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# 1 Web Services Security 2 SOAP Messages with Attachments 3 (SwA) Profile 1.1

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16 **Abstract:**

17 This specification defines how to use the OASIS Web Services Security: SOAP Message Security  
18 standard [WSS-Sec] with SOAP Messages with Attachments [SwA].

19 **Status:**

20 This is an **OASIS Standard** document produced by the Web Services Security Technical  
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22 location noted above for possible errata to this document.

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# 1 Introduction

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This section is non-normative. Note that sections 2.2 and 5 are normative. All other sections are non-normative.

This document describes how to use the OASIS Web Services Security: SOAP Message Security standard [WSS-Sec] with SOAP Messages with Attachments [SwA]. More specifically, it describes how a web service consumer can secure SOAP attachments using SOAP Message Security for attachment integrity, confidentiality and origin authentication, and how a receiver may process such a message.

A broad range of industries - automotive, insurance, financial, pharmaceutical, medical, retail, etc - require that their application data be secured from its originator to its ultimate consumer. While some of this data will be XML, quite a lot of it will not be. In order for these industries to deploy web service solutions, they need an interoperable standard for end-to-end security for both their XML data and their non-XML data.

Profiling SwA security may help interoperability between the firms and trading partners using attachments to convey non-XML data that is not necessarily linked to the XML payload. Many industries, such as the insurance industry require free-format document exchange in conjunction with web services messages. This profile of SwA should be of value in these cases.

In addition, some content that could be conveyed as part of the SOAP body may be conveyed as an attachment due to its large size to reduce the impact on message and XML processing, and may be secured as described in this profile.

This profile is applicable to using SOAP Message Security in conjunction with SOAP Messages with Attachments (SwA). This means the scope is limited to SOAP 1.1, the scope of SwA.

Goals of this profile include the following:

- Enable those who choose to use SwA to secure these messages, including chosen attachments, using SOAP Message Security
- Allow the choice of securing MIME header information exposed to the SOAP layer, if desired.
- Do not interfere with MIME transfer mechanisms, in particular, allow MIME transfer encodings to change to support MIME transfer, despite support for integrity protection.
- Do not interfere with the SOAP processing model – in particular allow SwA messages to transit SOAP intermediaries.

Non-goals include:

- Provide guidance on which of a variety of security mechanisms are appropriate to a given application. The choice of transport layer security (e.g. SSL/TLS), S/MIME, application use of XML Signature and XML Encryption, and other SOAP attachment mechanisms (MTOM) is explicitly out of scope. This profile assumes a need and desire to secure SwA using SOAP Message security.
- Outline how different security mechanisms may be used in combination.
- Enable persisting signatures. It may be possible depending on the situation and measures taken, but is not discussed in this profile.
- Support signing and/or encryption of portions of attachments. This is not supported by this profile, but is not necessarily precluded. Application use of XML Signature and XML Encryption may be used to accomplish this. SOAP Message security may also support this in some circumstances, but this profile does not address or define such usage.

The existence of this profile does not preclude using other mechanisms to secure attachments conveyed in conjunction with SOAP messages, including the use of XML security technologies at the application

133 layer or the use of security for the XML Infoset before a serialization that uses attachment technology  
134 [[MTOM](#)]. The requirements in this profile only apply when securing SwA attachments explicitly according  
135 to this profile.

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## 2 Notations and Terminology

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

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### 2.1 Notational Conventions

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The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this specification are to be interpreted as described in IETF RFC 2119 [RFC2119].

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```
Listings of productions or other normative code appear like this.
```

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Example code listings appear like this.
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**Note:** Non-normative notes and explanations appear like this.

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When describing abstract data models, this specification uses the notational convention used by the XML Infoset. Specifically, abstract property names always appear in square brackets (e.g., [some property]).

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When describing concrete XML schemas [XML-Schema], this specification uses the notational convention of OASIS Web Services Security: SOAP Message Security. Specifically, each member of an element's [children] or [attributes] property is described using an XPath-like [XPath] notation (e.g., /x:MyHeader/x:SomeProperty/@value1). The use of {any} indicates the presence of an element wildcard (<xs:any/>). The use of @{any} indicates the presence of an attribute wildcard (<xs:anyAttribute/>).

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Commonly used security terms are defined in the Internet Security Glossary [SECGLO]. Readers are presumed to be familiar with the terms in this glossary as well as the definitions in the SOAP Message Security specification [WSS-Sec] .

#### 2.1.1 Namespaces

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Namespace URIs (of the general form "some-URI") represent application-dependent or context-dependent URIs as defined in RFC 2396 [RFC2396]. This specification is designed to work with the SOAP 1.1 [SOAP11] message structure and message processing model, the version of SOAP supported by SOAP Messages with Attachments. The current SOAP 1.1 namespace URI is used herein to provide detailed examples.

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The namespaces used in this document are shown in the following table (note that for brevity, the examples use the prefixes listed below but do *not* include the URIs – those listed below are assumed).

Prefix	Namespace
S11	<a href="http://schemas.xmlsoap.org/soap/envelope/">http://schemas.xmlsoap.org/soap/envelope/</a>
wsse	<a href="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-secext-1.0.xsd</a>
wsu	<a href="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd">http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd</a>
wsswa	<a href="http://docs.oasis-open.org/wss/oasis-wss-SwAProfile-1.1.xsd">http://docs.oasis-open.org/wss/oasis-wss-SwAProfile-1.1.xsd</a>

163

The URLs provided for the wsse and wsu namespaces can be used to obtain the schema files.

## 164 2.1.2 Acronyms and Abbreviations

165 The following (non-normative) table defines acronyms and abbreviations for this document, beyond those  
166 defined in the SOAP Message Security standard.

Term	Definition
CID	Content ID scheme for URLs. Refers to Multipart MIME body part, that includes both MIME headers and content for that part. [RFC2392]
SwA	SOAP Messages with Attachments [SwA]

## 167 2.2 Normative References

- 168 [RFC 2119] S. Bradner. *Key words for use in RFCs to Indicate Requirement Levels*. IETF  
169 RFC 2119, March 1997. <http://www.ietf.org/rfc/rfc2119.txt>.
- 170 [CHARSETS] Character sets assigned by IANA. See [ftp://ftp.isi.edu/in-](ftp://ftp.isi.edu/in-notes/iana/assignments/character-sets)  
171 [notes/iana/assignments/character-sets](ftp://ftp.isi.edu/in-notes/iana/assignments/character-sets).
- 172 [Excl-Canon] "Exclusive XML Canonicalization, Version 1.0", W3C Recommendation, 18 July  
173 2002. <http://www.w3.org/TR/xml-exc-c14n/>.
- 174 [RFC2045] "Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet  
175 Message Bodies", IETF RFC 2045, November 1996,  
176 <http://www.ietf.org/rfc/rfc2045.txt>.
- 177 [RFC2046] "Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types", IETF  
178 RFC 2046, November 1996, <http://www.ietf.org/rfc/rfc2046.txt>.
- 179 [RFC2047] "Multipurpose Internet Mail Extensions (MIME) Part Three: Message Header  
180 Extensions for Non-ASCII Text", IETF RFC 2047, November 1996,  
181 <http://www.ietf.org/rfc/rfc2047.txt>.
- 182 [RFC2048] "Multipurpose Internet Mail Extensions (MIME) Part Four: Registration  
183 Procedures", <http://www.ietf.org/rfc/rfc2048.txt>.
- 184 [RFC2049] "Multipurpose Internet Mail Extensions(MIME) Part Five: Conformance Criteria  
185 and Examples", <http://www.ietf.org/rfc/rfc2049.txt>.
- 186 [RFC2119] S. Bradner, "Key words for use in RFCs to Indicate Requirement Levels", IETF  
187 RFC 2119, March 1997, <http://www.ietf.org/rfc/rfc2119.txt>.
- 188 [RFC2184] P. Resnick, "MIME Parameter Value and Encoded Word Extensions: Character  
189 Sets, Languages, and Continuations", IETF RFC 2184, August 1997,  
190 <http://www.ietf.org/rfc/rfc2184.txt>.
- 191 [RFC2392] E. Levinson, "Content-ID and Message-ID Uniform Resource Locators", IETF  
192 RFC 2392, <http://www.ietf.org/rfc/rfc2392.txt>.
- 193 [RFC2396] T. Berners-Lee, R. Fielding, L. Masinter, "Uniform Resource Identifiers (URI):  
194 Generic Syntax," RFC 2396, MIT/LCS, U.C. Irvine, Xerox Corporation, August  
195 1998, <http://www.ietf.org/rfc/rfc2396.txt>.
- 196 [RFC2557] "MIME Encapsulation of Aggregate Documents, such as HTML (MHTML)", IETF  
197 RFC 2557, March 1999, <http://www.ietf.org/rfc/rfc2557.txt>.
- 198 [RFC2633] Ramsdell B., "S/MIME Version 3 Message Specification", Standards Track RFC  
199 2633, June 1999. <http://www.ietf.org/rfc/rfc2633.txt>.
- 200 [RFC2822] "Internet Message Format", IETF RFC 2822, April 2001,  
201 <http://www.ietf.org/rfc/rfc2822.txt>.
- 202 [SECGLO] "Internet Security Glossary," Informational RFC 2828, May 2000.
- 203 [SOAP11] "SOAP: Simple Object Access Protocol 1.1", W3C Note, 08 May 2000.

204	<b>[SwA]</b>	“SOAP Messages with Attachments”, W3C Note, 11 December 2000, <a href="http://www.w3.org/TR/2000/NOTE-SOAP-attachments-20001211">http://www.w3.org/TR/2000/NOTE-SOAP-attachments-20001211</a> .
205		
206	<b>[WS-I-AP]</b>	“Attachments Profile Version 1.0”, <i>Final Material</i> , 2004-08-24, <a href="http://www.ws-i.org/Profiles/AttachmentsProfile-1.0.html">http://www.ws-i.org/Profiles/AttachmentsProfile-1.0.html</a> .
207		
208	<b>[WSS-Sec]</b>	A. Nadalin et al., “Web Services Security: SOAP Message Security 1.0 (WS-Security 2004)”, OASIS Standard 200401, March 2004, <a href="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-soap-message-security-1.0.pdf">http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-soap-message-security-1.0.pdf</a> .
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211	<b>[XML-Schema]</b>	W3C Recommendation, “XML Schema Part 1: Structures,” 2 May 2001, <a href="http://www.w3.org/TR/2001/REC-xmlschema-1-20010502/">http://www.w3.org/TR/2001/REC-xmlschema-1-20010502/</a> .
212		
213		W3C Recommendation, “XML Schema Part 2: Datatypes,” 2 May 2001, <a href="http://www.w3.org/TR/2001/REC-xmlschema-2-20010502/">http://www.w3.org/TR/2001/REC-xmlschema-2-20010502/</a> .
214		
215	<b>[XML-Sig]</b>	W3C Recommendation, “XML-Signature Syntax and Processing”, 12 February 2002, <a href="http://www.w3.org/TR/xmlsig-core/">http://www.w3.org/TR/xmlsig-core/</a> .
216		
217	<b>[XPath]</b>	W3C Recommendation, “XML Path Language”, 16 November 1999, <a href="http://www.w3.org/TR/xpath">http://www.w3.org/TR/xpath</a> .
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## 219 2.3 Non-normative References

220	<b>[DecryptT]</b>	M. Hughes et al, “Decryption Transform for XML Signature”, W3C Recommendation, 10 December 2002. <a href="http://www.w3.org/TR/xmlenc-decrypt/">http://www.w3.org/TR/xmlenc-decrypt/</a> .
221		
222	<b>[MTOM]</b>	“SOAP Message Transmission Optimization Mechanism”, W3C Recommendation, 25 January 2005, <a href="http://www.w3.org/TR/soap12-mtom/">http://www.w3.org/TR/soap12-mtom/</a> .
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## 3 MIME Processing

225 This profile is concerned with the securing of SOAP messages with attachments, attachments that are  
226 conveyed as MIME parts in a multi-part MIME message as outlined in SOAP Messages with Attachments  
227 [SwA]. This involves two processing layers, SOAP messaging and MIME transfer. This specification  
228 defines processing of a merged SOAP and MIME layer, in order to meet SwA security requirements. It  
229 relies on an underlying MIME transfer layer that allows changes to MIME transfer encoding as a message  
230 transits MIME nodes. This profile does not impose restrictions on that MIME transfer layer apart from  
231 aspects that are exposed to the SOAP processing layer. Likewise, this profile does not restrict the SOAP  
232 processing model, including use of SOAP intermediaries, allowing SOAP Messages with Attachments to  
233 transit SOAP nodes.

234 To accommodate the ability to secure attachment headers that are exposed to the SOAP message layer  
235 and application, this profile does not assume a strict protocol layering of MIME, SOAP and application.  
236 Rather, this profile allows a SOAP sender to create a primary SOAP envelope as well as attachments to  
237 be sent with the message. It is up to the application which, if any, of the attachments are referenced from  
238 SOAP header and/or body blocks. The application may be aware of, and concerned with, certain aspects  
239 of the attachment MIME representation, including Content-Type and Content-Length headers, to give two  
240 examples. Due to this concern, the application may choose to secure these exposed headers. This does  
241 not mean, however, that the application and SOAP layer are aware or concerned with all MIME headers  
242 used for MIME transit, in particular issues related to transfer encoding. The expectation is that the MIME  
243 processing layer of the sender and receiver will handle transfer encoding issues, hiding this detail from the  
244 processing layer associated with this profile. As a result, this specification focuses on those aspects of  
245 MIME processing that are exposed and of concern to higher protocol layers, while ignoring MIME transit  
246 specific details.

247 This model has two implications. First, it means that certain aspects of MIME processing, such as transfer  
248 encoding processing, are out of scope of the profile and do not need to be addressed. Secondly, it means  
249 that many of the MIME headers are also out of scope of the profile and the profile does not support  
250 integrity protection of these headers, since they are expected to change. If more security protection is  
251 required then it must occur by other means, such as with a protocol layer below the MIME layer, for  
252 example transport security (with the understanding that such security may not always apply end-end).

253 Use of this profile is intended to be independent of MIME-specific security processing, although care must  
254 be taken when using both SOAP Message Security and S/MIME. When conveyed end-to-end, S/MIME  
255 content may be conveyed opaquely as one or more attachments, as a MIME content type. If S/MIME  
256 security is to be used between nodes that convey the SOAP message, then this may also be opaque to  
257 SOAP Message Security, as long as the attachment that was sent by the initial SOAP sender is the same  
258 as that which is received by the receiving SOAP intermediary or ultimate SOAP receiver. Care must be  
259 taken to ensure this will be the case. Clearly SOAP Message Security encryption could prevent S/MIME  
260 processing of an attachment, and likewise S/MIME encryption could prevent SOAP Message Security  
261 signature verification if these techniques are interleaved. This potential concern is out of scope of this  
262 profile.

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## 4 XML Attachments

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A SOAP Messages with Attachments multi-part MIME structure contains a primary SOAP envelope in the root part and one or more attachments in additional MIME parts. Some of these attachments may have a content type corresponding to XML, but do not contain the primary SOAP envelope to be processed.

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Some attachments associated with the SOAP body may be targeted at the SOAP Ultimate Receiver along with the SOAP body and may be processed at the application layer along with the body. Others may be targeted at intermediaries. How attachments are to be processed and how these attachments are referenced from SOAP header and body blocks, if at all, is dependent on the application. In many cases the attachment content may not need to be processed as XML as the message traverses intermediaries.

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Generally requiring canonicalization of XML attachments whenever transmitting them is undesirable, both due to the potential ambiguities related to the canonicalization context of the attachment (e.g. Is it an independent XML document, a portion of the primary SOAP envelope, etc) as well as the universal performance impact of such a canonicalization requirement. When XML attachment content is signed, then XML canonicalization is required, as is generally the case when signing XML.

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MIME part canonicalization (as described below) is required for non-XML attachments to enable SOAP Message Security signatures that are stable despite MIME transfer processing.

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## 279 5 Securing SOAP With Attachments

280 Attachments may be associated with SOAP messages, as outlined in SOAP Messages with Attachments  
281 [SwA]. This profile defines how such attachments may be secured for integrity and confidentiality using the  
282 OASIS Web Services Security: SOAP Message Security standard. This does not preclude using other  
283 techniques. The requirements in this profile only apply when securing SwA attachments explicitly  
284 according to this profile.

285 This profile considers all attachments as opaque whether they are XML or some other content type. It is  
286 the sole responsibility of the application to perform further interpretation of attachments , including the  
287 ability to sign or encrypt portions of those attachments.

### 288 5.1 Primary SOAP Envelope

289 When SOAP attachments are used as specified in [SwA] each SOAP message is accompanied by a  
290 MIME header and possibly multiple boundary parts. This is known as a SOAP message package. This  
291 document assumes that a proper SOAP message package is constructed using the HTTP and MIME  
292 headers appropriate to [SwA].

293 The primary SOAP envelope SHOULD be conveyed in the first MIME part, but MAY be conveyed in  
294 another MIME part when the start attribute is specified in the HTTP Multipart/Related header.

295 In particular, implementations should take care in distinguishing between the HTTP headers in the SOAP  
296 message package and the start of the SOAP payload. For example, the following Multipart/Related  
297 header belongs to the HTTP layer and not the main SOAP payload:

```
298 Content-Type: Multipart/Related; boundary=xyl; type="text/xml"; start="<foo>"
```

299 The main SOAP payload begins with the appropriate boundary. For example:

```
300 --xyl  
301 Content-Type: text/xml; charset=utf-8  
302 Content-ID: <foo>  
  
303 <?xml version='1.0' ?>  
304 <s11:Envelope xmlns:s11="http://schemas.xmlsoap.org/soap/envelope/" />
```

### 305 5.2 Referencing Attachments

306 SOAP Messages with Attachments defines two MIME mechanisms for referencing attachments. The first  
307 mechanism uses a CID scheme URL to refer to the attachment that has a Content-ID MIME header with a  
308 value corresponding to the URL, as defined in [RFC 2392]. For example, a content id of "foo" may be  
309 specified in the MIME part with the MIME header "Content-ID: <foo>" and be referenced using the CID  
310 Schema URL "cid:foo".

311 The second mechanism is to use a URL to refer to an attachment containing a Content-Location MIME  
312 header. In this case the URL may require resolution to determine the referenced attachment [RFC2557].

313 For simplicity and interoperability this profile limits WS-Security references to attachments to CID scheme  
314 URLs. Attachments referenced from WS-Security signature references or cipher references MUST be  
315 referenced using CID scheme URLs.

316 This profile assumes, since it is not defined in RFC 2396 Section 4.2, that all cid: references are not same-  
317 document references and that therefore, under XMLDSIG, dereferencing a cid: URI always yields an octet  
318 stream as input to the transform chain [RFC2396], [XMLDSIG].

## 319 **5.3 MIME Part Reference Transforms**

320 By definition of RFC 2392, a URI reference to a MIME attachment includes the MIME headers associated  
321 with that attachment as well as the MIME part content [RFC2392]. Since there may be some confusion as  
322 to what is referenced, it is useful to clearly indicate what is included in the referenced attachment. In  
323 addition, some applications may wish to only encrypt or include the attachment content in a signature  
324 reference hash, and others may wish to include MIME headers and content.

325 For these reasons, this profile defines reference transforms, allowing a clear and explicit statement of  
326 what is included in a MIME reference. These transforms are called “MIME Part Reference Transforms”.

327 The input of each of these transforms is an octet stream, as defined in XML Security [XML-Sig].

### 328 **5.3.1 Attachment-Content-Signature-Transform**

329 The Attachment-Content-Signature-Transform indicates that only the content of a MIME part is referenced  
330 for signing. This transform MUST be identified using the URI value:

```
331 http://docs.oasis-open.org/wss/oasis-wss-SwAProfile-1.1#Attachment-Content-  
332 Signature-Transform
```

333 When this transform is used the content of the MIME part should be canonicalized as defined in section  
334 4.4.2.

335 The octet stream input to this transform is the entire content of the MIME attachment associated with the  
336 CID, including all the MIME headers and attachment content, as represented in the MIME part containing  
337 the attachment.

338 The output of the transform is an octet stream consisting of the canonicalized serialization of the  
339 attachment content. All of the MIME headers associated with the MIME part are ignored and not included  
340 in the output octet stream. The canonicalization of the content is described in section 4.4.2 of this  
341 specification.

### 342 **5.3.2 Attachment-Complete-Signature-Transform**

343 The Attachment-Complete-Signature-Transform indicates that both the content and selected headers of  
344 the MIME part are referenced for signing. This transform MUST be identified using the URI value:

```
345 http://docs.oasis-open.org/wss/oasis-wss-SwAProfile-1.1#Attachment-Complete-  
346 Signature-Transform
```

347 This transform specifies that in addition to the content the following MIME headers are to be included  
348 (when present):

- 349 • Content-Description
- 350 • Content-Disposition
- 351 • Content-ID
- 352 • Content-Location
- 353 • Content-Type

354 These headers are included because of their common use and the risks associated with inappropriate  
355 modification. If other headers are to be protected, other mechanisms at the application level should be  
356 used (such as copying values into a SOAP header) and this is out of scope of this profile.

357 Other MIME headers associated with the MIME part serialization are not referenced by the transform and  
358 are not to be included in signature calculations.

359 When this transform is used the MIME headers should be canonicalized as defined in section 4.4.1 and  
360 the MIME content should be canonicalized as defined in section 4.4.2.

361 The octet stream input to this transform is the entire content of the MIME attachment associated with the  
362 CID, including all the MIME headers and attachment content, as represented in the MIME part containing  
363 the attachment.

364 The output of the transform is an octet stream consisting of concatenation of the MIME canonicalized  
365 MIME headers selected by the transform followed by the canonicalized attachment content. The  
366 canonicalization of headers and content are described in sections 4.4.1 and 4.4.2 of this specification.

### 367 **5.3.3 Attachment-Ciphertext-Transform**

368 The Attachment-Ciphertext-Transform indicates that only the content of a MIME part is referenced, and  
369 contains the ciphertext related to an XML EncryptedData element. This transform MUST be identified  
370 using the URI value:

```
371 http://docs.oasis-open.org/wss/oasis-wss-SwAProfile-1.1#Attachment-Ciphertext-  
372 Transform
```

373 The octet stream input to this transform is the entire content of the MIME attachment associated with the  
374 CID, including all the MIME headers and attachment content, as represented in the MIME part containing  
375 the attachment.

376 The output of the transform is an octet stream consisting of the ciphertext as conveyed in the MIME part  
377 content. All of the MIME headers associated with the MIME part are ignored and not included in the output  
378 octet stream. The MIME text canonicalization of the content is described in section 4.4.2 of this  
379 specification.

## 380 **5.4 Integrity and Data Origin Authentication**

381 Integrity and data origin authentication may be provided for SwA attachments using XML Signatures, as  
382 outlined in the SOAP Message Security standard as profiled in this document. This is useful independent  
383 of the content of the MIME part – for example, it is possible to sign a MIME part that already contains a  
384 signed object created by an application. It may be sensible to sign such an attachment as part of SOAP  
385 Message security so that the receiving SOAP node may verify that all attachments are intact before  
386 delivering them to an application. A SOAP intermediary may also choose to perform this verification, even  
387 if the attachments are not otherwise processed by the intermediary.

### 388 **5.4.1 MIME header canonicalization**

389 The result of MIME header canonicalization is a UTF-8 encoded octet stream.

390 Each of the MIME headers listed for the Attachment-Complete transform MUST be canonicalized as part  
391 of that transform processing, as outlined in this section. This means the transform MUST perform the  
392 following actions in interpreting the MIME headers for signature creation or verification (this order is not  
393 prescriptive as long as the same result is obtained)

- 394 1. The transform MUST process MIME headers before the MIME content.
- 395 2. The transform MUST only process MIME headers that are explicitly present in the attachment part and  
396 are listed in the Attachment-Complete transform section of this specification, except that a MIME part

- 397 without a Content-Type header MUST be treated as having a Content-Type header with the value  
398 "Content-Type: text/plain; charset=us-ascii". MIME headers not listed in the Attachment-Complete  
399 transform section of this specification are to be ignored by the transform.
- 400 3. The MIME headers MUST be processed by the Attachment-Complete transform in lexicographic order  
401 (ascending).
  - 402 4. The MIME header names MUST be processed by the transform as having the case according to the  
403 MIME specifications (as shown in the Attachment-Complete section).
  - 404 5. The MIME header values MUST be unfolded [[RFC2822](#)].
  - 405 6. Any Content-Description MIME header containing RFC2047 encoding MUST be decoded [[RFC2047](#)].
  - 406 7. When a Content-ID header is processed, the "<>" characters associated with the msg-id MUST be  
407 included in the transform input. The reason is that although semantically these angle bracket  
408 characters are not part of the msg-id (RFC 2822) they are a standard part of the header lexicographic  
409 representation. If these characters are not integrity protected then an attacker could remove them  
410 causing the CID transformation specified in RFC2392 to fail.
  - 411 8. Folding whitespace in structured MIME headers (e.g. Content-Disposition, Content-ID, Content-  
412 Location, Content-Type) that is not within quotes MUST be removed. Folding whitespace in structured  
413 MIME headers that is within quotes MUST be preserved. Folding whitespace in unstructured MIME  
414 headers (e.g. Content-Description) MUST be preserved [[RFC2822](#)]. For example, whitespace  
415 immediately following the colon delimiter in the structured Content-Type header MUST be removed, but  
416 whitespace immediately following the colon delimiter in the unstructured Content-Description header  
417 MUST be preserved.
  - 418 9. Comments in MIME header values MUST be removed [[RFC2822](#)].
  - 419 10. Case-insensitive MIME header values (e.g. media type/subtype values and disposition-type values)  
420 MUST be converted to lowercase. Case-sensitive MIME header values MUST be left as is with  
421 respect to case [[RFC2045](#)].
  - 422 11. Quoted characters other than double-quote and backslash ("\") in quoted strings in structured MIME  
423 headers (e.g. Content-ID) MUST be unquoted. Double-quote and backslash ("\") characters in quoted  
424 strings in structured MIME headers MUST be character encoded [[RFC2822](#)].
  - 425 12. Canonicalization of a MIME header MUST generate a UTF-8 encoded octet stream containing the  
426 following: the MIME header name, a colon (":"), the MIME header value, and the result of  
427 canonicalizing the MIME header parameters in lexicographic order (ascending) as described below.
  - 428 13. MIME header parameter names MUST be converted to lowercase [[RFC2045](#)].
  - 429 14. MIME parameter values containing RFC2184 character set, language, and continuations MUST be  
430 decoded. The resulting canonical output MUST not contain the RFC2184 encoding [[RFC2184](#)].
  - 431 15. Case-insensitive MIME header parameter values MUST be converted to lowercase. Case-sensitive  
432 MIME header parameter values MUST be left as is with respect to case [[RFC2045](#)].
  - 433 16. Enclosing double-quotes MUST be added to MIME header parameter values that do not already  
434 contain enclosing quotes. Quoted characters other than double-quote and backslash ("\") in MIME  
435 header parameter values MUST be unquoted. Double-quote and backslash characters in MIME  
436 parameter values MUST be character encoded.
  - 437 17. Canonicalization of a MIME header parameter MUST generate a UTF-8 encoded octet stream  
438 containing the following: a semi-colon (";"), the parameter name (lowercase), an equals sign ("="), and  
439 the double-quoted parameter value.
  - 440 18. Each header MUST be terminated by a single CRLF pair, without any trailing whitespace.

441 19. The last header MUST be followed by a single CRLF and then the MIME content.

## 442 **5.4.2 MIME Content Canonicalization**

443 Before including attachment content in a signature reference hash calculation, that MIME attachment  
444 SHOULD be canonicalized. The reason is that signature verification requires an identical hash of content  
445 as when signing occurred.

446 Content of an XML Content-Type MUST be XML canonicalized using Exclusive XML Canonicalization  
447 without comments, as specified by the URI <http://www.w3.org/2001/10/xml-exc-c14n#> [Excl-Canon]. The  
448 reason for requiring Exclusive Canonicalization is that many implementations will support Exclusive  
449 Canonicalization for other XML Signature purposes, since this form of canonicalization supports context  
450 changes. The InclusiveNamespace PrefixList attribute SHOULD be empty or not present.

451 Other types of MIME content SHOULD be canonicalized according to the MIME part canonicalization  
452 mechanism appropriate to the Content-Type of the MIME part.

453 To quote the S/MIME specification (section 3.1.1 "Canonicalization") which deals with this issue  
454 [RFC2633]:

455       The exact details of canonicalization depend on the actual MIME type and subtype of an  
456       entity, and are not described here. Instead, the standard for the particular MIME type should  
457       be consulted. For example, canonicalization of type text/plain is different from  
458       canonicalization of audio/basic. Other than text types, most types have only one  
459       representation regardless of computing platform or environment which can be considered  
460       their canonical representation.

461 MIME types are registered. This registration includes a section on "Canonicalization and Format  
462 Requirements" [RFC2048] and requires each MIME type to have a canonical representation.

463 The MIME "text" type canonical form is defined in the MIME conformance specification (See "Canonical  
464 Encoding Model") [RFC2049]. Important aspects of "text" media type canonicalization include line ending  
465 normalization to <CR><LF> and ensuring that the charset is a registered charset (see RFC 2633 section  
466 "Canonicalization"). [RFC2633, CHARSETS, RFC2045].

## 467 **5.4.3 Protecting against attachment insertion threat**

468 Including an attachment in a signature calculation enables a receiver to detect modification of that  
469 attachment. Including all attachments in a signature calculation, by providing a <ds:Reference> for each,  
470 protects against the threat of attachment removal. This does not protect against insertion of a new  
471 attachment.

472 The simplest protection against attachment insertion is for the receiver to know that all attachments should  
473 be included in a signature calculation – unreferenced attachments are then an indication of an attachment  
474 insertion attack.

475 Such information may be communicated in or out of band. Definition of these approaches is out of the  
476 scope of this profile.

## 477 **5.4.4 Processing Rules for Attachment Signing**

478 The processing rule for signing is modified based on the SOAP Message Security rules.

479 After determining which attachments are to be included as references in a signature, create a  
480 <ds:Signature> element in a <wsse:Security> header block targeted at the recipient, including a  
481 <ds:Reference> for each attachment to be protected by the signature. Additional <ds:Reference>  
482 elements may refer to content in the SOAP envelope to be included in the signature.

483 For each attachment Reference, perform the following steps:

- 484 1. MIME Part Canonicalize the content of the attachment, as appropriate to the MIME type of the part, as  
485 outlined in section 4.4.2 Attachments of an XML content type require Exclusive XML Canonicalization  
486 without comments[[Excl-Canon](#)].
- 487 2. If MIME headers are to be included in the signature, perform MIME header canonicalization as  
488 outlined in section 4.4.1.
- 489 3. Determine the CID scheme URL to be used to reference the part and set the <ds:Reference> URL  
490 attribute value to this URL.
- 491 4. Include a <ds:Transforms> element in the <ds:Reference>. This <ds:Transforms> element MUST  
492 include a <ds:Transform> element with the Algorithm attribute having the full URL value specified  
493 earlier in this profile – corresponding to either the Attachment-Complete-Signature-Transform or  
494 Attachment-Content-Signature-Transform, depending on what is to be included in the hash calculation.  
495 This MUST be the first transform listed. The <ds:Transform> element MUST NOT contain any  
496 transform for a MIME transfer encoding purpose (e.g. base64 encoding) since transfer encoding is left  
497 to the MIME layer as noted in section 2. This does not preclude the use of XML Transforms, including a  
498 base64 transform, for other purposes.
- 499 5. Extract the appropriate portion of the MIME part consistent with the selected transform.
- 500 6. Create the <ds:Reference> hash value as outlined in the W3C XML Digital Signature  
501 Recommendation.

## 502 **5.4.5 Processing Rules for Attachment Signature Verification**

503 Signature verification is performed as outlined in SOAP Message Security and the XML Digital Signature  
504 Recommendation, with the following considerations for SwA attachments.

505 To verify <ds:Reference> hashes for SwA attachments, the following steps must be performed for each  
506 reference to an attachment:

- 507 1. Find the attachment corresponding to the <ds:Reference> URL attribute value. This value MUST  
508 correspond to the Content-ID for the attachment[[SwA](#)].
- 509 2. MIME Part Canonicalize the content of the attachment, as appropriate to the MIME type of the part, as  
510 outlined in section 4.4.2. Attachments of an XML content type require Exclusive XML Canonicalization  
511 without comments[[Excl-Canon](#)]. The MIME content to be MIME canonicalized MUST have had any  
512 transfer-encoding processed at the MIME layer before this step is performed.
- 513 3. If MIME headers were included in the signature, perform MIME header canonicalization as outlined in  
514 section 4.4.1.
- 515 4. Extract the appropriate portion of the MIME part according to the MIME Part Signature Transform  
516 value.
- 517 5. Calculate the reference hash and verify the reference.

## 518 **5.4.6 Example Signed Message**

```
519 Content-Type: multipart/related; boundary="BoundaryStr" type="text/xml"
```

```

520 --BoundaryStr
521 Content-Type: text/xml
522 <S11:Envelope xmlns:S11="..." xmlns:wsse="..." xmlns:wsu="..." xmlns:ds="..."
523 xmlns:xenc="...">
524   <S11:Header>
525     <wsse:Security>
526       <wsse:BinarySecurityToken wsu:Id="CertAssociatedWithSigningKey"
527         EncodingType="http://docs.oasis-open.org/wss/2004/01/oasis-200401-
528 wss-soap-message-security-1.0#Base64Binary"
529         ValueType="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-
530 x509-token-profile-1.0#x509v3">
531       ...
532     </wsse:BinarySecurityToken>
533     <ds:Signature>
534       <ds:SignedInfo>
535         <ds:CanonicalizationMethod Algorithm=
536 'http://www.w3.org/2001/10/xml-exc-c14n#' />
537         <ds:SignatureMethod Algorithm=
538 'http://www.w3.org/2000/09/xmldsig#rsa-sha1' />
539         <ds:Reference URI="cid:bar">
540           <ds:Transforms>
541             <ds:Transform Algorithm="http://docs.oasis-open.org/wss/oasis-
542 wss-SwAProfile-1.1#Attachment-Content-Signature-Transform"/>
543           </ds:Transforms>
544           <ds:DigestMethod Algorithm=
545 "http://www.w3.org/2000/09/xmldsig#sha1"/>
546           <ds:DigestValue>j6lwx3rvEPO0vKtMup4NbeVu8nk=</ds:DigestValue>
547         </ds:Reference>
548       </ds:SignedInfo>
549       <ds:SignatureValue>DeadBeef</ds:SignatureValue>
550     </ds:Signature>
551     <ds:KeyInfo>
552       <wsse:SecurityTokenReference>
553         <wsse:Reference URI="#CertAssociatedWithSigningKey"/>
554       </wsse:SecurityTokenReference>
555     </ds:KeyInfo>
556   </S11:Header>
557   <S11:Body>
558     some items
559   </S11:Body>
560 </S11:Envelope>
561 --BoundaryStr
562 Content-Type: image/png
563 Content-ID: <bar>
564 Content-Transfer-Encoding: base64
565 the image
566

```

## 567 5.5 Encryption

568 A SwA attachment may be encrypted for confidentiality protection, protecting either the MIME part content  
569 including selected MIME headers, or only the MIME part content.

570 This is done using XML Encryption to encrypt the attachment, placing the resulting cipher text in the  
571 updated attachment body replacing the original content, and placing a new <xenc:EncryptedData>

572 element in the <wsse:Security> header. An <xenc:CipherReference> MUST link the  
573 <xenc:EncryptedData> element with the cipher data.

574 The key used for encryption MAY be conveyed using an <xenc:EncryptedKey> element in the  
575 <wsse:Security> header. In this case the <xenc:ReferenceList> element in the <xenc:EncryptedKey>  
576 element MUST contain an <xenc:DataReference> with a URI attribute specifying the  
577 <xenc:EncryptedData> element in the <wsse:Security> header corresponding to the attachment.

578 When the same <xenc:EncryptedKey> corresponds to multiple <xenc:EncryptedData> elements, the  
579 <xenc:ReferenceList> in the <xenc:EncryptedKey> element SHOULD contain an <xenc:DataReference>  
580 for each <xenc:EncryptedData> element, both for attachments and encrypted items in the primary SOAP  
581 envelope. References should be ordered to correspond to ordering of the security header elements.

582 When an <xenc:EncryptedKey> element is not used when encrypting an attachment, then the  
583 <xenc:EncryptedData> element MAY contain a <ds:KeyInfo> element to specify a key as outlined in the  
584 SOAP Message Security standard. Different deployments may have different requirements on how keys  
585 are referenced. When an <xenc:EncryptedKey> element is used the <xenc:EncryptedData> element  
586 MUST NOT contain a <ds:KeyInfo> element.

587 When an attachment is encrypted, an <xenc:EncryptedData> element will be placed in the  
588 <wsse:Security> header. An <xenc:ReferenceList> element associated with this <xenc:EncryptedData>  
589 element may also be added, as recommended by WSS: SOAP Message Security.

590 Note: The same CID is used to refer to the attachment before encryption and after. This  
591 avoids the need to rewrite references to the attachment, avoiding issues related to  
592 generating unique CIDs and relating to preserving the correspondence to the original  
593 WSDL definition.

## 594 **5.5.1 MIME Part CipherReference**

595 This profile requires that <xenc:EncryptedData> elements corresponding to encrypted SwA attachments  
596 use a <xenc:CipherReference> to refer to the cipher text, to be conveyed in the attachment. Upon  
597 encryption the MIME part attachment content is replaced with the encoded cipher text.

598 The <xenc:CipherReference> MUST have a <xenc:Transforms> child element. This element MUST have  
599 a <ds:Transform> child having an Algorithm attribute with a URI value specifying the Attachment-  
600 Ciphertext-Transform. This transform explicitly indicates that when dereferencing the MIME part reference  
601 that only the MIME part content is to be used as the cipher value.

602 The <xenc:CipherReference> MUST NOT contain a transform used for a transfer encoding purpose (e.g.  
603 the base64 transform). Transfer encoding is left to the MIME layer, as noted in section 2.

## 604 **5.5.2 Encryption Processing Rules**

605 The order of the following steps is not normative, although the result should be the same as if this order  
606 were followed.

607 1. When encrypting both attachments and primary SOAP envelope content using the same key, perform  
608 the attachment processing first.

609 Note: The SOAP Message Security standard states that elements should be prepended  
610 to the security header. This processing rule supports putting the <xenc:EncryptedData>  
611 element first in the header with <xenc:EncryptedKey> and tokens following. Thus, a  
612 receiver should be able to process the <xenc:EncryptedKey> before the  
613 <xenc:EncryptedData> element for the attachment.

614 2. Encrypt the attachment part using XML Encryption, according to the rules of XML Encryption. Encrypt  
615 either the attachment including content and selected MIME headers or only the attachment content.

616 When encryption includes MIME headers, only the headers listed in this specification for the Attachment-  
617 Complete Reference Transform (Section 4.3.2) are to be included in the encryption. If a header listed in  
618 the profile is present it MUST be included in the encryption. If a header is not listed in this profile, then it  
619 MUST NOT be included in the encryption.

620 3. Set the <xenc:EncryptedData> Type attribute value to a URI that specifies adherence to this profile and  
621 that specifies what was encrypted (MIME content or entire MIME part including headers). The following  
622 URIs MUST be used for this purpose:

623 • Content Only:

624 `http://docs.oasis-open.org/wss/oasis-wss-SwAProfile-1.1#Attachment-Content-`  
625 `Only`

626 • Content and headers:

627 `http://docs.oasis-open.org/wss/oasis-wss-SwAProfile-1.1#Attachment-Complete`

628 4. Set the <xenc:EncryptedData> MimeType attribute to match the attachment MIME part Content-Type  
629 header before encryption when the Content-Only URI is specified for the Type attribute value. The  
630 MimeType attribute value MAY be set when the AttachmentComplete Type attribute value is specified.

631 5. Optionally set the <xenc:EncryptedData> Encoding attribute to reflect the attachment content  
632 encoding, as visible to the security layer at the time of encryption. This is advisory information to the  
633 decryption security layer. It should be understood that this has no relation with the actual encoding that  
634 could be performed independently by the MIME layer later for transfer purposes.

635 6. Set the <xenc:EncryptedData> <xenc:CipherReference> to the same reference URL for the attachment  
636 that was used before encryption . This MUST be a CID scheme URL referring to the attachment part  
637 Content-ID. Ensure this MIME header is in the part conveying the cipher data after encryption.

638 7. Include the Attachment-Ciphertext-Transform in the <xenc:CipherReference> <xenc:Transforms> list.

639 8. Prepend the <xenc:EncryptedData> element to the <wsse:Security> SOAP header block and then  
640 prepend the associated optional <xenc:ReferenceList> element.

641 9. Update the attachment MIME part, replacing the original content with the cipher text generated by the  
642 XML Encryption step.

643 10. Update the attachment MIME part header MIME Content-Type and Content-Length appropriate to the  
644 cipher data.

### 645 **5.5.3 Decryption Processing Rules**

646 The <xenc:CipherReference> URL MUST be a URL that refers to the MIME part containing the cipher text,  
647 and must also correspond to the reference value of the original attachment that was encrypted. This  
648 MUST be a CID scheme URL.

649 Decryption may be initiated upon locating the <xenc:EncryptedData> element in the <wsse:Security>  
650 header.

651 The following decryption steps must be performed so that the result is as if they were performed in this  
652 order:

- 653 1. Extract the cipher text from the attachment referenced by the <xenc:CipherReference> URL attribute.  
654 The Attachment-Ciphertext-Transform defined in this profile indicates that the MIME part content is  
655 extracted.
- 656 2. Decrypt the cipher text using the information present in the appropriate <xenc:EncryptedData> element  
657 and possibly other out of band information, according to the XML Encryption Standard.
- 658 3. If the <xenc:EncryptedData>Type attribute indicates that selected MIME headers were encrypted, then  
659 those MIME headers MUST be replaced by the result of decryption, as well as the MIME part content.
- 660 4. If the <xenc:EncryptedData>Type attribute indicates that only the content of the MIME part was  
661 encrypted, then the cipher text content of the attachment part MUST be replaced by the result of  
662 decryption. In this case the MIME part Content-Type header value MUST be replaced by the  
663 <xenc:EncryptedData> MimeType attribute value.
- 664 5. If the <xenc:EncryptedData> Encoding attribute is present then the decryption security layer may pass  
665 this advisory information to the application.

## 666 5.5.4 Example

667 This example shows encryption of the primary SOAP envelope body as well as an attachment using a  
668 single symmetric key conveyed using an EncryptedKey element.

```

669 Content-Type: multipart/related; boundary="BoundaryStr" type="text/xml"
670 --BoundaryStr
671 Content-Type: text/xml

672 <S11:Envelope
673   xmlns:S11="http://schemas.xmlsoap.org/soap/envelope/"
674   xmlns:wsse="http://docs.oasis-open.org/wss/2004/01/oasis-200401-
675   wsswssecurity-secext-1.0.xsd"
676   xmlns:xenc="http://www.w3.org/2001/04/xmlenc#"
677   xmlns:ds="http://www.w3.org/2000/09/xmldsig#">

678   <S11:Header>
679     <wsse:Security>

680       <wsse:BinarySecurityToken wsu:Id="Acert"
681         EncodingType="http://docs.oasis-open.org/wss/2004/01/oasis-200401-
682   wss-soap-message-security-1.0#Base64Binary"
683         ValueType="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-
684   x509-token-profile-1.0#x509v3">
685         ...
686       </wsse:BinarySecurityToken>

687       <xenc:EncryptedKey Id='EK'>
688         <EncryptionMethod
689           Algorithm="http://www.w3.org/2001/04/xmlenc#rsa-1_5"/>
690         <ds:KeyInfo Id="keyinfo">
691           <wsse:SecurityTokenReference>
692             <ds:X509Data>
693               <ds:X509IssuerSerial>
694                 <ds:X509IssuerName>
695                   DC=ACMECorp, DC=com
696                 </ds:X509IssuerName>
697                 <ds:X509SerialNumber>12345678</X509SerialNumber>
698               </ds:X509IssuerSerial>
699             </ds:X509Data>
700           </wsse:SecurityTokenReference>

```

```

701     </ds:KeyInfo>
702     <CipherData><CipherValue>xyzabc</CipherValue></CipherData>
703     <ReferenceList>
704         <DataReference URI='#EA' />
705         <DataReference URI='#ED' />
706     </ReferenceList>
707 </EncryptedKey>

708     <xenc:EncryptedData
709         Id='EA'
710         Type="http://docs.oasis-open.org/wss/oasis-wss-SwAProfile-
711 1.1#Attachment-Content-Only"
712         MimeType="image/png">
713         <xenc:EncryptionMethod
714             Algorithm='http://www.w3.org/2001/04/xmlenc#aes128-cbc' />
715         <xenc:CipherData>
716             <xenc:CipherReference URI=cid:bar">
717                 <xenc:Transforms>
718                     <ds:Transform Algorithm="http://docs.oasis-open.org/wss/oasis-
719 wss-SwAProfile-1.1#Attachment-Ciphertext-Transform"/>
720                 </xenc:Transforms>
721             </xenc:CipherReference>
722         </xenc:CipherData>
723     </xenc:EncryptedData>

724 </wsse:Security>
725 </S11:Header>
726 <S11:Body>
727     <xenc:EncryptedData Id='ED'
728         <xenc:EncryptionMethod
729             Algorithm='http://www.w3.org/2001/04/xmlenc#aes128-cbc' />
730         <xenc:CipherData>
731             <xenc:CipherValue>DEADBEEF</xenc:CipherValue>
732         </xenc:CipherData>
733     </xenc:EncryptedData>
734 </S11:Body>
735 </S11:Envelope>
736 --BoundaryStr
737 Content-Type: application/octet-stream
738 Content-ID: <bar>
739 Content-Transfer-Encoding: binary

740 BinaryCipherData

```

## 741 5.6 Signing and Encryption

742 When portions of content are both signed and encrypted, there is possible confusion as to whether  
743 encrypted content need first be decrypted before signature verification. This confusion can occur when  
744 the order of operations is not clear [[DecryptT](#)]. This problem may be avoided with SOAP Message  
745 Security for SwA attachments when attachments and corresponding signatures and encryptions are  
746 targeted for a single SOAP recipient (actor). The SOAP Message Security standard explicitly states that  
747 there may not be two <wsse:Security> headers targeted at the same actor, nor may there be two headers  
748 without a designated actor. In this case the SOAP Message Security and SwA profile processing rules  
749 may eliminate ambiguity since each signing or encryption produces an element in the <wsse:Security>  
750 header, and these elements are ordered. (Signing produces <ds:Signature> elements and encryption  
751 produces <xenc:EncryptedData> elements).

752 If an application produces different <wsse:Security> headers targeted at different recipients, these are  
753 processed independently by the recipients. Thus there is no need to correlate activities between distinct  
754 headers – the order is inherent in the SOAP node model represented by the distinct actors.

## A. Acknowledgments

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