Web Services Security
X509 Certificate Token Profile

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Abstract:
This document describes how to use X509 Certificates with the WS-Security specification.

Status:
This is an interim draft. Please send comments to the editors.

Committee members should send comments on this specification to the wss@lists.oasis-open.org list. Others should subscribe to and send comments to the wss-comment@lists.oasis-open.org list. To subscribe, visit http://lists.oasis-open.org/ob/adm.pl.

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

Table of Contents

1 Introduction

This specification describes the use of X509 certificates with respect to the WS-Security specification.

An X.509 Certificate specifies a binding between a public key and a set of attributes that include a subject name, issuer name, serial number and validity interval. This binding may be subject to subsequent revocation advertised by mechanisms that include issue of CRLs, OCSP tokens or mechanisms that are outside the X.509 framework such as XKMS.

An X.509 Certificate may be used to establish the authenticity of a public key used to authenticate a WS-Security enhanced message or to identify the public key under which a WS-Security enhanced message is encrypted.

Note that Section 1 is non-normative.

2 Notations and Terminology

This section specifies the notations, namespaces, and terminology used in this specification.

2.1 Notational Conventions

The keywords "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC2119.

Namespace URIs (of the general form "some-URI") represent some application-dependent or context-dependent URI as defined in RFC2396.

This specification is designed to work with the general SOAP message structure and message processing model, and should be applicable to any version of SOAP. The current SOAP 1.2 namespace URI is used herein to provide detailed examples, but there is no intention to limit the applicability of this specification to a single version of SOAP.

Readers are presumed to be familiar with the terms in the Internet Security Glossary.

2.2 Namespaces

The XML namespace URIs that MUST be used by implementations of this specification are as follows (note that different elements in this specification are from different namespaces):

```
http://schemas.xmlsoap.org/ws/2002/xx/secext
http://schemas.xmlsoap.org/ws/2002/xx/utility
```

The following namespaces are used in this document:

Prefix	Namespace
S	http://www.w3.org/2001/12/soap-envelope
ds	http://www.w3.org/2000/09/xmldsig#
xenc	http://www.w3.org/2001/04/xmlenc#
wsse	http://schemas.xmlsoap.org/ws/2002/xx/secext
wsu	http://schemas.xmlsoap.org/ws/2002/xx/utility

2.3 Terminology

This specification employs the terminology defined in the WS-Security Core Specification.

3 Usage

This section describes the profile (specific mechanisms and procedures) for the X509 binding of WS-Security.

Identification: urn:oasis:names:tc:WSS:1.0:profiles:WSS-X509-token

Contact information: TBD

Description: Given below.

Updates: None.

3.1 Processing Model

The processing model for WS-Security with X509 certificates is no different from that of WS-Security with other token formats as described in WS-Security .

3.2 Attaching Security Tokens

X.509 Certificates that are attached as security tokens within a WS-Security enhanced message SHOULD be attached by means of the `<wsse:BinarySecurityToken>` element.

The WS-Security specification indicates that X.509 certificates MAY be described inside of a `<ds:KeyInfo>` element, however, it is RECOMMENDED that they be specified using a `<wsse:BinarySecurityToken>`. If, however, an implementation needs to use `<ds:KeyInfo>`, it SHOULD place the `<ds:KeyInfo>` element as a child of the `<wsse:Security>` header rather than embedded within the signature. This allows receivers to have a single processing model.

The following values are defined for the ValueType attribute of the `<wsse:BinarySecurityToken>` element.

QName	Description
wsse:X509v3	X.509 v3 end entity certificate
wsse:PKCS7	An X.509 certificate chain packaged in a PKCS#7 wrapper

The following example illustrates a SOAP message with an X509 Certificate.

```
<S:Envelope xmlns:S="...">
    <S:Header>
        <wsse:Security xmlns:wsse="...">

            <wsse:BinarySecurityToken
              xmlns:wsse="http://schemas.xmlsoap.org/ws/2002/04/secext"
              Id="myToken"
              ValueType="wsse:X509v3"
              EncodingType="wsse:Base64Binary">
              MIIEZzCCA9CgAwIBAgIQEmtJZc0...
          </wsse:BinarySecurityToken>

            ...
        </wsse:Security>
    </S:Header>
```

```
    <S:Body>
        ...
    </S:Body>
</S:Envelope>
```

3.3 Identifying Certificates

3.3.1 Identifying End Entity Certificates by Value

An attached X.509 certificate that identifies an end entity is attached by means of the wsse:BinarySecurityToken element and referenced by means of a wsse:SecurityTokenReference element that contains a wsse:KeyIdentifier element. The wsu:Id attribute of the wsse:KeyIdentifier element references the value of the wsu:Id attribute specified in the wsse:BinarySecurityToken.

The following example shows a SOAP message that contains an X509v3 Certificate as a binary token:

```
Example TBS
<S:Envelope xmlns:S="...">
    <S:Header>
        <wsse:Security xmlns:wsse="...">

            <wsse:BinarySecurityToken
              xmlns:wsse="http://schemas.xmlsoap.org/ws/2002/04/secext"
              Id="myToken"
              ValueType="wsse:X509v3"
              EncodingType="wsse:Base64Binary">
              MIIEZzCCA9CgAwIBAgIQEmtJZc0...
          </wsse:BinarySecurityToken>

            ...
        </wsse:Security>
    </S:Header>
    <S:Body>
        ...
    </S:Body>
</S:Envelope>
```

3.3.2 Identifying and Referencing Certificate Chains

An attached X.509 certificate that identifies an end entity is attached by means of the wsse:BinarySecurityToken element and referenced by means of a wsse:SecurityTokenReference element that contains a wsse:KeyIdentifier element. The wsu:Id attribute of the wsse:KeyIdentifier element references the value of the wsu:Id attribute specified in the wsse:BinarySecurityToken.

The wsse:BinarySecurityToken element contains a PKCS#7 SignedData object, with the only significant field being certificates. In particular, the signature and the contents are ignored. If no certificates are present, a zero-length CertPath is assumed. Warning: PKCS#7 does not maintain the order of certificates in a certification path. This means that if a CertPath is converted to PKCS#7 encoded bytes and then converted back, the order of the certificates may change, potentially rendering the CertPath invalid. Users should be aware of this behavior. See [PKCS7] for more information.

The following example shows a SOAP message that contains an X509v3 Certificate chain encoded inside a PKCS#7 package:

```
Example TBS
<S:Envelope xmlns:S="...">
    <S:Header>
        <wsse:Security xmlns:wsse="...">

            <wsse:BinarySecurityToken
              xmlns:wsse="http://schemas.xmlsoap.org/ws/2002/04/secext"
              Id="myToken"
              ValueType="wsse:PKCS7"
              EncodingType="wsse:Base64Binary">
              MIIEZzCCA9CgAwIBAgIQEmtJZc0...
          </wsse:BinarySecurityToken>

            ...
        </wsse:Security>
    </S:Header>
    <S:Body>
        ...
    </S:Body>
</S:Envelope>
```

3.3.3 Identifying End Entity Certificates by Reference

An X.509 certificate that identifies an end entity that is not attached to the message payload is referenced by means of the Issuer Subject Name and Serial Number using the XML Signature <X509IssuerSerial> element.

The following example shows a SOAP message that identifies an X.509v3 end entity certificate by reference to the Issuer and serial number:

```
Example TBS
<S:Envelope xmlns:S="...">
    <S:Header>
        <wsse:Security xmlns:wsse="...">

             <ds:KeyInfo>
                <X509Data>
                   <X509IssuerSerial>
                      <X509IssuerName>CN=TAMURA Kent, OU=TRL, O=IBM,
                      L=Yamato-shi, ST=Kanagawa, C=JP</X509IssuerName>
                      <X509SerialNumber>12345678</X509SerialNumber>
                   </X509IssuerSerial>
                   <X509SKI>31d97bd7</X509SKI>
                   </X509Data>
             </ds:KeyInfo>

            ...
        </wsse:Security>
    </S:Header>
    <S:Body>
        ...
    </S:Body>
</S:Envelope>
```

3.4 Authentication

When an X.509 certificate is used to specify a signature key, the signature algorithm MUST be a digital signature algorithm.

The value of the signature key is the value of the public key specified in the certificate.

3.5 Encryption

When an X.509 certificate is used to specify an encryption key, the encryption algorithm MUST be a public key encryption algorithm.

The certificate that specifies the encryption key SHOULD be identified by reference since the receiver only requires the use of the certificate to identify the corresponding encryption key and does not require the certificate or the certificate chain to authenticate the public key it holds.

The value of the encryption key is the value of the public key specified in the certificate.

3.6 Error Codes

When using X509 Certificates the error codes defined in the WS-Security specification MUST be used.

If an implementation requires the use of a custom error it is recommended that a sub-code be defined as an extension of one of the codes defined in the WS-Security specification.

3.7 Threat Model and Countermeasures

The use of X509 certificates with WS-Security introduces no new threats beyond those identified for WS-Security with other types of security tokens.

Message alteration and eavesdropping can be addressed by using the integrity and confidentiality mechanisms described in WS-Security. Replay attacks can be addressed by using message timestamps and caching, as well as other application-specific tracking mechanisms. For X.509 certificates ownership is verified by use of keys, man-in-the-middle attacks are generally mitigated.

It is strongly RECOMMENDED that all relevant and immutable message data be signed.

It should be noted that transport-level security MAY be used to protect the message and the security token.

4 Acknowledgements

This specification was developed as a result of joint work of many individuals from the WSS TC including: TBD

The input specifications for this document were developed as a result of joint work with many individuals and teams, including: Keith Ballinger, Microsoft, Bob Blakley, IBM, Allen Brown, Microsoft, Joel Farrell, IBM, Mark Hayes, VeriSign, Kelvin Lawrence, IBM, Scott Konersmann, Microsoft, David Melgar, IBM, Dan Simon, Microsoft, Wayne Vicknair, IBM.

5 References

[DIGSIG] Informational RFC 2828, "Internet Security Glossary," May 2000.

[KEYWORDS] S. Bradner, "Key words for use in RFCs to Indicate Requirement Levels," RFC 2119, Harvard University, March 1997

[SOAP] W3C Note, "SOAP: Simple Object Access Protocol 1.1," 08 May 2000.

[URI] T. Berners-Lee, R. Fielding, L. Masinter, "Uniform Resource Identifiers (URI): Generic Syntax," RFC 2396, MIT/LCS, U.C. Irvine, Xerox Corporation, August 1998.

[WS-Security] TBS – point to the OASIS draft

[XML-ns] W3C Recommendation, "Namespaces in XML," 14 January 1999.

[XML Signature] W3C Recommendation, "XML Signature Syntax and Processing," 12 February 2002.

[PKCS7] **TBS** http://www.rsasecurity.com/rsalabs/pkcs/pkcs-7/index.html

[X509] **TBS**

[PKIPATH] **TBS**
ftp://ftp.bull.com/pub/OSIdirectory/DefectResolution/TechnicalCorrigenda/ApprovedTechnicalCorrigendaToX.509/8%7CX.509-TC1(4th).pdf.

Appendix A: Revision History

Rev	Date	What
01	18-Sep-02	Initial draft based on input documents and editorial review
03	30-Jan-03	Changes in title
04	19-May-03	Added by reference and pkipath modes of cert identification. Added section 1 introduction, changes to formatting etc.

Appendix B: Notices

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