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49 **1 Introduction**

50 A designer of a Web services application often uses interfaces defined by others. Managing faults
51 in such an application is more difficult when each interface uses a different convention for
52 representing common information in fault messages.

53 Support for problem determination and fault management can be enhanced by specifying Web
54 services fault messages in a common way. When the information available in faults from various
55 interfaces is consistent, it is easier for requestors to understand faults. It is also more likely that
56 common tooling can be created to assist in the handling of faults.

57 WS-BaseFaults defines an XML Schema type for a base fault, along with rules for how this fault
58 type is used by Web services.

59 WS-BaseFaults is inspired by a portion of the Global Grid Forum's "Open Grid Services
60 Infrastructure (OGSI) Version 1.0" specification [[OGSI](#)].

61 **1.1 Goals and Requirements**

62 The goal of WS-BaseFaults is to standardize the terminology, concepts, XML types, and WSDL
63 usage of a base fault type for Web service interfaces.

64 **1.1.1 Requirements**

65 This specification intends to meet the following requirements:

66 Define a standard XML Schema type containing base fault information.

67 Define how this base fault type is used within WSDL defined interfaces.

68 **1.1.2 Non-Goals**

69 The following topics are outside the scope of this specification:

70 It is not an objective of this specification to define a common hierarchy of common faults upon the
71 base fault.

72 **1.2 Terminology**

73 The keywords "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD",
74 "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be
75 interpreted as described in [RFC2119](#).

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

79 This specification uses a notational convention, referred to as "Pseudo-schemas" in a fashion
80 similar to the WSDL 2.0 Part 1 specification. A Pseudo-schema uses a BNF-style convention to
81 describe attributes and elements:

82 `?' denotes optionality (i.e. zero or one occurrences),

83 `*' denotes zero or more occurrences,

84 `+' one or more occurrences,

85 `[' and `]' are used to form groups,

86 `|` represents choice.
87 Attributes are conventionally assigned a value which corresponds to their type, as defined in the
88 normative schema.

```
89 <!-- sample pseudo-schema -->  
90 <element  
91     required_attribute_of_type_QName="xs:QName"  
92     optional_attribute_of_type_string="xs:string"? >  
93     <required_element />  
94     <optional_element />?  
95     <one_or_more_of_these_elements />+  
96     [ <choice_1 /> | <choice_2 /> ]*  
97 </element>
```

98
99 Where there is disagreement between the separate XML schema and WSDL files describing the
100 messages defined by this specification and the normative descriptive text (excluding any pseudo-
101 schema) in this document, the normative descriptive text will take precedence over the separate
102 files. The separate files take precedence over any pseudo-schema and over any schema and
103 WSDL included in the appendices

104 1.3 Namespaces

105 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
xsd	http://www.w3.org/2001/XMLSchema
xsi	http://www.w3.org/2001/XMLSchema-instance
wsrf-bf	http://docs.oasis-open.org/wsr/bf-2
wsa	http://www.w3.org/2005/08/addressing

106 1.4 Fault Definition

107 All faults defined by this specification MUST use the following wsa:Action

108 URI:

109

110 <http://docs.oasis-open.org/wsr/fault>

111

2 Base Fault Type

112

113 The base fault has the following syntax. The normative XML Schema definition is in Appendix D:

114

```
<BaseFault>
  {any}*
  <Timestamp>xsd:dateTime</Timestamp>
  <OriginatorReference>
    wsa:EndpointReferenceType
  </OriginatorReference> ?
  <ErrorCode dialect="anyURI">xsd:anyType</ErrorCode> ?
  <Description>xsd:string</Description> *
  <FaultCause>{any}</FaultCause> ?
</BaseFault>
```

115

116

117

118

119

120

121

122

123

124 /wsrf-bf:BaseFault/Timestamp

125 This REQUIRED element MUST be the time at which the fault occurred. There MUST be only
126 one timestamp element in BaseFault. In the absence of the time zone designation, the
127 xsd:dateTime value MUST be interpreted as universal time (UTC) time.

128 /wsrf-bf:BaseFault/OriginatorReference

129 This OPTIONAL element is a WS-Addressing [WS-Addressing] EndpointReference of the Web
130 service that generated the fault. This element MAY be omitted if the fault originator is clearly
131 implied by the context in which the fault appears (for example in a simple request response
132 message exchange). One use of this element is in a situation of nested faults.

133 /wsrf-bf:BaseFault/ErrorCode

134 This OPTIONAL element provides convenient support for legacy fault reporting systems (e.g.,
135 POSIX errno). The dialect attribute on ErrorCode MUST be a URI that defines the context in
136 which the ErrorCode MUST be interpreted. For example, a URI might be defined that describes
137 how a POSIX errno is mapped to a ErrorCode and that URI must appear on any ErrorCode
138 element carrying a POSIX errno.

139 /wsrf-bf:BaseFault/Description

140 This OPTIONAL element contains a plain language description of the fault. This description is
141 expected to be helpful in explaining the fault to users. There MAY be any number of description
142 elements.

143 /wsrf-bf:BaseFault/FaultCause

144 This OPTIONAL element, if present, MUST contain a BaseFault or an element whose type
145 extends the BaseFaultType that describes an underlying cause of this fault. The ability to include
146 a FaultCause element in a fault allows for *chaining* of fault information so that a recipient of a fault
147 MAY examine details underlying the cause of the fault.

148 Note that there is no required child element within BaseFault that identifies the particular type (or
149 class) of fault. Rather, an application-specific extension of BaseFault MUST be defined for each
150 distinct type of fault

151 /wsrf-bf:BaseFault/{any}

152 BaseFaultType includes open element extensibility. This provides a mechanism to add additional
153 information to each specific type of BaseFault, if desired. The extensibility element is not intended
154 to be used to distinguish between different reasons for a fault.

155 To define an extended fault, you MUST use XML Schema extension to extend the BaseFault type
156 to include additional attributes and/or elements.

157 2.1 Example SOAP 1.1 Encoding of a Base Fault

158 The WS-Resource [WS-Resource] specification defines the ResourceUnknownFault BaseFault.
159 The below shows a non-normative example SOAP 1.1 [SOAP 1.1] encoding of such a fault:

```
160 <s11:Envelope
161     xmlns="http://schemas.xmlsoap.org/soap/envelope/"
162     xmlns:s11="http://schemas.xmlsoap.org/soap/envelope/"
163     xmlns:wsa=" http://www.w3.org/2005/08/addressing"
164     xmlns:wsrf-bf="http://docs.oasis-open.org/wsrf/bf-2"
165     xmlns:wsrf-r="http://docs.oasis-open.org/wsrf/r-2">
166   <s11:Header>
167     <wsa:Action>
168       http://docs.oasis-open.org/wsrf/fault
169     </wsa:Action>
170     ...
171     <!-- other headers elided for clarity -->
172   </s11:Header>
173   <s11:Body>
174     <s11:Fault>
175       <faultcode>s11:Client</faultcode>
176       <faultstring>No such resource exists</faultstring>
177       <faultactor>http://example.org/someactor</faultactor>
178       <detail>
179         <wsrf-r:ResourceUnknownFault>
180           <wsrf-bf:Timestamp>
181             2005-05-04T20:18:44.970Z
182           </wsrf-bf:Timestamp>
183           <wsrf-bf:Description>
184             Resource unknown
185           </wsrf-bf:Description>
186         </wsrf-r:ResourceUnknownFault>
187       </detail>
188     </s11:Fault>
189   </s11:Body>
190 </s11:Envelope>
```

191 2.2 Example SOAP 1.2 Encoding of a Base Fault

192 The WS-Resource [WS-Resource] specification defines the ResourceUnknownFault BaseFault.
193 The below shows a non-normative example SOAP 1.2 [SOAP 1.2] encoding of such a fault:

```
194 <s12:Envelope
195     xmlns="http://schemas.xmlsoap.org/soap/envelope/"
196     xmlns:s12="http://www.w3.org/2003/05/soap-envelope"
197     xmlns:wsa="http://www.w3.org/2005/08/addressing"
198     xmlns:wsrf-bf="http://docs.oasis-open.org/wsrf/bf-2"
199     xmlns:wsrf-r="http://docs.oasis-open.org/wsrf/r-2">
200   <s12:Header>
201     <wsa:Action>
202       http://docs.oasis-open.org/wsrf/fault
203     </wsa:Action>
204     ...
205     <!-- other headers elided for clarity -->
206   </s12:Header>
207   <s12:Body>
```

```
208 <s12:Fault>
209   <Code>
210     <Value>s12:Sender</Value>
211   </Code>
212   <Reason>
213     <Text xml:lang="en">No such resource exists</Text>
214   </Reason>
215   <Detail>
216     <wsrf-r:ResourceUnknownFault>
217       <wsrf-bf:Timestamp>
218         2005-05-04T20:18:44.970Z
219       </wsrf-bf:Timestamp>
220       <wsrf-bf:Description>
221         Resource unknown
222       </wsrf-bf:Description>
223     </wsrf-r:ResourceUnknownFault>
224   </Detail>
225 </s12:Fault>
226 </s12:Body>
227 </s12:Envelope>
228
```

3 Use of Base Faults in WSDL 1.1

Each distinct type of base fault associated with a WSDL [WSDL 1.1] operation SHOULD be listed as a separate fault response in the WSDL operation definition, as follows:

1. As described above, there MUST be a distinct XML Schema complexType that extends wsrf-bf:BaseFaultType, which represents this fault's distinct type. This extended fault complexType MAY contain additional attributes and/or elements.
2. An element MUST be defined for this distinct fault, whose type is the complexType of the distinct fault as defined in step 1.
3. A WSDL message MUST be defined for this distinct fault. This message MUST have one part. The WSDL part MUST have an 'element' attribute and this MUST refer by QName to the element of this distinct fault as defined in step 2.
4. The WSDL operation MUST have a fault element for this distinct fault. The value of the WSDL fault element's *name* attribute SHOULD be the same as the NCName of the fault element defined in step 2, although it MAY choose to ignore this rule (for example to avoid NCName collisions between fault elements defined in different namespaces). The value of the WSDL fault element's *message* attribute MUST refer by QName to the WSDL message element of this distinct fault as defined in step 3.

In addition to any operation-specific faults, all WSDL operations MAY also have a WSDL fault element whose name attribute has the value "BaseFault" and whose message element has the value "wsrf-bf:BaseFaultMessage".

The following non-normative example defines a portType named "pt" with a single operation named "op" that has two distinct faults, "hisFault" and "herFault", in addition to a basic "baseFault". The "hisFault" element does not extend "BaseFault" with any additional information (i.e. it just defines a distinct fault type with the base information), while the "herFault" element extends "BaseFault" with an additional details element.

```

254 ...
255 <wsdl:definitions ...>
256   <wsdl:types>
257     <xsd:schema ...>
258       <!-- Type and element declarations for each distinct fault -->
259       <xsd:complexType name="HisFaultType">
260         <xsd:complexContent>
261           <xsd:extension base="wsrf-bf:BaseFaultType"/>
262         </xsd:complexContent>
263       </xsd:complexType>
264       <xsd:element name="hisFault" type="tns:HisFaultType"/>
265
266       <xsd:complexType name="HerFaultType">
267         <xsd:complexContent>
268           <xsd:extension base="wsrf-bf:BaseFaultType">
269             <xsd:sequence>
270               <xsd:element name="details" type="xsd:string"/>
271             </xsd:sequence>
272           </xsd:extension>
273         </xsd:complexContent>
274       </xsd:complexType>
275       <xsd:element name="herFault" type="tns:HerFaultType"/>
276
277     </xsd:schema>
278   </wsdl:types>
279

```

```

280 <!-- WSDL messages for each distinct fault -->
281 <wsdl:message name="hisFaultMessage">
282   <wsdl:part name="fault" element="tns:hisFault"/>
283 </wsdl:message>
284 <wsdl:message name="herFaultMessage">
285   <wsdl:part name="fault" element="tns:herFault"/>
286 </wsdl:message>
287
288 <wsdl:portType name="pt">
289   <wsdl:operation name="op">
290     <!-- WSDL operation fault elements for each distinct fault -->
291     <wsdl:input ... />
292     <wsdl:output ... />
293     <wsdl:fault name="hisFault"
294       message="tns:hisFaultMessage"/>
295     <wsdl:fault name="herFault"
296       message="tns:herFaultMessage"/>
297     <wsdl:fault name="BaseFault"
298       message="wsrf-bf:BaseFaultMessage"/>
299   </wsdl:operation>
300 </wsdl:portType>
301 </wsdl:definitions>

```

302

303 A Web service MAY return a more refined fault in place of a particular fault that is defined by a
304 WSDL operation. To do so, a complexType MUST be defined that extends one of the faults found
305 in the WSDL operation. The fault message that is returned by the service MUST then use the
306 element of the fault from which the more refined fault is derived with an xsi:type attribute whose
307 value is the QName of the complexType for the more refined fault.

308 For example, if an implementation of the “pt” example above wants to return a more refined
309 version hisFault for the “op” operation, it must define a complexType of hisFault such as:

```

310 ...
311 targetNamespace="http://example.com/ExtendedFaults" ...
312
313 <xsd:complexType name="ExtendedHisFaultType">
314   <xsd:complexContent>
315     <xsd:extension base="tns:HisFaultType">
316       <xsd:sequence>
317         <xsd:element name="otherDetails"
318           type="xsd:string"/>
319       </xsd:sequence>
320     </xsd:extension>
321   </xsd:complexContent>
322 </xsd:complexType>

```

323 This example service can then return a fault message for the “op” operation such as:

```

324 <hisFault
325   xmlns:ef="http://example.com/ExtendedFaults"
326   xsi:type="ef:ExtendedHisFaultType">
327   <timeStamp>...</timeStamp>
328   ...
329   <otherDetails>...</otherDetails>
330 </hisFault>

```

331

4 Security Considerations

332 Fault messages may contain sensitive information. Policies should be defined such that such
333 sensitive content of fault messages are appropriately protected. For example, the security policy
334 can be specified to require that the sensitive content be encrypted based on WS-Security [[WS-
335 Security](#)]. Depending on the context in which the fault occurred, it may also be desirable that
336 the integrity of the message be ensured. In such cases, the security policy can reflect this by
337 specifying the need to digitally sign the resulting fault messages based on the WS-Security
338 specification.

339 5 References

340 5.1 Normative References

341 [RFC2119]

342 S. Bradner, *Key words for use in RFCs to Indicate Requirement*
343 *1650 Levels*, <http://www.ietf.org/rfc/rfc2119.txt>, IETF RFC 2119, March
344 1651 1997.

345

346 [WSDL 1.1]

347 <http://www.w3.org/TR/wsdl>

348

349 [XML-Infoset]

350 <http://www.w3.org/TR/xml-infoset/>

351

352 [XML]

353 <http://www.w3.org/TR/REC-xml>

354 5.2 Non-Normative References

355 [OGSI]

356 <http://www.gridforum.org/documents/GFD.15.pdf>

357

358 [SOAP 1.1]

359 <http://www.w3.org/TR/2000/NOTE-SOAP-20000508/>

360

361 [SOAP 1.2]

362 <http://www.w3.org/TR/2003/REC-soap12-part1-20030624/>

363

364 [WS-Addressing]

365 <http://www.w3.org/TR/ws-addr-core/>

366

367 [WS-I Basic Profile 1.1]

368 <http://www.ws-i.org/Profiles/BasicProfile-1.1-2004-08-24.html>

369

370 [WS-Resource]

371 http://docs.oasis-open.org/wsr/wsr/ws_resource-1.2-spec-cs-01.pdf

372

373 [WS-Security]

374 <http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-soap-message-security-1.0.pdf>

375

376

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398

Appendix B. Revision History

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wd-02	2004-06-10	Sam Meder	Consistency fixes from Ian Robinson Updated namespaces Cleaned up the references
wd-02	2004-06-28	Lily Liu	Namespace fixes in xsd and wsd and minor format changes in the requirement section.
wd-02	2004-06-30	Sam Meder	Inserted updated schema and wsd – adds elementFormDefault="qualified" attributeFormDefault="unqualified" attributes to schema declarations.
wd-03	2004-11-11	Lily Liu	Issue resolutions from October F2F: WSRF43 Updated the status section Updated document identifier, location and namespaces <ul style="list-style-type: none"> o Changed doc identifier to "Summary Info Title"
wd-04	2005-02-17	Lily Liu	Issue resolutions from Jan F2F, 2005: Updated draft number and namespaces <ul style="list-style-type: none"> o Applied resolutions to issues 62, 81, 90, and 96.
wd-05	2005-05-17	Sam Meder	Updated draft number and namespaces <ul style="list-style-type: none"> o Applied resolutions to issues 92, 99, 100, 106, 109, 110, 114
pr-01	2005-06-13	Sam Meder	Changed status to PR
pr-02	2005-10-07	Lily Liu	PR draft 2
wd-07	2005-09-15	Bryan Murray	Address Public Review comments <ul style="list-style-type: none"> • Apply resolutions for issues 124, 141, 110, 142, 145
wd-08	2005-09-16	Bryan Murray	Correct link to WS-Addressing spec

Rev	Date	By Whom	What
wd-09	2005-09-16	Bryan Murray	Move WS-I reference to non-normative
pr-02.a	2005-11-17	Lily Liu	Accept all changes for PR draft 2

400

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430

431

Appendix D. XML Schema

432 The XML types and elements used in this specification are included here for convenience. The
433 authoritative version of this schema document is available at:

434 <http://docs.oasis-open.org/wsrf/bf-2.xsd>

```
435 <?xml version="1.0" encoding="UTF-8"?>
436 <!--
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476     INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE
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478     WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.
479 -->
480
481 <xsd:schema
482     xmlns="http://www.w3.org/2001/XMLSchema"
483     xmlns:xsd="http://www.w3.org/2001/XMLSchema"
484     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
485     xmlns:wsa="http://www.w3.org/2005/08/addressing"
486     xmlns:wsrf-bf=
487         "http://docs.oasis-open.org/wsrf/bf-2"
488     elementFormDefault="qualified"
```

```

489 attributeFormDefault="unqualified"
490 targetNamespace=
491 "http://docs.oasis-open.org/wsrf/bf-2">
492 <xsd:import
493 namespace="http://www.w3.org/2005/08/addressing"
494 schemaLocation=
495 "http://www.w3.org/2005/08/addressing/ws-addr.xsd"/>
496
497 <xsd:import namespace="http://www.w3.org/XML/1998/namespace"
498 schemaLocation="http://www.w3.org/2001/xml.xsd">
499 <xsd:annotation>
500 <xsd:documentation>
501 Get access to the xml: attribute groups for xml:lang as
502 declared on 'schema' and 'documentation' below
503 </xsd:documentation>
504 </xsd:annotation>
505 </xsd:import>
506
507 <!-- ===== BaseFault Types ===== -->
508
509 <xsd:element name="BaseFault" type="wsrf-bf:BaseFaultType"/>
510
511 <xsd:complexType name="BaseFaultType">
512 <xsd:sequence>
513 <xsd:any namespace="##other" processContents="lax"
514 minOccurs="0" maxOccurs="unbounded"/>
515 <xsd:element name="Timestamp" type="xsd:dateTime"
516 minOccurs="1" maxOccurs="1"/>
517 <xsd:element name="Originator" type="wsa:EndpointReferenceType"
518 minOccurs="0" maxOccurs="1"/>
519 <xsd:element name="ErrorCode"
520 minOccurs="0" maxOccurs="1">
521 <xsd:complexType>
522 <xsd:complexContent mixed="true">
523 <xsd:extension base="xsd:anyType">
524 <xsd:attribute name="dialect" type="xsd:anyURI"
525 use="required"/>
526 </xsd:extension>
527 </xsd:complexContent>
528 </xsd:complexType>
529 </xsd:element>
530
531 <xsd:element name="Description"
532 minOccurs="0" maxOccurs="unbounded">
533 <xsd:complexType>
534 <xsd:simpleContent>
535 <xsd:extension base="xsd:string">
536 <xsd:attribute ref="xml:lang" use="optional"/>
537 </xsd:extension>
538 </xsd:simpleContent>
539 </xsd:complexType>
540 </xsd:element>
541
542 <xsd:element name="FaultCause" minOccurs="0" maxOccurs="1">
543 <xsd:complexType>
544 <xsd:sequence>
545 <xsd:any namespace="##other" processContents="lax"
546 minOccurs="1" maxOccurs="1"/>
547 </xsd:sequence>
548 </xsd:complexType>
549 </xsd:element>
550 </xsd:sequence>
551 <xsd:anyAttribute namespace="##other" processContents="lax"/>

```

552
553

```
</xsd:complexType>  
</xsd:schema>
```

Appendix E. WSDL 1.1

555 The WSDL 1.1 for the Web service methods described in this specification is compliant with [WS-
556 I Basic Profile 1.1] and is included here for convenience. The authoritative version of this WSDL
557 is available at:

558 <http://docs.oasis-open.org/wsrf/bfw-2.wsdl>

```

559 <?xml version="1.0" encoding="UTF-8"?>
560 <!--
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562     intellectual property or other rights that might be claimed to pertain
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600     INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE
601     INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED
602     WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.
603     -->
604 <wsdl:definitions name="BaseFaults"
605     xmlns="http://schemas.xmlsoap.org/wsdl/"
606     xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
607     xmlns:xsd="http://www.w3.org/2001/XMLSchema"
608     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
609     xmlns:wsrf-bf=
610         "http://docs.oasis-open.org/wsrf/bf-2"
611     targetNamespace=

```

```
612         "http://docs.oasis-open.org/wsrif/bfw-2">
613
614     <!-- ===== Types Definitions ===== -->
615     <wsdl:types>
616         <xsd:schema
617             elementFormDefault="qualified"
618             attributeFormDefault="unqualified" >
619             <xsd:import
620                 namespace="http://docs.oasis-open.org/wsrif/bf-2"
621                 schemaLocation="http://docs.oasis-open.org/wsrif/bf-2.xsd" />
622             </xsd:schema>
623     </wsdl:types>
624
625     <wsdl:message name="BaseFaultMessage" >
626         <wsdl:part name="Fault" element="wsrf-bf:BaseFault" />
627     </wsdl:message>
628 </wsdl:definitions>
```