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User Management Interfaces for Earth Observation Services

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i. Preface

This document explains how user and identity management information is included in the protocol specifications for EO (Earth Observation) services, for example catalogue access (OGC 06-131), ordering (OGC 06-141) and programming (OGC 07-018).

The document was initially produced during the ESA HMA (Heterogeneous Missions Accessibility) project and refined during the FEDEO (Federated Earth Observation) Pilot. It was further refined in the ESA EODAIL and HMA-T projects.

This document is not a new specification, however, it describes how existing specifications from W3C and OASIS can be used in combination to pass identity information to Web services some of which are based on OGC Best Practice specifications.

ii. Submitting organisations

The following organisations will submit the original document or its revisions to the OGC™ Security Working Group.

- **Spacebel s.a.**
- **ESA – European Space Agency**
- **Intecs**

The editors would like to acknowledge that this work is the result of collaboration and review of many organisations and would like to thank for the comments and contributions from:

- **Astrium**
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- **CNES**
- **DLR**
- **Eumetsat**
- **EUSC**
- **MDA**
- **con terra**

Note: this does not imply a complete endorsement from these organisations.

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iv. Revision history

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15 September 2007	0.0.1 Draft	R.Smillie	All	Initialised Draft Document.
23 April 2008	0.0.2	R.Smillie		Updated in line with EO DAIL implementation project
07 Feb 2009	0.0.3	R.Smillie		Updated in line with EO DAIL implementation project SOAP version changed to 1.1 Authentication request does not use WS-Security Message examples added Encryption and signature descriptions improved

30 June 2009	0.0.4	R.Smillie		Updated in line with EO DAIL RID PRE-AR2#34: • Namespace in encrypted message example corrected to http://earth.esa.int/um/eop/saml <http://earth.esa.int/um/eop/saml> • decryptandCheckSignature removed from STS • authenticating identity correctly asserted in examples • authenticate and authenticateFederated merged into one operation • Attribute assertions updated in examples • WSDL provided for STS • Clarification made for the assertion element and schema attached • All schemas and references given in annex.

30 October 2009	0.0.5	P. Denis	All	Updates following RIDS of EUMETSAT/con terra, analysis by FP-7 GENESIS and HMA-T projects • Removed references to DAIL and GS, for the sake of generality • Added conformance (chapter 2) and Abstract Test Suite (annex A) • Put SOAP 1.2 as baseline protocol binding and put SOAP 1.1 support in annex C • Demote SAML token attributes specification as an example (annex D) • Added authorisation use cases (chapter 10) and XACML examples (annex E) • Added WS-Policy recommendation • Removed non-standard Assertion element • Remove certificate from SAML token • Changed protocol for authentication through external IdP • Added "future work" section • Clarify roles of each entity in the system • Added threats / countermeasures analysis (chapter 9) • Misc corrections and clarifications

29 January 2010	0.0.6	P. Denis	All	• Alignment on OASIS WS-Trust 1.3, i.e. Security Token Service (STS), providing Request Security Token operation (RST) • Precisions and changes on signature of security tokens • Created annex G for ESA UM-SSO / EO-DAIL Integration • Misc corrections and clarifications

v. Future work

The ability to have multiple federating entities is under investigation.

The main issue to solve is to allow multiple PEPs to consume the SAML token produced by the Federating IdP; this is not feasible with the present version of the specification due to encryption of SAML token (only one specific private key can make the decryption). To tackle this issue, two main ways are considered:

1. Several PEPs, designated in the circle of trust, share the same private key. Then, all these PEPs are able to decrypt the same SAML token.
2. The SAML token is no longer encrypted. Then, all PEP can directly consume SAML token.

Solution 1 clearly minimizes the impact on current architecture. However, it violates the principle of keeping private key local on one machine.

Solution 2 directly impacts SAML token producer (STS) and consumer (PEP). On a security level, only the confidentiality of SAML token attributes is removed. The integrity of SAML token is still kept through the signature mechanism already enforced in the present specification. Also, as a side-effect, the clients of STS become able to extract information of SAML token; in some way the clients become included in the circle of trust. It is under consideration to require each client to sign each service request, as a whole, so that the PEP can verify that such client is trusted and that the request has not been forged for malicious usage.

vi. Foreword

This document, through its implementation profile, references several external standards and specifications as dependencies. These are indicated in section 3.1.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The Open GIS Consortium, Inc. shall not be held responsible for identifying any or all such patent rights.

Introduction

This specification is complementary to a set of specifications that describe services for managing Earth Observation (EO) data products. These services include collection level, and product level catalogues, online-ordering for existing and future products, on-line access to these products, etc. The application of the current specification is not limited to the Earth Observation domain however.

The intent of this specification is to describe an identity management interface that can be supported by many data providers (satellite operators, data distributors …), most of whom have existing (and relatively complex) facilities for the management of their data and users. The strategy is to specify a platform and provider independent interface using existing standards.

1 Scope

This proposed interface document describes the interfaces required to authenticate and authorise users in a federated system of Earth Observation services.

2 Conformance

2.1 Conformance to base specifications

This present section covers the compliance testing of an implementation candidate with the present document.

It is worth highlighting that the present OGC document puts together specifications (SAML, WS Security, XACML) that come from other organizational bodies (OASIS) for which the concept of "conformance testing" does not apply; consequently, it is not possible to recursively testing the conformance to the compound specifications.

2.2 Conformance classes

We assume that a unique "core" conformance class encompassing all of the specification clauses of the document is defined and assume that the "Abstract Test Suite" is made up of this unique conformance class ("the core"). This class defines test cases, which covers:

- Test Module Basic requirements
- Test Module Authorisation

These are detailed in the Abstract Test Suite (see Annex A).

3 References

3.1 Normative references

[NR1] W3C Recommendation January 1999, Namespaces In XML, http://www.w3.org/TR/2000/REC-xml-names

[NR2] W3C Recommendation 6 October 2000, Extensible Markup Language (XML) 1.0 (Second Edition), http://www.w3.org/TR/REC-xml

[NR3] W3C Recommendation 2 May 2001: XML Schema Part 0: Primer, http://www.w3.org/TR/2001/REC-xmlschema-0-20010502/

[NR4] W3C Recommendation 2 May 2001: XML Schema Part 1: Structures, http://www.w3.org/TR/2001/REC-xmlschema-1-20010502/

[NR5] W3C Recommendation 2 May 2001: XML Schema Part 2: Datatypes, http://www.w3.org/TR/2001/REC-xmlschema-2-20010502/

[NR6] W3C Simple Object Access Protocol (SOAP) Version 1.1 W3C Note 08 May 2000 , http://www.w3.org/TR/2000/NOTE-SOAP-20000508/

[NR7] WSDL, Web Services Description Language (WSDL) 1.1, http://www.w3.org/TR/wsdl

[NR8] IETF RFC 2119, Keywords for use in RFCs to Indicate Requirement Levels, http://rfc.net/rfc2119.html

[NR9] WS-Security, SOAP Message Security V1.1 http://www.oasis-open.org/committees/download.php/16790/wss-v1.1-spec-os-SOAPMessageSecurity.pdf

[NR10] SAML, Assertions and Protocol for the OASIS Security Assertion Markup Language (SAML) V1.1 http://www.oasis-open.org/committees/download.php/3406/oasis-sstc-saml-core-1.1.pdf

[NR11] Web Services Security SAML Token Profile 1.1 http://www.oasis-open.org/committees/download.php/16768/wss-v1.1-spec-os-SAMLTokenProfile.pdf

[NR12] Secure Hash Standards (SHA-1) National Institute of Standards and Technology http://csrc.nist.gov/cryptval/shs.htm

[NR14] Glossary for the OASIS Security Assertion Markup Language (SAML) V2.0 http://docs.oasis-open.org/security/saml/v2.0/saml-glossary-2.0-os.pdf

[NR15] Java Cryptography Architecture API Specification & Reference

http://java.sun.com/j2se/1.5.0/docs/guide/security/CryptoSpec.html

[NR16] OGC 04-016r5, OWS Common Implementation Specification 2004/12/17

[NR17] XML encryption http://www.w3.org/TR/xmlenc-core/

[NR18] XML signature http://www.w3.org/TR/xmldsig-core/

[NR19] Apache XML Security http://santuario.apache.org/Java/index.html

[NR20] W3C Recommendation 4 September 2007, Web Services Policy 1.5 - Framework, http://www.w3.org/TR/ws-policy/

[NR21] OASIS eXtensible Access Control Markup Language (XACML) TC http://www.oasis-open.org/committees/xacml

[NR22] SOAP Version 1.2 Part 1: Messaging Framework (Second Edition), W3C Recommendation 27 April 2007, http://www.w3.org/TR/soap12-part1/

[NR23] OASIS WS-Trust 1.3 http://docs.oasis-open.org/ws-sx/ws-trust/v1.3/ws-trust.pdf

[NR24] OASIS WS-Security UsernameToken Profile 1.1
http://docs.oasis-open.org/wss/v1.1/wss-v1.1-spec-os-UsernameTokenProfile.pdf

3.2 Other references

[OR1] Shibboleth
http://shibboleth.internet2.edu/

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply:

4.1.
Authentication [NR14]
To confirm a system entity's asserted principal identity with a specified, or understood, level of confidence.

4.2.
circle of trust
A federation of Service Providers and identity providers within which Service Providers accept the authentication asserted by the identity provider.

4.3.
client
software component that can invoke an **operation** from a **server**

4.4.
external entity
This is the entity owning a protected Web service federated by the Federating Entity. The external entity can be both an identity provider and Service Provider. There can be many external entities.

4.5.
federated identity [NR14]
A principal's identity is said to be federated between a set of Providers when there is an agreement between the providers on a set of identifiers and/or attributes to use to refer to the Principal.

4.6.
Federating Entity
This is the entity performing the federation of the identities. The RST always passes through the Federating Entity. The Federating Entity can be both identity provider and Service Provider. The present specification assumes that there is only one Federating Entity.

4.7.
identifier
a character string that may be composed of numbers and characters that is exchanged between the client and the server with respect to a specific identity of a resource

4.8.
identity provider [NR14]
A kind of Service Provider that creates, maintains, and manages identity information for principals and provides principal authentication to other Service Providers within a federation, such as with Web browser profiles.

4.9.
interface
named set of operations that characterise the behaviour of an entity [ISO 19119]

4.10.
operation
specification of a transformation or query that an object may be called to execute [ISO 19119]

4.11.
parameter
variable whose name and value are included in an operation **request** or **response**

4.12.
PEP
Policy Enforcement Point.

4.13.
principal [NR14]
A system entity whose identity can be authenticated.

4.14.
request
invocation of an **operation** by a **client**

4.15.
response
result of an **operation,** returned from a **server** to a **client**

4.16.
server
service instance
a particular instance of a **service** [ISO 19119]

4.17.
service
distinct part of the functionality that is provided by an entity through interfaces [ISO 19119]

capability which a Service Provider entity makes available to a service user entity at the interface between those entities [ISO 19104 terms repository]

4.18.
service interface
shared boundary between an automated system or human being and another automated system or human being [ISO 19101]

4.19.
Service Provider [NR14]
A role donned by a system entity where the system entity provides services to principals or other system entities.

4.20.
transfer protocol
common set of rules for defining interactions between distributed systems [ISO 19118]

5 Symbols and abbreviations

5.1 Symbols (and abbreviated terms)

Some frequently used abbreviated terms:

ATS Abstract Test Suite

BPEL Business Process Execution Language

DAIL Data Access Integration Layer

EO Earth Observation

ETS Executable Test Suite

HMA Heterogeneous Missions Accessibility

HTTP HyperText Transport Protocol

IdP Identity Provider

ISO International Organisation for Standardisation

OASIS Advancing Open Standards for the Information Society

OGC Open Geospatial Consortium

PDP Policy Decision Point

PEP Policy Enforcement Point

RST Request Security Token

RSTR Request Security Token Response

SAML Security Assertion Markup Language

SOAP Simple Object Access Protocol

SP Service Provider

STS Security Token Service

URI Uniform Resource Identifier

URL Uniform Resource Locator

URN Uniform Resource Name

WSDL Web Service Definition Language

W3C World Wide Web Consortium

XACML eXtensible Access Control Markup Language

XML eXtensible Markup Language

5.2 Document terms and definitions

This document uses the specification terms defined in Subclause 5.3 of [NR16].

6 System context

This section documents special requirements and describes the context of use.

6.1 Application domain

Web service requests are received by Service Providers. These Service Providers should be able to identify who issued the request and react accordingly. The following approach is proposed:

1) A Security Token Service (STS) provides a Request Security Token (RST), with user identifier, password[1] and optionally his identity provider, which returns a SAML token which authenticates the user to the client (i.e. Web service consumer). (This authentication Web service may federate the identity to another identity provider for authentication. At the interface context this is transparent, the federated identity request being identical to the initial request.)
2) Each subsequent service request by the client (Web service consumer) should include the SAML token in the SOAP header as described later in this document.
3) Each Service Provider accepts service requests only via an Authorisation Service or "Policy Enforcement Point" (PEP). The PEP first checks the existence of SAML token and decrypts it.
4) The PEP verifies the SAML token (signature and expiry time)
5) The PEP decides based on the content of the message body, the contents of the message header (including authentication token) and the context (i.e. applicable policies) whether to accept or to refuse the service request or reroute it. Although this is not imposed, the use of XACML or geoXACML for definition of policy rules is recommended.
6) If the request is authorized, then the request is processed by the target SP.

If any of the steps from 3) to 5) fails, then a fault response is returned to the client.

This approach is detailed in the following figure, which highlight the typical sequence of steps from authentication to request authorisation and processing.

[1] In contexts where STS is not the identification entity (external SSO system), the password shall be omitted; then, the RST shall be signed in order to check that the requester is trusted. This will be detailed later in the present specification.

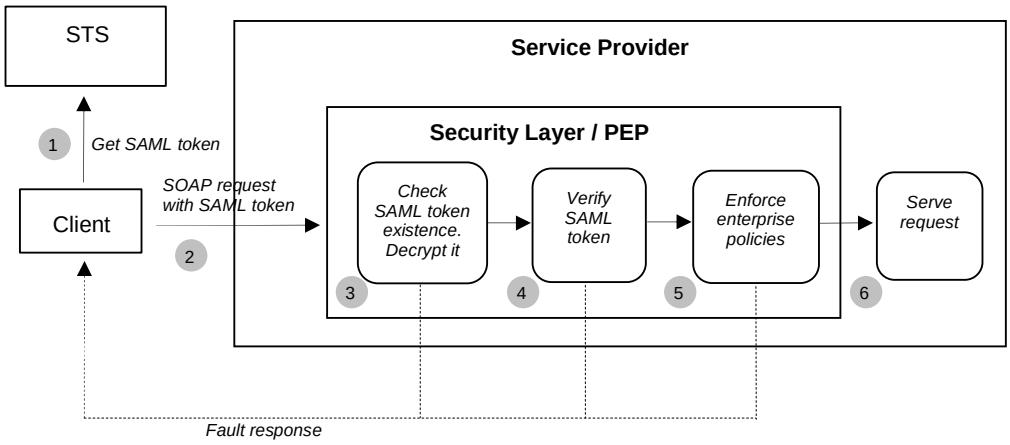


Figure 1 Sequence of authentication/authorisation activities

6.2 Protocol binding

To provide an overall coherent architecture within this context, operations shall support the embedding of requests and responses in SOAP messages. Only SOAP messaging (via HTTP/POST or HTTPS/POST) with document/literal style shall be used. Messages should conform to SOAP 1.2 [NR22].

For RSTs, the body of SOAP envelope is used, the SOAP header may be used to put a detached signature (see below). For authorisation requests, the message payload shall be in the body of the SOAP envelope and the authentication token shall be in the WS-Security element in the header of the SOAP envelope.

6.3 Basic use cases

The use cases covered by this specification are shown in the following sequence diagram:

- Authentication: A Request Security Token (RST) is first issued to the Security Token Service (STS).
- Authorisation: A service request sent to the Service Provider (SP). This service request is, for instance, a call to any of the operations defined in the catalogue (OGC 06-131), ordering (OGC 06-141) or programming (OGC 07-018) specifications. The service requests can be synchronous or asynchronous via ws-addressing. This is transparent for the current specification.

An entity may be either an identity provider (IdP), a Service Provider (SP) or both IdP and SP.

This specification covers identity federation whereby the receiving IdP (Federating Entity), if not the IdP for the request, resolves the IdP and passes the RST to the correct IdP.

Authorisation requests (service requests) may address more than one entity, to perform so-called multi-mission requests, these requests are orchestrated by a BPEL workflow.

The policy enforcement on the SP is non invasive meaning that it is independent of the SP implementation.

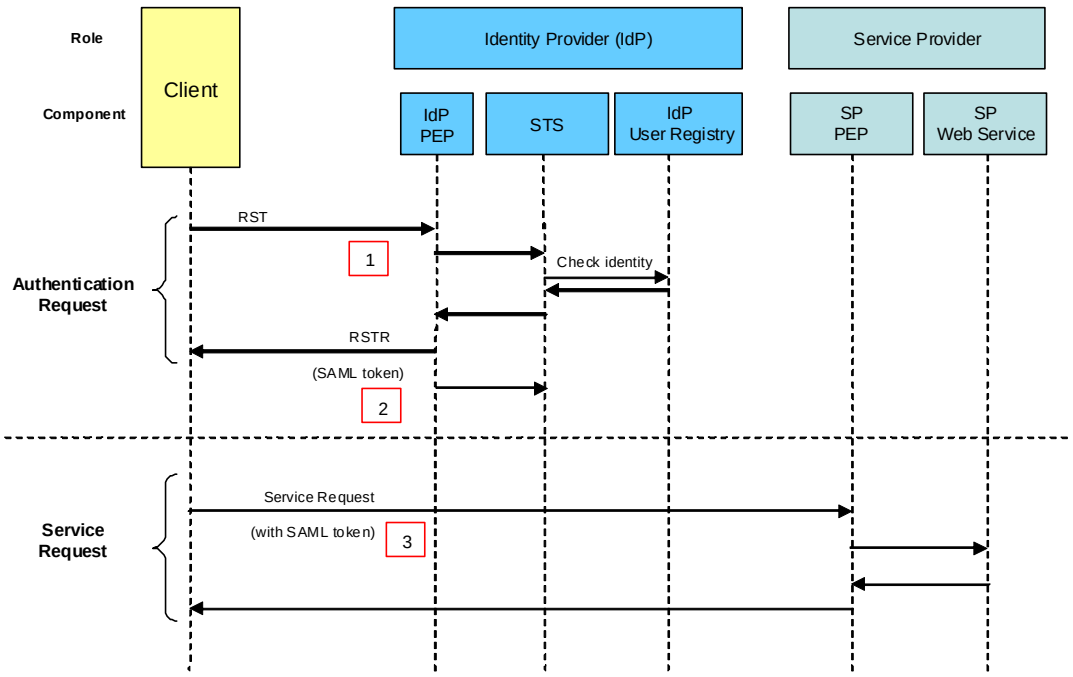


Figure 2 User Management Use Cases

The high level use case for authentication and authorisation is shown in the above figure. Note that the diagram has a higher level of abstraction than the other diagrams present in the remaining of the document; more precisely, the IdP depicted in the figure may be either on the Federating Entity or on any external entity. The same applies for the depicted SP. Following sections of this document further elaborate the detail of the authentication and authorisation.

1. The RST is sent by the client to the STS which in the Federating Entity is directly exposed as a Web service and does not pass through the PEP. However, if required a request could equally be intercepted by the IdP PEP and routed.

2. The client receives the RSTR containing the SAML token

3. The client then sends a service request i.e. an authorisation request. This request contains the SAML token.

6.4 Security Model

The model is based on WS-Security SAML token profile [NR11] and, for the issuance of SAML token, on OASIS WS-Trust 1.3 [NR23] and OASIS Web Services Security UsernameToken Profile 1.1 [NR24].

For the present need of SAML token delivery, only one operation of WS-Trust 1.3 is required: the *RequestSecurityToken* (RST), limited to the "Issue" action, as it is defined in the Issuance Binding section (§4) of [NR23]. This operation returns a RequestSecurityTokenResponse (RSTR).

The purpose of RST (with "Issue" action) in the present specification is to provide a SAML token to a requester, provided that it gets proof that it can trust this requester. The actual proof of trust depends on which entity is responsible to authenticate users, i.e. which entity is the

IdP. The present interface supports two kinds of IdP organisation, which entails two different RST formats:

1. *the IdP is the STS (or it can be accessed by the STS)*: in this case, the RST contains the name and password identifying the user plus an optional definition of the designated IdP; the STS checks that the user can be authenticated with these credentials or relay the authentication to the designated IdP;

2. *the IdP is an other system, not accessible by STS*: in this case, the RST shall contain a user id and shall be digitally signed: the STS checks that the signature corresponds to a requester that it trusts. For this purpose, the STS shall maintain a list of public keys of all the requester entities it trusts.

Case 1, based on user id/password pair, is the usual pattern that has been covered in all previous versions of the present specification. Case 2 is a new pattern, allowing subcontracting user identification to an external system, which should not be compliant with the present interface; we mean here SSO systems like OpenSSO, Shibboleth and ESA UM-SSO (see annex G). The context of case 2 is typically a Portal system that assures that a given user has been authenticated and then issues to the STS that trusts this Portal a signed RST with the authenticated user id.

For the ease of description of the differences between the two cases, we shall use in the following the wording *RST with password* for cases 1and *RST with signature* for case 2.

In all cases, the returned message is a *Request Security Token Response* (RSTR), carrying a SAML token (see [NR23]), which contains *assertions*[2] about the authentication and attributes of the identified user.

The STS receives user credentials in SOAP over an encrypted channel i.e. HTTPS. The signed and encrypted SAML token is returned as SOAP over HTTPS and subsequently used in service requests. It is an explicit design decision that the client is unable to decrypt the content of the encrypted SAML token.

6.4.1 Encryption

Encryption of the SAML token is performed by the STS during the processing of RST. Decryption is performed by the PEP during the processing of authorisation request. The encryption algorithm used is the AES-128 as defined in [NR15]. The encryption process is as follows:

1. The STS first creates the symmetric key using the AES-128 encryption algorithm.

2. This symmetric key is then itself encrypted with the public key of the target Service Provider using the RSA encryption algorithm to create a secret key.

3. The SAML token (i.e. the SAML Assertion element) is then encrypted with the generated secret key using the AES-128 encryption algorithm. Note that the encryption type is *Element*, which means that the SAML Assertion element itself is encrypted, not only its child elements; this is specified by the Type attribute of EncryptedData element:
```
<xenc:EncryptedData xmlns:xenc="http://www.w3.org/2001/04/xmlenc#"
Type="http://www.w3.org/2001/04/xmlenc#Element">
```

4. The message is then built.

[2] The concept of "assertion" here is equivalent to the concept of "claim" in WS-Trust ([NR23]).

The rationale of step 2 is that the SAML token is encrypted for a specific target Service Provider, which can be federated or not. Only the PEP of the targeted SP is able to decrypt the SAML token, through its private key. The criterion used by IdP to choose the "right" public key will be described in the Authentication Use Cases (section 6.5.3).

Example Request Security Token with password:

```
<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:wsse="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-
wssecurity-secext-1.0.xsd"
xmlns:wst="http://docs.oasis-open.org/ws-sx/ws-trust/200512/">
   <soapenv:Body>
      <wst:RequestSecurityToken>
         <wst:TokenType>
   http://docs.oasis-open.org/wss/oasis-wss-saml-token-profile-1.1#SAMLV1.1
         </wst:TokenType>
         <wst:RequestType>
            http://docs.oasis-open.org/ws-sx/ws-trust/200512/Issue
         </wst:RequestType>
         <wsse:UsernameToken>
            <wsse:Username>JohnDoe</wsse:Username>
            <wsse:Password>MyPassword</wsse:Password>
         </wsse:UsernameToken>
      </wst:RequestSecurityToken>
   </soapenv:Body>
</soapenv:Envelope>
```

Example Request Security Token with signature:

```
<S11:Envelope xmlns:S11="…" xmlns:wsse="…"
        xmlns:xenc="…" xmlns:wst="…">
  <S11:Header>
    <wsse:Security>
       <ds:Signature xmlns:ds="…">
          …
          <ds:Reference URI="#soapbody"/>
          …
       </ds:Signature>
    </wsse:Security>
  </S11:Header>
  <S11:Body Id="soapbody">
    <wst:RequestSecurityToken>
       <wst:TokenType>
    http://docs.oasis-open.org/wss/oasis-wss-saml-token-profile-1.1#SAMLV1.1
       </wst:TokenType>
       <wst:RequestType>
          http://docs.oasis-open.org/ws-sx/ws-trust/200512/Issue
       </wst:RequestType>
       <wsse:UsernameToken>
          <wsse:Username>JohnDoe</wsse:Username>
       </wsse:UsernameToken>
    </wst:RequestSecurityToken>
  </S11:Body>
</S11:Envelope>
```

Example Request Security Token Response:

```
<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
 <soapenv:Body>
      <wst:RequestSecurityTokenResponse xmlns:wst="http://docs.oasis-
open.org/ws-sx/ws-trust/200512/"
xmlns:wsa="http://www.w3.org/2005/08/addressing"
xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
xmlns:wsse="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-
wssecurity-secext-1.0.xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance">
         <wst:TokenType>http://docs.oasis-open.org/wss/oasis-wss-saml-
token-profile-1.1#SAMLV1.1</TokenType>
         <wst:RequestedSecurityToken>
            <xenc:EncryptedData
xmlns:xenc="http://www.w3.org/2001/04/xmlenc#"
Type="http://www.w3.org/2001/04/xmlenc#Element">
               <xenc:EncryptionMethod
Algorithm="http://www.w3.org/2001/04/xmlenc#aes128-cbc"/>
           <ds:KeyInfo xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
             <xenc:EncryptedKey>
               <xenc:EncryptionMethod
Algorithm="http://www.w3.org/2001/04/xmlenc#rsa-1_5"/>
               <xenc:CipherData>

<xenc:CipherValue>cbE8viFOmyDuxR8N4EdwS9UUKpSoUbMrWSVprW7IypMwFZLeHR9Rxd4iw5
dUl4K+TffyNdRJ9Tr9PD8YIdpFLzCvYas63g5x4/XnyA1E2AU8ZBBpM2dtbr3g4IYMywfraWrI76
mHM+MERVZdHMVBWFrhqXhcS92m23m+amt14mk=</xenc:CipherValue>
               </xenc:CipherData>
             </xenc:EncryptedKey>
           </ds:KeyInfo>
           <xenc:CipherData>

<xenc:CipherValue>VEHlprDMQ+DqIpoPqx6TYi/mMX2dGV5JCJCrhDquZHRKqOiaIFfwqOMZvn
2HW2JDFvUxJ6LRTKdNujQI7sxc6h3IGBL7NXF7bx4jGwQ09wAA7nm6OoB4jiGdaqb8wTx0olnzn2
WqOWoVeTng1lwBi0rv2+iD1HWnXAUUHfJH8ALq4IU3hR0vjoqJH6Y21EuXPeXp/dYPUw3oIFn2FE
ID2u+8T+xOxbbq2ezQbU3z8n1LbgvDtN3ex5lUCo260pOOPn92nn7nYErT682eYd+bCKoiENpQSY
gHszvvyqFf9o6O0u87zk4AORWsRhQH74L2gG8wVOeHKyhEx0RsBkf4xZcQKBvQ9JHWQWpDEB51NZ
aJe1hSyaUk6T5gf9ArDnz6UwL0ZTDp6Dxgjha91u5qIMG3ECxVYKcnBv+O6Om1Q0HbL0ecbUDR56
evS+mf0U9JxduBKwFJLqta6D0wmwqYWcaF3ZrKd7SatV8Z2l0DmWTMe5R+x6O1RpbKltlduKl4bL
aSYFpaqaU758ZsmTDmjQQj8fn1qCZbDtp4SEVPWumoTg2k7RAOay2QtV5b+VA9wloSXoxVf2csLS
OOH/NDE1noBIpzgUb9Xm/YIPwikQKsxNPFM72yLrS0vjAho1Cxrg+8l7XIVcmowhPnLqSs6ZpvA0
1YP8EhsOFlN+0y+9EfAuoY4jYcScfwqDehth76lER+EyAdFLi10VhVxKW14VLbmksAydndIQaw6V
zGm1Qwoc3CeCaeq4q4GgFgiem1BmW9IeBaUBTX2wZmIKG8Z9Xhjv6MwT7hOeWH5fefipJs8JS8l6
wQBo8WAczzmw6s1j8JW9YDyAWosfoTPrtOwFTaaYSiaEXvPOnb5RgR/W4ivZ64ioA8FXyLFoWcNE
JJ6AgWHDLAbCDg/zvnVwEs7OdaSxRTxVNsc7cpclGspSmk/HzGYxPHInGhn/QPsac5iN6t6HlwnQ
UJgt81rI/tbFfSYqqtYqXKeNoEtw91/1DZVUi7mSc7Xj2e2Wb65h8PIoYeX3Nli+i4SrOoeAKaZr
HtpqP6f+pI4lpkANS4RFxFDiL9Ddxv1WKD//nMck0Su0HfIbPYUYF0GGvlHsv6IiwT8dj/f0MnCx
kAgegliGageZthQiNavOcURRC/94d+1jDZGayowurzdxmJhxyiEY5REQQt3hK4aAD89wMjndzxHd
tcQEuvXA5uSm3T9qgIm4Qdvuh54PW/SKptG9fDj4paTxVVlfZ+0f/1Vxjj4pPIKOVjE3e4ChBPkJ
XD/nXqZ8DdR+zPxOLWYyiqnMaxv3OInd/Iz2Lq36a09b0JEfMVz4e39sGtFzNDbxXgQnTx4L3jDY
Fdl5+gelUNduK9HtgklXDWfNIMWtY5xhdTX0m3Q8hBtNgKOHeg7BcBXF+uT30mqwgJu5cbJQl/1j
/QlMvromUaUQATN2ULu7mMiTWkoYoMTiijJGAizbKIi6O5xmHvF/jicd7lBcmSz+B+BnrnqxY5DM
/qQSFsnRoGmPKlJeiao2g+QuMD5x7H+pBUIq3B8lkMlUBg5VoKx2+kCHuP2lamGFskQl80PRGygQ
5adA2iWwKoIKoCdcYIc9C2sPVkJz+slExJXizl4L51GEWDlQ8VGsqNV7CzOyIt0uXIIBQW3j0aX/
/7QoYVfM681TiqvtaDEY7Ip4nSV839e5xnj3s+qgzXOpoK5rw5EThDLhthPy97CJiuSbsfcGf1Dv
WNE74x2E4b8HazacItRBIbx0GFDHIoqaHEih6zlhQaqwloLnUHRpL8vAQLVKiW3q94569e3GenoQ
bpjxKQ9F58VuQh3ZiZtJ+17XOxDx6ZDXcTiQDa+3nXiTgT7k9gGtpIv8vYLMuUHDEZx1zGd/rMzU
3JAbbfKO8+Cs3pMnb2KpGL4rLLgivee1P35rbHK04V8D0NbwDk0TOVnmFQWIRsgVtPwmEHXbFl3j
qIUTx4xdishXmkKcDCwaNfqYo4yzmgLUlbtchkDGF9YBA0mXv4gT7z0TiBb1jUFBhTnciL4DBkI9
K8wEjklHUi7w4LjvhCB5B15y1ZG/baIscoRrVu41HUp7crwbsdKjcWGE//dBTXN1vrXDm0maAkCo
nuYNPpMY0Cf+ikVITJO73UaXplFjOOtm+mkql6e5nTd8qGQXwHZl/nGJOEO/rMsXSoVybxIn5bg+
97CFCtAdsRRjAJZRQcrJIztenGJX81U0rvAX+OuoSNrgVpdxcwuH/1x80i+CY5kdUkg3EMkU0m4F
iNQ6CyXiiimVSBRB0sHfWW5/Em+qlYeRjrXCyJBYPo2mCuMtqQN42VeShEkQ1XPx6o09NTaaxXRM
```

```
pV2IHjzALLrR0Px6zqbp7CuEhPdLxTYcXetDKQJt/XHJuWdvETMgsJnyQ0cCJSPXp21xsrK6zYLY
cQ1M8rS9RHCmWvFdTZg49mX3QPANOUDPoPR0y3mOT19FWKFYOfQhHN2xPJZAPV6ZJeReeAeTBRkT
vgIJE/3BsQpmqsSusjgEDYCrK8MfaybAC6CpE5ZKnQwV99YlTcbPx7vVKPuU13j3Aj4FjtGjkFun
fCOpLX1AA0FSbBfOOCVeYd94bCGaW8f+j3NBB+29ELYMskew2tyCBiw2HodBrMoDiYVWHbD+bWw8
qMOOBurEQihVdNq5Tbi3R2fnnX9DpfbVljJeKFjyVwCLZA5OdGIYPuJxrXGKsaBI+abTgciL4n4W
bsG7LalURKCMe/HH1jVuy8VjevwJMB+u7CHoOc9jVCwR4YSPjH9fbxcIn9UIuECm1CryEUYB6kkh
BEeyxdQclP0amPYlyxVU80KN+Mxvle4//B6kwUtjS+/Rv943oXrXxaLXTCpeds49x0FWSRo/HCxy
nunzpkyqD4wBfUyB7hYggeRUaCb7aNVuIB1QZSY9EqF3F26Aootz1cYpr1CBtizZK9Q6Ez6N3iYW
1dMUB7dsNp4a4emAU3CfhHYh3JNv4pD21PbPASO/t89v7uMDrsI8SOp1nHqV0hYG2+JhxNyhYKV1
oXv54mKzbW+4vwsU/ySrrexUvmkTzLCsYBI7nSZT5uVprRA+MQJBLx6dKVVuzO1x8hzTv9T2LvJr
7rpd6Ban94JJ8vG7OUO0OaNP9HDrz+34xmCqQRi/f0TkmfSo4uFcsIfAmdQVbd6uu22ZBoWqolaz
lBXjt5Oe2AQV51Zma53dlArSBLpvbg/RoMM7cMhnGn33DkSBDYU9rN2iApw0zswa/KJ/p1r33Jrk
5YTL6wTTEuaG+UxVrtCxX4VHk7syaOjI5dshRELos3ZeIJeqKAgS45H6cK+gjCq0l3qWDDnFHcGm
zYoP1665lC7c9TOs8i5OBLM6hGqgEgcKEiTIp+tRUvDEhyN1v/YngT3izvWbsijV0QTTJcjsyFWq
DSJiw8G1WH4oFqZAzF2UzE6fzEeQbMVlPPxlnpUjipTqdtWcuayLH7tifX7diBl1fjlUOTqPK2+5
vz1HckVtzJMS4g0W7rWHAbTv5nfrby/1IJBHMDutjI2dh6J7nXbSgFOiT98TFL7upJCNc7T3AH4j
Ro1TzzXqODFShamQeYlooCyvStQxqj08rz74+7ery+GapNEPL4cPZ1qV0bfKCBwOQrTV8lIZXsFt
Jj9TV+7lT6ZcePnCFY6pWI78u5WWePZunmI9FFhz+odZd4vfh0C3VEISmeEN28T8XdvtHt8A78sr
4/SmrPteZpZhByZe2n50ZHQU+ukncDgZirtz5A4LIBedcDLCgeNfonHYCQTNYOKoDA+eq5sBczKP
mqFKjPnBq1533/lptWhsgou8CZfsEaY4kZvEzK8YTVrfVt4T407A851vKxBfHIyXKxFFi17Yddr2
SiqebAUjT3waPAoUwgdJelDYTnnKUQy0Zm25gGRDiE9LUwoOp7ys0H9m/xXJROx76gbljguU3ad9
fcwQIm8RTKZvXvKrVRBUsHutEL6/qZAb5VBQ1JHsa4tknAFTdwh7lsB1/l0lHtZ+HzBdgZ8kOvRm
HiCKYb+2p26WMVNy8SRhW8EeYxx3t79LMU3pIp9w4rCnuClwAYAXN6PP1Gf5GgsGS228ur3vwNKO
8YZIdMatmKJDy8Ufkm1Ljvy4Z0/3+XcGLDWyxRx6M2mLvMPvJIz9iGSr684PRfSydR3nq6W7gwYc
Ohb62cmSLVWyECoaa+cqVFFGOKHcUT3ZS7Xlx0QkniCQI9d46XDEx64PFGeBXL/z4dj7ZYx6woX9
R+F5yOAdKoILV5N9m4xzauPO4EkmKakDBtsf9tzExrArDBoT664Xc7cVJ/2jTzX57Oms09Q7r+T8
hH0JNxhcXAqhxdbMitkcFSy7t0pBgrPXRhdXohbGlhuZPAOMVkWWDMf8x7Yc4k7F3l9ua67w5Z2Q
cDf8NBq5iYM3TkB+2qpmn16L7Pbp5qlAoIcB409+6VwxHiHQgBHOPGsP1xHNYGYyKcfR4VxaUUXf
5G18b5NOnx3S2VCBA9fJGXlHqW3RmtlMEP4dEQdCbhH7jw7jd5El0NabRA0fCBTAYR61vYa9Ov7S
DOIefy6NpDffg9sFltOa36ag==</xenc:CipherValue>
                </xenc:CipherData>
              </xenc:EncryptedData>
          </wst:RequestedSecurityToken>
      </wst:RequestSecurityTokenResponse>
   </soapenv:Body>
</soapenv:Envelope>
```

6.4.2 Signature / Message Digest

The SAML token is signed before it is encrypted. The signature process is characterized by the following statements:

- The secure hash SHA-1 digital signature message digest algorithm is used, as supported by [NR15].
- The element that is signed is the top-level SAML Assertion, i.e. `<urn:oasis:names:tc:SAML:1.0:assertion:Assertion>`.
- The signature is put as an "enveloped signature" method, which means that the signature element is embedded as a child of the afore-mentioned SAML Assertion element.
- No certificate is put in the signature. This means that the PEP verifying the signature has to know (from its keystore, for example) the public key of the IdP that produced the SAML token.
- A canonicalization method shall be used which eliminates namespace declarations that are not visibly used within the SAML token. A suitable algorithm is ”Exclusive XML Canonicalization” which is implemented through a digital signature declaration:

```
<ds:CanonicalizationMethod Algorithm="http://www.w3.org/2001/10/xml-
exc-c14n#"/>
```

Note that the specified canonicalization algorithm omits the comments.

- The URI attribute of the <ds:Reference URI="..."> element shall refer to the <saml:Assertion> node being signed (using XPointer, see 4.3.3.3 in [NR18]. The XML pattern is as follows:

```
<saml:Assertion …Id="xxxx" …>
   …
   <ds:Signature …">
      <ds:SignedInfo>
         …
         <ds:Reference URI="#xxxx">
            …
         </ds:Reference>
      </ds:SignedInfo>
      …
   </ds:Signature>
</saml:Assertion>
```

The XPointer format, used in Id and reference URI, shall comply to [NR18]; it is not additionally constrained by the present specification document.

Note that the present specification only enforces the signature of SAML token, which is put in the SOAP body of RSTR and in the SOAP header of authorisation request. Other digital signatures on the remaining elements of SOAP messages, which may be required by interfaces of federated Service Providers, are permitted but these are out of the scope of the present specification.

The example below uses the user attributes listed in Annex D.

Example: signed token before encryption.

```
<saml:Assertion xmlns:saml="urn:oasis:names:tc:SAML:1.0:assertion"
xmlns="urn:oasis:names:tc:SAML:1.0:assertion"
AssertionID="oracle.security.xmlsec.saml.Assertion1955a65" Id="xxxx"
IssueInstant="2009-06-25T13:34:55Z" Issuer="http://earth.esa.int"
MajorVersion="1" MinorVersion="1">
           <saml:Conditions NotBefore="2009-06-25T13:33:55Z"
NotOnOrAfter="2009-06-25T13:39:55Z"/>

           <saml:AuthenticationStatement AuthenticationInstant="2009-06-
25T13:34:55Z"
AuthenticationMethod="urn:oasis:names:tc:SAML:1.0:am:password">

                       <saml:Subject>


<saml:NameIdentifier>dail</saml:NameIdentifier>

                                    <saml:SubjectConfirmation>


<saml:ConfirmationMethod>urn:oasis:names:tc:SAML:1.0:cm:bearer</saml:Confirm
ationMethod>

                                    </saml:SubjectConfirmation>
```

```
                        </saml:Subject>
            </saml:AuthenticationStatement>
            <saml:AttributeStatement>
                        <saml:Subject>

<saml:NameIdentifier>DAIL42</saml:NameIdentifier>
                                    <saml:SubjectConfirmation>

<saml:ConfirmationMethod>urn:oasis:names:tc:SAML:1.0:cm:bearer</saml:Confirm
ationMethod>
                                    </saml:SubjectConfirmation>
                        </saml:Subject>
                        <saml:Attribute AttributeName="Id" >

<saml:AttributeValue>DAIL42</saml:AttributeValue>
                        </saml:Attribute>
                        <saml:Attribute AttributeName="c" >

<saml:AttributeValue>Italy</saml:AttributeValue>
                        </saml:Attribute>
                        <saml:Attribute AttributeName="o" >

<saml:AttributeValue>ESA</saml:AttributeValue>
                        </saml:Attribute>
                        <saml:Attribute AttributeName="ProjectName" >
                                    <saml:AttributeValue>HMA
imp</saml:AttributeValue>
                        </saml:Attribute>
                        <saml:Attribute AttributeName="Account" >

<saml:AttributeValue>dailsp</saml:AttributeValue>
                        </saml:Attribute>
                        <saml:Attribute AttributeName="ServiceName" >

<saml:AttributeValue>catalogue</saml:AttributeValue>
                        </saml:Attribute>
            </saml:AttributeStatement>
            <ds:Signature xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
```

```
                        <ds:SignedInfo>

                                    <ds:CanonicalizationMethod
Algorithm="http://www.w3.org/TR/2001/REC-xml-c14n-20010315"/>

                                    <ds:SignatureMethod
Algorithm="http://www.w3.org/2000/09/xmldsig#rsa-sha1"/>

                                    <ds:Reference URI="#xxxx">

                                                <ds:Transforms>

                                                            <ds:Transform
Algorithm="http://www.w3.org/2000/09/xmldsig#enveloped-signature"/>

                                                            <ds:Transform
Algorithm="http://www.w3.org/2001/10/xml-exc-c14n#"/>

                                                <ds:Transforms>

                                                <ds:DigestMethod
Algorithm="http://www.w3.org/2000/09/xmldsig#sha1"/>


<ds:DigestValue>nLkuqyqDggsxQnPiGzVDDckxaA0=</ds:DigestValue>

                                    </ds:Reference>

                        </ds:SignedInfo>


<ds:SignatureValue>oOkdc3KB2HwPB6YzhEa9MHx5yo1u/xqHp81wPj68uf5Ypet/5wHHEvfuN
hxD+S3ejT2f4lKIGkVDcsRNyUqaAn60CnJiN4RBpwcjcWQSUj5/XxesaR4nO4CtDylaLV6acLwww
lLN5PQ66UumASE=

                        </ds:SignatureValue>

           </ds:Signature>

</saml:Assertion>
```

The security model proposed requires that the case of RST is further decomposed into four cases as described in the following section.

6.4.3 Authentication Use Cases

6.4.3.1 Federated IdP - local identification (Default Case)

In this use case, the RST with password is used; it contains no IdP identifier, so the identification is performed by the STS .

Example:

```
<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:wsse="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-
wssecurity-secext-1.0.xsd"
xmlns:wst="http://docs.oasis-open.org/ws-sx/ws-trust/200512/">
   <soapenv:Body>
```

```
        <wst:RequestSecurityToken>
            <wst:TokenType>
    http://docs.oasis-open.org/wss/oasis-wss-saml-token-profile-1.1#SAMLV1.1
            </wst:TokenType>
            <wst:RequestType>
                http://docs.oasis-open.org/ws-sx/ws-trust/200512/Issue
            </wst:RequestType>
            <wsse:UsernameToken>
                <wsse:Username>JohnDoe</wsse:Username>
                <wsse:Password>MyPassword</wsse:Password>
            </wsse:UsernameToken>
        </wst:RequestSecurityToken>
    </soapenv:Body>
</soapenv:Envelope>
```

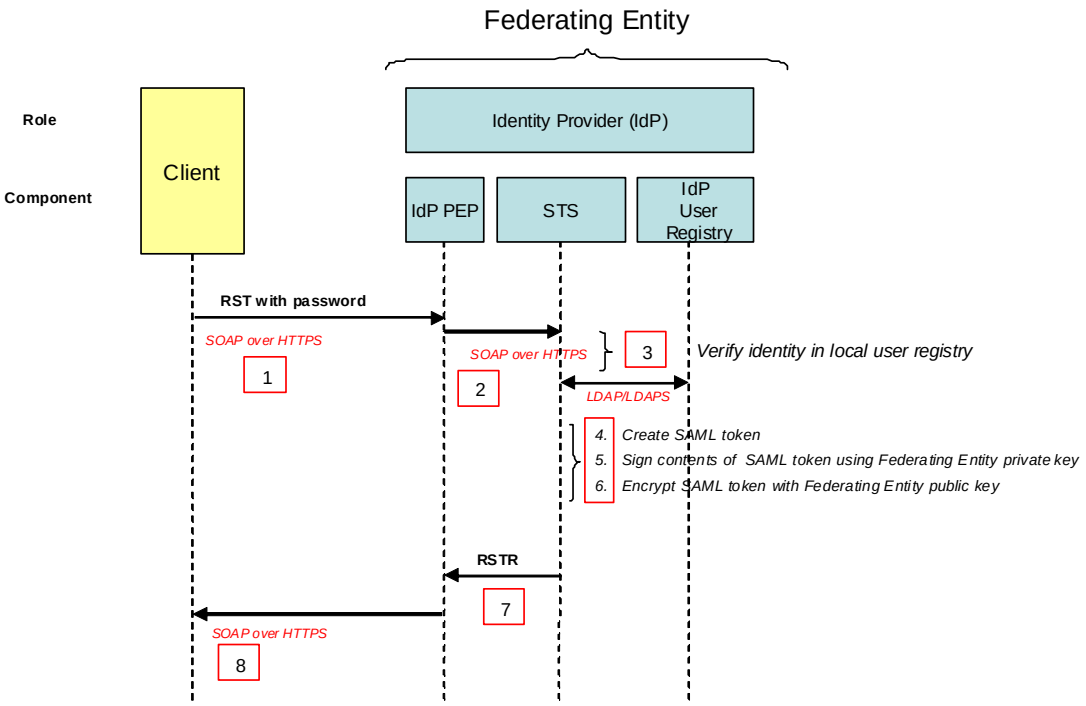


Figure 3 Federating (Local) Entity is request designated IdP (Default Case)

1. The RST with password is sent to the STS using SOAP over HTTPS. (May pass through the policy enforcement point (PEP) of the Federating Entity.)
2. (The PEP of the Federating Entity receives the request and forwards it to the STS of the Federating Entity.)
3. The STS verifies the identity in the **local** user registry over LDAP/LDAPS.
4. The STS creates a SAML token using the minimum profile attributes retrieved from the user registry. The SAML token is created containing assertion of the authentication and assertion regarding the value of the subset of attributes from the minimum user profile (see description in section 6.4.5).
5. The STS signs the SAML token using the Federating (local) Entity private key.

6. The STS encrypts the SAML token with the Federating (local) Entity public key.
7. The RSTR containing the encrypted and signed SAML token is returned to the PEP.
8. This RSTR is returned to the client using SOAP over HTTPS.

The client is unable to decrypt the content of SAML token present in the received RSTR; only the PEP of the Federating Entity can decrypt the SAML token.

6.4.3.2 Federated IdP - external identification

In this use case, the RST with password is used; it contains an identifier for the STS of a given external entity *n*. The relation table between identifiers and external entities STS URL shall be stored on the server and configured at service deployment time. It must be done in this way for security as the system must deny access to untrusted authentication server.

Example RST with external IdP specified:

```
<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:wsse="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-
wssecurity-secext-1.0.xsd"
xmlns:wst="http://docs.oasis-open.org/ws-sx/ws-trust/200512/">
   <soapenv:Body>
      <wst:RequestSecurityToken>
         <wst:TokenType>
   http://docs.oasis-open.org/wss/oasis-wss-saml-token-profile-1.1#SAMLV1.1
         </wst:TokenType>
         <wst:RequestType>
            http://docs.oasis-open.org/ws-sx/ws-trust/200512/Issue
         </wst:RequestType>
         <wsp:AppliesTo
            xmlns:wsp=http://schemas.xmlsoap.org/ws/2004/09/policy
            xmlns:wsa="http://www.w3.org/2005/08/addressing">
            <wsa:EndpointReference>
               <wsa:Address>…SpotImage…</wsa:Address>
            </wsa:EndpointReference>
         <wsp:AppliesTo>
         <wsse:UsernameToken>
            <wsse:Username>JohnDoe</wsse:Username>
            <wsse:Password>MyPassword</wsse:Password>
         </wsse:UsernameToken>
      </wst:RequestSecurityToken>
   </soapenv:Body>
</soapenv:Envelope>
```

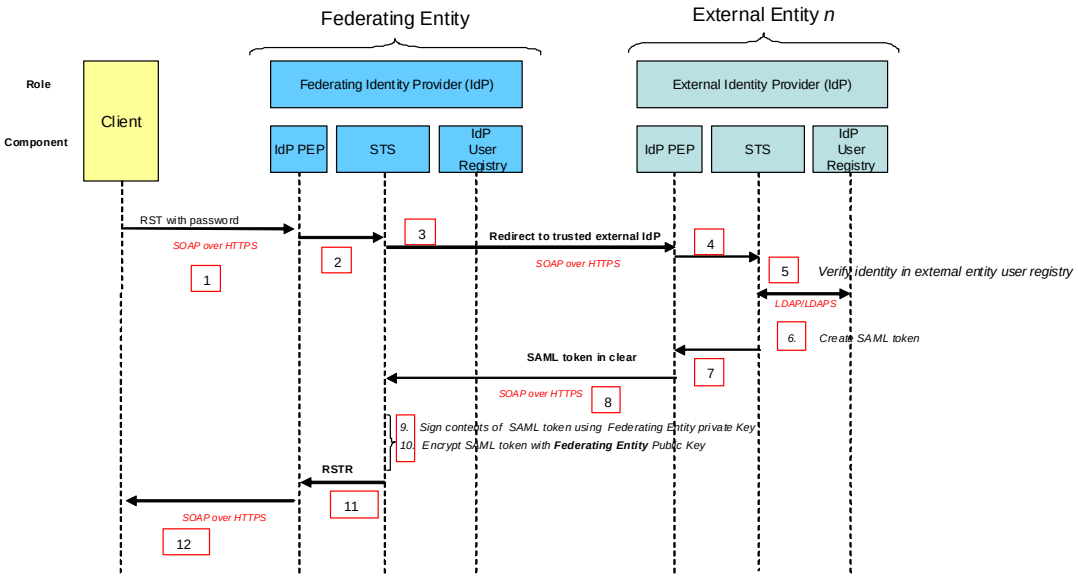


Figure 4 External Entity is request designated IdP

1. The RST with password is sent to the policy enforcement point (PEP) of the Federating Entity using SOAP over HTTPS.
2. The PEP of the Federating Entity receives the request and forwards it to the STS of the Federating Entity.
3. The STS redirects the RST to the PEP of the designated External IdP. The STS URL is extracted from the table previously described.
4. The PEP of the external entity forwards the message to the STS of the external entity.
5. The STS verifies the user in the external entity user registry.
6. The STS creates the SAML token using the minimum profile attributes retrieved from the user profile in the user registry.
7. The RSTR containing the SAML token, in clear, in the SOAP body is returned to the External Entity PEP.
8. The RSTR is returned to the Authentication Service of the Federating IdP, through SOAP over HTTPS.
9. The STS signs the SAML token using the Federating (local) Entity private key.
10. The STS encrypts the SAML token with the Federating (local) Entity public key.
11. The RSTR containing the encrypted SAML token is returned to the PEP of Federating IdP.
12. The RSTR is returned to the client.

Notes:

1. The client is unable to decrypt the content of SAML token present in the received RSTR; only the PEP of the Federating entity can decrypt the SAML token, by using the local private key, which matches the public key used in step 10.

2. The confidentiality of the SAML token provided in clear by the external IdP is assured 1° by the HTTPS protocol, which encrypts the SOAP response and 2° by assuring that the requester of the RST *is* the Federating Entity, known in the circle of trust. Actually, about the last point, the rule is:

   if the requester is the federated entity,
   then the SAML token is returned in clear *(present use case)*
   else the SAML token is encrypted with the external entity's public key *(see next use case)*

   The mechanism to identify the requester as a known federated entity is TBD or maybe left as an implementation decision. This could use WS-addressing.
   The rationale of this process is to support both Clients that access the Federating Entity and Clients that access External Entity directly (provided that this last has its own IdP). Also, the system scales up seamlessly in the case of multiple federating entities, should this need occurs[3], sharing one or several federated SPs and/or IdPs : the external IdP should simply know a list of authorized federating entities (instead of a single one) and check inclusion of the requester in this list.[4]

6.4.3.3 External IdP - local identification

In this use case, a Client interacts directly with an external entity, that has its own IdP and user registry, bypassing the federating IdP. The Client sends the RST with password to this IdP and receives an encrypted SAML token, that can only be used on this external entity. The process is essentially the same as the one described in the first use case seen above (Federated IdP - local identification").

---

[3] The design to which this specification applies has a single Federating Entity, which can have multiple clients. These clients are typically, but not only, Portals. For example the EO-DAIL (Federating Entity) will have at least two clients: EOLI-SA and DAIL Portal. Instead of having several federating entities, nothing prevents an existing Portal to become a client of the single Federating Entity. For example the EO-Portal may become a client of the EO-DAIL.

[4] Note that several variant mechanisms are feasible, if we allow the inclusion of *multiple SAML tokens* in the RSTR and/or authorisation requests. A client could then own several tokens for the same user at a given time, encrypted with different public keys and potentially carrying different contents. The PEP should then be given several "chances" (one per included SAML token) to succeed in decryption and to authorize a request. These variant mechanisms change the interfaces defined in the present version of the specification and, therefore, are no more than a subject of investigation.

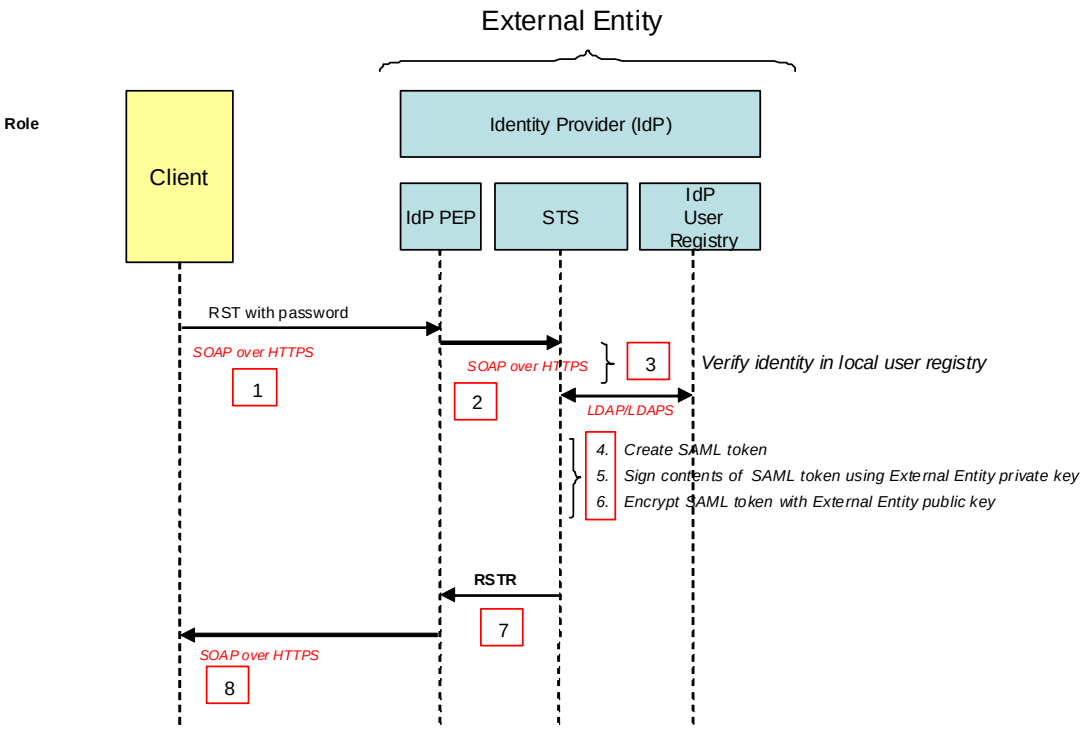


Figure 5 External Entity is IdP

1. The RST with password is sent to the STS using SOAP over HTTPS. (May pass through the policy enforcement point (PEP) of the External Entity.)
2. (The PEP of the External Entity receives the request and forwards it to the STS of the External Entity.)
3. The STS verifies the identity in the **local** user registry over LDAP/LDAPS.
4. The STS creates a SAML token using the minimum profile attributes retrieved from the user registry. The SAML token is created containing assertion of the authentication and assertion regarding the value of the subset of attributes from the minimum user profile (see description in section 6.4.5).
5. The STS signs the SAML token using the External Entity private key.
6. The STS encrypts the SAML token with the External Entity public key.
7. The RSTR containing the encrypted and signed SAML token is returned to the PEP.
8. This RSTR is returned to the client using SOAP over HTTPS.

The client is unable to decrypt the content of SAML token present in the received RSTR; only the PEP of the External Entity can decrypt the SAML token.

Note that the choice made at step 6 to encrypt the SAML token with the local public key is made on the basis of the decision rule presented in the previous use case (here, the Client has not been identified as the Federating Entity).

6.4.3.4 External IdP - external security domain

We cover here the case where there is an external IdP in an external security domain; it does not comply to the present specification but it is trusted by the STS. For instance, ESA UM-SSO defines a specific security domain with its own IdP (see annex G).

In this present case, the RST with signature is used.

In order to integrate such external IdP, a trust relationship shall be established between the two security domain such that any user that has been authenticated by the external IdP shall be able to get the SAML token.

In order to establish a trust relationship between the two security domains, a given Client *C* of external security domain shall provide its public key to the Federated IdP. The trust relationship between *C* and STS is established as soon as the STS security administrator has put this public key in the keystore of STS. From that point, the client *C* can obtain SAML token for any users authenticated on external IdP by issuing RST with signature.

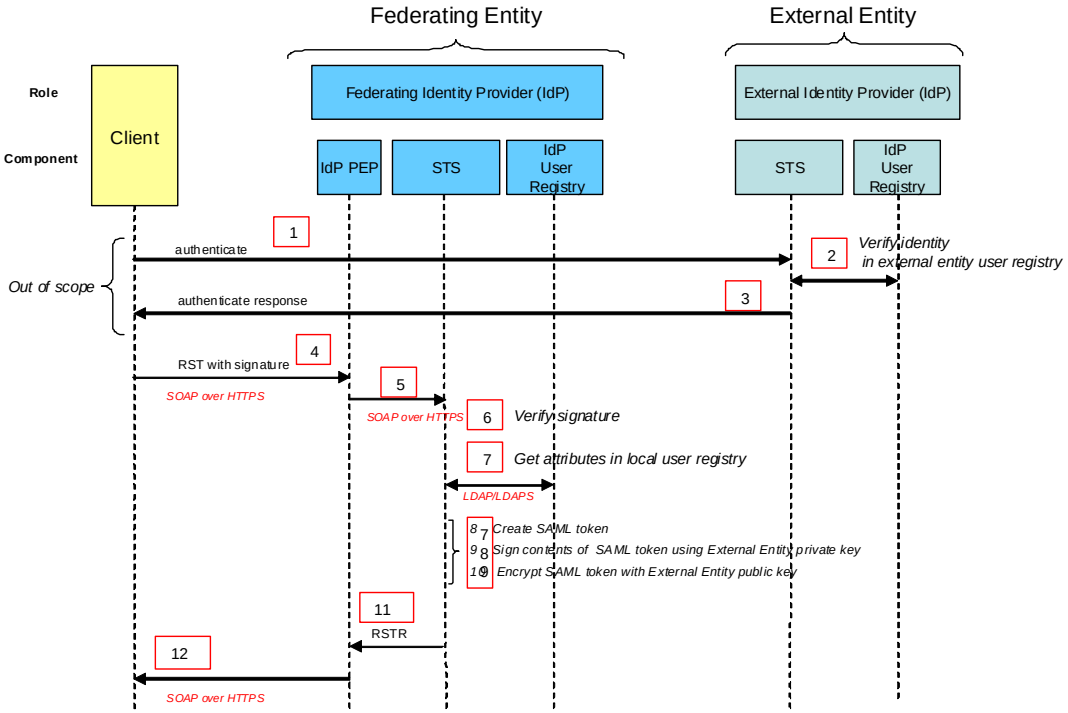


Figure 6 External Entity is IdP on external Security Domain

1. An authentication request is sent to the external IdP.
2. The external IdP verifies user identity in the external entity user registry.
3. The successful RSTR is returned to the Client
4. The RST with signature is sent to the STS using SOAP over HTTPS. (May pass through the policy enforcement point (PEP) of the External Entity.)
5. (The PEP of the Federated Entity receives the request and forwards it to the STS of the External Entity.)

6. The STS verifies the signature of the RTS.
7. The STS retrieves user attributes from local user registry
8. The STS creates a SAML token. The SAML token is created containing assertion of the authentication and assertions regarding the value of the subset of attributes (see description in section 6.4.5).
9. The STS signs the SAML token using the Federating (local) Entity private key.
10. The STS encrypts the SAML token with the Federating (local) Entity public key.
11. The RSTR containing the encrypted and signed SAML token is returned to the PEP.
12. This RSTR is returned to the client using SOAP over HTTPS.

6.4.4 Authorisation Request

The authorisation request may contain an encrypted SAML token in the WS-Security element of the SOAP header. This SAML token is obtained from an RST as previously described and is used to control access to services.

N.B. It is not mandatory that the authorisation request is preceded by an RST, as the SAML token is not mandatory in the service request. However, access to services is controlled by the policies applied in the PEP.

Since a specific SAML token protocol is required to access the protected Web Services, the use of WS-Policy [NR20] is recommended for the WSDL files describing these Web services. The WS-Policy elements are used to formally specify the presence of SAML token in SOAP header, the encryption algorithm, etc. With such dispositions, the Web services are self-describing, allowing for "discovery" by clients, hence improving the interoperability of the system. An example of WSDL using WS-Policy is provided in annex F.

The access policies applied in each PEP, based on the SAML token, are out of scope of the present specification. However, to help understanding, several examples of authorisation rules along with their XACML counterparts are provided in section 9.

6.4.5 OASIS SAML

SAML (Security Assertion Markup Language) [NR11] is the OASIS Security Services Technical Committee XML standard for exchanging authentication and authorisation data between security domains, i.e. exchange between an identity provider (producer of assertions) and a Service Provider (consumer of assertions).

SAML is required to implement federated identity and identifies two roles; the identity provider (IdP) and the Service Provider. These communicate through SAML assertions. A SAML assertion is an XML document containing information about how the user was authenticated and can contain other user attributes. SAML bindings are defined for HTTP Post and SOAP.

SAML includes mechanisms that allow providers to communicate privacy policy/settings from one to the other. For instance, a Principal's consent to some operation being performed can be obtained at one provider and this fact communicated to another provider through the SAML assertions and protocols.

A SAML assertion is a package of information that supplies one or more statements made by a SAML authority.

- Authentication: The specified subject was authenticated by a particular means at a particular time. A typical authentication statement asserts Subject S authenticated at time t using authentication method m.
- Attribute: The specified subject is associated with the supplied attributes. A typical attribute statement asserts Subject S is associated with attributes X,Y,Z having values v1,v2,v3. Relying parties use attributes to make access control decisions

WS-Security SAML Token Profile [NR11] defines how SAML assertions are processed in SOAP messages.

SAML 1.1 is proposed to encode the user authentication token.

The set of attributes that are put in the SAML token shall be defined by agreement of all the parties in the circle of trust. This is an essential part of the interface between the producer of SAML token (IdPs) and consumers (PEPs). Hence, the attribute names to be used in the SAML assertions as well as the semantic or their origin of the associated value shall be defined precisely. Typically, a table shall specify a set of associations between SAML token's attribute names and LDAP user directory's attribute names. The STS of IdP shall comply with this attributes specification to builds up the SAML tokens. On the other side, the access policy rules enforced on PEPs (i.e. XACML rules) shall be written on the basis of the same attributes specification.

The set of attributes shall be defined by respecting two groups of constraints:

- there shall be enough attributes to allow the different PEP implementing their specific access policies;
- the chosen attributes shall comply with the privacy policies of all the parties in the circle of trust.

Note that each of these two constraints "pulls" the selection decision in opposite directions, so the actual set of attributes to be included in the token results from a trade-off.

An example of such SAML token attributes specification is provided in annex.

6.4.6 OASIS Ws-Security

Web Services Security [NR9] from OASIS is a communications protocol providing for security of Web services. WS-Security 1.0 was released on April 19 2004 and version 1.1 on February 17 2006.

WS-Security is proposed to encode the SAML assertions in the SOAP header. WS-Security SAML Token Profile defines how SAML assertions are processed in SOAP messages and so it is proposed for this interface.

6.4.6.1 Encryption

Encryption is required to prevent the message content being read by someone other than the intended recipient. N.b. It does not prevent the message being modified, for this a digital signature is required.

The recipient, in this case the Service Providers “publish” their certificates allowing “anyone” to encrypt a message to them using the published public key. Only the recipient holding the corresponding private key can decrypt such a message.

6.4.6.2 Signature

WS-Security permits digital signatures to be used to prove that the message has not been changed since sending. A recipient can be sure that it is the user who has signed the message. The XML signature <ds:Signature> element of WS-Security can be used for signature.

a. Sender : Hash and signs (encrypts the hash code)

b. Receiver : Hash and verify hash (decrypts the hash)

c. Ensures that the message was sent by a known client and that the message arrived intact.

The following picture shows the general mechanism of digital signature. The sender, on the left of the picture, calculates a hash (or *digest*) value *xyz* from the message to be sent; this value is encrypted with the private key of the sender (*xyz#*) and appended in the message. The signed message is sent towards a receiver, on the right of the picture (this may include encryption / decryption steps, which are not represented). The receiver decrypts the signature *xyz#* with a public key of the sender to get the expected hash value *xyz*. It calculates the actual hash value from the message (with the same algorithm as the sender) and compares it with the received value *xyz*. If they differ, the signature is declared invalid, which means that the signed message has been altered during the transmission. If they are equal, the signature is declared valid, which means that the signed message has not been altered[5].

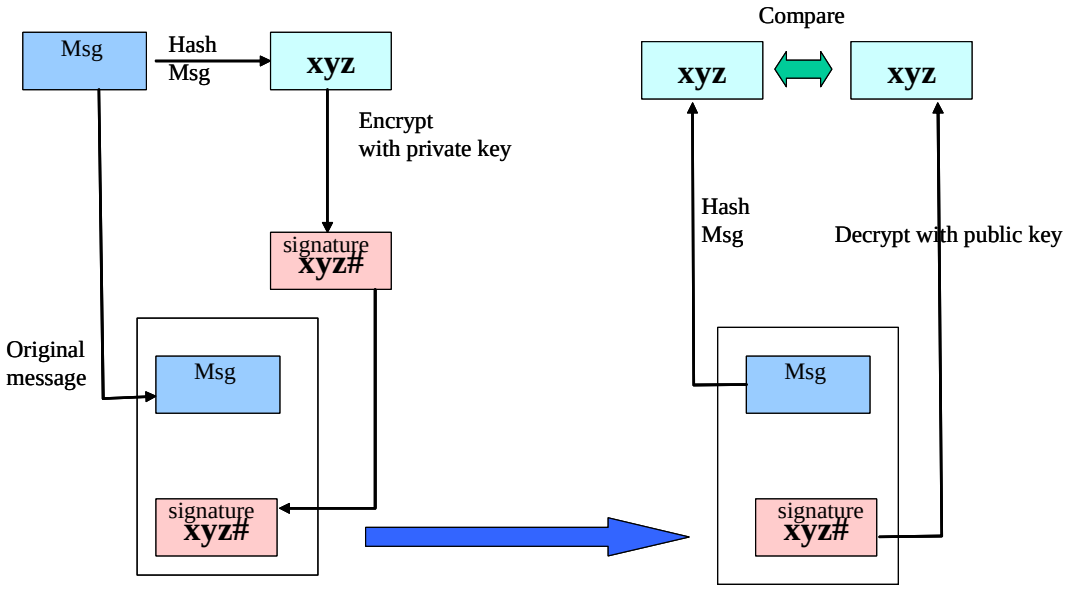


Figure 7 Digital Signature

[5] To be accurate, a valid signature means that it is extremely unlikely that the message has been altered.

Message encryption is not sufficient to guarantee that the message comes from a trusted client as this depends on how many people know the “encryption code”. It does not prevent someone from changing the message content.

SAML used with XML signature <ds:Signature> element of WS-Security allows signing the messages as well:

1. Sender : Hash and signs (encrypts the hash code)
2. Receiver : Hash and verify hash (decrypts the hash)

7 Interface

7.1 Request Security Token

The Request Security Token (RST) operation, as defined in WS-Trust 1.3 [NR23], allows clients to retrieve authentication metadata from a nominated IdP server. The response to an Authenticate request should be an XML document containing authentication metadata about the authentication and requestor.

7.1.1 Request

Protocol: SOAP over HTTPS

7.1.2 XML encoding

As explained in 6.4, we make a distinction between RST with password and RST with signature.

The following XML-Schema fragment defines the XML encoding of the message body of the RST with password .

```
<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:wsse="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-
wssecurity-secext-1.0.xsd"
xmlns:wst="http://docs.oasis-open.org/ws-sx/ws-trust/200512/">
   <soapenv:Body>
      <wst:RequestSecurityToken>
         <wst:TokenType>
   http://docs.oasis-open.org/wss/oasis-wss-saml-token-profile-1.1#SAMLV1.1
         </wst:TokenType>
         <wst:RequestType>
            http://docs.oasis-open.org/ws-sx/ws-trust/200512/Issue
         </wst:RequestType>
         <wsse:UsernameToken>
            <wsse:Username>JohnDoe</wsse:Username>
            <wsse:Password>MyPassword</wsse:Password>
         </wsse:UsernameToken>
      </wst:RequestSecurityToken>
   </soapenv:Body>
</soapenv:Envelope>
```

Figure 8: Example RST with password

The following XML-Schema fragment defines the XML encoding of the message body of the RST with signature.

```
<S11:Envelope xmlns:S11="…" xmlns:wsse="…"
        xmlns:xenc="…" xmlns:wst="…">
  <S11:Header>
    <wsse:Security>
       <ds:Signature xmlns:ds="…">
          …
          <ds:Reference URI="#soapbody"/>
          …
       </ds:Signature>
    </wsse:Security>
  </S11:Header>
  <S11:Body Id="soapbody">
    <wst:RequestSecurityToken>
       <wst:TokenType>
    http://docs.oasis-open.org/wss/oasis-wss-saml-token-profile-1.1#SAMLV1.1
       </wst:TokenType>
       <wst:RequestType>
          http://docs.oasis-open.org/ws-sx/ws-trust/200512/Issue
       </wst:RequestType>
        <wsse:UsernameToken>
          <wsse:Username>JohnDoe</wsse:Username>
        </wsse:UsernameToken>
    </wst:RequestSecurityToken>
  </S11:Body>
</S11:Envelope>
```

Figure 9: Example RST with signature

7.1.3 Response

The following XML shows an example of response, which is a Resquest Security Response (RSTR), as defineded in WS-Trust 1.3 [NR23], containing an encrypted SAML token.
The SAML Token is always encrypted with the Federating Entity public key i.e. in both the use cases the client receives the same response:

- the federated response message to the Federating Entity STS and coming from an external Idp.
- The federated response message returned by the Federating Entity STS to a client.

```
<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
 <soapenv:Body>
<RequestSecurityTokenResponse xmlns="http://docs.oasis-open.org/ws-sx/ws-
trust/200512/" xmlns:wsa="http://www.w3.org/2005/08/addressing"
xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
xmlns:wsse="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-
wssecurity-secext-1.0.xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance">
          <TokenType>http://docs.oasis-open.org/wss/oasis-wss-saml-token-
profile-1.1#SAMLV1.1</TokenType>
          <RequestedSecurityToken>
             <xenc:EncryptedData
xmlns:xenc="http://www.w3.org/2001/04/xmlenc#"
Type="http://www.w3.org/2001/04/xmlenc#Element">
           <xenc:EncryptionMethod
Algorithm="http://www.w3.org/2001/04/xmlenc#aes128-cbc"/>
           <ds:KeyInfo xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
             <xenc:EncryptedKey>
```

```
              <xenc:EncryptionMethod
Algorithm="http://www.w3.org/2001/04/xmlenc#rsa-1_5"/>
              <xenc:CipherData>

<xenc:CipherValue>cbE8viFOmyDuxR8N4EdwS9UUKpSoUbMrWSVprW7IypMwFZLeHR9Rxd4iw5
dUl4K+TffyNdRJ9Tr9PD8YIdpFLzCvYas63g5x4/XnyA1E2AU8ZBBpM2dtbr3g4IYMywfraWrI76
mHM+MERVZdHMVBWFrhqXhcS92m23m+amt14mk=</xenc:CipherValue>
              </xenc:CipherData>
            </xenc:EncryptedKey>
          </ds:KeyInfo>
          <xenc:CipherData>

<xenc:CipherValue>VEHlprDMQ+DqIpoPqx6TYi/mMX2dGV5JCJCrhDquZHRKqOiaIFfwqOMZvn
2HW2JDFvUxJ6LRTKdNujQI7sxc6h3IGBL7NXF7bx4jGwQ09wAA7nm6OoB4jiGdaqb8wTx0olnzn2
WqOWoVeTng1lwBi0rv2+iD1HWnXAUUHfJH8ALq4IU3hR0vjoqJH6Y21EuXPeXp/dYPUw3oIFn2FE
ID2u+8T+xOxbbq2ezQbU3z8n1LbgvDtN3ex5lUCo260pOOPn92nn7nYErT682eYd+bCKoiENpQSY
gHszvvyqFf9o6O0u87zk4AORWsRhQH74L2gG8wVOeHKyhEx0RsBkf4xZcQKBvQ9JHWQWpDEB51NZ
aJe1hSyaUk6T5gf9ArDnz6UwL0ZTDp6Dxgjha91u5qIMG3ECxVYKcnBv+O6Om1Q0HbL0ecbUDR56
evS+mf0U9JxduBKwFJLqta6D0wmwqYWcaF3ZrKd7SatV8Z2l0DmWTMe5R+x6O1RpbKltlduKl4bL
aSYFpaqaU758ZsmTDmjQQj8fn1qCZbDtp4SEVPWumoTg2k7RAOay2QtV5b+VA9wloSXoxVf2csLS
OOH/NDE1noBIpzgUb9Xm/YIPwikQKsxNPFM72yLrS0vjAho1Cxrg+8l7XIVcmowhPnLqSs6ZpvA0
1YP8EhsOFlN+0y+9EfAuoY4jYcScfwqDehth76lER+EyAdFLi10VhVxKW14VLbmksAydndIQaw6V
zGm1Qwoc3CeCaeq4q4GgFgiem1BmW9IeBaUBTX2wZmIKG8Z9Xhjv6MwT7hOeWH5fefipJs8JS8l6
wQBo8WAczzmw6s1j8JW9YDyAWosfoTPrtOwFTaaYSiaEXvPOnb5RgR/W4ivZ64ioA8FXyLFoWcNE
JJ6AgWHDLAbCDg/zvnVwEs7OdaSxRTxVNsc7cpclGspSmk/HzGYxPHInGhn/QPsac5iN6t6HlwnQ
UJgt81rI/tbFfSYqqtYqXKeNoEtw91/1DZVUi7mSc7Xj2e2Wb65h8PIoYeX3Nli+i4SrOoeAKaZr
HtpqP6f+pI4lpkANS4RFxFDiL9Ddxv1WKD//nMck0Su0HfIbPYUYF0GGvlHsv6IiwT8dj/f0MnCx
kAgegliGageZthQiNavOcURRC/94d+1jDZGayowurzdxmJhxyiEY5REQQt3hK4aAD89wMjndzxHd
tcQEuvXA5uSm3T9qgIm4Qdvuh54PW/SKptG9fDj4paTxVVlfZ+0f/1Vxjj4pPIKOVjE3e4ChBPkJ
XD/nXqZ8DdR+zPxOLWYyiqnMaxv3OInd/Iz2Lq36a09b0JEfMVz4e39sGtFzNDbxXgQnTx4L3jDY
Fdl5+gelUNduK9HtgklXDWfNIMWtY5xhdTX0m3Q8hBtNgKOHeg7BcBXF+uT30mqwgJu5cbJQl/1j
/QlMvromUaUQATN2ULu7mMiTWkoYoMTiijJGAizbKIi6O5xmHvF/jicd7lBcmSz+B+BnrnqxY5DM
/qQSFsnRoGmPKlJeiao2g+QuMD5x7H+pBUIq3B8lkMlUBg5VoKx2+kCHuP2lamGFskQl80PRGygQ
5adA2iWwKoIKoCdcYIc9C2sPVkJz+slExJXizl4L51GEWDlQ8VGsqNV7CzOyIt0uXIIBQW3j0aX/
/7QoYVfM681TiqvtaDEY7Ip4nSV839e5xnj3s+qgzXOpoK5rw5EThDLhthPy97CJiuSbsfcGf1Dv
WNE74x2E4b8HazacItRBIbx0GFDHIoqaHEih6zlhQaqwloLnUHRpL8vAQLVKiW3q94569e3GenoQ
bpjxKQ9F58VuQh3ZiZtJ+17XOxDx6ZDXcTiQDa+3nXiTgT7k9gGtpIv8vYLMuUHDEZx1zGd/rMzU
3JAbbfKO8+Cs3pMnb2KpGL4rLLgivee1P35rbHK04V8D0NbwDk0TOVnmFQWIRsgVtPwmEHXbFl3j
qIUTx4xdishXmkKcDCwaNfqYo4yzmgLUlbtchkDGF9YBA0mXv4gT7z0TiBb1jUFBhTnciL4DBkI9
K8wEjklHUi7w4LjvhCB5B15y1ZG/baIscoRrVu41HUp7crwbsdKjcWGE//dBTXN1vrXDm0maAkCo
nuYNPpMY0Cf+ikVITJO73UaXplFjOOtm+mkql6e5nTd8qGQXwHZl/nGJOEO/rMsXSoVybxIn5bg+
97CFCtAdsRRjAJZRQcrJIztenGJX81U0rvAX+OuoSNrgVpdxcwuH/1x80i+CY5kdUkg3EMkU0m4F
iNQ6CyXiiimVSBRB0sHfWW5/Em+qlYeRjrXCyJBYPo2mCuMtqQN42VeShEkQ1XPx6o09NTaaxXRM
pV2IHjzALLrR0Px6zqbp7CuEhPdLxTYcXetDKQJt/XHJuWdvETMgsJnyQ0cCJSPXp21xsrK6zYLY
cQ1M8rS9RHCmWvFdTZg49mX3QPANOUDPoPR0y3mOT19FWKFYOfQhHN2xPJZAPV6ZJeReeAeTBRkT
vgIJE/3BsQpmqsSusjgEDYCrK8MfaybAC6CpE5ZKnQwV99YlTcbPx7vVKPuU13j3Aj4FjtGjkFun
fCOpLX1AA0FSbBfOOCVeYd94bCGaW8f+j3NBB+29ELYMskew2tyCBiw2HodBrMoDiYVWHbD+bWw8
qMOOBurEQihVdNq5Tbi3R2fnnX9DpfbVljJeKFjyVwCLZA5OdGIYPuJxrXGKsaBI+abTgciL4n4W
bsG7LalURKCMe/HH1jVuy8VjevwJMB+u7CHoOc9jVCwR4YSPjH9fbxcIn9UIuECm1CryEUYB6kkh
BEeyxdQclP0amPYlyxVU80KN+Mxvle4//B6kwUtjS+/Rv943oXrXxaLXTCpeds49x0FWSRo/HCxy
nunzpkyqD4wBfUyB7hYggeRUaCb7aNVuIB1QZSY9EqF3F26Aootz1cYpr1CBtizZK9Q6Ez6N3iYW
1dMUB7dsNp4a4emAU3CfhHYh3JNv4pD21PbPASO/t89v7uMDrsI8SOp1nHqV0hYG2+JhxNyhYKV1
oXv54mKzbW+4vwsU/ySrrexUvmkTzLCsYBI7nSZT5uVprRA+MQJBLx6dKVVuzO1x8hzTv9T2LvJr
7rpd6Ban94JJ8vG7OUO0OaNP9HDrz+34xmCqQRi/f0TkmfSo4uFcsIfAmdQVbd6uu22ZBoWqolaz
lBXjt5Oe2AQV51Zma53dlArSBLpvbg/RoMM7cMhnGn33DkSBDYU9rN2iApw0zswa/KJ/p1r33Jrk
5YTL6wTTEuaG+UxVrtCxX4VHk7syaOjI5dshRELos3ZeIJeqKAgS45H6cK+gjCq0l3qWDDnFHcGm
zYoP1665lC7c9TOs8i5OBLM6hGqgEgcKEiTIp+tRUvDEhyN1v/YngT3izvWbsijV0QTTJcjsyFWq
DSJiw8G1WH4oFqZAzF2UzE6fzEeQbMVlPPxlnpUjipTqdtWcuayLH7tifX7diBl1fjlUOTqPK2+5
vz1HckVtzJMS4g0W7rWHAbTv5nfrby/1IJBHMDutjI2dh6J7nXbSgFOiT98TFL7upJCNc7T3AH4j
Ro1TzzXqODFShamQeYlooCyvStQxqj08rz74+7ery+GapNEPL4cPZ1qV0bfKCBwOQrTV8lIZXsFt
Jj9TV+7lT6ZcePnCFY6pWI78u5WWePZunmI9FFhz+odZd4vfh0C3VEISmeEN28T8XdvtHt8A78sr
4/SmrPteZpZhByZe2n50ZHQU+ukncDgZirtz5A4LIBedcDLCgeNfonHYCQTNYOKoDA+eq5sBczKP
mqFKjPnBq1533/lptWhsgou8CZfsEaY4kZvEzK8YTVrfVt4T407A851vKxBfHIyXKxFFi17Yddr2
SiqebAUjT3waPAoUwgdJelDYTnnKUQy0Zm25gGRDiE9LUwoOp7ys0H9m/xXJROx76gbljguU3ad9
fcwQIm8RTKZvXvKrVRBUsHutEL6/qZAb5VBQ1JHsa4tknAFTdwh7lsB1/l0lHtZ+HzBdgZ8kOvRm
HiCKYb+2p26WMVNy8SRhW8EeYxx3t79LMU3pIp9w4rCnuClwAYAXN6PP1Gf5GgsGS228ur3vwNKO
8YZIdMatmKJDy8Ufkm1Ljvy4Z0/3+XcGLDWyxRx6M2mLvMPvJIz9iGSr684PRfSydR3nq6W7gwYc
```

```
Ohb62cmSLVWyECoaa+cqVFFGOKHcUT3ZS7Xlx0QkniCQI9d46XDEx64PFGeBXL/z4dj7ZYx6woX9
R+F5yOAdKoILV5N9m4xzauPO4EkmKakDBtsf9tzExrArDBoT664Xc7cVJ/2jTzX57Oms09Q7r+T8
hH0JNxhcXAqhxdbMitkcFSy7t0pBgrPXRhdXohbGlhuZPAOMVkWWDMf8x7Yc4k7F3l9ua67w5Z2Q
cDf8NBq5iYM3TkB+2qpmn16L7Pbp5qlAoIcB409+6VwxHiHQgBHOPGsP1xHNYGYyKcfR4VxaUUXf
5G18b5NOnx3S2VCBA9fJGXlHqW3RmtlMEP4dEQdCbhH7jw7jd5El0NabRA0fCBTAYR61vYa9Ov7S
DOIefy6NpDffg9sFltOa36ag==</xenc:CipherValue>
                </xenc:CipherData>
              </xenc:EncryptedData>
            </RequestedSecurityToken>
            <wsp:AppliesTo/>
       </RequestSecurityTokenResponse>
 </soapenv:Body>
</soapenv:Envelope>
```

Figure 10: Example Authenticate Response

7.1.3.1 Example SAML Token Before Encryption

An example is given here for completeness of the fragment before encryption:

```
<saml:Assertion xmlns:saml="urn:oasis:names:tc:SAML:1.0:assertion"
xmlns="urn:oasis:names:tc:SAML:1.0:assertion"
AssertionID="oracle.security.xmlsec.saml.Assertion1955a65" Id="xxxx"
IssueInstant="2009-06-25T13:34:55Z" Issuer="http://earth.esa.int"
MajorVersion="1" MinorVersion="1" >

           <saml:Conditions NotBefore="2009-06-25T13:33:55Z"
NotOnOrAfter="2009-06-25T13:39:55Z"/>

           <saml:AuthenticationStatement AuthenticationInstant="2009-06-
25T13:34:55Z"
AuthenticationMethod="urn:oasis:names:tc:SAML:1.0:am:password">

                       <saml:Subject>


<saml:NameIdentifier>dail</saml:NameIdentifier>

                                    <saml:SubjectConfirmation>


<saml:ConfirmationMethod>urn:oasis:names:tc:SAML:1.0:cm:bearer</saml:Confirm
ationMethod>

                                    </saml:SubjectConfirmation>

                       </saml:Subject>

           </saml:AuthenticationStatement>

           <saml:AttributeStatement>

                       <saml:Subject>


<saml:NameIdentifier>DAIL42</saml:NameIdentifier>

                                    <saml:SubjectConfirmation>


<saml:ConfirmationMethod>urn:oasis:names:tc:SAML:1.0:cm:bearer</saml:Confirm
ationMethod>
```

```
                                    </saml:SubjectConfirmation>
                        </saml:Subject>
                        <saml:Attribute AttributeName="Id" >
<saml:AttributeValue>DAIL42</saml:AttributeValue>
                        </saml:Attribute>
                        <saml:Attribute AttributeName="c" >
<saml:AttributeValue>Italy</saml:AttributeValue>
                        </saml:Attribute>
                        <saml:Attribute AttributeName="o" >
<saml:AttributeValue>ESA</saml:AttributeValue>
                        </saml:Attribute>
                        <saml:Attribute AttributeName="ProjectName" >
                                    <saml:AttributeValue>HMA
imp</saml:AttributeValue>
                        </saml:Attribute>
                        <saml:Attribute AttributeName="Account" >
<saml:AttributeValue>dailsp</saml:AttributeValue>
                        </saml:Attribute>
                        <saml:Attribute AttributeName="ServiceName" >
<saml:AttributeValue>catalogue</saml:AttributeValue>
                        </saml:Attribute>
            </saml:AttributeStatement>
            <ds:Signature xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
                        <ds:SignedInfo>
                                    <ds:CanonicalizationMethod
Algorithm="http://www.w3.org/TR/2001/REC-xml-c14n-20010315"/>
                                    <ds:SignatureMethod
Algorithm="http://www.w3.org/2000/09/xmldsig#rsa-sha1"/>
                                    <ds:Reference URI="#xxxx">
                                                <ds:Transforms>
                                                            <ds:Transform
Algorithm="http://www.w3.org/2000/09/xmldsig#enveloped-signature"/>
                                                            <ds:Transform
Algorithm="http://www.w3.org/2001/10/xml-exc-c14n#"/>
```

```
                                                    </ds:Transforms>

                                                    <ds:DigestMethod
Algorithm="http://www.w3.org/2000/09/xmldsig#sha1"/>


<ds:DigestValue>nLkuqyqDggsxQnPiGzVDDckxaA0=</ds:DigestValue>

                                        </ds:Reference>

                          </ds:SignedInfo>


<ds:SignatureValue>oOkdc3KB2HwPB6YzhEa9MHx5yo1u/xqHp81wPj68uf5Ypet/5wHHEvfuN
hxD+S3ejT2f4lKIGkVDcsRNyUqaAn60CnJiN4RBpwcjcWQSUj5/XxesaR4nO4CtDylaLV6acLwww
lLN5PQ66UumASE=

                          </ds:SignatureValue>

               </ds:Signature>

</saml:Assertion>
```

7.1.4 Failed Request Security Token

If the RST cannot provide the RSTR due to a failure (failed authentication, invalid parameters, resource unavailable, etc), then the SOAP Fault mechansism shall be used, following the recommendation of WS-Trust 1.3 for error handling (see section 11 of [NR23]).

An example is given below, for the case of a failed authentication:

```
<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>wst:FailedAuthentication</faultcode>
      <faultstring>Authentication failed</faultstring>
    </soapenv:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

7.1.5 WSDL

The WSDL is given below for the Security Token Service, without the Bindings and Services elements. This WSDL have been obtained by updating reference files from WS-Trust 1.3: http://docs.oasis-open.org/ws-sx/ws-trust/200512/ws-trust-1.3.wsdl

Note that this WSDL refers to the local schema file ws-trust.xsd, which is a restricted version of the standard WS-Trust schema http://docs.oasis-open.org/ws-sx/ws-trust/200512/ws-trust-1.3.xsd.

```
<?xml version="1.0" encoding="UTF-8"?>
<wsdl:definitions xmlns:tns="http://docs.oasis-open.org/ws-sx/ws-
trust/200512/" xmlns:wst="http://docs.oasis-open.org/ws-sx/ws-trust/200512/"
xmlns:soap12="http://schemas.xmlsoap.org/wsdl/soap/"
xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
targetNamespace="http://docs.oasis-open.org/ws-sx/ws-trust/200512/">
```

```
   <wsdl:types>
      <xs:schema>
         <xs:import namespace="http://docs.oasis-open.org/ws-sx/ws-
trust/200512/" schemaLocation="ws-trust.xsd"/>
      </xs:schema>
   </wsdl:types>
   <wsdl:message name="RequestSecurityTokenMsg">
      <wsdl:part name="request" element="wst:RequestSecurityToken"/>
   </wsdl:message>
   <wsdl:message name="RequestSecurityTokenResponseMsg">
      <wsdl:part name="response"
element="wst:RequestSecurityTokenResponse"/>
   </wsdl:message>
   <wsdl:portType name="SecurityTokenService">
      <wsdl:operation name="RequestSecurityToken">
         <wsdl:input message="tns:RequestSecurityTokenMsg"/>
         <wsdl:output message="tns:RequestSecurityTokenResponseMsg"/>
      </wsdl:operation>
   </wsdl:portType>
</wsdl:definitions>
```

Figure 11: Security Token Service WSDL

7.2 ServiceRequest

Through the implementation of this interface to the ServiceRequest (i.e. the service operations such as the catalogue GetRecords, the programming GetFeasibility etc.) authenticated clients will send requests to a server controlling access to the final service. The request is made using WS-Security containing the SAML token previously returned in the AuthenticationResponse.

N.b. The service requests from a client to the Federating Entity or from the Federating Entity to a Service Provider are the same.

7.2.1 Request

Protocol: SOAP plus WS-Security over HTTP/HTTPS.

7.2.2 XML encoding

The following XML-Schema fragment defines the XML encoding of an example ServiceRequest operation

```
<?xml version="1.0" encoding="UTF-8"?>
<env:Envelope xmlns:env="http://schemas.xmlsoap.org/soap/envelope/">
   <env:Header>
      <wsa:MessageID
xmlns:wsa="http://schemas.xmlsoap.org/ws/2003/03/addressing"/>
      <wsa:ReplyTo
xmlns:wsa="http://schemas.xmlsoap.org/ws/2003/03/addressing">
         <wsa:Address/>
      </wsa:ReplyTo>
      <Security xmlns="http://docs.oasis-open.org/wss/2004/01/oasis-200401-
wss-wssecurity-secext-1.0.xsd">
            <xenc:EncryptedData
Type="http://www.w3.org/2001/04/xmlenc#Element"
xmlns:xenc="http://www.w3.org/2001/04/xmlenc#">
```

```
                <xenc:EncryptionMethod
Algorithm="http://www.w3.org/2001/04/xmlenc#aes128-cbc"/>
                <ds:KeyInfo xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
                   <xenc:EncryptedKey>
                            <xenc:EncryptionMethod
Algorithm="http://www.w3.org/2001/04/xmlenc#rsa-1_5"/>
                            <xenc:CipherData>

   <xenc:CipherValue>k4kkm+nBkutOsmP9Lm6v4gpPvtJqxOOJLEOoKCQfE4Q7qp1yOBkKRlu
j9zb7Y07cNdJf8OhzGaHFGz7OIfM9Tpl5QEntkoeOT9wg/PsYqlIaAsCRoDsYjJoQrqpHdIpv3wl
Cck8iysQus4LpqdK
Hc6pWRk0Gk9022z/3U=</xenc:CipherValue>
                            </xenc:CipherData>
                   </xenc:EncryptedKey>
                </ds:KeyInfo>
                <xenc:CipherData>

   <xenc:CipherValue>+X0OFMae+FV8zOr0pPA02icglYf4AKcaml/jNfP8gdmjIh/dB/utVIC
YxKtarBRSAlptozGoI92r+bwUwmAyIY3D7gX0h6EC0P3LqhojKiMRrNbvCaotOPWoMherMp1SUbx
eYgxdZVlpXa77mNHHEkjhcmNXHydgz4DJoLxzHUIdWm9Lv+UTufH+D680JicO0SCnGdIC6KEpM68
h+3x/PRRNdmzy
QRpS9WZ03DAADBokRmW8IbG5YlUG4NjZDhkPDRlFhaHBTn4ZDP4LEd98KXZclwAlAB9XIICTeNFh
9t0itufclexX0zu/icAM8ws/sEAh7NmLyw+k8MRI7lMXeldnqftBYYj5NzYZqUd87XXqTe6ytnS3
SwbZXgdkgKylqdp0p0FcJVOGb4obfP/6irwzf1ujK2DMJb+9+mTQzfdNIIXimegV5wY2r1Wsg7Xt
xiVU6TFMI6VA5CH1MkmgYyYFqgI2MoiNXW3c3sgAs6+QlRoPMR3uNzvtB7NKy0m9BET+zqxCRgPt
GPstjX5ATvJ7tbcAlSKGyHubEIE9Am1Q2nGv3ChGzPPw+rwtow1D8xeSnxWOKpp/whmXcN9AEQ/z
5HtDCmbw1+ExRTM8Xy1NWp135If/6ooxcJtOf5vavo5Mx1OQto8TieF35+5FXA0rUiCn//yJzJRz
2mXEMJfoO1HfwPpfGWxwId4yuhWeylNAA4sKWt2OVDc/zkZpRTIHOoOWuut2LdsZS1fBZ+RMnpt/
u8tivsRITLyd2htTILLXKIenNpdRWeUD4d23RxcFFt+bGh
yrbHnsrT+DIZJD0PfS0zxigXu+NG4wy+Plhj11h4pn2AosIP5v0ZXN/tObgsQonwKyjFwgqGH8js
Ik/96PLnu1ODRRYVIBOGlcV9K7NrHeqCkM1157HCwu/rflTXK61jzRsZ8/hzC8ADiOXQnpk8K4EO
AFs/A6LY54A8MFQndHkAHN6NEK0nbAkqhOTur99PHrXQtYfsf26Mrd8rTKhkP5zd3pdfzvhnqOnx
OSe2FuWX3WHwUTgAzMBlJC2PRzHM4Q4q/pHFyK+UrLE2QLYsBn6VzouHfcI3dikR/0d2RQPsrQKQ
PB8WXMjJxK7v05jRBjZaNYpmsFk08zweM1OWuVB8L57zSzAfb7CKpPgsgRk4ezLWrPVK7Z2UuQ+z
/UH66S3a9dYsneQMaDMh7wYQtLe3fEeUhbBYrjRBZWHriOnhxoN7Rll8bnKOXoJUJJMZqyZyvN7q
HTLUxG98KUncu3HYwKSIgZEog
ZhHsfbqp9jee0tx4MhW+t8z9Upsh7TPhWcEvaFxpn5pfz4c704nsM7Tmcq4IijlnW8m3kX/mBR/O
TFcjWh2mV8XZoa/Hro7Rj69HVjELBTlF/W+S7pNsN+hoErRDlWxuHqC6v7KDMakaLF/Cekz
WA27ozxm7z1+6a/BeiXSTNojoodOybmv7hxjObWg53RUp5H3rejnN52+7IDHJwik2DONIErqL5GP
Soy3+adE5mSnAQklZ4zeErsl/A82ySgovaQNskuqa+6aBLvhHQ9CPeQmlddOfyU6HebMSN2mE8OZ
2yejwhujnT5ha4KoefrE21bwi5xWkNDobJbfBPXgg7Wdf4M6n3zsRTT6ixugXrkdRhnYyTzpRJ6E
PpL5Cdunh2gyQHiyJbcCh37rzTcsx0CiWHfak0ObqDRUeJ8tPyOS5PhyxcNknQ4p3RCI0QJTxUYG
3jpWntAK7ZU3d0Bmk+DAaPGGGJ44fKZ3HZTWjnFTcqWxwYOXxsiJ/kKE8ZVcDJ6IL4pf4dTnJHaa
8hT09LVutVZJrqcYbI5q/QL1hcMclPBByoaP4EmFPxX3dpbap0uf2qbX80G+jjVtsHd9rhEmyoc6
tJjj27Z2B0ANPAI53AMDXGF5HHHzzficfizN0vK48EO/xk34EEylSmCIInrf72m54f7wh8RojgoO
zIWZkIU+tpCfO2HTcxRUT/rd6Wfb624YE9ov20+T1U0Yc9nyj
zoNDNBjCXh7+tr4FkUoZGyzqm5OlYkfkKvkwkp6rH8RzUhqKewHjWb7zdlYHEH8XkMtcHneYgeQ
pDQ/E8bshTuLILOELUtRODjszaTXyrm4xlhCzJ7mWlZa+viTV4PzHdRQCVByGxOsFfhJGtrOOrx
SUnyUNVDBbKxiTe7tzuTtZ9demhjAE17svhCxh5tIWg5NMJ3FeG4HzOL9UUoah4gwjyvFa/0azdt
1ZWaYc6SPufQIWk9I2HWRb1m4waiA24LkLBXvYMjWTto+DsVWPP3WQXtPaSBNtnD/VEbM+2bbPER
A1+drMTui6Gvl/iHNQ9uq+UrmXPoR9NtfSEAh/M5BdSH75zGifd369R1eFJqBuBWile2R7ryqnPP
BbVf89md0nhYe3RzdD0DKbJen5/r3eicrc3PculW8cGJDqtuEI9kC1xULyXuhWmpEACgTabmNmw3
T+3LnzEuKU97DtLpgqlJoAqXHBBImDsPmzX
JIDOoNc7J8ouh53L8ZM6jZwFXGqQBteV0HsDPwxTBSGE+tuPQHj/cWvovOBeltewUuBskG0EwsDt
kYwmP5yNlbY4vn0ouL+4tlprZr2oNSitv3Lle/usE5ps70ALpQYvzG369DAqf2T+m3Ld5HaKZ/N+
cWtQSt/EJGjjBTTodrzbkAe7Mkz/euMxU0Pj5Gv4kyLysfivPPuvar+ZuRos/jm5N+mHUQUzWd2i
zk4BvBuyWHNe3Jq45H/ELAND0OEZRoXCRbpz0io+a9C6T44BlOECJyXI1gp/m9lsbb5iSv0HpMSv
4xsLpM1AuXLpKmeqdsHO/zEnLUOhR2Dpk6hoqpnPvK+QbVO0c/YdJ+lkeGIz6C2OsrbbsiO+cUou
l+7mJ6WG7VqifJWNX8mzd6RklCntt0W1CgBk93vzOspDJfnvBkHSZ1VmuiWLWpesttUrYCwF77lc
SLDR3Rvqa29hUORrV4BRHl1LAuf9ofAyg9r3vb2TjlrG58FOekzRxomjP/rTL0jteYiBf6YwoMEw
g2chC3lhRoaTpzTpMSbAoByuI3VCsqMN81JwEAUOtXmjRFg/C8Cnc1/Zg8tYfNtIymNbzH9S5Mmo
Qy2oEUaM/RmAU1yhqEE+J1q4wBfJb933T8oPOQBgbNjntcDsJXwQt1xa/QxDs7d1TaGMkzbY6YxZ
Qxt0s6cTwyda2XwqO6Bd9pugluF4c4l218g+42PTzwHWpTcXbqOaQDLVITfM5LWK7JvAEK5fai9X
c2dooFiNiR+QgU3SwRrZ4GZ1d4wWgOJsPexgEkYOKQuwo6S1vl0WNZtuYC7/+ct4qiHzA2tk+5HB
vMoZ1WyxUQNXo/sfhRx5xK7lT2vHqBx0k1gwoZW7l8/IPPbo0frpdKT2iOGLB/YH46GkWztp0Ft8
+7uPbFebu76teSF04ei3utFf9h+UmcxgNmtGR1BuILEs5ERKI2KDLfr90+ltKhDZu6gOBrcOWxik
x+bhojouvj0o+LdZt9zjSaNPZTkym01zPoFv24xyAA3OUAc1WESHKcuPbwO18LIopmURoEROB3dY
```

```
N8veuTfekmYPv3tHOaLdZaL66oJklarJBcHWYlr/ob0/gElFmn+20y/kK7oq9vEP/oOSMYgtiyCW
mBEgcnm6rIQvklFxzt9FFMz06+2I5/W0OSRnr371Pb1nukHFXHJC5bDRMbnR7JobKhPAcDibzl2i
Nt/uWNX3K7L3Ddh1hCHFF/Dl+won2HJsfItOvbfxVoL3fs1Rk6+FXvO5QRqcrQVOKN/z2cn2Y8N/
bLIr86AH3+J7r4fGAspyqx985VMKzzl5OHvi+DzGDmmuzgtHpB3/R0NRbWgbW5
ebpeduehhmzGQ4vL3KbrrbH+QkU2DIlcp+DOYysnVNtDxlFJVSDfvHxBAeOYwm9sjzvrslpHMqkl
tSmiqOnuU/shfPtAdYyxoTTDV11R+TJNQo80Mq7cJUd9NeiYi+TjorpN5qtJW9/XQIPQjO
riuWkK3d/mv4dwGWQkS14CJ/5Em4ONdEJnJzwU4FndrLGh76IWczBM+3grhCVWBWf5EohxV8rMEJ
D7m3HeP6koPo4uxTylRkhSFO8GgP0aFR5cEGsjnIhyPVcf7ad1L9t+A3ajzpPW9m+pcdgWqvamCT
47B/Uc6S/nN8VA+7bIdXVCqTsNiyyNoNSEplk8Qi97nz2ZF6/UcxdoD6aVD/HvJA53usmluCKuyl
nFbFX9eIyOF0DGppo3RsP8ka61pSt+jXrn95xkisO1u/Efmt8lb0bhrPET+NEkA==</xenc:Ciph
erValue>
                </xenc:CipherData>
             </xenc:EncryptedData>
      </Security>
   </env:Header>
   <env:Body>
      <csw:GetRecords maxRecords="10" outputFormat="application/xml"
outputSchema="urn:oasis:names:tc:ebxml-regrep:xsd:rim:3.0"
resultType="results" service="CSW" startPosition="1" version="2.0.2"
xmlns:aoi="http://www.esa.int/xml/schemas/mass/aoifeatures"
xmlns:common="http://exslt.org/common"
xmlns:csw="http://www.opengis.net/cat/csw/2.0.2"
xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc"
xmlns:portal="http://www.esa.int/mass" xmlns:rim="urn:oasis:names:tc:ebxml-
regrep:xsd:rim:3.0" xmlns:serviceNs="http://www.opengis.net/cat/wrs/1.0"
xmlns:wrs="http://www.opengis.net/cat/wrs/1.0">
         <csw:Query typeNames="rim:RegistryPackage rim:ExtrinsicObject
rim:ExtrinsicObject rim:ExtrinsicObject_acquisitionPlatform
rim:ExtrinsicObject_dataLayer rim:Association_acquisitionPlatAsso
rim:Association_dataLayerAsso rim:Classification rim:ClassificationNode">
            <csw:ElementSetName
typeNames="rim:RegistryPackage">full</csw:ElementSetName>
            <csw:Constraint version="1.1.0">
               <ogc:Filter>
                  <ogc:And>
                        <ogc:BBOX>

   <ogc:PropertyName>/rim:ExtrinsicObject/rim:Slot[@name=&quot;urn:ogc:def:e
bRIM-Slot:OGC-06-
131:multiExtentOf&quot;]/wrs:ValueList/wrs:AnyValue[1]</ogc:PropertyName>
                              <gml:Envelope srsName="EPSG:4326"
xmlns="http://www.esa.int/xml/schemas/mass/aoifeatures"
xmlns:sch="http://www.ascc.net/xml/schematron"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
                                 <gml:lowerCorner>23.1368 -
40.7547</gml:lowerCorner>
                                 <gml:upperCorner>58.3726
32.2642</gml:upperCorner>
                              </gml:Envelope>
                        </ogc:BBOX>
                        <ogc:PropertyIsEqualTo>

   <ogc:PropertyName>/rim:ExtrinsicObject/rim:Slot[@name=&quot;urn:ogc:def:e
bRIM-Slot:OGC-06-
131:parentIdentifier&quot;]/rim:ValueList/rim:Value[1]</ogc:PropertyName>

   <ogc:Literal>urn:ogc:def:EOP:ESA:SIMU.EECF.ENVISAT_MER_FR_xS</ogc:Literal
>
                        </ogc:PropertyIsEqualTo>
                        <ogc:PropertyIsEqualTo>

   <ogc:PropertyName>/rim:ExtrinsicObject/@objectType</ogc:PropertyName>
                              <ogc:Literal>urn:x-ogc:specification:csw-
ebrim:ObjectType:EO:EOProduct</ogc:Literal>
                        </ogc:PropertyIsEqualTo>
```

```
                           <ogc:PropertyIsGreaterThanOrEqualTo>

   <ogc:PropertyName>/rim:ExtrinsicObject/rim:Slot[@name=&quot;urn:ogc:def:e
bRIM-Slot:OGC-06-
131:beginPosition&quot;]/rim:ValueList/rim:Value[1]</ogc:PropertyName>
                                    <ogc:Literal>2009-06-
26T00:00:00.000</ogc:Literal>
                           </ogc:PropertyIsGreaterThanOrEqualTo>
                           <ogc:PropertyIsLessThanOrEqualTo>

   <ogc:PropertyName>/rim:ExtrinsicObject/rim:Slot[@name=&quot;urn:ogc:def:e
bRIM-Slot:OGC-06-
131:endPosition&quot;]/rim:ValueList/rim:Value[1]</ogc:PropertyName>
                                    <ogc:Literal>2009-06-26T23:59:59.000

                                    </ogc:Literal>
                           </ogc:PropertyIsLessThanOrEqualTo>
                           <ogc:PropertyIsEqualTo>

   <ogc:PropertyName>$acquisitionPlatform/@objectType</ogc:PropertyName>
                                    <ogc:Literal>urn:x-ogc:specification:csw-
ebrim:ObjectType:EO:EOAcquisitionPlatform</ogc:Literal>
                           </ogc:PropertyIsEqualTo>
                           <ogc:PropertyIsEqualTo>

   <ogc:PropertyName>$acquisitionPlatAsso/@sourceObject</ogc:PropertyName>

   <ogc:PropertyName>/rim:ExtrinsicObject/@id</ogc:PropertyName>
                           </ogc:PropertyIsEqualTo>
                           <ogc:PropertyIsEqualTo>

   <ogc:PropertyName>$acquisitionPlatAsso/@associationType</ogc:PropertyName
>
                                    <ogc:Literal>urn:x-ogc:specification:csw-
ebrim:AssociationType:EO:AcquiredBy</ogc:Literal>
                           </ogc:PropertyIsEqualTo>
                           <ogc:PropertyIsEqualTo>

   <ogc:PropertyName>$acquisitionPlatAsso/@targetObject</ogc:PropertyName>

   <ogc:PropertyName>$acquisitionPlatform/@id</ogc:PropertyName>
                           </ogc:PropertyIsEqualTo>
                       </ogc:And>
                   </ogc:Filter>
               </csw:Constraint>
           </csw:Query>
       </csw:GetRecords>
   </env:Body>
</env:Envelope>
```

Figure 12: Service Request Example

7.2.3 Failed Request

An example is given below:

```
<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <soapenv:Fault>
      <faultcode>AuthorisationFailed</faultcode>
      <faultstring>Country of origin not authorised</faultstring>
```

```
    </soapenv:Fault>
  </soapenv:Body>
</soapenv:Envelope>
```

7.3 ServiceResponse

7.3.1 Synchronous

The service response is as defined in the corresponding catalogue, ordering and programming specifications.

7.3.2 Use Case: User logs in at client and makes Synchronous Service Request to Federating Entity Service

In this case the sequence is as follows:

1. A user already registered in the local (Federating Entity) user registry logs in at the client (Federating Entity Client or an external client).
2. The client authenticates the user through the Federating Entity STS.
3. The Federating Entity STS:
   - validates the user,
   - creates the SAML assertions from the information held in the user registry
   - signs the SAML assertion with the Federating Entity's private key.
   - encrypts the signed SAML assertion with the Federating Entity's public key.
4. The Federating Entity STS returns the RSTR containing the encrypted SAML token.
5. The user is given confirmation of login.
6. The user selects a service.
7. The client constructs the service request and inserts the encrypted SAML assertion in the request. (N.b. The client should manage the token validity as it is possible that the token has expired and will therefore not pass the PEP checks . To ensure the token has not expired an RST could be be requested at each service request).
8. The service request is sent.
9. The Federating Entity PEP decrypts the token using the Federating Entity private key and applies policy checks.
10. The request is forwarded to the Federating Entity Web service.
11. Service request for the external entity is constructed and the SAML token in the header is encrypted with the external entity's public key.
12. The service request is sent to the external entity PEP.
13. The external entity PEP decrypts the token using the external entity's private key and applies policy checks.

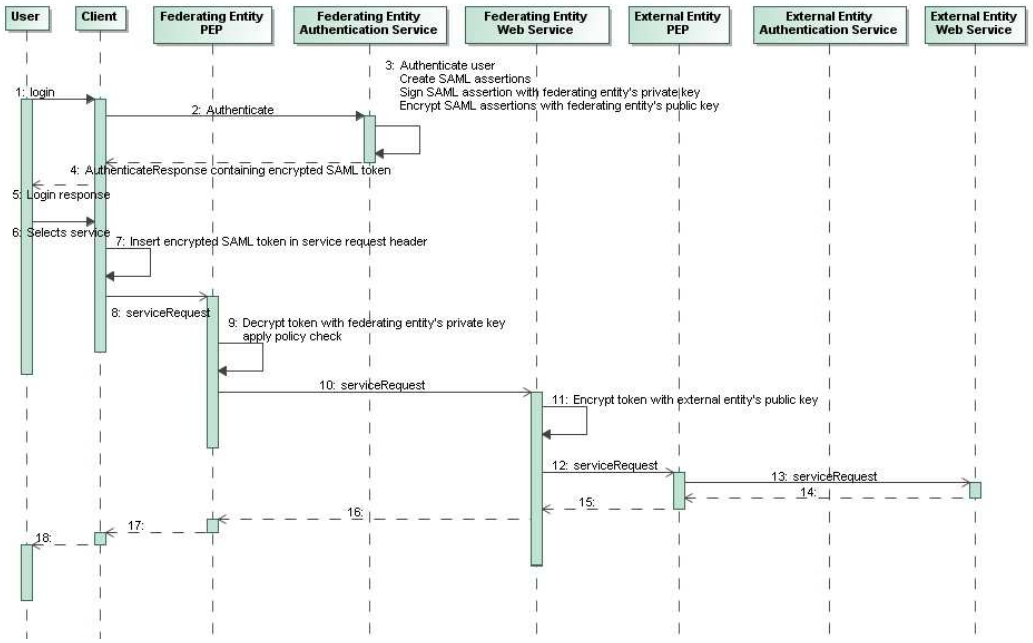


Figure 13 Federating Entity Sequence Diagram Showing Client Request with synchronous Response

7.3.3 Asynchronous

The asynchronous service response is as defined in the corresponding catalogue, ordering and programming specifications. This response may be protected by the same encryption and signature as defined for the service request and authentication. The sequence is as follows:

1. The SP prepares the response to the endpoint mentioned in the WS_Addressing.
2. The Service Provider creates a token authenticating himself i.e. external entity and signs it with his private key. This is then encrypted with the public key of the Federating Entity and inserted into the asynchronous response in the same way as previously described for a service request
3. The asynchronous response is returned to the address provided in the ws_addressing of the request. This will normally be the address of a PEP.

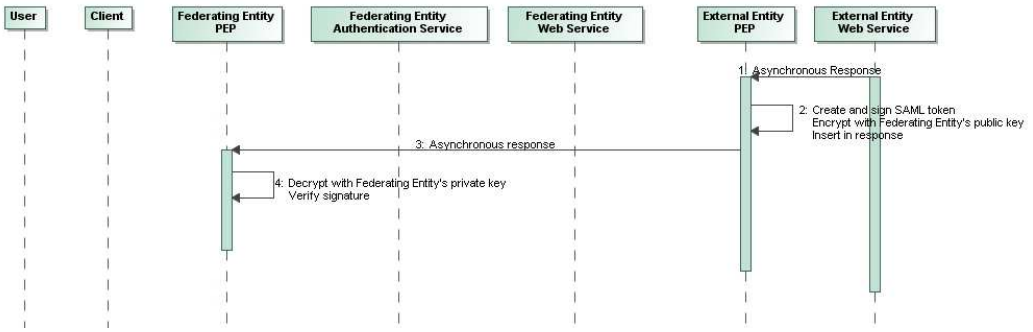


Figure 14 Sequence Diagram showing asynchronous request

8 Security Considerations

The interface that is presented in the current document was designed according to a specific set of security requirements. Other application domains may want to take additional security measures which are complementary to the minimal interface defined in the current document.

The present section identifies different types of attack or threats that are specific to the present interface; it provides for each of these types of attack or threat the answer or countermeasure, as entailed by the interface. When required, the distinction is made between RSTs and service requests.

Type of attack / threat	Answer / countermeasures
Identity Spoofing	If the IdP is the Federated Entity or an External Entity complying to the present specification (see cases 6.4.3.1, 6.4.3.2 and 6.4.3.3), then the sole artefact that conveys user identity, i.e. an evidence of authentication, is the SAML token, obtained by an RST with password. The IdP guarantees that the SAML token for user *X* is returned if and only if the credentials of *X* have been provided (see next threat topics related to password). If the IdP is an External Entity not complying with the present specification (see case 6.4.3.4), then the threat of identity spoofing has to be analysed at the level of this IdP, as well as the level of security gateway that shall request SAML token to Federating Entity STS. The action of registering the public key of such External entity on the Federating Entity STS means that this STS *trusts* both external IdP and security gateway. If this is done, then the STS shall serve any RST secured by signature from that security gateway, with no further identity control. The signature verification shall guarantee that the RST that it has been issued by a trusted security gateway and that it has not been tampered with. For the service requests, the risk is the theft of SAML token, which could be rebound to a new service request issued by a malicious user. This risk is limited by putting short expiry time on SAML token; as the expiry time is part of the SAML token itself, it is protected from changes by signature. The expiry time and signature are both checked by the PEP. Also, HTTPS could be used to avoid (through encryption) the risk of such forged service request. Another countermeasure consists in calculating the signature of SOAP body and putting this as detached signature in the security element of the SOAP header, itself secured by encryption. Then the PEP can verify, by signature checking, that the SAML token has not be rebound.
Man-in-the-middle	For RST (with password or with signature): the transport protocol is HTTPS, which is based on SSL; SSL includes a certificate mechanism to protect against man-in-the-middle attack. For service requests (if no secured HTTP is used): the signature protocol guarantees that the emitter of SAML token is a trusted IdP and that the token has not been tampered with; this is checked by the PEP. The threat is therefore located on the message payload (SOAP body) or its binding with SAML token. Such threat is analysed in Identity Spoofing, Data integrity, Data confidentiality topics.
Data integrity	The signature protocol enforced on SAML Token allows for the verification of its own data integrity, at the PEP level.

	The data integrity of the message payload may be checked by another signature mechanism on the SOAP body. Such signature should be bound in some way with the SOAP header, in order to avoid the risk of forged service request (see "identity spoofing" topic).
Data confidentiality / privacy violation	Encryption of SAML token (both for RSTs and service requests) guarantees that no entity excepting the target PEP can read conveyed user attributes. For service request, the data confidentiality of the message payload may be enforced by using HTTPS protocol or by encryption of the SOAP body. The LDAP registry is protected by password, which is known only by security officer and IdP. The IdP is a "trusted" entity.
Replay attack	For RSTs: the transport protocol is HTTPS, which is based on SSL; SSL includes a "nonce" mechanism to protect against replay attack. For service requests (if simple HTTP is used): the risk of unauthorized access through replay of a past service request is limited by putting short expiry time on SAML token, which is checked by the PEP. Also, a replay protection may be implemented using a hashing function or digital signature which provides a unique identifier that can be used to determine if the same message is received multiple times.
Denial of Service	Web service is susceptible to message flooding denial of service attacks from message replay. “replay detection” mechanisms can be used.
Password Disclosure	If the IdP is the Federated Entity or an External Entity complying to the present specification (see cases 6.4.3.1, 6.4.3.2 and 6.4.3.3), then RST with password is used, which relies on HTTPS. The password is therefore encrypted during transmission from client to IdP. It is an implementation decision whether deployments use an LDAP registry. If LDAP is used, the LDAP registry is protected by password, which is known only by security officer and IdP. The user passwords are stored encrypted on LDAP registry. Secure LDAP (SLDAP) protocol may be used also. The risk of password disclosure is therefore limited to known and usual factors, which can be mitigated by enforcing an adequate password policy (out of scope of the present interface). If the IdP is an External Entity not complying with the present specification (see case 6.4.3.4), then the RST with signature is used, which contains no password. The threat of password disclosure shall be analysed at the level of the external IdP, which is out of scope of the present specification.
Password Cracking / Guessing	If the IdP is the Federated Entity or an External Entity complying to the present specification (see cases 6.4.3.1, 6.4.3.2 and 6.4.3.3), then RST with password is used. The risk of password cracking/guessing is limited to known and usual factors, which can be mitigated by enforcing an adequate password policy (out of scope of the present interface). If the IdP is an External Entity not complying with the present specification (see case 6.4.3.4), then the RST with signature is used, which contains no password. The threat of password password

	cracking/guessing shall be analysed at the level of the external IdP, which is out of scope of the present specification.
Unauthorized access	The authorisation to Web services relies on PEP and associated access policy rules. The rules are based on asserted user attributes in the SAML token. The fact that these attributes match the actual requesting user relies on authentication.

The following table covers implementation-dependant threats.

Type of attack / threat	Answer / countermeasures
SQL injection	If a RDBMS is used for user registry, there is a risk of SQL injection for the authentication operation, i.e. a hacker enters as user id or password, some malicious character string that are interpreted by SQL engine. Such risk can be prevented by performing string validation and character escaping on input user id / password strings, before SQL lookup (out of scope of the present interface).
LDAP injection	If a LDAP registry is used for user registry, there is a risk of LDAP injection, i.e. a hacker enters as user id or password, some malicious character string that are interpreted by LDAP or JNDI API. See http://www.blackhat.com/presentations/bh-europe-08/Alonso-Parada/Whitepaper/bh-eu-08-alonso-parada-WP.pdf Such risk can be prevented by performing string validation and character escaping on input user id / password strings, before LDAP lookup (out of scope of the present interface).

9 Authorisation Use Cases (non-normative)

As explained before, authorisation rules that grant access to Web services shall be evaluated by a dedicated PEP that wraps such services. However, the PEP treatments and the way access rules are stored and evaluated are not in the scope of the present document. The present section provides non-normative information about this topic.

In order to separate responsibilities, a PEP typically relies on a PDP (Policy Decision Point) that performs the actual evaluation of access rules based on the request payload (i.e. the SOAP body), on the attributes of the SAML token, if any, present in the SOAP header and on "external" elements (e.g. current time). Each PDP should have a dedicated policy store, where needed access rules or policies can easily be stored, retrieved and maintained.

The rules used by each PDP should be expressed in a standard syntax: the eXtended Access Control Markup Language (XACML) is recommended here. XACML (see [NR21]) is, in essence, a declarative access control policy language implemented in XML.

The following provides use cases and examples of policy rules, with XACML fragments implementing them. More comprehensive examples shall be found in annex E.

9.1 Uses Case: restrict access for time period

Generic policy rule:

Restrict data access for a given time period

Analysis:

XACML allows to define Rules based on “environment attributes”, such as date and time. A rich set of functions for handling date, time and dateTime values (as defined in the W3C XML Schema specification) are predefined in XACML.

Example:

Although able to access the service the user cannot access images from period t1=09:00:00 to t2=12:00:00.

The time restriction can be expressed as a Condition in an XACML rule as follows:

```
<Condition>
  <Apply FunctionId=”urn:oasis:names:tc:xacml:2.0:function:time-in-range”>
    <Apply FunctionId=”urn:oasis:names:tc:xacml:1.0:function:time-one-and-only”>
      <EnvironmentAttributeDesignator
               AttributeId=”urn:oasis:names:tc:xacml:1.0:environment:current-time”
               DataType=”http:www.w3.org/2001/XMLSchema#time”/>
    </Apply>
    <AttributeValue
        DataType=”http:www.w3.org/2001/XMLSchema#time”>09:00:00</AttributeValue>
    <AttributeValue
        DataType=”http:www.w3.org/2001/XMLSchema#time”>12:00:00</AttributeValue>
  </Apply>
</Condition>
```

See annex E for a more comprehensive example.

9.2 Uses Case: enforce rules for specific group of users

Generic policy rule:

enforce rules, like temporal restriction seen before, for specific group of users

Analysis:

XACML allows defining rules which target specific subjects. The rule for the current requirement can be expressed by targeting the group of users whose access shall be regulated together with a time restriction condition.

Needless to say, the group of users shall be targetable through an attribute contained in the SAML authentication token. In this way, a Rule with the following target could be defined:

Example:

Enforce rule for the users having the role "guest".

```
<Target>
  <Subjects>
    <Subject>
      <SubjectMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
        <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">
            guest
```

```
        </AttributeValue>
        <SubjectAttributeDesignator
             AttributeId="urn:ogc:um:eop:0.0.4:saml:role"
             DataType="http://www.w3.org/2001/XMLSchema#string"/>
      </SubjectMatch>
    </Subject>
  </Subjects>
</Target>
```

where `AttributeId="urn:ogc:um:eop:0.0.4:saml:role"` is a user-defined attribute contained in the XACML decision request which holds the suitable SAML Token attribute value identifying the group of users subjects to the Rule.

Notice that a Rule Target can match more than one Subject.

See annex E for a more comprehensive example.

9.3 Uses Case: restrict access to the type of data

Generic policy rule:

restrict access to the type of data e.g. high or low resolution data

Analysis:

XACML allows to define Rules which target specific attributes of the resource to access. However, we assume that this information is either contained in the client request to the Service, or in a configuration file.

Notice that, building a Rule restricting access for certain data values but these data values are not provided in input, can result in an Indeterminate Policy (Indeterminate means that an error occurred or some required value was missing, so a decision cannot be made).

Example:

See annex E.

9.4 Uses Case: restrict access to data based on the age of the data

Generic policy rule:

restrict access to data based on the age of the data

The age of data is an essential parameter to be considered for some products within EUMETSAT data policy (for instance at the moment Meteosat data are only accessible for retrieval from the archive 24 hours after sensing time).

Analysis:

If the age of data is a piece of information contained in the service request, it is possible to define a rule which set restrictions on the access to the data based on their age.

Example:

For example, the following Condition evaluates to true if the current dateTime is greater than the acquisition end time of the data + 24 hours.

```
<Condition>
```

```
<Apply FunctionId="urn:oasis:names:tc:xacml:2.0:function: dateTime-greater-than-or-
equal ">
  <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:dateTime-one-and-only">
    <EnvironmentAttributeDesignator
        AttributeId="urn:oasis:names:tc:xacml:1.0:environment:current-dateTime"
        DataType="http://www.w3.org/2001/XMLSchema#dateTime"/>
  </Apply>

  <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function: dateTime-add-
dayTimeDuration">
    <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:dateTime-one-and-only">
      <ResourceAttributeDesignator
AttributeId="urn:ogc:def:ebRIM-Slot:OGC-06-131:endPosition"
DataType="http://www.w3.org/2001/XMLSchema#dateTime"/>
    </Apply>
    <AttributeValue
DataType="http://www.w3.org/TR/2002/WD-xquery-operators-20020816#dayTimeDuration">
      <xf:dt-dayTimeDuration>
               PT24H
      </xf:dt-dayTimeDuration>
    </AttributeValue>
  </Apply>
</Apply>
</Condition>
```

where `AttributeId="urn:ogc:def:ebRIM-Slot:OGC-06-131:endPosition"` is a user-defined attribute contained in the XACML decision request which holds the corresponding value of the service request.

9.5 Uses Case: imposing geographical constraints

Generic policy rule:

imposing geographical constraints, i.e. area of interest (AOI), allowing some users to access more areas than others.

Analysis:

XACML is a general-purpose access control policy language and does not include specific functions and attributes to handle geographical rules. Given that it is also an extensible language, the user can add his/her own attributes and functions, or, better, in this case, he/she can integrate the XACML rules with GeoXACML, which specifically addresses geographical constraints.

9.6 Uses Case: access and check source, content, user credentials and time

Generic policy rule:

access and check source, content, user credentials and time

Analysis:

XACML rules targets the following groups of attributes:

- Subject
- Resource
- Action
- Environment

A rich set of attributes are predefined for each group together with functions to handle them, according to their types. Additionally, XACML can be extended with user defined attributes and functions.

9.7 Uses Case: restricting access to users from certain geographic locations.

Generic policy rule:

restricting access to users from certain geographic locations.

Analysis:

An XACML Rule can be defined to restrict access to users from geographical locations provided that this information is contained in the request to the Service Provider.

For example, if the authentication is performed according to the present "User Management Interfaces for Earth Observation" specification, then the request may contain a SAML Token with attributes defined according to the "GMES Minimum Profile"; one of these attribute is the "country of origin" of the subject requesting access. Consequently, this attribute will be embedded in the XAML decision request and a Rule can be defined accordingly.

Example:

See annex E.

9.8 Uses Case: route service access based on user type

Generic policy rule:

Route a service access based on user type.

Note: e.g. This would allow a "scientific" user request to be routed to DLR and a "commercial" user request to be routed to Infoterra.

Analysis:

This requirement could be met using the XACML Obligations; the Obligation is defined as follows:

"Obligation - An operation specified in a policy or policy set that should be performed by the PEP in conjunction with the enforcement of an authorisation decision"

In our case, the operation to be carried out is sending the request to the suitable provider; for each user type value, a policy can be defined with the following features:

- a rule matching a target subject type and having effect "permit";
- an obligation to send the request to the suitable Service Provider if the policy evaluates to "permit";

Annex A: Abstract Test Suite (Normative)

1 Conformance Test Class: The core

1.1 Test Module M.1 Basic requirements

This Test Module is made up of Abstract Test Cases which establishes preliminaries conditions to the actual test cases, such as the protocol bindings, messaging framework, adoption of specification and algorithms to encrypt and sign the messages.

1.1.1 ATC-1.1 SOAP Binding of the request/response messages

Test case identifier	"urn:ogc:cite:ats:um:0.0.4:07-118r1:soap-binding"
Test assertion [purpose]	Operations shall support the embedding of requests and responses in SOAP messages. Only SOAP messaging (via HTTP/POST or HTTPS/POST) with document/literal style shall be used. Messages should conform to SOAP 1.2. The following assertions shall hold: • The SOAP Header holds the authentication token [if applicable], embedded in a WS-Security element. • The SOAP Body holds the message payload.
Test method	Send a request embedded in a SOAP Envelope over the HTTP[S] protocol; verify that a response is returned (even in case of failure) embedded in a SOAP Envelope over the HTTP[S] protocol. The SOAP Envelope shall be compliant with version 1.2 of SOAP (namespace http://schemas.xmlsoap.org/soap/envelope/)
Reference	Clause 6.2
Test type	Capability

1.1.2 ATC-1.2 SAML token encoding for authentication information

Test case identifier	"urn:ogc:cite:ats:um:0.0.4:07-118r1:saml-token"

Test assertion [purpose]	SAML 1.1 is proposed to encode the user authentication token. WS-Security is proposed to encode the SAML assertions in the SOAP header. A SAML token is made of the following statements: • Authentication statements: a typical authentication statement asserts Subject S authenticated at time t using authentication method m. • Attribute statements: a typical attribute statement asserts Subject S is associated with attributes X,Y,Z having values v1,v2,v3. The set of attribute statements returned in a SAML token shall be defined arbitrarily.
Test method	• Send a valid RST to [the Identity Provider of] the Federating Entity; the response shall contain a SOAP message whose SOAP Body holds an encrypted SAML token. • Decrypt the SAML token using the Orchestrating Service Provider private key, and verify that the SAML token has the expected statements covering the (arbitrarily) defined set of attributes. **Pre-condition:** For carrying out this test, the client needs a copy of the Orchestrating Service Provider private key. Since the Orchestrating Service Provider is a component of the Federating Entity, the client ultimately holds a copy of the private key of the Federating Entity. For testing purposes, a couple of private/public keys can be generated using available tools (for example, 'keytool' on JRE), where the certificate with the public key is self-signed by the Federating Entity itself
Reference	Clauses 6.4.5 and 6.4.6
Test type	Capability

1.1.3 ATC-1.3 Encryption algorithm for SAML token

Encryption of the SAML token is performed by the STS when creating an RSTR.

Decryption and encryption of SAML token is performed by [the PEP of] the Orchestrating Service Provider during authorisation request orchestration [assuming that an Orchestrating Service Provider receives all of the incoming authorisation requests].

Decryption of SAML token is performed by [the PEP of] the final Service Provider when handling the authorisation request.

Test case identifier	urn:ogc:cite:ats:um:0.0.6:07-118r4:encryption

Test assertion [purpose]	The encryption algorithm used for the SAML token is the AES-128. The symmetric AES-128 key used for encryption is made available to the recipient as follows: • The key is encrypted using the asymmetric RSA encryption algorithm with the public key of the recipient. • The rssulting value is added to the encrypted message, using the XML Encryption [NR17] and XML Signature [NR18] specifications
Test method	1. Send a valid RST to [the Identity Provider of] the Federating Entity; the response shall contain a SOAP message whose SOAP Body holds encrypted data. 2. Decrypt the AES-128 symmetric key contained in the response using the Orchestrating Service Provider private key. 3. Decrypt the SAML token using the AES-128 symmetric key and check that the result contains a valid SAML Assertion **Pre-condition:** For carrying out this test, the client needs a copy of the Orchestrating Service Provider private key. Since the Orchestrating Service Provider is a component of the Federating Entity, the client ultimately holds a copy of the private key of the Federating Entity. For testing purposes, a couple of private/public keys can be generated using available tools (for example, 'keytool' on JRE), where the certificate with the public key is self-signed by the Federating Entity itself.
Reference	Clauses 6.4.1 and 6.4.6.1
Test type	Basic

1.1.4 ATC-1.4 Digest algorithm for signing SAML tokens

Test case identifier	urn:ogc:cite:ats:um:0.0.6:07-118r4:digest
Test assertion [purpose]	The secure hash SHA-1 digital signature message digest algorithm is proposed. The SAML Token is signed before encryption. The XML signature <ds:Signature> element of can be used for signature, according to WS-Security specification.

Test method	1. Send an RST to [the Identity Provider of] the Federating Entity 2. Check that the response contains an encrypted SAML token and decrypt it following the process specified in ATC 1.3 3. Digest the SAML token using the SHA-1 algorithm 4. Decrypt the signature using the private key of the Orchestrating Service Provider. 5. Compare the digest obtained at step 3 with tha value resulting from step 4. The two values shall match. **Pre-condition:** For carrying out this test, the client needs a copy of the Orchestrating Service Provider private key. Since the Orchestrating Service Provider is a component of the Federating Entity, the client ultimately holds the private key of the Federating Entity. • For testing purposes, a couple of private/public keys can be generated using available tools (for example, 'keytool' on JRE), where the certificate with the public key is self-signed by the Federating Entity
Reference	Clause 6.4.2 and 6.4.6.2
Test type	Basic

1.1.5 Test Module M.2 Authentication

This Test Module is made up of Abstract Test Cases related to the management of RSTs and responses.

- The first test case is related to the following scenario: the client issues an RST to the Federating Entity without indicating the Identity Provider in charge of fulfilling the request; this is the default case, and implies that the recipient Federating Entity shall fulfil the request;

- The second test case is related to the following scenario: the client issues an RST to the Federating Entity explicitly indicating the Federating Entity as the Identity Provider in charge of fulfilling the request;

- The first test case is related to the following scenario: the client issues an RST to the Federating Entity explicitly indicating an external entity as the Identity Provider in charge of fulfilling the request;

A final test case (to be split into more specific test cases when the present specification will be completed) is devoted to handing of request failure

1.1.6 ATC-2.1 No request designated IdP - Federating entity resolved as IdP

Test case identifier	"urn:ogc:cite:ats:um:0.0.6:07-118r4:authentication-1"

Test assertion [purpose]	The Federating Entity is assumed to be the request designated IdP. In this use case the RST contains only the user credentials (username, password).
Test method	The client issues an RST with: • mandatory username/password information; Verify that the client receives a SAML token which is signed and encrypted according to ATC-1.4. The protocol to be used for the message exchange is SOAP/HTTPS. The SAML token shall be returned in the SOAP Body of the response.
Reference	Clause 6.4.3.1
Test type	Capability

1.1.7 ATC-2.2 Federating Entity is request designated Id

Test case identifier	"urn:ogc:cite:ats:um:0.0.6:07-118r4:authentication-2"
Test assertion [purpose]	The Federating Entity is the request designated IdP. In this use case the RST contains an identifier for the Federating Entity STS.
Test method	The client issues an RST with: • mandatory username/password information; • an identifier for the Federating Entity. Verify that the client receives a SAML token which is signed and encrypted according to ATC-1.4. The protocol to be used for the message exchange is SOAP/HTTPS. The SAML token shall be returned in the SOAP Body of the response.
Reference	Clause 6.4.3.1
Test type	Capability

1.1.8 ATC-2.3 External Entity is request designated IdP

Test case identifier	"urn:ogc:cite:ats:um:0.0.6:07-118r4:authentication-3"
Test assertion [purpose]	The External Entity is request designated IdP. In this use case the RST contains an identifier for the external entity.

Test method	The client issues an RST with: • mandatory username/password information; • an identifier for the External Entity. Verify that the client receives a SAML token which is signed and encrypted according to ATC-1.4. The protocol to be used for the message exchange is SOAP/HTTPS. The SAML token shall be returned in the SOAP Body of the response.
Reference	Clause 6.4.3.2
Test type	Capability

1.1.9 ATC-2.4 RST failure

Test case identifier	"urn:ogc:cite:ats:um:0.0.6:07-118r4:authentication-failure"
Test assertion [purpose]	The Federating Entity shall return a SOAP fault message if an RST cannot be fulfilled. The SOAP fault shall clearly indicate raison of failure
Test method	The client issues an RST to the Federating entity, with wrong credentials. Verify that a SOAP fault response is returned indicating reason of failure
Reference	Clause 7.1.4
Test type	Capability

1.2 Test Module M.3 Authorisation

This Test Module is made up of Abstract Test Cases related to the management of authorisation requests and responses.

Two abstract test cases are defined for authorisation requests, either for synchronous or asynchronous responses. In both test cases, the authorisation request contains a SAML token in the WS-Security element of the SOAP header. This SAML token is obtained from a previous RST and is used to control access to services.

A final test case (to be split into more specific test cases when the present specification will be completed) is devoted to handing of request failure

1.2.1 ATC-3.1 Authorisation with synchronous response

Test case identifier	"urn:ogc:cite:ats:um:0.0.6:07-118r4:synchronous-authorisation"
Test assertion [purpose]	Only an authorized client can access a requested protected service. The service request header contains a SAML Token returned by a previous successful RST.

Test method	Verify that the service to be invoked is protected, i.e. its WSDL specifies WS-Security policies. The client issues a request containing a SAML token previously obtained through authentication. Verify that the client is authorized to access the protected service, that is a successful response shall be returned.
Reference	Clauses 7.3.2.
Test type	Capability

1.2.2 ATC-3.2 Authorisation with asynchronous response

NOTE: This abstract test case is still under finalization

Test case identifier	"urn:ogc:cite:ats:um:0.0.6:07-118r4:asynchronous-authorization"
Test assertion [purpose]	Only an authorized client can access a requested protected service. The service request header contains a SAML Token returned by a previous successful RST and WS-Addressing information to allow dispatching of the response.
Test method	Verify that the service to be invoked is protected, i.e. its WSDL specifies WS-Security policies. The client issues a request containing a SAML token, previously obtained through authentication. The Service Provider shall return a service response according to the following format: • The SOAP Header contains a SAML Token which authenticates the Service Provider, signed with the private key of the Service Provider and encrypted with the public key of the Federating Entity; • The SOAP Body contains the actual response of the service. **Pre-condition:** The IUT shall support the asynchronous communication for the requested service.
Reference	Clauses 7.3.3
Test type	Capability

1.2.3 ATC-3.3 Authorisation request failure

Test case identifier	"urn:ogc:cite:ats:um:0.0.6:07-118r4:authorization-failure"

Test assertion [purpose]	The Service provider shall return a SOAP fault message if an authorisation request cannot be fulfilled. The SOAP fault shall clearly indicate raison of failure
Test method	The client issues a request containing a SAML token, previously signed and encrypted, but it is not authorized to access the protected service. Verify that a SOAP fault response is returned, such that: • the <faultstring> element holds an "Authorisation failure" [or equivalent] statement; • the <detail> element holds application specific information about the reason of failure.
Reference	Clause 7.2.3
Test type	Capability

Annex B: Schemas (Normative)

Since the schemas of WS-Trust have many optional elements, we provided here a narrower schema that limits the degree of freedom of the standard schemas, focusing on RST and RSTR. When the underlying child schemas can not be changed, English annotations are used to specify specific constraints. The constrained schema has been obtained by updating reference files from WS-Trust 1.3:
http://docs.oasis-open.org/ws-sx/ws-trust/200512/ws-trust-1.3.xsd

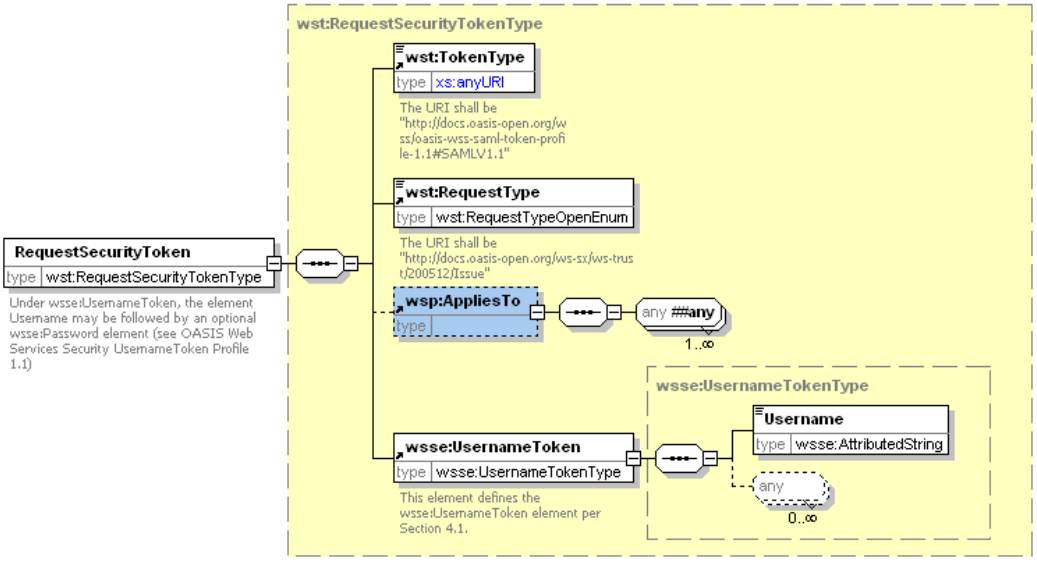
The constrained schema is compatible with the standard WS-Trust 1.3 (i.e. any service implementation conforming to constrained files shall also conform to the standard ones).

In the following, we provide, as support to the WS-Trust 1.3 schema, information on structure of RST, RSTR, then the constrained `ws-trust.xsd schema and oasis-sstc-saml-schema-assertion-1.1.xsd`.

For the following two subsections, namespace prefixes are defined in the following table:

Prefix	Namespace
ds	http://www.w3.org/2000/09/xmldsig#
saml	urn:oasis:names:tc:SAML:1.0:assertion
xenc	http://www.w3.org/2001/04/xmlenc#
wsp	http://schemas.xmlsoap.org/ws/2004/09/policy
wsse	http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd
wst	http://docs.oasis-open.org/ws-sx/ws-trust/200512/

RequestSecurityToken (RST)



Refer to WS-Trust 1.3 (§4.1 in [NR23]), with the following constraints:

wst:RequestSecurityToken/wst:TokenType
: is REQUIRED and shall have the following URI, defined in [NR11] (only SAML 1.1 is supported for the moment):
`http://docs.oasis-open.org/wss/oasis-wss-saml-token-profile-1.1#SAMLV1.1`

wst:RequestSecurityToken/wst:RequestType
: is REQUIRED and shall have the following URI, (only Issue action is supported by the RST, for the moment):
`http://docs.oasis-open.org/ws-sx/ws-trust/200512/Issue`

wst:RequestSecurityToken/wsp:AppliesTo
: is OPTIONAL. It shall contain a wsa:EndPointReference, itself containing a wsa:Address. This element shall be ignored for the moment. In the future, it can be used to make the STS more general, by providing SAML tokens that can be used by specified relying party, not only the main federating entity. The mechanism could be: if the AppliesTo element is absent, then the SAML token shall be encrypted with the public key of the federating entity known by the STS; if the AppliesTo element is present, then the WS-Address shall be used to retrieve the public key of a specific relying party and encrypt the SAML token accordingly, so that this relying party (other federating entity or GS) can use the SAML token directly.

wst:RequestSecurityToken/wsse:UsernameToken
: is REQUIRED. It contains the mandatory element Username, with the user id for which a SAML token is requested. In case of *RST with password*, a wsse:Password element is REQUIRED after Username. In case of *RST with signature*, it is REQUIRED to NOT put wsse:Password element.

Other elements defined in [NR23] are allowed in the RST but they shall be ignored by the STS complying with the present specification.

In case of *RST with signature*, it is REQUIRED to put in the SOAP header a wsse:Security element containing a ds:Signature element. The ds:Signature shall contain the digital

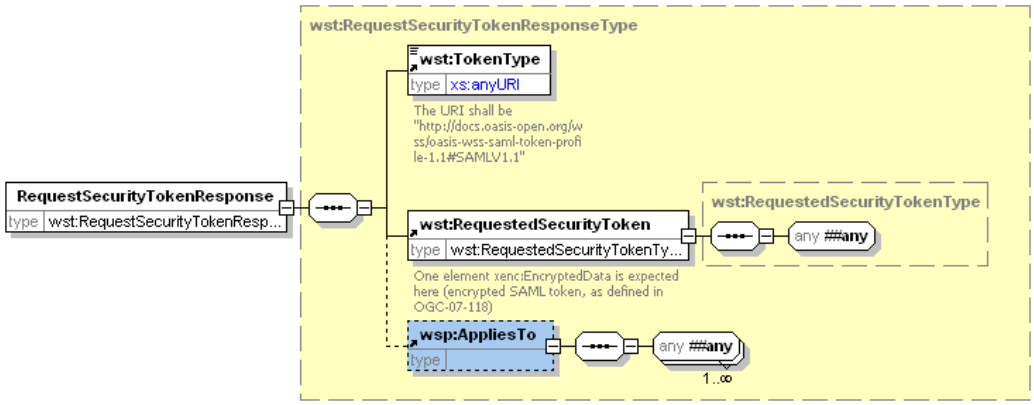
signature of the SOAP body (that contains the wst:RequestSecurityToken element), as a detached signature. The following

- The secure hash SHA-1 digital signature message digest algorithm is used, as supported by [NR15].
- The element that is signed is SOAP Body. The URI attribute of the <ds:Reference URI="..."> element shall refer to the <soap:Body> node being signed (using XPointer, see 4.3.3.3 in [NR18].
- The signature is “detached”.
- No certificate is put in the signature. This means that the STS verifying the signature has to know (from its keystore, for example) the public key of the requester, as an evidence of the trust it commits on this requester.
- A canonicalization method shall be used which eliminates namespace declarations that are not visibly used within the SAML token. A suitable algorithm is ”Exclusive XML Canonicalization” which is implemented through a digital signature declaration:

  ```
  <ds:CanonicalizationMethod
  Algorithm="http://www.w3.org/2001/10/xml-exc-c14n#"/>
  ```

  Note that the specified canonicalization algorithm omits the comments.

RequestSecurityTokenResponse (RSTR)



Refer to WS-Trust 1.3 (§4.1 in [NR23]), with the following constraints:

wst:RequestSecurityToken/wst:TokenType
: is REQUIRED and shall have the following URI, defined in [R11] (only SAML 1.1 is supported for the moment):
`http://docs.oasis-open.org/wss/oasis-wss-saml-token-profile-1.1#SAMLV1.1`

wst:RequestSecurityToken/wst:RequestedSecurityToken
: is REQUIRED an shall contains one `<xenc:EncryptedData>` element; once decrypted, it shall be a SAML 1.1 assertion, as defined in oasis-sstc-saml-schema-assertion-1.1.xsd (see below). Specific requirements concerning the encryption and signature of SAML assertion are provided in 6.4.1 and 6.4.2, respectively.

ws-trust.xsd

The following schema defines the types for RST and RSTR.

```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema targetNamespace="http://docs.oasis-open.org/ws-sx/ws-
trust/200512/" xmlns:wst="http://docs.oasis-open.org/ws-sx/ws-
trust/200512/" xmlns:wsa="http://www.w3.org/2005/08/addressing"
xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
xmlns:wsse="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-
wssecurity-secext-1.0.xsd"
xmlns:xenc="http://www.w3.org/2001/04/xmlenc#"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
elementFormDefault="qualified">
      <xs:import namespace="http://docs.oasis-
open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd"
schemaLocation="http://docs.oasis-open.org/wss/2004/01/oasis-200401-
wss-wssecurity-secext-1.0.xsd"/>
      <xs:import namespace="http://docs.oasis-
open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd"
schemaLocation="http://docs.oasis-open.org/wss/2004/01/oasis-200401-
wss-wssecurity-utility-1.0.xsd"/>
      <xs:import
namespace="http://schemas.xmlsoap.org/ws/2004/09/policy"
schemaLocation="http://schemas.xmlsoap.org/ws/2004/09/policy/ws-
policy.xsd"/>
      <xs:import namespace="http://www.w3.org/2005/08/addressing"
schemaLocation="http://www.w3.org/2006/03/addressing/ws-addr.xsd"/>
      <!-- WS-Trust Section 3.1 -->
      <xs:element name="RequestSecurityToken"
type="wst:RequestSecurityTokenType">
            <xs:annotation>
                  <xs:documentation>Under wsse:UsernameToken, the
element Username may be followed by an optional wsse:Password element
(see OASIS Web Services Security UsernameToken Profile
1.1)</xs:documentation>
            </xs:annotation>
      </xs:element>
      <xs:complexType name="RequestSecurityTokenType">
            <xs:sequence>
                  <xs:element ref="wst:TokenType"/>
                  <xs:element ref="wst:RequestType"/>
                  <xs:element ref="wsp:AppliesTo" minOccurs="0"/>
                  <xs:element ref="wsse:UsernameToken"/>
            </xs:sequence>
            <xs:attribute name="Context" type="xs:anyURI"
use="optional"/>
            <xs:anyAttribute namespace="##other"
processContents="lax"/>
      </xs:complexType>
      <xs:element name="TokenType">
            <xs:annotation>
                  <xs:documentation>The URI shall be
"http://docs.oasis-open.org/wss/oasis-wss-saml-token-profile-
1.1#SAMLV1.1"</xs:documentation>
            </xs:annotation>
```

```
            <xs:simpleType>
                  <xs:restriction base="xs:anyURI">
                        <xs:enumeration value="http://docs.oasis-
open.org/wss/oasis-wss-saml-token-profile-1.1#SAMLV1.1"/>
                        <xs:enumeration value="http://docs.oasis-
open.org/wss/oasis-wss-saml-token-profile-1.1#SAMLV2.0"/>
                  </xs:restriction>
            </xs:simpleType>
      </xs:element>
      <xs:element name="RequestType" type="wst:RequestTypeOpenEnum">
            <xs:annotation>
                  <xs:documentation>The URI shall be
"http://docs.oasis-open.org/ws-sx/ws-
trust/200512/Issue"</xs:documentation>
            </xs:annotation>
      </xs:element>
      <xs:simpleType name="RequestTypeOpenEnum">
            <xs:union memberTypes="wst:RequestTypeEnum xs:anyURI"/>
      </xs:simpleType>
      <xs:simpleType name="RequestTypeEnum">
            <xs:restriction base="xs:anyURI">
                  <xs:enumeration value="http://docs.oasis-
open.org/ws-sx/ws-trust/200512/Issue"/>
            </xs:restriction>
      </xs:simpleType>
      <!-- WS-Trust Section 3.2 -->
      <xs:element name="RequestSecurityTokenResponse"
type="wst:RequestSecurityTokenResponseType"/>
      <xs:complexType name="RequestSecurityTokenResponseType">
            <xs:sequence>
                  <xs:element ref="wst:TokenType"/>
                  <xs:element ref="wst:RequestedSecurityToken"/>
                  <xs:element ref="wsp:AppliesTo" minOccurs="0"/>
            </xs:sequence>
            <xs:attribute name="Context" type="xs:anyURI"
use="optional"/>
            <xs:anyAttribute namespace="##other"
processContents="lax"/>
      </xs:complexType>
      <xs:element name="RequestedSecurityToken"
type="wst:RequestedSecurityTokenType">
            <xs:annotation>
                  <xs:documentation>One element xenc:EncryptedData is
expected here (encrypted SAML token, as defined in OGC-07-
118)</xs:documentation>
            </xs:annotation>
      </xs:element>
      <xs:complexType name="RequestedSecurityTokenType">
            <xs:sequence>
                  <xs:any namespace="##any" processContents="lax"/>
            </xs:sequence>
      </xs:complexType>
</xs:schema>
```

oasis-sstc-saml-schema-assertion-1.1.xsd

The schema for SAML assertions 1.1 is defined at the following URL:

http://www.oasis-open.org/committees/download.php/3408/oasis-sstc-saml-schema-assertion-1.1.xsd

oasis-200401-wss-wssecurity-secext-1.0.xsd

Each service request may include, if required, the encrypted SAML token returned in the RSTR. In such situation, the SOAP header shall contain a `<wsse:Security>` element (WS-Security 1.1) having a `<xenc:EncryptedData>` (the SAML token) as child.

The schema defining the `<wsse:Security>` element is defined at the following URL:

http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd

Annex C: SOAP 1.1 Implementation (normative)

If SOAP 1.1 is used, only SOAP messaging (via HTTP/POST) with document/literal style shall be used. The expected SOAP action is:

```
http://docs.oasis-open.org/ws-sx/ws-trust/200512#RequestSecurityToken
```

Annex D: Example of SAML Token Attributes Specification (Non-Normative)

The following subset of attributes necessary to implement the basic EO DAIL policy steps are proposed to be included in the SAML token:

SAML Token attribute name	Description
Id	Unambiguous federated identity
C	Country of origin
O	Organisation
ProjectName	Names of projects with which user is affiliated.
Account	The account number
ServiceName	Associated services
UserProfile	Type of user (Commercial/GMES/Scientific)

Table 1: Attributes in SAML Token

Annex E: XACML Examples (Non-Normative)

Uses Case: restrict access for time period

```
<?xml version="1.0" encoding="UTF-8"?>

<Request  xmlns="urn:oasis:names:tc:xacml:2.0:context:schema:os"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="
urn:oasis:names:tc:xacml:2.0:context:schema:os http://docs.oasis-open.org/xacml/access_control-
xacml-2.0-context-schema-os.xsd">

  <Subject>

    <Attribute AttributeId="urn:oasis:names:tc:xacml:1.0:subject:subject-id" DataType="xs:string">

      <AttributeValue>anonymous</AttributeValue>

    </Attribute>

  </Subject>

  <Resource>

    <Attribute AttributeId="urn:oasis:names:tc:xacml:1.0:resource:resource-id" DataType="xs:string">

      <AttributeValue>WEB_Map_Server</AttributeValue>

    </Attribute>

  </Resource>

  <Action>

    <Attribute AttributeId="urn:oasis:names:tc:xacml:1.0:action:action-id" DataType="xs:string">

      <AttributeValue>GetMap</AttributeValue>

    </Attribute>

  </Action>

  <Environment/>

</Request>
```

Policy:

```
<?xml version="1.0" encoding="UTF-8"?>

<Policy xmlns="urn:oasis:names:tc:xacml:2.0:policy:schema:os" xmlns:xacml-
context="urn:oasis:names:tc:xacml:2.0:context:schema:os"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="
urn:oasis:names:tc:xacml:2.0:policy:schema:os http://docs.oasis-open.org/xacml/access_control-xacml-
2.0-policy-schema-os.xsd" PolicyId="urn:oasis:names:tc:xacml:2.0:example:policyid:HL-IDM-480"
RuleCombiningAlgId="urn:oasis:names:tc:xacml:1.0:rule-combining-algorithm:deny-overrides">

  <PolicyDefaults>

    <XPathVersion>http://www.w3.org/TR/1999/Rec-xpath-19991116</XPathVersion>

  </PolicyDefaults>

  <Target>
```

```
   <Resources>
    <Resource>
     <ResourceMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
      <AttributeValue
         DataType="http://www.w3.org/2001/XMLSchema#string">WEB_Map_Server</AttributeVal
ue>
      <ResourceAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:2.0:resource:resource-id"
         DataType="http://www.w3.org/2001/XMLSchema#string"/>
     </ResourceMatch>
    </Resource>
   </Resources>
  </Target>

  <Rule RuleId="urn:oasis:names:tc:xacml:2.0:example:ruleid:HL-IDM-480" Effect="Deny">
   <Description>
    User cannot access the service for getting maps  in the time range 9:00 AM - 12:00 AM
    </Description>
   <Target>
    <Actions>
     <Action>
      <ActionMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
       <AttributeValue
DataType="http://www.w3.org/2001/XMLSchema#string">GetMap</AttributeValue>
       <ActionAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:1.0:action:action-id"
         DataType="http://www.w3.org/2001/XMLSchema#string"/>
      </ActionMatch>
     </Action>
    </Actions>
   </Target>
   <Condition>
    <Apply FunctionId="urn:oasis:names:tc:xacml:2.0:function:time-in-range">
     <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:time-one-and-only">
      <EnvironmentAttributeDesignator
AttributeId="urn:oasis:names:tc:xacml:1.0:environment:current-time"
         DataType="http:www.w3.org/2001/XMLSchema#time"/>
     </Apply>
     <AttributeValue
DataType="http:www.w3.org/2001/XMLSchema#time">09:00:00</AttributeValue>
```

```
      <AttributeValue
DataType="http:www.w3.org/2001/XMLSchema#time">12:00:00</AttributeValue>
    </Apply>
   </Condition>
  </Rule>


  <Rule RuleId="urn:oasis:names:tc:xacml:2.0:example:ruleid:HL-IDM-480-OTHER"
Effect="Permit"/>


</Policy>
```

Uses Case: enforce rules for specific group of users

```
<?xml version="1.0" encoding="UTF-8"?>
<Request xmlns="urn:oasis:names:tc:xacml:2.0:context:schema:os"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="
urn:oasis:names:tc:xacml:2.0:context:schema:os http://docs.oasis-open.org/xacml/access_control-
xacml-2.0-context-schema-os.xsd">
  <Subject>
    <Attribute AttributeId="urn:oasis:names:tc:xacml:1.0:subject:subject-id" DataType="xs:string">
      <AttributeValue>dail_user_1</AttributeValue>
    </Attribute>
    <Attribute AttributeId="urn:ogc:um:eop:0.0.4:saml:role" DataType="xs:string">
      <AttributeValue>guest</AttributeValue>
    </Attribute>
  </Subject>
  <Resource>
    <Attribute AttributeId="urn:oasis:names:tc:xacml:1.0:resource:resource-id" DataType="xs:string">
      <AttributeValue>csw-ebrim_catalogue</AttributeValue>
    </Attribute>
  </Resource>
  <Action>
    <Attribute AttributeId="urn:oasis:names:tc:xacml:1.0:action:action-id" DataType="xs:string">
      <AttributeValue>GetRecords</AttributeValue>
    </Attribute>
  </Action>
  <Environment/>
</Request>
```

Policy:

```
<?xml version="1.0" encoding="UTF-8"?>

<Policy xmlns="urn:oasis:names:tc:xacml:2.0:policy:schema:os" xmlns:xacml-
context="urn:oasis:names:tc:xacml:2.0:context:schema:os"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="
urn:oasis:names:tc:xacml:2.0:policy:schema:os http://docs.oasis-open.org/xacml/access_control-xacml-
2.0-policy-schema-os.xsd" PolicyId="urn:oasis:names:tc:xacml:2.0:example:policyid:HL-IDM-490"
RuleCombiningAlgId="urn:oasis:names:tc:xacml:1.0:rule-combining-algorithm:deny-overrides">

 <PolicyDefaults>

  <XPathVersion>http://www.w3.org/TR/1999/Rec-xpath-19991116</XPathVersion>

 </PolicyDefaults>

 <Target>

  <Resources>

   <Resource>

    <ResourceMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">

     <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">

        csw-ebrim_catalogue

     </AttributeValue>

     <ResourceAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:2.0:resource:resource-id"

        DataType="http://www.w3.org/2001/XMLSchema#string"/>

    </ResourceMatch>

   </Resource>

  </Resources>

 </Target>

 <Rule RuleId="urn:oasis:names:tc:xacml:2.0:example:ruleid:HL-IDM-490" Effect="Deny">

  <Description>

   User with "guest" role cannot access the service in the time range 9:00 AM - 12:00 AM

  </Description>

  <Target>

   <Subjects>

    <Subject>

     <SubjectMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">

      <AttributeValue
DataType="http://www.w3.org/2001/XMLSchema#string">guest</AttributeValue>

       <SubjectAttributeDesignator AttributeId="urn:ogc:um:eop:0.0.4:saml:role"

        DataType="http://www.w3.org/2001/XMLSchema#string"/>

     </SubjectMatch>
```

```
      </Subject>
     </Subjects>
   </Target>
   <Condition>
    <Apply FunctionId="urn:oasis:names:tc:xacml:2.0:function:time-in-range">
     <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:time-one-and-only">
      <EnvironmentAttributeDesignator
AttributeId="urn:oasis:names:tc:xacml:1.0:environment:current-time"
          DataType="http:www.w3.org/2001/XMLSchema#time"/>
     </Apply>
     <AttributeValue
DataType="http:www.w3.org/2001/XMLSchema#time">09:00:00</AttributeValue>
     <AttributeValue
DataType="http:www.w3.org/2001/XMLSchema#time">12:00:00</AttributeValue>
    </Apply>
   </Condition>
  </Rule>
  <Rule RuleId="urn:oasis:names:tc:xacml:2.0:example:ruleid:HL-IDM-490-OTHER"
Effect="Permit"/>
</Policy>
```

Uses Case: restrict access to the type of data

```
<?xml version="1.0" encoding="UTF-8"?>
<Request xmlns="urn:oasis:names:tc:xacml:2.0:context:schema:os"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="
urn:oasis:names:tc:xacml:2.0:context:schema:os http://docs.oasis-open.org/xacml/access_control-
xacml-2.0-context-schema-os.xsd">
  <Subject>
   <Attribute AttributeId="urn:oasis:names:tc:xacml:1.0:subject:subject-id" DataType="xs:string">
    <AttributeValue>dail_user_1</AttributeValue>
   </Attribute>
   <Attribute AttributeId="urn:ogc:um:eop:0.0.4:saml:role" DataType="xs:string">
    <AttributeValue>guest</AttributeValue>
   </Attribute>
  </Subject>
  <Resource>
   <Attribute AttributeId="urn:oasis:names:tc:xacml:1.0:resource:resource-id" DataType="xs:string">
```

```
    <AttributeValue>csw-ebrim_catalogue</AttributeValue>
   </Attribute>
  </Resource>
  <Action>
   <Attribute AttributeId="urn:oasis:names:tc:xacml:1.0:action:action-id" DataType="xs:string">
    <AttributeValue>GetRecords</AttributeValue>
   </Attribute>
  </Action>
  <Environment/>
</Request>
```

Policy:

```
<?xml version="1.0" encoding="UTF-8"?>
<Policy xmlns="urn:oasis:names:tc:xacml:2.0:policy:schema:os" xmlns:xacml-
context="urn:oasis:names:tc:xacml:2.0:context:schema:os"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="
urn:oasis:names:tc:xacml:2.0:policy:schema:os http://docs.oasis-open.org/xacml/access_control-xacml-
2.0-policy-schema-os.xsd" PolicyId="urn:oasis:names:tc:xacml:2.0:example:policyid:HL-IDM-500"
RuleCombiningAlgId="urn:oasis:names:tc:xacml:1.0:rule-combining-algorithm:deny-overrides">
  <PolicyDefaults>
   <XPathVersion>http://www.w3.org/TR/1999/Rec-xpath-19991116</XPathVersion>
  </PolicyDefaults>
  <Target>
   <Resources>
    <Resource>
     <ResourceMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
      <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">
         csw-ebrim_catalogue
       </AttributeValue>
      <ResourceAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:2.0:resource:resource-id"
         DataType="http://www.w3.org/2001/XMLSchema#string"/>
     </ResourceMatch>
    </Resource>
   </Resources>
  </Target>
  <Rule RuleId="urn:oasis:names:tc:xacml:2.0:example:ruleid:HL-IDM-500" Effect="Deny">
   <Description>
    User with the "guest" role cannot access high-resolution data
```

```
    </Description>
   <Target>
    <Subjects>
     <Subject>
      <SubjectMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
       <AttributeValue
DataType="http://www.w3.org/2001/XMLSchema#string">guest</AttributeValue>
       <SubjectAttributeDesignator AttributeId="urn:ogc:um:eop:0.0.4:saml:role"
        DataType="http://www.w3.org/2001/XMLSchema#string"/>
      </SubjectMatch>
     </Subject>
    </Subjects>
   </Target>
   <Condition>
    <Apply FunctionId="urn:oasis:names:tc:xacml:2.0:function:double-greater-than">
     <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:double-one-and-only">
      <ResourceAttributeDesignator DataType="http://www.w3.org/2001/XMLSchema#double"
       AttributeId="urn:ogc:def:ebRIM-Slot:OGC-06-131:sensorResolution"/>
     </Apply>
     <AttributeValue DataType="http:www.w3.org/2001/XMLSchema#double">
       resolution_threshold
     </AttributeValue>
    </Apply>
   </Condition>
  </Rule>
  <Rule RuleId="urn:oasis:names:tc:xacml:2.0:example:ruleid:HL-IDM-500-OTHER"
Effect="Permit"/>
</Policy>
```

Uses Case: restricting access to users from certain geographic locations

```
<?xml version="1.0" encoding="UTF-8"?>
<Request xmlns="urn:oasis:names:tc:xacml:2.0:context:schema:os"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="
urn:oasis:names:tc:xacml:2.0:context:schema:os http://docs.oasis-open.org/xacml/access_control-
xacml-2.0-context-schema-os.xsd">
  <Subject>
```

```
  <Attribute AttributeId="urn:oasis:names:tc:xacml:1.0:subject:subject-id" DataType="xs:string">
    <AttributeValue>dail_user_1</AttributeValue>
  </Attribute>
  <Attribute AttributeId="urn:ogc:um:eop:0.0.4:saml:country" DataType="xs:string">
    <AttributeValue>France</AttributeValue>
  </Attribute>
 </Subject>
 <Resource>
  <Attribute AttributeId="urn:oasis:names:tc:xacml:1.0:resource:resource-id" DataType="xs:string">
    <AttributeValue>csw-ebrim_catalogue</AttributeValue>
  </Attribute>
 </Resource>
 <Action>
  <Attribute AttributeId="urn:oasis:names:tc:xacml:1.0:action:action-id" DataType="xs:string">
    <AttributeValue>GetRecords</AttributeValue>
  </Attribute>
 </Action>
 <Environment/>
</Request>
```

Policy:

```
<?xml version="1.0" encoding="UTF-8"?>
<Policy xmlns="urn:oasis:names:tc:xacml:2.0:policy:schema:os" xmlns:xacml-
context="urn:oasis:names:tc:xacml:2.0:context:schema:os"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="
urn:oasis:names:tc:xacml:2.0:policy:schema:os http://docs.oasis-open.org/xacml/access_control-xacml-
2.0-policy-schema-os.xsd" PolicyId="urn:oasis:names:tc:xacml:2.0:example:policyid:HL-IDM-550"
RuleCombiningAlgId="urn:oasis:names:tc:xacml:1.0:rule-combining-algorithm:deny-overrides">
 <PolicyDefaults>
  <XPathVersion>http://www.w3.org/TR/1999/Rec-xpath-19991116</XPathVersion>
 </PolicyDefaults>
 <Target>
  <Resources>
   <Resource>
    <ResourceMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
     <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">
        csw-ebrim_catalogue
     </AttributeValue>
```

```
        <ResourceAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:2.0:resource:resource-id"
            DataType="http://www.w3.org/2001/XMLSchema#string"/>
       </ResourceMatch>
     </Resource>
   </Resources>
  </Target>
  <Rule RuleId="urn:oasis:names:tc:xacml:2.0:example:ruleid:HL-IDM-550" Effect="Deny">
   <Description>
    User from the "France" country cannot access the service
   </Description>
   <Target>
    <Subjects>
     <Subject>
      <SubjectMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
       <AttributeValue
DataType="http://www.w3.org/2001/XMLSchema#string">France</AttributeValue>
        <SubjectAttributeDesignator AttributeId="urn:ogc:um:eop:0.0.4:saml:country"
         DataType="http://www.w3.org/2001/XMLSchema#string"/>
       </SubjectMatch>
      </Subject>
     </Subjects>
   </Target>
  </Rule>
  <Rule RuleId="urn:oasis:names:tc:xacml:2.0:example:ruleid:HL-IDM-550-OTHER"
Effect="Permit"/>
</Policy>
```

Annex F: Example of WSDL using WS-Policy (Non-Normative)

-To be completed-

Annex G: ESA UM-SSO / EO-DAIL Integration

UM-SSO deployed at ESA is an operational Single Sign-On system for ESA Web-based Applications which could be adopted by other EO Providers as well. It features typical UM functions (login-authentication, registration-account maintenance, access control). It is based on Shibboleth system ([OR1]). It allows ESA Web applications to outsource the sign-on process and offers the user access to several ESA EO Portals with one single sign-on on his browser ("WEB-SSO").

The present section provides specific information of usage the present interface in the context of integration of ESA UM-SSO with EO-DAIL.

ESA UM-SSO defines a specific security domain, which is separated from the security domain defined by EO-DAIL, which complies with the present interface. In concrete terms, the UM-SSO IdP authenticates ESA UM-SSO users without providing the SAML token defined by the present interface.

In this specific context, only the RST with signature shall be used (see 6.4.3.4).

In order to establish a trust relationship between the two security domains, a given Client *C* of ESA UM-SSO security domain shall provides its public key to the EO-DAIL STS. The trust relationship between *C* and EO-DAIL IdP is established as soon as the EO-DAIL security administrator has put this public key in the keystore of EO-DAIL IdP. From that point, the client *C* can obtain SAML token for any UM-SSO authenticated users by issuing RST with signature. The sequence of steps is as follows:

1. A user *U* activates a function on client *C*, that shall use an EO-DAIL service
2. The UM-SSO checkpoint on *C* relays the authentication to ESA UM-SSO IdP
3. User *U* enters his/her credentials and successfully signs on ESA UM-SSO IdP
4. The UM-SSO checkpoint on *C* sends a GET request containing UM-SSO-ID in HTTP header
5. *C* prepares a RST with signature, by putting UM-SSO-ID as username and by signing the request.
6. *C* issues the RST to EO-DAIL STS.
7. EO-DAIL STS verifies RST signature and returns an encrypted SAML token.
8. *C* issues a service request to EO-DAIL with encrypted SAML token in SOAP header.