Sign-On Service

A single sign-on (SSO) service is an HTTP resource controlled by the identity provider that receives and processes authentication requests sent through the browser from service providers and initiates the authentication process, eventually redirecting the browser to the inter-site transfer service.

This is a Shibboleth-specific service that is not defined by SAML 1.1. It supports a normative protocol to initiate SSO by a service provider, which SAML 1.1 does not define.

An identity provider may expose any number of SSO service endpoints. They SHOULD be protected by SSL/TLS [RFC 2246].

2.1.4 Inter-Site Transfer Service

An inter-site transfer service is an HTTP resource controlled by the identity provider that interacts with the authentication authority to issue HTTP responses to the principal's browser adhering to the SAML Browser/POST and/or Browser/Artifact profiles.

In the case of the POST profile, the HTTP response contains the form controls necessary to transmit a short-lived authentication assertion inside a digitally signed `<samlp:Response>` message to a service provider's assertion consumer service.

In the case of the Artifact profile, the HTTP response contains a `Location` header redirecting the browser to a service provider's assertion consumer service, and containing one or more SAML artifacts.

2.2 Service Provider

A service provider is an entity that provides a web-based service, application, or resource subject to authorization or customization on the basis of a security context established by means of the SAML Browser/POST and/or Browser/Artifact profiles. It consists of one or more *assertion consumer services*, defined by the Browser profiles, and may include an *attribute requester*.

> **Note:** Previous versions of this specification referred to these components as the "SHIRE" and "SHAR".

Each service provider MUST be assigned a unique identifier, or *provider ID*. The identifier MUST be a URI [RFC 2396] of no more than 1024 characters. Use of an "https" URL for this purpose may be advantageous for metadata publication (see section @@).

2.2.1 Assertion Consumer Service

An assertion consumer service is an HTTP resource controlled by the service provider that processes form submissions adhering to the SAML Browser/POST profile and/or HTTP GET requests adhering to the SAML Browser/Artifact profile to establish a new security context for a principal. Assuming this is successful, it eventually redirects the browser to a resource hosted by the service provider.

A service provider may expose any number of assertion consumer service endpoints. They SHOULD be protected by SSL/TLS [RFC 2246].

2.2.2 Attribute Requester

Shibboleth supplements the SAML Browser profiles with an out of band attribute exchange. A service provider MAY utilize a SAML protocol binding to send SAML `<samlp:Request>` messages containing the `<samlp:AttributeQuery>` element to Attribute Authorities and process the resulting attribute assertions, typically using SSL/TLS [RFC 2246] or SAML message signatures to mutually authenticate the exchange.

Note that in some environments where privacy is not required, a well-known principal identifier might be communicated in the authentication assertion, making the exchange of attributes optional, or to support a non-SAML mechanism such as LDAP to obtain additional information. Also, the authentication assertion MAY itself include `<saml:AttributeStatement>` elements (or be accompanied by additional assertions that do).

A Shibboleth attribute requester MAY implement support for `<saml:SubjectConfirmation>` when submitting queries and processing assertions, but is NOT REQUIRED to do so. That is, it MAY reject assertions containing unsupported confirmation methods.

2.3 WAYF

A WAYF, or "Where are you from?", service is a centralized mechanism for interactively determining a principal's identity provider. A service provider in general has no means to determine this without asking the principal or deriving the information through some browser interaction. The WAYF is a means for service providers to collectively delegate this step to a separate entity. Service providers are NOT REQUIRED to utilize a WAYF.

A WAYF service MUST support the Shibboleth authentication request protocol defined in section 3.1. This is the same protocol supported by an identity provider's SSO service; the WAYF acts as a proxy for a service provider and relays the authentication request from the service provider to the SSO service of the selected identity provider.

A WAYF service is free to interact with the principal's browser in whatever manner it deems appropriate to determine the identity provider to which to relay the authentication request. This includes, but is not limited to, presenting lists, a search interface, heuristics based on client characteristics, etc.

Both service providers and WAYF services MAY use the Identity Provider Discovery profile defined in section 3.6 as a means of determining (and caching) a principal's identity provider(s).

3 Protocols and Profiles

This section defines the message exchanges required of Shibboleth implementations (primarily defined by SAML 1.1), and additional profiles governing the behavior of Shibboleth components.

3.1 Authentication Request and Response

To establish a security context at a service provider, Shibboleth combines an authentication request mechanism defined in this specification with the SAML 1.1 Browser/POST or Browser/Artifact profiles [SAMLBind]. An identity provider MAY initiate this process without an authentication request by directing the principal's browser through unspecified means to its inter-site transfer service with sufficient information to create the proper HTTP response.

3.1.1 Authentication Request

A Shibboleth authentication request is a URL-encoded message sent from a service provider (or another entity on its behalf, such as a WAYF service) to an identity provider's single sign-on service endpoint using the principal's browser. Any means of causing the browser to access the SSO service endpoint can be used; typically an HTTP redirect is used subsequent to the browser accessing a secured resource without a valid security context.

3.1.1.1 Message Format and Transmission

The HTTP request to the identity provider's SSO service endpoint MUST use the GET method and MUST contain the following URL-encoded query string parameters:

`providerId`

: The unique identifier of the requesting service provider

`shire`

: The assertion consumer service endpoint at the service provider to which to deliver the profile response

`target`

: Generally the URL of a resource accessed at the service provider, it is returned by the identity provider in the TARGET form control of the authentication response

The query string MAY contain the following optional parameter:

`time`

: The current time, in seconds elapsed since midnight, January 1st, 1970, as a string of up to 10 base10 digits

A WAYF service MUST relay the parameters that it receives from a service provider unchanged to the identity provider that is ultimately selected, except that it MUST replace the `time` parameter (if present) with a value generated at the time the browser is redirected to the identity provider's SSO service.

3.1.1.2 Processing Rules

The SSO service endpoint MUST process the supplied request and either issue an error to the browser or attempt to fulfill the request by eventually redirecting the browser to the inter-site transfer service (assuming such a redirect is necessary). If an error occurs, the identity provider MAY return a

<samlp:Response> in accordance with the Browser/POST profile that contains a <samlp:Status> element with a Value other than samlp:Success.

The target parameter MUST be used as the value of the TARGET form control or query parameter in the HTTP response returned by the inter-site transfer service, whether or not an error has occurred.

When using the Browser/POST profile, the shire parameter is used as the value of the ACTION attribute in the HTML form in the HTTP response returned by the inter-site transfer service, and is also the value placed in the Recipient attribute of the <samlp:Response> element encoded into the SAMLResponse form control.

When using the Browser/Artifact profile, the shire parameter is used as the URL in the Location header in the HTTP redirect response returned by the inter-site transfer service.

The providerId parameter MAY be used by the identity provider to customize the processing of the request based on its knowledge of or relationship with the service provider. Such customization might include, but is not limited to, the format of the principal's identifier to be returned in the assertion(s), the credential to use while signing the <samlp:Response> message, and the set of attributes to include with the authentication assertion, if any.

Note that if the service provider's identity is used as input to processing the request (which is almost always the case), then the identity provider MUST have some means to establish that the assertion consumer service endpoint in the shire parameter is in fact associated with the requesting service provider. Any mechanism to establish this relationship MAY be used, but some mechanism MUST be used unless the data in the authentication response is invariant with respect to the requesting service provider. The metadata profile described in section 3.7 is RECOMMENDED for this purpose.

Finally, the time parameter MAY be used as an indicator of the freshness of the request so that replayed requests, such as might be triggered by navigation of a browser's history list, can be detected. The parameter MUST NOT be used as part of any security measures.

3.1.1.3 Example

```
https://idp.example.org/SSO?shire=https%3A%2F%2Fsp.example.com%2FShibboleth.shire&
target=https%3A%2F%2Fsp.example.com%2Fcgi-bin%2Flogin.cgi&time=1084819377&
providerId=https%3A%2F%2Fsp.example.com%2Fshibboleth%2F
```

3.1.2 Browser/POST Authentication Response

When the Browser/POST profile is used to authenticate the principal, a signed SAML response containing an authentication assertion is delivered directly to the service provider in a form POST operation. The format of the SAML response and the associated processing rules are defined entirely by the SAML Browser/POST profile in [SAMLBind].

An identity provider MAY send a response without having received an authentication request; in such a case, the TARGET form control MUST contain a value expected to be understood by the service provider. In most cases, this SHOULD be the URL of a resource to be accessed at the service provider, but MAY contain other values by prior agreement.

Note that the identity provider MAY supply attributes within the <samlp:Response> message, at its discretion (this is implicitly permitted by the Browser/POST profile).

The assertion(s) returned in the response MUST be consistent with the profiles described in sections 3.3-3.5.

3.1.2.1 Example

The example below shows XML that might be base64-encoded into the SAMLResponse form control.

```
<Response
  IssueInstant="2003-04-17T00:46:02Z" MajorVersion="1" MinorVersion="1"
  Recipient="https://sp.example.com/Shibboleth.shire"
  ResponseID="_c7055387-af61-4fce-8b98-e2927324b306"
  xmlns="urn:oasis:names:tc:SAML:1.0:protocol"
  xmlns:samlp="urn:oasis:names:tc:SAML:1.0:protocol">
<ds:Signature xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
<ds:SignedInfo>
<ds:CanonicalizationMethod Algorithm="http://www.w3.org/2001/10/xml-exc-c14n#"/>
<ds:SignatureMethod Algorithm="http://www.w3.org/2000/09/xmldsig#rsa-sha1"/>
<ds:Reference URI="#_c7055387-af61-4fce-8b98-e2927324b306">
<ds:Transforms>
<ds:Transform Algorithm="http://www.w3.org/2000/09/xmldsig#enveloped-signature"/>
<ds:Transform Algorithm="http://www.w3.org/2001/10/xml-exc-c14n#">
<InclusiveNamespaces PrefixList="#default saml samlp ds xsd xsi"
  xmlns="http://www.w3.org/2001/10/xml-exc-c14n#"/>
</ds:Transform>
</ds:Transforms>
<ds:DigestMethod Algorithm="http://www.w3.org/2000/09/xmldsig#sha1"/>
<ds:DigestValue>TCDVSuG6grhyHbzhQFWFzGrxIPE=</ds:DigestValue>
</ds:Reference>
</ds:SignedInfo>
<ds:SignatureValue>
x/GyPbzmFEe85pGD3c1aXG4Vspb9V9jGCjwcRCKrtwPS6vdVNCcY5rHaFPYWkf+5
EIYcPzx+pX1h43SmwviCqXRjRtMANWbHLhWAptaK1ywS7gFgsD01qjyen3CP+m3D
w6vKhaqledl0BYyrIzb4KkHO4ahNyBVXbJwqv5pUaE4=</ds:SignatureValue>
<ds:KeyInfo>
<ds:X509Data>
<ds:X509Certificate>
MIICyjCCAjOgAwIBAgICAnUwDQYJKoZIhvcNAQEEBQAwgakxCzAJBgNVBAYTAlVT
MRIwEAYDVQQIEwlXaXNjb25zaW4xEDAOBgNVBAcTB01hZGlzb24xIDAeBgNVBAoT
F1VuaXZlcnNpdHkgb2YgV2lzY29uc2luMSswKQYDVQQLEyJEaXZpc2lvbiBvZiBJ
bmZvcm1hdGlvbiBUZWNobm9sb2d5MSUwIwYDVQQDExxIRVBLSSBTZXJ2ZXIgQ0Eg
LS0gMjAwMjA3MDFBMB4XDTAyMDcyNjA3Mjc1MVoXDTA2MDkwNDA3Mjc1MVowgYsx
CzAJBgNVBAYTAlVTMREwDwYDVQQIEwhNaWNoaWdhbjESMBAGA1UEBxMJQW5uIEFy
Ym9yMQ4wDAYDVQQKEwVVQ0FJRDEcMBoGA1UEAxMTc2hpYjEuaW50ZXJuZXQyLmVk
dTEnMCUGCSqGSIb3DQEJARYYcm9vdEBzaGliMS5pbnRlcm5ldDIuZWR1MIGfMA0G
CSqGSIb3DQEBAQUAA4GNADCBiQKBgQDZSAb2sxvhAXnXVIVTx8vuRay+x50z7GJj
IHRYQgIv6IqaGG04eTcyVMhoekE0b45QgvBIaOAPSZBl13R6+KYiE7x4XAWIrCP+
c2MZVeXeTgV3Yz+USLg2Y1on+Jh4HxwkPFmZBctyXiUr6DxF8rvoP9W7O27rhRjE
pmqOIfGTWQIDAQABox0wGzAMBgNVHRMBAf8EAjAAMAsGA1UdDwQEAwIFoDANBgkq
hkiG9w0BAQQFAAOBgQBfDqEW+OI3jqBQHIBzhujN/PizdN7s/z4D5d3pptWDJf2n
qgi7lFV6MDkhmTvTqBtjmNk3No7v/dnP6Hr7wHxvCCRwubnmIfZ6QZAv2FU78pLX
8I3bsbmRAUg4UP9hH6ABVq4KQKMknxu1xQxLhpR1ylGPdiowMNTrEG8cCx3w/w==
</ds:X509Certificate>
</ds:X509Data>
</ds:KeyInfo>
</ds:Signature>
<Status><StatusCode Value="samlp:Success"/></Status>
<Assertion
  AssertionID="_a75adf55-01d7-40cc-929f-dbd8372ebdfc"
  IssueInstant="2003-04-17T00:46:02Z"
  Issuer="https://idp.example.org/shibboleth/"
  MajorVersion="1" MinorVersion="1"
  xmlns="urn:oasis:names:tc:SAML:1.0:assertion">
<Conditions NotBefore="2003-04-17T00:46:02Z" NotOnOrAfter="2003-04-17T00:51:02Z">
<AudienceRestrictionCondition>
<Audience>http://sp.example.com/shibboleth/</Audience>
</AudienceRestrictionCondition>
</Conditions>
<AuthenticationStatement
  AuthenticationInstant="2003-04-17T00:46:00Z"
  AuthenticationMethod="urn:oasis:names:tc:SAML:1.0:am:password">
<Subject>
<NameIdentifier Format="urn:mace:shibboleth:1.0:nameIdentifier"
  NameQualifier="https://idp.example.org/shibboleth/">
```

```
3F7B3DCF-1674-4ecd-92C8-1544F346BAF8
</NameIdentifier>
<SubjectConfirmation>
<ConfirmationMethod>urn:oasis:names:tc:SAML:1.0:cm:bearer</ConfirmationMethod>
</SubjectConfirmation>
</Subject>
<SubjectLocality IPAddress="127.0.0.1"/>
</AuthenticationStatement>
</Assertion>
</Response>
```

3.1.3 Browser/Artifact Authentication Response

When the Browser/Artifact profile is used to authenticate the principal, one or more SAML artifacts are issued to the service provider and transmitted in the query string of an HTTP redirect response. The format of the HTTP response and the associated processing rules are defined entirely by the SAML Browser/Artifact profile in [SAMLBind].

An identity provider MAY send a response without having received an authentication request; in such a case, the `TARGET` parameter MUST contain a value expected to be understood by the service provider. In most cases, this SHOULD be the URL of a resource to be accessed at the service provider, but MAY contain other values by prior agreement.

Upon receiving the artifact(s), the service provider uses a SAML request/response protocol binding to resolve the artifact(s) into the corresponding SAML assertion(s), in accordance with [SAMLBind].

It is RECOMMENDED that service providers enforce a single-use semantic on the artifact values they receive, to prevent an attacker from interfering with the resolution of an artifact by a user agent and then resubmitting it to the service provider. If an attempt to resolve an artifact does not complete successfully, the artifact SHOULD be placed into a blocked artifact list for a period of time that exceeds a reasonable acceptance period during which the identity provider would successfully resolve the artifact.

Note that the identity provider MAY supply attributes within the SAML assertions it returns in response to an artifact lookup, at its discretion (this is implicitly permitted by the Browser/Artifact profile).

The assertion(s) returned in the response MUST be consistent with the profiles described in sections 3.3-3.5.

3.1.3.1 Example

TODO

3.2 Attribute Request and Response

To support out of band attribute exchange from an identity provider to a service provider, Shibboleth specifies the use of the SAML request/response protocol using the `<samlp:AttributeQuery>` element, as defined in [SAMLCore].

As noted in section 2.1.2, Shibboleth Attribute Authorities MUST implement some form of access control over attribute release. They MAY support unauthenticated queries, but SHOULD limit the release of information in such a case, subject to administrative policy.

3.2.1 Attribute Request

An attribute request message is a `<samlp:Request>` element containing a `<samlp:AttributeQuery>` element.

Additionally, the `Resource` attribute in the query MUST contain the requesting service provider's unique identifier. This is used to make up for the lack of an explicit element or attribute to indicate the issuing service provider.

3.2.1.1 Example

The example shown does not include any surrounding context from the binding, such as a SOAP envelope.

```
<Request xmlns="urn:oasis:names:tc:SAML:1.0:protocol"
 xmlns:saml="urn:oasis:names:tc:SAML:1.0:assertion"
 xmlns:samlp="urn:oasis:names:tc:SAML:1.0:protocol"
 IssueInstant="2004-05-25T22:46:10Z" MajorVersion="1" MinorVersion="1"
 RequestID="aaf2319617732113474afe114412ab72">
<AttributeQuery Resource="http://sp.example.com/shibboleth/">
<Subject xmlns="urn:oasis:names:tc:SAML:1.0:assertion">
<NameIdentifier Format="urn:mace:shibboleth:1.0:nameIdentifier"
 NameQualifier="http://idp.example.org/shibboleth/">
 082dd87d-f380-4fd6-8726-694ef2bb71e9
</NameIdentifier>
</Subject>
</AttributeQuery>
</Request>
```

3.2.2 Attribute Response

An attribute response is a `<samlp:Response>` element containing a `<samlp:Status>` and zero or more `<saml:Assertion>` elements. The assertion(s), if any, SHOULD contain only attribute statements. The assertion(s) MUST be consistent with the profiles described in sections 3.3 and 3.5.

3.2.2.1 Example

The example shown does not include any surrounding context from the binding, such as a SOAP envelope.

```
<Response xmlns="urn:oasis:names:tc:SAML:1.0:protocol"
 xmlns:saml="urn:oasis:names:tc:SAML:1.0:assertion"
 xmlns:samlp="urn:oasis:names:tc:SAML:1.0:protocol"
 InResponseTo="aaf2319617732113474afe114412ab72"
 IssueInstant="2004-05-25T22:46:10.940Z" MajorVersion="1" MinorVersion="1"
 ResponseID="b07b804c7c29ea1673004f3d6f7928ac">
<Status><StatusCode Value="samlp:Success"></StatusCode></Status>
<Assertion xmlns="urn:oasis:names:tc:SAML:1.0:assertion"
 AssertionID="a144e8f3adad594a9649924517abe933"
 IssueInstant="2004-05-25T22:46:10.939Z" MajorVersion="1" MinorVersion="1"
 Issuer="https://idp.example.org/shibboleth/">
<Conditions NotBefore="2004-05-25T22:46:10.939Z"
 NotOnOrAfter="2004-05-25T23:16:10.939Z">
</Conditions>
<AttributeStatement>
<Subject>
 <NameIdentifier Format="urn:mace:shibboleth:1.0:nameIdentifier"
  NameQualifier="https://idp.example.org/shibboleth/">
082dd87d-f380-4fd6-8726-694ef2bb71e9
</NameIdentifier>
</Subject>
<Attribute AttributeName="urn:mace:dir:attribute-def:eduPersonEntitlement"
 AttributeNamespace="urn:mace:shibboleth:1.0:attributeNamespace:uri">
 <AttributeValue>urn:mace:oclc.org:100277910</AttributeValue>
 <AttributeValue>urn:mace:example.edu:exampleEntitlement</AttributeValue>
 <AttributeValue>urn:mace:incommon:entitlement:common:1</AttributeValue>
</Attribute>
```

```
    </AttributeStatement>
    </Assertion>
    </Response>
```

3.3 NameIdentifier Profile

SAML identifies principals in assertions using the `<saml:NameIdentifier>` element, which contains a pair of descriptive XML attributes, `Format` and `NameQualifier`.

Shibboleth permits any legal SAML name identifier to be used, and also defines a special kind of identifier with the `Format` value of `urn:mace:shibboleth:1.0:nameIdentifier`. Identifiers of this format MUST adhere to the following criteria:

- The identifier has transient semantics and SHOULD be treated as an opaque and temporary value by the relying party.
- The identifier MUST be constructed in accordance with the rules for SAML identifiers (see Section 1.2.3 of [SAMLCore]), and SHOULD NOT exceed a length of 256 characters.
- If present, the `NameQualifier` attribute MUST be set to the unique identifier of the identity provider issuing the assertion containing the element.

3.4 Authentication Assertion Profile

The authentication assertions issued by Shibboleth identity providers MUST adhere to the `<saml:NameIdentifier>` profile defined in section 3.3.

Furthermore, the `Issuer` attribute MUST be set to the unique identifier of the identity provider issuing the assertion.

3.5 Attribute Assertion Profile

The attribute assertions issued by Shibboleth identity providers MUST adhere to the `<saml:NameIdentifier>` profile defined in section 3.3.

Furthermore, the `Issuer` attribute MUST be set to the unique identifier of the identity provider issuing the assertion.

SAML does not constrain the naming of attributes or the syntax of values. It is RECOMMENDED that Shibboleth attributes be identified with a URI. In such a case, the `AttributeName` XML attribute MUST contain the URI that identifies the attriibute, and the `AttributeNamespace` XML attribute SHOULD contain the value `urn:mace:shibboleth:1.0:attributeNamespace:uri`. It MAY contain a different value by prior agreement.

It is also RECOMMENDED that attribute values be expressed, when possible, as a single XML text node within the `<saml:AttributeValue>` element, using an XML Schema built-in datatype ([Schema2]). In such a case, the `xsi:type` XML attribute SHOULD be used to indicate the built-in datatype that describes the allowable syntax of the value.

If the value is not from a built-in datatype, the `xsi:type` attribute MAY be used to indicate the extension type in use, but implementers are cautioned that this may require a relying party to be aware of the extension in order to process the assertion. Omitting the `xsi:type` attribute is RECOMMENDED in such a case.

3.6 Identity Provider Discovery Profile

[SAML2Prof] defines an "introduction" profile by which a service provider can discover which identity providers a principal is using with the Browser SSO profiles. In deployments having more than one identity provider, service providers need a means to discover which identity provider(s) a principal uses. The discovery profile relies on a cookie that is written in a domain that is common between identity providers and service providers in a deployment. The domain that the deployment predetermines is known as the common domain in this profile, and the cookie containing the list of identity providers is known as the common domain cookie.

Shibboleth specifies the use of this profile, unchanged.

3.7 Metadata Profile

SAML (and by extension Shibboleth) profiles require agreements between system entities regarding identifiers, binding/profile support and endpoints, certificates and keys, and so forth. A metadata specification is useful for describing this information in a standardized way.

Although SAML 1.1 did not include such a specification, SAML 2.0 includes one in [SAML2Meta]. Shibboleth specifies a profile of this specification for use with the SAML 1.1-based profiles and exchanges expected between system entities. Shibboleth identity and service providers SHOULD describe their characteristics using this profile.

SAML 2.0 metadata describes a system entity by means of the `<md:EntityDescriptor>` element and a set of "roles" supported by the entity. Role elements applicable to Shibboleth include `<md:IDPSSODescriptor>`, `<md:SPSSODescriptor>`, `<md:AttributeAuthorityDescriptor>`, and `<md:AttributeConsumerDescriptor>`.

Multiple Shibboleth entities can be collected into groups using the `<md:EntitiesDescriptor>` element.

Specific use of these elements by Shibboleth MUST adhere to the profile outlined in the following sections.

3.7.1 Element <md:EntitiesDescriptor>

The `Name` XML attribute, if present, SHOULD be a URI.

In other respects, this element is used as described in [SAML2Meta].

3.7.2 Element <md:EntityDescriptor>

A Shibboleth identity or service provider SHOULD be represented by exactly one `<md:EntityDescriptor>`. It's unique identifier MUST be placed in the `entityID` XML attribute.

If a URL is used as the unique identifier of an entity, it is RECOMMENDED that resolving this URL produce a SAML metadata document containing a single `<md:EntityDescriptor>` representing that entity.

For the purposes of Shibboleth, only the `<md:IDPSSODescriptor>`, `<md:SPSSODescriptor>`, `<md:AttributeAuthorityDescriptor>`, and `<md:AttributeConsumerDescriptor>` elements are defined. Use of any other element of a type derived from **md:RoleDescriptorType** is undefined.

In other respects, this element is used as described in [SAML2Meta].

3.7.3 Element <md:IDPSSODescriptor>

A Shibboleth identity provider MUST include this element in its metadata. The `protocolSupportEnumeration` XML attribute MUST include at least the values `urn:oasis:names:tc:SAML:1.0:protocol` and `urn:mace:shibboleth:1.0`.

At least one of its `<md:SingleSignOnService>` elements' `Binding` XML attribute MUST contain the value `urn:mace:shibboleth:1.0`. The location specified in its `Location` XML attribute MUST support the Authentication Request profile defined in section 3.1.1.

In other respects, this element is used as described in [SAML2Meta].

3.7.4 Element <md:AttributeAuthorityDescriptor>

A Shibboleth identity provider that supports an Attribute Authority service as described in section 2.1.2 MUST include this element in its metadata. The `protocolSupportEnumeration` XML attribute MUST include at least the value `urn:oasis:names:tc:SAML:1.0:protocol`.

The SAML 2.0 `<Attribute>` element (which can appear in this element) MAY be used to document support for particular SAML 1.1 attributes and values. By convention, the `NameFormat` and `Name` XML attributes MUST be used to represent the SAML 1.1 `AttributeNamespace` and `AttributeName` XML attributes respectively.

In other respects, this element is used as described in [SAML2Meta].

3.7.5 Element <md:SPSSODescriptor>

A Shibboleth service provider MUST include this element in its metadata. The `protocolSupportEnumeration` XML attribute MUST include at least the value `urn:oasis:names:tc:SAML:1.0:protocol`.

Its `<md:AssertionConsumerService>` elements' `Binding` XML attributes MUST contain the value `urn:oasis:names:tc:SAML:1.0:profiles:browser-post` to indicate support for the SAML 1.1 Browser/POST profile, or `urn:oasis:names:tc:SAML:1.0:profiles:artifact-01` to indicate support for the SAML 1.1 Browser/Artifact profile.

In other respects, this element is used as described in [SAML2Meta].

3.7.6 Element <md:AttributeConsumerDescriptor>

A Shibboleth service provider that utilizes SAML attributes MAY include this element in its metadata. The `protocolSupportEnumeration` XML attribute MUST include at least the value `urn:oasis:names:tc:SAML:1.0:protocol`.

The SAML 2.0 `<Attribute>` element (which can appear in this element) MAY be used to document requirements for particular SAML 1.1 attributes and values. By convention, the `NameFormat` and `Name` XML attributes MUST be used to represent the SAML 1.1 `AttributeNamespace` and `AttributeName` XML attributes respectively.

In other respects, this element is used as described in [SAML2Meta].

4 Security and Privacy Considerations

As Shibboleth is principally a set of SAML profiles, the general security and privacy considerations that apply to SAML apply to Shibboleth (see [SAMLSecure]).

4.1 Additional Browser Profile Considerations

4.1.1 Information Leakage and Impersonation

The SAML Browser profiles contain a presumption that they are initiated by an identity provider. Assertion information (or an artifact) is therefore sent directly to service providers using locations known to be appropriate and secure.

The use of the Authentication Request flow defined by section 3.1.1 introduces the possibility of a malicious entity impersonating another service provider by identifying itself as one provider while indicating that the authentication response be delivered to it instead. In the case of the POST profile, this can result in unintended leakage of personally identifying information within the assertion(s) to the attacker. In the case of the Artifact profile, the attacker could potentially impersonate the principal my immediately submitting the artifact(s) to the real service provider, who can subsequently authenticate to the identity provider to obtain the assertion.

To mitigate both attacks, it is critical for the identity provider to securely associate the assertion consumer service location to be used with the service provider to whom the assertion(s) or artifact(s) are issued. A digital signature over the authentication request would be an alternate countermeasure, but this is not supported by the current profile.

Another source of information leakage is the `target` parameter sent with the Authentication Request URL and returned in both Browser profiles. This parameter is informally associated with the resource URL being requested from the service provider, but it is in fact potentially opaque to the identity provider. Exposing the resource URL makes unneeded information available about the principal's activities to the identity provider and possibly various log files. It is therefore RECOMMENDED that service providers utilize some kind of obfuscation, mapping, encryption, or other mechanism to prevent the exposure of resource URLs in plaintext in this parameter.

Finally, when user privacy in service provider interactions is a consideration or requirement, Shibboleth provides an explicit mechanism for effective anonymity through the use of a transient identifier (see section 3.3), provided that the SAML attributes supplied in conjunction with it or subsequently are sufficiently generic so as not to inadvertently narrow down or identify the principal. It is important to avoid faciliating coordination by one or more service providers in correlating the principal's activity by insuring that a different transient identifier is used across time and space. Therefore, it is RECOMMENDED that a given transient identifier not be used more than once in assertions issued by an identity provider for a principal in different executions of a Browser profile.

4.1.2 Time Synchronization

The Browser/POST profile relies on tight synchronization of clocks between the identity and service providers to limit the usefulness of the bearer assertion. Additionally, assertions may be issued with expiration conditions that cannot be effectively honored if clock skew is excessive.

It is RECOMMENDED that secure time sources be used to maintain clock synchronization within the bounds usually associated with protocols like Kerberos (i.e. on the order of 5 minutes or less).

5 References

The following works are cited in the body of this specification.

5.1 Normative References

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[RFC 2246] T. Dierks, C. Allen. *The TLS Protocol Version 1.0*. IETF RFC 2246, January 1999. http://www.ietf.org/rfc/rfc2246.txt.

[RFC 2396] T. Berners-Lee et al. *Uniform Resource Identifiers (URI): Generic Syntax.* IETF RFC 2396, August, 1998. http://www.ietf.org/rfc/rfc2396.txt.

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[SAMLBind] E. Maler et al. *Bindings and Profiles for the OASIS Security Assertion Markup Language (SAML)*. OASIS, September 2003. Document ID oasis-sstc-saml-bindings-profiles-1.1. http://www.oasis-open.org/committees/security/.

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[SAMLMeta-xsd] S. Cantor et al., SAML metadata schema. OASIS SSTC, September 2004. Document ID sstc-saml-schema-metadata-2.0. See http://www.oasis-open.org/committees/security/.

[Schema2] P. V. Biron et al. *XML Schema Part 2: Datatypes*. World Wide Web Consortium Recommendation, May 2001. http://www.w3.org/TR/xmlschema-2/.

5.2 Non-Normative References

[SAML2Gloss] J. Hodges et al., *Glossary for the OASIS Security Assertion Markup Language (SAML) V2.0*. OASIS SSTC, September 2004. Document ID sstc-saml-glossary-2.0-cd-02. See http://www.oasis-open.org/committees/security/.

[LibertyBind] J. Kemp et al., *Liberty Bindings and Profiles Specification* Version 1.2, Liberty Alliance Project, August 2004, http://www.projectliberty.org/specs/v1_2/liberty-architecture-bindings-profiles-v1.2.pdf.

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