Subject-based Profiles for SAML V1.1 Assertions

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Abstract:
This profile places constraints upon SAML V1.1 subjects and assertions so that they have properties similar to SAML V2.0 subjects and assertions.

Status:
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1 Introduction

The Subject-based Profiles for SAML V1.1 Assertions specifies two profiles:

- SAML V1.1 Subject Profile
- SAML V1.1 Subject-based Assertion Profile

The primary goal of the SAML V1.1 Subject-based Assertion Profile (which relies on the SAML V1.1 Subject Profile) is to provide guidance to deployments that support both SAML V1.1 and V2.0. In that case, there is some flexibility in SAML V1.1 that is not present in SAML V2.0 (and vice versa). This profile places constraints upon SAML V1.1 subjects and assertions so that they have properties similar to SAML V2.0 subjects and assertions. This may aid interoperability and speed the ultimate transition from SAML V1.1 to SAML V2.0.

An implementation of the SAML V1.1 Web Browser SSO Profile is very likely conformant to this profile. Other applications of SAML may not be conformant, however. For example, the Web Services Security SAML Token Profile [WSSSAML] provides for both SAML V1.1 and SAML V2.0 tokens. Due to differences between the two versions of SAML, an implementation that wished to support both would tend to constrain the tokens such that they exhibited an equivalent semantic. This profile provides one such set of constraints.

A major difference between SAML V1.1 and SAML V2.0 is that the latter elevates the <saml2:Subject> element to be a child element of the <saml2:Assertion> element, and therefore the <saml2:Subject> element applies to all the statements in the assertion. In SAML V1.1, on the other hand, each statement has its own <saml:Subject> element, which opens the door to a range of possibilities. This profile constrains SAML V1.1 assertions so that each statement contains an equivalent <saml:Subject> element. Formally, this is done by extending the notion of strongly matches to an equivalence relation, which culminates in section 3.3.

1.1 Terminology

This specification uses normative text to describe the contents of conforming SAML subjects and assertions.

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

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

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

Listings of XML schemas appear like this.

Example code listings appear like this.

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

<table>
<thead>
<tr>
<th>Prefix</th>
<th>XML Namespace</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>saml:</td>
<td>urn:oasis:names:tc:SAML:1.1:assertion</td>
<td>This is the SAML V1.1 assertion namespace</td>
</tr>
<tr>
<td></td>
<td>[SAMLCore].</td>
<td></td>
</tr>
<tr>
<td>saml2:</td>
<td>urn:oasis:names:tc:SAML:2.0:assertion</td>
<td>This is the SAML V2.0 assertion namespace</td>
</tr>
<tr>
<td></td>
<td>[SAML2Core].</td>
<td></td>
</tr>
</tbody>
</table>
This specification uses the following typographical conventions in text: `<UnqualifiedElement>`, `<ns:QualifiedElement>`, Attribute, Datatype, OtherKeyword.

### 1.2 Outline

Section 2 describes a profile that constrains SAML V1.1 subjects so that they have properties similar to SAML V2.0 subjects. Section 3 describes a profile that places constraints upon SAML V1.1 assertions so that they have properties similar to SAML V2.0 assertions. Finally, section 4 specifies requirements that all conforming implementations must follow.

### 1.3 Normative References

- **[RFC 2119]**
  S. Bradner. *Key words for use in RFCs to Indicate Requirement Levels*. IETF

- **[SAML2Core]**
  http://docs.oasis-open.org/security/saml/v2.0/saml-core-2.0-os.pdf

- **[SAMLCore]**

- **[SAMLSAP-XSD]**

- **[Schema1]**
  http://www.w3.org/TR/2001/REC-xmlschema-1-20010502/

- **[XMLSig]**
  http://www.w3.org/TR/2002/REC-xmldsig-core-20020212/

- **[XMLSig-XSD]**

### 1.4 Non-Normative References

- **[MACEAttrib]**
  S. Cantor et al. *MACE-Dir SAML Attribute Profiles*. Internet2 MACE, April 2006.


2 SAML V1.1 Subject Profile

This SAML V1.1 Subject Profile constrains SAML V1.1 subjects so that they have properties similar to SAML V2.0 subjects.

2.1 Required Information


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

Description: Given below.

Updates: N/A

Extends: N/A

2.2 Profile Description

This profile specifies a SAML V1.1 <saml:Subject> element that can be readily mapped to SAML V2.0.

2.3 Usage of <saml:Subject> Element

Neither SAML V1.1 nor SAML V2.0 explicitly requires a name identifier, but certain SAML V2.0 profiles (most notably the Single Logout Profile) implicitly require one, so a <saml:Subject> element that conforms to this profile SHOULD contain a <saml:NameIdentifier> element. To further align with SAML V2.0, the NameQualifier attribute on the <saml:NameIdentifier> element SHOULD be omitted unless the identifier's type definition explicitly defines its use and semantics. In particular, if the Format attribute on the <saml:NameIdentifier> element has a value specified in section 7.3 of [SAMLCore], the NameQualifier attribute SHOULD be omitted.

Certain deprecated features of SAML V1.1 were removed in SAML V2.0. Thus a <saml:Subject> that conforms to this profile MUST NOT contain a <saml:NameIdentifier> element with any of the following Format attribute values:

- urn:oasis:names:tc:SAML:1.0:assertion#emailAddress
- urn:oasis:names:tc:SAML:1.0:assertion#X509SubjectName
- urn:oasis:names:tc:SAML:1.0:assertion#WindowsDomainQualifiedName

See section 7.3 of [SAMLCore] for the URIs to be used in lieu of these deprecated values.

In SAML V1.1, a <saml:Subject> element contains at most one <saml:SubjectConfirmation> element containing one or more <saml:ConfirmationMethod> elements. In SAML V2.0, on the other hand, there may be multiple <saml2:SubjectConfirmation> elements, each with a required Method attribute. Therefore, a <saml:Subject> element that conforms to this profile MAY contain a <saml:SubjectConfirmation> element, but that element MUST contain one and only one <saml:ConfirmationMethod> element.

2.4 Example

<!-- SAML V1.1 Subject -->
<saml:Subject>
  <saml:NameIdentifier
      Format="urn:oasis:names:tc:SAML:1.1:nameid-format:X509SubjectName">
    C=US, O=NCSA-TEST, OU=User, CN=trscavo@uiuc.edu
  </saml:NameIdentifier>
</saml:Subject>
2.5 Strongly Matching Subjects

In general, the notion of strongly matches defined in section 3.4.4 of [SAMLCore] is overly restrictive, for at least two reasons: 1) a <saml:NameIdentifier> element with no Format attribute is semantically equivalent to a <saml:NameIdentifier> element with Format equal to "urn:oasis:names:tc:SAML:1.1:nameid-format:unspecified", and 2) a <saml:SubjectConfirmation> element with confirmation method "urn:oasis:names:tc:SAML:1.0:cm:holder-of-key" must have a <ds:KeyInfo> element, but two distinct <ds:KeyInfo> elements can refer to the same key so two distinct <saml:SubjectConfirmation> elements can be semantically equivalent. For these reasons, especially the latter, this profile adopts an alternate definition of strongly matches that more closely aligns with SAML V2.0.

The name identifier part of the definition of strongly matches in the two versions of SAML is the same if we ignore the language regarding encryption in the SAML V2.0 definition (which of course SAML V1.1 does not support). On the other hand, the subject confirmation part of strongly matches has a distinctly different flavor, so we reformulate the subject confirmation part of strongly matches in SAML V1.1 so that it aligns with SAML V2.0.

Under the assumption that a <saml:SubjectConfirmation> element contains only and only one <saml:ConfirmationMethod> element (section 2.3), we define strongly matches as follows:

A <saml:Subject> element S1 strongly matches S2 if and only if the following two conditions both apply:

- If S2 includes a <saml:NameIdentifier> element, then S1 MUST include an identical <saml:NameIdentifier> element.

- If S2 contains a <saml:SubjectConfirmation> element such that the subject identified by S1 can be confirmed in the manner described by the <saml:SubjectConfirmation> element in S2.

Like the definition of strongly matches in [SAMLCore], the above relation is not symmetric since S1 strongly matches S2 does not imply that S2 strongly matches S1. In other words, the order of operands S1,S2 matters.
3 SAML V1.1 Subject-based Assertion Profile

This SAML V1.1 Subject-based Assertion Profile places constraints upon SAML V1.1 assertions so that they have properties similar to SAML V2.0 assertions.

In SAML V1.1, each statement contains a `<saml:Subject>` element, but in SAML V2.0, there is one `<saml2:Subject>` element per assertion. Thus, in SAML V2.0, every statement necessarily applies to the same subject. To achieve an equivalent semantic in SAML V1.1, this profile places suitable restrictions on multi-statement assertions.

See section 2 of the SAML V1.1 Assertions and Protocols specification [SAMLCore] for general requirements regarding SAML assertions. Where this profile conflicts with [SAMLCore], the former takes precedence.

3.1 Required Information

Identification:

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

Description: Given below.

Updates: N/A

Extends: N/A

3.2 Profile Description

This profile places the following constraints upon conforming assertions:

- Deprecated elements must not be used.
- Each statement of the assertion must have a `<saml:Subject>` element.
- Each `<saml:Subject>` element must satisfy the SAML Subject Profile described in section 2.
  Moreover, each pair of `<saml:Subject>` elements must very strongly match, a notion made precise in the next section.

Such an assertion is called a subject-based assertion.

3.3 Usage of `<saml:Assertion>` Element

An assertion that conforms to this profile MUST satisfy the following general requirements:

- The assertion MUST NOT contain a `<saml:AuthorityBinding>` element.
- Every statement in the assertion MUST have a type derived from abstract type `saml:SubjectStatementAbstractType` [SAMLCore].
- The `<saml:Subject>` element of each statement MUST satisfy the SAML Subject Profile described in section 2.
- If the `<saml:Assertion>` element contains more than one statement, each pair of `<saml:Subject>` elements MUST very strongly match, which we now define. Let S1 and S2 be two `<saml:Subject>` elements. S1 very strongly matches S2 if S1 strongly matches S2 and S2 strongly matches S1. Note that this definition depends on the notion of strongly matches defined in section 2.5.

An assertion is valid according to this profile if and only if it satisfies the above requirements.
3.4 Example

The following SAML assertion was obtained by a principal who authenticated to an identity provider via TLS [RFC2246] client authentication. Note that the `<saml:Subject>` elements in the two statements very strongly match (indeed, the `<saml:Subject>` elements are identical).

```xml
<!-- SAML Assertion for an X.509 Subject -->
<saml:Assertion
    xmlns:saml="urn:oasis:names:tc:SAML:1.0:assertion"
    xmlns:xs="http://www.w3.org/2001/XMLSchema"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:ds="http://www.w3.org/2000/09/xmldsig#"
    AssertionID="_33776a319493ad607b7ab3e689482e45"
    IssueInstant="2006-07-17T20:31:41Z"
    Issuer="https://idp.example.org/saml"
    MajorVersion="1" MinorVersion="1">
    <!-- assertion lifetime constrained by principal's X.509 cert -->
    <saml:Conditions
        NotBefore="2006-07-17T20:31:41Z"
        NotOnOrAfter="2006-07-18T20:21:41Z">
    </saml:Conditions>
    <saml:AuthenticationStatement
        AuthenticationInstant="2006-07-17T20:31:41Z"
        AuthenticationMethod="urn:ietf:rfc:2246">
        <saml:Subject>
            <saml:NameIdentifier
                Format="urn:oasis:names:tc:SAML:1.1:nameid-format:X509SubjectName">
                C=US, O=NCSA-TEST, OU=User, CN=trscavo@uiuc.edu
            </saml:NameIdentifier>
            <saml:SubjectConfirmation>
                <saml:ConfirmationMethod>
                    urn:oasis:names:tc:SAML:1.0:cm:holder-of-key
                </saml:ConfirmationMethod>
                <ds:KeyInfo>
                    <ds:X509Data>
                        <!-- subject's X.509 cert -->
                        MIICidCCAXAQCCDEgeiWrm62jANBgkqhkiG9w0BAQQQFADB6FMQswCQDVQQGEwJY
                        UzEEMbBGA1UEChMtNTQ5QSIURVNUMQ0wCwYDVQQLExVcV2RRMwEoYDVQQDEwEz
                        UC1TZXJ2aWN1MB4XDTA2MDcxNizwMjE0MV0xMDcxMjE0MwswZzELMAKg
                        A1UEBhMCVVMxMjQjAQ0gNVBAoTCU5DU0EtVEVTVDENMAsGA1UECxMVXVNlcjE8
                        A1UEAwQfDHJzY2FsbOBla1xVjLmVvdTBncANBgkqhkjiG9w0BAQEFAAOFbjQwYK
                        gVYEat9QMe41l1XRxxWcfliBjC9Kgty6zBjmp+XaXJNMOVaBazZt+5XNNnXeYi
                        ncCo203ya76a53QWy+x5wKQYo8RsDw28NV3a73wfxjXZh09Gq8Rcscs9EF11WC
                        q2bHqBshfBv31IlH41 BjM5C5bifu7s2r7i/rxadd2UzKCaWxwAqN0Bgkqk11G
                        9oWiBAQQQFADB6FMQswCQDVQQGEwJY
                        Ejk0QxaZKhre26+ZIdiMN7zRv7DJSsNMZl8W+l+sVs6voB5EXl3eZ+CEAll4g
                        cyczV2UR4dMrjWswNBKMKFul=r7rUr9uvIWI2KbMeE9Kp+kiiiITskLcKfFznw1J
                        seim5Ht7CtCcrDcn5n40v2-d3dolg52vSt0Fd8Bvux02hv679JR6Hlqjtk4GExp
                        9F1V1V450dPEO381uQIJTXXLhMfMLuUGVh/c0ReJbn92Vj4dI/yy6PtY/8ncYLYNK
                        oVNOj/yomOktn91l1Fyt0iY40uJ72R0z1+zWty9g==
                    </ds:X509Data>
                </ds:KeyInfo>
            </saml:SubjectConfirmation>
        </saml:Subject>
    </saml:AuthenticationStatement>
</saml:AuthenticationStatement>
</saml:Assertion>
</saml:Assertion>
```
387 urn:oasis:names:tc:SSOSAML:1.0:cm:holder-of-key
388 </sp:saml:ConfirmationMethod>
389 </sp:KeyInfo>
390 </sp:X509Data>
391 <!-- subject's X.509 cert -->
392 </sp:X509Certificate>
393 MIICiDCCAXACCDQEE+9eiWm6zjNbgkkthrkiG9w0BAQQQAFDBFMQswCQYDVQQGEwJwJV
394 UzESMBwAGA1UECwFMTkQxTjQQLURNVUNQoCwYDVQQLERv2VysMRRwEQYDVQQDEweT
395 UC1TZXJ2aWN1MB4XDTA2MDcxMi1wNi1wIj0EMVoXDTA2MDcxODIwMjE0MwczZElmAKG
396 A1UEBhMCVMVQmJqAQBGVBAGA1UEExZEVTVDBNMAAGA1UEExEjMCExG
397 A1UEAwQWdJHsZy2F2b0laXYvjmVkJdTCBnznANNgkqkhkiG9w0BAQEQFAAOBJQA4WqYKC
398 gYEAy9QMe41J3kWfCfblcycjK9g6ty62BjMq4tsaj1NMVouBz3t+cSXkneeYife
399 nCce2O3yaXf76aq53QWxy+5w+3Qy68Rzow28hV3a73vfjXJXouBqkvinERcssc9EfiWCC
400 g2hsHg98uSh+Fbv31ih41Bj5MCB2bi1bs7d1r/xsadU2RcCAwEAATANBgkqhkiG
401 9w0BAQQQFAOCAQEdytcMTob77TVke1fsJ7+i1j01024UIKbLz2OPvFCv6fVHX
402 Ejk0QxaZJhre26+iIdiMXEz1RdJEeNMxtDw8++sVs6aovB5EXl3ez+CEAIL4g
403 cvKZUR4dMryWbHBKF6l+7urUgyWIL2KbMeE9KF+kiiiiTskLcKgFngw1j
404 selmh/QCexCn50y02+d3dog52V0tVFDhBQSvDix02hv679JR6Hlqjtk4GExp
405 E91V10wdPE103bqQJX7XhsmMLvUghan/cOrCJb9n2Vj4dI/yy6ptY/8ncYLYNkjg
406 oVNUj/ym0ktn91lPfY1uy40ouJsZ0RO1+zWLy9g==
407 </sp:X509Certificate>
408 </sp:X509Data>
409 </sp:KeyInfo>
410 </sp:saml:SubjectConfirmation>
411 </sp:saml:Subject>
412 </sp:saml:Attribute
413 AttributeNamespace="urn:mace:shibboleth:1.0:attributeNamespace:uri"
414 AttributeName="urn:mace:dir:attribute-def:eduPersonPrincipalName">
415 </sp:saml:AttributeValue Scope="uiuc.edu">
416 trscavo
417 </sp:saml:AttributeValue>
418 </sp:saml:Attribute>
419 </sp:saml:Attribute>
420 AttributeNamespace="urn:mace:shibboleth:1.0:attributeNamespace:uri"
421 AttributeName="urn:mace:dir:attribute-def:givenName">
422 <sp:saml:AttributeValue xsi:type="xs:string">
423 Tom
424 </sp:saml:AttributeValue>
425 </sp:saml:Attribute>
426 </sp:saml:Attribute>
427 </sp:saml:Attribute>
428 </sp:saml:Attribute>
429 AttributeNamespace="urn:mace:shibboleth:1.0:attributeNamespace:uri"
430 AttributeName="urn:mace:dir:attribute-def:sn">
431 </sp:saml:AttributeValue xsi:type="xs:string">
432 Scavo
433 </sp:saml:Attribute>
434 </sp:saml:Attribute>
435 </sp:saml:Attribute>
436 </sp:saml:Attribute>
437 <sp:saml:Attribute xsi:type="xs:string">
438 trscavo@gmail.com
439 </sp:saml:AttributeValue>
440 </sp:saml:Attribute>
441 </sp:saml:Assertion>
442 </sp:saml:AttributeStatement>
443 </sp:ds:Signature>
444 </sp:saml:Assertion>
445 The attributes in the above example conform to the MACE-Dir Attribute Profile for SAML 1.x [MACEAttrib]
446 and are for illustration purposes only.
447
448 3.5 Complex type SubjectStatementType
449
450 Recall that a SAML V1.1 assertion contains at least one statement. SAML V2.0, on the other hand,
451 permits empty assertions, that is, subject-based assertions with no statements. To duplicate this capability
452 in SAML V1.1, we define a trivial extension of saml:SubjectStatementAbstractType:
The following example illustrates a `<saml:Assertion>` containing a `<saml:SubjectStatement>` of type `samlsap:SubjectStatementType`.

```xml
<saml:Assertion
  xmlns:saml="urn:oasis:names:tc:SAML:1.0:assertion"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  AssertionID="cT_S_T-vKMwidT8_PzkkeSUkC68."
  IssueInstant="2006-07-17T20:31:41Z"
  Issuer="https://idp.example.org/saml"
  MajorVersion="1" MinorVersion="1">
  <saml:Conditions
    NotBefore="2006-07-17T20:31:41Z"
    NotOnOrAfter="2006-07-18T20:21:41Z">
    <!-- Conditions -->
  </saml:Conditions>
  <saml:SubjectStatement
    xsi:type="samlsap:SubjectStatementType">
    <saml:Subject>
      <saml:NameIdentifier
        Format="urn:oasis:names:tc:SAML:1.1:nameid-format:X509SubjectName">
        C=US, O=NCSA-TEST, OU=User, CN=trscavo@uiuc.edu
      </saml:NameIdentifier>
    </saml:Subject>
  </saml:SubjectStatement>
</saml:Assertion>
```

Note that the above `<saml:SubjectStatement>` element has no content apart from a `<saml:Subject>` element.
4 Implementation Conformance

An implementation of this specification shall be ...
5 Acknowledgments

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# 6 Revision History

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