Web Services Security Kerberos Token Profile Version 1.1.1

Committee Specification 01

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Specification URIs

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http://docs.oasis-open.org/wss-m/wss/v1.1.1/cs01/wss-KerberosTokenProfile-v1.1.1-cs01.html
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This prose specification is one component of a multi-part Work Product which includes:

- Web Services Security Kerberos Token Profile Version 1.1.1 (this document)
- Web Services Security Rights Expression Language (REL) Token Profile Version 1.1.1
- Web Services Security SAML Token Profile Version 1.1.1
- Web Services Security: SOAP Message Security Version 1.1.1
- Web Services Security SOAP Message with Attachments (SwA) Profile Version 1.1.1
- Web Services Security Username Token Profile Version 1.1.1
- Web Services Security X.509 Certificate Token Profile Version 1.1.1
- XML schemas: http://docs.oasis-open.org/wss-m/wss/v1.1.1/cs01/xsd/

Related work:

This specification supersedes:

- *Web Services Security Kerberos Token Profile 1.1*. 01 November 2006. OASIS Standard incorporating Approved Errata. http://docs.oasis-open.org/wss/v1.1/wss-v1.1-spec-errata-os-KerberosTokenProfile.htm
- *Web Services Security Kerberos Token Profile 1.1*. 01 November 2006. OASIS Approved Errata. http://docs.oasis-open.org/wss/v1.1/wss-v1.1-errata-os-KerberosTokenProfile.htm

Abstract:

This document describes how to use Kerberos [Kerb] tickets (specifically the AP-REQ packet) with the Web Services Security: SOAP Message Security 1.1.1.

This document integrates specific error corrections or editorial changes to the preceding specification, within the scope of the Web Services Security and this TC.

This document introduces a third digit in the numbering convention where the third digit represents a consolidation of error corrections, bug fixes or editorial formatting changes (e.g., 1.1.1); it does not add any new features beyond those of the base specifications (e.g., 1.1).

Status:

This document was last revised or approved by the OASIS Web Services Security Maintenance (WSS-M) TC on the above date. The level of approval is also listed above. Check the "Latest version" location noted above for possible later revisions of this document.

Technical Committee members should send comments on this specification to the Technical Committee's email list. Others should send comments to the Technical Committee by using the "Send A Comment" button on the Technical Committee's web page at http://www.oasis-open.org/committees/wss-m/.

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Table of Contents

1 Introduction

This specification describes the use of Kerberos [**RFC1510**] tokens with respect to the WSS: SOAP Message Security specification [WSS].

Specifically, this document defines how to encode Kerberos tickets and attach them to SOAP messages. As well, it specifies how to add signatures and encryption to the SOAP message, in accordance with WSS: SOAP Message Security, which uses and references the Kerberos tokens.

For interoperability concerns, and for some security concerns, the specification is limited to using the `AP-REQ` packet (service ticket and authenticator) defined by Kerberos as the Kerberos token. This allows a service to authenticate the ticket and interoperate with existing Kerberos implementations.

It should be noted that how the `AP-REQ` is obtained is out of scope of this specification as are scenarios involving other ticket types and user-to-user interactions.

Note that Sections 2.1, 2.2, all of 3, and indicated parts of 6 are normative. All other sections are 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 [2119].

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

This specification is designed to work with the general SOAP [S11, S12] 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.

2.2 Namespaces

The XML namespace [XML-ns] 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://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd
http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd
http://docs.oasis-open.org/wss/oasis-wss-wssecurity-secext-1.1.xsd
```

Note that this specification does not introduce new schema elements.

The following namespaces are used in this document:

Prefix	Namespace
S11	http://schemas.xmlsoap.org/soap/envelope/
S12	http://www.w3.org/2003/05/soap-envelope
wsse	http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd
wsse11	http://docs.oasis-open.org/wss/oasis-wss-wssecurity-secext-1.1.xsd
wsu	http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd
ds	http://www.w3.org/2000/09/xmldsig#
xenc	http://www.w3.org/2001/04/xmlenc#

39

40 The URLs provided for the `wsse` and `wsu` namespaces can be used to obtain the schema files. URI
41 fragments defined in this specification are relative to the following base URI unless otherwise specified:

42 `http://docs.oasis-open.org/wss/oasis-wss-kerberos-token-profile-1.1`

43 2.3 Terminology

44 Readers are presumed to be familiar with the terms in the Internet Security Glossary [ISG].

45

46 This specification employs the terminology defined in the WSS: SOAP Message Security Core
47 Specification [WSS].

48

49 The following (non-normative) table defines additional acronyms and abbreviations for this document.

Term	Definition
SHA	Secure Hash Algorithm
SOAP	Simple Object Access Protocol
URI	Uniform Resource Identifier
XML	Extensible Markup Language

50

3 Usage

This section describes the profile (specific mechanisms and procedures) for the Kerberos binding of WSS: SOAP Message Security.

Identification: `http://docs.oasis-open.org/wss/oasis-wss-kerberos-token-profile-1.1`

3.1 Processing Model

The processing model for WSS: SOAP Message Security with Kerberos tokens is no different from that of WSS: SOAP Message Security with other token formats as described in WSS: SOAP Message Security.

3.2 Attaching Security Tokens

Kerberos tokens are attached to SOAP messages using WSS: SOAP Message Security by using the `<wsse:BinarySecurityToken>` described in WSS: SOAP Message Security. When using this element, the `@ValueType` attribute MUST be specified. This specification defines six values for this attribute as defined in the table below:

URI	Description
`http://docs.oasis-open.org/wss/oasis-wss-kerberos-token-profile-1.1#Kerberosv5_AP_REQ`	Kerberos v5 AP-REQ as defined in the Kerberos specification [Kerb]. This `ValueType` is used when the ticket is an AP Request.
`http://docs.oasis-open.org/wss/oasis-wss-kerberos-token-profile-1.1#GSS_Kerberosv5_AP_REQ`	A GSS-API Kerberos V5 mechanism token containing an KRB_AP_REQ message as defined in RFC-1964 [1964], Sec. 1.1 and its successor RFC-4121 [4121], Sec. 4.1. This `ValueType` is used when the ticket is an AP Request (ST + Authenticator).
`http://docs.oasis-open.org/wss/oasis-wss-kerberos-token-profile-1.1#Kerberosv5_AP_REQ1510`	Kerberos v5 AP-REQ as defined in RFC1510. This `ValueType` is used when the ticket is an AP Request per RFC1510.
`http://docs.oasis-open.org/wss/oasis-wss-kerberos-token-profile-1.1#GSS_Kerberosv5_AP_REQ1510`	A GSS-API Kerberos V5 mechanism token containing an KRB_AP_REQ message as defined in RFC-1964, Sec. 1.1 and its successor RFC-4121, Sec. 4.1. This `ValueType` is used when the ticket is an AP Request (ST + Authenticator) per RFC1510.
`http://docs.oasis-open.org/wss/oasis-wss-kerberos-token-profile-1.1#Kerberosv5_AP_REQ4120`	Kerberos v5 AP-REQ as defined in RFC4120. This `ValueType` is used when the ticket is an AP Request per

	RFC4120
http://docs.oasis-open.org/wss/oasis-wss-kerberos-token-profile-1.1#GSS_Kerberosv5_AP_REQ4120	A GSS-API Kerberos V5 mechanism token containing an KRB_AP_REQ message as defined in RFC-1964, Sec. 1.1 and its successor RFC-4121, Sec. 4.1. This ValueType is used when the ticket is an AP Request (ST + Authenticator) per RFC4120.

It should be noted that the URIs in the table above also serve as the official URIs identifying the Kerberos tokens defined in this specification.

All token types defined in this section use the type 0x8003 defined in RFC1964 for the checksum field of the authenticator inside the AP_REQ.

The octet sequence of either the GSS-API framed KRB_AP_REQ token or an unwrapped AP_REQ is encoded using the indicated encoding (e.g. base 64) and the result is placed inside of the <wsse:BinarySecurityToken> element.

The following example illustrates a SOAP message with a Kerberos token.

```
<S11:Envelope xmlns:S11="..." xmlns:wsu="...">
    <S11:Header>
        <wsse:Security xmlns:wsse="...">
            <wsse:BinarySecurityToken EncodingType="http://docs.oasis-
open.org/wss/2004/01/oasis-200401-wss-soap-message-security-1.0#Base64Binary"
ValueType="http://docs.oasis-open.org/wss/oasis-wss-kerberos-token-profile-
1.1#Kerberosv5_AP_REQ" wsu:Id="MyToken">boIBxDCCAcCgAwIBBaEDAgEOogcD...
            </wsse:BinarySecurityToken>
            ...
        </wsse:Security>
    </S11:Header>
    <S11:Body>
        ...
    </S11:Body>
</S11:Envelope>
```

3.3 Identifying and Referencing Kerberos Tokens

A Kerberos Token is referenced by means of the <wsse:SecurityTokenReference> element. This mechanism, defined in WSS: SOAP Message Security, provides different referencing mechanisms. The following list identifies the supported and unsupported mechanisms:

The wsu:Id MAY be specified on the <wsse:BinarySecurityToken> element allowing the token to be directly referenced.

A <wsse:KeyIdentifier> element MAY be used which specifies the identifier for the Kerberos ticket. This value is computed as the SHA1 of the pre-encoded octets that were used to form the contents of the <wsse:BinarySecurityToken> element. The <wsse:KeyIdentifier> element contains the encoded form the of the KeyIdentifier which is defined as the base64 encoding of the SHA1 result.

Key Name references MUST NOT be used.

When a Kerberos Token is referenced using <wsse:SecurityTokenReference> the @wsse11:TokenType attribute SHOULD be specified. If the @wsse11:TokenType is specified its value MUST be the URI that identifies the Kerberos token type as defined for a corresponding

104 BinarySecurityToken/@ValueType attribute. The Reference/@ValueType attribute is not
105 required. If specified, its value MUST be equivalent to that of the @wsse11:TokenType attribute..

106 The <wsse:SecurityTokenReference> element from which the reference is made contains the
107 <wsse:KeyIdentifier> element. The <wsse:KeyIdentifier> element MUST have a ValueType
108 attribute on the <wsse:KeyIdentifier> element with the value #Kerberosv5APREQSHA1 and its
109 contents MUST be the SHA1 of GSS-API framed KRB_AP_REQ token or unwrapped AP-REQ, as
110 appropriate, encoded as per the <wsse:KeyIdentifier> element's EncodingType attribute.

111

Reference Identifier	**ValueType URI**	Description
Kerberos v5 AP-REQ	http://docs.oasis-open.org/wss/oasis-wss-kerberos-token-profile-1.1#Kerberosv5APREQSHA1	SHA1 of the v5 AP-REQ octets, either GSS-API framed KRB_AP_REQ token or just the Kerberos AP-REQ.

112

113 The following example illustrates using ID references to a Kerberos token:

114

```
115 <S11:Envelope xmlns:S11="..." xmlns:wsse="..." xmlns:wsu="...">
116     <S11:Header>
117         <wsse:Security>
118             <wsse:BinarySecurityToken EncodingType="http://docs.oasis-
119 open.org/wss/2004/01/oasis-200401-wss-soap-message-security-1.0#Base64Binary"
120 ValueType="http://docs.oasis-open.org/wss/oasis-wss-kerberos-token-profile-
121 1.1#Kerberosv5_AP_REQ" wsu:Id="MyToken">
122                     boIBxDCCAcCgAwIBBaEDAgEOogcD...
123             </wsse:BinarySecurityToken>
124             ...
125                <wsse:SecurityTokenReference TokenType="http://docs.oasis-
126 open.org/wss/oasis-wss-kerberos-token-profile-1.1#Kerberosv5_AP_REQ">
127                   <wsse:Reference URI="#MyToken"
128 ValueType="http://docs.oasis-open.org/wss/oasis-wss-kerberos-token-profile-
129 1.1#Kerberosv5_AP_REQ">
130                   </wsse:Reference>
131                </wsse:SecurityTokenReference>
132             ...
133         </wsse:Security>
134     </S11:Header>
135     <S11:Body>
136         ...
137     </S11:Body>
138 </S11:Envelope>
139
```

140

141 The AP-REQ packet is included in the initial message to the service, but need not be attached to
142 subsequent messages exchanged between the involved parties. Consequently, the KeyIdentifier
143 reference mechanism SHOULD be used on subsequent exchanges as illustrated in the example below:

144

```
145 <S11:Envelope xmlns:S11="..." xmlns:wsse="..." xmlns:wsu="...">
146     <S11:Header>
147         <wsse:Security>
148             ...
149                <wsse:SecurityTokenReference
150 wsse11:TokenType=http://docs.oasis-open.org/wss/oasis-wss-kerberos-token-
151 profile-1.1#Kerberosv5_AP_REQ>
```



```
                <wsse:KeyIdentifier ValueType="http://docs.oasis-
open.org/wss/oasis-wss-kerberos-token-profile-1.1#Kerberosv5APREQSHA1">
                   GbsDt+WmD9XlnUUWbY/nhBveW8I=
                </wsse:KeyIdentifier>
              </wsse:SecurityTokenReference>
            ...
        </wsse:Security>
    </S11:Header>
    <S11:Body>
        ...
    </S11:Body>
</S11:Envelope>
```

3.4 Authentication

When a Kerberos ticket is referenced as a signature key, the signature algorithm [DSIG] MUST be a hashed message authentication code.

When a Kerberos ticket is referenced as an encryption key, the encryption algorithm MUST be a symmetric encryption algorithm.

The value of the signature or encryption key is constructed from the value of the Kerberos sub-key when it is present in the authenticator or a session key from the ticket if the sub-key is absent, either by using the Kerberos sub-key or session key directly or using a key derived from that key using a mechanism agreed to by the communicating parties.

3.5 Encryption

When a Kerberos ticket is referenced as an encryption key, the encryption algorithm MUST be a symmetric encryption algorithm.

The value of the signature or encryption key is constructed from the value of the Kerberos sub-key when it is present in the authenticator or a session key from the ticket if the sub-key is absent, either by using the Kerberos sub-key or session key directly or using a key derived from that key using a mechanism agreed to by the communicating parties..

3.6 Principal Name

Kerberos principal name definition and mapping of non-Kerberos names to Kerberos V principal names are out of scope of this document.

3.7 Error Codes

When using Kerberos tokens, it is RECOMMENDED to use the error codes defined in the WSS: SOAP Message Security specification. However, implementations MAY use custom errors, defined in private namespaces if they desire. Care should be taken not to introduce security vulnerabilities in the errors returned.

4 Threat Model and Countermeasures

The use of Kerberos assertion tokens with WSS: SOAP Message Security introduces no new message-level threats beyond those identified for Kerberos itself or by WSS: SOAP Message Security with other types of security tokens.

One potential threat is that of key re-use. The mechanisms described in WSS: SOAP Message Security can be used to prevent replay of the message; however, it is possible that for some service scopes, there are host security concerns of key hijacking within a Kerberos infrastructure. The use of the AP-REQ and its associated authenticator and sequencer mitigate this threat.

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

It is strongly recommended that GSS wrapped AP-REQ be used or that unwrapped AP-REQ be combined with timestamp be used to prevent replay attack.

It is strongly recommended that all relevant and immutable message data be signed to prevent replay attacks.

It should be noted that transport-level security MAY be used to protect the message and the security token in cases where neither a GSS-API framed KRB_AP_REQ token or an unwrapped AP-REQ combined with timestamp and signature are being used.

The last numbered section in the specification must be the Conformance section. Conformance Statements/Clauses go here.

5 References

The following are normative references

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

[Kerb] J. Kohl and C. Neuman, "The Kerberos Network Authentication Service (V5)," RFC 1510, September 1993, http://www.ietf.org/rfc/rfc1510.txt .

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

[S11] W3C Note, "SOAP: Simple Object Access Protocol 1.1," 08 May 2000.

[S12] W3C Recommendation, "SOAP Version 1.2 Part 1: Messaging Framework", 23 June 2003.

[URI] T. Berners-Lee, R. Fielding, L. Masinter, "Uniform Resource Identifiers (URI): Generic Syntax," RFC 3986, MIT/LCS, Day Software, Adobe Systems, January 2005.

[WSS] A. Nadalin et al., Web Services Security: SOAP Message Security 1.1.1 http://docs.oasis-open.org/wss-m/wss/v1.1.1/csd01/wss-SOAPMessageSecurity-v1.1.1-csd01.pdf.

[1964] J. Linn , The Kerberos Version 5 GSS-API Mechanism, RFC 1964, June 1996.

[4121] L, Zhu, K. Jaganathan, S. Hartman, The Kerberos Version 5 Generic Security Service Application Program Interface (GSS-API) Mechanism: Version 2, RFC 4121, July 2005.

The following are non-normative references

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

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

[DSIG] D. Eastlake, J. R., D. Solo, M. Bartel, J. Boyer , B. Fox , E. Simon. *XML-Signature Syntax and Processing*, W3C Recommendation, 12 February 2002. http://www.w3.org/TR/xmldsig-core/.

6 Conformance

An implementation conforms to this specification if it meets the requirements in Sections 2.1, 2.2 and 3.

A. Acknowledgements

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Wayne	Vicknair	IBM
Phil	Griffin	Individual
Mark	Hayes	Individual
John	Hughes	Individual
Peter	Rostin	Individual
Davanum	Srinivas	Individual
Bob	Morgan	Individual/Internet2
Bob	Atkinson	Microsoft
Keith	Ballinger	Microsoft
Allen	Brown	Microsoft
Giovanni	Della-Libera	Microsoft
Alan	Geller	Microsoft
Johannes	Klein	Microsoft

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B. Revision History

Revision	Date	Editor	Changes Made
WD01	17-January-2011	Carlo Milono	Corrected/added hyperlinks where missing; added Status section
WD02	8-February-2011	Carlo Milono	Added Related Work to reflect v1.1.1 of the specs; changed References for SOAP Message Security to reflect v1.1.1; Changed WD# to 2; Added Date; Changed the Acknowledgements from Participants to reflect them as Current Contributors and Previous Contributors
WD03	16-March-2011	David Turner	Corrected and updated links
CSD01	2-May-2011	TC Admin	Generated from WD03
CSD02-draft	16-May-11	David Turner	Added conformance statement and corrected a few formatting issues.

