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

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Abstract:
SAML profiles require agreements between system entities regarding identifiers, binding support and endpoints, certificates and keys, and so forth. A metadata specification is useful for describing this information in a standardized way. This document defines an extensible metadata format for SAML system entities, organized by roles that reflect SAML profiles. Such roles include that of Identity Provider, Service Provider, Affiliation, Attribute Authority, Attribute Consumer, and Policy Decision Point.

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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).

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1 Introduction

SAML profiles require agreements between system entities regarding identifiers, binding support and endpoints, certificates and keys, and so forth. A metadata specification is useful for describing this information in a standardized way. This specification defines an extensible metadata format for SAML system entities, organized by roles that reflect SAML profiles. Such roles include that of SSO Identity Provider, SSO Service Provider, Affiliation, Attribute Authority, Attribute Requester, and Policy Decision Point.

This specification further defines profiles for the dynamic exchange of metadata among system entities, which may be useful in some deployments.

1.1 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]. The prefix is generally elided in mentions of SAML assertion-related elements in text.
`samlp:`	urn:oasis:names:tc:SAML:2.0:protocol	This is the SAML V2.0 protocol namespace [SAMLCore]. The prefix is generally elided in mentions of XML protocol-related elements in text.
`md:`	urn:oasis:names:tc:SAML:2.0:metadata	This is the SAML V2.0 metadata namespace, defined in a schema [SAMLMeta-xsd].
`ds:`	http://www.w3.org/2000/09/xmldsig#	This is the XML Signature namespace [XMLSig].
`xenc:`	http://www.w3.org/2001/04/xmlenc#	This is the XML Encryption namespace [XMLEnc].
`xs:`	http://www.w3.org/2001/XMLSchema	This namespace is defined in the W3C XML Schema specification . In schema listings, this is the default namespace and no prefix is shown. For clarity, the prefix is generally shown in specification text when XML Schema-related constructs are mentioned.

2 Metadata for SAML V2.0

SAML metadata is organized around an extensible collection of roles representing common combinations of SAML protocols and profiles supported by system entities. Each role is described by an element derived from the extensible base type of `RoleDescriptor`. Such descriptors are in turn collected into the `<EntityDescriptor>` container element, the primary unit of SAML metadata. An entity might alternatively represent an affiliation of other entities, such as an affiliation of service providers. The `<AffiliationDescriptor>` is provided for this purpose.

Such descriptors may in turn be aggregated into nested groups using the `<EntitiesDescriptor>` element.

A variety of security mechanisms for establishing the trustworthiness of metadata can be supported, particularly with the ability to individually sign most of the elements defined in this specification.

2.1 Namespaces

SAML Metadata uses the following namespace (defined in a schema [SAMLMeta-xsd]):

```
urn:oasis:names:tc:SAML:2.0:metadata
```

This specification uses the namespace prefix `md:` to refer to the namespace above.

The following schema fragment illustrates the use of namespaces in SAML metadata documents:

```
<schema
    targetNamespace="urn:oasis:names:tc:SAML:2.0:metadata"
    xmlns:md="urn:oasis:names:tc:SAML:2.0:metadata"
    xmlns:ds="http://www.w3.org/2000/09/xmldsig#"
    xmlns:xenc="http://www.w3.org/2001/04/xmlenc#"
    xmlns:saml="urn:oasis:names:tc:SAML:2.0:assertion"
    xmlns="http://www.w3.org/2001/XMLSchema"
    elementFormDefault="unqualified"
    attributeFormDefault="unqualified"
    blockDefault="substitution"
    version="2.0">
    <import namespace="http://www.w3.org/2000/09/xmldsig#"
        schemaLocation="http://www.w3.org/TR/xmldsig-core/xmldsig-core-
schema.xsd"/>
    <import namespace="http://www.w3.org/2001/04/xmlenc#"
        schemaLocation="http://www.w3.org/TR/2002/REC-xmlenc-core-
20021210/xenc-schema.xsd"/>
    <import namespace="urn:oasis:names:tc:SAML:2.0:assertion"
        schemaLocation="sstc-saml-schema-assertion-2.0.xsd"/>
    <import namespace="http://www.w3.org/XML/1998/namespace"
        schemaLocation="http://www.w3.org/2001/xml.xsd"/>
    <annotation>
        <documentation>
            Document identifier: sstc-saml-schema-metadata-2.0
            Location: http://www.oasis-
open.org/committees/documents.php?wg_abbrev=security
            Revision history:
            V2.0 (August, 2004):
              Schema for SAML metadata, first published in SAML 2.0.
        </documentation>
    </annotation>
…
</schema>
```

2.2 Common Types

The SAML V2.0 Metadata specification defines several types as described in the following subsections. These types are used in defining SAML V2.0 Metadata elements and attributes.

2.2.1 Simple Type entityIDType

The simple type **entityIDType** restricts the XML schema data type **anyURI** to a maximum length of 1024 characters. **entityIDType** is used as a unique identifier for SAML entities. See also Section 8.3.6 of [SAMLCore]. An identifier of this type MUST be unique across all entities that interact within a given deployment. The use of a URI and holding to the rule that a single URI MUST NOT refer to different entities satisfies this requirement.

The following schema fragment defines the **entityIDType** simple type:

```
<simpleType name="entityIDType">
   <restriction base="anyURI">
      <maxLength value="1024"/>
   </restriction>
</simpleType>
```

2.2.2 Complex Type EndpointType

The complex type **EndpointType** describes a SAML protocol binding endpoint at which a SAML entity can be sent protocol messages. Various protocol or profile-specific metadata elements are bound to this type. It consists of the following attributes:

`Binding` [Required]

A required attribute that specifies the SAML binding supported by the endpoint. Each binding is assigned a URI to identify it.

`Location` [Required]

A required URI attribute that specifies the location of the endpoint. The allowable syntax of this URI depends on the protocol binding.

`ResponseLocation` [Optional]

Optionally specifies a secondary location to which response messages sent as part of the protocol or profile should be sent. The allowable syntax of this URI depends on the protocol binding.

This element also permits the use of arbitrary elements and attributes defined in a non-SAML namespace. Any such content MUST be namespace-qualified.

The following schema fragment defines the **EndpointType** complex type:

```
<complexType name="EndpointType">
   <sequence>
      <any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
   </sequence>
   <attribute name="Binding" type="anyURI" use="required"/>
   <attribute name="Location" type="anyURI" use="required"/>
   <attribute name="ResponseLocation" type="anyURI" use="optional"/>
   <anyAttribute namespace="##other" processContents="lax"/>
</complexType>
```

2.2.3 Complex Type IndexedEndpointType

The complex type **IndexedEndpointType** extends **EndpointType** with a pair of attributes to permit the indexing of otherwise identical endpoints so that they can be referenced by protocol messages. It consists of the following additional attributes:

`index` [Required]

A required attribute that assigns a unique integer value to the endpoint so that it can be referenced in a protocol message.

`isDefault` [Optional]

An optional boolean attribute used to designate the default endpoint among an indexed set. If omitted, the value is assumed to be `false`.

In any such sequence of like endpoints based on this type, the default endpoint is the first such endpoint with the `isDefault` attribute set to `true`. If no such endpoints exist, the default endpoint is the first such endpoint without the `isDefault` attribute set to `false`. If no such endpoints exist, the default endpoint is

the first element in the sequence.

The following schema fragment defines the **IndexedEndpointType** complex type:

```
<complexType name="IndexedEndpointType">
   <complexContent>
      <extension base="md:EndpointType">
         <attribute name="index" type="unsignedShort" use="required"/>
         <attribute name="isDefault" type="boolean" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

2.2.4 Complex Type localizedNameType

The **localizedNameType** complex type extends a string-valued element with a standard XML language attribute. The following schema fragment defines the **localizedNameType** complex type:

```
<complexType name="localizedNameType">
   <simpleContent>
      <extension base="string">
         <attribute ref="xml:lang" use="required"/>
      </extension>
   </simpleContent>
</complexType>
```

2.2.5 Complex Type localizedURIType

The **localizedURIType** complex type extends a URI-valued element with a standard XML language attribute.

The following schema fragment defines the **localizedURIType** complex type:

```
<complexType name="localizedURIType">
   <simpleContent>
      <extension base="anyURI">
         <attribute ref="xml:lang" use="required"/>
      </extension>
   </simpleContent>
</complexType>
```

2.3 Root Elements

A SAML metadata instance describes either a single entity or multiple entities. In the former case, the root element MUST be `<EntityDescriptor>`. In the latter case, the root element MUST be `<EntitiesDescriptor>`.

2.3.1 Element <EntitiesDescriptor>

The `<EntitiesDescriptor>` element contains the metadata for an optionally named group of SAML entities. Its **EntitiesDescriptorType** complex type contains a sequence of `<EntityDescriptor>` elements, `<EntitiesDescriptor>` elements, or both:

`ID` [Optional]

A document-unique identifier for the element, typically used as a reference point when signing.

`validUntil` [Optional]

Optional attribute indicates the expiration time of the metadata contained in the element and any contained elements.

`cacheDuration` [Optional]

Optional attribute indicates the maximum length of time a consumer should cache the metadata contained in the element and any contained elements.

`Name` [Optional]

A string name that identifies a group of SAML entities in the context of some deployment.

`<ds:Signature>` [Optional]

An XML signature that authenticates the containing element and its contents, as described in Section 3.

`<Extensions>` [Optional]

This contains optional metadata extensions that are agreed upon between a metadata publisher and consumer. Extensions MUST NOT include local (non-namespace-qualified) elements or elements qualified by a SAML-defined namespace within this element.

`<EntitiesDescriptor>` or `<EntityDescriptor>` [One or More]

Contains the metadata for one or more SAML entities, or a nested group of additional metadata.

When used as the root element of a metadata instance, this element MUST contain either a `validUntil` or `cacheDuration` attribute. It is RECOMMENDED that only the root element of a metadata instance contain either attribute.

The following schema fragment defines the `<EntitiesDescriptor>` element and its **EntitiesDescriptorType** complex type:

```
<element name="EntitiesDescriptor" type="md:EntitiesDescriptorType"/>
<complexType name="EntitiesDescriptorType">
   <sequence>
      <element ref="ds:Signature" minOccurs="0"/>
      <element ref="md:Extensions" minOccurs="0"/>
      <choice minOccurs="1" maxOccurs="unbounded">
         <element ref="md:EntityDescriptor"/>
         <element ref="md:EntitiesDescriptor"/>
      </choice>
   </sequence>
   <attribute name="validUntil" type="dateTime" use="optional"/>
   <attribute name="cacheDuration" type="duration" use="optional"/>
   <attribute name="ID" type="ID" use="optional"/>
   <attribute name="Name" type="string" use="optional"/>
</complexType>
<element name="Extensions" type="md:ExtensionsType"/>
<complexType final="#all" name="ExtensionsType">
   <sequence>
      <any namespace="##other" processContents="lax"
maxOccurs="unbounded"/>
   </sequence>
</complexType>
```

2.3.2 Element <EntityDescriptor>

The `<EntityDescriptor>` element specifies metadata for a single SAML entity. A single entity may act in many different roles in the support of multiple profiles. This specification directly supports the following concrete roles as well as the abstract `<RoleDescriptor>` element for extensibility (see subsequent sections for more details):

- SSO Identity Provider
- SSO Service Provider
- Authentication Authority

- Attribute Authority
- Attribute Consumer
- Policy Decision Point
- Affiliation

Its **EntityDescriptorType** complex type consists of the following elements and attributes:

`entityID` [Required]

Specifies the unique identifier of the SAML entity whose metadata is described by the element's contents.

`ID` [Optional]

A document-unique identifier for the element, typically used as a reference point when signing.

`validUntil` [Optional]

Optional attribute indicates the expiration time of the metadata contained in the element and any contained elements.

`cacheDuration` [Optional]

Optional attribute indicates the maximum length of time a consumer should cache the metadata contained in the element and any contained elements.

`<ds:Signature>` [Optional]

An XML signature that authenticates the containing element and its contents, as described in Section 3.

`<Extensions>` [Optional]

This contains optional metadata extensions that are agreed upon between a metadata publisher and consumer. Extensions MUST NOT include local (non-namespace-qualified) elements or elements qualified by a SAML-defined namespace within this element.

`<RoleDesciptor>`, `<IDPSSODescriptor>`, `<SPSSODescriptor>`, `<AuthnAuthorityDescriptor>`, `<AttributeAuthorityDescriptor>`, `<AttributeConsumerDescriptor>`, `<PDPDescriptor>`, or any element from a non-SAML namespace [One or More]

OR

`<AffiliationDescriptor>` [Required]

The primary content of the element is either a sequence of one or more role descriptor or wildcard elements, or a specialized descriptor that defines an affiliation.

`<Organization>` [Optional]

Optional element identifying the organization responsible for the SAML entity described by the element.

`<ContactPerson>` [Zero or More]

Optional sequence of elements identifying various kinds of contact personnel.

`<AdditionalMetadataLocation>` [Zero or More]

Optional sequence of namespace-qualified locations where additional metadata exists for the SAML entity. This may include metadata in alternate formats or describing adherence to other non-SAML specifications.

Arbitrary qualified attributes from non-SAML namespaces may also be included.

When used as the root element of a metadata instance, this element MUST contain either a `validUntil` or `cacheDuration` attribute. It is RECOMMENDED that only the root element of a metadata instance contain either attribute.

The following schema fragment defines the `<EntityDescriptor>` element and its **EntityDescriptorType** complex type:

```
<element name="EntityDescriptor" type="md:EntityDescriptorType"/>
<complexType name="EntityDescriptorType">
   <sequence>
      <element ref="ds:Signature" minOccurs="0"/>
      <element ref="md:Extensions" minOccurs="0"/>
      <choice>
         <choice maxOccurs="unbounded">
            <element ref="md:RoleDescriptor"/>
            <element ref="md:IDPSSODescriptor"/>
            <element ref="md:SPSSODescriptor"/>
            <element ref="md:AuthnAuthorityDescriptor"/>
            <element ref="md:AttributeAuthorityDescriptor"/>
            <element ref="md:AttributeConsumerDescriptor"/>
            <element ref="md:PDPDescriptor"/>
            <any namespace="##other" processContents="lax"/>
         </choice>
         <element ref="md:AffiliationDescriptor"/>
      </choice>
      <element ref="md:Organization" minOccurs="0"/>
      <element ref="md:ContactPerson" minOccurs="0"
maxOccurs="unbounded"/>
      <element ref="md:AdditionalMetadataLocation" minOccurs="0"
maxOccurs="unbounded"/>
   </sequence>
   <attribute name="entityID" type="md:entityIDType" use="required"/>
   <attribute name="validUntil" type="dateTime" use="optional"/>
   <attribute name="cacheDuration" type="duration" use="optional"/>
   <attribute name="ID" type="ID" use="optional"/>
   <anyAttribute namespace="##other" processContents="lax"/>
</complexType>
```

2.3.2.1 Element <Organization>

The `<Organization>` element specifies basic information about an organization responsible for a SAML entity or role. The use of this element is always optional. Its content is informative in nature and does not directly map to any core SAML elements or attributes. Its **OrganizationType** complex type consists of the following elements:

`<Extensions>` [Optional]

This contains optional metadata extensions that are agreed upon between a metadata publisher and consumer. Extensions MUST NOT include local (non-namespace-qualified) elements or elements qualified by a SAML-defined namespace within this element.

`<OrganizationName>` [One or More]

One or more language-qualified names that may or may not be suitable for human consumption.

`<OrganizationDisplayName>` [One or More]

One or more language-qualified names that are suitable for human consumption.

`<OrganizationURL>` [One or More]

One or more language-qualified URIs that specify a location to which to direct a principal for additional information. Note that the language qualifier refers to the content of the material at the specified location.

Arbitrary qualified attributes from non-SAML namespaces may also be included.

The following schema fragment defines the <Organization> element and its **OrganizationType** complex type:

```
<element name="Organization" type="md:OrganizationType"/>
<complexType name="OrganizationType">
   <sequence>
      <element ref="md:Extensions" minOccurs="0"/>
      <element ref="md:OrganizationName" maxOccurs="unbounded"/>
      <element ref="md:OrganizationDisplayName" maxOccurs="unbounded"/>
      <element ref="md:OrganizationURL" maxOccurs="unbounded"/>
   </sequence>
   <anyAttribute namespace="##other" processContents="lax"/>
</complexType>
<element name="OrganizationName" type="md:localizedNameType"/>
<element name="OrganizationDisplayName" type="md:localizedNameType"/>
<element name="OrganizationURL" type="md:localizedURIType"/>
```

2.3.2.2 Element <ContactPerson>

The <ContactPerson> element specifies basic contact information about a person responsible in some capacity for a SAML entity or role. The use of this element is always optional. Its content is informative in nature and does not directly map to any core SAML elements or attributes. Its **ContactType** complex type consists of the following elements and attributes:

contactType [Required]

Specifies the type of contact using the **ContactTypeType** enumeration. The possible values are technical, support, administrative, billing, and other.

<Extensions> [Optional]

This contains optional metadata extensions that are agreed upon between a metadata publisher and consumer. Extensions MUST NOT include local (non-namespace-qualified) elements or elements qualified by a SAML-defined namespace within this element.

<Company> [Optional]

Optional string element that specifies the name of the company for the contact person.

<GivenName> [Optional]

Optional string element that specifies the given (first) name of the contact person.

<SurName> [Optional]

Optional string element that specifies the surname of the contact person.

<EmailAddress> [Zero or More]

Zero or more elements containing mailto: URIs representing e-mail addresses belonging to the contact person.

<TelephoneNumber> [Zero or More]

Zero or more string elements specifying a telephone number of the contact person.

Arbitrary qualified attributes from non-SAML namespaces may also be included.

The following schema fragment defines the <ContactPerson> element and its **ContactType** complex type:

```
<element name="ContactPerson" type="md:ContactType"/>
<complexType name="ContactType">
   <sequence>
      <element ref="md:Extensions" minOccurs="0"/>
      <element ref="md:Company" minOccurs="0"/>
      <element ref="md:GivenName" minOccurs="0"/>
```

```
      <element ref="md:SurName" minOccurs="0"/>
      <element ref="md:EmailAddress" minOccurs="0"
maxOccurs="unbounded"/>
      <element ref="md:TelephoneNumber" minOccurs="0"
maxOccurs="unbounded"/>
   </sequence>
   <attribute name="contactType" type="md:ContactTypeType"
use="required"/>
   <anyAttribute namespace="##other" processContents="lax"/>
</complexType>
<element name="Company" type="string"/>
<element name="GivenName" type="string"/>
<element name="SurName" type="string"/>
<element name="EmailAddress" type="anyURI"/>
<element name="TelephoneNumber" type="string"/>
<simpleType name="ContactTypeType">
   <restriction base="string">
      <enumeration value="technical"/>
      <enumeration value="support"/>
      <enumeration value="administrative"/>
      <enumeration value="billing"/>
      <enumeration value="other"/>
   </restriction>
</simpleType>
```

2.3.2.3 Element <AdditionalMetadataLocation>

The `<AdditionalMetadataLocation>` element is a namespace-qualified URI that specifies where additional XML-based metadata may exist for a SAML entity. Its **AdditionalMetadataLocationType** complex type extends the **anyURI** type with a `namespace` attribute (also of type **anyURI**). This required attribute MUST contain the XML namespace of the root element of the instance document found at the specified location.

The following schema fragment defines the `<AdditionalMetadataLocation>` element and its **AdditionalMetadataLocationType** complex type:

```
<element name="AdditionalMetadataLocation"
type="md:AdditionalMetadataLocationType"/>
<complexType name="AdditionalMetadataLocationType">
   <simpleContent>
      <extension base="anyURI">
         <attribute name="namespace" type="anyURI" use="required"/>
      </extension>
   </simpleContent>
</complexType>
```

2.4 Role Descriptor Elements

The elements in this section make up the bulk of the operational support component of the metadata. Each element (save for the abstract one) define a specific collection of operational behavior in support of SAML profiles defined in [SAMLProf].

2.4.1 Element <RoleDescriptor>

The `<RoleDescriptor>` element is an abstract extension point that contains common descriptive information intended to provide processing commonality across different roles. New roles can be defined by extending its abstract **RoleDescriptorType** complex type, which contains the following elements and attributes:

`ID` [Optional]

A document-unique identifier for the element, typically used as a reference point when signing.

`validUntil` [Optional]

Optional attribute indicates the expiration time of the metadata contained in the element and any contained elements.

`cacheDuration` [Optional]

Optional attribute indicates the maximum length of time a consumer should cache the metadata contained in the element and any contained elements.

`protocolSupportEnumeration` [Required]

A space-delimited set of URIs that identify the set of protocol specifications supported by the role element. For SAML V2.0 entities, this set MUST include the SAML protocol namespace URI, `urn:oasis:names:tc:SAML:2.0:protocol`.

`errorURL` [Optional]

Optional URI attribute that specifies a location to direct a user for problem resolution and additional support related to this role.

`<ds:Signature>` [Optional]

An XML signature that authenticates the containing element and its contents, as described in Section 3.

`<Extensions>` [Optional]

This contains optional metadata extensions that are agreed upon between a metadata publisher and consumer. Extensions MUST NOT include local (non-namespace-qualified) elements or elements qualified by a SAML-defined namespace within this element.

`<KeyDescriptor>` [Zero or More]

Optional sequence of elements that provides information about the cryptographic keys that the entity uses when acting in this role.

`<Organization>` [Optional]

Optional element specifies the organization associated with this role. Identical to the element used within the `<EntityDescriptor>` element.

`<ContactPerson>` [Zero or More]

Optional sequence of elements specifying contacts associated with this role. Identical to the element used within the `<EntityDescriptor>` element.

Arbitrary qualified attributes from non-SAML namespaces may also be included.

The following schema fragment defines the `<RoleDescriptor>` element and its **RoleDescriptorType** complex type:

```
<element name="RoleDescriptor" type="md:RoleDescriptorType"/>
<complexType name="RoleDescriptorType" abstract="true">
   <sequence>
      <element ref="ds:Signature" minOccurs="0"/>
      <element ref="md:Extensions" minOccurs="0"/>
      <element ref="md:KeyDescriptor" minOccurs="0"
maxOccurs="unbounded"/>
      <element ref="md:Organization" minOccurs="0"/>
      <element ref="md:ContactPerson" minOccurs="0"
maxOccurs="unbounded"/>
   </sequence>
   <attribute name="ID" type="ID" use="optional"/>
   <attribute name="validUntil" type="dateTime" use="optional"/>
   <attribute name="cacheDuration" type="duration" use="optional"/>
```

```
    <attribute name="protocolSupportEnumeration" type="NMTOKENS"
use="required"/>
    <attribute name="errorURL" type="anyURI" use="optional"/>
    <anyAttribute namespace="##other" processContents="lax"/>
</complexType>
```

2.4.1.1 Element <KeyDescriptor>

The `<KeyDescriptor>` element provides information about the cryptographic key(s) that an entity uses to sign data or receive encrypted keys, along with additional cryptographic details. Its **KeyDescriptorType** complex type consists of the following elements and attributes:

`use` [Optional]

Optional attribute specifying the purpose of the key being described. Values are drawn from the **KeyTypes** enumeration, and consist of the values `encryption` and `signing`.

`<ds:KeyInfo>` [Required]

Optional element that directly or indirectly identifies a key. See [XMLSig] for additional details on the use of this element.

`<EncryptionMethod>` [Zero or More]

Optional element specifying an algorithm and algorithm-specific settings supported by the entity. The exact content varies based on the algorithm supported. See [XMLEnc] for the definition of this element's **xenc:EncryptionMethodType** complex type.

The following schema fragment defines the `<KeyDescriptor>` element and its **KeyDescriptorType** complex type:

```
<element name="KeyDescriptor" type="md:KeyDescriptorType"/>
<complexType name="KeyDescriptorType">
    <sequence>
        <element ref="ds:KeyInfo"/>
        <element ref="md:EncryptionMethod minOccurs="0"
maxOccurs="unbounded"/>
    </sequence>
    <attribute name="use" type="md:KeyTypes" use="optional"/>
</complexType>
<simpleType name="KeyTypes">
    <restriction base="string">
        <enumeration value="encryption"/>
        <enumeration value="signing"/>
    </restriction>
</simpleType>
<element name="EncryptionMethod" type="xenc:EncryptionMethodType"/>
```

2.4.2 Complex Type SSODescriptorType

The **SSODescriptorType** abstract type is a common base type for the concrete types **SPSSODescriptorType** and **IDPSSODescriptorType**, described in subsequent sections. It extends **RoleDescriptorType** with elements reflecting profiles common to both identity providers and service providers that support SSO, and contains the following additional elements:

`<ArtifactResolutionService>` [Zero or More]

Zero or more elements of type **IndexedEndpointType** that describe indexed endpoints that support the Artifact Resolution profile defined in [SAMLProf]. The `ResponseLocation` attribute MUST be omitted.

`<SingleLogoutService>` [Zero or More]

Zero or more elements of type **EndpointType** that describe endpoints that support the Single

Logout profiles defined in [SAMLProf].

`<ManageNameIDService>` [Zero or More]

Zero or more elements of type **EndpointType** that describe endpoints that support the Name Identifier Management profiles defined in [SAMLProf].

`<NameIDFormat>` [Zero or More]

Zero or more elements of type **anyURI** that enumerate the name identifier formats supported by this system entity acting in this role. See section 8.3 of [SAMLCore] for some possible values for this element.

The following schema fragment defines the **SSODescriptorType** complex type:

```
<complexType name="SSODescriptorType" abstract="true">
   <complexContent>
      <extension base="md:RoleDescriptorType">
         <sequence>
            <element ref="md:ArtifactResolutionService" minOccurs="0"
maxOccurs="unbounded"/>
            <element ref="md:SingleLogoutService" minOccurs="0"
maxOccurs="unbounded"/>
            <element ref="md:ManageNameIDService" minOccurs="0"
maxOccurs="unbounded"/>
            <element ref="md:NameIDFormat" minOccurs="0"
maxOccurs="unbounded"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
<element name="ArtifactResolutionService" type="md:IndexedEndpointType"/>
<element name="SingleLogoutService" type="md:EndpointType"/>
<element name="ManageNameIDService" type="md:EndpointType"/>
<element name="NameIDFormat" type="anyURI"/>
```

2.4.3 Element <IDPSSODescriptor>

The `<IDPSSODescriptor>` element extends **SSODescriptorType** with content reflecting profiles specific to identity providers supporting SSO. Its **IDPSSODescriptorType** complex type contains the following additional elements and attributes:

`WantAuthnRequestsSigned` [Optional]

Optional attribute that indicates a requirement for the `<samlp:AuthnRequest>` messages received by this identity provider to be signed. If omitted, the value is assumed to be `false`.

`<SingleSignOnService>` [One or More]

One or more elements of type **EndpointType** that describe endpoints that support the profiles of the Authentication Request protocol defined in [SAMLProf]. All identity providers support at least one such endpoint, by definition. The `ResponseLocation` attribute MUST be omitted.

`<NameIDMappingService>` [Zero or More]

Zero or more elements of type **EndpointType** that describe endpoints that support the Name Identifier Mapping profile defined in [SAMLProf]. The `ResponseLocation` attribute MUST be omitted.

The following schema fragment defines the `<IDPSSODescriptor>` element and its **IDPSSODescriptorType** complex type:

```
<element name="IDPSSODescriptor" type="md:IDPSSODescriptorType"/>
<complexType name="IDPSSODescriptorType">
   <complexContent>
```

```
      <extension base="md:SSODescriptorType">
         <sequence>
            <element ref="md:SingleSignOnService"
maxOccurs="unbounded"/>
            <element ref="md:NameIDMappingService" minOccurs="0"
maxOccurs="unbounded"/>
         </sequence>
         <attribute name="WantAuthnRequestsSigned" type="boolean"
use="optional"/>
      </extension>
   </complexContent>
</complexType>
<element name="SingleSignOnService" type="md:EndpointType"/>
<element name="NameIDMappingService" type="md:EndpointType"/>
```

2.4.4 Element <SPSSODescriptor>

The `<SPSSODescriptor>` element extends **SSODescriptorType** with content reflecting profiles specific to service providers. Its **SPSSODescriptorType** complex type contains the following additional elements and attributes:

`AuthnRequestsSigned` [Optional]

Optional attribute that indicates whether the `<samlp:AuthnRequest>` messages sent by this service provider will be signed. If omitted, the value is assumed to be `false`.

`WantAssertionsSigned` [Optional]

Optional attribute that indicates a requirement for the `<saml:Assertion>` elements received by this service provider to be signed. If omitted, the value is assumed to be `false`. This requirement is in addition to any requirement for signing derived from the use of a particular profile/binding combination.

`<AssertionConsumerService>` [One or More]

One or more elements that describe indexed endpoints that support the profiles of the Authentication Request protocol defined in [SAMLProf]. All service providers support at least one such endpoint, by definition.

The following schema fragment defines the `<SPSSODescriptor>` element and its **SPSSODescriptorType** complex type:

```
<element name="SPSSODescriptor" type="md:SPSSODescriptorType"/>
<complexType name="SPSSODescriptorType">
   <complexContent>
      <extension base="md:SSODescriptorType">
         <sequence>
            <element ref="md:AssertionConsumerService"
maxOccurs="unbounded"/>
         </sequence>
         <attribute name="AuthnRequestsSigned" type="boolean"
use="optional"/>
         <attribute name="WantAssertionsSigned" type="boolean"
use="optional"/>
      </extension>
   </complexContent>
</complexType>
<element name="AssertionConsumerService"
type="md:AssertionConsumerServiceType"/>
```

2.4.5 Element <AuthnAuthorityDescriptor>

The `<AuthnAuthorityDescriptor>` element extends **RoleDescriptorType** with content reflecting profiles specific to authentication authorities, SAML authorities that respond to `<samlp:AuthnQuery>`

messages. Its **AuthnAuthorityDescriptorType** complex type contains the following additional element:

`<AuthnQueryService>` [One or More]

One or more elements of type **EndpointType** that describe endpoints that support the profile of the Authentication Query protocol defined in [SAMLProf]. All authentication authorities support at least one such endpoint, by definition.

`<AssertionIDRequestService>` [Zero or More]

Zero or more elements of type **EndpointType** that describe endpoints that support the profile of the Assertion Request protocol defined in [SAMLProf] or the special URI binding for assertion requests defined in [SAMLBind].

`<NameIDFormat>` [Zero or More]

Zero or more elements of type **anyURI** that enumerate the name identifier formats supported by this authority. See section 8.3 of [SAMLCore] for some possible values for this element.

The following schema fragment defines the `<AuthnAuthorityDescriptor>` element and its **AuthnAuthorityDescriptorType** complex type:

```
<element name="AuthnAuthorityDescriptor"
type="md:AuthnAuthorityDescriptorType"/>
<complexType name="AuthnAuthorityDescriptorType">
   <complexContent>
      <extension base="md:RoleDescriptorType">
         <sequence>
            <element ref="md:AuthnQueryService" maxOccurs="unbounded"/>
            <element ref="md:AssertionIDRequestService" minOccurs="0"
maxOccurs="unbounded"/>
            <element ref="md:NameIDFormat" minOccurs="0"
maxOccurs="unbounded"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
<element name="AuthnQueryService" type="md:EndpointType"/>
<element name="AssertionIDRequestService" type="md:EndpointType"/>
```

2.4.6 Element <PDPDescriptor>

The `<PDPDescriptor>` element extends **RoleDescriptorType** with content reflecting profiles specific to policy decision points, SAML authorities that respond to `<samlp:AuthzDecisionQuery>` messages. Its **PDPDescriptorType** complex type contains the following additional element:

`<AuthzService>` [One or More]

One or more elements of type **EndpointType** that describe endpoints that support the profile of the Authorization Decision Query protocol defined in [SAMLProf]. All policy decision points support at least one such endpoint, by definition.

`<AssertionIDRequestService>` [Zero or More]

Zero or more elements of type **EndpointType** that describe endpoints that support the profile of the Assertion Request protocol defined in [SAMLProf] or the special URI binding for assertion requests defined in [SAMLBind].

`<NameIDFormat>` [Zero or More]

Zero or more elements of type **anyURI** that enumerate the name identifier formats supported by this authority. See section 8.3 of [SAMLCore] for some possible values for this element.

The following schema fragment defines the `<PDPDescriptor>` element and its **PDPDescriptorType** complex type:

```
<element name="PDPDescriptor" type="md:PDPDescriptorType"/>
<complexType name="PDPDescriptorType">
   <complexContent>
      <extension base="md:RoleDescriptorType">
         <sequence>
            <element ref="md:AuthzService" maxOccurs="unbounded"/>
            <element ref="md:AssertionIDRequestService" minOccurs="0"
maxOccurs="unbounded"/>
            <element ref="md:NameIDFormat" minOccurs="0"
maxOccurs="unbounded"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
<element name="AuthzService" type="md:EndpointType"/>
```

2.4.7 Element <AttributeAuthorityDescriptor>

The <AttributeAuthorityDescriptor> element extends **RoleDescriptorType** with content reflecting profiles specific to attribute authorities, SAML authorities that respond to <samlp:AttributeQuery> messages. Its **AttributeAuthorityDescriptorType** complex type contains the following additional elements:

<AttributeService> [One or More]

One or more elements of type **EndpointType** that describe endpoints that support the profile of the Attribute Query protocol defined in [SAMLProf]. All attribute authorities support at least one such endpoint, by definition.

<AssertionIDRequestService> [Zero or More]

Zero or more elements of type **EndpointType** that describe endpoints that support the profile of the Assertion Request protocol defined in [SAMLProf] or the special URI binding for assertion requests defined in [SAMLBind].

<saml:Attribute> [Zero or More]

Zero or more elements that identify the SAML attributes supported by the authority. Specific values MAY optionally be included, indicating that only certain values permitted by the attribute's definition are supported.

<NameIDFormat> [Zero or More]

Zero or more elements of type **anyURI** that enumerate the name identifier formats supported by this authority. See section 8.3 of [SAMLCore] for some possible values for this element.

<AttributeProfile> [Zero or More]

Zero or more elements of type **anyURI** that enumerate the attribute profiles supported by this authority. See [SAMLProf] for some possible values for this element.

The following schema fragment defines the <AttributeAuthorityDescriptor> element and its **AttributeAuthorityDescriptorType** complex type:

```
<element name="AttributeAuthorityDescriptor"
type="md:AttributeAuthorityDescriptorType"/>
<complexType name="AttributeAuthorityDescriptorType">
   <complexContent>
      <extension base="md:RoleDescriptorType">
         <sequence>
            <element ref="md:AttributeService" maxOccurs="unbounded"/>
            <element ref="md:AssertionIDRequestService" minOccurs="0"
maxOccurs="unbounded"/>
            <element ref="saml:Attribute" minOccurs="0"
maxOccurs="unbounded"/>
```

```
            <element ref="md:NameIDFormat" minOccurs="0"
maxOccurs="unbounded"/>
            <element ref="md:AttributeProfile" minOccurs="0"
maxOccurs="unbounded"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
<element name="AttributeService" type="md:EndpointType"/>
<element name="AttributeProfile" type="anyURI"/>
```

2.4.8 Element <AttributeConsumerDescriptor>

The `<AttributeConsumerDescriptor>` element extends **RoleDescriptorType** with content reflecting information specific to consumers of SAML attributes. Its **AttributeConsumerDescriptorType** complex type contains the following additional element:

`<AttributeConsumingService>` [One or More]

One or more elements that describe a service provided by the entity that requires or desires the use of SAML attributes.

At most one `<AttributeConsumingService>` element can have the attribute `isDefault` set to `true`. When multiple elements are specified and none has the attribute `isDefault` set to `true`, then the first element whose `isDefault` attribute is not set to `false` is to be used as the default. If allelements have their `isDefault` attribute set to `false`, then the first element is considered the default.

The following schema fragment defines the `<AttributeConsumerDescriptor>` element and its **AttributeConsumerDescriptorType** complex type:

```
<element name="AttributeConsumerDescriptor"
type="md:AttributeConsumerDescriptorType"/>
<complexType name="AttributeConsumerDescriptorType">
   <complexContent>
      <extension base="md:RoleDescriptorType">
         <sequence>
            <element ref="md:AttributeConsumingService"
maxOccurs="unbounded"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
```

2.4.8.1 Element <AttributeConsumingService>

The `<AttributeConsumingService>` element defines a particular service of the attribute consumer in terms of the attributes the service requires or desires. Its **AttributeConsumingServiceType** complex type contains the following elements and attributes:

`index` [Required]

A required attribute that assigns a unique integer value to the element so that it can be referenced in a protocol message.

`isDefault` [Optional]

Identifies the default service supported by the attribute consumer. Useful if the specific service is not otherwise indicated by application context. If omitted, the value is assumed to be `false`.

`WantAssertionsSigned` [Optional]

Optional attribute that indicates a requirement for the `<saml:Assertion>` elements received by this service to be signed. If omitted, the value is assumed to be `false`. This requirement is in addition to any requirement for signing derived from the use of a particular profile/binding

combination.

<ServiceName> [One or More]

One or more language-qualified names for the service.

<ServiceDescription> [Zero or More]

Zero or more language-qualified strings that describe the service.

<RequestedAttribute> [One or More]

One or more elements specifying attributes required or desired by this service.

The following schema fragment defines the <AttributeRequestingService> element and its **AttributeRequestingServiceType** complex type:

```
<element name="AttributeConsumingService"
type="md:AttributeConsumingServiceType"/>
<complexType name="AttributeConsumingServiceType">
   <sequence>
      <element ref="md:ServiceName" maxOccurs="unbounded"/>
      <element ref="md:ServiceDescription" minOccurs="0"
maxOccurs="unbounded"/>
      <element ref="md:RequestedAttribute" maxOccurs="unbounded"/>
   </sequence>
   <attribute name="index" type="unsignedShort" use="required"/>
   <attribute name="isDefault" type="boolean" use="optional"/>
   <attribute name="WantAssertionsSigned" type="boolean" use="optional"/>
</complexType>
<element name="ServiceName" type="md:localizedNameType"/>
<element name="ServiceDescription" type="md:localizedNameType"/>
```

2.4.8.2 Element <RequestedAttribute>

The <RequestedAttribute> element specifies an attribute consumer's interest in a specific SAML attribute, optionally including specific values. Its **RequestedAttributeType** complex type extends the **saml:AttributeType** with the following attribute:

isRequired [Optional]

Optional XML attribute indicates if the service requires the corresponding SAML attribute in order to function at all (as opposed to merely finding an attribute useful or desirable).

If specific <saml:AttributeValue> elements are included, then only matching values are relevant to the service. See [SAMLCore] for more information on attribute value matching.

The following schema fragment defines the <RequestedAttribute> element and its **RequestedAttributeType** complex type:

```
<element name="RequestedAttribute" type="md:RequestedAttributeType"/>
<complexType name="RequestedAttributeType">
   <complexContent>
      <extension base="saml:AttributeType">
         <attribute name="isRequired" type="boolean" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

2.5 Element <AffiliationDescriptor>

The <AffiliationDescriptor> element is an alternative to the sequence of role descriptors described in Section 2.4 that is used when an <EntityDescriptor> describes an affiliation of SAML entities (typically service providers) rather than a single entity. The <AffiliationDescriptor>

element provides a summary of the individual entities that make up the affiliation along with general information about the affiliation itself. Its **AffiliationDescriptorType** complex type contains the following elements and attributes:

`affiliationOwnerID` [Required]

Specifies the unique identifier of the entity responsible for the affiliation. The owner is NOT presumed to be a member of the affiliation; if it is a member, its identifier MUST also appear in an `<AffiliateMember>` element.

`ID` [Optional]

A document-unique identifier for the element, typically used as a reference point when signing.

`validUntil` [Optional]

Optional attribute indicates the expiration time of the metadata contained in the element and any contained elements.

`cacheDuration` [Optional]

Optional attribute indicates the maximum length of time a consumer should cache the metadata contained in the element and any contained elements.

`<ds:Signature>` [Optional]

An XML signature that authenticates the containing element and its contents, as described in Section 3.

`<Extensions>` [Optional]

This contains optional metadata extensions that are agreed upon between a metadata publisher and consumer. Extensions MUST NOT include local (non-namespace-qualified) elements or elements qualified by a SAML-defined namespace within this element.

`<AffiliateMember>` [One or More]

One or more elements enumerating the members of the affiliation by specifying each member's unique identifier. See also Section 8.3.6 of [SAMLCore].

`<KeyDescriptor>` [Zero or More]

Optional sequence of elements that provides information about the cryptographic keys that the affiliation uses as a whole, as distinct from keys used by individual members of the affiliation, which are published in the metadata for those entities.

The following schema fragment defines the `<AffiliationDescriptor>` element and its **AffiliationDescriptorType** complex type:

```
<element name="AffiliationDescriptor"
type="md:AffiliationDescriptorType"/>
<complexType name="AffiliationDescriptorType">
   <sequence>
      <element ref="ds:Signature" minOccurs="0"/>
      <element ref="md:Extensions" minOccurs="0"/>
      <element ref="md:AffiliateMember" maxOccurs="unbounded"/>
      <element ref="md:KeyDescriptor" minOccurs="0"
maxOccurs="unbounded"/>
   </sequence>
   <attribute name="affiliationOwnerID" type="md:entityIDType"
use="required"/>
   <attribute name="validUntil" type="dateTime" use="optional"/>
   <attribute name="cacheDuration" type="duration" use="optional"/>
   <attribute name="ID" type="ID" use="optional"/>
   <anyAttribute namespace="##other" processContents="lax"/>
</complexType>
<element name="AffiliateMember" type="md:entityIDType"/>
```

2.6 Examples

The following is an example of metadata for a SAML system entity acting as an identity provider and an attribute authority. A signature is shown as a placeholder, without the actual content.

```
<EntityDescriptor xmlns="urn:oasis:names:tc:SAML:2.0:metadata"
   xmlns:saml="urn:oasis:names:tc:SAML:2.0:assertion"
   xmlns:ds="http://www.w3.org/2000/09/xmldsig#"
   entityID="https://IdentityProvider.com/SAML">
   <ds:Signature>...</ds:Signature>
    <IDPSSODescriptor WantAuthnRequestsSigned="true"
   protocolSupportEnumeration="urn:oasis:names:tc:SAML:2.0:protocol">
        <KeyDescriptor use="signing">
            <ds:KeyInfo>
                <ds:KeyName>IdentityProvider.com SSO Key</ds:KeyName>
            </ds:KeyInfo>
        </KeyDescriptor>
        <ArtifactResolutionService isDefault="true" index="0"
       Binding="urn:oasis:names:tc:SAML:2.0:bindings:SOAP"
       Location="https://IdentityProvider.com/SAML/Artifact"/>
        <SingleLogoutService
       Binding="urn:oasis:names:tc:SAML:2.0:bindings:SOAP"
       Location="https://IdentityProvider.com/SAML/SLO/SOAP"/>
        <SingleLogoutService
       Binding="urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Redirect"
       Location="https://IdentityProvider.com/SAML/SLO/Browser"
ResponseLocation="https://IdentityProvider.com/SAML/SLO/Response"/>
        <NameIDFormat>
        urn:oasis:names:tc:SAML:1.1:nameid-format:X509SubjectName
        </NameIDFormat>
        <NameIDFormat>
        urn:oasis:names:tc:SAML:2.0:nameid-format:persistent
        </NameIDFormat>
        <NameIDFormat>
        urn:oasis:names:tc:SAML:2.0:nameid-format:transient
        </NameIDFormat>
        <SingleSignOnService
       Binding="urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Redirect"
       Location="https://IdentityProvider.com/SAML/SSO/Browser"/>
        <SingleSignOnService
       Binding="urn:oasis:names:tc:SAML:2.0:bindings:HTTP-POST"
       Location="https://IdentityProvider.com/SAML/SSO/Browser"/>
    </IDPSSODescriptor>
    <AttributeAuthorityDescriptor
   protocolSupportEnumeration="urn:oasis:names:tc:SAML:2.0:protocol">
        <KeyDescriptor use="signing">
            <ds:KeyInfo>
                <ds:KeyName>IdentityProvider.com AA Key</ds:KeyName>
            </ds:KeyInfo>
        </KeyDescriptor>
        <AttributeService
       Binding="urn:oasis:names:tc:SAML:2.0:bindings:SOAP"
       Location="https://IdentityProvider.com/SAML/AA/SOAP"/>
        <AssertionIDRequestService
       Binding="urn:oasis:names:tc:SAML:2.0:bindings:URI"
       Location="https://IdentityProvider.com/SAML/AA/URI"/>
        <saml:Attribute
       NameFormat="urn:oasis:names:tc:SAML:2.0:attrname-format:uri"
       Name="urn:oid:1.3.6.1.4.1.5923.1.1.1.6"
       FriendlyName="eduPersonPrincipalName">
        </saml:Attribute>
        <saml:Attribute
       NameFormat="urn:oasis:names:tc:SAML:2.0:attrname-format:uri"
       Name="urn:oid:1.3.6.1.4.1.5923.1.1.1.1"
       FriendlyName="eduPersonAffiliation">
            <saml:AttributeValue>member</saml:AttributeValue>
            <saml:AttributeValue>student</saml:AttributeValue>
```

```
            <saml:AttributeValue>faculty</saml:AttributeValue>
            <saml:AttributeValue>employee</saml:AttributeValue>
            <saml:AttributeValue>staff</saml:AttributeValue>
        </saml:Attribute>
        <NameIDFormat>
        urn:oasis:names:tc:SAML:1.1:nameid-format:X509SubjectName
        </NameIDFormat>
        <NameIDFormat>
        urn:oasis:names:tc:SAML:2.0:nameid-format:persistent
        </NameIDFormat>
        <NameIDFormat>
        urn:oasis:names:tc:SAML:2.0:nameid-format:transient
        </NameIDFormat>
    </AttributeAuthorityDescriptor>
    <Organization>
        <OrganizationName xml:lang="en">
        Identity Providers R US
        </OrganizationName>
        <OrganizationDisplayName xml:lang="en">
        Identity Providers R US, a Division of Lerxst Corp.
        </OrganizationDisplayName>
        <OrganizationURL xml:lang="en">
        https://IdentityProvider.com
        </OrganizationURL>
    </Organization>
</EntityDescriptor>
```

The following is an example of metadata for a SAML system entity acting as a service provider and an attribute consumer. A signature is shown as a placeholder, without the actual content. For illustrative purposes, the service is one that does not require users to uniquely identify themselves, but rather authorizes access on the basis of a role-like attribute.

```
<EntityDescriptor xmlns="urn:oasis:names:tc:SAML:2.0:metadata"
   xmlns:saml="urn:oasis:names:tc:SAML:2.0:assertion"
   xmlns:ds="http://www.w3.org/2000/09/xmldsig#"
   entityID="https://ServiceProvider.com/SAML">
   <ds:Signature>...</ds:Signature>
    <SPSSODescriptor AuthnRequestsSigned="true"
   protocolSupportEnumeration="urn:oasis:names:tc:SAML:2.0:protocol">
        <KeyDescriptor use="signing">
            <ds:KeyInfo>
                <ds:KeyName>ServiceProvider.com SSO Key</ds:KeyName>
            </ds:KeyInfo>
        </KeyDescriptor>
        <SingleLogoutService
       Binding="urn:oasis:names:tc:SAML:2.0:bindings:SOAP"
       Location="https://ServiceProvider.com/SAML/SLO/SOAP"/>
        <SingleLogoutService
       Binding="urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Redirect"
       Location="https://ServiceProvider.com/SAML/SLO/Browser"
ResponseLocation="https://ServiceProvider.com/SAML/SLO/Response"/>
        <NameIDFormat>
        urn:oasis:names:tc:SAML:2.0:nameid-format:transient
        </NameIDFormat>
        <AssertionConsumerService isDefault="true" index="0"
       Binding="urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Artifact"
       Location="https://ServiceProvider.com/SAML/SSO/Artifact"/>
        <AssertionConsumerService index="1"
       Binding="urn:oasis:names:tc:SAML:2.0:bindings:HTTP-POST"
       Location="https://ServiceProvider.com/SAML/SSO/POST"/>
    </SPSSODescriptor>
    <AttributeConsumerDescriptor
   protocolSupportEnumeration="urn:oasis:names:tc:SAML:2.0:protocol">
        <KeyDescriptor use="encryption">
            <ds:KeyInfo>
                <ds:KeyName>ServiceProvider.com Encrypt Key</ds:KeyName>
            </ds:KeyInfo>
```

```
            <EncryptionMethod
      Algorithm="http://www.w3.org/2001/04/xmlenc#rsa-1_5"/>
        </KeyDescriptor>
        <AttributeConsumingService index="0">
            <ServiceName xml:lang="en">
            Academic Journals R US
            </ServiceName>
            <RequestedAttribute
      NameFormat="urn:oasis:names:tc:SAML:2.0:attrname-format:uri"
         Name="urn:oid:1.3.6.1.4.1.5923.1.1.1.7"
         FriendlyName="eduPersonEntitlement">
               <saml:AttributeValue>
               https://ServiceProvider.com/entitlements/123456789
               </saml:AttributeValue>
            </RequestedAttribute>
        </AttributeConsumingService>
    </AttributeConsumerDescriptor>
    <Organization>
        <OrganizationName xml:lang="en">
        Academic Journals R US
        </OrganizationName>
        <OrganizationDisplayName xml:lang="en">
        Academic Journals R US, a Division of Dirk Corp.
        </OrganizationDisplayName>
        <OrganizationURL xml:lang="en">
        https://ServiceProvider.com
        </OrganizationURL>
    </Organization>
</EntityDescriptor>
```

3 Signature Processing

Various elements in a metadata instance can be digitally signed (as indicated by the element's inclusion of a <ds:Signature> element), with the following benefits:

- Metadata integrity
- Authentication of the metadata by a trusted signer

A digital signature is not always required, for example if the relying party obtains the information directly from the publishing entity directly (with no intermediaries) through a secure channel, with the entity having authenticated to the relying party by some means other than a digital signature.

Many different techniques are available for "direct" authentication and secure channel establishment between two parties. The list includes TLS/SSL, HMAC, password-based mechanisms, etc. In addition, the applicable security requirements depend on the communicating applications.

Additionally, elements can inherit signatures on enclosing parent elements that are themselves signed.

In the absence of such context, it is RECOMMENDED that at least the root element of a metadata instance be signed.

3.1 XML Signature Profile

The XML Signature specification [XMLSig] calls out a general XML syntax for signing data with flexibility and many choices. This section details the constraints on these facilities so that metadata processors do not have to deal with the full generality of XML Signature processing. This usage makes specific use of the **xs:ID**-typed attributes optionally present on the elements to which signatures can apply. These attributes are collectively referred to in this section as the identifier attributes.

3.1.1 Signing Formats and Algorithms

XML Signature has three ways of relating a signature to a document: enveloping, enveloped, and detached.

SAML metadata MUST use enveloped signatures when signing the elements defined in this specification. SAML processors SHOULD support the use of RSA signing and verification for public key operations in accordance with the algorithm identified by http://www.w3.org/2000/09/xmldsig#rsa-sha1.

3.1.2 References

Signed metadata elements MUST supply a value for the identifier attribute on the signed element. The element may or may not be the root element of the actual XML document containing the signed metadata element.
Signatures MUST contain a single <ds:Reference> containing a URI reference to the identifier attribute value of the metadata element being signed. For example, if the identifier attribute value is "foo", then the URI attribute in the <ds:Reference> element MUST be "#foo".
As a consequence, a metadata element's signature MUST apply to the content of the signed element and any child elements it contains.

3.1.3 Canonicalization Method

SAML implementations SHOULD use Exclusive Canonicalization, with or without comments, both in the <ds:CanonicalizationMethod> element of <ds:SignedInfo>, and as a <ds:Transform> algorithm. Use of Exclusive Canonicalization ensures that signatures created over SAML metadata

1151 embedded in an XML context can be verified independent of that context.

1152 3.1.4 Transforms

1153 Signatures in SAML metadata SHOULD NOT contain transforms other than the enveloped signature
1154 transform (with the identifier http://www.w3.org/2000/09/xmldsig#enveloped-signature) or the exclusive
1155 canonicalization transforms (with the identifier http://www.w3.org/2001/10/xml-exc-c14n# or
1156 http://www.w3.org/2001/10/xml-exc-c14n#WithComments).

1157 Verifiers of signatures MAY reject signatures that contain other transform algorithms as invalid. If they do
1158 not, verifiers MUST ensure that no content of the signed metadata element is excluded from the
1159 signature. This can be accomplished by establishing out-of-band agreement as to what transforms are
1160 acceptable, or by applying the transforms manually to the content and reverifying the result as consisting
1161 of the same SAML metadata.

1162 3.1.5 KeyInfo

1163 XML Signature [XMLSig] defines usage of the `<ds:KeyInfo> element.` SAML does not require the
1164 use of `<ds:KeyInfo>` nor does it impose any restrictions on its use. Therefore, `<ds:KeyInfo>` MAY
1165 be absent.

4 Metadata Publication and Resolution

Two mechanisms are provided for an entity to publish (and for a consumer to resolve the location of) metadata documents: via a "well-known-location" by directly dereferencing the entity's unique identifier (a URI variously referred to as an *entityID* or *providerID*), or indirectly by publishing the location of metadata in the DNS. Other out-of-band mechanisms are of course also permitted. A consumer that supports both approaches defined in this document MUST attempt resolution via DNS before using the "well-known-location" mechanism.

When retrieval requires network transport of the document, the transport SHOULD be protected with mechanisms providing server authentication and integrity protection. For example, HTTP-based resolution SHOULD be protected with *TLS/SSL* [RFC2246] as amended by [RFC3546].

Various mechanisms are described in this section to aid in establishing trust in the accuracy and legitimacy of metadata, including use of XML signatures, SSL/TLS server authentication, and DNS signatures. Regardless of the mechanism(s) used, relying parties SHOULD have some means by which to establish trust in metadata information before relying on it.

4.1 Publication and Resolution via Well-Known Location

The following sections describe publication and resolution of metadata by means of a well-known location.

4.1.1 Publication

Entities MAY publish their metadata documents at a well known location by placing the document at the location denoted by its unique identifier, which MUST be in the form of a URL (rather than a URN). See Section 8.3.6 of [SAMLCore] for more information about such identifiers. It is STRONGLY RECOMMENDED that `https` URLs be used for this purpose. An indirection mechanism supported by the URL scheme (such as an HTTP 1.1 302 redirect) MAY be used if the document is not placed directly at the location. If the publishing protocol permits MIME-based identification of content types, the content type of the metadata instance MUST be `application/samlmetadata+xml`.

The XML document provided at the well-known location MUST describe the metadata only for the entity represented by the unique identifier (that is, the root element MUST be an `<EntityDescriptor>` with an `entityID` matching the location). If other entities need to be described, the `<AdditionalMetaLocation>` element MUST be used. Thus the `<EntitiesDescriptor>` element MUST NOT be used in documents published using this mechanism, since a group of entities are not defined by such an identifier.

4.1.2 Resolution

If an entity's unique identifier is a URL, metadata consumers MAY attempt to resolve an entity's unique identifier directly, in a scheme-specific manner, by dereferencing the identifier.

4.2 Publishing and Resolution via DNS

To improve the accessibility of metadata documents and provide additional indirection between an entity's unique identifier and the location of metadata, entities MAY publish their metadata document locations in a zone of their corresponding DNS [RFC1034]. The entity's unique identifier (a URI) is used as the input to the process. Since URIs are flexible identifiers, location publication methods and the resolution process are determined by the URI's scheme and fully-qualified name. URI locations for metadata are

subsequently be derived through queries of the NAPTR Resource Record (RR) as defined in [RFC2915] and [RFC3403].

It is RECOMMENDED that entities publish their resource records in signed zone files using [RFC2535] such that relying parties may establish the validity of the published location and authority of the zone, and integrity of the DNS response. If DNS zone signatures are present, relying parties MUST properly validate the signature.

4.2.1 Publication

This specification makes use of the NAPTR resource record described in [RFC2915] and [RFC3403]. Familiarity with these documents is encouraged.

Dynamic Delegation Discovery System (DDDS) [RFC3401] is a general purpose system for the retrieval of information based on an application-specific input string and the application of well known rules to transform that string until a terminal condition is reached requiring a look-up into an application-specific defined database or resolution of a URL based on the rules defined by the application. DDDS defines a specific type of DNS Resource Record, NAPTR records, for the storage of information in the DNS necessary to apply DDDS rules.

Entities MAY publish separate URLs when multiple metadata documents need to be distributed, or when different metadata documents are required due to multiple trust relationships that require separate keying material, or when service interfaces require separate metadata declarations. This may be accomplished through the use of the optional `<AdditionalMetaLocation>` element, or through the regexp facility and multiple service definition fields in the NAPTR resource record itself.

If the publishing protocol permits MIME-based identification of content types, the content type of the metadata instance MUST be `application/samlmetadata+xml`.

If the entity's unique identifier is a URN, publication of the corresponding metadata location proceeds as specified in [RFC3404]. Otherwise, the resolution of the metadata location proceeds as specified below.

The following is the application-specific profile of DDDS for SAML metadata resolution.

4.2.1.1 First Well Known Rule

The "first well-known-rule" for processing SAML metadata resolution is to parse the entity's unique identifier and extract the fully-qualified domain name (subexpression 3) as described in Section “Parsing the providerID”.

4.2.1.2 The Order Field

The order field indicates the order for processing each NAPTR resource record returned. Publishers MAY provide multiple NAPTR resource records which MUST be processed by the resolver application in the order indicated by this field.

4.2.1.3 The Preference Field

For terminal NAPTR resource records, the publisher expresses the preferred order of use to the resolving application. The resolving application MAY ignore this order, in cases where the service field value does not meet the resolver's requirements (e.g.: the resource record returns a protocol the application does not support).

4.2.1.4 The Flag Field

SAML metadata resolution twice makes use of the "U" flag, which is terminal, and the null value (implying additional resource records are to be processed). The "U" flag indicates that the output of the rule is a URI.

4.2.1.5 The Service Field

The SAML-specific service field, as described in the following BNF, declares the modes by which instance document(s) shall be made available:

```
servicefield = 1("PID2U" / "NID2U") "+" proto [*(":" class) *(":" servicetype)]
proto = 1("https" / "uddi")
class = 1[ "entity" / "entitygroup" )
servicetype = 1(si / "spsso" / "idpsso" / "authn" / "authnauth" / "pdp" / "attrauth" /
"attrcons" / alphanum )
si = "si" [":" alphanum] [":endpoint"]
alphanum = 1*32(ALPHA / DIGIT)
```

where:

- `servicefield` PID2U resolves an entity's unique identifier to metadata URL.
- `servicefield` NID2U resolves a principal's `<NameIdentifier>` into a metadata URL.
- `proto` describes the retrieval protocol (`https` or `uddi`). In the case of UDDI, the URL will be an http(s) URL referencing a WSDL document.
- `class` identifies whether the referenced metadata document describes a single entity, or multiple. In the latter case, the referenced document MUST contain the entity defined by the original unique identifier as a member of a group of entities within the document itself such as an `<AffiliationDescriptor>` or `<EntitiesDescriptor>`.
- `servicetype` allows an entity to publish metadata for distinct roles and services as separate documents. Resolvers who encounter multiple `servicetype` declarations will dereference the appropriate URI, depending on which service is required for an operation (e.g.: an entity operating both as an identity provider and a service provider can publish metadata for each role at different locations). The `authn` service type represents a `<SingleSignOnService>` endpoint.
- `si` (with optional endpoint component) allows the publisher to either directly publish the metadata for a service instance, or by articulating a SOAP endpoint (using `endpoint`).

For example:

- `PID2U+https:entity` - represents the entity's complete metadata document available via the https protocol
- `PID2U+uddi:entity:si:foo` - represents the WSDL document location that describes a service instance "foo"
- `PID2U+https:entitygroup:idpsso` - represents the metadata for a group of entities acting as SSO identity providers, of which the original entity is a member.
- `NID2U+https:idp` - represents the metadata for the SSO identity provider of a principal

4.2.1.6 The Regex and Replacement Fields

The expected output after processing the input string through the regex MUST be a valid `https` URL or UDDI node (WSDL document) address.

4.2.2 NAPTR Examples

4.2.2.1 Entity Metadata NAPTR Examples

Entities publish metadata URLs in the following manner:

```
$ORIGIN provider.biz

;; order pref f service regexp or replacement

IN NAPTR 100 10 "U" PID2U+https:entity
   "!^.*$!https://host.provider.biz/some/directory/trust.xml!" ""
IN NAPTR 110 10 "U" PID2U+https: entity:trust
   "!^.*!https://foo.provider.biz:1443/mdtrust.xml!" ""
IN NAPTR 125 10 "U" PID2U+https:"
IN NAPTR 110 10 "U" PID2U+uddi:entity
   "!^.*$!https://this.uddi.node.provider.biz/libmd.wsdl" ""
```

4.2.2.2 Name Identifier Examples

A principal's employer `example.int` operates an identity provider which may be used by an office supply company to authenticate authorized buyers. The supplier takes a users' email address `buyer@example.int` as input to the resolution process, and parses the email address to extract the FQDN (example.int). The employer publishes the following NAPTR record in the `example.int` DNS:

```
$ORIGIN example.int

IN NAPTR 100 10 "U" NID2U+https:authn
   "!^([^@]+)@(.*)$!https://serv.example.int:8000/cgi-bin/getmd?\1!" ""
IN NAPTR 100 10 "U" NID2U+https:idp
   "!^([^@]+)@(.*)$!https://auth.example.int/app/auth?\1" ""
```

4.2.3 Resolution

When resolving metadata for an entity via the DNS, the unique identifier of the entity is used as the initial input into the resolution process, rather than as an actual location Proceed as follows:

- If the unique identifier is a URN, proceed with the resolution steps as defined in [RFC3404].
- Otherwise, parse the identifier to obtain the fully-qualified domain name.
- Query the DNS for NAPTR resource records of the domain iteratively until a terminal resource record is returned.
- Identify which resource record to use based on the service fields, then order fields, then preference fields of the result set.
- Obtain the document(s) at the provided location(s) as required by the application.

4.2.3.1 Parsing the Unique Identifier

To initiate the resolution of the location of the metadata information, it will be necessary in some cases to decompose the entity's unique identifier (expressed as a URI) into one or more atomic elements.

The following regular expression should be used when initiating the decomposition process:

```
   ^([^:/?#]+:)?/*([^:/?#]*@)?(([^/?:#]*\.)*(([^/?#:\.]+)\.([^/?#:\.]+)))
(:\d+)?([^?#]*)(\?[^#]*)?(#.*)?$
     1            2           34            56             7
8       9       10        11
```

Subexpression 3 MUST result in a Fully-Qualified Domain Name (FQDN), which will be the basis for retrieving metadata locations from this zone.

4.2.3.2 Obtaining Metadata via the DNS

Upon completion of the parsing of the identifier, the application then performs a DNS query for the resulting domain (subexpression 5) for NAPTR resource records; it should expect 1 or more responses. Applications MAY exclude from the result set any service definitions that do not concern the present request operations.

Resolving applications MUST subsequently order the result set according to the order field, and MAY order the result set based on the preference set. Resolvers are NOT REQUIRED to follow the ordering of the preferences field. The resulting NAPTR resource record(s) are operated on iteratively (based on the order flag) until a terminal NAPTR resource record is reached.

The result will be a well-formed, absolute URL, which is then used to retrieve the metadata document.

4.2.4 Metadata Location Caching

Location caching MUST NOT exceed the TTL of the DNS zone from which the location was derived. Resolvers MUST obtain a fresh copy of the metadata location upon reaching the expiration of the TTL of the zone.

Publishers of metadata documents should carefully consider the TTL of the zone when making changes to metadata document locations. Should such a location change occur, a publisher MUST either keep the document at both the old and new location until all conforming resolvers are certain to have the updated location (e.g.: time of zone change + TTL), or provide an HTTP Redirect [RFC2616] response at the old location specifying the new location.

4.3 Post-Processing of Metadata

The following sections describe the post-processing of metadata.

4.3.1 Metadata Instance Caching

Document caching MUST NOT exceed the `validUntil` or `cacheDuration` attribute of the subject element(s). If metadata elements have parent elements which contain caching policies, the parent element takes precedence.

To properly process the `cacheDuration` attribute, consumers MUST retain the date and time when the document was retrieved.

When a document or element has expired, the consumer MUST retrieve a fresh copy, which may require a refresh of the document location(s). Consumers SHOULD process document cache processing according to [RFC2616] Section 13, and MAY request the Last-Modified date and time from the HTTP server. Publishers SHOULD ensure acceptable cache processing as described in [RFC2616] (Section 10.3.5 304 Not Modified).

4.3.2 Handling of HTTPS Redirects

Publishers MAY issue an HTTP Redirect (301 Moved Permanently, 302 or 307 Temporary Redirect) [RFC2616], and user agents MUST follow the specified URL in the Redirect response. Redirects SHOULD be of the same protocol as the initial request.

4.3.3 Processing of XML Signatures and General Trust Processing

Metadata processing provides several mechanisms for trust negotiation for both the metadata itself and for the trust ascribed to the entity described by such metadata:

- Trust derived from the signature of the DNS zone from which the metadata location URL was

resolved, ensuring accuracy of the metadata document location(s)

- Trust derived from signature processing of the metadata document itself, ensuring the integrity of the XML document
- Trust derived from the SSL/TLS server authentication of the metadata location URL, ensuring the identity of the publisher of the metadata

Post-processing of the metadata document MUST include signature processing at the XML-document level and MAY include one of the other two processes. Specifically, the relying party MAY choose to trust any of the cited authorities in the resolution and parsing process. Publishers of metadata MUST employ a document-integrity mechanism and MAY employ any of the other two processing profiles to establish trust in the metadata document, governed by implementation policies.

4.3.3.1 Processing Signed DNS Zones

Verification of DNS zone signature SHOULD be processed, if present, as described in [RFC2535].

4.3.3.2 Processing Signed Documents and Fragments

Published metadata documents SHOULD be signed, as described in Section 3, either by a certificate issued to the subject of the document, or by another trusted party. Publishers MAY consider signatures of other parties as a means of trust conveyance.

Metadata consumers MUST validate signatures, when present, on the metadata document as described by Section 3.

4.3.3.3 Processing Server Authentication during Metadata Retrieval via TLS/SSL

It is STRONGLY RECOMMENDED that publishers implement TLS/SSL URLs; therefore, consumers SHOULD consider the trust inherited from the issuer of the TLS/SSL certificate. Publication URLs may not always be located in the domain of the subject of the metadata document; therefore, consumers SHOULD NOT presume certificates whose subject is the entity in question, as it may be hosted by another trusted party.

As the basis of this trust may not be available against a cached document, other mechanisms SHOULD be used under such circumstances.

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