

Web Services Management Framework - Web Services Management (WSMF-WSM) Version 2.0

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Abstract

Web Services Management Framework - Web Services Management (WSMF-WSM) is an application of the WSMF-Foundation specification for the management of Web Services. It contains a model defined for this purpose since there is currently no satisfying model available to manage web services. It also contains other mandatory instructions necessary to achieve efficient management of Web services through the use of WSMF. It uses the mechanisms described in WSMF-Foundation to describe a model that can be used to manage Web services. Like all models exposed by WSMF-Foundation, it is composed of managed objects, operations, attributes, relations and notifications. The managed objects defined in WSMF-WSM are fully compliant with the WSMF-Foundation specification. The managed objects identified by WSMF-WSM are `Service`, `WSExecutionEnvironment`, `Conversation`, `Registry` and `Intermediary`. Those fully specified in the current version of WSMF-WSM are `Service`, `WSExecutionEnvironment` and `Conversation`. The others are briefly described in the future directions section.

Status of this Document

The WSMF-WSM specification is an initial public draft release and is provided for review and evaluation only. Hewlett-Packard Company hopes to solicit your contributions and suggestions in the near future. Hewlett-Packard Company makes no warranties or representations regarding the specification in any manner whatsoever.

Table of Contents

1. [Introduction](#)
2. [Notations and Terminology](#)
 - 2.1 [Notational Conventions](#)
 - 2.2 [Namespaces](#)
 - 2.3 [Compliance](#)
3. [Overview](#)
4. [Relations](#)
 - 4.1 [Relations defined by WSMF-WSM](#)
 - 4.2 [Usage of the relations defined by WSMF-WSM](#)
5. [Web Service Managed Object](#)
 - 5.1 [Discovery mechanism for Web services managed objects](#)
 - 5.2 [Service managed object interfaces](#)
6. [WSExecutionEnvironment Managed Object](#)
 - 6.1 [WSExecutionEnvironment managed object interfaces](#)
7. [Conversation Managed Object](#)
 - 7.1 [Conversation managed object interfaces](#)
8. [Future directions \(non-normative\)](#)
9. [References](#)
 - 9.1 [Normative References](#)
 - 9.2 [Informative References](#)

1. Introduction

WSMF-WSM provides a rich and extensible solution to managed Web services environments. It achieves this result by leveraging the WSMF-Foundation specification. WSMF-Foundation defines a model-agnostic way to manage resources through Web services technologies. The WSMF-WSM specification provides the recommended application of the WSMF-Foundation framework to the management of the most common resources encountered during the execution of Web services. Currently, WSMF-WSM defines three managed object types to represent the following resource: Web service, Web services execution environment and conversation. This document provides a quick overview of each managed object. Other relevant documents include WSDL files that contain the normative interfaces defined in WSMF-WSM, using the WSDL mapping defined by the WSMF-Foundation specification (see links below).

WSMF-WSM is based on WSMF-Foundation which was designed from the ground up to support among other things composition of management interfaces. As a result, the interfaces defined in the WSMF-WSM managed object can all be composed and extended as needed. WSMF-WSM itself does not rely on any other WSMF application than the base WSMF-Foundation specification.

2. Notations and Terminology

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

2.1 Notational Conventions

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

This specification uses an informal syntax to describe the XML grammar of the messages making up the management interfaces. This syntax uses the following rules:

- The syntax appears as an XML instance, but the values indicate the data types instead of values.
- `<!-- extension elements -->` is a placeholder for elements from some other namespace (like `##other` in XML Schema).
- Characters are appended to attributes, elements, and `<!-- extension elements -->` to indicate the number of times they may occur as follows: ? (0 or 1), * (0 or more), + (1 or more). No character indicates exactly 1 occurrence. The characters [and] are used to indicate that contained items are to be treated as a group with respect to the ?, *, and + characters.
- Attributes, elements, and values separated by | and grouped with (and) are meant to be syntactic alternatives.
- `...` is used in XML start elements to indicate that attributes from some other namespace are allowed.
- The XML namespace prefixes (defined below) are used to indicate the namespace of the element being defined.

The terms managed object, resource, relationship (and other terms defined in the WSMF-Foundation spec) are used based on the definitions of these terms provided in the terminology section of [\[WSMF-Foundation\]](#).

2.2 Namespaces

This specification defines several interface collections, each associated with a [\[XML-Namespace\]](#) URI that MUST be used by implementations of interfaces defined in the interface collection. The namespaces are:

<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/service/>
<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/wsexecutionenvironment/>
<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/conversation/>

The WSDL documents describing each of these interface collections may be found at:

<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/Service.wsdl>
<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/WsExecutionEnvironment.wsdl>
<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/Conversation.wsdl>

The following namespaces are used in this document:

Prefix	Namespace
wSDL	http://schemas.xmlsoap.org/wSDL/
xs	http://www.w3.org/2001/XMLSchema
evt	http://devresource.hp.com/drc/specifications/wsmf/2003/07/events/
wsmf	http://devresource.hp.com/drc/specifications/wsmf/2003/07/foundation/
wsm	http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/
wsm-serv	http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/service/
wsm-wsee	http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/wsexecutionenvironment/
wsm-conv	http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/conversation/

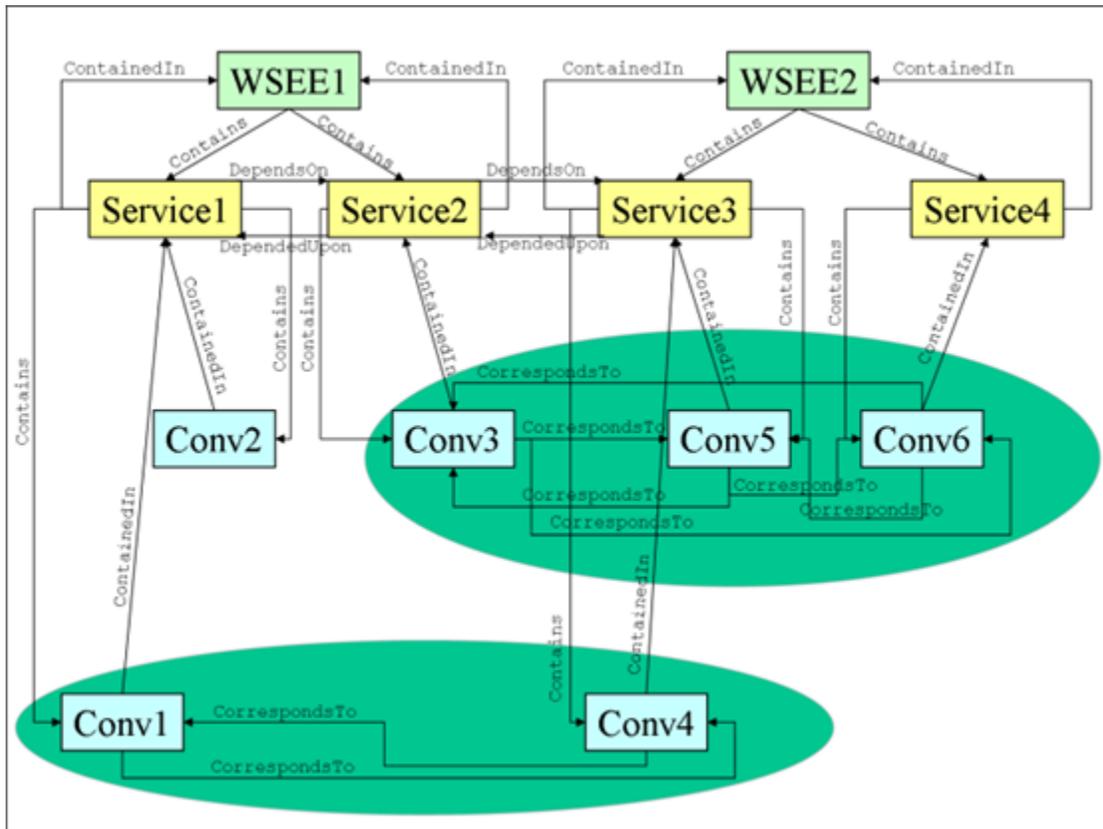
2.3 Compliance

Compliance with this specification includes compliance with all its normative parts and compliance with [\[WSMF-Foundation\]](#).

The whole document is normative unless otherwise noted. In case of discrepancy between the specification and the WSDL documents, the WSDL documents should prevail.

3. Overview

The following graphic represents as an example of the content of very simple ecosystem at a point in time, in which the three types of managed objects introduced by WSMF-WSM are present. The relationships represented on this graphic are explained in the next section. Note that the content of an ecosystem is likely to change over time as, for example, conversations appear and disappear.



In this example, we have two Web services execution environments (WSEE1 and WSEE2). WSEE1 contains two Web services, Service1 and Service2. WSEE2 contains two other Web services, Service3 and Service4. In this deployment, Service1 depends on Service2 to function and Service2 depends on Service3. A manager eager to understand the dependencies that affect Service1 would be able to discover them by asking Service1 for the Web services it depends on and recursively asking these Web services for the Web services they themselves depend on. In this case, the algorithm would quickly terminate and the manager would discover that Service1 depends on Service2 who depends on Service3 and that these are the only known dependencies affecting Service1.

Service1 contains two conversations, Conv1 and Conv2, meaning that Service1 is currently involved in two long-lived interactions with other Web services. One of these long-lived interactions involves Service3. The conversation managed object that represents Service1's view of this long-lived interaction is Conv1. The conversation managed object that represents Service3's view of this long-lived interaction is Conv4. Another, distinct, long-lived interaction currently in existence involves Service3, Service4 and Service5. The Web services' individual view of this interaction is represented by Conv3 (for Service2), Conv5 (for Service3) and Conv6 (for Service4). This example illustrates that a service can have multiple simultaneous conversations (as is the case for Service3) and that Web services can have conversations with Web services that are or are not contained in the same Web services execution environment.

The managed objects that compose this ecosystem have attributes attached to them (such as their state or, for a Web service, the number of conversations it has), operations (allowing to control and

monitor them) and they emit notifications that managers can subscribe to be informed of events that affect the resources represented by the managed objects. The rest of this document will describe in more details the attributes, operations and notifications that each type of managed object can provide.

4. Relations

WSMF-Foundation offers the concept of relationships linking managed objects. WSMF-WSM defines a set of relations corresponding to relationships that link together the managed objects defined by WSMF-WSM. This section lists these relations.

4.1 Relations defined by WSMF-WSM

The relations defined by WSMF-WSM are:

- <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/relations/contains/> : The containing object to indicate its relationship with a managed object it contains uses this relation.
- <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/relations/contained-in/> : An object contained by another to indicate its relationship with its container uses this relation.
- <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/relations/depends-on/> : An object that depends on another managed object to indicate its relation with the managed object on which it depends uses this relation.
- <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/relations/depended-upon/> : An object that is depended upon by another managed object to indicate its relationship with the dependent objects uses this relation.
- <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/relations/corresponds-to/> : An object to indicate a peer relationship with another managed object uses this relation.

4.2 Usage of the relations defined by WSMF-WSM

The relations defined by WSMF-WSM can be used to establish the following relationships between the managed objects defined by WSMF-WSM:

- **A WSExecutionEnvironment contains 0 to many Services** : This uses the <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/relations/contains/> relation and means that Web services are hosted inside the WSExecutionEnvironment and the WSExecutionEnvironment provides functionalities to the Web service. This relation implies that the WSExecutionEnvironment is depended upon (<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/relations/depended-upon/>) by the Web service.
- **A Service is contained in a WSExecutionEnvironment** : This uses the <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/relations/contained-in/> relation and means that the Web service is hosted in the WSExecutionEnvironment. This relation implies that the Web service depends on (<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/relations/depends-on/>) the WSExecutionEnvironment.
- **A Service depends on 0 to many Services** : This uses the <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/relations/depends-on/> relation and means that the dependant Web service relies on the other Web service to provide it with functionalities that are essential to its functioning. If the Web service that is depended upon is not able to perform properly this could signify that the dependant Web service will not be able to perform properly either.
- **A Service is depended upon by 0 to many Services** : This uses the <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/relations/depended-upon/>

relation and means that the other Web services are dependant on the Web service. See the reverse relation (a service depends on 0 to many services) for more info.

- **A Service contains 0 or more Conversations** : This uses the <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/relations/contains/> relation and means that the conversation is a representation of a set of correlated messages that the Web service exchanges with other Web services.
- **A Conversation is contained in a Service** : This uses the <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/relations/contained-in/> relation and means that the conversation represents a set of related messages that the Web service exchanges with other Web services.
- **A Conversation corresponds to one or more Conversations** : This uses the <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/relations/correspondsto/> relation and means that the two conversations have the same global unique ID. In other words, it means that if conversation 1 contained by Web service 1 corresponds to conversation 2 hosted by Web service 2 then all the messages that are included in conversation 1 and that either originate from or are sent to Web service 2 are also included in conversation 2 and that if there are no such message common to conversation 1 and conversation 2 then there are some other conversations that correspond to conversations 1 and 2 and that provide a string of corresponding conversations between them in which each element of the sequence is made of a correspondence relationship that includes at least one common message.

5. Web Service Managed Object

The `Service` managed object is used to manage a resource which is a Web service. A Web service is defined as a program whose interface is described by a WSDL document and which consumes and produces XML messages. In this definition, the service is not limited to a listener and can also initiate interactions. So, an application that sends XML messages compatible with a WSDL document can also be managed as a web service. This definition includes basic Web services such as a request/response invocation or a one-way message. It also includes long-lived, process-driven, reliable, secure business to business Web services. The `Service` managed object is the lowest common denominator for all software that behaves as a Web service. It is expected that more specialized managed objects will be created by extending the `Service` managed object to expose additional management capabilities when appropriate. For example, a process-driven Web service can expose management capabilities to return the number of instances of the Web service in each step of a flow. This kind of capability is not present in the `Service` managed object because it is not relevant to simple Web services.

Some examples of the management capabilities of the `Service` managed object allow the manager to retrieve the container of the Web service (if any is defined), the conversations that this Web service is participating in (see the section on the `Conversation` managed object) and performance information about the Web service.

It is also often natural to have a `Service` managed object implement the `Collection` management interface to allow centralized management of the `Conversation` managed objects contained in the `Service`, but this is in no way mandatory.

5.1 Discovery mechanism for Web services managed objects

WSMF-WSM provides a special requirement for managed objects that are intended to represent a Web service resource. In order to allow a user of a Web service to more easily retrieve the management interface for the Web service, a WSMF-WSM compliant `Service` managed object must allow for discovery of its implementation of the `ManagedObjectIdentity` interface by looking at its operational WSDL. More specifically, if a WSDL-described resource is managed through a WSMF-WSM-compliant managed object then the WSDL description of the resource MUST either include or import (through `wsdl:import` of the containing service) a port that implements the `ManagedObjectIdentity` interface (the only required interface in WSMF) for the managed object corresponding to the resource.

If a Web service is not WSMF-compliant, then this discovery method will not allow the invoker to

retrieve the URL of the management WSDL for this Web service. If a WSMF-compliant entity wishes to refer to a non-WSMF compliant Web service, it should at this point use the URL for the operation WSDL description for this Web service instead of the URL of the management WSDL for the Web service (which does not exist).

This mechanism is designed to allow Web services that interact with other Web services to get hold of the WSMF identity of these Web services, which WSMF defines as the URL of the management WSDL for the Web service (see the WSMF-Foundation specification for more details). This way, if Web service A uses Web service B to process the message it receives, Web service A is able to tell its manager, through WSMF that it depends on Web service B.

5.2 Service managed object interfaces

5.2.1 Service Configuration management interface

This interface extends `wsmf:ManagedObjectConfigurationInterface` from [\[WSMF-Foundation\]](#) and therefore all attributes and operations defined in the base interface also need to be provided if the service configuration management interface is provided.

5.2.1.1 OperationalWsdUrl Attribute

```
<wsm-ws:GetOperationalWsdUrl />

<wsm-ws:GetOperationalWsdUrlResponse>
  xs:anyURI
</wsm-ws:GetOperationalWsdUrlResponse>
```

- `wsm-ws:GetOperationalWsdUrl`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the URL of its operational WSDL. The response message MUST include the URL of the Web service's operational WSDL. This WSDL MUST contain the concrete binding for the Web service including the Web service and port elements.

- `wsm-ws:GetOperationalWsdUrlResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the operational WSDL URL of the Web service.

5.2.2 Service Monitoring management interface

This interface extends `wsmf:ManagedObjectMonitoringInterface` in [\[WSMF-Foundation\]](#) and therefore all attributes and operations defined in the base interface also need to be provided if the service monitoring management interface is provided.

5.2.2.1 Conversations Attribute

```
<wsm-ws:GetConversations />

<wsm-ws:GetConversationsResponse>
  <wsmf:EntityReferenceList>
    <wsmf:EntityReference>wsmf:EntityReferenceType</wsmf:EntityReference> *
  </wsmf:EntityReferenceList>
</wsm-ws:GetConversationsResponse>
```

- `wsm-ws:GetConversations`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the current set of conversations involving this Web service which are in progress. This attribute returns a subset of the values returned by the

Relationships attribute in the ManagedObject Discovery management interface. The value of the response is a list of EntityReference elements which each contain the information about the specific conversation managed object. The list may be empty which means the Web service is currently engaged in no conversation.

- `wsm-ws:GetConversationsResponse`

This element specifies the response message of a request/response pair of messages. It is received by a manager as an indication of a successful attempt to query for the conversations that a Web service is engaged in.

- `wsm-ws:GetConversationsResponse/wsmf:EntityReferenceList`

This element encapsulates the list of conversations returned. This element MAY be empty.

- `wsm-ws:GetConversationsResponse/wsmf:EntityReferenceList/wsmf:EntityReference`

This element specifies information about one conversation. The EntityReference type is described in [\[WSMF-Foundation\]](#). Zero or more occurrences of this element are allowed.

5.2.2.2 LastMessageReceived Attribute

```
<wsm-ws:GetLastMessageReceived />

<wsm-ws:GetLastMessageReceivedResponse>
  wsm:MessageType
</wsm-ws:GetLastMessageReceivedResponse>
```

- `wsm-ws:GetLastMessageReceived`

This element specifies the request message of a request/response pair of messages. It is sent by a manager to query the service for the last message received by the Web service through its operational interface (not its management interface).

- `wsm-ws:GetLastMessageReceivedResponse`

This element specifies the response message of a request/response pair of messages. It is received by a manager as an indication of a successful attempt to query for the last message received by a Web service through its operational interface. The Message type is defined by the WSMF-WSM specification and its associated [XSD document](#). It contains the SOAP envelope of the message sent as well as some transport information (origin, destination and date). It also allows additional elements to be added for further information, as appropriate.

5.2.2.3 LastMessageSent Attribute

```
<wsm-ws:GetLastMessageSent />

<wsm-ws:GetLastMessageSentResponse>
  wsm:MessageType
</wsm-ws:GetLastMessageSentResponse>
```

- `wsm-ws:GetLastMessageSent`

This element specifies the request message of a request/response pair of messages. It is sent by a manager to query the service for the last message sent by the Web service through its operational interface (not its management interface).

- `wsm-ws:GetLastMessageSentResponse`

This element specifies the response message of a request/response pair of messages. It is sent by a manager as an indication of a successful attempt to query for the last message sent by a Web service through its operational interface. The Message type is defined by the WSMF-WSM specification and its associated XSD document.

5.2.2.4 LastFaultMessageReceived Attribute

```

<wsm-ws:GetLastFaultMessageReceived />

<wsm-ws:GetLastFaultMessageReceivedResponse>
  wsm:MessageType
</wsm-ws:GetLastFaultMessageReceivedResponse>

```

- `wsm-ws:GetLastFaultMessageReceived`
This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the last fault message received by the Web service through its operational interface (not its management interface).
- `wsm-ws:GetLastFaultMessageReceivedResponse`
This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the last fault message received by a Web service through its operational interface. The Message type is defined by the WSMF-WSM specification and its associated XSD document.

5.2.2.5 LastFaultMessageSent Attribute

```

<wsm-ws:GetLastFaultMessageSent />

<wsm-ws:GetLastFaultMessageSentResponse>
  wsm:MessageType
</wsm-ws:GetLastFaultMessageSentResponse>

```

- `wsm-ws:GetLastFaultMessageSent`
This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the last fault message sent by the Web service through its operational interface (not its management interface).
- `wsm-ws:GetLastFaultMessageSentResponse`
This element specifies the response message of a request/response pair of messages. It is sent by a `manager` as an indication of a successful attempt to query for the last fault message sent by a Web service through its operational interface. The Message type is defined by the WSMF-WSM specification and its associated XSD document.

5.2.2.6 GetConversationByID operation

```

<wsm-ws:GetConversationByID />
  <wsmf-ws:ConversationId>xs:anyURI</wsmf-ws:conversationID>
</wsm-ws:GetConversationByID />

<wsm-ws:GetConversationByIDResponse />
  wsmf:EntityReferenceType
</wsm-ws:GetConversationByIDResponse />

```

- `wsm-ws:GetConversationByID`
This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for a specific conversation that the Web service is engaged in based on the global conversation ID of this conversation. For more information, see the `GlobalConversationID` attribute in the Conversation Monitoring management interface.
- `wsm-ws:GetConversationByIDResponse`
This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for a conversations that a Web service is engaged in based on the global conversation ID.
- `wsm-ws:GetConversationByIDResponse/wsmf:EntityReference`
This element specifies information about the conversation retrieved. The EntityReference type is

described in [\[WSMF-Foundation\]](#).

5.2.3 Service Discovery management interface

This interface extends `wsmf:ManagedObjectDiscoveryInterface` in [\[WSMF-Foundation\]](#) and therefore all attributes and operations defined in the base interface also need to be provided if the service discovery management interface is provided.

5.2.3.1 Container Attribute

```
<wsm-ws:GetContainer />

<wsm-ws:GetContainerResponse>
  wsmf:EntityType
</wsm-ws:GetContainerResponse>
```

- `wsm-ws:GetContainer`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the `WSExecutionEnvironment` managed object in which this Web service executes.

- `wsm-ws:GetContainerResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the container of the Web service. If this `Service` managed object is not aware of its container or does not have one, an empty response may be returned.

5.2.4 Service Performance management interface

5.2.4.1 TotalMessagesReceivedCount Attribute

```
<wsm-ws:GetTotalMessagesReceivedCount />

<wsm-ws:GetTotalMessagesReceivedCountResponse>
  xs:nonNegativeInteger
</wsm-ws:GetTotalMessagesReceivedCountResponse>
```

- `wsm-ws:GetTotalMessagesReceivedCount`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the total number of operational messages (as opposed to management-related messages) this Web service has received since the creation of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration` management interface.

- `wsm-ws:GetTotalMessagesReceivedCountResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the total number of operational messages received by the Web service.

5.2.4.2 TotalMessagesSentCount Attribute

```
<wsm-ws:GetTotalMessagesSentCount />

<wsm-ws:GetTotalMessagesSentCountResponse>
  xs:nonNegativeInteger
</wsm-ws:GetTotalMessagesSentCountResponse>
```

- `wsm-ws:GetTotalMessagesSentCount`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the total number of operational messages this Web service has sent since the creation of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the ManagedObject Configuration management interface.

- `wsm-ws:GetTotalMessagesSentCountResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the total number of operational messages sent by the Web service.

5.2.4.3 *FaultMessagesReceivedCount Attribute*

```
<wsm-ws:GetFaultMessagesReceivedCount />

<wsm-ws:GetFaultMessagesReceivedCountResponse>
  xs:nonNegativeInteger
</wsm-ws:GetFaultMessagesReceivedCountResponse>
```

- `wsm-ws:GetFaultMessagesReceivedCount`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the total number of operational fault messages this Web service has received since the creation of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the ManagedObject Configuration management interface.

- `wsm-ws:GetFaultMessagesReceivedCountResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the total number of operational fault messages received by the Web service.

5.2.4.4 *FaultMessagesSentCount Attribute*

```
<wsm-ws:GetFaultMessagesSentCount />

<wsm-ws:GetFaultMessagesSentCountResponse>
  xs:nonNegativeInteger
</wsm-ws:GetFaultMessagesSentCountResponse>
```

- `wsm-ws:GetFaultMessagesSentCount`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the total number of operational fault messages this Web service has sent since the creation of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the ManagedObject Configuration management interface.

- `wsm-ws:FaultMessagesSentCountResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the total number of operational fault messages sent by the Web service.

5.2.4.5 *SuccessMessagesReceivedCount Attribute*

```
<wsm-ws:GetSuccessMessagesReceivedCount />

<wsm-ws:GetSuccessMessagesReceivedCountResponse>
  xs:nonNegativeInteger
</wsm-ws:GetSuccessMessagesReceivedCountResponse>
```

- `wsm-ws:GetSuccessMessagesReceivedCount`

This element specifies the request message of a request/response pair of messages. It is sent by a *manager* to query the *service* for the total number of operational non-fault messages this Web service has received since the creation of the managed object. Its creation date and time is indicated by the *CreatedOn* attribute in the *ManagedObject Configuration management interface*.

- `wsm-ws:GetSuccessMessagesReceivedCountResponse`

This element specifies the response message of a request/response pair of messages. It is received by a *manager* as an indication of a successful attempt to query for the total number of operational non-fault messages received by the Web service.

5.2.4.6 *SuccessMessagesSentCount Attribute*

```
<wsm-ws:GetSuccessMessagesSentCount />
<wsm-ws:GetSuccessMessagesSentCountResponse>
  xs:nonNegativeInteger
</wsm-ws:GetSuccessMessagesSentCountResponse>
```

- `wsm-ws:GetSuccessMessagesSentCount`

This element specifies the request message of a request/response pair of messages. It is sent by a *manager* to query the *service* for the total number of operational non-fault messages this Web service has sent since the creation of the managed object. Its creation date and time is indicated by the *CreatedOn* attribute in the *ManagedObject Configuration management interface*.

- `wsm-ws:GetSuccessMessagesSentCountResponse`

This element specifies the response message of a request/response pair of messages. It is received by a *manager* as an indication of a successful attempt to query for the total number of operational non-fault messages sent by the Web service.

5.2.4.7 *TotalMaximumResponseTime Attribute*

```
<wsm-ws:GetTotalMaximumResponseTime />
<wsm-ws:GetTotalMaximumResponseTimeResponse>
  xs:nonNegativeInteger
</wsm-ws:GetTotalMaximumResponseTimeResponse>
```

- `wsm-ws:GetTotalMaximumResponseTime`

This element specifies the request message of a request/response pair of messages. It is sent by a *manager* to query the *service* for the maximum number of milliseconds that operational requests executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the *CreatedOn* attribute in the *ManagedObject Configuration management interface*. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations.

- `wsm-ws:GetTotalMaximumResponseTimeResponse`

This element specifies the response message of a request/response pair of messages. It is received by a *manager* as an indication of a successful attempt to query for the maximum number of milliseconds that operational requests executed before returning a response.

5.2.4.8 *TotalMinimumResponseTime Attribute*

```
<wsm-ws:GetTotalMinimumResponseTime />
```

```
<wsm-ws:GetTotalMinimumResponseTimeResponse>
  xs:nonNegativeInteger
</wsm-ws:GetTotalMinimumResponseTimeResponse>
```

- `wsm-ws:GetTotalMinimumResponseTime`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the minimum number of milliseconds that operational requests executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration management interface`. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations.

- `wsm-ws:GetTotalMinimumResponseTimeResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the minimum number of milliseconds that operational requests executed before returning a response.

5.2.4.9 *TotalCumulativeResponseTime Attribute*

```
<wsm-ws:GetTotalCumulativeResponseTime />

<wsm-ws:GetTotalCumulativeResponseTimeResponse>
  xs:nonNegativeInteger
</wsm-ws:GetTotalCumulativeResponseTimeResponse>
```

- `wsm-ws:GetTotalCumulativeResponseTime`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the cumulative number of milliseconds that operational requests executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration management interface`. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations.

Among other things, this attribute (and the other "cumulative response time" attributes) is useful to allow the calculation of average response times during any interval. For example, if the manager wants to know the average response time between two times t_1 and t_2 (as opposed to since the creation of the managed object) it can proceed in the following way: At time t_1 , request the cumulative response time (crt_1) and the total count of incoming messages (n_1). At time t_2 , request the cumulative response time (crt_2) and the total count of incoming messages (n_2). The average processing time between t_1 and t_2 is then calculated as $(crt_2 - crt_1) / (n_2 - n_1)$. This assumes that all operations are request-response operations. If such is not the case, the above method doesn't work as one-way operations will be counted in the number of incoming messages but not in the cumulative response time. In this situation, the manager has to apply the same method at the level of the specific operations it is interested in, using the service operation performance management interface.

- `wsm-ws:GetTotalCumulativeResponseTimeResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the cumulative

number of milliseconds that operational requests executed before returning a response.

5.2.4.10 *SuccessMaximumResponseTime Attribute*

```
<wsm-ws:GetSuccessMaximumResponseTime />

<wsm-ws:GetSuccessMaximumResponseTimeResponse>
  xs:nonNegativeInteger
</wsm-ws:GetSuccessMaximumResponseTimeResponse>
```

- `wsm-ws:GetSuccessMaximumResponseTime`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the maximum number of milliseconds that successful operational requests (defined as requests that did not result in a fault message being generated) executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration` management interface. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations.

- `wsm-ws:GetSuccessMaximumResponseTimeResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the maximum number of milliseconds that successful operational requests executed before returning a response.

5.2.4.11 *SuccessMinimumResponseTime Attribute*

```
<wsm-ws:GetSuccessMinimumResponseTime />

<wsm-ws:GetSuccessMinimumResponseTimeResponse>
  xs:nonNegativeInteger
</wsm-ws:GetSuccessMinimumResponseTimeResponse>
```

- `wsm-ws:GetSuccessMinimumResponseTime`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the minimum number of milliseconds that successful operational requests (defined as requests that did not result in a fault message being generated) executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration` management interface. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations.

- `wsm-ws:GetSuccessMinimumResponseTimeResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the minimum number of milliseconds that successful operational requests executed before returning a response.

5.2.4.12 *SuccessCumulativeResponseTime Attribute*

```

<wsm-ws:GetSuccessCumulativeResponseTime />

<wsm-ws:GetSuccessCumulativeResponseTimeResponse>
  xs:nonNegativeInteger
</wsm-ws:GetSuccessCumulativeResponseTimeResponse>

```

- `wsm-ws:GetSuccessCumulativeResponseTime`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the cumulative number of milliseconds that successful operational requests (defined as requests that did not result in a fault message being generated) executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration` management interface. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations.

- `wsm-ws:GetSuccessCumulativeResponseTimeResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the cumulative number of milliseconds that successful operational requests executed before returning a response.

5.2.4.13 *FailedMaximumResponseTime Attribute*

```

<wsm-ws:GetFailedMaximumResponseTime />

<wsm-ws:GetFailedMaximumResponseTimeResponse>
  xs:nonNegativeInteger
</wsm-ws:GetFailedMaximumResponseTimeResponse>

```

- `wsm-ws:GetFailedMaximumResponseTime`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the maximum number of milliseconds that failed operational requests (defined as requests that resulted in a fault message being generated) executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration` management interface. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations.

- `wsm-ws:GetFailedMaximumResponseTimeResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the maximum number of milliseconds that failed operational requests executed before returning a response.

5.2.4.14 *FailedMinimumResponseTime Attribute*

```

<wsm-ws:GetFailedMinimumResponseTime />

<wsm-ws:GetFailedMinimumResponseTimeResponse>
  xs:nonNegativeInteger

```

```
</wsm-ws:GetFailedMinimumResponseTimeResponse>
```

- `wsm-ws:GetFailedMinimumResponseTime`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the minimum number of milliseconds that failed operational requests (defined as requests that resulted in a fault message being generated) executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the ManagedObject Configuration management interface. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations.

- `wsm-ws:GetFailedMinimumResponseTimeResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the minimum number of milliseconds that failed operational requests executed before returning a response.

5.2.4.15 FailedCumulativeResponseTime Attribute

```
<wsm-ws:GetFailedCumulativeResponseTime />
<wsm-ws:GetFailedCumulativeResponseTimeResponse>
  xs:nonNegativeInteger
</wsm-ws:GetFailedCumulativeResponseTimeResponse>
```

- `wsm-ws:GetFailedCumulativeResponseTime`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the cumulative number of milliseconds that failed operational requests (defined as requests that resulted in a fault message being generated) executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the ManagedObject Configuration management interface. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations.

- `wsm-ws:GetFailedCumulativeResponseTimeResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the cumulative number of milliseconds that failed operational requests executed before returning a response.

5.2.5 Service Operation Performance management interface

5.2.5.1 GetTotalMessagesReceivedCountForOperation Operation

```
<wsm-ws:GetTotalMessagesReceivedCountForOperation >
  xs:QName
</wsm-ws:GetTotalMessagesReceivedCountForOperation>
<wsm-ws:GetTotalMessagesReceivedCountForOperationResponse>
  xs:nonNegativeInteger
</wsm-ws:GetTotalMessagesReceivedCountForOperationResponse>
```

- `wsm-ws:GetTotalMessagesReceivedCountForOperation`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the total number of operational messages this Web service has received for a particular operation since the creation of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration` management interface. The operation is identified by its QName.

- `wsm-ws:GetTotalMessagesReceivedCountForOperationResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the total number of operational messages received by the Web service for a particular operation.

5.2.5.2 *GetTotalMessagesSentCountForOperation Operation*

```
<wsm-ws:GetTotalMessagesSentCountForOperation >
  xs:QName
</wsm-ws:GetTotalMessagesSentCountForOperation>

<wsm-ws:GetTotalMessagesSentCountForOperationResponse>
  xs:nonNegativeInteger
</wsm-ws:GetTotalMessagesSentCountForOperationResponse>
```

- `wsm-ws:GetTotalMessagesSentCountForOperation`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the total number of operational messages this Web service has sent as a response to a request for a particular operation since the creation of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration` management interface. The operation is identified by its QName.

- `wsm-ws:GetTotalMessagesSentCountForOperationResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the total number of operational messages sent by the Web service as a response to a request for a particular operation.

5.2.5.3 *GetFaultMessagesReceivedCountForOperation Operation*

```
<wsm-ws:GetFaultMessagesReceivedCountForOperation >
  xs:QName
</wsm-ws:GetFaultMessagesReceivedCountForOperation>

<wsm-ws:GetFaultMessagesReceivedCountForOperationResponse>
  xs:nonNegativeInteger
</wsm-ws:GetFaultMessagesReceivedCountForOperationResponse>
```

- `wsm-ws:GetFaultMessagesReceivedCountForOperation`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the total number of operational fault messages this Web service has received for a particular operation since the creation of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration` management interface. The operation is identified by its QName.

- `wsm-ws:GetFaultMessagesReceivedCountForOperationResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the total number of operational fault messages received by the Web service for a particular operation.

5.2.5.4 *GetFaultMessagesSentCountForOperation Operation*

```

<wsm-ws:GetFaultMessagesSentCountForOperation >
  xs:QName
</wsm-ws:GetFaultMessagesSentCountForOperation>

<wsm-ws:GetFaultMessagesSentCountForOperationResponse>
  xs:nonNegativeInteger
</wsm-ws:GetFaultMessagesSentCountForOperationResponse>

```

- `wsm-ws:GetFaultMessagesSentCountForOperation`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the total number of operational fault messages this Web service has sent as a response to a request for a particular operation since the creation of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration management interface`. The operation is identified by its `QName`.

- `wsm-ws:GetFaultMessagesSentCountForOperationResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the total number of operational fault messages sent by the Web service as a response to a request for a particular operation.

5.2.5.5 *GetSuccessMessagesReceivedCountForOperation Operation*

```

<wsm-ws:GetSuccessMessagesReceivedCountForOperation >
  xs:QName
</wsm-ws:GetSuccessMessagesReceivedCountForOperation>

<wsm-ws:GetSuccessMessagesReceivedCountForOperationResponse>
  xs:nonNegativeInteger
</wsm-ws:GetSuccessMessagesReceivedCountForOperationResponse>

```

- `wsm-ws:GetSuccessMessagesReceivedCountForOperation`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the total number of operational non-fault messages this Web service has received for a particular operation since the creation of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration management interface`. The operation is identified by its `QName`.

- `wsm-ws:GetSuccessMessagesReceivedCountForOperationResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the total number of operational non-fault messages received by the Web service for a particular operation.

5.2.5.6 *GetSuccessMessagesSentCountForOperation Operation*

```

<wsm-ws:GetSuccessMessagesSentCountForOperation >
  xs:QName
</wsm-ws:GetSuccessMessagesSentCountForOperation>

<wsm-ws:GetSuccessMessagesSentCountForOperationResponse>
  xs:nonNegativeInteger
</wsm-ws:GetSuccessMessagesSentCountForOperationResponse>

```

- `wsm-ws:GetSuccessMessagesSentCountForOperation`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the total number of operational non-fault messages this Web service has sent as a response to a request for a particular operation since the creation of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration management interface`. The operation is identified by its `QName`.

- `wsm-ws:GetSuccessMessagesSentCountForOperationResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the total number of operational non-fault messages sent by the Web service as a response for a request for a particular operation.

5.2.5.7 *GetTotalMaximumResponseTimeForOperation Operation*

```
<wsm-ws:GetTotalMaximumResponseTimeForOperation >
  xs:QName
</wsm-ws:GetTotalMaximumResponseTimeForOperation>

<wsm-ws:GetTotalMaximumResponseTimeForOperationResponse>
  xs:nonNegativeInteger
</wsm-ws:GetTotalMaximumResponseTimeForOperationResponse>
```

- `wsm-ws:GetTotalMaximumResponseTimeForOperation`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the maximum number of milliseconds that operational requests for a specific operation executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration` management interface. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations. The operation is identified by its QName.

- `wsm-ws:GetTotalMaximumResponseTimeResponseForOperation`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the maximum number of milliseconds that operational requests for a specific operation executed before returning a response.

5.2.5.8 *GetTotalMinimumResponseTimeForOperation Operation*

```
<wsm-ws:GetTotalMinimumResponseTimeForOperation >
  xs:QName
</wsm-ws:GetTotalMinimumResponseTimeForOperation>

<wsm-ws:GetTotalMinimumResponseTimeForOperationResponse>
  xs:nonNegativeInteger
</wsm-ws:GetTotalMinimumResponseTimeForOperationResponse>
```

- `wsm-ws:GetTotalMinimumResponseTimeForOperation`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the minimum number of milliseconds that operational requests for a specific operation executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration` management interface. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations. The operation is identified by its QName.

- `wsm-ws:GetTotalMinimumResponseTimeForOperationResponse`

This element specifies the response message of a request/response pair of messages. It is

received by a `manager` as an indication of a successful attempt to query for the minimum number of milliseconds that operational requests for a specific operation executed before returning a response.

5.2.5.9 *GetTotalCumulativeResponseTimeForOperation Operation*

```
<wsm-ws:GetTotalCumulativeResponseTime >
  xs:QName
</wsm-ws:GetTotalCumulativeResponseTime>

<wsm-ws:GetTotalCumulativeResponseTimeResponse>
  xs:nonNegativeInteger
</wsm-ws:GetTotalCumulativeResponseTimeResponse>
```

- `wsm-ws:GetTotalCumulativeResponseTimeForOperation`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the cumulative number of milliseconds that operational requests for a specific operation executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration` management interface. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations. The operation is identified by its QName.

- `wsm-ws:GetTotalCumulativeResponseTimeForOperationResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the cumulative number of milliseconds that operational requests for a specific operation executed before returning a response.

5.2.5.10 *GetSuccessMaximumResponseTimeForOperation Operation*

```
<wsm-ws:GetSuccessMaximumResponseTimeForOperation >
  xs:QName
</wsm-ws:GetSuccessMaximumResponseTimeForOperation>

<wsm-ws:GetSuccessMaximumResponseTimeForOperationResponse>
  xs:nonNegativeInteger
</wsm-ws:GetSuccessMaximumResponseTimeForOperationResponse>
```

- `wsm-ws:GetSuccessMaximumResponseTimeForOperation`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the maximum number of milliseconds that successful operational requests (defined as requests that did not result in a fault message being generated) for a specific operation executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration` management interface. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations. The operation is identified by its QName.

- `wsm-ws:GetSuccessMaximumResponseTimeResponseForOperation`

This element specifies the response message of a request/response pair of messages. It is

received by a `manager` as an indication of a successful attempt to query for the maximum number of milliseconds that successful operational requests for a specific operation executed before returning a response.

5.2.5.11 *GetSuccessMinimumResponseTimeForOperation Operation*

```
<wsm-ws:GetSuccessMinimumResponseTimeForOperation >
  xs:QName
</wsm-ws:GetSuccessMinimumResponseTimeForOperation>

<wsm-ws:GetSuccessMinimumResponseTimeForOperationResponse>
  xs:nonNegativeInteger
</wsm-ws:GetSuccessMinimumResponseTimeForOperationResponse>
```

- `wsm-ws:GetSuccessMinimumResponseTimeForOperation`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the minimum number of milliseconds that successful operational requests (defined as requests that did not result in a fault message being generated) for a specific operation executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration` management interface. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations. The operation is identified by its QName.

- `wsm-ws:GetSuccessMinimumResponseTimeForOperationResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the minimum number of milliseconds that successful operational requests for a specific operation executed before returning a response.

5.2.5.12 *GetSuccessCumulativeResponseTimeForOperation Operation*

```
<wsm-ws:GetSuccessCumulativeResponseTime >
  xs:QName
</wsm-ws:GetSuccessCumulativeResponseTime>

<wsm-ws:GetSuccessCumulativeResponseTimeResponse>
  xs:nonNegativeInteger
</wsm-ws:GetSuccessCumulativeResponseTimeResponse>
```

- `wsm-ws:GetSuccessCumulativeResponseTimeForOperation`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the cumulative number of milliseconds that successful operational requests (defined as requests that did not result in a fault message being generated) for a specific operation executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration` management interface. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations. The operation is identified by its QName.

- `wsm-ws:GetSuccessCumulativeResponseTimeForOperationResponse`

This element specifies the response message of a request/response pair of messages. It is

received by a `manager` as an indication of a successful attempt to query for the cumulative number of milliseconds that successful operational requests for a specific operation executed before returning a response.

5.2.5.13 *GetFaultMaximumResponseTimeForOperation Operation*

```
<wsm-ws:GetFaultMaximumResponseTimeForOperation >
  xs:QName
</wsm-ws:GetFaultMaximumResponseTimeForOperation>

<wsm-ws:GetFaultMaximumResponseTimeForOperationResponse>
  xs:nonNegativeInteger
</wsm-ws:GetFaultMaximumResponseTimeForOperationResponse>
```

- `wsm-ws:GetFaultMaximumResponseTimeForOperation`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the maximum number of milliseconds that failed operational requests (defined as requests that resulted in a fault message being generated) for a specific operation executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration` management interface. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations. The operation is identified by its QName.

- `wsm-ws:GetFaultMaximumResponseTimeForOperationResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the maximum number of milliseconds that failed operational requests for a specific operation executed before returning a response.

5.2.5.14 *GetFaultMinimumResponseTime Operation*

```
<wsm-ws:GetFaultMinimumResponseTimeForOperation >
  xs:QName
</wsm-ws:GetFaultMinimumResponseTimeForOperation>

<wsm-ws:GetFaultMinimumResponseTimeForOperationResponse>
  xs:nonNegativeInteger
</wsm-ws:GetFaultMinimumResponseTimeForOperationResponse>
```

- `wsm-ws:GetFaultMinimumResponseTimeForOperation`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the minimum number of milliseconds that failed operational requests (defined as requests that resulted in a fault message being generated) for a specific operation executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration` management interface. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations. The operation is identified by its QName.

- `wsm-ws:GetFaultMinimumResponseTimeForOperationResponse`

This element specifies the response message of a request/response pair of messages. It is

received by a `manager` as an indication of a successful attempt to query for the minimum number of milliseconds that failed operational requests for a specific operation executed before returning a response.

5.2.5.15 *GetFaultCumulativeResponseTimeForOperation Operation*

```
<wsm-ws:GetFaultCumulativeResponseTimeForOperation />
  xs:QName
</wsm-ws:GetFaultCumulativeResponseTimeForOperation>

<wsm-ws:GetFaultCumulativeResponseTimeForOperationResponse>
  xs:nonNegativeInteger
</wsm-ws:GetFaultCumulativeResponseTimeForOperationResponse>
```

- `wsm-ws:GetFaultCumulativeResponseTimeForOperation`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `service` for the cumulative number of milliseconds that failed operational requests (defined as requests that resulted in a fault message being generated) for a specific operation executed before returning a response since the creation time of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration management interface`. For this and all other time attributes in this interface, it is important to note that if a request is an asynchronous request to initiate a long-running operation, the Web service may send a response before the operation is actually complete. The response time will be from the time the request is received to the point at which the response is sent even though the operation may still be executing. This attribute only includes in its calculation request/response type of operations as no response time can be calculated for one-way operations. The operation is identified by its QName.

- `wsm-ws:GetFaultCumulativeResponseTimeForOperationResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the cumulative number of milliseconds that failed operational requests for a specific operation executed before returning a response.

5.2.6 Service Control management interface

This interface extends `wsmf:ManagedObjectControlInterface` in [\[WSMF-Foundation\]](#) and therefore all attributes and operations defined in the base interface also need to be provided if the service control management interface is provided.

5.2.6.1 *Start operation*

```
<wsm-ws:Start />
<wsm-ws:StartResponse />
```

- `wsm-ws:Start`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to instruct the `service` to start the Web service. If the Web service is already running, no additional action is required. Once started, a Web service should be able to receive all operational requests that it supports. State attribute **MUST** be updated before responding to this request.

- `wsm-ws:StartResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to start the Web service.

5.2.6.2 *Stop operation*

```
<wsm-ws:Stop />
<wsm-ws:StopResponse />
```

- `wsm-ws:Stop`
This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to instruct the `service` to stop the Web service. If the Web service is already stopped, no additional action is required. Once stopped, a Web service should not serve any operational request. Stopping the Web service does not prevent the managed object from serving management requests. State attribute **MUST** be updated before responding to this request.
- `wsm-ws:StopResponse`
This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to stop the Web service.

5.2.7 State values

The WSMF-Foundation specification defines three states:

- <http://devresource.hp.com/drc/specifications/wsmf/2003/07/managedobject/state/up/> (referred as UP in the rest of this document)
- <http://devresource.hp.com/drc/specifications/wsmf/2003/07/managedobject/state/down/> (referred as DOWN in the rest of this document)
- <http://devresource.hp.com/drc/specifications/wsmf/2003/07/managedobject/state/unknown/> (referred as UNKNOWN in the rest of this document)

[\[WSMF-Foundation\]](#) specifies that applications of WSMF-Foundation, such as the present specification, **SHOULD** define values for sub-state appropriate to the managed objects and the domain. This specification defines the following sub-states for the `Service` managed object. Many of these sub-states are derived from the [\[MTF-lifecycle\]](#) document created in the W3C WS-Arch working group.

- <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/service/state/busy/> This is the value of State returned when the underlying Web service resource is currently processing operational requests. This sub-state is a sub-state of the UP state.
- <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/service/state/idle/> This is the value of State returned when the underlying Web service resource is currently not processing any operational request. This sub-state is a sub-state of the UP state.
- <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/service/state/stopped/> This is the value of State returned when the underlying Web service resource was intentionally stopped. This sub-state is a sub-state of the DOWN state.
- <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/service/state/crashed/> This is the value of State returned when the underlying Web service resource is unavailable because of an internal malfunction. This sub-state is a sub-state of the DOWN state.
- <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/service/state/saturated/> This is the value of State returned when the underlying Web service resource has exhausted external resources that it depends on. This sub-state is a sub-state of the DOWN state.

5.2.8 Event types

As defined in [\[WSMF-Foundation\]](#), WSMF-WSM uses [\[WSEvents\]](#) to provide notifications when events occur that impact the resource represented by the managed object. If a `Service` managed object supports notifications, it **MUST** support the notifications listed for managed objects in [\[WSMF-Foundation\]](#) (e.g. StateChanged, AttributeModified, etc...). It **MUST** also support the notifications

defined specifically for *Service* managed objects, listed in this section. The normative schema for these notifications can be found in the [WSMF-WSM XSD document](#).

5.2.8.1 Started

<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/service/event/started/>

This event indicates that the Web service has transitioned from a DOWN state (i.e. the DOWN state itself or a sub-state of the DOWN state) to an UP state (i.e. the UP state itself or a sub-state of the UP state). The format of the notification is shown in the following non-normative grammar:

```
<wsm:ServiceStartedNotification>
  <!-- evt:NotificationType elements and attributes -->
  <wsm:StartTime>xs:dateTime</wsm:StartTime>
  <!-- extension elements --> *
</wsm:ServiceStartedNotification>
```

- *wsm:ServiceStartedNotification*

This type MAY be used wherever a Notification element may appear, as defined by [WSEvents](#). It is generated by a *managed object* when the resource has transitioned from a DOWN state to an UP state. This element is of type `wsm:ServiceStartedNotificationType`

- *wsm:ServiceStartedNotification/wsm:StartTime*

The starting time of the resource. It doesn't have to be the same as the `evt:CreatedOn` which represents the creation time of the notification.

5.2.8.2 Stopped

<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/service/event/stopped/>

This event indicates that the Web service has transitioned from an UP state (i.e. the UP state itself or a sub-state of the UP state) to a DOWN state (i.e. the DOWN state itself or a sub-state of the DOWN state). The format of the notification is shown in the following non-normative grammar:

```
<wsm:ServiceStoppedNotification>
  <!-- evt:NotificationType elements and attributes -->
  <wsm:StopTime>xs:dateTime</wsm:StopTime>
  <!-- extension elements --> *
</wsm:ServiceStoppedNotification>
```

- *wsm:ServiceStoppedNotification*

This type MAY be used wherever a Notification element may appear, as defined by [WSEvents](#). It is generated by a *managed object* when the resource has transitioned from an UP state to a DOWN state. This element is of type `wsm:ServiceStoppedNotificationType`

- *wsm:ServiceStoppedNotification/wsm:StopTime*

The stopping time of the resource. It doesn't have to be the same as the `evt:CreatedOn` which represents the creation time of the notification.

5.2.8.3 Conversation Added

<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/service/event/conversation-added/>

This event indicates that the Web service has engaged in a new long-lived interaction with other Web services for which its *Service* managed object has created a corresponding *Conversation* managed object.

```
<wsm:ServiceConversationAddedNotification>
  <!-- evt:NotificationType elements and attributes -->
  <wsmf:EntityReference>wsmf:EntityReferenceType</wsmf:EntityReference>
  <!-- extension elements --> *
</wsm:ServiceConversationAddedNotification>
```

- *wsm:ServiceConversationAddedNotification*

This type MAY be used wherever a Notification element may appear, as defined by [WSEvents]. It is generated by a *managed object* when the Web service it represents has entered a new long-lived interaction. This element is of type `wsm:ServiceConversationAddedNotificationType`

- *wsm:ServiceConversationAddedNotification/wsmf:EntityReference*

This element is of type `EntityReferenceType` as defined by [WSMF-Foundation] and specifies the newly added `Conversation` managed object. The `referenceType` attribute of this `EntityReference` MUST be set to `ManagedObject`.

5.2.8.4 Conversation Removed

<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/service/event/conversation-removed/>

This event indicates that the Web service has terminated its engagement in a new long-lived interaction with other Web services for which its `Service` managed object had created a corresponding `Conversation` managed object.

```
<wsm:ServiceConversationRemovedNotification>
  <!-- evt:NotificationType elements and attributes -->
  <wsmf:EntityReference>wsmf:EntityReferenceType</wsmf:EntityReference>
  <!-- extension elements --> *
</wsm:ServiceConversationRemovedNotification>
```

- *wsm:ServiceConversationRemovedNotification*

This type MAY be used wherever a Notification element may appear, as defined by [WSEvents]. It is generated by a *managed object* when the Web service it represents has ended its participation in a long-lived interaction. This element is of type `wsm:ServiceConversationRemovedNotificationType`.

- *wsm:ServiceConversationRemovedNotification/wsmf:EntityReference*

This element is of type `EntityReferenceType` as defined by [WSMF-Foundation] and specifies the `Conversation` managed object that was just removed. The `referenceType` attribute of this `EntityReference` MUST be set to `ManagedObject`. Since the long-lived interaction that this `Conversation` managed object was representing has ended, the managed object will not be available anymore to service management requests.

6. WSExecutionEnvironment Managed Object

The `WSExecutionEnvironment` managed object is used to manage a resource which is a Web services execution environment, defined as any software entity which hosts Web services and provides useful features to enable Web services to perform their tasks. This could be a simple SOAP container or it could be an advanced B2B engine that supports Web services.

Even though a `WSExecutionEnvironment` is generally not visible to the invokers of a Web service, exposing it as a managed object is useful in many scenarios, such as to facilitate discovery of services and conversations. Web services execution environments tend to be more static and it is easier for an administrator to keep a listing of `WSExecutionEnvironment` managed objects to monitor than a list of Web services. It might also allow to drill-down in order to troubleshoot malfunctioning Web services.

It is also often natural to have a `Service` managed object implement the `Collection` management interface to allow centralized management of the `Conversation` managed objects contained in the `Service`, but this is in no way mandatory.

6.1 WSExecutionEnvironment managed object interfaces

6.1.1 WSExecutionEnvironment Configuration management interface

This interface extends `wsmf:ManagedObjectConfigurationInterface` in [\[WSMF-Foundation\]](#) and therefore all attributes and operations defined in the base interface also need to be provided if the WSEE configuration management interface is provided.

6.1.1.1 ConfigurationUrl Attribute

```
<wsm-wsee:GetConfigurationUrl />

<wsm-wsee:GetConfigurationUrlResponse>
  xs:anyURI
</wsm-wsee:GetConfigurationUrlResponse>
```

- `wsm-wsee:GetConfigurationUrl`
This element specifies the request message of a request/response pair of messages. It is sent by a manager to query the Web services execution environment for the URL of its configuration information. The response message MUST include the URL of the Web services execution environment's configuration information. The format of this information is not specified by WSMF-WSM.
- `wsm-wsee:GetConfigurationUrlResponse`
This element specifies the response message of a request/response pair of messages. It is received by a manager as an indication of a successful attempt to query for the URL of the configuration information of a Web services execution environment.

6.1.2 WSExecutionEnvironment Monitoring management interface

This interface extends `wsmf:ManagedObjectMonitoringInterface` in [\[WSMF-Foundation\]](#) and therefore all attributes and operations defined in the base interface also need to be provided if the WSEE monitoring management interface is provided.

6.1.2.1 Services Attribute

```
<wsm-wsee:GetServices />

<wsm-wsee:GetServicesResponse>
  <wsmf:EntityReferenceList>
    <wsmf:EntityReference>wsmf:EntityReferenceType</wsmf:EntityReference> *
  </wsmf:EntityReferenceList>
</wsm-wsee:GetServicesResponse>
```

- `wsm-wsee:GetServices`
This element specifies the request message of a request/response pair of messages. It is sent by a manager to query the Web services execution environment for the list of service managed object contained by this Web services execution environment. Since it might be a security issue, it is up to the implementer as to whether all Web services actually running in the environment are returned to this particular requester. This attribute returns a subset of the values returned by the Relationships attribute in the ManagedObject interface.
- `wsm-wsee:GetServicesResponse`
This element specifies the response message of a request/response pair of messages. It is received by a manager as an indication of a successful attempt to query for the services contained in the Web services execution environment.
- `wsm-wsee:GetServicesResponse/wsmf:EntityReferenceList`
This element encapsulates the list of services returned. This element MAY be empty.
- `wsm-wsee:GetServicesResponse/wsmf:EntityReferenceList/wsmf:EntityReference`
This element specifies information about one service. The EntityReference type is described in [\[WSMF-Foundation\]](#). Zero or more occurrences of this element are allowed.

6.1.3 WSEExecutionEnvironment Control management interface

This interface extends `wsmf:ManagedObjectControlInterface` in [\[WSMF-Foundation\]](#) and therefore all attributes and operations defined in the base interface also need to be provided if the WSEE control management interface is provided.

6.1.3.1 Start operation

```
<wsm-wsee:Start />
<wsm-wsee:StartResponse />
```

- `wsm-wsee:Start`
This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to instruct the `Web services execution environment` to start the execution environment. If the execution environment is already running, no additional action is required. State attribute **MUST** be updated before responding to this request.
- `wsm-wsee:StartResponse`
This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to start the execution environment.

6.1.3.2 Stop operation

```
<wsm-wsee:Stop />
<wsm-wsee:StopResponse />
```

- `wsm-wsee:Stop`
This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to instruct the `Web services execution environment` to stop the execution environment. If the execution environment is already stopped, no additional action is required. State attribute **MUST** be updated before responding to this request.
- `wsm-wsee:StopResponse`
This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to stop the Web service.

6.1.4 State values

WSMF-WSM defines the following sub-states of states UP and DOWN for Web services execution environment type of resources:

- <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/service/state/starting/>
This is the value of State returned when the underlying resource is in the process of transitioning from the DOWN state or a sub-state of the DOWN state to the UP state a sub-state of the UP state. Some resources transition so quickly that this sub-state will never be returned. This sub-state is a sub-state of the DOWN state.
- <http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/service/state/stopping/>
This is the value of State returned when the underlying resource is in the process of transitioning from the UP state or a sub-state of the UP state to the DOWN state a sub-state of the DOWN state. Some resources transition so quickly that this sub-state will never be returned. This sub-state is a sub-state of the DOWN state.

6.1.5 Event types

As defined in [\[WSMF-Foundation\]](#), WSMF-WSM uses [\[WSEvents\]](#) to provide notifications when events occur that impact the resource represented by the managed object. If a `WSExecutionEnvironment` managed object supports notifications, it MUST support the notifications listed for managed objects in [\[WSMF-Foundation\]](#) (e.g. `StateChanged`, `AttributeModified`, etc...). It MUST also support the notifications defined specifically for `WSExecutionEnvironment` managed objects, listed in this section. The normative schema for these notifications can be found in the [WSMF-WSM XSD document](#).

6.1.5.1 Started

<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/wsee/event/started/>

This event indicates that the Web service execution environment has transitioned from a DOWN state (i.e. the DOWN state itself or a sub-state of the DOWN state) to an UP state (i.e. the UP state itself or a sub-state of the UP state). The format of the notification is shown in the following non-normative grammar:

```
<wsm:WSEESTartedNotification>
  <!-- evt:NotificationType elements and attributes -->
  <wsm:StartTime>xs:dateTime</wsm:StartTime>
  <!-- extension elements --> *
</wsm:WSEESTartedNotification>
```

- *wsm:WSEESTartedNotification*

This type MAY be used wherever a Notification element may appear, as defined by [\[WSEvents\]](#). It is generated by a *managed object* when the resource has transitioned from a DOWN state to an UP state. This element is of type `wsm:WSEESTartedNotificationType`

- *wsm:WSEESTartedNotification/wsm:StartTime*

The starting time of the resource. It doesn't have to be the same as the `evt:CreatedOn` which represents the creation time of the notification.

6.1.5.2 Stopped

<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/wsee/event/stopped/>

This event indicates that the Web service execution environment has transitioned from an UP state (i.e. the UP state itself or a sub-state of the UP state) to a DOWN state (i.e. the DOWN state itself or a sub-state of the DOWN state). The format of the notification is shown in the following non-normative grammar:

```
<wsm:WSEESToppedNotification>
  <!-- evt:NotificationType elements and attributes -->
  <wsm:StopTime>xs:dateTime</wsm:StopTime>
  <!-- extension elements --> *
</wsm:WSEESToppedNotification>
```

- *wsm:WSEESToppedNotification*

This type MAY be used wherever a Notification element may appear, as defined by [\[WSEvents\]](#). It is generated by a *managed object* when the resource has transitioned from an UP state to a DOWN state. This element is of type `wsm:WSEESToppedNotificationType`

- *wsm:WSEESToppedNotification/wsm:StopTime*

The stopping time of the resource. It doesn't have to be the same as the `evt:CreatedOn` which represents the creation time of the notification.

6.1.5.3 Service Added

<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/wsee/event/service-added/>

This event indicates that a Web service was added to the Web service execution environment for which its `WSExecutionEnvironment` managed object has created a corresponding `Service` managed object.

```

<wsm:WSEEServiceAddedNotification>
  <!-- evt:NotificationType elements and attributes -->
  <wsmf:EntityReference>wsmf:EntityReferenceType</wsmf:EntityReference>
  <!-- extension elements --> *
</wsm:WSEEServiceAddedNotification>

```

- *wsm:WSEEServiceAddedNotification*

This type MAY be used wherever a Notification element may appear, as defined by [\[WSEvents\]](#). It is generated by a *managed object* when the Web service execution environment it represents has added a new Web service. This element is of type `wsm:WSEEServiceAddedNotificationType`

- *wsm:WSEEServiceAddedNotification/wsmf:EntityReference*

This element is of type `EntityReferenceType` as defined by [\[WSMF-Foundation\]](#) and specifies the newly added `Service` managed object. The `referenceType` attribute of this `EntityReference` MUST be set to `ManagedObject`.

6.1.5.4 Service Removed

<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/wsee/event/service-removed/>

This event indicates that a Web service was removed from the Web service execution environments for which its `WSEExecutionEnvironment` managed object had created a corresponding `Service` managed object.

```

<wsm:WSEEServiceRemovedNotification>
  <!-- evt:NotificationType elements and attributes -->
  <wsmf:EntityReference>wsmf:EntityReferenceType</wsmf:EntityReference>
  <!-- extension elements --> *
</wsm:WSEEServiceRemovedNotification>

```

- *wsm:WSEEServiceRemovedNotification*

This type MAY be used wherever a Notification element may appear, as defined by [\[WSEvents\]](#). It is generated by a *managed object* when the Web service it represents has removed a Web service. This element is of type `wsm:WSEEServiceRemovedNotificationType`.

- *wsm:WSEEServiceRemovedNotification/wsmf:EntityReference*

This element is of type `EntityReferenceType` as defined by [\[WSMF-Foundation\]](#) and specifies the `Service` managed object that was just removed. The `referenceType` attribute of this `EntityReference` MUST be set to `ManagedObject`. Since the Web service that this `Conversation` managed object was representing has been removed, the managed object will not be available anymore to service management requests.

7. Conversation Managed Object

The `Conversation` managed object is used to manage a resource which is a Web services conversation, defined as one Web service's view of a set of related messages exchanged with other Web services. For example, if Web services A, B and C are exchanging messages that are correlated with one another (through some mechanism, either in the SOAP envelop or specific to the transport protocol) then each one of the participating Web services can keep a context associated with this set of messages. This context is called a conversation. In this example, each of the three Web services would have its own conversation to represent its view of the interaction going on (i.e. of the set of correlated messages). This definition does not assume that there is any description of what is the expected sequence of messages (this is possible, but not required for a conversation), does not assume that each party is aware of all the messages exchanged, does not assume that roles are assigned to the parties.

A Web-services-based process execution is one example of a case where a Web service managed object would be useful. But in this case, since additional information is available because the sequence of allowed messages is constrained by the process description, it is expected that more capable

managed objects will be defined by extending the `Conversation` managed object to provide these additional capabilities.

The `Conversation` managed object defined in WSMF-WSM is the lowest common denominator of all long-lived interactions between Web services and only assumes that there is correlation between messages and that a common unique ID can be provide by each party to identify this set of correlated messages (this corresponds to attribute `GlobalUniqueID`, see below).

7.1 `Conversation` managed object interfaces

7.1.1 `Conversation` Monitoring management interface

This interface extends `wsmf:ManagedObjectMonitoringInterface` in [\[WSMF-Foundation\]](#) and therefore all attributes and operations defined in the base interface also need to be provided if the conversation monitoring management interface is provided.

7.1.1.1 `OtherConversationsInvolved` Attribute

```
<wsm-conv:GetOtherConversationsInvolved />

<wsm-conv:GetOtherConversationsInvolvedResponse>
  <wsmf:EntityReferenceList>
    <wsmf:EntityReference>wsmf:EntityReferenceType</wsmf:EntityReference> *
  </wsmf:EntityReferenceList>
</wsm-conv:GetOtherConversationsInvolvedResponse>
```

- `wsm-conv:GetOtherConversationsInvolved`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `conversation` for a list of the other `Conversation` managed objects participating in this conversation (these `Conversation` managed objects are contained by the other Web services involved in the conversation). The list returned represents this objects view of who the other parties are and may not be the same list as that returned by another corresponding `Conversation` managed object. It might also not always contain `Conversation` managed objects for all the parties involved in the conversation in the case where the `Conversation` managed object which received this request does not have knowledge of a reference to all the other `Conversation` managed objects involved.

- `wsm-conv:GetOtherConversationsInvolvedResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the list of the other `Conversation` managed objects participating in this conversation.

- `wsm-conv:GetOtherConversationsInvolvedResponse/wsmf:EntityReferenceList`

This element encapsulates the list of conversations returned. This element MAY be empty.

- `wsm-`

`conv:GetOtherCovnersationsInvolvedResponse/wsmf:EntityReferenceList/wsmf:EntityRe.`

This element specifies information about one conversation. The `EntityReference` type is described in [\[WSMF-Foundation\]](#). Zero or more occurrences of this element are allowed.

7.1.1.2 `OtherServicesInvolved` Attribute

```
<wsm-conv:GetOtherServicesInvolved />

<wsm-conv:GetOtherServicesInvolvedResponse>
  <wsmf:EntityReferenceList>
    <wsmf:EntityReference>wsmf:EntityReferenceType</wsmf:EntityReference> +
  </wsmf:EntityReferenceList>
</wsm-conv:GetOtherServicesInvolvedResponse>
```

- `wsm-conv:GetOtherServicesInvolved`
 This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `conversation` for a list of the other `Service` managed objects having a `Conversation` managed object participating in this conversation. The list returned **MUST** represent this objects' view of who the other parties are and may not be the same list as that returned by another corresponding `Conversation` managed object. This list **MUST NOT** include the `Service` managed object that contains this managed object.
- `wsm-conv:GetOtherServicesInvolvedResponse`
 This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the list of the other service managed objects participating in this conversation.
- `wsm-conv:GetOtherServicesInvolvedResponse/wsmf:EntityReferenceList`
 This element encapsulates the list of services returned.
- `wsm-conv:GetOtherServicesInvolvedResponse/wsmf:EntityReferenceList/wsmf:EntityReference`
 This element specifies information about one service. The `EntityReference` type is described in [\[WSMF-Foundation\]](#). Zero or more occurrences of this element are allowed.

7.1.1.3 *NumberOfServicesInvolved Attribute*

```
<wsm-conv:GetNumberOfServicesInvolved />

<wsm-conv:GetNumberOfServicesInvolvedResponse>
  xs:nonNegativeInteger
</wsm-conv:GetNumberOfServicesInvolvedResponse>
```

- `wsm-conv:GetNumberOfServicesInvolved`
 This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `conversation` for the number of other Web services involved in the conversation. Other parties should be included in this count whether or not the conversation managed object has access to a pointer to these other parties' `Service` managed objects or their `Conversation` managed objects.
- `wsm-conv:GetNumberOfServicesInvolvedResponse`
 This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the number of other Web services involved in the conversation.

7.1.1.4 *GlobalConversationId Attribute*

```
<wsm-conv:GetGlobalConversationId />

<wsm-conv:GetGlobalConversationIdResponse>
  xs:anyURI
</wsm-conv:GetGlobalConversationIdResponse>
```

- `wsm-conv:GetGlobalConversationId`
 This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `conversation` for the global id associated with this conversation. All of the parties returned by the `OtherPartiesInvolved` attribute must return the same value for the global conversation ID. If the ID is different, the conversations do not correspond. This specification does not specify how this global ID is derived. It could be provided by a conversation description language or business process description language used to control this conversation. Alternatively, it could be derived from the message ID of the first message in the conversation or as a result of a handshake mechanism. Or some other source of information that

is known to all parties in the conversation.

- `wsm-conv:GetGlobalConversationIdResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the global id associated with this conversation.

7.1.1.5 *LastSuccessMessage Attribute*

```
<wsm-conv:GetLastSuccessMessage />

<wsm-conv:GetLastSuccessMessageResponse>
  wsm:MessageType
</wsm-conv:GetLastSuccessMessageResponse>
```

- `wsm-conv:GetLastSuccessMessage`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `conversation` for the last non-fault message received by the Web service in the context of this conversation.

- `wsm-conv:GetLastSuccessMessageResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the last non-fault message received by the Web service in the context of this conversation.

7.1.1.6 *LastFaultMessage Attribute*

```
<wsm-conv:GetLastFaultMessage />

<wsm-conv:GetLastFaultMessageResponse>
  wsm:MessageType
</wsm-conv:GetLastFaultMessageResponse>
```

- `wsm-conv:GetLastFaultMessage`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `conversation` for the last fault message received by the Web service in the context of this conversation.

- `wsm-conv:GetLastFaultMessageResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the last fault message received by the Web service in the context of this conversation.

7.1.2 Conversation Discovery management interface

This interface extends `wsmf:ManagedObjectDiscoveryInterface` in [\[WSMF-Foundation\]](#) and therefore all attributes and operations defined in the base interface also need to be provided if the conversation discovery management interface is provided.

7.1.2.1 *Container Attribute*

```
<wsm-conv:GetContainer />

<wsm-conv:GetContainerResponse>
  wsmf:EntityReference
</wsm-conv:GetContainerResponse>
```

- `wsm-conv:GetContainer`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `conversation` for the `Service Managed Object` which contains this conversation.

- `wsm-conv:GetContainerResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the `Service Managed Object` which contains this conversation.

7.1.3 Conversation Performance management interface

7.1.3.1 *TotalMessagesReceivedCount* Attribute

```
<wsm-conv:GetTotalMessagesReceivedCount />

<wsm-conv:GetTotalMessagesReceivedCountResponse>
  xs:nonNegativeInteger
</wsm-conv:GetTotalMessagesReceivedCountResponse>
```

- `wsm-conv:GetTotalMessagesReceivedCount`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `conversation` for the number of operational messages received by the Web service in the context of this conversation since the creation of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration management interface`.

- `wsm-conv:GetTotalMessagesReceivedCountResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the number of operational fault messages received by the Web service in the context of this conversation.

7.1.3.2 *TotalMessagesSentCount* Attribute

```
<wsm-conv:GetTotalMessagesSentCount />

<wsm-conv:GetTotalMessagesSentCountResponse>
  xs:nonNegativeInteger
</wsm-conv:GetTotalMessagesSentCountResponse>
```

- `wsm-conv:GetTotalMessagesSentCount`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `conversation` for the number of operational messages sent by the Web service in the context of this conversation since the creation of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration management interface`.

- `wsm-conv:GetTotalMessagesSentCountResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the number of operational fault messages sent by the Web service in the context of this conversation.

7.1.3.3 *FaultMessagesReceivedCount* Attribute

```
<wsm-conv:GetFaultMessagesReceivedCount />

<wsm-conv:GetFaultMessagesReceivedCountResponse>
  xs:nonNegativeInteger
</wsm-conv:GetFaultMessagesReceivedCountResponse>
```

- `wsm-conv:GetFaultMessagesReceivedCount`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `conversation` for the number of operational fault messages received by the Web service in the context of this conversation since the creation of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration management interface`.

- `wsm-conv:GetFaultMessagesReceivedCountResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the number of operational fault messages received by the Web service in the context of this conversation.

7.1.3.4 *FaultMessagesSentCount Attribute*

```
<wsm-conv:GetFaultMessagesSentCount />

<wsm-conv:GetFaultMessagesSentCountResponse>
  xs:nonNegativeInteger
</wsm-conv:GetFaultMessagesSentCountResponse>
```

- `wsm-conv:GetFaultMessagesSentCount`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `conversation` for the number of operational fault messages sent by the Web service in the context of this conversation since the creation of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration management interface`.

- `wsm-conv:GetFaultMessagesSentCountResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the number of operational fault messages sent by the Web service in the context of this conversation.

7.1.3.5 *SuccessMessagesReceivedCount Attribute*

```
<wsm-conv:GetSuccessMessagesReceivedCount />

<wsm-conv:GetSuccessMessagesReceivedCountResponse>
  xs:nonNegativeInteger
</wsm-conv:GetSuccessMessagesReceivedCountResponse>
```

- `wsm-conv:GetSuccessMessagesReceivedCount`

This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `conversation` for the number of operational non-fault messages received by the Web service in the context of this conversation since the creation of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject Configuration management interface`.

- `wsm-conv:GetSuccessMessagesReceivedCountResponse`

This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the number of operational non-fault messages received by the Web service in the context of this conversation.

7.1.3.6 *SuccessMessagesSentCount Attribute*

```
<wsm-conv:GetSuccessMessagesSentCount />

<wsm-conv:GetSuccessMessagesSentCountResponse>
  xs:nonNegativeInteger
```

```
</wsm-conv:GetSuccessMessagesSentCountResponse>
```

- `wsm-conv:GetSuccessMessagesSentCount`
This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to query the `conversation` for the number of operational non-fault messages sent by the Web service in the context of this conversation since the creation of the managed object. Its creation date and time is indicated by the `CreatedOn` attribute in the `ManagedObject` Configuration management interface.
- `wsm-conv:GetSuccessMessagesSentCountResponse`
This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to query for the number of operational non-fault messages sent by the Web service in the context of this conversation.

7.1.4 Conversation Control management interface

This interface extends `wsmf:ManagedObjectControlInterface` in [\[WSMF-Foundation\]](#) and therefore all attributes and operations defined in the base interface also need to be provided if the conversation control management interface is provided.

7.1.4.1 Terminate operation

```
<wsm-conv:Terminate />
<wsm-conv:TerminateResponse />
```

- `wsm-conv:Terminate`
This element specifies the request message of a request/response pair of messages. It is sent by a `manager` to instruct the `conversation` to terminate this `Conversation ManagedObject`. The containing Web service **MUST** not accept or send any further message in the context of this conversation, other than those necessary to graciously terminate the conversation if needed. On the other hand `Conversation` managed objects which this object is related to **MAY** see their containing services continue to exchange messages between one another.
- `wsm-conv:TerminateResponse`
This element specifies the response message of a request/response pair of messages. It is received by a `manager` as an indication of a successful attempt to terminate this `Conversation` managed object.

7.1.5 State values

No additional state defined (all states defined by WSMF-Foundation for a managed object still apply).

7.1.6 Event types

As defined in [\[WSMF-Foundation\]](#), WSMF-WSM uses [\[WSEvents\]](#) to provide notifications when events occur that impact the resource represented by the managed object. If a `Conversation` managed object supports notifications, it **MUST** support the notifications listed for managed objects in [\[WSMF-Foundation\]](#) (e.g. `StateChanged`, `AttributeModified`, etc...). It **MUST** also support the notifications defined specifically for `Conversation` managed objects, listed in this section. The normative schema for these notifications can be found in the [WSMF-WSM XSD document](#).

7.1.6.1 Incorrect Message Received

<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/conversation/event/incorrect->

message-received/

This event indicates that an incorrect message was received in the context of the long-lived interaction represented by this `Conversation` managed object. The Web service that is involved in the long-lived interaction represented by this `Conversation` managed object is the judge of what an incorrect message is. When the long-lived interaction is described by a conversation description document or other Web services-based business process document, an incorrect message is typically a message that cannot be validated against the description of the long-lived interaction. Note that a specific message can be incorrect at some point in time and correct at another point in time within the same long-lived interaction. The format of the notification is shown in the following non-normative grammar:

```
<wsm:ConversationIncorrectMessageReceivedNotification>
  <!-- evt:NotificationType elements and attributes -->
  <wsm:Message>wsm:MessageType</wsm:Message>
  <!-- extension elements --> *
</wsm:ConversationIncorrectMessageReceivedNotification>
```

- *wsm:ConversationIncorrectMessageReceivedNotification*

This type MAY be used wherever a Notification element may appear, as defined by [\[WSEvents\]](#). It is generated by a *managed object* when an incorrect message has been received as part of the long-lived interaction represented by this managed object. This element is of type `wsm:ConversationIncorrectMessageReceivedNotificationType`

- *wsm:ConversationIncorrectMessageReceivedNotification/wsm:Message*

The incorrect message that caused this event.

7.1.6.2 Participant Missing**<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/conversation/event/participant-missing/>**

This event indicates that a participant in the long-lived interaction represented by this `Conversation` managed object is missing in action. Either a message could not be sent to the participant or a message expected from the participant was not received in time. The Web service that is involved in the long-lived interaction represented by this `Conversation` managed object is the judge of what "in time" means. When the long-lived interaction is described by a conversation description document or other Web services-based business process document, the time allowed for a certain message to be sent is often specified in the interaction description document or an attached policy document. The format of the notification is shown in the following non-normative grammar:

```
<wsm:ConversationMissingParticipantNotification>
  <!-- evt:NotificationType elements and attributes -->
  <wsmf:EntityReference>wsmf:EntityReferenceType</wsmf:EntityReference>
  <!-- extension elements --> *
</wsm:ConversationMissingParticipantNotification>
```

- *wsm:ConversationMissingParticipantNotification*

This type MAY be used wherever a Notification element may appear, as defined by [\[WSEvents\]](#). It is generated by a *managed object* when a participant has gone missing as part of the long-lived interaction represented by this managed object. This element is of type `wsm:ConversationMissingParticipantNotificationType`

- *wsm:ConversationMissingParticipantNotification/wsmf:EntityReference*

The participant that has gone missing in the interaction.

7.1.6.3 Remote Failure**<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/conversation/event/remote-failure/>**

This event indicates that one of the participants in the long-lived interaction represented by this `Conversation` managed object has sent a fault message. The format of the notification is shown in the

following non-normative grammar:

```
<wsm:ConversationRemoteFailureNotification>
  <!-- evt:NotificationType elements and attributes -->
  <wsm:Message>wsm:MessageType</wsm:Message>
  <!-- extension elements --> *
</wsm:ConversationRemoteFailureNotification>
```

- *wsm:ConversationRemoteFailureNotification*
This type MAY be used wherever a Notification element may appear, as defined by [\[WSEvents\]](#). It is generated by a *managed object* when a fault message has been received as part of the long-lived interaction represented by this managed object. This element is of type `wsm:ConversationRemoteFailureNotificationType`
- *wsm:ConversationRemoteFailureNotification/wsm:Message*
The fault message that caused this event.

7.1.6.4 Local Failure

<http://devresource.hp.com/drc/specifications/wsmf/2003/07/wsm/conversation/event/local-failure/>

This event indicates that a fault occurred while processing a message that was received as part of the long-lived interaction described by this `Conversation` managed object. The format of the notification is shown in the following non-normative grammar:

```
<wsm:ConversationLocalFailureNotification>
  <!-- evt:NotificationType elements and attributes -->
  <wsm:Message>wsm:MessageType</wsm:Message>
  <!-- extension elements --> *
</wsm:ConversationLocalFailureNotification>
```

- *wsm:ConversationLocalFailureNotification*
This type MAY be used wherever a Notification element may appear, as defined by [\[WSEvents\]](#). It is generated by a *managed object* when a fault occurred while processing a message that was received as part of the long-lived interaction described by this managed object. This element is of type `wsm:ConversationLocalFailureNotificationType`
- *wsm:ConversationLocalFailureNotification/wsm:Message*
The fault message that was generated as a result of this fault occurring.

8. Future directions (non-normative)

Several directions have been identified for future versions of this specifications or for related specifications not yet written. They include:

- Create an "intermediary" interface collection to allow management of SOAP intermediaries.
- Create a "registry" interface collection to allow management of UDDI registries.
- Create interface collections to manage long-lived business process described in languages such as BPEL. The "conversation" interface collection defined in this specification is meant to be extended (using the inheritance mechanism described in WSMF-Foundation) for this purpose. This should also include support for transactions.
- Add support for service level agreements (SLA) and service level monitoring (SLM).
- Add support for service provisioning.
- Add support for deployment-related service events, such as change of endpoint, configuration change, etc... Not just runtime monitoring.

9. References

9.1 Normative References

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9.2 Informative References

[IETF RFC 2616]

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