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**SAML 2.0 Bearer Assertion Grant Type Profile for OAuth 2.0**  
**draft-ietf-oauth-saml2-bearer-04**

Abstract

This specification defines the use of a SAML 2.0 Bearer Assertion as means for requesting an OAuth 2.0 access token.

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## **1. Introduction**

The Security Assertion Markup Language (SAML) 2.0 [[OASIS.saml-core-2.0-os](#)] is an XML-based framework that allows identity and security information to be shared across security domains. The SAML specification, while primarily targeted at providing cross domain Web browser single sign-on, was also designed to be modular and extensible to facilitate use in other contexts.

The Assertion, an XML security token, is a fundamental construct of SAML that is often adopted for use in other protocols and specifications. An Assertion is generally issued by an identity provider and consumed by a service provider who relies on its content to identify the Assertion's subject for security related purposes.

The OAuth 2.0 Authorization Protocol [[I-D.ietf.oauth-v2](#)] provides a method for making authenticated HTTP requests to a resource using an access token. Access tokens are issued to third-party clients by an authorization server (AS) with the (sometimes implicit) approval of the resource owner. In OAuth, an authorization grant is an abstract term used to describe intermediate credentials that represent the resource owner authorization. An authorization grant is used by the client to obtain an access token.

Several authorization grant types are defined to support a wide range of client types and user experiences. OAuth also allows for the definition of new extension grant types to support additional clients or to provide a bridge between OAuth and other trust frameworks.

This specification defines an extension grant type that profiles the use of a SAML 2.0 Bearer Assertion in requesting an OAuth 2.0 access token. The format and processing rules for the SAML Assertion defined in this specification are intentionally similar, though not identical, to those in the Web Browser SSO Profile defined in SAML Profiles [[OASIS.saml-profiles-2.0-os](#)]. This specification is reusing, to the extent reasonable, concepts and patterns from that well-established Profile.

### **1.1. Notational Conventions**

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

Unless otherwise noted, all the protocol parameter names and values are case sensitive.



## 2. SAML Assertion Access Token Request

A SAML Assertion can be used to request an access token when a client wishes to utilize an existing trust relationship, expressed through the semantics of (and digital signature calculated over) the SAML Assertion, without a direct user approval step at the authorization server.

The process by which the client obtains the SAML Assertion, prior to exchanging it with the authorization server, is out of scope.



Figure 1: Assertion Access Token Request

The request/response flow illustrated in Figure 1 includes the following steps:

- (A) The client sends an access token request to the authorization server that includes a SAML 2.0 Assertion and a grant\_type of "http://oauth.net/grant\_type/saml/2.0/bearer".
- (B) The authorization server validates the Assertion per the processing rules defined in this specification and issues an access token.

### 2.1. Client Requests Access Token

The client includes the Assertion in the access token request, the core details of which are defined in OAuth [[I-D.ietf.oauth-v2](#)], by specifying "http://oauth.net/grant\_type/saml/2.0/bearer" as the absolute URI value of the "grant\_type" parameter and by adding the following parameter:

assertion

REQUIRED. The value of the assertion parameter MUST contain a single SAML 2.0 Assertion. When used with the "http://oauth.net/grant\_type/saml/2.0/bearer" grant type, the assertion MUST be a SAML 2.0 Assertion. The SAML Assertion XML



data MUST be encoded using base64url, where the encoding adheres to the definition in [Section 5 of RFC4648](#) [[RFC4648](#)] and where the padding bits are set to zero. To to avoid the need for subsequent encoding steps (by "application/x-www-form-urlencoded" [[W3C.REC-html401-19991224](#)], for example), the base64url encoded data SHOULD NOT be line wrapped and pad characters ("=") SHOULD NOT be included.

#### scope

OPTIONAL. The scope of the access request expressed as a list of space-delimited, case sensitive strings. The value is defined by the authorization server. If the value contains multiple space-delimited strings, their order does not matter, and each string adds an additional access range to the requested scope.

Authorization servers SHOULD issue access tokens with a limited lifetime and require clients to refresh them by requesting a new access token using the same assertion, if it is still valid, or with a new assertion. The authorization server SHOULD NOT issue a refresh token.

## **[2.2.](#) Assertion Format and Processing Requirements**

Prior to issuing an access token response as described in [[I-D.ietf.oauth-v2](#)], the authorization server MUST validate the Assertion according to the criteria below. If present, the authorization server MUST also validate the client credentials. Application of additional restrictions and policy are at the discretion of the authorization server.

- o The Assertion's <Issuer> element MUST contain a unique identifier for the entity that issued the Assertion. The Format attribute MUST be omitted or have a value of "urn:oasis:names:tc:SAML:2.0:nameid-format:entity".
- o The Assertion MUST contain a <Subject> element. The subject MAY identify the resource owner for whom the access token is being requested.
- o The <Subject> element MUST contain at least one <SubjectConfirmation> element that allows the authorization server to confirm it as a Bearer Assertion. Conditions for bearer subject confirmation are described below.
  - \* The <SubjectConfirmation> MUST have a Method attribute with a value of "urn:oasis:names:tc:SAML:2.0:cm:bearer" and MUST contain a <SubjectConfirmationData> element.





- \* The <SubjectConfirmationData> element MUST have a Recipient attribute with a value indicating the token endpoint URL of the authorization server. The authorization server MUST verify that the value of the Recipient attribute matches the token endpoint URL (or an acceptable alias) to which the Assertion was delivered.
- \* The <SubjectConfirmationData> element MUST have a NotOnOrAfter attribute that limits the window during which the Assertion can be confirmed. The authorization server MUST verify that the NotOnOrAfter instant has not passed, subject to allowable clock skew between systems. The authorization server MAY ensure that Bearer Assertions are not replayed, by maintaining the set of used ID values for the length of time for which the Assertion would be considered valid based on the NotOnOrAfter attribute in the <SubjectConfirmationData>. The authorization server MAY reject assertions with a NotOnOrAfter instant that is unreasonably far in the future.
- \* The <SubjectConfirmationData> element MAY also contain an Address attribute limiting the client address from which the Assertion can be delivered. Verification of the Address is at the discretion of the authorization server.
- o If the Assertion issuer authenticated the subject, the Assertion SHOULD contain a single <AuthnStatement> representing that authentication event.
- o If the Assertion was issued with the intention that the client act autonomously on behalf of the subject, an <AuthnStatement> SHOULD NOT be included. The client SHOULD be identified in the <NameID> or similar element, the <SubjectConfirmation> element, or by other available means like [[OASIS.saml-deleg-cs](#)].
- o Other statements, in particular <AttributeStatement> elements, MAY be included in the Assertion.
- o The Assertion MUST contain an <AudienceRestriction> element with an <Audience> element containing a URI reference that identifies the authorization server, or the service provider SAML entity of its controlling domain, as an intended audience. The authorization server MUST verify that it is an intended audience for the Assertion.
- o The Assertion MUST be digitally signed by the issuer and the authorization server MUST verify the signature.



- o Encrypted elements MAY appear in place of their plain text counterparts as defined in [[OASIS.saml-core-2.0-os](#)].
- o The authorization server MUST verify that the Assertion is valid in all other respects per [[OASIS.saml-core-2.0-os](#)], such as (but not limited to) evaluating all content within the Conditions element including the NotOnOrAfter and NotBefore attributes, rejecting unknown condition types, etc.

### **[2.3.](#) Error Response**

If the Assertion is not valid, or its subject confirmation requirements cannot be met, the authorization server MUST construct an error response as defined in [[I-D.ietf.oauth-v2](#)]. The value of the error parameter MUST be the "invalid\_grant" error code. The authorization server MAY include additional information regarding the reasons the Assertion was considered invalid using the error\_description or error\_uri parameters.

For example:

HTTP/1.1 400 Bad Request

Content-Type: application/json

Cache-Control: no-store

```
{
  "error": "invalid_grant",
  "error_description": "Audience validation failed"
}
```

### **[2.4.](#) Example (non-normative)**

Though non-normative, the following examples illustrate what a conforming Assertion and access token request would look like.



Below is an example SAML 2.0 Assertion (whitespace formatting is for display purposes only):

```
<Assertion IssueInstant="2010-10-01T20:07:34.619Z"
  ID="ef1xsbZxPV2oqjd7HTLRLIBlBb7"
  Version="2.0"
  xmlns="urn:oasis:names:tc:SAML:2.0:assertion">
  <Issuer>https://saml-idp.example.com</Issuer>
  <ds:Signature xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
    [...omitted for brevity...]
  </ds:Signature>
  <Subject>
    <NameID
      Format="urn:oasis:names:tc:SAML:1.1:nameid-format:emailAddress">
      brian@example.com
    </NameID>
    <SubjectConfirmation
      Method="urn:oasis:names:tc:SAML:2.0:cm:bearer">
      <SubjectConfirmationData
        NotOnOrAfter="2010-10-01T20:12:34.619Z"
        Recipient="https://authz.example.net/token.oauth2"/>
      </SubjectConfirmation>
    </Subject>
    <Conditions>
      <AudienceRestriction>
        <Audience>https://saml-sp.example.net</Audience>
      </AudienceRestriction>
    </Conditions>
    <AuthnStatement AuthnInstant="2010-10-01T20:07:34.371Z">
      <AuthnContext>
        <AuthnContextClassRef>
          urn:oasis:names:tc:SAML:2.0:ac:classes:X509
        </AuthnContextClassRef>
      </AuthnContext>
    </AuthnStatement>
  </Assertion>
```

Figure 2: Example SAML 2.0 Assertion



To present the Assertion shown in the previous example as part of an access token request, for example, the client might make the following HTTPS request (line breaks are for display purposes only):

```
POST /token.oauth2 HTTP/1.1
Host: authz.example.net
Content-Type: application/x-www-form-urlencoded

grant_type=http%3A%2F%2Foauth.net%2Fgrant_type%2Fsaml%2F2.0%2F
bearer&assertion=PEFzc2VydGlvbiBJc3N1ZU1uc3RhbnQ9IjIwMTEtMDUtM
[...omitted for brevity...]V0aG5TdGF0ZW1lbnQ-PC9Bc3NlcnRpb24-
```

Figure 3: Example Request

### 3. Security Considerations

No additional considerations beyond those described within the OAuth 2.0 Protocol Framework [[I-D.ietf.oauth-v2](#)] and in the Security and Privacy Considerations for the OASIS Security Assertion Markup Language (SAML) V2.0 [[OASIS.saml-sec-consider-2.0-os](#)].

### 4. IANA Considerations

#### 4.1. Parameter Registration Request

The following is the parameter registration request, as defined in The OAuth Parameters Registry of The OAuth 2.0 Authorization Protocol [[I-D.ietf.oauth-v2](#)], for the "assertion" parameter:

- o Parameter name: assertion
- o Parameter usage location: token request
- o Change controller: IETF
- o Specification document(s): [draft-ietf-oauth-saml2-bearer](#)

### Appendix A. Contributors

The following people contributed wording and concepts to this document: Paul Madsen, Patrick Harding, Peter Motykowski, Eran Hammer-Lahav, Peter Saint-Andre, Ian Barnett, Eric Fazendin, Torsten Lodderstedt, Susan Harper, Scott Cantor, and David Waite





## **Appendix B. Document History**

[[ to be removed by RFC editor before publication as an RFC ]]

### [draft-ietf-oauth-saml2-bearer-04](#)

- o Changed the grant\_type URI from "http://oauth.net/grant\_type/assertion/saml/2.0/bearer" to "http://oauth.net/grant\_type/saml/2.0/bearer" - dropping the word assertion from the path. Recent versions of [draft-ietf-oauth-v2](#) no longer refer to extension grants using the word assertion so this URI is more reflective of that. It also more closely aligns with the grant type URI in [draft-jones-oauth-jwt-bearer-00](#) which is "http://oauth.net/grant\_type/jwt/1.0/bearer".
- o Added "case sensitive" to scope definition to align with [draft-ietf-oauth-v2-15](#)/16.
- o Updated to reference [draft-ietf-oauth-v2-16](#)

### [draft-ietf-oauth-saml2-bearer-03](#)

- o Cleanup of some editorial issues.

### [draft-ietf-oauth-saml2-bearer-02](#)

- o Added scope parameter with text copied from [draft-ietf-oauth-v2-12](#) (the reorg of [draft-ietf-oauth-v2-12](#) made it so scope wasn't really inherited by this spec anymore)
- o Change definition of the assertion parameter to be more generally applicable per the suggestion near the end of <http://www.ietf.org/mail-archive/web/oauth/current/msg05253.html>
- o Editorial changes based on feedback

### [draft-ietf-oauth-saml2-bearer-01](#)

- o Update spec name when referencing [draft-ietf-oauth-v2](#) (The OAuth 2.0 Protocol Framework -> The OAuth 2.0 Authorization Protocol)
- o Update wording in Introduction to talk about extension grant types rather than the assertion grant type which is a term no longer used in OAuth 2.0
- o Updated to reference [draft-ietf-oauth-v2-12](#) and denote as work in progress



- o Update Parameter Registration Request to use similar terms as [draft-ietf-oauth-v2-12](#) and remove Related information part
- o Add some text giving discretion to AS on rejecting assertions with unreasonably long validity window.

#### [draft-ietf-oauth-saml2-bearer-00](#)

- o Added Parameter Registration Request for "assertion" to IANA Considerations.
- o Changed document name to [draft-ietf-oauth-saml2-bearer](#) in anticipation of becoming a OAUTH WG item.
- o Attempt to move the entire definition of the 'assertion' parameter into this draft (it will no longer be defined in OAuth 2 Protocol Framework).

#### [draft-campbell-oauth-saml-01](#)

- o Updated to reference [draft-ietf-oauth-v2-11](#) and reflect changes from -10 to -11.
- o Updated examples.
- o Relaxed processing rules to allow for more than one SubjectConfirmation element.
- o Removed the 'MUST NOT contain a NotBefore attribute' on SubjectConfirmationData.
- o Relaxed wording that ties the subject of the Assertion to the resource owner.
- o Added some wording about identifying the client when the subject hasn't directly authenticated including an informative reference to SAML V2.0 Condition for Delegation Restriction.
- o Added a few examples to the language about verifying that the Assertion is valid in all other respects.
- o Added some wording to the introduction about the similarities to Web SSO in the format and processing rules
- o Changed the grant\_type (was assertion\_type) URI from [http://oauth.net/assertion\\_type/saml/2.0/bearer](http://oauth.net/assertion_type/saml/2.0/bearer) to [http://oauth.net/grant\\_type/assertion/saml/2.0/bearer](http://oauth.net/grant_type/assertion/saml/2.0/bearer)



- o Changed title to include "Grant Type" in it.
- o Editorial updates based on feedback from the WG and others (including capitalization of Assertion when referring to SAML).

[draft-campbell-oauth-saml-00](#)

- o Initial I-D

## **5. References**

### **5.1. Normative References**

- [I-D.ietf.oauth-v2]  
Hammer-Lahav, E., Ed., Recordon, D., and D. Hardt, "The OAuth 2.0 Authorization Protocol", ID [draft-ietf-oauth-v2-16](#) (work in progress), May 2011.
- [OASIS.saml-core-2.0-os]  
Cantor, S., Kemp, J., Philpott, R., and E. Maler, "Assertions and Protocol for the OASIS Security Assertion Markup Language (SAML) V2.0", OASIS Standard [saml-core-2.0-os](#), March 2005.
- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC4648] Josefsson, S., "The Base16, Base32, and Base64 Data Encodings", [RFC 4648](#), October 2006.

### **5.2. Informative References**

- [OASIS.saml-deleg-cs]  
Cantor, S., Ed., "SAML V2.0 Condition for Delegation Restriction", Nov 2009.
- [OASIS.saml-profiles-2.0-os]  
Hughes, J., Cantor, S., Hodges, J., Hirsch, F., Mishra, P., Philpott, R., and E. Maler, "Profiles for the OASIS Security Assertion Markup Language (SAML) V2.0", OASIS Standard [OASIS.saml-profiles-2.0-os](#), March 2005.
- [OASIS.saml-sec-consider-2.0-os]  
Hirsch, F., Philpott, R., and E. Maler, "Security and Privacy Considerations for the OASIS Security Markup Language (SAML) V2.0", OASIS Standard [saml-sec-consider-2.0-os](#), March 2005.



[W3C.REC-html401-19991224]

Hors, A., Jacobs, I., and D. Raggett, "HTML 4.01 Specification", World Wide Web Consortium Recommendation REC-html401-19991224, December 1999, <<http://www.w3.org/TR/1999/REC-html401-19991224>>.

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