Bindings for the OASIS Security Assertion Markup Language (SAML) V2.0

Committee Draft 01, 18 August 2004

Document identifier:
sstc-saml-bindings-2.0-cd-01

Location:
http://www.oasis-open.org/committees/documents.php?wg_abbrev=security

Editors:
Scott Cantor, Internet2
Frederick Hirsch, Nokia
John Kemp, Nokia
Rob Philpott, RSA Security
Eve Maler, Sun Microsystems

SAML V2.0 Contributors:
Conor P. Cahill, AOL
Hal Lockhart, BEA Systems
Michael Beach, Boeing
Rick Randall, Booze, Allen, Hamilton
Tim Alsop, Cybersafe
Nick Ragouzis, Enosis
John Hughes, Entegrity Solutions
Paul Madsen, Entrust
Irving Reid, Hewlett-Packard
Paula Austel, IBM
Maryann Hondo, IBM
Michael McIntosh, IBM
Tony Nadalin, IBM
Scott Cantor, Internet2
RL 'Bob' Morgan, Internet2
Rebekah Metz, NASA
Prateek Mishra, Netegrity
Peter C Davis, Neustar
Frederick Hirsch, Nokia
John Kemp, Nokia
Charles Knouse, Oblix
Steve Anderson, OpenNetwork
John Linn, RSA Security
Rob Philpott, RSA Security
Jahan Moreh, Sigaba
Anne Anderson, Sun Microsystems
Jeff Hodges, Sun Microsystems
Eve Maler, Sun Microsystems

Ron Monzillo, Sun Microsystems
Greg Whitehead, Trustgenix

Abstract:

This specification defines protocol bindings for the use of SAML assertions and request-response messages in communications protocols and frameworks.

Status:

This is a **Committee Draft** approved by the Security Services Technical Committee on 17 August 2004.

Committee members should submit comments and potential errata to the security-services@lists.oasis-open.org list. Others should submit them by filling out the web form located at http://www.oasis-open.org/committees/comments/form.php?wg_abbrev=security. The committee will publish on its web page (http://www.oasis-open.org/committees/security) a catalog of any changes made to this document as a result of comments.

For information on whether any patents have been disclosed that may be essential to implementing this specification, and any offers of patent licensing terms, please refer to the Intellectual Property Rights web page for the Security Services TC (http://www.oasis-open.org/committees/security/ipr.php).

Table of Contents

1 Introduction

This document specifies SAML protocol bindings for the use of SAML assertions and request-response messages in communications protocols and frameworks.

[SAMLCore] defines the SAML assertions and request-response messages themselves, and [SAMLProfile] defines specific usage patterns that reference both [SAMLCore] and bindings defined in this specification or elsewhere.

1.1 Protocol Binding Concepts

Mappings of SAML request-response message exchanges onto standard messaging or communication protocols are called SAML *protocol bindings* (or just *bindings*). An instance of mapping SAML request-response message exchanges into a specific communication protocol <FOO> is termed a *<FOO> binding for SAML* or a *SAML <FOO> binding*.

For example, a SAML SOAP binding describes how SAML request and response message exchanges are mapped into SOAP message exchanges.

The intent of this specification is to specify a selected set of bindings in sufficient detail to ensure that independently implemented SAML-conforming software can interoperate when using standard messaging or communication protocols.

Unless otherwise specified, a binding should be understood to support the transmission of any SAML protocol message derived from the **samlp:RequestAbstractType** and **samlp:StatusResponseType** types. Further, when a binding refers to "SAML requests and responses", it should be understood to mean any protocol messages derived from those types.

For other terms and concepts that are specific to SAML, refer to the SAML glossary [SAMLGloss].

1.2 Notation

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this specification are to be interpreted as described in IETF RFC 2119 [RFC2119].

```
Listings of productions or other normative code appear like this.
```

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

Note: Non-normative notes and explanations appear like this.

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

Prefix	XML Namespace	Comments
`saml:`	urn:oasis:names:tc:SAML:2.0:assertion	This is the SAML V2.0 assertion namespace [SAMLCore].
`samlp:`	urn:oasis:names:tc:SAML:2.0:protocol	This is the SAML V2.0 protocol namespace [SAMLCore].
`ds:`	http://www.w3.org/2000/09/xmldsig#	This namespace is defined in the XML Signature Syntax and Processing specification [XMLSig] and its governing schema.

Prefix	XML Namespace	Comments
`SOAP-ENV:`	http://schemas.xmlsoap.org/soap/envelope	This namespace is defined in SOAP V1.1 [SOAP1.1].

This specification uses the following typographical conventions in text: `<ns:Element>`, `XMLAttribute`, **Datatype**, `OtherKeyword`. In some cases, angle brackets are used to indicate non-terminals, rather than XML elements; the intent will be clear from the context.

2 Guidelines for Specifying Additional Protocol Bindings

This specification defines a selected set of protocol bindings, but others will possibly be developed in the future. It is not possible for the OASIS Security Services Technical Committee (SSTC) to standardize all of these additional bindings for two reasons: it has limited resources and it does not own the standardization process for all of the technologies used. This section offers guidelines for third parties who wish to specify additional bindings.

The SSTC welcomes submission of proposals from OASIS members for new protocol bindings. OASIS members may wish to submit these proposals for consideration by the SSTC in a future version of this specification. Other members may simply wish to inform the committee of their work related to SAML. Please refer to the SSTC web site for further details on how to submit such proposals to the SSTC.

Following is a checklist of issues that MUST be addressed by each protocol binding:

1. Specify three pieces of identifying information: a URI that uniquely identifies the protocol binding, postal or electronic contact information for the author, and a reference to previously defined bindings or profiles that the new binding updates or obsoletes.
2. Describe the set of interactions between parties involved in the binding. Any restrictions on applications used by each party and the protocols involved in each interaction must be explicitly called out.
3. Identify the parties involved in each interaction, including how many parties are involved and whether intermediaries may be involved.
4. Specify the method of authentication of parties involved in each interaction, including whether authentication is required and acceptable authentication types.
5. Identify the level of support for message integrity, including the mechanisms used to ensure message integrity.
6. Identify the level of support for confidentiality, including whether a third party may view the contents of SAML messages and assertions, whether the binding requires confidentiality, and the mechanisms recommended for achieving confidentiality.
7. Identify the error states, including the error states at each participant, especially those that receive and process SAML assertions or messages.
8. Identify security considerations, including analysis of threats and description of countermeasures.
9. Identify metadata considerations, such that support for a binding involving a particular communications protocol or used in a particular profile can be advertised in an efficient and interoperable way.

3 Protocol Bindings

The following sections define the protocol bindings that are specified as part of the SAML standard.

3.1 General Considerations

The following sections describe normative characteristics of all protocol bindings defined for SAML.

3.1.1 Use of RelayState

Some bindings define a "RelayState" mechanism for preserving and conveying state information. When such a mechanism is used in conveying a request message as the initial step of a SAML protocol, it places requirements on the selection and use of the binding subsequently used to convey the response. Namely, if a SAML request message is accompanied by RelayState data, then the SAML responder MUST return its SAML protocol response using a binding that also supports a RelayState mechanism, and it MUST place the exact RelayState data it received with the request into the corresponding RelayState parameter in the response.

3.1.2 Security

Unless stated otherwise, these security statements about apply to all bindings. Bindings may also make additional statements about these security features.

3.1.2.1 Use of SSL 3.0 or TLS 1.0

Unless otherwise specified, in any SAML binding's use of SSL 3.0 [SSL3] or TLS 1.0 [RFC2246], servers MUST authenticate to clients using a X.509 v3 certificate. The client MUST establish server identity based on contents of the certificate (typically through examination of the certificate's subject DN field).

TLS-capable implementations MUST implement the TLS_RSA_WITH_3DES_EDE_CBC_SHA cipher suite and MAY implement the TLS_RSA_WITH_AES_128_CBC_SHA cipher suite [AES].

FIPS TLS-capable implementations MUST implement the coresponding TLS_RSA_FIPS_WITH_3DES_EDE_CBC_SHA cipher suite and MAY implement the corresponding TLS_RSA_FIPS_AES_128_CBC_SHA cipher suite [AES] [FIPS].

SSL-capable implementations MUST implement the SSL_RSA_WITH_3DES_EDE_CBC_SHA cipher suite.

FIPS SSL-capable implementations MUST implement the FIPS cipher suite corresponding to the SSL SSL_RSA_WITH_3DES_EDE_CBC_SHA cipher suite [FIPS].

3.1.2.2 Data Origin Authentication

Authentication of both the SAML requester and the SAML responder associated with a message is OPTIONAL and depends on the environment of use. Authentication mechanisms available at the SOAP message exchange layer or from the underlying substrate protocol (for example in many bindings the SSL/TLS or HTTP protocol) MAY be utilized to provide data origin authentication.

Transport authentication will not meet end-end origin-authentication requirements in bindings where the SAML protocol message passes through an intermediary – in this case message authentication is recommended.

Note that SAML itself offers mechanisms for parties to authenticate to one another, but in addition SAML may use other authentication mechanisms to provide security for SAML itself.

3.1.2.3 Message Integrity

Message integrity of both SAML requests and SAML responses is OPTIONAL and depends on the environment of use. The security layer in the underlying substrate protocol or a mechanism at the SOAP message exchange layer MAY be used to ensure message integrity.

Transport integrity will not meet end-end integrity requirements in bindings where the SAML protocol message passes through an intermediary – in this case message integrity is recommended.

3.1.2.4 Message Confidentiality

Message confidentiality of both SAML requests and SAML responses is OPTIONAL and depends on the environment of use. The security layer in the underlying substrate protocol or a mechanism at the SOAP message exchange layer MAY be used to ensure message confidentiality.

Transport confidentiality will not meet end-end confidentiality requirements in bindings where the SAML protocol message passes through an intermediary.

3.1.2.5 Security Considerations

Before deployment, each combination of authentication, message integrity, and confidentiality mechanisms SHOULD be analyzed for vulnerability in the context of the specific protocol exchange and the deployment environment. See specific protocol processing rules in [SAMLCore] and the SAML security considerations document [SAMLSecure] for a detailed discussion.

[RFC2617] describes possible attacks in the HTTP environment when basic or message-digest authentication schemes are used.

Special care should be given to the impact of possible caching on security.

3.2 SAML SOAP Binding

SOAP is a lightweight protocol intended for exchanging structured information in a decentralized, distributed environment [SOAP1.1]. It uses XML technologies to define an extensible messaging framework providing a message construct that can be exchanged over a variety of underlying protocols. The framework has been designed to be independent of any particular programming model and other implementation specific semantics. Two major design goals for SOAP are simplicity and extensibility. SOAP attempts to meet these goals by omitting, from the messaging framework, features that are often found in distributed systems. Such features include but are not limited to "reliability", "security", "correlation", "routing", and "Message Exchange Patterns" (MEPs).

A SOAP message is fundamentally a one-way transmission between SOAP nodes from a SOAP sender to a SOAP receiver, possibly routed through one or more SOAP intermediaries. SOAP messages are expected to be combined by applications to implement more complex interaction patterns ranging from request/response to multiple, back-and-forth "conversational" exchanges [SOAP-PRIMER].

SOAP defines an XML message envelope that includes header and body sections, allowing data and control information to be transmitted. SOAP also defines processing rules associated with this envelope and an HTTP binding for SOAP message transmission.

The SAML SOAP binding defines how to use SOAP to send and receive SAML requests and responses.

Like SAML, SOAP can be used over multiple underlying transports. This binding has protocol-independent aspects, but also calls out the use of SOAP over HTTP as REQUIRED (mandatory to implement).

3.2.1 Required Information

Identification: urn:oasis:names:tc:SAML:2.0:bindings:SOAP

Contact information: security-services-comment@lists.oasis-open.org

Description: Given below.

Updates: urn:oasis:names:tc:SAML:1.0:bindings:SOAP-binding

3.2.2 Protocol-Independent Aspects of the SAML SOAP Binding

The following sections define aspects of the SAML SOAP binding that are independent of the underlying protocol, such as HTTP, on which the SOAP messages are transported. Note this binding only supports the use of SOAP 1.1.

3.2.2.1 Basic Operation

SOAP 1.1 messages consist of three elements: an envelope, header data, and a message body. SAML request-response protocol elements MUST be enclosed within the SOAP message body.

SOAP 1.1 also defines an optional data encoding system. This system is not used within the SAML SOAP binding. This means that SAML messages can be transported using SOAP without re-encoding from the "standard" SAML schema to one based on the SOAP encoding.

The system model used for SAML conversations over SOAP is a simple request-response model.

1. A system entity acting as a SAML requester transmits a SAML request element within the body of a SOAP message to a system entity acting as a SAML responder. The SAML requester MUST NOT include more than one SAML request per SOAP message or include any additional XML elements in the SOAP body.

2. The SAML responder MUST return either a SAML response element within the body of another SOAP message or generate a SOAP fault. The SAML responder MUST NOT include more than one SAML response per SOAP message or include any additional XML elements in the SOAP body. If a SAML responder cannot, for some reason, process a SAML request, it MUST generate a SOAP fault. SOAP fault codes MUST NOT be sent for errors within the SAML problem domain, for example, inability to find an extension schema or as a signal that the subject is not authorized to access a resource in an authorization query. (SOAP 1.1 faults and fault codes are discussed in [SOAP1.1] §4.1.)

On receiving a SAML response in a SOAP message, the SAML requester MUST NOT send a fault code or other error messages to the SAML responder. Since the format for the message interchange is a simple request-response pattern, adding additional items such as error conditions would needlessly complicate the protocol.

[SOAP1.1] references an early draft of the XML Schema specification including an obsolete namespace. SAML requesters SHOULD generate SOAP documents referencing only the final XML schema namespace. SAML responders MUST be able to process both the XML schema namespace used in [SOAP1.1] as well as the final XML schema namespace.

3.2.2.2 SOAP Headers

A SAML requester in a SAML conversation over SOAP MAY add arbitrary headers to the SOAP message. This binding does not define any additional SOAP headers.

> **Note:** The reason other headers need to be allowed is that some SOAP software and libraries might add headers to a SOAP message that are out of the control of the SAML-aware process. Also, some headers might be needed for underlying protocols that require

routing of messages or by message security mechanisms.

A SAML responder MUST NOT require any headers in the SOAP message in order to process the SAML message correctly itself, but MAY require additional headers that address underlying routing or message security requirements.

> **Note:** The rationale is that requiring extra headers will cause fragmentation of the SAML standard and will hurt interoperability.

3.2.3 Use of SOAP over HTTP

A SAML processor that claims conformance to the SAML SOAP binding MUST implement SAML over SOAP over HTTP. This section describes certain specifics of using SOAP over HTTP, including HTTP headers, caching, and error reporting.

The HTTP binding for SOAP is described in [SOAP1.1] §6.0. It requires the use of a `SOAPAction` header as part of a SOAP HTTP request. A SAML responder MUST NOT depend on the value of this header. A SAML requester MAY set the value of `SOAPAction` header as follows:

```
http://www.oasis-open.org/committees/security
```

3.2.3.1 HTTP Headers

A SAML requester in a SAML conversation over SOAP over HTTP MAY add arbitrary headers to the HTTP request. This binding does not define any additional HTTP headers.

> **Note:** The reason other headers need to be allowed is that some HTTP software and libraries might add headers to an HTTP message that are out of the control of the SAML-aware process. Also, some headers might be needed for underlying protocols that require routing of messages or by message security mechanisms.

A SAML responder MUST NOT require any headers in the HTTP request to correctly process the SAML message itself, but MAY require additional headers that address underlying routing or message security requirements.

> **Note:** The rationale is that requiring extra headers will cause fragmentation of the SAML standard and will hurt interoperability.

3.2.3.2 Caching

HTTP proxies should not cache SAML protocol messages. To insure this, the following rules SHOULD be followed.

When using HTTP 1.1, requesters SHOULD:

- Include a `Cache-Control` header field set to "`no-cache, no-store`".
- Include a `Pragma` header field set to "`no-cache`".

When using HTTP 1.1, responders SHOULD:

- Include a `Cache-Control` header field set to "`no-cache, no-store, must-revalidate, private`".
- Include a `Pragma` header field set to "`no-cache`".
- NOT include a Validator, such as a `Last-Modified` or ETag header.

3.2.3.3 Error Reporting

A SAML responder that refuses to perform a message exchange with the SAML requester SHOULD return a "`403 Forbidden`" response. In this case, the content of the HTTP body is not significant.

As described in [SOAP1.1] § 6.2, in the case of a SOAP error while processing a SOAP request, the SOAP HTTP server MUST return a "`500 Internal Server Error`" response and include a SOAP message in the response with a SOAP `<SOAP-ENV:fault>` element. This type of error SHOULD be returned for SOAP-related errors detected before control is passed to the SAML processor, or when the SOAP processor reports an internal error (for example, the SOAP XML namespace is incorrect, the SAML schema cannot be located, the SAML processor throws an exception, and so on).

In the case of a SAML processing error, the SOAP HTTP server MUST respond with "`200 OK`" and include a SAML-specified `<samlp:Status>` element in the SAML response within the SOAP body. Note that the `<samlp:Status>` element does not appear by itself in the SOAP body, but only within a SAML response of some sort.

For more information about the use of SAML status codes, see the SAML assertions and protocols specification [SAMLCore].

3.2.3.4 Metadata Considerations

Support for the SOAP binding SHOULD be reflected by indicating either a URL endpoint at which requests contained in SOAP messages for a particular protocol or profile are to be sent, or alternatively with a WSDL port/endpoint definition.

3.2.3.5 Example SAML Message Exchange Using SOAP over HTTP

Following is an example of a query that asks for an assertion containing an attribute statement from a SAML attribute authority.

```
POST /SamlService HTTP/1.1
Host: www.example.com
Content-Type: text/xml
Content-Length: nnn
SOAPAction: http://www.oasis-open.org/committees/security
<SOAP-ENV:Envelope
    xmlns:SOAP-ENV=”http://schemas.xmlsoap.org/soap/envelope/”>
    <SOAP-ENV:Body>
        <samlp:AttributeQuery xmlns:samlp:=”…”
xmlns:saml=”…” xmlns:ds=”…” ID=”_6c3a4f8b9c2d” Version=”2.0”
IssueInstant=”2004-03-27T08:41:00Z”
            <ds:Signature> … </ds:Signature>
            <saml:Subject>
            …
            </saml:Subject>
        </samlp:AttributeQuery>
    </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

Following is an example of the corresponding response, which supplies an assertion containing the attribute statement as requested.

```
HTTP/1.1 200 OK
Content-Type: text/xml
Content-Length: nnnn

<SOAP-ENV:Envelope
    xmlns:SOAP-ENV=”http://schemas.xmlsoap.org/soap/envelope/”>
    <SOAP-ENV:Body>
        <samlp:Response xmlns:samlp=”…” xmlns:saml=”…” xmlns:ds=”…”
ID=”_6c3a4f8b9c2d” Version=”2.0” IssueInstant=”2004-03-27T08:42:00Z”>
            <saml:Issuer>https://www.example.com/SAML</saml:Issuer>
```

```
                <ds:Signature> … </ds:Signature>
                <Status>
                  <StatusCode Value="…"/>
                </Status>

                <saml:Assertion>
                    <saml:Subject>
                    …
                    </saml:Subject>
                    <saml:AttributeStatement>
                …
                    </saml:AttributeStatement>
                 </saml:Assertion>
            </samlp:Response>
        </SOAP-Env:Body>
</SOAP-ENV:Envelope>
```

3.3 Reverse SOAP (PAOS) Binding

This binding leverages the Reverse HTTP Binding for SOAP specification [PAOS]. Implementers MUST comply with the general processing rules specified in [PAOS] in addition to those specified in this document. In case of conflict, [PAOS] is normative.

3.3.1 Required Information

Identification: urn:oasis:names:tc:SAML:2.0:bindings:PAOS

Contact information: security-services-comment@lists.oasis-open.org

Description: Given below.

Updates: None.

3.3.2 Overview

The reverse SOAP binding is a mechanism by which an HTTP requester can advertise the ability to act as a SOAP responder or a SOAP intermediary to a SAML requester. The HTTP requester is able to support a pattern where a SAML request is sent to it in a SOAP envelope in an HTTP response from the SAML requester, and the HTTP requester responds with a SAML response in a SOAP envelope in a subsequent HTTP request. This message exchange pattern supports the use case defined in the ECP SSO profile (described in the SAML profiles specification [SAMLProfile]), in which the HTTP requester is an intermediary in an authentication exchange.

3.3.3 Message Exchange

The PAOS binding includes two component message exchange patterns:

1. The HTTP requester sends an HTTP request to a SAML requester. The SAML requester responds with an HTTP response containing a SOAP envelope containing a SAML request message.
2. Subsequently, the HTTP requester sends an HTTP request to the original SAML requester containing a SOAP envelope containing a SAML response message. The SAML requester responds with an HTTP response, possibly in response to the original service request in step 1.

The ECP profile uses the PAOS binding to provide authentication of the client to the service provider before the service is provided. This occurs in the following steps, illustrated in Figure A:

1. Client requests service using HTTP request.
2. Service Provider responds with a SAML authentication request. This is sent using a SOAP request, carried in the HTTP response.

3. The Client returns a SOAP response carrying a SAML authentication response. This is sent using a new HTTP request.
4. Assuming service provider authentication and authorization is successful the service provider may respond to the original service request in the HTTP response.

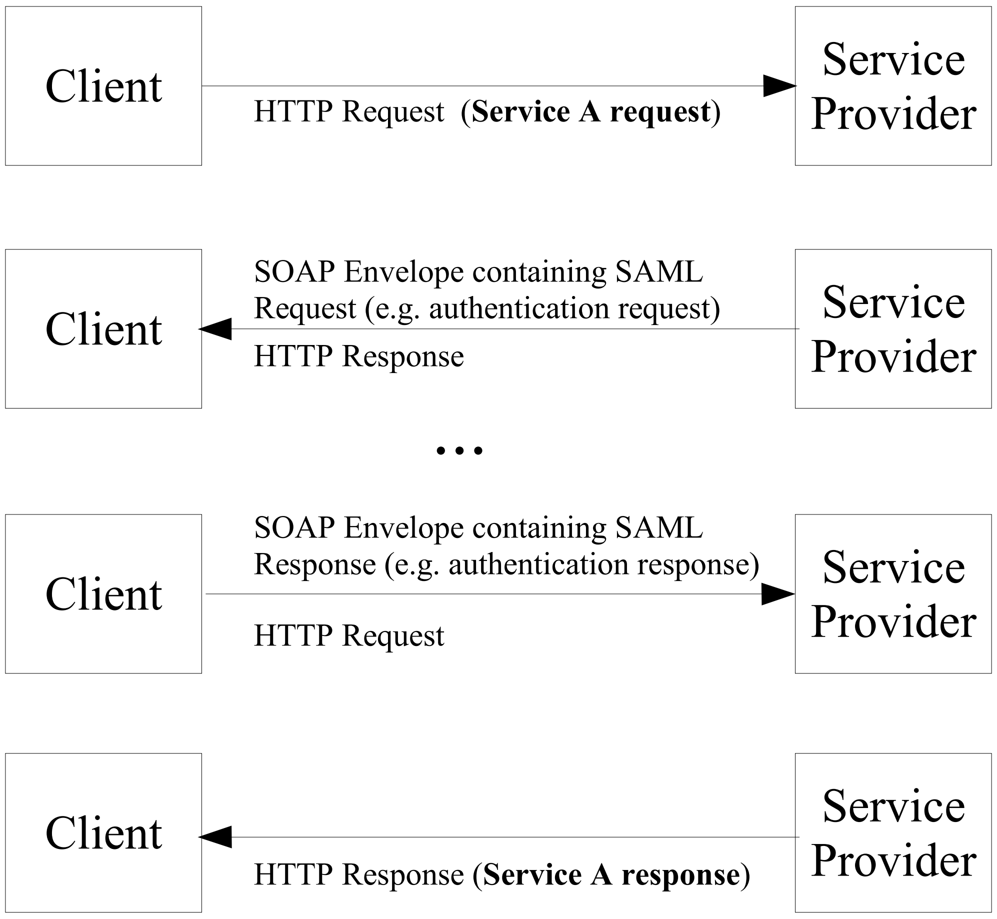

Client
HTTP Request (Service A request)
Service Provider
Client
SOAP Envelope containing SAML Request (e.g. authentication request)
HTTP Response
Service Provider
• • •
Client
SOAP Envelope containing SAML Response (e.g. authentication response)
HTTP Request
Service Provider
Client
HTTP Response (Service A response)
Service Provider

Figure 1: PAOS Binding Message Exchanges

The HTTP requester advertises the ability to handle this reverse SOAP binding in its HTTP requests using the HTTP headers defined by the PAOS specification. Specifically:

- The HTTP `Accept` Header field MUST indicate an ability to accept the "`application/vnd.paos+xml`" content type.
- The HTTP `PAOS` Header field MUST be present and specify the PAOS version with "`urn:liberty:paos:2003-08`" at a minimum.

Additional PAOS headers such as the service value MAY be specified by profiles that use the PAOS binding. The HTTP requester MAY add arbitrary headers to the HTTP request.

Note that this binding does not define a RelayState mechanism. Specific profiles that make use of this binding must therefore define such a mechanism, if needed. The use of a SOAP header is suggested for this purpose.

The following sections provide more detail on the two steps of the message exchange.

3.3.3.1 HTTP Request, SAML Request in SOAP Response

In response to an arbitrary HTTP request, the HTTP responder MAY return a SAML request message using this binding by returning a SOAP 1.1 envelope in the HTTP response containing a single SAML request message in the SOAP body, with no additional body content. The SOAP envelope MAY contain arbitrary SOAP headers defined by PAOS, SAML profiles, or additional specifications.

Note that while the SAML request message is delivered to the HTTP requester, the actual intended recipient MAY be another system entity, with the HTTP requester acting as an intermediary, as defined by specific profiles.

3.3.3.2 SAML Response in SOAP Request, HTTP Response

When the HTTP requester delivers a SAML response message to the intended recipient using the PAOS binding, it places it as the only element in the SOAP body in a SOAP envelope in an HTTP request. The HTTP requester may or may not be the originator of the SAML response. The SOAP envelope MAY contain arbitrary SOAP headers defined by PAOS, SAML profiles, or additional specifications. The SAML exchange is considered complete and the HTTP response is unspecified by this binding.

Profiles MAY define additional constraints on the HTTP content of non-SOAP responses during the exchanges covered by this binding.

3.3.4 Caching

HTTP proxies should not cache SAML protocol messages. To insure this, the following rules SHOULD be followed.

When using HTTP 1.1, requesters sending SAML protocol messages SHOULD:

- Include a `Cache-Control` header field set to "`no-cache, no-store`".
- Include a `Pragma` header field set to "`no-cache`".

When using HTTP 1.1, responders returning SAML protocol messages SHOULD:

- Include a `Cache-Control` header field set to "`no-cache, no-store, must-revalidate, private`".
- Include a `Pragma` header field set to "`no-cache`".
- NOT include a Validator, such as a `Last-Modified` or ETag header.

3.3.5 Security Considerations

The HTTP requester in the PAOS binding may act as a SOAP intermediary and when it does, transport layer security for origin authentication, integrity and confidentiality may not meet end-end security requirements. In this case security at the SOAP message layer is recommended.

3.3.5.1 Error Reporting

Standard HTTP and SOAP error conventions MUST be observed. Errors that occur during SAML processing MUST NOT be signaled at the HTTP or SOAP layer and MUST be handled using SAML response messages with an error `<samlp:Status>` element.

3.3.5.2 Metadata Considerations

Support for the PAOS binding SHOULD be reflected by indicating a URL endpoint at which HTTP requests and/or SAML protocol messages contained in SOAP envelopes for a particular protocol or profile are to be sent. Either a single endpoint or distinct request and response endpoints MAY be supplied.

3.4 HTTP Redirect Binding

The HTTP Redirect binding defines a mechanism by which SAML protocol messages can be transmitted within URL parameters. Permissible URL length is theoretically infinite, but unpredictably limited in practice. Therefore, specialized encodings are needed to carry XML messages on a URL, and larger or more complex message content can be sent using the HTTP POST or Artifact bindings.

This binding MAY be composed with the HTTP POST binding (see Section 3.5) and the HTTP Artifact binding (see Section 3.6) to transmit request and response messages in a single protocol exchange using two different bindings.

This binding involves the use of a message encoding. While the definition of this binding includes the definition of one particular message encoding, others MAY be defined and used.

3.4.1 Required Information

Identification: urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Redirect

Contact information: security-services-comment@lists.oasis-open.org

Description: Given below.

Updates: None.

3.4.2 Overview

The HTTP Redirect binding is intended for cases in which the SAML requester and responder need to communicate using an HTTP user agent (as defined in HTTP 1.1 [RFC2616]) as an intermediary. This may be necessary, for example, if the communicating parties do not share a direct path of communication. It may also be needed if the responder requires an interaction with the user agent in order to fulfill the request, such as when the user agent must authenticate to it.

Note that some HTTP user agents may have the capacity to play a more active role in the protocol exchange and may support other bindings that use HTTP, such as the SOAP and Reverse SOAP bindings. This binding assumes nothing apart from the capabilities of a common web browser.

3.4.3 RelayState

RelayState data MAY be included with a SAML protocol message transmitted with this binding. The value MUST NOT exceed 80 bytes in length and SHOULD be integrity protected by the entity creating the message independent of any other protections that may or may not exist during message transmission.

If a SAML request message is accompanied by RelayState data, then the SAML responder MUST return its SAML protocol response using a binding that also supports a RelayState mechanism, and it MUST place the exact data it received with the request into the corresponding RelayState parameter in the response.

If no such value is included with a SAML request message, or if the SAML response message is being generated without a corresponding request, then the SAML responder MAY include RelayState data to be interpreted by the recipient based on the use of a profile or prior agreement between the parties.

3.4.4 Message Encoding

Messages are encoded for use with this binding using a URL encoding technique, and transmitted using the HTTP GET method. There are many possible ways to encode XML into a URL, depending on the constraints in effect. This specification defines one such method without precluding others. Binding endpoints SHOULD indicate which encodings they support using metadata, when appropriate. Particular encodings MUST be uniquely identified with a URI when defined. It is not a requirement that all possible SAML messages be encodable with a particular set of rules, but the rules MUST clearly indicate which messages or content can or cannot be so encoded.

A URL encoding MUST place the message entirely within the URL query string, and MUST reserve the rest of the URL for the endpoint of the message recipient.

A query string parameter named `SAMLEncoding` is reserved to identify the encoding mechanism used. If this parameter is omitted, then the value is assumed to be `urn:oasis:names:tc:SAML:2.0:bindings:URL-Encoding:DEFLATE`.

3.4.4.1 DEFLATE Encoding

Identification: urn:oasis:names:tc:SAML:2.0:bindings:URL-Encoding:DEFLATE

SAML protocol messages can be encoded into a URL via the DEFLATE compression method (see [RFC1951]). In such an encoding, the following procedure should be applied to the original SAML protocol message's XML serialization:

1. Any signature on the SAML protocol message, including the `<ds:Signature>` XML element itself, MUST be removed. Note that if the content of the message includes another signature, such as a signed SAML assertion, this embedded signature is not removed. However, the length of such a message after encoding essentially precludes using this mechanism. Thus SAML protocol messages that contain signed content SHOULD NOT be encoded using this mechanism.
2. The DEFLATE compression mechanism, as specified in [RFC1951] is then applied to the entire remaining XML content of the original SAML protocol message.
3. The compressed data is subsequently base64-encoded according to the rules specified in [RFC2045]. Linefeeds or other whitespace MUST be removed from the result.
4. The base-64 encoded data is then URL-encoded, and added to the URL as a query string parameter which MUST be named `SAMLRequest` (if the message is a SAML request) or `SAMLResponse` (if the message is a SAML response).
5. If the original SAML protocol message was signed using an XML digital signature, a new signature covering the encoded data as specified above MUST be attached using the rules stated below.
6. If RelayState data is to accompany the SAML protocol message, it MUST be URL-encoded and placed in an additional query string parameter named `RelayState`.

XML digital signatures are not directly URL-encoded according to the above rules, due to space concerns. If the underlying SAML protocol message is signed with an XML signature [XMLSig], the URL-encoded form of the message MUST be signed as follows:

1. The signature algorithm identifier MUST be included as an additional query string parameter, named `SigAlg`. The value of this parameter MUST be a URI that identifies the algorithm used to sign the URL-encoded SAML protocol message, specified according to [XMLSig] or whatever specification governs the algorithm.
2. To construct the signature, a string consisting of the concatenation of the `RelayState` (if present), `SigAlg`, and `SAMLRequest` (or `SAMLResponse`) query string parameters is constructed in one of the following ways:

```
SAMLRequest=value&RelayState=value&SigAlg=value
SAMLResponse=value&RelayState=value&SigAlg=value
```

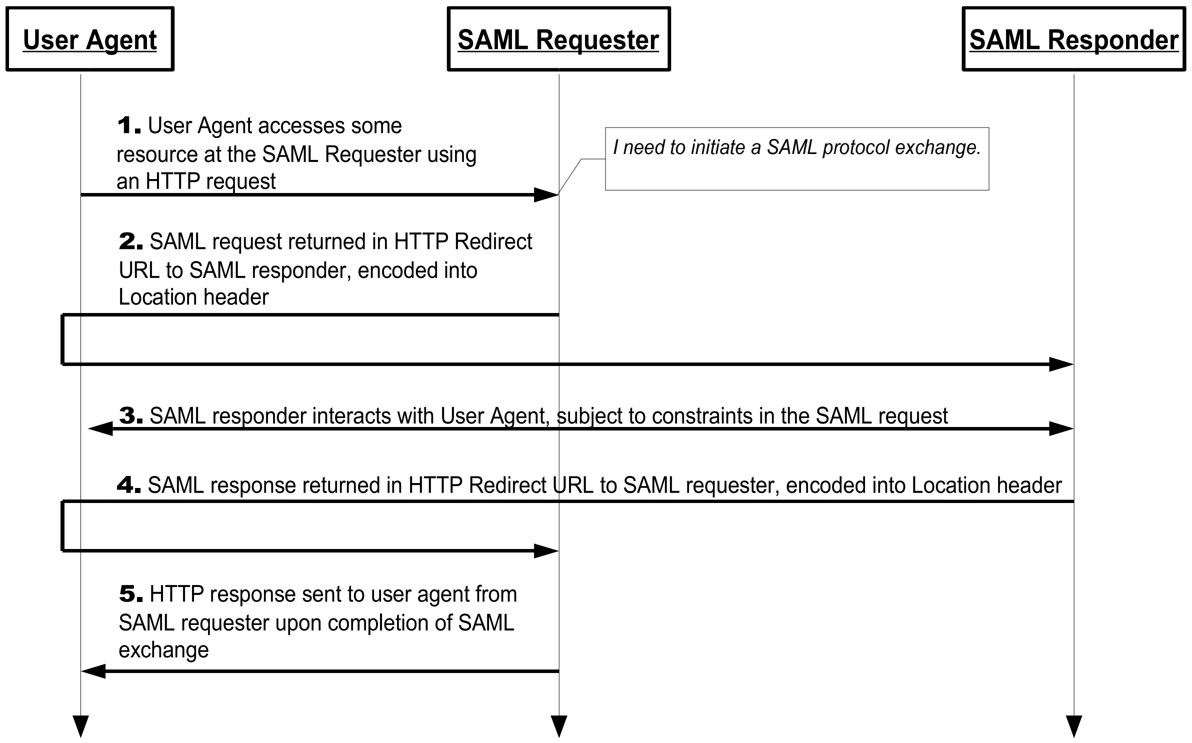
3. The resulting string of bytes is the octet string to be fed into the signature algorithm. Any other content in the original query string is not included and not signed.
4. The signature value MUST be encoded using the base64 encoding [RFC2045] with any whitespace removed, and included as a query string parameter named `Signature`. Note that some characters

in the base64-encoded signature value may themselves require URL-encoding before being added.

5. The following signature algorithms (see [XMLSig]) and their URI representations MUST be supported with this encoding mechanism:
   - DSAwithSHA1 – http://www.w3.org/200/09/xmldsig#dsa-sha1
   - RSAwithSHA1 – http://www.w3.org/200/09/xmldsig#rsa-sha1

3.4.5 Message Exchange

The system model used for SAML conversations via this binding is a request-response model, but these messages are sent to the user agent in an HTTP response and delivered to the message recipient in an HTTP request. The HTTP interactions before, between, and after these exchanges take place is unspecified. Both the SAML requester and the SAML responder are assumed to be HTTP responders. See the following sequence diagram illustrating the messages exchanged.


User Agent
SAML Requester
SAML Responder
1. User Agent accesses some resource at the SAML Requester using an HTTP request
I need to initiate a SAML protocol exchange.
2. SAML request returned in HTTP Redirect URL to SAML responder, encoded into Location header
3. SAML responder interacts with User Agent, subject to constraints in the SAML request
4. SAML response returned in HTTP Redirect URL to SAML requester, encoded into Location header
5. HTTP response sent to user agent from SAML requester upon completion of SAML exchange

1. Initially, the user agent makes an arbitrary HTTP request to a system entity. In the course of processing the request, the system entity decides to initiate a SAML protocol exchange.
2. The system entity acting as a SAML requester responds to the HTTP request from the user agent in step 1 by returning a SAML request. The SAML request is returned encoded into the HTTP response's Location header, and the HTTP status MUST be either 303 or 302. The SAML requester MAY include additional presentation and content in the HTTP response to facilitate the user agent's transmission of the message, as defined in HTTP 1.1 [RFC2616]. The user agent delivers the SAML request by issuing an HTTP GET request to the SAML responder.
3. In general, the SAML responder MAY respond to the SAML request by immediately returning a SAML response or MAY return arbitrary content to facilitate subsequent interaction with the user agent necessary to fulfill the request. Specific protocols and profiles may include mechanisms to indicate the requester's level of willingness to permit this kind of interaction (for example, the `IsPassive` attribute in `<samlp:AuthnRequest>`) .
4. Eventually the responder SHOULD return a SAML response to the user agent to be returned to the

SAML requester. The SAML response is returned in the same fashion as described for the SAML request in step 2.

5. Upon receiving the SAML response, the SAML requester returns an arbitrary HTTP response to the user agent.

3.4.5.1 HTTP and Caching Considerations

HTTP proxies and the user agent intermediary should not cache SAML protocol messages. To insure this, the following rules SHOULD be followed.

When returning SAML protocol messages using HTTP 1.1, HTTP responders SHOULD:

- Include a `Cache-Control` header field set to "`no-cache, no-store`".
- Include a `Pragma` header field set to "`no-cache`".

There are no other restrictions on the use of HTTP headers.

3.4.5.2 Security Considerations

The presence of the user agent intermediary means that the requester and responder cannot rely on the transport layer for end-end authentication, integrity and confidentiality. URL-encoded messages MAY be signed to provide origin authentication and integrity if the encoding method specifies a means for signing.

This binding SHOULD NOT be used if the content of the request or response should not be exposed to the user agent intermediary. Otherwise, confidentiality of both SAML requests and SAML responses is OPTIONAL and depends on the environment of use. If confidentiality is necessary, SSL 3.0 or TLS 1.0 SHOULD be used to protect the message in transit between the user agent and the SAML requester and responder.

Note also that URL-encoded messages may be exposed in a variety of HTTP logs as well as the HTTP "Referer" header.

Before deployment, each combination of authentication, message integrity, and confidentiality mechanisms SHOULD be analyzed for vulnerability in the context of the specific protocol exchange, and the deployment environment. See specific protocol processing rules in [SAMLCore], and the SAML security considerations document [SAMLSecure] for a detailed discussion.

In general, this binding relies on message-level authentication and integrity protection via signing and does not support confidentiality of messages from the user agent intermediary.

3.4.6 Error Reporting

A SAML responder that refuses to perform a message exchange with the SAML requester SHOULD return a SAML response message with a second-level `<samlp:StatusCode>` value of `urn:oasis:names:tc:SAML:2.0:status:RequestDenied`.

HTTP interactions during the message exchange MUST NOT use HTTP error status codes to indicate failures in SAML processing, since the user agent is not a full party to the SAML protocol exchange.

For more information about SAML status codes, see the SAML assertions and protocols specification [SAMLCore].

3.4.7 Metadata Considerations

Support for the HTTP Redirect binding SHOULD be reflected by indicating URL endpoints at which requests and responses for a particular protocol or profile should be sent. Either a single endpoint or distinct request and response endpoints MAY be supplied.

3.4.8 Example SAML Message Exchange Using HTTP Redirect

In this example, a `<LogoutRequest>` and `<LogoutResponse>` message pair are exchanged using the HTTP Redirect binding.

First, here are the actual SAML protocol messages being exchanged:

```
<samlp:LogoutRequest xmlns:samlp="urn:oasis:names:tc:SAML:2.0:protocol"
xmlns="urn:oasis:names:tc:SAML:2.0:assertion"
    ID="d2b7c388cec36fa7c39c28fd298644a8" IssueInstant="2004-01-
21T19:00:49Z" Version="2.0">
    <Issuer>https://IdentityProvider.com/SAML</Issuer>
    <NameID Format="urn:oasis:names:tc:SAML:2.0:nameid-
format:persistent">005a06e0-ad82-110d-a556-004005b13a2b</NameID>
    <samlp:SessionIndex>1</samlp:SessionIndex>
</samlp:LogoutRequest>
```

```
<samlp:LogoutResponse xmlns:samlp="urn:oasis:names:tc:SAML:2.0:protocol"
xmlns="urn:oasis:names:tc:SAML:2.0:assertion"
    ID="b0730d21b628110d8b7e004005b13a2b"
InResponseTo="d2b7c388cec36fa7c39c28fd298644a8"
    IssueInstant="2004-01-21T19:00:49Z" Version="2.0">
    <Issuer>https://ServiceProvider.com/SAML</Issuer>
    <samlp:Status>
        <samlp:StatusCode
Value="urn:oasis:names:tc:SAML:2.0:status:Success"/>
    </samlp:Status>
</samlp:LogoutResponse>
```

The initial HTTP request from the user agent in step 1 is not defined by this binding. To initiate the logout protocol exchange, the SAML requester returns the following HTTP response, containing a signed SAML request message. The `SAMLRequest` parameter value is actually derived from the request message above. The signature portion is only illustrative and not the result of an actual computation. Note that the line feeds in the HTTP `Location` header below are an artifact of the document, and there are no line feeds in the actual header value.

```
HTTP/1.1 302 Object Moved
Date: 21 Jan 2004 07:00:49 GMT
Location:
https://ServiceProvider.com/SAML/SLO/Browser?SAMLRequest=H4sIAOCuDUEAA32R
UUvDMBSF3wf9DyXvWZOsq23oCsIQCpuIGz74liWZVtqk5qYy%2F73puoGCLE%2Fhu%2Bfecw%
2B3BNG1Pd%2FYNzv4Z%
2F05aPDxqWsN8HNlhQZnuBXQADei08C95Lv77YazOeG9s95K26Kp5bZYAGjnG2tQNIvDq9crp
NjhTi7yXGq5yI4i%
2FAvJ8qNiRZ6lqchRXAMMujbghfErxAhJMaGY0T0tOCE8LV5RvBUf1r1oB2F40ATQmF%
2BAoGpyLM%2FDXPXufQ88SWqljW%
2F895OzX43Sbi5tl4z7lslFeel7DGHqdfxgXSf87ZQjaRQ%
2BnqW8H3cAH2xQRchSkEwTLFTOMKVEYbFcZjhECqUDXQh2KJPJ6mo8XWenYUxSG6VPFS2Tf2g
0u%2BI%2Fpww8mv0ALfRRUOQBAAA%
3D&RelayState=0043bfc1bc45110dae17004005b13a2b&SigAlg=http%3A%2F%
2Fwww.w3.org%2F200%2F09%2Fxmldsig%23rsa-
sha1&Signature=NOTAREALSIGNATUREBUTTHEREALONEWOULDGOHERE
Content-Type: text/html; charset=iso-8859-1
```

After any unspecified interactions may have taken place, the SAML responder returns the HTTP response below containing the signed SAML response message. Again, the `SAMLResponse` parameter value is actually derived from the response message above. The signature portion is only illustrative and not the result of an actual computation.

```
HTTP/1.1 302 Object Moved
Date: 21 Jan 2004 07:00:49 GMT
```

```
Location:
https://IdentityProvider.com/SAML/SLO/Response?SAMLResponse=H4sIAKO3DUEAA
31RTWvDMAy991cE39vYTtY6pimM7VJoYSylh94cR90yEitYTtnPX5a0sDKoTtLT09PXmkzbdH
qHH9iHd6AOHUH03TaO9JjKWe%
2BdRkM1aWdaIB2sLp73Oy0XXHceA1ps2FTymGyIwIcaHZtFg21fc1byVcIrKcqlVELwSpUr4D
zl%
2FKkUiZEli7buNtUBc1bJcmUTpSzYZHk2g59Zqc6VzNQyTY26KhP1sHUUjAs5k4PgnIu5FAeR
ac51mp1YtDdf6I%2FgaZhn4AxA7f4AnG1GqfWo5TefIXSk47gAf6ktvHm81BX4hcU2%
2Fl1wHV%2BJU9V01SKY0NME%2FYNfsILoaJoeHl%2BNRrYuemuBiMXXDvF9i1t8%
2F8jN7AcCxjwc4AEAAA%3D%
3D&RelayState=0043bfc1bc45110dae17004005b13a2b&SigAlg=http%3A%2F%
2Fwww.w3.org%2F200%2F09%2Fxmldsig%23rsa-
sha1&Signature=NOTAREALSIGNATUREBUTTHEREALONEWOULDGOHERE
Content-Type: text/html; charset=iso-8859-1
```

3.5 HTTP POST Binding

The HTTP POST binding defines a mechanism by which SAML protocol messages may be transmitted within the base64-encoded content of an HTML form control.

This binding MAY be composed with the HTTP Redirect binding (see Section 3.4) and the HTTP Artifact binding (see Section 3.6) to transmit request and response messages in a single protocol exchange using two different bindings.

3.5.1 Required Information

Identification: urn:oasis:names:tc:SAML:2.0:bindings:HTTP-POST

Contact information: security-services-comment@lists.oasis-open.org

Description: Given below.

Updates: Effectively replaces the binding aspects of the Browser/POST profile in [SAML 1.1].

3.5.2 Overview

The HTTP POST binding is intended for cases in which the SAML requester and responder need to communicate using an HTTP user agent (as defined in HTTP 1.1 [RFC2616]) as an intermediary. This may be necessary, for example, if the communicating parties do not share a direct path of communication. It may also be needed if the responder requires an interaction with the user agent in order to fulfill the request, such as when the user agent must authenticate to it.

Note that some HTTP user agents may have the capacity to play a more active role in the protocol exchange and may support other bindings that use HTTP, such as the SOAP and Reverse SOAP bindings. This binding assumes nothing apart from the capabilities of a common web browser.

3.5.3 RelayState

RelayState data MAY be included with a SAML protocol message transmitted with this binding. The value MUST NOT exceed 80 bytes in length and SHOULD be integrity protected by the entity creating the message independent of any other protections that may or may not exist during message transmission.

If a SAML request message is accompanied by RelayState data, then the SAML responder MUST return its SAML protocol response using a binding that also supports a RelayState mechanism, and it MUST place the exact data it received with the request into the corresponding RelayState parameter in the response.

If no such value is included with a SAML request message, or if the SAML response message is being generated without a corresponding request, then the SAML responder MAY include RelayStatedata to be interpreted by the recipient based on the use of a profile or prior agreement between the parties.

3.5.4 Message Encoding

Messages are encoded for use with this binding by encoding the XML into an HTML form control and are transmitted using the HTTP POST method. A SAML protocol message is form-encoded by applying the base-64 encoding rules to the XML representation of the message and placing the result in a hidden form control within a form as defined by [HTML401] §17. The HTML document MUST adhere to the XHTML specification, [XHTML] . The base64-encoded value MAY be line-wrapped at a reasonable length in accordance with common practice.

If the message is a SAML request, then the form control MUST be named `SAMLRequest`. If the message is a SAML response, then the form control MUST be named `SAMLResponse`. Any additional form controls or presentation MAY be included but MUST NOT be required in order for the recipient to process the message.

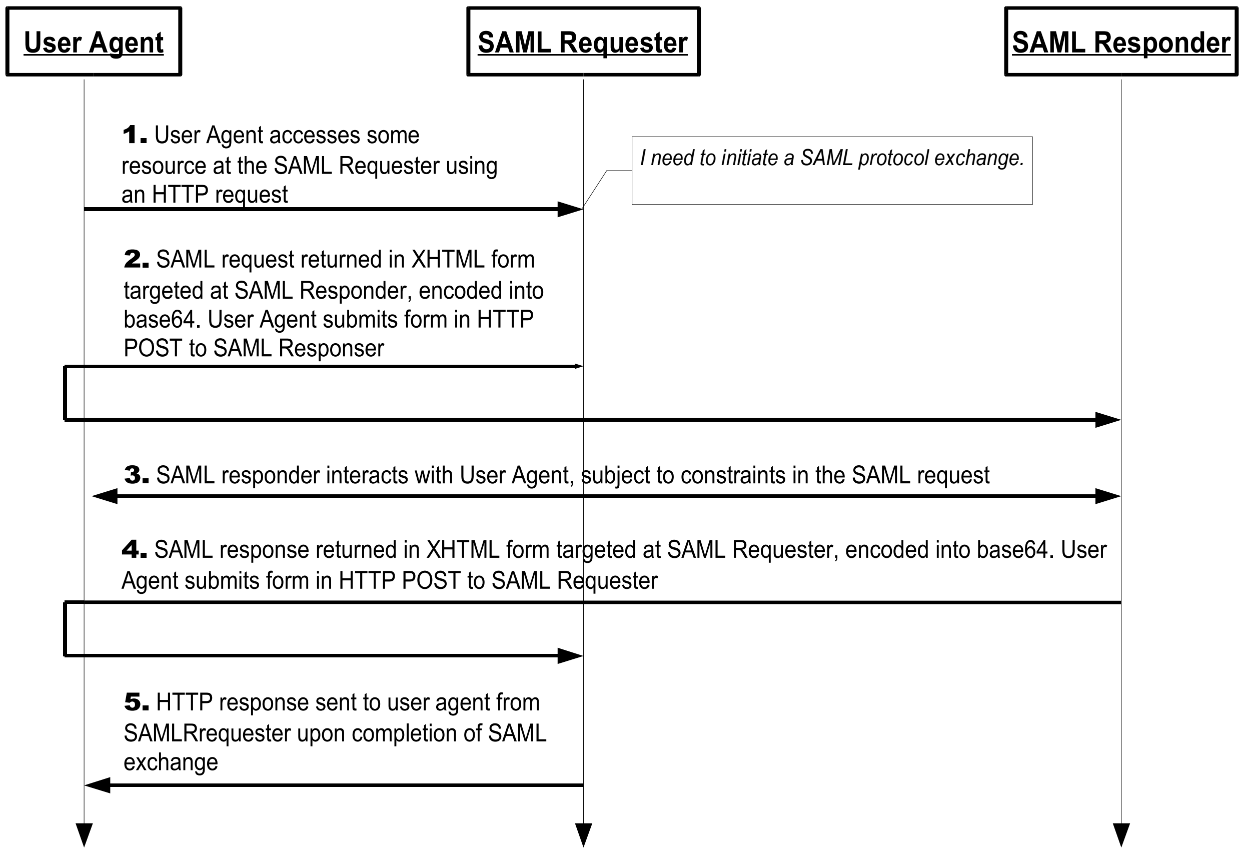
If a “RelayState” value is to accompany the SAML protocol message, it MUST be placed in an additional hidden form control named `RelayState` within the same form with the SAML message.

The `action` attribute of the form MUST be the recipient's HTTP endpoint for the protocol or profile using this binding to which the SAML message is to be delivered. The `method` attribute MUST be "POST".

Any technique supported by the user agent MAY be used to cause the submission of the form, and any form content necessary to support this MAY be included, such as submit controls and client-side scripting commands. However, the recipient MUST be able to process the message without regard for the mechanism by which the form submission is initiated.

3.5.5 Message Exchange

The system model used for SAML conversations via this binding is a request-response model, but these messages are sent to the user agent in an HTTP response and delivered to the message recipient in an HTTP request. The HTTP interactions before, between, and after these exchanges take place is unspecified. Both the SAML requester and responder are assumed to be HTTP responders. See the following diagram illustrating the messages exchanged.


User Agent
SAML Requester
SAML Responder
1. User Agent accesses some resource at the SAML Requester using an HTTP request
I need to initiate a SAML protocol exchange.
2. SAML request returned in XHTML form targeted at SAML Responder, encoded into base64. User Agent submits form in HTTP POST to SAML Responser
3. SAML responder interacts with User Agent, subject to constraints in the SAML request
4. SAML response returned in XHTML form targeted at SAML Requester, encoded into base64. User Agent submits form in HTTP POST to SAML Requester
5. HTTP response sent to user agent from SAMLRrequester upon completion of SAML exchange

1. Initially, the user agent makes an arbitrary HTTP request to a system entity. In the course of processing the request, the system entity decides to initiate a SAML protocol exchange.
2. The system entity acting as a SAML requester responds to an HTTP request from the user agent by returning a SAML request. The request is returned in an [XHTML] document containing the form and content defined in section 3.5.4. The user agent delivers the SAML request by issuing an HTTP POST request to the SAML responder.
3. In general, the SAML responder MAY respond to the SAML request by immediately returning a SAML response or MAY return arbitrary content to facilitate subsequent interaction with the user agent necessary to fulfill the request. Specific protocols and profiles may include mechanisms to indicate the requester's level of willingness to permit this kind of interaction (for example, the `IsPassive` attribute in `<samlp:AuthnRequest>`).
4. Eventually the responder SHOULD return a SAML response to the user agent to be returned to the SAML requester. The SAML response is returned in the same fashion as described for the SAML request in step 2.
5. Upon receiving the SAML response, the SAML requester returns an arbitrary HTTP response to the user agent.

3.5.5.1 HTTP and Caching Considerations

HTTP proxies and the user agent intermediary should not cache SAML protocol messages. To insure this, the following rules SHOULD be followed.

When returning SAML protocol messages using HTTP 1.1, HTTP responders SHOULD:

- Include a `Cache-Control` header field set to "`no-cache, no-store`".

- Include a `Pragma` header field set to "`no-cache`".

There are no other restrictions on the use of HTTP headers.

3.5.5.2 Security Considerations

The presence of the user agent intermediary means that the requester and responder cannot rely on the transport layer for end-end authentication, integrity or confidentiality protection. and must authenticate the messages received instead. SAML provides for a signature on protocol messages for authentication and integrity for such cases. Form-encoded messages MAY be signed before the base64 encoding is applied.

This binding SHOULD NOT be used if the content of the request or response should not be exposed to the user agent intermediary. Otherwise, confidentiality of both SAML requests and SAML responses is OPTIONAL and depends on the environment of use. If confidentiality is necessary, SSL 3.0 or TLS 1.0 SHOULD be used to protect the message in transit between the user agent and the SAML requester and responder.

In general, this binding relies on message-level authentication and integrity protection via signing and does not support confidentiality of messages from the user agent intermediary.

Note also that there is no mechanism defined to protect the integrity of the relationship between the SAML protocol message and the "RelayState" value, if any. That is, an attacker can potentially recombine a pair of valid HTTP responses by switching the "RelayState" values associated with each SAML protocol message. The individual "RelayState" and SAML message values can be integrity protected, but not the combination. As a result, the producer and consumer of "RelayState" information MUST take care not to associate sensitive state information with the "RelayState" value without taking additional precautions (such as based on the information in the SAML message).

3.5.6 Error Reporting

A SAML responder that refuses to perform a message exchange with the SAML requester SHOULD return a response message with a second-level `<samlp:StatusCode>` value of `urn:oasis:names:tc:SAML:2.0:status:RequestDenied`.

HTTP interactions during the message exchange MUST NOT use HTTP error status codes to indicate failures in SAML processing, since the user agent is not a full party to the SAML protocol exchange.

For more information about SAML status codes, see the SAML assertions and protocols specification [SAMLCore].

3.5.7 Metadata Considerations

Support for the HTTP POST binding SHOULD be reflected by indicating URL endpoints at which requests and responses for a particular protocol or profile should be sent. Either a single endpoint or distinct request and response endpoints MAY be supplied.

3.5.8 Example SAML Message Exchange Using HTTP POST

In this example, a `<LogoutRequest>` and `<LogoutResponse>` message pair are exchanged using the HTTP POST binding.

First, here are the actual SAML protocol messages being exchanged:

```
<samlp:LogoutRequest xmlns:samlp="urn:oasis:names:tc:SAML:2.0:protocol"
xmlns="urn:oasis:names:tc:SAML:2.0:assertion"
    ID="d2b7c388cec36fa7c39c28fd298644a8" IssueInstant="2004-01-
21T19:00:49Z" Version="2.0">
    <Issuer>https://IdentityProvider.com/SAML</Issuer>
    <NameID Format="urn:oasis:names:tc:SAML:2.0:nameid-
format:persistent">005a06e0-ad82-110d-a556-004005b13a2b</NameID>
    <samlp:SessionIndex>1</samlp:SessionIndex>
</samlp:LogoutRequest>
```

```
<samlp:LogoutResponse xmlns:samlp="urn:oasis:names:tc:SAML:2.0:protocol"
xmlns="urn:oasis:names:tc:SAML:2.0:assertion"
    ID="b0730d21b628110d8b7e004005b13a2b"
InResponseTo="d2b7c388cec36fa7c39c28fd298644a8"
    IssueInstant="2004-01-21T19:00:49Z" Version="2.0">
    <Issuer>https://ServiceProvider.com/SAML</Issuer>
    <samlp:Status>
        <samlp:StatusCode
Value="urn:oasis:names:tc:SAML:2.0:status:Success"/>
    </samlp:Status>
</samlp:LogoutResponse>
```

The initial HTTP request from the user agent in step 1 is not defined by this binding. To initiate the logout protocol exchange, the SAML requester returns the following HTTP response, containing a SAML request message. The `SAMLRequest` parameter value is actually derived from the request message above.

```
HTTP/1.1 200 OK
Date: 21 Jan 2004 07:00:49 GMT
Content-Type: text/html; charset=iso-8859-1

<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.1//EN"
"http://www.w3.org/TR/xhtml11/DTD/xhtml11.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en">
<body onload="document.forms[0].submit()">

<noscript>
<p>
<strong>Note:</strong> Since your browser does not support JavaScript,
you must press the Continue button once to proceed.
</p>
</noscript>

<form action="https://ServiceProvider.com/SAML/SLO/Browser"
method="post">
<div>
<input type="hidden" name="RelayState"
value="0043bfc1bc45110dae17004005b13a2b"/>
<input type="hidden" name="SAMLRequest"
value="PHNhbWxwOkxvZ291dFJlcXVlc3QgeG1sbnM6c2FtbHA9InVybjpvYXNpczpuYW1l
czp0YzpTQU1MOjIuMDpwcm90b2NvbCIgeG1sbnM9InVybjpvYXNpczpuYW1lczp0
YzpTQU1MOjIuMDphc3NlcnRpb24iDQogICAgSUQ9ImQyYjdjMzg4Y2VjMzZmYTdj
MzljMjhmZDI5ODY0NGE4IiBJc3N1ZUluc3RhbnQ9IjIwMDQtMDEtMjFUMTk6MDA6
NDlaIiBNYWpvclZlcnNpb249IjIiIE1pbm9yVmVyc2lvbj0iMCI+DQogICAgPElz
c3Vlcj5odHRwczovL0lkZW50aXR5UHJvdmlkZXIuY29tL1NBTUw8L0lzc3Vlcj4N
CiAgICA8TmFtZUlEIEZvcm1hdD0idXJuOm9hc2lzOm5hbWVzOnRjOlNBTUw6Mi4w
Om5hbWVpZC1mb3JtYXQ6cGVyc2lzdGVudCI+MDA1YTA2ZTAtYWQ4Mi0xMTBkLWE1
NTYtMDA0MDA1YjEzYTJiPC9OYW1lSUQ+DQogICAgPHNhbWxwOlNlc3Npb25JbmRl
eD4xPC9zYW1scDpTZXNzaW9uSW5kZXg+DQo8L3NhbWxwOkxvZ291dFJlcXVlc3Q+
DQoNCg=="/>
</div>
<noscript>
<div>
<input type="submit" value="Continue"/>
</div>
</noscript>
</form>
</body>
</html>
```

After any unspecified interactions may have taken place, the SAML responder returns the HTTP response below containing the SAML response message. Again, the `SAMLResponse` parameter value is actually derived from the response message above.

```
HTTP/1.1 200 OK
Date: 21 Jan 2004 07:00:49 GMT
Content-Type: text/html; charset=iso-8859-1

<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.1//EN"
"http://www.w3.org/TR/xhtml11/DTD/xhtml11.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en">
<body onload="document.forms[0].submit()">

<noscript>
<p>
<strong>Note:</strong> Since your browser does not support JavaScript,
you must press the Continue button once to proceed.
</p>
</noscript>

<form action="https://IdentityProvider.com/SAML/SLO/Response"
method="post">
<div>
<input type="hidden" name="RelayState"
value="0043bfc1bc45110dae17004005b13a2b"/>
<input type="hidden" name="SAMLResponse"
value="PHNhbWxwOkxvZ291dFJlc3BvbnNlIHhtbG5zOnNhbWxwPSJ1cm46b2FzaXM6bmFt
ZXM6dGM6U0FNTDoyLjA6cHJvdG9jb2wiIHhtbG5zPSJ1cm46b2FzaXM6bmFtZXM6
dGM6U0FNTDoyLjA6YXNzZXJ0aW9uIgogICAgSUQ9ImIwNzMwZDIxYjYyODExMGQ4
YjdlMDA0MDA1YjEzYTJiIiBJblJlc3BvbnNlVG89ImQyYjdjMzg4Y2VjMzZmYTdj
MzljMjhmZDI5ODY0NGE4IgogICAgSXNzdWVJbnN0YW50PSIyMDA0LTAxLTIxVDE5
OjAwOjQ5WiIgTWFqb3JWZXJzaW9uPSIyIiBNaW5vclZlcnNpb249IjAiPgogICAg
PElzc3Vlcj5odHRwczovL1NlcnZpY2VQcm92aWRlci5jb20vU0FNTDwvSXNzdWVy
PgogICAgPHNhbWxwOlN0YXR1cz4KICAgICAgICA8c2FtbHA6U3RhdHVzQ29kZSBW
YWx1ZT0idXJuOm9hc2lzOm5hbWVzOnRjOlNBTUw6Mi4wOnN0YXR1czpTdWNjZXNz
Ii8+CiAgICA8L3NhbWxwOlN0YXR1cz4KPC9zYW1scDpMb2dvdXRSZXNwb25zZT4K"/>
</div>
<noscript>
<div>
<input type="submit" value="Continue"/>
</div>
</noscript>
</form>
</body>
</html>
```

3.6 HTTP Artifact Binding

In the HTTP Artifact binding, the SAML request, the SAML response, or both are transmitted by reference using a small stand-in called an artifact. A separate, synchronous binding, such as the SAML SOAP binding, is used to exchange the artifact for the actual protocol message using the artifact resolution protocol defined in the SAML assertions and protocols specification [SAMLCore].

This binding MAY be composed with the HTTP Redirect binding (see Section 3.4) and the HTTP POST binding (see Section 3.5) to transmit request and response messages in a single protocol exchange using two different bindings.

3.6.1 Required Information

Identification: urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Artifact

Contact information: security-services-comment@lists.oasis-open.org

Description: Given below.

Updates: Effectively replaces the binding aspects of the Browser/Artifact profile in [SAML 1.1].

3.6.2 Overview

The HTTP Artifact binding is intended for cases in which the SAML requester and responder need to communicate using an HTTP user agent as an intermediary, but the intermediary's limitations preclude or discourage the transmission of an entire message (or message exchange) through it. This may be for technical reasons or because of a reluctance to expose the message content to the intermediary (and if the use of encryption is not practical).

Note that because of the need to subsequently resolve the artifact using another synchronous binding, such as SOAP, a direct communication path must exist between the SAML message sender and recipient in the reverse direction of the artifact's transmission (the receiver of the message and artifact must be able to send a `<samlp:ArtifactResolve>` request back to the artifact issuer). The artifact issuer must also maintain state while the artifact is pending, which has implications for load-balanced environments.

3.6.3 Message Encoding

There are two methods of encoding an artifact for use with this binding. One is to encode the artifact into a URL parameter and the other is to place the artifact in an HTML form control. When URL encoding is used, the HTTP GET method is used to deliver the message, while POST is used with form encoding. All endpoints that support this binding MUST support both techniques.

3.6.3.1 RelayState

RelayState data MAY be included with a SAML artifact transmitted with this binding. The value MUST NOT exceed 80 bytes in length and SHOULD be integrity protected by the entity creating the message independent of any other protections that may or may not exist during message transmission.

If an artifact that represents a SAML request is accompanied by RelayState data, then the SAML responder MUST return its SAML protocol response using a binding that also supports a RelayState mechanism, and it MUST place the exact data it received with the artifact into the corresponding RelayState parameter in the response.

If no such value is included with an artifact representing a SAML request, or if the SAML response message is being generated without a corresponding request, then the SAML responder MAY include RelayState data to be interpreted by the recipient based on the use of a profile or prior agreement between the parties.

3.6.3.2 URL Encoding

To encode an artifact into a URL, the artifact value is URL-encoded and placed in a query string parameter named `SAMLart`.

If a “RelayState” value is to accompany the SAML artifact, it MUST be URL-encoded and placed in an additional query string parameter named `RelayState`.

3.6.3.3 Form Encoding

A SAML artifact is form-encoded by placing it in a hidden form control within a form as defined by [HTML401], chapter 17. The HTML document MUST adhere to the XHTML specification, [XHTML] . The form control MUST be named `SAMLart`. Any additional form controls or presentation MAY be included but MUST NOT be required in order for the recipient to process the artifact.

If a “RelayState” value is to accompany the SAML artifact, it MUST be placed in an additional hidden form control named `RelayState`, within the same form with the SAML message.

The `action` attribute of the form MUST be the recipient's HTTP endpoint for the protocol or profile using this binding to which the artifact is to be delivered. The `method` attribute MUST be set to "POST".

Any technique supported by the user agent MAY be used to cause the submission of the form, and any form content necessary to support this MAY be included, such as submit controls and client-side scripting commands. However, the recipient MUST be able to process the artifact without regard for the mechanism by which the form submission is initiated.

3.6.4 Artifact Format

With respect to this binding, an artifact is a short, opaque string. Different types can be defined and used without affecting the binding. The important characteristics are the ability of an artifact receiver to identify the issuer of the artifact, resistance to tampering and forgery, uniqueness, and compactness.

The general format of any artifact includes a mandatory two-byte artifact type code and a two-byte index value identifying a specific endpoint of the artifact resolution service of the issuer, as follows:

```
SAML_artifact      := B64(TypeCode EndpointIndex RemainingArtifact)
TypeCode           := Byte1Byte2
EndpointIndex      := Byte1Byte2
```

The notation `B64(TypeCode EndpointIndex RemainingArtifact)` stands for the application of the base64 [RFC2045] transformation to the catenation of the `TypeCode`, `EndpointIndex`, and `RemainingArtifact`.

The following practices are RECOMMENDED for the creation of SAML artifacts:

- Each issuer is assigned an identifying URI, also known as the issuer's entity (or provider) ID. See section 8.3.6 of [SAMLCore] for a discussion of this kind of identifier.
- The issuer constructs the `SourceID` component of the artifact by taking the SHA-1 hash of the identification URL. The hash value is NOT encoded into hexadecimal.
- The `MessageHandle` value is constructed from a cryptographically strong random or pseudorandom number sequence [RFC1750] generated by the issuer. The sequence consists of values of at least 16 bytes in size. These values should be padded as needed to a total length of 20 bytes.

The following describes the single artifact type defined by SAML 2.0.

3.6.4.1 Required Information

Identification: urn:oasis:names:tc:SAML:2.0:artifact-04

Contact information: security-services-comment@lists.oasis-open.org

Description: Given below.

Updates: None.

3.6.4.2 Format Details

SAML 2.0 defines an artifact type of type code 0x0004. This artifact type is defined as follows:

```
TypeCode           := 0x0004
RemainingArtifact  := SourceID MessageHandle
SourceID           := 20-byte_sequence
MessageHandle      := 20-byte_sequence
```

`SourceID` is a 20-byte sequence used by the artifact receiver to determine artifact issuer identity and the set of possible resolution endpoints.

It is assumed that the destination site will maintain a table of `SourceID` values as well as one or more indexed URL endpoints (or addresses) for the corresponding SAML responder. The SAML metadata specification [SAMLMeta] MAY be used for this purpose. On receiving the SAML artifact, the receiver determines if the `SourceID` belongs to a known artifact issuer and obtains the location of the SAML responder using the `EndpointIndex` before sending a SAML `<samlp:ArtifactResolve>` message to it.

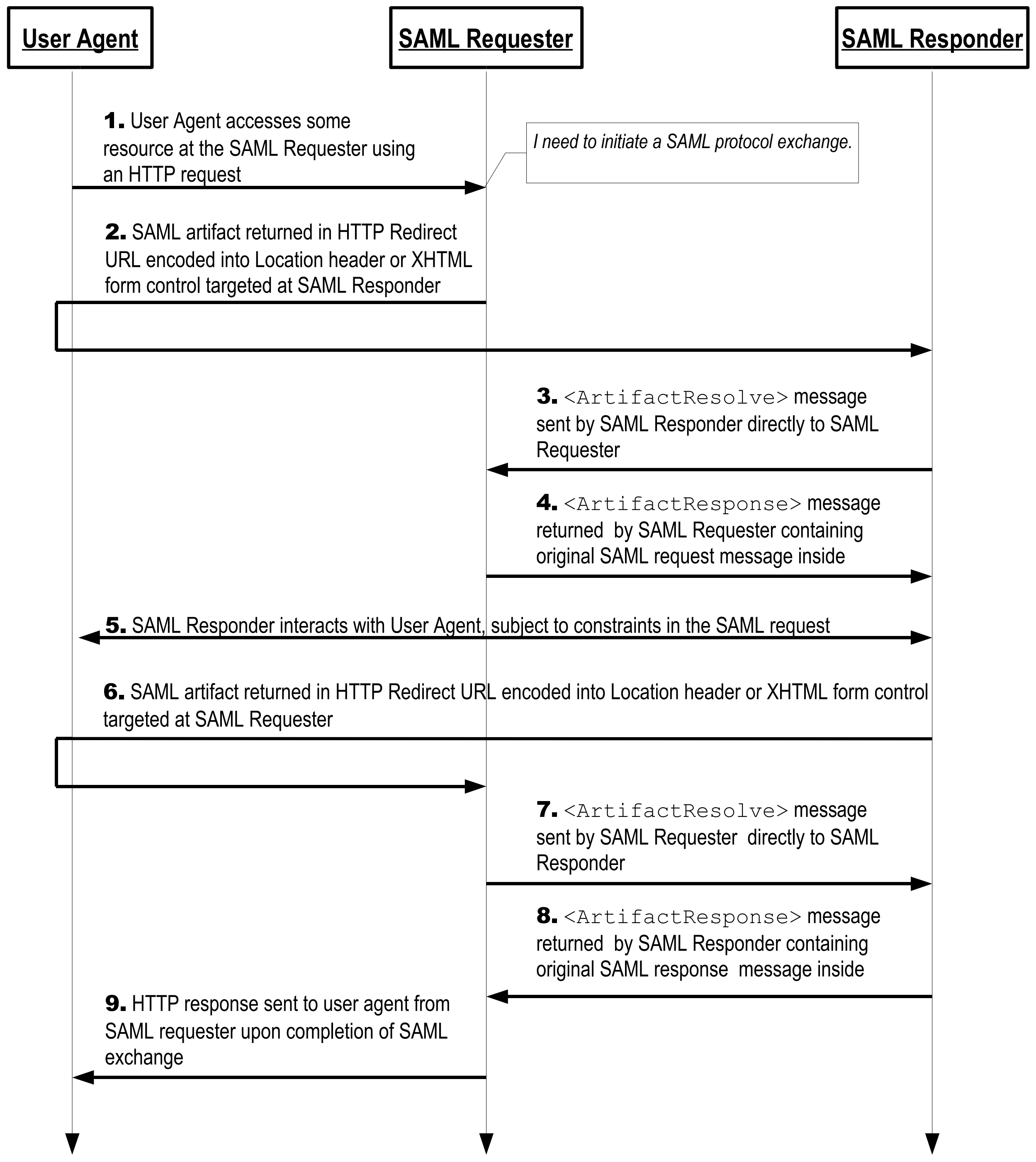
Any two artifact issuers with a common receiver MUST use distinct `SourceID` values. Construction of `MessageHandle` values is governed by the principle that they SHOULD have no predictable relationship to the contents of the referenced message at the issuing site and it MUST be infeasible to construct or guess the value of a valid, outstanding message handle.

3.6.5 Message Exchange

The system model used for SAML conversations by means of this binding is a request-response model in which an artifact reference takes the place of the actual message content, and the artifact reference is sent to the user agent in an HTTP response and delivered to the message recipient in an HTTP request. The HTTP interactions before, between, and after these exchanges take place is unspecified. Both the SAML requester and responder are assumed to be HTTP responders.

Additonally, it is assumed that on receipt of an artifact by way of the user agent, the recipient invokes a separate, direct exchange with the artifact issuer using the Artifact Resolution Protocol defined in [SAMLCore]. This exchange MUST use a binding that does not use the HTTP user agent as an intermediary, such as the SOAP binding. On the successful acquisition of a SAML protocol message, the artifact is discarded and the processing of the primary SAML protocol exchange resumes (or ends, if the message is a response).

Issuing and delivering an artifact, along with the subsequent resolution step, constitutes half of the overall SAML protocol exchange. This binding can be used to deliver either or both halves of a SAML protocol exchange. A binding composable with it, such as the HTTP Redirect (see Section 3.4) or POST (see Section 3.5) binding, MAY be used to carry the other half of the exchange. The following sequence assumes that the artifact binding is used for both halves. See the diagram below illustrating the messages exchanged.


User Agent
SAML Requester
SAML Responder
1. User Agent accesses some resource at the SAML Requester using an HTTP request
I need to initiate a SAML protocol exchange.
2. SAML artifact returned in HTTP Redirect URL encoded into Location header or XHTML form control targeted at SAML Responder
3. <ArtifactResolve> message sent by SAML Responder directly to SAML Requester
4. <ArtifactResponse> message returned by SAML Requester containing original SAML request message inside
5. SAML Responder interacts with User Agent, subject to constraints in the SAML request
6. SAML artifact returned in HTTP Redirect URL encoded into Location header or XHTML form control targeted at SAML Requester
7. <ArtifactResolve> message sent by SAML Requester directly to SAML Responder
8. <ArtifactResponse> message returned by SAML Responder containing original SAML response message inside
9. HTTP response sent to user agent from SAML requester upon completion of SAML exchange

1. Initially, the user agent makes an arbitrary HTTP request to a system entity. In the course of processing the request, the system entity decides to initiate a SAML protocol exchange.

2. The system entity acting as a SAML requester responds to an HTTP request from the user agent by returning an artifact representing a SAML request.

   - If URL-encoded, the artifact is returned encoded into the HTTP response's Location header, and the HTTP status MUST be either 303 or 302. The SAML requester MAY include additional presentation and content in the HTTP response to facilitate the user agent's transmission of the message, as defined in HTTP 1.1 [RFC2616]. The user agent delivers the artifact by issuing an HTTP GET request to the SAML responder.

  - If form-encoded, then the artifact is returned in an XHTML document containing the form and content defined in Section 3.6.3.3. The user agent delivers the artifact by issuing an HTTP POST request to the SAML responder.

3. The SAML responder determines the SAML requester by examining the artifact (the exact process depends on the type of artifact), and issues a `<samlp:ArtifactResolve>` request containing the artifact to the SAML requester using a direct SAML binding, temporarily reversing roles.
4. Assuming the necessary conditions are met, the SAML requester returns a `<samlp:ArtifactResponse>` containing the original SAML request message it wishes the SAML responder to process.
5. In general, the SAML responder MAY respond to the SAML request by immediately returning a SAML artifact or MAY return arbitrary content to facilitate subsequent interaction with the user agent necessary to fulfill the request. Specific protocols and profiles may include mechanisms to indicate the requester's level of willingness to permit this kind of interaction (for example, the `IsPassive` attribute in `<samlp:AuthnRequest>`).
6. Eventually the responder SHOULD return a SAML artifact to the user agent to be returned to the SAML requester. The SAML response artifact is returned in the same fashion as described for the SAML request artifact in step 2.The SAML requester determines the SAML responder by examining the artifact, and issues a `<samlp:ArtifactResolve>` request containing the artifact to the SAML responder using a direct SAML binding, as in step 3.
7. Assuming the necessary conditions are met, the SAML responder returns a `<samlp:ArtifactResponse>` containing the SAML response message it wishes the requester to process, as in step 4.
8. Upon receiving the SAML response, the SAML requester returns an arbitrary HTTP response to the user agent.

3.6.5.1 HTTP and Caching Considerations

HTTP proxies and the user agent intermediary should not cache SAML artifacts. To insure this, the following rules SHOULD be followed.

When returning SAML artifacts using HTTP 1.1, HTTP responders SHOULD:

- Include a `Cache-Control` header field set to "`no-cache, no-store`".
- Include a `Pragma` header field set to "`no-cache`".

There are no other restrictions on the use of HTTP headers.

3.6.5.2 Security Considerations

This binding uses a combination of indirect transmission of a message reference followed by a direct exchange to return the actual message. As a result, the message reference (artifact) need not itself be authenticated or integrity protected, but the callback request/response exchange that returns the actual message MAY be mutually authenticated and integrity protected, depending on the environment of use.

If the actual SAML protocol message is intended for a specific recipient, then the artifact's issuer MUST authenticate the sender of the subsequent `<samlp:ArtifactResolve>` message before returning the actual message.

The transmission of an artifact to and from the user agent SHOULD be protected with confidentiality; SSL 3.0 or TLS 1.0 SHOULD be used. The callback request/response exchange that returns the actual message MAY be protected, depending on the environment of use.

In general, this binding relies on the artifact as a hard-to-forge short-term reference and applies other security measures to the callback request/response that returns the actual message. All artifacts MUST have a single-use semantic enforced by the artifact issuer. Furthermore, it is RECOMMENDED that artifact receivers also 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 artifact receiver.

Note also that there is no mechanism defined to protect the integrity of the relationship between the artifact and the "RelayState" value, if any. That is, an attacker can potentially recombine a pair of valid HTTP responses by switching the "RelayState" values associated with each artifact. As a result, the producer/consumer of "RelayState" information MUST take care not to associate sensitive state information with the "RelayState" value without taking additional precautions (such as based on the information in the SAML protocol message retrieved via artifact).

3.6.6 Error Reporting

A SAML responder that refuses to perform a message exchange with the SAML requester SHOULD return a response message with a second-level `<samlp:StatusCode>` value of `urn:oasis:names:tc:SAML:2.0:status:RequestDenied`.

HTTP interactions during the message exchange MUST NOT use HTTP error status codes to indicate failures in SAML processing, since the user agent is not a full party to the SAML protocol exchange.

If the issuer of an artifact receives a `<samlp:ArtifactResolve>` message that it can understand, it MUST return a `<samlp:ArtifactResponse>` with a `<samlp:StatusCode>` value of `urn:oasis:names:tc:SAML:2.0:status:Success`, even if it does not return the corresponding message (for example because the artifact requester is not authorized to receive the message or the artifact is no longer valid).

For more information about SAML status codes, see the SAML assertions and protocols specification [SAMLCore].

3.6.7 Metadata Considerations

Support for the HTTP Artifact binding SHOULD be reflected by indicating URL endpoints at which requests and responses for a particular protocol or profile should be sent. Either a single endpoint or distinct request and response endpoints MAY be supplied. One or more indexed endpoints for processing `<samlp:ArtifactResolve>` messages SHOULD also be described.

3.6.8 Example SAML Message Exchange Using HTTP Artifact

In this example, a `<LogoutRequest>` and `<LogoutResponse>` message pair are exchanged using the HTTP Artifact binding, with the artifact resolution taking place using the SOAP binding bound to HTTP.

First, here are the actual SAML protocol messages being exchanged:

```
<samlp:LogoutRequest xmlns:samlp="urn:oasis:names:tc:SAML:2.0:protocol"
xmlns="urn:oasis:names:tc:SAML:2.0:assertion"
    ID="d2b7c388cec36fa7c39c28fd298644a8" IssueInstant="2004-01-
21T19:00:49Z" Version="2.0">
    <Issuer>https://IdentityProvider.com/SAML</Issuer>
    <NameID Format="urn:oasis:names:tc:SAML:2.0:nameid-
format:persistent">005a06e0-ad82-110d-a556-004005b13a2b</NameID>
    <samlp:SessionIndex>1</samlp:SessionIndex>
</samlp:LogoutRequest>
```

```
<samlp:LogoutResponse xmlns:samlp="urn:oasis:names:tc:SAML:2.0:protocol"
xmlns="urn:oasis:names:tc:SAML:2.0:assertion"
    ID="b0730d21b628110d8b7e004005b13a2b"
InResponseTo="d2b7c388cec36fa7c39c28fd298644a8"
```

```
    IssueInstant="2004-01-21T19:00:49Z" Version="2.0">
    <Issuer>https://ServiceProvider.com/SAML</Issuer>
    <samlp:Status>
        <samlp:StatusCode
Value="urn:oasis:names:tc:SAML:2.0:status:Success"/>
    </samlp:Status>
</samlp:LogoutResponse>
```

The initial HTTP request from the user agent in step 1 is not defined by this binding. To initiate the logout protocol exchange, the SAML requester returns the following HTTP response, containing a SAML artifact. Note that the line feeds in the HTTP `Location` header below are a result of document formatting, and there are no line feeds in the actual header value.

```
HTTP/1.1 302 Object Moved
Date: 21 Jan 2004 07:00:49 GMT
Location:
https://ServiceProvider.com/SAML/SLO/Browser?SAMLart=AAQAADWNEw5VT47wcO4z
X%2FiEzMmFQvGknDfws2ZtqSGdkNSbsW1cmVR0bzU%
3D&RelayState=0043bfc1bc45110dae17004005b13a2b
Content-Type: text/html; charset=iso-8859-1
```

The SAML responder then resolves the artifact it received into the actual SAML request using the Artifact Resolution protocol and the SOAP binding in steps 3 and 4, as follows:

Step 3:

```
POST /SAML/Artifact/Resolve HTTP/1.1
Host: IdentityProvider.com
Content-Type: text/xml
Content-Length: nnn
SOAPAction: http://www.oasis-open.org/committees/security
<SOAP-ENV:Envelope
    xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
    <SOAP-ENV:Body>
        <samlp:ArtifactResolve
             xmlns:samlp="urn:oasis:names:tc:SAML:2.0:protocol"
             xmlns="urn:oasis:names:tc:SAML:2.0:assertion"
             ID="_6c3a4f8b9c2d" Version="2.0"
             IssueInstant="2004-01-21T19:00:49Z">
             <Issuer>https://ServiceProvider.com/SAML</Issuer>
             <Artifact>
             AAQAADWNEw5VT47wcO4zX/iEzMmFQvGknDfws2ZtqSGdkNSbsW1cmVR0bzU=
             </Artifact>
        </samlp:ArtifactResolve>
    </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

Step 4:

```
HTTP/1.1 200 OK
Date: 21 Jan 2004 07:00:49 GMT
Content-Type: text/xml
Content-Length: nnnn

<SOAP-ENV:Envelope
    xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
    <SOAP-ENV:Body>
        <samlp:ArtifactResponse
             xmlns:samlp="urn:oasis:names:tc:SAML:2.0:protocol"
             xmlns="urn:oasis:names:tc:SAML:2.0:assertion"
             ID="_FQvGknDfws2Z" Version="2.0"
             InResponseTo="_6c3a4f8b9c2d"
             IssueInstant="2004-01-21T19:00:49Z">
             <Issuer>https://IdentityProvider.com/SAML</Issuer>
             <samlp:Status>
                    <samlp:StatusCode
             Value="urn:oasis:names:tc:SAML:2.0:status:Success"/>
             </samlp:Status>
```

```
                <samlp:LogoutRequest ID="d2b7c388cec36fa7c39c28fd298644a8"
                        IssueInstant="2004-01-21T19:00:49Z"
                        Version="2.0">
                        <Issuer>https://IdentityProvider.com/SAML</Issuer>
                        <NameID Format="urn:oasis:names:tc:SAML:2.0:nameid-
format:persistent">005a06e0-ad82-110d-a556-004005b13a2b</NameID>
                        <samlp:SessionIndex>1</samlp:SessionIndex>
                </samlp:LogoutRequest>
        </samlp:ArtifactResponse>
    </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

After any unspecified interactions may have taken place, the SAML responder returns a second SAML artifact in its HTTP response in step 6:

```
HTTP/1.1 302 Object Moved
Date: 21 Jan 2004 07:05:49 GMT
Location:
https://IdentityProvider.com/SAML/SLO/Response?SAMLart=AAQAAFGIZXv5%
2BQaBaE5qYurHWJO1nAgLAsqfnyiDHIggbFU0mlSGFTyQiPc%
3D&RelayState=0043bfc1bc45110dae17004005b13a2b
Content-Type: text/html; charset=iso-8859-1
```

The SAML responder then resolves the artifact it received into the actual SAML request using the Artifact Resolution protocol and the SOAP binding in steps 7 and 8, as follows:

Step 7:

```
POST /SAML/Artifact/Resolve HTTP/1.1
Host: ServiceProvider.com
Content-Type: text/xml
Content-Length: nnn
SOAPAction: http://www.oasis-open.org/committees/security
<SOAP-ENV:Envelope
    xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
    <SOAP-ENV:Body>
        <samlp:ArtifactResolve
             xmlns:samlp="urn:oasis:names:tc:SAML:2.0:protocol"
             xmlns="urn:oasis:names:tc:SAML:2.0:assertion"
             ID="_ec36fa7c39" Version="2.0"
             IssueInstant="2004-01-21T19:05:49Z">
             <Issuer>https://IdentityProvider.com/SAML</Issuer>
             <Artifact>
             AAQAAFGIZXv5+QaBaE5qYurHWJO1nAgLAsqfnyiDHIggbFU0mlSGFTyQiPc=
             </Artifact>
        </samlp:ArtifactResolve>
    </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

Step 8:

```
HTTP/1.1 200 OK
Date: 21 Jan 2004 07:05:49 GMT
Content-Type: text/xml
Content-Length: nnnn

<SOAP-ENV:Envelope
    xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
    <SOAP-ENV:Body>
        <samlp:ArtifactResponse
             xmlns:samlp="urn:oasis:names:tc:SAML:2.0:protocol"
             xmlns="urn:oasis:names:tc:SAML:2.0:assertion"
             ID="_FQvGknDfws2Z" Version="2.0"
             InResponseTo="_ec36fa7c39"
             IssueInstant="2004-01-21T19:05:49Z">
             <Issuer>https://ServiceProvider.com/SAML</Issuer>
             <samlp:Status>
                    <samlp:StatusCode
```

```
                Value="urn:oasis:names:tc:SAML:2.0:status:Success"/>
                </samlp:Status>
                <samlp:LogoutResponse ID="_b0730d21b628110d8b7e004005b13a2b"
                      InResponseTo="_d2b7c388cec36fa7c39c28fd298644a8"
                      IssueInstant="2004-01-21T19:05:49Z"
                      Version="2.0">
                      <Issuer>https://ServiceProvider.com/SAML</Issuer>
                      <samlp:Status>
                            <samlp:StatusCode
                Value="urn:oasis:names:tc:SAML:2.0:status:Success"/>
                      </samlp:Status>
                </samlp:LogoutResponse>
           </samlp:ArtifactResponse>
    </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

3.7 SAML URI Binding

URIs are a protocol-independent means of referring to a resource. This binding is not a general SAML request/response binding, but rather supports the encapsulation of a `<samlp:AssertionIDRequest>` message with a single `<saml:AssertionIDRef>` into the resolution of a URI. The result of a successful request is a SAML `<saml:Assertion>` element (but not a complete SAML response).

Like SOAP, URI resolution can occur over multiple underlying transports. This binding has transport-independent aspects, but also calls out the use of HTTP with SSL 3.0 or TLS 1.0 as REQUIRED (mandatory to implement).

3.7.1 Required Information

Identification: urn:oasis:names:tc:SAML:2.0:bindings:URI

Contact information: security-services-comment@lists.oasis-open.org

Description: Given below.

Updates: None

3.7.2 Protocol-Independent Aspects of the SAML URI Binding

The following sections define aspects of the SAML URI binding that are independent of the underlying transport protocol of the URI resolution process.

3.7.2.1 Basic Operation

A SAML URI reference identifies a specific SAML assertion. The result of resolving the URI MUST be a message containing the assertion, or a transport-specific error. The specific format of the message depends on the underlying transport protocol. If the transport protocol permits the returned content to be described, such as HTTP 1.1 [RFC2616], then the assertion MAY be encoded in whatever format is permitted. If not, the assertion MUST be returned in a form which can be unambiguously interpreted as or transformed into an XML serialization of the assertion.

It MUST be the case that if the same URI reference is resolved in the future, then either the same SAML assertion, or an error, is returned. That is, the reference MAY be persistent but MUST consistently reference the same assertion, if any.

3.7.3 Security Considerations

Indirect use of a SAML assertion presents dangers if the binding of the reference to the result is not secure. The particular threats and their severity depend on the use to which the assertion is being put. In general, the result of resolving a URI reference to a SAML assertion SHOULD only be trusted if the requester can be certain of the identity of the responder and that the contents have not been modified in transit.

It is often not sufficient that the assertion itself be signed, because URI references are by their nature somewhat opaque to the requester. The requester SHOULD have independent means to insure that the assertion returned is actually the one that is represented by the URI; this is accomplished by both authenticating the responder and relying on the integrity of the response.

3.7.4 MIME Encapsulation

For resolution protocols that support MIME as a content description and packaging mechanism, the resulting assertion SHOULD be returned as a MIME entity of type `application/samlassertion+xml`, as defined by [SAMLmime].

3.7.5 Use of HTTP URIs

A SAML authority that claims conformance to the SAML URI binding MUST implement support for HTTP. This section describes certain specifics of using HTTP URIs, including URI syntax, HTTP headers, and error reporting.

3.7.5.1 URI Syntax

In general, there are no restrictions on the permissible syntax of a SAML URI reference as long as the SAML authority responsible for the reference creates the message containing it. However, authorities MUST support a URL endpoint at which an HTTP request can be sent with a single query string parameter named `ID`. There MUST be no query string in the endpoint URL itself independent of this parameter.

For example, if the documented endpoint at an authority is "https://saml.example.edu/assertions", a request for an assertion with an `ID` of `abcde` can be sent to:

```
        https://saml.example.edu/assertions?ID=abcde
```

Note that the use of wildcards is not allowed for such ID queries.

3.7.5.2 HTTP and Caching Considerations

HTTP proxies MUST NOT cache SAML assertions. To insure this, the following rules SHOULD be followed.

When returning SAML assertions using HTTP 1.1, HTTP responders SHOULD:

- Include a `Cache-Control` header field set to "`no-cache, no-store`".
- Include a `Pragma` header field set to "`no-cache`".

3.7.5.3 Security Considerations

[RFC2617] describes possible attacks in the HTTP environment when basic or message-digest authentication schemes are used.

Use of SSL 3.0 or TLS 1.0 is STRONGLY RECOMMENDED as a means of authentication, integrity protection, and confidentiality.

3.7.5.4 Error Reporting

As an HTTP protocol exchange, the appropriate HTTP status code SHOULD be used to indicate the result of a request. For example, a SAML responder that refuses to perform a message exchange with the SAML requester SHOULD return a "`403 Forbidden`" response. If the assertion specified is unknown to the responder, then a "`404 Not Found`" response SHOULD be returned. In these cases, the content of the HTTP body is not significant.

3.7.5.5 Metadata Considerations

Support for the URI binding over HTTP SHOULD be reflected by indicating a URL endpoint at which requests for arbitrary assertions are to be sent.

3.7.5.6 Example SAML Message Exchange Using an HTTP URI

Following is an example of a request for an assertion.

```
GET /SamlService?ID=abcde HTTP/1.1
Host: www.example.com
```

Following is an example of the corresponding response, which supplies the requested assertion.

```
HTTP/1.1 200 OK
Content-Type: application/samlassertion+xml
Cache-Control: no-cache, no-store
Pragma: no-cache
Content-Length: nnnn

<saml:Assertion ID="abcde" ...>
...
</saml:Assertion>
```

4 References

[AES]	FIPS-197, Advanced Encryption Standard (AES), available from http://www.nist.gov/.
[Anders]	A suggestion on how to implement SAML browser bindings without using "Artifacts", http://www.x-obi.com/OBI400/andersr-browser-artifact.ppt.
[CoreAssnEx]	Core Assertions Architecture, Examples and Explanations, http://www.oasis-open.org/committees/security/docs/draft-sstc-core-phill-07.pdf.
[HTML401]	HTML 4.01 Specification, W3C Recommendation 24 December 1999, http://www.w3.org/TR/html4.
[XHTML]	XHTML 1.0 The Extensible HyperText Markup Language (Second Edition), http://www.w3.org/TR/xhtml1/.
[Liberty]	The Liberty Alliance Project, http://www.projectliberty.org.
[MSURL]	Microsoft technical support article, http://support.microsoft.com/support/kb/articles/Q208/4/27.ASP.
[PAOS]	Aarts, R., "Liberty Reverse HTTP Binding for SOAP Specification", Version: 1.0, https://www.projectliberty.org/specs/liberty-paos-v1.0.pdf
[Rescorla-Sec]	E. Rescorla et al., *Guidelines for Writing RFC Text on Security Considerations*, http://www.ietf.org/internet-drafts/draft-iab-sec-cons-03.txt.
[RFC1952]	GZIP file format specification version 4.3, http://www.ietf.org/rfc/rfc1952.txt
[RFC1738]	Uniform Resource Locators (URL), http://www.ietf.org/rfc/rfc1738.txt
[RFC1750]	Randomness Recommendations for Security. http://www.ietf.org/rfc/rfc1750.txt
[RFC1945]	Hypertext Transfer Protocol -- HTTP/1.0, http://www.ietf.org/rfc/rfc1945.txt.
[RFC2045]	Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies, http://www.ietf.org/rfc/rfc2045.txt
[RFC2119]	S. Bradner, *Key words for use in RFCs to Indicate Requirement Levels*, IETF RFC 2119, March 1997, http://www.ietf.org/rfc/rfc2119.txt.
[RFC2246]	The TLS Protocol Version 1.0, http://www.ietf.org/rfc/rfc2246.txt.
[RFC2279]	UTF-8, a transformation format of ISO 10646, http://www.ietf.org/rfc/rfc2279.txt.
[RFC2616]	Hypertext Transfer Protocol -- HTTP/1.1, http://www.ietf.org/rfc/rfc2616.txt.
[RFC2617]	*HTTP Authentication: Basic and Digest Access Authentication*, IETF RFC 2617, http://www.ietf.org/rfc/rfc2617.txt.
[SAMLCore]	S. Cantor et al., *Assertions and Protocols for the OASIS Security Assertion Markup Language (SAML) V2.0*. OASIS SSTC, August 2004. Document ID sstc-saml-core-2.0-cd-01. See http://www.oasis-open.org/committees/security/.
[SAMLGloss]	J. Hodges et al., *Glossary for the OASIS Security Assertion Markup Language (SAML) V2.0*. OASIS SSTC, August 2004. Document ID sstc-saml-glossary-2.0-cd-01. See http://www.oasis-open.org/committees/security/.
[SAMLProfile]	S. Cantor et al., *Profiles for the OASIS Security Assertion Markup Language (SAML) V2.0*. OASIS SSTC, August 2004. Document ID sstc-saml-profiles-2.0-cd-01. See http://www.oasis-open.org/committees/security/.
[SAMLMeta]	S. Cantor et al., *Metadata for the OASIS Security Assertion Markup Language (SAML) V2.0*. OASIS SSTC, August 2004. Document ID sstc-saml-metadata-2.0-cd-01. See http://www.oasis-open.org/committees/security/.
[SAMLmime]	http://www.ietf.org/internet-drafts/draft-hodges-saml-mediatype-01.txt.

[SAMLSecure]	F. Hirsch et al., *Security and Privacy Considerations for the OASIS Security Assertion Markup Language (SAML) V2.0*. OASIS SSTC, August 2004. Document ID sstc-saml-sec-consider-2.0-cd-01. See http://www.oasis-open.org/committees/security/.
[SAMLReqs]	Darren Platt et al., SAML Requirements and Use Cases, OASIS, April 2002, http://www.oasis-open.org/committees/security/.
[SAMLWeb]	OASIS Security Services Technical Committee website, http://www.oasis-open.org/committees/security.
[SESSION]	RL “Bob” Morgan, Support of target web server sessions in Shibboleth, http://middleware.internet2.edu/shibboleth/docs/draft-morgan-shibboleth-session-00.txt
[ShibMarlena]	Marlena Erdos, Shibboleth Architecture DRAFT v1.1, http://shibboleth.internet2.edu/draft-internet2-shibboleth-arch-v05.html .
[SOAP1.1]	D. Box et al., *Simple Object Access Protocol (SOAP) 1.1*, World Wide Web Consortium Note, May 2000, http://www.w3.org/TR/SOAP.
[SOAP-PRIMER]	N. Mitra, SOAP Version 1.2 Part 0: Primer, W3C Recommendation 24 June 2003, http://www.w3.org/TR/soap12-part0/
[SSL3]	A. Frier et al., *The SSL 3.0 Protocol*, Netscape Communications Corp, November 1996.
[WEBSSO]	RL “Bob” Morgan, Interactions between Shibboleth and local-site web sign-on services, http://middleware.internet2.edu/shibboleth/docs/draft-morgan-shibboleth-websso-00.txt
[WSS-SAML]	P. Hallam-Baker et al., *Web Services Security: SAML Token Profile*, OASIS, March 2003, http://www.oasis-open.org/committees/wss.
[**WSS-Sec]**	A. Nadalin et al., Web Services Security: SOAP Message Security 1.0 (WS-Security 2004), OASIS Standard 200401, March 2004, http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-soap-message-security-1.0.pdf
[XMLSig]	D. Eastlake et al., *XML-Signature Syntax and Processing*, World Wide Web Consortium, http://www.w3.org/TR/xmldsig-core/.

Appendix A. Acknowledgments

The editors would like to acknowledge the contributions of the OASIS Security Services Technical Committee, whose voting members at the time of publication were:

- Conor Cahill, AOL
- Hal Lockhart, BEA Systems
- Rick Randall, Booz Allen Hamilton
- Ronald Jacobson, Computer Associates
- Gavenraj Sodhi, Computer Associates
- Tim Alsop, CyberSafe Limited
- Paul Madsen, Entrust
- Carolina Canales-Valenzuela, Ericsson
- Dana Kaufman, Forum Systems
- Irving Reid, Hewlett-Packard
- Paula Austel, IBM
- Maryann Hondo, IBM
- Michael McIntosh, IBM
- Anthony Nadalin, IBM
- Nick Ragouzis, Individual
- Scott Cantor, Internet2
- Bob Morgan, Internet2
- Prateek Mishra, Netegrity
- Forest Yin, Netegrity
- Peter Davis, Neustar
- Frederick Hirsch, Nokia
- John Kemp, Nokia
- Senthil Sengodan, Nokia
- Scott Kiester, Novell
- Steve Anderson, OpenNetwork
- Ari Kermaier, Oracle
- Vamsi Motukuru, Oracle
- Darren Platt, Ping Identity
- Jim Lien, RSA Security
- John Linn, RSA Security
- Rob Philpott, RSA Security
- Dipak Chopra, SAP
- Jahan Moreh, Sigaba
- Bhavna Bhatnagar, Sun Microsystems
- Jeff Hodges, Sun Microsystems
- Eve Maler, Sun Microsystems
- Ronald Monzillo, Sun Microsystems
- Emily Xu, Sun Microsystems
- Mike Beach, Boeing

- Greg Whitehead, Trustgenix
- James Vanderbeek, Vodafone

The editors also would like to acknowledge the following people for their contributions to previous versions of the OASIS Security Assertions Markup Language Standard:

- Stephen Farrell, Baltimore Technologies
- David Orchard, BEA Systems
- Krishna Sankar, Cisco Systems
- Zahid Ahmed, CommerceOne
- Carlisle Adams, Entrust
- Tim Moses, Entrust
- Nigel Edwards, Hewlett-Packard
- Joe Pato, Hewlett-Packard
- Bob Blakley, IBM
- Marlena Erdos, IBM
- Marc Chanliau, Netegrity
- Chris McLaren, Netegrity
- Lynne Rosenthal, NIST
- Mark Skall, NIST
- Simon Godik, Overxeer
- Charles Norwood, SAIC
- Evan Prodromou, Securant
- Robert Griffin, RSA Security (former editor)
- Sai Allarvarpu, Sun Microsystems
- Chris Ferris, Sun Microsystems
- Emily Xu, Sun Microsystems
- Mike Myers, Traceroute Security
- Phillip Hallam-Baker, VeriSign (former editor)
- James Vanderbeek, Vodafone
- Mark O'Neill, Vordel
- Tony Palmer, Vordel

Finally, the editors wish to acknowledge the following people for their contributions of material used as input to the OASIS Security Assertions Markup Language specifications:

- Thomas Gross, IBM
- Birgit Pfitzmann, IBM

Appendix B. Notices