

[MS-WSTEP-Diff]:

WS-Trust X.509v3 Token Enrollment Extensions

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1 Introduction

The WS-Trust X.509v3 Token Enrollment Extensions are extensions of WS-Trust that are used by a system to request that a certificate be issued.

The communication is initiated by a requesting client who requests a new certificate, retrieval of an issued certificate, or retrieval of a server certificate. The server processes the request and generates a response based on the request type.

Sections 1.5, 1.8, 1.9, 2, and 3 of this specification are normative. All other sections and examples in this specification are informative.

1.1 (Updated Section) Glossary

This document uses the following terms:

Abstract Syntax Notation One (ASN.1): A notation to define complex data types to carry a message, without concern for their binary representation, across a network. ASN.1 defines an encoding to specify the data types with a notation that does not necessarily determine the representation of each value. ASN.1 encoding rules are sets of rules used to transform data that is specified in the ASN.1 language into a standard format that can be decoded on any system that has a decoder based on the same set of rules. ASN.1 and its encoding rules were once part of the same standard. They have since been separated, but it is still common for the terms ASN.1 and Basic Encoding Rules (BER) to be used to mean the same thing, though this is not the case. Different encoding rules can be applied to a given ASN.1 definition. The choice of encoding rules used is an option of the protocol designer. ASN.1 is described in the following specifications: [ITUX660] for general procedures; [ITUX680] for syntax specification; [ITUX690] for the Basic Encoding Rules (BER), Canonical Encoding Rules (CER), and Distinguished Encoding Rules (DER) encoding rules; and [ITUX691] for the Packed Encoding Rules (PER). Further background information on ASN.1 is also available in [DUBUISSON].

certificate: When referring to X.509v3 certificates, that information consists of a public key, a distinguished name (DN) of some entity assumed to have control over the private key corresponding to the public key in the certificate, and some number of other attributes and extensions assumed to relate to the entity thus referenced. Other forms of certificates can bind other pieces of information.

Certificate Management Messages over CMS (CMC): An internet standard for transport mechanisms for CMS [RFC2797].

certification authority (CA): A third party that issues public key certificates. Certificates serve to bind public keys to a user identity. Each user and certification authority (CA) can decide whether to trust another user or CA for a specific purpose, and whether this trust should be transitive. For more information, see [RFC3280].

Hypertext Transfer Protocol Secure (HTTPS): An extension of HTTP that securely encrypts and decrypts web page requests. In some older protocols, "Hypertext Transfer Protocol over Secure Sockets Layer" is still used (Secure Sockets Layer has been deprecated). For more information, see [SSL3] and [RFC5246].

Public Key Cryptography Standards (PKCS): A group of Public Key Cryptography Standards published by RSA Laboratories.

security token service (STS): A special type of server defined in WS-Trust [WSTrust1.3].

SOAP action: The HTTP request header field used to indicate the intent of the SOAP request, using a URI value. See [SOAP1.1] section 6.1.1 for more information.

SOAP fault: A container for error and status information within a SOAP message. See [SOAP1.2-1/2007] section 5.4 for more information.

SOAP message: An XML document consisting of a mandatory SOAP envelope, an optional SOAP header, and a mandatory SOAP body. See [SOAP1.2-1/2007] section 5 for more information.

Unicode: A character encoding standard developed by the Unicode Consortium that represents almost all of the written languages of the world. The Unicode standard [UNICODE5.0.0/2007] provides three forms (UTF-8, UTF-16, and UTF-32) and seven schemes (UTF-8, UTF-16, UTF-16 BE, UTF-16 LE, UTF-32, UTF-32 LE, and UTF-32 BE).

Web Services Description Language (WSDL): An XML format for describing network services as a set of endpoints that operate on messages that contain either document-oriented or procedure-oriented information. The operations and messages are described abstractly and are bound to a concrete network protocol and message format in order to define an endpoint. Related concrete endpoints are combined into abstract endpoints, which describe a network service. WSDL is extensible, which allows the description of endpoints and their messages regardless of the message formats or network protocols that are used.

X.509: An ITU-T standard for public key infrastructure subsequently adapted by the IETF, as specified in [RFC3280].

XML: The Extensible Markup Language, as described in [XML1.0].

XML namespace: A collection of names that is used to identify elements, types, and attributes in XML documents identified in a URI reference [RFC3986]. A combination of XML namespace and local name allows XML documents to use elements, types, and attributes that have the same names but come from different sources. For more information, see [XMLNS-2ED].

XML Schema (XSD): A language that defines the elements, attributes, namespaces, and data types for XML documents as defined by [XMLSCHEMA1/2] and [~~W3C XSD~~XMLSCHEMA2/2] standards. An XML schema uses XML syntax for its language.

MAY, SHOULD, MUST, SHOULD NOT, MUST NOT: These terms (in all caps) are used as defined in [RFC2119]. All statements of optional behavior use either MAY, SHOULD, or SHOULD NOT.

1.2 References

Links to a document in the Microsoft Open Specifications library point to the correct section in the most recently published version of the referenced document. However, because individual documents in the library are not updated at the same time, the section numbers in the documents may not match. You can confirm the correct section numbering by checking the Errata.

1.2.1 Normative References

We conduct frequent surveys of the normative references to assure their continued availability. If you have any issue with finding a normative reference, please contact dohelp@microsoft.com. We will assist you in finding the relevant information.

[MS-WCCE] Microsoft Corporation, "Windows Client Certificate Enrollment Protocol".

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997, <http://www.rfc-editor.org/rfc/rfc2119.txt>

[RFC2797] Myers, M., Liu, X., Schaad, J., and Weinstein, J., "Certificate Management Messages Over CMS", RFC 2797, April 2000, <http://www.ietf.org/rfc/rfc2797.txt>

[RFC2986] Nystrom, M. and Kaliski, B., "PKCS#10: Certificate Request Syntax Specification", RFC 2986, November 2000, <http://www.ietf.org/rfc/rfc2986.txt>

[RFC3066] Alvestrand, H., "Tags for the Identification of Languages", BCP 47, RFC 3066, January 2001, <http://www.ietf.org/rfc/rfc3066.txt>

[RFC3852] Housley, R., "Cryptographic Message Syntax (CMS)", RFC 3852, July 2004, <http://www.ietf.org/rfc/rfc3852.txt>

[RFC5246] Dierks, T., and Rescorla, E., "The Transport Layer Security (TLS) Protocol Version 1.2", RFC 5246, August 2008, <http://www.ietf.org/rfc/rfc5246.txt>

[WSDL] Christensen, E., Curbera, F., Meredith, G., and Weerawarana, S., "Web Services Description Language (WSDL) 1.1", W3C Note, March 2001, <http://www.w3.org/TR/2001/NOTE-wsdl-20010315>

[WSSUTP] OASIS, "Web Services Security UsernameToken Profile 1.0", OASIS Standard, March 2004, <http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0.pdf>

[WSS] OASIS, "Web Services Security: SOAP Message Security 1.1 (WS-Security 2004)", February 2006, <http://www.oasis-open.org/committees/download.php/16790/wss-v1.1-spec-os-SOAPMessageSecurity.pdf>

[WSTrust1.3Schema] OASIS Standard, "WS-Trust 1.3", <http://docs.oasis-open.org/ws-sx/ws-trust/200512/ws-trust-1.3.xsd>

[WSTrust1.3] Lawrence, K., Kaler, C., Nadalin, A., et al., "WS-Trust 1.3", March 2007, <http://docs.oasis-open.org/ws-sx/ws-trust/200512/ws-trust-1.3-os.html>

[XMLNS] Bray, T., Hollander, D., Layman, A., et al., Eds., "Namespaces in XML 1.0 (Third Edition)", W3C Recommendation, December 2009, <http://www.w3.org/TR/2009/REC-xml-names-20091208/>

[XMLSCHEMA1] Thompson, H., Beech, D., Maloney, M., and Mendelsohn, N., Eds., "XML Schema Part 1: Structures", W3C Recommendation, May 2001, <http://www.w3.org/TR/2001/REC-xmlschema-1-20010502/>

[XMLSCHEMA2] Biron, P.V., Ed. and Malhotra, A., Ed., "XML Schema Part 2: Datatypes", W3C Recommendation, May 2001, <http://www.w3.org/TR/2001/REC-xmlschema-2-20010502/>

1.2.2 Informative References

[DUBUISSON] Dubuisson, O., "ASN.1 Communication between Heterogeneous Systems", Morgan Kaufmann, October 2000, ISBN: 0126333610.

[SCEP] Nourse, A., and Vilhuber, J. Ed., "Cisco Systems' Simple Certificate Enrollment Protocol", April 2009, <http://tools.ietf.org/html/draft-nourse-scep-19>

1.3 Overview

The WS-Trust X.509v3 Token Enrollment Extensions (WSTEP) defines the token enrollment profile for WS-Trust [WSTrust1.3] to allow a client to request X.509v3 certificates.

Existing certificate authorities (CAs) support Abstract Syntax Notation One (ASN.1) formats such as PKCS#10 ([RFC2986]), PKCS#7 ([RFC3852]), or CMC ([RFC2797]) to encode a certificate request, and those requests are carried in an existing protocol, such as Windows Client Certificate Enrollment Protocol [MS-WCCE] or Cisco's SCEP ([SCEP]). WSTEP also carries those requests from the client to the issuer.

WSTEP provides for issuance, renewal, and delayed-issuance scenarios for X.509v3 digital certificates. The server is known in WS-Trust [WSTrust1.3] terminology as a Security Token Service (STS).

The WS-Trust protocol [WSTrust1.3] definition provides the framework for the STS and for enrollment profile extensions. A typical client interacts with a STS with a request security token (RST) message. The STS responds to a client request security token message with a request security token response (RSTR) or a SOAP fault.

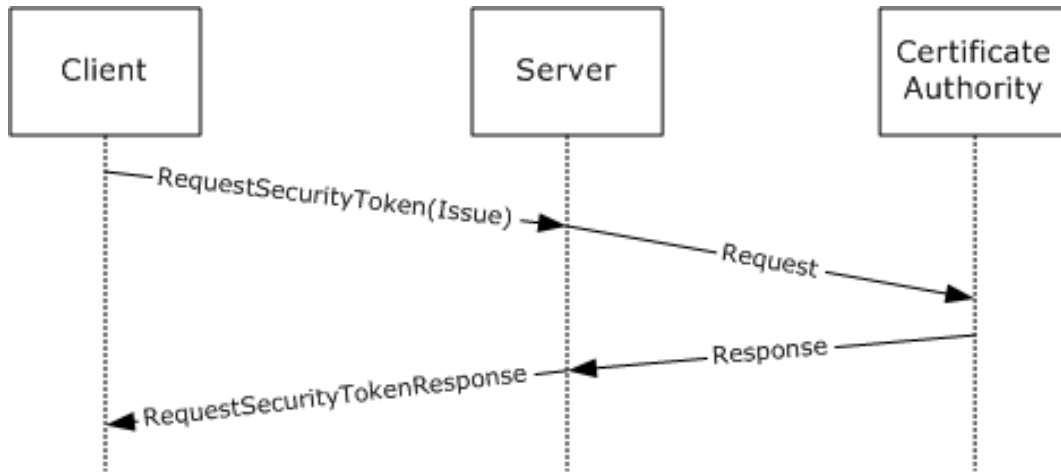


Figure 1: Typical sequence for certificate enrollment

The following figure shows a scenario in which a request cannot be satisfied immediately. In this scenario, the client makes a request, and the server reply indicates that the request is pending some other action. The client then queries the request at a later time, presumably after any conditions for its satisfaction have been met, and receives a reply that the request was issued, rejected, or is still pending.

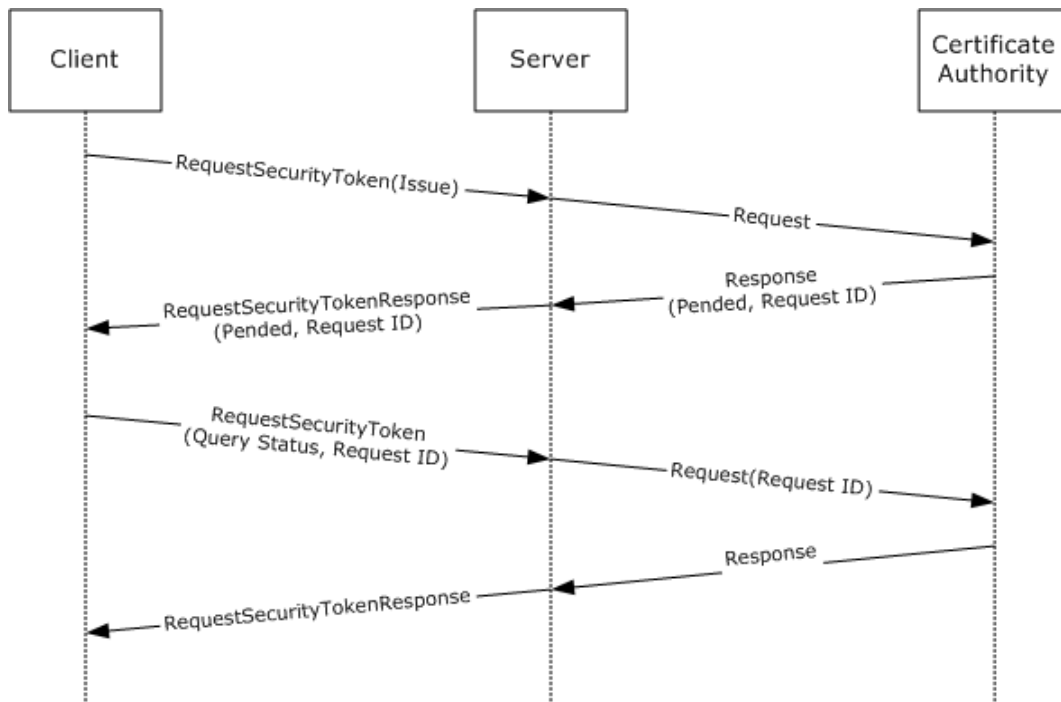


Figure 2: Typical sequence for a pended certificate enrollment request

In some circumstances, the client request could be rejected. In these instances, the STS responds with a SOAP fault. The following figure shows the typical sequence.

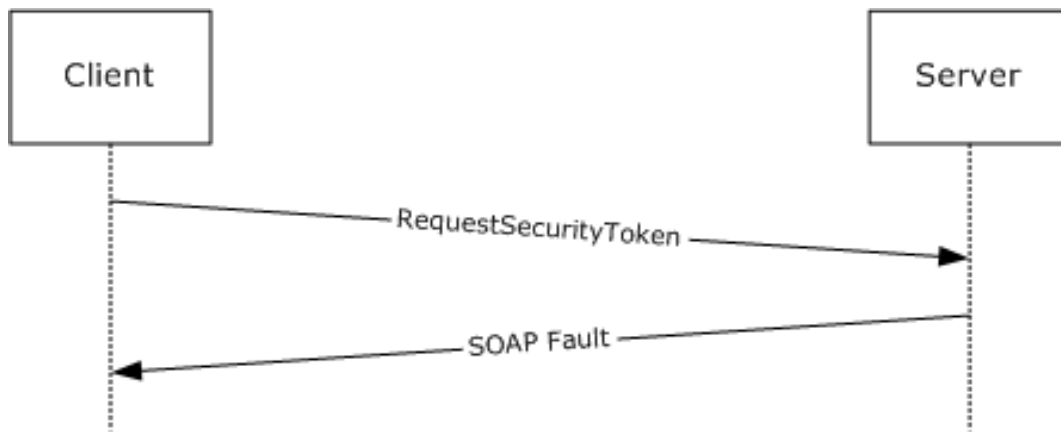


Figure 3: Typical sequence for a rejected certificate renewal request

The following figure is an example of a message exchange for a renewal request. A renewal request uses an existing certificate and requests a new lifespan. From the point of view of the WSTEP protocol, this is the same as an issue request, as the message format is unchanged.

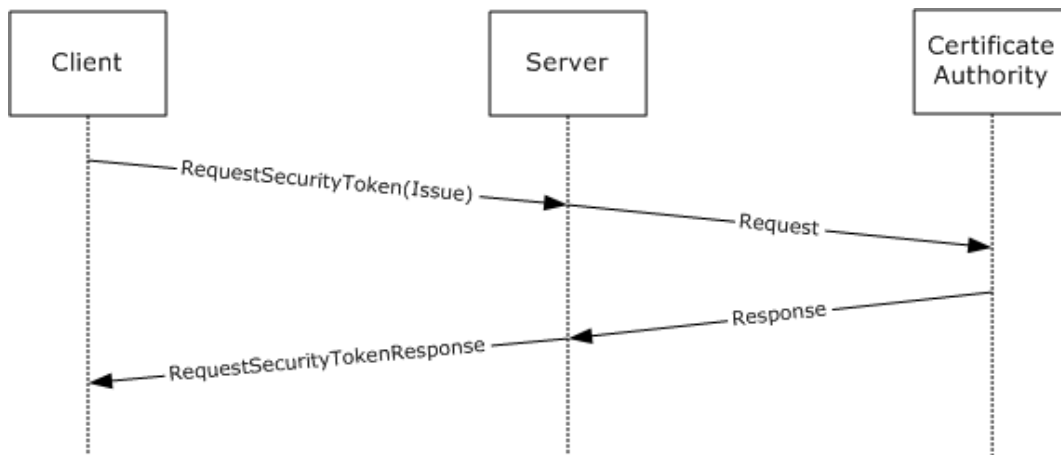


Figure 4: Typical sequence for a certificate renewal request

1.4 Relationship to Other Protocols

The following figure shows the WSTEP Protocol stack diagram.

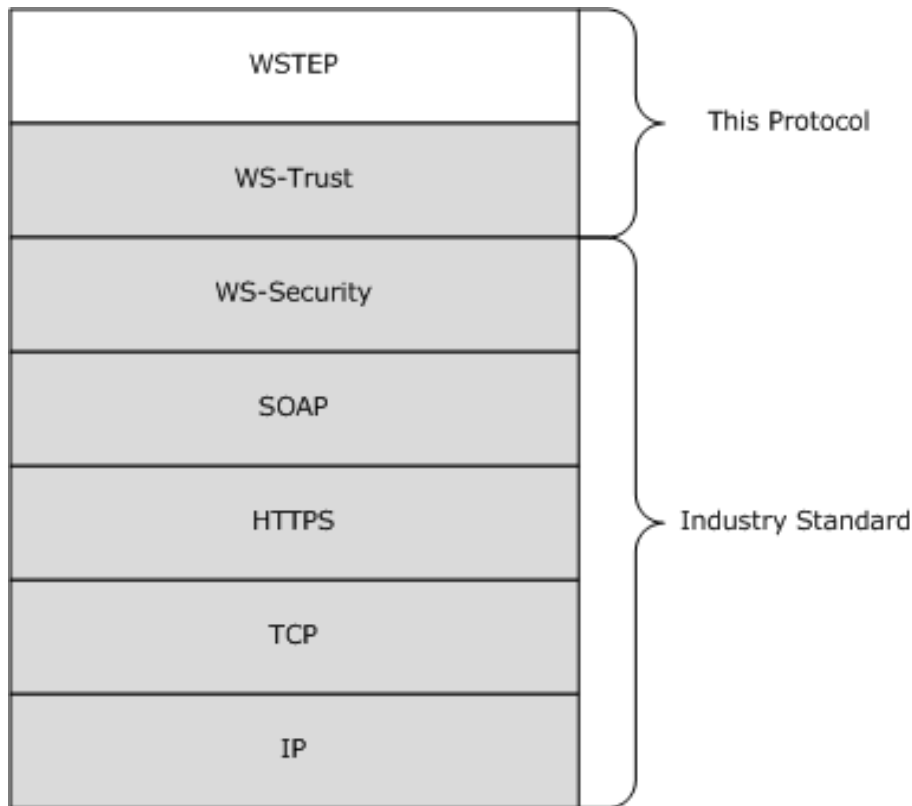


Figure 5: WSTEP Protocol stack diagram

The WSTEP protocol specification is a profile of the WS-Trust Protocol [WSTrust1.3] and makes use of the SOAP and Hypertext Transfer Protocol over Secure Sockets Layer (HTTPS) protocols for messaging and security.

1.5 Prerequisites/Preconditions

The WSTEP protocol specification facilitates the issuance of X.509v3 certificates. A server implementation of the protocol requires the functionality of a certificate authority, capable of interpreting requests in at least one of PKCS#7, PKCS#10, or Certificate Management Messages over CMS (CMC).

1.6 Applicability Statement

The WSTEP protocol specification is applicable only for requests for X.509v3 certificates.

1.7 Versioning and Capability Negotiation

The WSTEP protocol specification does not include versioning and capability negotiation.

1.8 Vendor-Extensible Fields

The WSTEP protocol specification does not include any vendor-extensible fields. WSTEP adheres to the WS-Trust 1.3 [WSTrust1.3] provided extension points.

1.9 Standards Assignments

None.

2 Messages

2.1 Transport

SOAP version 1.2 MUST be used for messaging for the WSTEP protocol. HTTPS protocol MUST be used as the transport.

2.2 Common Message Syntax

This section contains common definitions used by this protocol. The syntax of the definitions uses the XML schema as defined in [XMLSCHEMA1] and [XMLSCHEMA2], and the Web Services Description Language (WSDL) as defined in [WSDL].

2.2.1 Namespaces

This specification defines and references various XML namespaces, using the mechanisms specified in [XMLNS]. Although this specification associates a specific XML namespace prefix for each XML namespace that is used, the choice of any particular XML namespace prefix is implementation-specific and not significant for interoperability.

Prefixes and XML namespaces used in this specification are as follows.

Prefix	Namespace URI	Reference
xs	http://www.w3.org/2001/XMLSchema	[XMLSCHEMA1]
wst	http://docs.oasis-open.org/ws-sx/ws-trust/200512	[WSTrust1.3]
auth	http://schemas.xmlsoap.org/ws/2006/12/authorization	[XMLSCHEMA1]
wsu	http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd	
wsse	http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd	
wstep	http://schemas.microsoft.com/windows/pki/2009/01/enrollment	This document

2.2.2 Messages

None.

2.2.3 Elements

This specification does not define any common XML schema element definitions.

2.2.4 Complex Types

This specification does not define any common XML schema complex type definitions.

2.2.5 Simple Types

The WSTEP protocol specification does not define any common XML schema simple type definitions.

2.2.6 Attributes

The WSTEP protocol specification does not define any common XML schema attribute definitions.

2.2.7 Groups

The WSTEP protocol specification does not define any common XML schema group definitions.

2.2.8 Attribute Groups

The WSTEP protocol specification does not define any common XML schema attribute group definitions.

3 Protocol Details

The client side of this protocol is a simple pass-through. No additional timers or other state is required on the client side of this protocol. Calls made by the higher-layer protocol or application are passed directly to the transport layer, and the results returned by the transport are passed directly back to the higher-layer protocol or application.

This section addresses the message processing model for the protocol. It includes related information required by an implementation to successfully send and consume protocol messages.

3.1 SecurityTokenService Server Details

The **SecurityTokenService** hosts a message endpoint that receives **RequestSecurityToken** messages. When received, the server processes the client request and sends it to the certificate authority. Upon receiving a response from the certificate authority, a response is generated, and the server sends either a **RequestSecurityTokenResponse** message or a SOAP fault. When the message has been sent to the client, the server returns to the waiting state.



Figure 6: Security token service state model

The items of information that are communicated between the server and the certificate authority are specified in this section, but the method of communication used, including timeout and error handling (local API, local remote procedure call (RPC), or some other protocol) is not specified.

The certificate authority MAY have additional requirements that MUST be met in order to issue an X.509v3 certificate, such as manager approval, payment processing, or validation of request information. In these instances, a certificate authority response indicating the issuance is pending.

3.1.1 Abstract Data Model

A server supporting the WSTEP protocol maintains a relationship to an issuer which processes messages submitted by the server. When communicating with requestors, a server can support a variety of languages.

Issuer: An address of a certificate authority (CA). The format of the stored address is specific to the implementation and to the form of communication used between the Issuer and the Server.

SupportedLanguages: A list of language identifiers supported by the server. The set of languages are of type xml:lang and defined in [RFC3066].

DefaultLanguage: The default language for the server. DefaultLanguage is of type xml:lang, and the set of supported languages is defined in [RFC3066].

3.1.1.1 Authentication

The WS-Trust X.509v3 Token Enrollment Extensions use the authentication provisions in WS-Security ([WSS]) for the X.509v3 Security Token issuer to authenticate the X.509v3 Security Token requestor. This section defines the schema used to express the credential descriptor for each supported credential type.

3.1.1.1.1 Kerberos Authentication

Authentication using Kerberos is done at the transport layer.

3.1.1.1.2 X.509v3 Certificate Authentication

Authentication using X.509v3 certificates is done at the transport level using Transport Level Security (TLS) 1.2 as defined in [RFC5246].

3.1.1.1.3 Username and Password Authentication

The username and password credential is provided in a request message using the WS-Security Username Token Profile 1.0. The username is provided as defined in section 3.1 of the Ws-Security document [WSSUTP].

3.1.1.1.4 No (Anonymous) Authentication

If no authentication is provided at either the transport layer or the message layer, the request is considered to be anonymous. Anonymous authentication is supported only for renewal requests, where the signature from the existing certificate on the request object serves as authentication for the X.509v3 Security Token requestor.

3.1.2 Timers

None.

3.1.3 Initialization

The *SupportedLanguages* object MUST be initialized with the set of languages that the server supports.

The *DefaultLanguage* parameter MUST be initialized with the language that is to be used by the server when a request does not define a language preference, or the preference is not in *SupportedLanguages*.<1>

3.1.4 Message Processing Events and Sequencing Rules

Operation	Description
wst:RequestSecurityToken2	The wst:RequestSecurityToken2 operation is the sole operation in the WSTEP protocol. It provides the mechanism for certificate enrollment requests, retrieval of pending certificate status, and the request of the server key exchange certificate. The wst:RequestSecurityToken2 operation is defined in WS-Trust 1.3 [WSTrust1.3].

3.1.4.1 wst:RequestSecurityToken2

The wst:RequestSecurityToken2 operation provides the mechanism for certificate enrollment requests, retrieval of pending certificate status, and the request of the server key exchange certificate. The wst:SecurityTokenService port and wst:RequestSecurityToken2 operation are defined in the [WSTrust1.3] WSDL wsdl:portType definition.

```
<wsdl:operation name="RequestSecurityToken2">  
  <wsdl:input message="wst:RequestSecurityTokenMsg" />  
  <wsdl:output message="wst:RequestSecurityTokenResponseCollectionMsg" />  
</wsdl:operation>
```

WSTEP makes use of the wst:RequestSecurityToken2 operation. The wst:RequestSecurityToken operation defined in the SecurityTokenService operation is not used. The **wst:RequestSecurityTokenMsg** message consists of a single object definition: the client request. The client request is made using the acceptable SOAP actions as defined in section 3.1.4.2 and RequestType values, as defined in section 3.1.4.1.2.7.

3.1.4.1.1 Messages

The following WSDL message definitions are specific to this operation.

3.1.4.1.1.1 wst:RequestSecurityTokenMsg

The wst:RequestSecurityTokenMsg is an incoming message, and is defined in WS-Trust 1.3 [WSTrust1.3] WSDL.

wst:RequestSecurityToken: An instance of a **wst:RequestSecurityTokenType** complex type as defined in section 3.1.4.1.3.3. The **wst:RequestSecurityToken** element defines the client request and the required information for it to be processed.

3.1.4.1.1.2 wst:RequestSecurityTokenResponseCollectionMsg

The wst:RequestSecurityTokenResponseCollectionMsg is an outgoing message, and is defined in WS-Trust 1.3 [WSTrust1.3] WSDL.

wst:RequestSecurityTokenResponseCollectionMsg: An instance of a **wst:RequestSecurityTokenResponseCollection** element as defined in section 3.1.4.1.2.6. This element contains the results of the client request.

3.1.4.1.2 Elements

3.1.4.1.2.1 wstep:CertificateEnrollmentWSDetail

The **wstep:CertificateEnrollmentWSDetail** element is used to convey additional information to a client as part of the SOAP fault structure when a server returns a SOAP fault.

```
<xs:element name="CertificateEnrollmentWSDetail" nillable="true"
type="wstep:CertificateEnrollmentWSDetailType" />
```

wstep:CertificateEnrollmentWSDetail: An instance of a `<wstep:CertificateEnrollmentWSDetailType>` as defined in section 3.1.4.1.3.7. If there is no additional information, the **wstep:CertificateEnrollmentWSDetail** SHOULD be omitted in the SOAP fault.

3.1.4.1.2.2 DispositionMessage

```
<xs:element name="DispositionMessage"
type="wstep:DispositionMessageType" nillable="true" />
```

DispositionMessage: An instance of a `DispositionMessageType` object as defined in section 3.1.4.1.3.1.

3.1.4.1.2.3 wst:KeyExchangeToken

The `<wst:KeyExchangeToken>` element is defined in WS-Trust 1.3 [WSTrust1.3] section 8.4.

wst:KeyExchangeToken: The `wst:KeyExchangeToken` element provides a key exchange token that can be used in certificate enrollment requests that include the private key.

3.1.4.1.2.4 RequestID

```
<xs:element name="RequestID"
type="xs:string" nillable="true"/>
```

RequestID: A string identifier used to identify a request.

3.1.4.1.2.5 wst:RequestSecurityToken

The `<wst:RequestSecurityToken>` element is defined in WS-Trust 1.3 [WSTrust1.3], section 3.1.

wst:RequestSecurityToken: An instance of a **wst:RequestSecurityTokenType** object as specified in section 3.1.4.1.3.3.

3.1.4.1.2.6 RequestSecurityTokenResponseCollection

The `RequestSecurityTokenResponseCollection` is defined in WS-Trust 1.3 [WSTrust1.3], section 3.2.

RequestSecurityTokenResponseCollection: An instance of a **wst:RequestSecurityTokenResponseCollectionType** object as specified in section 3.1.4.1.3.5.

3.1.4.1.2.7 wst:RequestType

The `<wst:RequestType>` element is defined in [WSTrust1.3] section 3.1.

wst:RequestType: An instance of a `<wst:RequestTypeOpenEnum>` object as defined in [WSTrust1.3] XML schema definition (XSD).

The <wst:RequestType> MUST have one of the following values:

```
"http://docs.oasis-open.org/ws-sx/ws-trust/200512/Issue"  
"http://schemas.microsoft.com/windows/pki/2009/01/enrollment/QueryTokenStatus"  
"http://docs.oasis-open.org/ws-sx/ws-trust/200512/KET"
```

If the <wst:RequestType> has any other value, the server MUST respond with a SOAP fault.

3.1.4.1.2.8 wst:TokenType

The <TokenType> element is defined in [WSTrust1.3], section 3.1.

wst:TokenType: For the X.509v3 enrollment extension to WS-Trust, the <wst:tokentype> element MUST be http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-x509-token-profile-1.0#X509v3.

3.1.4.1.3 Complex Types

The following XML schema complex type definitions are specific to this operation.

3.1.4.1.3.1 DispositionMessageType

The DispositionMessageType is an extension to the string type that allows an attribute definition of the language for the string. The DispositionMessageType is used to provide additional information about the server processing.

```
<xs:complexType name="DispositionMessageType">  
  <xs:simpleContent>  
    <xs:extension base="xs:string">  
      <xs:attribute ref="xml:lang" use="optional" />  
    </xs:extension>  
  </xs:simpleContent>  
</xs:complexType>
```

xs:string: The string element contains the literal string disposition message returned from the server. The string element contains an xml:lang attribute that defines the language for the string. The language SHOULD be provided for each string element instance.

xml:lang: The language reference xml:lang, indicating the natural or formal language the string element content is written in.

3.1.4.1.3.2 wst:RequestedSecurityTokenType

The wst:RequestedSecurityTokenType is defined in WS-Trust XML schema definition (XSD) [WSTrust1.3Schema].

```
<xs:complexType name="RequestedSecurityTokenType">  
  <xs:sequence>  
    <xs:any namespace="##any" processContents="lax" />  
  </xs:sequence>  
</xs:complexType>
```

The WSTEP extends wst: RequestedSecurityTokenType with two additional elements.

```
<xs:element ref="wsse:BinarySecurityToken" />
```

```
<xs:element ref="wsse:SecurityTokenReference" />
```

wsse:BinarySecurityToken: The wsse:BinarySecurityToken element contains the issued certificate. The issued certificate follows the encoding and data structure defined in [MS-WCCE] section 2.2.2.8.

wsse:SecurityTokenReference: A URI reference used to indicate where a pending Certificate Request can be retrieved. The server MUST provide its own URI as the value of the <wsse:BinarySecurityTokenReference:Reference> element as specified in [WSTrust1.3] section 4.2.

3.1.4.1.3.3 wst:RequestSecurityTokenType

The **wst:RequestSecurityTokenType** complex type contains the elements for the security token request in the RequestSecurityTokenMsg message. It is the client-provided object for a certificate enrollment request. **wst:RequestSecurityTokenType** is defined in the WS-Trust [WSTrust1.3] XML schema definition (XSD).

```
<xs:complexType name="RequestSecurityTokenType">
  <xs:annotation>
    <xs:documentation>
      Actual content model is non-deterministic, hence wildcard. The following shows intended
      content model:
      <xs:element ref='wst:TokenType' minOccurs='0' />
      <xs:element ref='wst:RequestType' />
      <xs:element ref='wsp:AppliesTo' minOccurs='0' />
      <xs:element ref='wst:Claims' minOccurs='0' />
      <xs:element ref='wst:Entropy' minOccurs='0' />
      <xs:element ref='wst:Lifetime' minOccurs='0' />
      <xs:element ref='wst:AllowPostdating' minOccurs='0' />
      <xs:element ref='wst:Renewing' minOccurs='0' />
      <xs:element ref='wst:OnBehalfOf' minOccurs='0' />
      <xs:element ref='wst:Issuer' minOccurs='0' />
      <xs:element ref='wst:AuthenticationType' minOccurs='0' />
      <xs:element ref='wst:KeyType' minOccurs='0' />
      <xs:element ref='wst:KeySize' minOccurs='0' />
      <xs:element ref='wst:SignatureAlgorithm' minOccurs='0' />
      <xs:element ref='wst:Encryption' minOccurs='0' />
      <xs:element ref='wst:EncryptionAlgorithm' minOccurs='0' />
      <xs:element ref='wst:CanonicalizationAlgorithm' minOccurs='0' />
      <xs:element ref='wst:ProofEncryption' minOccurs='0' />
      <xs:element ref='wst:UseKey' minOccurs='0' />
      <xs:element ref='wst:SignWith' minOccurs='0' />
      <xs:element ref='wst:EncryptWith' minOccurs='0' />
      <xs:element ref='wst:DelegateTo' minOccurs='0' />
      <xs:element ref='wst:Forwardable' minOccurs='0' />
      <xs:element ref='wst:Delegatable' minOccurs='0' />
      <xs:element ref='wsp:Policy' minOccurs='0' />
      <xs:element ref='wsp:PolicyReference' minOccurs='0' />
      <xs:any namespace='##other' processContents='lax' minOccurs='0' maxOccurs='unbounded'
    />
  />
</xs:documentation>
</xs:annotation>
<xs:sequence>
  <xs:any namespace="##any" processContents="lax" minOccurs="0" maxOccurs="unbounded" />
</xs:sequence>
<xs:attribute name="Context" type="xs:anyURI" use="optional" />
<xs:anyAttribute namespace="##other" processContents="lax" />
</xs:complexType>
```

WSTEP extends <wst:RequestSecurityTokenType> with the following elements:

```
<xs:element ref="wsse:BinarySecurityToken" minOccurs="0"
```

```

maxOccurs="1" />
<xs:element ref="auth:AdditionalContext" minOccurs="0"
maxOccurs="1" />
<xs:element ref="wst:RequestKET" minOccurs="0" maxOccurs="1" />
<xs:element ref="wstep:RequestID" minOccurs="0" maxOccurs="1" />

```

Only the elements specified below are used in WSTEP. Any element received that is not specified below SHOULD be ignored.

wst:TokenType: Refers to the wst:TokenType definition in section 3.1.4.1.2.8.

wst:RequestType: Refers to the wst:RequestType definition in section 3.1.4.1.2.7. The wst:RequestType is used to identify the type of the security token request.

wst:RequestKET: Used when requesting a key exchange token as defined in [WSTrust1.3] section 8.4.

wsse:BinarySecurityToken: Provides the DER ASN.1 representation of the certificate request. The type of token is defined by the wst:TokenType element. For the X.509v3 enrollment extension the wst:TokenType MUST be specified as in section 3.1.4.1.2.8. The certificate request follows the formatting from [MS-WCCE] section 2.2.2.6. The EncodingType attribute of the wsse:BinarySecurityToken element MUST be set to base64Binary.

auth:AdditionalContext: The auth:AdditionalContext element is used to provide extra information in a wst:RequestSecurityToken message. It is an optional element, and SHOULD be omitted if there is no extra information to be passed.

wstep:RequestID: An instance of **wstep:RequestID** as specified in section 3.1.4.1.2.4.

3.1.4.1.3.4 wst:RequestSecurityTokenResponseType

The wst:RequestSecurityTokenResponseType contains the elements that are part of a server response to a wst:RequestSecurityToken message. wst:RequestSecurityTokenResponseType is defined in the WS-Trust [WSTrust1.3] XML schema definition (XSD).

```

<xs:complexType name="RequestSecurityTokenResponseType">
  <xs:annotation>
    <xs:documentation>
      Actual content model is non-deterministic, hence wildcard. The following shows intended
      content model:
      <xs:element ref='wst:TokenType' minOccurs='0' />
      <xs:element ref='wst:RequestType' />
      <xs:element ref='wst:RequestedSecurityToken' minOccurs='0' />
      <xs:element ref='wsp:AppliesTo' minOccurs='0' />
      <xs:element ref='wst:RequestedAttachedReference' minOccurs='0' />
      <xs:element ref='wst:RequestedUnattachedReference' minOccurs='0' />
      <xs:element ref='wst:RequestedProofToken' minOccurs='0' />
      <xs:element ref='wst:Entropy' minOccurs='0' />
      <xs:element ref='wst:Lifetime' minOccurs='0' />
      <xs:element ref='wst:Status' minOccurs='0' />
      <xs:element ref='wst:AllowPostdating' minOccurs='0' />
      <xs:element ref='wst:Renewing' minOccurs='0' />
      <xs:element ref='wst:OnBehalfOf' minOccurs='0' />
      <xs:element ref='wst:Issuer' minOccurs='0' />
      <xs:element ref='wst:AuthenticationType' minOccurs='0' />
      <xs:element ref='wst:Authenticator' minOccurs='0' />
      <xs:element ref='wst:KeyType' minOccurs='0' />
      <xs:element ref='wst:KeySize' minOccurs='0' />
      <xs:element ref='wst:SignatureAlgorithm' minOccurs='0' />
      <xs:element ref='wst:Encryption' minOccurs='0' />
      <xs:element ref='wst:EncryptionAlgorithm' minOccurs='0' />
      <xs:element ref='wst:CanonicalizationAlgorithm' minOccurs='0' />
      <xs:element ref='wst:ProofEncryption' minOccurs='0' />
    
```

```

    <xs:element ref='wst:UseKey' minOccurs='0' />
    <xs:element ref='wst:SignWith' minOccurs='0' />
    <xs:element ref='wst:EncryptWith' minOccurs='0' />
    <xs:element ref='wst:DelegateTo' minOccurs='0' />
    <xs:element ref='wst:Forwardable' minOccurs='0' />
    <xs:element ref='wst:Delegatable' minOccurs='0' />
    <xs:element ref='wsp:Policy' minOccurs='0' />
    <xs:element ref='wsp:PolicyReference' minOccurs='0' />
    <xs:any namespace='##other' processContents='lax' minOccurs='0' maxOccurs='unbounded'
  />
</xs:documentation>
</xs:annotation>
<xs:sequence>
  <xs:any namespace="##any" processContents="lax" minOccurs="0" maxOccurs="unbounded" />
</xs:sequence>
<xs:attribute name="Context" type="xs:anyURI" use="optional" />
<xs:anyAttribute namespace="##other" processContents="lax" />
</xs:complexType>

```

WSTEP extends the `wst:RequestSecurityTokenResponseType` with the following elements:

```

  <xs:element ref="wstep:DispositionMessage" />
  <xs:element ref="wsse:BinarySecurityToken" minOccurs="0" maxOccurs="1" />
  <xs:element ref="wstep:RequestID" minOccurs="0" maxOccurs="1"
<xs:element ref="wst:KeyExchangeToken" minOccurs="0" maxOccurs="1" />
/>

```

Only the elements documented as follows are used by WSTEP. Any element received that is not documented as follows SHOULD be ignored.

wst:TokenType: Refers to the `TokenType` definition in section 3.1.4.1.2.8.

wstep:DispositionMessage: Refers to the definition in section 3.1.4.1.2.2. The `wstep:DispositionMessage` element is used to convey any additional server disposition information as part of the response message.

wsse:BinarySecurityToken: Refers to the `wsse:BinarySecurityToken` definition in section 3.1.4.1.3.2.

wst: KeyExchangeToken: Refers to the `wst:KeyExchangeToken` definition in section 3.1.4.1.2.3.

wst:RequestedSecurityToken: An instance of a `wst:RequestedSecurityTokenType` object as defined in section 3.1.4.1.3.2.

wstep:RequestID: An instance of a **wstep:RequestID** as defined in section 3.1.4.1.2.4 that conveys the request identifier of the originating request.

3.1.4.1.3.5 wst:RequestSecurityTokenResponseCollectionType

The `<wst:RequestSecurityTokenResponseCollectionType>` is defined in the [WSTrust1.3] XML schema definition (XSD) as a collection of one or more `<wst:RequestSecurityTokenResponse>` elements. The WS-Trust X.509v3 Token Enrollment Extensions further constrain the [WSTrust1.3] definition and the `<wst:RequestSecurityTokenResponseCollection>` collection MUST contain at most one `<wst:RequestSecurityTokenResponse>` element.

```

<xs:complexType name="RequestSecurityTokenResponseCollectionType">
  <xs:annotation>
    <xs:documentation>
      The <wst:RequestSecurityTokenResponseCollection> element (RSTRC) MUST be used to return a
      security token or response to a security token request on the final
      response.</xs:documentation>

```

```

</xs:annotation>
<xs:sequence>
<xs:element ref="wst:RequestSecurityTokenResponse" minOccurs="1" maxOccurs="unbounded" />
</xs:sequence>
<xs:anyAttribute namespace="##other" processContents="lax" />
</xs:complexType>

```

wst:RequestSecurityTokenResponse: An instance of a `wst:RequestSecurityTokenResponseType` object. The `<wst:RequestSecurityTokenResponseCollectionType>` MUST contain only one `<RequestSecurityTokenResponse>` element.

3.1.4.1.3.6 wst:RequestTypeEnum

The `<wst:RequestTypeEnum>` is defined in WS-Trust [WSTrust1.3] XML schema definition (XSD). WSTEP defines the following values for `<wst:RequestTypeEnum>`.

```
"http://schemas.microsoft.com/windows/pki/2009/01/enrollment/QueryTokenStatus"
```

WSTEP makes use of the Key Exchange Token request type defined in [WSTrust1.3] section 10:

```
"http://docs.oasis-open.org/ws-sx/ws-trust/200512/KET"
```

and the issue request type defined in [WSTrust1.3] XML schema definition (XSD):

```
"http://docs.oasis-open.org/ws-sx/ws-trust/200512/Issue"
```

3.1.4.1.3.7 wstep:CertificateEnrollmentWSDetailType

The `<wstep:CertificateEnrollmentWSDetailType>` contains additional information pertaining to error conditions.

```

<xs:complexType name="CertificateEnrollmentWSDetailType">
  <xs:sequence>
    <xs:element minOccurs="0" maxOccurs="1" name="BinaryResponse" nillable="true"
type="xs:string" />
    <xs:element minOccurs="0" maxOccurs="1" name="ErrorCode" nillable="true" type="xs:int"
/>
    <xs:element minOccurs="0" maxOccurs="1" name="InvalidRequest" nillable="true"
type="xs:boolean" />
    <xs:element minOccurs="0" maxOccurs="1" name="RequestID" type="xs:string"
nillable="true" />
  </xs:sequence>
</xs:complexType>

```

wstep:BinaryResponse: The `wstep:BinaryResponse` element is used to provide a response if the Issuer generates one. If there is no response to provide, the `wstep:BinaryResponse` element MUST be nil.

wstep:ErrorCode: An integer value representing a server error. If there is no error to provide, `wstep:ErrorCode` MUST be specified as nil.

wstep:InvalidRequest: If the request is denied by the Issuer the server MUST return true. For other errors the `wstep:InvalidRequest` SHOULD be false.

wstep:RequestID: If the Issuer provides a wstep:RequestID to the server, it MUST be provided to a client. If no wstep:RequestID is provided by the Issuer, the wstep:RequestID element must be specified as nil.

3.1.4.1.4 Attributes

There are no attributes that are specific to this operation.

3.1.4.2 Processing Rules

An incoming SOAP message MUST be processed to evaluate the SOAP actions and authentication information.

If the user is authenticated successfully using the provided authentication information, message processing MUST continue, and the authentication information SHOULD be provided to the Issuer. If the authentication fails, the server MUST respond with a SOAP fault.

If the SOAP action is "http://schemas.microsoft.com/windows/pki/2009/01/enrollment/RST/wstep" the server must follow the Request Security Token Processing Rules per section 3.1.4.2.1.

If the SOAP action is "http://docs.oasis-open.org/ws-sx/ws-trust/200512/RST/KET" the server must follow the Key Exchange Token Processing Rules per section 3.1.4.2.2.

If any other SOAP action is defined, the server SHOULD respond with a SOAP fault.

3.1.4.2.1 WSTEP Action: Request Security Token Processing Rules

A <wst:RequestSecurityTokenMsg> MUST contain a <wst:RequestType> element as defined in section 3.1.4.1.2.7. If the <wst:RequestType> element is absent, nil, or undefined, the server MUST respond with a SOAP fault.

If a **wstep:PreferredLanguage** attribute is not present in a <RequestSecurityTokenType> object, or the value is not in SupportedLanguages, the server SHOULD use DefaultLanguage.

If the <wst:RequestType> is "http://docs.oasis-open.org/ws-sx/ws-trust/200512/Issue", the server MUST process the request per section 3.1.4.2.1.1.

If the <wst:RequestType> is "http://schemas.microsoft.com/windows/pki/2009/01/enrollment/QueryTokenStatus" the server MUST process the request per section 3.1.4.2.1.2.

If the <wst:RequestType> is any other value, the server MUST respond with a SOAP fault.

3.1.4.2.1.1 New and Renewal Request Processing

A wst:RequestSecurityToken message with a wst:RequestType value of "http://docs.oasis-open.org/ws-sx/ws-trust/200512/Issue" is used for the purposes of issuing an X.509v3 certificate or for renewal of an existing X.509v3 certificate.

For this type of message, a server has additional syntax constraints on the request message.

wsse:BinarySecurityToken: If the wsse:BinarySecurityToken element is absent or undefined, the server MUST respond with a SOAP fault.

wstep:RequestID: If the **wstep:RequestID** element is present and defined, the server SHOULD ignore it.

The server MUST provide the **wsse:BinarySecurityToken** to the Issuer and SHOULD provide the **auth:AdditionalContext** (see section 3.1.4.1.3.3) to the Issuer.

If the Issuer responds with an error, the server MUST respond with a SOAP fault. If the Issuer indicates the issuance is pending, the server MUST use the Issuer response to generate a pending **wst:RequestSecurityTokenResponseCollectionMsg** message. If the Issuer responds with an issued certificate, the server MUST respond with a **wst:RequestSecurityTokenResponseCollectionMsg** message providing the issued certificate.

3.1.4.2.1.2 QueryTokenStatus Request Processing

A **wst:RequestSecurityToken** message with a `<wst:RequestType>` of "http://schemas.microsoft.com/windows/pki/2009/01/enrollment/QueryTokenStatus" is used to retrieve an issued certificate or check the status of a certificate request that was pending.

For this type of message, the server has additional syntax constraints on the request message.

The **wstep:RequestID** element is a null-terminated Unicode string that contains a certificate request identifier (as defined in section 3.1.4.1.2.4). If the `<wstep:RequestID>` element is absent, defined as nil, or contains no value the server MUST return a SOAP fault.

The server MUST provide the **wstep:RequestID** to the Issuer.

If the Issuer responds with an error, the server MUST respond with a SOAP fault. If the Issuer indicates the issuance is pending, the server MUST use the Issuer response to generate a pending **wst:RequestSecurityTokenResponseCollectionMsg** message. If the Issuer responds with an issued certificate, the server MUST respond with a **wst:RequestSecurityTokenResponseCollectionMsg** message providing the issued certificate.

3.1.4.2.2 KET Action: Request Security Token Processing Rules

A **wst:RequestSecurityTokenMsg** MUST contain a `<wst:RequestType>` element as defined in section 3.1.4.1.2.7. If the `<wst:RequestType>` element is absent, nil, or undefined, the server MUST respond with a SOAP fault.

If the `<wst:RequestType>` is "http://docs.oasis-open.org/ws-sx/ws-trust/200512/KET" the server MUST process the request per section 3.1.4.2.2.1.

If the `<wst:RequestType>` is any other value, the server MUST respond with a SOAP fault.

3.1.4.2.2.1 Key Exchange Token Request Processing

A RequestSecurityToken message of `wst:RequestType` of "http://docs.oasis-open.org/ws-sx/ws-trust/200512/KET" is used to retrieve the Key Exchange Token.

For this type of message, a server has additional syntax constraints on the **wst:RequestSecurityTokenMsg** message.

If the `<wst:RequestKET>` element is absent, the server MUST return a SOAP fault.

The server requests the Key Exchange Token from the issuer. If the issuer responds with an error, the server MUST respond with a SOAP fault. Otherwise, the server uses the Issuer response to generate a **wst:RequestSecurityTokenResponseCollectionMsg** message.

The `<wst:RequestSecurityTokenResponse>` element in the server response follows the [WSTrust1.3] definition in section 8, but for key exchange in the WSTEP protocol, the `<wst:KeyExchangeToken>` element MUST be present, and provides the key exchange token provided from the Issuer.

3.1.5 Timer Events

None.

3.1.6 Other Local Events

None.

4 Protocol Examples

4.1 RequestSecurityToken Request/Response Message Sequence

In the following message sequence, the username/password authentication headers have been included in the message sequences for clarity.

4.1.1 Standard Certificate Request

4.1.1.1 RequestSecurityToken Message (Issue Request)

```
<s:Envelope xmlns:a="http://www.w3.org/2005/08/addressing"
xmlns:s="http://www.w3.org/2003/05/soap-envelope">
  <s:Header>
    <a:Action s:mustUnderstand="1">
http://schemas.microsoft.com/windows/pki/2009/01/enrollment/RST/wstep</a:Action>
    <a:MessageID>urn:uuid:b5d1a601-5091-4a7d-b34b-5204c18b5919</a:MessageID>
    <a:ReplyTo>
    <a:Address>http://www.w3.org/2005/08/addressing/anonymous</a:Address>
    </a:ReplyTo>
  </s:Header>
  <s:Body xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema">
    <RequestSecurityToken xmlns="http://docs.oasis-open.org/ws-sx/ws-trust/200512">
    <TokenType>http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-x509-token-profile-
1.0#X509v3</TokenType>
    <RequestType>http://docs.oasis-open.org/ws-sx/ws-trust/200512/Issue</RequestType>
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4.1.1.2 Server RequestSecurityToken Response

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U4XUoiJnpyM3+Bs+HzihMCRnJdEWh23igwaeXvZcdWejMvuH2xp9qOfLwdOcETH2
Gt9RyJ4Dv/gtlvvaTsbDx10n0fKsH4mAqS6LummQuNBttU0pHJaWb7gqnDhA9gj2
h6HFvX9jhWfDKMovsxbTRWNOaeUx9ovbMgqDl0rxeBLG2pkyy26k0XTywsdlc/gQ
f58E3pmc9b3e2QcPPQvanmyOkFW/LnUYtpceTi6kGVLScolqb/984aUeni/Q6G7M
SK4XODae637doX6KZx7pWS4cBUZnhlXkWagWmwzDpAntale19oMjB+jWw0V3Pzn
xTk=</BinarySecurityToken>
</RequestedSecurityToken>
<RequestID
xmlns="http://schemas.microsoft.com/windows/pki/2009/01/enrollment">61</RequestID>
</RequestSecurityTokenResponse>
</RequestSecurityTokenResponseCollection>
</s:Body>
</s:Envelope>
```

4.1.2 Key Exchange Token Request

4.1.2.1 Client Exchange Token Request

```
<s:Envelope xmlns:a="http://www.w3.org/2005/08/addressing"
xmlns:s="http://www.w3.org/2003/05/soap-envelope">
  <s:Header>
    <a:Action s:mustUnderstand="1">
http://docs.oasis-open.org/ws-sx/ws-trust/200512/RST/KET</a:Action>
    <a:MessageID>urn:uuid:c2884a79-b943-45c6-ac02-7256071de309</a:MessageID>
    <a:ReplyTo>
    <a:Address>http://www.w3.org/2005/08/addressing/anonymous</a:Address>
    </a:ReplyTo>
    </s:Header>
  <s:Body xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema">
    <RequestSecurityToken xmlns="http://docs.oasis-open.org/ws-sx/ws-trust/200512">
    <TokenType>http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-x509-token-profile-
1.0#X509v3</TokenType>
    <RequestType>http://docs.oasis-open.org/ws-sx/ws-trust/200512/KET</RequestType>
    <RequestKET />
    <RequestID xsi:nil="true"
xmlns="http://schemas.microsoft.com/windows/pki/2009/01/enrollment" />
    </RequestSecurityToken>
  </s:Body>
</s:Envelope>
```

4.1.1.2 Server Key Exchange Token Response

```
<s:Envelope xmlns:s="http://www.w3.org/2003/05/soap-envelope"
xmlns:a="http://www.w3.org/2005/08/addressing">
  <s:Header>
    <a:Action s:mustUnderstand="1">
      http://docs.oasis-open.org/ws-sx/ws-trust/200512/RSTR/KETFinal</a:Action>
    <ActivityId CorrelationId="45f6782a-fb93-4a48-b0bb-a21496balf3c"
xmlns="http://schemas.microsoft.com/2004/09/ServiceModel/Diagnostics">
      17f6073c-c108-4268-9ce4-713ed86894b6</ActivityId>
    <a:RelatesTo>urn:uuid:c2884a79-b943-45c6-ac02-7256071de309</a:RelatesTo>
  </s:Header>
  <s:Body>
    <RequestSecurityTokenResponseCollection
xmlns="http://docs.oasis-open.org/ws-sx/ws-trust/200512">
      <RequestSecurityTokenResponse>
        <TokenType>http://docs.oasis-open.org/wss/2004/01/
oasis-200401-wss-x509-token-profile-1.0#X509v3</TokenType>
        <RequestedSecurityToken>
          <KeyExchangeToken>
            <BinarySecurityToken ValueType="http://docs.oasis-open.org/wss/2004/01/
oasis-200401-wss-x509-token-profile-1.0#X509v3"
EncodingType="http://docs.oasis-open.org/wss/2004/01/
oasis-200401-wss-wssecurity-secext-1.0.xsd#base64binary"
xmlns="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-
1.0.xsd">MIIFoJCCBfIqgAwIBAgIKGNn1JQAAAAAQDANBgkqhkiG9w0BAQUFADAzMRswGQYD
VQQLEXJNaWNYb3NvZnZnQGUETJFRlYw0xFDASBgNVBAMMC0ZCX0VudFN1YkNBMB4X
DTA5MDMwNTE4MjYyMl0xDTA5MDMwMjE4MzYyMl0wOEBMBkGAlUECXMSTWljcm9z
b2Z0IFBLSzBUZWFtMRkwFwYDVQ0DDBBGQl9FbnRTdWJDQS1Y2hnMIIBIjANBgkq
hkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAWaBSajsw24Kk106+39WQT87+hxahSizX
BXOqJC1cZOLjqrSkdc4KnUHV+XXohDO6ETCJ5vkXw90ThT6YWDqpn06G0PJ+h9S3
rmyz1EvXaXg4/eTnDygrVji5QgyXUWK5/BSJFDF160yG2lLlueeS7Eux13Rn12m2
IuvL40ErxvhM08XvohaQmYi1YGkYJImeT2Uq1mVJ0hxjAPI4SY56z2rHdsLFt1Pf
tpQIrHPJfWsa3ILMoaW5JODCYf7ixL4IyTaJQJ4+vSttcz0Jyezje0m7mNS8k6aw
P0bzJnGMZkiq50q9TYN0ZfBYGE0cQRLLyPCITIoav6np0lZEkvCsCQIDAQABo4IC
sTCCAg0wHQYDVR0OBBYEFDO96yx8TPm5xHhJkxqrsGmokCeJMB8GA1UdIwQYMBaA
FJ+3jZGC0QUd0DHiPfaXeoF15VzIMIHRBgNVHR8EgeMwgeAwgd2ggdgggdeGgdRs
ZGFwOi8vL0NOPUZCX0VudFN1YkNBLENOPtktMTM1MUMwNDA3QSxDTj1DRFAsQ049
UHVibG1jJTIwS2V5JTIwU2VydmljZXMsQ049U2VydmljZXMsQ049Q29uZmlndXJh
dGlvbixEQz1kOS0xMzUxQzA0MDZBLERDPW50dGVzdCxEQz1taWNYb3NvZnZnQsREM9
Y29tP2N1cnRmZmljYXRlUmV2b2NhdG1vbKxpc3Q/YmFzZT9vYmplY3RDbGFzZz1j
UkxEaXN0cmliidXRpb250b21udDCB2gYIKwYBBQUHAQEgEgc0wgcowgccGCCsGAQUF
BzAChoG6bGRhcDovLy9DTj1GQl9FbnRTdWJDQSxDTj1BSUeS0049UHVibG1jJTIw
S2V5JTIwU2VydmljZXMsQ049U2VydmljZXMsQ049Q29uZmlndXJhdGlvbixEQz1k
OS0xMzUxQzA0MDZBLERDPW50dGVzdCxEQz1taWNYb3NvZnZnQsREM9Y29tP2N1cnRm
ZmlndXJhdG1maWNYb3NvZnZnQsREM9Y29tP2N1cnRmZmlndXJhdG1maWNYb3NvZnZn
MCMGCSSGAQ0BjcuUAgQWHhQAQwBBAAEUAEABjAGgAYQBUAGcAZTA3BgkrBgEEAYI3
FQcEKjAoBiArBgEEAYI3FQIuDPliY7eQShOGZGYGtn3+D2dr4gUYBGgIBagIBADAU
BgNVHUEDTALBgkrBgEEAYI3FQUwDgYDVR0PAQH/BAQDAGUgMBwGCCsGAQQ0BjcuV
CgQPMa0wCwYJKwYBBAGCNxUFMA0GCSqGSIb3DQEBBQUAA4IBAQDESvFy3wAl1BjJ
pcWYC736HTLsu+90215XQvfFvqswJayHQy6aRGvkoWf6qQcm8IJFp2fM/K29ov1o
KEdR1U/zC36TEL2jCxtJAW9/bwA5XEm9Ph+TFBH9focXFCS9FisFuuJzdaL357eI
WXBuKydGzQXJcl+naKjC+74dKft/T7URU0e/8TRX0LFLXJg+7tECNEtSE5/oBMMo
yF+HNUmSjyoXmVZoHwB3J7/9ULMpI6lc0BrLVIKghMmCuIdkIuv67WQj/6NfG7uR
shWg/QbRwuEQk2ls9D9dtZwrN7XWgBbNAF6FnwZg7X9GqIDQ9erb6sZPYWg5GbZ
XVTXYIKj</BinarySecurityToken>
          </KeyExchangeToken>
        </RequestedSecurityToken>
      </RequestSecurityTokenResponse>
    </RequestSecurityTokenResponseCollection>
  </s:Body>
</s:Envelope>
```

4.1.3 Retrieval of a previously pended certificate request with Query Token Status

4.1.3.1 Client Request

```
<s:Envelope xmlns:a="http://www.w3.org/2005/08/addressing"
xmlns:s="http://www.w3.org/2003/05/soap-envelope">
  <s:Header>
    <a:Action s:mustUnderstand="1">
http://schemas.microsoft.com/windows/pki/2009/01/enrollment/RST/wstep</a:Action>
    <a:MessageID>urn:uuid:ce330bb2-0ca2-473b-a29a-19e9264666ff</a:MessageID>
    <a:ReplyTo>
    <a:Address>http://www.w3.org/2005/08/addressing/anonymous</a:Address>
    </a:ReplyTo>
  </s:Header>
  <s:Body xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema">
    <RequestSecurityToken xmlns="http://docs.oasis-open.org/ws-sx/ws-trust/200512">
    <TokenType>http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-x509-token-profile-
1.0#X509v3</TokenType>

<RequestType>http://schemas.microsoft.com/windows/pki/2009/01/enrollment/QueryTokenStatus</Re
questType>
    <RequestID
xmlns="http://schemas.microsoft.com/windows/pki/2009/01/enrollment">65</RequestID>
    </RequestSecurityToken>
  </s:Body>
</s:Envelope>
```

4.1.4 Message exchange with a server fault

4.1.4.1 Client Request

See section 4.1.1.1 for an example of a client request.

4.1.4.2 Server Fault Response

```
<s:Envelope xmlns:s="http://www.w3.org/2003/05/soap-envelope"
xmlns:a="http://www.w3.org/2005/08/addressing">
  <s:Header>
    <a:Action s:mustUnderstand="1">http://schemas.microsoft.com/net/2005/12/
windowscommunicationfoundation/dispatcher/fault</a:Action>
    <a:RelatesTo>urn:uuid:ce330bb2-0ca2-473b-a29a-19e9264666ff</a:RelatesTo>
    <ActivityId CorrelationId="4f0e4425-4883-41c1-b704-771135d18f84"
xmlns="http://schemas.microsoft.com/2004/09/ServiceModel/Diagnostics">
eda7e63d-0c42-455d-9c4f-47ab85803a50</ActivityId>
  </s:Header>
  <s:Body>
    <s:Fault>
    <s:Code>
    <s:Value>s:Receiver</s:Value>
    <s:Subcode>
    <s:Value xmlns:a="http://schemas.microsoft.com/net/2005/12/windowscommunicationfoundation/
dispatcher">a:InternalServiceFault</s:Value>
    </s:Subcode>
    </s:Code>
    <s:Reason>
    <s:Text xml:lang="en-US">The server was unable to process the request
due to an internal error. For more information about the error, either turn
on IncludeExceptionDetailInFaults (either from ServiceBehaviorAttribute or
from the <lt;<serviceDebug>> configuration behavior) on the server in order to
```



```
send the exception information back to the client, or turn on tracing as per
the Microsoft .NET Framework 3.0 SDK documentation and inspect the server
trace logs.</s:Text>
</s:Reason>
</s:Fault>
</s:Body>
</s:Envelope>
```

4.1.5 Certificate Renewal

4.1.5.1 Client Renewal Request

```
<s:Envelope xmlns:a="http://www.w3.org/2005/08/addressing"
xmlns:s="http://www.w3.org/2003/05/soap-envelope">
  <s:Header>
    <a:Action s:mustUnderstand="1">http://schemas.microsoft.com/windows/pki/2009/
01/enrollment/RST/wstep</a:Action>
    <a:MessageID>urn:uuid:b0a9b388-2581-451d-8c03-270d4ffe2928</a:MessageID>
    <a:ReplyTo>
      <a:Address>http://www.w3.org/2005/08/addressing/anonymous</a:Address>
    </a:ReplyTo>
  </s:Header>
  <s:Body xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema">
    <RequestSecurityToken xmlns="http://docs.oasis-open.org/ws-sx/ws-trust/200512">
      <TokenType>http://docs.oasis-open.org/wss/2004/01/
oasis-200401-wss-x509-token-profile-1.0#X509v3</TokenType>
      <RequestType>http://docs.oasis-open.org/ws-sx/ws-trust/200512/Issue</RequestType>
      <BinarySecurityToken EncodingType="http://docs.oasis-open.org/wss/2004/01/
oasis-200401-wss-wssecurity-secext-1.0.xsd#base64binary"
ValueType="http://docs.oasis-open.org/wss/2004/01/
oasis-200401-wss-wssecurity-secext-1.0.xsd#PKCS7"
xmlns="http://docs.oasis-open.org/wss/2004/01/
oasis-200401-wss-wssecurity-secext-1.0.xsd">
MIUIIAYJKoZiHvcNAQcCoIIUETCCFA0CAQExCzAJBgUrDgMCGGUAMIIL9wYJKoZI
hvcNAQcBoIIL6ASCC-QwggvgMI IKyAIBADCBvjETMBEGCGmS JomT8ixkARKWA2Nv
bTEZMBcGCgMS JomT8ixkARKWCW1pY3Jvc29mdDEWMBQGCGmS JomT8ixkARKWBM50
dGVzdDEdMBsGCgMS JomT8ixkARKWDWQ5LTEzNTFDMDQwNkExDjAMBgNVBAMTBVVz
ZXJzMQ0wCwYDVQQDEwRhYmJ5MjY5MjY5MjY5MjY5MjY5MjY5MjY5MjY5MjY5MjY5
MDQwNkEuTlRURVNUlk1JQ1JFU09GVC5DT00wgGgEiMA0GCSqGSIb3DQEBAQUAA4IB
DwAwggEKAoIBAQQD7WYEmBjrr1iF0S4zEY2JZG7yTThp8cXI5OLdYS0bwXJLZJW3
fmTD646zr/oCeGKi0ogMJO7JUeMgb0F70fcmJH7GaXe6i+QGPY7DaYYCtn94wPZQ
QGK6Mrnr1jPQyUU/1IOVQxukjZnzT11y9E/XfPloqTm6p3F6GksLe0kTOMIq0xqX
Vl8lHh5mzR7ddrZ4YUjyQf200n1qNe233vHmiJbLTR1WFn4a+onBSFAUINtYJXqu
NdDgza8eyNWeleJlJzXwBgtGjPhXrjL8wqpxOCS1VgOvdDEDU3mCoCaOLw4i5pU
RRnj6RN8VemOIVQSB/XR7si3Xfi5wauKNC6rAgMBAAGgggjaMBoGCisGAQQBgjcN
AgMxDBYKNI4xLjcwNTMuMjBkBgkrBgEEAYI3FRQxVzBVAgEFDc85LTEzNTFDMDQw
NUEuZDktMTM1MUMwNDA2QS5udHRLc3QubWljcm9zb2Z0LmNvbQwSRDktMTM1MUMw
NDA2QVxhYmJ5MjY5MjY5MjY5MjY5MjY5MjY5MjY5MjY5MjY5MjY5MjY5MjY5MjY5
aQBjAQIBAbwBzAG8AAGAgAGAgAGAgAGAgAGAgAGAgAGAgAGAgAGAgAGAgAGAgAGAg
ZwByAGEAcABOAGkAYwAgAFAAcgBvAHYAaQBkAGUAcgAgAHYAMQAUADADAQAwwgE5
BgkqhkiG9w0BCQ4xggEgMIIBJjBEBgkqhkiG9w0BCQ8ENzA1MA4GCCqGSIb3DQMC
AgIAgDAOBggqhkiG9w0DBAICAIAwBwYFKw4DAgcwCgYIKoZIhvcNAQcwwYDVR0R
BGQwYqA3BgorBgEEAYI3FAIDoCkMj2FiYnLAZDktMTM1MUMwNDA2QS5udHRLc3Qu
bWljcm9zb2Z0LmNvbYEnYWJjeUBEOs0xMzUxQzA0MDZBLk5UVEVTVCSNSUNST1NP
RlQuQ09NMBcGCSSGAQQBgjcUAgQKHggAVQBzAGUAcjApBgNVHSUEIjAgBgorBgEE
AYI3CGMEBggrBgEFBQcDBAYIKwYBBQUHAWIwDgYDVR0PAQH/BAQDAgWgMBOGA1Ud
dGQWB2ht3VgSMOvE7763YZRfhpYEZ0zCCBgEGCSsGAQQBgjcNATGCBpIwggAo
MIIFdQADAgECAgY2d8GAAAAA+MA0GCSqGSIb3DQEBBQUAMDMxGzAZBgNVBAst
Ek1pY3Jvc29mdCBQSQ0kgVGvhbTEUMBIGALUEAwWLRkJfERW5OU3ViQ0EwHhcnMDkw
MzA1MTgyNjE3W3hcnMTAwMzA1MTgyNjE3W3JCBvjETMBEGCGmS JomT8ixkARKWA2Nv
bTEZMBcGCgMS JomT8ixkARKWCW1pY3Jvc29mdDEWMBQGCGmS JomT8ixkARKWBM50
dGVzdDEdMBsGCgMS JomT8ixkARKWDWQ5LTEzNTFDMDQwNkExDjAMBgNVBAMTBVVz
ZXJzMQ0wCwYDVQQDEwRhYmJ5MjY5MjY5MjY5MjY5MjY5MjY5MjY5MjY5MjY5MjY5
MDQwNkEuTlRURVNUlk1JQ1JFU09GVC5DT00wgGgEiMA0GCSqGSIb3DQEBAQUAA4IB
```

DwAwggEKAoIBAQCUIUFleKRjXgCHj0u0lmiL+GqluG85wgfsz2th+w0jM+BA+lKL
e57dbCc+FqzpzqJruPgGDSAFMP4o6Kk8roM/4kPEVSYJIBidn3hRx2txSR7HrcS
Lo8/xhnxWY7m8WjpcFro2mBV/JbOnTT5KfU0Z+YSSCGzEVahJqN2Wj1l3VBZ8YC
J3BEUWY1UDYp33zDnPAMULKDPUPJlMXUmLx+pUL4vycfnm1on4iGw0kHHCqfM77L
NPyJfkdZSgeTfRd2qSPDFUeOurwoS8whyFvPe2LFT5BRcAoF4dIaRK5DYSCP8yvlx
Q+6z/yqD+tZ9WpR0TC7gFi1xeHPrU3TpBq5AgMBAAGjggMWMIIDEjBEBgkqhkiG
9w0BCQ8ENzA1MA4GCCqGS Ib3DQMCAGIAGDAOBggqhk iG9w0DBAICAIawBwYFKw4D
AgcwCgYIKoZIhvcNAwcwFwYJKwYBAGCNxQCBaoeCABVAHMAZQBByMIHaBggRbGgEF
BQCBAQSBZTCByjCBxwYIKwYBBQUHMAKGbbsZGFwOi8vLONOPUZCX0VudFN1YkNB
LENOPUFJQSxDtj1QdWJsaWMLmJBLZxklmJBTZXJ2aWNlcYxDtj1TZxJ2aWNlcYx
D Tj1Db25maWdlcmF0aW9uLERDPWQ5LTEzNTFDMDQwNkEsREM9bnR0ZXN0LERDPW1p
Y3Jvc29mdCxEQz1jb20/Y0FDZXJ0aWZpY2F0ZT9iYXNlP29iamVjdENsYXNzPWNl
cnRpb25BdXR0b3JpdHkwHQYDVRO0BBYEFaIBMzPGoRkGpoPN1ZHy7InYlG+MA4G
AlUdDwEB/wQEAWIfoDBrBgNVHREEZDBioDcGCisGAQQBgjcUAQOgKQwnYWJieUBk
OS0xMzUxQzA0MDZBLm50dGVzdC5taWNyb3NvZnQuY29tgSdhYmJ5QEQQ5LTEz
NTFDMDQwNkEuTlRURVNULk1JQ1JPU09GV5DT00wgesGA1UdHwSB4zCB4DCB3a
CB2qCB14aB1GxkYXA6Ly8vQ049RkJFRW50U3ViQ0EsQ049OS0xMzUxQzA0MDdB
LENOPUNEUCxDTj1QdWJsaWMLmJBLZxklmJBTZXJ2aWNlcYxDtj1TZxJ2aWNlcYx
D Tj1Db25maWdlcmF0aW9uLERDPWQ5LTEzNTFDMDQwNkEsREM9bnR0ZXN0LERDPW1p
Y3Jvc29mdCxEQz1jb20/Y2VydGlmawNhdGV5ZXZvY2F0aW9uTG1zdD9iYXNlP29i
amVjdENsYXNzPWNSTERpc3RyaWJldG1vblBvaW50MB8GA1UdIwQYMBaAFJ+3jZGC
0QUd0DHI PfaXeoF15VzIMCGALUdJQqIMCAGCisGAQQBgjcKAwQGCCsGAQUFBwME
BggrBgEFBQcDAjANBgkqhkiG9w0BAQUFAAOCAQEAge5W3XJ3766qGf8Y+r2Yu1Gm
Q0cSkpa7tqeZXWZ51skiv6i0S1NPo67HNp08+UFLyRpdghF+ZwtpnhCdTPieAVN
0HmdlLvO+LxTGA16oVCixa3qRG1x2NUQLH7VzH34ugf/YEaJDPj/9818TJhQQ7iP
Ti3jl9e52rYmNLb450egdMvJhbKJIftpcQqbWZy7HP3tzizf50dXhhzg3CGkOJI
WqSQPQQRknUkVxcjvFIIovrvNM3IluGDjIu9Ejj1gE1ZSqa4Lixjko2M/hzhWpej
KnVAEV9eb+ppWh25jbievK6WrYmgnwPgS9gRBB150q01ahPi6Vj5EOfxOe99KTAN
BqkqhkiG9w0BAQUFAAOCAQEAL89mJFAUL4Bi2e/8KvIXY6r8CLEsXVVUSNNv16r4
wPdkWeuGNteclvyufhxr3jNAEVwaechKQcIGKNz5cyd6fBE4LDPp+fiI4Ywb1bPU
gJvzQpJV5j2+dSux5TiJQYyEX1qrQfG3ioz7m7WSOvoFlmBomGpfUmHMMdsVSj
xFvJ7DShQe0JomRKc5G1Xp7o5/W5Xi6bn4T0RTIGd6vtsbvaTa1DJ/jaisGurlv8
yqedfAJIE62BbbEWOvIoa6wqdhCLLUXilPv3eZy5SsyZdDBwkbJsVfEhr0yivq6q
0ErE0fcdm/WBqQWfUgJwIUF9Dte7vykt7n043VZYQLTAcCBpIwggAOMIIFdqAD
AgECAgoY2d8GAAAAA+MA0GCSqGS Ib3DQEBBQUAMDMxGzAZBgNVBAStEk1pY3Jv
c29mdCBQ50kgVGVhbTEUMBIGALUEAAwLRkJFRW50U3ViQ0EwHhcNMdkwMzAlMTgy
NjE3WhcNMTAwMzAlMTgyNjE3WjCBvjETMBEGCgmSjomT8ixkARkWA2NvbTEZMBCg
CgmSjomT8ixkARkWBm50dGVzdDEdMBsGCgmSjomT8ixkARkWDWQ5LTEzNTFDMDQwNk
ExDjAMBGNVBAZBAMTBVVzZXJzMQ0wCwYDVQDEwRhYmJ5MTYwNAZKozIhvcNAQkBFi
dhYmJ5QEQQ5LTEzNTFDMDQwNkEuTlRURVNULk1JQ1JPU09GV5DT00wggEiMA0GCS
qGS Ib3DQEBBQUAA4IBDwAwggEKAoIBAQCUIUFleKRjXgCHj0u0lmiL+GqluG85wg
fsz2th+w0jM+BA+lKLe57dbCc+FqzpzqJruPgGDSAFMP4o6Kk8roM/4kPEVSYJIB
idn3hRx2txSR7HrcSLo8/xhnxWY7m8WjpcFro2mBV/JbOnTT5KfU0Z+YSSCGzEVah
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```

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xmlns="http://schemas.microsoft.com/windows/pki/2009/01/enrollment" />
</RequestSecurityToken>
</s:Body>
</s:Envelope>

```

4.1.5.2 Server Request Security Token Response

```

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xmlns:a="http://www.w3.org/2005/08/addressing">
  <s:Header>
    <a:Action s:mustUnderstand="1">
http://schemas.microsoft.com/windows/pki/2009/01/enrollment/RSTRC/wstep</a:Action>
    <ActivityId CorrelationId="b17bfb40-747b-477a-a83c-175624e401aa"
xmlns="http://schemas.microsoft.com/2004/09/ServiceModel/Diagnostics">
0a9f1849-8211-489c-a2b7-6a07ed1e6832</ActivityId>
    <a:RelatesTo>urn:uuid:b0a9b388-2581-451d-8c03-270d4ffe2928</a:RelatesTo>
  </s:Header>
  <s:Body>
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xmlns="http://docs.oasis-open.org/ws-sx/ws-trust/200512">
      <RequestSecurityTokenResponse>
        <TokenType>
http://docs.oasis-open.org/wss/2004/01/
oasis-200401-wss-x509-token-profile-1.0#X509v3</TokenType>
        <DispositionMessage xml:lang="en-US"
xmlns="http://schemas.microsoft.com/windows/pki/2009/01/
enrollment">Issued</DispositionMessage>
        <BinarySecurityToken
ValueType="http://docs.oasis-open.org/wss/2004/01/
oasis-200401-wss-wssecurity-secext-1.0.xsd#PKCS7"
EncodingType="http://docs.oasis-open.org/wss/2004/01/
oasis-200401-wss-wssecurity-secext-1.0.xsd#base64binary"
xmlns="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-
1.0.xsd">MIIRLAYJKoZIHvcNAQcCoIIRhTCCEYECAQMxCzAJBgUrDgMCGGUAMHOGCCsGAQUF
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```

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6kXZaY/Ppz3ON1jxfVmuAipYHn033A8PqR2i2/fj0+z2MC5grmkFOHxd4Sg90inQ
deT08i8ksQ+aO/LsbEShmK/qWmHnnQ45Z8bWxkpvt7EtxpYwQiZt61U2oQt/UYL
hZBPEYQC1KpgCTMmVuzk6NdEim2z7RXUMIFBmjDTA6M9FdlmMKQDw==</BinarySecurityToken>

5 Security

5.1 Security Considerations for Implementers

None.

5.2 Index of Security Parameters

None.

6 Appendix A: Full WSDL

The WSTEP protocol is a profile extension of WS-Trust1.3. As such, it does not have a WSDL.

WS-Trust 1.3 WSDL: The full WSDL for WS-Trust can be found at: <http://docs.oasis-open.org/ws-sx/ws-trust/200512/ws-trust-1.3.wsdl>.

WSTEP XML Schema: For the convenience of implementation, the XML Schema is provided here.

```
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:wstep="http://schemas.microsoft.com/windows/pki/2009/01/enrollment"
  targetNamespace="http://schemas.microsoft.com/windows/pki/2009/01/enrollment"
  elementFormDefault="qualified">

  <xs:import namespace="http://www.w3.org/XML/1998/namespace"
    schemaLocation="http://www.w3.org/2001/xml.xsd" />

  <xs:element name="DispositionMessage" type="wstep:DispositionMessageType" nillable="true"
  />
  <xs:complexType name="DispositionMessageType">
    <xs:simpleContent>
      <xs:extension base="xs:string">
        <xs:attribute ref="xml:lang" use="optional" />
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>
  <xs:element name="CertificateEnrollmentWSDetail" nillable="true"
    type="wstep:CertificateEnrollmentWSDetailType" />
  <xs:complexType name="CertificateEnrollmentWSDetailType">
    <xs:sequence>
      <xs:element minOccurs="0" maxOccurs="1" name="BinaryResponse" nillable="true"
        type="xs:string" />
      <xs:element minOccurs="0" maxOccurs="1" name="ErrorCode" nillable="true" type="xs:int"
        />
      <xs:element minOccurs="0" maxOccurs="1" name="InvalidRequest" nillable="true"
        type="xs:boolean" />
      <xs:element minOccurs="0" maxOccurs="1" name="RequestID" type="xs:string"
        nillable="true" />
    </xs:sequence>
  </xs:complexType>
  <xs:element name="RequestID" type="xs:string" nillable="true" />
</xs:schema>
```

7 (Updated Section) Appendix B: Product Behavior

The information in this specification is applicable to the following Microsoft products or supplemental software. References to product versions include updates to those products.

The following table shows the relationships between Microsoft product versions or supplemental software and the roles they perform.

Windows Releases	Server Role	Client Role
Windows 7 operating system	No	Yes
Windows Server 2008 R2 operating system	Yes	Yes
Windows 8 operating system	No	Yes
Windows Server 2012 operating system	Yes	Yes
Windows 8.1 operating system	No	Yes
Windows Server 2012 R2 operating system	Yes	Yes
Windows 10 operating system	No	Yes
Windows Server 2016 operating system	Yes	Yes
Windows Server operating system	Yes	Yes
Windows Server 2019 operating system	Yes	Yes
Windows Server 2022 operating system	Yes	Yes

Exceptions, if any, are noted in this section. If an update version, service pack or Knowledge Base (KB) number appears with a product name, the behavior changed in that update. The new behavior also applies to subsequent updates unless otherwise specified. If a product edition appears with the product version, behavior is different in that product edition.

Unless otherwise specified, any statement of optional behavior in this specification that is prescribed using the terms "SHOULD" or "SHOULD NOT" implies product behavior in accordance with the SHOULD or SHOULD NOT prescription. Unless otherwise specified, the term "MAY" implies that the product does not follow the prescription.

<1> Section 3.1.3: Applicable Windows Server releases set the *DefaultLanguage* parameter to the installed language.

8 Change Tracking

This section identifies changes that were made to this document since the last release. Changes are classified as Major, Minor, or None.

The revision class **Major** means that the technical content in the document was significantly revised. Major changes affect protocol interoperability or implementation. Examples of major changes are:

- A document revision that incorporates changes to interoperability requirements.
- A document revision that captures changes to protocol functionality.

The revision class **Minor** means that the meaning of the technical content was clarified. Minor changes do not affect protocol interoperability or implementation. Examples of minor changes are updates to clarify ambiguity at the sentence, paragraph, or table level.

The revision class **None** means that no new technical changes were introduced. Minor editorial and formatting changes may have been made, but the relevant technical content is identical to the last released version.

The changes made to this document are listed in the following table. For more information, please contact dochelp@microsoft.com.

Section	Description	Revision class
7 Appendix B: Product Behavior	Updated for this version of Windows Server.	Major

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