



Web Services Distributed Management: Management Using Web Services (MUWS 1.0) Part 2

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Abstract:

There are two specifications produced by the Web services Distributed Management technical committee: Management *Using* Web services (MUWS) and Management *Of* Web services (MOWS, see [MOWS]). This document is part of MUWS.

MUWS defines how an Information Technology resource connected to a network provides manageability interfaces such that the IT resource can be managed locally or from remote locations using Web services technologies.

MUWS is composed of two parts. This document is MUWS part 2 and provides specific messaging formats used to enable the interoperability of MUWS implementations. MUWS part 1 [MUWS Part 1] provides the fundamental concepts for management using Web services. MUWS part 2 depends on MUWS part 1 while part 1 is independent of part 2.

Status:

This document is a committee draft of version 1.0. There is no guarantee that any part of the content in this document will appear in the final, released MUWS 1.0 specification.

Committee members should send comments on this specification to the wsdm@lists.oasis-open.org list. Others should subscribe and send comments to the wsdm-comment@lists.oasis-open.org list. To subscribe, send an email message to wsdm-comment-request@lists.oasis-open.org, with the word "subscribe" as the body of the message.

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

The errata document for this specification is maintained at:

<http://docs.oasis-open.org/wsdm/2004/12/cd-wsdm-muws-part2-1.0-errata.pdf>

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108 1 Introduction

109 This document, MUWS Part 2, builds upon the foundation provided by [MUWS Part 1]. All of the
110 normative text presented in MUWS Part 1 is considered normative text for MUWS Part 2. All
111 informational text presented in MUWS Part 1 is relevant informational text for MUWS Part 2.
112 Compliance with MUWS Part 1 is REQUIRED for every aspect of MUWS Part 2.

113 The text of this specification along with Appendix C (Schemas), Appendix D (WSDL elements),
114 Appendix E (Topics) and Appendix F (Description of situation types) is considered normative with
115 the following exceptions: the abstract, the examples, the UML diagrams, and any section
116 explicitly marked as non-normative.

117 The terminology and notational conventions defined in [MUWS Part 1] apply to this document.

118 The following namespaces are used, unless specified otherwise.

Prefix	Namespace
muws-p1-xs	http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-muws-part1.xsd
muws-p2-xs	http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-muws-part2.xsd
muws-p2-wsdl	http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-muws-part2.wsdl
muws-events	http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-muws-part2-events.xml
wsnt	http://docs.oasis-open.org/wsn/2004/06/wsn-WS-BaseNotification-1.2-draft-01.xsd
wstop	http://docs.oasis-open.org/wsn/2004/06/wsn-WS-Topics-1.2-draft-01.xsd
wsrf-rp	http://docs.oasis-open.org/wsr/2004/06/wsr/WS-ResourceProperties-1.2-draft-01.xsd
wssg	http://docs.oasis-open.org/wsr/2004/06/wsr/WS-ServiceGroup-1.2-draft-01.xsd
wsdl	http://www.w3.org/2002/07/wsdl
wsa	http://schemas.xmlsoap.org/ws/2004/08/addressing
soap	http://schemas.xmlsoap.org/soap/envelope/
xs	http://www.w3.org/2001/XMLSchema

119 XML elements ([XML 1.0 3rd Edition]) and schema ([XML Schema Part 1] and [XML Schema Part
120 2]) types introduced in this section belong to the namespace mapped to “muws-p2-xs”.

121 WSDL ([WSDL]) elements introduced in this section belong to the namespace mapped to “muws-
122 p2-wsdl”.

2 Use of the Web Services Platform

123

124 As a complement to the Web services platform described in [MUWS Part 1], MUWS Part 2
125 presents an additional set of specifications in order to achieve interoperability among disparate
126 implementations of MUWS. This goal is achieved by the precise specification of the format for
127 each management message.

128 2.1 Use of WS-Addressing and the WS-Resource concept

129 MUWS Part 2 depends upon concepts presented in the Web Services Resources Framework
130 ([WSRF]). A "manageable resource" is a refinement of a WSRF "resource". A WS-Resource, as
131 defined by [WS-Resource], is created by composing a manageability endpoint with a manageable
132 resource made accessible through this endpoint. In addition, a reference to a manageability
133 endpoint relies upon reference mechanisms as defined in [WS-Resource], and more specifically,
134 leverages and refine the endpoint reference (EPR) concept, as defined in [WS-Addressing].

135 If a manageability endpoint corresponds to zero or more manageable resources, then the
136 "WS-Addressing Using Reference Properties Embodiment" of [WS-Resource] MUST be followed.
137 In other words, each element listed in the *ReferenceProperties* of a WS-Resource qualified EPR
138 MUST be included in the header of each message sent to each corresponding manageability
139 endpoint. The MUWS specification does not currently define how to obtain an EPR. Currently, to
140 obtain an EPR, there may be some out-of-band agreement between a service provider and a
141 manageability consumer. Possibly, some future version of the MUWS specification might clarify
142 and standardize an approach to obtain an EPR. This specification provides some guidelines on
143 discovering EPRs for manageability endpoints.

144 In the specific case where a manageability endpoint corresponds to one and only one
145 manageable resource, then either the "WS-Addressing Using Reference Properties Embodiment"
146 concept, as above, or the "WS-Addressing Without Using Reference Properties Embodiment"
147 concept MUST be followed. If the "WS-Addressing Without Using Reference Properties
148 Embodiment" is followed, then the manageability endpoint does not expect to receive a list of
149 elements in the *ReferenceProperties* of WS-Resource qualified EPR included in the message
150 header.

151 A manageability consumer without an EPR for a manageability endpoint MAY try to invoke
152 manageability operations without including reference properties information. If such an invocation
153 succeeds, the manageability consumer can infer it is accessing a manageable resource through a
154 manageability provider.

155 2.2 Use of WS-Resource Properties

156 Management properties as defined in MUWS are represented as WSRF "properties" , and use
157 the mechanisms defined in *WS-ResourceProperties* ([WS-RP]). In other words, each manageable
158 resource exposes a resource properties document containing, as children of the document root,
159 all the properties of the manageable resource. The manageable resource then makes this
160 document available, as described in *WS-ResourceProperties*.

161 Supporting *WS-ResourceProperties* means that any implementation of an interface that includes
162 properties MUST include access methods to these properties as defined by
163 *WS-ResourceProperties*. Specifically, the interface MUST include the *GetResourceProperty*
164 operation defined by [WS-RP] and MAY include the *GetMultipleProperties*,
165 *SetResourceProperties* and *QueryResourceProperties* operations. If the
166 *QueryResourceProperties* operation is provided, then the *QueryResourceProperties* operation
167 SHOULD support the XPath 1.0 query expression dialect, represented by URI
168 <http://www.w3.org/TR/1999/REC-xpath-19991116>.

169 2.3 Use of WS-Notification

170 MUWS uses the notification mechanism described by WS-BaseNotification ([WSN]). If a
171 manageability capability includes an ability to offer events to a consumer, then the definition of
172 the capability SHALL include topic space, as described in WS-Topics ([WST]). The topic space
173 MUST contain an appropriate set of topics for the events offered by the capability. As described
174 in MUWS Part 1, an event is defined by a “topic” QName and a “content” element. The “topic” is
175 mapped to the topic of the event, as defined by [WST].

176 As specified by WS-BaseNotification, whether the event payload (of type *muws-p1-*
177 *xs:ManagementEvent*) is the first child of the SOAP ([SOAP]) body or whether it is wrapped in a
178 *wsnt:Notify* element is determined based on whether the *wsnt:UseNotify* element in the
179 subscription message is set to *true* or *false*.

180 Note that WS-BaseNotification does not currently support a means to specify that only some of
181 the information contained in the notification message should be sent to the consumer. MUWS
182 does not define a means to specify this either. The manageability consumer and the implementer
183 of a manageability endpoint should be aware that there is a performance cost for processing
184 many, large notification messages.

185 2.4 Metadata

186 MUWS defines a set of base schema for metadata elements. These metadata elements can be
187 represented as XML Schema elements. The purpose of a metadata element is to supplement the
188 information available in the WSDL [WSDL] and the WS-ResourceProperties [WS-RP] declaration
189 for a manageability interface. A metadata element provides additional description relevant to the
190 managed resource. In particular, a metadata element enables a tool or management application,
191 to perform detailed reasoning and make specialized inferences about a manageable resource at
192 runtime, and, during development, when no instance is available for a manageable resource.

193 If metadata is required, then an XML document containing metadata is defined and associated
194 with a WS-ResourceProperties document and WSDL. Document processing, like an XPath
195 query, is used to extract all or part of the metadata. Currently, WSDM does not define the format
196 of, how to associate, or, how to access document metadata content. Although some mechanism
197 is necessary, this MUWS specification does not provide any mechanism for accessing metadata
198 from an instance of a manageable resource.

199 Also, this MUWS specification does not provide any description of how metadata is associated
200 with a type of manageable resource, is stored, or made available.

201 The MUWS specification defines a set of metadata elements that apply to the basic
202 manageability of a manageable resource. The MUWS specification uses Global Element
203 Declarations to represent a metadata element.

204 2.4.1 Metadata applicable to all aspects of manageability interfaces

205 MUWS defines metadata elements applicable to all aspects of a manageability interface
206 (operations, properties, events...). These elements are:

207

208 `<muws-p2-xs:Capability>xs:anyURI</muws-p2-xs:Capability> *`

209 **muws-p2-xs:Capability** metadata element SHOULD be provided for any MUWS aspect of a
210 manageability interface. This enables discovery of aspects of an interface associated with a
211 capability. This element contains a URI identifying the capability.

212 This metadata element indicates the classification of an aspect of an interface according to an
213 intended capability, or capabilities. For example, an aspect may be classified as a metric, or, as
214 a configuration property. A property may be relevant to more than one capability. For example, a

215 configuration property of a computer system contains the IP address but this same property could
216 also be used for identification purposes.

217 Some of the known capabilities are listed below for illustration. This is not an exhaustive list. For a
218 detailed explanation, see the relevant MUWS manageability capability specification. Additional
219 capabilities are expected to be added as extensions to MUWS.

- 220 • <http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/Identity>
221 Identity capability. See [MUWS Part 1].
- 222 • <http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/Configuration>
223 Configuration property. See section 3.5.
- 224 • <http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/CorrelatableProperties>
225 "Correlatable Properties" capability. See [MUWS Part 1].
- 226 • <http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/State>
227 State capability. See section 3.1.3.
- 228 • <http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/Metrics>
229 Metrics capability. See section 3.4.
- 230 • *User defined*
231 A user defined capability that extends, or, is different from, a standard capability defined
232 in MUWS.

233
234

```
235 <muws-p2-xs:ValidWhile Dialect="xs:anyURI" > {any} * </muws-p2-  
236 xs:ValidWhile>
```

237 **muws-p2-xs:ValidWhile** contains a statement that, when true, asserts that the interface aspect
238 to which this metadata element is related is valid. This is used, for example, to express the fact
239 that an operation can only be invoked when certain properties have certain values.

240 **muws-p2-xs:ValidWhile/@muws-p2-xs:Dialect** is a URI identifying how the statement in *muws-*
241 *p2-xs:ValidWhile* is built and what rules govern its evaluation. MUWS defines one possible value
242 for this element. Other values can also be defined.

243 The value defined by MUWS is <http://www.w3.org/TR/1999/REC-xpath-19991116>. When this
244 dialect is used, the content of *muws-p2-xs:ValidWhile* is an [XPath 1.0] expression. This
245 expression is evaluated against the resource properties document of the manageable resource. If
246 the XPath expression evaluates to a Boolean value of *true*, or if it evaluates to a non-empty non-
247 boolean value without any errors, then the statement is considered true.

248 2.4.2 Metadata applicable to properties

249 General purpose metadata that is not management specific is defined in the MUWS specification,
250 but not specified in schema. General purpose metadata that can be defined for any property
251 include:

- 252 • *Mutability* – indicates if the property value can change over time
- 253 • *Modifiability* – indicates if the property can be set directly (not as a side-effect)
- 254 • *Valid Values* – a set of valid values for the property
- 255 • *Valid Range* – a range of valid values for the property
- 256 • *Static Values* – a set of permanent values for the property
- 257 • *Notifiability* – indicates if a notification is sent when there is a change to the value of the
258 property

259 Schema to represent general purpose metadata should be composed from a metadata
260 specification, for example, the WS-Resource Metadata Descriptor [WSRMD], as developed in the
261 WS-RF OASIS technical committee.

262 In addition, MUWS defines a set of metadata related to management. Any property element may
263 have the following manageability metadata element:

264 `<muws-p2-xs:Units>xs:string</muws-p2-xs:Units>`

265 **muws-p2-xs:Units** indicates the default unit for this property as a string.

266 Other metadata elements, applicable for metric-type properties, are defined in section 3.4.3.

267 2.4.3 Operations

268 General purpose metadata, that is not management specific, is defined in the MUWS
269 specification, but not specified in schema. General purpose metadata that can be defined for any
270 operation includes:

- 271 • *Idempotency* – indicates if invoking the operation twice is equivalent to invoking it once

272 Schema to represent general purpose metadata should be composed from a metadata
273 specification, for example, the WS-Resource Metadata Descriptor [WSRMD], as developed in the
274 WS-RF OASIS technical committee.

275 In addition, MUWS defines metadata related to management. Any operation element may have
276 the following manageability metadata element:

277

```
278 <muws-p2-xs:PostCondition Dialect="xs:anyURI">  
279   {any} *  
280 </muws-p2-xs:PostCondition>
```

281 **muws-p2-xs:PostCondition** contains a statement that asserts "true" immediately after the
282 corresponding operation is complete.

283 **muws-p2-xs:PostCondition/@muws-p2-xs:Dialect** is a URI identifying how the statement in
284 *muws-p2-xs:PostCondition* is built, and what rules govern its evaluation. MUWS defines one
285 possible value for this element. Other values can be defined.

286 The value defined by MUWS is <http://www.w3.org/TR/1999/REC-xpath-19991116>. When this
287 dialect is used, the content of *muws-p2-xs:PostCondition* is an [XPath 1.0] expression. This
288 expression is evaluated against the resource properties document of the manageable resource. If
289 the XPath expression evaluates to a Boolean value of *true*, or, if it evaluates to a non-empty non-
290 boolean value without any errors, then the statement is considered true.

291 2.5 Events

292 2.5.1 Event Format

293 [MUWS Part 1] defines the *muws-p1-xs:ManagementEvent* Global Element Declaration as a
294 container for management events. *muws-p1-xs:ManagementEvent* allows information to be
295 added via extensibility elements. The *muws-p2-xs:Situation* element defined below MUST be
296 present as a child of the *muws-p1-xs:ManagementEvent* element in notifications.

297 As a result, the event format is flexible and extensible. At the same time, automated analysis is
298 possible, as the event format provides a means to classify an event into one of a limited set of
299 classifications and sub-classifications.

300 MUWS event classifications are based on a thorough analysis of event types, as produced by a
301 wide range of IT equipment, and grouped according to the general nature of events. For example,
302 virtually all manageable resources have a means of being started. However, almost all managed
303 resources express a start event in some unique way. The basic knowledge that the resource has
304 started is all that is necessary, even for fairly sophisticated, automated management.

305 To support event classifications, the MUWS specification defines the *SituationCategoryType*
306 element, a specialization of a *muws-p2-xs:CategoryType*. MUWS defines the top level of
307 classifications. Extensions to these classifications enable a refined event classification. Through

308 the use of the extensible *muws-p2-xs:CategoryType* mechanism, WSDM event consumers can
309 comprehend the situation for an event to a degree commensurate with their ability.

```
310 <muws-p2-xs:Situation>  
311   <muws-p2-xs:SituationCategory>  
312     muws-p2-xs:SituationCategoryType  
313   </muws-p2-xs:SituationCategory>  
314   <muws-p2-xs:SuccessDisposition>  
315     (Successful|Unsuccessful)  
316   </muws-p2-xs:SuccessDisposition> ?  
317   <muws-p2-xs:SituationTime>xs:dateTime</muws-p2-xs:SituationTime> ?  
318   <muws-p2-xs:Priority>xs:short</muws-p2-xs:Priority> ?  
319   <muws-p2-xs:Severity>xs:short</muws-p2-xs:Severity> ?  
320   <muws-p2-xs:Message>muws:LangString</muws-p2-xs:Message> ?  
321   <muws-p2-xs:SubstitutableMsg MsgId="xs:string" MsgIdType="xs:anyURI">  
322     <muws-p2-xs:Value>xs:anySimpleType</muws-p2-xs:Value> *  
323   </muws-p2-xs:SubstitutableMsg> ?  
324 </muws-p2-xs:Situation>
```

325 **muws-p2-xs:Situation/muws-p2-xs:SituationCategory** categorizes the type of the situation
326 that caused the event report. The values, listed below, represent the names of elements in the
327 *muws-p2-xs* namespace. The categories are listed in the order of precedence. In a case where
328 there may be some ambiguity about which category to use, the higher precedent category
329 SHOULD be used. The ordering of situation categories is based on empirical data showing
330 relative importance of various types of events. The use of a higher precedent category permits
331 more effective and timely correlation and analysis of events that may indicate the presence of a
332 serious problem. Details and examples for use of the following values are documented in
333 Appendix F. This element is REQUIRED.

- 334 • AvailabilitySituation
 - 335 • CapabilitySituation
 - 336 • ConfigureSituation
 - 337 • StopSituation
 - 338 • StartSituation
 - 339 • RequestSituation
 - 340 • DestroySituation
 - 341 • CreateSituation
 - 342 • DependencySituation
 - 343 • ConnectSituation
 - 344 • ReportSituation
 - 345 • OtherSituation
- 346

347 **muws-p2-xs:Situation/muws-p2-xs:SuccessDisposition** in the case where this situation is
348 triggered by a command, this value specifies a successful disposition of the command causing a
349 report of this situation. This element is OPTIONAL and should not be included if the situation is
350 not the result of a command. The element is a restriction of the type *xs:string* allowing the
351 following values:

- 352 • Successful
 - 353 • Unsuccessful
- 354

355 **muws-p2-xs:Situation/muws-p2-xs:SituationTime** represents the date and time an event is
356 observed. If the value does not include a time zone designation, or, if the value does not use 'Z'
357 for UCT, then the value MUST be interpreted as having a time zone of UCT. The value of
358 SituationTime MUST provide granularity as precise as supported by the generating platform. This
359 is a REQUIRED element and MUST be provided by the component acting as the originator of an
360 event.

361 **muws-p2-xs:Situation/muws-p2-xs:Priority** represents the importance of an event. This
362 element supports management functions requiring an event to be associated with a priority. This
363 is an OPTIONAL element. Values are constrained to a range from 0 through 100. The predefined
364 priorities are:

- 365 • Low (10)
- 366 • Medium (50)
- 367 • High (70).

368 Other priorities MAY be used but MUST NOT be less than 0 or greater than 100.

369 **muws-p2-xs:Situation/muws-p2-xs:Severity** represents the perceived severity of the status the
370 event is describing with respect to the application that reports the event. This element supports
371 management functions requiring an event to be associated with a severity. This is an OPTIONAL
372 element. Severity levels, based upon the DMTF CIM Alert Indications Perceived Severity, are as
373 follows:

- 374 • 6 (Fatal): a condition is unrecoverable and the service is no longer available.
- 375 • 5 (Critical): a condition affecting the service has occurred. Immediate corrective action is
376 required.
- 377 • 4 (Major): a problem of relatively high severity has occurred. It is likely that normal use of
378 the service is impeded.
- 379 • 3 (Minor): a problem of relatively low severity has occurred. It is unlikely that normal use
380 of the service is impeded.
- 381 • 2 (Warning): a problem affecting the service may occur. Diagnostic and corrective action
382 is recommended.
- 383 • 1 (Information): a message output considered as normal and expected. For example, a
384 process begins, a process finishes, or status information is displayed.
- 385 • 0 (Unknown): a severity level cannot be determined.

386

387 **muws-p2-xs:Situation/muws-p2-xs:Message** represents the text accompanying an event. This
388 is typically the resolved message string in a human-readable format, as rendered for a specific
389 locale, and is of type *muws-p2-xs:LangString* which is an extension of *xs:string* requiring the
390 *xml:lang* attribute. This is an OPTIONAL property. While the string length for *Message* is
391 unbounded, it is RECOMMENDED that the string length for *Message* does not exceed 1024
392 characters.

393 **muws-p2-xs:Situation/muws-p2-xs:SubstitutableMsg** – represents the message data in a
394 substitutable form. The attributes *MsgId* and *MsgIdType* identify the base message type and
395 text. The element value contains the data that will be formatted according to the formatting rules
396 defined by the *MsgId*. This is an OPTIONAL element. However, if this element is used, it must
397 contain all the attributes and elements specified below.

398 **muws-p2-xs:Situation/muws-p2-xs:SubstitutableMsg/@muws-p2-xs:MsgId** specifies the
399 message identifier of an event. This identifier SHOULD be a unique value string, consisting of
400 alphanumeric or numeric characters. The value can be as simple as a string of numeric
401 characters that identify a message in a message catalog. As an alternative, the value can be a
402 multipart string of alphanumeric characters, for example, DBT1234E. This is a REQUIRED
403 attribute. The maximum string length for *MsgId* MUST NOT exceed 256 characters. The
404 *MsgIdType* attribute indicates the formatting type of the *MsgId*.

405 **muws-p2-xs:Situation/muws-p2-xs:SubstitutableMsg/@muws-p2-xs:MsgIdType** specifies
406 the meaning and format of the *MsgId*. This is a REQUIRED attribute. The type of the *MsgIdType*
407 attribute is a URI.

408 **muws-p2-xs:Situation/muws-p2-xs:SubstitutableMsg/muws-p2-xs:Value** can be of any
409 simple type. There are one or more occurrences of this element with each occurrence containing
410 an *xsi:type* attribute defining the type of the contained data. This element is used to pass data
411 values that are substituted as a message is formatted. This element is OPTIONAL. A *MsgId* and

412 *MsgIdType* define rules to map parameters into a composed message, based upon the order of
413 the *Value* elements.

414 As an example, a minimal *SituationType* report for the initiation of a requested restart (at 6:06PM
415 in Greenwich on Nov 11, 2004) would be as follows.

```
416 <muws-p2-xs:Situation>  
417   <muws-p2-xs:SituationCategory>  
418     <foo:RestartInitiated>  
419       <muws-p2-xs:StartSituation/>  
420     </foo:RestartInitiated>  
421   </muws-p2-xs:SituationCategory>  
422   <muws-p2-xs:SuccessDisposition>Successful</muws-p2-xs:SuccessDisposition>  
423   <muws-p2-xs:SituationTime>2004-11-11T18:06:00Z  
424   </muws-p2-xs:SituationTime>  
425   <muws-p2-xs:Message xml:lang="en">  
426     Managed Thing XXX: restart processing begun  
427   </muws-p2-xs:Message>  
428 </muws-p2-xs:Situation>
```

429 Please note, as outlined in the description of *muws-p2-xs:CategoryType*, the most general
430 situation classification appears as the innermost element within the XML nest.

431 2.5.2 Topics for capabilities

432 For each capability defined by MUWS, topics are defined that encompasses every event related
433 to that capability. For example, if a property related to capability "foo" changes, then a notification
434 is sent to subscribers of the topic corresponding to a change event on this property, as described
435 by [WS-RP]. Concurrently, since this property is associated with the "foo" capability, a notification
436 is also sent to subscribers of the topic encompassing change events associated with capability
437 "foo".

438 Appendix E contains the XML description of all the topics defined in the MUWS specification. The
439 sections of this document that define a capability also define the topic(s) associated with that
440 capability. The following MUWS topics encompass every event associated with the capability
441 defined in MUWS Part 1:

442 The *muws-events:IdentityCapability* topic defined below is used for events related to the *Identity*
443 capability.

```
444 <wstop:Topic name="IdentityCapability"  
445   messageTypes="muws-pl-xs:ManagementEvent ">  
446 </wstop:Topic>
```

447 The *muws-events:ManageabilityCharacteristicsCapability* topic defined below is used for events
448 related to the *ManageabilityCharacteristics* capability.

```
449 <wstop:Topic name="ManageabilityCharacteristicsCapability"  
450   messageTypes="muws-pl-xs:ManagementEvent ">  
451 </wstop:Topic>
```

452 The *muws-events:CorrelatablePropertiesCapability* topic defined below is used for events related
453 to the *CorrelatableProperties* capability.

```
454 <wstop:Topic name="CorrelatablePropertiesCapability"  
455   messageTypes="muws-pl-xs:ManagementEvent ">  
456 </wstop:Topic>
```

457 2.6 Representation of Categorization Taxonomies in XML

458 In the description of several manageability capabilities, categories of information are organized in
459 taxonomies. This is for example the case for the categories of relationships between manageable

460 resources, for operational states of resources, etc. In order to convey category information,
461 including taxonomy lineage, to a manageability consumer, and, in order to represent XML
462 information instances, the following convention is used:

463 MUWS defines an XML Schema complex type called `CategoryType`. The content of XML
464 elements of this type is any XML element. When an element is defined of this type, it MUST obey
465 the following rules:

- 466 • The element and each descendant has, at most, one child element.
- 467 • The top-level element and each descendant represent one category in a taxonomy.
- 468 • The top level element represents the most specialized category. Each element
469 represents a more specialized category than the category represented by the element it
470 contains, if any.

471 The `CategoryType` XML Schema type is declared as follows:

```
472 <xs:complexType name="CategoryType">  
473 <xs:sequence>  
474 <xs:any namespace="##any" minOccurs="0" processContents="lax" />  
475 </xs:sequence>  
476 </xs:complexType>
```

477 The `CategoryType` type is used to declare an XML element containing instances of general, or
478 unqualified, category information. The `CategoryType` type is also used to derive an XML Schema
479 type representing a specific category, for example, a relationship among resources, or among
480 operational states.

481 Category information MUST be declared as follows:

- 482 • An XML element declaring which QName identifies the semantics of the category.
- 483 • The XML element declaring an XML Schema type which is a restriction of `muws-p2-`
484 `xs:Category`, or a specialized XML Schema type derived from some other refinement of
485 `muws-p2-xs:Category`, for example, `muws-p2-xs:RelationshipType`.
- 486 • The contents of the XML element MUST be either:
 - 487 • The one XML element corresponding to the generalization of the currently declared
488 category
 - 489 • The empty sequence. This case occurs if the declared category does not have any
490 generalizations. For example, the declared category might be the top of a taxonomy.

491 For example, assume that information about a maintenance state is represented, using the
492 approach described above. In this example, "off-for-maintenance" is a substate of "offline", which
493 is a substate of a resource being "unavailable". The XML representation for this example follows:

```
494 <mydomain:Off-for-Maintenance>  
495 <mydomain:Offline>  
496 <anyresource:Unavailable/>  
497 </mydomain:Offline>  
498 </mydomain:Off-for-Maintenance>
```

499 By processing the XML information, a manageability consumer may learn that a resource is in a
500 state identified by the `mydomain:Off-for-Maintenance` element. However, at the same time, if the
501 manageability consumer is not aware of definitions and semantics associated with the `mydomain`
502 namespace, the consumer may safely assume the resource is in the commonly known state
503 identified by `anyresource:Unavailable`. Since the most specialized elements are first encountered,
504 a consumer can generally stop processing an element of type `muws-p2-xs:Category` as soon as it
505 reaches an element the semantic of which it understands.

506 3 Capabilities applicable to manageable 507 resources

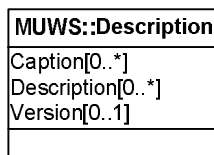
508 This section defines capabilities applicable to manageable resources. The capabilities defined in
509 this section complement the capabilities defined in MUWS Part 1.

510 3.1 Description

511 The manageability capability URI for the description capability is
512 <http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/Description>

513 3.1.1 Definition

514 Figure 1 shows a UML representation of the *Description* capability.



515
516

Figure 1: MUWS Description

517 3.1.2 Properties

518 This capability defines the following properties:

```
519 <muws-p2-xs:Caption>muws-p2-xs:LangString</muws-p2-xs:Caption> *
```

520 **muws-p2-xs:Caption** contains a descriptive name for the manageable resource.. The *Caption*
521 property is intended for human consumption. A *Caption* is expected to be short and is suitable for
522 display next to a graphic icon. *Caption* is a read-write, optional property with a cardinality of 0 to
523 many. *Caption* is of type *muws-p2-xs:LangType*, which is a restriction of *xs:string* carrying an
524 *xml:lang* attribute. This attribute contains a language identifier as defined by [RFC3066]. There
525 can not be more than one *Caption* per language identifier.

526 Metadata for *Caption*:

527 It is *Mutable*

528 It is *Modifiable*

529 It has the following *Capability* metadata item:

```
530 <muws-p2-xs:Capability>  
531   http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/Description  
532 </muws-p2-xs:Capability>
```

533

```
534 <muws-p2-xs:Description>muws-p2-xs:LangString</muws-p2-xs:Description> *
```

535 **muws-p2-xs:Description** is a string containing a description for the resource being managed.
536 The *Description* property is intended for human consumption. A *Description* is expected to be
537 longer and more detailed than a *Caption*. *Description* is a read-write optional property with a
538 cardinality of 0 to many. *Description* is of type *muws-p2-xs:LangType*, which is a restriction of
539 *xs:string* carrying an *xml:lang* attribute. This attribute contains a language identifier as defined by
540 [RFC3066]. There cannot be more than one *Description* per language identifier.

541 Metadata for *Description*:

542 It is *Mutable*
543 It is *Modifiable*
544 It has the following *Capability* metadata item:

```
545 <muws-p2-xs:Capability>  
546   http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/Description  
547 </muws-p2-xs:Capability>
```

548

```
549 <muws-p2-xs:Version>xs:string</muws-p2-xs:Version> ?
```

550 **muws-p2-xs:Version** is a string representing the version of the resource being managed. MUWS
551 does not specify how this string is constructed. The *Version* string can be specified by any
552 domain-specific specification that uses MUWS. *Version* is an optional property with a cardinality
553 of 0 to 1.

554 Metadata for *Version*:

555 It is *Mutable*
556 It is *Modifiable*
557 It has the following *Capability* metadata item:

```
558 <muws-p2-xs:Capability>  
559   http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/Description  
560 </muws-p2-xs:Capability>
```

561 3.1.3 Events

562 The *muws-events:DescriptionCapability* topic defined below is used for events related to the
563 *Description* capability.

```
564 <wstop:Topic name="DescriptionCapability"  
565   messageTypes="muws-p1-xs:ManagementEvent" >  
566 </wstop:Topic>
```

567 3.2 State

568 The manageability capability URI for the State capability is
569 <http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/State>

570 3.2.1 Definition

571 A resource may exhibit behavior according to one or more state models. Since a single definition
572 of an operational state model is not sufficient for all types of resource, the *State* capability is a
573 means to allow different state models to be used by different resources. The state capability
574 provides a pattern for representing any type of state or state model that a manageable resource
575 can expose. This section uses operational state as an example to illustrate the application of this
576 pattern to a simple state model.

577 Although MUWS defines no state model, there should be a very limited and well defined set of
578 states to facilitate interoperability. Each state is identified by a URI. This URI is exposed by a
579 resource via some resource property.

580 This capability does not define any specific property, operation or event. A manageability
581 endpoint is said to provide this capability if at least one property exposes state information and
582 follows the pattern described in section 3.2.3.2.

583 **3.2.2 Describing State Models**

584 Each state in a state-machine has a well-defined meaning. It is possible to reuse state definitions
585 in different state machines. States are identified by an element with a particular QName, using
586 the taxonomy scheme defined in section 2.6.

587 States in the state model may have duration. Transitions between states are considered to be
588 instantaneous.

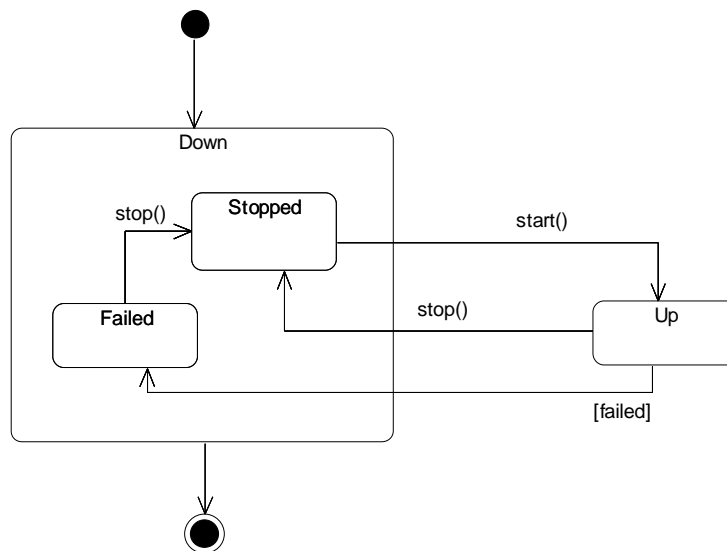
589 States can have sub-states that MUST be wholly contained within a higher-level state.

590 A state model may also define an operation that can be used to affect some transition in the
591 model. Note that a transition may also occur as a result of some internal or external event on the
592 resource.

593 Each state machine has an associated resource property element exposing a read-only view of
594 the current state of the state machine. Therefore, a consumer cannot change a resource state by
595 modifying a state resource property.

596 There may be more than one possible transition between two states in the state model. The
597 individual transitions between states are identified by a URI. This identification allows, for
598 example, a receiver of state transition notifications to discern which transition occurred.

599 Figure 2 shows a simple state model that is used as an example in this section – it does not
600 constitute the specification of a recommended state model.



601

602

Figure 2: Example Operational State Model

603 In this example, the state machine is identified by URI

604 <http://example.com/StateModels/SimpleOperationalState>, bound to namespace prefix *exns*.

605 In this example, the state model has four states. Each state is represented by elements with a
606 QName, as follows:

- 607 • *exns:Down*

608 This QName corresponds to the “Down” state in the UML diagram. A resource in this
609 state is unable to perform any of its functional tasks.

- 610 • *exns:Stopped*

611 This QName corresponds to the “Stopped” sub-state of the “Down” state in the UML
612 diagram. Since this state is a sub-state of the “Down” state, it follows that a resource in

- 613 the "Stopped" sub-state is unable to perform any of its functional tasks. A manageable
 614 resource exposing this state model can be started from the "Stopped" sub-state.
- 615 • *exns:Failed*
 616 This QName corresponds to the "Failed" sub-state of the Down state in the UML diagram.
 617 Since this state is a sub-state of the "Down" state, it follows that a resource in the "Failed"
 618 sub-state is unable to perform any of its functional tasks. A manageable resource
 619 exposing this state model can not be started directly from the "Failed" sub-state. Such a
 620 resource must first transition to the "Stopped" sub-state.
 - 621 • *exns:Up*
 622 This QName corresponds to the "Up" state in the UML diagram. A resource in this state is
 623 able to perform at least some of its functional tasks.

624 3.2.3 Information Markup Declarations

625 3.2.3.1 Representation of States

626 A state, as represented in a state model, may be a top level state or a state that is nested within
 627 another state according to some defined taxonomy. MUWS defines a way to represent a state
 628 category and its taxonomy lineage, but an actual definition of any category is specific to a
 629 particular resource management model. Therefore MUWS defines no state model. In other
 630 words, MUWS specifies only the mechanism used to convey a state category in XML. The
 631 MUWS mechanism applied to the representation of states is defined as follows:

632 *muws-p2-xs:StateType* XML Schema type is declared as follows

```
633 <xs:complexType name="StateType">
634   <xs:complexContent>
635     <xs:extension base="muws-p2-xs:CategoryType" />
636   </xs:complexContent>
637 </xs:complexType>
```

638 The *muws-p2-xs:StateType* type is used to declare an XML element containing an instance of
 639 state.

640 A state MUST be declared as follows:

- 641 • An XML element declaring which QName identifies the semantics of the state.
- 642 • The XML element has an XML Schema type of *muws-p2-xs:StateType*, or a restriction of
 643 *muws-p2-xs:StateType*.
- 644 • The contents of the XML element MUST be either:
 - 645 • The one XML element that corresponds to the state containing this state. In other
 646 words, this state is a sub-state of another state.
 - 647 • The empty sequence. This case occurs if this state is not a sub-state of another
 648 state.

649 For example, the "Failed" state in the example above is a sub-state of the "Down" state. An
 650 instance of the "Failed" state may be represented, using the rules described above, by the
 651 following XML fragment:

```
652 <my:StateTypeInstanceElement xsi:type="StateType">
653   <exns:Failed>
654     <exns:Down/>
655   </exns:Failed>
656 </my:StateTypeInstanceElement>
```


657 3.2.3.2 Representation of state

658 MUWS defines the following Global Element Declaration (GED) to represent an instance of a
659 state:

```
660 <muws-p2-xs:State>muws-p2-xs:StateType</muws-p2-xs:State>
```

661 The State element provides a representation of the state of a manageable resource. The State
662 element follows the convention for the *muws-p2-xs:CategoryType* type described in section 2.6.
663 This convention allows the rendering of a hierarchy of states and sub-states. State values are
664 defined in the operational state model for the resource. This specification does not define the
665 operational state model for any resource.

666 3.2.3.3 Representation of state transition

667 MUWS defines the following Global Element Declaration (GED) which contains an XML
668 representation of a change of state in a state model.

```
669 <muws-p2-xs:StateTransition Time"xs:dateTime"  
670 TransitionIdentifier=" xs:anyURI" ?>  
671 <muws-p2-xs:EnteredState>muws-p2-xs:StateType</muws-p2-xs:EnteredState>  
672 <muws-p2-xs:PreviousState>muws-p2-xs:StateType</muws-p2-  
673 xs:PreviousState>?  
674 {any} *  
675 </muws-p2-xs:StateTransition>
```

676 **muws-p2-xs:StateTransition** is used for representing information about a state change.

677 **muws-p2-xs:StateTransition/@muws-p2-xs:Time** attribute indicates the time at which the
678 transition occurred (transitions are assumed to be instantaneous). This attribute is REQUIRED.

679 **muws-p2-xs:StateTransition/@muws-p2-xs:TransitionIdentifier** attribute indicates the actual
680 transition that occurred. This attribute is OPTIONAL and may be omitted where, for example,
681 there is only one transition between the *EnteredState* and the *PreviousState*.

682 **muws-p2-xs:StateTransition/muws-p2-xs:EnteredState** element indicates which state has
683 been entered during the transition. This element is REQUIRED.

684 **muws-p2-xs:StateTransition/muws-p2-xs:PreviousState** element indicates the state that the
685 resource was in immediately prior to the state change occurring. This element is OPTIONAL to
686 allow for the time between the state model being created in some initial state, for example when
687 the resource is created, and the time of the transition from that initial state.

688 3.2.4 Properties

689 This capability does not define any standard property.

690 A capability defining a state model SHOULD define a resource property that exposes the state., It
691 is RECOMMENDED that a state model also define a resource property that exposes the last
692 state transition.

693 The property used to expose the state must either contain the *muws-p2-xs:State* element or be of
694 type *muws-p2-xs:StateType*. The name of the property can be any name meaningful to the state
695 model defined in the capability. There may be multiple state capabilities, and therefore multiple
696 state properties for a resource. The metadata for this property SHOULD include the possible
697 values. That is, the state model should provide a list of states in the state model.

698 The property to represent the last transition, if such a property is provided, must contain the
699 element *muws-p2-xs:StateTransition*. The name of the last transition property can be any name
700 meaningful to the state model. There may be multiple state capabilities and multiple properties
701 exposing the last transition.

702 3.2.4.1 Example

703 Examples of resource properties for an operational state capability could be specified as follows:

```
704 <foo:OperationalState>
705   <muws-p2-xs:State>...</muws-p2-xs:State>
706 </foo:OperationalState>
707 <foo>LastOperationalStateTransition>
708   <muws-p2-xs:StateTransition>...</muws-p2-xs:StateTransition>
709 </foo>LastOperationalStateTransition>
```

710 The following fragment provides an example from a resource properties instance document
711 containing the properties defined in this example:

```
712 <foo:OperationalState>
713   <muws-p2-xs:State>
714     <exns:Failed><exns:Down/></exns:Failed>
715   </muws-p2-xs:State>
716 </foo:OperationalState>
717 <foo>LastOperationalStateTransition>
718   <muws-p2-xs:StateTransition Time="2004-03-11T11:30:56Z"
719   TransitionIdentifier="http://example.com/SimpleOperationalState/T/Failed">
720     <muws-p2-xs:EnteredState>
721       <exns:Failed><exns:Down/></exns:Failed>
722     </muws-p2-xs:EnteredState>
723     <muws-p2-xs:PreviousState>
724       <exns:Up/>
725     </muws-p2-xs:PreviousState>
726   </muws-p2-xs:StateTransition>
727 </foo>LastOperationalStateTransition>
```

728 In this example, the *foo:OperationalState* property contains the current operational state of the
729 resource, using the *muws-p2-xs:State* element defined in section 3.2.3.2. The
730 *foo>LastOperationalStateTransition* property contains a description of the most recent operational
731 state transition for the resource, using the *muws-p2-xs:StateTransition* element as defined in
732 section 3.2.3.2.

733 3.2.5 Operations

734 A capability defining a state model usually defines any operations that can be used to cause
735 some of the transitions within the state model. These operations are specific to the resource and
736 its state model.

737 3.2.6 Events

738 The *muws-events:StateCapability* topic defined below is used for events related to the *State*
739 capability.

```
740 <wstop:Topic name="StateCapability"
741   messageTypes="muws-pl-xs:ManagementEvent">
742 </wstop:Topic>
```

743 It is RECOMMENDED that resources send a notification on a transition between states. The topic
744 defined for the *State* capability SHALL be used to publish such notifications. If a resource sends
745 such a notification, then the notification message MUST contain at least the XML element
746 representing a state transition (*muws-p2-xs:StateTransition*).

747 To obtain events about a certain state transition, a subscriber can use a *Selector*, on the
748 notification subscription, to select only those events containing the required *muws-p2-*
749 *xs:TransitionIdentifier* element in the notification content, or, a combination of *muws-p2-*
750 *xs:EnteredState* and *muws-p2-xs:PreviousState* elements in the notification content. The *Selector*
751 mechanism is described in [WSN].

752 To filter for events about entry into a particular state or set of states, a Selector expression based
753 on the *muws-p2-xs:EnteredState* element can be used. To filter for events about exit from a
754 particular state or set of states a *Selector* expression based on the *muws-p2-xs:PreviousState*
755 element can be used.

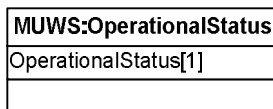
756 3.3 Operational Status

757 The manageability capability URI for this capability is
758 <http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/OperationalStatus>

759 3.3.1 Definition

760 The operational status capability defines a simple representation of the availability of a resource.
761 This is expressed in terms defined by MUWS. These terms are independent of any specific state
762 model, as defined by domain experts. An operational status property reflects whether the
763 resource is available, unavailable, or degraded. Operational status does not conform to a specific
764 state model. Rather, each value may correspond to more than one state in the operational state
765 model, and conversely more than one operational status value may correspond to a single state
766 in the operational state model. The manageable resource provides the appropriate mapping from
767 state to status and sets the *OperationalStatus* property accordingly.

768 Figure 3 shows the UML representation of the *Operational Status* capability.



769

770

Figure 3: Operational Status

771 3.3.2 Properties

772 The operational status properties and elements are specified as follows:

```
773 <muws-p2-xs:OperationalStatus>
774   (Available|PartiallyAvailable|Unavailable|Unknown)
775 </muws-p2-xs:OperationalStatus>
```

776 The following fragment provides an example from a resource properties instance document
777 containing this property:

```
778 <muws-p2-xs:OperationalStatus>Available</muws-p2-xs:OperationalStatus>
```

779 The *muws-p2-xs:OperationalStatus* property is of type *muws-p2-xs:OperationalStatusType*. The
780 type is a restriction of *xs:string* and provides a simple indication of the availability of the resource,
781 independent of the potentially complex operational state model. This property has a cardinality of
782 1. The valid values are:

- 783 • *Available*: This value indicates that a manageable resource is operating normally within
784 any configured operating parameters, and is able to perform all functional tasks.
- 785 • *PartiallyAvailable*: This value indicates that a manageable resource is operating, but
786 outside of configured operating parameters. A manageable resource reporting this
787 operational status is able to perform some, but not all, functional tasks. A manageable
788 resource may, for example, be in the process of starting or a resource may be lacking
789 some resource it needs to perform.
- 790 • *Unavailable*: This value indicates that a manageable resource is not operating, and is not
791 able to perform any functional tasks. A manageable resource may have been stopped,
792 or may have failed.
- 793 • *Unknown*: This value indicates that a manageable resource is unable to report status at
794 this time.

795 Metadata for *OperationalStatus*:
796 It is *Mutable*
797 It is not *Modifiable*
798 It has the following *Capability* metadata item:

```
799 <muws-p2-xs:Capability>  
800   http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/OperationalStatus  
801 </muws-p2-xs:Capability>
```

802 3.3.3 Events

803 The *muws-events:OperationalStatusCapability* topic defined below is used for events related to
804 the *Operational Status* capability.

```
805 <wstop:Topic name="OperationalStatusCapability"  
806   messageTypes="muws-p1-xs:ManagementEvent" >  
807 </wstop:Topic>
```

808 No specific event is defined, since the notification on property value change provided by WS-
809 ResourceProperties is sufficient, when applied to the *muws-p2-xs:OperationalStatus* property.

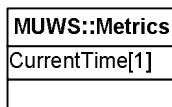
810 3.4 Metrics

811 The manageability capability URI for this capability is
812 <http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/Metrics>

813 3.4.1 Definition

814 A metric is a specific type of property. A metric represents a collected value during a collection
815 period. A common characteristic of metrics is that they change over time. This section defines
816 how to represent metrics and the metadata necessary to correctly process and interpret a metric
817 value.

818 Figure 4 presents the *Metrics* capability.



819
820

Figure 4: MUWS metrics

821 As a simple example, to clarify what a metric is, consider a toll bridge with two properties, the
822 length of the bridge and the number of cars that have passed over the bridge. The length of the
823 bridge, while numeric is not a metric. Length represents a current configuration of the bridge. One
824 can not reset the length of the bridge. By contrast, the number of cars that have passed over the
825 bridge is a metric. It requires collecting, counting, or measuring the number of cars. Typically, a
826 count occurs for some interval, or duration of time, such as the last hour, the last day, or, since
827 the bridge was constructed. One might reset the number of cars, for example, at the start of a
828 new interval.

829 3.4.2 Information Markup Declarations

830 The following schema fragment declares the (reusable) data type used to expose the metrics of a
831 resource. All attributes defined in the *muws-p2-xs:MetricAttributes* attribute group are OPTIONAL.

```
832 <xs:attributeGroup name="MetricAttributes" >  
833   <xs:attribute name="ResetAt" type="xs:dateTime" />  
834   <xs:attribute name="LastUpdated" type="xs:dateTime" />  
835   <xs:attribute name="Duration" type="xs:duration" />
```

836 </xs:attributeGroup>

837 **(MetricAttributes)** attribute group MUST be included in every metric type or metric type property
838 element declaration.

839 **(MetricAttributes)/ResetAt** indicates the time when a metric value was reset. See the definition
840 of *muws-p2-xs:TimeScope* for information on when to provide this attribute. If the attribute value
841 does not include a time zone indication, or Z for UTC, then the value MUST be interpreted as
842 UTC.

843 **(MetricAttributes)/LastUpdated** indicates the last update time of a metric value. If the value
844 does not include a time zone indication, or Z for UTC,, then the value MUST be interpreted as
845 UTC.

846 **(MetricAttributes)/Duration** indicates the time over which a metric value was collected, counted,
847 or measured previous to the *LastUpdated* time. The *Duration* attribute MUST be included for a
848 metric having a *TimeScope* of *Interval* and MUST NOT be included for a metric having a
849 *TimeScope* of *PointInTime* and *SinceReset*. For these cases, an implementer should make use of
850 *ResetTime* and *CurrentTime* to calculate the duration for the collection of a metric value.

851 The following metric type definition is an example of how a metric attribute is incorporated into a
852 metric type. All metric types MUST incorporate the *muws-p2-xs:MetricAttributes* attribute group.

```
853 <xs:complexType name="MyExampleIntegerMetricType">  
854   <xs:simpleContent>  
855     <xs:extension base="xs:integer">  
856       <xs:attributeGroup ref="muws-p2-xs:MetricAttributes"/>  
857       <xs:anyAttribute namespace="##other" processContents="lax"/>  
858     </xs:extension>  
859   </xs:simpleContent>  
860 </xs:complexType>
```

861 The following fragment shows an example instance of the above metric type.

```
862 <MyIntegerMetric  
863   LastUpdated="2004-03-11T11:30:56Z"  
864   Duration="PT1H">  
865   12345  
866 </MyIntegerMetric>
```

867 3.4.3 Metadata

868 The following metadata is applicable to any property that is a metric:

869 It is *Mutable*

870 It is not *Modifiable*

871 It has the following *Capability* metadata item:

```
872 <muws-p2-xs:Capability>  
873   http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/Metrics  
874 </muws-p2-xs:Capability>
```

875 The following additional metadata items are defined for a property that is a metric:

```
876 <muws-p2-xs:ChangeType>(Counter|Gauge|Unknown)</muws-p2-xs:ChangeType>
```

877 **muws-p2-xs:ChangeType** is an enumeration indicating how a change to an associated metric
878 value should be interpreted by a consumer. A property representing a metric MUST include a
879 single instance of *ChangeType* in its metadata description. Each *ChangeType* value is interpreted
880 as follows:

- 881 • *Counter* - the value of the metric is a monotonically increasing integer. Such a metric
882 value increases by increments of "1" over successive counts, collections, or
883 measurements.

- 884 • *Gauge* – changes of the value of the metric are not constrained in the way changes to
- 885 *Counter* metrics are constrained.
- 886 • *Unknown* - the change behavior for the value of the metric is not known or cannot be
- 887 described.

888

```
889 <muws-p2-xs:TimeScope>
890   ( Interval | PointInTime | SinceReset )
891 </muws-p2-xs:TimeScope>
```

892 **muws-p2-xs:TimeScope** is an enumeration for indicating if there is some interval, over which the
 893 data is collected, counted, or measured. A property that is a metric MUST include a single
 894 instance of *TimeScope* in its metadata description. Each *TimeScope* value is interpreted as
 895 follows:

- 896 • *Interval* - the value of a metric is collected over some time interval. In this case a *Duration*
- 897 attribute MUST be reported with a metric property. The value of a *Duration* attribute is the
- 898 elapsed time, from the beginning of an interval, to the end of an interval. A *Duration*
- 899 usually remains the same for every reading of a metric. The *ResetAt* attribute MAY also
- 900 be reported with such a metric property.
- 901 • *PointInTime* - the value of a metric is counted, collected, or measured at a single instant
- 902 in time. In this case a *Duration* attribute MUST NOT be reported with a metric property.
- 903 A metric defined with a *TimeScope* of *PointInTime* does not support a reset capability
- 904 and MUST NOT include a *ResetAt* attribute.
- 905 • *SinceReset* - the value of the metric is collected since the last reset of a resource, or
- 906 since the manageable resource started collecting data for a metric. . In this case a
- 907 *Duration* attribute MUST NOT be reported with a metric property, and a *ResetAt* attribute
- 908 MUST be reported.

909

```
910 <muws-p2-xs:GatheringTime>
911   ( OnChange | Periodic | OnDemand | Unknown )
912 </muws-p2-xs:GatheringTime>
```

913 **muws-p2-xs:GatheringTime** is an enumeration indicating under which circumstance the value of
 914 a metric is updated. A property that is a metric MUST include a single instance of *muws-p2-*
 915 *xs:GatheringTime* in its metadata description. Each *muws-p2-xs:GatheringTime* value is
 916 interpreted as follows:

- 917 • *OnChange* - the value of a metric is updated whenever a change occurs to the quantity
- 918 measured.
- 919 • *Periodic* - the value of a metric is updated on a regularly scheduled basis.
- 920 • *OnDemand* - the value of a metric is updated when processing a request for the metric
- 921 value.
- 922 • *Unknown* - it is unknown when the value of a metric is updated.

923

```
924 <muws-p2-xs:CalculationInterval>xs:duration</muws-p2-
925 xs:CalculationInterval>
```

926 **muws-xs-p2:CalculationInterval** represents the interval at which a value of a metric is gathered
 927 or calculated by a resource. The value of a metric is not updated during a calculation interval.
 928 Unlike *Duration*, which can change every time the metric is updated, the value of
 929 *CalculationInterval* is expected to change rarely. This is because *CalculationInterval* is used only
 930 for a value of a metric that is updated at regular intervals.

931

```
932 <muws-p2-xs:MetricGroup>xs:anyURI</muws-p2-xs:MetricGroup>
```

933 **muws-p2-xs:MetricGroup** indicates that a metric property is a member of a group of metrics. A
934 metric property MAY be a member of zero or more metric groups. A metric group is identified by a
935 URI. Each metric property included in a metric group MUST have a *muws-p2-xs:MetricGroup*
936 element containing an identical URI. A metric property MAY include zero or more *muws-p2-*
937 *xs:MetricGroup* elements in its metadata description. Each *muws-p2-xs:MetricGroup* element
938 represents a membership of the metric property in a metric group.

939 3.4.4 Properties

940 The following fragment provides the specification of a resource metrics property:

```
941 <muws-p2-xs:CurrentTime>xs:dateTime</muws-p2-xs:CurrentTime>
```

942 **muws-p2-xs:CurrentTime** contains the current time, as known to a resource, when a property
943 was retrieved from a manageable resource. This property is useful to a manageability consumer,
944 in the absence of a time synchronization mechanism, when analyzing the time values received
945 from a manageability endpoint. *muws-p2-xs:CurrentTime* is a read-only mandatory property with
946 a resource cardinality of 1.

947 The Metrics capability requires the *muws-p2-xs:CurrentTime* property to be present in a resource
948 property. The *muws-p2-xs:CurrentTime* property provides a reference point for time-based
949 attributes, as defined by metric data types. Note that *muws-p2-xs:CurrentTime* is not a metric.
950 Rather, it is a property of type *xs:dateTime* defined as part of the "Metrics" capability,
951 consequently, any reset operations has no effect on *muws-p2-xs:CurrentTime*.

952 3.4.5 Events

953 The *muws-events:MetricsCapability* topic defined below is used for events related to the *Metrics*
954 capability.

```
955 <wstop:Topic name="MetricsCapability"  
956           messageTypes="muws-pl-xs:ManagementEvent ">  
957 </wstop:Topic>
```

958 *WS-ResourceProperties* specifies the ability to define optional topics for a resource property that
959 can emit notifications when a value changes. These topics allow a consumer to request
960 notifications on an update of a metric property.

961 3.5 Configuration

962 The manageability capability URI for this capability is
963 <http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/Configuration>

964 3.5.1 Definition

965 A configuration property is any resource property exposing a value that, when changed, changes
966 some operational behavior of the resource.

967 The value of a configuration property may be changed directly by a set operation, or, may be
968 changed as a side effect of some other operation.

969 3.5.2 Properties

970 MUWS does not define any required property for the *Configuration* capability. Domain experts
971 can define configuration properties which are then marked as associated with the configuration
972 capability. The metadata for a configuration property MUST be:

973 It is *Mutable*

974 It is *Modifiable* only if the *WS-ResourceProperties SetResourceProperty* operation can be used to
975 change the value of the property. It is not *Modifiable* if the property is changed only as a side

976 effect.
977 It has the following *Capability* metadata item:

```
978 <muws-p2-xs:Capability>  
979     http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/Configuration  
980 </muws-p2-xs:Capability>
```

981 **3.5.3 Operations**

982 WS- ResourceProperties *SetResourceProperty* operation MAY be used to change a configuration
983 value.

984 **3.5.4 Events**

985 The *muws-events:ConfigurationCapability* topic defined below is used for events related to the
986 *Configuration* capability.

```
987 <wstop:Topic name="ConfigurationCapability"  
988     messageTypes="muws-pl-xs:ManagementEvent">  
989 </wstop:Topic>
```

4 Capabilities applicable to management in general

990

991

992 Section 3, "Capabilities applicable to manageable resources", when merged with the capabilities
993 defined in [MUWS Part 1], provide the list of manageability capabilities defined by MUWS. This
994 section provides management-related capabilities that are different from manageability
995 capabilities.

996 A *manageability capability* is offered by a manageability representation and a manageability
997 capability applies to a resource as represented by a manageability representation. In contrast, a
998 *management-related capability* can be offered by any endpoint of a Web service, not just a
999 manageability endpoint.

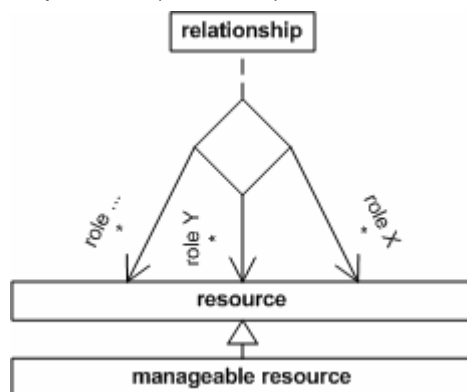
1000 The function of a management-related capability is related to the management of a resource, but
1001 it is not necessarily offered directly by a manageability endpoint of a resource. For example, the
1002 capability to help a manageability consumer discover a new manageable resource can be
1003 provided by a registry instead of by a management representation of the resource. As another
1004 example, a manageable resource may provide information about relationships in which it
1005 participates. The information about a relationship may also provide valid information for another
1006 entity or resource that is not manageable, like a registry, maintaining and providing relationship
1007 information about a resource without the resource providing the relationship information directly.

1008 4.1 Relationships

1009 The manageability capability URI for this capability is
1010 <http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/Relationships>

1011 4.1.1 Definition

1012 A relationship is an N-ary association between resources. A relationship may have properties and
1013 other characteristics. One of these properties is a type that conveys the semantic of the
1014 relationship. The resources involved in the relationship are called participants. Each participant
1015 has a role in the relationship. The participants may or may not be manageable resources in the
1016 MUWS sense. The notion of "direction" of a relationship is a semantic interpretation based on role
1017 definitions. There could be many instances of relationships between many instances of
1018 resources. The arrows in Figure 5 depict navigability, which means that by following the arrow
1019 one could resolve what the end points to (reference).

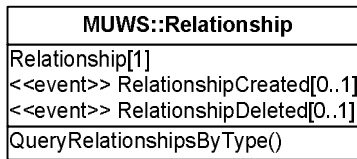


1020

1021

Figure 5: Relationship conceptual model

1022 Note that this capability is not limited to manageable resources and can be exposed by any
 1023 resource that wants to expose relationships that it knows about.
 1024 Figure 6 is a UML representation of the relationship capability.



1025
 1026

Figure 6: Relationship capability

1027 A relationships may become stale. The information about a relationship should be validated,
 1028 either manually or automatically, before it can be relied upon. Exposing the information about a
 1029 relationship should be considered a potential security risk if a participating resource should not be
 1030 visible for security reasons.

1031 4.1.2 Information Markup Declarations

1032 4.1.2.1 Representation of Categories of Relationships

1033 A relationship may be categorized as a certain type of relationship. A relationship type defines the
 1034 semantics of the relationship. One relationship type may be a specialization or generalization of
 1035 another type..This defines a taxonomy of relationship categories. MUWS defines a way to
 1036 represent a type and its taxonomy lineage, but the actual definition of a relationship type is
 1037 specific to a resource management model. Therefore, no relationship type is defined by MUWS.
 1038 In other words, MUWS specifies only the mechanism to convey a relationship type, or category,
 1039 in XML as follows.

1040 *RelationshipTypeType* type is declared as follows

```
1041 <xs:complexType name="RelationshipTypeType">
1042   <xs:complexContent>
1043     <xs:extension base="muws-p2-xs:CategoryType" />
1044   </xs:complexContent>
1045 </xs:complexType>
```

1046 The *RelationshipTypeType* type is used to declare an XML element containing instances of
 1047 relationship type information.

1048 The relationship type information MUST be declared as follows:

- 1049 • An XML element declaring which QName identifies the semantics of a relationship type..
- 1050 • The XML element MUST be declared with an XML Schema type that is a restriction of
 1051 *RelationshipTypeType*.
- 1052 • The contents of the XML element MUST be either
 - 1053 • The only one XML element corresponding to the generalization of the currently
 1054 declared relationship type
 - 1055 • The empty sequence, if the currently declared relationship type does not have a
 1056 generalization, such as the top of a taxonomy.

1057 For example, the "USB attached" relationship type may be generalized to the "Bus connected"
 1058 type which, in turn, may be generalized to the "Generally linked" type. An instance of the "USB
 1059 attached" relationship type information may be represented in the following XML fragment by
 1060 using the rules described above:

```
1061 <my:RelationshipTypeInstanceElement xsi:type="RelationshipTypeType">
1062   <usb:Attached>
1063     <bus:Connected>
```

```

1064     <generally:Linked/>
1065     <bus:Connected>
1066     </usb:Attached>
1067 </my:RelationshipTypeInstanceElement>

```

1068 4.1.2.2 Representation of an Instance of a Relationship

1069 MUWS defines the following Global Element Declaration (GED) to represent an instance of a
 1070 relationship.

```

1071 <muws-p2-xs:Relationship>
1072   <muws-p2-xs:Name>xs:string</muws-p2-xs:Name> ?
1073   <muws-p2-xs:Type>muws-p2-xs:RelationshipTypeType</muws-p2-xs:Type>
1074   <muws-p2-xs:Participant>
1075     <muws-p1-xs:ManageabilityEndpointReference/> *
1076     <muws-p1-xs:ResourceId/> ?
1077     <muws-p2-xs:Role>xs:anyURI</muws-p2-xs:Role>
1078     {any} *
1079   </muws-p2-xs:Participant>
1080   <muws-p2-xs:Participant/>+
1081   <muws-p2-xs:AccessEndpointReference>
1082     wsa:EndpointReferenceType
1083   </muws-p2-xs:AccessEndpointReference>?
1084   {any} *
1085 </muws-p2-xs:Relationship>

```

1086 **muws-p2-xs:Relationship/muws-p2-xs:Name** is a human readable name for a relationship.
 1087 *Name* should not be used for machine reasoning about the semantics of a relationship. Type
 1088 should be used instead. This element is OPTIONAL.

1089 **muws-p2-xs:Relationship/muws-p2-xs:Type** is the relationship type this relationship belongs
 1090 to. Examples of such types include linkage, containment, or dependency. MUWS does not define
 1091 any specific relationship type. This is left to domain-specific models. MUWS only defines a way to
 1092 convey the type as part of the representation of a relationship. In order to allow relationships to be
 1093 defined as part of a taxonomy, the mechanism used by MUWS to represent relationship types
 1094 leverages the *muws-p2-xs:CategoryType* type defined in section 2.6. This element is
 1095 REQUIRED.

1096 **muws-p2-xs:Relationship/muws-p2-xs:Participant** contains information about a participant in
 1097 the relationship. There MUST be at least two participants, but there MAY be more than two
 1098 participants.

1099 **muws-p2-xs:Relationship/muws-p2-xs:Participant/muws-p1-
 1100 xs:ManageabilityEndpointReference** is a reference to a WSDM manageability endpoint. This
 1101 GED is defined in part 1. It MAY be included if a participant is a WSDM manageable resource
 1102 and the provider wishes to expose this information.. If more than one manageability endpoint is
 1103 known, then more than one instance of this element MAY be present.

1104 **muws-p2-xs:Relationship/muws-p2-xs:Participant/muws-p1-xs:ResourceID** is a WSDM
 1105 manageable resource identifier which MAY be reported by the provider of relationship
 1106 information. This GED is defined in part 1. This information may be used to locate manageability
 1107 endpoints for a participant, or may be used for other purposes. For example, a resource identifier
 1108 SHOULD be used to express that the provider of relationship information is also a participant in a
 1109 relationship by returning its own resource identifier as one of the participants. Obviously, in order
 1110 for this assertion to work, the provider of relationship information must be a WSDM manageable
 1111 resource.

1112 **muws-p2-xs:Relationship/muws-p2-xs:Participant/muws-p2-xs:Role** is a URI which identifies
 1113 the role a participant plays in a relationship. A participant role MUST be unique within a given
 1114 instance of the relationship. The set of valid roles is defined by a relationship type. This attribute
 1115 is REQUIRED.

1116 **muws-p2-xs:Relationship/muws-p2-xs:Participant/{any}*** is an XML extensibility content
1117 which MAY contain elements that further or otherwise describe a participant. For example, when
1118 a participant is an endpoint of a Web service, an *EndpointReference* element as defined by
1119 MOWS MAY be included in the extensibility content to reference a functional or operational
1120 endpoint of a Web service that participates in a relationship.

1121 **muws-p2-xs:Relationship/muws-p2-xs:AccessEndpoint** is a reference to a Web service
1122 endpoint which provides access to this relationship (if available). The endpoint MUST implement
1123 the relationship access capability (see section 4.2).

1124 The following is an example of a relationship information instance. The relationship is a WSDM
1125 manageable network host myhost.myorg.org containing an attached SCSI disk. The SCSI disk is
1126 not manageable by itself, but is exposed as a functional or operational endpoint of a Web service
1127 (e.g. to read/write from the disk). The “containment” relationship is represented by the following
1128 XML instance fragment:

```
1129 <muws-p2-xs:Relationship>  
1130   <muws-p2-xs:Name>SCSI disk attached to the host computer</muws-p2-  
1131   xs:Name>  
1132   <muws-p2-xs:Type>  
1133     <scsi:Attached>  
1134       <bus:Connected>  
1135         <generally:Linked/>  
1136       </bus:Connected>  
1137     </scsi:Attached>  
1138   </muws-p2-xs:Type>  
1139   <muws-p2-xs:Participant>  
1140     <muws-p1-xs:ManageabilityEndpointReference>  
1141       ...EPR1...  
1142     </muws-p1-xs:ManageabilityEndpointReference>  
1143     <muws-p1-xs:ResourceID>urn:uuid:123</muws-p1-xs:ResourceID>  
1144     <muws-p2-xs:Role>urn:role:bus:host</muws-p2-xs:Role>  
1145     <netop-xs:HostName>myhost.myorg.org</netop-xs:HostName>  
1146   </muws-p2-xs:Participant>  
1147   <muws-p2-xs:Participant>  
1148     <muws-p2-xs:Role>urn:role:bus:device</muws-p2-xs:Role>  
1149     <scsi-xs:Port>2</scsi-xs:Port>  
1150     <scsi-xs:CH>0</scsi-xs:CH>  
1151     <scsi-xs:BusID>5</scsi-xs:BusID>  
1152     <scsi-xs:LUN>0</scsi-xs:LUN>  
1153     <mows-xs:EndpointReference>  
1154       ...EPR2...  
1155     </mows-xs:EndpointReference>  
1156   </muws-p2-xs:Participant>  
1157 </muws-p2-xs:Relationship>
```

1158 4.1.3 Properties

1159 The Relationship capability defines the following property:

```
1160 <muws-p2-xs:Relationship/> *
```

1161 **muws-p2-xs:Relationship** is a representation of a relationship of which the provider of this
1162 capability is aware. See section 4.1.2 for the definition of the Relationship element. The provider
1163 of this capability is not necessarily a participant in any relationship represented by this property.

1164 It is not recommended to request all values of the Relationship property with either *wsrf-*
1165 *rp:GetResourceProperty* or *wsrf-rp:GetMultipleResourceProperties* operations as there may be
1166 too many relationships. The use of the *wsrf-rp:QueryResourceProperties* operation is
1167 RECOMMENDED when retrieving the Relationships property. A provider of this manageability
1168 capability SHOULD, in general, support the *wsrf-rp:QueryResourceProperties* operation.

1169 However, if the provider of this capability knows of just a few relationships, it MAY choose not to
1170 support *wsrp-rp:QueryResourceProperties* operation.

1171 For example, the following request may be sent to retrieve all “Bus connected” relationships
1172 which point to devices exposed as Web services.

```
1173 <soap:Envelope ...>  
1174   <soap:Header>  
1175     ...  
1176   </soap:Header>  
1177   <soap:Body>  
1178     <wsrf-rp:QueryResourceProperties>  
1179       <wsrf-rp:QueryExpression  
1180         Dialect="http://www.w3.org/TR/1999/REC-xpath-19991116" >  
1181         boolean(/*/muws-p2-xs:Relationship/muws-p2-xs:Type/*/bus:Connected and  
1182         /*/muws-p2-xs:Relationship/muws-p2-  
1183         xs:Participant[Role="urn:role:bus:device"]/mows-xs:EndpointReference)  
1184       </wsrf-rp:QueryExpression>  
1185     </wsrf-rp:QueryResourceProperties>  
1186   </soap:Body>  
1187 </soap:Envelope>
```

1188 4.1.4 Operations

1189 This capability defines the following message exchanges.

1190 4.1.4.1 QueryRelationshipsByType

1191 This operation is OPTIONAL. It is a shortcut to query relationships of the same type. The request
1192 to perform this operation has a payload as follows:

```
1193 <muws-p2-xs:QueryRelationshipsByType>  
1194   <muws-p2-xs:RequestedType>xs:QName/muws-p2-xs:RequestedType +  
1195 </muws-p2-xs:QueryRelationshipsByType>
```

1196 **muws-p2-xs:QueryRelationshipsByType** is a Global Element Declaration (GED) which
1197 identifies the operation requested.

1198 **muws-p2-xs:QueryRelationshipsByType/muws-p2-xs:RequestedType** is a QName which
1199 identifies the requested type(s) of relationship(s). When processing this request, the
1200 manageability endpoint MUST return any available instance relationship that is of the requested
1201 type or of any type that is a specialization of the requested type. There can be more than one
1202 requested type, in which case any relationship instance corresponding to any requested type
1203 MUST be returned.

1204 The response to the above request is either a fault (any fault) or the following message:

```
1205 <muws-p2-xs:QueryRelationshipsByTypeResponse>  
1206   <muws-p2-xs:Relationship/> *  
1207 </muws-p2-xs:QueryRelationshipsByTypeResponse>
```

1208 **muws-p2-xs:QueryRelationshipsByTypeResponse** is a GED which identifies a response to
1209 the requested operation.

1210 **muws-p2-xs:QueryRelationshipByTypeResponse/muws-p2-xs:Relationship** is a relationship
1211 representation matching a requested type. There is one such element for each relationship
1212 instance corresponding to at least one requested type.

1213 This operation has the following *Capability* metadata item:

```
1214 <muws-p2-xs:Capability>  
1215   http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/Relationships  
1216 </muws-p2-xs:Capability>
```

1217 4.1.5 Events

1218 To support notifications on a change in a relationship, the following notification topics are defined
1219 in the manageable relationships capability:

```
1220 <wstop:Topic name="RelationshipCreated" messageTypes="muws-p2-  
1221 xs:RelationshipCreatedNotification" >  
1222   <wstop:MessagePattern  
1223     Dialect="http://www.w3.org/TR/1999/REC-xpath-19991116">//muws-p1-  
1224 xs:ManagementEvent[count(muws-p2-xs:RelationshipCreatedNotification)=1]  
1225   </wstop:MessagePattern>  
1226 </wstop:Topic>  
1227 <wstop:Topic name="RelationshipDeleted" messageTypes="muws-p2-  
1228 xs:RelationshipDeletedNotification" >  
1229   <wstop:MessagePattern  
1230     Dialect="http://www.w3.org/TR/1999/REC-xpath-19991116">//muws-p1-  
1231 xs:ManagementEvent[count(muws-p2-xs:RelationshipDeletedNotification)=1]  
1232   </wstop:MessagePattern>  
1233 </wstop:Topic>
```

1234 **muws-events:ManageableRelationships/muws-events:RelationshipCreated** indicates the
1235 addition of a new relationship. It is RECOMMENDED that a consumer subscribe to this
1236 notification with an appropriate selector against the content of notification messages in order to
1237 reduce the volume of received messages. Each notification message contains at least the
1238 following information:

```
1239 <RelationshipCreatedNotification>  
1240   <Relationship/>  
1241 </RelationshipCreatedNotification>
```

1242 **muws-events:ManageableRelationships/muws-events:RelationshipDeleted** indicates
1243 removal of an existing relationship. It is RECOMMENDED that a consumer subscribe to this
1244 notification with an appropriate selector against the content of notification messages in order to
1245 reduce the volume of received messages. Each notification message contains at least the
1246 following information:

```
1247 <RelationshipDeletedNotification>  
1248   <Relationship/>  
1249 </RelationshipDeletedNotification>
```

1250 4.2 Relationship Access Capability

1251 The manageability capability URI for this capability is
1252 <http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/RelationshipAccess>

1253 4.2.1 Definition

1254 Sometimes, a relationship is more than just a reflection of some physical fact. A relationship may
1255 also have its own properties, operations, events, and lifecycle. In this case, interactions with a
1256 relationship service could cause, as a side effect, a system or physical fact to be changed in
1257 order to comply with the semantics of its role in the relationship. For this reason, we allow a
1258 relationship to be exposed as an independent service. The provider of a Web service endpoint
1259 supporting the *Relationship Access* capability also provides access to the participants in a
1260 relationship. If this capability is supported, then an endpoint reference for a service implementing
1261 the capability MUST contain sufficient information to allow a provider to disambiguate which
1262 relationship is being accessed by a message exchange. An endpoint reference could be obtained
1263 from the *muws-p2-xs:Relationship/AccessEndpointReference* in relationship element defined in
1264 section 4.1.2.2.

1265 The endpoint in this case is a WS-Resource, not a WSDM Manageable resource. Section 4.2.2
 1266 describes relationships as WSDM Manageable resources. The relationship access endpoint
 1267 supports any exchange of messages where the exchange is specific to a particular relationship
 1268 and management model, and, where the exchange is necessary in order to provide access to the
 1269 relationship.
 1270 The only other normative requirement is that if the relationship lifecycle is exposed by a provider
 1271 of this capability, then the Web service endpoint MUST implement the WS-ResourceLifetime
 1272 specification [WS-RL].

1273 4.2.2 Events

1274 The *muws-events:RelationshipAccessCapability* topic defined below is used for events related to
 1275 the *Relationship Access* capability.

```
1276 <wstop:Topic name="RelationshipAccessCapability"  

  1277           messageTypes="muws-pl-xs:ManagementEvent">  

  1278 </wstop:Topic>
```

1279 4.3 Relationship Resource Capability

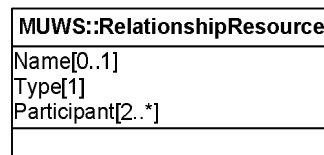
1280 The manageability capability URI for this capability is
 1281 <http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/RelationshipResource>

1282 4.3.1 Definition

1283 A Web service endpoint, in addition to providing access to a relationship as described in section
 1284 4.2, may also represent a relationship. Representing a relationship means that an endpoint is
 1285 able to provide relationship information as described in section 4.1.2.2. In this case, a Web
 1286 service endpoint MUST be a WS-Resource, as defined by the WSRF. One such WS-Resource
 1287 provides information about one relationship instance. Representing a relationships as WS-
 1288 Resource is useful when a manageability model defines additional properties, operations or
 1289 events for a relationship.

1290 In order to represent a relationship as a WS-Resource, a set of properties is normatively required.
 1291 The rest of the representation depends upon the relationship manageability model and discretion
 1292 of the provider of a WS-Resource and relationship.

1293 Figure 7 is a UML representation of the Relationship Resource capability.



1294
 1295

Figure 7: Relationship Resource capability

1296 4.3.2 Properties

1297 The Relationship Resource capability defines the following properties.

```
1298 <muws-p2-xs:Name>xs:string</muws-p2-xs:Name> ?
```

1299 **muws-p2-xs:Name** is an element as defined by the Relationship/Name in section 4.1.2.2. It is
 1300 OPTIONAL.

1301

```
1302 <muws-p2-xs:Type>muws-p2-xs:RelationshipTypeType</muws-p2-xs:Type>
```

1303 **muws-p2-xs:Type** is an element as defined by the Relationship/Type in section 4.1.2.2. It is
1304 REQUIRED and can only appear once.

1305

```
1306 <muws-p2-xs:Participant>  
1307   <muws-p1-xs:ManageabilityEndpointReference/> *  
1308   <muws-p1-xs:ResourceId/> ?  
1309   <muws-p2-xs:Role>xs:anyURI</muws-p2-xs:Role>  
1310   {any} *  
1311 </muws-p2-xs:Participant>
```

1312 **muws-p2-xs:Participant** is an element as defined by the Relationship/Participant in section
1313 4.1.2.2. This element MUST appear at least twice, and exactly once per participant in the
1314 relationship.

1315 4.3.3 Events

1316 The *muws-events:RelationshipResourceCapability* topic defined below is used for events related
1317 to the *Relationship Resource* capability.

```
1318 <wstop:Topic name="RelationshipResourceCapability"  
1319             messageTypes="muws-p1-xs:ManagementEvent">  
1320 </wstop:Topic>
```

1321 4.4 Advertisement

1322 The manageability capability URI for the Advertisement capability is
1323 <http://docs.oasis-open.org/wsdm/2004/12/muws/capabilities/Advertisement>

1324 4.4.1 Definition

1325 The *Advertisement* capability is exposed by a Web service that is able to provide a notification on
1326 the creation or the destruction of a manageable resource. Since a consumer cannot register for a
1327 notification on a resource before the resource is created, a creation event is reported for some
1328 other resource by the implementer of a “lifetime notification” capability. .

1329 Note that this capability may be implemented by a manageable resource or by some other
1330 service (see section 4 on the distinction between “manageability capability” and “management-
1331 related capability”.. A service might offer a capability to notify on the creation or the destruction of
1332 a resource even though the service itself is not manageable. For example, if a system includes a
1333 registry, to which a resource is added as soon as it is created, and from which it is removed when
1334 it is destroyed, then this registry could expose the *Advertisement* capability and use it to share
1335 information about resource creation and destruction events with manageability consumers.
1336 Likewise, a resource factory might emit creation events for a resource it creates, yet the factory
1337 itself might not be manageable. Another example is a container, a J2EE server or a business
1338 process execution engine for example, that can send a notification when a contained resource is
1339 created.

1340 This capability defines four topics used for notification but does not define any property or
1341 operation.

1342 In addition to advertisement by sending notifications, as defined in this capability, another
1343 approach for advertisement is to register a manageable resource in a registry. A resource
1344 advertised in this way can be discovered using the mechanisms introduced in section 5.2.

1345 Figure 8 is a UML representation of the *Advertisement* capability.

MUWS::Advertisement
<<event>> ManageabilityEndpointCreation[0..1]
<<event>> ManageableResourceCreation[0..1]
<<event>> ManageabilityEndpointDestruction[0..1]
<<event>> ManageableResourceDestruction[0..1]

1346

1347

Figure 8: Advertisement capability

1348 4.4.2 Events

1349 The Advertisement capability defines four notification topics:

```

1350 <wstop:Topic name="ManageabilityEndpointCreation" messageTypes="muws-p2-
1351 xs:CreationNotification">
1352   <wstop:MessagePattern
1353     Dialect="http://www.w3.org/TR/1999/REC-xpath-19991116">//muws-p1-
1354 xs:ManagementEvent[count(muws-p2-xs:CreationNotification)=1]
1355   </wstop:MessagePattern>
1356   <wstop:Topic name="ManageableResourceCreation" messageTypes="muws-p2-
1357 xs:CreationNotification">
1358     <wstop:MessagePattern
1359       Dialect="http://www.w3.org/TR/1999/REC-xpath-19991116">//muws-p1-
1360 xs:ManagementEvent[count(muws-p2-xs:CreationNotification)=1]
1361     </wstop:MessagePattern>
1362   </wstop:Topic>
1363 </wstop:Topic>
1364 <wstop:Topic name="ManageabilityEndpointDestruction" messageTypes="muws-
1365 p2-xs:DestructionNotification">
1366   <wstop:MessagePattern
1367     Dialect="http://www.w3.org/TR/1999/REC-xpath-19991116">//muws-p1-
1368 xs:ManagementEvent[count(muws-p2-xs:DestructionNotification)=1]
1369   </wstop:MessagePattern>
1370   <wstop:Topic name="ManageableResourceDestruction" messageTypes="muws-p2-
1371 xs:DestructionNotification"/>
1372   <wstop:MessagePattern
1373     Dialect="http://www.w3.org/TR/1999/REC-xpath-19991116">//muws-p1-
1374 xs:ManagementEvent[count(muws-p2-xs:DestructionNotification)=1]
1375   </wstop:MessagePattern>
1376   </wstop:Topic>
1377 </wstop:Topic>

```

1378 The **"muws-events:ManageabilityEndpointCreation"** topic corresponds to notification on the
1379 creation of a new manageability endpoint for a new or existing resource. A manageability
1380 endpoint may be created in conjunction with, or independent of, the creation of the manageable
1381 resource. A new manageability endpoint could be the first one for a resource or be an addition to
1382 others. An associated *muws-p2-xs:CreationNotification* message contains the EPR of a newly
1383 created manageability endpoint.

1384 The **"muws-events:ManageableResourceCreation"** topic is a specialization of the
1385 "Manageability EndpointCreation" topic. This topic corresponds to the case where a resource
1386 itself is newly created. Note that if a resource is created that is not manageable (i.e. which does
1387 not have a manageability endpoint) no notification on this topic will be sent. If a resource and a
1388 manageability endpoint for the resource are created then a notification will be sent to a subscriber
1389 on this topic.

1390 The **"muws-events:ManageabilityEndpointDestruction"** topic corresponds to notification on
1391 the destruction of a manageability endpoint. It does not imply that the associated resource was
1392 destroyed. An associated *muws-p2-xs:DestructionNotification* message contains the *muws-p2-*
1393 *xs:ResourceId* that a newly destroyed manageability endpoint provided for the resource before its
1394 destruction.

1395 The “**muws-events:ManageableResourceDestruction**” topic is a specialization of the
1396 “**ManageabilityEndpointDestruction**” topic. This topic corresponds to the case where a resource
1397 itself is destroyed at the same time as the manageability endpoint. Note that if a resource is
1398 destroyed that is not manageable (i.e. which does not have a manageability endpoint) no
1399 notification on this topic will be sent. An associated *muws-p2-xs:DestructionNotification* message
1400 contains the *muws-p2-xs:ResourceId* that a newly destroyed manageability endpoint provided for
1401 the resource before its destruction.

1402 The content element for these topics are described as follows:

```
1403 <muws-p2-xs:CreationNotification">  
1404   <muws-p1-xs:ManageabilityEndpointReference" /> *  
1405 </muws-p2-xs:CreationNotification">
```

1406 **muws-p2-xs:CreationNotification/muws-p1-xs:ManageabilityEndpointReference** is a
1407 reference to the manageability endpoint of a newly created resource. There can be more than
1408 one such reference if there is more than one known manageability endpoint.

1409

```
1410 <muws-p2-xs:DestructionNotification">  
1411   <muws-p1-xs:ResourceId" /> ?  
1412 </muws-p2-xs:DestructionNotification">
```

1413 **muws-p2-xs:DestructionNotification/muws-p1-xs:ResourceId** is the *ResourceId* of a newly
1414 destroyed resource.

1415

1416 5 Discovery

1417 Many forms of discovery are supported by Web services. This specification does not prescribe a
1418 normative method for discovering manageability services. It is expected that discovery methods
1419 commonly used for Web services will be used as discovery methods for manageability services.
1420 The goal of discovery is to obtain the EPR of a manageability endpoint. The Advertisement
1421 capability (section 4.4), when supported, provides one way to facilitate discovery via events. This
1422 section also describes two other ways to discover manageable resources. These are just some of
1423 the discovery methods that can be used.

1424 The only normative requirement relative to discovering manageability services is that a
1425 manageability service **MUST** provide the Identity capability as defined by MUWS. As a result of
1426 this requirement, a consumer can inspect the WSDL description for a Web service or attempt to
1427 use the Identity capability of a Web service to determine if a discovered service acts as a
1428 manageability service. If a discovered service provides at least the Identity capability as defined
1429 by MUWS, then it is a manageability service.

1430 5.1 Discovery using Relationships

1431 There are at least two scenarios in which a relationship can be used to discover a manageable
1432 resource.

1433 The first scenario is when a manageable resource points to some other manageable resource
1434 through a relationship. A manageable resource that supports the Relationship capability enables
1435 discovery of an EPR for some other resource that participates in a relationship with the
1436 manageable resource. This is done by using the "Relationship" property defined in section 4.1.3
1437 or invoking the operations defined in section 4.1.4. Any EPRs contained in such a response
1438 message may be used by the manageability consumer to disambiguate a manageable resource
1439 in an exchange of messages with a manageability endpoint.

1440 The second scenario is when a consumer has access to a WS-Resource representing a
1441 relationship and the relationship has a manageable resource as a member. A consumer can then
1442 use the properties of the Relationship Resource capability to retrieve any EPRs of a manageable
1443 resource participating in the relationship.

1444 5.2 Discovery using Registries

1445 In addition to emitting a notification on the creation and the destruction of a resource as defined
1446 by the Advertisement capability in section 4.4, a resource can be advertised to a registry by
1447 invoking an insertion interface of the registry. A consumer can then discover a manageable
1448 resource by invoking a query interface of the registry.

1449 The WSRF WS-Service Group specification [WS-SG] defines a type of registry, along with the
1450 message exchanges used to interact with a registry of this type. It is **RECOMMENDED** that a
1451 registry used to discover a manageable resource conforms to the WS-Service Group specification
1452 and that the registry conform to the following additional constraints:

1453 The service group **SHOULD** include as properties the following two elements:

```
1454 <wssg:MembershipContentRule  
1455   MemberInterface="muws-pl-xs:Identity"  
1456   ContentElements="muws-pl-xs:ResourceId">  
1457 <wssg:MembershipContentRule  
1458   MemberInterface="muws-pl-xs:ManageabilityCharacteristics"  
1459   ContentElements="muws-pl-xs:ManageabilityCapability">
```

1460 The service group **MAY** also have any other "MembershipContentRule", including a rule with an
1461 empty value for both MemberInterface and ContentElements. In effect, this lifts any constraint on

1462 a member of the service group. The two membership content rules defined above are useful even
1463 in a service group with no effective constraint because they allow querying the service group on
1464 the "ResourceId" and "ManageabilityCapability" properties.

1465 When adding a manageability endpoint for a resource to the membership of a service group using
1466 the "Add" operation, the requestor SHOULD include the *muws-p1-xs:ResourceId* element of a
1467 manageable resource in a *wssg:Add/wssg:Content* element of a request, even if the service
1468 group supports additional membership content rules that would have permitted registration of a
1469 manageability endpoint in the service group without providing this content element. Similarly, if
1470 the manageable resource supports the Manageability Characteristics capability, then the
1471 consumer SHOULD include all the *muws-p1-xs:ManageabilityCapability* elements of a
1472 manageable resource in a *wssg:Add/wssg:Content* element of a request, even if the service
1473 group supports additional membership content rules that would have permitted registration of the
1474 manageability endpoint in the service group without providing this content element.

1475 Like any manageability endpoint, a manageability endpoint listed in a resource registry MUST
1476 implement the Identity capability defined in [MUWS Part 1]. In addition, in order to facilitate
1477 discovery, the manageability endpoint SHOULD implement the Manageability Characteristics
1478 capability as defined in [MUWS Part 1].

1479

1480

6 References

1481

6.1 Normative

1482

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1498

1499

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1505

1506

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1510

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1514

1515

1516

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1518

1519

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1523

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1534		open.org/wsr/2004/06/wsr-WS-ResourceLifetime-1.2-draft-03.pdf
1535		
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1550		ResourceMetadataDescriptor-1.0-draft-01.PDF
1551		

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Appendix B. Notices

1561

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1591

1592

1593

1594

1595

Appendix C. Schemas

1596

```
1597 <?xml version="1.0" encoding="utf-8"?>
1598 <xs:schema
1599     targetNamespace="http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-muws-
1600     part2.xsd"
1601     xmlns:muws-p2-xs="http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-muws-
1602     part2.xsd"
1603     xmlns:muws-p1-xs="http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-muws-
1604     part1.xsd"
1605     xmlns:wsa="http://schemas.xmlsoap.org/ws/2004/08/addressing"
1606     xmlns:xs="http://www.w3.org/2001/XMLSchema"
1607     elementFormDefault="qualified" attributeFormDefault="unqualified">
1608
1609     <xs:import namespace="http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-muws-
1610     part1.xsd"
1611             schemaLocation="http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-
1612     muws-part1.xsd"/>
1613     <xs:import namespace="http://schemas.xmlsoap.org/ws/2004/08/addressing"
1614
1615     schemaLocation="http://schemas.xmlsoap.org/ws/2004/08/addressing"/>
1616     <xs:import namespace="http://www.w3.org/XML/1998/namespace"
1617             schemaLocation="http://www.w3.org/2001/xml.xsd"/>
1618
1619     <xs:complexType name="LangString">
1620         <xs:simpleContent>
1621             <xs:extension base="xs:string">
1622                 <xs:attribute ref="xml:lang" use="required"/>
1623                 <xs:anyAttribute namespace="##other"/>
1624             </xs:extension>
1625         </xs:simpleContent>
1626     </xs:complexType>
1627
1628
1629     <!-- Begin properties for the Description capability -->
1630     <xs:element name="Caption" type="muws-p2-xs:LangString"/>
1631     <xs:element name="Description" type="muws-p2-xs:LangString"/>
1632     <xs:element name="Version" type="xs:string"/>
1633     <!-- End properties for the Description capability -->
1634
1635     <xs:complexType name="DescriptionPropertiesType">
1636         <xs:sequence>
1637             <xs:element ref="muws-p2-xs:Caption"
1638                 minOccurs="0" maxOccurs="unbounded"/>
1639             <xs:element ref="muws-p2-xs:Description"
1640                 minOccurs="0" maxOccurs="unbounded"/>
1641             <xs:element ref="muws-p2-xs:Version"
1642                 minOccurs="0"/>
1643         </xs:sequence>
1644     </xs:complexType>
1645
1646     <xs:element name="DescriptionProperties"
1647             type="muws-p2-xs:DescriptionPropertiesType"/>
1648
1649     <xs:complexType name="CategoryType">
1650         <xs:sequence>
1651             <xs:any minOccurs="0"
1652                 namespace="##any" processContents="lax"/>
1653         </xs:sequence>
1654     </xs:complexType>
1655
```

```

1656 <xs:complexType name="StateType">
1657   <xs:complexContent>
1658     <xs:extension base="muws-p2-xs:CategoryType"/>
1659   </xs:complexContent>
1660 </xs:complexType>
1661
1662 <xs:element name="State" type="muws-p2-xs:StateType"/>
1663
1664 <xs:element name="EnteredState" type="muws-p2-xs:StateType"/>
1665 <xs:element name="PreviousState" type="muws-p2-xs:StateType"/>
1666
1667 <xs:complexType name="StateTransitionType">
1668   <xs:sequence>
1669     <xs:element ref="muws-p2-xs:EnteredState"/>
1670     <xs:element ref="muws-p2-xs:PreviousState"
1671       minOccurs="0"/>
1672     <xs:any minOccurs="0" maxOccurs="unbounded"
1673       namespace="##other" processContents="lax"/>
1674   </xs:sequence>
1675   <xs:attribute name="TransitionIdentifier" type="xs:anyURI"
1676     use="optional"/>
1677   <xs:attribute name="Time" type="xs:dateTime" use="required"/>
1678   <xs:anyAttribute namespace="##other"/>
1679 </xs:complexType>
1680
1681 <xs:element name="StateTransition"
1682   type="muws-p2-xs:StateTransitionType"/>
1683
1684
1685 <!-- Begin properties for the OperationalStatus capability -->
1686 <xs:element name="OperationalStatus">
1687   <xs:simpleType>
1688     <xs:restriction base="xs:string">
1689       <xs:enumeration value="Available"/>
1690       <xs:enumeration value="PartiallyAvailable"/>
1691       <xs:enumeration value="Unavailable"/>
1692       <xs:enumeration value="Unknown"/>
1693     </xs:restriction>
1694   </xs:simpleType>
1695 </xs:element>
1696 <!-- End properties for the OperationalStatus capability -->
1697
1698 <xs:complexType name="OperationalStatusPropertiesType">
1699   <xs:sequence>
1700     <xs:element ref="muws-p2-xs:OperationalStatus"/>
1701   </xs:sequence>
1702 </xs:complexType>
1703
1704 <xs:element name="OperationalStatusProperties"
1705   type="muws-p2-xs:OperationalStatusPropertiesType"/>
1706
1707 <xs:attributeGroup name="MetricAttributes">
1708   <xs:attribute name="ResetAt" type="xs:dateTime"/>
1709   <xs:attribute name="LastUpdated" type="xs:dateTime"/>
1710   <xs:attribute name="Duration" type="xs:duration"/>
1711 </xs:attributeGroup>
1712
1713 <!-- Begin properties for the Metrics capability -->
1714 <xs:element name="CurrentTime" type="xs:dateTime"/>
1715 <!-- End properties for the Metrics capability -->
1716
1717 <xs:complexType name="MetricsPropertiesType">
1718   <xs:sequence>

```

```

1719     <xs:element ref="muws-p2-xs:CurrentTime" />
1720   </xs:sequence>
1721 </xs:complexType>
1722
1723 <xs:element name="MetricsProperties"
1724           type="muws-p2-xs:MetricsPropertiesType" />
1725
1726 <xs:complexType name="RelationshipTypeType">
1727   <xs:complexContent>
1728     <xs:extension base="muws-p2-xs:CategoryType" />
1729   </xs:complexContent>
1730 </xs:complexType>
1731
1732 <xs:complexType name="RelationshipParticipantType">
1733   <xs:sequence>
1734     <xs:element ref="muws-p1-xs:ManageabilityEndpointReference"
1735                 minOccurs="0" maxOccurs="unbounded" />
1736     <xs:element ref="muws-p1-xs:ResourceId"
1737                 minOccurs="0" />
1738     <xs:element name="Role" type="xs:anyURI" />
1739     <xs:any minOccurs="0" maxOccurs="unbounded"
1740             namespace="##other" processContents="lax" />
1741   </xs:sequence>
1742   <xs:anyAttribute namespace="##other" />
1743 </xs:complexType>
1744
1745 <!-- Begin properties for the RelationshipResource capability -->
1746 <xs:element name="Name" type="xs:string" />
1747 <xs:element name="Type" type="muws-p2-xs:RelationshipTypeType" />
1748 <xs:element name="Participant"
1749             type="muws-p2-xs:RelationshipParticipantType" />
1750 <!-- End   properties for the RelationshipResource capability -->
1751
1752 <xs:complexType name="RelationshipType">
1753   <xs:sequence>
1754     <xs:element ref="muws-p2-xs:Name"
1755                 minOccurs="0" />
1756     <xs:element ref="muws-p2-xs:Type" />
1757     <xs:element ref="muws-p2-xs:Participant"
1758                 minOccurs="2" maxOccurs="unbounded" />
1759     <xs:element name="AccessEndpointReference"
1760                 type="wsa:EndpointReferenceType" minOccurs="0" />
1761     <xs:any minOccurs="0" maxOccurs="unbounded"
1762             namespace="##other" processContents="lax" />
1763   </xs:sequence>
1764   <xs:anyAttribute namespace="##other" />
1765 </xs:complexType>
1766
1767 <!-- Begin properties for the Relationship capability -->
1768 <xs:element name="Relationship"
1769             type="muws-p2-xs:RelationshipType" />
1770 <!-- End   properties for the Relationship capability -->
1771
1772 <xs:complexType name="RelationshipPropertiesType">
1773   <xs:sequence>
1774     <xs:element ref="muws-p2-xs:Relationship"
1775                 minOccurs="0" maxOccurs="unbounded" />
1776   </xs:sequence>
1777 </xs:complexType>
1778
1779 <xs:element name="RelationshipProperties"
1780             type="muws-p2-xs:RelationshipPropertiesType" />
1781

```

```

1782 <xs:element name="RelationshipCreatedNotification">
1783   <xs:complexType>
1784     <xs:sequence>
1785       <xs:element ref="muws-p2-xs:Relationship"/>
1786       <xs:any minOccurs="0" maxOccurs="unbounded"
1787         namespace="##other" processContents="lax"/>
1788     </xs:sequence>
1789     <xs:anyAttribute namespace="##other"/>
1790   </xs:complexType>
1791 </xs:element>
1792
1793 <xs:element name="RelationshipDeletedNotification">
1794   <xs:complexType>
1795     <xs:sequence>
1796       <xs:element ref="muws-p2-xs:Relationship"/>
1797       <xs:any minOccurs="0" maxOccurs="unbounded"
1798         namespace="##other" processContents="lax"/>
1799     </xs:sequence>
1800     <xs:anyAttribute namespace="##other"/>
1801   </xs:complexType>
1802 </xs:element>
1803
1804 <xs:complexType name="RelationshipResourcePropertiesType">
1805   <xs:sequence>
1806     <xs:element ref="muws-p2-xs:Name" minOccurs="0"/>
1807     <xs:element ref="muws-p2-xs:Type"/>
1808     <xs:element ref="muws-p2-xs:Participant"
1809       minOccurs="2" maxOccurs="unbounded"/>
1810   </xs:sequence>
1811 </xs:complexType>
1812
1813 <xs:element name="RelationshipResourceProperties"
1814   type="muws-p2-xs:RelationshipResourcePropertiesType"/>
1815
1816 <xs:element name="QueryRelationshipsByType">
1817   <xs:complexType>
1818     <xs:sequence>
1819       <xs:element name="RequestedType" type="xs:QName"/>
1820     </xs:sequence>
1821   </xs:complexType>
1822 </xs:element>
1823
1824 <xs:element name="QueryRelationshipsByTypeResponse">
1825   <xs:complexType>
1826     <xs:sequence>
1827       <xs:element ref="muws-p2-xs:Relationship"
1828         minOccurs="0" maxOccurs="unbounded"/>
1829     </xs:sequence>
1830   </xs:complexType>
1831 </xs:element>
1832
1833 <xs:element name="CreationNotification">
1834   <xs:complexType>
1835     <xs:sequence>
1836       <xs:element ref="muws-p1-xs:ManageabilityEndpointReference"
1837         minOccurs="0" maxOccurs="unbounded"/>
1838     </xs:sequence>
1839     <xs:anyAttribute namespace="##other"/>
1840   </xs:complexType>
1841 </xs:element>
1842
1843 <xs:element name="DestructionNotification">
1844   <xs:complexType>

```

```

1845     <xs:sequence>
1846         <xs:element ref="muws-p1-xs:ResourceId"
1847             minOccurs="0" />
1848     </xs:sequence>
1849     <xs:anyAttribute namespace="##other" />
1850 </xs:complexType>
1851 </xs:element>
1852
1853 <xs:complexType name="SituationCategoryType">
1854     <xs:complexContent>
1855         <xs:extension base="muws-p2-xs:CategoryType" />
1856     </xs:complexContent>
1857 </xs:complexType>
1858
1859 <xs:complexType name="SubstitutableMsgType">
1860     <xs:sequence>
1861         <xs:element name="Value" type="xs:anySimpleType"
1862             minOccurs="0" maxOccurs="unbounded" />
1863     </xs:sequence>
1864     <xs:attribute name="MsgId" type="xs:string"
1865         use="required" />
1866     <xs:attribute name="MsgIdType" type="xs:anyURI"
1867         use="required" />
1868 </xs:complexType>
1869
1870 <xs:complexType name="SituationType">
1871     <xs:sequence>
1872         <xs:element name="SituationCategory"
1873             type="muws-p2-xs:SituationCategoryType" />
1874         <xs:element name="SuccessDisposition" minOccurs="0">
1875             <xs:simpleType>
1876                 <xs:restriction base="xs:string">
1877                     <xs:enumeration value="Successful" />
1878                     <xs:enumeration value="Unsuccessful" />
1879                 </xs:restriction>
1880             </xs:simpleType>
1881         </xs:element>
1882         <xs:element name="SituationTime" type="xs:dateTime" />
1883         <xs:element name="Priority" type="xs:short"
1884             minOccurs="0" />
1885         <xs:element name="Severity" type="xs:short"
1886             minOccurs="0" />
1887         <xs:element name="Message" type="muws-p2-xs:LangString"
1888             minOccurs="0" />
1889         <xs:element name="SubstitutableMsg"
1890             type="muws-p2-xs:SubstitutableMsgType"
1891             minOccurs="0" />
1892     </xs:sequence>
1893 </xs:complexType>
1894
1895 <xs:element name="Situation" type="muws-p2-xs:SituationType" />
1896
1897
1898
1899 <!-- ##### Metadata description elements ##### -->
1900
1901 <xs:element name="Capability" type="xs:anyURI" />
1902
1903 <xs:complexType name="DialectableExpressionType" mixed="true">
1904     <xs:sequence>
1905         <xs:any namespace="##other" processContents="lax"
1906             minOccurs="0" maxOccurs="unbounded" />
1907     </xs:sequence>

```

```

1908     <xs:attribute name="Dialect" type="xs:anyURI" use="required"/>
1909     <xs:anyAttribute namespace="##other"/>
1910 </xs:complexType>
1911
1912 <xs:element name="ValidWhile"
1913           type="muws-p2-xs:DialectableExpressionType"/>
1914
1915 <xs:element name="Units" type="xs:string"/>
1916
1917 <xs:element name="ChangeType">
1918   <xs:simpleType>
1919     <xs:restriction base="xs:string">
1920       <xs:enumeration value="Counter"/>
1921       <xs:enumeration value="Gauge"/>
1922       <xs:enumeration value="Unknown"/>
1923     </xs:restriction>
1924   </xs:simpleType>
1925 </xs:element>
1926
1927 <xs:element name="TimeScope">
1928   <xs:simpleType>
1929     <xs:restriction base="xs:string">
1930       <xs:enumeration value="Interval"/>
1931       <xs:enumeration value="PointInTime"/>
1932       <xs:enumeration value="SinceReset"/>
1933     </xs:restriction>
1934   </xs:simpleType>
1935 </xs:element>
1936
1937 <xs:element name="GatheringTime">
1938   <xs:simpleType>
1939     <xs:restriction base="xs:string">
1940       <xs:enumeration value="OnChange"/>
1941       <xs:enumeration value="Periodic"/>
1942       <xs:enumeration value="OnDemand"/>
1943       <xs:enumeration value="Unknown"/>
1944     </xs:restriction>
1945   </xs:simpleType>
1946 </xs:element>
1947
1948 <xs:element name="CalculationInterval" type="xs:duration"/>
1949
1950 <xs:element name="MetricGroup" type="xs:anyURI"/>
1951
1952 <xs:element name="PostCondition"
1953           type="muws-p2-xs:DialectableExpressionType"/>
1954
1955 </xs:schema>

```

Appendix D. WSDL elements

1956

```
1957 <?xml version="1.0" encoding="utf-8"?>
1958 <definitions
1959     targetNamespace="http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-muws-
1960     part2.wsdl"
1961     xmlns:muws-p2-wsdl="http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-muws-
1962     part2.wsdl"
1963     xmlns:muws-p2-xs="http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-muws-
1964     part2.xsd"
1965     xmlns:muws-p1-xs="http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-muws-
1966     part1.xsd"
1967     xmlns:wsrf-rp="http://docs.oasis-open.org/wsrf/2004/06/wsrf-WS-
1968     ResourceProperties-1.2-draft-01.xsd"
1969     xmlns:xs="http://www.w3.org/2001/XMLSchema"
1970     xmlns="http://schemas.xmlsoap.org/wsdl/">
1971
1972     <types>
1973         <xs:schema elementFormDefault="qualified"
1974             targetNamespace="http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-
1975             muws-part2.wsdl">
1976
1977             <xs:import namespace="http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-
1978             muws-part2.xsd"
1979                 schemaLocation="http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-
1980             muws-part2.xsd"/>
1981
1982             <xs:import namespace="http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-
1983             muws-part1.xsd"
1984                 schemaLocation="http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-
1985             muws-part1.xsd"/>
1986
1987         </xs:schema>
1988     </types>
1989
1990
1991     <message name="QueryRelationshipsByTypeRequest">
1992         <part name="body" element="muws-p2-xs:QueryRelationshipsByType" />
1993     </message>
1994
1995     <message name="QueryRelationshipsByTypeResponse">
1996         <part name="body" element="muws-p2-xs:QueryRelationshipsByTypeResponse" />
1997     </message>
1998
1999
2000     <portType name="Identity"
2001         wsrf-rp:ResourceProperties="muws-p1-xs:IdentityProperties">
2002     </portType>
2003
2004     <portType name="ManageabilityCharacteristics"
2005         wsrf-rp:ResourceProperties="muws-p1-
2006     xs:ManageabilityCharacteristicsProperties">
2007     </portType>
2008
2009     <portType name="CorrelatableProperties"
2010         wsrf-rp:ResourceProperties="muws-p1-xs:CorrelatablePropertiesProperties">
2011     </portType>
2012
2013     <portType name="Description"
2014         wsrf-rp:ResourceProperties="muws-p2-xs:DescriptionProperties">
2015     </portType>
```

```
2016
2017 <portType name="OperationalStatus"
2018     wsrf-rp:ResourceProperties="muws-p2-xs:OperationalStatusProperties">
2019 </portType>
2020
2021 <portType name="Metrics"
2022     wsrf-rp:ResourceProperties="muws-p2-xs:MetricsProperties">
2023 </portType>
2024
2025 <portType name="Relationships"
2026     wsrf-rp:ResourceProperties="muws-p2-xs:RelationshipsProperties">
2027
2028     <operation name="QueryRelationshipsByType">
2029         <input name="QueryRelationshipsByTypeRequest"
2030             message="muws-p2-wsdl:QueryRelationshipsByTypeRequest" />
2031         <output name="QueryRelationshipsByTypeResponse"
2032             message="muws-p2-wsdl:QueryRelationshipsByTypeResponse" />
2033     </operation>
2034
2035 </portType>
2036
2037 <portType name="RelationshipResource"
2038     wsrf-rp:ResourceProperties="muws-p2-xs:RelationshipResourceProperties">
2039 </portType>
2040
2041 </definitions>
```


2042

Appendix E. Topics

```
2043 <wstop:TopicSpace name="MuwsNotificationTopics"
2044     targetNamespace="http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-muws-
2045     part2-events.xml"
2046     xmlns:muws-p1-xs="http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-muws-
2047     part1.xsd"
2048     xmlns:muws-p2-xs="http://docs.oasis-open.org/wsdm/2004/12/muws/wsdm-muws-
2049     part2.xsd"
2050     xmlns:wstop="http://docs.oasis-open.org/wsn/2004/06/wsn-WS-Topics-1.2-
2051     draft-01.xsd"
2052     xmlns:wsrp="http://docs.oasis-open.org/wsrp/2004/06/wsrp-WS-
2053     ResourceProperties-1.2-draft-01.xsd">
2054
2055     <wstop:Topic name="IdentityCapability"
2056         messageTypes="muws-p1-xs:ManagementEvent" >
2057     </wstop:Topic>
2058
2059     <wstop:Topic name="ManageabilityCharacteristicsCapability"
2060         messageTypes="muws-p1-xs:ManagementEvent" >
2061     </wstop:Topic>
2062
2063     <wstop:Topic name="CorrelatablePropertiesCapability"
2064         messageTypes="muws-p1-xs:ManagementEvent" >
2065     </wstop:Topic>
2066
2067     <wstop:Topic name="DescriptionCapability"
2068         messageTypes="muws-p1-xs:ManagementEvent" >
2069     </wstop:Topic>
2070
2071     <wstop:Topic name="StateCapability"
2072         messageTypes="muws-p1-xs:ManagementEvent" >
2073     </wstop:Topic>
2074
2075     <wstop:Topic name="OperationalStatusCapability"
2076         messageTypes="muws-p1-xs:ManagementEvent" >
2077     </wstop:Topic>
2078
2079     <wstop:Topic name="MetricsCapability"
2080         messageTypes="muws-p1-xs:ManagementEvent" >
2081     </wstop:Topic>
2082
2083     <wstop:Topic name="ConfigurationCapability"
2084         messageTypes="muws-p1-xs:ManagementEvent" >
2085     </wstop:Topic>
2086
2087     <wstop:Topic name="RelationshipsCapability"
2088         messageTypes="muws-p1-xs:ManagementEvent" >
2089
2090         <wstop:Topic name="RelationshipCreated"
2091             messageTypes="muws-p1-xs:ManagementEvent" >
2092             <wstop:MessagePattern Dialect="http://www.w3.org/TR/1999/REC-xpath-
2093             19991116">
2094                 //muws-p1-xs:ManagementEvent[ count (muws-p2-
2095                 xs:RelationshipCreatedNotification)=1 ]
2096             </wstop:MessagePattern>
2097         </wstop:Topic>
2098
2099         <wstop:Topic name="RelationshipDeleted"
2100             messageTypes="muws-p1-xs:ManagementEvent" >
```

```

2101     <wstop:MessagePattern Dialect="http://www.w3.org/TR/1999/REC-xpath-
2102 19991116">
2103         //muws-p1-xs:ManagementEvent[count(muws-p2-
2104 xs:RelationshipDeletedNotification)=1]
2105     </wstop:MessagePattern>
2106     </wstop:Topic>
2107
2108 </wstop:Topic>
2109
2110 <wstop:Topic name="RelationshipAccessCapability"
2111     messageTypes="muws-p1-xs:ManagementEvent">
2112 </wstop:Topic>
2113
2114 <wstop:Topic name="RelationshipResourceCapability"
2115     messageTypes="muws-p1-xs:ManagementEvent">
2116 </wstop:Topic>
2117
2118 <wstop:Topic name="ManageabilityEndpointCreation"
2119     messageTypes="muws-p1-xs:ManagementEvent">
2120     <wstop:MessagePattern Dialect="http://www.w3.org/TR/1999/REC-xpath-
2121 19991116">
2122         //muws-p1-xs:ManagementEvent[count(muws-p2-xs:CreationNotification)=1]
2123     </wstop:MessagePattern>
2124
2125     <wstop:Topic name="ManageableResourceCreation"
2126         messageTypes="muws-p1-xs:ManagementEvent">
2127         <wstop:MessagePattern Dialect="http://www.w3.org/TR/1999/REC-xpath-
2128 19991116">
2129             //muws-p1-xs:ManagementEvent[count(muws-p2-xs:CreationNotification)=1]
2130         </wstop:MessagePattern>
2131     </wstop:Topic>
2132
2133 </wstop:Topic>
2134
2135 <wstop:Topic name="ManageabilityEndpointDestruction"
2136     messageTypes="muws-p1-xs:ManagementEvent">
2137     <wstop:MessagePattern Dialect="http://www.w3.org/TR/1999/REC-xpath-
2138 19991116">
2139         //muws-p1-xs:ManagementEvent[count(muws-p2-xs:DestructionNotification)=1]
2140     </wstop:MessagePattern>
2141
2142     <wstop:Topic name="ManageableResourceDestruction"
2143         messageTypes="muws-p1-xs:ManagementEvent">
2144         <wstop:MessagePattern Dialect="http://www.w3.org/TR/1999/REC-xpath-
2145 19991116">
2146             //muws-p1-xs:ManagementEvent[count(muws-p2-
2147 xs:DestructionNotification)=1]
2148         </wstop:MessagePattern>
2149     </wstop:Topic>
2150
2151 </wstop:Topic>
2152
2153 </wstop:TopicSpace>

```

2154 Appendix F. Description of situation types

2155 This appendix defines in more details the situation types introduced in section 2.5.1.

2156 AvailabilitySituation

2157 This category deals with the situations reported from the component, regarding its operational
2158 state and availability. This situation provides a context for operations that can be performed by
2159 the component to establish if a product is installed, operational and ready to process functional
2160 requests, or operational and ready or not ready to process management requests. Existing
2161 message include words like “now ready to take requests”, “online”, and “offline”, for example::

- 2162 • “SOAP connector available at port 8888”

2163

2164 CapabilitySituation

2165 This category is specified when a change in capability of a resource occurs. For example, a
2166 printer has an envelope tray attached to it so that the printer is now has additional paper choices.
2167 The same category would be used if the envelope tray is removed from the printer.

2168

2169 ConfigurationSituation

2170 This category deals with the components identifying configuration changes. Any changes that a
2171 component makes to its configuration should be logged using this category. Existing message
2172 include words like “port number is”, “address is”, and “process id”, for example:

- 2173 • “File transfer configured with host='9.27.11.13', port='9090', securityEnabled='false'”

2174

2175 StopSituation

2176 This category deals with the shutdown process for a component. Messages that indicate that a
2177 component has begun to stop, that it has stopped, or that the stopping process has failed all fall
2178 into this category. Existing messages include words like “stop”, “stopping”, “stopped”,
2179 “completed”, and “exiting”, for example:

- 2180 • “Application stopped: myApp.exe”
- 2181 • “An error occurred while stopping myApp.exe”
- 2182 • “Stopping the JMS provider”

2183

2184 StartSituation

2185 This category deals with the startup process for a component. Messages that indicate that a
2186 component has begun the startup process, that it has finished the startup process, or that it has
2187 aborted the startup process all fall into this category. Existing messages include words like
2188 “starting”, “started”, “initializing”, and “initialized”, for example:

- 2189 • “XYZ protocol support was successfully started”
- 2190 • “XYZ protocol support failed to start”
- 2191 • “Starting EJB: myEjb.jar”

2192

2193 RequestSituation

2194 This category is used in situations that a component uses to identify the completion status of a
2195 request. Typically, these requests are complex management tasks or transactions that a
2196 component undertakes on behalf of a requestor and not the mainline simple requests or
2197 transactions. Existing messages are of the form “*request* started” or “*request* completed” as in
2198 phrases like “configuration synchronization started”, and “backup procedure complete”, for
2199 example:

2200 • “Configuration synchronization completed”
2201 Note that events generated from requests that start up or stop a resource would be categorized
2202 as **StartSituation** or **StopSituation** respectively because they are higher precedent than
2203 **RequestSituation**.

2204

2205 **DestroySituation**

2206 This category deals with the situations occurring when an entity or component was removed or
2207 destroyed. Messages telling that a document was destroyed or a file was deleted all fall into this
2208 category. Existing messages include phrases like “was destroyed”, “about to remove”, and “no
2209 longer exists”, for example:

2210 • “The connection pool was destroyed for data source foo”

2211

2212 **CreateSituation**

2213 This category deals with the situations occurring when a component creates an entity. Messages
2214 telling that a document was created, or a file was created, or an Enterprise JavaBean (EJB) was
2215 created all fall into this category. Existing message include words like was created, about to
2216 create, and now exists, for example:

2217 • “New log file was created”

2218

2219 **DependencySituation**

2220 This category deals with the situations where components cannot find some component or
2221 feature that they require. This category includes messages about not finding the “version” of the
2222 component that was expected. Messages that say a resource was not found, or that an
2223 application or subsystem that was unavailable, also fall into this category. Existing messages
2224 include words like “could not find”, and “no such component”, for example:

2225 • “Error encountered while deploying database schema: no database found”

2226

2227

2228 **ConnectSituation**

2229 This category deals with the situations related to aspects about a connection attempt from one
2230 component to another component. Messages that say a connection failed, that a connection was
2231 created, or that a connection was ended all fall into this category. Existing messages include
2232 words like “connection reset”, “connection failed”, and “failed to get a connection”, for example:

2233 • “Connection creation failed”

2234 • “Connection with http://foo.com created”

2235 • “Failed to close a connection”

2236

2237 **ReportSituation**

2238 This category deals with situations that occur as a result of some setting or occurrence that
2239 causes the resource to asynchronously report various types of data. Types of information that
2240 falls into this category are:

2241

2242 • **Exception related** – some exception has occurred within the resource and it not covered
2243 by any other category.

2244 • **Performance related** – some event occurs, that does not fall into any other category,
2245 that has affected performance in some way. For example, weather conditions may be
2246 affected line quality and network speeds are affected.

- 2247 • **Security related** – some security issue has been detected, like the cabinet door to a
- 2248 secure piece of equipment has been opened or an attack of some sort has been
- 2249 detected.
- 2250 • **Heartbeat related** – the resource has been configured to periodically report a ‘heartbeat’.
- 2251 • **Status related** – some change of status that does not affect availability or capability of
- 2252 the resource has been detected. For example, printer ink cartridge is low.
- 2253 • **Log related** – the resource has been configured to generate a log entry based on some
- 2254 event or at a fixed interval. This category identifies this event as a requested log entry.
- 2255 • **Debug related** – the resource has been enabled to turn on diagnostic information flow
- 2256 and will report the information within this category.
- 2257 • **Trace related** – the resource has been enabled to run trace information and reports this
- 2258 information using this category

2259

2260 **OtherSituation**

2261

2262 This category is for those events that do not fall into any other category. Note that this category
2263 is defined for syntactic completeness but any events placed in this category will not be able to be
2264 effectively correlated and its use is therefore discouraged unless absolutely necessary.

2265

2266